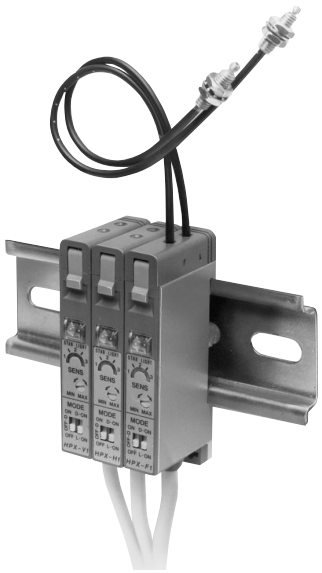
Photoelectric Sensors/Controls

Fiber Optic–Miniature Sensors

HPX Series



FEATURES

- Satisfies needs for low hysteresis, high sensitivity, mark detection and ultra-fast response sensors.
- Units can be snap-in DIN rail mounted or bracket mounted, for worldwide compatibility.
- Fiber optic cables attach quickly, without tools.
- Mutual interference protection enhances detection stability and performance reliability.
- Self-diagnostic output gives advance warning of marginal operating conditions.
- Selectable light operate or dark operate.
- Slim-profile housing.
- Current sourcing PNP or current sinking NPN output.
- Optional 40-msec Off-delay on all listings.
- Listings available with 6″ pigtail with 12mm connector.

GENERAL INFORMATION

HPX Series Fiber Optic Photoelectric Sensors deliver versatile, high-performance scanning in a slim-profile package. Options are: High Sensitivity/High Power HPX-H, Low Hysteresis HPX-A, Ultra-Fast (50μs) Response HPX-F, and Mark Detection HPX-V. They will provide diffuse/retro or thru scan, depending on the fiber optic cables used. Fiber optic cables attach to sensors quickly, without tools.

Fine-tuning is quick and easy, using a green LED stability indicator and a red LED which indicates light is being received. When the self-diagnostic circuit provides an output, the green LED will flash. The three-turn sensitivity potentiometer has superior linearity, enabling precision adjustments. A dial pointer shows users at a glance where they are in the sensitivity adjustment range. Sensors automatically shift their LED pulse phase to prevent up to three closely mounted units from interfering with each other.

SENSOR ORDER GUIDE, LEADWIRES

Sensor Type	Description	Output Mode	Catalog Listing
High Sensitivity/High Power 2m leads	HPX-**H** high sensitivity/high power sensors normally have twice the scan power of other HPX sensors (up to 400 mm) when applied in the standard opposed mode using fiber optic cables with 1.0 mm dia. fiber.	NPN	**HPX-H1-H**
	The extra power allows low reflectance of objects to be sensed (diffuse scan). Hysteresis of 10.6% enables clean on/off operation in high-contrast applications.	PNP	**HPX-H2-H**
Low Hysteresis 2m leads	HPX-**A** low hysteresis sensors are ideal for use when the difference in On/Off contrast is very small. Hysteresis of 3.2% enables reliable detection of high speed, low reflectance objects.	NPN	**HPX-A1-H**
	Superior temperature stability, e.g., the operation setting point will not change more than 1% of set range over entire operational temperature.	PNP	**HPX-A2-H**
Ultra-fast Response 2m leads	HPX-**F** ultra-fast response sensors have a 50-microsecond response time. They can reliably detect small objects moving at high rates of speed.	NPN	**HPX-F1-H**
	For example, an object as small as 2.0 mm diameter can be detected while it is traveling up to 56 meters per second.	PNP	**HPX-F2-H**
Mark Detection 2m leads	HPX-**V** mark detection sensors emit a visible green light to allow sensing of color marks printed on fast-moving objects.	NPN	**HPX-V1-H**
	500-microsecond response time enables high-speed detection of small, different-colored marks displayed on various background colors.	PNP	**HPX-V2-H**

