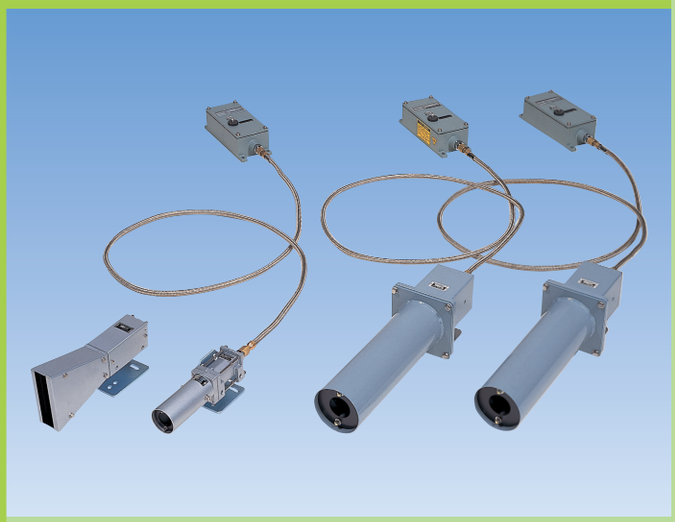
Photo Sensors
for Steel & Heavy industries



- HMD
  - FD-A300 P Series
  - FD300A series
  - FD600A series
  - FD-A310C series
  - FD-A300AN series
  - HMPD801-EX series
  - KD150C series
  - KD50 series
  - HD series
- CMD
  - FT44A series
  - FT10A series
  - FT101 series
  - KL(R)50 series
  - NT50(P)/NT100(P) series
- Punch hole detection sensor
  - SWD55
  - SWD60

Photo Sensors for Steel and Heavy Industries

HMD Overview and List of Models

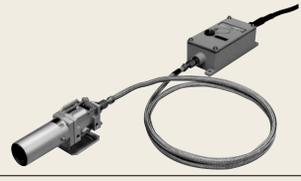
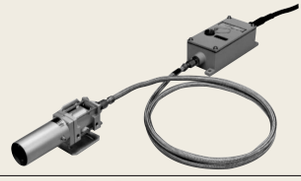
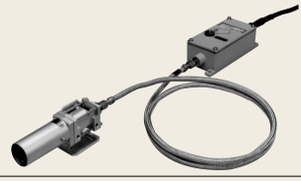
Operating temperature range (°C)	Appearance	Type	Model/Series Set Price	Detection object temperature (min.)	See Page
−30 −25 −20 −10 0 50 100 150 200				700 650 600 550 500 450 400 350 300	
−25 Detecting head 200 −25 Amplifier 50		Fiber type	**FD-A300P** Series	2m 490／350 5m 540／385 10m 610／445 (High temperature range/low temperature range)	474
−25 Detecting head 200 −25 Amplifier 50			**FD300A FD600A** Series	2m 580／360 5m 585／395 10m 595／455 (FD600A/ED300A)	482
−25 Detecting head 200 −25 Amplifier 50			**FD-A310C** Series	0.5m 340 1m 360 2m 385	488
−25 Detecting head 200 −25 Amplifier 50			**FD-A300AN** Series	2m 720~340 7m 760~360	492
−10 Without water-cooling 55 With water-cooling 80		Water-cooled type	**HMPD801-EX** Series	800	494
−25 Without water-cooling 55 With water-cooling 150			**KD150C** Series	150	496
			KD50 Series	450	498
200 −20 Detecting head −30 HD502F 70 −10 Amplifier 50		Simplified type	**HD400** Series	430(0.5m) 440(1m) 490(2m)	500
			HD502F Series	560	
−25 HD601 70 −25 HD301 50 −10 Amplifier 50			**HD301** Series	350	
			HD601 Series	650	

Photo Sensors for Steel and Heavy Industries

Detection Field of View Characteristics (Typical example)

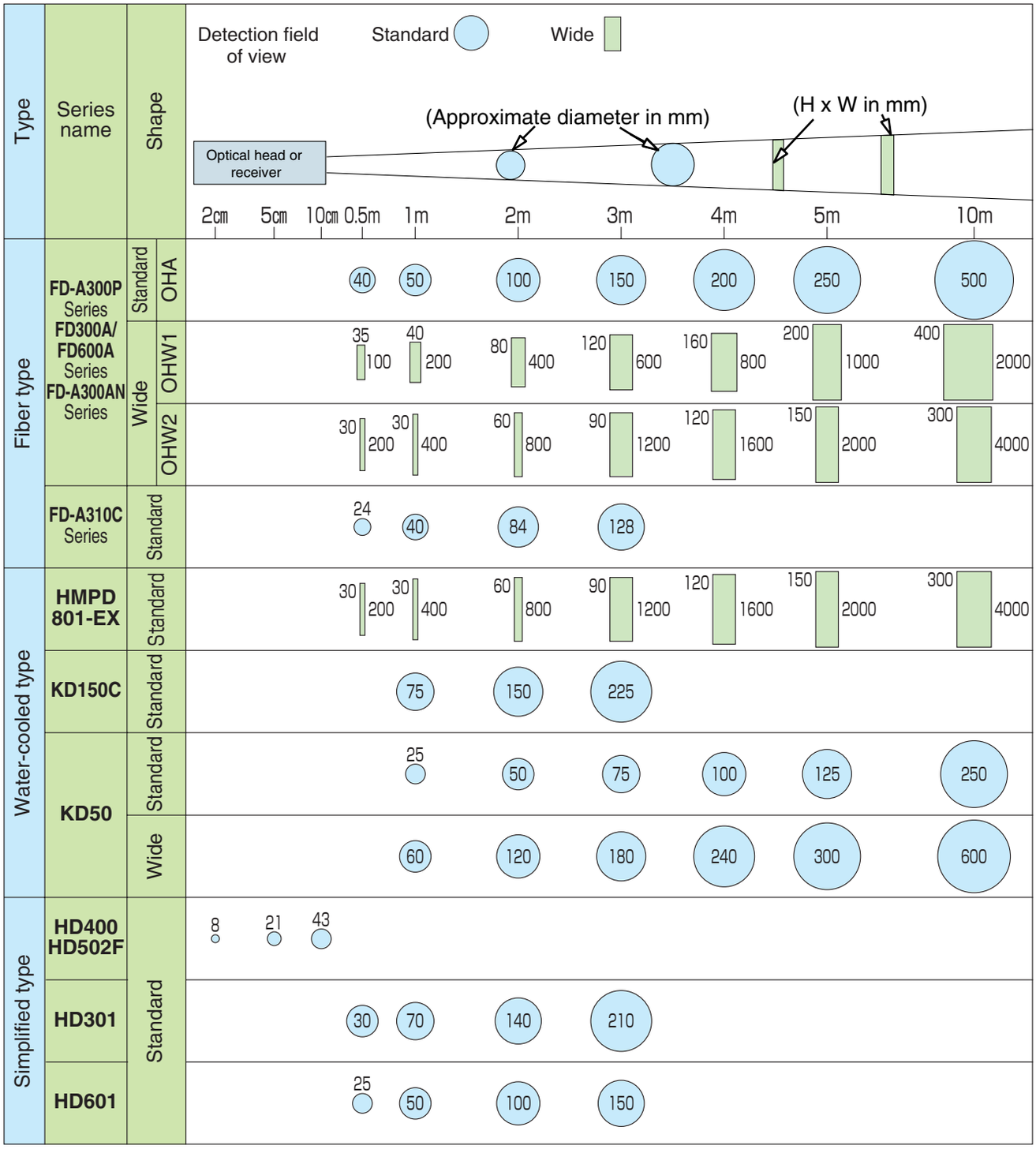


Photo Sensors for Steel and Heavy Industries

CMD Overview and List of Models

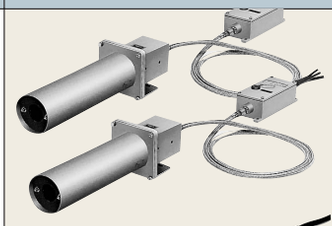
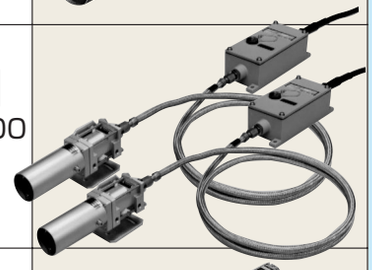
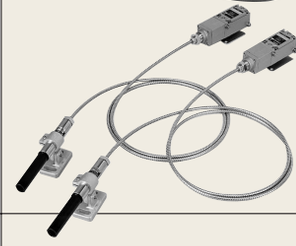
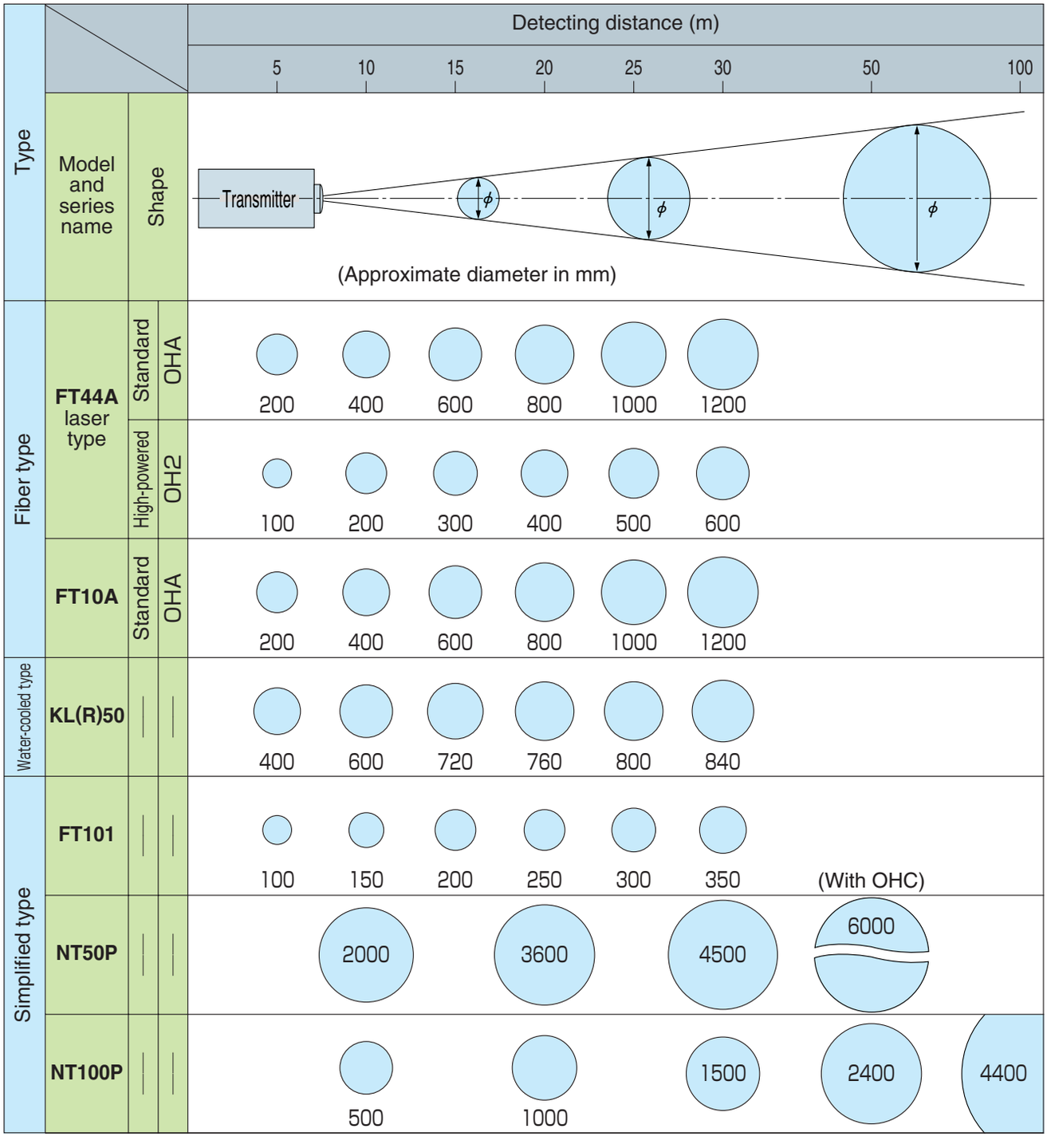
Operating temperature range (°C) (−30 −25 −20 −10 0 50 100 150 200)	Appearance	Type	Model/Series Set Price	Detecting distance (m) (10 20 30 40 50 60 70 80 90)	See Page
−25 Detecting head 200 −25 Amplifier 55		Fiber type	**FT44A** Series	50	504
−25 Detecting head 200 −25 Amplifier 55			**FT10A** Series	2m 40 3·4·5m 30 7·10m 20	514
−25 Detecting head 200 −25 Amplifier 55			**FT101** Series	0.5m 30 3m 20 10m 15	522
With water-cooling 150 −10 Without water-cooling 55		Water-cooled type	**KL(R)50** Series	50	526
−25 55		Simplified type	**NT50(P)**	50	528
−25 55			**NT100(P)**	100	

Photo Sensors for Steel and Heavy Industries

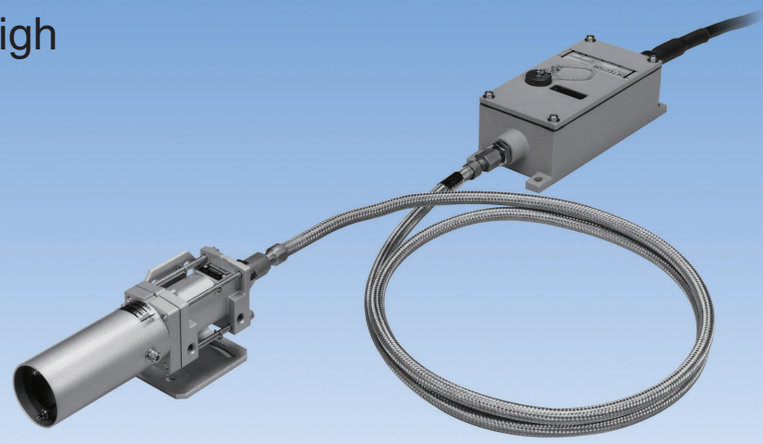
Directional Characteristics (Typical example)



FD-A300P series

Fiber type / HMD

Sensitivity adjustment unnecessary: auto sensing
One sensor covers a wide range of temperatures from low to high



FD-A300P is a series of optical fiber-type hot metal detection photo sensor (HMD) that directly detect infrared energy emitted from heated material (steel products, etc.).
Equipped with a controller that employs an 8-bit microcomputer, this intelligent hot metal detection sensor integrates various functions.

Features

- Sensitivity adjustment unnecessary: auto sensing mode
  Auto sensing mode automatically adjusts the operation level based on the received light intensity at detection of heated material and manual mode that allows manual setting of operation level are available.
- One sensor for a wide range of temperatures
  Two different ranges for low and high temperatures can be switched with external signal and support low and high temperatures.
- Numerical indication of received light intensity convenient for operation level setting
  Received light intensity at detection of heated material is represented in value between 0.1 and 10.0 for arbitrary setting of output operation level.
  Broad dynamic range of amplifier allows numerical expression of wide range of temperatures of heated materials in analog quantity, which, unlike the conventional HMD sensitivity adjustment, facilitates setting of operation level in concrete figures.
- Recall function: received light intensity detected in the past viewable
  Maximum received light intensity of heated material detected is stored to allow viewing during non-detection.
  Eight most recent maximum received light intensities of heated materials are stored to allow viewing of previous received light intensities in figures by selecting a mode.

Ordering Guide

The FD-A300P Series does not have set model Nos. Order by specifying the individual model Nos. of components. Models marked with * compose a set shown on the previous page.

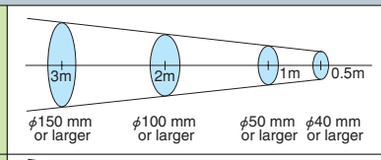
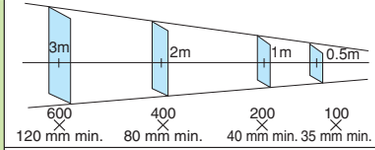
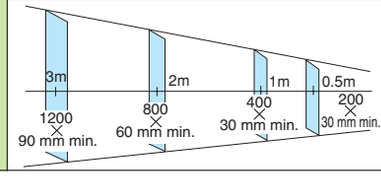
- Example

For ordering sensor with the following properties:
- Temperature of detection object: 600 °C or higher
- Mini power relay output
- Fiber length: 2 m
- Standard-view- Compact, lightweight Airless hood

Component	Model	Quantity
Hood	**F38A**	1
Optical head	**OHA**	1
Fiber	**FG2**	1
Amplifier	**FD-A300P**	1

[Optical head]

- The standard and wide types have different optical systems.Detection field of view characteristics (Typical example)

Field of view	Model
Standard type 	**OHA** ※
Wide type 	**OHW1**
Wide type 	**OHW2**

- Narrow-view optical head

See P.491 for details.

[Hood]

Type		Length	Model	Applicable optical head
Airless hood	Standard-view	120㎜	**F38A** ※	**OHA**
		200㎜	**F38A-02**	
		300㎜	**F38A-03**	
		400㎜	**F38A-04**	
		500㎜	**F38A-05**	
	Wide-view	200㎜	**F38W**	**OHW1** **OHW2**
Air purge hood	Standard-view	200㎜	**F38PC-02**	**OHA**
		300㎜	**F38PC-03**	
		400㎜	**F38PC-04**	
		500㎜	**F38PC-05**	
	Wide-view	——	**302W**	**OHW1** **OHW2**

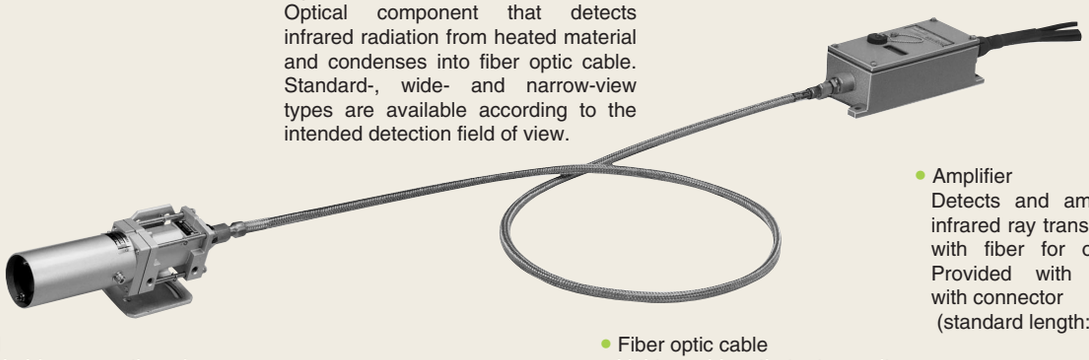
[Fiber optic cable]

Length	Model	Appearance (Typical example)
2m	**FG2** ※	
3m	**FG3**	
4m	**FG4**	
5m	**FG5**	
7m	**FG7**	
10m	**FG10**	
15m	**FG15**	
20m	**FG20**	
30m	**FG30**	

[Amplifier] Appearance common to all models

Control output type	Model
Mini power relay output	**FD-A300P** ※
Reed relay output	**FD-A300PH**
Solid-state output	**FD-A300PC**
Photo-MOS relay output	**FD-A300PM**

Configuration



- Optical head
Optical component that detects infrared radiation from heated material and condenses into fiber optic cable. Standard-, wide- and narrow-view types are available according to the intended detection field of view.

- Amplifier
Detects and amplifies infrared ray transmitted with fiber for output. Provided with cable with connector (standard length: 2 m).

- Hood
Provided for prevention of soiling of optical head lens or protection from disturbing light. Choice between airless and air purge hoods is available.

- Fiber optic cable
Light guide that transmits infrared ray captured with optical head into amplifier. Flexible tube with stainless steel braid is used as covering.

FD-A300P

Rating/Performance/Specification/Environmental Specification

Output specification					
Model		FD-A300P	FD-A300PH	FD-A300PC	FD-A300PM
Output type		Mini power relay output	Relay output	Solid-state output	Photo-MOS relay output
Control output		ON-OFF control			
	Operation mode	Light-ON/Dark-ON selector switch provided (DIP switch) Default setting: Light-ON (output activated when light received)			
	Rating	Transfer contact MAX 5A 250V AC (Resistance load)	Transfer contact MAX 0.5A 48V DC (Resistance load)	MAX 0.5A 250V AC/DC (Resistance load)	MAX 0.1A 100V AC/DC (Resistance load)
	*1) Response time	About 15ms (17ms)	About 5ms (7ms)	About 5ms (7ms)	About 4ms (6ms)
STB output		a contact 5A 250V AC max. (Resistance load)			
	*2) Rating				
General specification					
Valid lens diameter		28mm DIA (OHA)			
Power Supply		100 - 220V AC +10%, -15% 50/60Hz			
Power consumption		10W max.			
Connection		with Connector cable 2m (CVV1.25mm²)			
Ambient temperature		Optical head, Fiber: -25 to +200°C Amplifier: -25 +50°C (Non-freezing)			
Storage temperature range		-40 to +70°C (Non-condensing)			
Ambient humidity		35 to 85%RH max. (Non-condensing)			
Fiber-optic unit allowable bending radius		50mm			
Insulation resistance		Between power supply and case: 500 VDC, 20 MΩ or higher			
		Between output and case: 500 VDC, 20 MΩ or higher			
		Between power supply and output: 500 VDC, 20 MΩ or higher			
		Temperature range selection input: omitted			
Dielectric withstanding		Between power supply and case: 1500VAC for 1 minute			
		Between output and case: 1500VAC for 1 minute Unless, Reed relay output: AC1000V for 1 minute			
		Between power supply and output: 1500VAC for 1 minute Unless, Reed relay output: AC1000V for 1 minute			
		Temperature range selection input: omitted			
Vibration		10-55 Hz / 1.5 mm amplitude / 2 hours each in 3 direction			
Shock		500 m/s2 / 3 times each in 3 directions			
Protective structure		IP66			
Weight	Optical head	Basic type (OHA): 680g Wide type (OHW1/OHW2): About 1300g			
	Airless hood	F38A: about 240g F38A-02: about 340g F38A-03: about 430g	F38A-04: about 550g F38A-05: about 650g F38W: about 600g		
	Air purge hood	F38PC-02: about 240g F38PC-03: about 300g F38PC-04: about 370g	F38PC-05: about 440g 302W: about 600g		
	Fiber	FG2: about 0.7kg FG3: about 0.9kg FG4: about 1.1kg	FG5 : about 1.3kg FG7 : about 1.6kg FG10: about 2.1kg	FG15: about3.1kg FG10: about4.1kg FG30: about6.1kg	
	Amplifier	About 1.5kg			

Amplifier Major Specification

Light-sensitive element	Ge photodiode
Sensitivity wavelength	0.8～1.8μm
HMD function	Auto sensing mode (automatic setting of operation level)
	Manual mode (automatic setting of operation level)
Detecting temperature range	2 ranges: low temperature and high temperature ranges (selectable with external input)
Auxiliary function	- Succeed sensing function/STB function/Initial check function/Recall function
Indication	- Output indictor (OP.L): red LED / STB indicator (STB): green LED - Received light intensity display: 3-digit figure
Received light intensity scale range	0.1-10.0 (in increments of 0.1)
Operation level setting range	Auto sensing mode: 1.0-8.0 (in increments of 0.1) / Manual mode: 1.0-9.0 (in increments of 0.1)

*1)Response speed is for operation level setting at [received light intensity –2.0]. With extremely low operation level setting with reference to received light intensity, the response time for deactivation becomes longer. Values in parentheses show response times for deactivation with operation level setting of [1.0] against received light intensity [10.0].

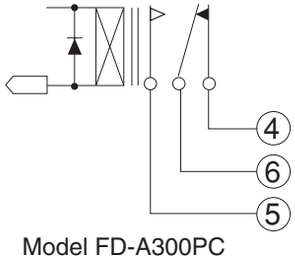
*2)STB output is mini power relay for all models regardless of detection output type.

Input/Output Circuit and Connection

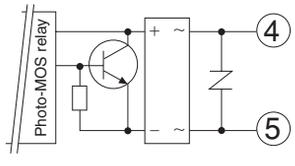
- Control output

Model FD-A300P

Model FD-A300PH

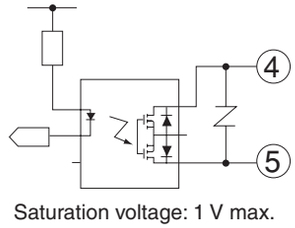


Model FD-A300PC



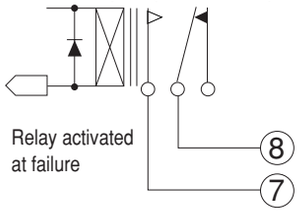
Saturation voltage: 3 V max.

Model FD-A300PM



Saturation voltage: 1 V max.

- STB output (all models)



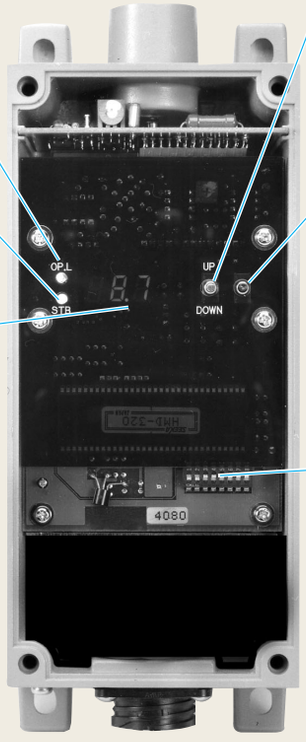
When connecting an inductive load such as relay as the load, be sure to use diode, surge absorber, etc. for protection of output transistor from back electromotive force.

Amplifier panel layout (with case lid removed)

Operation indicator
(red LED)
Illuminated when output is activated.

Stability indicator
(green LED)
Illuminated to indicate normal operation.
Flashes when there is not much margin in the level of received light intensity.

Received light intensity display
Shows information such as operation level setting, etc. when no detection is taking place (light completely blocked).
At detection of heated material, shows received light intensity in real time.



SET switch
Toggle switch between ON - (OFF) - ON used for changing operation level setting or selection of previous received light intensity to be displayed.

Mode switch
Pushbutton switch for selecting functions.
Pressing the switch when no detection is taking place shows a number for a function mode on the display.
The number for function mode changes every time the switch is pressed.

Switch for changing function
Functions as a general HMD are factory-set. This switch allows changing of some functions.

Lowest Detectable Temperature

Select between two (high and low) temperature ranges by mode setting

Low temperature range	350～ 800°C
High temperature range	490～1300°C

Guidelines are given below for the temperature of a detection object larger than the detecting field of view with optical head (OHA) and fiber optic cable (FG2) used for detection.

Guidelines for minimum temperature of detected object

The minimum temperature depends on the length of the fiber optic cable used or detecting field of view of the optical head. Temperatures shown in this table are for heated material larger than the field of view. If the material is smaller than the field of view, the lowest detectable temperature is increased. The guidelines are for the minimum temperatures of detection objects and include margins of about 4 times as much as the inherent performance. For detailed data, see “Minimum Detectable Object and Lowest Detectable Temperature.”

Fiber length	Low temperature range		Low temperature range	
	Optical head		Optical head	
	Standard-view model OHA	Wide-view model OHW1/OHW2	Standard-view model OHA	Wide-view model OHW1/OHW2
2m	350 °C min.	415 °C min.	490 °C min.	590 °C min.
3m	356 °C min.	430 °C min.	510 °C min.	610 °C min.
4m	375 °C min.	445 °C min.	525 °C min.	625 °C min.
5m	385 °C min.	450 °C min.	540 °C min.	635 °C min.
7m	400 °C min.	475 °C min.	560 °C min.	660 °C min.
10m	445 °C min.	520 °C min.	610 °C min.	725 °C min.
15m	480 °C min.	555 °C min.	655 °C min.	775 °C min.
20m	500 °C min.	580 °C min.	680 °C min.	800 °C min.
30m	530 °C min.	610 °C min.	720 °C min.	850 °C min.

FD-A300P

Convenient High Performance and Various Functions

HMD function in 2 modes and auxiliary function in 4 modes provided in addition to auto sensing mode, eliminating need for sensitivity adjustment

HMD modes

Mode0 auto sensing mode

- Automatically sets the operation level according to the received light intensity at detection of heated material. Factory setting for the operation level is 1.0. Once any heated material is detected, the received light intensity data at that point is used as the basis for automatic setting of the next activation level and deactivation level.
- This operation takes place every time heated material is detected.

Mode1 manual mode

- HMD operation with the operation level fixed.
- The operation level can be manually adjusted at will. The set operation level is stored, which remains applied even after power-up.

Auxiliary function modes

Mode2

- Operation level setting mode for high temperature range (H)
- The sensor temperature ranges may be switched with external input for selection between low temperature detection and high temperature detection. This sets the operation level for the high temperature range regardless of the currently active temperature range.

Mode3

- Operation level setting mode for low temperature range (L)
- As with Mode 2, this sets the operation level for the low temperature range regardless of the currently active temperature range.

Mode4 (recall function)

- Displays the previous maximum data for received light intensity.
- The current maximum value of the received light intensity is stored at every activation and deactivation.
- Up to 8 data may be stored.

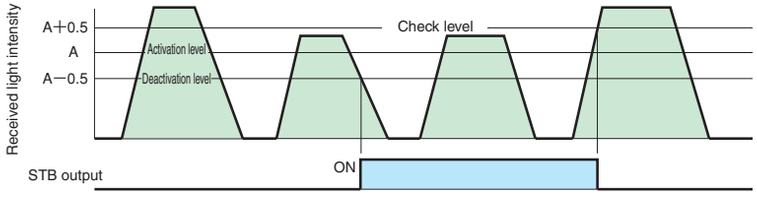
Mode5

- Mode that helps identify the cause of any STB output.

STB detection function

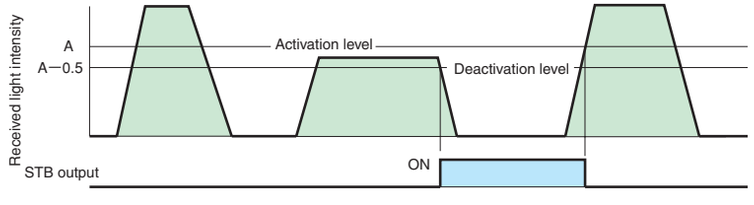
Gives an alert for any abnormality found in the received light intensity level with the STB output and flashing of the lamp.
Selection of **Mode5** enables detection of received light level error in 3 patterns:

STB 1 : Insufficient margin of received light intensity at detection with reference to operation (activation) level



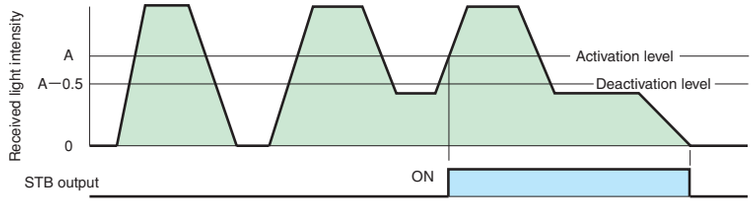
The check level for STB 1 is set at a level 0.5 or 1.0 higher than the activation level (A).
Activation level (A) ≤ 5.0: Check level = A + 0.5
Activation level (A) > 5.0: Check level = A + 1.0
Alert is given when the detection object has passed and the received light intensity detected at deactivation is equal to or lower than the check level.
This alert output is reset when the received light intensity exceeds the check level.

STB2 : Heated material passed but not detected due to excessively high activation level setting



Signal is output when the received light intensity at non-detection is 0.1 or higher.

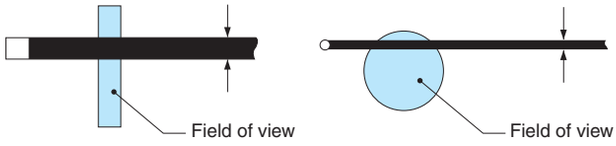
STB3 : Light not fully blocked even with no heated material (light blocking state)



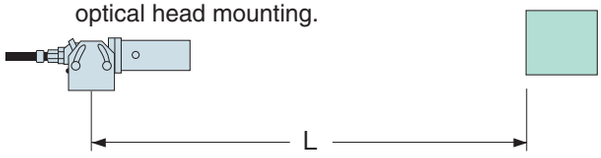
Minimum Detectable Object and Lowest Detectable Temperature

The graphs below may be used to find the relationship between the diameter of a detection object and its lowest detectable temperature.

- The minimum detectable object diameter means the width of a round or square bar or board with a length equal to or more than the field of view that may be detected at any point in the field of view.



- Detecting distance means the distance between the surface of a detection object and the center of the optical head mounting.



- Using graphs

The graphs show data for a detecting distance of 1 m.
For a detecting distance other than 1 m, use the following formula to find the coefficient and multiply the reading on the Y-axis of the graph (detection object diameter) by the coefficient [K].
Coefficient K = L + (0.6 - 0.6 x L) (L = detecting distance (m))
Example: for detecting distance of 50 cm (L = 0.5)
K = 0.5 + (0.6 - 0.6 x 0.5) = 0.8
The coefficient is 0.8. Multiply this by Y-axis reading of the graph (detection object diameter): 50 x 0.8 = 40
This means that the point for detection object diameter 50 mm must be regarded as the point for diameter 40 mm.
Multiply other values by the coefficient above in the same way and complete the replaced Y-axis scale.

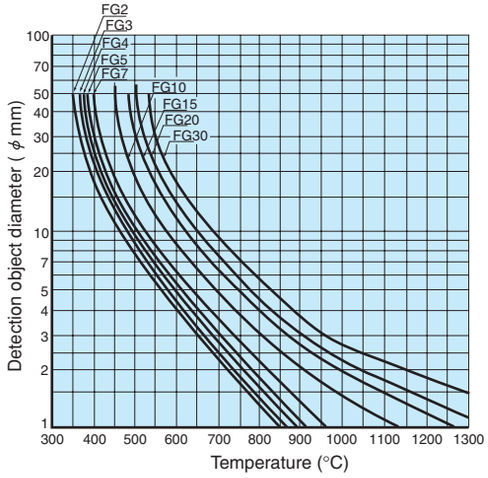
For detection with (OHW1/OHW2) used as optical head and detecting distance of 1 m or shorter

Use the distance as the coefficient.
Example: for detection using OHW1 and distance 0.7 m
In this case, the coefficient is 0.7.
Multiply the Y-axis readings of the graph by 0.7 to complete the replaced Y-axis scale.
The point for detection object diameter 200 must be regarded as the point for diameter 140.

