OMRON

Displacement Sensor and Parallel Beam Sensor | ZX Series

Compact Amplifier With Digital Resolution Display Supports 3 Through-Beam and 8 Displacement Visible Red Sensing Heads

- Amplifier supports displacement and parallel beam sensing applications
- Diffuse distance measurement up to 500 mm
- Through-beam measurement up to 10 mm
- Selectable linear analog output 4-20 mA, 1 to 5 VDC, 0 to 5 VDC, ±4 VDC, ±5 VDC
- Amplifier displays achieved resolution of application
- 3 discrimination outputs: High, Low, Pass
- FDA class 1 and class 2 visible red laser
- PC interface for setup, monitoring, direct data logging

Ordering Information

Important note for ordering:
Choose normally stocked products whenever possible to ensure availability that matches your schedule. Normally stocked items are shown as shaded in the Ordering Information tables. Non-stocked items are available but are subject to longer lead times. For the most up-to-date information on stock status, contact your Omron representitive.

■ Sensor Heads

Reflective

Optical system	Beam shape	Beam size at sensing distance	Sensing distance ± measurement range	Resolution (See Note)	Part number
Diffuse reflective	Spot beam	40 μm x 30 μm	40±10 mm (1.57 in ±0.40 in)	2 μm	**ZX-LD40**
		100 μm x 65 μm	100±40 mm (3.93 in ±1.57 in)	16 μm	**ZX-LD100**
		180 μm x 300 μm	300±200 mm (11.81 in ±7.87 in)	300 μm	**ZX-LD300**
	Line beam	2000 μm x 50 μm	40±10 mm (1.57 in ±0.40 in)	2 μm	**ZX-LD40L**
		2000 μm x 100 μm	100±40 mm (3.93 in ±1.57 in)	16 μm	**ZX-LD100L**
		2000 μm x 300 μm	300±200 mm (11.81 in ±7.87 in)	300 μm	**ZX-LD300L**
Regular reflective	Spot beam	30 μm x 40 μm	30±2 mm (1.18 in ±0.08 in)	0.25 μm	**ZX-LD30V**
	Line beam	1800 μm x 60 μm			**ZX-LD30VL**

Note: For an average sampling of 4,096.

Through-beam

Optical system	Measuring width	Sensing distance	Resolution (See Note 1)	Part number
Through-beam	1-mm dia.	0 to 2000 mm (0 to 78.74 in)	4 μm	**ZX-LT001**
	5 mm	0 to 500 mm (0 to 19.69)		**ZX-LT005**
	10 mm			**ZX-LT010 (See Note 2)**

Note: **1.** For an average sampling of 64.

2. Availability pending

■ Amplifier Units

Use with Reflective or Through-beam sensor heads

Appearance	Power supply	Analog output (Switch selectable)	Output type	Discrimination output function	Part number
	12 to 24 VDC	4 to 20 mA, 1 to 5 VDC, 0 to 5 VDC, ±4 VDC, ±5 VDC	NPN	High Pass Low	**ZX-LDA11 2M (See note)**
			PNP		**ZX-LDA41 2M (See note)**

Note: Order operation manual for the ZX Amplifier separately (Part number: Z157-E1-01)

Accessories (Order Separately)

■ Calculating Unit For 2-sided Thickness Measurement

Appearance	Sensor operation	Part number
	Insert between 2 amplifier units. Use with reflective sensors with same sensing distance only.	**ZX-CAL**

■ Side-view Attachments

Appearance	Applicable Sensor Head	Part number
	ZX-LT1001/LT005	**ZX-XF12**
	ZX-LT010	**ZX-XF22**

■ SmartMonitor Sensor Setup Tool for Personal Computer Connection

Appearance	Name	Part number
	ZX-series Communications Interface Unit	**ZX-SF11**
CD-ROM	ZX-series Sensor Setup Software	**ZX-SW11E**

■ Extension Cables with Connectors on Both Ends

Cable length	Quantity	Part number
1 m	1	**ZX-XC1A**
4 m		**ZX-XC4A**
8 m		**ZX-XC8A**
9 m		**ZX-XC9A (See Note)**

Note: For use with reflective sensors only.

■ Operation Manual for ZX Amplifier

Quantity	Part number
1	**Z157-E1-01**

Specifications

■ Sensor Heads (Reflective)

Item	Part number							
	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.; class 2							
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 (See Note 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 (See Note 2)	2 μm	16 μm	300 μm	0.25 μm	2 μm	16 μm	300 μm	0.25 μm
Linearity (See Note 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 (See Note 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)							

Note: **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 target is more reflective than the target.

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.

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

■ Sensor Heads (Through-beam)

Item	Part number			
	ZX-LT001		ZX-LT005	ZX-LT010
Optical system	Through-beam			
Light source (wave length)	Visible-light semiconductor laser with a wavelength of 650 nm and an output of 1mW max.; class1			
Measurement width	1 mm dia.	1 to 2.5 mm dia.	5 mm	10 mm
Measurement distance	0 to 500 mm	500 to 2,000 mm	0 to 500 mm	
Minimum target	8 μm dia. (opaque)	8 to 50 μm dia. (opaque)	0.05 mm dia. (opaque)	0.1 mm dia. (opaque)
Resolution (See Note 1)	4 μm (See Note 2)	---	4 μm (See Note 3)	
Temperature characteristic	0.2% FS max.			
Ambient illumination	Incandescent lamp: 3,000 lx max. (on light-receiving side)			
Ambient temperature	Operating: 0 to 50°C, Storage: −25 to 70°C (with no icing or condensation)			
Degree of protection	IEC60529, IP40			
Cable length	Extendable up to 10 m with special extension cable.			
Materials	Case: Polyether imide, Case cover: Polycarbonate, Unit cover: Glass			
Tightening torque	0.3 N·m max.			
Accessories	Optical axis adjustment seal, sensor head-amplifier connection cable, instruction sheet			

Note: **1.** This value is obtained by converting the deviation (±3σ) 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 target 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.

■ Amplifier Units

Item	Part number	
	ZX-LDA11	ZX-LDA41
Measurement period	150 μs	
Possible average count settings (See Note 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 (See Note 2)	4 to 20 mA/FS, Max. load resistance: 300 Ω, ±4 V [± 5 V, 1 to 5, 0 to 5 VDC (See Note 3)], Output impedance: 100 Ω	
Judgement outputs (3 outputs: HIGH/PASS/LOW) (See Note 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, 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, intensity mode, zero reset, initial reset, ON-delay timer, OFF-delay timer, one-shot timer, deviation/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, (A-B) calculations (See Note 4), (A+B) calculations (See Note 4), mutual interference (See Note 4), laser deterioration detection, zero reset memory, 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 ±10%, Ripple (p-p): 10% max.	
Current consumption	200 mA max. (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 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)	
Connection method	Prewired (standard cable length: 2 m)	
Weight (packed state)	Approx. 350 g	
Materials	Case: PBT (polybutylene terephthalate), Cover: Polycabonate	
Accessories	Instruction sheet	

Note: **1.** The response speed of the linear output is calculated as the measurement period x (average count setting +1) (with fixed sensitivity).
The response speed of the judgement outputs is calculated and the measurement period x (average count setting + 1) (with fixed sensitivity).

2. The output can be switched between a current output and a voltage output using a switch on the bottom of the amplifier unit.

3. Setting is possible via the monitor focus function.

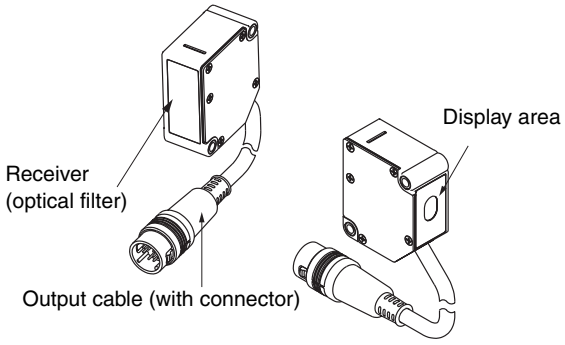
4. A calculating unit is required.

Nomenclature

■ Sensor Heads and Amplifiers

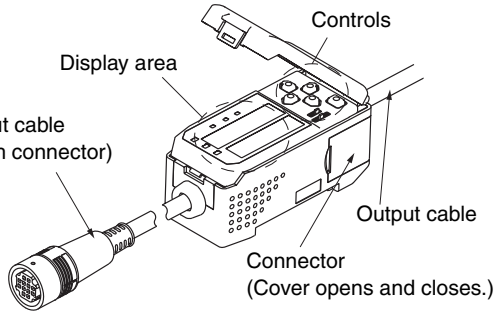
Sensor Heads (Reflective)

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



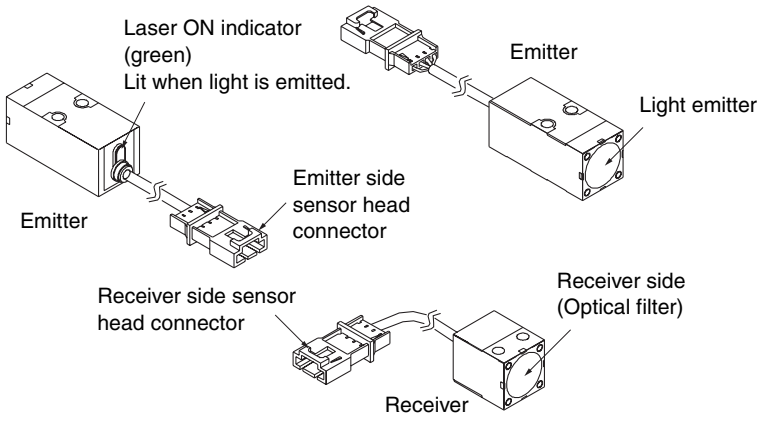
Amplifier Units

ZX-LDA11, ZX-LDA41



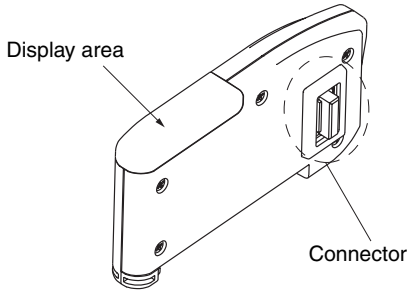
Sensor Heads (Through-beam)

ZX-LT001, ZX-LT005, ZX-LT010



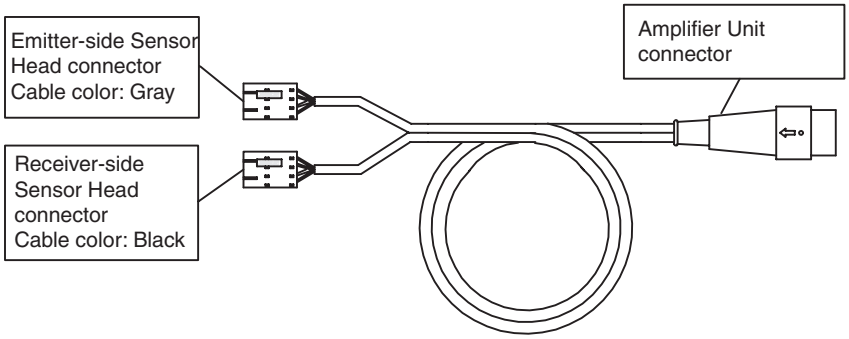
Calculating Unit

ZX-CAL



Connecting Cable

Through-beam sensor to amplifier (1.5 m)



Operation

■ Linear Output

The default linear output settings are listed in the following table. These settings are set at the factory and also after initializing the settings.