SENSOR ORDER GUIDE, 6″ PIGTAIL WITH 12mm CONNECTOR

Sensor Type	Description	Output Mode	Catalog Listing
High Sensitivity/High Power 6″ pigtail w/ connector	HPX-**H** high sensitivity/high power sensors normally have twice the scan power of other HPX sensors (up to 400 mm) when applied in the standard opposed mode using fiber optic cables with 1.0 mm dia. fiber.	NPN	**HPX-H1-HC**
	The extra power allows low reflectance of objects to be sensed (diffuse scan). Hysteresis of 10.6% enables clean on/off operation in high-contrast applications.	PNP	**HPX-H2-HC**
Low Hysteresis 6″ pigtail w/ connector	HPX-**A** low hysteresis sensors are ideal for use when the difference in On/Off contrast is very small. Hysteresis of 3.2% enables reliable detection of high speed, low reflectance objects.	NPN	**HPX-A1-HC**
	Superior temperature stability, e.g., the operation setting point will not change more than 1% of set range over entire operational temperature.	PNP	**HPX-A2-HC**

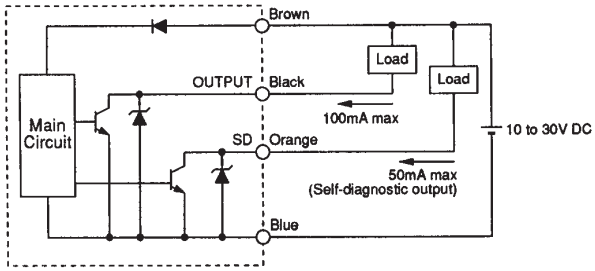
Fiber Optic–Miniature Sensors

SENSOR SPECIFICATIONS

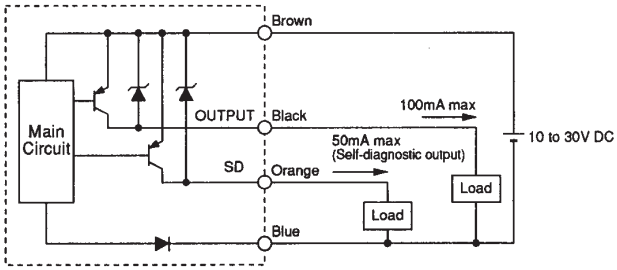
Input Supply	10 to 30 VDC (10% ripple)
Current Consumption	35 mA max.
Output	NPN or PNP open collector transistor, 100 mA max., 1 V drop
Diagnostic Output	50 mA max.
Mode Selections	Switchable light or dark operate
Light Type	Visible red: HPX-H, HPX-A, and HPX-F types Visible green: HPX-V type
Response Time	HPX-H, HPX-A, and HPX-V types: 500 microseconds On, 500 microseconds Off HPX-F types: 50 microseconds On, 70 microseconds Off
Optional Off Delay Timing	40±10 milliseconds
Circuit Protection	Polarity reversible, false pulse, short circuit
Temperature Range	Operating: –20° to 60°C @ 5-85% RH (50°C max. if gang mounted) Storage: –40° to 70°C @ 5-85% RH
Ambient Light Immunity	Incandescent: 5,000 lux Sunlight: 20,000 lux
Materials	Housing: Polycarbonate/ABS alloy Bracket: 304 Stainless steel Cable: Oil resistant PVC sleeve (2m, Ø 4,2 mm)

