

# Long-distance Separate-amplifier Proximity Sensors

## ES Series

### Features

- Detecting distance twice that of conventional sensors
- Detecting distance easily adjustable
- Wide range of sensor head types available
- Built-in alarm output

### Detecting Distance

Shielded – Up to 8 mm (0.31")

Non-shielded – Up to 70 mm (2.76")



Refer to P.609 for a list of products complying with EMC directive.

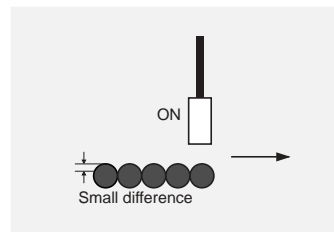
## Description

### Long-detecting distance

A separate amplifier gives the ES Series twice the detecting distance of self-contained proximity sensors.

### Detecting distance can be easily adjusted

The ES Series doesn't need precise adjustments to sensor position during setup. You can adjust the detecting distance using the adjustment trimmer after the sensor head is installed or during operation, when necessary. Because of its small hysteresis, the ES Series can detect minute height differences of continuously moving objects.



### Dust cover (ES-X38)

The ES-X38 is equipped with a dust cover to protect the amplifier. The hinged cover remains on the amplifier when opened or closed.



### 17 models of sensor heads available

Sensor heads are available in sizes ranging from 2.8 mm to 90.0 mm 0.11" to 3.54" in diameter.

- **Protected cable (EH-305S/308S/110S)**

The sensor cable is encased in a stainless steel spiral tube to prevent breakage.



- **Compact size (EH-402)**

The smallest ES Series proximity sensor, with a sensor head 2.8 mm 0.11" in diameter, offers the maximum detecting distance of 7 mm 0.28".



- **Space-saving (EH-614A)**

The ES Series thin-type sensor is only 4.8 mm 0.19" thick, enabling it to be installed in areas of limited space.



- **Resistant to welding spatter (optional)**

The Teflon® cap protects the sensor head (EH-308/110/114) from welding spatters.



- **Oil-resistant (EH-108)**

Precision-machined stainless steel and a special sealing mechanism makes the EH-108 highly resistant to oil.

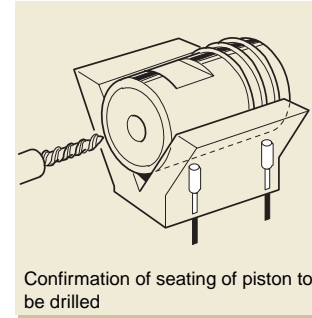
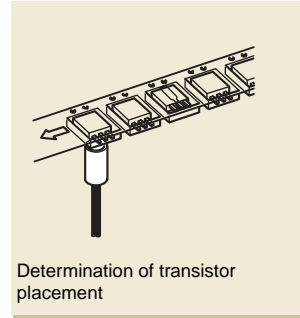
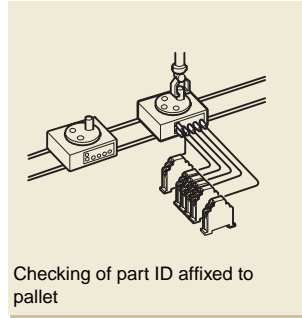
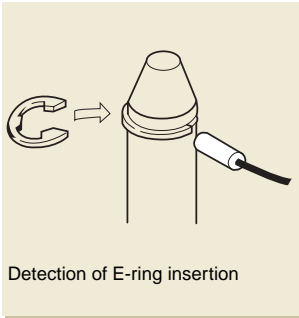


For More Info & Data

[www.keyence.com/askg](http://www.keyence.com/askg)

- Photoelectric Sensors
- Safety Light Curtain
- Proximity Sensors**
- Pressure Sensors
- PLCs
- Counters, Timers
- Bar Code Readers
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- Thrubeam Measuring
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## Applications



## Selection Chart




### Sensor head

	Type	Size	Shape	Detecting distance	Model
<b>Shielded</b>	Cylindrical	2.8 mm dia. 0.11"		1.2 mm 0.05" (0.6 mm) 0.02"	EH-302
		3.8 mm dia. 0.15"		2 mm 0.08" (0.8 mm) 0.03"	EH-303A
		5.4 mm dia. 0.21"		3 mm 0.12" (1 mm) 0.04"	EH-305
	Cylindrical, with spiral tube	5.4 mm dia. 0.21"		3 mm 0.12" (1 mm) 0.04"	EH-305S
	Cylindrical	8 mm dia. 0.31"		5 mm 0.20" (2 mm) 0.08"	EH-308
	Cylindrical, with spiral tube	8 mm dia. 0.31"		5 mm 0.20" (2 mm) 0.08"	EH-308S
	Threaded, oil-resistant	M8		2.5 mm 0.10" (1.5 mm) 0.06"	EH-108
	Threaded	M10		5 mm 0.20" (2 mm) 0.08"	EH-110
	Threaded, with spiral tube	M10		5 mm 0.20" (2 mm) 0.08"	EH-110S
	Threaded	M14		8 mm 0.31" (5 mm) 0.20"	EH-114
Thin	t=4.8 mm 0.19"		8 mm 0.31" (5 mm) 0.20"	EH-614A	
<b>Non-shielded</b>	Cylindrical	2.8 mm dia. 0.11"		7 mm 0.28" (3 mm) 0.12"	EH-402
	Cylindrical, Threaded	14.5 mm dia. 0.57"		13 mm 0.51" (6 mm) 0.24"	EH-416
		22 mm dia. 0.87"		18 mm 0.71" (9 mm) 0.35"	EH-422
		30 mm dia. 1.18"		25 mm 0.98" (12 mm) 0.47"	EH-430
		40 mm dia. 1.57"		36 mm 1.42" (18 mm) 0.71"	EH-440
Cylindrical	90 mm dia. 3.54"		70 mm 2.76" (35 mm) 1.38"	EH-290	

Stable detecting distance      Maximum detecting distance

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## Amplifier

Shape	Power supply	Output	Output mode	Model
	10 to 28 VDC	NPN 200 mA (40 V) max.	N.O./ N.C. selectable	ES-32DC
	85 to 115 VAC	Thyristor output 115 VAC, 5 to 300 mA	N.O./ N.C. selectable	ES-12AC <sup>1</sup>
	12 to 24 VDC	NPN 100 mA (40 V) max.	N.O./ N.C. selectable	ES-X38
	85 to 240 VAC	Thyristor output 240 VAC, 5 to 300 mA	N.O.	ES-11AC <sup>1</sup>
			N.C.	ES-21AC <sup>1</sup>

