Digital Fiber-Optic Sensors

HPX-AG Series

Easy operation and high performance for a variety of applications

- Dual display shows incoming light level and preset value side by side.
- High sensitivity and ultra long distance (1,200mm with the standard HPF-T003 thru scan fiber in high power mode)
- Three types of auto-tuning: 2-point, BGS and %
- RoHS-compliant

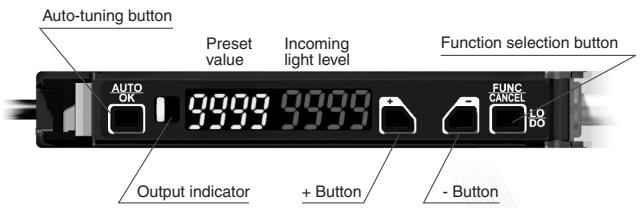
PHOTOELECTRIC SENSORS
A
CLICK

EXPLANATION OF MAJOR FUNCTIONS AND FEATURES

Easy-to-use design

Dual display panel

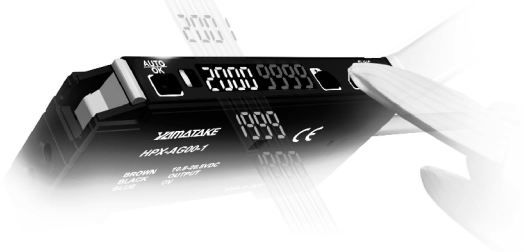
The digital dual display panel indicates incoming light level and preset value side by side, so it is easy to check current scanning status while setting the sensor.
The button layout is especially designed to ensure easy operation of gang-mounted sensors.



Easy operation

With controls that are as easy to operate as a conventional potentiometer, and with easy-to-read digital display, settings can be changed directly in RUN mode.

Digital manual tuning

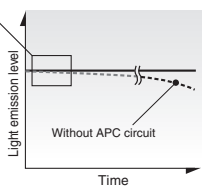


APC ensures stable light emission level

Auto Power Control (APC, light emission level control) monitors the level of light emitted by the LED, and regulates the current to maintain light emission at a constant level.

Long and short term stabilization

Stability when power is first supplied is also improved.

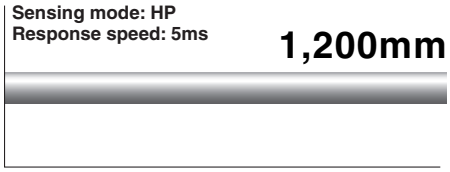


Note: APC controls the light emission level of the LED emitter, but does not compensate for a drop in received light level due to other factors.

Advanced scanning performance for expanded possibilities

●High sensitivity and ultra long distance

High-level performance is achieved with the built-in APC.

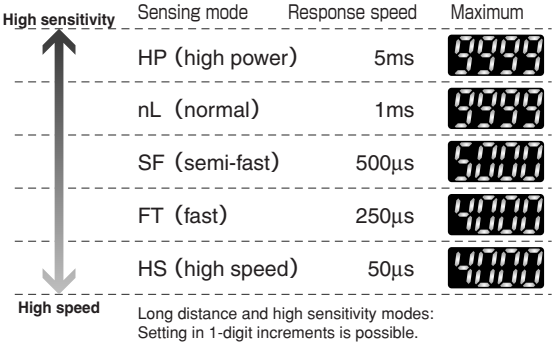


With **HPF-T003** standard thru scan fiber unit.

Scanning distance

●Five selectable sensing modes

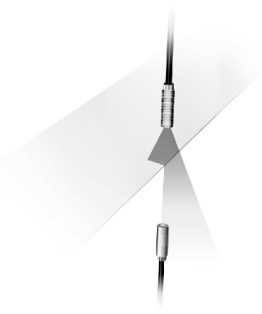
Five sensing modes are selectable by desired response speed and sensitivity, according to what is best for your application.



Long distance and high sensitivity modes: Setting in 1-digit increments is possible.

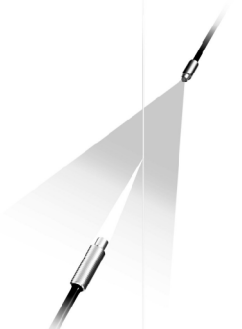
●High accuracy detection

Note: Under optimum conditions



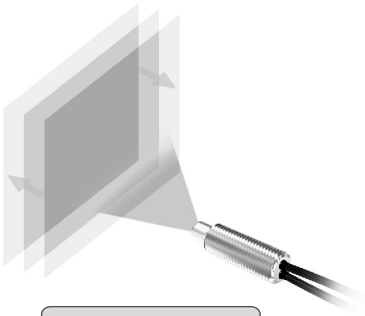
Repeatability ±5µm or less (4σ)

With 1mm core dia. **HPF-T003** standard fiber unit



Smallest detectable object: 5µm dia.

With 1mm core dia. **HPF-T003** standard fiber unit

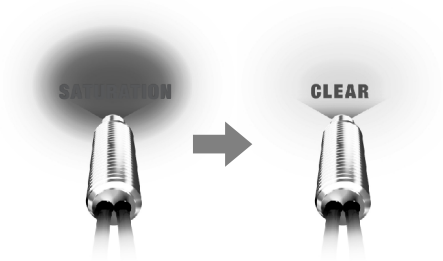


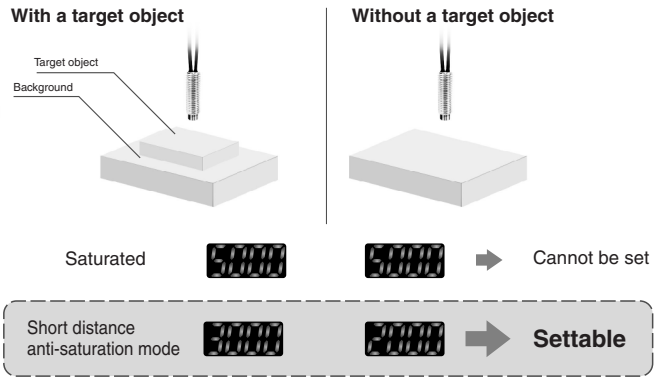
Detectable displacement 20µm or less

With **HPF-D034** coaxial fiber unit

●Countermeasures for short-distance saturation

New countermeasures have been added since the sales release of the HPX Series. Even for small difference detection at short distances or for a high reflection ratio on both target object and background, HPX sensors deliver reliable detection performance.





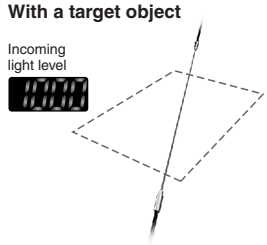
Easy to operate

●Easy auto-tuning Patent Pending

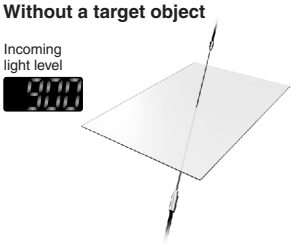
Percent (%) tuning —— For re-tuning on the same application, simply press the AUTO button in the % tuning setting mode.

Fewer tuning man-hours | **Fewer detection errors due to setting variations**

With a target object



Without a target object



Example: % tuning at 95%

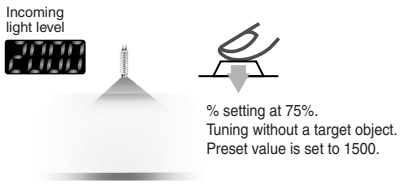
For the same environment or target object, the ratio of two tuning levels with and without a target object is approximately the same.