Default linear output setting		Operation after setting reference incident level		
Voltage output	±4 VDC (See Note)	Incident level display	None of beam intercepted	4 VDC
			Entire beam intercepted	–4 VDC
		Intercepted amount display	None of beam intercepted	–4 VDC
			Entire beam intercepted	4 VDC
Current output	4 to 20 mA (See Note)	Incident level display	None of beam intercepted	20 mA
			Entire beam intercepted	4 mA
		Intercepted amount display	None of beam intercepted	4 mA
			Entire beam intercepted	20 mA

Note: Use the monitor focus function when setting the output voltage to ±5 VDC, 0 to 5 VDC or 1 to 5 VDC instead of ±4 VDC.

■ Outputs

Discrimination Outputs

There are three discrimination outputs: HIGH, PASS, and LOW.

The following table and illustration show the timing of each output.

Threshold Values

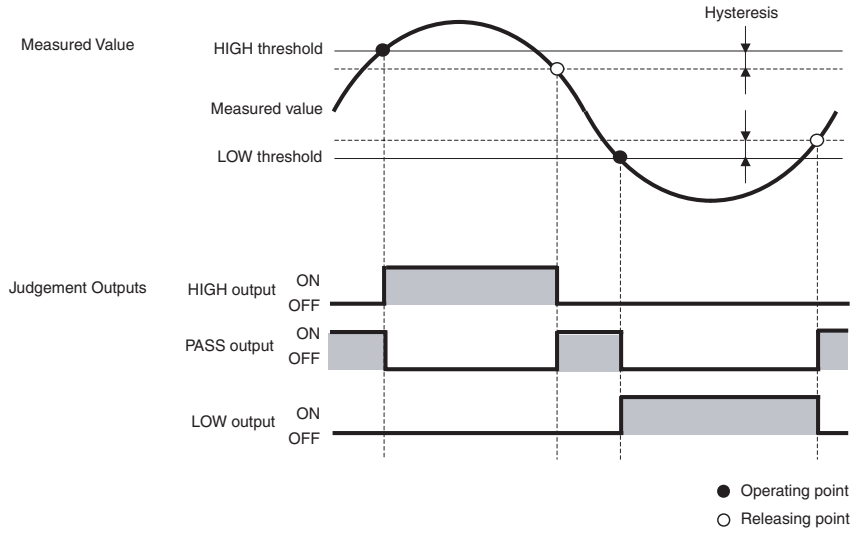
The threshold values form the boundaries between the HIGH, PASS, and LOW outputs for the measured value.

There are two threshold values: The HIGH threshold and the LOW threshold. The threshold values contain hysteresis.

Hysteresis

The hysteresis (hysteresis width) is the difference between the operating and releasing values. If the hysteresis is too small, chattering may occur. If it is too large, releasing may be difficult.

Measured value	Judgement outputs
Larger than or equal to HIGH threshold	PASS → HIGH
Smaller than or equal to HIGH threshold – Hysteresis	HIGH → PASS
Smaller than or equal to LOW threshold	PASS → LOW
Larger than or equal to LOW threshold – Hysteresis	LOW → PASS

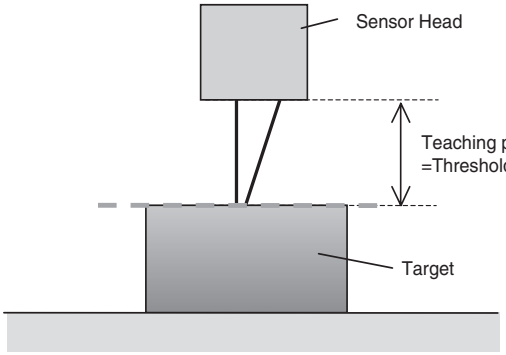


Teach Functions to Set Threshold Values For Displacement Sensor Heads

Refer to operating manual for through beam teach functions.

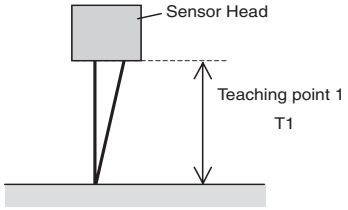
Position teaching

When teaching is executed, the measured value is set as a threshold.

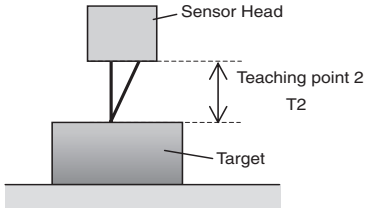


Two point teaching

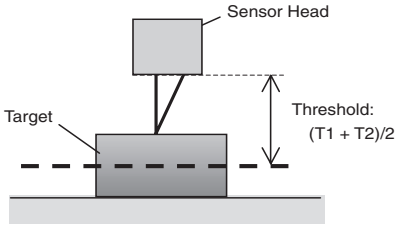
The mid point between the first teaching point and the second point is set as a throeshold. With two point teaching, small steps, such as a sheet of paper can be measured.



First Point



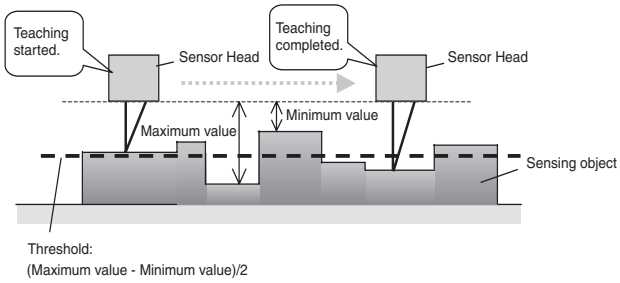
Second Point



Threshold

Automatic Teaching

For automatic teaching, measurements are performed while the RIGHT Key and the ENT key are pressed at the same time. The center value between maximum and minimum values is set as a threshold. The threshold value is set when the keys are released. The threshold can be set according to the target.



■ Inputs

Power Supply (12 to 24 VDC)

A 12 to 24-VDC power supply is connected to the power supply terminal. When using an Amplifier Unit with a PNP output, the power supply terminal is also the common I/O terminal for all I/O except for the linear output.

GND (0 V)

The GND terminal is the 0-V power supply terminal. When using an Amplifier Unit with an NPN output, the GND terminal is also the common I/O terminal for all I/O except for the linear output.

Laser OFF Input

When the Laser OFF input is turned ON, the laser emission will turn OFF, LdoFF will be displayed on the sub-display, and an optical level error will occur. The linear output, main display, judgement outputs, and judgement output indicators will be output according to the setting for non-measurement.

Zero Reset Input

The zero reset input is used to reset zero or to release the zero reset. The settings are as follows, according to the length of time the input is ON:

Input pulse ON time	Operation
0.2 to 0.8 s	Zero reset
Over 1 s	Zero reset release

Note: The above operations are performed when the input is turned OFF.

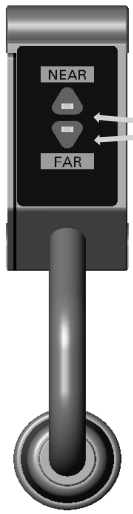
Timing Input

The timing input is used to control the timing of the hold functions. Sampling is performed while this input is ON. It is used, for example, to hold a specified measured value from during the time that the timing input is ON.

Reset Input

The reset input is used to reset the outputs. When the reset input is turned ON, internal operation is interrupted and the specified values are output from the judgement and linear outputs.