1. This product does not comply with the EMC directive.

## Specifications

### Sensor head

Type	Shielded				
	Cylindrical				Threaded
Model	EH-302	EH-303A	EH-305	EH-308	EH-110
Stable detecting range	0 to 0.6 mm 0.02"	0 to 0.8 mm 0.03"	0 to 1 mm 0.04"	0 to 2 mm 0.08"	
Maximum detecting distance	1.2 mm 0.05"	2 mm 0.08"	3 mm 0.12"	5 mm 0.20"	
Detectable object	Ferrous metals (see Characteristics for nonferrous metals)				
Standard target (iron, t=1 mm 0.04")	5 x 5 mm 0.20"			10 x 10 mm 0.39"	
Repeatability	0.002 mm 0.00008"			0.005 mm 0.0002"	
Hysteresis	0.04 mm 0.002"	0.05 mm 0.002"		0.04 mm 0.002"	
Temperature fluctuation	±10% max. (EH-302: -10 to +20%) of detecting distance at +23°C (73.4°F), within -10 to +60°C (14 to 140°F)				
Enclosure rating	IP-67				
Ambient temperature	-10 to +60°C (14 to 140°F), No freezing				
Relative humidity	35 to 85%, No condensation				
Weight (including nuts and 3-m 9.8' cable)	Approx. 29 g	Approx. 38 g	Approx. 45 g	Approx. 47 g	Approx. 55 g

Type	Shielded		
	Threaded	Thin	Oil-resistant
Model	EH-114	EH-614A	EH-108 <sup>1</sup>
Stable detecting range	0 to 5 mm 0.20"		0 to 1.5 mm 0.06"
Maximum detecting distance	8 mm 0.31"		2.5 mm 0.10"
Detectable object	Ferrous metals (see Characteristics for nonferrous metals)		
Standard target (iron, t=1 mm 0.04")	15 x 15 mm 0.59"		10 x 10 mm 0.39"
Repeatability	0.005 mm 0.0002"		
Hysteresis	0.05 mm 0.002"		0.07 mm 0.003"
Temperature fluctuation	±10% max. of detecting distance at +23°C (73.4°F), within -10 to +60°C (14 to 140°F)		
Enclosure rating	IP-67		
Ambient temperature	-10 to +60°C (14 to 140°F), No freezing		
Relative humidity	35 to 85%, No condensation		
Weight (including nuts and 3-m 9.8' cable)	Approx. 62 g	Approx. 57 g	Approx. 51 g

1. Not designed for immersed use.

Type	Shielded; Spiral tube			Non-shielded	
	Cylindrical		Threaded	Cylindrical	Cylindrical and threaded
	EH-305S	EH-308S	EH-110S	EH-402	EH-416
Stable detecting range	0 to 1 mm <b>0.04"</b>	0 to 2 mm <b>0.08"</b>		0 to 3 mm <b>0.12"</b>	0 to 6 mm <b>0.24"</b>
Maximum detecting distance	3 mm <b>0.12"</b>	5 mm <b>0.20"</b>		7 mm <b>0.28"</b>	13 mm <b>0.51"</b>
Detectable object	Ferrous metals (see Characteristics for nonferrous metals)				
Standard target (iron, t=1 mm <b>0.04"</b> )	5 x 5 mm <b>0.20"</b>	10 x 10 mm <b>0.39"</b>			20 x 20 mm <b>0.79"</b>
Repeatability	0.002 mm <b>0.00008"</b>	0.005 mm <b>0.0002"</b>		0.002 mm <b>0.00008"</b>	0.012 mm <b>0.0005"</b>
Hysteresis	0.05 mm <b>0.002"</b>	0.04 mm <b>0.002"</b>			0.05 mm <b>0.002"</b>
Temperature fluctuation	±10% max. (EH-402: +30%, -10% max.) of detecting distance at +23°C (73.4°F), within -10 to +60°C (14 to 140°F)				
Enclosure rating	IP-67				
Ambient temperature	-10 to +60°C (14 to 140°F), No freezing				
Relative humidity	35 to 85%, No condensation				
Weight (including nuts and 3-m <b>9.8'</b> cable)	Approx. 76 g	Approx. 88 g	Approx. 100 g	Approx. 28 g	Approx. 72 g

Type	Non-shielded			
	Cylindrical and threaded			Cylindrical
	EH-422	EH-430	EH-440	EH-290
Stable detecting range	0 to 9 mm <b>0.35"</b>	0 to 12 mm <b>0.47"</b>	0 to 18 mm <b>0.71"</b>	0 to 35 mm <b>1.38"</b>
Maximum detecting distance	18 mm <b>0.71"</b>	25 mm <b>0.98"</b>	36 mm <b>1.42"</b>	70 mm <b>2.76"</b>
Detectable object	Ferrous metals (see Characteristics for nonferrous metals)			
Standard target (iron, t=1 mm <b>0.04"</b> )	25 x 25 mm <b>0.98"</b>	30 x 30 mm <b>1.18"</b>	40 x 40 mm <b>1.57"</b>	150 x 150 mm <b>5.91"</b>
Repeatability	0.02 mm <b>0.0008"</b>	0.025 mm <b>0.001"</b>	0.037 mm <b>0.001"</b>	0.075 mm <b>0.003"</b>
Hysteresis	0.06 mm <b>0.002"</b>	0.08 mm <b>0.003"</b>	0.1 mm <b>0.004"</b>	0.2 mm <b>0.008"</b>
Temperature fluctuation	±10% max. (EH-402: +30%, -10% max.) of detecting distance at +23°C (73.4°F), within -10 to +60°C (14 to 140°F)			
Enclosure rating	IP-67			
Ambient temperature	-10 to +60°C (14 to 140°F), No freezing			
Relative humidity	35 to 85%, No condensation			
Weight (including nuts and 3-m <b>9.8'</b> cable)	Approx. 175 g	Approx. 225 g	Approx. 280 g	Approx. 650 g

### Amplifier

Type	DC		AC		
	ES-32DC	ES-X38	ES-12AC <sup>1</sup>	ES-11AC <sup>1</sup>	ES-21AC <sup>1</sup>
Power supply	10 to 28 VDC	12 to 24 VDC	85 to 115 VAC 50/60 Hz	85 to 240 VAC 50/60 Hz	85 to 240 VAC 50/60 Hz
Current/power consumption	18 mA max.	25 mA max.	1.5 VA max.	1 VA max.	1 VA max.
Response time	1 ms max.		10 ms max.		
Temperature fluctuation	±8% of detecting distance at +23°C (73.4°F), within 0 to +50°C (32 to 122°F)				
Sensitivity adjustment	15-turn trimmer				
Operation mode	N.O./N.C. (switch-selectable)			N.O.	N.C.
Indicator	Output: Red LED				
Control output	NPN: 200 mA (40 V) max. Residual voltage: 1 V max.	NPN: 100 mA (40 V) max. Residual voltage: 1 V max.	Thyristor 115 VAC, 5 to 300 mA	Thyristor 240 VAC, 5 to 300 mA	
Disconnection alarm output	NPN: 100 mA (40 V) max. Residual voltage: 1 V max.		—		
Leakage current (OFF time)	—		0.2 mA max.		
Ambient temperature	0 to +50°C (32 to 122°F), No freezing				
Relative humidity	35 to 85%, No condensation				
Weight	Approx. 48 g	Approx. 67g (including 2-m <b>6.6'</b> cable)	Approx. 82 g	Approx. 125 g	