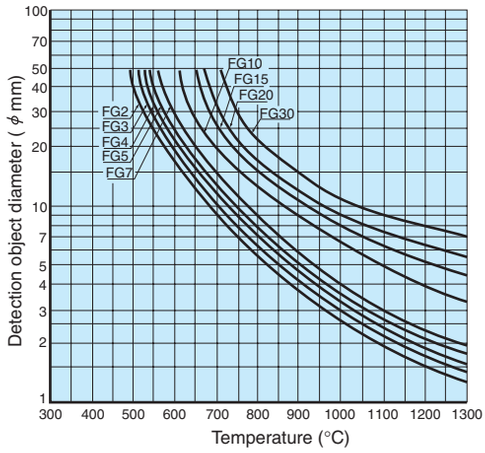
For detecting distance of 1 m or longer (with any optical head model)

Use the distance as the coefficient.
Example: for detecting distance 2.5 m
In this case, the coefficient is 2.5.
Multiply the Y-axis readings of the graph by 2.5 to complete the replaced Y-axis scale.

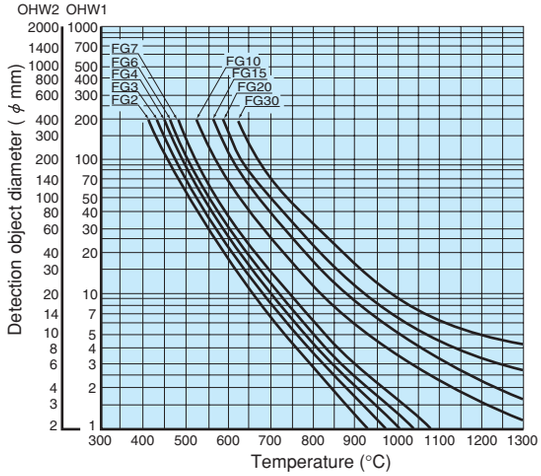
Temperature range	L
Optical head	OHA



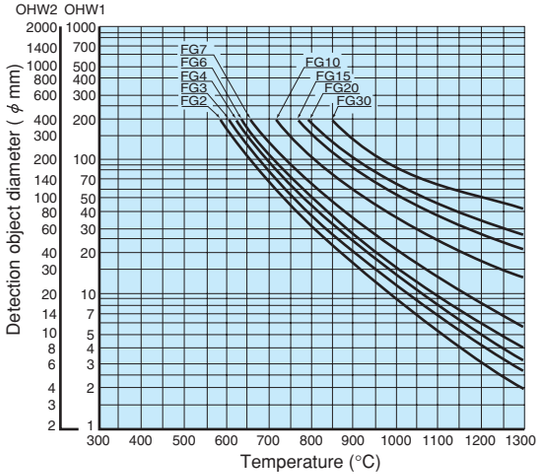
Temperature range	H
Optical head	OHA



Temperature range	L
Optical head	OHW1/OHW2



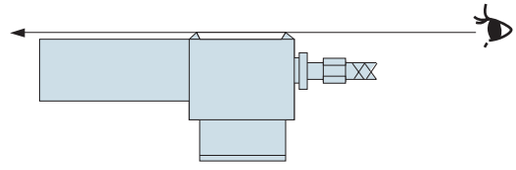
Temperature range	H
Optical head	OHW1/OHW2



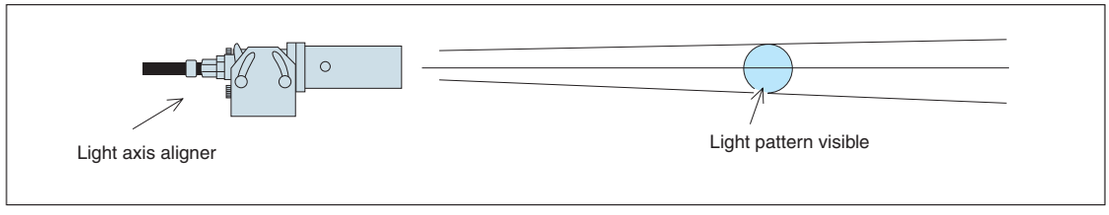
FD-A300P

Light Axis Alignment

- Alignment with optical sight
  Use the optical sight provided on the optical head.



- Alignment with Light axis aligner (optional)
  Mount an Light axis aligner containing a halogen lamp on the optical head and radiate the light beam pattern through the lens surface.
  The projected beam pattern shows the detection field of view, which allows more accurate field adjustment.



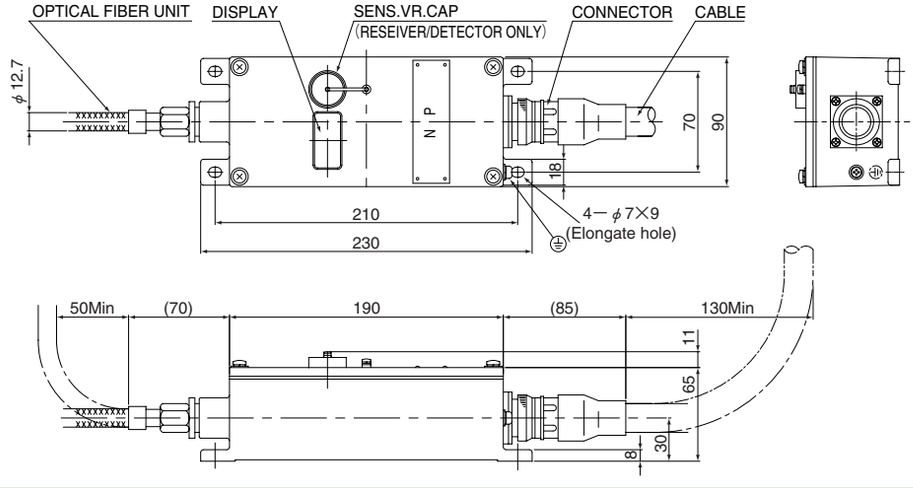
Product name : Light axis aligner for fiber optic sensor
Model : OHF-CL/CLP

- Light axis aligner
  OHF-CL
- Power supply unit
  OHF-CLP
- Halogen lamp (spare)
  OHF-L5

Dimensions (in mm)

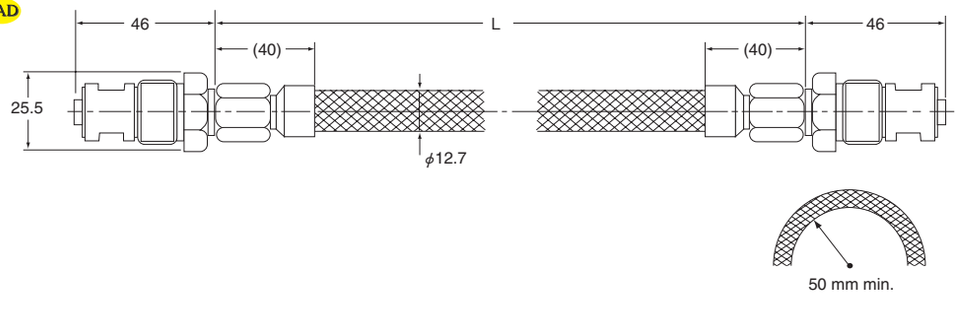
Amplifier

CAD



Fiber

CAD



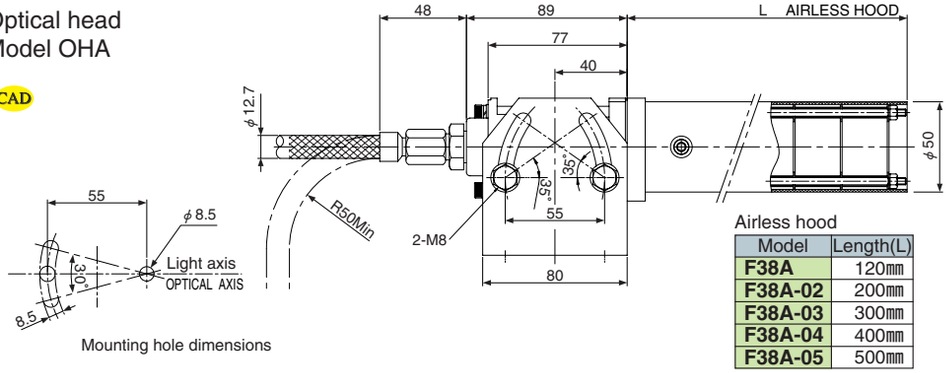
Model	Length(L)
FG2	2m
FG3	3m
FG4	4m
FG5	5m
FG7	7m
FG10	10m
FG20	20m
FG30	30m

Dimensions (in mm; example combinations of hood and applicable optical head)

Example of combination of Airless hood and optical head

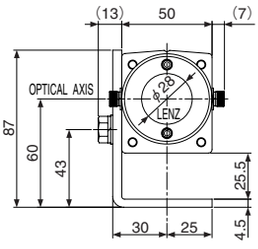
Optical head
Model OHA

CAD

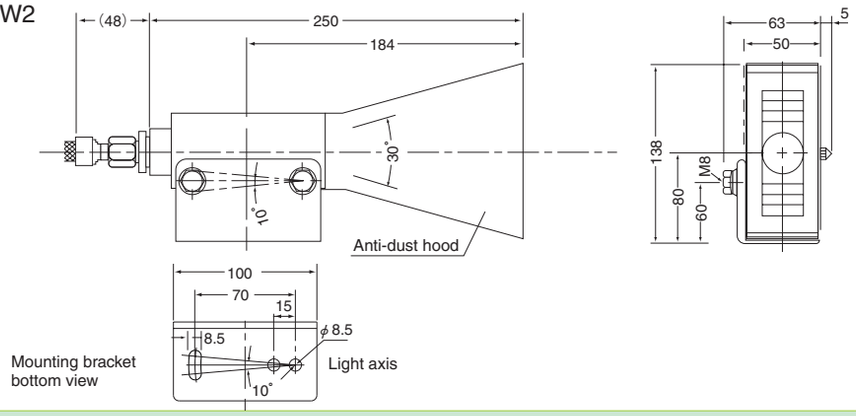


Airless hood

Model	Length(L)
F38A	120mm
F38A-02	200mm
F38A-03	300mm
F38A-04	400mm
F38A-05	500mm



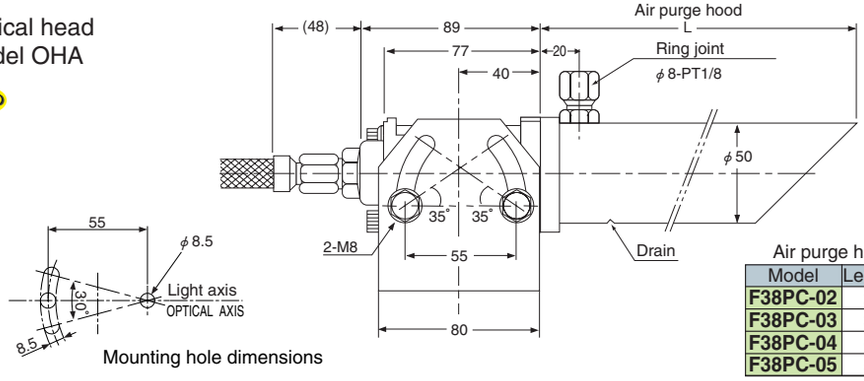
Optical head Model OHW1／OHW2
Airless hood Model F38W



Example of combination of Airless hood and optical head

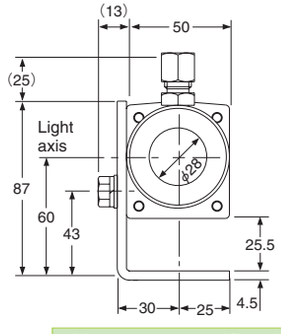
Optical head
Model OHA

CAD



Air purge hood

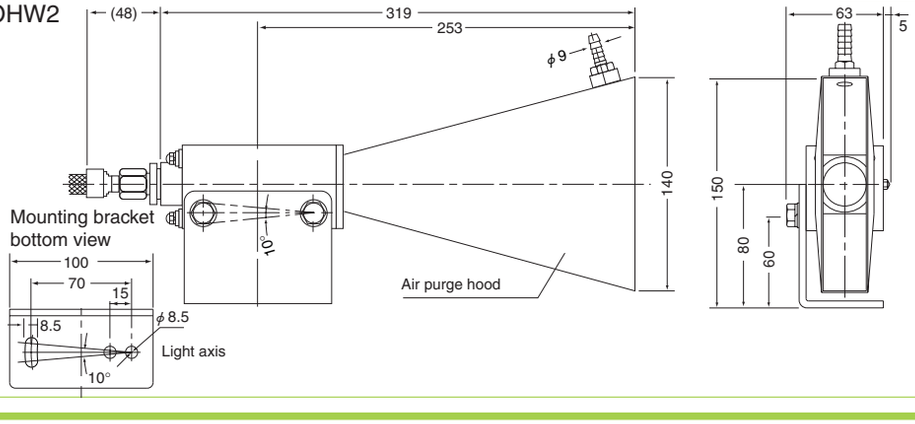
Model	Length(L)
F38PC-02	200mm
F38PC-03	300mm
F38PC-04	400mm
F38PC-05	500mm



Air purge specification
Flow rate ···200 ℓ/min
Withstand pressure ···0.98MPa

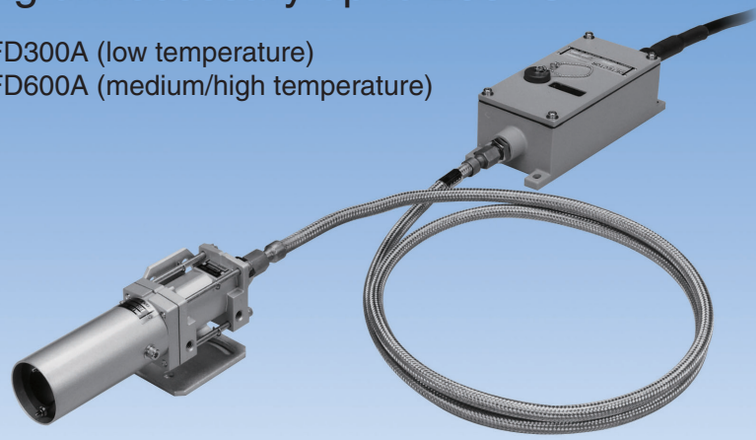
Optical head
Model OHW1／OHW2
Air purge hood
Model 302W

CAD



5-point level indicator facilitating light axis alignment
Cooling unnecessary up to 200 °C

Model : FD300A (low temperature)
Model : FD600A (medium/high temperature)



The optical head and amplifier are connected with a fiber optic cable and the infrared ray captured with the optical head is transmitted through highly transmissive glass fiber into an amplifier installed at a distant location. The infrared ray transmitted into the amplifier is optically converted in the light-sensitive element and amplified for control signal output (mini power relay, relay or Solid-state output).
Sensors for low temperature (FD300A Series) and medium/high temperature (FD600A Series) are available.

Features

- No cooling required
  The optical head integrating hood and optical lens and fiber have no electronic component, which allows use in ambient temperature of up to 200 °C without cooling.

- Excellent durability
  Reliable design with the hood and optical head made of metal, fiber optic cable covered with flexible stainless steel braid and metal-cased amplifier provides robustness and resistance to heat and corrosion.

- 5-point level indicator
  Received light intensity is indicated at 5 levels, offering easy viewing of stability.

- Self-check feature integrated (SAFETY feature)
  Operation can be checked with external signal. Stability check feature is provided, which outputs alarm signal (SAFETY ALARM) when there is not much margin in the received light intensity level at detection due to soiling of lens, light axis misalignment, etc. or external disturbing light or residual heat.

Ordering Guide

The FD-300A/FD600A Series does not have set model Nos. Order by specifying the individual model Nos. of components. Models with marked with *compose a set shown on the previous page.

- Example

For ordering sensor with the following properties:

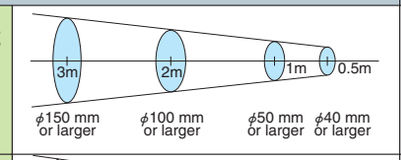
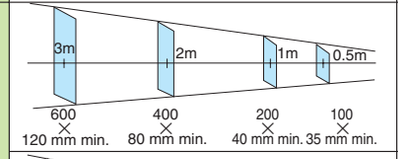
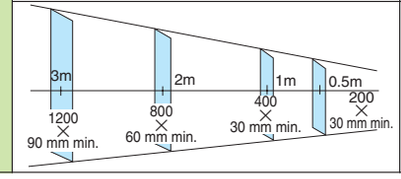
- Temperature of detection object: 600 °C or higher
- Mini power relay output
- Fiber length: 2 m
- Standard-view
- Compact, lightweight Airless hood

Component	Model	Quantity
Hood	**F38A**	1
Optical head	**OHA**	1
Fiber	**FG2**	1
Amplifier	**FD600A**	1

[Optical head]

- The standard and wide types have different optical systems.

Detection field of view characteristics (Typical example)

Field of view	Model
Standard type 	**OHA※**
Wide type 	**OHW1**
Wide type 	**OHW2**

[Hood]

Type		Length	Model	Applicable optical head
Airless hood	Standard-view	120㎜	**F38A ※**	**OHA**
		200㎜	**F38A-02**	
		300㎜	**F38A-03**	
		400㎜	**F38A-04**	
		500㎜	**F38A-05**	
	Wide-view	200㎜	**F38W**	**OHW1 OHW2**
Air purge hood	Standard-view	200㎜	**F38PC-02**	**OHA**
		300㎜	**F38PC-03**	
		400㎜	**F38PC-04**	
		500㎜	**F38PC-05**	
	Wide-view	——	**302W**	**OHW1 OHW2**

[Fiber optic cable]

Length	Model	Appearance (Typical example)
2m	**FG2 ※**	
3m	**FG3**	
4m	**FG4**	
5m	**FG5**	
7m	**FG7**	
10m	**FG10**	
15m	**FG15**	
20m	**FG20**	
30m	**FG30**	

- Narrow-view optical head

See P.491 for details

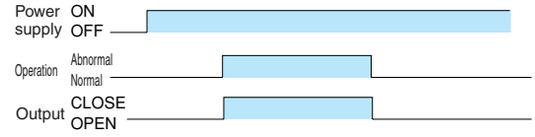
[Amplifier]

- Select an amplifier based on the temperature of the detection object. The lowest detectable temperature varies depending on the fiber length. Temperatures shown in the table below are applicable only when the heated material (object) is larger than the detection field of view. If the material is smaller than the detection field, the lowest detectable temperature is increased. For detailed data, see “Minimum Detectable Object and Lowest Detectable Temperature.”

Type	Fiber length and detectable temperature				Applicable amplifier series	Output type	Model
	Length	Model	Standard	Wide			
Low temperature	2m	**FG2**	360 °C or higher	425 °C or higher	FD300A series	Mini power relay output	**FD300A※**
	3m	**FG3**	375 °C or higher	440 °C or higher			
	4m	**FG4**	385 °C or higher	460 °C or higher			
	5m	**FG5**	395 °C or higher	465 °C or higher		Reed relay output	**FD300AH**
	7m	**FG7**	415 °C or higher	485 °C or higher			
	10m	**FG10**	455 °C or higher	530 °C or higher			
	15m	**FG15**	490 °C or higher	570 °C or higher		Solid-state output	**FD300AC**
	20m	**FG20**	510 °C or higher	595 °C or higher			
	30m	**FG30**	540 °C or higher	625 °C or higher			
Medium/high temperature	2m	**FG2**	580 °C or higher	660 °C or higher	FD600A series	Mini power relay output	**FD600A**
	3m	**FG3**	580 °C or higher	660 °C or higher			
	4m	**FG4**	585 °C or higher	665 °C or higher			
	5m	**FG5**	585 °C or higher	670 °C or higher		Reed relay output	**FD600AH**
	7m	**FG7**	590 °C or higher	675 °C or higher			
	10m	**FG10**	595 °C or higher	680 °C or higher			
	15m	**FG15**	610 °C or higher	695 °C or higher		Solid-state output	**FD600AC**
	20m	**FG20**	620 °C or higher	710 °C or higher			
	30m	**FG30**	650 °C or higher	740 °C or higher			

FD300A·FD600A

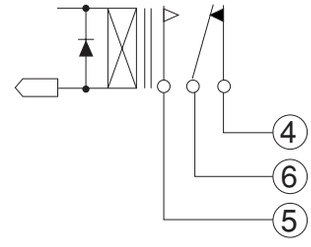
Rating/Performance/Specification/Environmental Specification

Output specification				
Model		**FD-300A FD-600A**	**FD300AH FD600AH**	**FD300AC FD600AC**
Output mode		Mini power relay output	Relay output	Solid-state output
Control output		On-OFF control (Light-ON)		
	Rating	Transfer contact MAX 5A 250V AC (Resistance load)	Transfer contact MAX 0.5A 48V DC (Resistance load)	MAX 0.5A 250V AC/DC (Resistance load)
	Response time	15ms max.	5mx max.	3ms max.
SAFETY ALARM output				
	Rating	a contact 5A 250V AC max. (Resistance load)		
General specification				
Valid lens diameter		28mm DIA (OHA)		
Power Supply		100 - 220VAC+10%, -15% 50/60Hz		
Power consumption		10W max.		
Connection		with Connector cable 2m (CVV1.25mm²)		
Ambient temperature		Optical head, Fiber: -25 to +200°C Amplifier: -25 +50°C (Non-freezing)		
Storage temperature range		-40 to +70°C (Non-condensing)		
Ambient humidity		35 to 85%RH Max. (Non-condensing)		
Fiber-optic unit allowable bending radius		50㎜		
Insulation resistance		Between power supply and case: 500 VDC, 20 MΩ or higher		
		Between output and case: 500 VDC, 20 MΩ or higher		
		Between power supply and output: 500 VDC, 20 MΩ or higher		
		Operation check input: omitted		
Dielectric withstanding		Between power supply and case: 1500VAC for 1 minute		
		Between output and case: 1500VAC for 1 minute Unless, Reed relay output: AC1000V for 1 minute		
		Between power supply and output: 1500VAC for 1 minute Unless, Reed relay output: AC1000V for 1 minute		
		Operation check input: omitted		
Vibration		10-55 Hz / 1.5 mm amplitude / 2 hours each in 3 direction		
Shock		500 m/s² / 3 times each in 3 directions		
Protective structure		IP66		
Weight	Optical head	Basic type (OHC): 680g Wide type (W1/W2): About 1300g		
	Airless hood	F38A : about 240g F38A-04 : about 550g F38W : about 600g	F38A-03 : about 430g F38A-05 : about 650g	
	Air purge hood	F38PC-02 : about 240g F38PC-04 : about 370g 302W : about 600g	F38PC-03 : about 300g F38PC-05 : about 440g	
	Fiber	FG2 : about 0.7kg FG5 : about 1.3kg FG15 : about 3.1kg	FG3 : about 0.9g FG7 : about 1.6g FG20 : about 4.1g	FG4 : about1.1kg FG10 : about2.1kg FG30 : about6.1kg
	Amplifier	About 1.5kg		

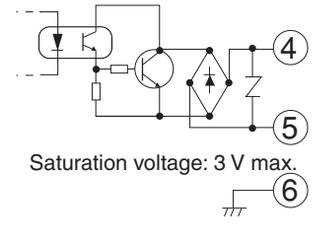
Input/Output Circuit and Connection

- Control output

Model FD300A・FD600A
Model FD300AH・FD600AH

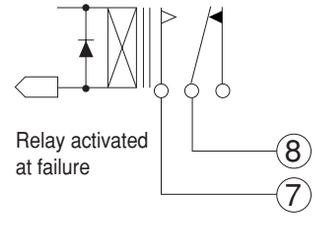


Model FD300AC・FD600AC



Saturation voltage: 3 V max.

- SAFETY ALARM output (all models)



When connecting an inductive load such as relay as the load, be sure to use diode, surge absorber, etc. for protection of output transistor from back electromotive force

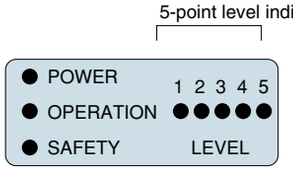
Dimensions

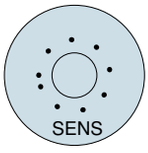
The dimensions are the same with the FD-A300P Series.
See PP. 480-481.

Configuration

Configuration and functions of components are the same with model FD-A300P.
See P. 475.

Amplifier panel layout (with case lid removed)





Sensitivity adjustment
MAIN volume

Illuminated at power-up.
Operation indicator: illuminated when control output is activated.
Stability check indicator (safety indicator)
When there is not much margin in the received light intensity, SAFETY ALARM is output and the LED starts flashing.
Received light intensity is shown with an indicator with 5 LEDs, which are illuminated differently for the individual levels:

LEVEL 1: 1/2 of operation level
LEVEL 2: operation level
LEVEL 3: double the operation level (±50% variable)
LEVEL 4: triple the operation level
LEVEL 5: quadruple the operation level

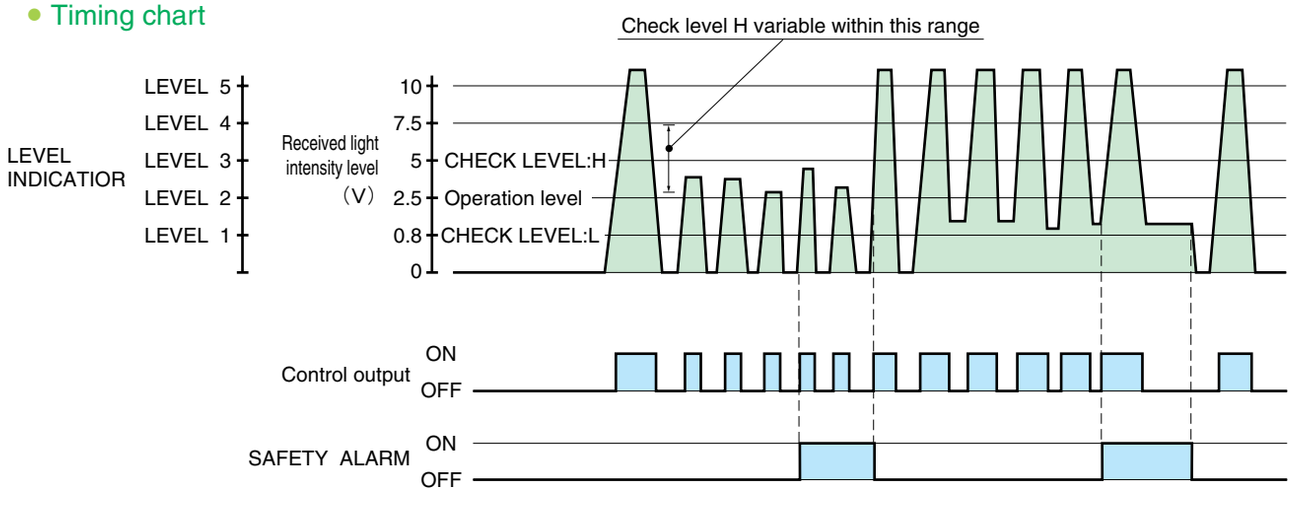
illuminated

Sensitivity adjustment
Two volumes are provided: MAIN and SUB. Only the MAIN volume can be manually operated from outside.

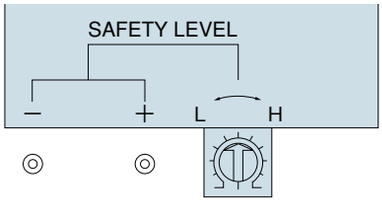
Control Output and Stability Check Feature

◇Control output: obtained by detecting infrared radiation from heated material.
◇Stability check feature (SAFETY ALARM output): self-check feature. When there have been several consecutive detections with received light intensity at light reception less than double the operation level or intensity at light blocking state more than 1/2 of the operation level, a level error signal is output to notify of unstable detection.
This check level of ※double the operation level※ is variable within 50% by adjusting the internal volume.
This alarm output is automatically reset when the stable detection condition is restored.
The timing chart below shows variation of received light intensity level at each passage of heated material and output condition.

• Timing chart



• Adjustment of SAFETY LEVEL for stability check



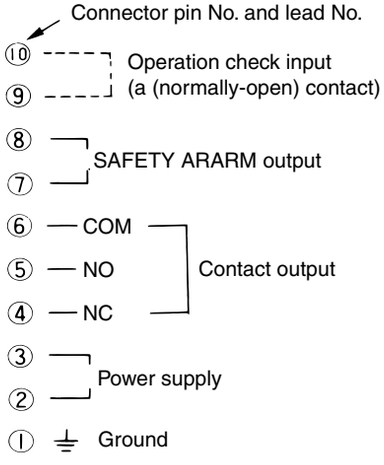
The volume is not provided on the surface.
Remove the case lid to access the volume for adjustment.

SAFETY ALARM operation : The number of checks is set at 7, which means that seven consecutive unstable detections activate the SAFETY ALARM output.
Operation check : The simulated light source in the detector is illuminated by external check signal to activate the detector.

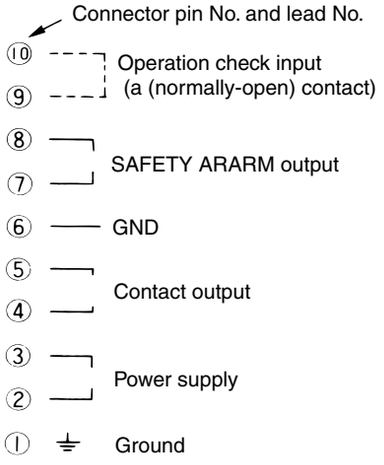
FD300A·FD600A

Connection

Mini power relay output type
FD300A・FD600A
Relay output type
FD300AH・FD600AH



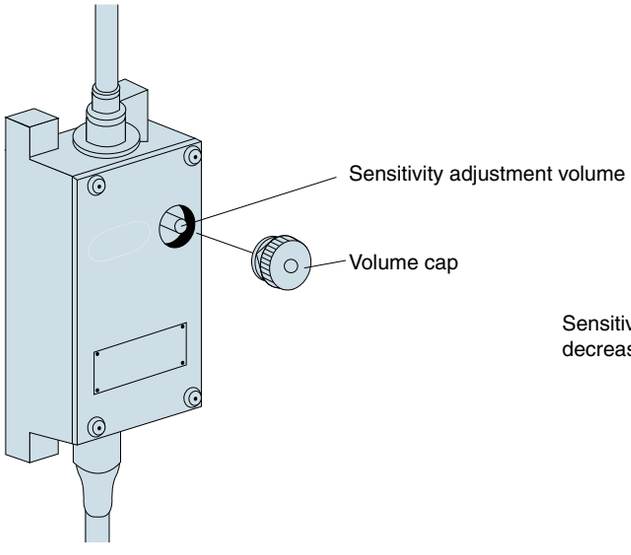
Solid-state output type
FD300AC・FD600AC

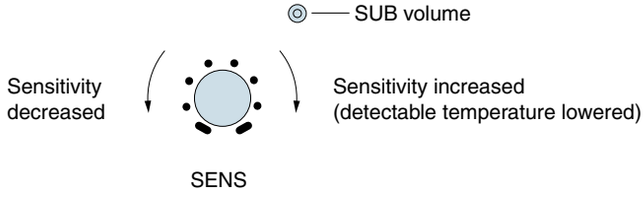


- When connecting an inductive load such as relay as the load, be sure to use diode, surge absorber, etc. for protection of output transistor from back electromotive force.
- When the leads are extended (100-300 m), stray capacitance between leads may cause rush current. If this poses any problem, provide a resistor (10-50 Ω) in series with the contact.

Sensitivity adjustment

Two volumes are provided for sensitivity adjustment: MAIN and SUB.





Light Axis Alignment

Alignment with optical sight

Use the optical sight provided on the optical head.

Alignment with Light axis aligner - Light axis aligner is optionally available

See PP. 480 and 520 for details.

Minimum Detectable Object and Lowest Detectable Temperature

The graphs below may be used to find the relationship between the diameter of a detection object and its lowest detectable temperature.

- The minimum detectable object diameter means the width of a round or square bar or board with a length equal to or more than the field of view that may be detected at any point in the field of view.
- Using graphs

The graphs show data for a detecting distance of 1 m.

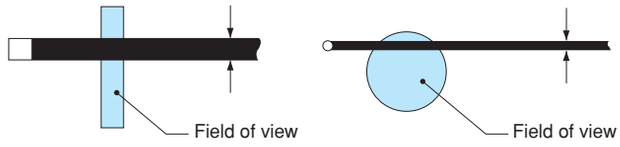
For example, if a combination of amplifier FD300A, optical head OHA and fiber optic cable FG10 are used for detecting a round bar of 10 mm, the lowest detectable temperature is 590 °C according to the first graph.

For a detecting distance other than 1 m, use the following procedure to find the "coefficient" and multiply the reading on the Y-axis of the graph (detection object diameter) by the resulting coefficient [K].

For detection with (OHW1/OHW2) used as optical head and detecting distance of 1 m or shorter.

Example : If OHW1 is used and the detecting distance is 0.7 m, the coefficient is 0.7.

Multiply the Y-axis readings of the graph by 0.7 to complete the replaced Y-axis scale.



For detection with (OHA) used as optical head and detecting distance of 1 m or shorter

Coefficient K = L + (0.6 - 0.6 x L) (L = detecting distance (m))

Example : for detecting distance of 50 mm (L = 0.5)

K = 0.5 + (0.6 °0.6 x 0.5) = 0.8

The coefficient is 0.8. Multiply this by Y-axis reading of the graph (detection object diameter) : 50 x 0.8 = 40

This means that the point for detection object diameter 50 mm must be regarded as the point for diameter 40 mm.

Multiply other values by the coefficient above in the same way and complete the replaced Y-axis scale.

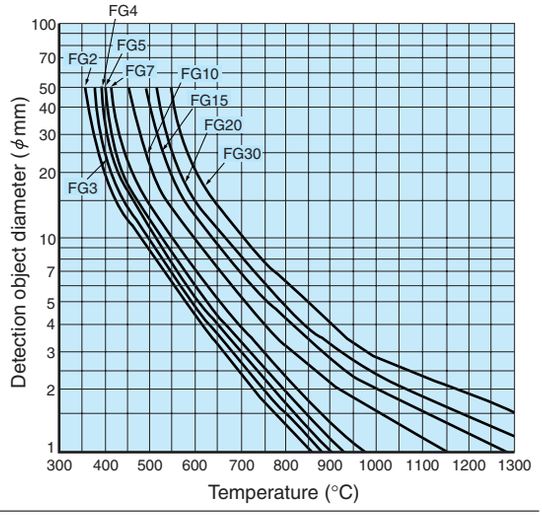
For detecting distance of 1 m or longer (with any optical head model)

Use the distance as the coefficient.

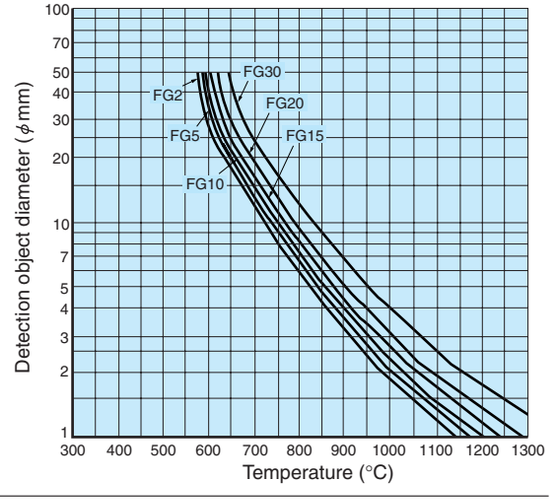
Example: If the detecting distance is 2.5 m, the coefficient is 2.5.