OUTPUT DIAGRAMS

NPN

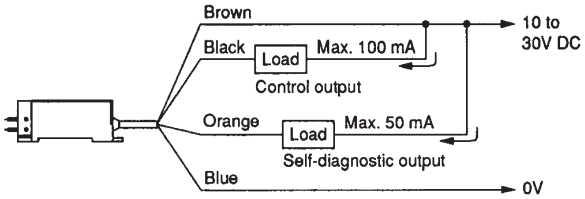


PNP

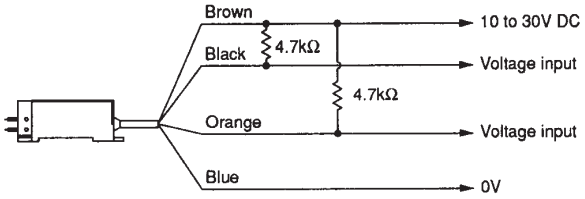


WIRING DIAGRAMS

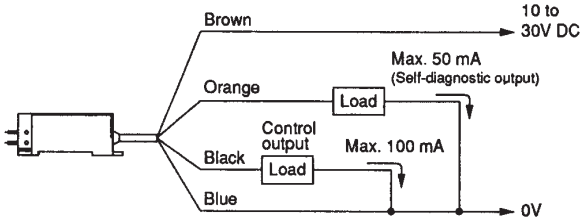
NPN – When a load is directly applied



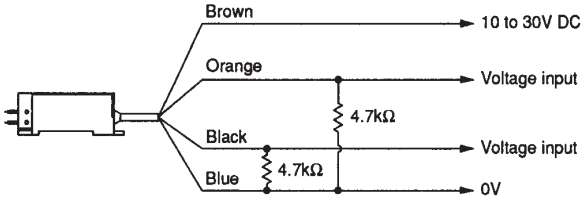
NPN – When a voltage input device is connected



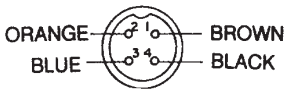
PNP – When a load is directly applied



PNP – When a voltage input device is connected



CONNECTOR

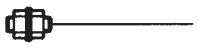
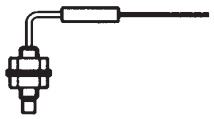


Fiber Optic–Miniature Sensors

FIBER OPTIC CABLE SPECIFICATIONS

Operating Temperature	–30° to 70°C at 35 to 85% RH, unless otherwise noted
Fiber Length	2 meters
Thru Scan/Min. Target Size (Opaque Object)	Target object should be at least the diameter of the cable fiber
Diffuse Scan/Std. Target Size (White Paper)	With HPX-H sensor: 20 x 20 cm
	With HPX-A sensor: 10 x 10 cm
	With HPX-F sensor: 5 x 5 cm
	With HPX-V sensor: 5 x 5 cm
Materials	Sheathing: Black polyethylene
	Heads: Stainless steel, unless otherwise noted

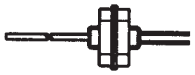
THRU SCAN FIBER OPTIC CABLE ORDER GUIDE/SCANNING DISTANCES

Fiber Optic Cable Type	Cable Shape	Sensor Type	Scanning Dist. (mm)	Features	Min. Bend Radius	Cable Catalog Listing
Long Distance	M4 thread 	HPX-H HPX-A HPX-F HPX-V	800 400 160 60	Twice scan distance of standard cable	R20 mm	HPF-T001-H Freecut*
	φ3mm 	HPX-H HPX-A HPX-F HPX-V	800 400 160 60	Twice scan distance of standard cable. No thread.	R20 mm	HPF-T002-H Freecut*
Standard	M4 thread 	HPX-H HPX-A HPX-F HPX-V	400 200 80 30	Standard detection	R20 mm	HPF-T003-H Freecut*
	φ3mm 	HPX-H HPX-A HPX-F HPX-V	400 200 80 30	Standard detection. No thread	R20 mm	HPF-T004-H Freecut*
	M4 thread 	HPX-H HPX-A HPX-F HPX-V	400 200 80 30	Standard detection. Bendable probe.	R20 mm	HPF-T005-H Freecut*
	φ3mm 	HPX-H HPX-A HPX-F HPX-V	400 200 80 30	Standard stainless steel tube. Flexible tube unit. No thread.	R20 mm	HPF-T006-H Freecut*
Side View	φ2.5mm 	HPX-H HPX-A HPX-F HPX-V	60 30 12 4	Small dia. fiber, side view sleeve. Detects minute targets.	R15 mm	HPF-T007-H Freecut*
Elasticity and Small Diameter	M3 thread 	HPX-H HPX-A HPX-F HPX-V	100 40 20 8	Small dia. fiber. Detects minute objects.	R15 mm	HPF-T008-H Freecut*
	φ1.5mm 	HPX-H HPX-A HPX-F HPX-V	100 40 20 8	Small dia. fiber. Detects minute targets. No thread.	R15 mm	HPF-T009-H Freecut*
Elbow	M4 thread 	HPX-H HPX-A HPX-F HPX-V	300 150 60 20	90° bend. With thread.	R25 mm	HPF-T010-H Freecut*
Coiled	M4 thread 	HPX-H HPX-A HPX-F HPX-V	300 150 60 20	Coiled fiber. Can be attached to moving elements.	—	HPF-T011-H Freecut*
Heat Resistant	M4 thread 	HPX-H HPX-A HPX-F HPX-V	250 120 50 15	Heat resistance to 105°C.	R25 mm	HPF-T012-H Freecut*

