KEYENCE

Pattern Matching Sensor
AI Series



Area Detection Redefined

Just present the target

Then teach using just one button

1
TEACH







Standard / Long Range
Built-in Amplifier Models



Amplifier

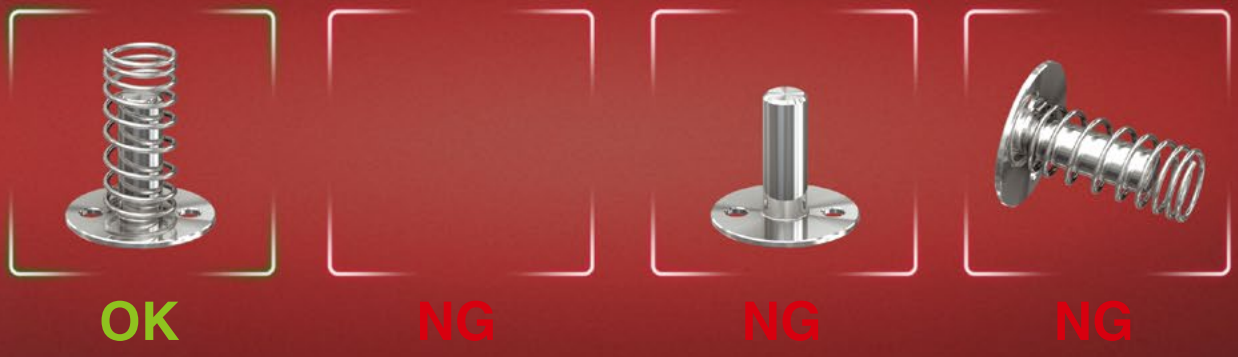


Short Range
Standard / Long Range
Separate Amplifier Models

Pattern Matching Sensor
AI Series



2
COMPARE

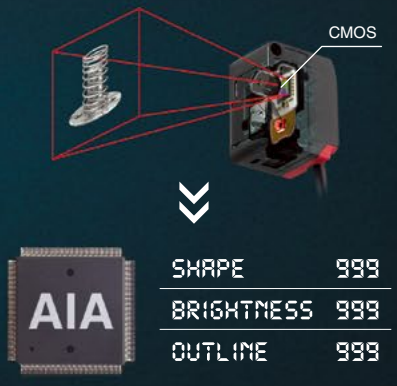


New technology

Just one AI can solve multiple applications

The proprietary “AIA(Auto Intelligent Adjustment)”

Quantifies the targets brightness, shape and outline information automatically. Immediately judges if the target is the same as the master. Now it's possible to judge parts stably, which is difficult for light intensity sensors and position measurement sensors.



Necessary steps for stable detection with conventional sensors

1 Choose the correct type of sensor.

2 Mount at specific angles.

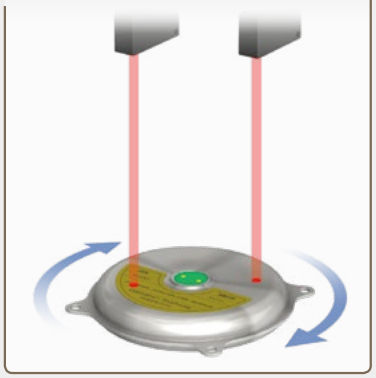
3 Create a custom configuration to fit your application, likely with help from a representative.

Even when this is done, sometimes it is still not completely stable. For example...

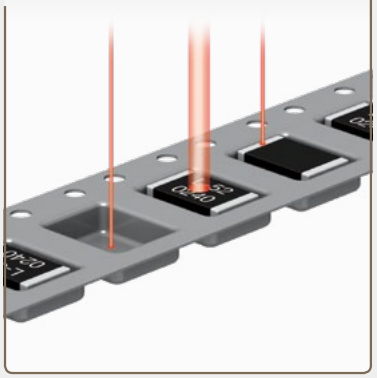
Position is not fixed



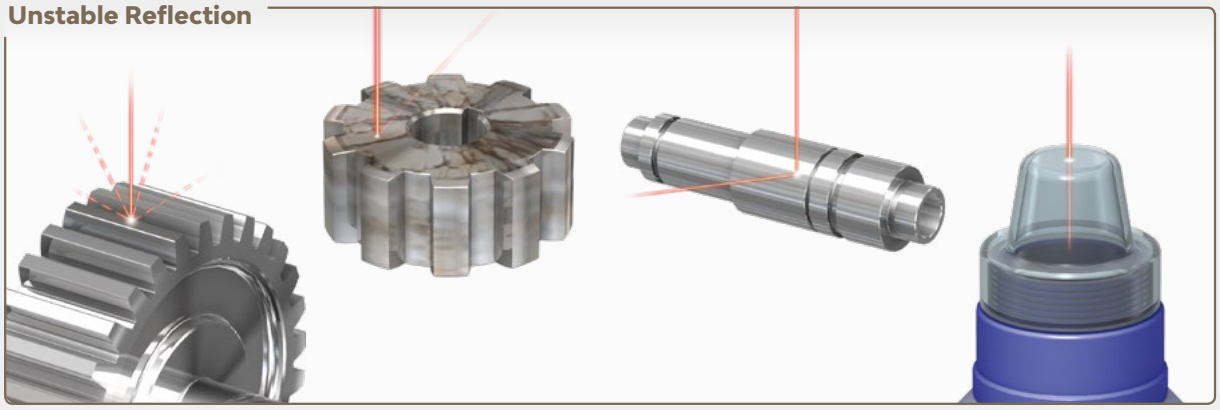
Position of the target is random



Target with several NG cases



Unstable Reflection

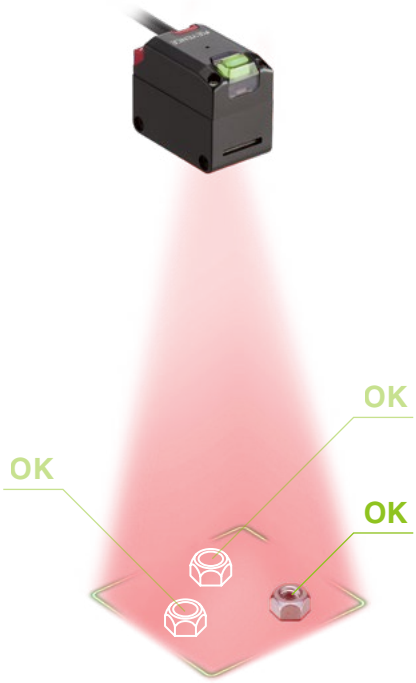


With the next generation sensor that can be taught automatically using only one button

0 Nothing necessary.

This will solve everything.

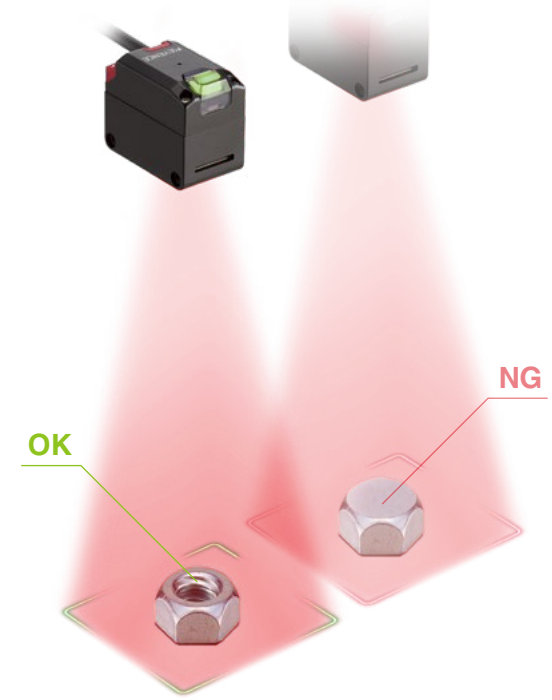
Searching the entire area



Presence Check in an

Area

Comparing the whole pattern

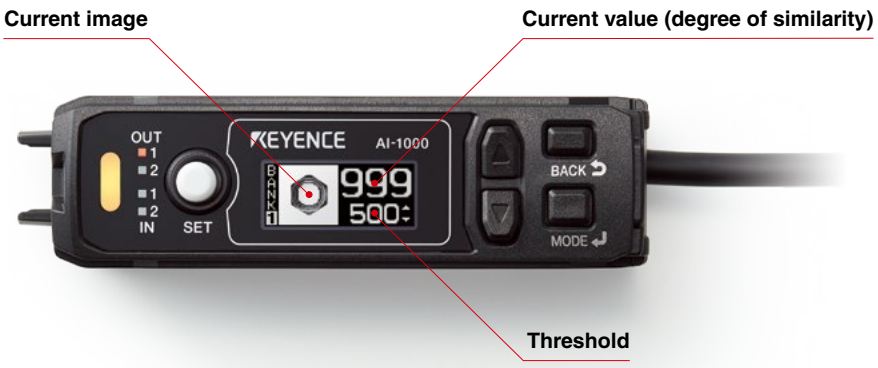


Difference Check by

Pattern

Compact amplifier is still easy to use

Detection result shown as an image for easy configuration



POINT

Text + animation helps with configuration

The OLED display incorporated into the amplifier makes configuration easy with text and animation support. Even first-time users can use the device without referring to the manual. As well, buttons can be used to zoom in and out and adjust the position of the target shown in the display. This reduces time required for adjusting the sensor position.

