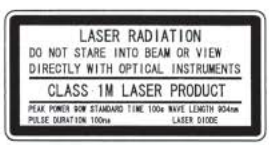
TAKEX

# OPTICAL FIBER TYPE PHOTOELECTRIC SWITCH [CMD]

## —— INSTRUCTION MANUAL ——

**TYPE** TRANSMITTER : **FTL44A**
RECEIVER : **FTR44A FTR44AH FTR44AC**

- 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.




Explanatory label (class 1M)

**TAKENAKA ELECTRONIC INDUSTRIAL CO.,LTD.**

# OPTICAL FIBER TYPE PHOTOELECTRIC SWITCH [CMD]

## —— INSTRUCTION MANUAL ——

MODEL TRANSMITTER : FTL44A
RECEIVER : FTR44A FTR44AH FTR44AC

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—— CONTENTS ——

# 1. Outline

FT44A series is a through beam type high powered laser CMD (Cold Metal Detector) equipped with heat-resistant optical glass fiber cable. Three output types, mini power relay, contact relay and solid-state outputs are available.

# 2. Features

■ High powered 90W laser (FT44A)
A laser diode of optical output 90W is used as the light source, which is more than 3,000 times as strong as the conventional LED in TAKEX products.

■ No cooling required
Hood, optical head and fiber unit consist of optical parts and fiber glass, and includes no electrical parts. Cooling is not necessary up to 200℃ ambient temperature.

■ Highly durable fiber cable
The sheath of the optical fiber cable is flexible stainless steel blades with high heat and corrosion resistance.

■ Self-check function
A monitoring circuit for the transmitter issues an alarm upon reduction of light intensity or failure of light emission. The receiver has an excess gain check function which monitors the light intensity level. A Safety alarm output is issued when the received light intensity has not enough margin due to deviation of the optical axis alignment or soiling of the lens, etc.

■ 5 point level indicator
Received light intensity is displayed in five stages by LEDs.

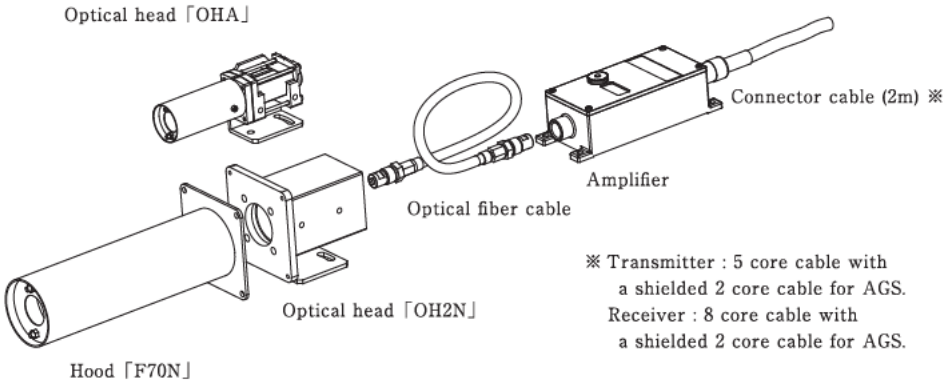
■ Wide range of power supply
100 to 220 VAC is adaptable.

■ Mutual interference prevention
Scanning control units (LSC series) are available for mutual interference prevention between adjacent units.

■ Replacement for KL44A or KR44A water-cooled CMD
Can be used as a direct replacement for KL44A or KR44A that were discontinued.

# 3. Parts description

Each sensor unit consists of an optical head, hood, optical fiber cable and amplifier. The optical head, hood and optical fiber cable are common for the transmitter and the receiver.




■ Optical head

Two types are available, standard type (OHA) and high power type (OH2 and OH2N). High power type has larger lens and higher margin in the received light intensity than the standard OHA. OH2 is 10 times and OH2N is 50 times higher than OHA.

■ Hood

F38A series airless hood and F38PC series air purge hood are fittable for OHA. F70N airless hood and 702L to 705L air purge hoods are available for OH2 and OH2N.

■ Fiber optical cable

Transmits light from the optical head to the amplifier. The cable is covered by a flexible stainless steel blades.

■ Amplifier

All electrical components including LED, photodiode and power unit are enclosed. The model number FTL is a transmitter and FTR is a receiver. Each unit is provided with 2m connector cable.

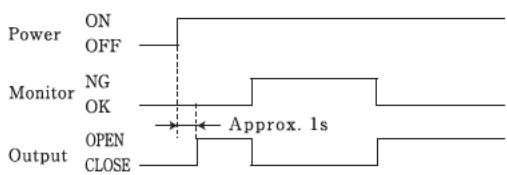
# 4. Specification

■ Model

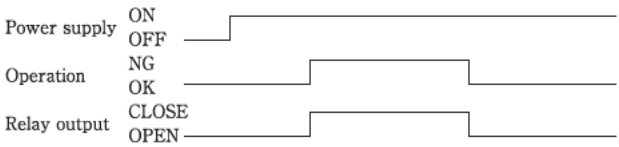
| Component | | | Type | Description |
|---|---|---|---|---|
| Amplifier | | Transmitter | FTL44A | High power Type. |
| | | Receiver | FTR44A | Minipower relay output Type. |
| | | | FTR44AH | Signal relay output Type. |
| | | | FTR44AC | Solod state output Type. |
| Optical head | | | OHA | Standard Type. |
| | | | OH2 | High power Type. |
| | | | OH2N | Narrow view Type. |
| Hood | Airless hood | OHA | F38A | Length 120㎜ (Standard Type.) |
| | | | F38A-02 | Length 200㎜ |
| | | | F38A-03 | Length 300㎜ |
| | | | F38A-04 | Length 400㎜ |
| | | | F38A-05 | Length 500㎜ |
| | | for OH2, OH2N | F70N | Length 300㎜ |
| | Airpurge hood | OHA | F38PC-02 | Length 200㎜ |
| | | | F38PC-03 | Length 300㎜ |
| | | | F38PC-04 | Length 400㎜ |
| | | | F38PC-05 | Length 500㎜ |
| | | for OH2, OH2N | 702L | Length 200㎜ |
| | | | 703L | Length 300㎜ (Standard Type.) |
| | | | 704L | Length 400㎜ |
| | | | 705L | Length 500㎜ |
| Optical fiber cable | | | FG2 | Length 2 m |
| | | | FG3 | Length 3 m |
| | | | FG4 | Length 4 m |
| | | | FG5 | Length 5 m |
| | | | FG7 | Length 7 m |
| | | | FG10 | Length 10m |
| | | | FG15 | Length 15m |
| | | | FG20 | Length 20m |
| | | | FG30 | Length 30m |

■ Output

◇ Transmitter

| Model | FTL44A |
|---|---|
| Output type | 90W(TYP.) type |
| Monitor output (Operation) Mode |   |
| Rating | Relay output Max. 5A at 250 VAC or less (resistive load) |

◇ Receiver

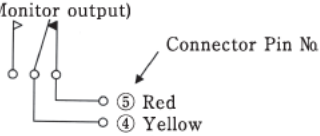
| Type | FTR44A | FTR44AH | FTR44AC |
|---|---|---|---|
| Output modes | Minipower relay output | Contact relay output (※1) | Solid state output (※2) |
| Control output | ON－OFF control (Light ON) | | |
| Rating | 1 c<br>Max. 5A 250 VAC<br>Resistive load | 1 c<br>Max. 0.5A 48 VDC<br>Resistive load | Max. 0.5A 250 VAC.DC<br>Resistive load |
| Response time | 25 ms or less | 12 ms or less | 10 ms or less |
| Safety alarm output |  | | |
| Rating | 1a 5A at 250 VAC or less (resistive load) | | |

(※1) Contact relay is only used for the control output while a mini-power relay is for the safety alarm output.