The setting range for % tuning without a target object is 10 to 999%.

Easy re-tuning

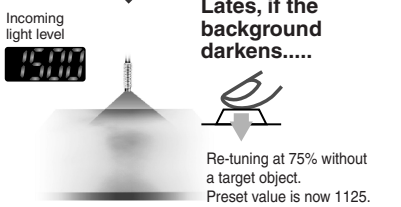
Detection of remaining chips.....

Setting can be based on the background with no chips present.



% setting at 75%.
Tuning without a target object.
Preset value is set to 1500.

Lates, if the background darkens.....



Re-tuning at 75% without a target object.
Preset value is now 1125.

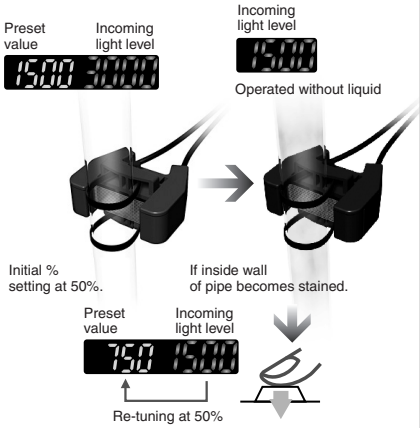
An LO signal is used for chip supply.

Detection of liquid level.....

Different time, different person –same setting!

Tuning can be done only with no liquid present.

HPF-T034 pipe-mounted fiber-optic liquid-level sensor

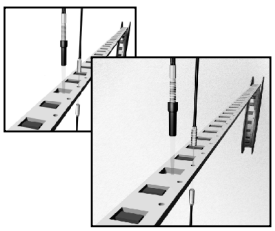


When used with incoming light level without liquid.

●Remote tuning

BGS or % tuning can be done remotely from a connected device. Even when the light level is dropping due to a change in tooling, application environment, or installation conditions, stable and highly accurate detection can be assured by periodic re-tuning.

Flexibility for tooling changes | **Long-term reliability**



Environment has worsened due to paper powder.

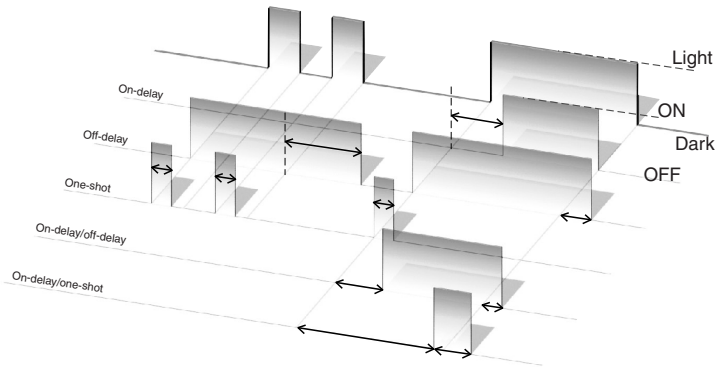
For remote full auto-tuning, use the **HPX-AG03** series.

Remote tuning

●Superior timer functions

The advanced functions of the HPX-AG's combination timer go beyond the standard on-delay/off-delay functions and the newer one-shot timer function.

Time chart—LO (light ON)

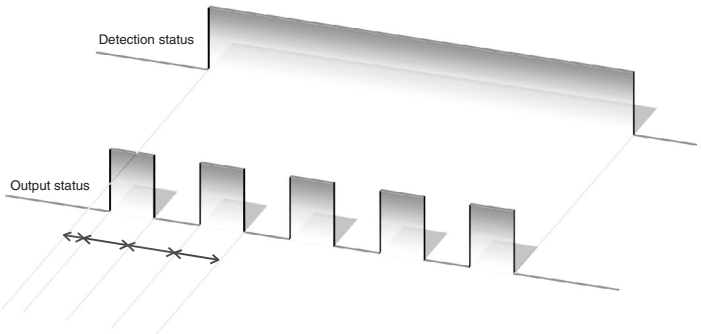


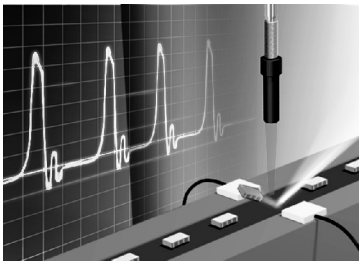
Timer setting time

Timer setting range	Setting unit
250µs / 500µs	—
1ms to 5ms	500µs
6ms to 99ms	1ms
100ms to 900ms	100ms
1s to 20s	1s

●Heartbeat **Patent Pending**

ON-delay and one-shot output are repeated at regular intervals while an object is detected.





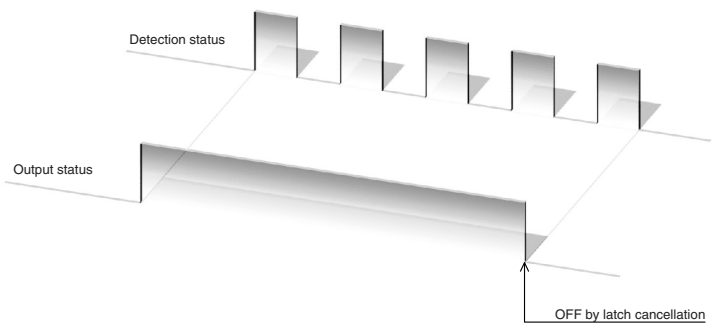
Example application: In chip sorting, an air jet is repeated at regular intervals until a rejected chip is removed.

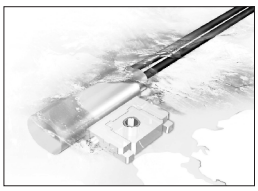
●Output latch

When an object is detected (or is not detected), latched output is turned ON, and remains ON no matter what the detection status is.

Used for interlock

During  operation, the amplifier display blinks.





Example application: An interlock for liquid leakage detection, used in combination with the **HPF-D040** liquid leak fiber-optic detector.

●Peak / bottom display

Since peak and incoming light levels are displayed at the same time, the light axis can be aligned precisely.

For more precise light axis alignment

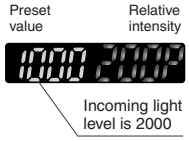
Selectable peak / bottom display modes

Peak hold	&	Incoming light level
Bottom hold	&	Incoming light level
Peak hold	&	Bottom hold

Hold time can be selected from 2s, 10s, and unlimited.

●Display type selection

Relative incoming light intensity (instead of absolute) can also be displayed with the preset value.

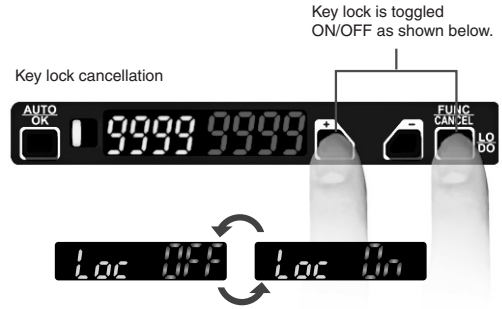


The incoming light level is indicated as a percentage of the preset value (= 100%). Scanning status can be managed by ratio.

●Key lock function

Key lock can be set for all keys, or for all except tuning keys.