Animation during configuration



Required operations shown visually

Digital zoom function (17 steps)



No zoom　2X　4X

Zoom position adjustment (Up/Dn & L/R)



Before adjustment　Left/right adjustment　Up/down adjustment

As easy to use as general-purpose sensors

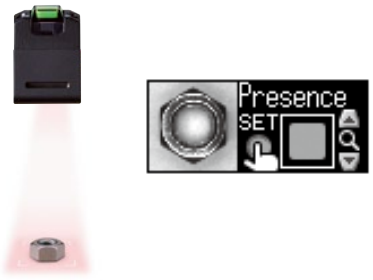
The detection principles used in the AI series are completely different from the light intensity detection methods of general-purpose sensors, but two detection modes make the AI series just as easy to use.

Presence check mode

Presence check mode is easily configured in only two steps, following the exact same flow as the two-point calibration of general-purpose sensors.

Example: Detecting the presence of a nut

STEP 1 **Register target as present**



STEP 2 **Register target as absent**



Difference check mode

The difference check mode is easily configured in only three steps and is an optimal choice for users who want to make simple determinations about targets without resorting to vision systems.

Example: Identifying a defect in an O ring assembly

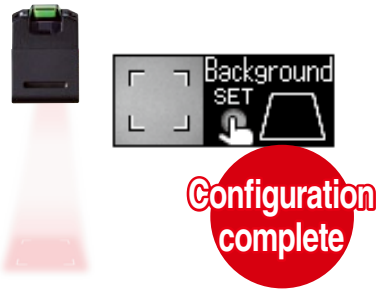
STEP 1 **Register OK product**



STEP 2 **Register NG product (failure)**



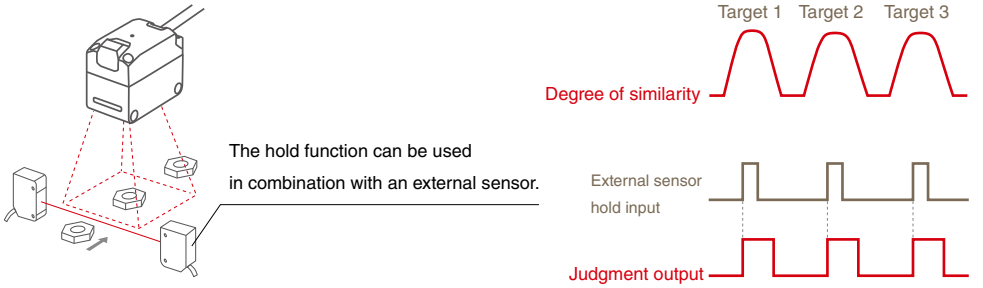
STEP 3 **Register target as absent**



Incorporates many useful and easy-to-use features

Synchronizes and judges without a controller

Hold input and failure hold display



When using the sensor for differentiation, it is possible to judge each target without a controller by using hold input and synchronizing with the input from an external sensor. Further, by using the failure hold function, the system can retain the degree of similarity and display image when an NG (failure) occurs.

Visualize line operation

Stat displays

Maximum degree of similarity



Minimum degree of similarity



The maximum and minimum degrees of similarity can be updated and displayed with the image. Users can check the operation status and analysis at start-up.

Use on lines with multiple product types

Bank switching/External calibration

Reading the bank



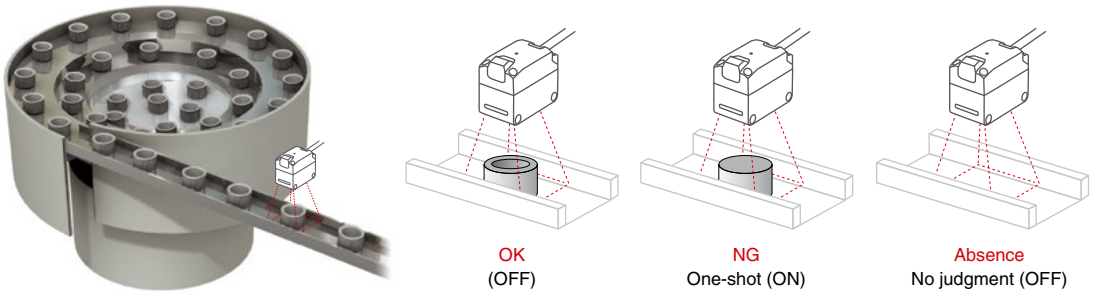
↑ ↓ Switch



With the external calibration function and bank function (which can register up to four product types), one unit can handle multiple product types.

Optimize for parts feeder

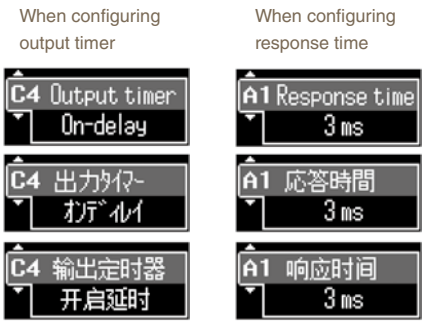
Feeder mode



A special mode is incorporated that detects objects and the orientation of targets conveyed by a parts feeder.
The system automatically identifies targets when they pass, and performs a judgment only on identified targets.

Language selection for easy export

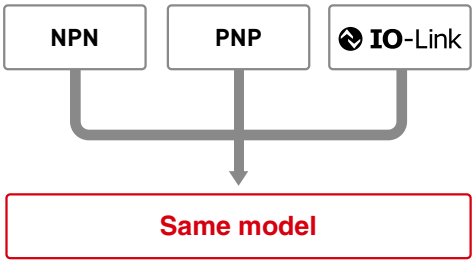
Choose English/Japanese/Chinese



Users can switch between English, Japanese, and Chinese, meaning the unit can be easily used overseas.

Multiple output options are standard

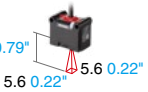
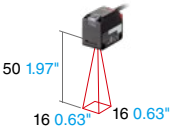
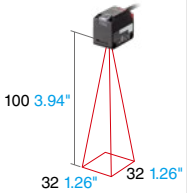
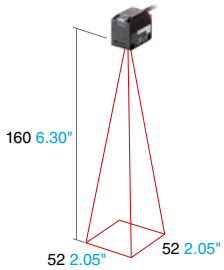
Toggle between NPN/PNP and IO-Link



Control output for a single model can be switched to NPN, PNP, and even IO-Link, for warehouse consolidation.

Separate Amplifier Models

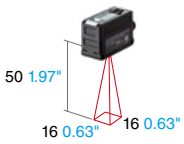
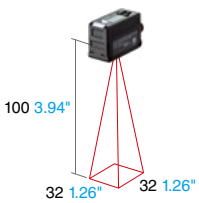
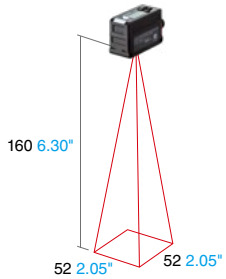
Sensor Head

Type	Short Range		Standard		Long Range
Model	AI-H010	AI-H020	AI-H050	AI-H100	AI-H160
Appearance					
Installation Distance	9 to 11 mm 0.35 to 0.43"	18 to 22 mm 0.71 to 0.87"	45 to 55 mm 1.77 to 2.17"	90 to 110 mm 3.54 to 4.33"	140 to 180 mm 5.51 to 7.09"
Detecting Area	2 × 2 mm 0.08 × 0.08"	5.6 × 5.6 mm 0.22 × 0.22"	16 × 16 mm 0.63 × 0.63"	32 × 32 mm 1.26 × 1.26"	52 × 52 mm 2.05 × 2.05"
At 4X digital zoom	0.5 × 0.5 mm 0.02 × 0.02"	1.4 × 1.4 mm 0.06 × 0.06"	4 × 4 mm 0.16 × 0.16"	8 × 8 mm 0.31 × 0.31"	13 × 13 mm 0.51 × 0.51"
					
Transmitter Light Source	Red LED (660 nm)				Infrared LED (850 nm)

Amplifier

Type	Cable Type (2 m)	Connector Type (M8 Connector)
Model	AI-1000	AI-1000C
Appearance		 *Connector cable not included
Number of Inputs/Outputs	2 outputs + 2 inputs	1 output + 1 selectable I/O

Built-in Amplifier Models

Type	Standard		Long Range
Model	AI-B050	AI-B100	AI-B160
Appearance			
Installation Distance	45 to 55 mm 1.77 to 2.17"	90 to 110 mm 3.54 to 4.33"	140 to 180 mm 5.51 to 7.09"
Detecting Area	16 × 16 mm 0.63 × 0.63"	32 × 32 mm 1.26 × 1.26"	52 × 52 mm 2.05 × 2.05"
At 4X digital zoom	4 × 4 mm 0.16 × 0.16"	8 × 8 mm 0.31 × 0.31"	13 × 13 mm 0.51 × 0.51"
			
Transmitter Light Source	Red LED (660 nm)		Infrared LED (850 nm)
Number of Inputs/Outputs	1 output + 1 selectable I/O		

Attachments

POINT

Sensors come standard with polarized light filter attachments (AI-H010/H020 excluded). When specular reflections reach the sensor from glossy surfaces, use a dome attachment. When there is insufficient illumination, remove the polarized filter attachment.