1. This product does not comply with the EMC directive.

Photoelectric Sensors

Safety Light Curtain

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Pressure Sensors

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Vision Systems

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Thrubeam Measuring

Analog Sensor Controllers

Video Microscopes

EM

EZ/EV

**ES**

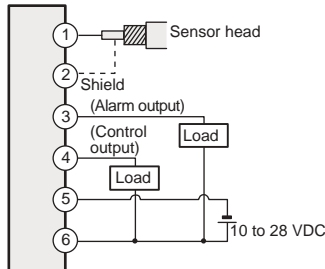
ED

ET

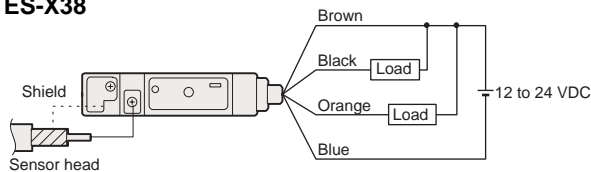
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## Connections

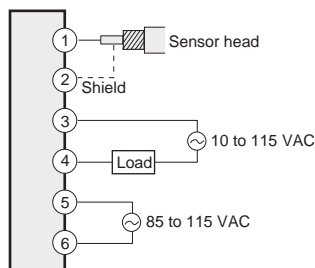
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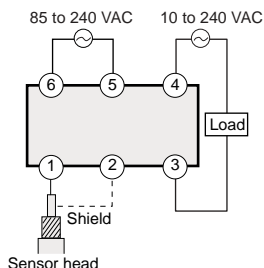
### ES-X38



### ES-12AC



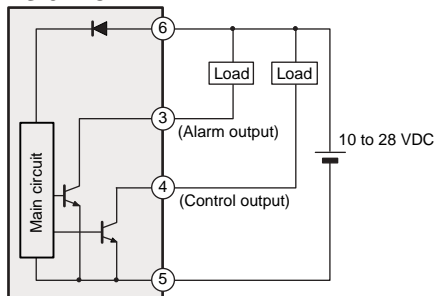
### ES-11AC/ES-21AC



## Output Circuits

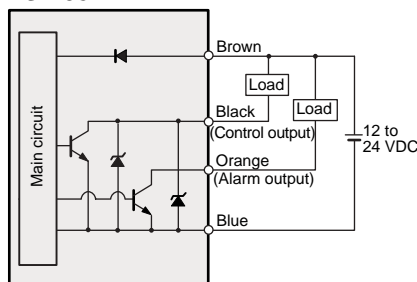
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#### ES-32DC



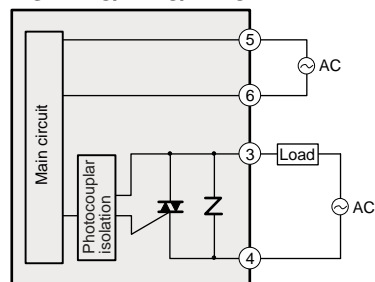
### NPN

#### ES-X38



### THYRISTOR

#### ES-12AC/11AC/21AC



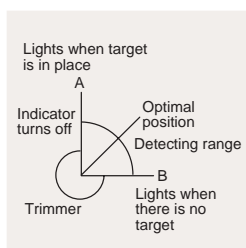
## Adjustment

### Both NEAR-ON and NEAR-OFF modes are available

NEAR-ON mode uses a normally open relay that closes when the target is detected.

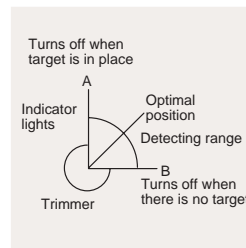
NEAR-OFF mode uses a normally closed relay that opens when the target is detected.

#### NEAR-ON operation (ES-32DC/12AC/11AC)



1. With the target in place, turn the trimmer clockwise and find point A at which the output indicator lights. (If the output indicator is already lit, turn the trimmer counterclockwise.)
2. With the target removed, again turn the trimmer clockwise and find point B at which the output indicator lights.
3. Set the trimmer midway between points A and B. The output circuit will now actuate when the output indicator lights.

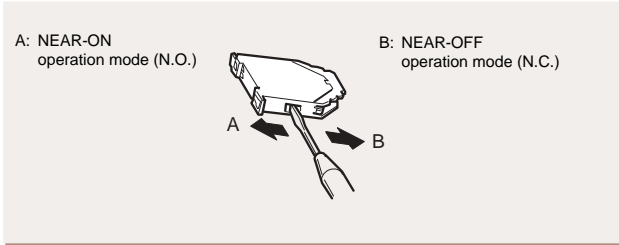
#### NEAR-OFF operation (ES-32DC/12AC/21AC)



1. With the target in place, turn the trimmer clockwise and find point A at which the output indicator turns off. (If the output indicator is already off, turn the trimmer counterclockwise.)
2. With the target removed, again turn the trimmer clockwise and find point B at which the output indicator turns off.
3. Set the trimmer midway between points A and B. The output circuit will now actuate when the output indicator lights.

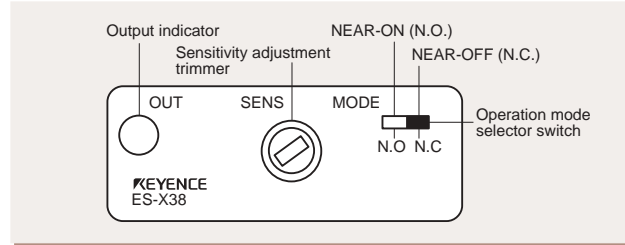
### Operation mode selector switch

Use a screwdriver to set the position of the operation mode selector switch, located in the lower part of the controller, to the desired operation mode.  
(ES-32DC/12AC)



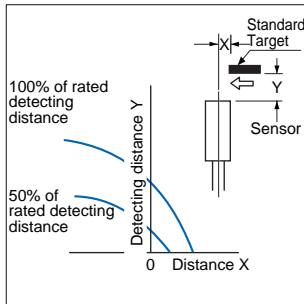
### ES-X38:

Set the operation mode selector switch provided on the panel.