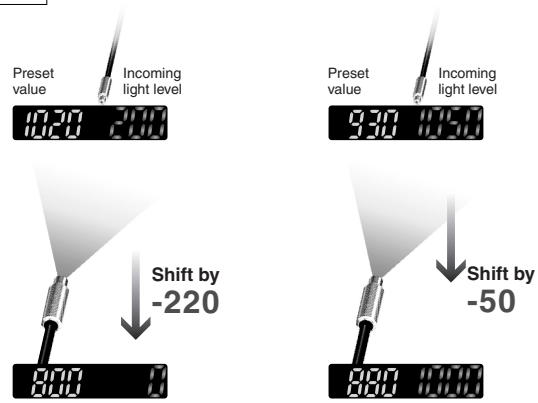
Accidental key-press prevention



●Displayed value shift function

This function compensates for variation in the incoming light level. The incoming light level during operation can be adjusted to an easy-to-control value.

For control of incoming light level



REFERENCE DATE FOR TARGET DETECTION

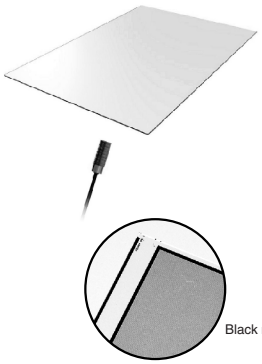
(Be sure to test using an actual target object.)

●Standard diffuse scan fiber

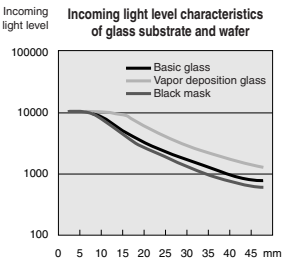
HPF-D002

Glass substrate

Sensing mode: HP



Black mask

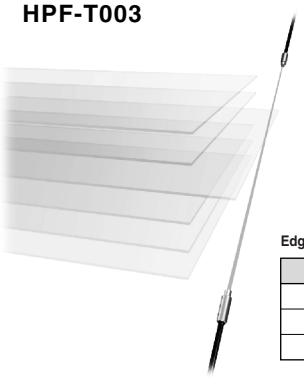


●Standard thru scan fiber unit

HPF-T003

Glass substrate

Sensing mode: HP



Edge detection repeatability accuracy

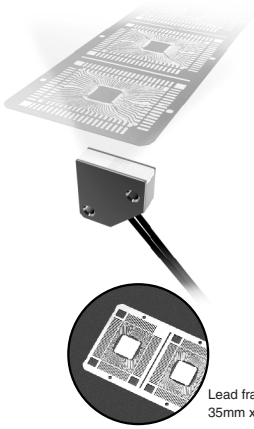
Item	Amount
σ	3μm max.
4σ	13μm max.
Max.-min.	11μm

●Fiber unit with diffuse scan array

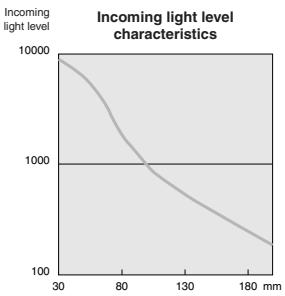
HPF-D026

Lead frame

Sensing mode: HP



Lead frame size
35mm x 150mm

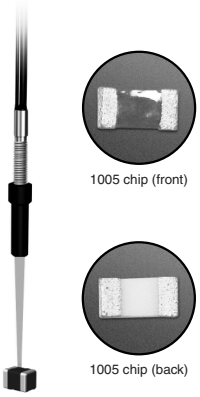


●Coaxial diffuse scan fiber unit

HPF-D034 / HPF-LU07

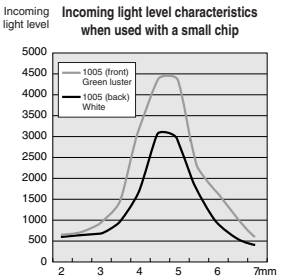
Small chip

Sensing mode: SF



1005 chip (front)

1005 chip (back)



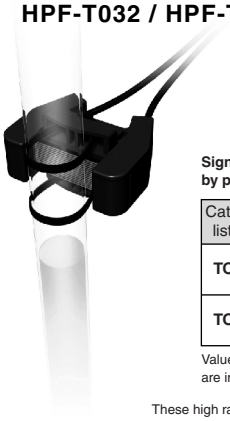
Be sure to use at focas point of the lens. Incoming light level changes depending on the size of the mark or spot.

●Pipe-mounted fiber-optic liquid-level

HPF-T032 / HPF-T034

Liquid-level in pipe

Sensing mode: nL
For 8mm dia. pipe only: nL_L



Signal-to-noise ratio(SN) data by pipe diameter Liquid: water

Catalog listing	Pipe diameter	Presence of liquid	Absence of liquid	SN
TO32	6mm	9650	530	18
	8mm	5080	150	34
TO34	12mm	110	7560	69
	19mm	75	5800	77

Values for presence or absence of liquid are incoming light level values.

These high ratios of liquid-present to liquid-absent light levels show that detection is fully reliable.

●Coaxial diffuse scan fiber unit

HPF-D038 / HPF-LU08

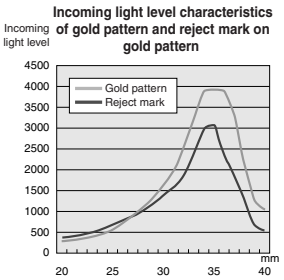
Reject mark

Sensing mode: FT

Gold pattern
Approx. 1mm dia.

Reject mark

The reject mark is applied to the gold pattern using an oil-based red felt pen.



Be sure to use at the lens focal point. Incoming light level changes depending on the size of mark and spot.

Environment-friendly design

●RoHS Directive compliance

Yamatake products are developed to meet RoHS directives restricting the use of hazardous substances such as lead, mercury, cadmium, hexavalent chromium heavy metals, and the brominated flame retardants PBB and PBDE. For example, non-halogen type flame retardants that do not generate dioxin are used, and the polyethylene used for packing material does not generate hazardous gas even if it is burned.

The RoHS Directive

RoHS is European environmental directive. The name is an abbreviation for Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment.

●Selection of standard 1, 2 and 5m cables

Optimum cable length can be selected for reduced waste.

●Monitor sleep mode for low power consumption

The digital display can be set so that all display is off.In monitor sleep mode, power consumption can be reduced to 500mW. Since 1-segment display remains on, the power supply condition can still be checked.

When monitor sleep mode is enabled, sleep mode begins whenever there is no normal mode operation for 20 seconds. When any button is depressed, normal operation mode resumes.

One segment display changes in a fixed cycle.

AMPLIFIER SELECTION GUIDE

Cable lead-out type

Catalog listing		Features
NPN	PNP	
HPX-AG00-1	**HPX-AG00-2**	Standard
HPX-AG01-1	**HPX-AG01-2**	Remote tuning input
HPX-AG02-1	**HPX-AG02-2**	Remote tuning input Alarm (light level drop and stability safety margin) output
HPX-AG03-1	**HPX-AG03-2**	Remote tuning input Tuning error output

Reduced wiring type

Catalog listing		Type	Features
NPN	PNP		
HPX-AG00-3	**HPX-AG00-4**	Main unit	Standard
HPX-AG00-5	**HPX-AG00-6**	Expansion unit	
HPX-AG01-3	**HPX-AG01-4**	Main unit	Remote tuning input
HPX-AG01-5	**HPX-AG01-6**	Expansion unit	

Reduced wiring type

Catalog listing	Type	Features
NPN		
HPX-AG04-3	Main unit	Advanced function timer (latch and heartbeat) function, latch cancellation input, alarm output
HPX-AG04-5	Expansion unit	
HPX-AG06-3	Main unit	Dual output, dual set values
HPX-AG06-5	Expansion unit	
HPX-AG07-3	Main unit	Active zone setting
HPX-AG07-5	Expansion unit	
HPX-AG08-3	Main unit	Differential setting, alarm output
HPX-AG08-5	Expansion unit	
HPX-AG09-3	Main unit	Data bank setting, changeover input
HPX-AG11-3	Main unit	Synchronous external input
HPX-AG11-5	Expansion unit	

Standard cable length is 2m. Catalog listings for 1m or 5m cable models have the suffix **-L01** or **-L05** respectively.

