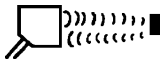
Sensing	Supply voltage	Output	
Ultrasonic beam  30 to 70 mm	12 to 24 VDC	 80 mA, 30 VDC	 4 to 20 mA

OMRON

Ultrasonic Displacement Sensor

E4DA

Sensor's Narrow Ultrasonic Beam Accurately Detects Small Objects, Provides Linear Analog Output For Inspection, Measurement

- Narrow 5 mm ultrasonic beam detects objects as small as 1 mm diameter at 50 mm distance with 0.2 mm resolution
- Ultrasonic beam can detect objects regardless of color
- Amplifier provides three inspection outputs–High, Pass and Low–and 4-20 mA analog output
- Fast, 2 ms response time
- Alarm output helps identify irregular beam reflection
- Input hold function retains previous input level up to 40 ms to stabilize operation
- External gate input and 40 ms OFF-delay available on amplifier
- Includes mounting hardware and 2 m (6.6 ft) cable

Ordering Information

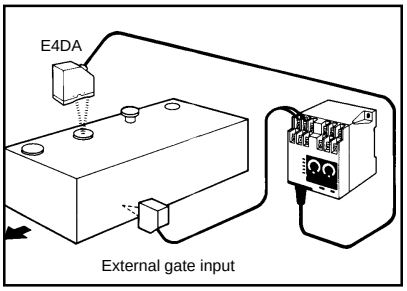
Description	Part number
Ultrasonic sensor head with 2 m (6.56 ft cable)	**E4DA-LS7**
Amplifier with three level outputs, alarm output	**E4DA-WL1C**
Extension cable between sensor and amplifier, 5 m (16.4 ft)	**E49-DD5**

■ REPLACEMENT PARTS

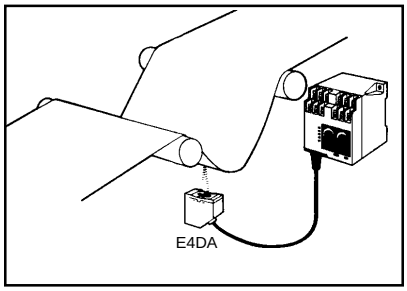
Description	Part number
Sensor mounting bracket; supplied with each sensor	**E39-L52**

■ TYPICAL APPLICATIONS

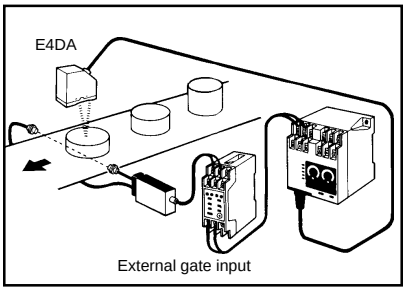
Checking proper height of inserted objects using external gate input to coordinate inspection



Analog feedback for precise web control



Measuring height of different objects on a conveyor using external gate input to coordinate inspection