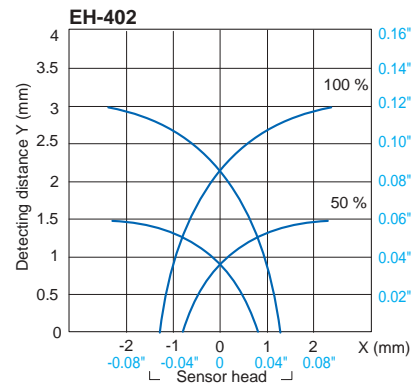
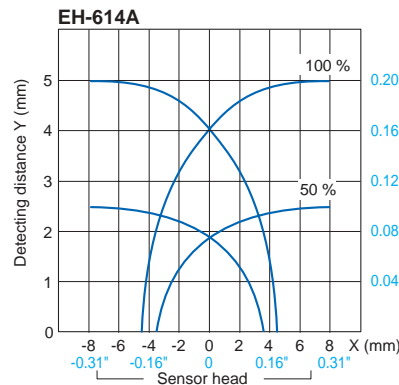
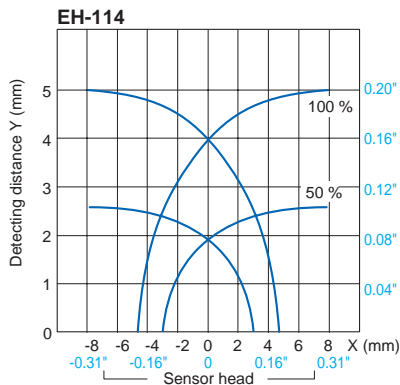
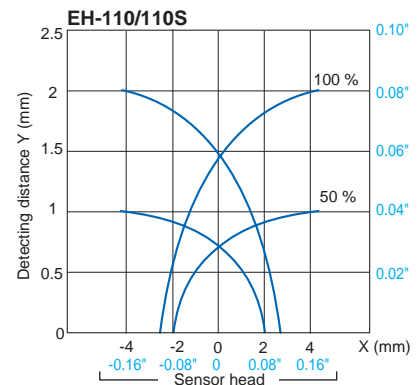
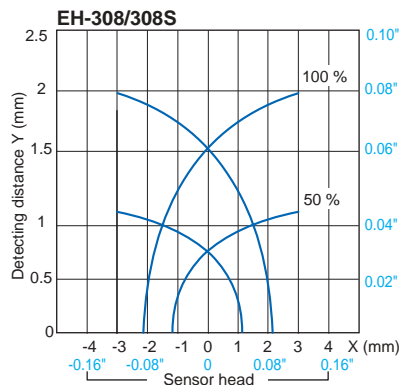
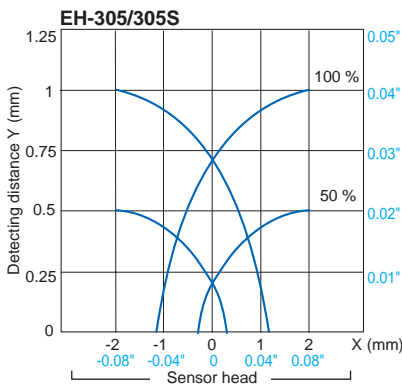
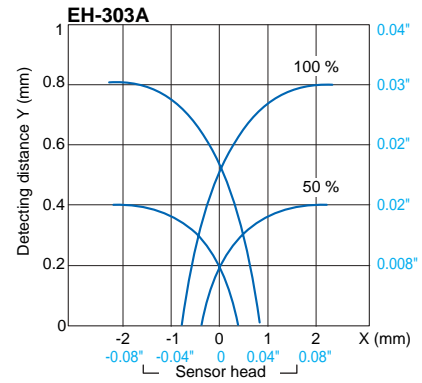
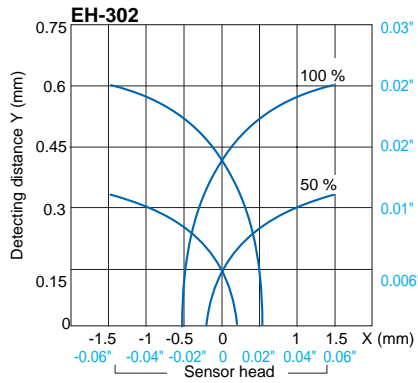


## Characteristics

### Detecting range (Typical)



These graphs show variations in detecting distance measured by moving the target parallel to the sensor head for a distance 50% and 100% of the stable detecting distance.



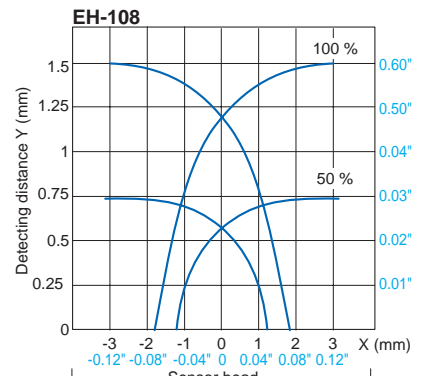
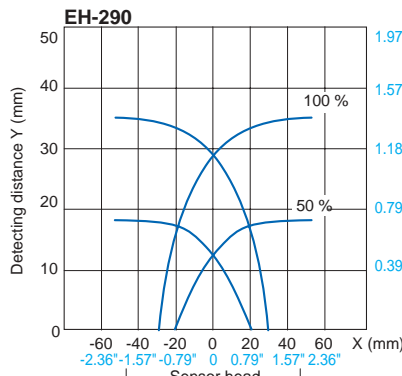
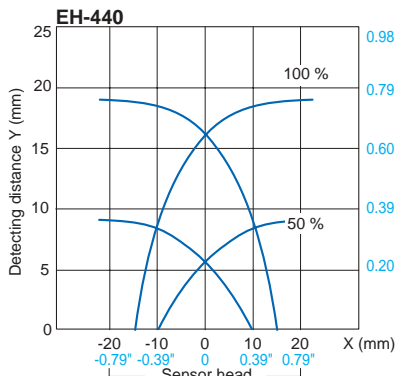
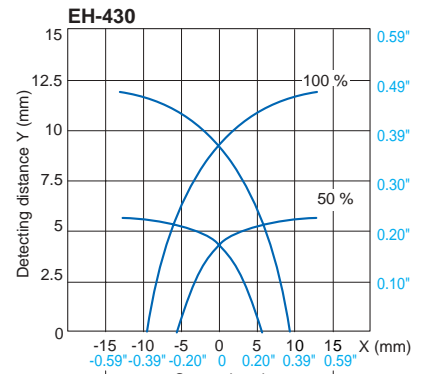
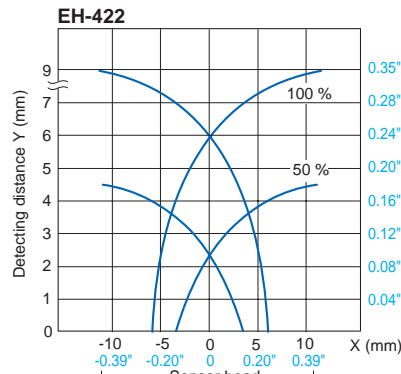
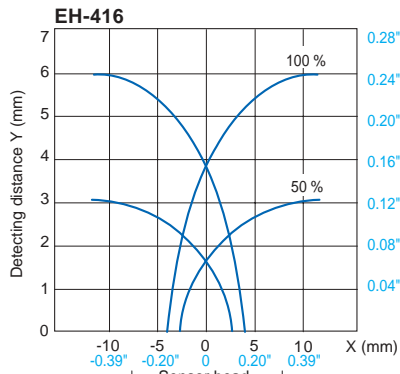
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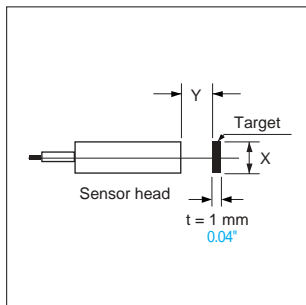


