

## Introduction

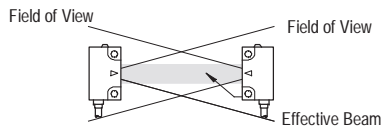
Transmitted beam sensors provide the longest sensing distances and the highest level of operating margin. For example, PHOTOSWITCH<sup>®</sup> Series 4000B Transmitted Beam sensors are capable of sensing distances of up to 274 m (900 ft).

Transmitted beam application margins at ranges of less than 10 m (3.1 ft) can exceed 10,000X. For this reason, transmitted beam is the best sensing mode when operating in very dusty or dirty industrial environments.

Another example: Series 9000 Transmitted Beam photoelectric sensors offer 300X margin at a sensing distance of 3 m (9.8 ft). At this distance, these sensors will continue to operate even if 99.67% of the combined lens area of the light source and receiver is covered with contamination.

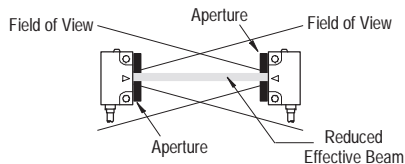
The "effective beam" of a transmitted beam sensor is equivalent to the diameter of the lens on the light source and receiver (Figure 6). Reliable detection occurs when the target is opaque and breaks at least 50% of the effective beam.

**Figure 6**  
Effective Beam



Detection of objects smaller than the effective beam can best be achieved by reducing the beam diameter through means of apertures placed in front of the light source and receiver (Figure 7). Apertures are available for most 42KL, 42KB and 42EF transmitted beam sensors. Some users have created their own apertures for other sensor families.

**Figure 7**  
Effective Beam with Apertures



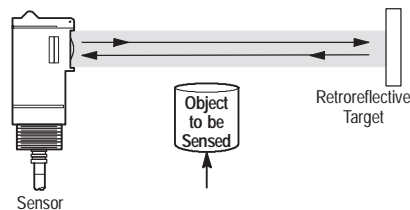
The most reliable transmitted beam applications have a very high margin when the target is absent, and a margin of zero (or close to zero) when the target is present.

Transmitted beam sensing may not be suitable for detection of translucent or transparent targets. The high margin levels allow the sensor to "see through" these targets. While it is often possible to reduce the sensitivity of the receiver, retroreflective or diffuse sensing may provide a better solution.

### Retroreflective

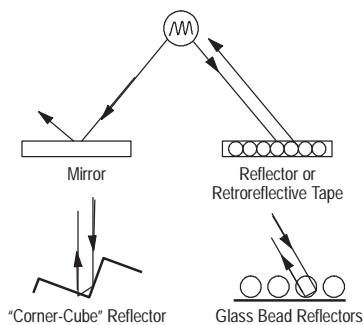
Retroreflective (reflex) is the most popular sensing mode. A retroreflective sensor contains both the light source and receiver in one housing. The light beam emitted by the light source is reflected by a special reflective object and detected by the receiver. The target is detected when it breaks this light beam (Figure 8).

**Figure 8**  
Retroreflective Sensing



Special reflectors or reflective tapes are used for retroreflective sensing. Unlike mirrors or other flat reflective surfaces, these reflective objects do not have to be aligned perfectly perpendicular to the sensor. Misalignment of a reflector or reflective tape of up to 15° will typically not significantly reduce the margin of the sensing system (see Figure 9).

**Figure 9**  
Retroreflective Materials



A wide selection of reflectors and reflective tapes are available.

The maximum available sensing distance of a sensor and reflector will depend in part upon the efficiency of the reflector or reflective tape. These reflective materials (page 1-306) are rated with a reflective index.

The PHOTOSWITCH standard 78 mm (3 in.) diameter round reflector (catalog number 92-39) is used to determine the maximum sensing distance of most PHOTOSWITCH sensors.

The 92-39 reflector has a reflective index of 100. The 92-99 reflective tape has a reflective index of 77 meaning that it will reflect only 77% as much light as a 92-39 reflector.

Retroreflective sensors are easier to install than transmitted beam sensors. Only one sensor housing must be installed and wired. However, margins when the target is absent are typically 10 to 1000 times lower than transmitted beam sensing, making retroreflective sensing less desirable in highly contaminated environments.