Multiply the Y-axis readings of the graph by 2.5 to complete the replaced Y-axis scale.

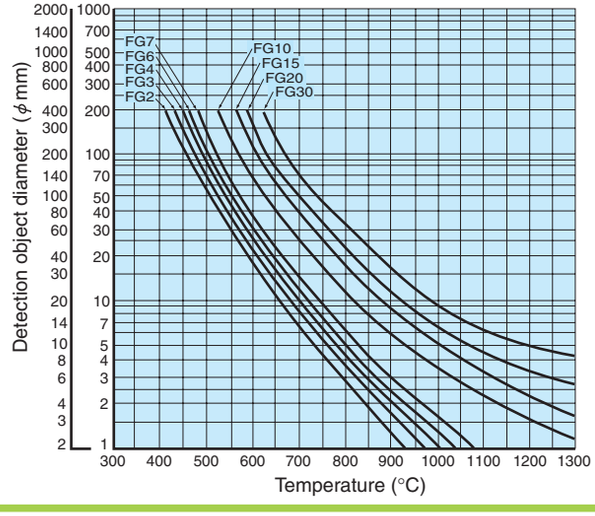
Amplifier	FD300A
Optical head	OHA



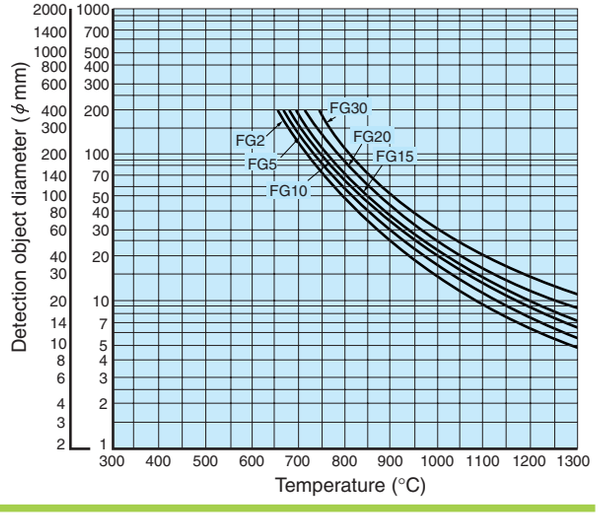
Amplifier	FD600A
Optical head	OHA



Amplifier	FD300A
Optical head	OHW1/OHW2



Amplifier	FD600A
Optical head	OHW1/OHW2



FD-A310C series

Fiber type / HMD

Focus on basic functions for low cost

Amplifier
Model:FD-A310C
Model:FD-A310CM

Fiber optic cable
(different models available)

Optical head
Model : OHC

FD-A310 C series photo switches are hot metal detectors (HMDs) that directly detect infrared radiation from heated glass or steel.
Glass fiber optic cables with good heat resistance and transmission factor are used for detecting heads, which transmit the detected infrared rays to amplifiers that amplifies the signals for output.
Two output types are available: mini power relay output and photo-MOS relay output for AC/DC control.

- Compact, lightweight amplifier
- Flexible heat-resistant fiber optic cables

Type/Price

Type	Model	Specification overview				
Amplifier	**FD-A310C**	Power supply : 100-220V AC		Output	Relay output	
	FD-A310CM				Photo-MOS relay output	
Fiber	**GT205AD**	Fiber length	0.5m	Lowest detectable temperature (*)	320℃	Heat resistance 200 °C, IP 67
	GT21AD		1m		330℃	
	GT22AD		2m		350℃	
	GT23AD		3m		370℃	
	GT25AD		5m		390℃	
	GT27AD		7m		410℃	
	GT210AD		10m		430℃	
Optical head	**OHC**	Heat resistance 200 °C, IP 67				

*)These temperatures are inherent performance applicable when heated material is larger than the detecting field of view. For actual usage, consider at least 50 °C above these temperatures as guidelines. Heated material smaller than the field increases the lowest detectable temperature.

Ordering Guide

The FD-A310C series does not have set model Nos. Order by specifying the individual model Nos. of components.

Component Hood	Model	Quantity
Optical head	**OHC**	1
Fiber	**GT205AD**	1
Amplifier	**FD-A310C**	1

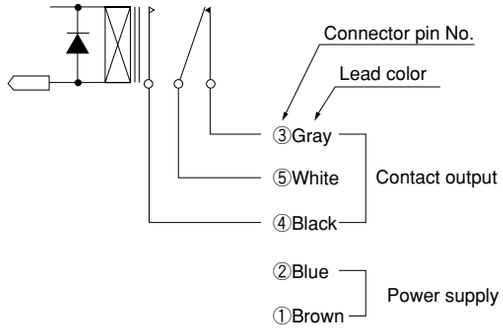
FD-A310C

Rating/Performance /Specification /Environmental Specification

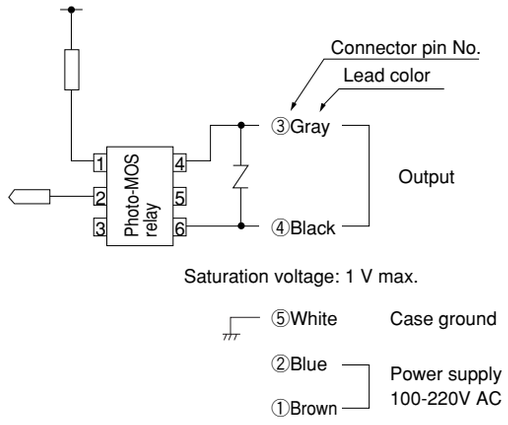
Model		FD-A310C	FD-A310CM
Output mode		Relay output	Photo-MOS relay output
Control output		Light-ON/Dark-ON selector switch provided (DIP switch)	
	Rating	Transfer contact MAX 5A 250V AC (Resistance load)	1a MAX 80mA 250V AC.DC (Resistance load) Saturation voltage = 1 V max.
Response time		10ms max.	5ms max
Light-sensitive element		Ge photodiode	
Sensitivity wavelength		0.8～1.8μm	
Sensitivity adjustment		10-position digital switch without stopper	
Indication		Power indica]tor (P.L), operation indicator (OP.L), received light intensity indicator: 3-point	
Power Supply		AC100～220V +10% −15% 50/60Hz	
Power consumption		5W Max.	
Connection		Connector type: cord length 2 m Cord: 0.75 x 5 mm² cores, (Outer dimension: dia. 4.5)	
Ambient temperature		Optical head, Fiber: -40 to +200°C Amplifier: -25 +50°C (Non-freezing)	
Storage temperature range		-40 to +70°C (Non-condensing)	
Ambient humidity		35 - 85%RH Max. (Non-condensing)	
Insulation resistance		500VDC 20MΩor higher	
Dielectric withstanding		1500 VAC for 1 minute	
Vibration		10-55 Hz / 1.5 mm amplitude / 2 hours each in 3 direction	
Shock		500 m/s² / 3 times each in 3 directions	
Protective structure		IP54	
Mass		About 950 g (including cord with connector)	

Input/Output Circuit and Connection

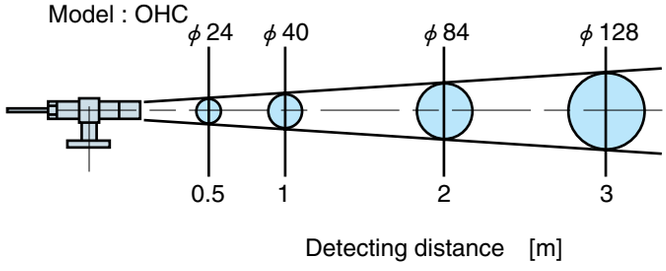
Model FD-A310C (Relay output type)



Model FD-A310C (Photo-MOS relay output type)

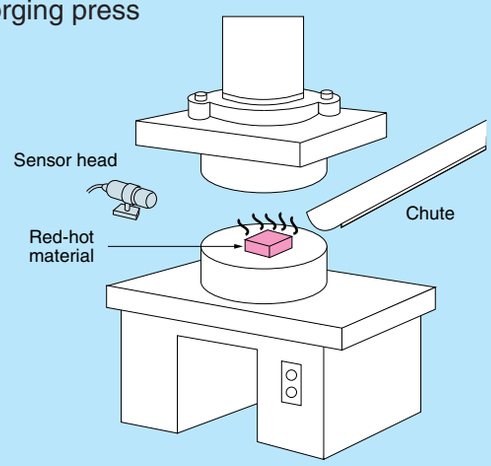


Detection field of view (mm)

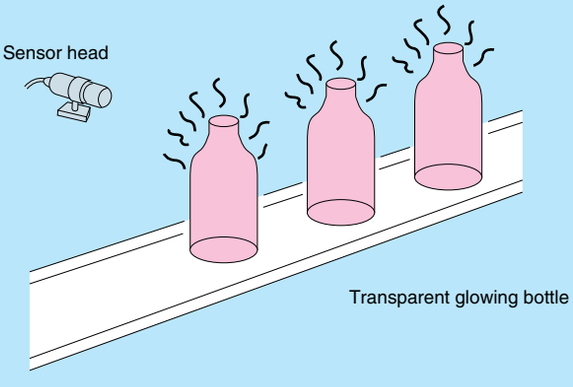


Sample Applications

Detection of material on forging press



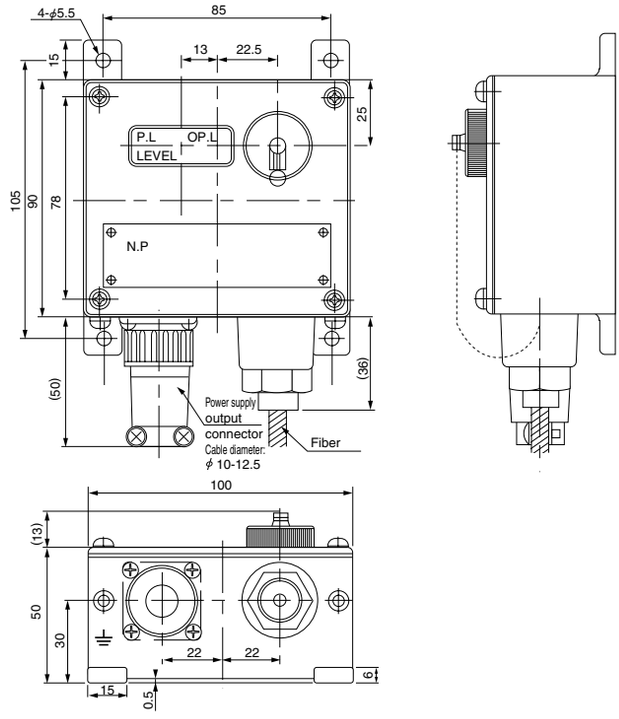
Detection of passage of heated bottles



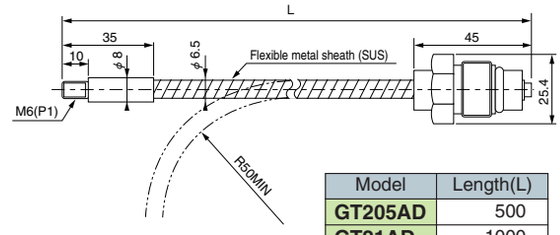
FD-A310C

Dimensions (in mm)

Amplifier



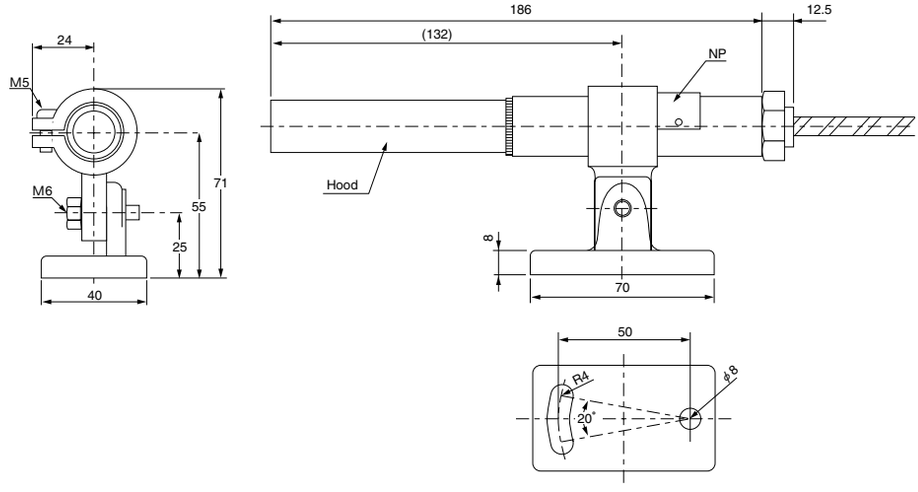
Fiber



Model	Length(L)
GT205AD	500
GT21AD	1000
GT22AD	2000
GT23AD	3000
GT25AD	5000
GT27AD	7000
GT210AD	10000

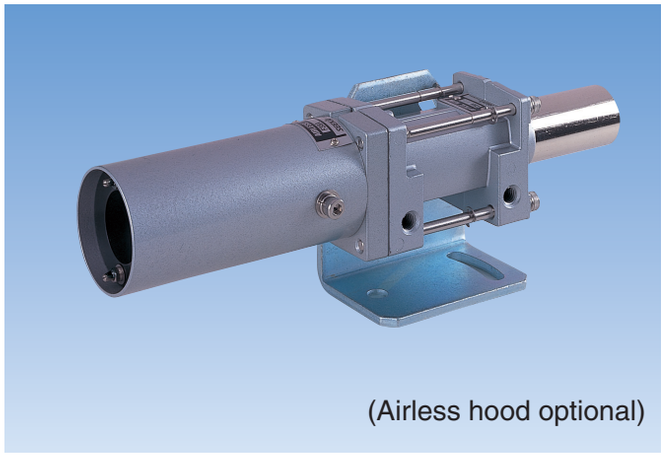
(mm)

Optical head



Optical head

Fiber type / HMD

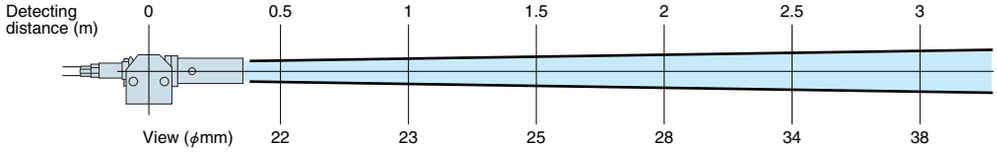


(Airless hood optional)

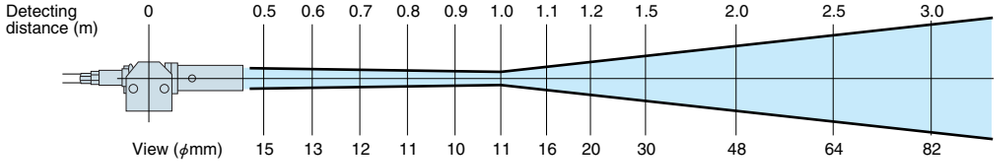
- Narrow-view optical head with dramatically improved detection position accuracy
- Parallel-view
  Model OHAN
- Spot-view
  Model OHAN10

Detecting Distance and Detection Field of View

- Parallel-view (OHAN): narrow view regardless of detecting distance



- Spot-view (OHAN10): even narrower view available at limited detecting distance

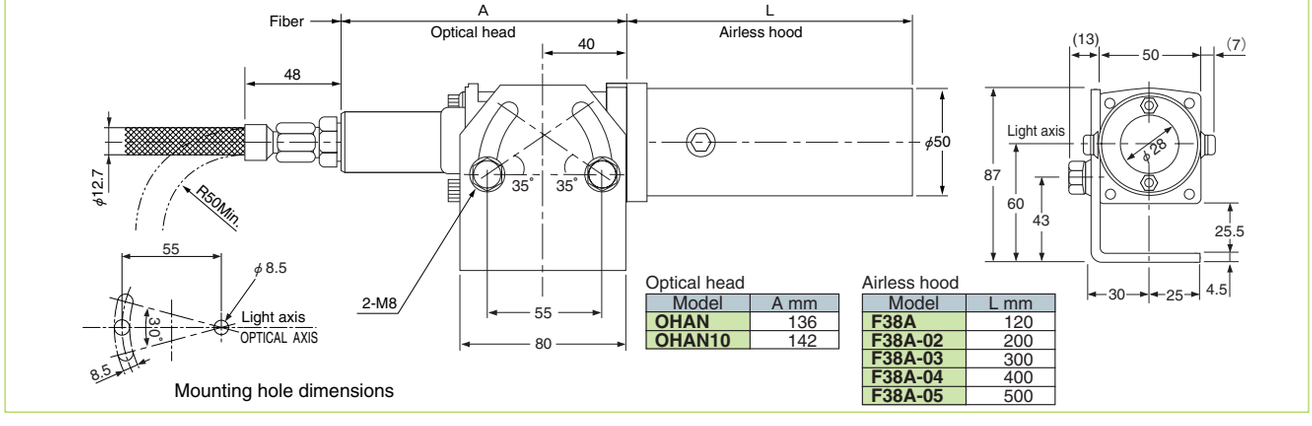


Guidelines for Lowest Detectable Temperature (℃)

Fiber \ Amplifier	FFD-A300P series	FD-300A series	FD-600A series
FG2	480	490	750
FG3	500	510	750
FG4	515	525	755
FG5	530	540	760
FG7	550	560	770
FG10	600	610	775
FG20	665	680	820
FG30	705	720	860

The table shows the lowest detectable temperature of detection objects with combinations of different fiber optic cables and amplifiers. Use as guidelines only as temperatures may vary to some extend depending on the conditions.

Dimensions (in mm; with Airless hood and fiber attached)



Mounting hole dimensions

Optical head

Model	A mm
OHAN	136
OHAN10	142

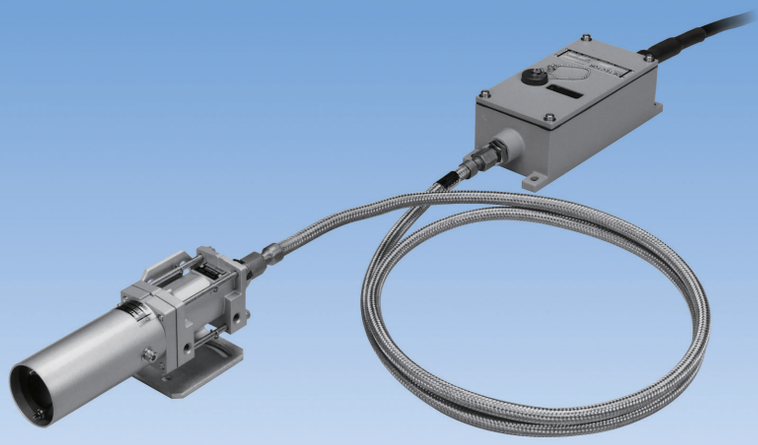
Airless hood

Model	L mm
F38A	120
F38A-02	200
F38A-03	300
F38A-04	400
F38A-05	500

FD-A300AN

Fiber type analog HMD

Direct reading of analog voltage



Control unit

Unlike ordinary HMDs that detect radiation from heated material and output the presence of the material as a signal such as a relay contact, FD-A300AN Series sensors convert the radiation intensity from heated material into analog voltage.
The large analog dynamic range allows analog output of a wide range between low temperature of 350 °C and high temperature of 750 °C.
(The signal is not linearized with reference to temperature and the sensors cannot be used as thermometer.)

Features

- Supports a wide range of temperature 350-750 °C (with fiber optic cable FG2)
  Attaching a pinhole plate to the optical head allows analog output ranging from 400 to 850 °C (OHA with ϕ10 pinhole) or from 460 to 1,100 °C (OHA with ϕ5 pinhole).
- Direct reading of analog voltage
  Output analog quantity is fed into the control unit, which displays the analog voltage.
  Setting a comparator at an arbitrary analog quantity provides output of relay contact or open collector output.
  Comparator setting corresponds to sensitivity adjustment of the conventional HMDs. With the FD-A300AN Series, viewing concrete figure of analog voltage facilitates setting.
- Dual comparators for a variety of applications
  The conventional HMDs had weaknesses such as low accuracy of detection position as in situations where high sensitivity to detect low-temperature material caused unwanted reflection with high-temperature material. The dual comparators for the FD-A300AN allow setting of one of the two for low temperature and the other for high temperature. On top of this, selection of output in agreement with the line conditions can increase the detection position accuracy.
- Use of insulating transformer (isolator) for long-distance transmission
  The output from the amplifier is voltage output of 0-10 V and use of a commercially-available insulating transformer allows long-distance transmission as a measurement signal of 4-20 mA.

FD-A300AN

Rating/Performance/ Specification/Environmental Specification

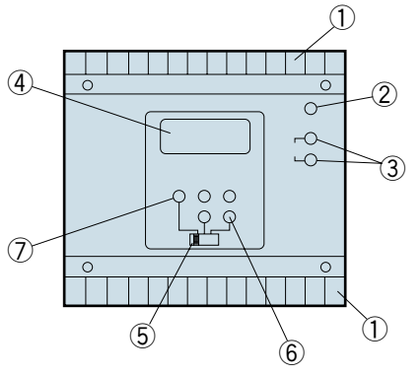
Amplifier

Model	FD-A300AN
Detection method	Fiber type
Detection temperature analog range	350～750°C (with optical head OHA and fiber optic cable FG2)
Power Supply	AC100～220V ±10% 50/60Hz
Power consumption	10W Max.
Output mode	Voltage output: 0-10 V; output impedance: 10 kΩ Effective range: 1.0-10.0 V
Response time	5ms./Full
Indicator	5-point level indicator (yellow LED)
Case material	Aluminum die-cast
Connection	Connector type: cord length 2 m
Mass	About 1.5kg
Ambient temperature	-25 +50C° (Non-freezing)
Ambient humidity	35 - 85%RH (Non-condensing)
Protective structure	IP66

Control unit

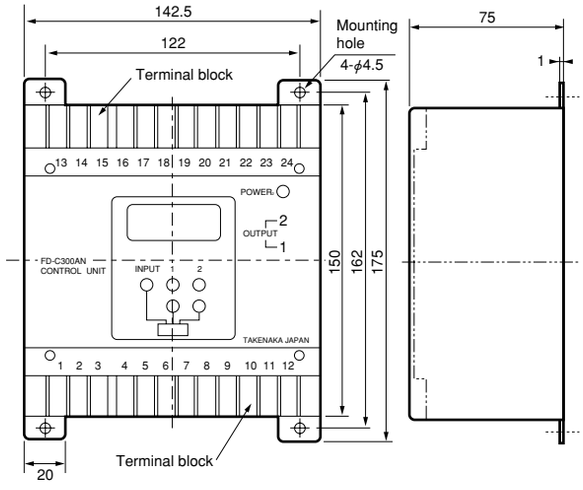
Model	FD-C300AN
Power Supply	AC100～220V ±10% 50／60Hz
Power consumption	10W max.
Input mode	Linear input: 0-10 V; input impedance: 10 kΩ
Comparator	2
Output type	2 relay contact 1c 250 VAC 3 A outputs (resistance load) 2 NPN open collector (photocoupler) 30 VDC 100 mA outputs
Response time	Relay contact output: 20 ms max. NPN open collector output: 1 ms
Input voltage display	Panel meter (LCD) display/ Character height: 12.7 mm
Indicator	POWER: power indicator (green LED) OUTPUT 1/2: output indicator (yellow LED) INPUT 1/2: panel meter switching (green LED)
Volume	2 comparator adjustment volumes: 4-turn
Switch	Panel meter switching Selectable between input voltage/comparator voltage 1 and 2
Connection	Terminal block
Mass	About 1kg
Ambient temperature	-25 +50°C (Non-freezing)
Ambient humidity	35 - 85%RH Max. (Non-condensing)

Control Unit Panel Description



(1) Terminal block, (2) Power indicator, (3) Output indicator
(4) Panel meter
(5) Panel meter switching
The panel meter usually shows the input voltage and individual comparator voltages can be shown by switching the display. For this reason, set the display at Comparator for adjusting comparator voltage and normally set at Input.
(6) Comparator voltage adjustment, (7) Panel meter switching indicator

Dimension(in mm)

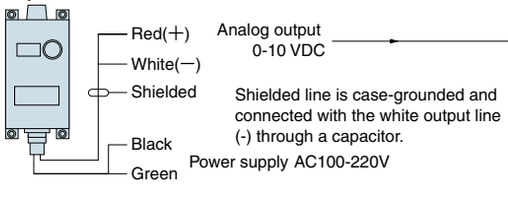


Head

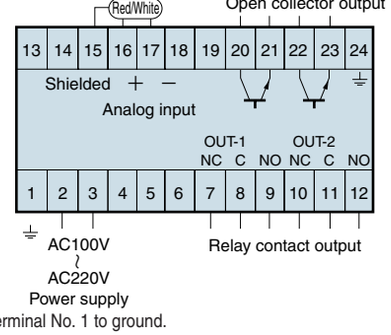
Hoods, optical head and fiber are the same with those for FD-A300P, etc. (See P. 492.)

Connection

Amplifier



Control unit



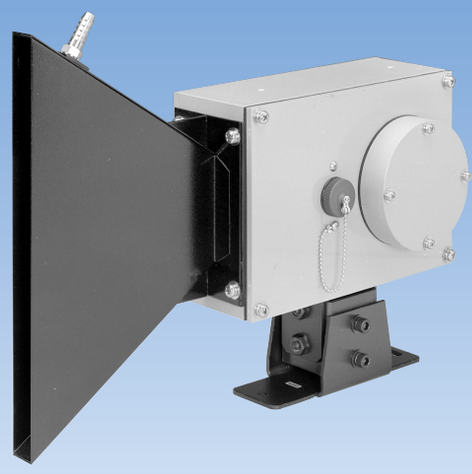
- Ideally, the amplifier and control unit should be installed in the same box. For separate installation, wiring should be several meters to several tens of meters in principle. For longer wiring of tens-to-hundreds of meters, use an instrument isolator. The length of a data transmission cable depends on the ambient noise and this information should only be used as guidelines.

Connect Terminal No. 1 to ground.
Do not connect anything to the unused terminals, which may be used for the circuitry.

HMPD801-EX

Water-cooled heated material position detection sensor

CCD system delivers small size, light weight and long life. Provided with monitor and remote-controlled sensitivity adjustment.

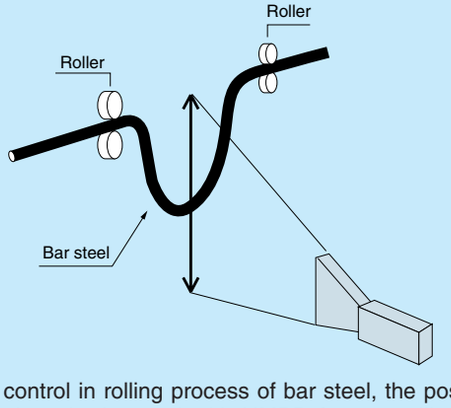


The HMPD801-EX Series senses infrared radiation from red-hot wire rod or bar steel and outputs the position of heated material in analog voltage.
Ideal for loop control.

Features

- Use of CCD system eliminates parts with limited service life such as motors of PBS cells, offering constantly stable detection and dramatic reduction of maintenance cost.
- External control for sensitivity switching and monitor output for remote observation of received light intensity and slice levels are provided.
- Easy-to-process static analog output eliminates the need for consideration of read timing, etc.
- Finder convenient for adjustment is integrated, facilitating positioning.
- Compact, lightweight and low cost.。

Sample Application



Loop control in rolling process of bar steel, the position of the loop is detected with HMPD for controlling the speed.

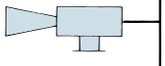
Contact Takex for detailed material data.

HMPD801-EX

Rating/Performance/ Specification/Environmental Specification

Rating / Performance	Model		**HMPD801-EX**
	Detection method		CCD scanning
	Detectable temperature		800 °C min.
	Detection field of view		800㎜/1m
	Resolution		Field of view x 1/256
	Minimum detectable object diameter		Field of view x 2/256 min.
	Power Supply		24VDC ±10% Ripple 10% max.
	Current consumption		200mA max.
	Output mode	Analog voltage rating	0-10 VDC ±5%, output impedance 4.7 kΩ
		Control output rating	2 NPN open collector outputs / Sink current 100 mA (30 VDC) max.
Specification	Operation mode		(voltage output in proportion to position of radiation)
	Response speed		10ms
	Indicator		Power indicator (green LED), operation indicator (red LED) for presence of material 1 and 2
	Adjustment feature		Self-check switch, external sensing control
	Monitoring feature		Video monitor output, slicing timing output
	Material		Case: aluminum / Lens: glass
	Connection		Connector (twisted pair cable 5 m)
	Mass		About 5kg
Environmental specification	Ambient light		500 lx max.
	Ambient temperature		-10 - +55 °C (non-freezing, non-condensing) / +80 °C max. with water-cooling
	Ambient humidity		35-85%RH (anti-moisture coated)
	Vibration		10-55 Hz / 1.5 mm amplitude / 2 hours each in 3 direction
	Protective structure		IP66

Connection

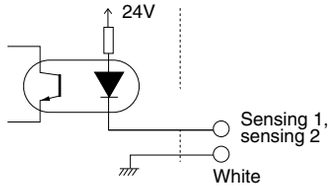


Pin No.	Lead color	Descriptionption
1	Red/purple	Power supply 24 VDC
2	White/white	0V
3	Black	Analog output 0-10 VDC
	White	Analog output 0 V
4	Green	Material present 1 30 VDC 100 mA
5	White	Material present 1 0 V
6	Blue	Material present 2 30 VDC 100 mA
7	White	Material present 2 0 V
8	Yellow	External check
9	White	External check 0 V
10	Brown	Video monitor output Video 0 V
14	White	Video 0 V
11	Pink	Slice, timing monitor output
	White	Slice
12	Pale blue	Sensing 1
15	White	Sensing 1 0 V
13	Orange	Sensing 2
16	White	Sensing 2 0 V

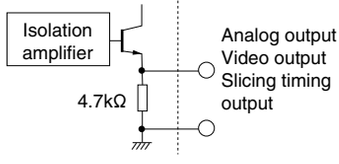
Input/Output Circuit

Input circuit

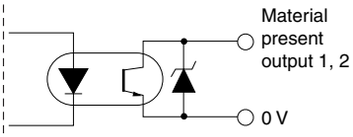
External sensing control, external check



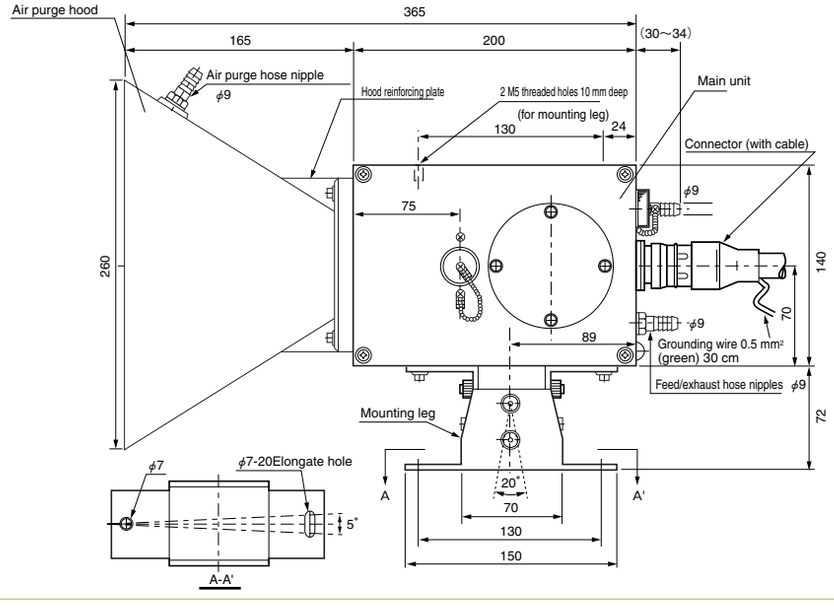
Output circuit



Output circuit



Dimension(in mm)

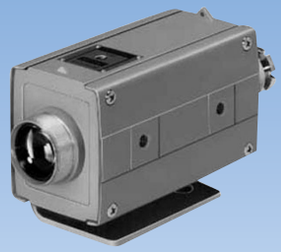


- Air purge specification
  Flow rate:200 ℓ/min
  Withstand pressure:0.98MPa
- Cooling water specification
  Flow rate: 2 ℓ/min
  Temperature: +10-30 degrees C
  Withstand pressure: 0.59 MPa

KD150C

Water-cooled HMD

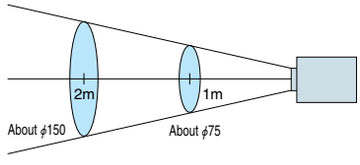
Lowest detectable temperature: 150°C



Model KD150C

KD150C is extremely compact and low-cost for amplifier-integrated water-cooled sensors. KD150C directly detects infrared radiation and outputs ON-OFF signals, which is useful for applications such as detection of passage or position of red-hot steel materials including ingots, slabs, steel plates and mold steel.

- Detection field of view
  Model: KD150C



(• Without hood
• Detection object larger than detection field)

Features

- Water-cooled
  KD150C is the smallest of water-cooled sensors with built-in amplifiers and enclosed in robust case that withstands severe operating conditions.
- Reasonable cost
  High performance allows detection of low-temperature (150°C min.) steel material. Streamlined design offers even more reasonable price.
- Performance comparable to full-size HMDs
  Long detecting distance, sensitivity adjustment feature and high sensitivity offer excellent stability.
- Attachable airless dust hood or air purge hood
  For the prevention of dirt deposits on lens, dust hoods that do not require air (F38S, F38N) and air purge hoods (302NC-305NC) are available.