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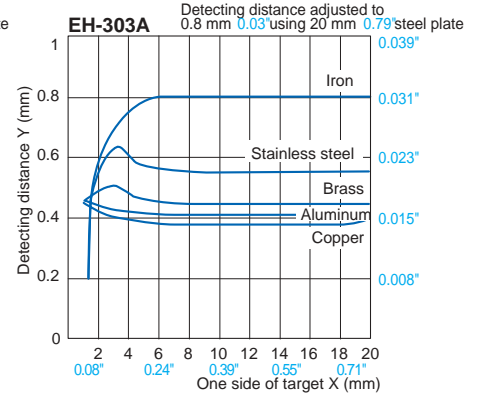
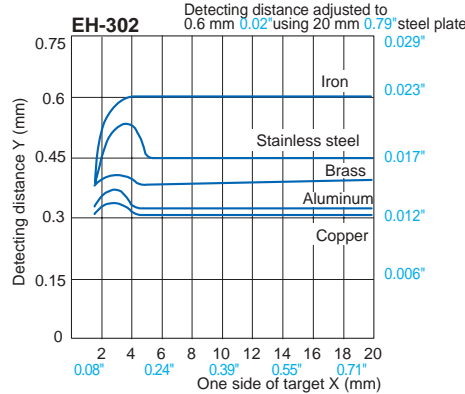
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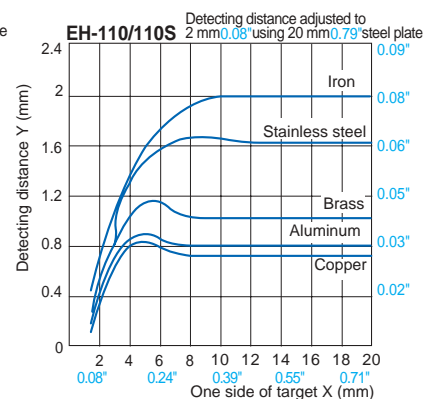
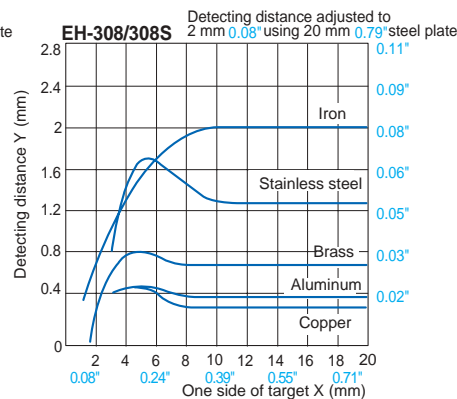
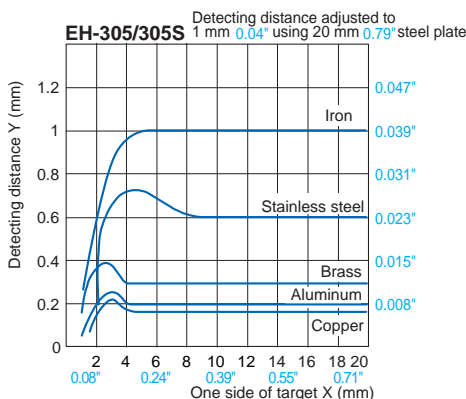
## Detecting distance vs. size and material of target (Typical)