Specifications

■ SENSOR E4DA-LS7

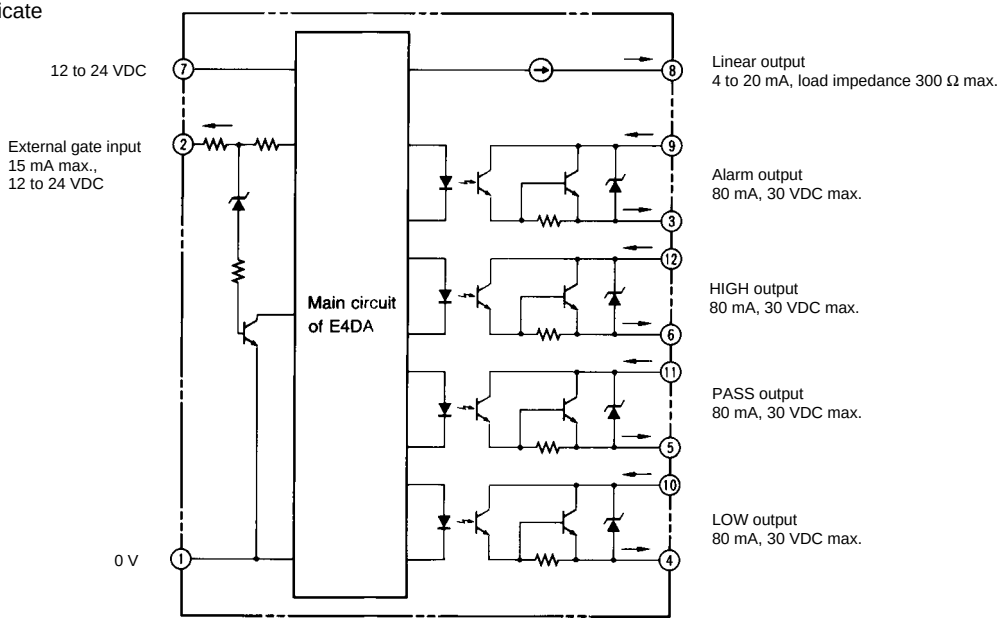
Method of detection		Ultrasonic displacement
Sensing distance		30 to 70 mm (1.18 to 2.76 in) with 40 x 40 mm (1.57 x 1.57 in) flat object
Minimum detectable object		1 mm (0.04 in) diameter at 50 mm (1.97 in) sensing distance without a background object
Resolution		0.2 mm (0.008 in) at 50 mm (1.97 in)
Differential travel		1 to 3% of 70 mm (2.76 in) rated sensing distance
Directional angle		±3° max.
Variation due to temperature changes		±4% full scale max. for output value at 25°C in ambient range of -10° to 55°C (14° to 131°F)
Variation due to voltage changes		±2% full scale max. over operating voltage range of 10.8 to 26.4 VDC
Indicators		SENSING (red LED)
Materials		Plastic case
Mounting		Side surface mount with two through holes. E39-L52 bracket and mounting hardware supplied.
Connections		Cable, 2 m (6.6 ft) length, supplied
Weight		130 g (4.6 oz.)
Enclosure ratings	UL	—
	NEMA	2
	IEC 144	IP66
Approvals	UL	—
	CSA	—
Ambient operating temperature		-10° to 55°C (14° to 131°F)

■ AMPLIFIER E4DA-WL1C

Supply voltage			12 to 24 VDC
Operating voltage			10.8 to 26.4 VDC; ripple 10% max. peak-to-peak
Current consumption			200 mA
Response time			2 ms
External gate input		Type	No-voltage contact or NPN solid-state input
		Signal voltage level	ON: 0 to 1 V, 1 mA minimum OFF: 4 to 24 V, 15 mA max. or open between terminals
Control outputs	Analog	Range	4 to 20 mA, 300 Ω max. load impedance
		Linearity	±1% full scale max.
	ON/OFF	Number	Three (HIGH, PASS, LOW)
		Type	Optoisolated transistor outputs
		Rating	80 mA, 30 VDC max.
		Residual voltage	1 V max.
	Alarm	Number	One
		Type	Optoisolated transistor output
		Rating	80 mA, 30 VDC max.
		Residual voltage	1 V max.
Materials			Plastic case
Mounting			Two through holes for surface mounting using M4 screws
Connection			Screw terminals
Weight			230 g (8.1 oz.)
Enclosure ratings		UL	—
		NEMA	—
		IEC 144	IP30
Approvals		UL	—
		CSA	—
Ambient operating temperature			-10° to 55°C (14° to 131°F)

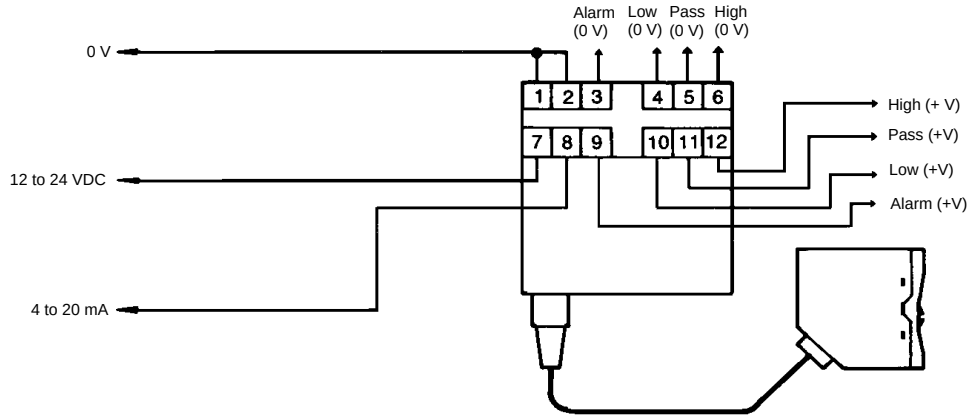
■ OUTPUT CIRCUIT DIAGRAM

The figures in small circles indicate terminal numbers.