*Freecut; all plastic cables except special ones can be freely cut to adjust the length with the cutter FE-PA-FL.

Fiber Optic–Miniature Sensors

DIFFUSE SCAN FIBER OPTIC CABLE ORDER GUIDE/SCANNING DISTANCES

Fiber Optic Cable Type	Cable Shape	Sensor Type	Scanning Dist. (mm)	Features	Min. Bend Radius	Cable Catalog Listing
Long Distance	M6 thread 	HPX-H HPX-A HPX-F HPX-V	230 120 45 15	One and one-half times the scan distance of standard cable.	R20 mm	HPF-D001-H Freecut*
Standard	M6 thread 	HPX-H HPX-A HPX-F HPX-V	150 80 30 10	Standard detection.	R20 mm	HPF-D002-H Freecut*
	M6 thread 	HPX-H HPX-A HPX-F HPX-V	150 80 30 10	Bendable probe.	R20 mm	HPF-D003-H Freecut*
Small Diameter	M3 thread 	HPX-H HPX-A HPX-F HPX-V	40 20 8 3	Small dia. fiber. Small sensing head.	R20 mm	HPF-D004-H Freecut*
	φ3mm 	HPX-H HPX-A HPX-F HPX-V	40 20 8 3	Small dia. fiber. Small sensing head. No threads.	R20 mm	HPF-D005-H Freecut*
	M4 thread 	HPX-H HPX-A HPX-F HPX-V	40 20 8 3	Small dia. fiber. Bendable probe.	R20 mm	HPF-D006-H Freecut*
Coiled	M6 thread 	HPX-H HPX-A HPX-F HPX-V	50 25 10 4	Can be attached to moving elements.	—	HPF-D007-H Freecut*
	M6 thread 	HPX-H HPX-A HPX-F HPX-V	50 25 10 4	Can be attached to moving elements. Bendable probe.	—	HPF-D008-H Freecut*
Coaxial	M6 thread 	HPX-H HPX-A HPX-F HPX-V	150 80 30 10	Coaxial fiber. Suitable for small part detection.	R25 mm	HPF-D009-H Freecut*
	M3 thread 	HPX-H HPX-A HPX-F HPX-V	40 20 8 3	Can combine with HPF-LU01 lens to get 0.4 mm spot.	R15 mm	**HPF-D010-H** Freecut*
Side View	φ3mm 	HPX-H HPX-A HPX-F	15 8 3	Small dia. Side view sleeve.	R15 mm	**HPF-D011-H** Freecut*
Elasticity	M6 thread 	HPX-H HPX-A HPX-F HPX-V	100 50 20 8	Elastic fiber.	R4 mm	**HPF-D012-H** Freecut*
Heat Resistant	M6 thread 	HPX-H HPX-A HPX-F HPX-V	100 50 20 5	Withstands up to 105°C.	R20 mm	**HPF-D013-H** Freecut*

*Freecut; all plastic cables except special ones can be freely cut to adjust the length with the cutter FE-PA-FL.