■ Sensor Head Displays

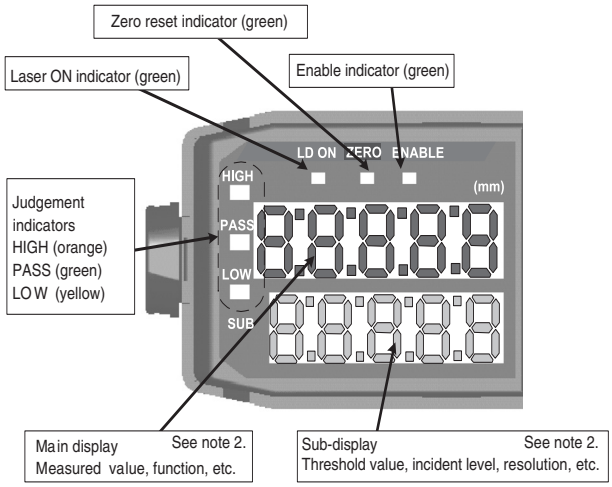


Range indicators (green)

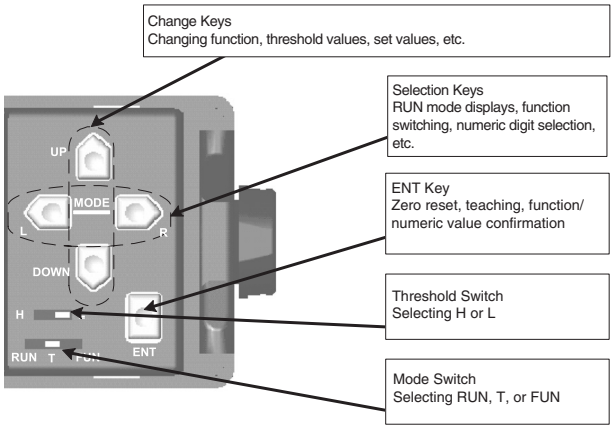
Range Indicator Lighting Status

Both NEAR/FAR light:	**Measurement center distance ±(measurement range x 10%)**
NEAR lights:	**Short distance side within the measurement range**
FAR lights:	**Long distance side within the measurement range**
Both NEAR/FAR flash:	**Outside the measurement range**

■ Amplifier Displays



■ Amplifier Keys



Note: **1.** The current/voltage switch for the linear output is on the bottom of the Amplifier Unit

2. The information displayed on the main display and sub-display is reversed if Reverse Mode is enabled.

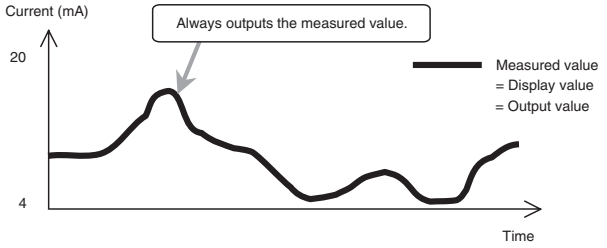
■ Hold Functions

The hold functions extract, output, and display data for specific points, such as the maximum value, the minimum value, etc.

There are six hold functions: Peak hold, bottom hold, sample hold, peak-to-peak hold, self-peak hold, and self-bottom hold.

Normal Mode (Hold Not Enabled)

In Normal Mode, the measured value is always displayed and output. The timing input is disabled and no hold function will operate.

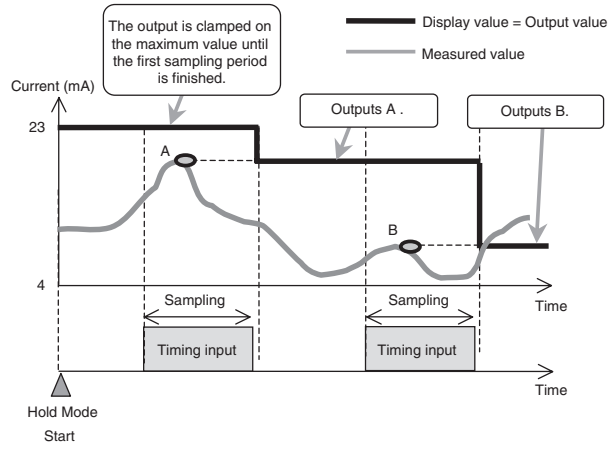


Peak Hold

In Peak Hold Mode, measurements are performed while the timing input is ON, and the maximum value during the sampling period will be the output value.

Hold Mode starts when the power is turned ON, immediately after changing to RUN or T Mode, or immediately after the reset input is turned OFF.

The output is held at the maximum output (current: approximately 23 mA, voltage: approximately 5.5 V) until the first sampling period is finished. The first measured result (A in the figure below) is output from the end of the first sampling period to the end of the second sampling period. After the second sampling period, the second measured result (B in the figure below) is output and the sequence is repeated.

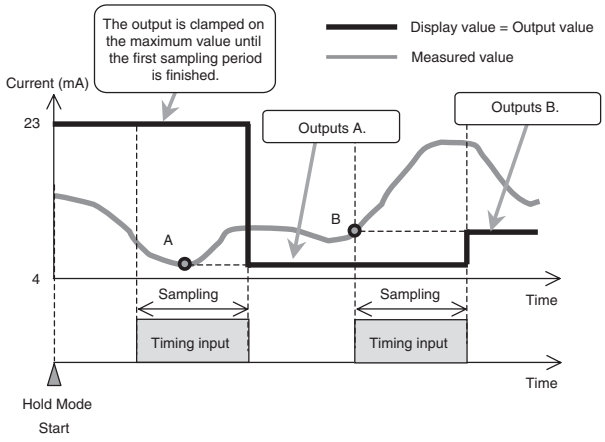


Bottom Hold

In Bottom Hold Mode, measurements are performed while the timing input is ON, and the minimum value during the sampling period will be the output value.

Hold Mode starts when the power is turned ON, immediately after changing to RUN or T Mode, or immediately after the reset input is turned OFF.

The output is held at the maximum output (current: approximately 23 mA, voltage: approximately 5.5 V) until the first sampling period is finished. The first measured result (A in the figure below) is output from the end of the first sampling period to the end of the second sampling period. After the second sampling period, the second measured result (B in the figure below) is output and the sequence is repeated.

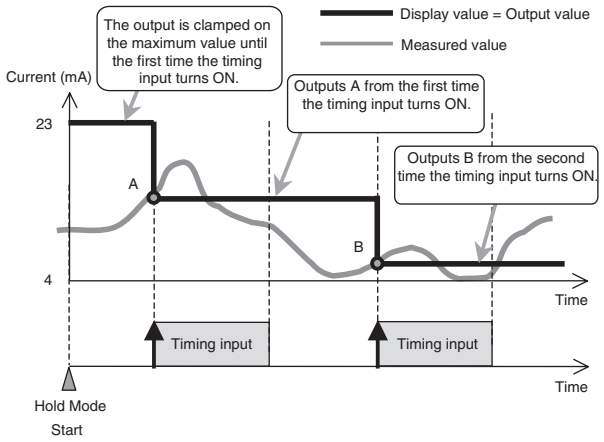


Sample hold

In Sample Hold Mode, the measured result when the timing input is turned ON will be the output value.

Hold Mode starts when the power is turned ON, immediately after changing to RUN or T Mode, or immediately after the reset input is turned OFF.

The output is held at the maximum output (current: approximately 23 mA, voltage: approximately 5.5 V) until the first time the timing input turns ON. The first measured result (A in the figure below) is output from the beginning of the first sampling period to the second sampling period. After the beginning of the second sampling period, the second measured result (B in the figure below) is output and the sequence is repeated.

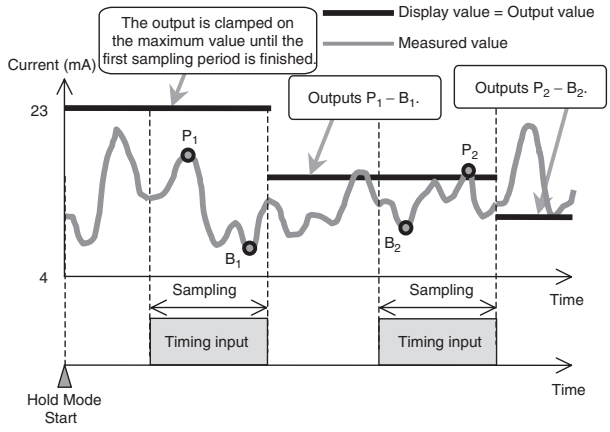


Peak-to-peak hold

In Peak-to-peak Hold Mode, measurements are performed while the timing input is ON, and the difference between the maximum value and the minimum value in the sampling period will be the output value.

Hold Mode starts when the power is turned ON, immediately after changing to RUN or T Mode, or immediately after the reset input is turned OFF.

The output is held at the maximum output (current: approximately 23 mA, voltage: approximately 5.5 V) until the first sampling period is finished. The first measured result ($P_1 - B_1$ in the figure below) is output from the end of the first sampling period to the end of the second sampling period. After the second sampling period, the second measured result ($P_2 - B_2$ in the figure below) is output and the sequence is repeated.

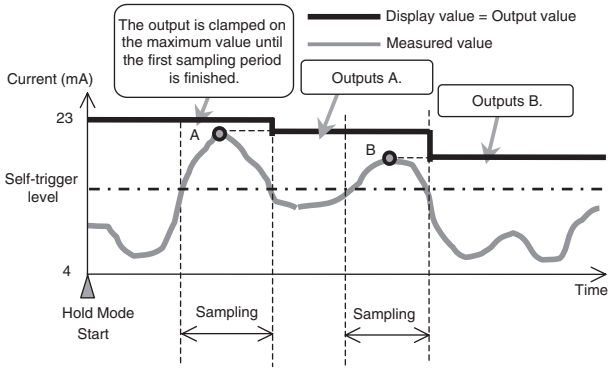


Self-peak hold

In Self-peak Hold Mode, measurements are performed while the measured value is larger than or equal to the self-trigger level, and the maximum value in the period will be the output value.

Hold Mode starts when the power is turned ON, immediately after changing to RUN or T Mode, or immediately after the reset input is turned OFF.

The output is head at the maximum output (current: approximately 23 mA, voltage: approximately 5.5 V) until the first sampling period is finished. The first measured result (A in the figure below) is output from the end of the first sampling period to the end of the second sampling period. After the second sampling period, the second measured result (B in the figure below) is output and the sequence is repeated.



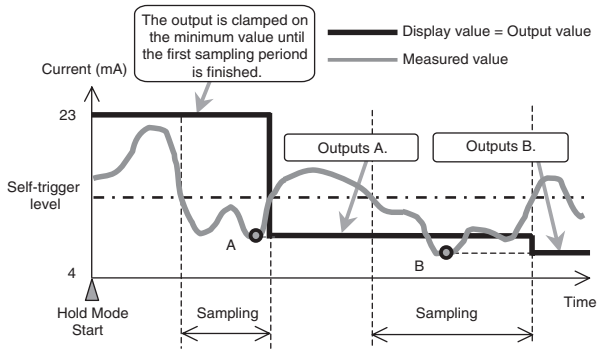
Self-bottom hold

In Self-bottom Hold Mode, measurements are performed while the measured value is smaller than or equal to the self-trigger level, and the minimum value in the period will be the output value.

Hold Mode starts when the power is turned ON, immediately after changing to RUN or T Mode, or immediately after the reset input is turned OFF.

