TAKEX

OPTICAL FIBER TYPE PHOTOELECTRIC SWITCH [CMD]

INSTRUCTION MANUAL

TYPE TRANSMITTER (LIGHT SOURCE) : **FTL10A**
RECEIVER : **FTR10A FTR10AH FTR10AC**

- Use it properly in accordance with the instruction manual and the delivery specification.
- Keep an instruction manual carefully.
- Approve the specification of this product and a contour dimension because it may be changed to the one without the notice.
- The guarantee period of this product is one year after the delivery.
- When a problem by out responsibility arises in the quarantee period of this product. It lets me do only the repair of the part of the problem or the exchange of the problem product.
- Each our product doesn't have a control function such as the prevention of disasters and the prevention of the accident as a product's own function.
- Approve it because our company isn't responsible for the damages due to the disaster if it occurred in the one related to the machine which these products were used for, the accident, and so on and others.

TAKENAKA ELECTRONIC INDUSTRIAL CO.,LTD.

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INSTRUCTION MANUAL

TYPE **TRANSMITTER : FTL10A**
RECEIVER : FTR10A FTR10AH FTR10AC

Contents

■ Prior to your use, carefully read this manual.

■ After reading, securely file and keep the manual.

1. OUTLINE

- This photoelectric switch (CMD : Cold Metal Detector) is a detector which is mainly used in steel plants to detect passage or presence of steel materials and generates ON-OFF output.
  In the detector unit, highly heat-resistant and transparent optical fiber is used.
  Therefore, no cooling is needed even in high temperature and the detector can be applied effectively to the detection of ingots, slabs, shaped steels etc. even in bad and rigorous ambient conditions in steel plants, etc.
- Three models with different outputs are available; mini-power relay output, high speed signal relay output and AC/DC control solid state output.
  A suitable model can be selected according to the response speed and load of the processing.

2. FEATURES

- NO COOLING
  The detector unit consists of optical system and optical fiber, which include no electronic parts, so it can be used up to 200℃ of ambient temperature without water cooling.

- HIGHLY DURABLE DETECTOR UNIT
  The outer covering of the optical fiber is stainless steel blades fitted on a flexible tube and is highly heat and corrosion resistive and highly durable.

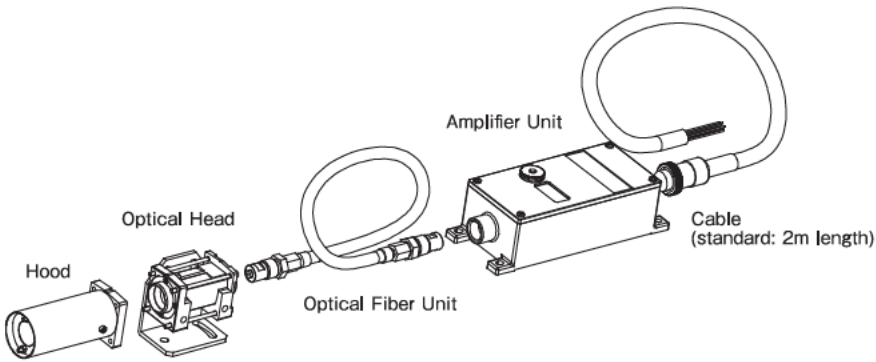
- POWER SUPPLY IS OPTIONAL
  Selectable freely between 100V to 220V AC

- SELF-CHECK FUNCTION
  A monitoring circuit is built in the transmitter, which issues an alarm upon reduction of light intensity or failure of light emission due to trouble or the like.
  The receiver has a margin check function, by which the light level is always checked when the light is received. If no margin is left in the received light level due to the deviation of the photo-beam axis or stains on the lens surface, safety alarm is output.

- 5-POINT LEVEL INDICATOR
  Photo sensing level is always displayed by five LEDs.

3. CONFIGURATION OF THE DEVICE

This product consists of an optical head, a hood, an optical fiber unit and an amplifier unit.
The optical head, hood and optical fiber unit are common for both the transmitter and receiver.



■ Optical Head
This unit consists of only optical parts and has a heat resistance of 200℃.

■ Hood
Hood prevents dirt sticking on the lens of the optical head.
Airless and air-purge hood are available.

■ Optical Fiber Unit
Light guide to transfer the light between optical head and amplifier unit.
A flexible tube with stainless steel blade is employed as the covering.

■ Amplifier Unit
All electronic components including the trasmitter / receiver and the power supply unit are enclosed in this amplifier unit.

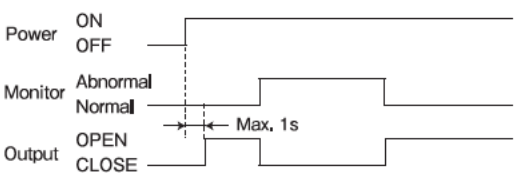
4. SPECIFICATIONS

■ TYPE

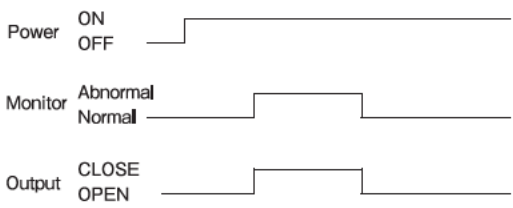
Unit			Type	Remark
Amplifier unit		Transmitter	FTL10A	
		Receiver	FTR10A	Mini power relay output Type
			FTR10AH	Signal relay output Type
			FTR10AC	Solid state output Type
Optical head			OHA	Standard Type
			OH2	High power Type
			OH2N	Narrowness view Type
Hood	Airless hood	For OHA	F38A	Compact and light weight type, 120mm in length
			F38A-02	200mm in length
			F38A-03	300mm in length
			F38A-04	400mm in length
			F38A-05	500mm in length
		For OH2/OH2N	F70N	300mm in length
	Air-purge hood	For OHA	F38PC-02	200mm in length
			F38PC-03	300mm in length
			F38PC-04	400mm in length
			F38PC-05	500mm in length
		For OH2/OH2N	702L	200mm in length
			703L	300mm in length
			704L	400mm in length
			705L	500mm in length
Optical fiber unit			FG2	2m in length
			FG3	3m in length
			FG4	4m in length
			FG5	5m in length
			FG7	7m in length
			FG10	10m in length
			FG12	12m in length
			FG15	15m in length
			FG20	20m in length
			FG30	30m in length

■ OUTPUT SPECIFICATIONS

◇ TRANSMITTER

Type	FTL10A
Operating output Mode	
Rating	Contact output, Max.5A 250V AC (Resistive load)

◇ RECEIVER

Type	FTR10A	FTR10AH	FTR10AC
Output modes	Mini power relay output	Signal relay output	Solid state output
Control output	ON-OFF control (Light ON)		
Rating	SPDT Max.5A 250V AC (Resistive load)	SPDT Max.0.5A 48V DC (Resistive load)	Max.0.5A 250V AC.DC (Resistive load)
Response time	15ms or less	5ms or less	3ms or less
Safety alarm output Mode			
Rating	a contact Max.5A 250V AC (Resistive load)		

All models have a mini power relay output for the Safety alarm output.