KD150C

Rating/Performance/ Specification/ Environmental Specification

Model	KD150C
Detection method	Radiation detection
Power Supply	12-24VDC ±10%
Current consumption	20 mA max
Output mode	• Open collector output Rating: 100 mA (30 VDC) max. Hysteresis: about 2 °C • Analog output Op-amp voltage output 0-3 V (3 V at 300 °C)
Detection object temperature	150 °C min. (iron oxide)
Effective lens diameter	φ28㎜
Response time	0.5s
Indicator	Operation indicator (red LED)
Sensitivity adjustment	Adjustable with volume
Ambient temperature	10 +55°C (Non-freezing)/ 180 °C max. with water-cooling
Ambient humidity	35 - 85%RH max. (Non-condensing)
Storage temperature	-20 +65°C. (Non-condensing)
Protective structure	IP66
Vibration	10-55 Hz / 1.5 mm amplitude / 2 hours each in 3 direction
Dielectric withstanding	AC 500V for 1 minute
Shock	500 m/s² / 3 times each in 3 directions
Insulation resistance	250 VDC, 20 MΩor higher
Case material	Aluminum die-cast (cord opening ground hub)
Connection	Terminal block
Mass	About 2kg

• Cooling water specification

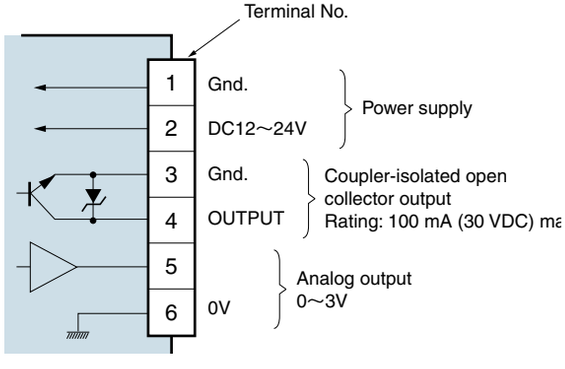
Flow rate	2 ℓ/minute min.
Temperature	+10～+35℃
Withstand voltage	0.29MPa

• Air purge specification (with optional part)

Flow rate	200 ℓ/minute min.
Withstand voltage	0.98MPa

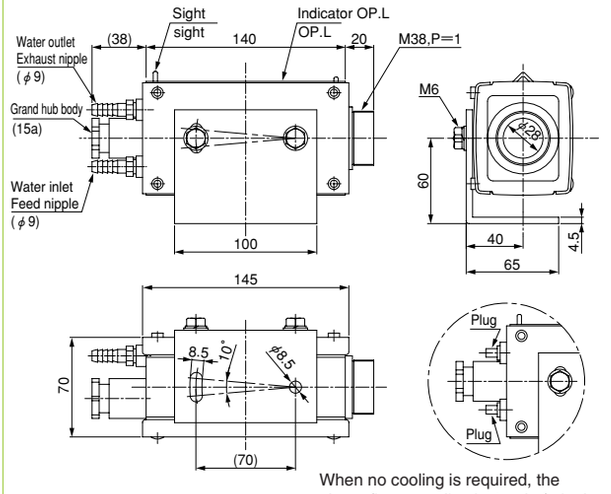
Air not required for use of airless dust hood.

Connection



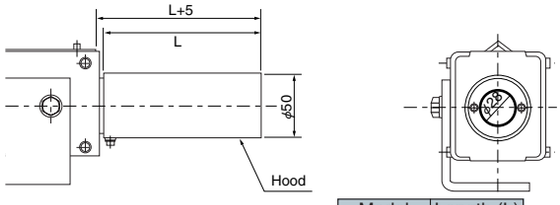
Note) The open collector output is isolated from power supply. The analog output "0" and "0" of power supply have different potentials.

Dimensions(in mm)



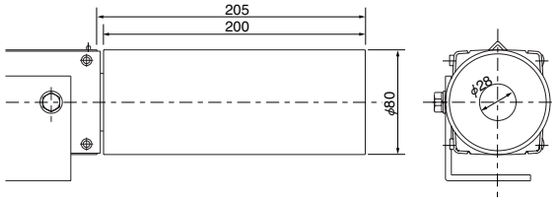
When no cooling is required, the above figure applies instead of nipples.

• With Airless hood F38S Series attached

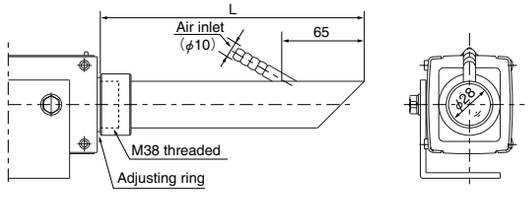


Model	Length (L)
F38S	120㎜
F38S-03	300㎜
F38S-04	400㎜
F38S-05	500㎜

• With Airless hood F38N Series attached



• With air purge hood attached

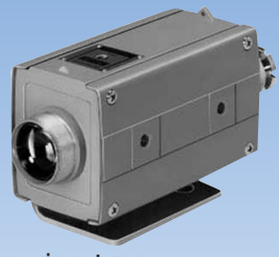


Model	Length (L)
302NC	215㎜
303NC	315㎜
304NC	415㎜
305NC	515㎜

KD50 series

Water-cooled HMD

Inexpensive
Reliably detects low-temperature (450°C min.) steel material



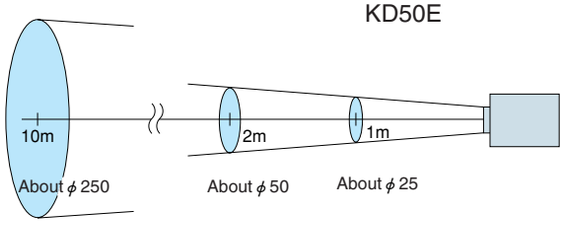
Narrow-view type
Model KD50 (relay output)
KD50E (voltage output)

Wide-view type
Model KD50W (relay output)
KD50EW (voltage output)

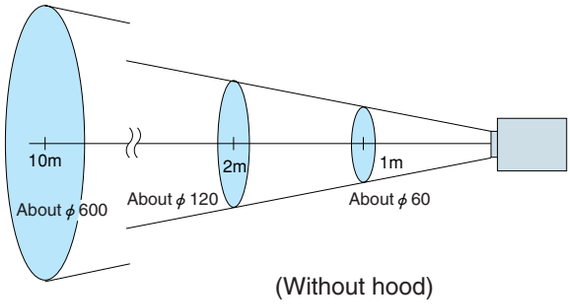
The KD50 Series HMDs are extremely compact and low-cost for an amplifier-integrated water-cooled sensors. The KD50 Series sensors directly detect infrared radiation and output ON-OFF signals, which is useful for applications such as detection of passage or position of red-hot steel materials including ingots, slabs, steel plates and mold steel.

- Detection field of view

Narrow-view type Model・KD50
KD50E



Wide-view type Model・KD50W
KD50EW



(Without hood)

Features

- Water-cooled
  The KD50 Series sensors are the smallest of water-cooled sensors with built-in amplifiers and are enclosed in a robust case that withstands severe operating conditions.
- Narrow-view and wide-view types available
  Choice between narrow-view and wide-view types allows selection according to installation conditions, etc.
- Reasonable Cost
  High performance allows detection of low-temperature (450 °C min.) steel material. Streamlined design offers even more reasonable price.
- Performance comparable to full-size HMDs
  Long detecting distance, sensitivity adjustment feature and high sensitivity offer excellent stability
- Airless dust hood or air purge hood attachable
  Prevents dirt deposits on lens, dust hoods that do not require air (F38S, F38N) and air purge hoods (302NC-305NC) are available.

Contact Takex for detailed material data.

Rating/Performance/ Specification/ Environmental Specification

Model	KD50	KD50W	KD50E	KD50EW
Detection method	Radiation detection			
Power Supply	AC100～110V/200～220V ±10%% 50/60Hz			
Power consumption	4W max.			
Operation mode	Light-ON			
Output mode	Relay output		Voltage output	
Rating	1 transfer contact 200 VAC 0.5 A resistance load		10VDC 5mA	
Detection object temperature	450 °C min. (ordinary steel material)			
Response time	25ms max.		5ms max.	
Indicator	Light reception indicator (red LED)			
Sensitivity adjustment	Adjustable with volume			
Ambient temperature	-10 - +55 °C (150 °C max. with water-cooling)			
Ambient humidity	35-85%RH (non-freezing, non-condensing)			
Insulation resistance	500 VDC, 20 M_ or higher (between primary side of transformer/output terminal and case)			
Dielectric withstanding	1.5 kVAC for 1 minute (between primary side of transformer/output terminal and case)			
Vibration	10-55 Hz / 1.5 mm amplitude / 2 hours each in 3 direction			
Shock	500 m/s² / twice each in 3 directions			
Protective structure	IP66			
Case material	Aluminum die-cast (cord opening ground hub)			
Connection	Terminal block			
Mass	About 2kg			

● Cooling water specification

Flow rate	2R/minute min.
Temperature	+10～+35℃
Withstand voltage	0.29MPa

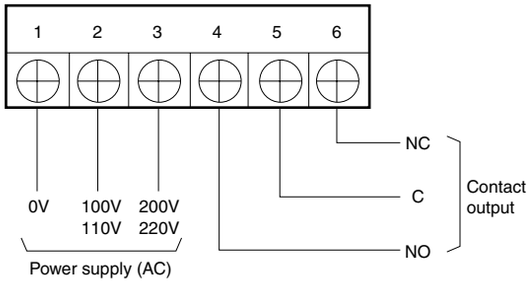
● Air purge specification (with optional part)

Flow rate	200R/minute min.
Withstand voltage	0.98MPa

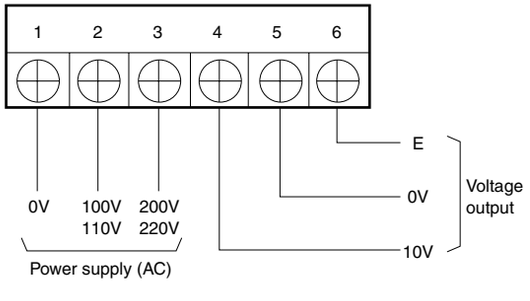
Air not required for use of airless dust hood.

Connection

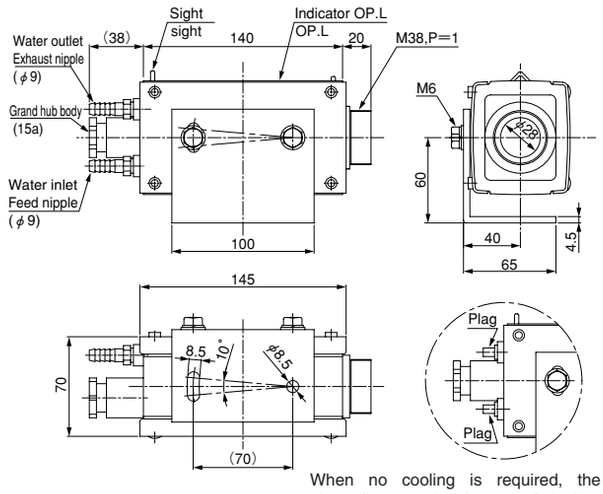
Relay output type



Voltage output type

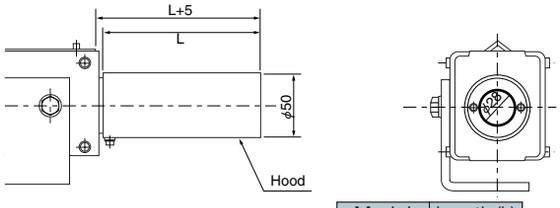


Dimensions (in mm)



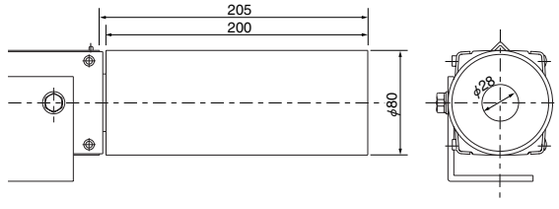
When no cooling is required, the above figure applies instead of nipples.

● With Airless hood F38S Series attached

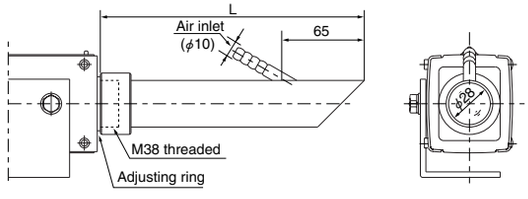


Model	Length (L)
F38S	120mm
F38S-03	300mm
F38S-04	400mm
F38S-05	500mm

● With Airless hood F38N Series attached



● With air purge hood attached



Model	Length (L)
302NC	215mm
303NC	315mm
304NC	415mm
305NC	515mm

HD

Low-temperature model: 350 °C min.
Medium/high temperature model: 650 °C min.

Model HD301 (low temperature)
Model HD601 (Medium/high temperature)

Amplifier

Model HDA300

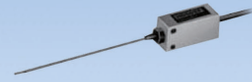
Medium/high temperature model: 430°C min. (with HD400 + GT205)
560 °C min. (HD502F)

Model HD400

Lens unit

Model FA51

Model FA52



Model HD502F

The HD Series HMDs are radiation detection photo sensors with separate amplifiers that have achieved compact sizes and low cost.

HD301 and 601 are intended for sites where temperature in the vicinity of the receiver is up to 50 or 70 °C and available in models for low temperature and medium/high temperature. Applications include detection of presence or passage of heated steel material, glass, etc.

HD400 and 502F are optical fiber type sensors with ultra-small heads.
Applications include detection of heated steel material, glass, etc.

- Ordering guide (for HD400 Series)
  A set is composed of an amplifier, receiver and fiber optic cable unit and there is no set No. Order by specifying the individual model Nos. of components as shown below:

Type	Model	Quantity
Amplifier	HDA300	1
Receiver	HD400	1
1-m fiber	GT21	1

Features

- Low-cost
  The HD Series offers the lowest cost of all HMDs. Amplifiers are separately installed and no water-cooling is involved.
- Airless hood provided
  The HD Series sensors come with Airless hood for prevention of soiling of lens.
- Fiber type
  HD 400 may be used in combination with heat-resistant generic fiber optic cables, which improves the resistance to heat and electric safety of the sensing head. Attaching a lens unit at the end extends the detecting distance.
  HD502F is the lowest-cost model of HMD. The fiber optic cable covered with ø1.1 stainless tube allows focused detection of heated condition of electronic components or mechanical parts.

Compact multifunctional amplifier (HDA300)

- 3-point level indicator
  The received light intensity level is shown by flashing 3 indictors for easy checking of stability.
- Sensitivity adjustment volume
- Relay output and voltage output available

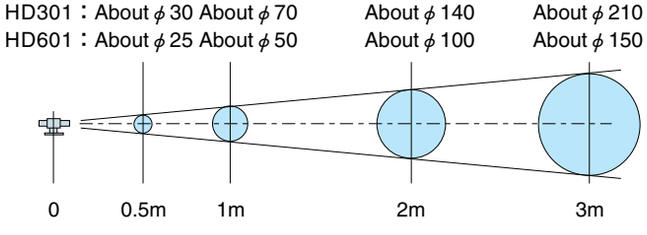
Rating/Performance/ Specification/ Environmental Specification

Type		Cord connection type		Fiber detachable type				Permanently attached fiber type
Model	Fiber (length)	———		GT205 (50cm)	GT21 (1m)	GT22 (2m)	GT23 (3m)	70mm fixed
	Sensor	HD301 (low temperature model)	HD601 (medium/high temperature model)	HD400				HD502F
	Amplifier	HDA300						
Detection object temperature		350°C min.	650 °C min.	430°C min.	440°C min.	460°C min.	490°C min.	560°C min.
Output mode		Relay contact output/voltage output						
	Rating	Relay contact output: 1c 250 VAC 5 A (resistance load) Voltage output 12 VDC 5 mA max.						
Operation mode		Light-ON (activated for presence of material) Timer operation selectable/external gating						
	Timer	On-delay, off-delay, one-shot, timer disabled (ON/OFF)						
	Time	Selectable between 0.1-1 s and 1-10 s						
Response time		Relay contact output: 25 ms; voltage output: 3 ms						
Power supply		AC100/110V･AC200/220V±10%, 50/60Hz						
Power consumption		5VA max.						
Connection	Amplifier	(screw diameter 3.5 mm)						
	Sensor	Two 0.5 mm² shielded cords 20 m						One 0.3 mm² shielded cord 2 m
Ambient temperature (non-freezing)	Amplifier	–10～+50°C						
	Sensor	–25～+50°C	–25～+70°C	–25～+50°C				
	Fiber	———		–20～+200°C				(Fiber tip: maximum + 70 °C)
Ambient humidity (non-condensing)	Amplifier	35～85%RH						
	Sensor	35～95%RH		35～85%RH				
	Fiber	———		95%RH max. (20%RH max. for 70 °C or higher)				
Insulation resistance	Amplifier	DC 500 V 20MΩ min. *1						Omitted (case-grounded)
	Sensor	DC 500 V 20MΩ min.						
Dielectric withstanding	Amplifier	1500V AC for 1 minute *1						Omitted (case-grounded)
	Sensor	1500V AC for 1 minute						
Vibration		10-55 Hz / 1.5 mm amplitude / 2 hours each in 3 direction						
Shock		500 m/s² / 3 times each in 3 directions (twice for sensor)						
Protective structure	Amplifier	IP40						
	Sensor	IP66		IP40				IP66
Mass	Amplifier	About 450 g (including socket)						
	Sensor	1500 g max. (including cord)		1100 g max. (including cord)				50 g max. (including cord)
	Fiber	———		110 g max.	190 g max.	350 g max.	530 g max.	
Fiber allowable bending radius		———		R50				10 mm (except for 15 mm from the tip)
Fiber material (covering)		———		Glass (stainless steel spiral tube)				Glass (annealed stainless steel tube)

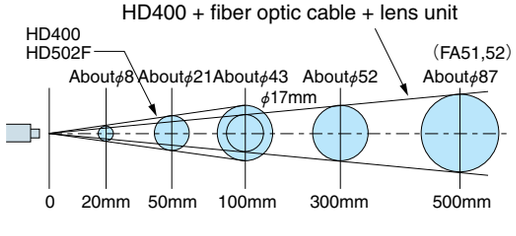
*1 Between case and grounding terminal (No. 1) Between case and relay contacts (collective) Between grounding terminal (No. 1) and relay contacts (collective)
Between case and entire power supply Between grounding terminal (No. 1) and entire power supply Between entire power supply and relay contacts (collective)

Detection Field of View Characteristics (Typical example)

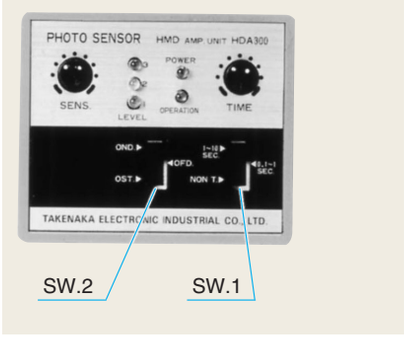
- Cord connection type
  Model HD301 (low temperature)
  Model HD601 (high temperature)



- Fiber type
  Model HD400
  Model HD502F

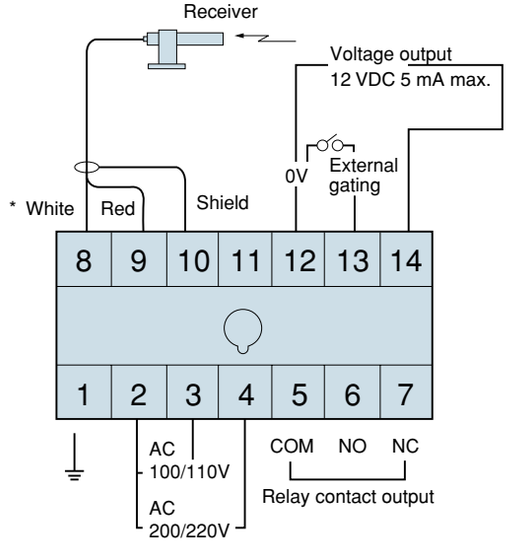


Amplifier panel layout (HDA300)



SENS	Sensitivity adjustment volume Turning clockwise increases the sensitivity and decreases the minimum detectable temperature.
LEVEL	Level indicator Received light intensity is shown with 3 LEDs, which are illuminated differently for the individual levels: LEVEL 1: operation level LEVEL 2: double the operation level LEVEL 3: 3.5 times as much as the operation level
POWER	Illuminated at power-up.
OPERATION	Operation indicator: illuminated when control output is activated.
TIME	Delay time adjustment
SW.1	Delay time range selection and timer enabled/disabled
SW.2	Time limit operation selector switch

Connection



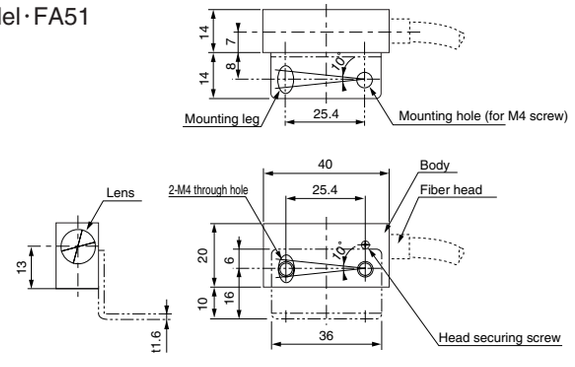
*Only red and shielded lines for HD502F.

1. Be sure to limit the length of the receiver cord within the length of the provided cord (20 m) and route separately from power supply lines.
   Extension of the cord or insecure connection of the shielded line may cause induction, which may lead to faulty operation
2. Be sure to connect the grounding terminal. Failure to ground may cause faulty operation due to induction.
3. Terminals Nos. 12 and 13 are for external gating.
   Short-circuiting these terminals disables the internal circuit (output). Provide contact or open collector for operation.
   When not using external gating leave the terminals open.

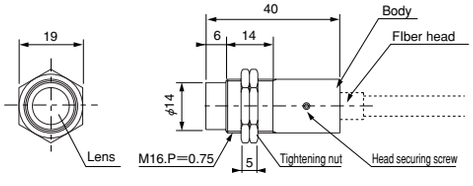
Dimension (in mm)

Lens unit

Model·FA51

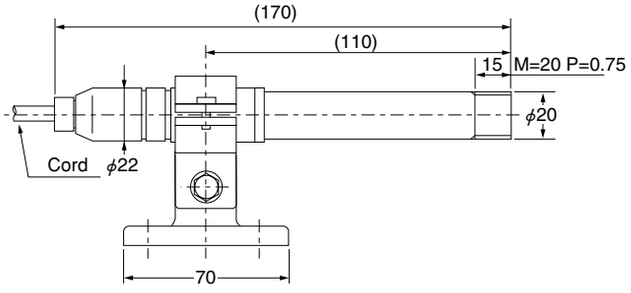


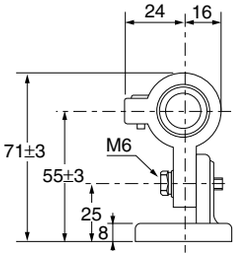
Model·FA52

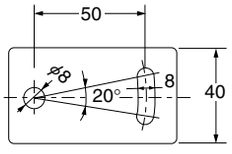


Dimension (in mm)

(Sensor) model HD301/601

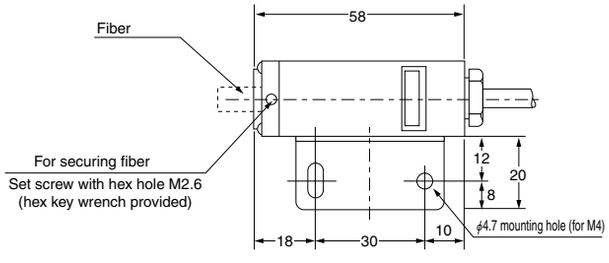


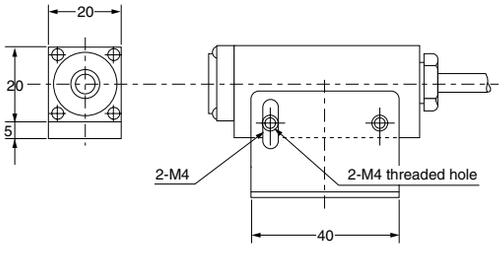




Mounting bracket bottom view

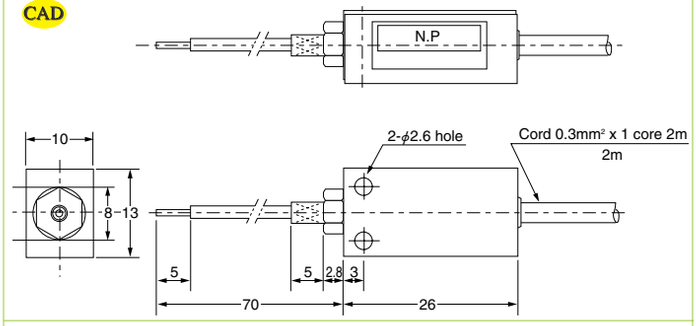
(Sensor) model HD400



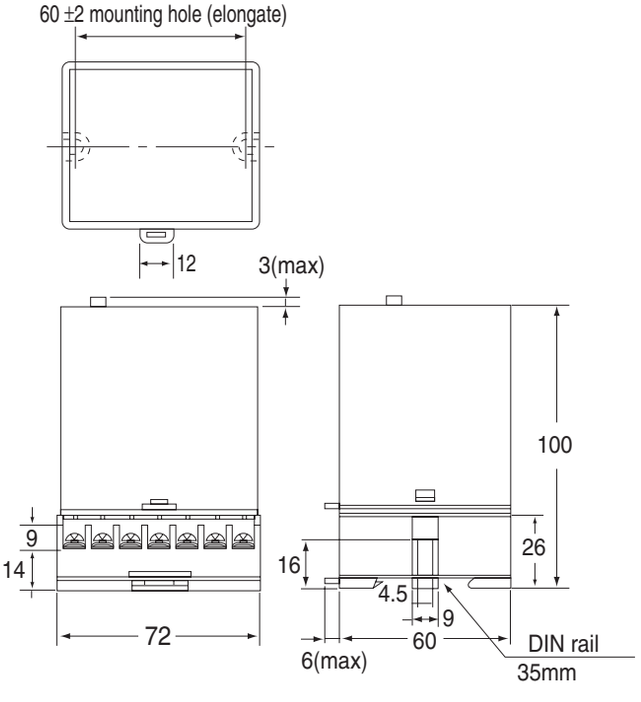


(Sensor) model HD502F

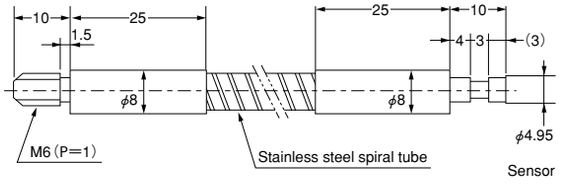
CAD



(Amplifier) model HDA300



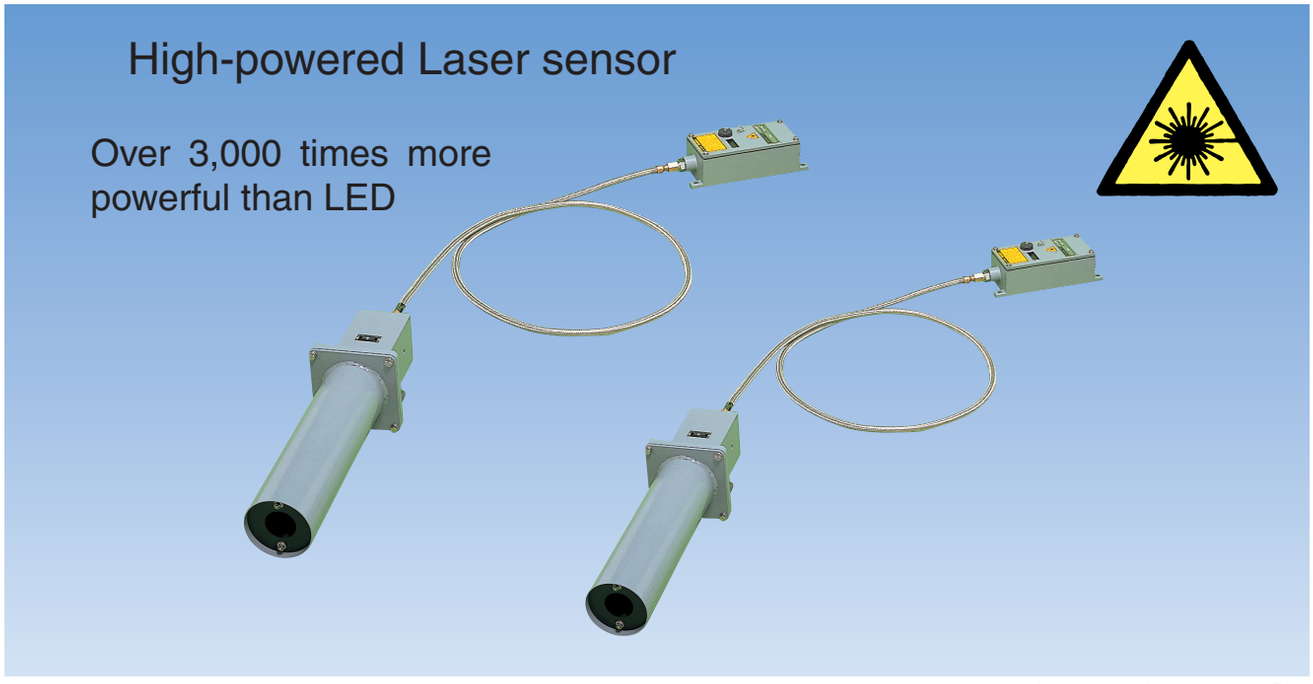
(Fiber) GT series



Model	Length
GT205	500mm
GT21	1m
GT22	2m
GT23	3m

FT44A series

Fiber type CMD



For basic information about semiconductor laser, see P540)

Features

- High-powered output 90 W (FTL44A)
  Laser diode of optical output 90 W is used as the light source, over 3,000 times as high-powered as LED type (of Takex). The output of model FTL441A is 10 W.
- No cooling required
  Supports ambient temperature of up to 200°C without cooling.
- Detector with superb durability
  Fiber covered with flexible tube with stainless steel braid for robustness and resistance to heat and corrosion.
- Self-check feature integrated (SAFETY feature)
  The transmitter is provided with light emission monitor circuit, which outputs alarm signal (SAFETY ALARM) when light emission stops due to failure, etc. The receiver is provided with a stability check feature, which constantly checks the received light intensity at light reception and outputs error signal (SAFETY ALARM) when there is not much margin in the received light intensity level due to soiling of lens, light axis misalignment, etc.
- 5-point level indicator
  Received light intensity is shown with 5 LEDs, offering easy viewing of stability and facilitating light axis alignment.

Notes on Safety

- Laser emission warning lamp
  The transmitter panel of the standard model is provided with power and light emission indicators to indicate that laser beam is emitted while power indicator or both indicators are illuminated.
- Do not attempt to look into the laser beam emitter or touch the beam.
- Take measures to prevent any unexpected specular reflection of laser beam caused by mirror-like detection object or mirror-like object crossing the route of the laser beam.
- Do not direct light to human body or use the sensor to detect people.
- Take safety measures according to the operation manual.

Ordering Guide

The FT44A Series does not have set model Nos.
Order by specifying the individual model Nos. of components.
Models marked with * compose a set shown on the previous page.

- Example
  - Optical power 90 W
  - Mini power relay output
  - Fiber length : 2 m
  - Airless hood

Component		Model	Quantity
Amplifier	Transmitter	**FTL44A**	1
	Receiver	**FTR44A**	1
Optical head		**OH2**	2
Fiber		**FG2**	2
Hood		**F70N**	2

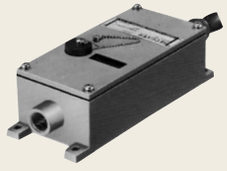
[Optical head]

Model	Compatible hood	Appearance
OH2 ※	F70N 700L series	 (High-powered)
OHA	F38A series F38PC series	 (Standard)

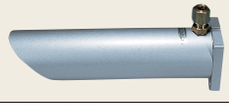
[Fiber]

Length	Model	Appearance (Typical example)
2m	**FG2** ※	
3m	**FG3**	
4m	**FG4**	
5m	**FG5**	
7m	**FG7**	
10m	**FG10**	
15m	**FG15**	
20m	**FG20**	
30m	**FG30**	

[Amplifier]

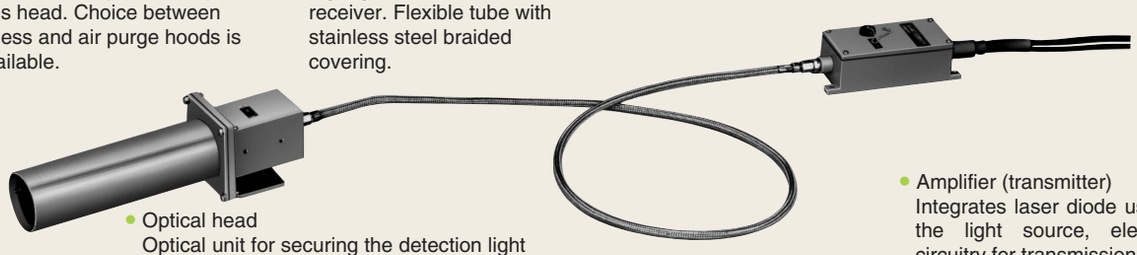
Type		Model	Appearance (Typical example)
Transmitter amplifier	90W type	**FTL44A** ※	
	10W type	**FTL441A**	
Receiver amplifier	Mini power relay output	**FTR44A** ※	
	Relay output	**FTR44AH**	
	Solid-state output	**FTR44AC**	

[Hood]

Type		Length	Model/shape (Typical example)	Compatible optical head
Airless hood	Standard type			**OHA**
		120mm	**F38A**	
		200mm	**F38A-02**	
		300mm	**F38A-03**	
		400mm	**F38A-04**	
		500mm	**F38A-05**	
	High-powered type			**OH2**
			F70N ※	
Air purge hood	Standard type			**OHA**
		200mm	**F38PC-02**	
		300mm	**F38PC-03**	
		400mm	**F38PC-04**	
		500mm	**F38PC-05**	
	High-powered type			**OH2**
		200mm	**702L**	
		300mm	**703L**	
		400mm	**704L**	
		500mm	**705L**	

Configuration

- Hood
  Prevent dirt deposits on optical lens head. Choice between airless and air purge hoods is available.
- Fiber optic cable
  Light guide for transmitter/receiver. Flexible tube with stainless steel braided covering.

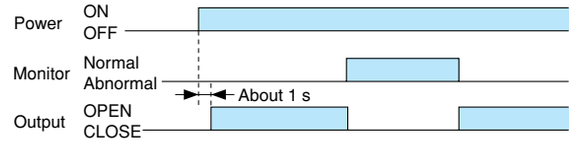
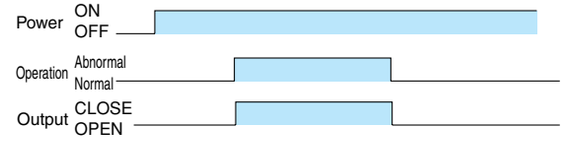


- Optical head
  Optical unit for securing the detection light axis for transmitter/receiver. Standard and high-powered types (margin in operation tenfold) are available.
- Amplifier (transmitter)
  Integrates laser diode used as the light source, electronic circuitry for transmission, etc.
- Amplifier (receiver)
  Converts the light transmitted through fiber optic cable with (light-sensitive element) into electric signals for control output (mini power relay output, reed relay output or Solid-state output) via electronic circuitry.

Components for transmitter and receiver are the same except for amplifiers.