Caution must be used when applying standard retroreflective sensors in applications where shiny or highly reflective targets must be sensed. Reflections from the target itself may be detected. It may be possible to orient the sensor and reflector or reflective tape so that the shiny target reflects light away from the receiver. However, for most applications with shiny targets, *polarized retroreflective* sensing offers a better solution.

Polarized retroreflective sensors contain polarizing filters in front of the light source and receiver. These filters are perpendicular or 90° out of phase with each other (Figure 10, on page 1-23).

The sensor cannot see light reflected by most targets. The reflected polarized light cannot pass through the polarizing filter located in front of the receiver.

Reflectors depolarize reflected light. Some of the reflected depolarized light can pass through the polarizing filter in front to the receiver and can be detected by the sensor.

In summary, the sensor can "see" the reflection from a reflector, and it cannot "see" the reflection from most shiny targets.

# PHOTOSWITCH<sup>R</sup> Photoelectric Sensors

## 42KB

### Micro Rectangular



### Features

- § Compact rectangular package
- § Four sensing modes
- § Sensitivity adjustment
- § Selectable light/dark operate
- § Highly visible LED Indicators
- § NPN or PNP output models
- § 2 m cable or pico connections

### Specifications

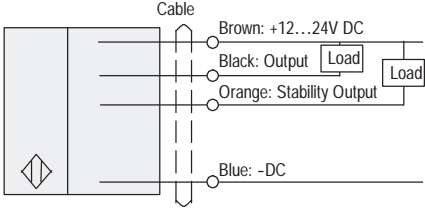
Environmental	
Certifications	cULus Listed and CE Marked for all applicable directives
Operating Environment	NEMA 1, 4, 6, 12, 13; IP67 (IEC 60529)
Operating Temperature [C (F)]	-25...+55° (-13...+131°)
Vibration	10...55 Hz, 1 mm amplitude, meets or exceeds IEC 60947-5-2
Shock	30g with 1 ms pulse duration, meets or exceeds IEC 60947-5-2
Relative Humidity	5...85%
Optical	
Sensing Mode	Retroreflective, diffuse, sharp cutoff diffuse, transmitted beam
Sensing Range	See Product Selection table on page 1-95
Field of View	See Product Selection table on page 1-95
Light Source	Visible red LED (660 nm), infrared LED (880 nm)
LED Indicators	See User Interface Panel below
Adjustments	Sensitivity potentiometer
Electrical	
Voltage	12...24V DC
Current Consumption	30 mA max
Sensor Protection	Short circuit (NPN models only), reverse polarity, false pulse, transient noise
Outputs	
Response Time	350 μs
Output Type	PNP or NPN by cat. no., stability output for NPN models only
Output Mode	Light or dark operate selectable
Output Current	100 mA max @ 24V DC
Output Leakage Current	0.5 mA max
Mechanical	
Housing Material	Polyarylate
Lens Material	Acrylic, polycarbonate, polyarylate by cat. no.
Connection Types	2 m cable, 3-pin DC pico (M8) QD
Supplied Accessories	Mounting bracket, adhesive apertures (transmitted beam models), screwdriver, reflector (retroreflective models)
Optional Accessories	See mounting brackets and cordsets on page 1-97

### User Interface Panel

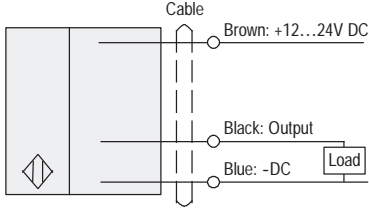
Label	Color	State	Status
STB	Green	OFF	0.8<math><1.2</math>
		ON	0.8>math>>1.2</math>
OUT	Red	OFF	Output not activated
		ON	Output activated

Wiring Diagrams

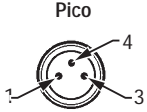
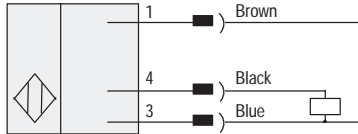
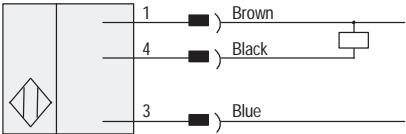
Cable NPN Output



