Instruction Manual

# CROSS STACK LASER GAS ANALYZER

**TYPE: ZSS-6**

Fuji Electric Co., Ltd.

INZ-TN6ZSS-E

# PREFACE

We thank you very much for purchasing Fuji Electric's cross-stack laser gas analyzer (Type: ZSS).

- First read this instruction manual carefully until an adequate understanding is acquired. Then proceed to installation, operation and maintenance of the laser gas analyzer. Improper handling may result in an accident or a failure.
- The specifications of the laser gas analyzer may be changed without prior notice for further product improvement.
- Modification of the laser gas analyzer is strictly prohibited unless a written approval is obtained from the manufacturer. We will not be responsible for any accident attributable to such remodeling without permission. If it becomes necessary to modify the laser gas analyzer, contact the manufacturer in advance.
- This instruction manual shall be stored by the person who actually uses the laser gas analyzer.
- After reading the manual, be sure to keep it at a place easy to access.
- This instruction manual should be delivered to the end user without fail.
- This product falls under Category 9 (monitoring and control instruments) set out in Annex I of the RoHS directive 2011/65/EU, and not for consumer use.

| | |
|---|---|
| Manufacturer: | Fuji Electric Co., Ltd. |
| Type: | Described in nameplate on main frame |
| Date of manufacture: | Described in nameplate on main frame |
| Product nationality: | Japan |

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**Request**

- Transcription of a part or the whole of this manual without permission is prohibited.
- The contents of this manual are subject to change without prior notice.

# Contents

# CAUTION ON SAFETY

**First of all, read this "Caution on safety" carefully, and then use the particle counter in the correct way.**

The following items are important for safe operation and must be fully observed. These safety precautions are ranked in 2 levels; "DANGER" and "CAUTION."

| | |
|---|---|
| ⚠ **DANGER** | If operation is incorrect, a dangerous situation may occur, resulting in death or serious injury. |
| ⚠ **CAUTION** | If operation is incorrect, a dangerous situation may occur, resulting in minor to medium injuries or only physical damage to equipment. |

| **Caution on installation and transportation** | |
|---|---|
| ⚠ **DANGER** | (1) When the analyzer (receiver unit and transmitter unit) is installed on incineration facility, make sure the facility has stopped completely. Installing in an operating facility may cause high temperature gas injection resulting in burn.<br>(2) This analyzer is not explosion-proof. Do not use it in an atmosphere of explosive gas. This may result in serious accidents such as explosion, fire, etc. |
| ⚠ **CAUTION** | (1) The analyzer should be installed in a place conforming with the installation requirements noted in this instruction manual, and where the weight of the analyzer can be endured. Otherwise, it may cause a tip-over, drop, electric shocks, fire or malfunction of the unit.<br>(2) Ask professional services or your dealer for installation, transportation, reinstallation, and associated piping and wiring work. Improper installation may result in a falling accident, electric shock, or injury.<br>(3) Check the installation site once every 6 months to make sure that the installation surface is free of rattling. If the instrument is used under insecure installation conditions, a falling accident may occur.<br>(4) During installation, make sure that the inside of the unit is free from cable chips and other foreign objects. Otherwise, it may cause fire, failure or malfunction.<br>(5) For lifting the gas analyzer, be sure to wear protective gloves. Bare hands may leave you prone to injury. If the temperature in the installation site is high, it is imperative to wear leather gloves to prevent burn.<br>(6) The analyzer is heavy. It should be transported carefully by two or more persons if manually required. Otherwise, bodily harm may ensue.<br>(7) Do not look into the transmitter unit or direct the laser beam to the eyes of people while the power is turned ON. Otherwise, the laser beam may damage cornea of the eye.<br>(8) The laser beam is the invisible infrared light. Do not watch the laser beam directly or scattering light.<br>(9) Do not watch the laser beam directly with the optical measuring device. Otherwise, it may cause serious damage to your eyes. |