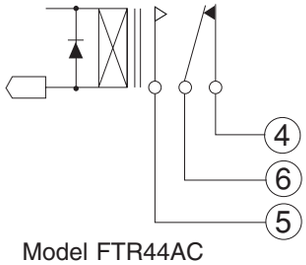
FT44A

Rating/Performance/Specification/Environmental Specification

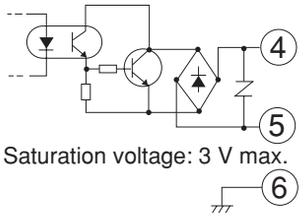
Output specification				
Transmitter model		FTL44A·FTL441A		
Monitor output (operation)				
	Rating	Contact output 5A 250V AC max. (Resistance load)		
Receiver model		FTR44A	FTR44AH	FTR44AC
Output mode		Mini power relay output	Relay output	Solid-state output
Control output		ON-OFF operation (Light-ON)		
	Rating	Transfer contact 5 A 250 VAC max. (resistance load)	Transfer contact 0.5 A 48 VDC max. (resistance load)	0.5 A 250 VAC/DC (resistance load)
	Response time	25 ms max.	12 ms max.	10 ms max.
Safety Alarm output				
	Rating	a contact 5A 250VAC max. (resistance load)		
General specification				
Light source		FTL44A: semiconductor laser 904 nm, 90 W max. JIS C 6802 Class 1M)		
		FTL441A: semiconductor laser 904 nm, 10 W max. JIS C 6802 Class 1)		
Detecting distance		50 m max.		
Valid lens diameter		Optical head OHA: 28 mm Optical head OH2: 56 mm		
Smallest detectable object		Optical head OHA: 30 mm Optical head OH2: 60 mm		
Power Supply		100-220 VAC rated voltage –20%/+10%, 50/60 Hz		
Power consumption		Transmitter: 10 W max.; receiver: 10 W max.		
Connection		with Connector cable 2m (CVV 0.75mm²)		
Ambient temperature		Optical head, Fiber: –25 to +200°C Amplifier: –25 +55°C (Non-freezing)		
Storage temperature		–40 to +70°C (Non-condensing)		
Ambient humidity		35 to 85%RH (Non-condensing)		
Fiber-optic unit allowable bending radius		50mm		
Insulation resistance		Between power supply and case: 500 VDC, 20 MΩ or higher		
		Between output and case: 500 VDC, 20 MΩ or higher		
		Between power supply and output: 500 VDC, 20 MΩ or higher		
Dielectric withstanding		Between power supply and case: 1500VAC for 1 minute		
		Between output and case: 1500VAC for 1 minute (between reed relay outputs: 1,000 VAC for 1 minute)		
		Between power supply and output: 1500VAC for 1 minute (between reed relay outputs: 1,000 VAC for 1 minute)		
Vibration		10-55 Hz / 1.5 mm amplitude / 2 hours each in 3 direction		
Shock		500 m/s² / 3 times each in 3 directions		
Protective structure		IP66		
Mass	Optical head	OHC: About 680g / OH²: About 2.5kg		
	Airless hood	F38S : about 240g F38S-04 : about 550g F38S-03 : about 430g F38S-05 : about 650g F70N : about 1.8kg		
	Air purge hood	F38PC-02 : about 240g F38PC-04 : about 370g 703L : about 3.3kg F38PC-03 : about 300g F38PC-05 : about 440g		
	Fiber	FG2 : about 0.7kg FG3 : about 0.9kg FG4 : about1.1kg FG5 : about 1.3kg FG7 : about 1.6kg FG10: about2.1kg FG15 : about 3.1kg FG20 : about 4.1kg FG30: about6.1kg		
	Amplifier	Transmitter: about 1.5 kg; receiver: about 1.5 kg		

Input/Output Circuit and Connection

- Control output
  Model FTR44A
  Model FTR44AH

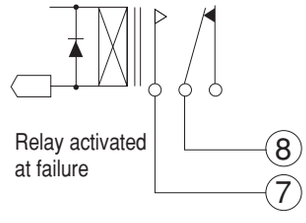


Model FTR44AC



Saturation voltage: 3 V max.

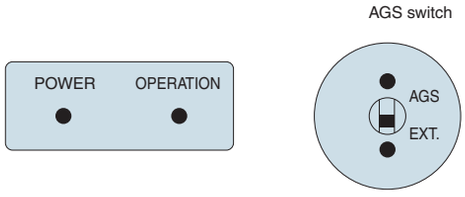
- SAFETY ALARM OUTPUT (all models)



When connecting an inductive load such as a relay for the load, be sure to use diode, surge absorber, etc. for protection of output transistor from back electromotive force.

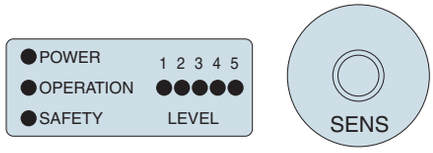
Amplifier panel layout

Transmitter



Power	Illuminated at power-up.
Operation	Illuminated when the transmitter is normally functioning.
AGS switch	Switch used for external control for anti interference when two or more sensors are adjacently installed. Set at EXT. when using the controller. Normally, set at AGS.
◇Light emission monitor :	Used to see if the transmitter is functioning normally. An amplifier for monitoring is integrated in the sensor amplifier, which monitors the radiation from the laser diode used as the light source and outputs alarm signal (OPERATION error output) if the emission stops. The alert output relay is normally at ON state.

Receiver



POWER	Illuminated at power-up
OPERATION	Operation indicator: illuminated when control output is activated (light emission detected).
SAFETY	Stability check (stability operation) indicator: Green indicator is illuminated to indicate stable operation. When there is not much margin in the received light intensity level, SAFETY ALARM output is activated and the indicator starts flashing.
LEVEL	Received light intensity is shown with a 5-point indicator.
SENS	SAFETY LEVEL adjustment volume Volume for adjustment of the SAFETY LEVEL and LEVEL INDICATOR illumination level.

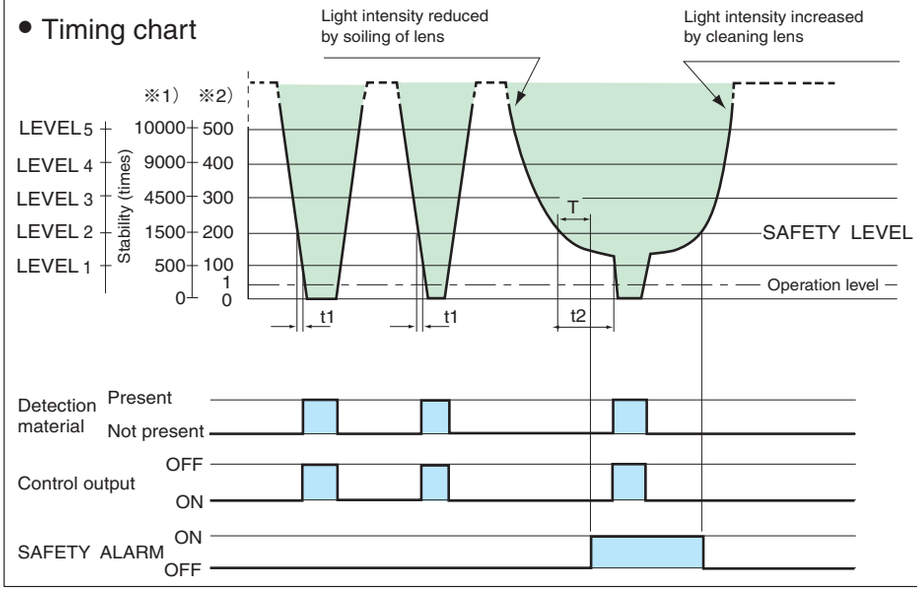
Control Output and Stability Check Feature

Control output : Relay is activated when the light from the transmitter is detected by the output receiver. Relay is deactivated when the light from the transmitter is blocked by the detected object.

Stability check feature (SAFETY ALARM output)

Operation : The light intensity level (stability) at light reception is observed and an alarm signal is output when the light intensity is equal to or below the SAFETY LEVEL due to dirt deposits on lens or light axis misalignment, etc. The SAFETY LEVEL is variable between 200 and 1,500 times as much as the operation level. The output is reset when the received light intensity exceeds the SAFETY LEVEL.

● Timing chart

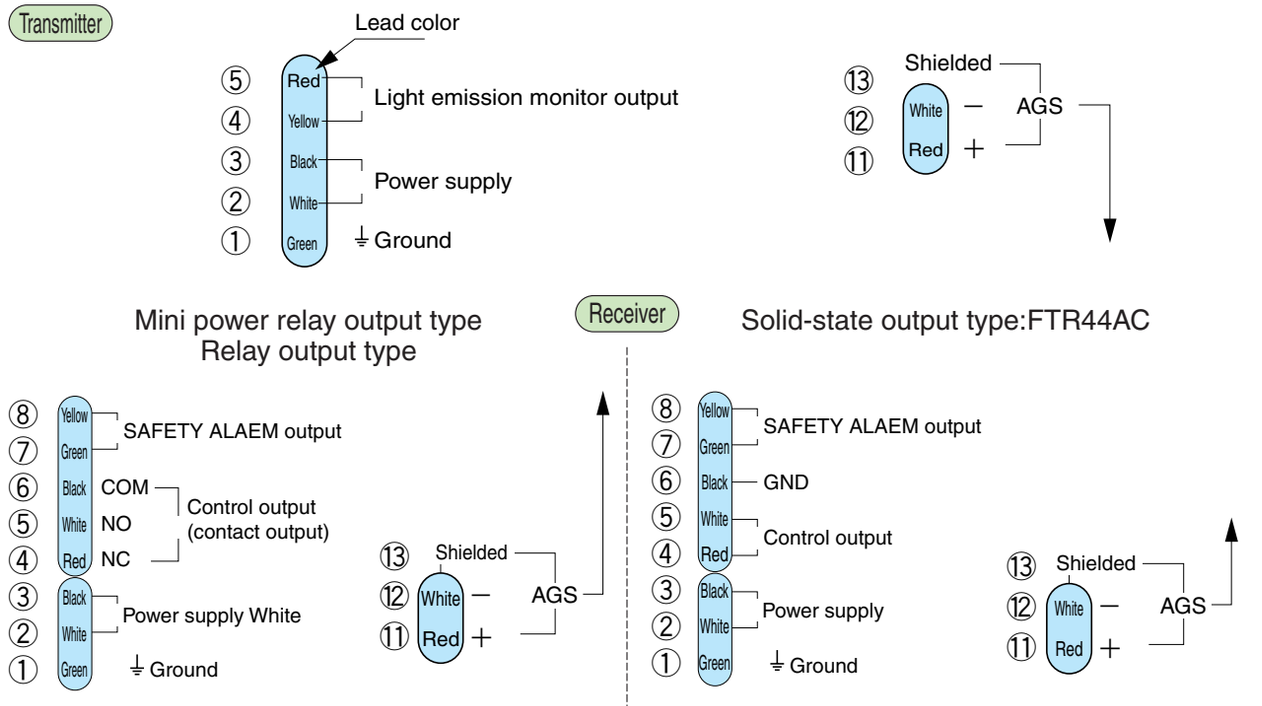


*1) The SAFETY LEVEL and LEVELs (received light intensity) are adjustable with the volume. *1 indicates the stability at “MIN” on SENS scale.
*2 indicates the stability at “MAX” on SENS scale.

SAFETY ALARM operation : The duration between the reduction of the received light intensity level under the SAFETY LEVEL and the control output activation is calculated and, if this duration is longer than a certain duration T, the SAFETY ALARM is output.
For example, the duration t1 between the reduction of the received light intensity level under the SAFETY LEVEL and the control output activation at material detection is shorter than the duration T and the ALARM is not output. With soiled lens or misaligned light axis, duration t2 during which the light intensity is under the SAFETY LEVEL is longer, which is regarded as no margin in received light intensity level.
(The duration T for SAFETY LEVEL check is set at about 2 minutes in the above example.)

FT44A

Connection



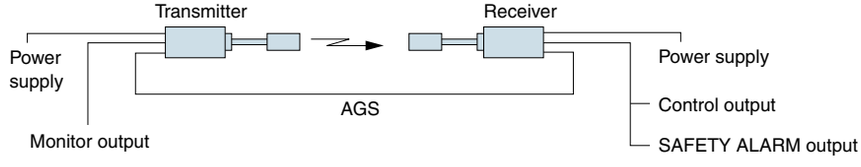
When the leads are extended (100-300 m), stray capacitance between leads may cause rush current.
If this poses any problem, provide a resistor (10-50 Ω) in series with the contact.

When connecting an inductive load such as relay as the load, be sure to use diode, surge absorber, etc. for protection of output transistor from back electromotive force.

AGS

The AGS terminals on the transmitter and receiver can be used in the following three ways:

1) Detection power increase



When the AGS terminals are connected with each other, a synchronization signal is sent out from the transmitter, which is detected with the AGS circuit in the receiver, and the sensitivity (amplifier gain) is automatically increased to about double that before the connection of AGS. This provides high power.
The synchronous rectifier circuit is activated at the same time, which increases resistance to noise for even higher reliability. This feature is effective for use in situations such as hampered light transmission due to smoke or vapor or environment subject to electric noise.

2) Prevention of interference

When two or more sensors are adjacently installed, light from the neighboring transmitter reaches the receiver even if the object blocks the light beam, this causes faulty operation. To prevent this situation, connect the AGS to an external controller to externally synchronize the transmitter emission and receiver gating.
This also automatically increases the receiver sensitivity and activates the synchronous rectifier circuit.
For details about the scanning controller, see “LSC Series.”

3) Normal operation without connecting AGS

Connection of AGS provides advantages as described above. However, leaving the AGS unconnected has no effect on operation in ordinary environment and the sensor may be used as an ordinary photo sensor.

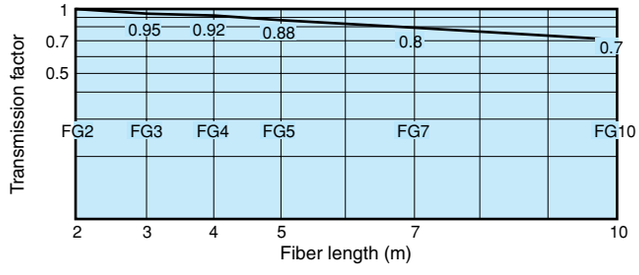
Optical Head Power Characteristics (Typical example)

Different models of optical head (OHA and OH2) have different levels of power. The same optical head model may generate different levels of power depending on whether it is used for transmitter or receiver. This is due to the difference of power density depending on the effective lens diameter or spread of light beam.
The table on the right shows power levels with reference to the power 100 with OH2 used as the optical heads for both transmitter and receiver.

Optical head		Relative power (with OH2 as 100
Transmitter	Receiver	
OH2	**OH2**	100
OH2	**OHA**	35
OHA	**OH2**	25
OHA	**OHA**	9

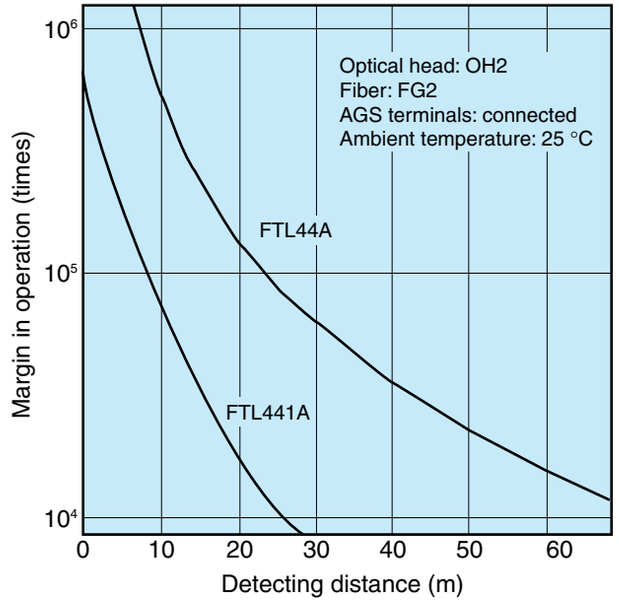
Fiber Transmission Factor Characteristics (Typical example)

The figure shows relative transmission factor with reference to fiber optic cable FG2 as 1.
The transmission factor of FG10 is 70% of that of FG2.
When FG10 (10 m length) is used for both transmitter and receiver, the transmission factor is:
0.7 x 0.7 = 0.49



Received Light Intensity Level Characteristics (Typical example)

The data shows margin in operation against detecting distance with fiber optic cable FG2 (length 2 m) and optical head OH2 used for both transmitter and receiver. For other fiber and optical head models, find the data based on the transmission factor of the fiber and power of the optical head.
When fiber optic cable FG2 (length 2 m) is used for both transmitter and receiver, the graphs directly shows the data and the margin in operation at detecting distance of 20 m is about 130,000 times.
When fiber optic cable FG10 (length 10 m) is used for both transmitter and receiver, the transmission factor is:
0.7 x 0.7 = 0.49.
Using this to find the margin in operation at detecting distance of 20 m with FG10 used for both transmitter and receiver,
130,000 (times) x 0.49 = 60,000 (times)



Light axis alignment

See P. 520.

Do not attempt to visually align (with optical sight) the axis when laser beam is emitted.

FT44A

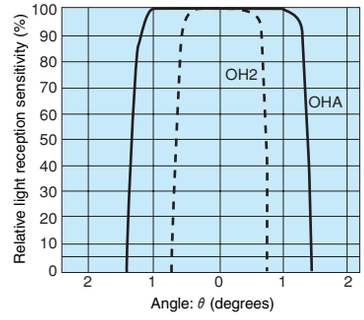
Directional Characteristics

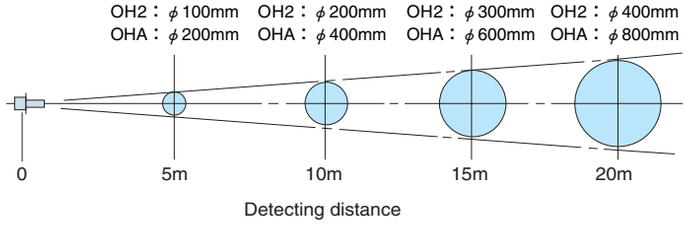
The graph shows the spread of transmitter light beam and receiver angle of aperture.

For the spread of transmitter light beam, the maximum angle of aperture is ±1.7 degrees, which translates to a spread of about 600 mm at 10 m.

The sides of this spread do not have enough light intensity and are not practical. To find a practical beam spread, consider relative light reception sensitivity of 50% or higher.

The angle of aperture for relative light reception sensitivity 50% is ±1.2 degrees, which means that practical light beam spread is about ø400 mm at detecting distance 10 m.

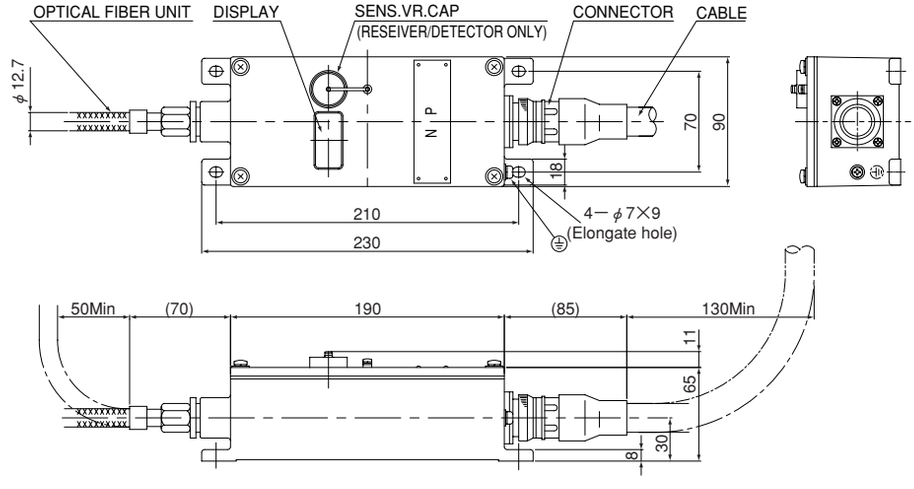




Dimensions(in mm)

Amplifier

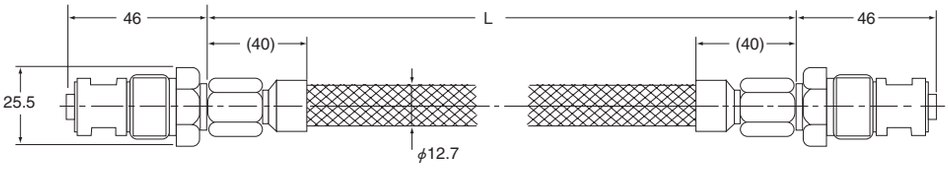
CAD



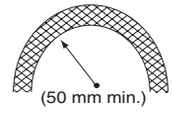
Fiber

CAD

Model	Length (L)
FG2	2m
FG3	3m
FG4	4m
FG5	5m
FG7	7m
FG10	10m
FG15	15m
FG20	20m
FG30	30m



(Allowable bending radius)



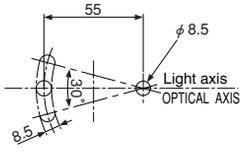
Dimensions (in mm)

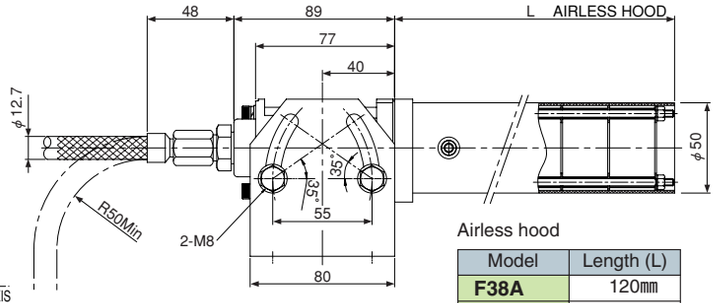
Example of combination of Airless hood and optical head

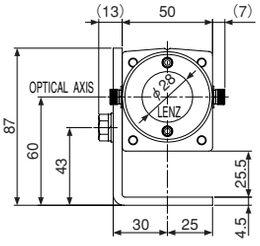
Optical head
Model OHA

CAD

Mounting hole dimensions







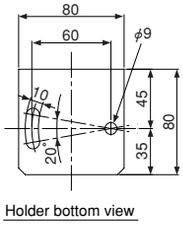
Airless hood

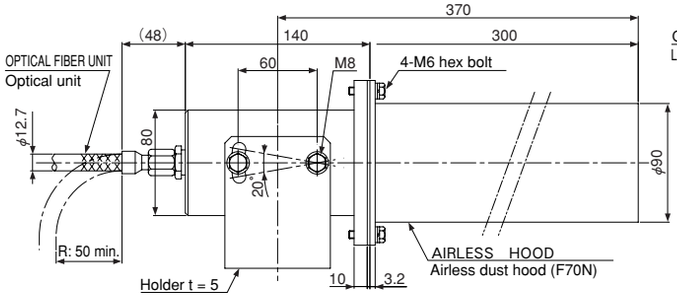
Model	Length (L)
F38A	120mm
F38A-02	200mm
F38A-03	300mm
F38A-04	400mm
F38A-05	500mm

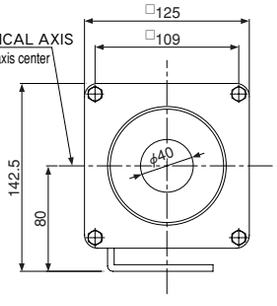
Optical head Model OH2
Airless hood Model F70N

CAD

Mounting bracket bottom view





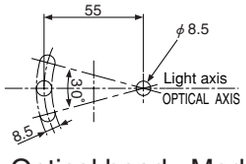


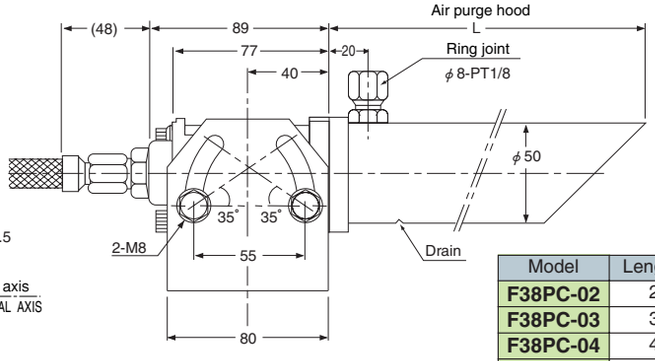
Example of combination of air purge hood and optical head

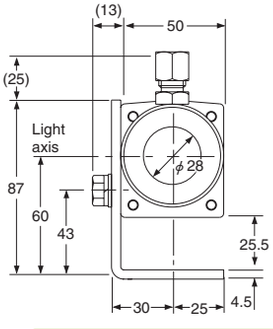
Optical head Model OHA

CAD

Mounting hole dimensions







Model	Length (L)
F38PC-02	200mm
F38PC-03	300mm
F38PC-04	400mm
F38PC-05	500mm

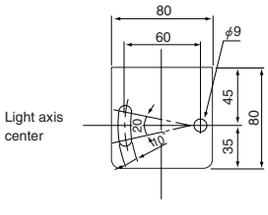
Air purge specification
Flow rate···200 ℓ/min
Withstand pressure···0.98MPa

Optical head Model OH2

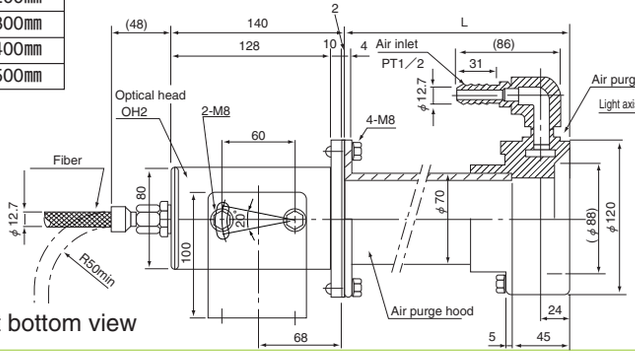
CAD

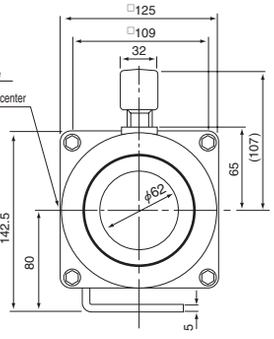
Air purge hood

Model	Length (L)
702L	200mm
703L	300mm
704L	400mm
705L	500mm



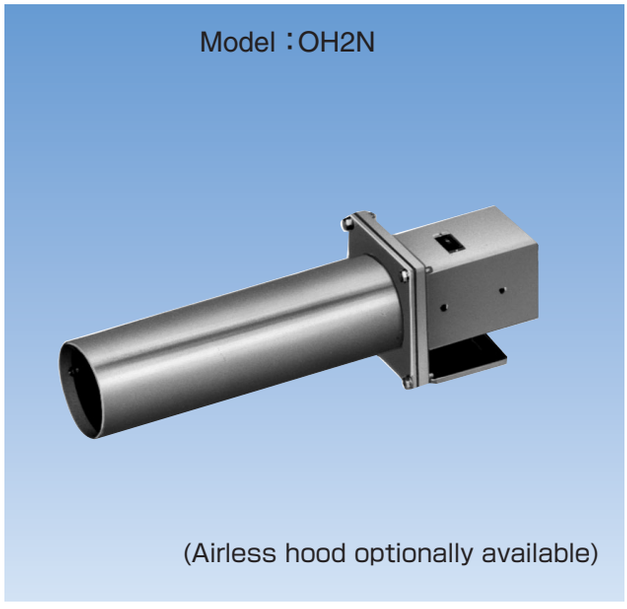
Mounting bracket bottom view





Optical head

Optical head for FT44A series



- **Greatly increased power**

  About fivefold enhancement (compared with Takex OH2)

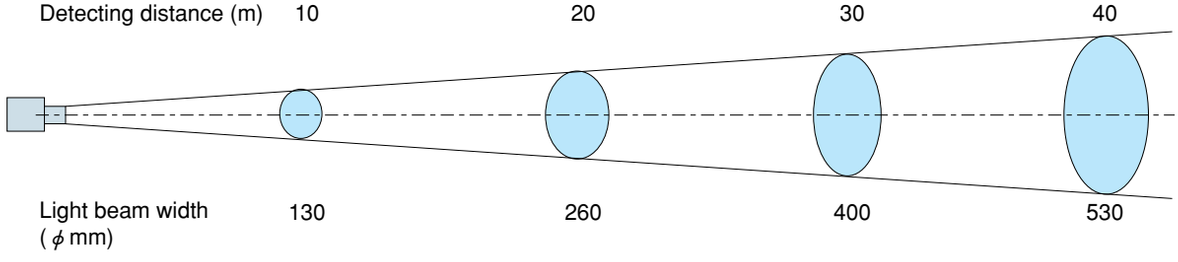
- **Narrow-view achieved**

  Light beam width and view reduced to about 60%

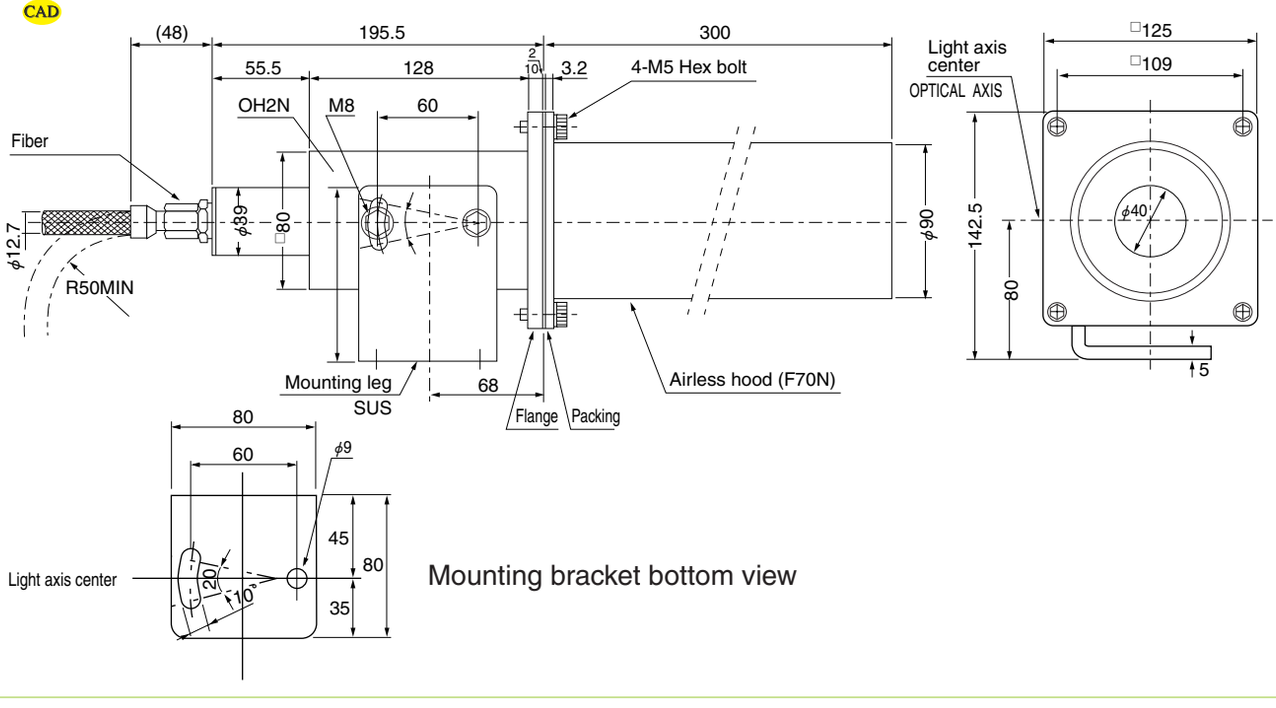
- **Easily replaceable**

  Readily replaceable where OH2 was not powerful enough

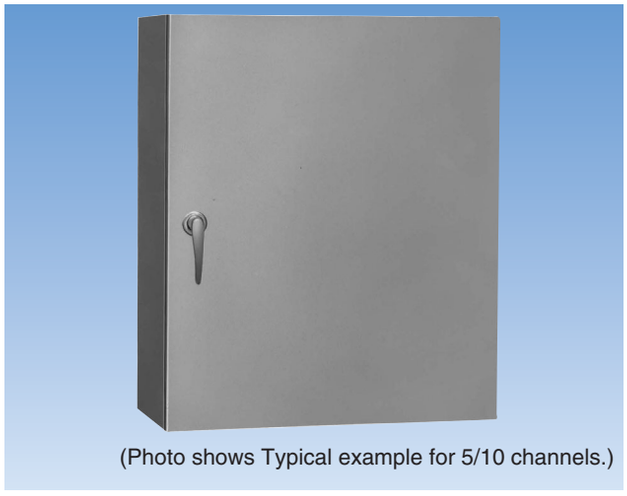
Detecting distance and Light Beam Width



Dimensions(in mm: with Airless hood and fiber attached)



Mounting bracket bottom view



(Photo shows Typical example for 5/10 channels.)

(Model No.)

L S C 05 L

- Transmitter: L
- Receiver: R
- Scanning channel count (number of connectable transmitters/receivers)
  - For 5 ch: 05
  - For 10 ch: 10
  - For 20 ch: 20

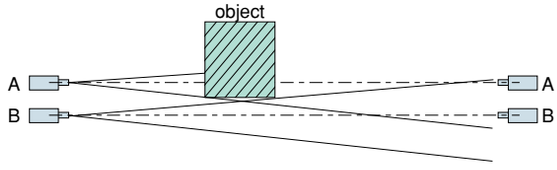
Specification

Type		LSC05L	LSC10L	LSC20L
	For transmitter			
	For receiver	LSC05R	LSC10R	LSC20R
Channel count		5	10	20
Power supply		100-110 VAC or 200-220 VAC +10%–15%, 50/60 Hz		
Power consumption		10W max		
Wiring length		100 m max. (AGS/CLOCK signal)		

Contact Takex for detailed material data.

Prevents interference between adjacently installed sensors

- Controller prevents interference between adjacent installation of two or more sensors
- Controllers separate for transmitter and receiver
- When two or more sensors are adjacently installed, light from the neighboring transmitter reaches the receiver even if the object blocks the light beam, which causes faulty operation. To prevent this situation, the LSC Series controller synchronizes sensors for externally controlling the light emission pulse of the transmitter and gating of the receiver.

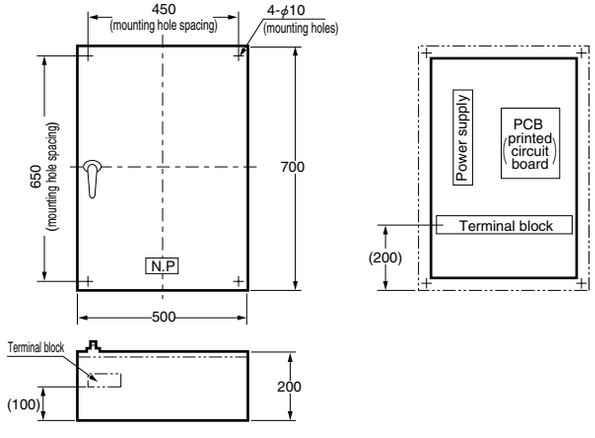


Although the light from Transmitter A is blocked by the object, light from Transmitter B enters Receiver A and the object cannot be detected.