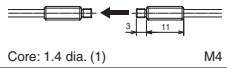
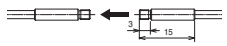
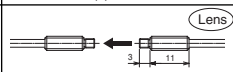
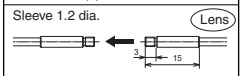
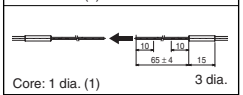
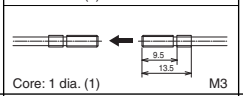
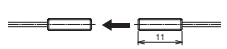
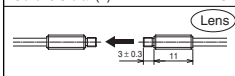
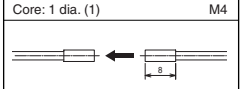
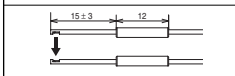
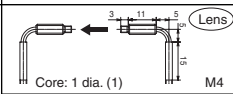
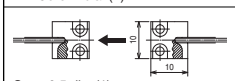
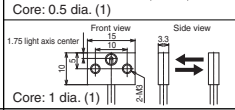
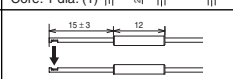
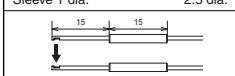
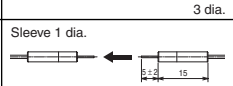
AMPLIFIER SPECIFICATIONS

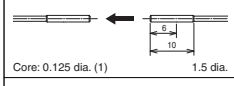
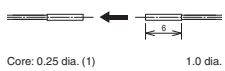
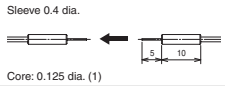
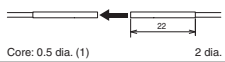
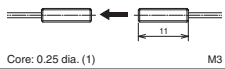
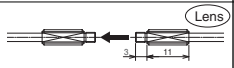
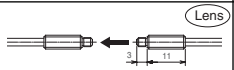
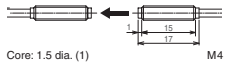
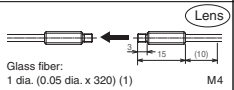
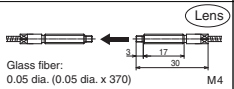
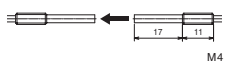
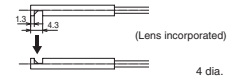
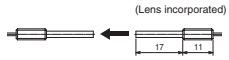
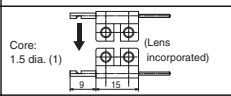
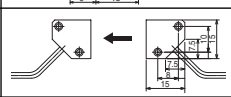
Catalog listing	NPN	**HPX-AG00-1 HPX-AG00-3 HPX-AG00-5**	**HPX-AG01-1 HPX-AG01-3 HPX-AG01-5**	**HPX-AG02-1 HPX-AG03-1 HPX-AG04-3 HPX-AG04-5**	**HPX-AG06-3 HPX-AG06-5 HPX-AG07-3 HPX-AG07-5**	**HPX-AG08-3 HPX-AG08-5 HPX-AG09-3 HPX-AG11-3 HPX-AG11-5**
	PNP	**HPX-AG00-2 HPX-AG00-4 HPX-AG00-6**	**HPX-AG01-2 HPX-AG01-4 HPX-AG01-6**	**HPX-AG02-2 HPX-AG03-2**	**—**	**—**
Addition	Output	**—**	**—**	**02-□,04-□: alarm output 03-□: error output**	**06-□: control output**	**08-□: alarm output**
	Input	**—**	**Remote tuning**	**02-□: remote tuning 03-□: remote tuning 04-□: latch cancellation**	**—**	**09-3: changeover 2-input 11-□: synchronous input**
Supply voltage		12 to 24Vdc ±10% (ripple 10% max.)				
Current consumption		750mW max. (at 24V power supply and 30mA current consumption), monitor sleep mode 500mW max.				
Hysteresis		20% max. (at rated scanning distance)				
Operation mode		Light-ON / Dark-ON changeable (setting by changeover switch)				
Control output		**HPX-AG□□-1/-3/-5**: NPN transistor open collector. **-2/-4/-6**: PNP transistor open collector. Cable lead-out type (1 output): switching current 100mA max. (resistive load), output voltage 26.4V, voltage drop 2V max. (switching current 100mA). Cable lead-out type (2 output): switching current 50mA max. (resistive load), output voltage 26.4V, voltage drop 2V max. (switching current 50mA). Reduced wiring type (1 output): switching current 50mA max. (resistive load), output voltage 26.4V, voltage drop 2V max. (switching current 30mA). Reduced wiring type (2 output): switching current 30mA max. (resistive load), output voltage 26.4V, voltage drop 2V max. (switching current 30mA).				
External input		When ON (short-circuit current is approx. 1mA): DC 0–1V. When OFF: open or connection to + side of power supply				
Response time		50µs (High Speed), 250µs (Fast), 500µs (Semi-Fast), 1ms (Normal) and 5ms (High Power)				
Timer function	Type	Timer OFF, ON delay, OFF delay, one shot, ON-delay + one shot , and ON delay + OFF delay. **04**_□: ON heartbeat , OFF heartbeat, ON delay + heartbeat, and OFF delay + heartbeat. Positive edge latch, negative edge latch, ON delay + positive edge latch, and ON delay + negative edge latch.				
	Preset value	200µs, 500µs and 1ms to 4.5ms: 1ms unit, 500µs unit and 5 to 99ms: 1ms unit, 100ms to 900ms: 100ms unit, and 1s to 20s: 1s unit. Heartbeat only: 1ms to 4.5ms: 1ms unit, 500µs unit and 5 to 99ms: 1ms unit, 100ms to 900ms: 100ms unit, and 1s to 20s: 1s unit.				
Light emitter		Red LED				
Display function		Output indicator: orange. Preset value: green 4-digit LED. Incoming light level: red 4-digit LED. Preset value + incoming light level / preset value + relative value / peak + incoming / bottom + incoming / peak + bottom.				
Reduced wiring type addition		Up to 15 expansion units can be connected.				
Ambient light immunity		Incandescent light: 5,000 lux max. Sunlight: 20,000 lux max.				
Operating temperature		-20 to +55˚C*				
Storage temperature		-40 to +70˚C				
Operating humidity		35 to 85% (no condensation allowed)				
Vibration resistance		10 to 55Hz, 1.5mm peak-to-peak amplitude, 2 hours each in X, Y and Z directions				
Shock resistance		500mm^2, 3 times each in X, Y and Z directions				
Weight		**HPX-AG□□-1/-2/-3/-4**: approx. 75g, **-5/-6**: approx. 40g (body only with 2m cable)				
Circuit protection		Power supply reverse connection protection circuit, malfunction prevention circuit at power ON (approx. 200ms), output short-circuit protection circuit				