| Caution on Wiring | |
|---|---|
| ⚠ **CAUTION** | (1) Be sure to connect a ground wire securely to the specified place by performing class D grounding work. Otherwise electric shock or malfunction may result.<br>(2) If the power supply voltage exceeds the rating, electric shock or damage to the instrument may result. Be sure to use the instrument within the specified rating range.<br>(3) Be sure to turn off the power before performing wiring work.<br>(4) Be sure to use a 600V-IV ground wire 2 mm or larger in diameter with sufficient dielectric strength.<br>(5) Select input/output wires of materials and diameter that satisfy the rating of each device. If a wire which cannot endure the rating is used, electric shock or fire may occur.<br>(6) Fasten the input/output wires to the floor or wall, and use a wire protection device. |

| Caution on operation and use | |
|---|---|
| ⚠ **DANGER** | (1) When handling the standard gas such as calibration gas, read the instruction manual of the standard gas carefully, and use the gas correctly.<br>(2) When toxic fumes, corrosive gas or inert gas is used as calibration gas, be sure that the position of the air ventilation or exhaust port is suitable. Otherwise you may inhale exhaust gas. Furthermore, suffocation, brain disorder, circulatory deficit, or contraction of the breathing system may occur, resulting in death. |
| ⚠ **CAUTION** | (1) Do not touch the switch with a wet hand. Otherwise it may cause electric shock.<br>(2) Do not operate the laser gas analyzer for a long time with its door left open. Otherwise, dust, foreign matter, etc. may stick on internal walls, thereby causing faults.<br>(3) Do not touch the unit terminal block during operation. Otherwise, it may cause electric shock or injury.<br>(4) Before leaving unused for a long time or restarting after left at such a status for an extended length of time, follow the directions of each instruction manual because they are different from normal starting or shutdown. Otherwise, adequate performance will not be provided. Furthermore, an accident or fault may be caused.<br>(5) Do not allow water to go into the gas analyzer. Otherwise, electric shock or fire in the instrument may be caused.<br>(6) Do not smoke nor use a flame near the gas analyzer. Otherwise, it may result in a fire. |

| Caution on maintenance and inspection | |
|---|---|
| ⚠ **DANGER** | (1) When the analyzer (receiver unit and transmitter unit) is installed on incineration facility, make sure the facility has stopped completely. Installing on the operating facility may cause high temperature gas injection, resulting in burn.<br>(2) If the analyzer is installed or removed from the location higher than operator's height, set up a fence to keep someone from approaching under or near the unit. If the analyzer inadvertently falls off and hits someone, serious injuries may occur, resulting in death. |
| ⚠ **CAUTION** | (1) Be careful not to drop the analyzer on your foot. Otherwise, it may cause fracture of the bone.<br>(2) Do not touch the terminal block of each unit of the instrument carelessly during operation. Otherwise, it may cause electric shock.<br>(3) Before working, take off a wrist watch, finger ring or the like metallic accessories. And never touch the instrument with a wet hand to avoid electric shocks.<br>(4) If the fuse is blown, eliminate the cause, and then replace it with the one of the same capacity and type as before. Otherwise, it may cause electric shock or accident.<br>(5) Do not wash or splash water on the switch or electrical parts inside the device. Otherwise it may cause an electric shock, failure, or fire.<br>(6) Do not use replacement parts other than recommended ones. Otherwise, adequate performance will not be provided. Furthermore, an accident or fault may be caused.<br>(7) Dispose replacement parts such as maintenance parts as incombustibles in accordance with the local waste disposal requirements. |

| Others | |
|---|---|
| ⚠ **CAUTION** | • If the cause of any fault cannot be determined despite reference to the instruction manual, be sure to contact your dealer or Fuji Electric's technician in charge of adjustment. If the instrument is disassembled carelessly, you may get an electric shock or injury. |

# 1. GENERAL

## 1.1 General

Cross-stack laser gas analyzer (ZSS) provides continuous measurement of HCl in-flue gas incineration, $NH_3$ density of denitration equipment and heat treat furnace, and $O_2$, CO, and $CO_2$ density for combustion control within a short response time. The cross-stack configuration eliminates the need for transfer of the preparation measurement gas to the analyzer for proper measurement.
Dust resistant construction enables installation upstream of bug filter units and the application for which injection volume of calcium hydroxide is controlled while measuring HCl concentration.
The analyzer adopts near-infrared laser as light source. The measuring object of the analyzer is only one spectrum line from large numbers of absorption spectrum lines, and it measures concentration by controlling temperature and power current. Since the range of wavelengths to be measured is a few nano meters, the analyzer has minimum interference by other crossovers.
For the concentration detection, the modulated intensity of signal amplitude is employed instead of the amount of change of light.