Connections

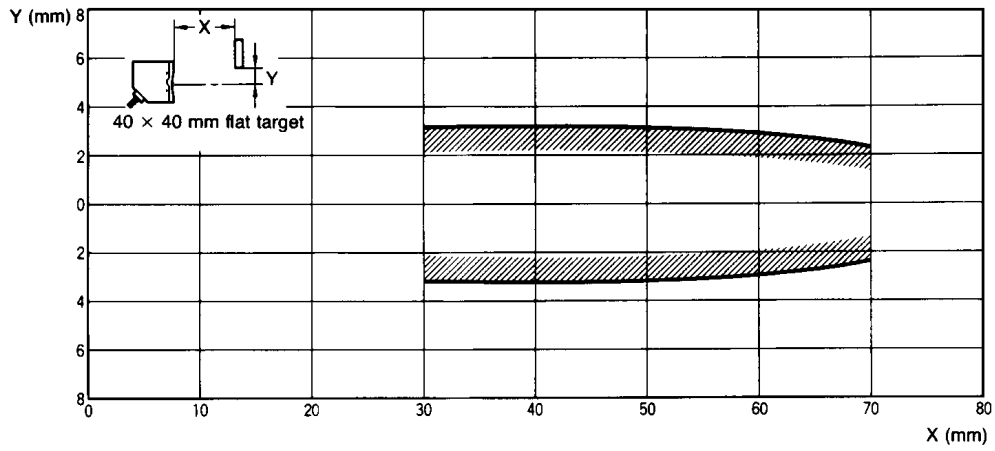
Terminals 1 and 2 are intentionally shorted. To use an external gate input, connect an external switching device (NPN output sensor or no-voltage contact switch) to terminals 1 and 2.



Engineering Data

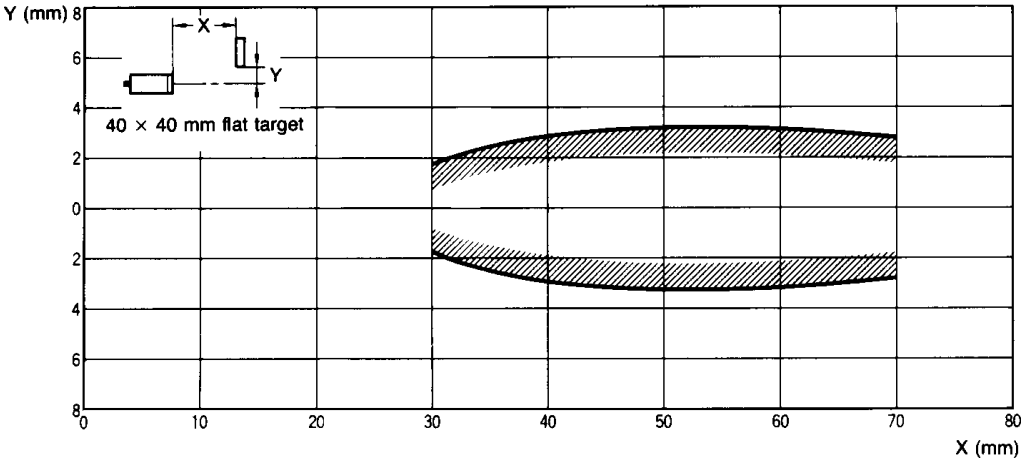
■ OPERATING RANGE

The operating range depends on the target object's direction of approach.

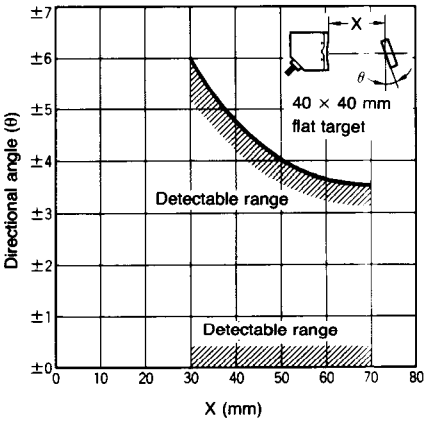


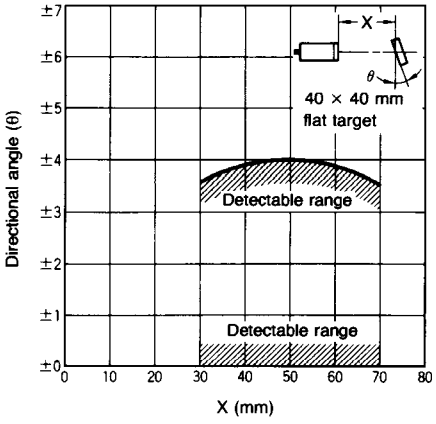
■ OPERATING RANGE (continued)

The operating range depends on the target object's direction of approach.