Photoelectric

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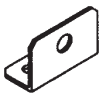
FIBER OPTIC CABLE ACCESSORIES ORDER GUIDE

Accessory	Shape	Features	Fiber Unit Used	Catalog Listing
Micro-spot Lens		Light will converge to a spot dia. of .4 mm @ 7 mm for D017 and .4 mm @ 8 mm for D010-H when this lens is attached to a diffuse scan fiber unit.	HPF-D017, D010-H	HPF-LU01
		Light will converge to a spot dia. of 2 mm @ 19± mm when this lens is attached to a diffuse scan fiber unit.	HPF-D017	HPF-LU02
Long Distance Lens Pair		Increase scanning distance 6-fold by attaching this lens to the light emitter and receiver of a thru scan fiber unit.	HPF-T003-H, T004-H, T010-H, T011-H	**FE-PA-L1**
Side View Lens Pair		Convert to side view type by attaching this lens to the light emitter and receiver of a thru scan fiber unit.	HPF-T003-H, T004-H, T010-H, T011-H	**FE-PA-S1**
Mounting Bracket for Fiber Heads		For mounting fiber heads.	Fits M3 dia. head: Fits M4 dia. head: Fits M6 dia. head:	**FE-PA-FB1** **FE-PA-FB2** **FE-PA-FB4**

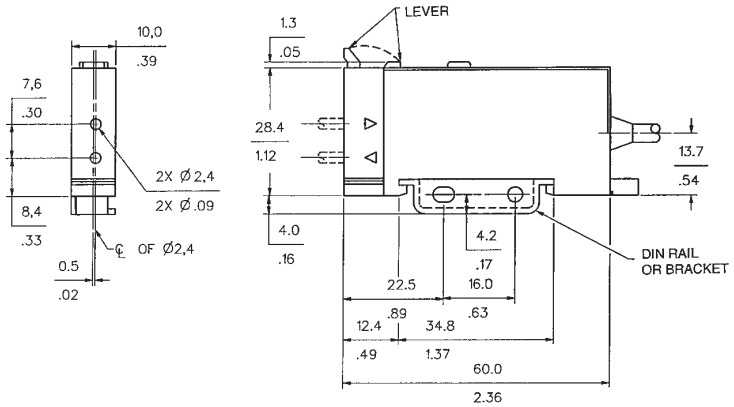
SCANNING DISTANCE FOR ABOVE LENSES WITH VARIOUS CABLE/SENSOR COMBINATIONS

Sensor/Fiber Unit Combination	With HPF-LU01 Micro-spot Lens Attached*		With HPF-LU02 Micro-spot Lens Attached*	With FE-PA-L1 Long Distance Lens Attached*			
Fiber Optic Cable	**HPF-D010-H**	**HPF-D017**	**HPF-D017**	**HPF-T003-H**	**HPF-T004-H**	**HPF-T010-H**	**HPF-T011-H**
HPX-H Sensor	8 mm	7 mm	2 mm @ 19 ± 1 mm	2400 mm	2400 mm	1800 mm	1000 mm
HPX-A Sensor	8 mm	7 mm	2 mm @ 19 ± 1 mm	1200 mm	1200 mm	900 mm	500 mm
HPX-F Sensor	—	—	—	480 mm	480 mm	360 mm	200 mm
HPX-V Sensor	—	—	—	160 mm	160 mm	100 mm	70 mm

Sensor/Fiber Unit Combination	With FE-PA-S1 Side View Lens Attached*			
Fiber Optic Cable	**HPF-T003-H**	**HPF-T004-H**	**HPF-T010-H**	**HPF-T011-H**
HPX-H Sensor	300 mm	300 mm	200 mm	200 mm
HPX-A Sensor	150 mm	150 mm	100 mm	100 mm
HPX-F Sensor	60 mm	60 mm	40 mm	40 mm
HPX-V Sensor	20 mm	20 mm	15 mm	15 mm

* Using standard target object

MOUNTING DIMENSIONS
(For reference only)



Fiber Optic–Miniature Sensors

MARK DETECTION

To aid you in applying HPX-V sensors for mark detection, use the Color Application Chart as a guide to making color choices.