Type			Polarized Light Filter Attachment					Dome Attachment			
			Separate amplifier models			Built-in amplifier models		Separate amplifier models		Built-in amplifier models	
Appearance/Model			 AI-F01H Short range	 AI-F05H* Standard range	 AI-F10H* Long range	 AI-F05B* Standard range	 AI-F10B* Long range	 AI-D16H Small	 AI-D32H Large	 AI-D16B Small	 AI-D32B Large
Separate Amplifier	Short Range	AI-H010	✓								
		AI-H020	✓								
	Standard	AI-H050		✓				Effective area 16 × 16 mm 0.63 × 0.63"			
		AI-H100		✓				Effective area 16 × 16 mm 0.63 × 0.63"	Effective area 32 × 32 mm 1.26 × 1.26"		
	Long Range	AI-H160			✓			Effective area 16 × 16 mm 0.63 × 0.63"	Effective area 32 × 32 mm 1.26 × 1.26"		
Built-in Amplifier	Standard	AI-B050				✓				Effective area 16 × 16 mm 0.63 × 0.63"	
		AI-B100				✓				Effective area 16 × 16 mm 0.63 × 0.63"	Effective area 32 × 32 mm 1.26 × 1.26"
	Long Range	AI-B160					✓			Effective area 16 × 16 mm 0.63 × 0.63"	Effective area 32 × 32 mm 1.26 × 1.26"

*Included in sensor head package

Mounting Brackets

Type			Vertical Mounting Bracket	Rear Mounting Bracket	Adjustable Bracket
Appearance					
Separate Amplifier	Short Range	AI-H010	OP-88100	OP-88101	-
		AI-H020			
	Standard	AI-H050	OP-88104	OP-88105	OP-88106
		AI-H100			
	Long Range	AI-H160			
Built-in Amplifier	Standard	AI-B050	OP-88114	OP-88115	OP-88116
		AI-B100			
	Long Range	AI-B160			

Cable for Separate Amplifier Models

Sensor Head

Type	Length	Model
Sensor Head to Amplifier Cable	2 m 78.74"	OP-87056
	5 m 196.85"	OP-87057
	10 m 393.70"	OP-87058

Amplifier (Connector Type)

Type	Length	Model
M8 Wiring Harness	2 m 78.74"	OP-88095
	10 m 393.70"	OP-88096
M8-M8	2 m 78.74"	OP-88069
M8-M12	2 m 78.74"	OP-88071
	5 m 196.85"	OP-88072

Cable for Built-in Amplifier Models

Type	Length	Model
M12 Wiring Harness	2 m 78.74"	OP-88107
	10 m 393.70"	OP-88108
M12L Wiring Harness	2 m 78.74"	OP-88109
	10 m 393.70"	OP-88110
M12-M12	2 m 78.74"	OP-88112
	5 m 196.85"	OP-88113
M12L-M12	1 m 39.37"	OP-88111

Presence/ Absence

Automobiles/Metals



Check for arrival of product conveyor cages



Check for passage of O rings in a parts feeder

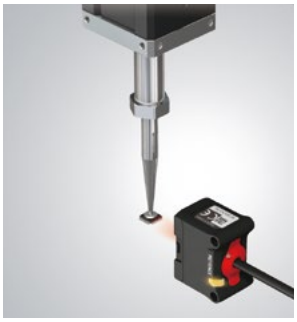


Detect presence of springs

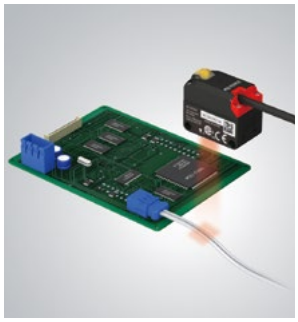
Electrical



Detect presence of minuscule chip parts



Check attachment of chip parts

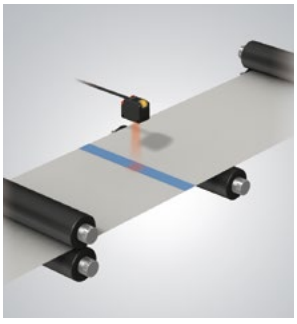


Detect presence of lead wires

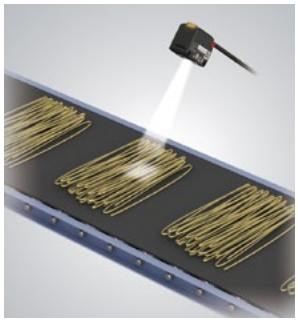
Food/Medicine



Check passage of transparent bottles



Detect tape seams



Detect presence of noodles

Differentiation

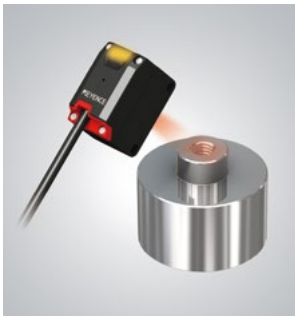
Automobiles/Metals



Differentiate processed product types



Check O ring assemblies

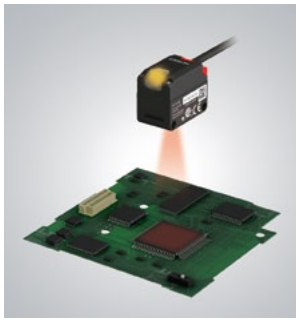


Detect incomplete processing of machined parts

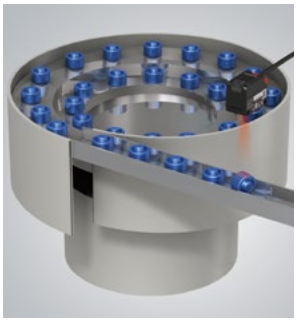
Electrical



Differentiate front/back of chip parts

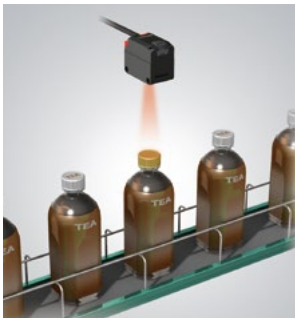


Check PCB parts mountings

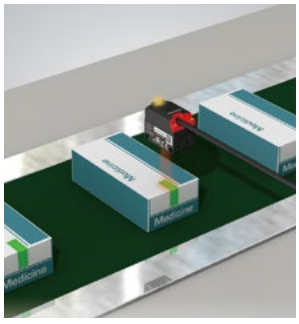


Check for fallen parts in parts feeders

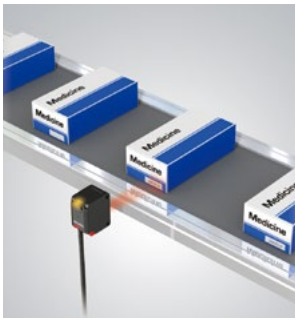
Food/Medicine



Differentiate cap types



Check sealing tape presence



Check for presence of labeling

Separate Amplifier Models

Sensor Head

Model		AI-H010	AI-H020	AI-H050	AI-H100	AI-H160
Installation Distance		9 to 11 mm 0.35 to 0.43"	18 to 22 mm 0.71 to 0.87"	45 to 55 mm 1.77 to 2.17"	90 to 110 mm 3.54 to 4.33"	140 to 180 mm 5.51 to 7.09"
Detection Area*1	1X Zoom to 4X Zoom	0.5 × 0.5 mm 0.02 × 0.02" to 2 × 2 mm 0.08 × 0.08"	1.4 × 1.4 mm 0.06 × 0.06" to 5.6 × 5.6 mm 0.22 × 0.22"	4 × 4 mm 0.16 × 0.16" to 16 × 16 mm 0.63 × 0.63"	8 × 8 mm 0.31 × 0.31" to 32 × 32 mm 1.26 × 1.26"	13 × 13 mm 0.51 × 0.51" to 52 × 52 mm 2.05 × 2.05"
	Digital Zoom	1X to 4X (17 steps) adjustment, zoom position adjustment				
Light Receiving Element		BW CMOS				
Transmitter	Light Source	Red LED (660 nm)				Infrared LED (850 nm)
	Lighting Method	Pulse lighting				
Indicators		1 (green/red/orange)				
Environmental Resistance	Ambient Temperature	-10 to +50°C (no freezing)				
	Ambient Humidity	35 to 85% RH (no condensation)				
	Vibration Resistance	10 to 55 Hz, double amplitude 1.5 mm 0.06", each X, Y, Z axis for 2 hours				
	Shock Resistance	500 m/s^2, 6 directions, 3 times each				
	Enclosure Rating	-		IP67*2		
Materials		Main unit case: Zinc die-cast/PBT; Front cover: Acrylic (hard coat); Cable: PVC				
		Operation indicator: TPU		Operation indicator: PPSU; Polarized filter case: POM		
Weight		Approx. 50 g		Approx. 70 g (including polarized filter)		

*1: When positioned in the midpoint of the installation distance range.
*2: Except when polarized filters or dome filters are mounted.