Cable PNP Output



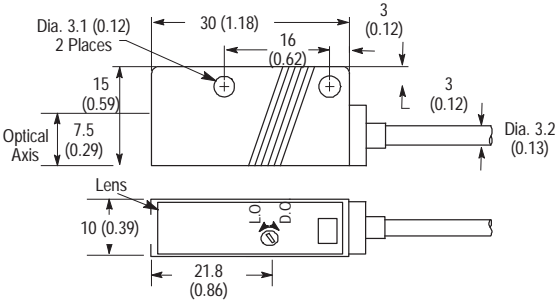
Quick-Disconnect



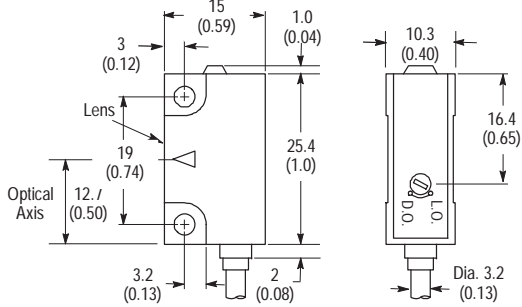
Note: Details regarding connection of Rockwell Automation Bulletin 42KB photoelectric sensors to Rockwell Automation Programmable Controllers can be found in "PHOTOSWITCH<sup>®</sup> Photoelectric Sensors and Programmable Controller Interface Manual" on [www.ab.com/literature](http://www.ab.com/literature).

Approximate Dimensions [mm (in.)]

End View Sensors

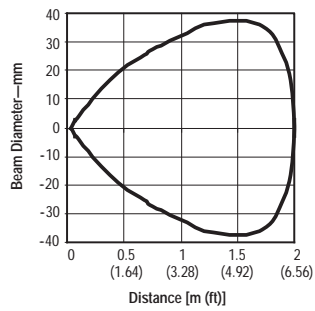
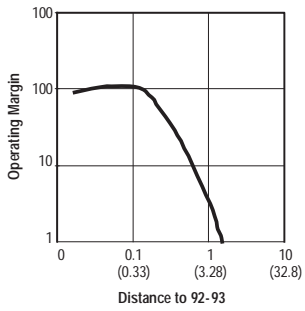


Side View Sensors



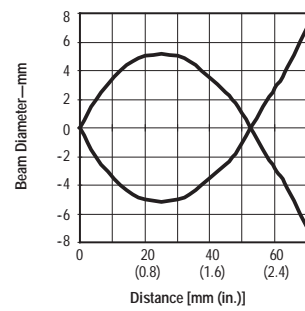
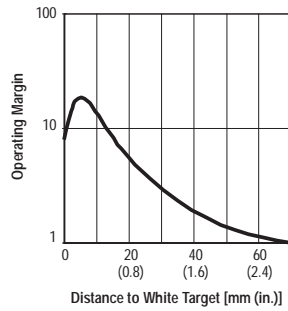
Typical Response Curve Beam Pattern

Retroreflective

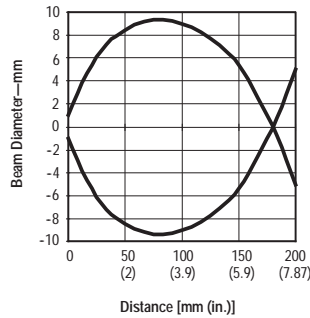
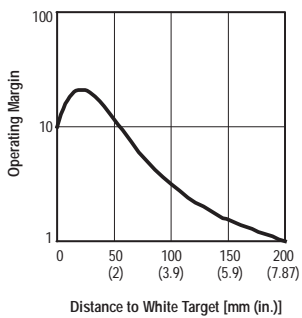