## 1.2 Handling of product and operating precautions

First read this instruction manual carefully, and then make a plan for periodic inspection to perform appropriate maintenance management. To maintain the long-term performance of the cross-stack laser gas analyzer (ZSS), our periodic inspection contract is recommended.
This analyzer uses the invisible infrared laser (excluding $O_2$). Do not watch the laser beam directly (with an optical measuring device included) or scattering light.

Laser Classification : Class 1 (excluding $O_2$ analyzer and some $CO+O_2$ analyzer) according to IEC/EN60825-1
Protection Class : IP65
Pollution degree : 2

Certification Label
Complies with 21CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice No.50 dated July 26, 2001

EC Directive Compliance
The product conforms to the requirements of the Low Voltage Directive 2006/95/EC and EMC directive 2004/108/EC.
It conforms to following standards for product safety and electromagnetic compatibility ;

■ EN61010-1 : 2010 Safety requirements for electrical equipment for measurement , control and laboratory use.
"Installation Category II"
"Pollution Degree 2"

■ EN61326-1 : 2006 Electrical equipment for measurement , control and laboratory use
— EMC requirements.

■ EN61326-2-3 : 2006
■ EN61000-3-2 : 2006, A1 ; 2009, A2 ; 2009
■ EN61000-3-3 : 2008

# 2. CHECKING DELIVERED ITEMS

Upon receiving the recorder unit, check if the correct quantity of the accessories are supplied.
Separately supplied document are given first priority. When you have purchased or want to purchase spare parts for 1-year operation or a list of calibration/installation fixtures, refer to “CAUTION ON SAFETY”at the end of this Manual.