(※2) Solid state output type is only used for the control output and the mini-power relay output is used for the safety alarm output.

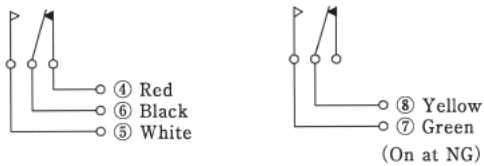
◇ Output Circuit

Transmitter (Monitor output)

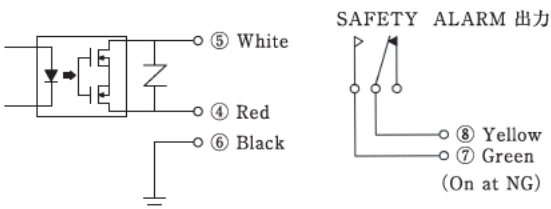



Receiver Minipower relay output Type. FTR44A

Signal relay output Type. FTR44AH




Solid state output Type. FTR44AC



■ Specification

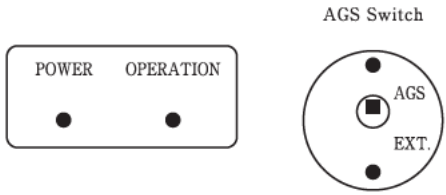
| | | |
|---|---|---|
| Operating range | | 50m or less |
| Lens aperture | | Optical Head 『OHA』 ; 28㎜DIA<br>Optical Head 『OH2, OH2N』 ; 56㎜DIA |
| Minimum detectable object | | Optical Head 『OHA』 ; 30㎜DIA or larger<br>Optical Head 『OH2, OH2N』 ; 60㎜DIA or larger |
| Power supply | | AC100V to 220V +10% −20% 50/60Hz |
| Power consumption | | Transmitter : 10W or less Receiver : 10W or less |
| Operating Temperature Range | | Optical Head & Optical Fiber unit ; −25℃ to +200℃<br>Amplifier unit ; −25℃ to +55℃ |
| Storage Temperature Range | | −40℃ to +70℃ |
| Relative humidity | | 35% to 85%RH |
| Bending limit of Optical Fiber | | 50㎜ |
| Insulation resistance | | Power supply to Case : 20MΩ or more. DC500V<br>Power supply to Output : 20MΩ or more. DC500V<br>Output to Case : 20MΩ or more. DC500V |
| Dielectric withstanding | | Power supply to Case : AC1500V 1 min.<br>Mini-power relay output to Case : AC1500V 1 min.<br>Solid state output to Case : AC1500V 1 min.<br>Signal relay output to Case : AC1000V 1 min.<br>Mini-power relay output to Power supply : AC1500V 1 min.<br>Solid state output to Power supply : AC1500V 1 min.<br>Signal relay output to Power supply : AC1000V 1 min. |
| Vibration resistance | | 10Hz to 55Hz Double amplitude 1.5㎜<br>2h each in X.Y.Z. directions |
| Shock resistance | | 500 m/s² 3 times each in X.Y.Z. directions |
| Constructions | | I P66 |
| Weight | Optical head | OHA : Approx 680g OH2 : Approx 2.5kg OH2N : Approx 2.6kg |
| | Airless hood | F38A : Approx 240g F38A−02 : Approx 330g<br>F38A−03 : Approx 430g F38A−04 : Approx 550g<br>F38A−05 : Approx 650g F70N : Approx 1.8kg |
| | Air purge hood | F38PC−02 : Approx 240g F38PC−03 : Approx 300g<br>F38PC−04 : Approx 370g F38PC−05 : Approx 440g<br>702L : Approx 2.6kg 703L : Approx 3.3kg 704L : Approx 4kg<br>705L : Approx 4.6kg |
| | Optical fiber unit<br>FG series | FG 2 Approx 0.7kg FG 3 Approx 0.9kg<br>FG 4 Approx 1.1kg FG 5 Approx 1.3kg<br>FG 7 Approx 1.6kg FG10 Approx 2.1kg<br>FG15 Approx 3.1kg FG20 Approx 4.1kg<br>FG30 Approx 6.1kg |
| | Amplifier unit | Transmitter : Approx 1.5kg<br>Receiver : Approx 1.5kg |

■ Air purge − In case of use the air purge hood

| | |
|---|---|
| Quantity | 200 ℓ／min |
| Withstand pressure | 1 MPa |

# 5. Operation

## ■ Transmitter

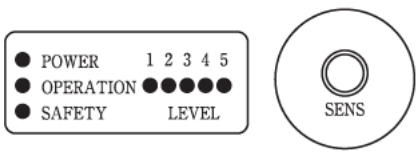



| | |
|---|---|
| POWER | Turns on when power is supplied. |
| OPERATION | Turns on while the unit operates normally. |
| AGS switch | Switch to EXT when using LSC series controller for murual interference prevention. |

◇ Monitor output

Checks if the transmitter is operating normally. Integrated monitoring circuit generates an alarm output upon reduction of light intesity or failure of light emission. The alarm output relay is normal closed.

## ■ Receiver



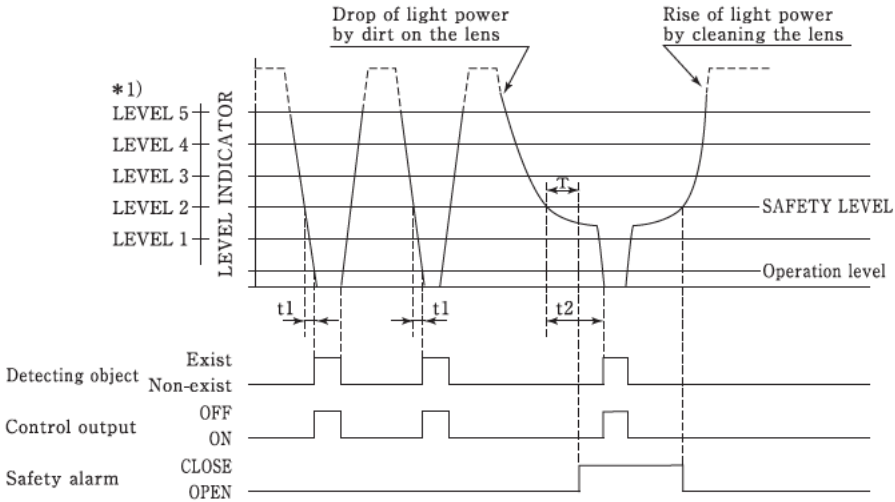

| | |
|---|---|
| POWER | Turns on when power is supplied. |
| OPERATION | Turns on when the control output is generated. (Light is received) |
| SAFETY | Turn on when the operation is stable. A safety alarm output is issued and the SAFETY LED flickers when there is not enough margin in the received light intensity due to some reasons including deviation of the optical axis alignment or soiling of the lens, etc. |
| LEVEL | Received light intensity is displayed in five stages by LEDs. |
| SENS | Adjustment volume for the threshold for the safety alarm output and the LEVEL indicator illumination level. The threshold for the control output (operation level) is not changed by the volume. |

◇ Control output

The relay is activated when the light is received. When the light is blocked by an object, the relay is deactivated.