Amplifier

Model		AI-1000	AI-1000C
Connection Type		6-core cable	M8 connector (4-core)
Detection Modes		Presence check mode / Difference check mode / Feeder mode	
Response Time		Switchable between 3 ms/10 ms/20 ms/50 ms/100 ms	
Timer		OFF/Off-delay/On-delay/One-shot	
Bank Function		Bank slots: Up to 4	Bank slots: Up to 2
Other Functions		Filter, orientation detection, anti-blur, hysteresis, mutual interference prevention, indicator LED color change, finder display, statistics display, failure hold display, key lock function, I/O test	
Display Panel		Organic LED (OLED) display	
Languages		Japanese/English/Chinese (Simplified)	
Indicators	Main Indicator	1 (green/red/orange)	
	I/O Indicators	4 indicators (red): OUT1/OUT2/IN1/IN2	2 indicators (red): OUT1/OUT2 or IN
Input		Non-voltage input/voltage input can be switched Non-voltage input: ON voltage 2 V or lower, OFF current 0.1 mA or lower, ON current 2 mA or lower (short circuit) Voltage input: Maximum input rating 30 V, ON current 18 V or higher, OFF current 0.1 mA or lower, ON current 2 mA or lower (at 30 V)	
	Number of Inputs	2: IN1/IN2	1: IN or no input*1
	Functions	Assignable functions: Bank/Hold (level)/Hold (edge)/Reset/External calibration/Interference prevention/Light off	
Output		Open collector output: Can be switched between NPN/PNP and N.O./N.C. Maximum rating: 30 V 50 mA, remaining voltage 2 V or lower	
	Number of Outputs	2: OUT1/OUT2	1: OUT1 or 2: OUT1/OUT2*1
	Functions	Assignable functions for OUT2: Error output/Judgment output 2/Interference prevention output (sync-output)	
Communication Functions		IO-Link: Specification v. 1.1 (1.0)/COM2 (38.4 kbps)	
Ratings	Power Voltage	20 to 30 VDC, ripple (P-P) 10% included	
	Current Consumption	0.35 A or lower (power voltage at 20 V, excluding the output load)	
Environmental Resistance	Ambient Temperature	-10 to +50°C 14 to 122°F (no freezing)	
	Ambient Humidity	35 to 85% RH (no condensation)	
	Vibration Resistance	10 to 55 Hz, double amplitude 1.5 mm 0.06", each X, Y, Z axis for 2 hours	
Materials		Main unit case/Dust cover: Polycarbonate; Button: POM; Display panel: Acrylic	
Weight		Approx. 110 g (including the cable of 2 m 78.74")	Approx. 40 g

*1 Used with OUT2 or IN assigned to I/O line (white line or 2nd pin of M8 connector).

Built-in Amplifier Models

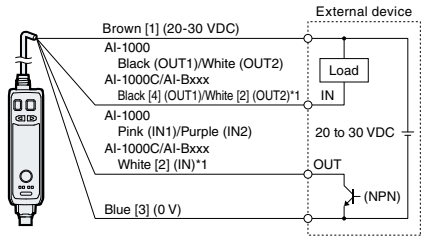
Sensor

Model		AI-B050	AI-B100	AI-B160
Installation Distance		45 to 55 mm 1.77 to 2.17"	90 to 110 mm 3.54 to 4.33"	140 to 180 mm 5.51 to 7.09"
Detection Area*1	1X Zoom to 4X Zoom	4 × 4 mm 0.16 × 0.16" to 16 × 16 mm 0.63 × 0.63"	8 × 8 mm 0.31 × 0.31" to 32 × 32 mm 1.26 × 1.26"	13 × 13 mm 0.51 × 0.51" to 52 × 52 mm 2.05 × 2.05"
	Digital Zoom	1X to 4X (17 steps) adjustment, zoom position adjustment		
Light Receiving Element		BW CMOS		
Transmitter	Light Source	Red LED (660 nm)		Infrared LED (850 nm)
	Lighting Method	Pulse lighting		
Detection Modes		Presence check mode / Difference check mode / Feeder mode		
Response Time		Switchable between 3 ms/10 ms/20 ms/50 ms/100 ms		
Timer		OFF/Off-delay/On-delay/One-shot		
Bank Function		Bank slots: Up to 2		
Other Functions		Filter, orientation detection, anti-blur, hysteresis, mutual interference prevention, indicator LED color change, screen display orientation, statistics display, failure hold display, key lock function, I/O test		
Display Panel		Organic LED (OLED) display		
Languages		Japanese/English/Chinese (Simplified)		
Indicators	Main Indicator	1 (green/red/orange)		
	I/O Indicators	2 indicators (red): OUT1/OUT2 or IN		
Input		Non-voltage input/voltage input can be switched Non-voltage input: ON voltage 2 V or lower, OFF current 0.1 mA or lower, ON current 2 mA or lower (short circuit) Voltage input: Maximum input rating 30 V, ON current 18 V or higher, OFF current 0.1 mA or lower, ON current 2 mA or lower (at 30 V)		
	Number of Outputs	1: IN or no input*2		
	Functions	Assignable functions: Bank/Hold (level)/Hold (edge)/Reset/External calibration/Interference prevention/Light off		
Output		Open collector output: Can be switched between NPN/PNP and N.O./N.C. Maximum rating: 30 V 50 mA, remaining voltage 2 V or lower		
	Number of Outputs	1: OUT1 or 2: OUT1/OUT2*2		
	Functions	Assignable functions for OUT2: Error output/Judgment output 2/Interference prevention output (sync-output)		
Communication Functions		IO-Link: Specification v. 1.1 (1.0)/COM2 (38.4 kbps)		
Ratings	Power Voltage	20 to 30 VDC, ripple (P-P) 10% included		
	Current Consumption	0.3 A or lower (power voltage at 20 V, excluding the output load)		
Environmental Resistance	Ambient Temperature	-10 to +50°C 14 to 122°F (no freezing)		
	Ambient Humidity	35 to 85% RH (no condensation)		
	Vibration Resistance	10 to 55 Hz, double amplitude 1.5 mm 0.06", each X, Y, Z axis for 2 hours		
	Shock Resistance	500 m/s^2, 6 directions, 3 times each		
	Enclosure Rating	IP67*3		
Materials		Main unit case: Zinc die-cast/PBT; Front cover: Acrylic (hard coating); Operation indicator: TPU; Button: POM; Display sheet: PET; Polarizing filter body: POM		
Weight		Approx. 120 g (including polarized filter)		

*1: When positioned in the midpoint of the installation distance range.
*2: Used with OUT2 or IN assigned to I/O line (white line or 2nd pin of M12 connector).
*3: Except when polarized filters or dome filters are mounted.

NPN Output Selected

When selecting NPN as the default setting for I/O type.

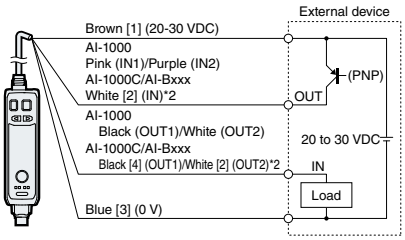


*1 Select OUT2 or IN with default settings.
- Square brackets ([ ]) indicate pin number when using connector cable.
- Assign desired functions to OUT2 and IN1/IN2/IN.

Wire Harness color	Connector Pin No.	Model		Assigned Initial Value
		AI-1000	AI-1000C/AI-Bxxx	
Brown	1	20 to 30 VDC		-
Blue	3	0 V		-
Black	4	OUT1	OUT1	-
White	2	OUT2	Select OUT2/IN	OFF
Pink	-	IN1	-	OFF
Purple	-	IN2	-	OFF

PNP Output Selected

When selecting PNP as the default setting for I/O type.



*2 Select OUT2 or IN with default settings.
- Square brackets ([ ]) indicate pin number when using connector cable.
- Assign desired functions to OUT2 and IN1/IN2/IN.

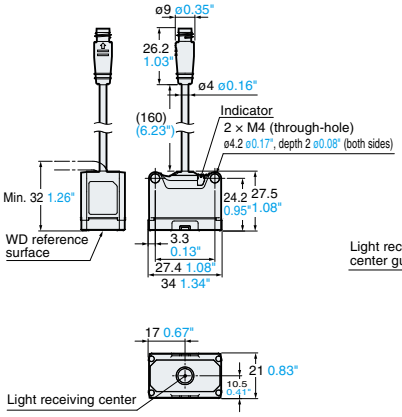
- OUT1: Judgment output 1 (fixed)
- Functions that can be assigned to OUT2:
  Error output/Judgment output 2/Sync-output/OFF (do not use)
- Functions that can be assigned to IN1/IN2 or N:
  Bank-A/Bank-B/Bank*3/Hold (level)/Hold (edge)/Reset/
  External calibration/Interference prevention/Laser emission stop/
  OFF (do not use)

*3 When IN is selected with AI-1000C/AI-Bxxx series.

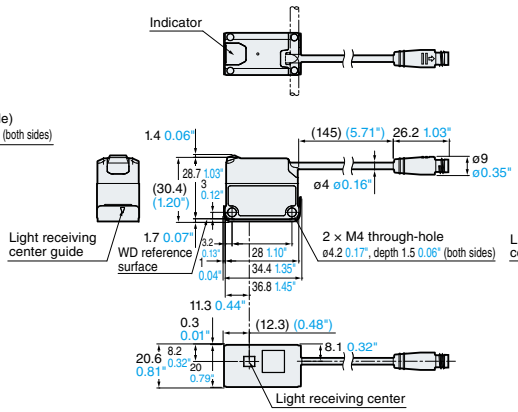
Separate Amplifier Models

Sensor heads

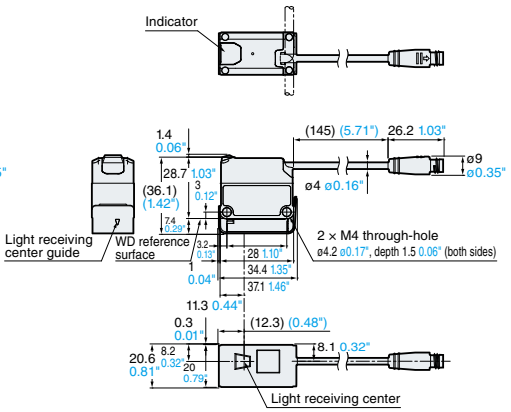
AI-H010/H020



AI-H050/H100

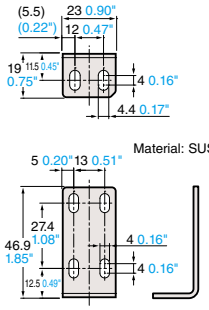


AI-H160

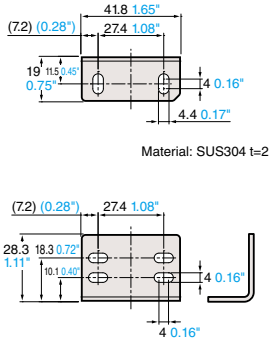


Mounting brackets (separate amplifier model)