Typical Response Curve Beam Pattern

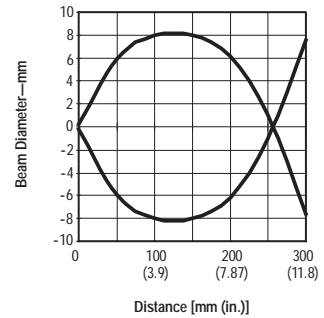
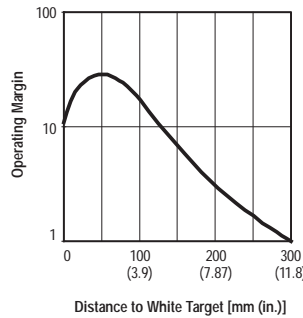
Standard Diffuse—70 mm



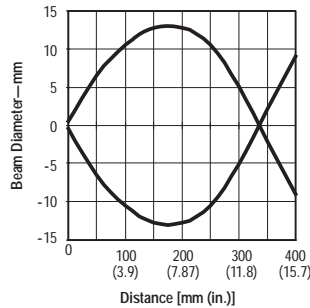
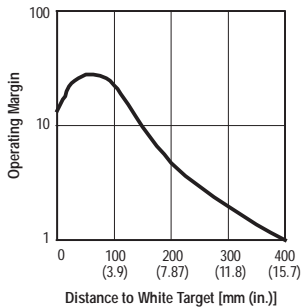
Standard Diffuse—200 mm



Standard Diffuse—300 mm

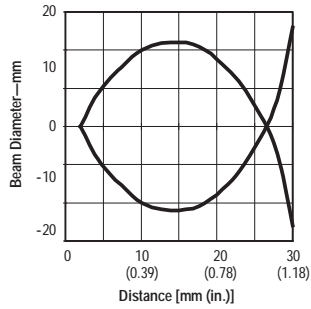
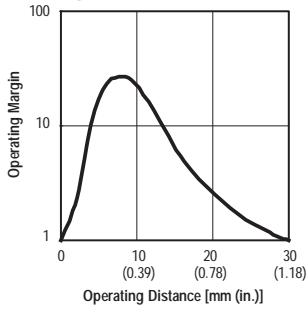


Standard Diffuse—400 mm



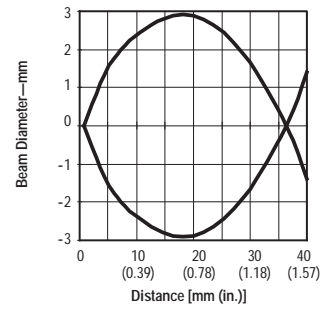
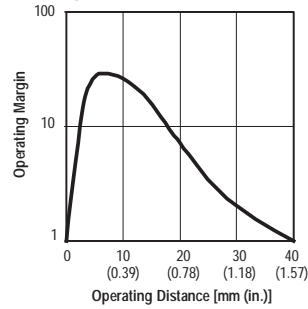
Typical Response Curve Beam Pattern

Sharp Cutoff Diffuse—30 mm

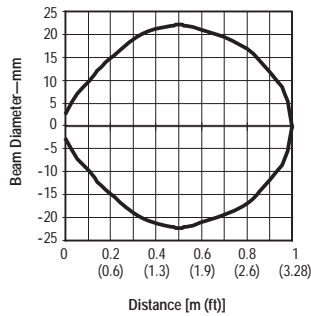
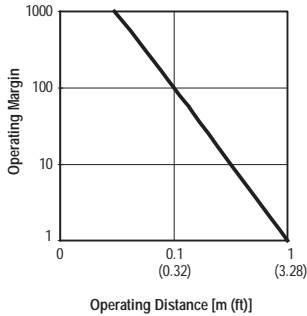


Typical Response Curve Beam Pattern

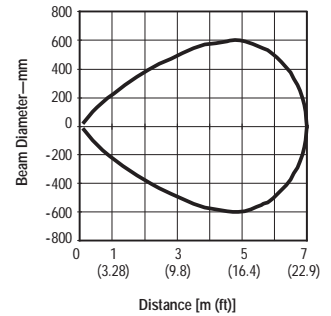
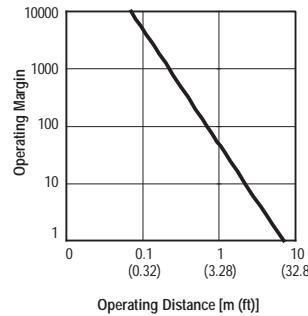
Sharp Cutoff Diffuse—40 mm