◇ Received light level check (Safety alarm output)

A safety alarm output is issued when the received light intensity has not enough margin due to deviation of the optical axis alignment or sioling of the lens, etc. The threshold for the alarm output can be adjusted from 200 to 1,500 times of the operation level. The alarm output will be reset when the received light intensity exceeds the threshold.




◇ Judgement for Safety alarm

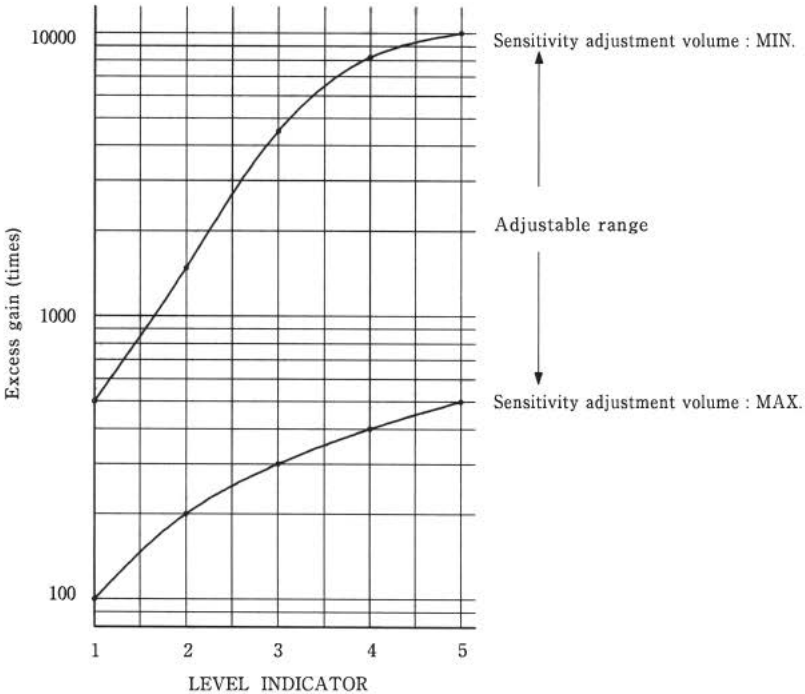
A timer starts when the received light intensity becomes lower than the Safety level. When a control output is issued, the timer is reset. If the timer elapses over a judgement time T, a Safety alarm output is issued. The above chart shows that a control output is generated as the time t1 is shorter than T. If t2 becomes longer than T by some reasons like the lens is dirty or the light axis is deviated, a Safety output is issued. T if fixed at approximately 2 minutes.

*1) The threshold for the Safety alarm output and the illumination level for the level indicator can be adjusted by the adjustment volume.

*2) T = 2 min. (fixed)

◇ SENS.

The threshold for the safety alarm output and the LEVEL indicator illumination level can be adjusted by the volume. Threshold level (excess gain : times) for each LEVEl are shown in the figure below. The threshold for the control output (operation level) is not changed by the volume.




Operating Level

MAX : Level indicator 5 illuminates at 500 times excess gain.
Safety alarm is generated at Level 2 or 200 times excess gain.

MIN : Level indicator 5 illuminates at 10,000 times excess gain.
Safety alarm is generated at Levevl 2 or 1,500 times excess gain.

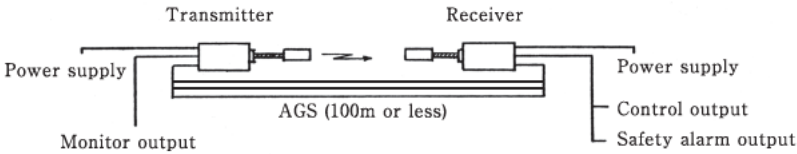
※ The ajustment volume while optical axis alignment

Set the volume at MIN and adjust the optical axis alignment so that the Level indicator 5 is illuminated. This makes the operative margin 10,000 times or more.

◇ AGS

1 ) Enhance detection power

By connecting the AGS lines (white, red and shielded line) of the transmitter and the receiver, the both units are synchronized and the amplifier gain is automatically increased by twice. Noise performance is also improved by the rectifier circuit activated at the same time. Use to endure harsh environment containing smoke or vapor, or of hostile electric noise.




2 ) Mutual interference prevention

To avoid mutual interference between two or more sensors installed adjacently, connect the AGS lines to the LSC series scanning controller which is sold separately. The amplifier automatically increases the gain and the noise performance is improved. Refer to the instruction manual of the LSC controller as well.

3 ) Normal operation

Insulate the AGS lines when ASG function is not used.

※ AGS cable extension

When extending the cable, use 2 core shielded cable with conductors of 1.25$mm^2$ or 2.0$mm^2$ cross-sectional area. The length of the cable should be 100m or less.

# 6. Installation

## ■ Components

The product consists of the following components.

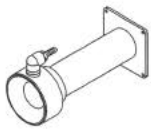
1. Optical head

OHA 

OH2, OH2N 

2. Hood

F38A 

702L 

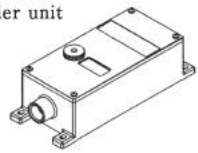
3. Fiber optic cable

F G * *

※Transmitter : 5 core cable with a shielded 2 core cable for AGS.
Receiver : 8 core cable with a shielded 2 core cable for AGS.

4. Amplifier unit

Amplifier unit



Connector

Cable
(Standard : 2m length attached)

Do not remove the protective cap applied on the optical fiber cable ends and each connector of the optical head and the amplifier until installation. The optical head and fiber cable is a part of optical system and the performance is significantly affected by fouling due to flaws or dust. Handle them with care. After installation keep the protective caps for the future maintenance.

## ■ Installation

### ◇ Amplifier unit

- Install the transmitter amp unit in lower temperature zone in order to obtain higher operative margin. Laser diode has a quality of decreasing light emission power in high ambient temperature. Refer to the temperature characteristic data in Chapter 11.
- Ambient temperature has little effects on the performance of receiver amp unit, but avoid to dispose the unit to direct heat radiation from hot materials.
- Install the amp unit in a dust-proof box in a place where is subject to scales or water splashing.