This data is based on using the diffuse scan HPF-D009-H fiber optic cables. It will help you to determine which of the many color combinations provide the best contrast between the color of the mark to be detected and its background.

Example: *Red* marks applied to *yellow* backgrounds result in a stable sensing condition, while *blue* marks on a *red* background are not likely to be sensed at all.

CHART SYMBOLS

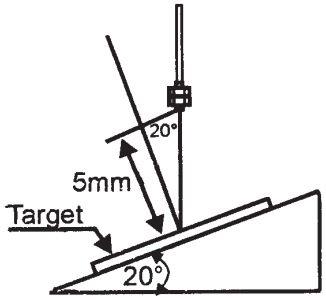
◎ : Stable sensing

○ : Sensing is possible

▲ : Sensing is marginal

× : Not sensing

COLOR MARK DETECTION SETUP



COLOR APPLICATION CHART

Using HPX-A \ Using HPX-V	White	Light Brown	Yellow	Yellowish Brown	Red	Brown	Light Blue	Green/Yellow	Dark Brown	Dark Green	Green	Blue	Indigo
White		○	×	×	◎	◎	◎	◎	◎	◎	◎	◎	◎
Light Brown	○		×	×	○	◎	◎	◎	◎	◎	◎	◎	◎
Yellow	○	×		×	◎	◎	◎	◎	◎	◎	◎	◎	◎
Yellowish Brown	◎	◎	◎		◎	◎	◎	◎	◎	◎	◎	◎	◎
Red	◎	◎	◎	○		◎	◎	◎	◎	◎	◎	◎	◎
Brown	◎	◎	◎	▲	◎		×	○	○	◎	◎	◎	◎
Light Blue	○	○	○	◎	◎	◎		○	○	◎	◎	◎	◎
Green/Yellow	◎	○	○	◎	◎	◎	▲		×	◎	◎	◎	◎
Dark Brown	◎	◎	◎	○	○	○	◎	◎		◎	◎	◎	◎
Dark Green	◎	◎	◎	◎	○	◎	◎	◎	○		○	○	○
Green	◎	◎	◎	○	○	○	◎	◎	×	○		○	○
Blue	◎	◎	◎	◎	○	◎	◎	◎	○	×	○		◎
Indigo	◎	◎	◎	◎	○	◎	◎	◎	○	×	○	×	

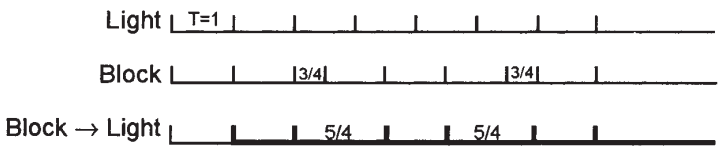
HPX BUILT-IN MUTUAL INTERFERENCE PREVENTION

Sensors automatically shift their LED pulse phase to prevent up to three closely mounted units from interfering with each other. HPX uses synchronous detection, i.e., when the LED is being pulsed, the receiver is also activated.

There are either four (F1/F2) or six pulses required for detection before the output is switched. For a typical pulse phase under the three sensor conditions, see chart below.

The pulse interval remains T = 1 when light is being received. After the first two LED pulses are blocked, the pulse inverval is changed to T = 3/4 every 4th pulse and this is repeated. When light is again received while in the dark condition, the pulse interval is changed again every 3rd and 5th pulse to T = 5/4.

Sensors are most susceptible to crosstalk from adjacent sensors when light is blocked. (One unit's synchronous phase could be the same as another.) But automatic phase shifting makes it impossible for three sensors in the same area to interfere with each other.



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