■ DIRECTIONAL ANGLE vs. OPERATING DISTANCE



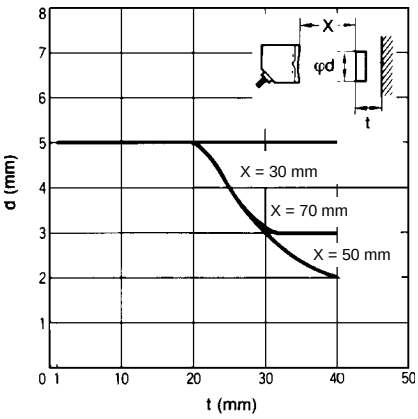


Note :
1. The maximum allowable inclination angle depends on the target object's direction of approach.
2. To reduce the influence of inclination, use the sensor within the detecting distance range of 30 to 50 mm.
3. If surface roughness or unevenness of the detected object affects the operation, use the input hold function described in "Operation" to make the output stable.

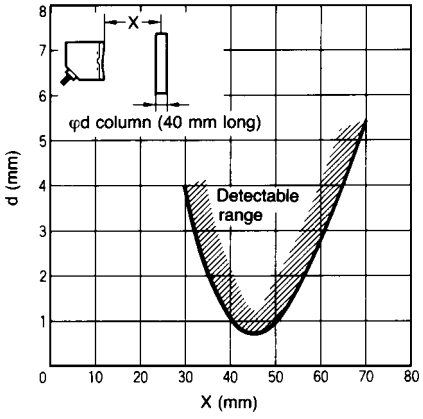
■ MINIMUM DETECTABLE OBJECT

The size of the minimum detected object depends on whether or not a background object is present.
To detect a very small object, keep the background at least 40 mm away from the object.

With Background Object

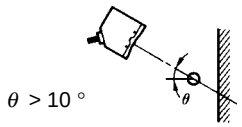


Without Background Object



■ DETECTING ROUND OBJECTS

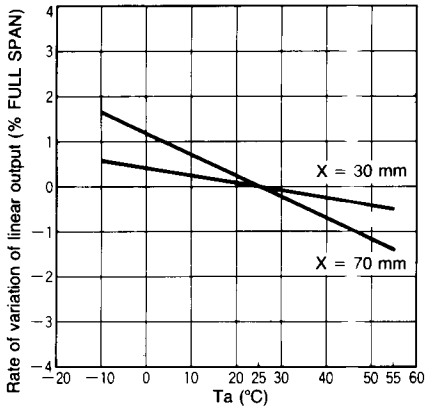
Use the layout at right to detect round objects when a background object is present.



■ INFLUENCE OF TEMPERATURE VARIATION

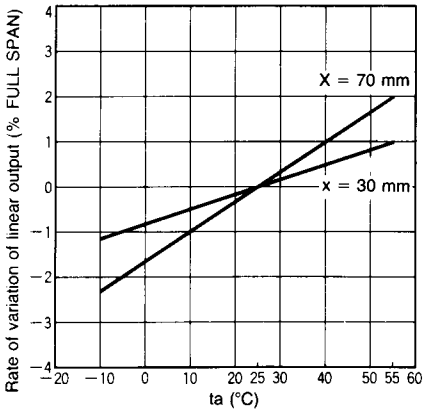
The influence of temperature variation depends on the detecting distance.

Sensor and Amplifier at the Same Temperature



Both sensor and amplifier: same and variable temperature

Sensor at Variable Temperature, Amplifier at 25°C

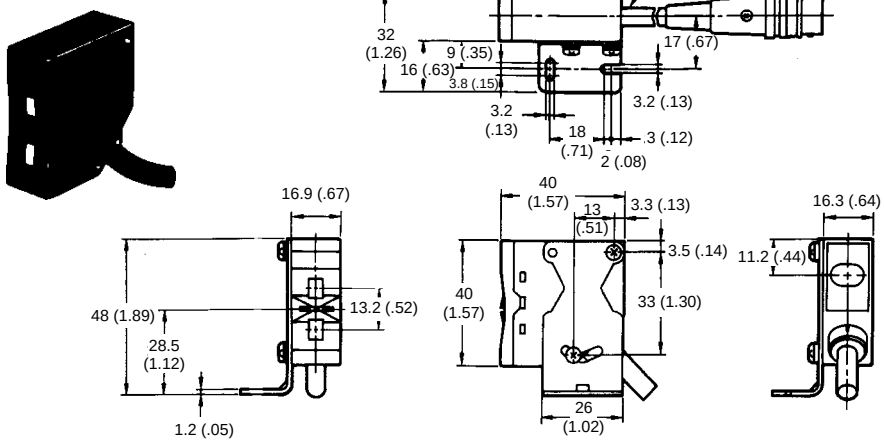


Sensor variable temperature Amplifier constant 25°C

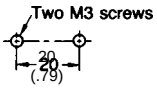
Dimensions

Unit: mm (inch)