Mini power relay ST1-DC24V : Panasonic

Signal relay TN2-24 : Panasonic

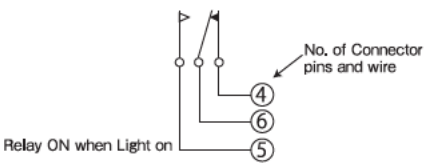
◇ OUTPUT CIRCUIT

Control output

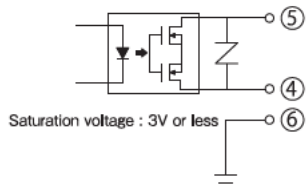
Minipower relay output type : FTR10A

Signal relay output type : FTR10AH

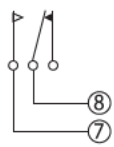
Control output



Solid state output type : FTR10AC

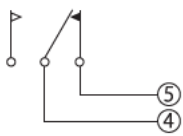


Safety alarm output type: FTR10A, FTR10AH, FTR10AC



Relay CLOSE when it is abnormal state

Monitor output type : FTL10A



Relay CLOSE when it is abnormal state

■ GENERAL SPEC

Sensing distance		Optical fiber length : 2m…40m or less 12m…19m or less 5m…30m or less 15m…18m or less 10m…20m or less 20m…15m or less 30m…10m or less
Lens aperture		28mm DIA (OHA) 56mm DIA (OH2, OH2N)
Minimum detectable object		28mm DIA or large (OHA) 60mm DIA or larger (OH2, OH2N)
Power supply		AC100 to 220V −15% to +10% 50/60Hz
Light source (light wavelength)		Infrared LED (950nm)
Power consumption		Transmitter : 10W or less Receiver : 10W or less
Connection		Connector type leaded 2m wire (CVV 1.25mm^2)
Ambient temperature		Optical Head & Optical Fiber unit : −25 to +200℃ Amplifier unit : −25 to +55℃ (with no icing)
Storage Temperature		−40 to +70℃ (with no condensation and no icing)
Relative humidity		35 to 85% RH or less (with no condensation)
Bending limit of Optical Fiber		50mm
Insulation resistance		Power supply to Case : 20MΩ or more. DC500V
		Output to Case : 20MΩ or more. DC500V
		Power supply to Output : 20MΩ or more. DC500V
Dielectric withstanding		Power supply to Case : AC1500V 1 min.
		Solid state output to Case : AC1500V 1 min. Signal relay output to Case : AC1000V 1 min.
		Solid state output to Power supply : AC1500V 1 min. Signal relay output to Power supply : AC1000V 1 min.
Vibration resistance		10 to 55Hz Double amplitude 1.5mm 2 hours each in X, Y and Z directions
Shock resistance		500m/s^2 3 times each in X, Y and Z directions
Constructions		IP66
Weight	Optical head	OHA : Approx. 680g OH2 : Approx. 2.5kg OH2N: Approx. 2.6kg
	Air-less hood	F38A : Approx. 240g F38A-02 : Approx. 330g F38A-03 : Approx. 430g F38A-04 : Approx. 550g F38A-05 : Approx. 650g F70N : Approx. 1.8kg
	Air-purge hood	F38PC-02 : Approx. 240g F38PC-03 : Approx. 300g F38PC-04 : Approx. 370g F38PC-05 : Approx. 440g 702L : Approx. 2.6kg 703L : Approx. 3.3kg 704L : Approx. 4kg 705L : Approx. 4.6kg
	Optical fiber unit FG series	FG2 : Approx. 0.7kg FG3 : Approx. 0.9kg FG4 : Approx. 1.1kg FG5 : Approx. 1.3kg FG7 : Approx. 1.6kg FG10 : Approx. 2.1kg FG12 : Approx. 2.5kg FG15 : Approx. 3.1kg FG20 : Approx. 4.1kg FG30 : Approx. 6.1kg
	Amplifier unit	Transmitter : Approx. 1.5kg Receiver : Approx. 1.5kg

■ Air-purge specification (When air-purge hood is used)

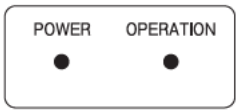
Flow volume : 200 ℓ /min.

Withstand pressure : 1 MPa

5. OPERATION

■ TRANSMITTER (LIGHT SOURCE)

◇ Display Panel



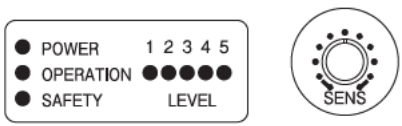
POWER : Lights ON when powered on.
OPERATION : Lights ON at normal operation.

◇ Monitor output

This monitor output is used to check if the transmitter operates properly.
A light detecting amplifier built into the transmitter monitors the light emitted from the LED.
The monitoring amplifier issues an alarm output if the LED stops emitting.
The warning output relay is open when it is normal.

■ RECEIVER

◇ Display Panel



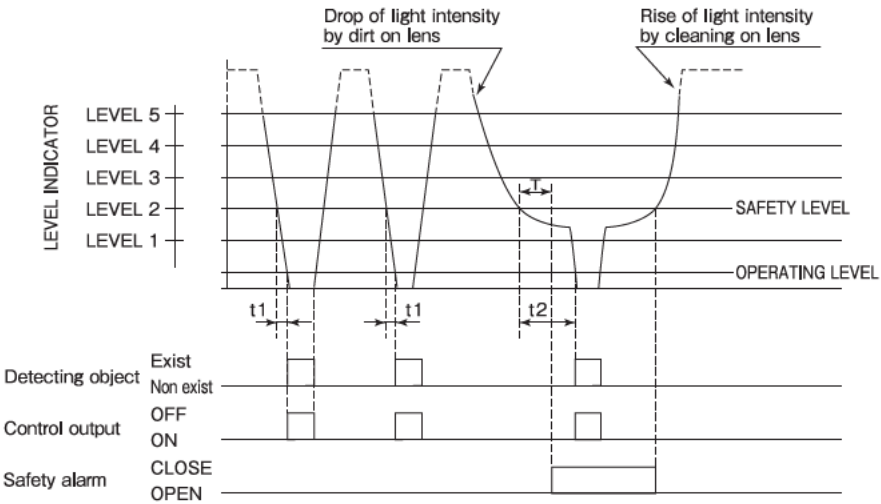
POWER : Lights ON when powered on.
OPERATION : The indicator lamp is lit when the control output signal is issued.
SAFETY (Excess gain check indicator)
: The (safety operation) green indicator lamp is lit to indicate that the current operation is stable.
If the received light is insufficient, the SAFETY ALARM OUTPUT will be issued and the indicator lamp will flicker.
LEVEL : The received light level is indicated by the 5-point level indicator lamps.
SENS. (Sensitivity adjustment volume)
: This volume changes the SAFETY LEVEL and threusholds for LEVEL INDICATOR (see the next page).
The sensitivity of the amplifier (operation sensitivity) does't change.

◇ CONTROL OUTPUT:

The relay stays ON, while the light from the transmitter is received by the RECEIVER.
The relay is turned OFF when the light from the transmitter is blocked by a detected material.

◇ Excess gain check function (SAFETY ALARM OUTPUT)

This function checks received light levels and issues an alarm when the received level is below the SAFETY LEVEL due to stains on the lens surface or light axis deviation.
This SAFETY LEVEL can be changed within the range from 2 to 8 times margin of the operation level.
The alarm output is reset when the received light level reaches above the SAFETY LEVEL.