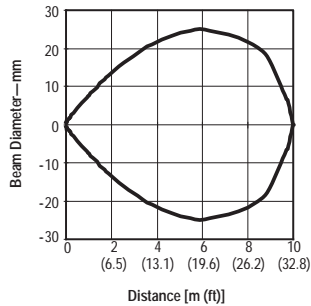
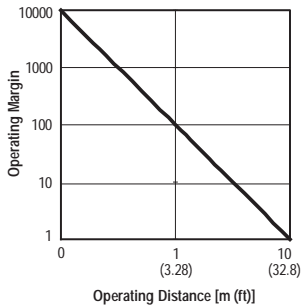
Transmitted Beam—1 m



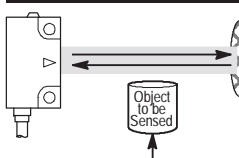
Transmitted Beam—7 m



Transmitted Beam—10 m



Product Selection

Sensing Mode	Operating Voltage Supply Current	Sensing Distance	Output Energized	LED Source	Output Type Capacity Response Time	End or Side View	Connection Type	Cat. No.
 <p>Retroreflective</p> <p>Field of View: 5°</p> <p>Emitter LED: Visible red 660 nm</p>	12...24V DC ±10% 20 mA	3 mm... 2 m (0.12 in... 6.6 ft)	Light/Dark Selectable	—	NPN Output: 100 mA Stability: 50 mA 350 μs	Side	2 m 500V cable	42KB-U2LNSN-A2
							3-pin pico	42KB-U2LNSN-Y3
	12...24V DC ±10% 25 mA						2 m 500V cable	42KB-U2LPSN-A2
							3-pin pico	42KB-U2LPSN-Y3


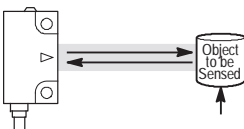
Refer to page 1-97 for cordsets and accessories.

PHOTOSWITCH<sup>R</sup> Photoelectric Sensors

42KB

Micro Rectangular

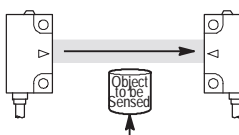
Product Selection (continued)