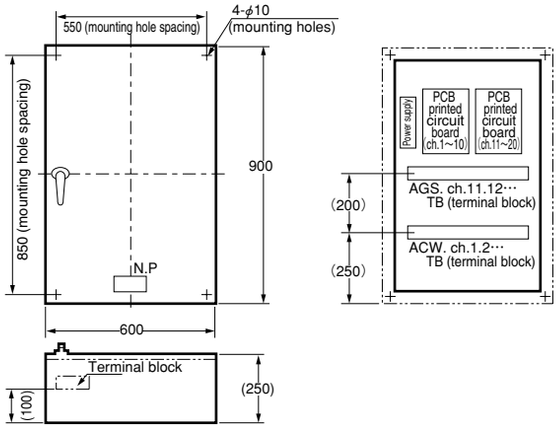
- Controllers for 5, 10 and 20 channels are available according to the number of sensors to be controlled.

Dimensions (in mm)

For 5/10 ch



For 20 ch

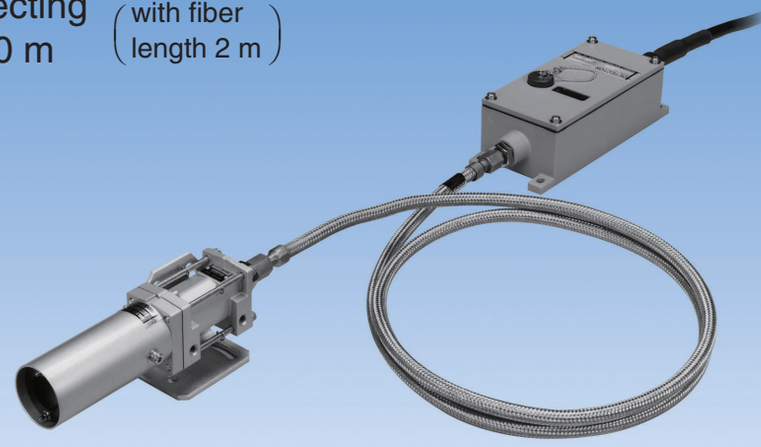


FT10A series

Fiber type / CMD

Self-check feature provided

Within detecting distance 40 m (with fiber length 2 m)



Transmitter and receiver as a set; dimensions same for both

The sensor is composed of an optical head and amplifier connected with a fiber optic cable.
This allows installation of the detecting head that contains no electronic components at a high-temperature location and of the amplifier containing electronic components at a remote location.

Features

- No cooling required
  The optical head that comprises the detecting part integrating hood and optical lens and fiber have no electronic component, which allows use in ambient temperature of up to 200 °C without cooling.
- 5-point level indicator
  Received light intensity is indicated at 5 levels, offering easy checking of stability and light axis alignment.
- Self-check feature integrated
  Transmitter outputs alarm signals if light emission stops due to failure, etc. Receiver outputs alarm signal (SAFETY ALARM) when there is not much margin in the received light intensity level at detection due to light axis misalignment, soiling of lens, etc.
- Excellent durability
  Reliable design provides robustness and resistance to heat and corrosion.
- Different hoods available
  Attachable airless hood that requires no air purging in ordinary installation such as horizontal and angled downward installation and air purge hood for comparatively dusty locations.

Ordering Guide

Fiber type CMDs do not have set model Nos. Order by specifying the individual model Nos. of components.

- Example

  For ordering sensor with the following properties:
  - Detecting distance: up to 40 m
  - Relay output
  - Fiber length: 2 m
  - Compact, lightweight Airless hood

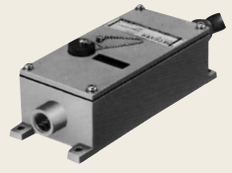
Product name		Model	Quantity
Amplifier	Transmitter	**FTL10A**	1
	Receiver	**FTR10A**	1
Optical head		**OHA**	2
Fiber		**FG2**	2
Hood		**F38A**	2

For combination of models marked with*

[Fiber optic cable]

Length	Model	Appearance (Typical example)
2m	**FG2** *	
3m	**FG3**	
4m	**FG4**	
5m	**FG5**	
7m	**FG7**	
10m	**FG10**	
15m	**FG15**	
20m	**FG20**	
30m	**FG30**	

[Amplifier]

Type		Model	Appearance (Typical example)
Transmitter amplifier	——	**FTL10A** *	
Receiver amplifier	Mini power relay output	**FTR10A** *	
	Relay output	**FTR10AH**	
	Solid-state output	**FTR10AC**	Photo: amplifier for receiver

[Optical head] For transmitter/receiver

Model	Appearance
OHA *	

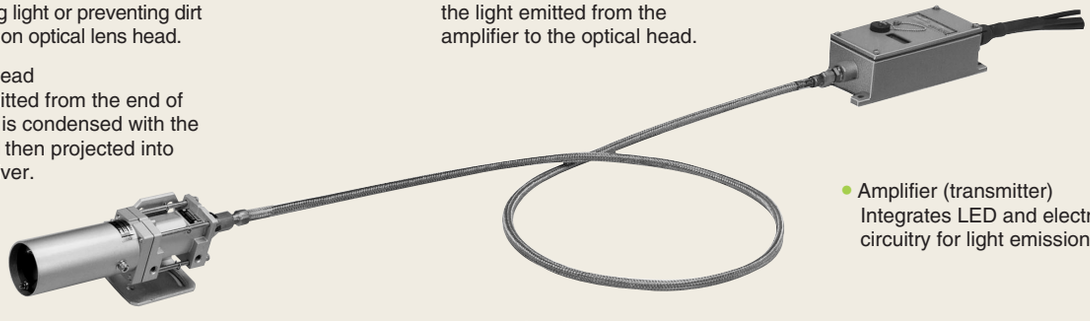
Note: This product is not compatible with the existing airless hood or air purge hood. Spacer model OHA-12 is available for users of existing hoods.

[Hood]

Type	Length	Model/shape	Appearance (Typical example)
Airless hood	120mm	**F38A** *	
	200mm	**F38A-02**	
	300mm	**F38A-03**	
	400mm	**F38A-04**	
	500mm	**F38A-05**	
Air purge hood	200mm	**F38PC-02**	
	300mm	**F38PC-03**	
	400mm	**F38PC-04**	
	500mm	**F38PC-05**	

Configuration

- Hood
  Provided for protection from disturbing light or preventing dirt deposits on optical lens head.
- Optical head
  Light emitted from the end of the fiber is condensed with the lens and then projected into the receiver.
- Fiber optic cable
  Glass optical fiber that directs the light emitted from the amplifier to the optical head.



- Amplifier (transmitter)
  Integrates LED and electronic circuitry for light emission.
- Amplifier (receiver)
  Converts the light transmitted through fiber optic cable with the light-sensitive element into electric signals for control output (mini power relay output, reed relay output or Solid-state output) via electronic circuitry.

Components for transmitter and receiver are the same except for amplifiers.

FT10A

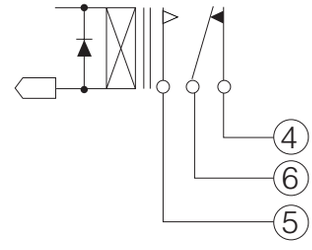
Rating/Performance/Specification/Environmental Specification

Output specification				
Transmitter model		**FTL10A**		
Monitor output (operation)		Power: ON / OFF Monitor: Abnormal / Normal (Max 1 s) Output: OPEN / CLOSE		
	Rating	Contact output 5A 250V AC max. (Resistance load)		
Receiver model		**FTR10A**	**FTR10AH**	**FTR10AC**
Output type		Mini power relay output	Relay output	Solid-state output
Control output		ON-OFF operation (Light-ON)		
	Rating	Transfer contact 5 A 250 VAC max. (resistance load)	Transfer contact 0.5 A 48 VDC max. (resistance load)	0.5 A 250 VAC/DC max. (resistance load)
	Response time	15ms max.	5ms max.	3ms max.
Safety Alarm output		Power: ON / OFF Monitor: Abnormal / Normal Output: ON (L) / OFF (H)		
	Rating	a contact 5A 250VAC max. (resistance load)		
General specification				
Detecting distance		Fiber length 2m: 40 m max. 5m: 30 m max. 10m: 20 m max.		
Valid lens diameter		28 mm		
Smallest detectable object		28 mm diameter		
Power Supply		100-220 VAC +10%/-15% 50/60Hz		
Power consumption		Transmitter: 10 W max.; receiver: 10 W max.		
Connection		with Connector cord 2m (CVV1.25mm²)		
Ambient temperature		Optical head, Fiber: -25 to +200℃ Amplifier: -25 +55°C (Non-freezing)		
Storage temperature		-40 to +70°C (Non-condensing)		
Ambient humidity		35 to 85%RH Max. (Non-condensing)		
Fiber-optic unit allowable bending radius		50mm		
Insulation resistance		Between power supply and case: 500 VDC, 20 MΩ or higher Between output and case: 500 VDC, 20 MΩ or higher Between power supply and output: 500 VDC, 20 MΩ or higher		
Dielectric withstanding		Between power supply and case: 1500VAC for 1 minute Between output and case: 1500VAC for 1 minute (between reed relay outputs: 1,000 VAC for 1 minute) Between power supply and output: 1500VAC for 1 minute (between reed relay outputs: 1,000 VAC for 1 minute)		
Vibration		10-55 Hz / 0.75 mm amplitude / 2 hours each in 3 direction		
Shock		500 m/s² / 3 times each in 3 directions		
Protective structure		IP66		
Mass	Optical head	OHA: About 680g		
	Airless hood	F38A: about 240g F38A-04: about 550g	F38A-03: about 430g F38A-05: about 650g	
	Air purge hood	F38PC-02: about 240g F38PC-04: about 370g	F38PC-03: about 300g F38PC-05: about 440g	
	Fiber	FG2 : about 0.7kg FG5 : about 1.3kg FG15: about 3.1kg	FG3 : about 0.9g FG7 : about 1.6g FG20: about 4.1g	FG4 : about1.1kg FG10: about2.1kg FG30: about6.1kg
	Amplifier	Transmitter: about 1.5 kg; receiver: about 1.5 kg		

Input/Output Circuit and Connection

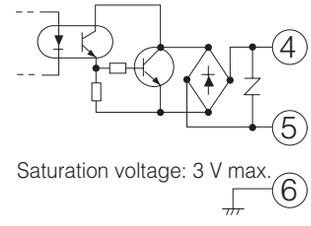
- Control output

Model FTR10A
Model FTR10AH



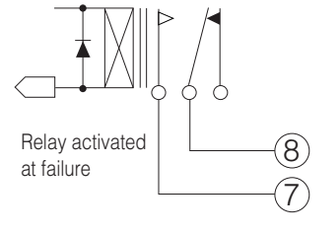
Relay activated at light reception

Model FTR10AC



Saturation voltage: 3 V max.

- SAFETY ALARM OUTPUT (all models)



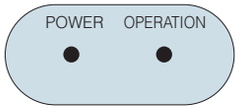
When connecting an inductive load such as relay as the load, be sure to use diode, surge absorber, etc. for protection of output transistor from back electromotive force.

Amplifier panel layout

Transmitter

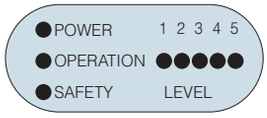
- Light emission monitor
  Used to determine if the transmitter is functioning normally. An amplifier for monitoring is integrated in the sensor, which monitors the radiation from the LED used as the light source and outputs alarm signal (OPERATION error output) if the emission stops.
  The alert output relay is normally at ON state.

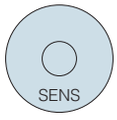
- Power
  Illuminated at power-up.



- OPERATION
  Illuminated when the transmitter is normally functioning and goes out when it stops functioning.

Receiver





POWER	Illuminated at power-up
OPERATION	Operation indicator: illuminated when control output is activated.
SAFETY	Stability check (stability operation) indicator: Green indicator is illuminated to indicate stable operation. When there is not much margin in the received light intensity level, SAFETY ALARM output is activated and the indicator starts flashing.
LEVEL	Received light intensity is shown with a 5-point indicator.
SENS	SAFETY LEVEL adjustment volume Volume for adjustment of the SAFETY LEVEL and LEVEL INDICATOR illumination level.

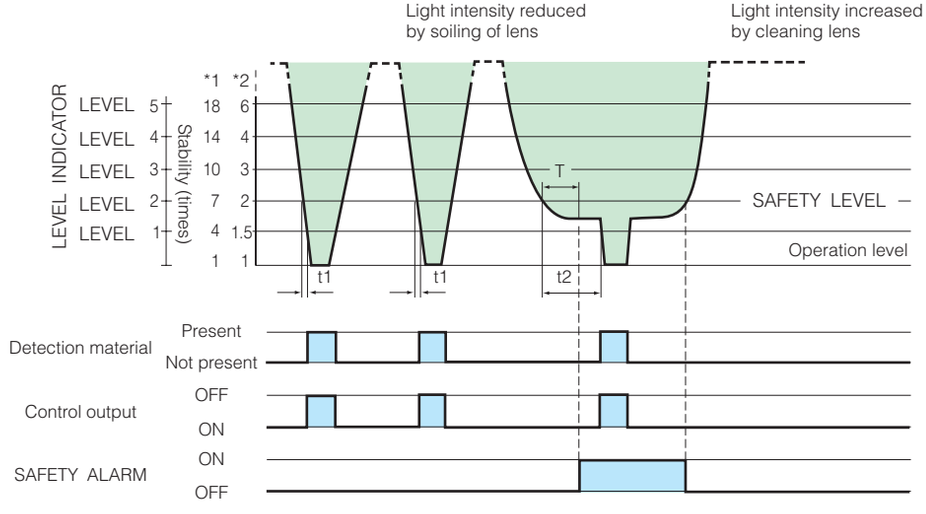
Control Output and Stability Check Feature

Control output: Relay is activated when the light from the transmitter is detected by the receiver for output.
Relay is deactivated when the light from the transmitter is blocked by the detection object.

Stability check feature (SAFETY ALARM output)

Operation: The light intensity level at light reception is observed and an alarm signal is output when the light intensity is equal to or below the SAFETY LEVEL due to soiling of lens or light axis misalignment, etc.
The SAFETY LEVEL is variable between 2 and 4 times as much as the operation level. The output is reset when the received light intensity exceeds the SAFETY LEVEL.

- Timing chart

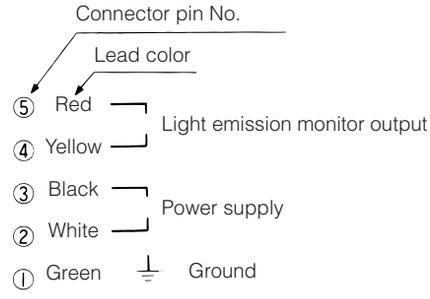


SAFETY ALARM operation: Timing is started when the received light intensity level is reduced to below the SAFETY LEVEL, which is reset when operation output is activated. SAFETY ALARM signal is output if this duration is longer than a certain duration T.
For example, the duration t1 between the reduction of the received light intensity level under the SAFETY LEVEL and the output activation at material detection is shorter than the duration T and the ALARM is not output. With soiled lens or misaligned light axis, duration t2 during which the light intensity is under the SAFETY LEVEL is longer (always under the check level at light reception), which is regarded as no margin in received light intensity level. (The duration T for SAFETY LEVEL check is set at about 2 minutes in the above example.)
The SAFETY LEVEL and LEVELs on the level indicator (received light intensity) are adjustable with the volume. *1 indicates the stability at “MIN” on SENS scale and *2 indicates the stability at “MAX” on SENS scale.

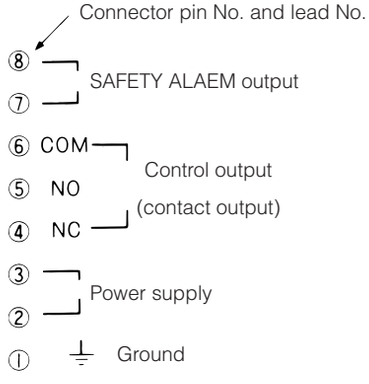
FT10A

Connection

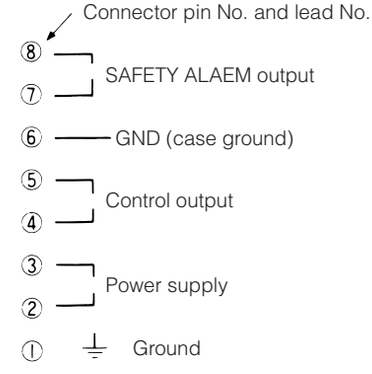
Transmitter: **FTL10A**



Receiver: **FTR10A** (Mini power relay output)
FTR10AH (Relay output)

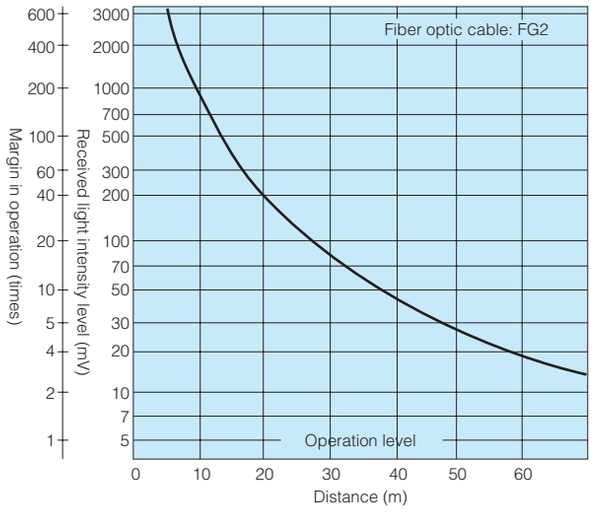


Receiver: **FTR10AC** (Solid-state output type)



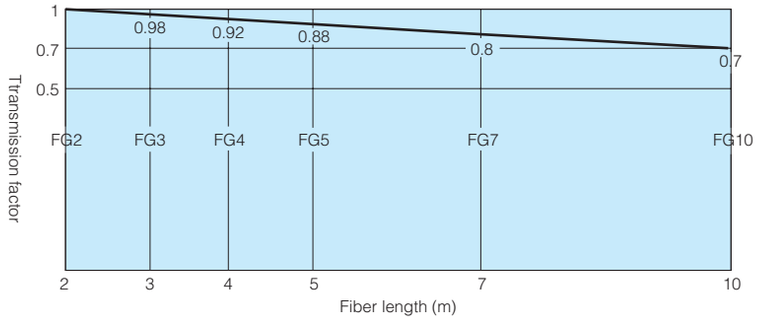
Received Light Intensity Level Characteristics (Typical example)

The data shows margin in operation against detecting distance with fiber optic cable FG2 (length 2 m) used for both transmitter and receiver. For other fiber models, find the data based on the transmission factor of the fiber.
When fiber optic cable FG2 (length 2 m) is used for both transmitter and receiver, the graphs directly shows the data and the margin in operation at detecting distance of 10 m is about 180 times.
When fiber optic cable FG10 (length 10 m) is used for both transmitter and receiver, the transmission factor is:
0.7 x 0.7 = 0.49.
Using this to find the margin in operation at detecting distance of 10 m with FG10 used for both transmitter and receiver,
180 (times) x 0.49 = 88.2 (times)



Fiber Transmission Factor Characteristics (Typical example)

The figure shows relative transmission factor with reference to fiber optic cable FG2 as 1.
The transmission factor of FG10 is 70% of that of FG2.
When FG10 (10 m length) is used for both transmitter and receiver, the transmission factor is:
0.7 x 0.7 = 0.49



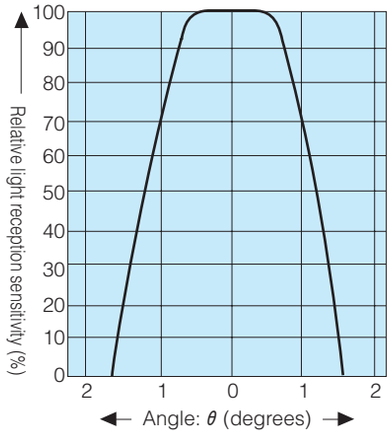
Directional Characteristics (Typical example)

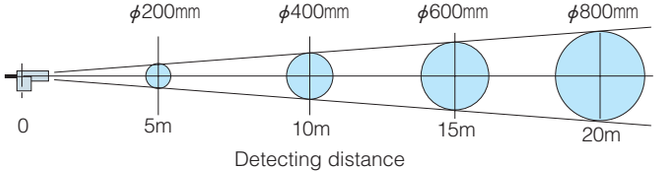
The graph shows the spread of transmitter light beam and receiver angle of aperture.

For the spread of transmitter light beam, the maximum angle of aperture is ± 1.7 degrees, which translates to a spread of about ø600 mm at 10 m.

The sides of this spread do not have enough light intensity and are not practical. To find a practical beam spread, consider relative light reception sensitivity of 50% or higher.

The angle of aperture for relative light reception sensitivity 50% is ± 1.2 degrees.
This means that practical light beam spread is about ø400 mm at detecting distance 10 m.





FT10A

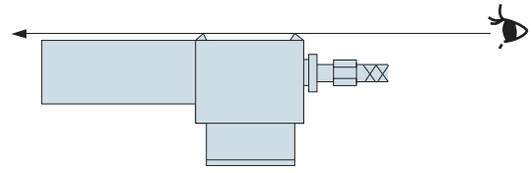
Light Axis Alignment

Align the light axis so that all LEDs are illuminated while checking with the 5-point level indicator on the receiver.

At the maximum sensitivity (SENS MAX), LEVEL 5 indicator is illuminated at the margin of 6 times but this does not mean that the light axis is perfectly aligned.
Although the distance and atmosphere may have some effect, as a general rule, align the light axis with the sensitivity at SENS MIN so that the LEVEL 5 indicator is illuminated for operation with the maximum margin (this makes the margin more than 18 times).

◇Alignment with optical sight

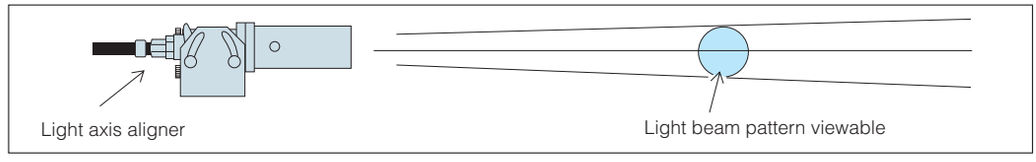
Use the optical sight provided on the optical head.



◇Alignment with Light axis aligner (optional)

Mount an Light axis aligner on the optical head and radiate the light beam pattern through the transmitter lens. More accurate field adjustment may be made based on the projected beam pattern.

(Transmitter)



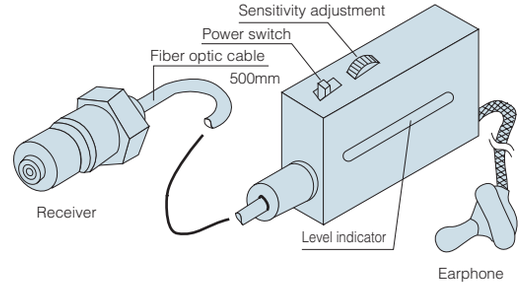
- Two types are available depending on light source

(Halogen lamp type)
- Light axis aligner
  - Model OHF-CL
- Power supply unit
  - Model OHF-CLP
- Halogen lamp (spare)
  - Model OHF-L5

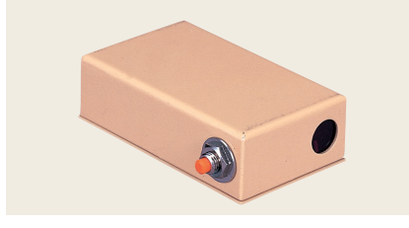
(Red semiconductor laser type)
- Class 2
- Light axis aligner
  - Model OHF-LD
- Power supply unit
  - Model OHF-LDP

◇Receiver for Light axis alignment (optional)

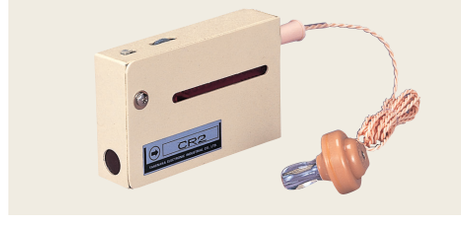
Used for light axis alignment of receiver of fiber type CMD.
Mount on the optical head of the receiver and check the received light intensity with the volume of sound from the earphone and the LED level indictor.
Model OHF-CR



◇Checker (optional)



Model CL1 (transmitter)
Portable transmitter used for checking the operation of the receiver.

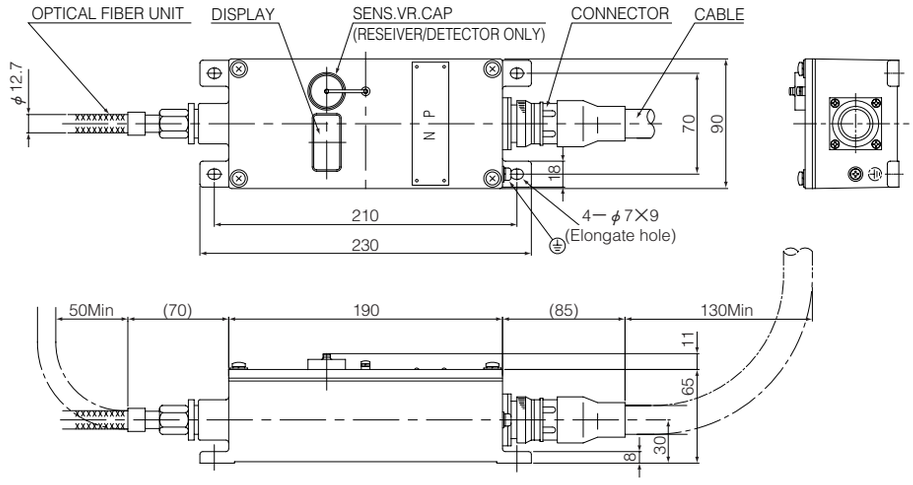


Model CR2 (with indicator)
Portable receiver for checking the transmitter and light axis alignment of position of light emitted from the transmitter while listening to the sound.

Dimensions (in mm)

Amplifier

CAD

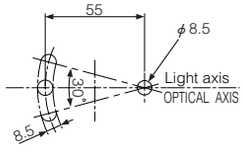


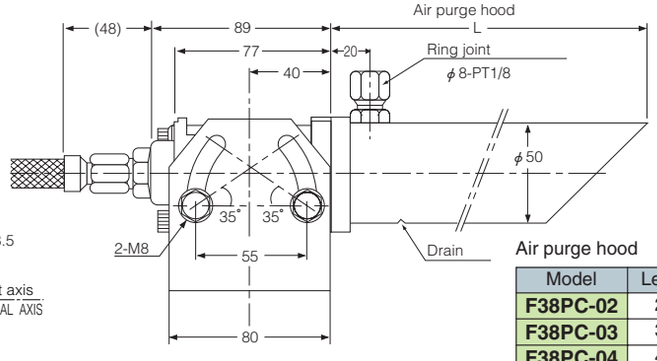
Example of combination of air purge hood and optical head

Optical head
Model OHA

CAD

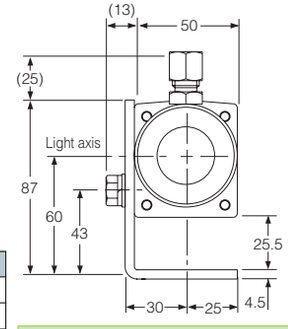
Mounting hole dimensions





Air purge hood

Model	Length (L)
F38PC-02	200mm
F38PC-03	300mm
F38PC-04	400mm
F38PC-05	500mm



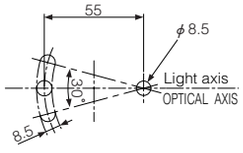
Air purge specification
Flow rate: 200 ℓ/min
Withstand pressure: 0.99MPa

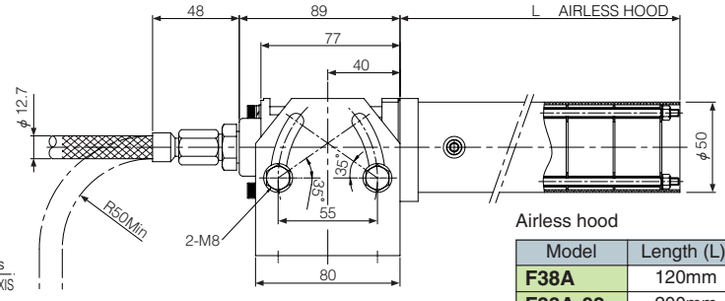
Example of combination of Airless hood and optical head

Optical head
Model OHA

CAD

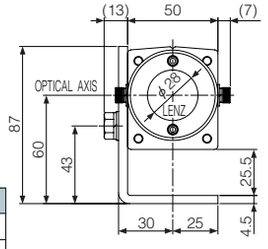
Mounting hole dimensions





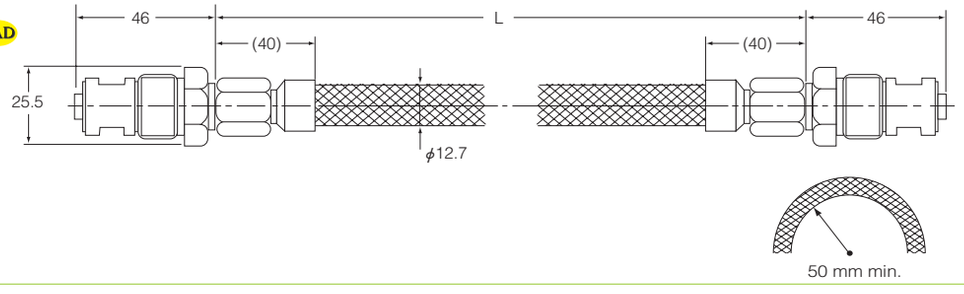
Airless hood

Model	Length (L)
F38A	120mm
F38A-02	200mm
F38A-03	300mm
F38A-04	400mm
F38A-05	500mm



Fiber

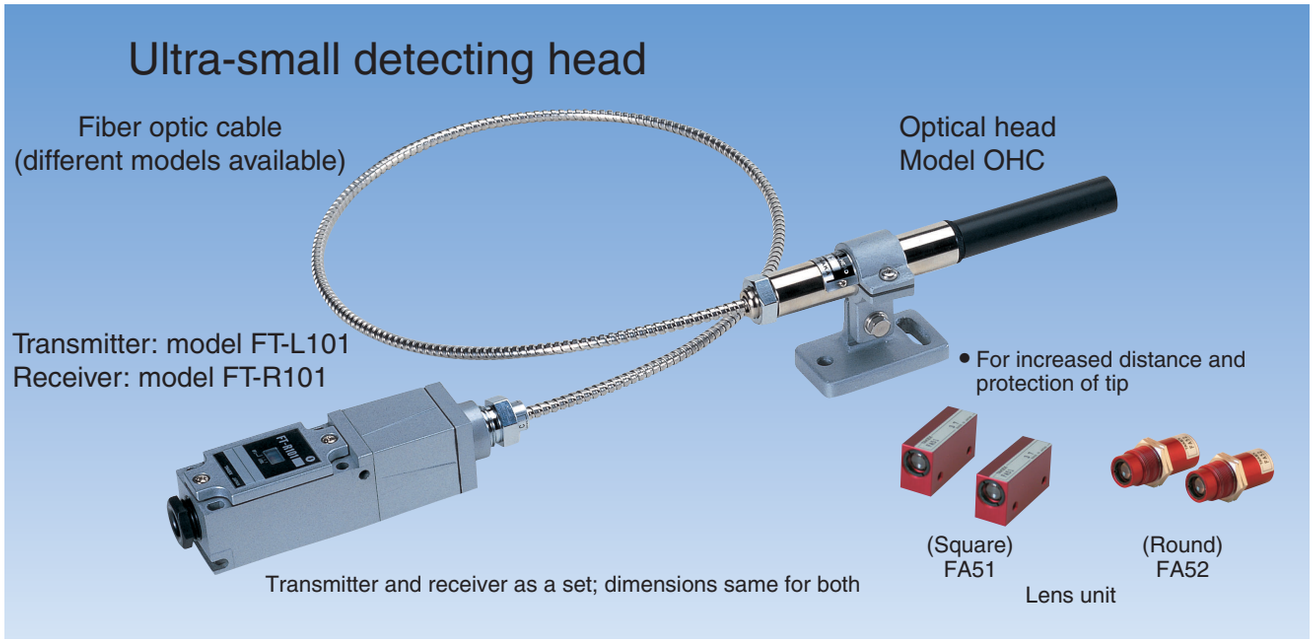
CAD



Model	Length (L)
FG2	2m
FG3	3m
FG4	4m
FG5	5m
FG7	7m
FG10	10m

FT101 series

Fiber type / CMD



The photo sensor is composed of an optical head and amplifier connected with a fiber optic cable.
This allows installation of the detecting head that contains no electronic components at a high-temperature location and of the amplifier containing electronic components at a remote location.