SAFETY ALARM decision

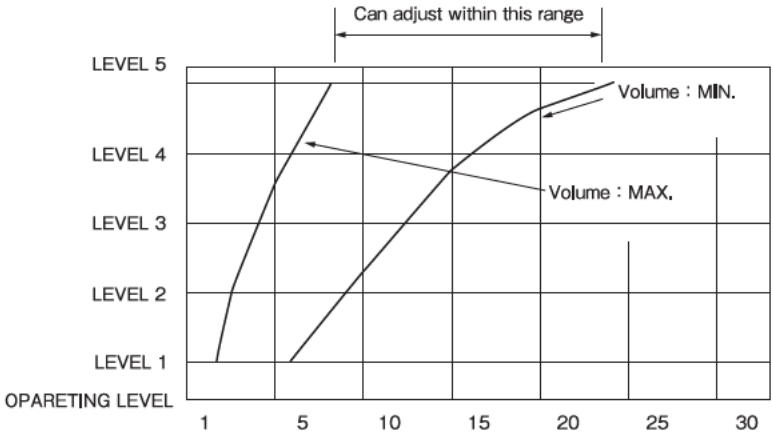
The timer starts when the received level becomes lower than the SAFETY LEVEL, and it is reset when the control output is issued.
If the time is longer than a specified time T, the safety alarm is issued.
For example, the time **t1** between when the received light level becomes lower than the SAFETY LEVEL and when the control output is issued is shorter than a specified time T, no safety alarm is issued.
When the lens is dirty or the light axis is deviated, the time **t2** below the SAFETY LEVEL becomes longer (always below the check level while the light is received), so it is decided that there is no excess gain to make stable detection.
(The duration of T is set at about 2 minutes. (fixed)).

- The SAFETY LEVEL and the LEVEL INDICATOR operation level (received light amount) can be changed by the volume.

◇ SENS.

This variable volume changes the received light amount (margin) of the safety level.
Depending on its position, each level indicator will turn on in accordance with the degree of margin shown in the table below.

The sensitivity of the amplifier (operation sensitivity) doesn't change.



[Example of representative]

OPERATING LEVEL

SENS. Volume MAX	LEVEL 5: Margin = 8 times
SENS. Volume MIN	LEVEL 5: Margin = 25 times

※ How to use the SENS. volume for photo-beam axis adjustment

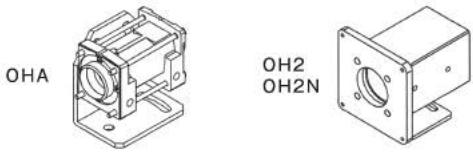
In the maximum sensitivity, the LEVEL 5 indicator will be lit when the margin is 8 times of the operation level. The photo-beam axis, however, is not aligned correctly yet with that level.
To use the system with higher margin, adjust the photo-beam axis so that the LEVEL 5 is achieved with minimum sensitivity.
(The margin level at this time will be 25 times.)

6. INSTALLATION

■ Packed components

The product is classified into the following four components.
Check the quantity of the components first.

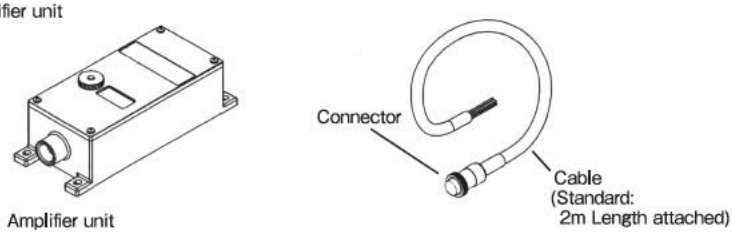
1. Optical head



2. Hood

3. Optical fiber unit

4. Amplifier unit

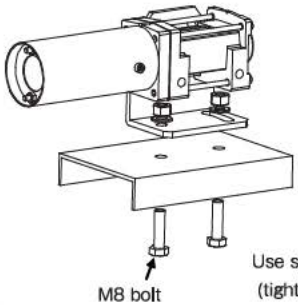


■ Assembly

Connecting inlets for optical fiber of the optical head and amplifier unit are protected by blind plugs.
The top end of the optical fiber unit is covered with a protector cap.
The optical head and optical fiber unit are optical devices which are largely affected in performance by flaws and wastes. Handling shall, consequently, be made carefully. Do not remove the protector cap until connection is ready.

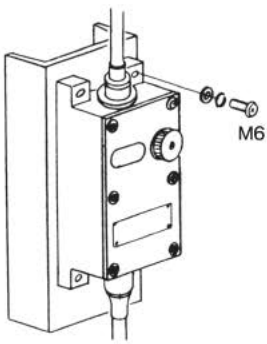
■ INSTALLATION

Install and keep the mounting trestle free from vibration, etc. Secure the optical head unit with two M8 bolts. (The M8 bolts, nuts and washers should be prepared by a user.)

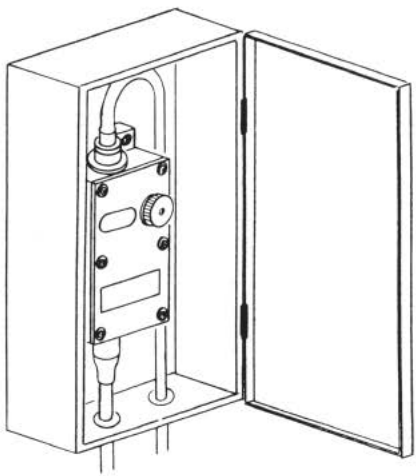


Use spana or the like and tighten the optical fiber unit firmly.
(tightening torque 10N·m or less)

Install the amplifier unit in a place with normal temperature and free from radiation light from heated materials.
Enclose the unit in a dust-preventive box in a place where is subject to scale or water scattering.



(The M6 bolts, nuts and washers should be prepared by a user.)

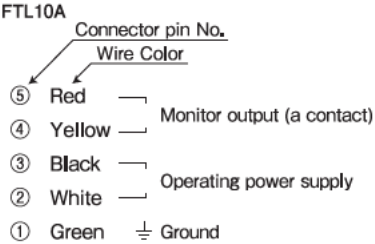


7. CONNECTION DIAGRAM

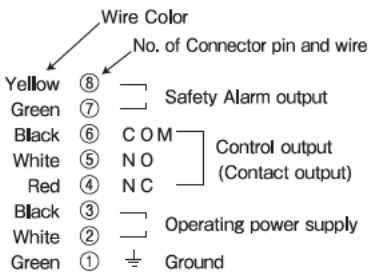
- Accepts 100VAC to 220VAC. The voltage is limited for old version models. Check the voltage on the terminal label.
- To connect extension cable, use seperate cables and relay terminal boxes for high-voltage circuit and low-voltage circuit.
  For example, the operation power source employs the high-voltage circuit and the solid state output of low voltage the low-voltage circuit.
- Cautions to use the reed relay output type FTR10AH
  If a long lead line (100 to 300m) is used, a trouble may occur in the rush current due to stray capacity across line. If so, insert resistance (10 to 50Ω) serially in the contact.
- Cautions to use the solid state output type (FTR10AC)
  For connection of the inductive load such as a relay to load.
  Connect a diode or a surge absorber to avoid the reverse electromotive force for protecting the output device.

■ CONNECTOR

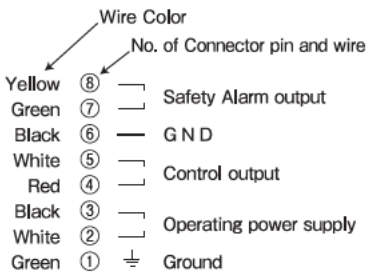
(TRANSMITTER) : **FTL10A**



(RECEIVER) : **FTR10A**
(Mini power relay output type)
FTR10AH
(Signal relay output type)



(RECEIVER) : **FTR10AC**
(Solid state output type)



When connecting an inductive load such as relay, be sure to use diode, surge absorber, etc. to protect output transistors from counter electromotive force.

■ FRAME EARTH

Connect the earth line to the earth screw (M4) on the side of the terminal cover.