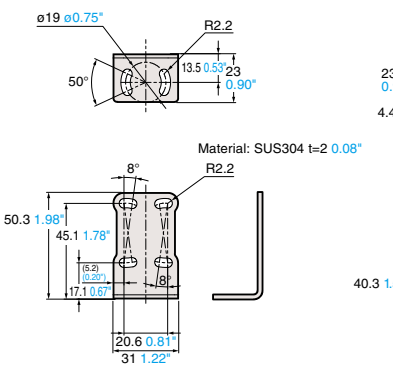
OP-88100



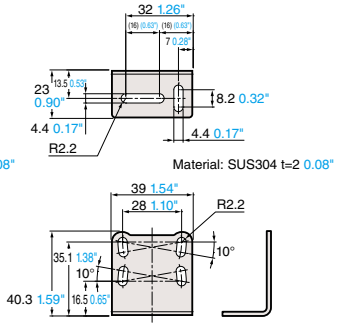
OP-88101



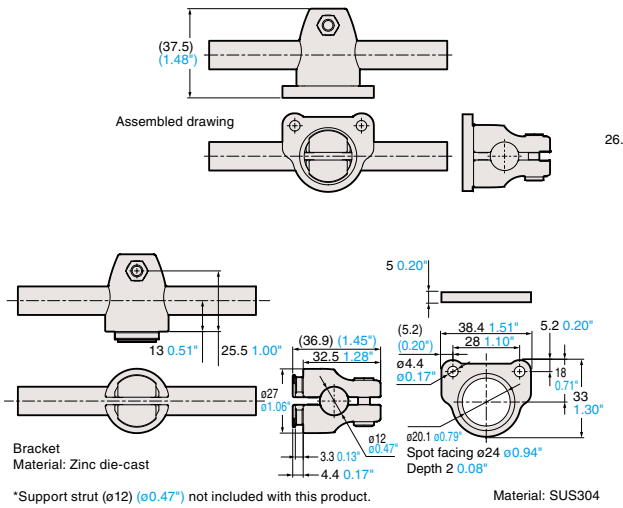
OP-88104



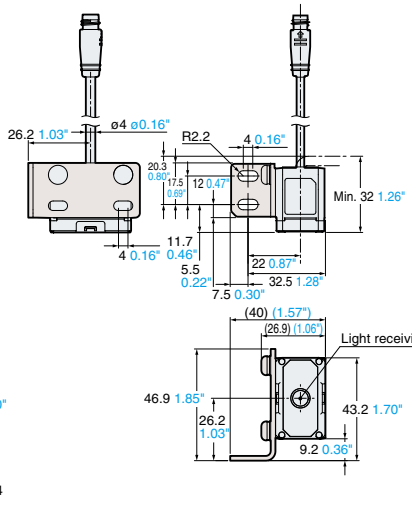
OP-88105



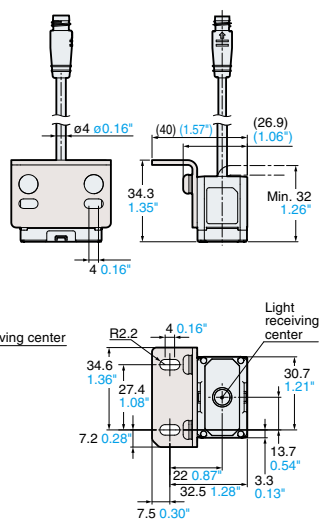
OP-88106



OP-88100 (AI-H010/H020)

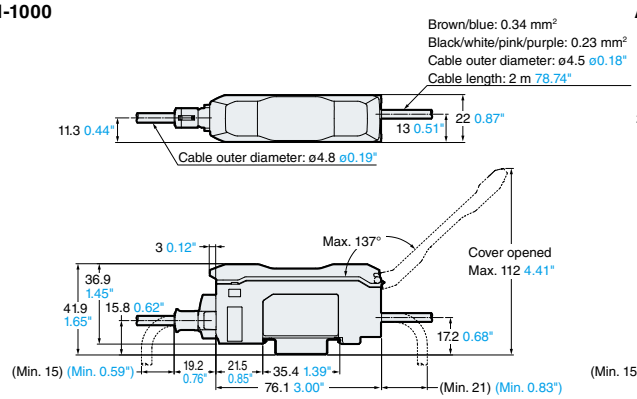


OP-88101 (AI-H010/H020)

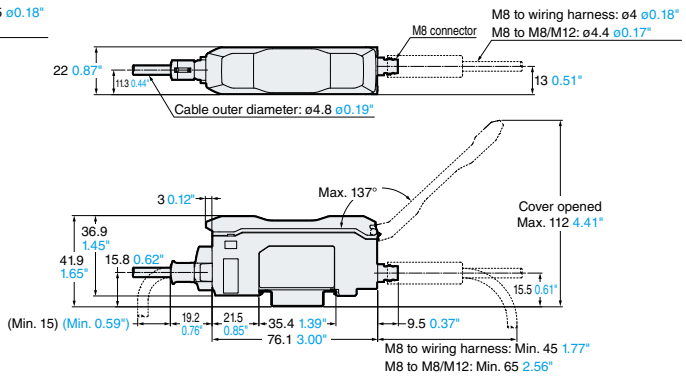


Amplifiers

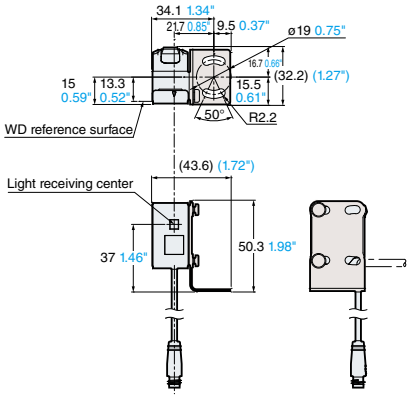
AI-1000



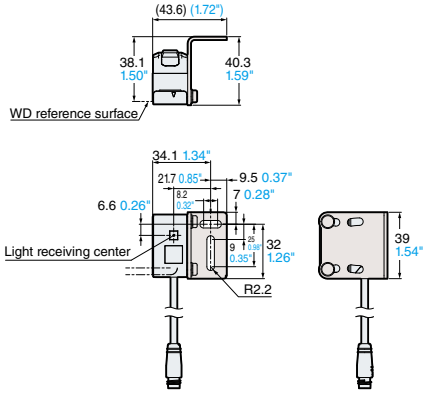
AI-1000C



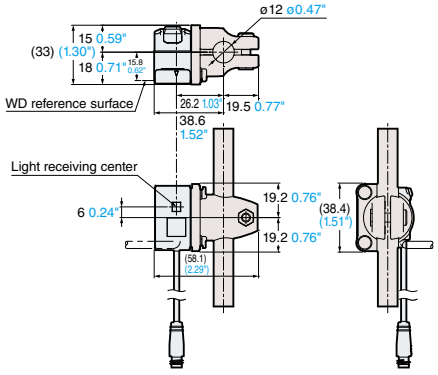
OP-88104 (AI-H050/H100)



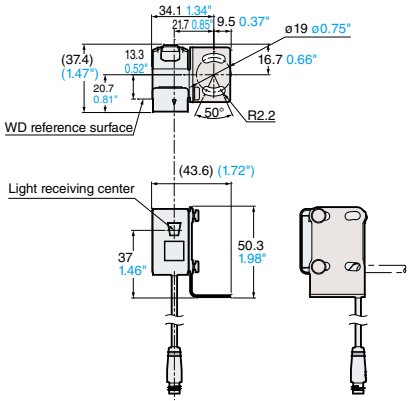
OP-88105 (AI-H050/H100)



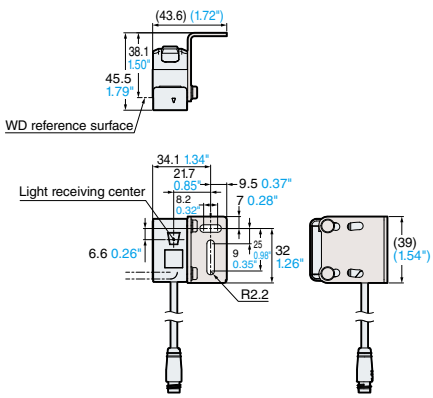
OP-88106 (AI-H050/H100)



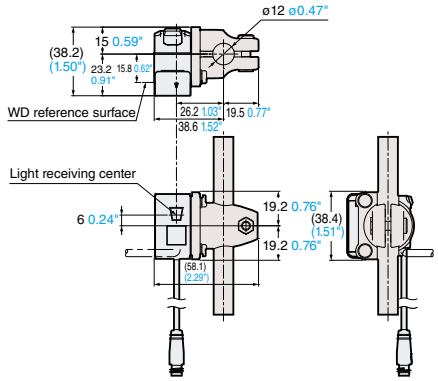
OP-88104 (AI-H160)



OP-88105 (AI-H160)

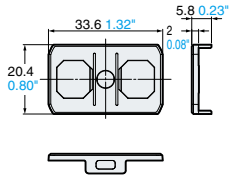


OP-88106 (AI-H160)