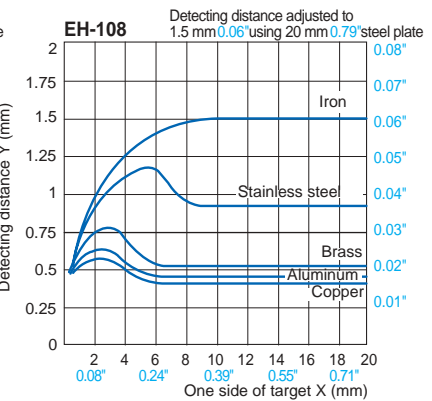
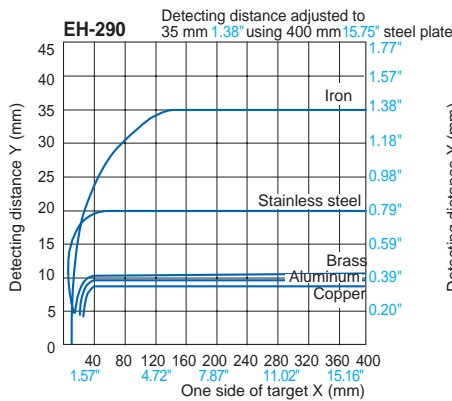
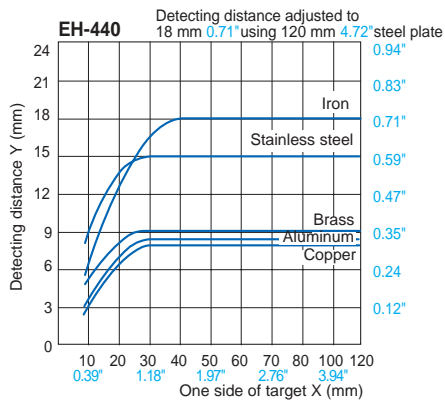
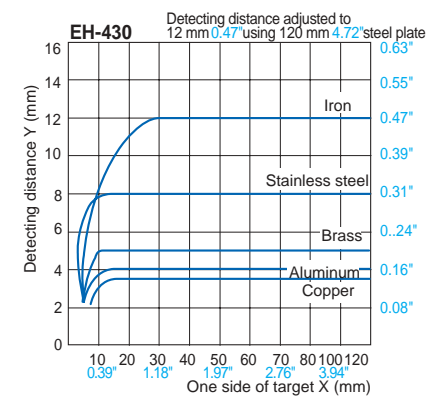
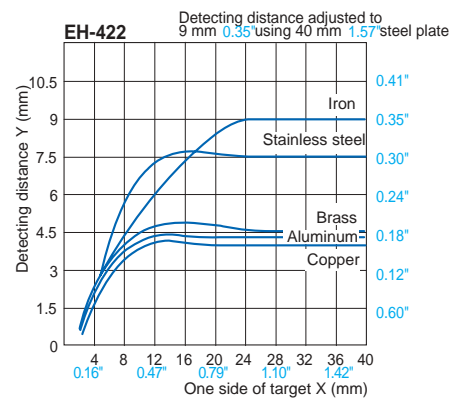
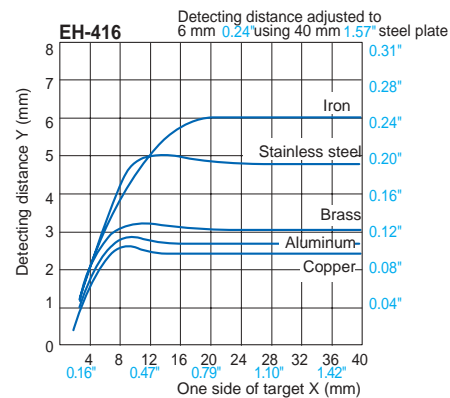
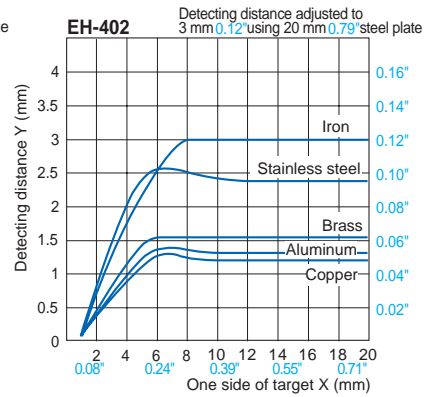
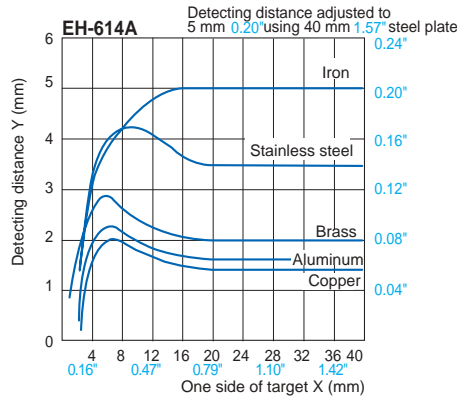
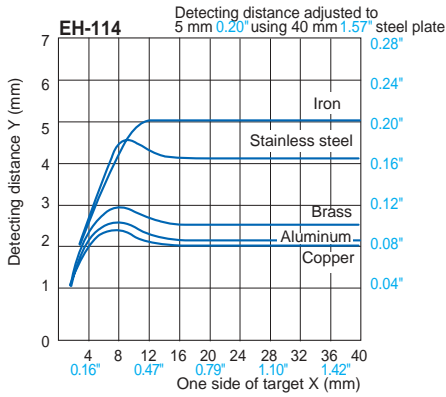


These graphs show variations in detecting distance (Y mm), obtained by using square metal plates (X x X x 1 mm 0.04", where X is varied) after adjusting the detecting distance of the sensor head to a stable detecting distance using the standard target.



## Detecting distance vs. size and material of target (Typical)

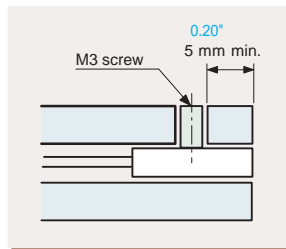




## Hints on Correct Use

### Mounting

- Cylindrical type  
Secure the sensor head with a screw at a position 5 mm 0.20" or more from the tip of the head. (Tightening torque: 2 N•m max.)
- Threaded type  
When mounting the threaded-type sensor head, do not tighten beyond the torque specified in the following table.



Model	Tightening torque
EH-108	8 N•m max.
EH-110	10 N•m max.
EH-114	20 N•m max.
EH-416	20 N•m max.
EH-422	10 N•m max.
EH-430	10 N•m max.
EH-440	10 N•m max.

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Proximity Sensors

Pressure Sensors

PLCs

Counters, Timers

Bar Code Readers

Vision Systems

High Precision Sensors

Displacement Sensors

Throughbeam Measuring

Analog Sensor Controllers

Video Microscopes

EM

EZ/EV

ES

ED

ET

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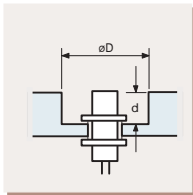
- Photoelectric Sensors
- Safety Light Curtain
- Proximity Sensors**
- Pressure Sensors
- PLCs
- Counters, Timers
- Bar Code Readers
- Vision Systems
- High Precision Sensors
- Displacement Sensors
- Thru-beam Measuring
- Analog Sensor Controllers
- Video Microscopes

## Wiring

Use a coaxial cable to connect the sensor head to the amplifier. Limit the length of extension to within 10 m **32.8'** (5 m **16.4'** for models EH-302 and EH-402).

## Surrounding metal

Shielded-type sensors can be flush-mounted in a metal base. Sensors of the non-shielded type, however, should be mounted according to the guidelines given below in order to minimize interference from the surrounding metal.



Model	D (mm min.)	d (mm min.)
EH-402	20 <b>0.79"</b>	15 <b>0.59"</b>
EH-416	30 <b>1.18"</b>	10 <b>0.39"</b>
EH-422	45 <b>1.77"</b>	20 <b>0.79"</b>
EH-430	70 <b>2.76"</b>	25 <b>0.98"</b>
EH-440	100 <b>3.94"</b>	30 <b>1.18"</b>
EH-290	260 <b>10.24"</b>	30 <b>1.18"</b>

## Interference

When installing two or more sensors of the same model face-to-face or in parallel, separate by the distance specified in the following table to prevent interference.

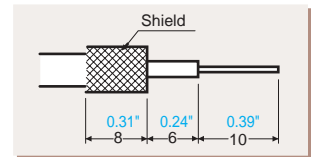
Model	Distance	Face-to-face (mm min.)	Parallel (mm min.)
EH-302		2 <b>0.08"</b> (1) <b>0.04"</b>	No space required
EH-303A		2 <b>0.08"</b> (1) <b>0.04"</b>	No space required
EH-305(S)		5 <b>0.20"</b> (3) <b>0.12"</b>	No space required
EH-308(S)		10 <b>0.39"</b> (7) <b>0.28"</b>	No space required
EH-110(S)		7 <b>0.28"</b> (4) <b>0.16"</b>	35 <b>1.38"</b> (no space required)
EH-114		11 <b>0.43"</b> (6) <b>0.24"</b>	39 <b>1.54"</b> (no space required)
EH-614A		11 <b>0.43"</b> (6) <b>0.24"</b>	64 <b>2.52"</b> (no space required)
EH-402		53 <b>2.09"</b> (12) <b>0.47"</b>	23 <b>0.91"</b> (11) <b>0.43"</b>
EH-416		11 <b>0.43"</b> (7) <b>0.28"</b>	115 <b>4.53"</b> (no space required)
EH-422		26 <b>1.02"</b> (9) <b>0.35"</b>	122 <b>4.80"</b> (no space required)
EH-430		41 <b>1.61"</b> (14) <b>0.55"</b>	250 <b>9.84"</b> (no space required)
EH-440		38 <b>1.50"</b> (29) <b>1.14"</b>	300 <b>11.81"</b> (no space required)
EH-108		7 <b>0.28"</b> (4) <b>0.16"</b>	No space required

[Note]

The above figures apply when the trimmer is turned to its optimal position for stable detection. The figures in parentheses apply when an optional interference prevention adapter is connected parallel to the sensor head (Except for ES-X38). Contact KEYENCE for further information.