8. ADJUSTMENT

■ ADJUSTMENT OF THE OPTICAL AXIS

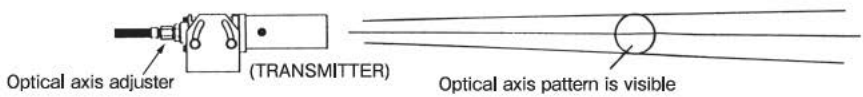
- ◆ Set the SENS. to "MAX." and adjust the TRANSMITTER and RECEIVER so that the level indicators light up to LEVEL5. (Excess gain 8 times; not completed)
- ◆ Set the SENS to "MIN." and adjust the TRANSMITTER and RECEIVER so that the level indicators still light up to LEVEL5. (Excess gain 25 times; completed)

◇ Adjustment by using a sighting device

Adjust optical axis by using a sighting device that is attached on the optical head.

◇ Adjustment by optical axis adjuster (optional)

Install the optical axis adjuster with halogen lamp adopted on the optical head, and the optical axis adjuster projects the optical axis pattern.



Two types of adjuster are available.

<Halogen lamp>

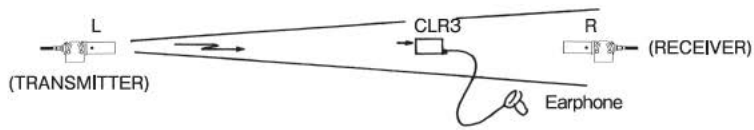
Optical axis adjuster : O H F — C L
Power unit : O H F — C L P
Halogen lamp (spare) : O H F — L 5

<Red semiconductor laser>

Safety class 2
Optical axis adjuster : O H F — L D
Power unit : O H F — L D P

◇ Adjusting by the checker (option)

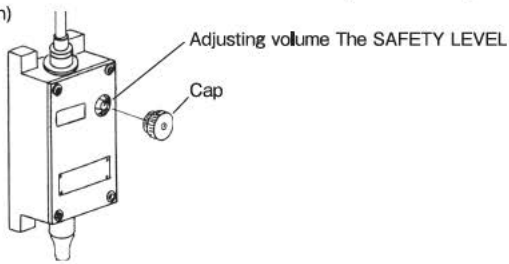
The checker (type : CLR3) is used to adjust the light axis by audible alignment tone.
You can adjust the light axis of the transmitter more accurately.



Detecting the light from the transmitter by using the checker adjust the transmitter setting position so that the tone pitch becomes highest.

■ SEFETY LEVEL ADJUSTMENT

This volume is adjustment for the SAFETY LEVEL and LEVEL INDICATOR Operation level. (Received light amount) (Refer to -5.Operation)



9. INSPECTIONS

◆ PERFORM THE FOLLOWING INSPECTIONS PERIODICALLY

◇ Optical axis check

Check if the level indicators light up to LEVEL 5 while the SAFETY LEVEL ADJUSTMENT volume is MIN. If not, the received light intensity may be reduced due to deviation of the photo-beam axis or contamination on the lens surface.

◇ Lens surface cleaning

Remove the hood by loosing 4 bolts (M5) fixing it to the optical head and the lens will be exposed. Clean the lens surface.

◇ When the SAFETY ALARM OUTPUT is issued ;

If the SAFETY ALARM OUTPUT is issued, the amplifier unit SAFETY indicator lamp (green) will flicker, and only one of the 5 LEVEL INDICATOR lamps turns on even when the light is received. In this case, the light axis may be deviated or the lens surface is dirty and the margin of the received light has become insufficient. Check the light axis and the lens surface. When the received light amount increases and all the LEVEL INDICATOR lamps are lit, the SAFETY ALARM OUTPUT is reset and the SAFETY indicator lamp will turn on.

10. NOTES

— Attention in case of using LEAD RELAY OUTPUT type (FTR10AH)

In case to use a long (100 to 300m) lead wire, the inrush current may be occured by the floating capacity between the wires. In this case, insert the resistance (10 to 50Ω) into connection in series.

— Attention in case of using SOLID STATE OUTPUT type (FTR10AC)

In case of connection with inductive load like relay, connect a diode or a surge-absorber, etc. to prevent the inverse electromotive force and protect the output.

— Notes in handling the optical fiber unit and its connecting portion.

■ Note the following points when the optical fiber unit is removed from the optical head unit or the amplifier unit for installation or maintenance.

◇ The optical fiber unit transmits the detected light. So, protect the ends of the optical fiber unit by the attached rubber cap, vinyl tape, etc. to prevent damages.

◇ Also use the attached rubber cap, vinyl tape, etc to the connecting ends of the optical head unit and the amplifier unit to protect from being contaminated with scale, dust, etc

■ Be sure to tighten the tightening glands (nuts) of the optical fiber unit by using a spanner or the like. Incomplete or loosen tightening may cause incorrect operation.
(Tightning torque 10N·m or less)

■ O-ring is used for the connecting part of the optical fiber unit and the ends of the optical fiber unit. The spare O-ring is attached to the fiber unit.

■ Correct handling of optical fiber unit

Do not bend it excessively.

Glass fibers (optical fibers) are used inside the optical unit
If the optical fiber unit is bent with excessively small diameter,
it may damage the unit. Keep allowable bending radius.

Do not pull / twist.

Do not apply forcible pull or twist, but keeps a suitable slack.

Install and fix firmly.

Optical fiber unit consists of approx. 1,500 bundled glass fibers.
Loose installation may cause a break in the fibers by friction.

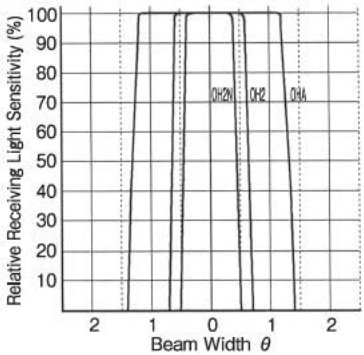
— Various data

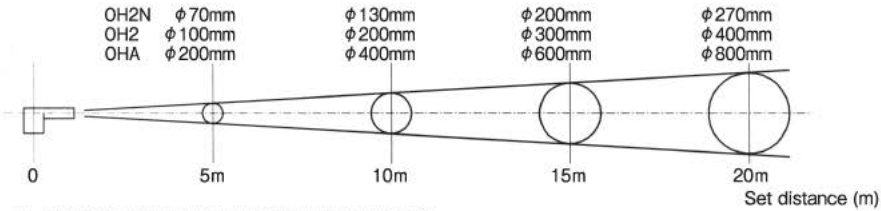
The numerical values described on each characteristic are representative values of the products sampling from a certain allotment. These do not warrant "specifications / performance". Please make use of the values as a reference.

11. TECHNICAL DATA

■ DIRECTIONAL CHARACTERISTIC

Indicates an extent of light flux of the transmitter and a directional angle of the receiver.
The directional angle varies with the optical head (OHA, OH2, OH2N)
The beam spread corresponding to the set distance is illustrated as below.





■ OPTICAL HEAD POWER CHARACTERISTIC

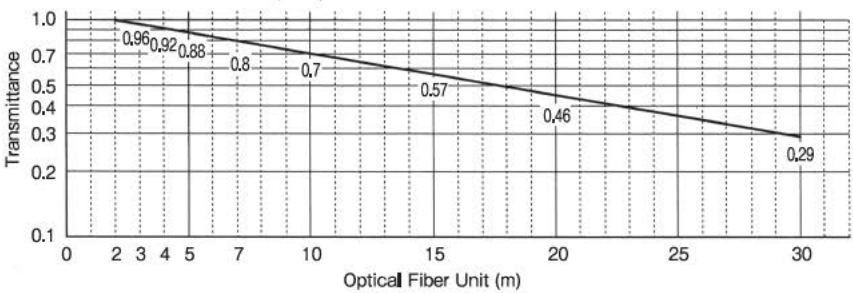
The power characteristic is different depending on the optical head used. Moreover, the optical head has different power characteristic whether it is used for the transmitter side or the receiver side.
These are derived from the difference of the power density by the extension of the light beam and effective lens diameter.
The following table shows the relative power factors to use "OHA" both for the transmitter and the receiver as 1.