*Operating temperature is different depending on the number of gang-mounted sensor units.
1 or 2 units: -20 to +55˚C, 3 units: -20 to +50˚C, 4 or 5 units: -20 to +45˚C, 6 units: -20 to +40˚C

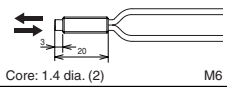
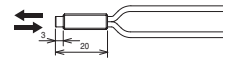
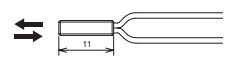
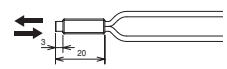
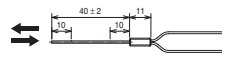
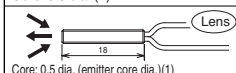
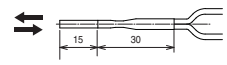
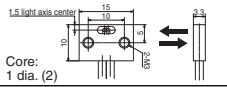
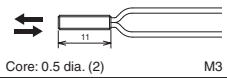
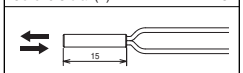
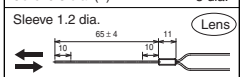
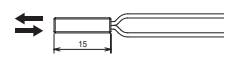
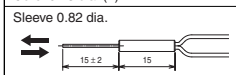
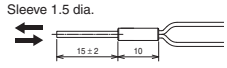
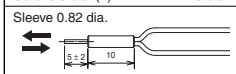
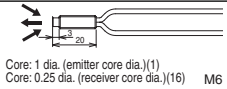
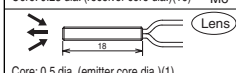
FIBER UNIT AND SENSING TYPE COMBINATIONS

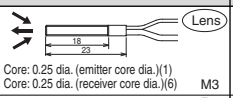
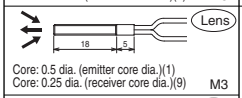
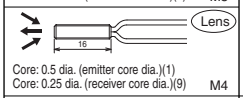
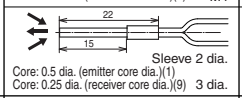
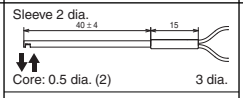
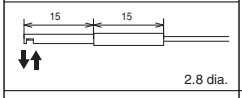
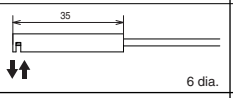
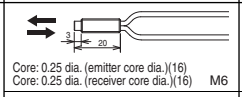
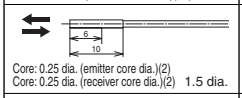
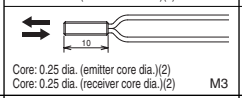
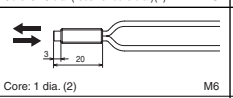
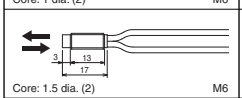
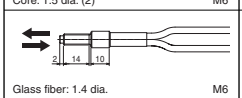
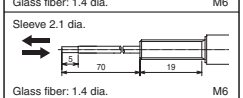
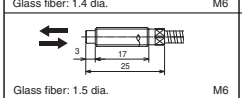
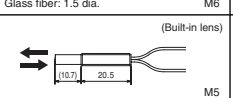
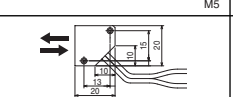
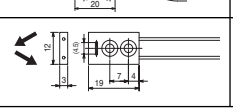
Thru scan

Group	Appearance	Sensing type	Scanning distance (mm)	Features	Cable length (cuttable)	Bend radius	Catalog listing
Long distance	 Core: 1.4 dia. (1) M4	HP nL SF FT HS	2,230 1,450 1,160 635 215	Long scanning distance	Cut to length 2m	R20	HPF-T001
	 Core: 1.4 dia. (1) 3 dia.						HPF-T002
Standard	 Core: 1 dia. (1) M4			Standard		R20	HPF-T003
	 Core: 1 dia. (1) 3 dia.						HPF-T004
	 Core: 1 dia. (1) M4	HP nL SF FT HS	1,200 800 640 350 120	Sleeve (flexible)		R10/R20	HPF-T005
	 Core: 1 dia. (1) 3 dia.						HPF-T006
	 Core: 1 dia. (1) M3			Standard diameter and compact		R20	HPF-T045
Ultra bend - tolerant	 Core: 0.5 dia. (1) M3	HP nL SF FT HS	140 95 75 42 14	Static installation, flexible, and small diameter		R1	HPF-T024
	 Core: 1 dia. (1) M4	HP nL SF FT HS	865 600 470 260 90	Static installation, flexible, and standard model	Cut to length 2m	R2	HPF-T025
	 Core: 1 dia. (1) 3 dia.						HPF-T031
	 Sleeve 1 dia. 2.5 dia.	HP nL SF FT HS	55 35 28 15 5	Static installation, flexible, and side view model		R1	HPF-T026
Space saving	 Core: 1 dia. (1) M4	HP nL SF FT HS	865 570 450 250 85	Elbow	Cut to length 2m	R20	HPF-T010
	 Core: 0.5 dia. (1)	HP nL SF FT HS	140 95 75 42 14	Static installation, flexible, small diameter, and flat top view model		R1	HPF-T028
	 Core: 1 dia. (1)	HP nL SF FT HS	210 140 110 60 21	Static installation, flexible, standard, and flat side view model		R5	HPF-T028LF
Side view	 Sleeve 1 dia. 2.5 dia.	HP nL SF FT HS	145 110 90 48 17	Small diameter sleeve	Cut to length 2m	R15	HPF-T007
	 Sleeve 0.88 dia. 2.5 dia.	HP nL SF FT HS	55 35 28 15 5	Fine diameter sleeve	Cut to length 1m	R5	HPF-T037
	 3 dia.	HP nL SF FT HS	660 440 350 190 65	Standard diameter	Cut to length 2m	R20	HPF-T042
Small diameter	 Core: 0.25 dia. (1) 3 dia.	HP nL SF FT HS	34 25 20 11 4	Fine diameter	Cut to length 2m	R15	HPF-T015