## Amplifier unit (ES-X38)

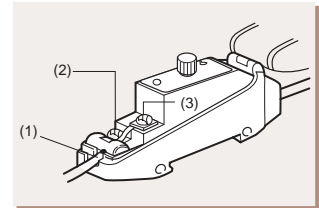
### Sensor cable end treatment



\* Fold back the shielded cable over the sheath.

### Sensor cable connections

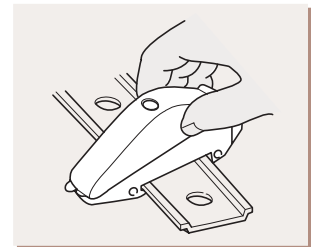
To connect the sensor cable, insert the end of the cable through the entry port (1), tighten the screw (2), connect the core wire to the terminal (3), and then tighten the screw (3).



- For connections to the EH-422/430/440/290, contact KEYENCE for more information.

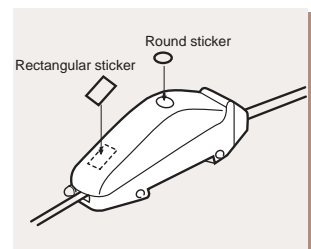
### Mounting/dismounting the amplifier unit on DIN rail or mounting bracket

Hook the rear of the amplifier unit on the DIN rail. Push the amplifier unit forward to hook the front of the unit. To dismount the amplifier unit, push the unit forward and unhook the front of the unit.



### How to use the attached sticker

Write the sensor number on the rectangular sticker and stick it on the dust cover. Stick the round sticker over the round cover hole if the sensitivity adjustment trimmer setting should not be changed.



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Thrubeam Measuring
Analog Sensor Controllers
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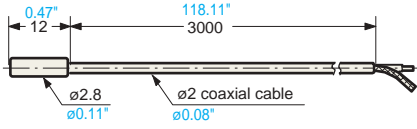
**Dimensions**