### ◇ Optical head

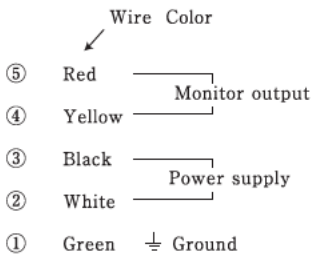
- Install the optical head on a mounting trestle. Tightening torque should be 10N·m or less.

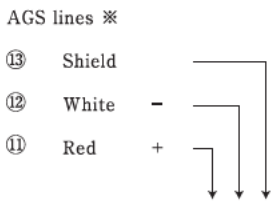
# 7. Wiring

- When extending the wires, use a junction box and separate cables for heavy (power supply) and weak current (solid state output with 12 to 24VDC) circuit.
- When using FTR44AH with a long wire (100 to 300m) for the control output (relay output) insert a resistor (10 to 50 ohms) in series to avoid rush current due to stray capacitance between the lines.
- When using FTR44AC with an inductive load like a relay, connect a diode or surge absorber to avoid counter electromotive force and protect the output transistor.
- When AGS is not used, insulate the AGS lines. Connector cables without AGS lines are available and seperately sold.
- The pin assignment is same as FT10A series except AGS and an existing FT10A system can be easily renewed by replacing only amp units with FT44A series.

■ Connector

◇ Transmitter

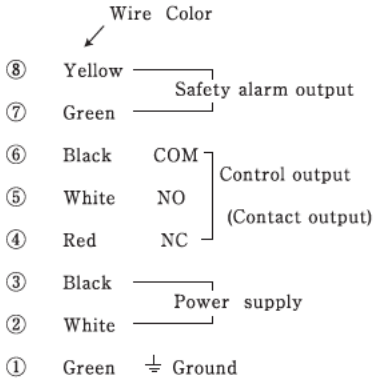


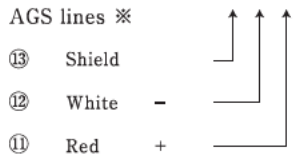




※ Connect the AGS lines with that of the receiver when using the AGS function.

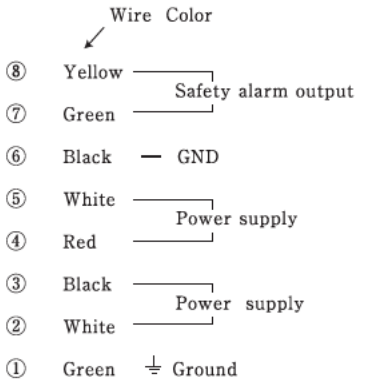
◇ Receiver

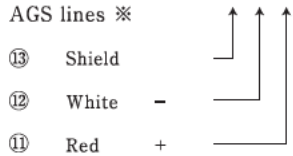
— FTR44A : Mini power relay output
FTR44AH : Contact relay output




— FTR44AC : Solid state output




※ Connect the AGS lines with that of the transmitter when using the AGS function.

■ Frame earth
Use M4 screw beside the connector on the amp unit for grounding.
It is not necessary when the wire 1 is connected to the earth.

■ Connector cable without AGS wires is separately available. 1.25㎟ CVV 5/8 core cable for the transmitter / the receiver.

# 8. Adjustment

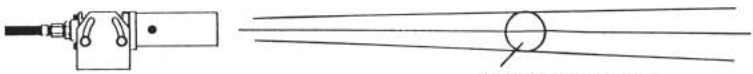
■ Optical axis alignment

Set the volume at MIN and adjust the optical axis alignment so that the Level indicator 5 is illuminated. This makes the operative margin 10,000 times or more.

◇ Optical axis adjuster (optional)

Attach the optical axis adjuster on the optical head, and it projects a light spot which enables easy alignment.

<Halogen lamp>




· Two types of adjuster are available ;

<Halogen lamp>

Optical axis adjuster : OHF-CL, Power unit : OHF-CLP,

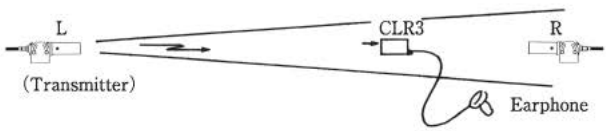
Halogen lamp (spare) : OHF-L5

<Red semiconductor laster, class 2>

Optical axis adjuster : OHF-LD, Power unit : OHF-LDP

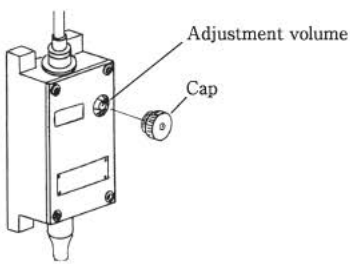
◇ Audio checker CLR3 (optional)

CLR3 indicates receiving light intensity with sound pitch. Make the optical axis alignment so that the audio checker makes the highest tone.




■ Safety level / Level indicator

The safety level (the threshold for the Safety alarm output) and the Level indicator operation level can be adjusted by the volume. Refer to Chapter 5. Operation.



# 9. Inspection

Perform the following inspections periodically

■ Received light level check

Check if the Level indicator turns on up to Level 5. If not, the received light intensity may be reduced due to some reasons including deviation of the optical axis or contamination on the lens surface. Finer optical axis alignment can be done at lower position of the adjustment volume.

■ Lens cleaning

Remove the hood form the optical head and clean the lens surface.

■ Safety alarm

The Safety LED flickers when the Safety output is issued. Check the optical axis alignment and cleanness of the lens surface. The Safety alarm output will be reset when the received light intensity exceeds the Safety level (LEVEL 2).

# 10. Notes

■ Cover and protect the fiber cable ends and the connector on the optical head and the amplifier with the attached protective cap or a vinyl tape when the optical fiber cable is dismounted for maintenance or the like.

■ Use a spanner or wrench to screw the nuts of the optical fiber cable.
The tightening torque should be 10N·m or less.

■ O-rings are applied on the fiber cable ends. Two O-rings are attached as a spare.

■ Allowable bending radius for the optical fiber cable is 50㎜. Grass fibers in the cable may be damaged if it is bent at smaller radius.

■ Do not pull or twist the fiber cable. Give some slack for wiring.

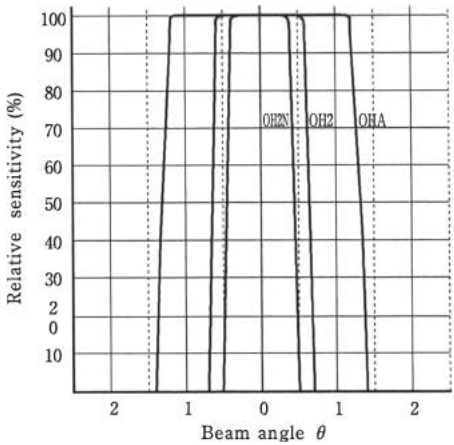
■ Firmly fix the optical fiber cable and avoid shock or vibration.