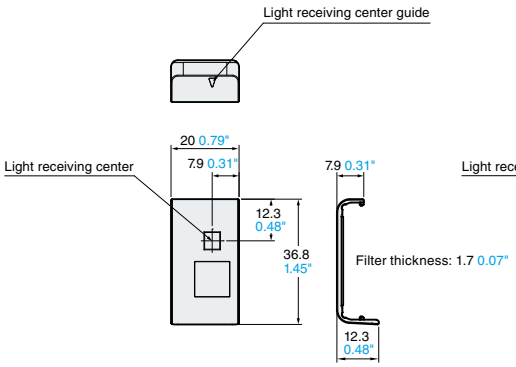


Attachments (Separate amplifier models)

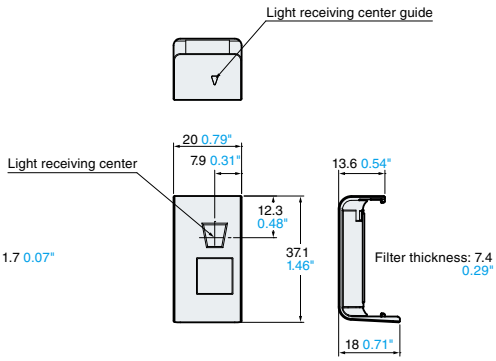
AI-F01H



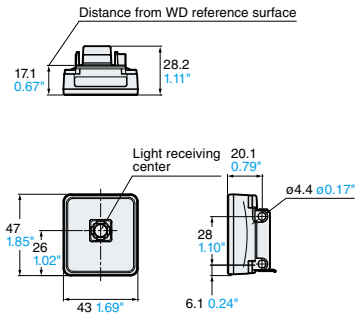
AI-F05H



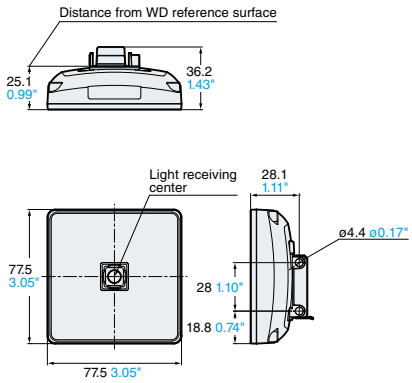
AI-F10H



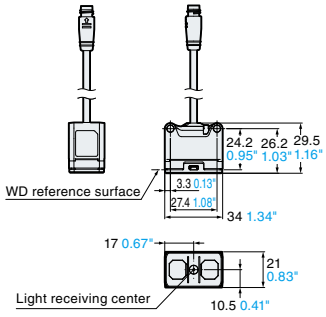
AI-D16H



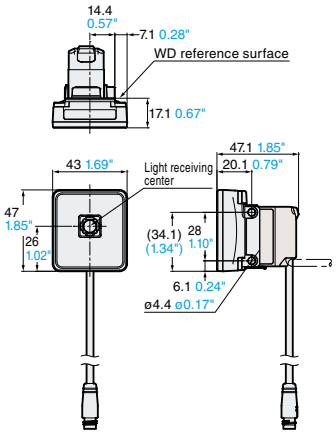
AI-D32H



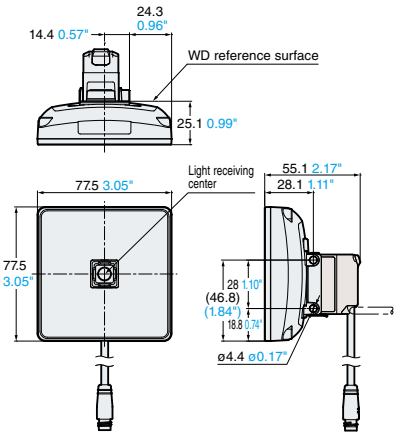
AI-F01H (AI-H010/H020)



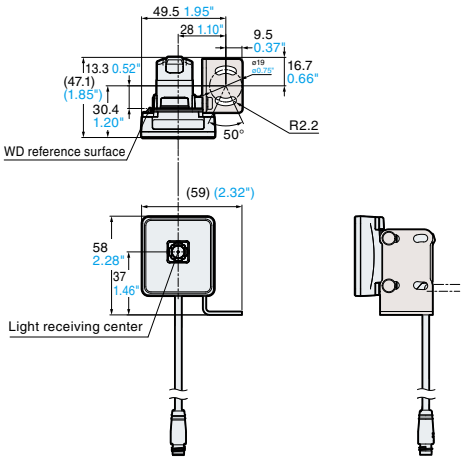
AI-D16H (AI-H050/H100/H160)



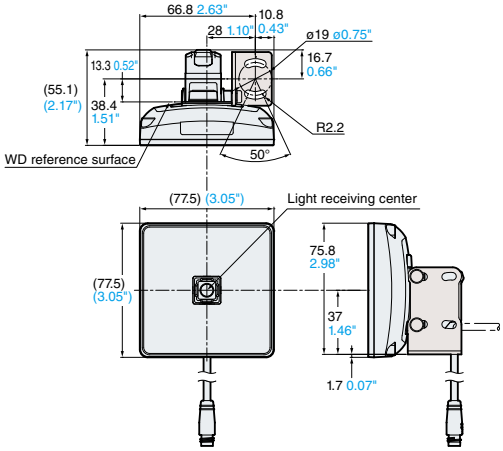
AI-D32H (AI-H100/H160)



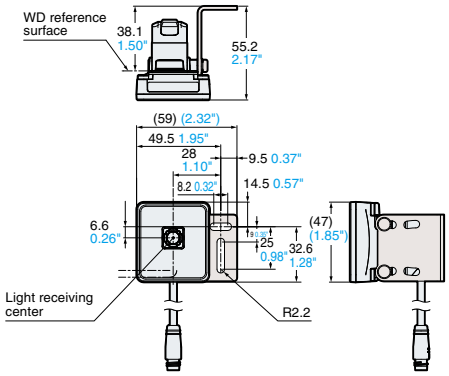
AI-D16H/OP-88104 (AI-H050/H100/H160)



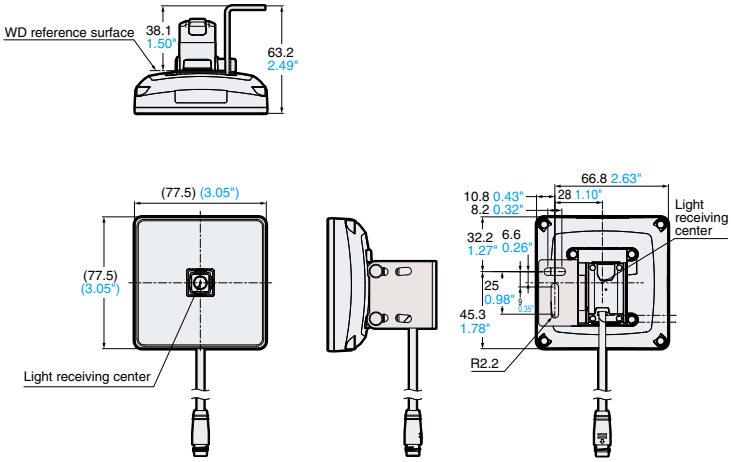
AI-D32H/OP-88104 (AI-H100/H160)



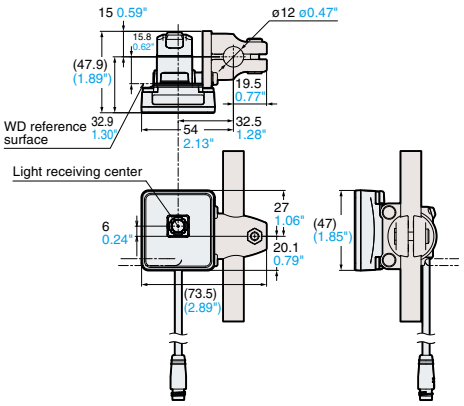
AI-D16H/OP-88105 (AI-H050/H100/H160)



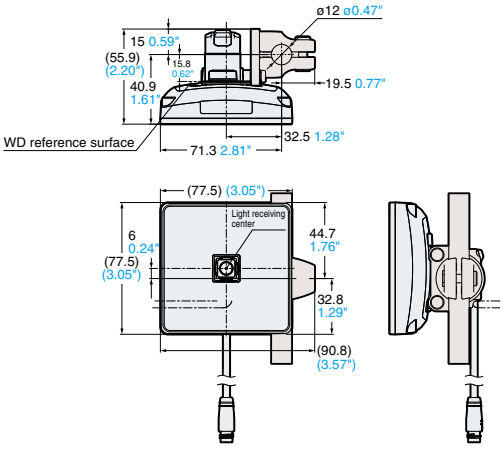
AI-D32H/OP-88105 (AI-H100/H160)



AI-D16H/OP-88106 (AI-H050/H100/H160)



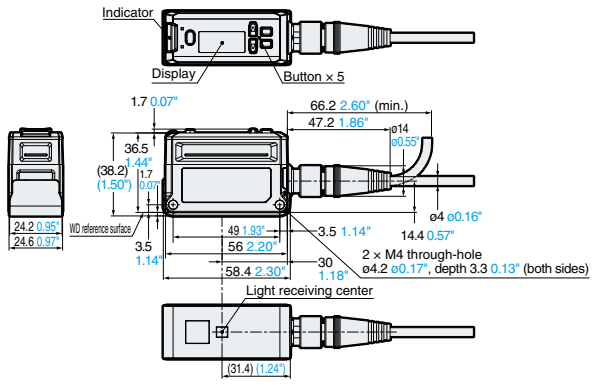
AI-D32H/OP-88106 (AI-H100/H160)