■ SENSOR E4DA-LS7

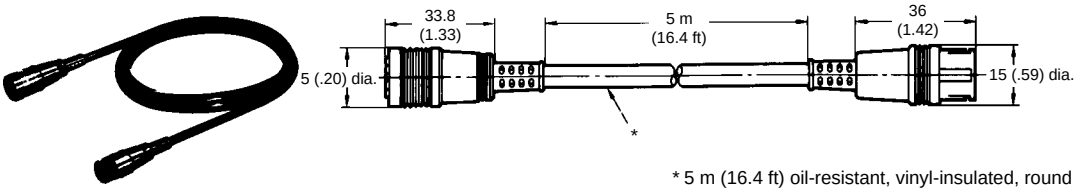


Mounting holes



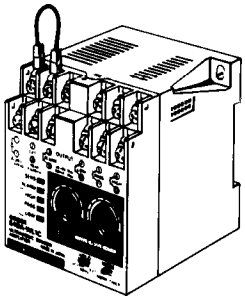
* 2 m (6.56 ft) oil-resistant, vinyl-insulated, shield wire, 6 mm OD

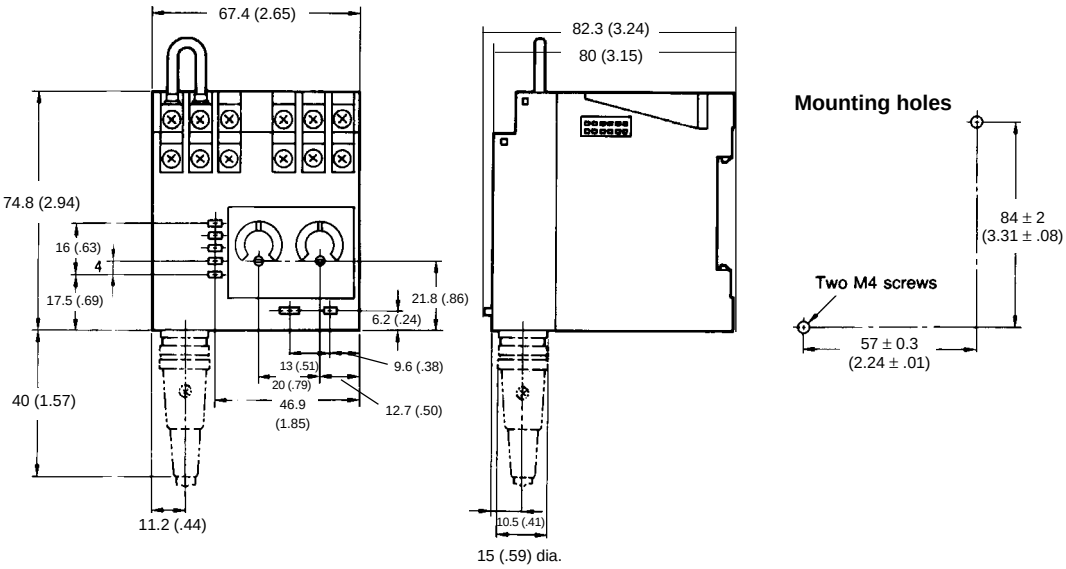
■ OPTIONAL EXTENSION CABLE E49-DD5



* 5 m (16.4 ft) oil-resistant, vinyl-insulated, round Outside 6 dia. 5 m

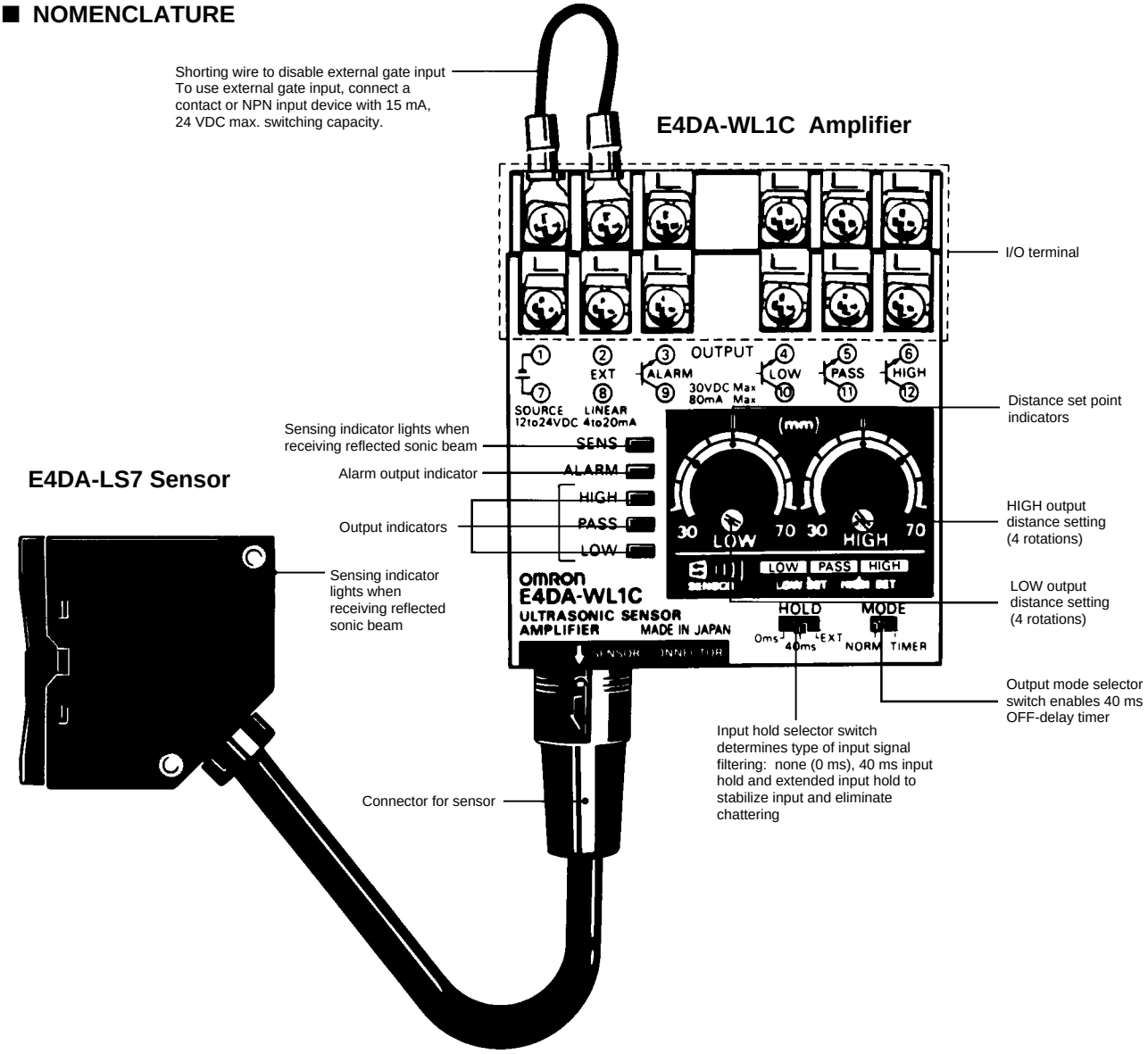
■ AMPLIFIER E4DA-WL1C





Operation

■ NOMENCLATURE



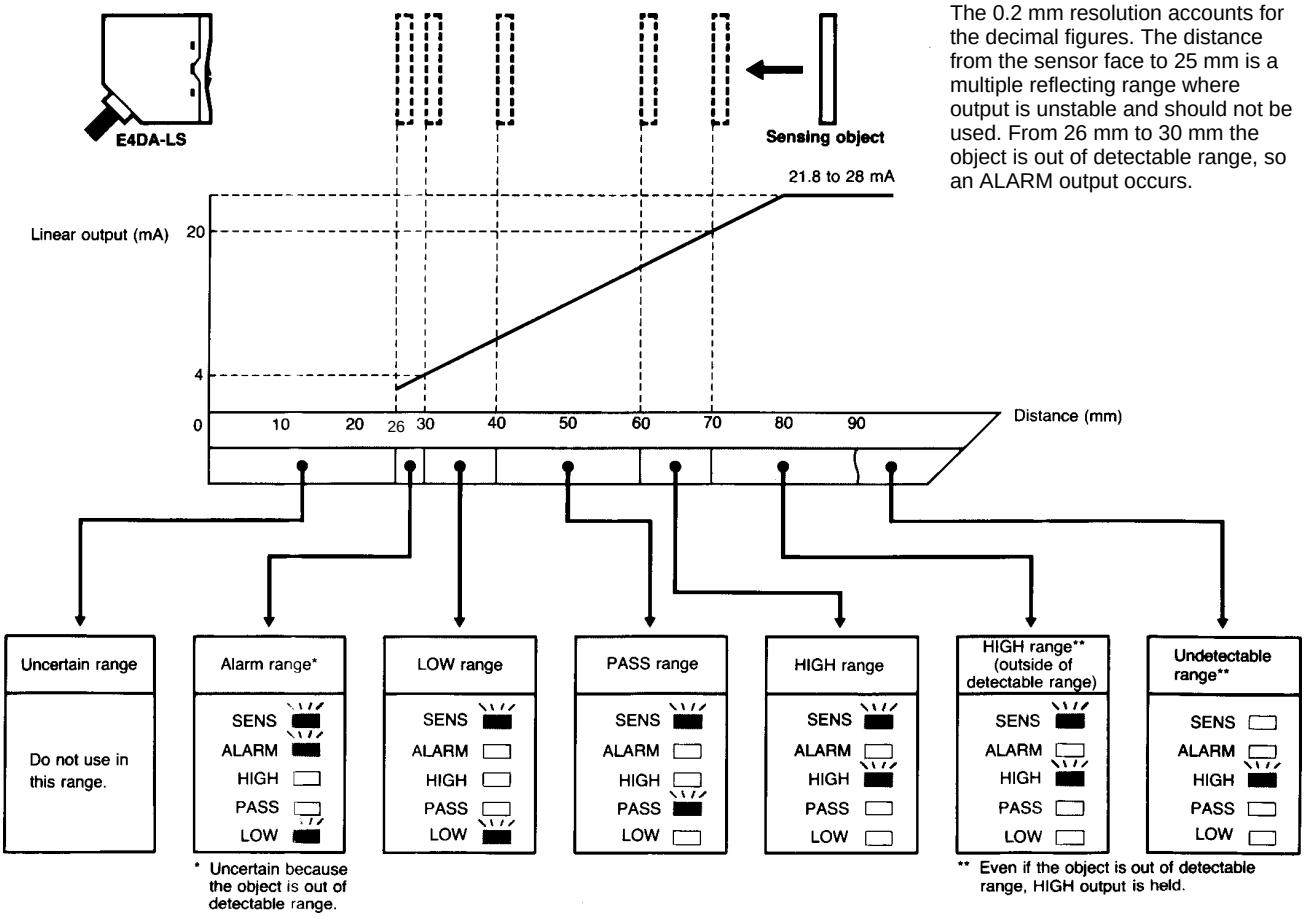
■ THREE-STAGE CONTROL OUTPUT

The two variable distance adjusters on the amplifier front panel are used to establish three control output stages from the 4 to 20 mA input signal. Each four-turn adjuster allows fine tuning