The output is held at the maximum output (current: approximately 23 mA, voltage: approximately 5.5 V) until the first sampling period is finished. The first measured result (A in the figure below) is output from the end of the first sampling period to the end of the second sampling period. After the second sampling period, the second measured result (B in the figure below) is output and the sequence is repeated.

Note: Sampling is not affected by the timing input in Self-bottom Hold Mode.



■ Timing Functions

Setting Time delay

The time set for the timer is the delay time for the ON-delay timer, the delay time for the OFF-delay timer, or the pulse width for the one-shot timer. Set the time according to the requirements of the control system (e.g., PLC). The timer time can be set to between 0 and 5,999 ms.

Timer Disable

If the timer is disabled, judgement outputs will be made immediately and the output response time will be determined by the number of samples to average.

OFF-delay Timer

When the measured value changes from HIGH to PASS or from LOW to PASS, turning OFF the PASS output is delayed for the timer time.

ON-delay Timer

When the measured value changes from HIGH to PASS or from LOW to PASS, turning ON the PASS output is delayed for the timer time.

One-shot Timer

When the measured value changes from HIGH to PASS or from LOW to PASS, the PASS output is turn ON with a pulse width equivalent to the timer time.

When PASS output pulses overlap, the latter pulse has priority. Therefore, overlapping pulses might sometimes become a single pulse rather than separate pulses.

Note: Neither the HIGH nor the LOW output are output when the one-shot timer

■ Two-sensor operation

Two-sensor operation enables mutual operation using the measured values from the two Sensor Heads to generate final outputs. Two kinds of outputs, A–B or A+B, can then be selected.

Note: The ranges of display values and linear output values are automatically doubled when two-sensor operation is used. An example application of Sensor Heads is given in the following table when the sensing distance is 100 ± 40 mm .

Linear output	4 to 20 mA
A – B	–80 to 80
A + B	120 to 280

Note: Correct distance operation cannot be performed if Sensor Heads with different sensing distances are used.

• A – B

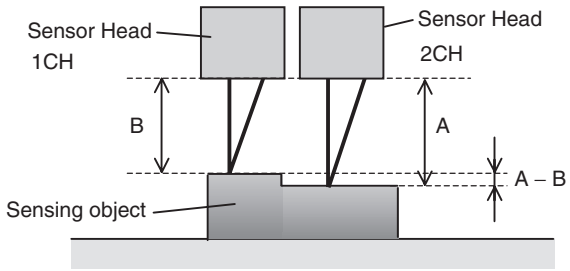
The difference between the measured values of the two Sensor Heads is the final output. The measured value of the 1CH Amplifier Unit is B and the measured value of the 2CH Amplifier Unit is A.

• A + B

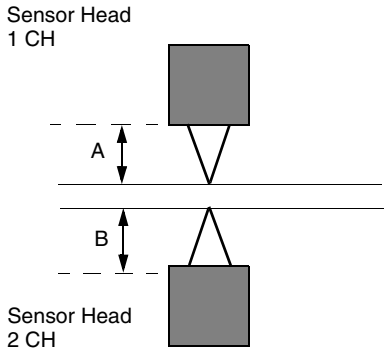
The sum of measured values of the two Sensor Heads is the final output. The measured value of the 1CH Amplifier Unit is B and the measured value of the 2CH Amplifier Unit is A.

• Operation Result Output

The result of the operation is displayed on and output from the 2CH Amplifier Unit. The B measured value is displayed on and output from the 1CH Amplifier Unit.



• Two sided thickness measurement

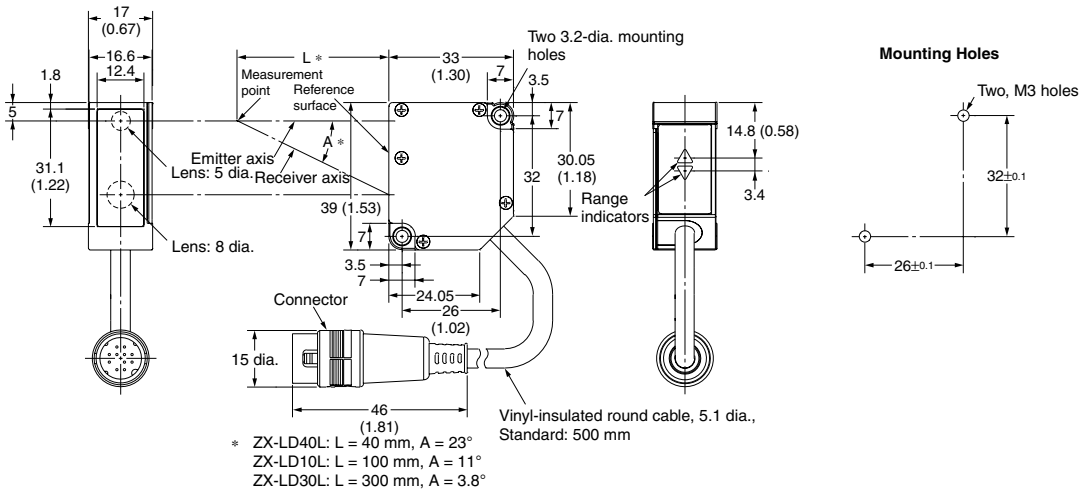


Dimensions

Unit: mm (inch)

■ Sensor Heads (Diffuse Reflective)

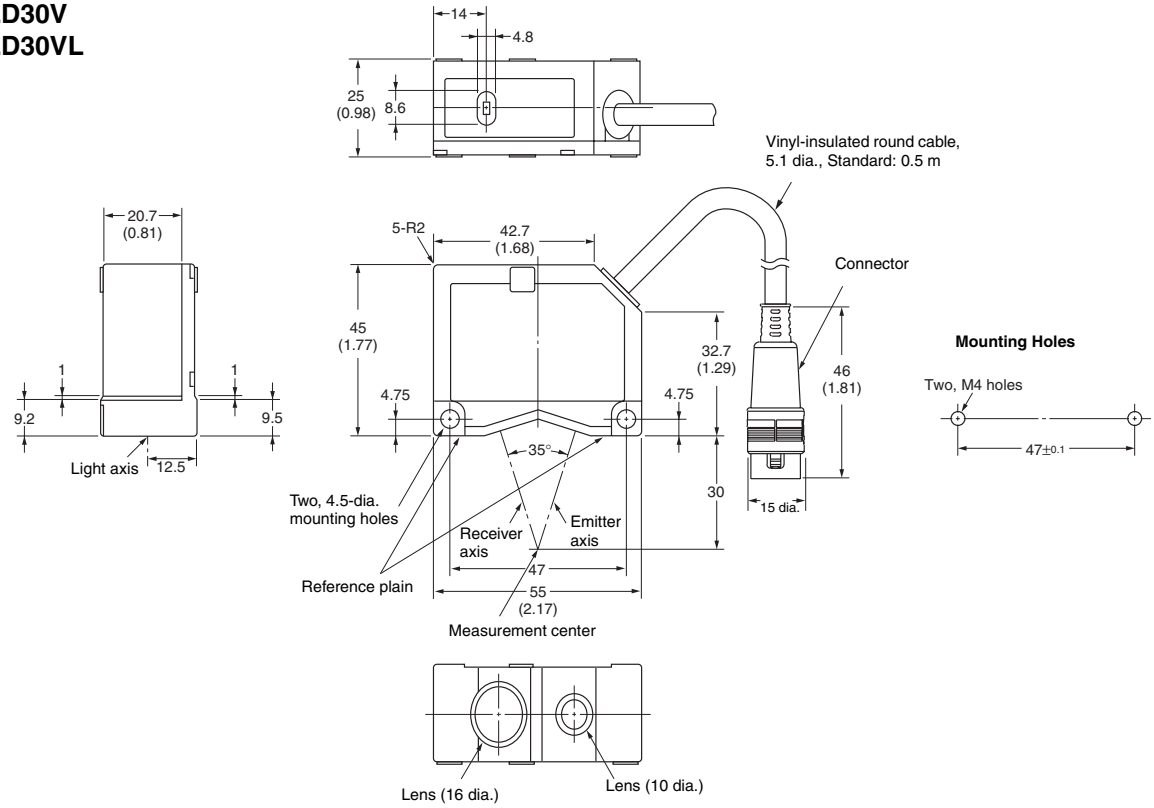
ZX-LD40
ZX-LD100
ZX-LD300
ZX-LD40L
ZX-LD100L
ZX-LD300L



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

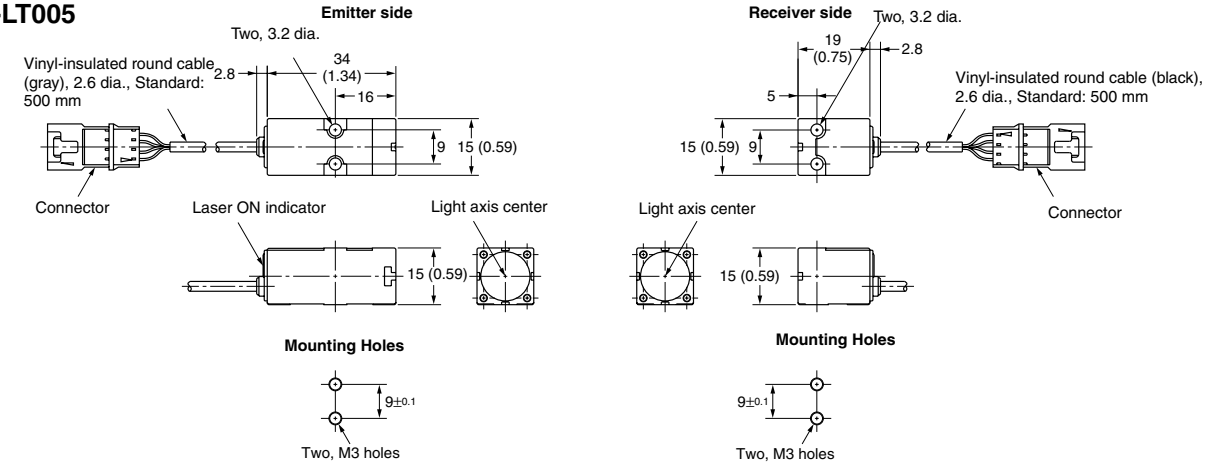
■ Sensor Heads (Regular Reflective)