		RECEIVER SIDE		
		OH2	OH2N	OHA
TRANSMITTER SIDE	OH2	11	22	4
	OH2N	28	55	10
	OHA	2.8	5	1

■ TRANSMISSION FACTOR

The figure shows relative transmission factor with reference to the Optical Fiber Unit FG2 as 1.
The transmittance of FG10 is 70% comparing with that of FG2.
When the optical fiber unit FG10 (10m long) is used for both the transmitter and receiver, the transmission factor is :

0.7 × 0.7 = 0.49 (49%)



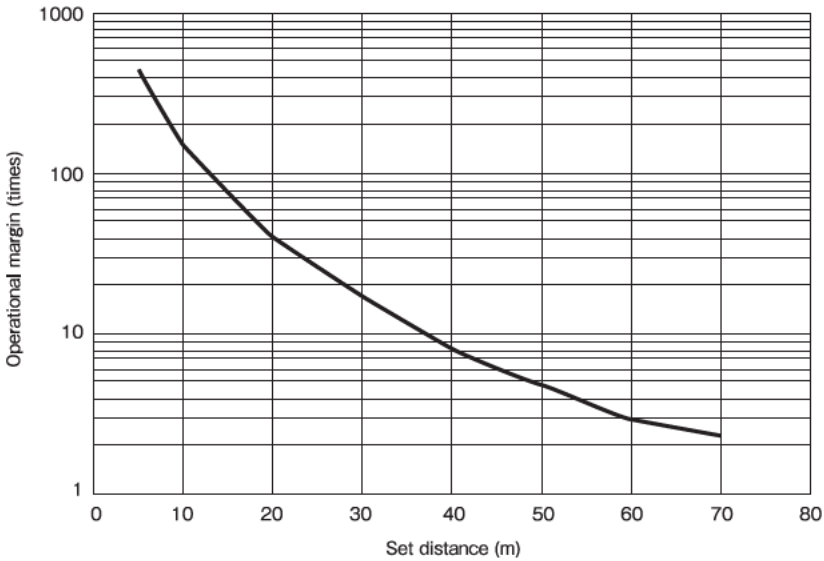
■ EXCESS GAIN CURVES

The following indicates operational margin against a set distance.
The graph shows a data obtained by using FG2 (2m long) and OHA to both the transmitter and receiver. For other optical fiber unit and optical head, obtain data according to the transmission factor of optical fiber unit and the power characteristic of optical head. When the optical fiber unit: (2m long) is used to both the transmitter and receiver, for example, a necessary data is obtained directly in the graph where the operational margin at the set distance of 10m is about 180 times.
When using the optical fiber unit: FG10 (10m long) to both the transmitter and receiver,
0.7 × 0.7 = 0.49 is obtained by the transmission factor.
Consequently, the operational margin at the set distance of 10m by using the optical fiber unit FG10 (10m long) to both the transmitter and receiver is 180 time × 0.49 = 88.2 times.

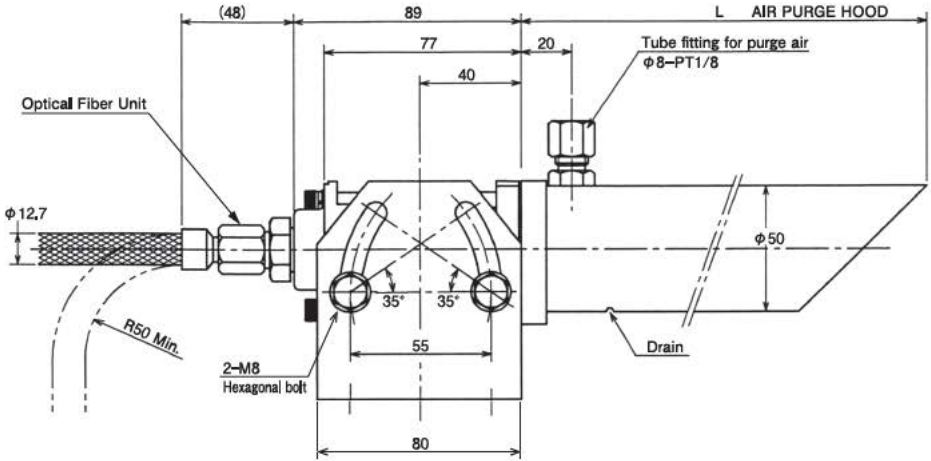
Optical Fiber Unit : F G 2

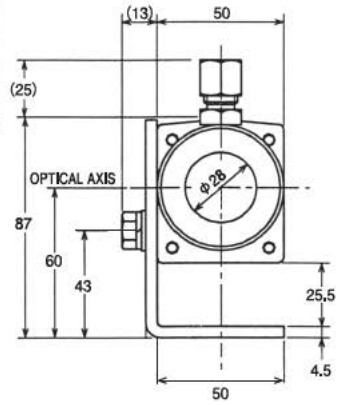
Excess Gain Curves (Oputical fiber unit: FG2)

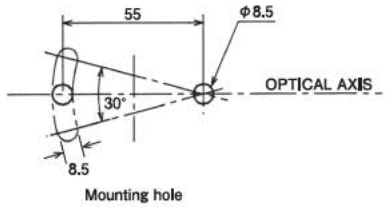
[Example of representative]



□ AIRPURGE HOOD F38PC−** (in mm)





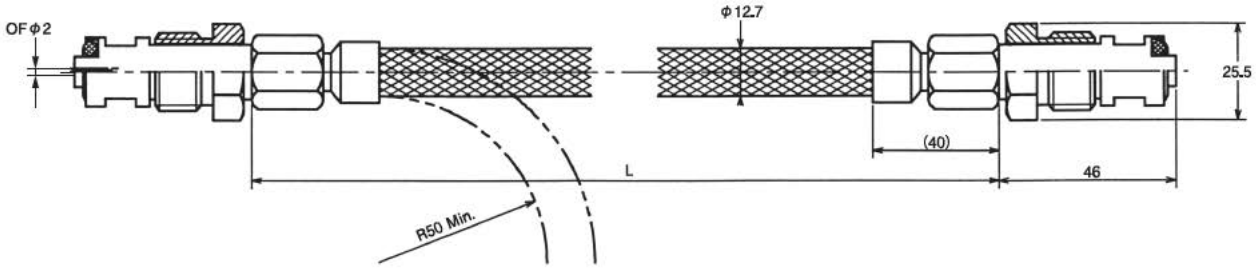


AIRPURGE HOOD

Type	L (mm)
F38PC −02	200
F38PC −03	300
F38PC −04	400
F38PC −05	500

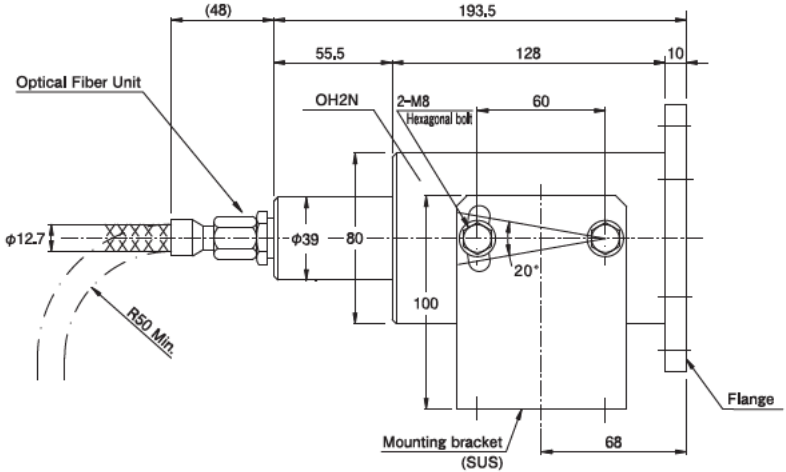
AIRPURGE
QUANTITY : 200 ℓ /min
PRESSURE : 1MPa