# 11. Technical data

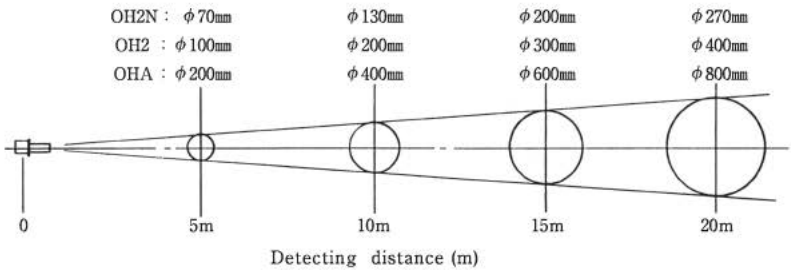
Each data shown in this capter is a typical example or a representative.

■ Directional pattern

Shows the spread of light beam from the transmitter and the directional angle of the receiver. The directional angle varies with the Optical head (OHA, OH2, OH2N). The directional angle as a light flux width to the set distance is illustrated as in the following drawing.

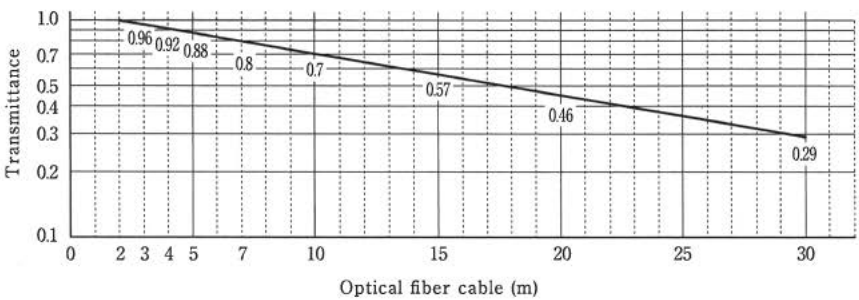



■ Light beam spread




■ Transmittance and cable length

The figure shows a relative comparison as FG2 (L=2m) is set to 1.
The transmittance for FG10 becomes 70% of FG2. When using FG10 both for the transmitter and the receiver, the composite transmittance is 0.49 ; $0.7 \times 0.7 = 0.49$.
This can be used for obtaining excess gain from the following figure.

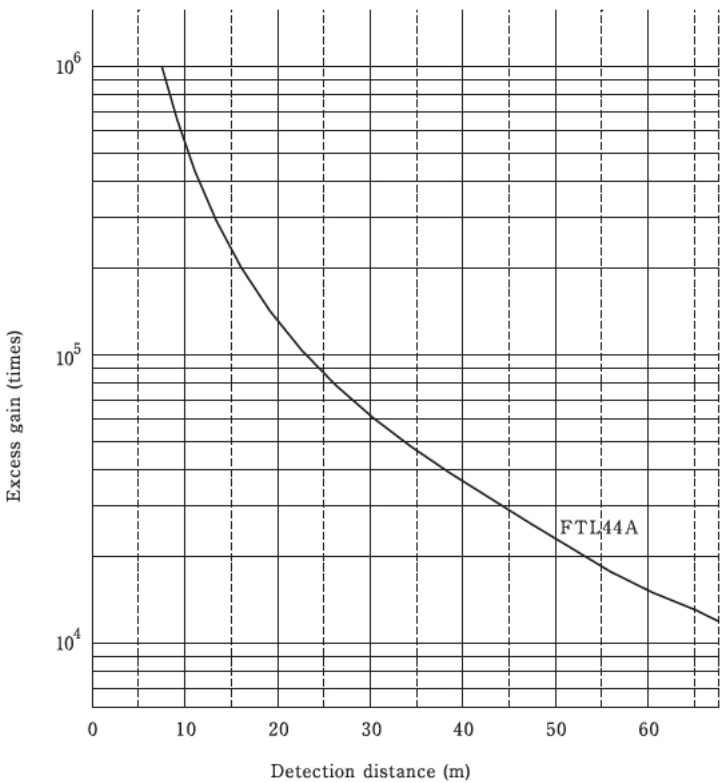


■ Excess gain

The figure shows an excess gain against a detection distance. The figure is obtained by FG2 (2m) and OH2. For the other models, calculate the excess gain by a transmittance of the fiber optic cable and the relative power factor shown in the following page. The figure show the excess gain is about 130,000 times at 20m for FG2. It will be approximately 60,000 times (130,000 × 0.49) when using FG10 for both transmitter and receiver.

Optical Head : OH 2
Optical Fiber Unit : FG 2
Ambient Temperature : 25 ℃

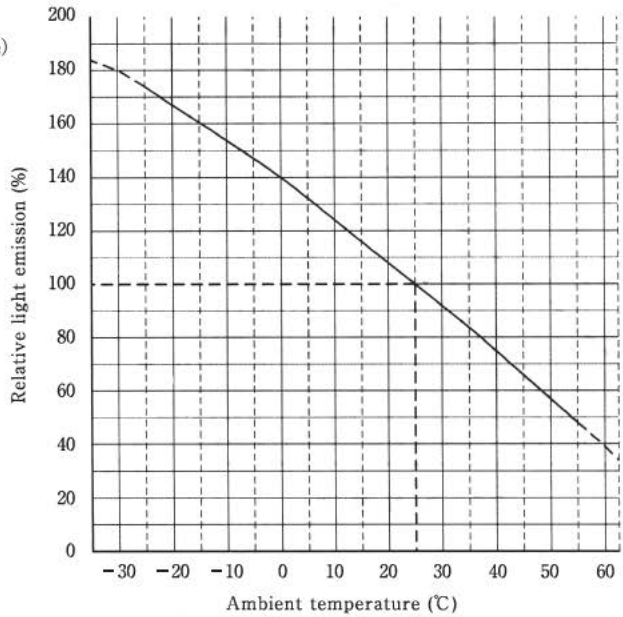
(Example)



■ Temperature

The laser diode used in the transmitter has a quality of decreasing light emission power in high ambient temperature. Refer to the below figure and install the transmitter amp unit in lower temperature zone in order to obtain higher operative margin.

(Example)




■ Relative power factor for optical head

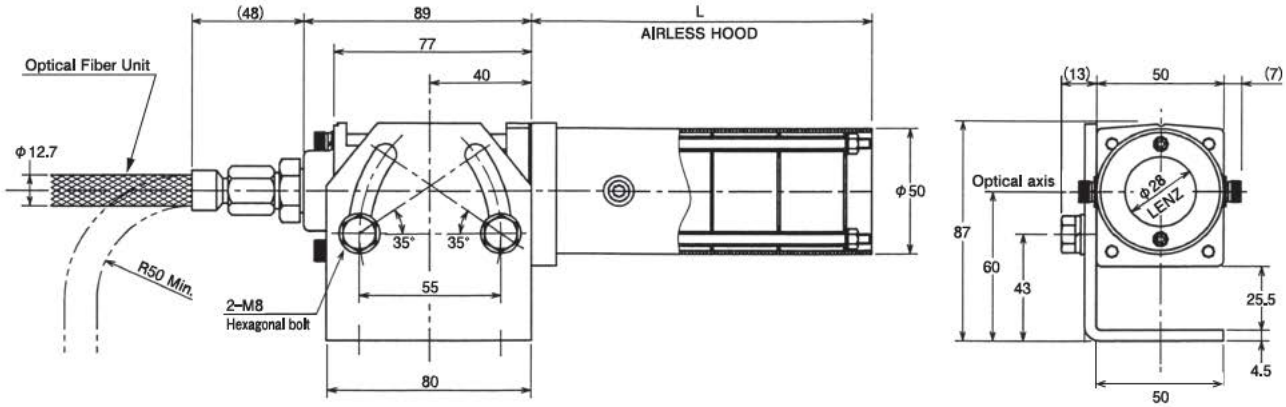
The table shows the relative power factor for each optical head.