Sensing Mode	Operating Voltage Supply Current	Sensing Distance [mm (in.)]	Output Energized	LED Source	Output Type Capacity Response Time	End or Side View <sup>①</sup>	Connection Type	Cat. No.	
 <p><i>Standard Diffuse</i></p> <p>Field of View: 50 mm Infrared sensors: 20_; All others: 12_ Emitter LED: See Product Selection</p>	12...24V DC ±10% 25 mA	3...70 (0.12...2.8)	Light/Dark Selectable	IR 950 nm	NPN Output: 100 mA, Stability: 50 mA 350 μs	End	2 m 500V cable	42KB-D1LNED-A2	
							3-pin pico	42KB-D1LNED-Y3	
	12...24V DC ±10% 28 mA	3...70 (0.12...2.8)	Light/Dark Selectable	IR 950 nm	PNP Output: 100 mA 350 μs	End	2 m 500V cable	42KB-D1LPED-A2	
							3-pin pico	42KB-D1LPED-Y3	
	12...24V DC ±10% 22 mA	3...200 (0.12...7.9)	Light/Dark Selectable	IR 900 nm	NPN Output: 100 mA, Stability: 50 mA 350 μs	End	2 m 500V cable	42KB-D1LNEG-A2	
							3-pin pico	42KB-D1LNEG-Y3	
	12...24V DC ±10% 25 mA	3...200 (0.12...7.9)	Light/Dark Selectable	IR 900 nm	PNP Output: 100 mA 350 μs	End	2 m 500V cable	42KB-D1LPEG-A2	
							3-pin pico	42KB-D1LPEG-Y3	
	12...24V DC ±10% 20 mA	3...300 (0.12...11.8)	Light/Dark Selectable	Red 700 nm	NPN Output: 100 mA, Stability: 50 mA 350 μs	End	2 m 500V cable	42KB-D2LNEH-A2	
							3-pin pico	42KB-D2LNEH-Y3	
	12...24V DC ±10% 25 mA	3...300 (0.12...11.8)	Light/Dark Selectable	Red 700 nm	PNP Output: 100 mA 350 μs	End	2 m 500V cable	42KB-D2LPEH-A2	
							3-pin pico	42KB-D2LPEH-Y3	
12...24V DC ±10% 22 mA	3...400 (0.12...15.8)	Light/Dark Selectable	IR 900 nm	NPN Output: 100 mA, Stability: 50 mA 350 μs	Side	2 m 500V cable	42KB-D1LNSH-A2		
						3-pin pico	42KB-D1LNSH-Y3		
12...24V DC ±10% 25 mA	3...400 (0.12...15.8)	Light/Dark Selectable	IR 900 nm	PNP Output: 100 mA 350 μs	Side	2 m 500V cable	42KB-D1LPSH-A2		
						3-pin pico	42KB-D1LPSH-Y3		
12...24V DC ±10% 20 mA	3...400 (0.12...15.8)	Light/Dark Selectable	Red 700 nm	NPN Output: 100 mA, Stability: 50 mA 350 μs	Side	2 m 500V cable	42KB-D2LNSG-A2		
						3-pin pico	42KB-D2LNSG-Y3		
12...24V DC ±10% 25 mA	3...400 (0.12...15.8)	Light/Dark Selectable	Red 700 nm	PNP Output: 100 mA 350 μs	Side	2 m 500V cable	42KB-D2LPSG-A2		
						3-pin pico	42KB-D2LPSG-Y3		
 <p><i>Sharp Cutoff Diffuse</i></p> <p>Field of View: Infrared sensors: 15_; Visible red sensors: 20_ Emitter LED: Infrared 900 nm or Visible red 660 nm (See Product Selection)</p>	12...24V DC ±10% 20 mA	3...30 (0.12...1.2)	Light/Dark Selectable	Red 660 nm	NPN Output: 100 mA Stability: 50 mA 350 μs	Side	2 m 500V cable	42KB-S2LNSA-A2	
							3-pin pico	42KB-S2LNSA-Y3	
	12...24V DC ±10% 22 mA	3...40 (0.12...1.6)	Light/Dark Selectable	IR 900 nm	Red 660 nm	NPN Output: 100 mA Stability: 50 mA 350 μs	Side	2 m 500V cable	42KB-S1LNSB-A2
								3-pin pico	42KB-S1LNSB-Y3
	12...24V DC ±10% 25 mA	3...30 (0.12...1.2)	Light/Dark Selectable	Red 660 nm	PNP Output: 100 mA 350 μs	Side	2 m 500V cable	42KB-S2LPSA-A2	
							3-pin pico	42KB-S2LPSA-Y3	
12...24V DC ±10% 25 mA	3...40 (0.12...1.6)	Light/Dark Selectable	IR 900 nm	Red 660 nm	PNP Output: 100 mA 350 μs	Side	2 m 500V cable	42KB-S1LPSB-A2	
							3-pin pico	42KB-S1LPSB-Y3	

① See page 1-93 for detailed dimensions.

Refer to page 1-97 for cordsets and accessories.

Product Selection (continued)