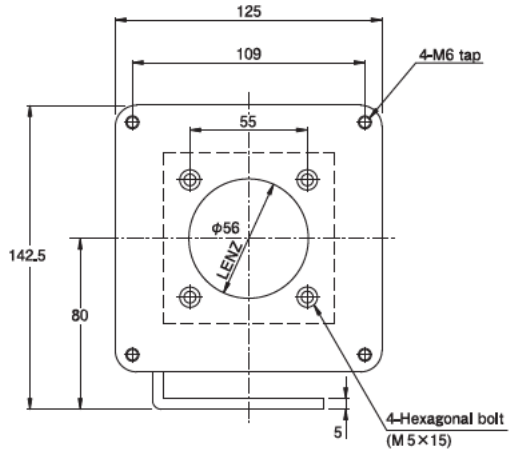
□ OPTICAL FIBER UNIT FG** (in mm)

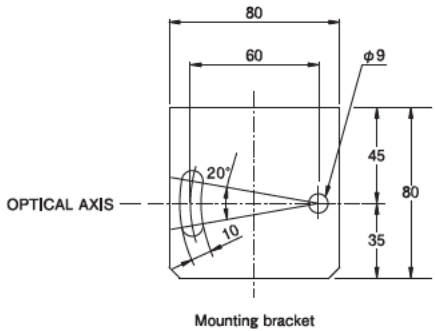


Type	L (m)
FG2	2
FG3	3
FG4	4
FG5	5
FG7	7
FG10	10
FG12	12
FG15	15
FG20	20
FG30	30

□ OPTICAL HEAD OH2N (in mm)

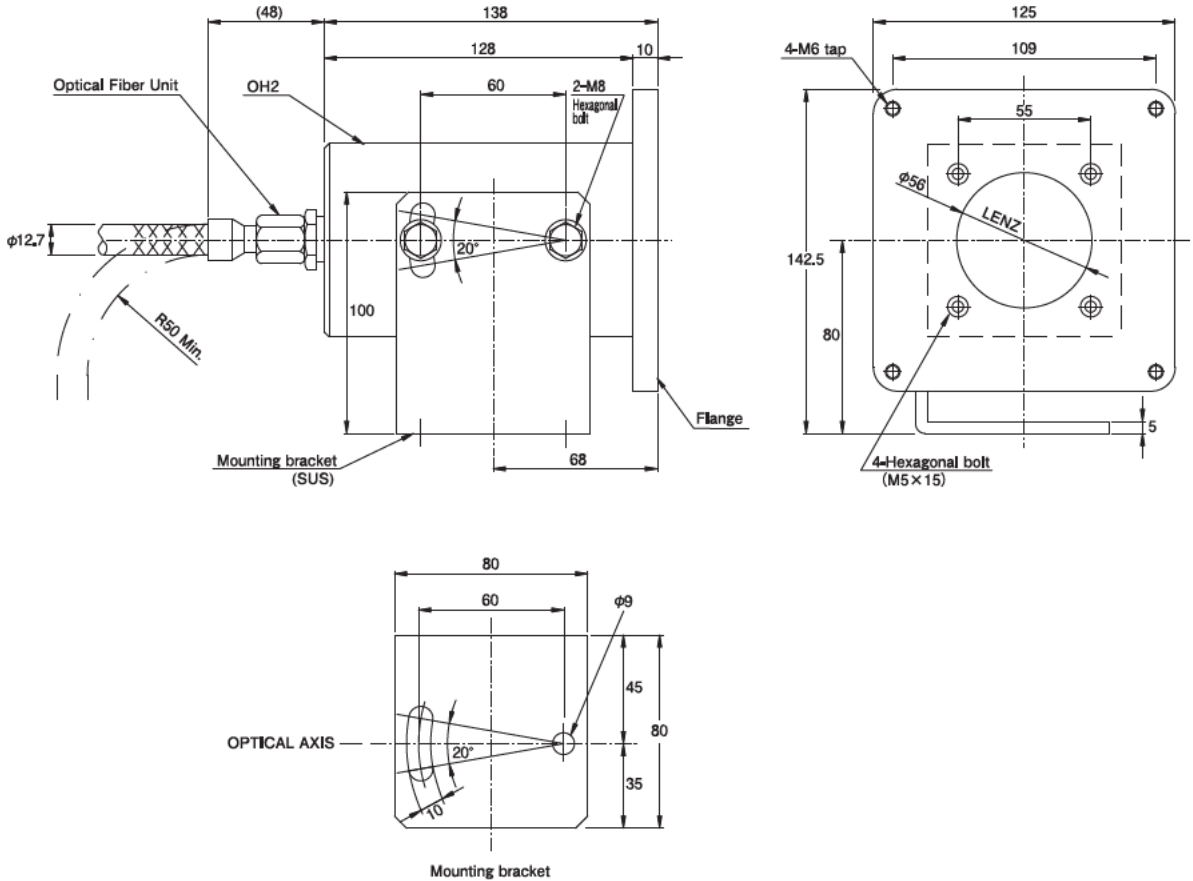




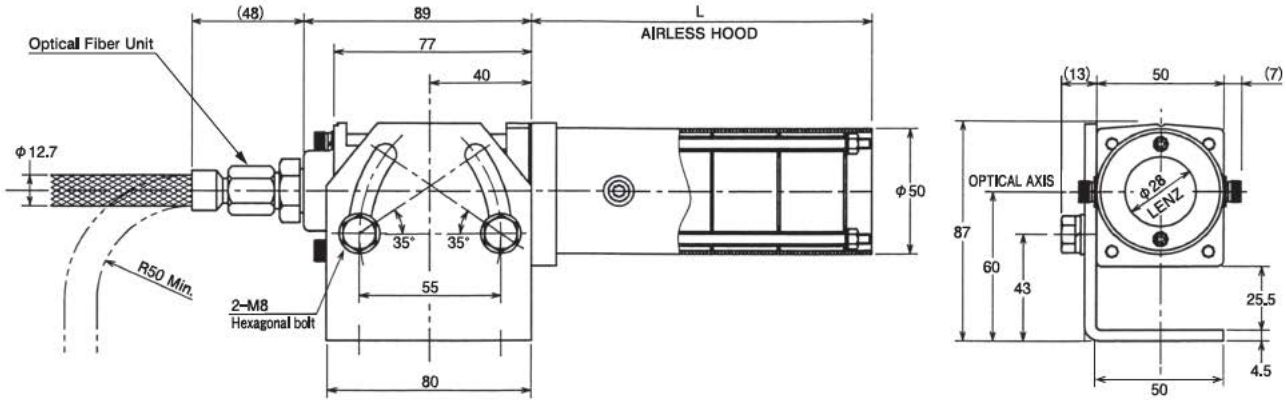


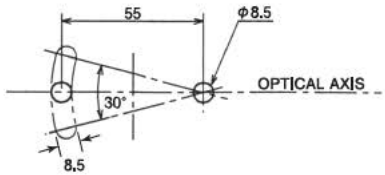
Weight : Approx. 2.6kg

□ OPTICAL HEAD OH2 (in mm)



□ AIRLESS HOOD OHA+F38A−** (in mm)