ZX-LD30V
ZX-LD30VL

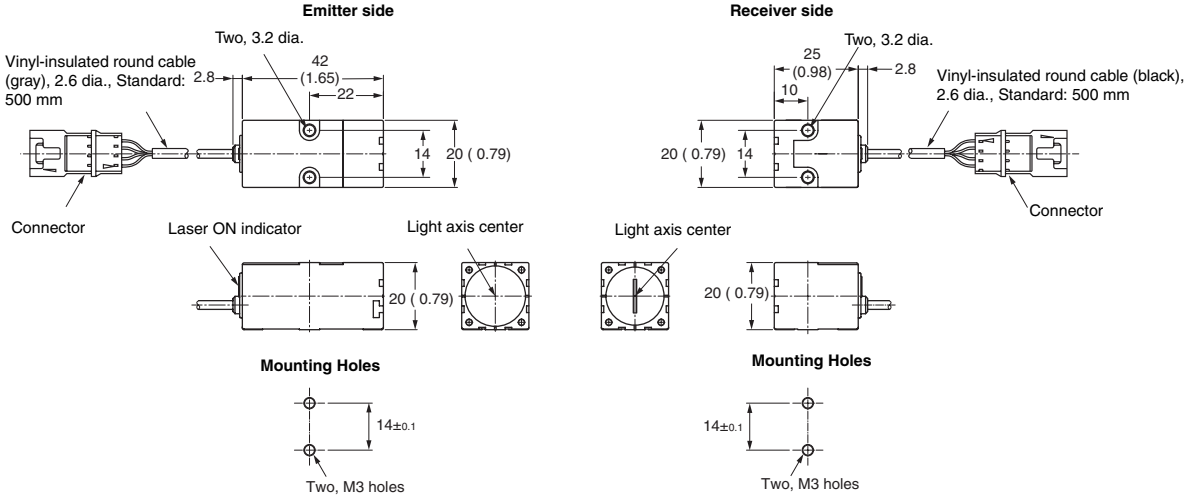


■ Sensor Heads (Through-beam)

ZX-LT001
ZX-LT005

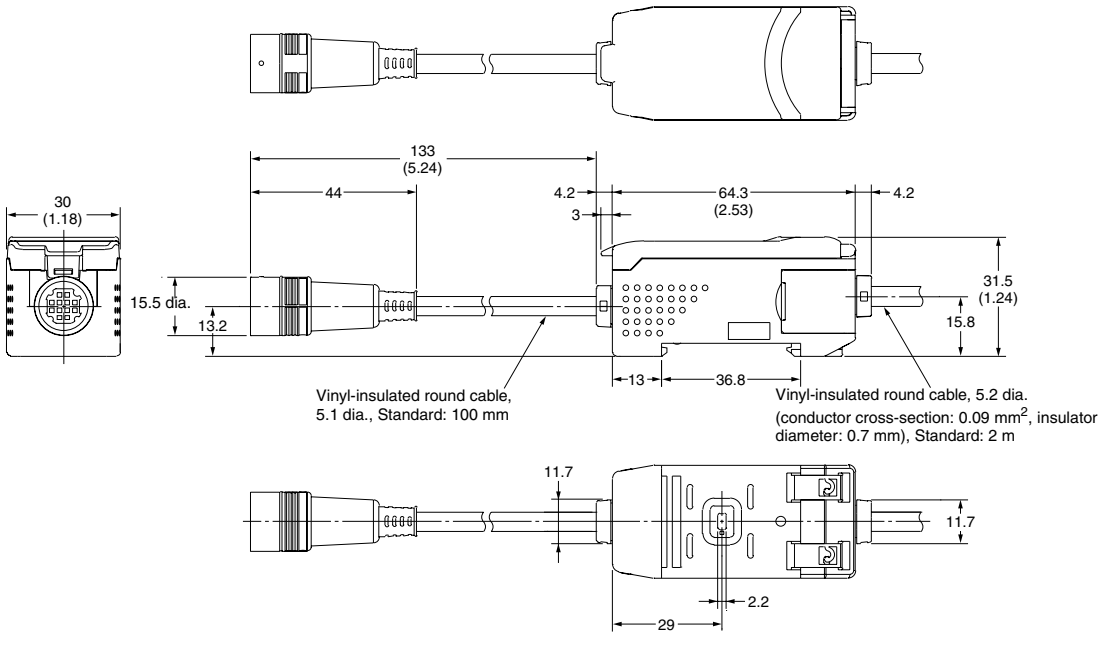


ZX-LT010



■ Amplifier Units

ZX-LDA11
ZX-LDA41

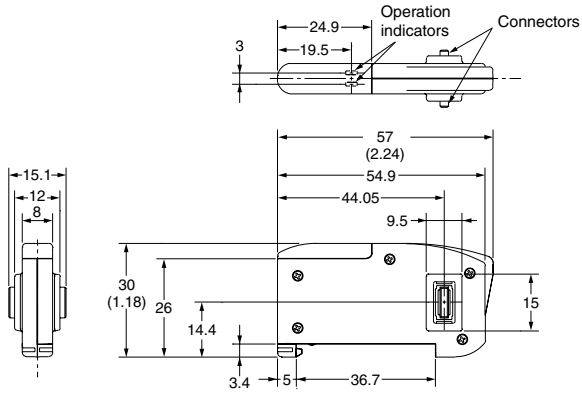


Accessories (Order Separately)

Unit: mm (inch)

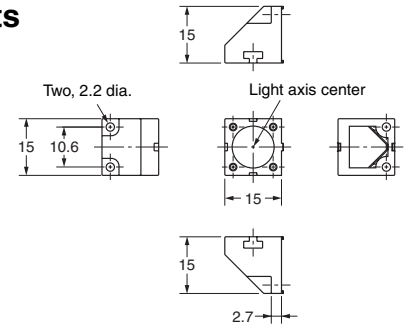
■ Calculating Unit

ZX-CAL

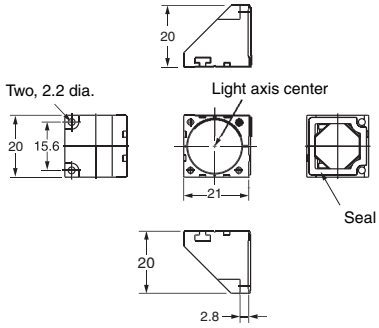


■ Side-view Attachments

ZX-XF12

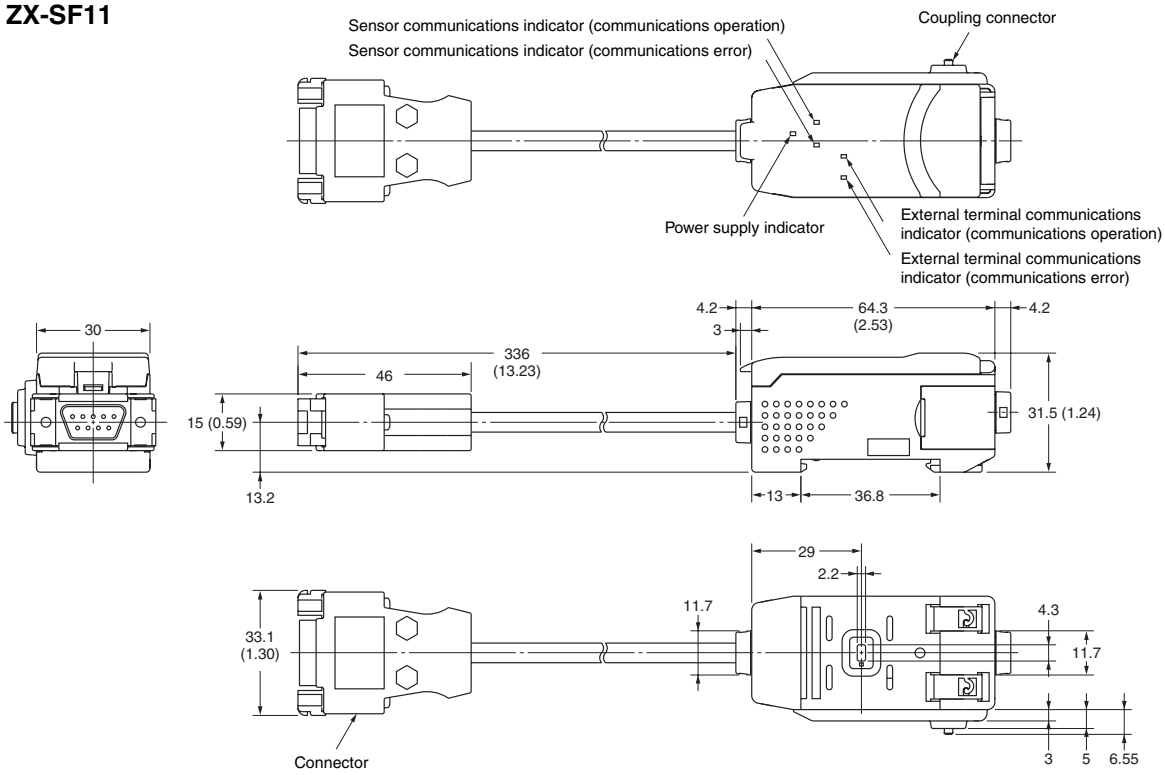


ZX-XF22



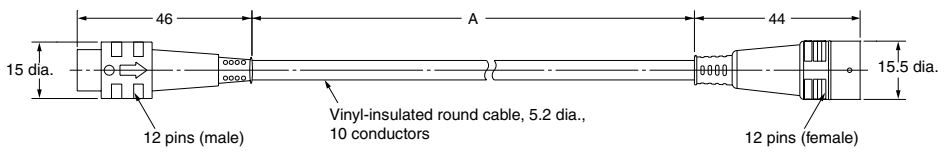
■ ZX-series Communications Interface Unit

ZX-SF11



■ Extension Cables with Connectors on Both Ends

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



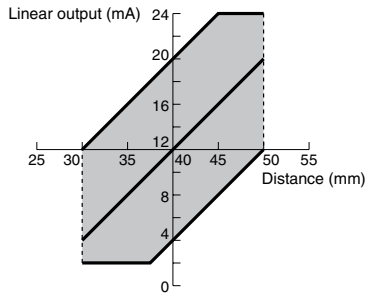
Measurement “A”
ZX-XC1A: 1,000 (39.37)
ZX-XC4A: 4,000 (157.48)
ZX-XC8A: 8,000 (314.96)
ZX-XC9A: 9,000 (354.33)

Linear Output vs. Sensing Distance

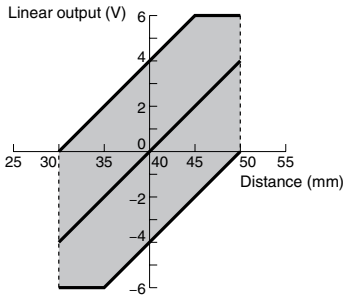
The output can be switched between a 4 to 20 mA current output and a -4 to +4 VDC voltage output using a switch on the Amplifier Unit. For a ±5 VDC, 0 to 5 VDC or 1 to 5 VDC output, use the Monitor Focus Functions setup on the Amplifier Unit.