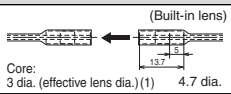
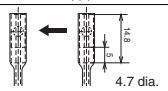
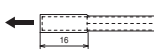
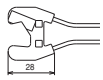
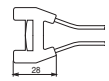
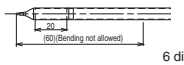
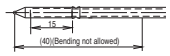
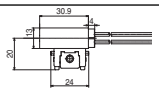
Group	Appearance	Sensing type	Scanning distance (mm)	Features	Cable length (cuttable)	Bend radius	Catalog listing
Small diameter	 Core: 0.125 dia. (1) 1.5 dia.	HP nL SF FT HS	17 12 10 5 2	Fine diameter	Connector 0.5m	R15	HPF-T036
	 Core: 0.25 dia. (1) 1.0 dia.	HP nL SF FT HS	34 25 20 11 4				HPF-T038
	Sleeve 0.4 dia.  Core: 0.125 dia. (1)	HP nL SF FT HS	17 12 10 5 2	Fine diameter sleeve			HPF-T039
	Sleeve 0.4 dia.  Core: 0.25 dia. (1) 3 dia.	HP nL SF FT HS	35 20 18 10 5	Fine diameter sleeve	Cut to length 2m		HPF-T040
	 Core: 0.5 dia. (1) 2 dia.	HP nL SF FT HS	300 200 160 90 28	Small diameter			HPF-T043
	 Core: 0.75 dia. (1) M3	HP nL SF FT HS	675 450 360 195 65	Small diameter and long scanning distance			HPF-T044
Elastic	 Core: 0.25 dia. (1) M3	HP nL SF FT HS	180 120 100 50 18	Elastic small diameter	Cut to length 2m	R4	HPF-T008
	 Core: 0.25 dia. (4) 1..5 dia.	HP nL SF FT HS	180 120 100 50 18				HPF-T009
	Lens  Core: 0.25 dia. (16) M4	HP nL SF FT HS	940 650 520 280 95	Elastic standard diameter			HPF-T033
Heat resistant	Lens  Core: 1 dia. (1) M4	HP nL SF FT HS	700 460 365 200 70	To 105˚C	Cut to length 2m	R25	HPF-T012
	 Core: 1.5 dia. (1) M4	HP nL SF FT HS	1200 800 640 350 120	To 150˚C		R35	HPF-T017
	Lens  Glass fiber: 1 dia. (0.05 dia. x 320) (1) M4	HP nL SF FT HS	620 410 325 180 60	To 200˚C	Connector 1m	R15	HPF-T018
	Lens  Glass fiber: 0.05 dia. (0.05 dia. x 370) M4	HP nL SF FT HS	660 440 355 190 65	Heat and cold resistant from -60˚C to +350˚C	Connector 2m	R25	HPF-T014
Narrow beam	(Lens incorporated)  M4	HP nL SF FT HS	4,110 2,760 2,200 1,200 410	Parallel beam top view	Cut to length 2m	R20	HPF-T019
	 (Lens incorporated) 4 dia.	HP nL SF FT HS	4,540 3,000 2,390 1,300 450	Parallel beam side view			HPF-T020
	(Lens incorporated)  M4	HP nL SF FT HS	3,600 2,400 1,920 1,050 360	Narrow beam top view		R15	HPF-T023
Mapping	Core: 1.5 dia. (1)  (Lens incorporated)	HP nL SF FT HS	500 500 80	Narrow beam -1.5˚/+1.5˚max. side view	Cut to length 2m	R5	HPF-T030
Wide beam		HP nL SF FT HS	790 520 415 230 80	Array	Cut to length 2m	R4	HPF-T021

Diffuse scan

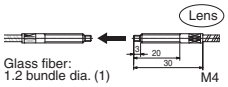
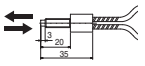
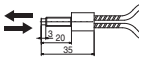
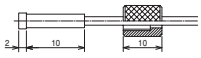
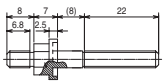
Group	Appearance	Sensing type	Scanning distance (mm)	Features	Cable length (cuttable)	Bend radius	Catalog listing
Long distance	 Core: 1.4 dia. (2) M6	HP nL SF FT HS	580 400 285 175 48	Long scanning distance	Cut to length 2m	R20	HPF-D001
Standard	 Core: 1 dia. (2) M6	HP nL SF FT HS	430 300 215 130 36	Standard	Cut to length 2m	R20	HPF-D002
	 Core: 1 dia. (2) M6						HPF-D003
Ultra bend - tolerant	 Core: 0.5 dia. (2) M3	HP nL SF FT HS	25 19 15 8 2	Small diameter	Cut to length 2m	R1	HPF-D029
	 Core: 1 dia. (2) M6	HP nL SF FT HS	230 160 115 70 18	Standard		R2	HPF-D030
	Sleeve 1.2 dia.  Core: 0.5 dia. (2) M4	HP nL SF FT HS	25 19 15 8 2	Small diameter sleeve (bendable)		R10/R1	HPF-D031
	Lens  Core: 0.5 dia. (emitter core dia.)(1) Core: 0.25 dia. (receiver core dia.)(4) M3	HP nL SF FT HS	50 35 25 14 4	Coaxial		R1/R4	HPF-D032
	 Core: 1 dia. (2) 3 dia.	HP nL SF FT HS	240 160 130 70 24	Standard diameter		R5	HPF-D044
Compact	 Core: 1 dia. (2)	HP nL SF FT HS	105 70 55 30 10	Static installation, flexible, standard, and flat side-view model	Cut to length 2m	R2	HPF-D045LF
Small diameter	 Core: 0.5 dia. (2) M3	HP nL SF FT HS	110 80 60 35 10	Small diameter	Cut to length 2m	R15	HPF-D004
	 Core: 0.5 dia. (2) 3 dia.						HPF-D005
	Sleeve 1.2 dia. Lens  Core: 0.5 dia. (2) M4			Small diameter sleeve			HPF-D006
	 Core: 0.75 dia. (2) M4	HP nL SF FT HS	215 150 110 65 18	Small diameter long scanning distance			HPF-D018
	Sleeve 0.82 dia.  Core: 0.25 dia. (2) 3 dia.	HP nL SF FT HS	11 8 6 4 1	Fine diameter sleeve	Cut to length 0.5m		HPF-D019
	Sleeve 1.5 dia.  Core: 0.5 dia. (2) 3 dia.	HP nL SF FT HS	95 65 45 28 8	Small diameter sleeve	Cut to length 2m		HPF-D021
	Sleeve 0.82 dia.  Core: 0.25 dia. (2)	HP nL SF FT HS	11 8 6 4 1	Fine diameter sleeve	Cut to length 0.5m	R4	HPF-D039
Coaxial	 Core: 1 dia. (emitter core dia.)(1) Core: 0.25 dia. (receiver core dia.)(16) M6	HP nL SF FT HS	430 300 215 130 36	Coaxial	Cut to length 2m	R20	HPF-D009
	Lens  Core: 0.5 dia. (emitter core dia.)(1) Core: 0.25 dia. (receiver core dia.)(4) M3	HP nL SF FT HS	95 65 45 28 8	Coaxial		R15	HPF-D010

Group	Appearance	Sensing type	Scanning distance (mm)	Features	Cable length (cuttable)	Bend radius	Catalog listing
Coaxial	 Core: 0.25 dia. (emitter core dia.)(1) Core: 0.25 dia. (receiver core dia.)(6) M3	HP nL SF FT HS	70 45 30 20 5	Coaxial	Connector 0.5m	R4	HPF-D034
	 Core: 0.5 dia. (emitter core dia.)(1) Core: 0.25 dia. (receiver core dia.)(9) M3	HP nL SF FT HS	95 95 70 40 11		Cut to length 2m	R15	HPF-D035
	 Core: 0.5 dia. (emitter core dia.)(1) Core: 0.25 dia. (receiver core dia.)(9) M4						HPF-D038
	 Sleeve 2 dia. Core: 0.5 dia. (emitter core dia.)(1) Core: 0.25 dia. (receiver core dia.)(9) 3 dia.	HP nL SF FT HS	100 65 50 30 10	Small diameter coaxial			HPF-D042
Side view	Sleeve 2 dia.  Core: 0.5 dia. (2) 3 dia.	HP nL SF FT HS	45 30 20 13 4	Small diameter sleeve	Cut to length 2m	R15	HPF-D011
	 2.8 dia.			Small diameter short sleeve			HPF-D041
	 6 dia.	HP nL SF FT HS	180 120 95 50 18	Standard diameter		R20	HPF-D043
Elastic	 Core: 0.25 dia. (emitter core dia.)(16) Core: 0.25 dia. (receiver core dia.)(16) M6	HP nL SF FT HS	265 190 140 80 24	Standard	Cut to length 2m		HPF-D012
	 Core: 0.25 dia. (emitter core dia.)(2) Core: 0.25 dia. (receiver core dia.)(2) 1.5 dia.	HP nL SF FT HS	17 15 11 7 2	Small diameter sleeve	Connector 1m	R4	HPF-D036
	 Core: 0.25 dia. (emitter core dia.)(2) Core: 0.25 dia. (receiver core dia.)(2) M3	HP nL SF FT HS	21 15 11 7 2	Small diameter	Cut to length 2m		HPF-D037
Heat resistant	 Core: 1 dia. (2) M6	HP nL SF FT HS	190 190 140 80 24	To 105˚C	Cut to length 2m	R25	HPF-D013
	 Core: 1.5 dia. (2) M6	HP nL SF FT HS	430 300 215 130 36	To 150˚C		R35	HPF-D022
	 Glass fiber: 1.4 dia. M6	HP nL SF FT HS	190 130 95 60 16	To 200˚C	Connector 1m	R15	HPF-D023
	Sleeve 2.1 dia.  Glass fiber: 1.4 dia. M6			Sleeve heat resistant to 200˚C			HPF-D024
	 Glass fiber: 1.5 dia. M6	HP nL SF FT HS	160 160 120 70 18	Heat and cold resistant from -60˚C to 350˚C	Cut to length 2m	R25	HPF-D015
Parallel beam	(Built-in lens)  M5	HP nL SF FT HS	20 20 20 20 20	Parallel beam reflection	Cut to length 2m	R15	HPF-D025
Wide beam		HP nL SF FT HS	290 200 150 90 24	Array	Cut to length 2m	R4	HPF-D026
Limited reflection		HP nL SF FT HS	2.5 ± 0.5 2.5 ± 0.5	Limited reflection	Cut to length 2m	R15	HPF-D028