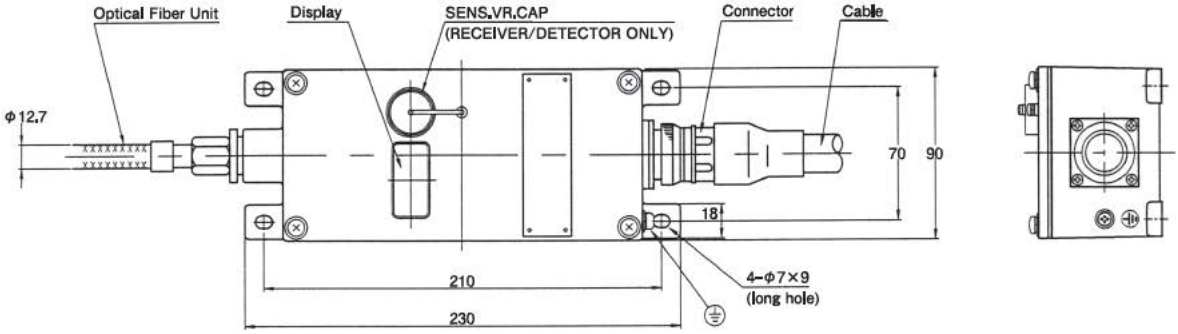
Mounting hole

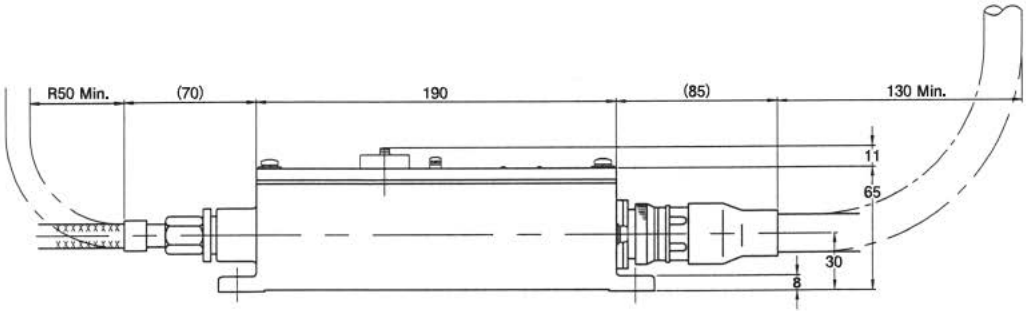
AIRLESS HOOD

Type	L (mm)
F38A	120
F38A−02	200
F38A−03	300
F38A−04	400
F38A−05	500

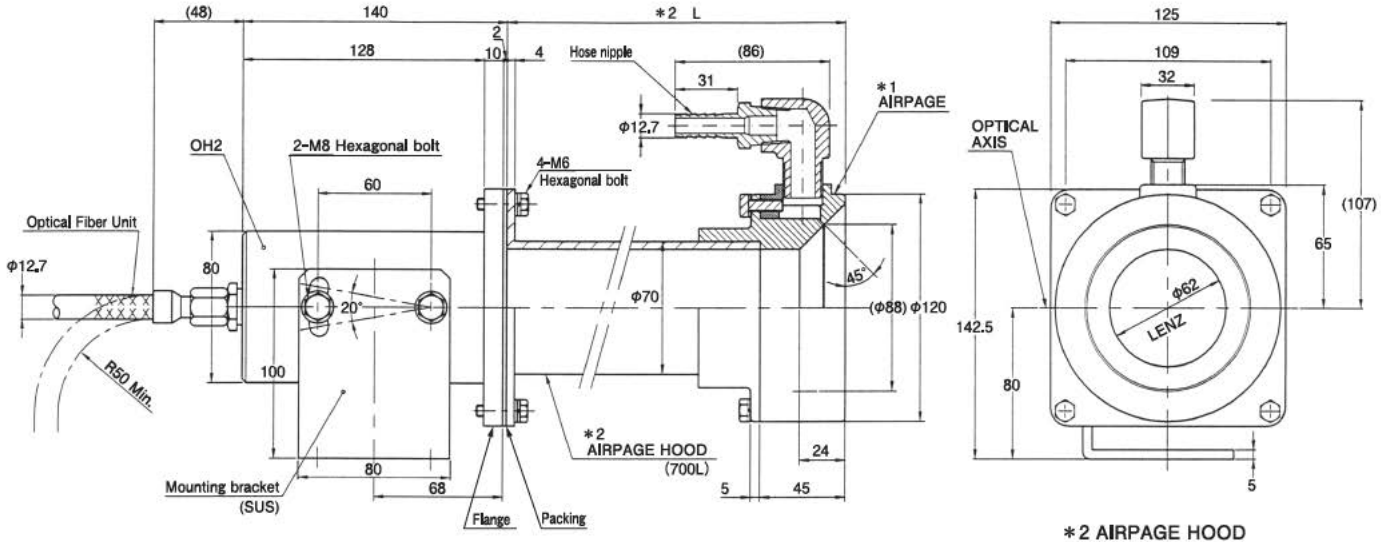
□ AMP UNIT (in mm)

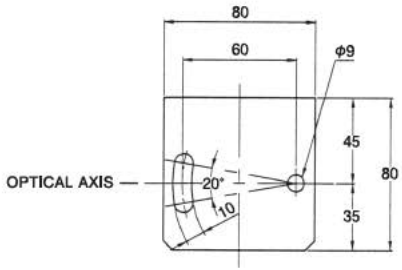
・TRANSMITTER : FTL10A
・RECEIVER : FTR10A





□ AIRPURGE HOOD OH2+700L (in mm)





Mounting bracket

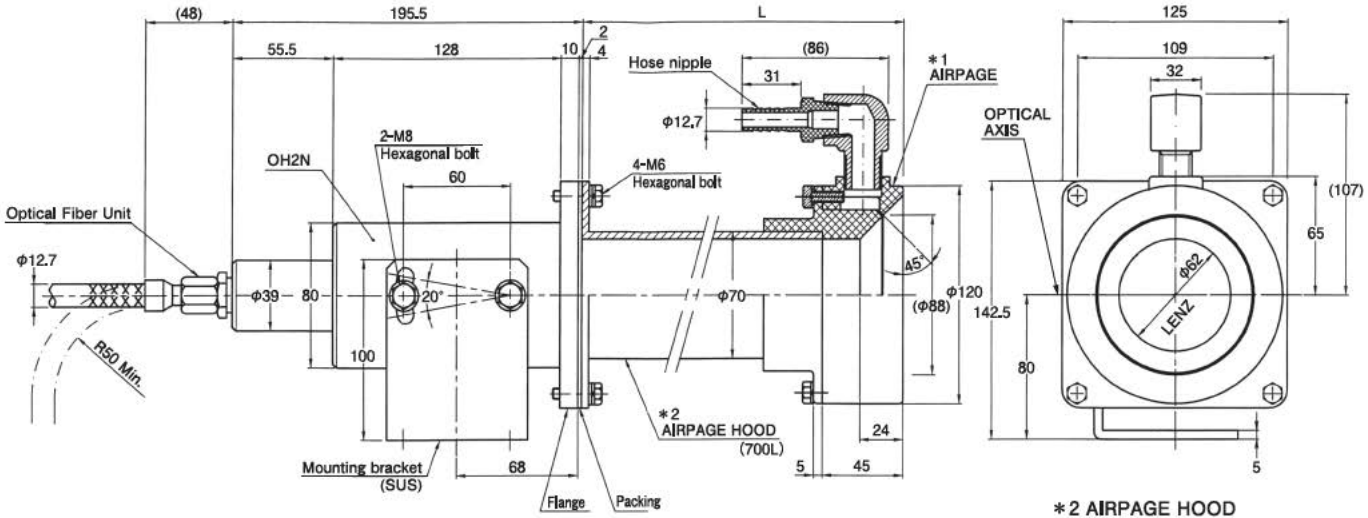
＊1 AIRPAGE

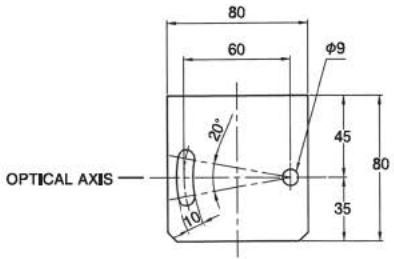
Quantity	200 ℓ /min
Pressure	1MPa

＊2 AIRPAGE HOOD

Type	L (mm)	Weight
702L	200	Approx. 2.6kg
703L	300	Approx. 3.3kg
704L	400	Approx. 4.0kg
705L	500	Approx. 4.6kg
OH2		Approx. 2.5kg