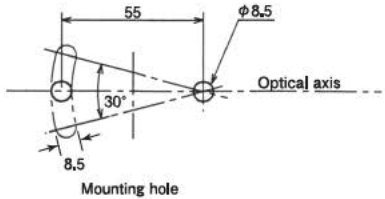
A same optical head has different optical power depending on whether it is used for a transmitter or a receiver.

This is due to the difference of light beam spread and effective lens diameter between the transmitter and the receiver. The table shows indexes using the relative power factor when OH2 is used both for the transmitter and the receiver as 100.

| Optical head | | Ralative power factor OH2 as 100 |
|---|---|---|
| On transmitter | On receiver | |
| OH2N | OH2N | 500 |
| OH2N | OH2 | 250 |
| OH2 | OH2N | 200 |
| OH2 | OH2 | 100 |
| OH2 | OHA | 35 |
| OHA | OH2 | 25 |
| OHA | OHA | 9 |

□ AIRLESS HOOD (in mm)
(combined with OHA)

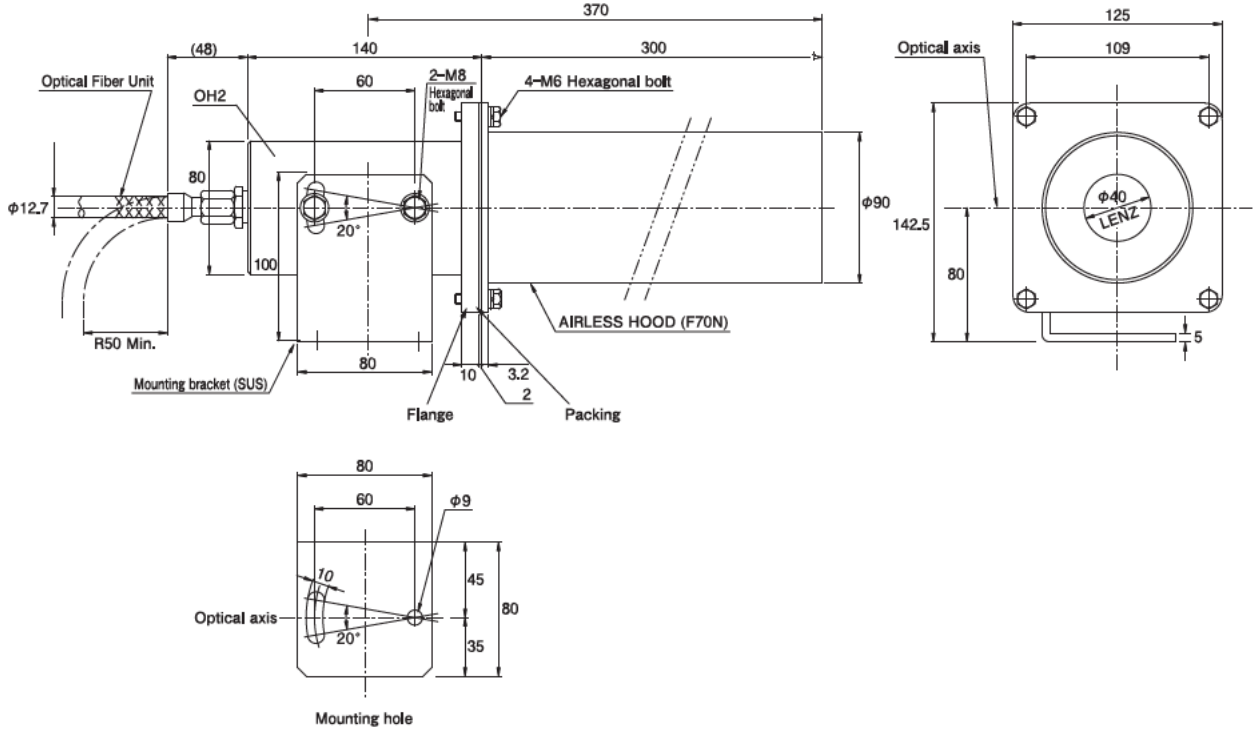


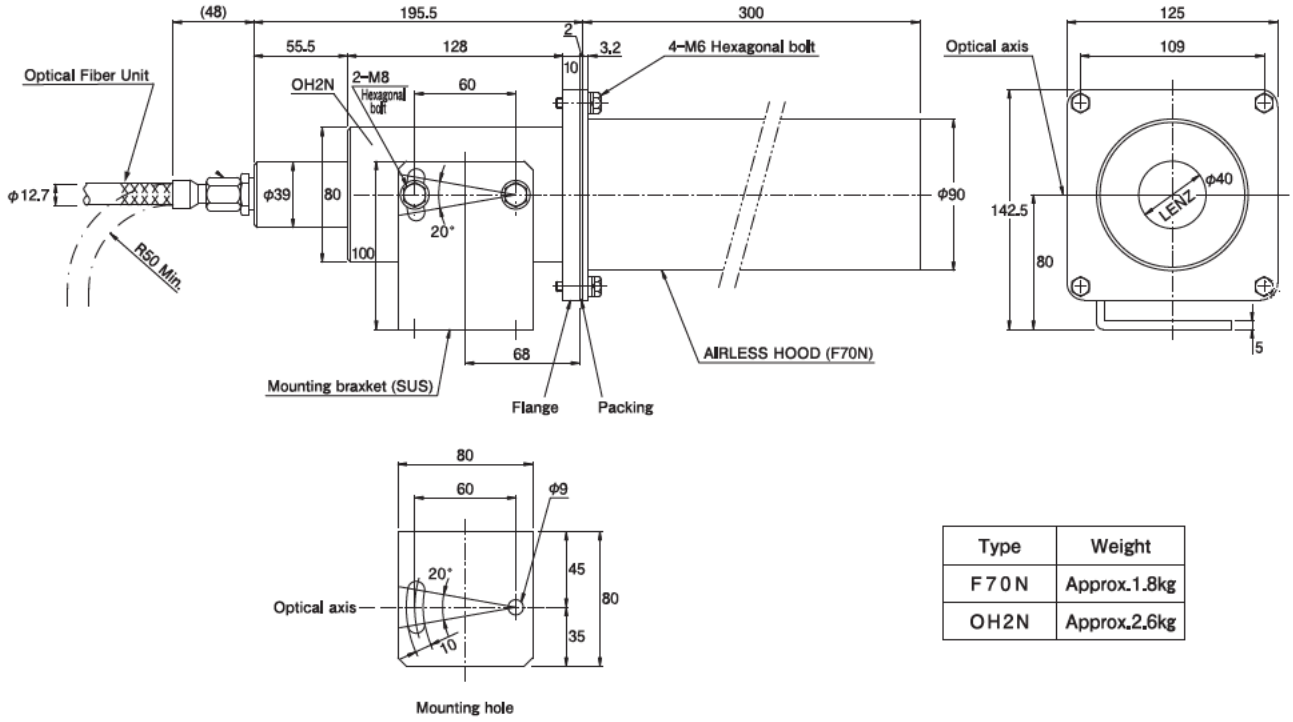

AIRLESS HOOD

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

□ AIRLESS HOOD (in mm)
(combined with OH2)