Sensing Mode	Operating Voltage Supply Current	Sensing Distance	Output Energized	LED Source	Output Type Capacity Response Time	End or Side View <sup>①</sup>	Connection Type	Cat. No.							
 <p>Transmitted Beam<sup>②</sup></p> <p>Field of View: 1 m sensors: 50°; All others: 24° Emitter LED: Infrared 880 nm or Visible red 700 nm (See Product Selection)</p>	12...24V DC ±10% Source: 23 mA Receiver: 18 mA	3 mm...1 m (0.12 in... 3.2 ft)	Light/Dark Selectable	IR 880 nm	NPN Output: 100 mA, Stability: 50 mA 350 µs	End	2 m 500V cable	42KB-T1LNEL-A2 <sup>③</sup>							
							3-pin pico	42KB-T1LNEL-Y3							
		Side				2 m 500V cable	42KB-T1LNLSL-A2 <sup>③④</sup>								
						3-pin pico	42KB-T1LNLSL-Y3								
		End				2 m 500V cable	42KB-T1LNEQ-A2								
						3-pin pico	42KB-T1LNEQ-Y3								
	Side	12...24V DC ±10% Source: 20 mA Receiver: 18 mA		3 mm...7 m (0.12 in... 23 ft)	Red 700 nm	PNP Output: 100 mA 350 µs	Red 700 nm	Side	2 m 500V cable	42KB-T1LNSQ-A2 <sup>③</sup>					
									3-pin pico	42KB-T1LNSQ-Y3					
				Side				2 m 500V cable	42KB-T2LNSR-A2 <sup>③</sup>						
								3-pin pico	42KB-T2LNSR-Y3						
				End				12...24V DC ±10% Source: 23 mA Receiver: 21 mA	3 mm...1 m (0.12 in... 3.2 ft)	IR 880 nm	PNP Output: 100 mA 350 µs	IR 880 nm	End	2 m 500V cable	42KB-T1LPEL-A2 <sup>③</sup>
														3-pin pico	42KB-T1LPEL-Y3
Side	2 m 500V cable	42KB-T1LPSL-A2 <sup>③④</sup>													
	3-pin pico	42KB-T1LPSL-Y3													
End	3 mm...7 m (0.12 in... 23 ft)	3 mm...7 m (0.12 in... 23 ft)	Red 700 nm	PNP Output: 100 mA 350 µs	Red 700 nm	Side	2 m 500V cable	42KB-T1LPEQ-A2							
							3-pin pico	42KB-T1LPEQ-Y3							
Side	12...24V DC ±10% Source: 20 mA Receiver: 21 mA	3 mm...10 m (0.12 in... 32.8 ft)	Red 700 nm	PNP Output: 100 mA 350 µs	Red 700 nm	Side	2 m 500V cable	42KB-T1LPSQ-A2 <sup>③</sup>							
							3-pin pico	42KB-T1LPSQ-Y3							
Side	12...24V DC ±10% Source: 20 mA Receiver: 21 mA	3 mm...10 m (0.12 in... 32.8 ft)	Red 700 nm	PNP Output: 100 mA 350 µs	Red 700 nm	Side	2 m 500V cable	42KB-T2LPSR-A2 <sup>③</sup>							
							3-pin pico	42KB-T2LPSR-Y3							

- ① See page 1-93 for detailed dimensions.
- ② Adhesive 1 mm apertures are included with these sensors.
- ③ Optional metal apertures are available for these sensors under Accessories .
- ④ Both a light source (emitter) and receiver are included in the package. To identify the light source, replace the "T" in the cat. no. with "E." To identify the receiver, replace the "T" in the cat. no. with "R." Example: 42KB-T2KNHK-A2 contains one 42KB-E2KNHK-A2 light source and one 42KB-R2KNHK-A2 receiver. Light sources and receivers are not available separately.

Maximum Operating Distance with Apertures

Aperture Cat. No.				Sensor Cat. No.	
61-6726	61-6727	61-6728	61-6729		
100 mm (3.93 in.)	300 mm (11.8 in.)	400 mm (15.7 in.)	300 mm (11.8 in.)	42KB-T1LNLSL-A2	42KB-T1LPSL-A2
400 mm (1.57 in.)	1 m (39.3 in.)	3 m (9.8 ft)	2 m (6.56 ft)	42KB-T2LNSR-A2	42KB-T2LPSR-A2
300 mm (11.8 in.)	1 m (39.3 in.)	2.5 m (8.2 ft)	1.7 m (5.6 ft)	42KB-T1LNSQ-A2	42KB-T1LPSQ-A2

Cordsets and Accessories

Description	Cat. No.	Description	Cat. No.
Pico QD Cordset, 3-pin 2 m	889P-F3AB-2	Aperture, 2 mm (10 pcs)	61-6727
End View Bracket (included)	60-2632	Aperture, 3 mm (10 pcs)	61-6728
Side View Bracket (included)	60-2633	Aperture, 1 x 5 mm (10 pcs)	61-6729
Aperture, 1 mm (10 pcs)	61-6726	Reflectors (included)	92-93