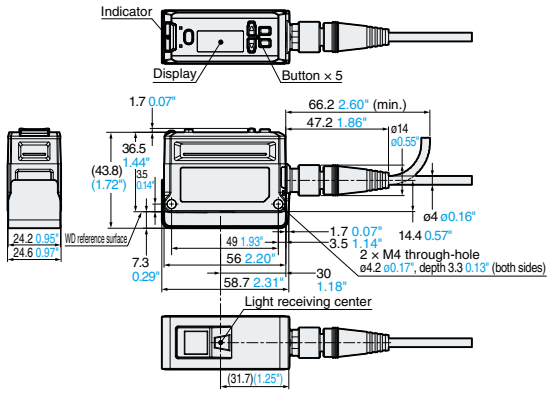
Built-in Amplifier Models

Sensors

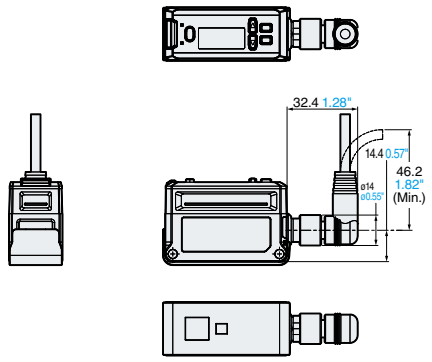
AI-B050/B100



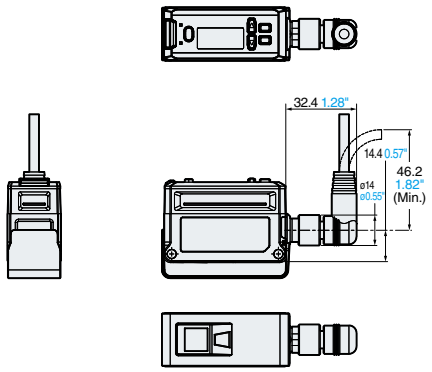
AI-B160



AI-B050/B100 (L connector)

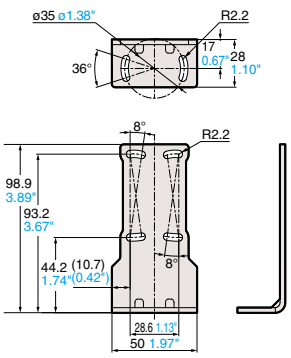


AI-B160 (L connector)



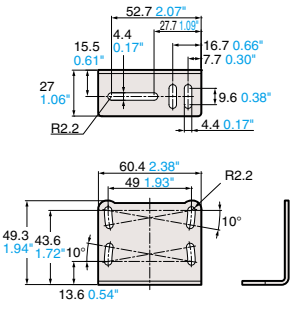
Mounting brackets (built-in amplifier models)

OP-88114



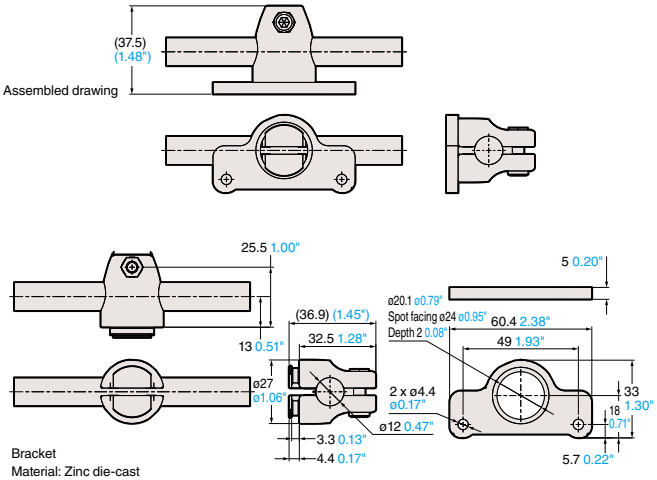
Material: SUS304 t=3 0.12"

OP-88115



Material: SUS304 t=2 0.08"

OP-88116

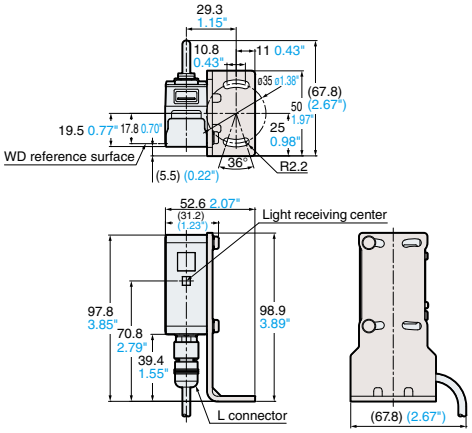


Bracket
Material: Zinc die-cast

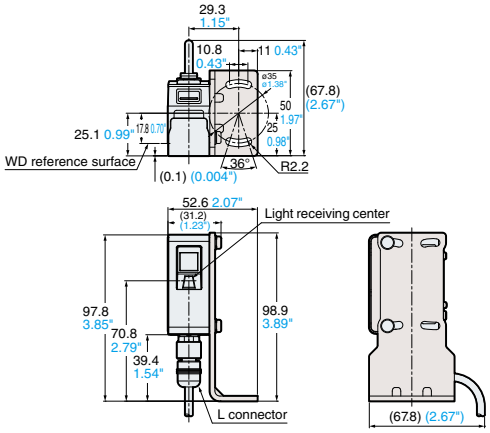
*Support strut (ø12 ø0.47") not included with this product.

Material: SUS304

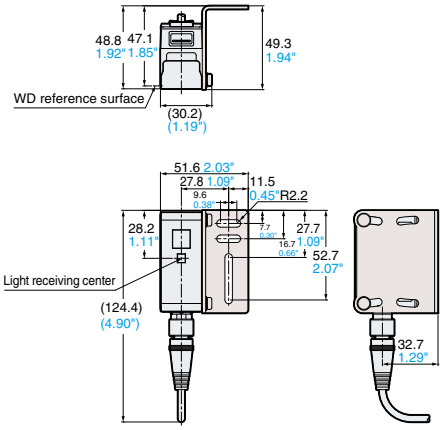
OP-88114 (AI-B050/B100)



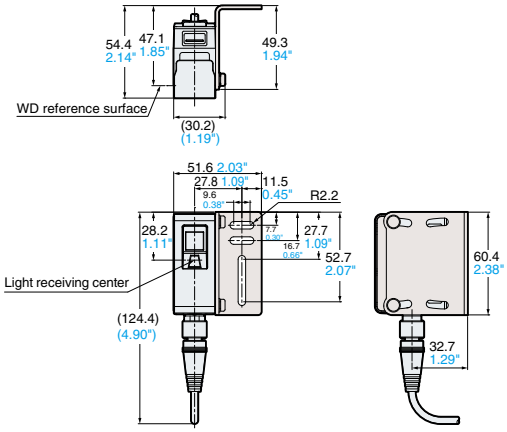
OP-88114 (AI-B160)



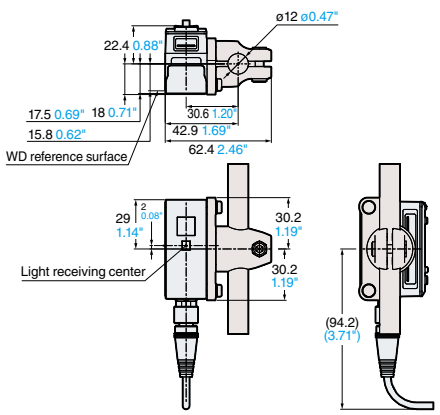
OP-88115 (AI-B050/B100)



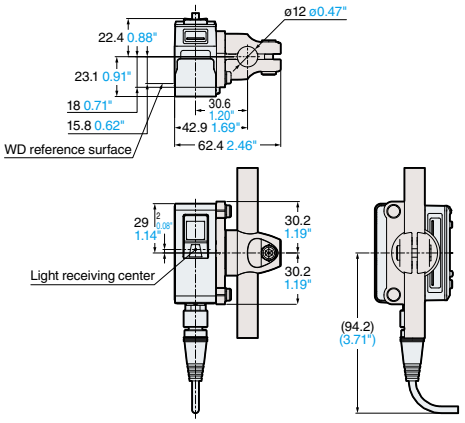
OP-88115 (AI-B160)



OP-88116 (AI-B050/B100)

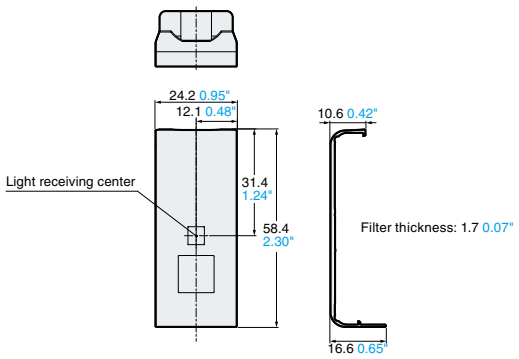


OP-88116 (AI-B160)

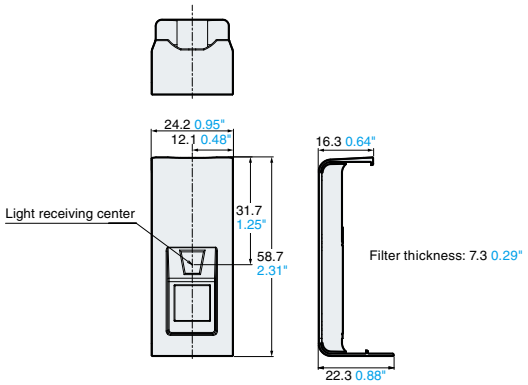


Attachments (built-in amplifier models)