Wet process

Group	Appearance	Sensing type	Scanning distance (mm)	Features	Cable length (cuttable)	Bend radius	Catalog listing
Oil and chemical-proof	(Built-in lens)  Core: 3 dia. (effective lens dia.) (1) 4.7 dia.	HP nL SF FT HS	4,500 3,000 2,160 1,300 360	PFA tube small diameter	Cut to length 2m	R20	HPF-T029
	 4.7 dia.	HP nL SF FT HS	1,030 690 490 300 85				HPF-T035
	 Core: 1 dia. (2) 6 dia.	HP nL SF FT HS	190 130 95 60 16	PFA tube		R25/R80	HPF-D014
Liquid level		—	—	Pipe-mounted. Light received when liquid present. 3 to 13mm dia. pipes.	Cut to length 5m	R4	HPF-T032
		—	—	Pipe-mounted. Light received when liquid absent. 8 to 19mm dia. pipes.			HPF-T034
	 6 dia.	—	—	Contact type. PFA tube 6mm dia.	Cut to length 2m	R25/R40	HPF-D027
	 4 dia.	—	—	Contact type. PFA tube 4mm dia.		R15/R30	HPF-D033
Liquid leak		—	—	Contact type	Cut to length 5m	R20	HPF-D040

Vacuum

Group	Appearance	Sensing type	Scanning distance (mm)	Features	Cable length (cuttable)	Bend radius	Catalog listing
Thru scan	Lens  Glass fiber: 1.2 bundle dia. (1) M4	HP nL SF FT HS	360 240 170 105 30	Heat resistant to 350˚C. Elbow connection	Connector 1m	R25	HPF-VT07
Diffuse scan	 Glass fiber: 1.7 bundle dia. M6	HP nL SF FT HS	35 35 35 15				HPF-VD07
	 Glass fiber: 1.7 bundle dia. M6			Heat resistant to 350˚C. Straight connection			HPF-VD09
—	 Core: 1 dia.	—	—	Air side	Cut to length 2m	R20	HPF-VA01
		—	—	Heat resistant to 200˚C. Light connector	—	—	HPF-VJ03

SCANNING DISTANCE WHEN USED WITH ATTACHMENT

Attachment	**FE-PA-L1** long-distance lens unit				
Sensing mode / Fiber unit	**HPF-T003/T004**	**HPF-T010**	**HPF-T012**	**HPF-T014**	**HPF-T018**
High Power／5ms	8,400mm	6,000mm	3,000mm	4,500mm	4,300mm
Normal／1ms	4,800mm	3,400mm	1,850mm	2,600mm	2,480mm

Attachment	**FE-PA-S1** or **HPF-VL05** side view lens unit				
Sensing mode / Fiber unit	**HPF-T003/T004**	**HPF-T012**	**HPF-T014**	**HPF-T018**	**HPF-VT07**
High Power／5ms	1,400mm	670mm	570mm	550mm	420mm
Normal／1ms	800mm	370mm	330mm	310mm	240mm

Attachment	**HPF-VL06** ultra long distance lens unit				
Sensing mode / Fiber unit	**HPF-T003/T004**	**HPF-T012**	**HPF-T014**	**HPF-T018**	**HPF-VT07**
High Power／5ms	14m	5m	7.7m	7.2m	4.2m
Normal／1ms	8m	3.1m	4.4m	4.2m	2.4m

Notes : 1. Values indicate capability. Actual scanning distance is limited by fiber length (standard 2m x 2 ≒4m).
2. The data for combinations with the **HPF-VT07** assumes that it is used with the **HPF-VJ03** light connector and the **HPF-VA01** fiber unit for air.

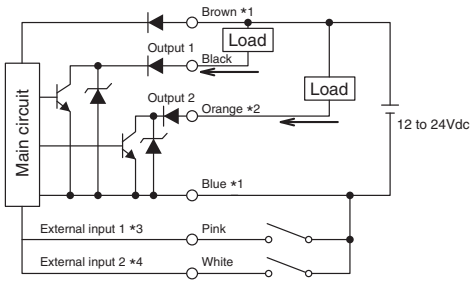
CHARACTERISTICS OF COAXIAL DIFFUSE SCAN FIBER UNIT AND LENS ATTACHMENT (spot diameter) COMBINATIONS

Fiber unit catalog listing	Lens catalog listing	Scanning distance / spot diameter	High Power	Normal	High Speed
HPF-D034	**HPF-LU07**	4.6mm / approx. 0.1mm	✓	✓	✓
HPF-D010		4.6mm → approx. 0.2mm	✓	✓	✓
HPF-D032			✓	✓	✓
HPF-D035			✓	✓	✓
HPF-D034	**HPF-LU01**	7mm → approx. 0.2mm	✓	✓	*
HPF-D010		7mm → approx. 0.4mm	✓	✓	✓
HPF-D032			✓	✓	✓
HPF-D035			✓	✓	✓
HPF-D010	**HPF-LU02**	19mm → approx. 0.2mm	✓	✓	*
HPF-D032			✓	✓	*
HPF-D035			✓	✓	*
HPF-D034		19mm → approx. 1mm	✓	✓	*
HPF-D038	**HPF-LU08**	33mm → approx. 1mm	✓	✓	*
HPF-D025	—	Depends on amplifier used.	✓	✓	✓

Notes : 1. The **HPF-D025** is not combined with a lens.
2. This data is based on a standard target (white paper). For individual applications, check detection under actual operating circumstances.
3. ✓: Applicable. *: Detection may be possible, depending on the target.