Features

- Wide power supply range
  Wide range of power voltage 100-240 VAC.
- Light emission monitor and 3-point level indicator
  The transmitter is provided with light emission monitor circuit, which outputs alarm signal when light emission stops due to failure, etc. The receiver has 3 LEDs for checking the received light intensity level, offering easy checking of stability and light axis alignment

Type/Price

Type	Model	Overview	
Amplifier	**FT-L101**	Transmitter	
	FT-R101	Receiver	
Fiber	**GT205AD**	Fiber length	0.5m
	GT21AD		1m
	GT22AD		2m
	GT23AD		3m
	GT25AD		5m
	GT27AD		7m
	GT210AD		10m
Optical head	**OHC**	Heat resistance 200°C, IP 67	
Lens unit	**FA51**	Square	
	FA52	Round	
Adapter	**FT101-AD2**	Adapter for OHA	

Adapter

- An adapter is required to use an OHA optical head.
  Adapter for OHA
  Model FT101-AD2

Simplified combination
Detecting distance: 1.5-2.7 m (depending on fiber)

Order example

Product name		Model	Quantity
Sensor main unit	Transmitter	**FT-L101**	1
	Receiver	**FT-R101**	1
Lens unit		(Respective model)	2
Fiber		(Respective model)	2

Standard combination
Detecting distance: 12-22 m (depending on fiber)

Order example

Product name		Model	Quantity
Sensor main unit	Transmitter	**FT-L101**	1
	Receiver	**FT-R101**	1
Optical head		**OHC**	2
Fiber		(Respective model)	2

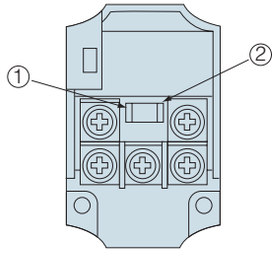
Rating/Performance/Specification/Environmental Specification

Output specification		
Transmitter model		**FT-L101**
Light source		Infrared LED
Light emission monitor output		Relay contact output 1C
	Operation	Power: ON / OFF Monitor: Normal / Abnormal Output: ON / OFF
	Rating	250V AC (Resistance load)
Receiver model		**FT-R101**
Output type		Relay contact output 1C
	Rating	250V AC (Resistance load)
Operation mode		Light-ON / Dark-ON (Switching)
Response time		20ms max.
General specification		
Detecting distance		See table below
Fiber-optic unit allowable bending radius		50mm
Power Supply		100-240 VAC ±10%, 50/60 Hz
Power consumption		Transmitter: 2 W max.; receiver: 2 W max.
Indicator	Transmitter.	Power indicator: Green LED, Monitor indicator: Red LED
	Receiver.	Power indicator r: Green LED, Monitor indicator: Red LED
Connection		Terminal block (screw: M3.5, width: 8.1mm)
Ambient temperature		Optical head, Fiber: -25 to +200°C Amplifier: -25 +55°C (Non-freezing)
Storage temperature		-40 to +70°C (Non-condensing)
Ambient humidity		35 to 85%RH (Non-condensing)
Ambient light		10,000 lx (incandescent lamp)
Protective structure		IP66
Vibration		10-55 Hz / 1.5 mm amplitude / 2 hours each in 3 direction
Shock		500 m/s² / 3 times each in 3 directions
Dielectric withstanding		Input/Output - Case, Input - Output AC2000V for 1 minute
Insulation resistance		20MΩ max. (at 500VDC)
Case material		Zinc die-cast
Mass		Transmitter. 720g, Receiver.:720g

Fiber	Only Fiber	on FA51/52	on OHC
GT205AD	55cm	2.7m	22m
GT21AD	55cm	2.7m	22m
GT22AD	50cm	2.5m	20m
GT23AD	45cm	2.2m	18m
GT25AD	40cm	2.0m	16m
GT27AD	35cm	1.8m	14m
GT210AD	30cm	1.5m	12m

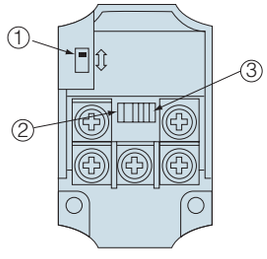
Operation and Switch Setting

Transmitter



①P.L: power indicator
②OP.L: light emission monitoring operation indicator
Illuminated when transmitter is functioning normally.

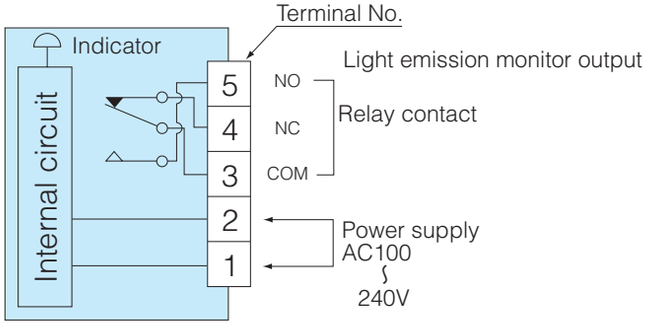
Receiver



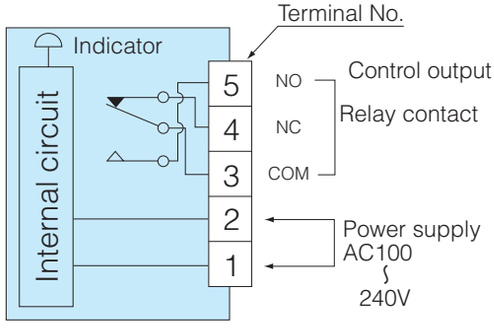
①Light-ON/Dark-ON selector switch
Set according to the situation
L.ON: signal output when light from transmitter is received.
D.ON: signal output when light is blocked.
②Operation indicator
Illuminated when output is activated.
③Level indicator
A set of 3 LEDs indicates stability.
LEVEL 1: illuminated when light intensity of about twice as much as operation level is detected.
LEVEL 2: illuminated when light intensity of about four times as much as operation level is detected.
LEVEL 3: illuminated when light intensity of about eight times as much as operation level is detected.

Input/Output Circuit and Connection

Transmitter



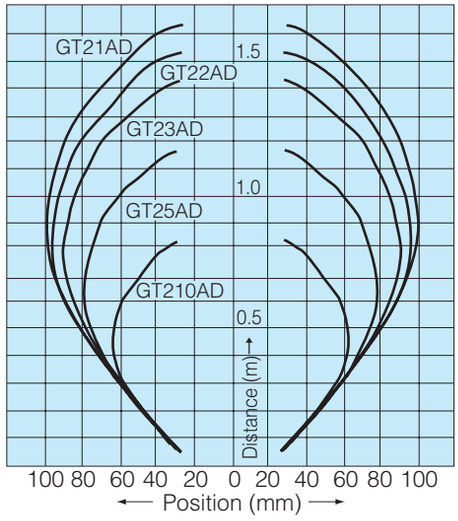
Receiver



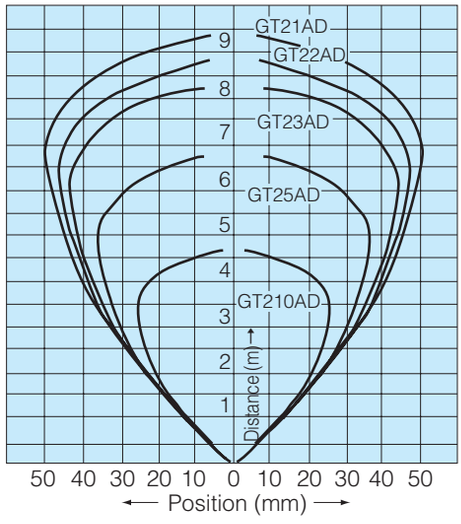
FT101

Directional Characteristics (Typical example)

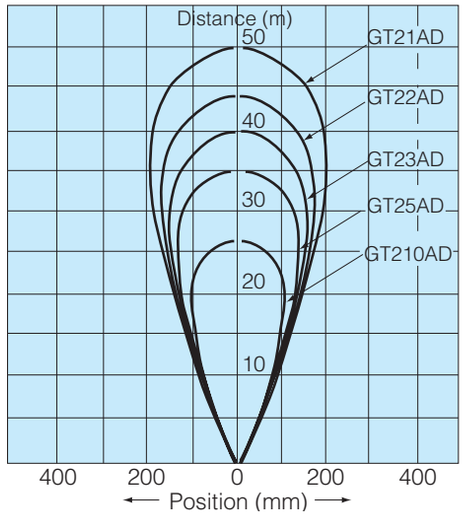
- Fiber only



- With lens unit FA51/52 attached

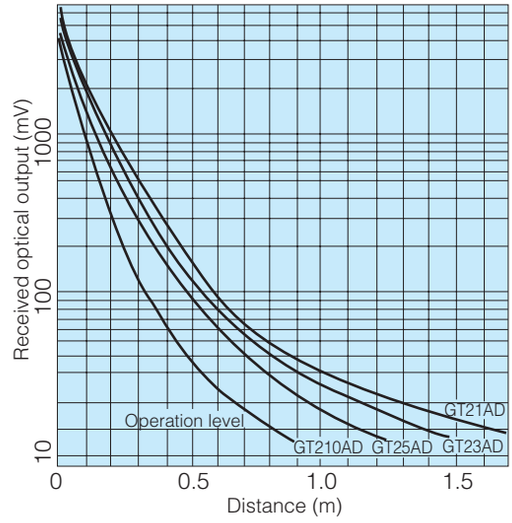


- With optical head OHC attached

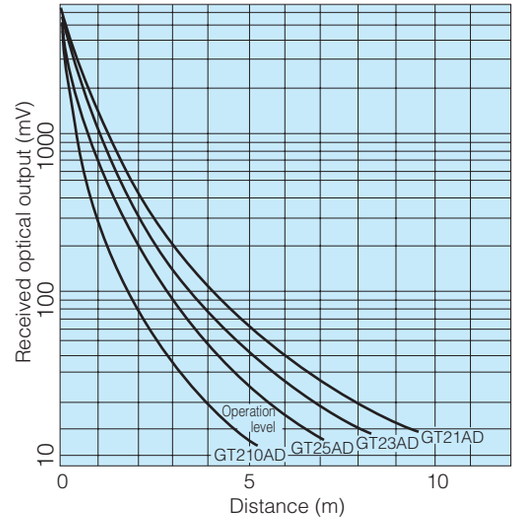


Distance-Output Characteristics (Typical example)

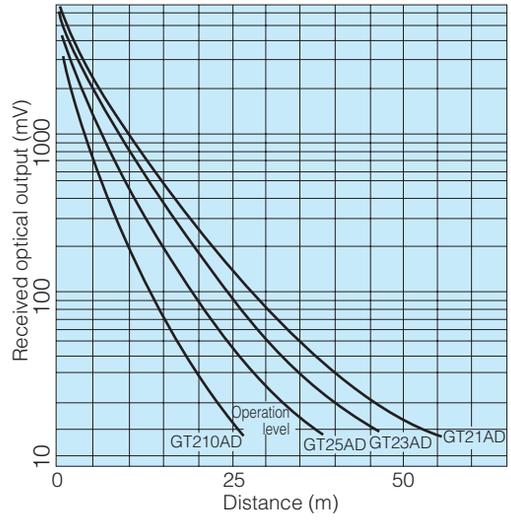
- Fiber only



- With lens unit FA51/52 attached



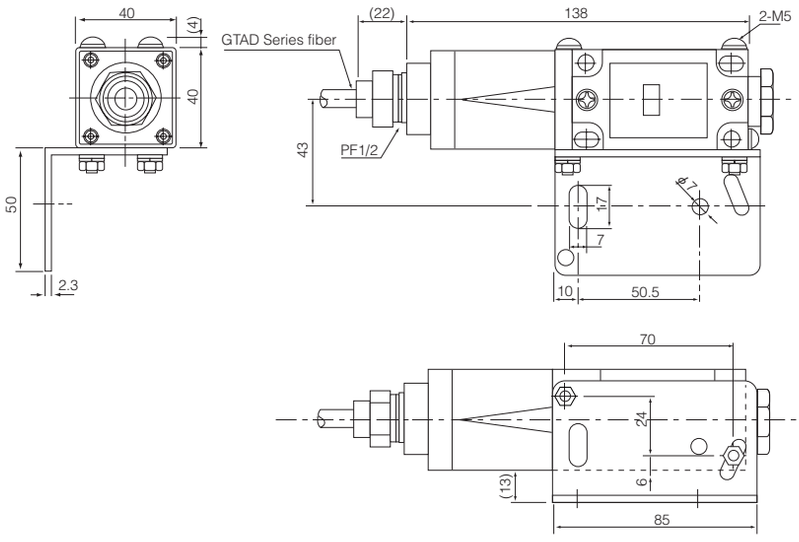
- With optical head OHC attached



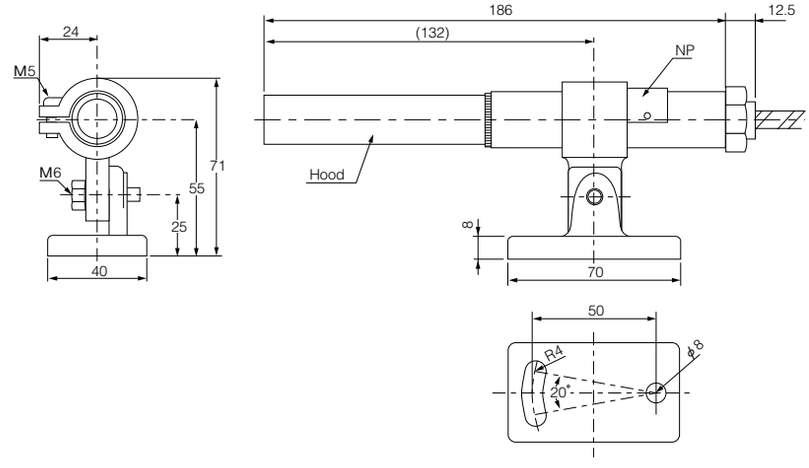
Dimensions (in mm; for transmitter and receiver)

Sensor main unit

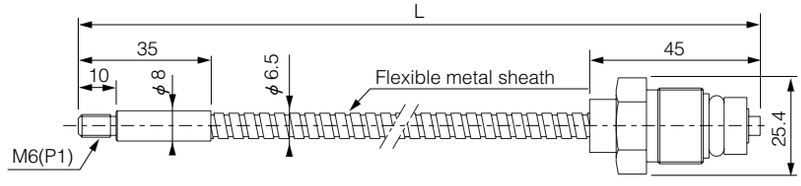
CAD



Optical head



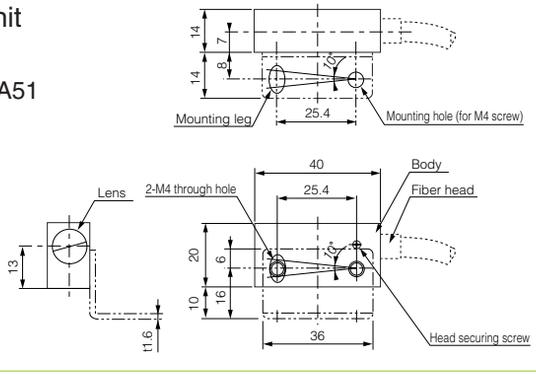
Fiber



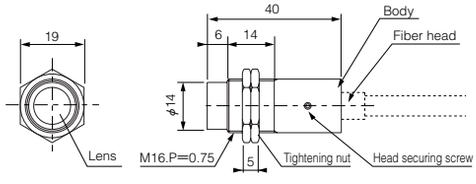
For fiber length (L), see Type/Price.

Lens unit

Model FA51



Model FA52

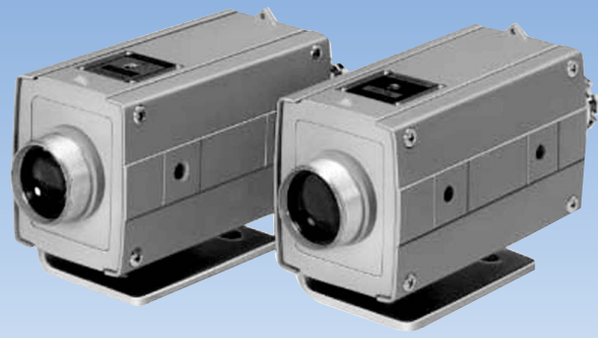


KL(R)50 series

Water-cooled CMD

Long distance (50 m) detection with high sensitivity
Compact, robust and inexpensive

Operating temperature: –10 - +150 °C



The KL(R)50 Series sensors are through-beam type CMDs that output ON-OFF signals by detecting blocking of light by the detected object that passes between the transmitter and receiver.
For receivers, relay output and voltage output types are available depending on the output mode.

Features

- Compact, low-cost
  Streamlined design provides the smallest size and lowest cost of all water-cooled, amplifier built-in type sensors
- Robust and lightweight case
  Robust case capable of withstanding severe operating conditions such as heat, water and shock also offering light weight is employed.
- Fully prepared for externa lightl disruption
  Unique circuitry ensures stable operation and high reliability under natural light of 300,000 lx or red-hot steel material of over 1,000 °C
- Excellent stability
  Received optical output about tenfold of operation level at detecting distance of 50 m ensures detection even with minor soiling of lens or in adverse environment.
- Optical sight convenient for alignment
  Both transmitter and receiver are provided with optical sight that facilitates light axis alignment
- Attachable airless dust hood or air purge hood
  Different types of airless dust hoods and air purge hoods are available for prevention of soiling of lens, etc.

Rating/Performance/ Specification/ Environmental Specification

Model	KL(R)50	KL(R)50E
Detection method	Through-beam type	
Detecting distance	50m max.	
Light source	Infrared LED	
Power Supply	AC100-110V/200-220V ±10% 50/60Hz	
Power consumption	4W max	
Operation mode	Light-ON	
Output type	Relay output	Voltage output
Rating	1 transfer contact 200 VAC 0.5 A (resistance load)	DC 10V 5mA
Smallest detectable object	ø28mm	
Operating angle	5° min.	
Response time	25ms max.	5ms max.
Resistance to external light	300,000 lx	
Indication	Transmitter: power indicator (red LED); receiver: light reception indicator (red LED)	
Ambient temperature	–10 - +55 °C (150 °C max. with water-cooling)	
Ambient humidity	35 - 85%RH Max. (Non-condensing)	
Insulation resistance	500 VDC, 20 MΩ or higher (between primary side of transformer/output terminal and case)	
Dielectric withstanding	1,500 VAC for 1 minute (between primary side of transformer/output terminal and case)	
Vibration	10-55 Hz / 1.5 mm amplitude / 2 hours each in 3 direction	
Shock	500 m/s² / 2 times each in 3 directions	
Protective structure	IP66	
Case material	Aluminum die-cast	
Connection	Terminal block (cord opening ground hub)	
Mass	Transmitter: 2kg max., receiver: 2kg max.	

Cooling water specification

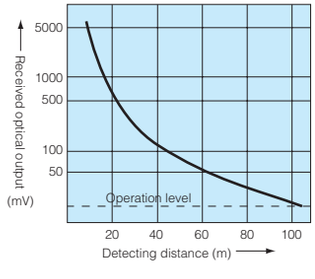
Flow rate	2 ℓ /minute min.
Temperature	+10 - +35°C
Withstand voltage	0.29MPa

Air purge specification (with optional part)

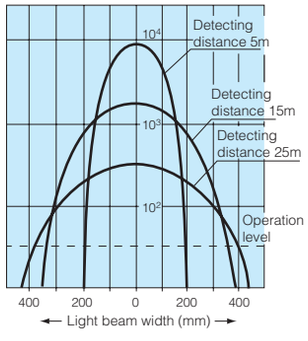
Flow rate	200 ℓ /minute min.
Withstand voltage	0.98MPa

Air not required for use of airless dust hood.

Distance-Output Characteristics (Typical example)

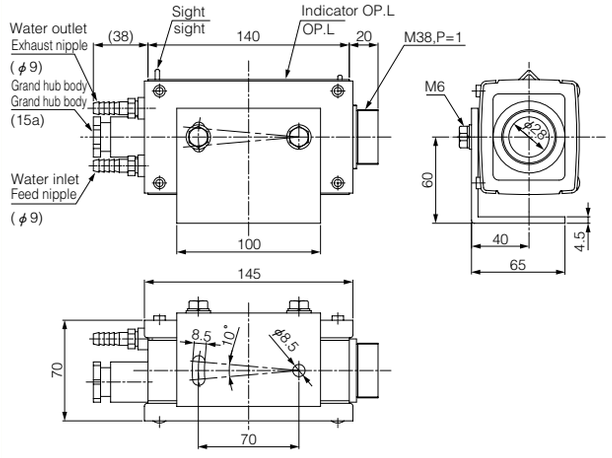


Light Beam Width Characteristics (Typical example)

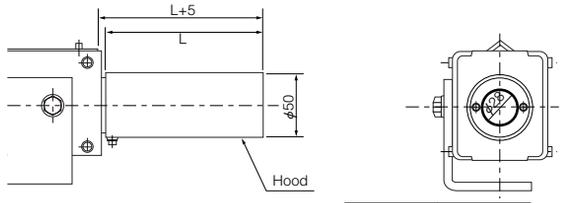


Dimensions (in mm)

Transmitter/receiver

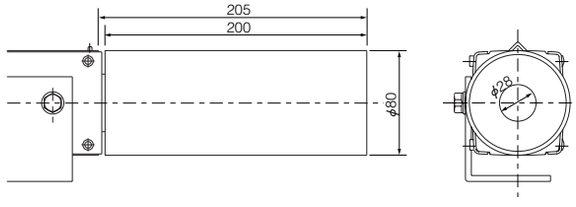


With Airless hood F38S Series attached

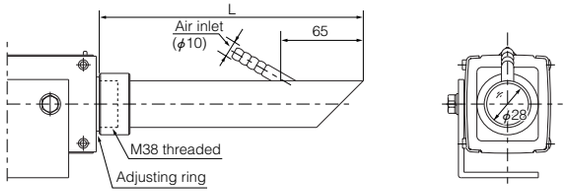


Model	Length (L)
F38S	120mm
F38S-03	300mm
F38S-04	400mm
F38S-05	500mm

With Airless hood F38N Series attached



With air purge hood attached

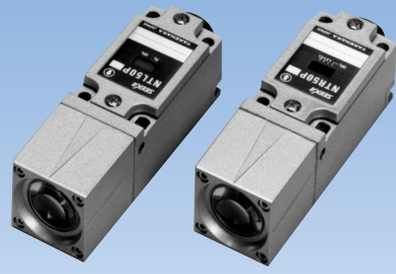


Model	Length (L)
302NC	215mm
303NC	315mm
304NC	415mm
305NC	515mm

NT50/100(P) series

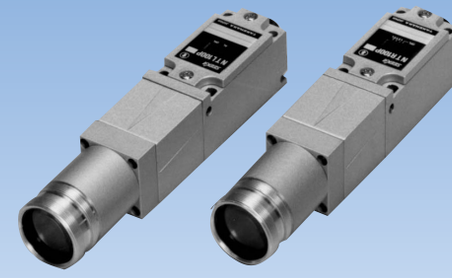
High-powered light transmission capable of withstanding adverse environmental conditions. Optional parts available for a wide range of applications

Detecting distance: 50 m max.
(NT50P)



Model NT50
Model NT50P

Detecting distance: 100 m max.
(NT100P)



Model NT100
Model NT100P

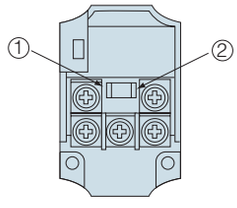
The NT50/100(P) Series sensors are high-powered CMDs designed to withstand severe operating environment (water, dust, etc.).

Features

- Smallest size of long-distance sensors
- 3-point level indicator with margin for reliable detection
  The green LED is illuminated at a level 8 times as much as the operation level but the inherent performance of the emission is over tenfold.
- DIN compatible robust Zinc die-cast case
- Integrated light emission monitor circuit in transmitter
  Alarm signal is output if light emission stops in the unlikely event of failure.
- Operation mode selectable
  Operation mode is selectable between Light-ON and Dark-ON with the switch provided.

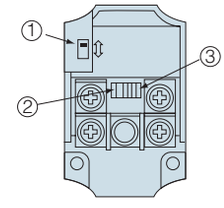
Panel Description

Transmitter



①P.L.
Indicator
②OP.L
Light emission monitoring operation indicator
Illuminated when transmitter is functioning normally.

Receiver



①Light-ON/Dark-ON selector switch
Set according to the situation
②Operation indicator
Illuminated when output is activated.
③Level indicator
A set of 3 LEDs indicates stability.

Rating/Performance/ Specification/ Environmental Specification

Rating/Performance	Models	Set type	**NT50**	**NT100**	**NT50P**	**NT100P**
		Transmitter type	**NTL50**	**NTL100**	**NTL50P**	**NTL100P**
		Receiver type	**NTR50**	**NTR100**	**NTR50P**	**NTR100P**
	Detection method		Through-beam			
	Detecting distance		50m	100m	50m	100m
	Detection object		ø22mm min.	ø28mm min.	ø22mm min.	ø28mm min.
	Power Supply		12-24VDC ±10% Ripple 10% max.		100 to 240V AC ±10% 50/60Hz	
	Current consumption / Power consumption		Transmitter: 30mA max. / Receiver: 35mA max.		Transmitter: 5W max. / Receiver: 5W max.	
	Output mode		NPN open collector Rating: sink current 200mA (30VDC) max.		Relay contact output 1C Rating: 250V AC 2A max. (resistance load)	
	Operation mode		Light-ON/Dark-ON selectable (with switch)			
	Light monitor		NPN open collector Rating: sink current 200mA (30VDC) max.		Relay contact output 1C Rating: 250V AC 2A max. (resistance load)	
		Power supply	ON OFF			
		Lighting	Normal (ON) Abnormal (OFF)			
		Output	ON OFF			
	Safety margin output		NPN open collector Rating: sink current 200mA (30VDC) max.			
	Response time		5ms max.		20ms max.	
Specification	Light source		Infrared LED (910nm)			
	Indicator		(Transmitter) P.L: Power indicator (Green LED) … Illuminated when power-on OP.L: Monitor indicator (Red LED) … Illuminated when emit light normally (Receiver) OP.L: Operation indicator (Red LED) …Illuminated when output-on LEVEL: Level indicator (Three level display) LEVEL1: yellow LED illuminated when light intensity of about twice as much as operation level is detected. LEVEL2: yellow LED illuminated when light intensity of about four times as much as operation level is detected. LEVEL3: green LED illuminated when light intensity of about eight times as much as operation level is detected.			
	Switch (SW)		Light-ON/Dark-ON selector switch provided (Remove the case lid of the receiver to access the switch.) Light-ON … Output at light receiving Dark-ON … Output at light blocking			
	Case materials		Zinc die-cast			
	Connection		Terminal block (screw: M3.5, width: 8.1mm)			
	Mass		Transmitter: about 700g Receiver: about 700g	Transmitter: about 800g Receiver: about 800g	Transmitter: about 700g Receiver: about 700g	Transmitter: about 800g Receiver: about 800g

Environmental Specification

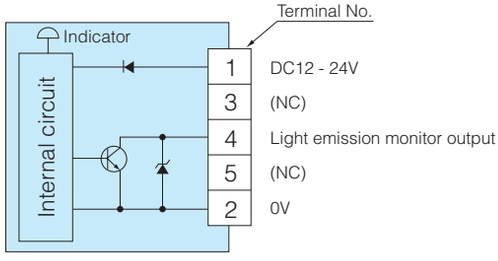
Environment	Ambient light (on light receiving surface)	50,000 lx max. (incandescent lamp)	50,000 lx max. (incandescent lamp) 100,000 lx max. (sunlight)
	Ambient temperature	-25 - +55°C (Non-freezing)*	
	Storage temperature	-40 - +70°C (Non-condensing)	
	Ambient humidity	35 - 85%RH (Non-condensing)	
	Protective structure	IP66	
	Vibration	10-55 Hz / 1.5 mm amplitude / 2 hours each in 3 direction	
	Shock	1000 m/s² / 3 times each in 3 directions	500 m/s² / 3 times each in 3 directions
	Dielectric withstanding	500 VAC for 1 minute (between input/output and case)	2000 VAC for 1 minute (between input/output and case)
	Insulation resistance	500 VDC, 20 MΩ or higher	

* Some models may be used in environment of up to 110°C by attaching water-cooling jacket. Contact Takex for details.

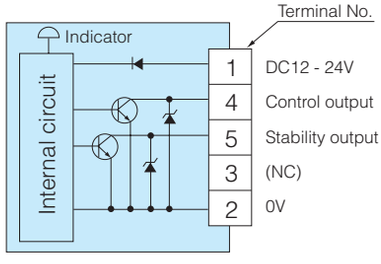
Input/Output Circuit and Connection

NT50/NT100

(Transmitter)

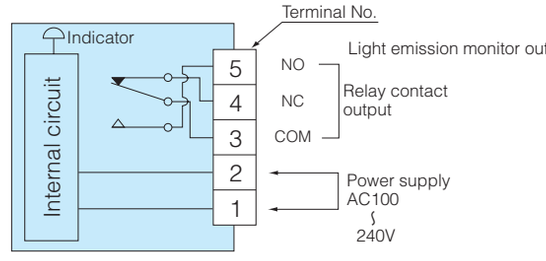


(Receiver)

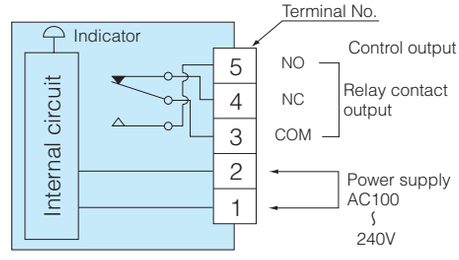


NT50P/NT100P

(Transmitter)



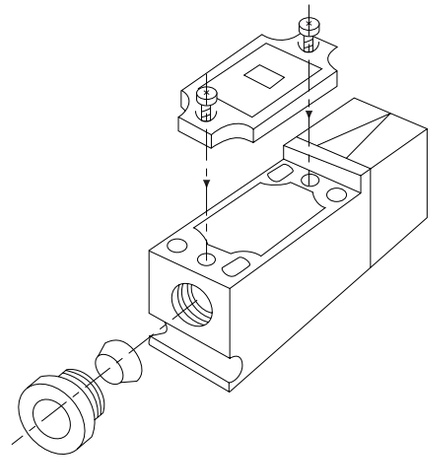
(Receiver)



- Connection

For connection, use cables of 9-11 mm in diameter.

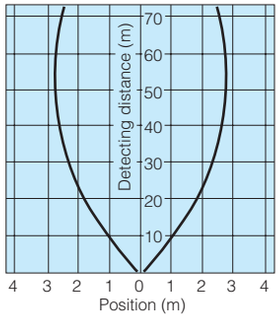
Loosen the screws on the lid of the body to remove the lid.



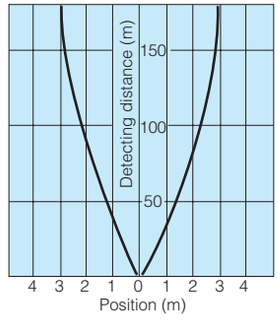
The rubber packing must be attached in the right orientation.

Directional Characteristics (Typical example)

NT50 (P)

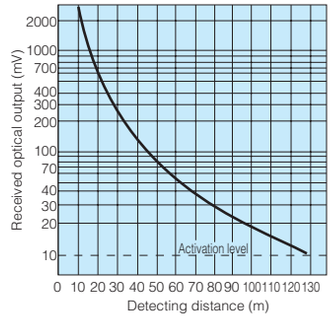


NT100 (P)

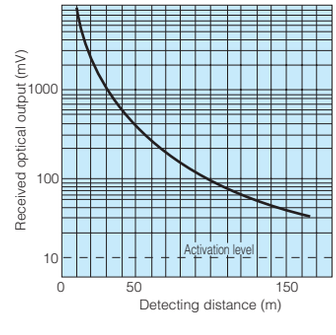


Distance-Output Characteristics (Typical example)

NT50 (P)



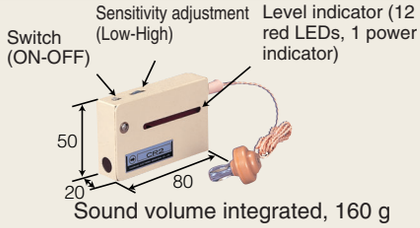
NT100 (P)



Optional Parts

Checker CR2

Used for aligning the light axis while observing the light emitted from the transmitter with “sound” and “level indicator.” Find the light from the transmitter with the checker and adjust the orientation of the transmitter so that the receiver is installed at the center of the light.



Sound volume integrated, 160 g
Level indicator provided

Hood (Applicable to NT50(P))

Hood H301

Airless hood F301

Air purge hood A301

Energy-saving airless dust hood taking advantage of muffler effect for preventing soiling of lens.

Air purge hood for prevention of soiling of lens.

Airless hood (Applicable to NT100(P))

F38S

Energy-saving airless dust hood taking advantage of muffler effect for preventing soiling of lens.

Pinhole plate (Applicable to NT50(P))

Use of pinhole plates reduces the smallest allowable detection object diameter and activation area. Note that the detecting distance is reduced as well.

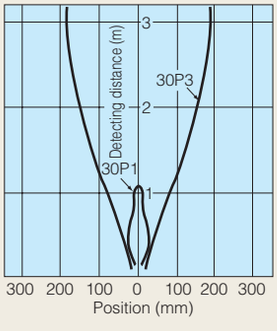
Model	Pinhole diameter
30P1	ø1
30P3	ø3
30P5	ø5
30P7	ø7
30P10	ø10

(mm)

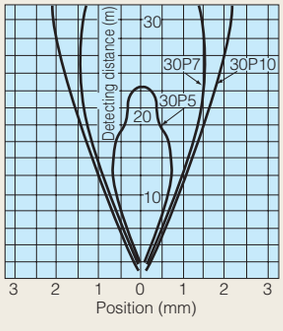
Directional Characteristics (Typical example)

NT50(P): with pinhole plate (optional) attached to both transmitter and receiver

With 30P1/30P3 attached

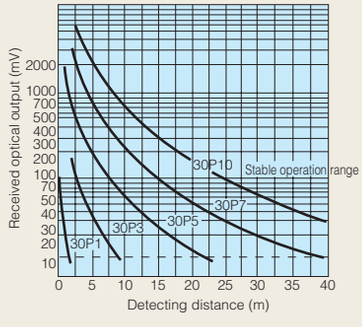


With 30P5/30P7/30P10 attached



Distance-Output Characteristics (Typical example)

NT50(P): with pinhole plate (optional) attached to both transmitter and receiver



Installation

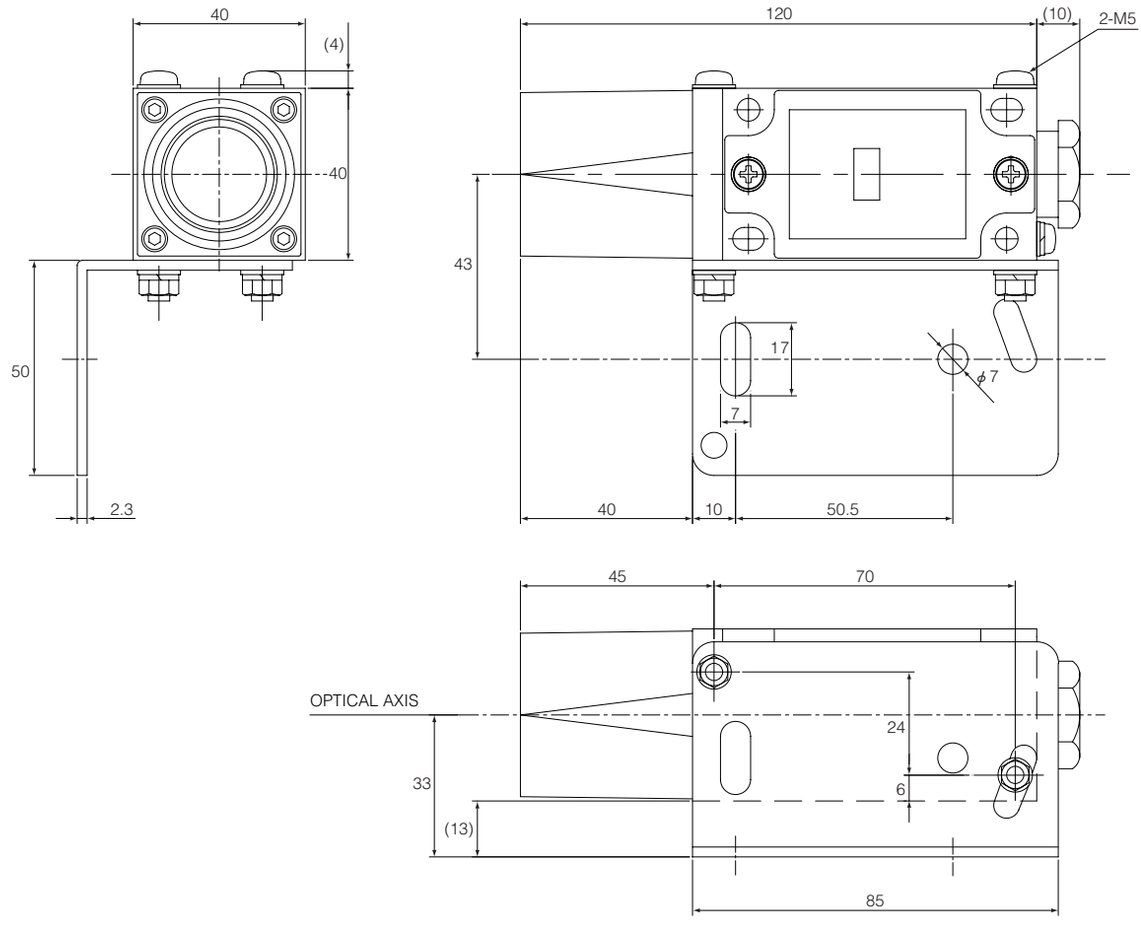
For mounting, use a solid base not subject to vibration.