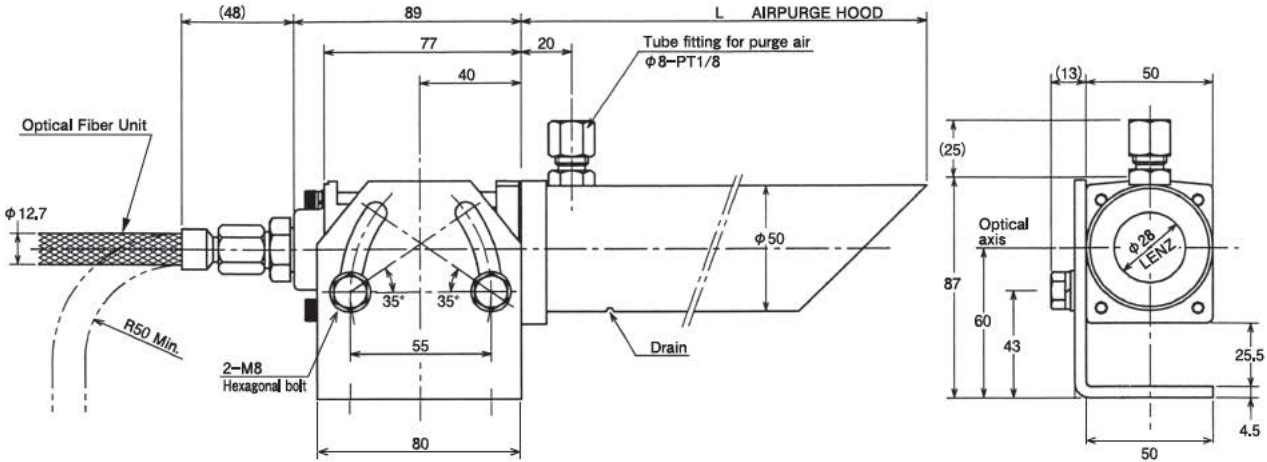


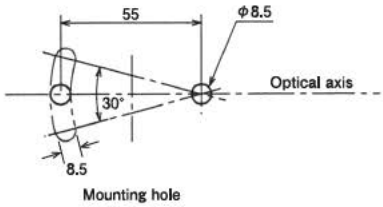
□ AIRLESS HOOD (in mm)
(combined with OH2N)




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

□ AIRPURGE HOOD (in mm)
(combined with OHA)



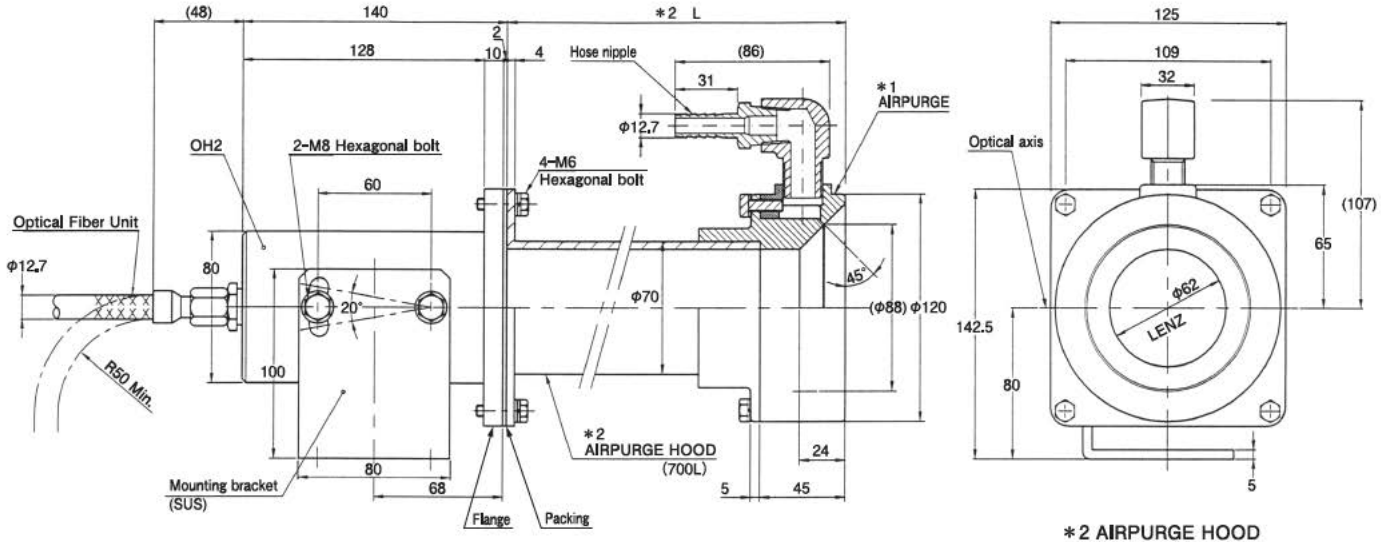



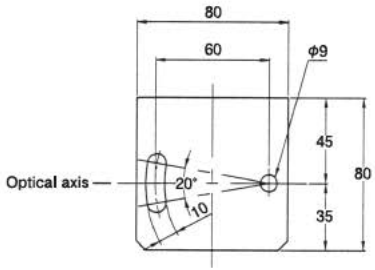

AIRPURGE HOOD

| Type | L (mm) |
|---|---|
| F38PC –02 | 200 |
| F38PC –03 | 300 |
| F38PC –04 | 400 |
| F38PC –05 | 500 |

AIRPURGE
QUANTITY : 200 ℓ /min
PRESSURE : 1MPa

□ AIRPURGE HOOD (in mm)
(combined with OH2)