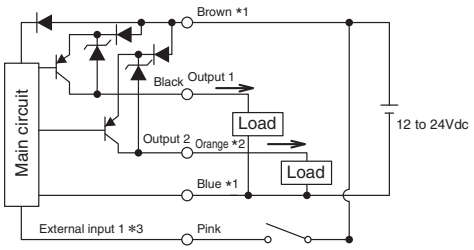
WIRING DIAGRAM FOR AMPLIFIER

Input/output circuit and connection NPN type



*1. Power to expansion units is supplied through the main unit.
*2. **HPX-AG02/03/04/06/08-**□only.
*3. **HPX-AG01/02/03/09/11-**□only.
*4. **HPX-AG09-3** only.

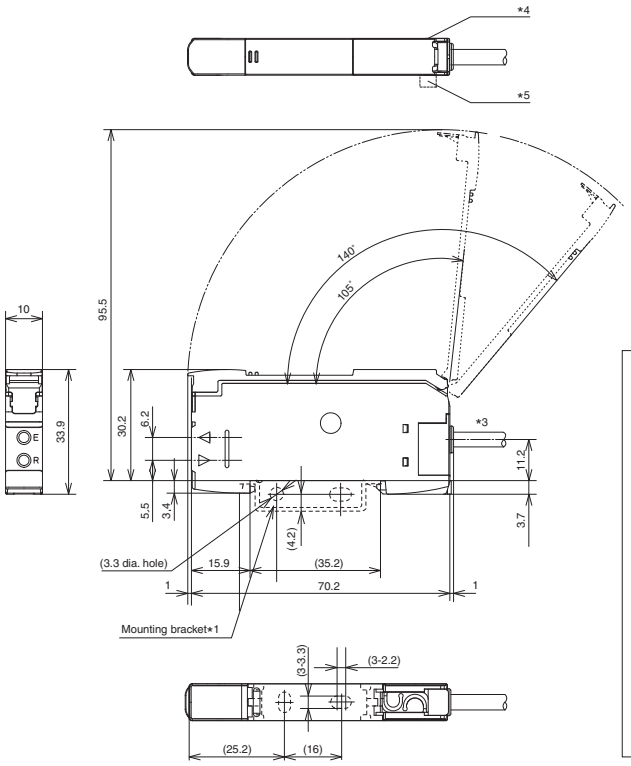
Input/output circuit and connection PNP type



*1. Power to expansion units is supplied through the main unit.
*2. **HPX-AG02/03-** □only.
*3. **HPX-AG01/02/03-**□only.

EXTERNAL DIMENSIONS

(unit: mm)



Notes:

*1. Mounting bracket sold separately (catalog listing: **HPX-PA04**).

2. Materials.
Case: PC resin, black
Control panel cover: PC resin, gray transparent
Mounting bracket: Stainless steel plate

*3. Oil-resistant cable.
2-core: **AG06-5, AG08-5, AG11-5**
3-core: **AG00-1/2/3/4, AG04-5, AG07-3**
4-core: **AG01-1/2/3/4, AG06-3, AG083, AG11-3**
5-core: **AG02-1/2, AG03-1/2, AG04-3, AG09-3**
For the above units: outer diameter 4.2, insulator diameter 1.2, and nominal cross-section 0.2mm^2. Sheath color is gray.

1-core: **AG00-5/6, AG07-5**
Outer diameter 2.6, insulator diameter 1.2, nominal cross-section 0.2mm^2. Sheath color is gray.

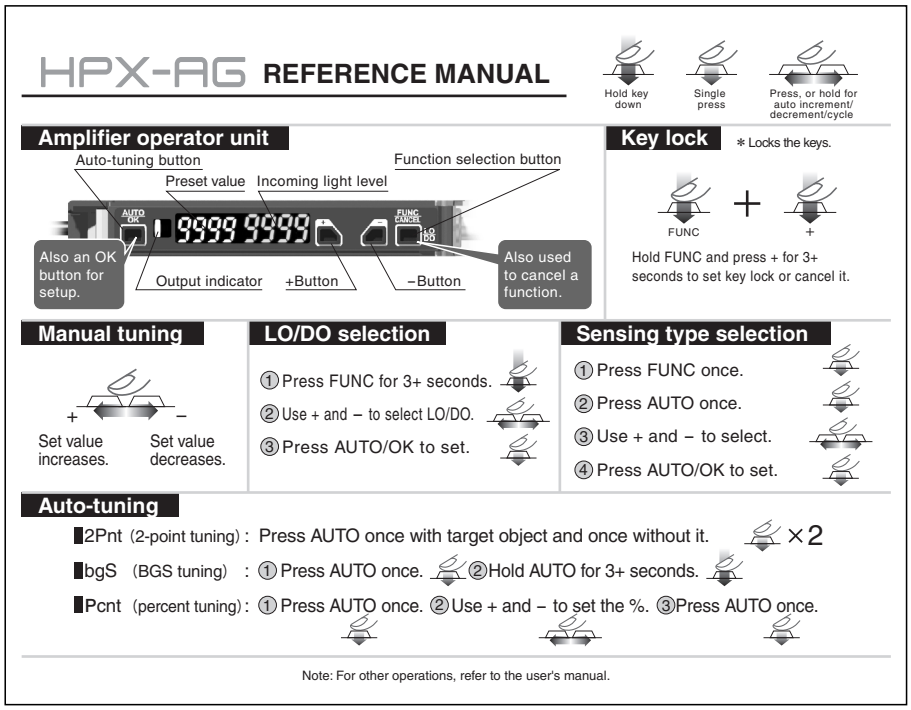
*4. Female connector structure for attaching a reduced wiring connector (for both main unit and expansion unit).

*5. Reduced-wiring type expansion unit has a connector structure (male) for attaching additional units.

HPX-AG REFERENCE MANUAL

Frequently used operations are summarized on this card. For more detail, refer to the user's manual included with the **HPX-AG** digital fiber-optic sensor.

Peel-off reference stickers are also available in Japanese, English or Chinese.



BASIC PRECAUTIONS

Wiring

● If an extension is necessary, use cable at least 0.3mm^2 in dia. and at most 100m long. ● If the wires of photoelectric sensor are laid in the same conduit as high-voltage or power lines, inductance may cause malfunction or damage. Isolate the photoelectric sensor's cable or lay it in a separate conduit. ● When using a commercially available switching regulator, ground the frame ground and ground terminals. If used without grounding, switching noise may cause malfunction. ● When using a load which generates an inrush current above the switching capacity, such as a capacitive load or incandescent lamp, connect a current-limiting resistor between the load and the output terminals. (Otherwise, the output short-circuit protection function will be activated.)

Handling

● Output is disabled upon power-up for approx. 200ms until the unit stabilizes. ● When used in an environment with much dust, be sure to take countermeasures to keep dust away from the sensor head by using a sealed case or air purge. ● Use a cover or change the mounting direction to ensure the sensor's correct operation if interference from ambient light is considerable. ● Even when oil-resistant cable is used, do not use in a location subject to continuous splashing by water or oil, or where the unit is dipped in liquid. Ensure that the end of the cable is not subject to splashing by water or oil. ● Water or oil splashed on the fiber head may cause incorrect operation. Shield the sensor head to prevent direct splashes. ● Do not use where exposed to chemicals (organic solvents, acids, alkalis, etc.) ● To clean the sensor head, wipe lightly with a soft, clean cloth. Do not use an organic solvent such as benzine or paint thinner. ● Pulling with excessive force may break the cable. Do not apply a force of more than 50N. ● Do not bend the part of the cable nearest to the amplifier beyond the bend radius of 30mm. Avoid continuous bending stress. ● The detection distance or display value may vary depending on variations in the individual amplifier, installation circumstances, and/or type of fiber unit.