Use 2 M6 bolts for securing the sensor body (separately prepare bolts, nuts, washers, etc.).

Dimensions (in mm)

Model NT50 NT50P

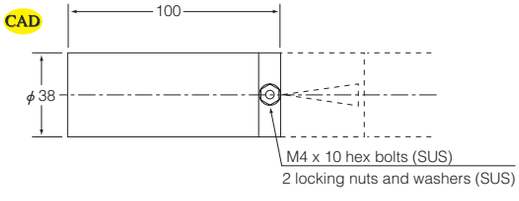
CAD



Hoods (optional)

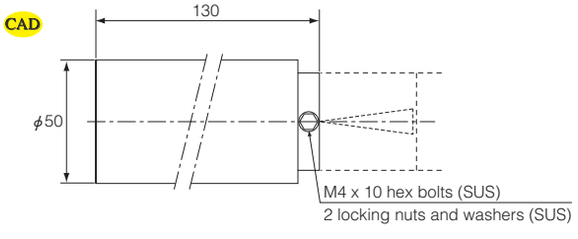
H301 (hood)

CAD



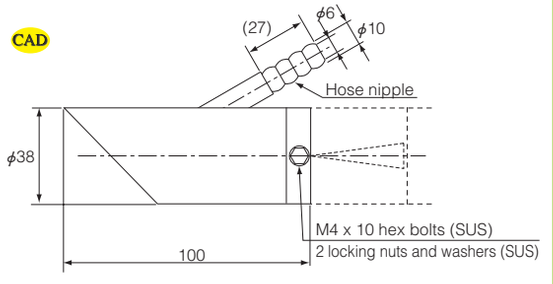
F301 (Airless hood)

CAD



A301 (air purge hood)

CAD

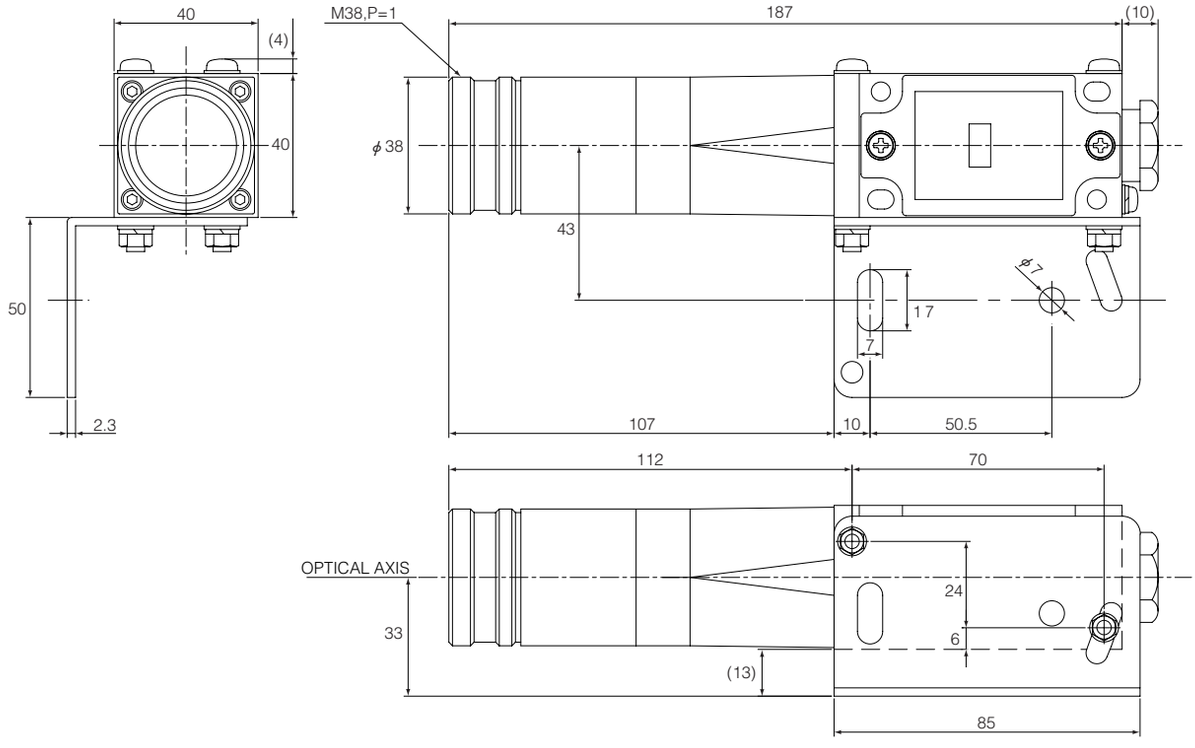


Air purge specification
Flow rate···200ℓ/min
Withstand pressure···0.98MPa

Dimensions (in mm)

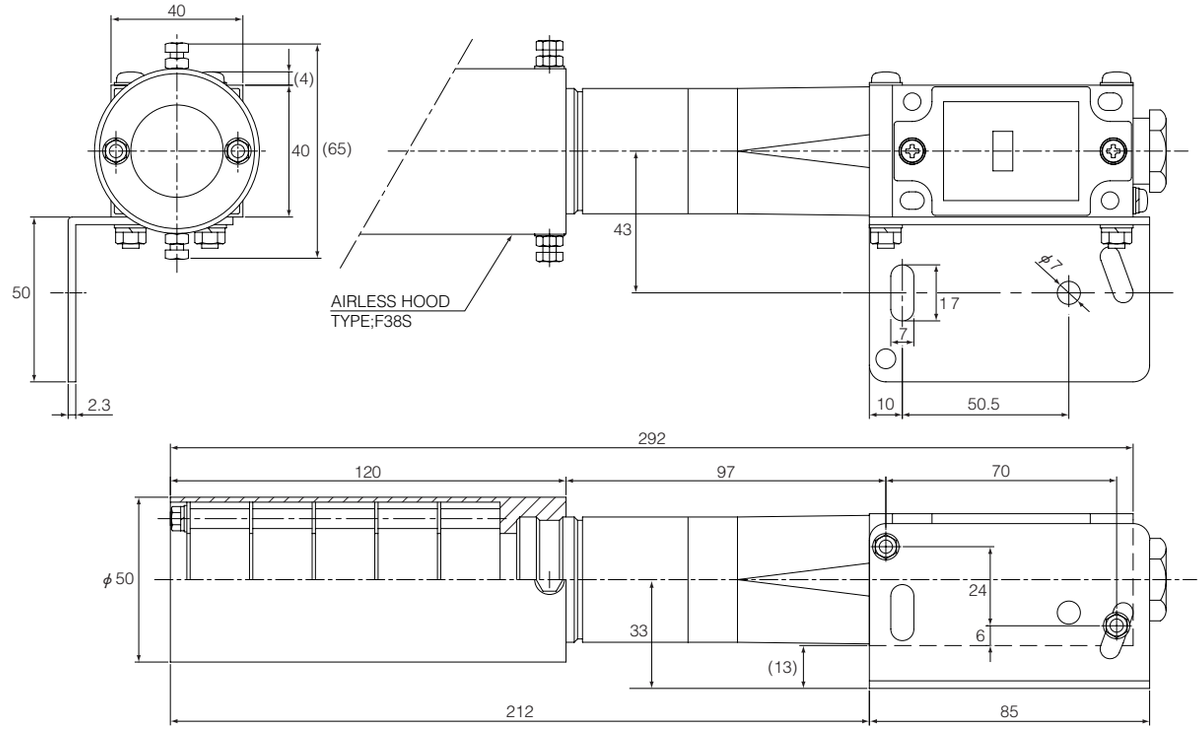
Model NT100 NT100P

CAD



With F38S Airless hood (optional) attached

CAD



SWD55

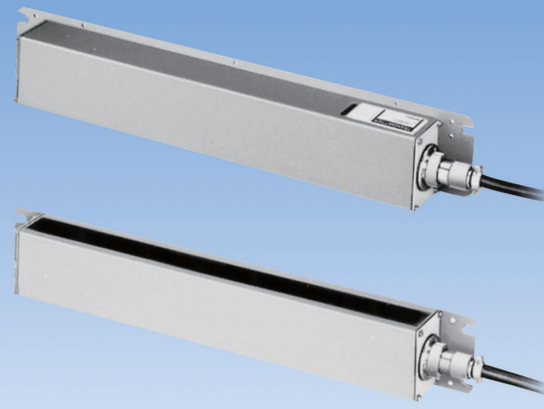
Punch hole detection sensor

High sensitivity provides reliable detection of ø8 hole

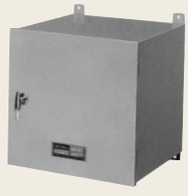
For single hole

Transmitter SWD55L

Receiver SWD55R



Controller SWD55B



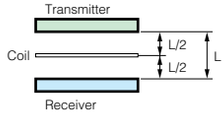
With case

Without case

Features

- Excellent reliability
  High performance characterized by the smallest detectable hole diameter of 8 mm and margin in operation of over 30 times as much as operation level for transmitter and receiver circuits ensures detection even with minor soiling of lens.
- Simple light axis alignment
  Transmitter and receiver are provided with devices exclusively for light axis alignment and lamps are illuminated when the light axis is aligned, facilitating accurate alignment.
- Superb Vibration and waterproofing
  Case and structure time-tested in press safety sensors are employed for transmitter and receiver, withstanding adverse environment.
- Streamlined circuit design has further reduced power consumption. Unitization of transmitter and receiver has achieved about 50-% reduction of size from the conventional model.
- Air purge hood or water-cooling jacket can be attached as required.

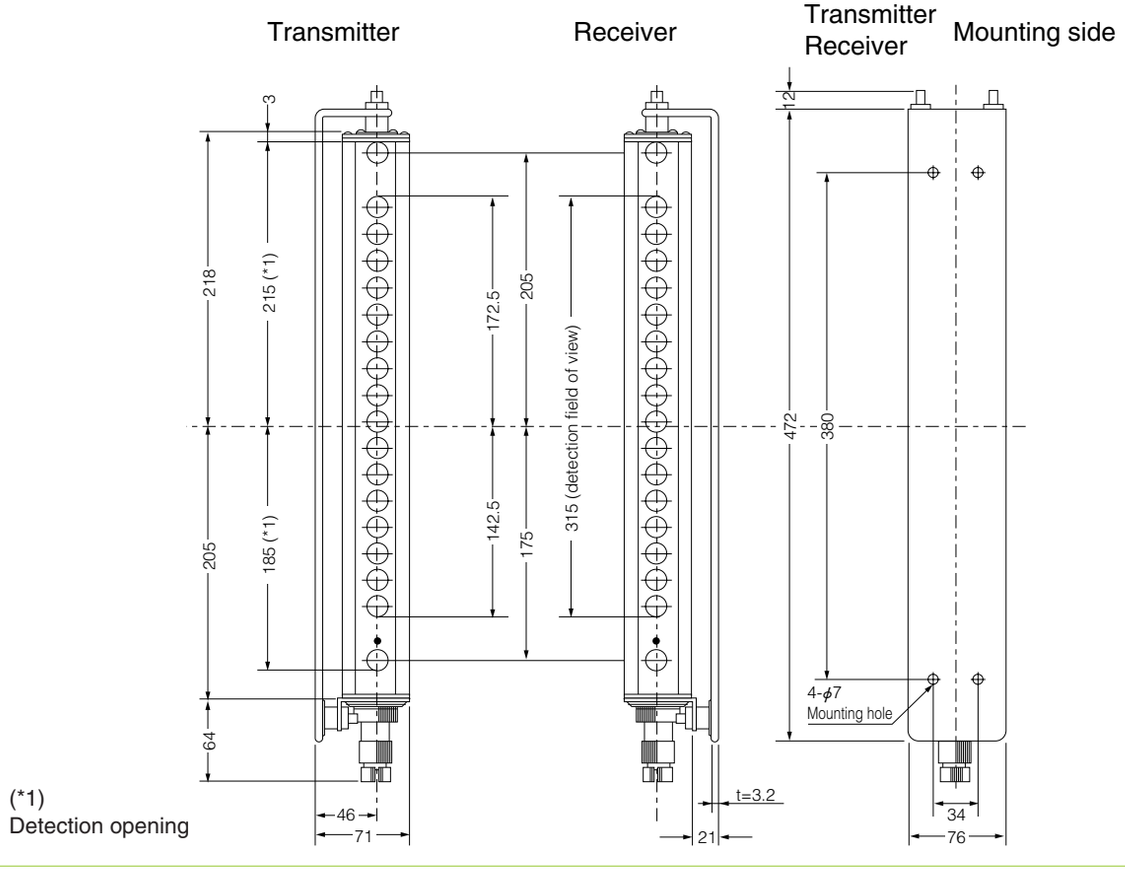
Rating/Performance/ Specification (Transmitter/Receiver)

Model	SWD55L·SWD55R
Detecting distance	Between transmitter and receiver L=400-1000mm Between transmitter and coil L1=200mm min. Between receiver and coil L2=200mm min. 
Light source	Infrared LED
Light-sensitive element	Silicon phototransistor
Effective detecting width	300mm
Ambient temperature	–10 - +55 °C (Non-freezing/ Non-condensing)
Insulation resistance	500 VDC, 20 MΩ or higher (between power supply and case) 500 VDC, 20 MΩ or higher (between output and case) (receiver only)
Dielectric withstanding	500 VAC for 1 minute (between power supply and case) 500 VAC for 1 minute (between output supply and case) (receiver only)
Connection	Metal connector (cord not provided)
Protective structure	IP66
Mass	Transmitter: about 3kg, receiver: about 3kg max.
Power Supply	Supplied by controller

(Controller)

Model	SWD55B
Output	Relay contact 1c and open collector output (Light-ON)
Output rating	Relay contact: 250 VAC 5 A (resistance load) Open collector output: 48 VDC 75 mA max., transistor activated for output
Operation	One-shot output, duration variable between 0.1 and 1 second
Response time	25ms max
Power supply	100-110 VAC or 200-220 VAC (Normal-rated voltage: +10%/–15%, 50/60 Hz)
Power consumption	20W max.
Ambient temperature	–10 - +55 °C(Non-freezing/ Non-condensing)
Insulation resistance	500 VDC, 20 MΩ or higher (between power supply/output and case) 500 VDC, 20 MΩ or higher (between power supply and output) (receiver only)
Dielectric withstanding	1,500 VAC for 1 minute (between power supply/output and case) 1,500 VAC for 1 minute (between power supply and output)
Connection	Terminal block
Protective structure	IP40 (with case)
Mass	About 8.7kg

Dimension (in mm) (in mm; for controller, see P.551)



SWD60(E)

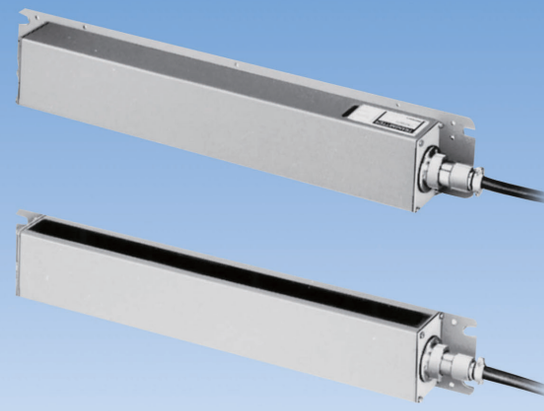
Punch hole detection sensor

Self-check feature integrated

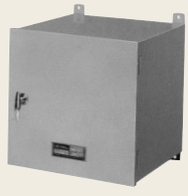
Transmitter SWD60T

Receiver SWD60R (E)

For single- and double-hole detection



Controller SWD60B



With case

Without case

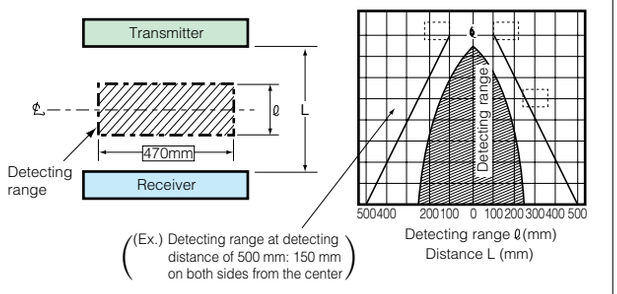
Air purge unit or water-cooling jacket can be optionally attached to the transmitter and receiver.
Air purge unit: model AP60ET (for transmitter)
AP60ER (for receiver)
Water-cooling jacket: model WJ60E (for transmitter/receiver)

- Edge processing feature available (separate model)
  For plate width narrower than effective detecting width of the sensor, receiver provided with an edge processing feature is available.
  Receiver model: SWD60RE

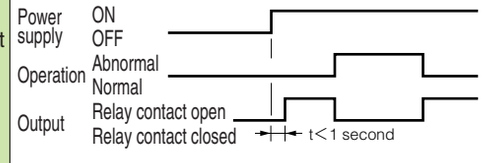
Features

- Differentiation between single and double holes
  One set of sensor is capable of differentiation between single and double holes, generating various types of output signals
- Simple light axis alignment
  When light is fully received (nothing in the detection area between the transmitter and receiver), the AMP gain of the receiver is reduced to about 1/10 of the ordinary detection of punch holes. When the light axis is aligned in this condition, the SAFETY lamp on the receiver is illuminated.
- Self-check feature
  The transmitter is provided with light emission monitor circuit, which checks for any abnormality in light emission and outputs alarm signal accordingly. The receiver allows external checking of whether it is functioning normally.
  When light is fully received, the AMP gain of the receiver is automatically reduced to about 1/10. If the receiver detects full light reception in this condition, the SAFETY lamps on the receiver and controller are illuminated, indicating that the received light intensity level has a margin of more than tenfold.

Rating/Performance/ Specification (Transmitter/Receiver)

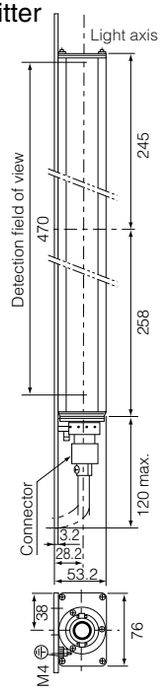
Detecting distance	250-1,000 mm between transmitter and receiver (500 mm recommended)
Detecting range within detecting distance	
Effective detecting width	470mm
Light source	Infrared LED
Light-sensitive element	Silicon photodiode
Power supply	Supplied by controller (24 VDC (20-30 V), ripple 10% max.)
Current consumption	Transmitter: 280 mA max.; receiver: 210 mA max.
Ambient temperature	–25 - +55 °C (80 °C max. with water-cooling)
Storage temperature range	-40 - 70°C (Non-freezing)
Ambient humidity	35 - 85%RH (Non-condensing)
Vibration	10-55 Hz / 1.5 mm amplitude / 2 hours each in 3 direction
Shock	500 m/s² / 3 times each in 3 directions
Connection	Metal connector (cord length: 2 m)
Protective structure	IP66
Mass	Transmitter: about 2.6 kg (including 2-m cord) Receiver: about 2.9 kg (including 2-m cord) Air purge unit: about 0.3 kg Water-cooling jacket: about 1.7 kg.

(Controller)

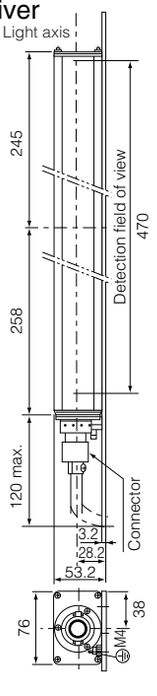
Control output	Single-hole detection output	Relay contact 1c and NPN open collector output (floating)
	Double-hole detection output	Relay contact 1c and NPN open collector output (floating)
	Output rating	Relay contact: 250 VAC 5 A (resistance load) NPN Open collector output: 30VDC 100mA.
	Operation mode	One-shot output; duration variable between 0.1-1 second (adjustment volume on panel)
	Response time	Relay contact: 30 ms max. NPN Open collector output: 3ms max.
SAFETY output		Relay contact 1a
	Output rating	250 VAC 5 A (resistance load)
ALARM output operation mode		
	Output rating	Relay contact 250VAC 5A (resistance load)
Receiver check input		a (normally-open) contact input (short-circuiting of Terminals 9 and 10)
Power supply		100, 110, 200 or 220 VAC (rated voltage: –15+10%, 50/60 Hz)
Power consumption		30W max.
Ambient temperature		–25 - +55 °C (non-freezing)
Storage temperature range		-40 to 70°C (Non-condensing)
Ambient humidity		35 - 85%RH max. (Non-condensing)
Dielectric withstanding/ Insulation resistance	Between power supply and case Between relay contact output and case Between relay contact output and power supply	1,500 VAC for 1 minute 20 MΩ or higher (with 500 VDC megohmmeter)
	Between open collector output and case Between open collector output and power supply	1,000 VAC for 1 minute 20 MΩ or higher (with 250 VDC megohmmeter)
Vibration		10-55 Hz / 1.5 mm amplitude / 2 hours each in 3 direction
Shock		500 m/s² / 3 times each in 3 directions
Connection		Terminal block
Protective structure		IP40 (with case)
Mass		About 9kg

Dimension (in mm)

Transmitter

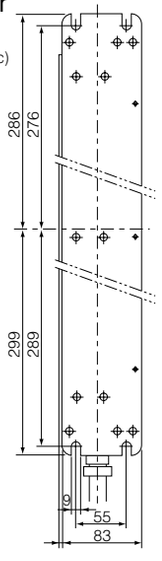


Receiver



Transmitter/receiver mounting side

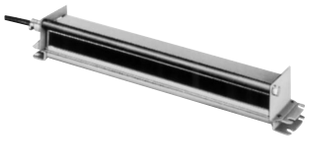
(Transmitter symmetric)

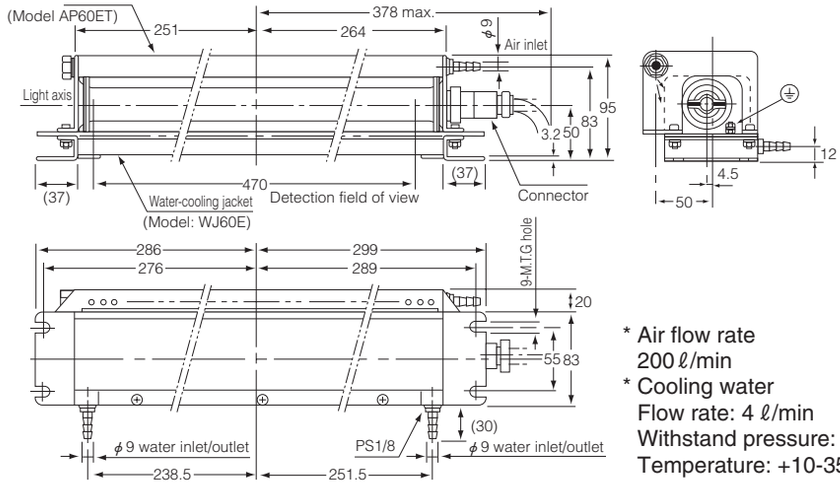


SWD60

Dimensions (in mm; transmitter/receiver)

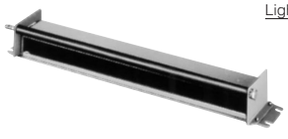
- With air purge unit and water-cooling jacket attached

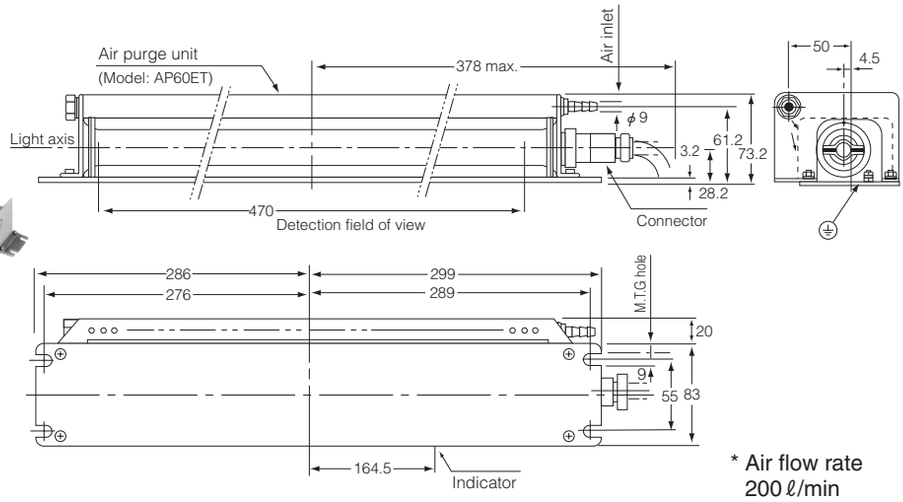




* Air flow rate
  200 ℓ/min
* Cooling water
  Flow rate: 4 ℓ/min
  Withstand pressure: 0.59MPa
  Temperature: +10-35 degrees C

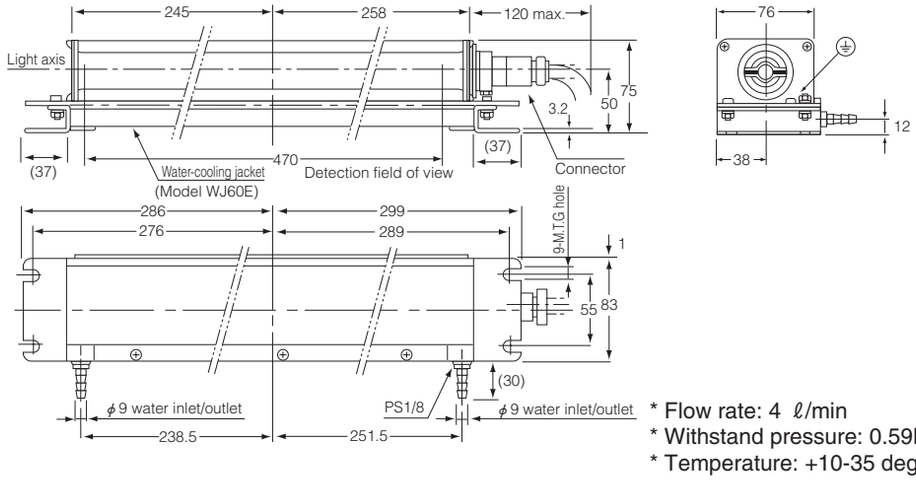
- With air purge unit attached





* Air flow rate
  200 ℓ/min

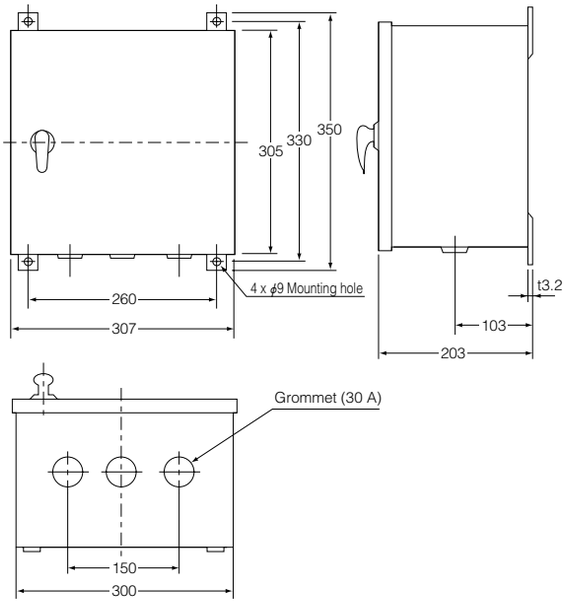
- With water-cooling jacket attached



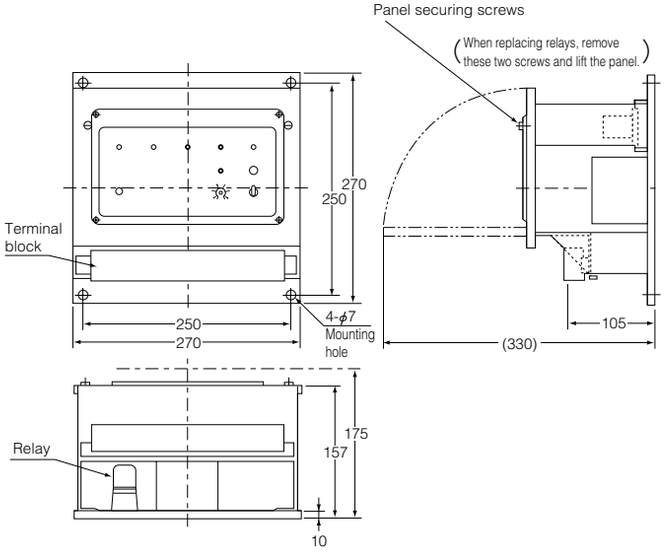
* Flow rate: 4 ℓ/min
* Withstand pressure: 0.59MPa
* Temperature: +10-35 degrees C

Dimensions (in mm; controller SWD55/SWD60)

With case



Without case



Basic Knowledge about Semiconductor Laser Photo Sensors

1. Laser types and applications

Types of laser include gas laser, solid-state laser, semiconductor laser, etc., of which He-Ne laser (for detection of objects moving at high speeds, detection of flaws, defects, marking, etc.) and semiconductor laser (laser diode) are used for photo sensors.

2. Semiconductor laser (laser diode)

In terms of light emission, semiconductor laser is based on a similar principle to that of LEDs. For this reason, light emission output depends on the driving current (Figure 1).
At small current, laser emits light based on the same principle as that of LEDs (power as low as LEDs). When the current value exceeds a certain level (threshold current), however, the optical power rapidly increases. This phenomenon is called laser oscillation (Figure 2).

Figure 1

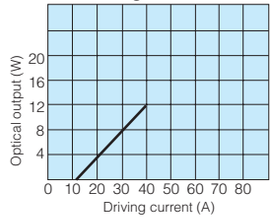
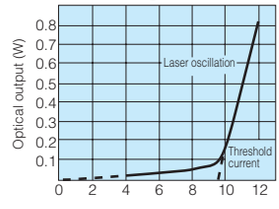


Figure 2

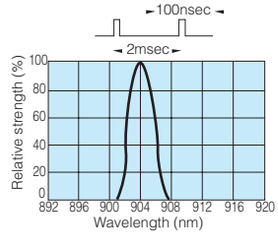


Types of semiconductor laser include laser for continuous oscillation used for optical communication, audio, etc. and laser for pulsed oscillation used in photo sensors.
Optical output is a few mW for laser for continuous oscillation. Laser for pulsed oscillation emits light of extremely short time with a pulse width of 100 nsec and provides several-to-100 W.
Laser beam is characterized by monochromatic spectrum and continuous wave (coherence) as well as high output.
Photo sensors take advantage of the latter property: high power. This allows semiconductor laser CMDs to be used in atmosphere that does not allow use of LED type CMDs.

3. Laser diode and modulation frequency used in KL/R44A(HP), FT44/441A

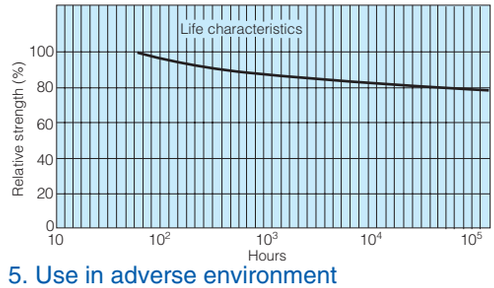
	KL44A FTL441A	KL44A-HP FTL44A
Optical peak output	10W	90W
Peak wavelength	904nm	
Modulation frequency	500Hz	

$$\text{Duty ratio} = \frac{100\text{nsec}}{2\text{msec}} = 0.005\%$$



4. Life of laser diode

Service life of laser diode depends on the operating conditions. Generally, optical output is reduced to about 80% when used at the maximum rating for about 1,000 hours.
Takex's laser CMDs are driven at about 60% of the maximum rating and the service life may be generalized as shown in the figure based on the operating conditions and past results.
Reduction of optical output (emission efficiency) applies to LEDs as well.
With a laser diode, if the optical output is reduced to 80%, it is incomparably higher than that of an LED and received light intensity level has a sufficient margin, which poses no problem in the actual use.
Takex's CMDs integrate a light emission monitor circuit in the transmitter for constantly high optical output (large margin in operation), which outputs an alarm signal when the optical output is reduced to 80% of the initial value.



5. Use in adverse environment

(1) Heating furnace
If the atmosphere in the furnace is clean without flame, CMDs that employ LED as the light source serves the purpose. If partial combustion generates flame that blocks the light axis, light from the transmitter is absorbed by the flame and the received light intensity is greatly reduced.
Especially, any black smoke generated absorbs significant amount of light and CMDs with LED will be in a light blocking state.
CMDs with laser diode used as the light source compensate for this absorption with the high output of the light source and minor black smoke poses no problem at all.
(2) Vapor
Vapor causes absorption and irregular reflection. Ordinary photo sensors emit light beam that penetrates tens of meters under water and absorption can be disregarded.
Vapor irregularly reflects all types of light and even laser beam is not perfectly insusceptible of this effect in that it has properties of light. If a large amount of vapor is present as in descaling spray, sensors that use near-infrared ray virtually cannot be used.
For this reason, be sure to conduct a test to check the operation in a situation subject to vapor.

6. Safety measures

Safety measures according to JIS C 6802 "Safety of Laser Products," etc. must be taken. See "Notes on Safety" on p. 516, "Laser Safety Standards" on p. 853, etc.