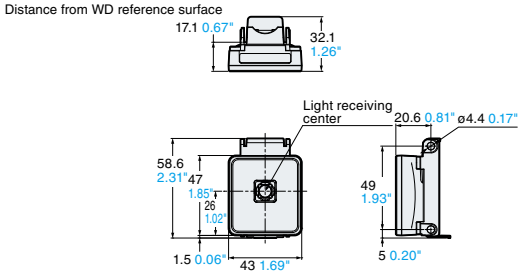
AI-F05B



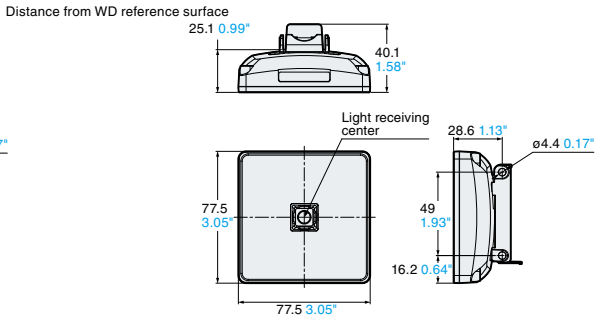
AI-F10B



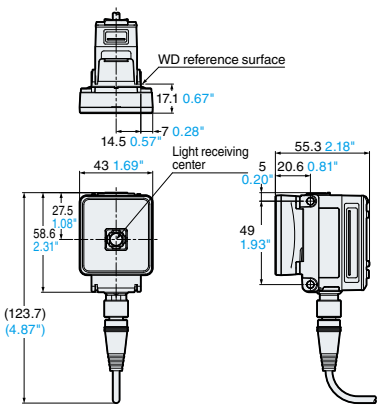
AI-D16B



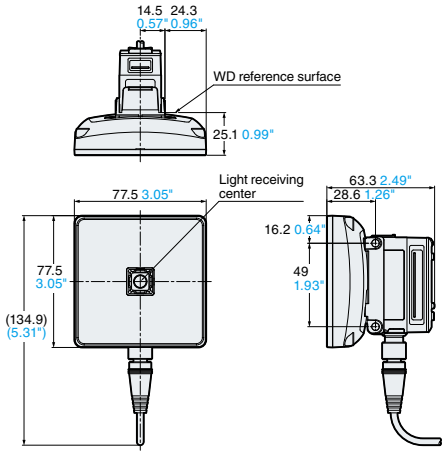
AI-D32B



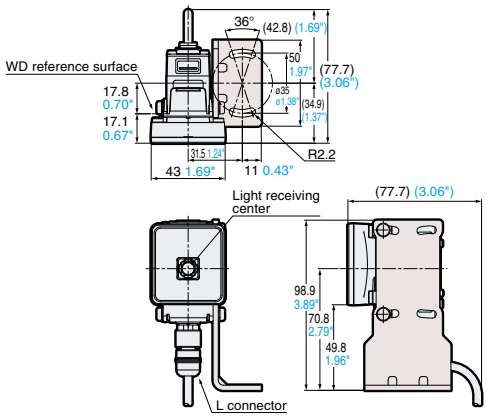
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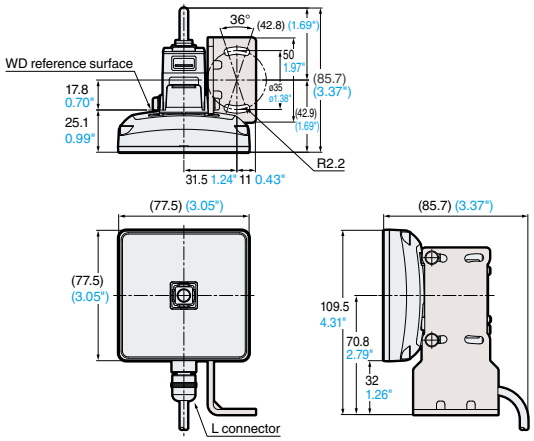
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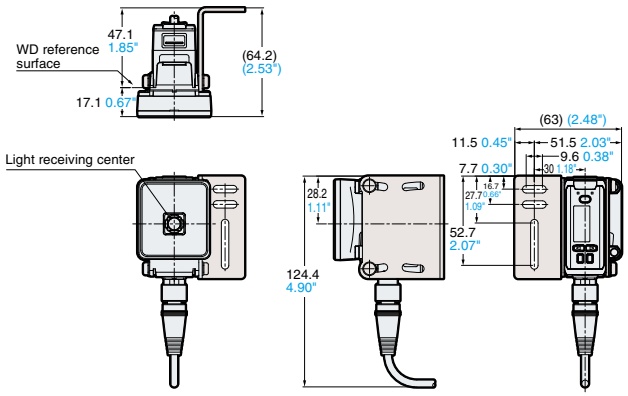
AI-D16B/OP-88114 (AI-B050/B100/B160)



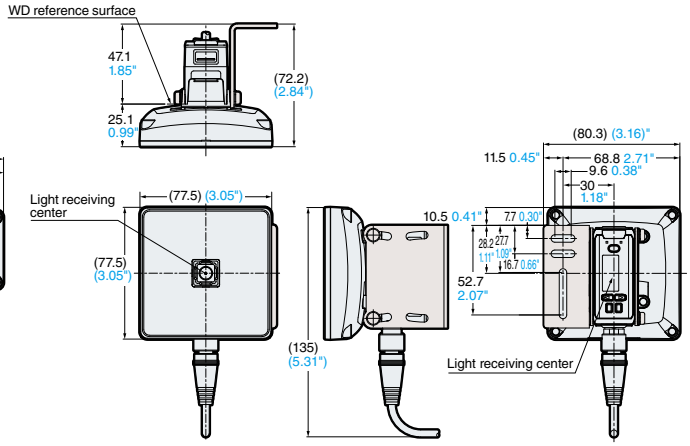
AI-D32B/OP-88114 (AI-B100/B160)



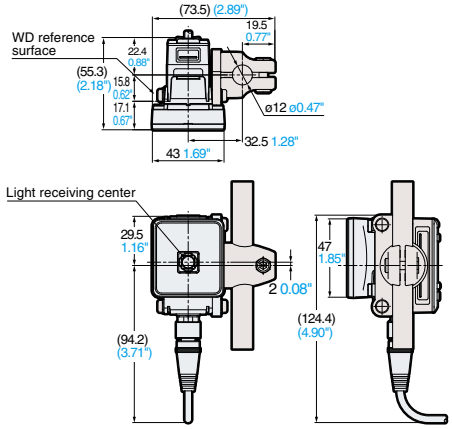
AI-D16B/OP-88115 (AI-B050/B100/B160)



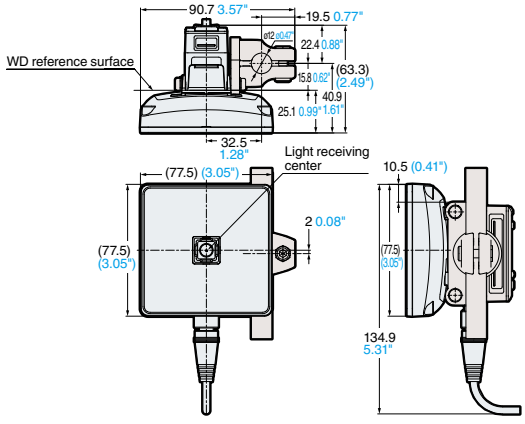
AI-D32B/OP-88115 (AI-B100/B160)



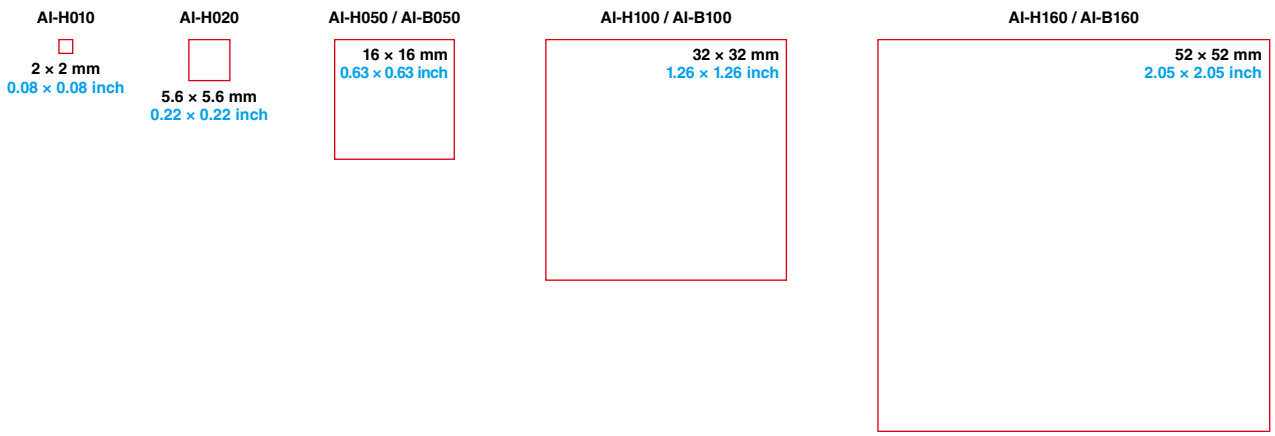
AI-D16B/OP-88116 (AI-B050/B100/B160)



AI-D32B/OP-88116 (AI-B100/B160)



Detecting Area



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