□ AIRPAGE HOOD OH2N+700L (in mm)





Mounting bracket

*1 AIRPAGE

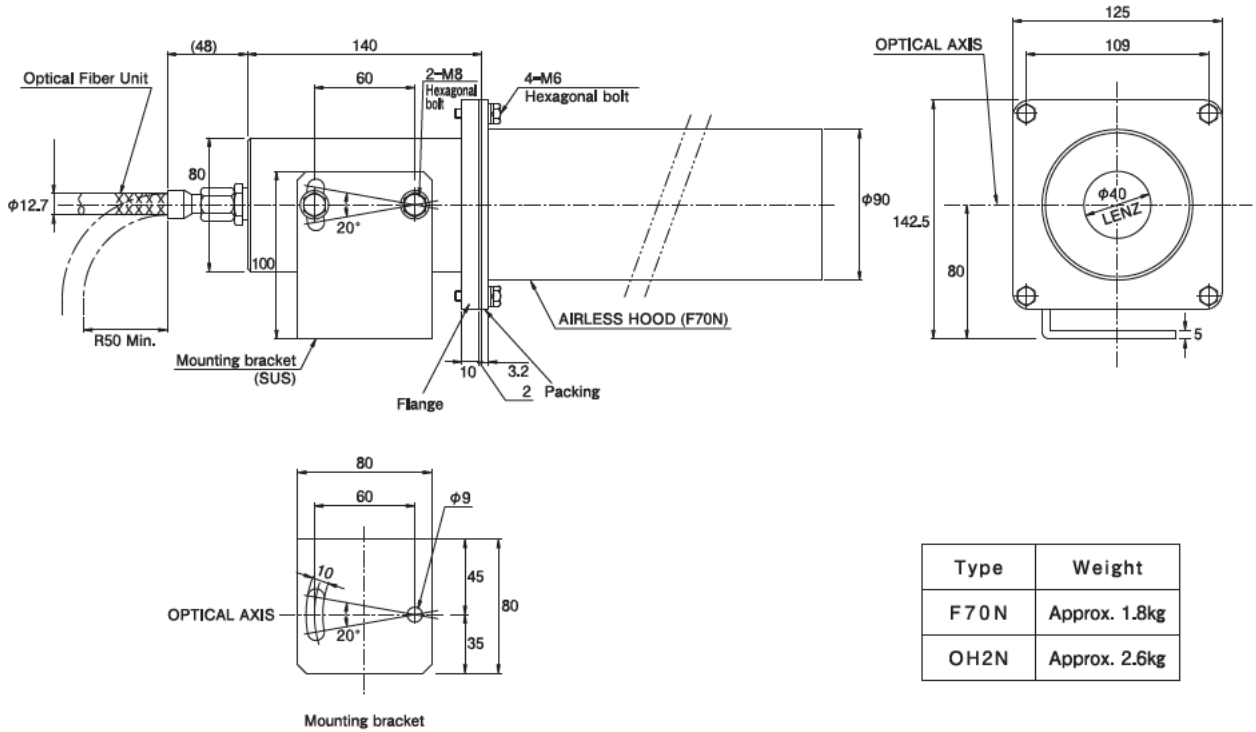
Quantity	200 ℓ /min
Pressure	1MPa

(Use air without dust and oil.)

*2 AIRPAGE HOOD

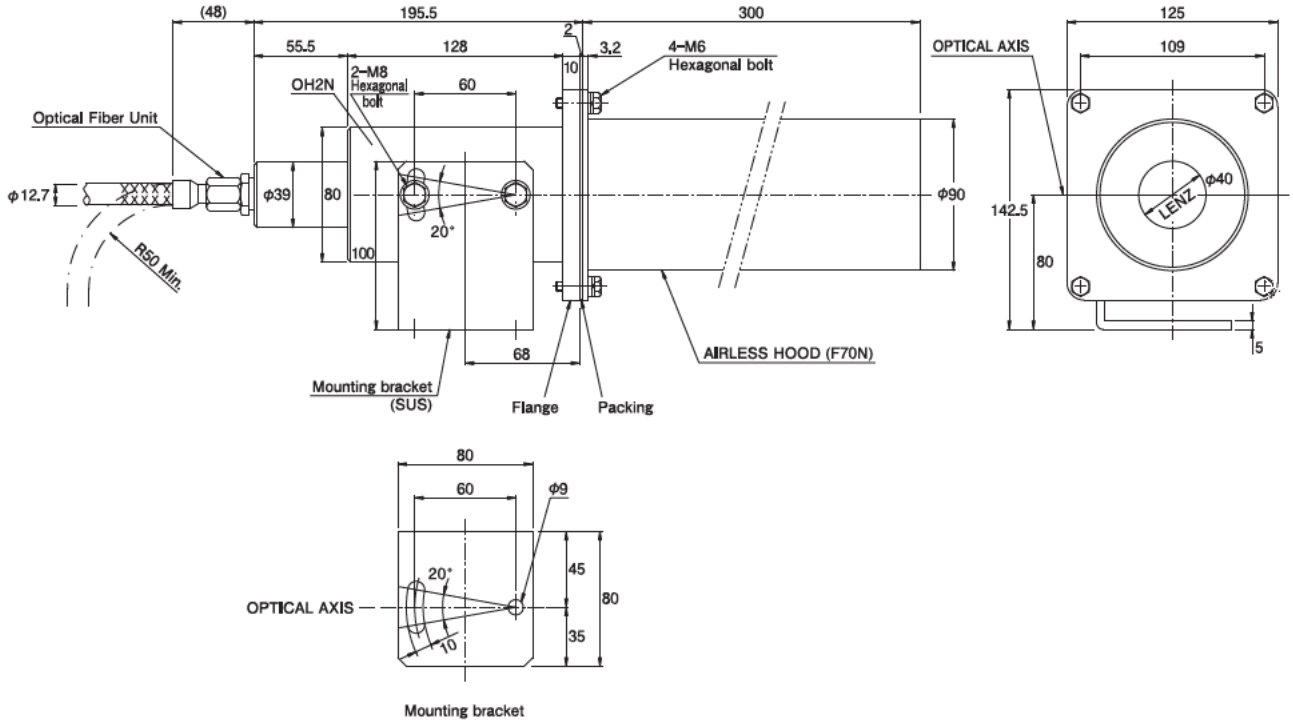
Type	L (mm)	Weight
702L	200	Approx. 2.6kg
703L	300	Approx. 3.3kg
704L	400	Approx. 4.0kg
705L	500	Approx. 4.6kg
OH2N		Approx. 2.6kg

□ AIRLESS HOOD OH2+F70N (in mm)



Type	Weight
F70N	Approx. 1.8kg
OH2N	Approx. 2.6kg

□ AIRLESS HOOD OH2N+F70N (in mm)



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