ZX-LD40/LD40L

Current Output

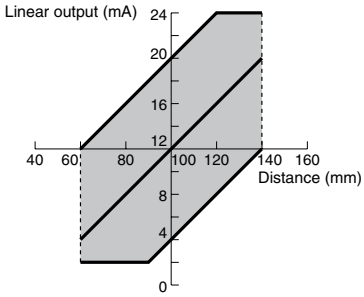


Voltage Output

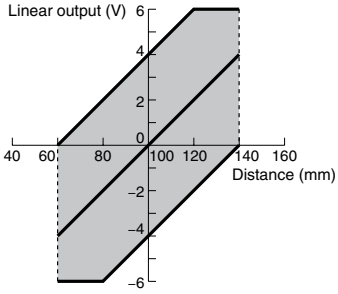


ZX-LD100/LD100L

Current Output

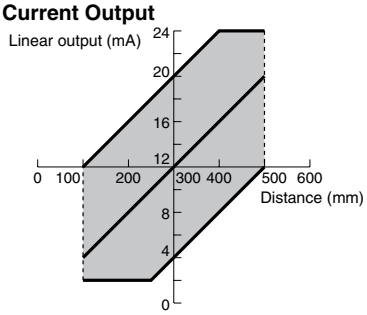


Voltage Output

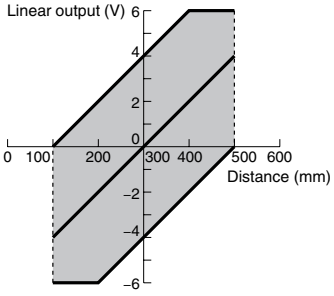


ZX-LD300/LD300L

Current Output

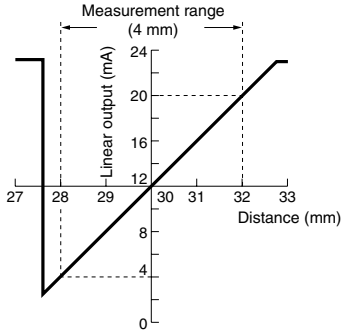


Voltage Output

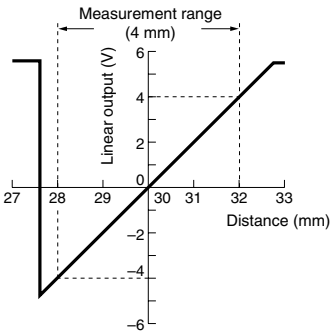


ZX-LD30V/LD30VL

Current Output



Voltage Output



Engineering Data (Typical)

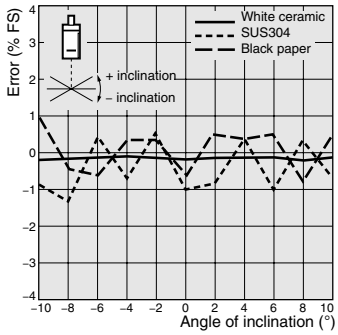
■ Angle Characteristic (Reflective Sensors)

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

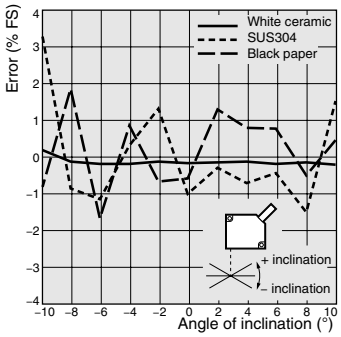
Note: SUS304 = Stainless steel SUS304

ZX-LD40

Side-to-side Inclination

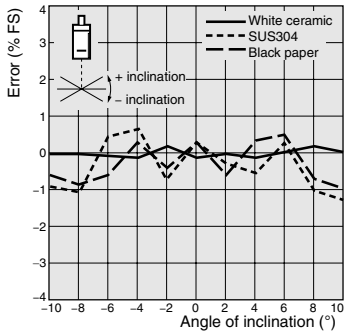


Front-to-back Inclination

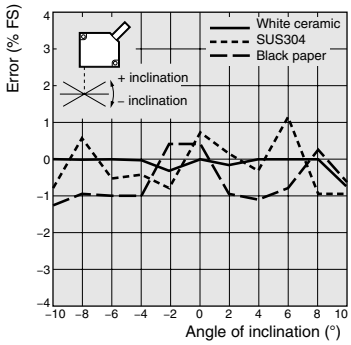


ZX-LD100

Side-to-side Inclination

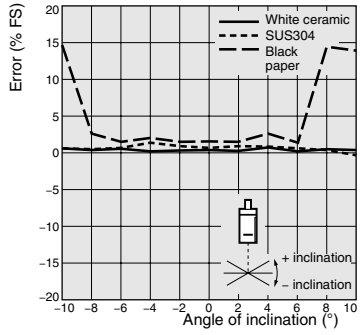


Front-to-back Inclination

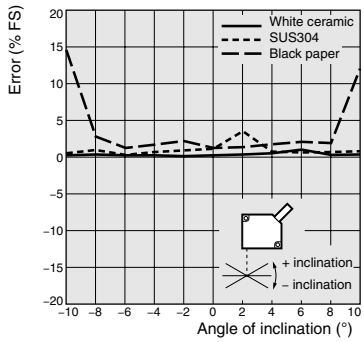


ZX-LD300

Side-to-side Inclination

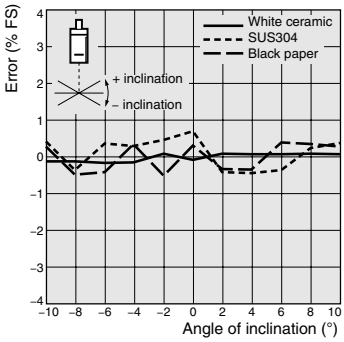


Front-to-back Inclination

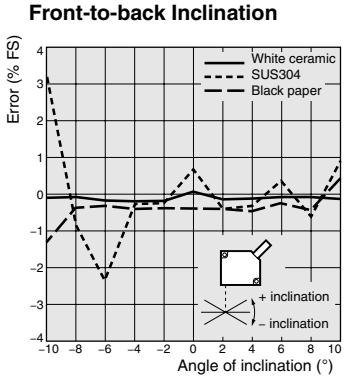


ZX-LD40L

Side-to-side Inclination

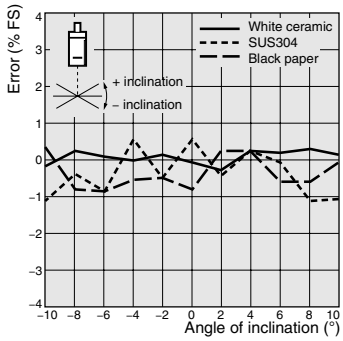


Front-to-back Inclination

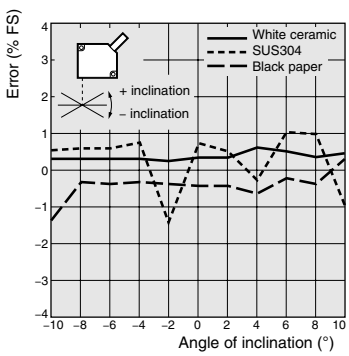


ZX-LD100L

Side-to-side Inclination

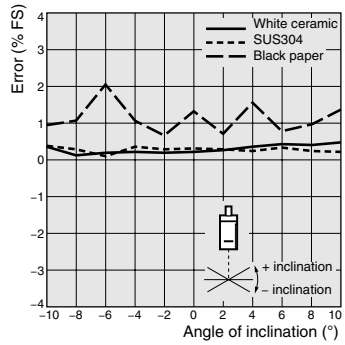


Front-to-back Inclination

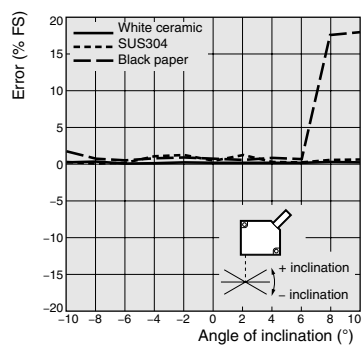


ZX-LD300L

Side-to-side Inclination

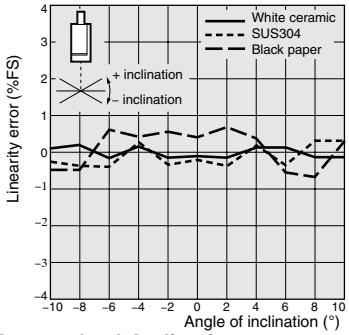


Front-to-back Inclination

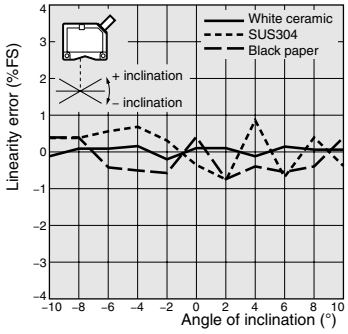


ZX-LD30V

Side-to-side Inclination

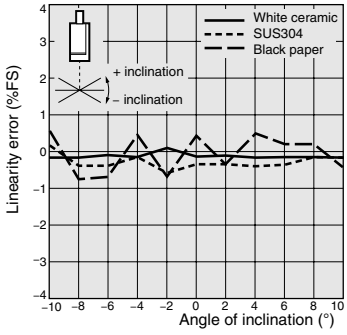


Front-to-back Inclination

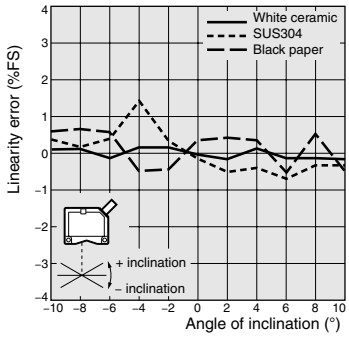


ZX-LD30VL

Side-to-side Inclination



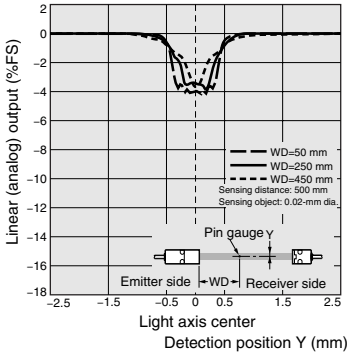
Front-to-back Inclination



■ Target Characteristics (Through-beam Sensors)