► For CAD Data Download >>> <http://www.keyence.com/cadg>

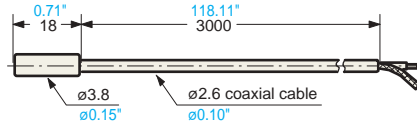
Unit: mm Inch

**Sensor heads**

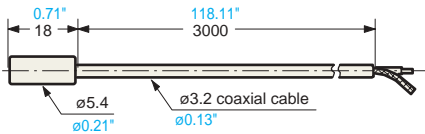
**EH-302**



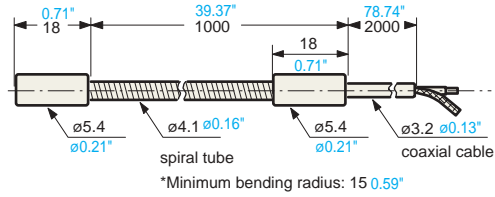
**EH-303A**



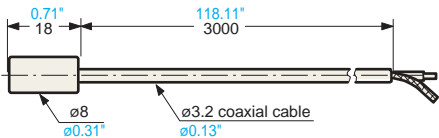
**EH-305**



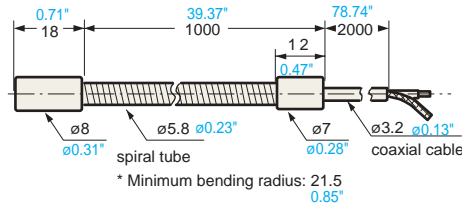
**EH-305S**



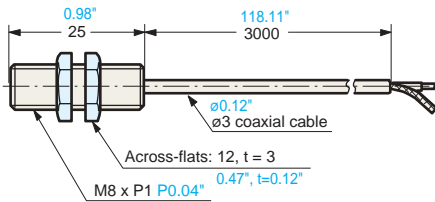
**EH-308**



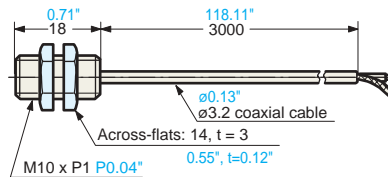
**EH-308S**



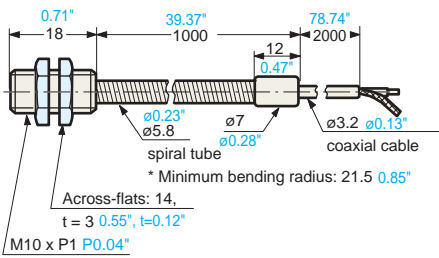
**EH-108**



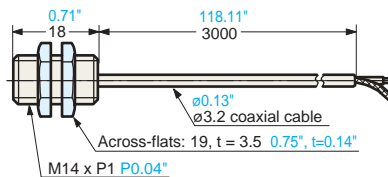
**EH-110**



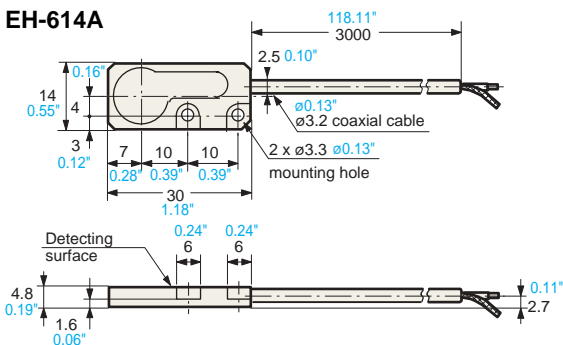
**EH-110S**



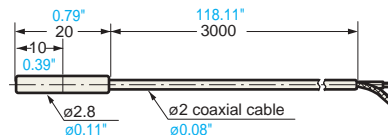
**EH-114**



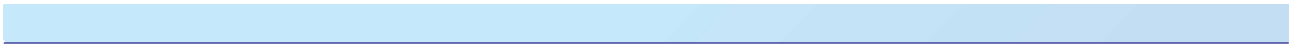
**EH-614A**



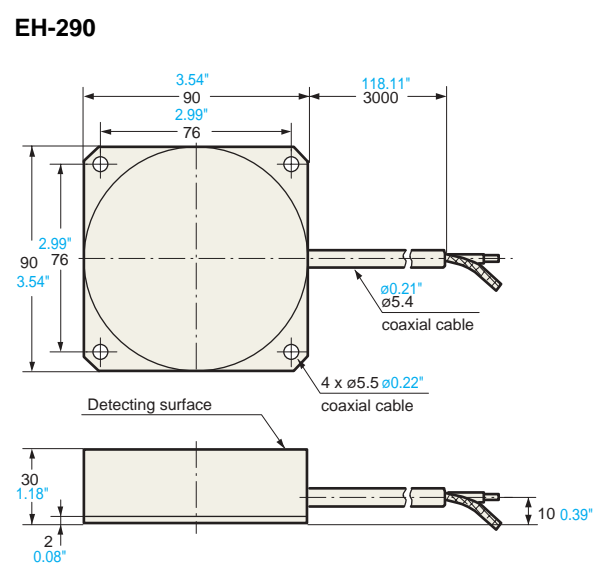
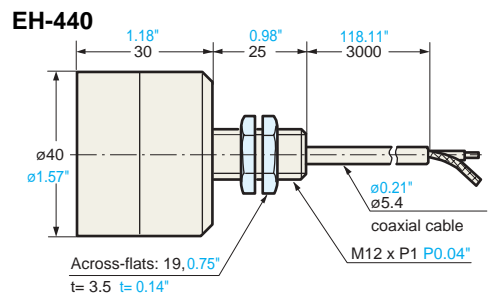
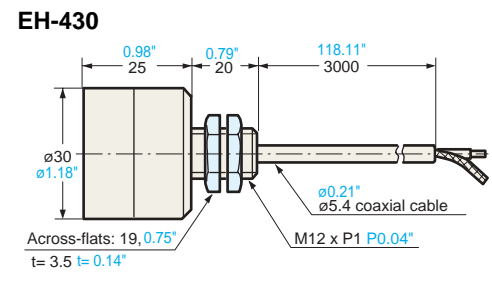
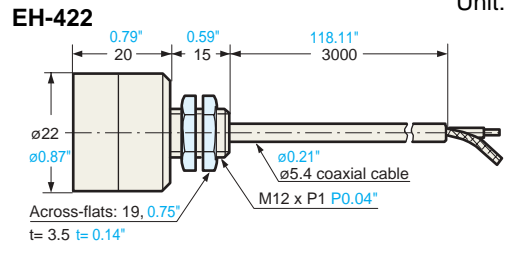
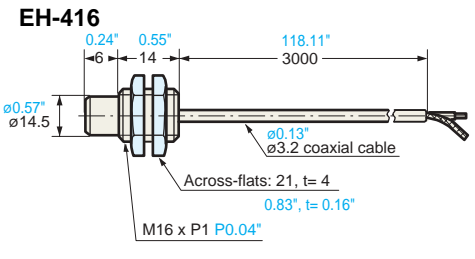
**EH-402**



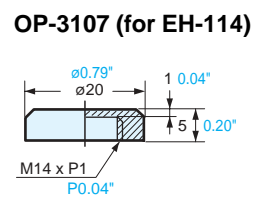
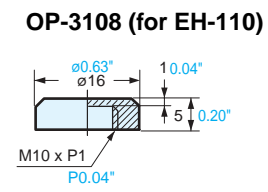
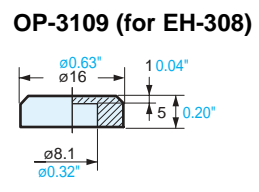
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Unit: mm    Inch

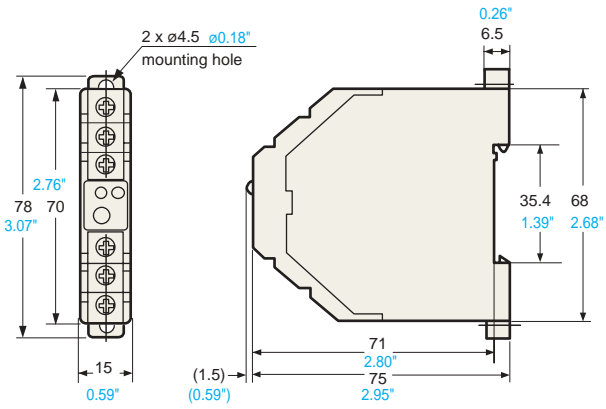


**Teflon® cap (for protection against welding spatter)**

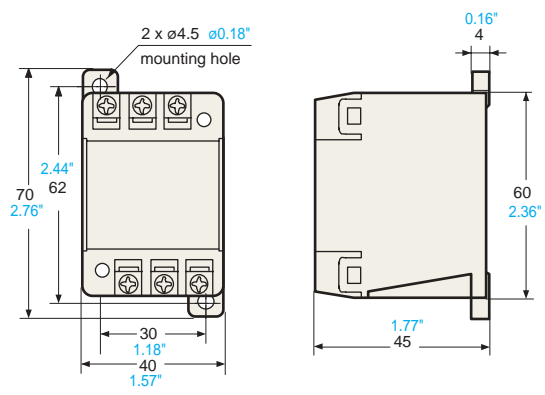


**Amplifier units**  
**ES-32DC/ES-12AC**

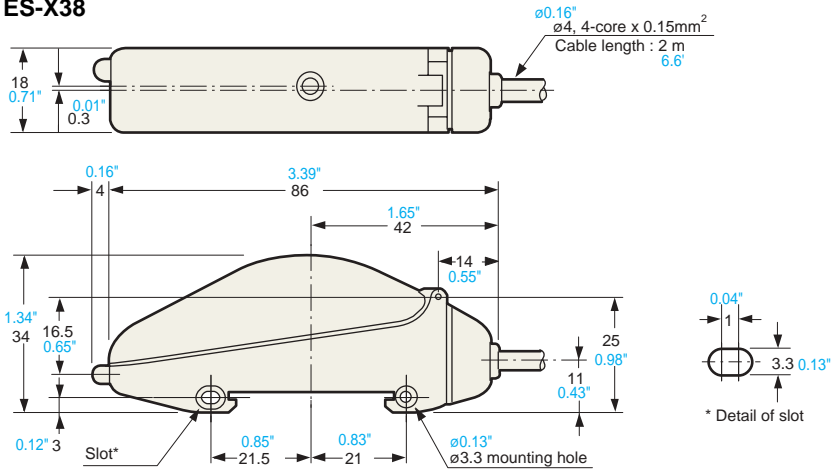
Unit: mm Inch



**ES-11AC/ES-21AC**



**ES-X38**



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