Mounting hole

＊1 AIRPURGE

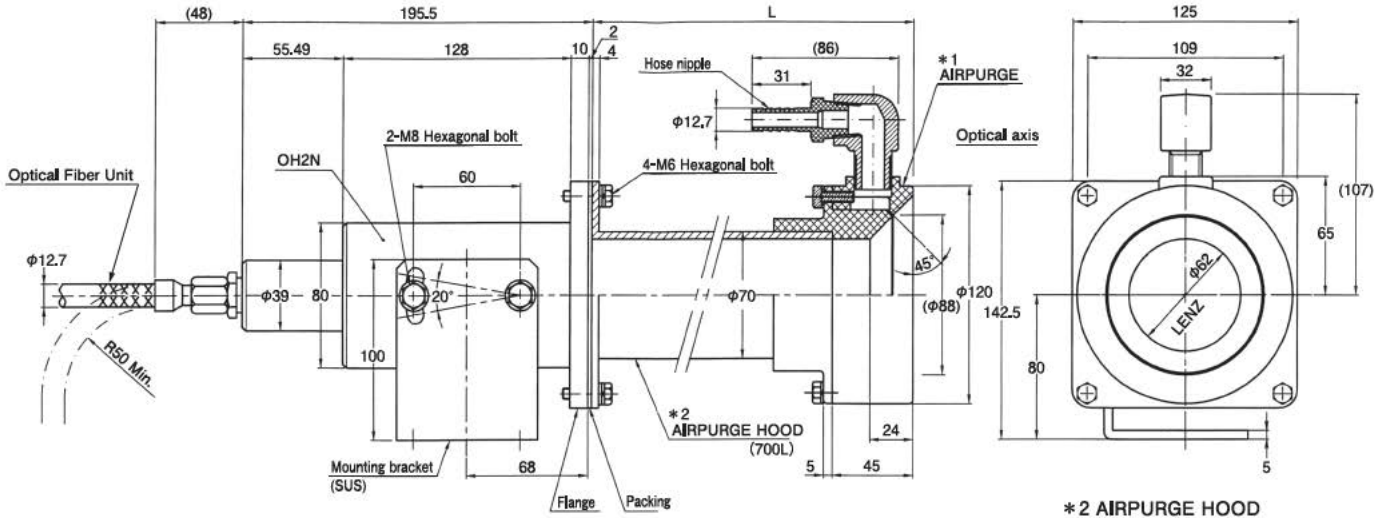
| | |
|---|---|
| Quantity | 200 ℓ /min |
| Pressure | 1MPa |

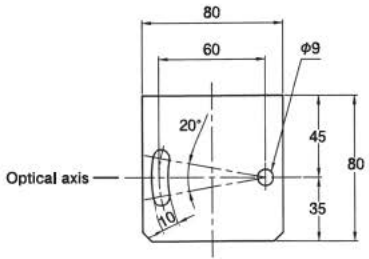
(Use air without dust and oil.)

＊2 AIRPURGE 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 |

□ AIRPURGE HOOD (in mm)
(combined with OH2N)




Mounting hole

*1 AIRPURGE

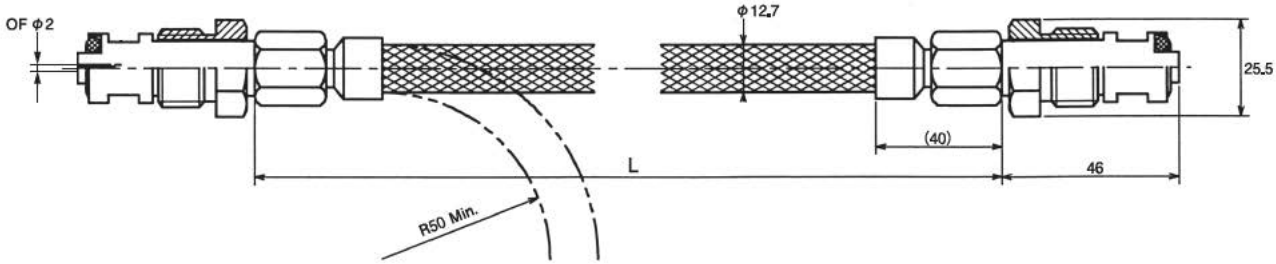
| | |
|---|---|
| Quantity | 200 ℓ /min |
| Pressure | 1MPa |

(Use air without dust and oil.)

*2 AIRPURGE 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 |

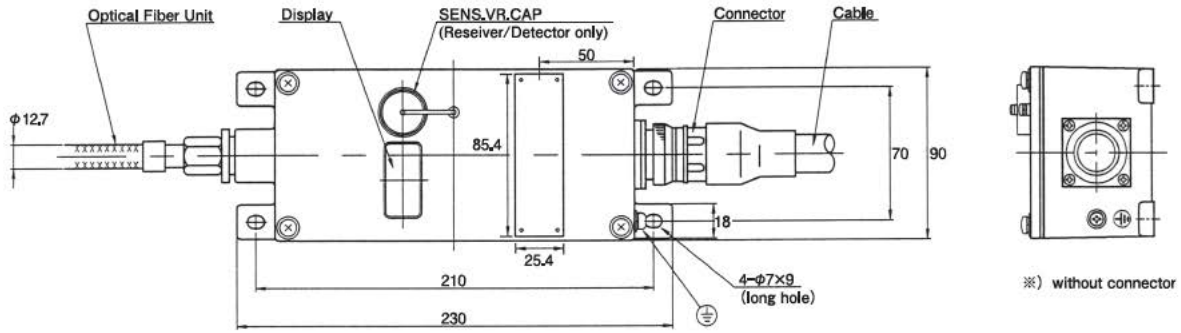
□ FIBER UNIT (in mm)

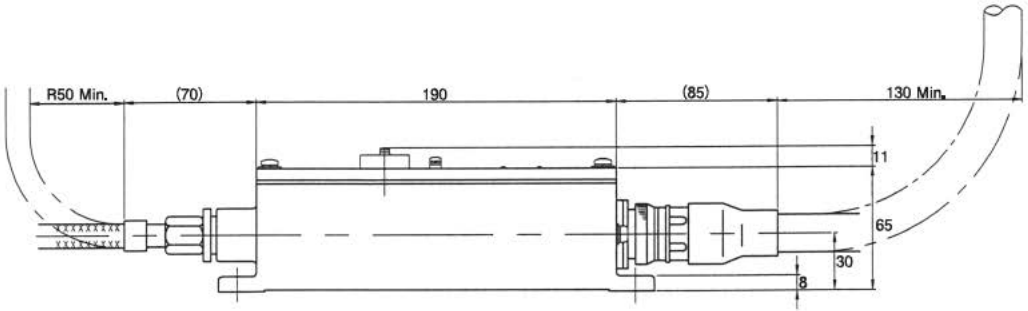



| TYPE | L (m) |
|---|---|
| FG2 | 2 |
| FG3 | 3 |
| FG4 | 4 |
| FG5 | 5 |
| FG7 | 7 |
| FG10 | 10 |
| FG15 | 15 |
| FG20 | 20 |
| FG30 | 30 |

□ AMPLIFIER UNIT (in mm)

- Transmitter : FTL44A
- Receiver : FTR44A




**TAKENAKA ELECTRONIC INDUSTRIAL CO.,LTD.**

Head office : 5-22 Higashino Kitainoue-cho, Yamashina-ku, Kyoto, 607-8141, Japan
Telephone : +81-75-581-7111
Fax : +81-75-581-7118

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