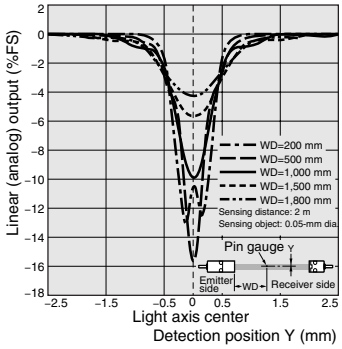
ZX-LT001

(For 0.02-mm-dia. pin gauge)



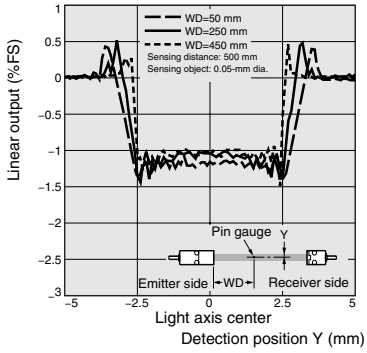
ZX-LT001

(For 0.05-mm-dia. pin gauge)



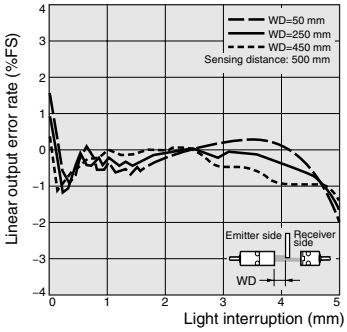
ZX-LT005

(For 0.05-mm-dia. pin gauge)



■ Linearity Characteristics

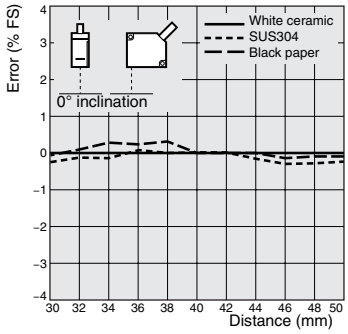
ZX-LT005



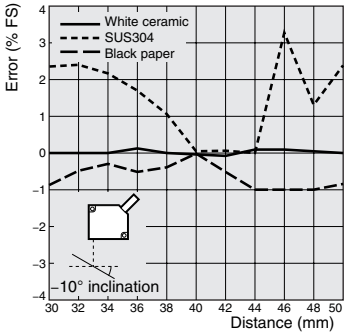
■ Linearity Characteristic for Different Materials (Reflective Sensors)

ZX-LD40

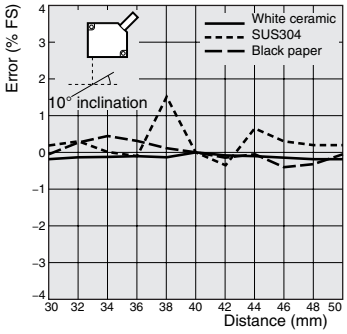
0° Inclination



−10° Inclination Front-to-back

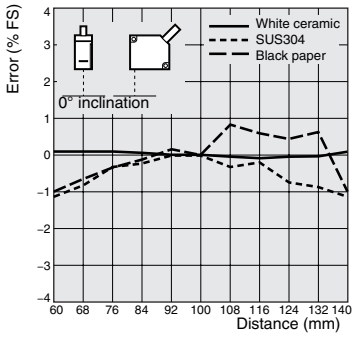


10° Inclination

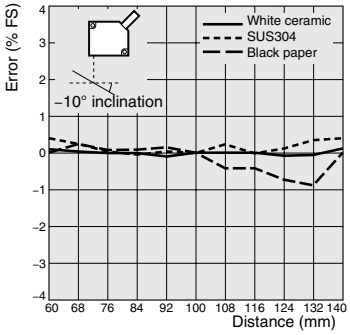


ZX-LD100

0° Inclination



−10° Inclination Front-to-back



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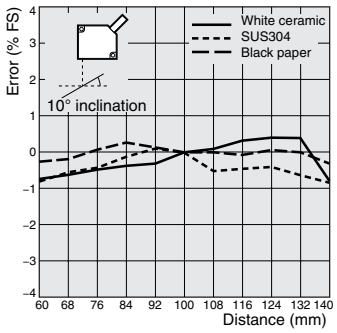

ZX-LD300

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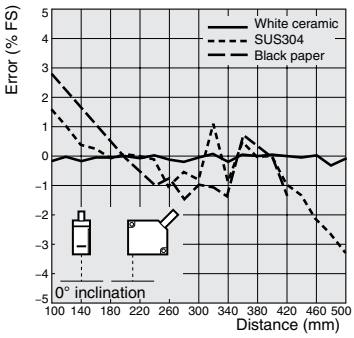

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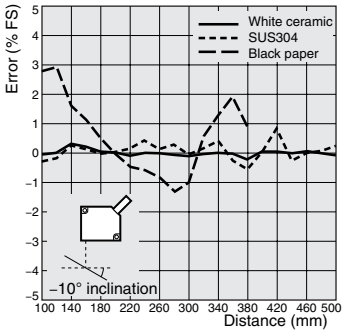

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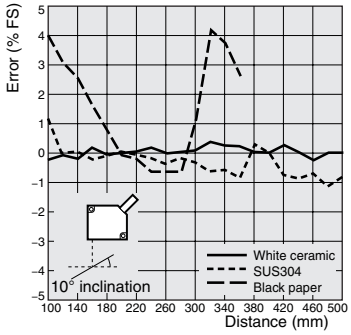

ZX-LD40L

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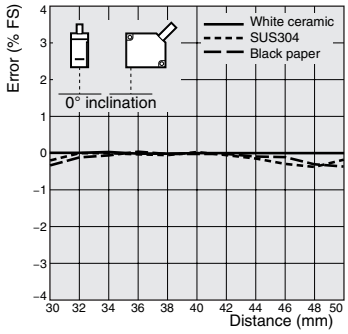

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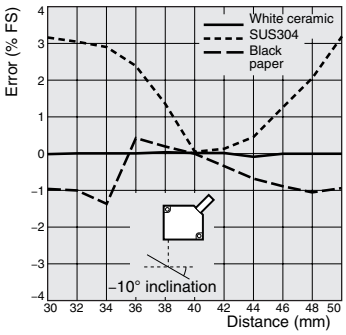

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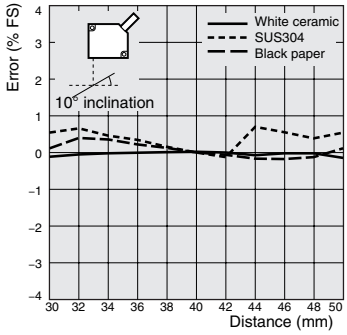

ZX-LD100L

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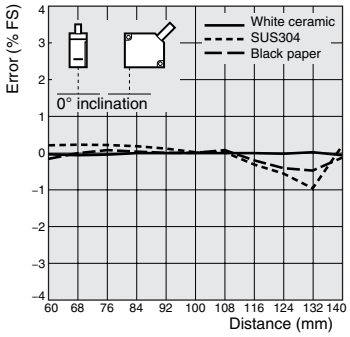

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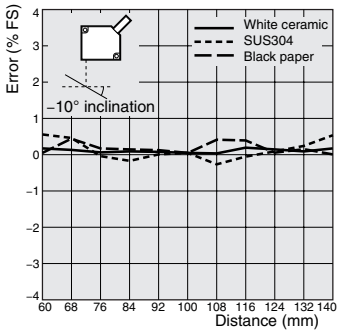

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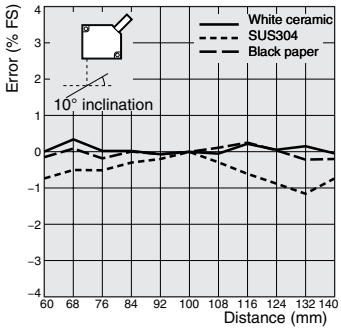

ZX-LD300L

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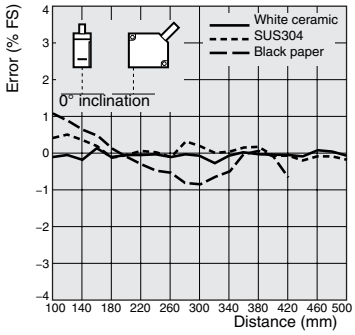

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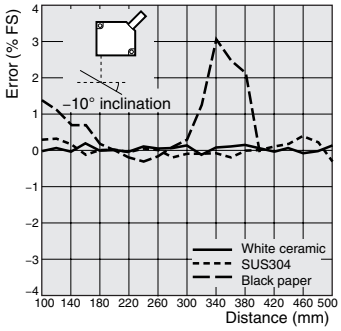