of the setting. The reference scale above the adjuster is in 5 mm increments. The linear output current is proportional to the distance to the detected object and is independent of the distance settings.

In the example below, the LOW setting is at 40 mm and the HIGH setting is at 60 mm. The table below summarizes the three output ranges:

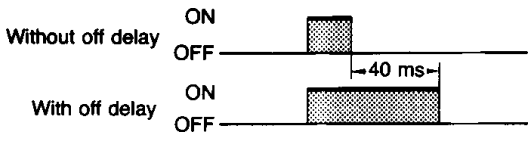
LOW range	30 to 39.8 mm
PASS range	40 to 60 mm
HIGH range	60.2 to 70 mm

The 0.2 mm resolution accounts for the decimal figures. The distance from the sensor face to 25 mm is a multiple reflecting range where output is unstable and should not be used. From 26 mm to 30 mm the object is out of detectable range, so an ALARM output occurs.



■ OUTPUT OFF-DELAY FUNCTION

The E4DA amplifier's response time of 2 ms may provide an output signal too fast for a programmable controller to read. The timer function provides a 40 ms OFF-delay that holds only the PASS output for the full duration. The High and Low outputs are disabled and do not operate during the OFF-delay. Regardless of whether the gate input is used, the OFF-delay timer will operate. The output OFF-delay timer is independent of the input HOLD timing.

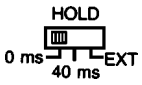


MODE NORM TIMER	No timer function. Disables OFF-delay timer.
MODE NORM TIMER	40 ms OFF-delay enabled. Holds only the PASS output for the full duration.

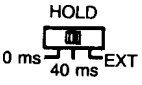
■ INPUT HOLD FUNCTION

When the detected object tilts or when it has a rough surface that absorbs the ultrasonic beam, the E4DA sensor may judge that there is no detected object or the signal has not been returned, causing the output to be unstable (chatter). The input hold function, stabilizes detection by adding a time delay until the next stable input is received.

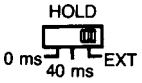
The three-position slide switch located on the front panel of the amplifier, has settings for 0 ms, 40 ms (for time delay) and EXT for extended delay.



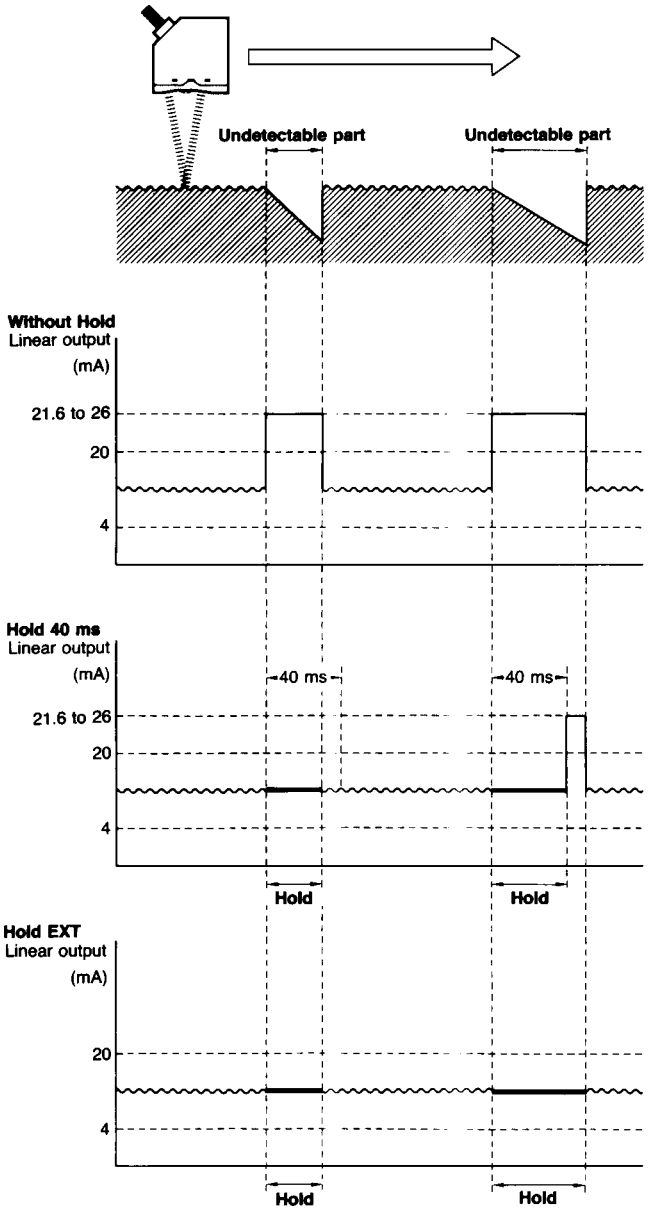
The 0 ms setting disables the input hold function.



The 40 ms setting enables an internal timer to hold a stable input value for up to 40 ms until a new stable value is input. The hold function is automatically cancelled when a new stable value is input.



The EXT setting provides an extended hold period until a new stable input value is received.



Precautions

■ INSTALLATION AND MAINTENANCE PRECAUTIONS

Avoid mutual interference by placing sensors side by side, more than 5 mm apart. Mutual interference occur when the object is inclined or when sensors are mounted opposite one another.

Avoid the following environmental conditions that adversely affect the sound wave transmission through the air:

- locations subject to air convection
- locations with temperature differences within the sensing area
- rapid change in air flow within the operating range of the sensor
- use of a transceiver near the sensor

Ultrasonic sensors may not be capable of detecting sound-absorbent materials, including: cotton, powders, foam, froth, soft porous materials, etc.

Condensation or drops of water on the vibrator surface of the ultrasonic sensor may decrease detecting distance.

A 10-minute warm-up period is required from power-up to allow the linear output to stabilize.

Clean dust off the vibrator surface of the sensor using a blast of air or a cotton swab. Do not apply pressure on the vibrator surface.

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

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