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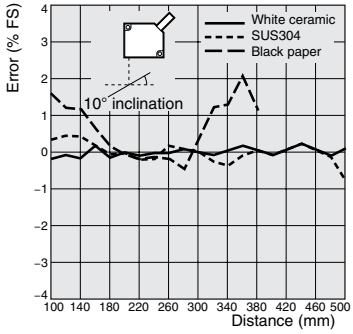
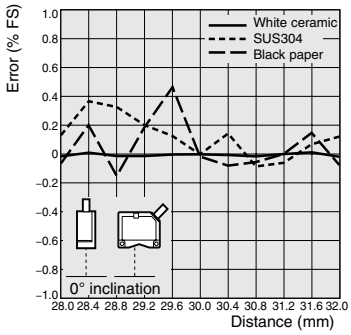


ZX-LD30V

0° Inclination



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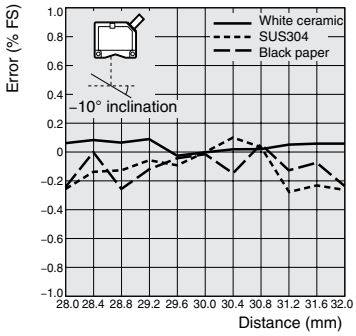

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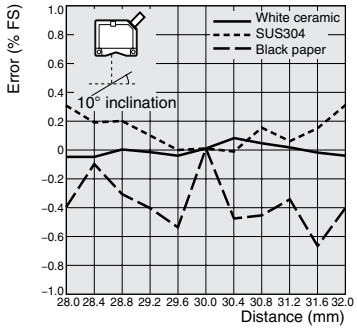

ZX-LD30VL

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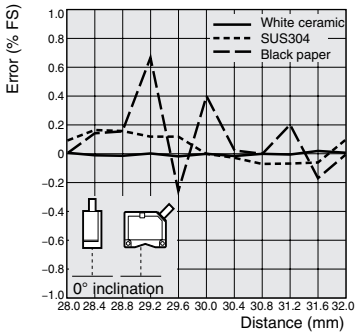

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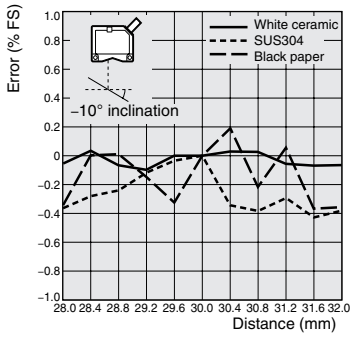

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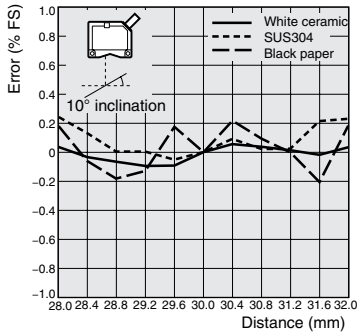
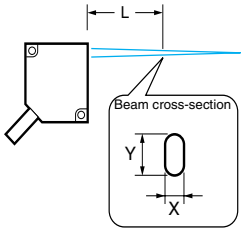


■ Beam Size (Reflective Sensors)

Spot Beams



ZX-LD40

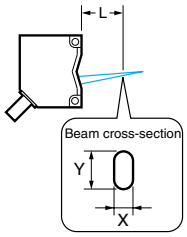
L	30 mm	40 mm	50 mm
X	240 μm	40.0 μm	250 μm
Y	350 μm	30.0 μm	370 μm

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

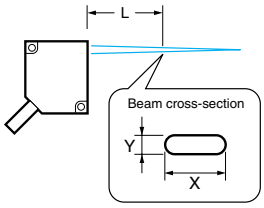
L	100 mm	300 mm	500 mm
X	1,050 μm	180 μm	1,100 μm
Y	450 μm	300 μm	850 μm



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-LD40L

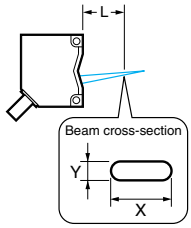
L	30 mm	40 mm	50 mm
X	2,000 μm	2,000 μm	2,000 μm
Y	240 μm	50.0 μm	250 μm

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



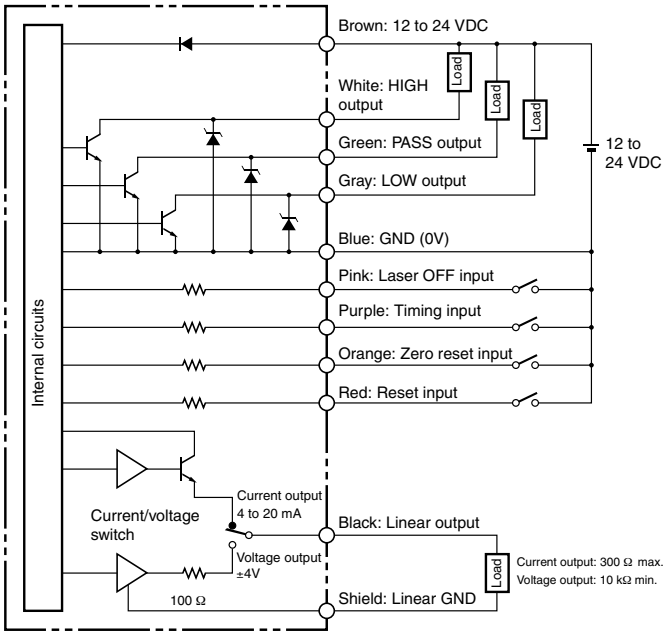
ZX-LD30VL

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

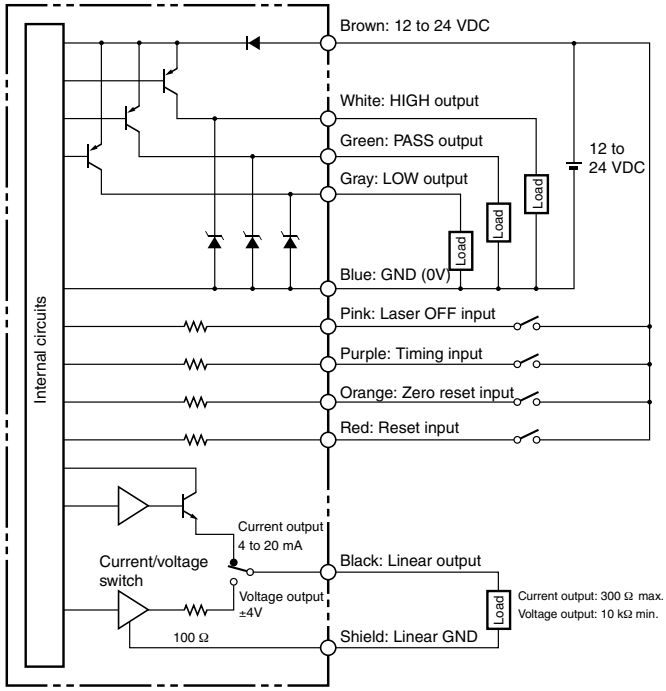
Installation

■ I/O Circuit Diagrams

NPN Amplifier Unit: ZX-LDA11

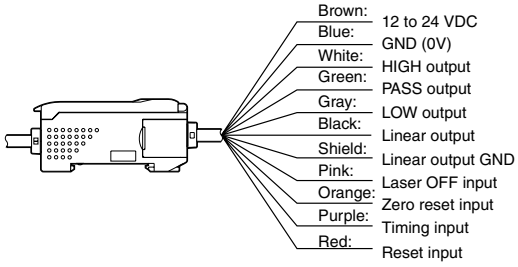


PNP Amplifier Unit: ZX-LDA41



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.

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 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

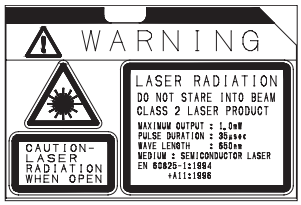
1. Do not use the Sensor in strong electromagnetic fields or in an environment where the operation of the Sensor is subject to the reflection of intense light (such as other laser beams or electric arc-welding machines.)
2. Do not operate the Sensor in the following locations:
   - Locations subject 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□□, ZX-LD□□L, ZX-LD□□V, and ZX-LD□□VL Sensor Heads are Class 2 Laser Products according to EN60825-1 (IEC825-1) and Class II Laser Products according to FDA (21 CFR1040.10) (See Note). The ZX-LT□□□ Sensor Heads are Class 1 and Class I Laser Products, respectively. 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

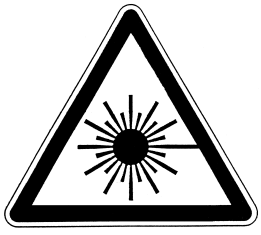


Figure A Warning label - Hazard symbol

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 cm^2 or less, DANGER if greater than 2.5 mW cm^{-2}.
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
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.

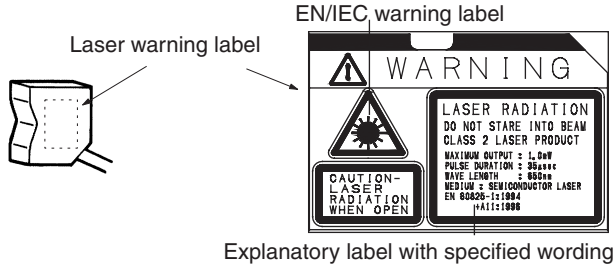
Note: Conditions for safe viewing of diffuse reflections for Class 3B visible lasers are: minimum viewing distance of 13 cm between screen and cornea and a maximum viewing time of 10 s. Other viewing conditions require a comparison of the diffuse reflection exposure with the MPE.

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

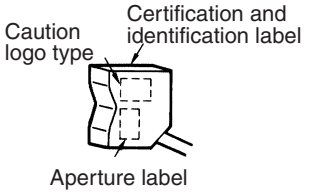
EN



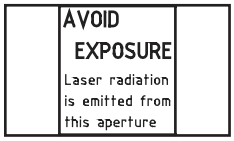
Explanatory label with specified wording

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

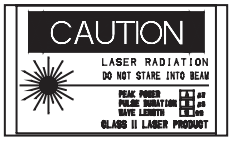
FDA



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.

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS. To convert millimeters into inches, divide by 25.4

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