## 2.1 Delivered articles (products and standard accessories)

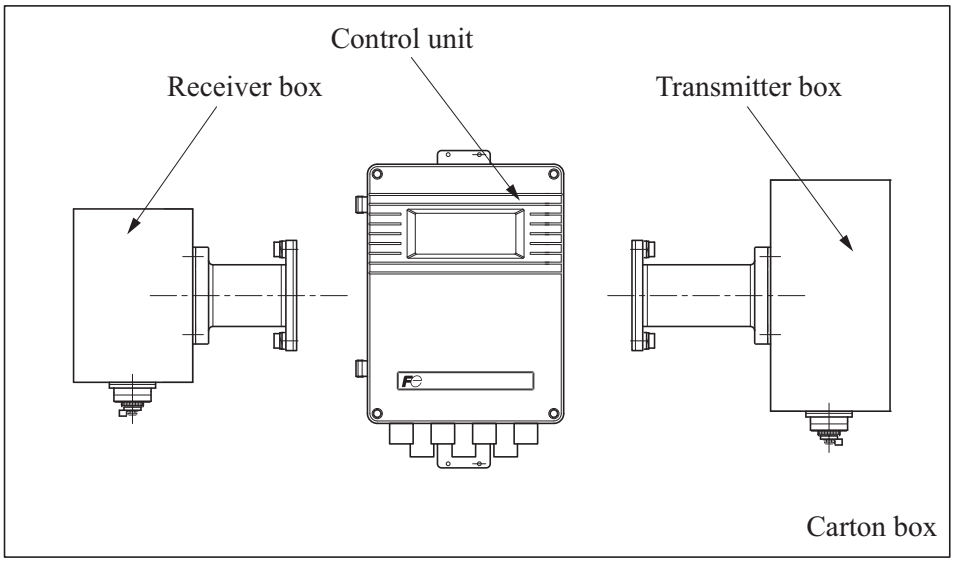
Table 2－1 Products

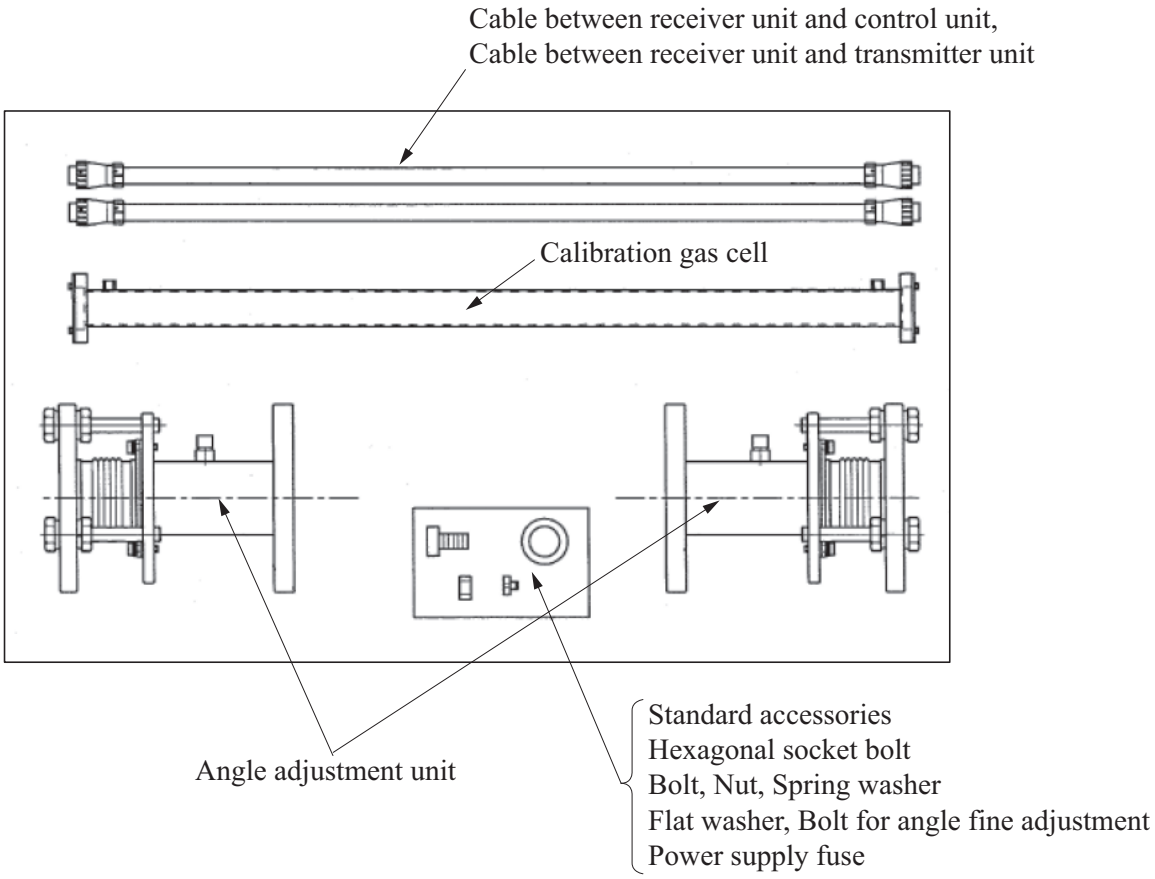
| No. | Product name | Quantity |
|---|---|---|
| 1. | Control unit | 1 |
| 2. | Receiver box | 1 |
| 3. | Transmitter box | 1 |
| 4. | Angle adjustment unit | 2 |
| 5. | Cable between receiver unit and control unit | 1 |
| 6. | Cable between receiver unit and transmitter unit | 1 |
| 7. | Hexagonal socket bolt | 2 |
| 8. | | |
| 9. | | |
| 10. | | |

Table 2－2 Standard accessories

| No. | Product name | Quantity |
|---|---|---|
| 1. | Bolt (*1) | 8 (16) |
| 2. | Nut (*1) | 8 (16) |
| 3. | Spring washer (*1) | 8 (16) |
| 4. | Flat washer (*1) | 8 (16) |
| 5. | Companion flange packing or flange packing specified for use in high temperature | 2 |
| 6. | Bolt for angle fine adjustment (*2) | 6 |
| 7. | Power supply fuse | 2 |
| 8. | Instruction manual | 1 |
| 9. | | |
| 10. | | |

*1: When B, C, or D is selected for the 9th digit of the code symbols, the length of the bolt becomes 70mm. In other cases, it becomes 55mm (inch bolt is not supplied).
*2: The bolts may be connected to the main unit at the time of delivery.

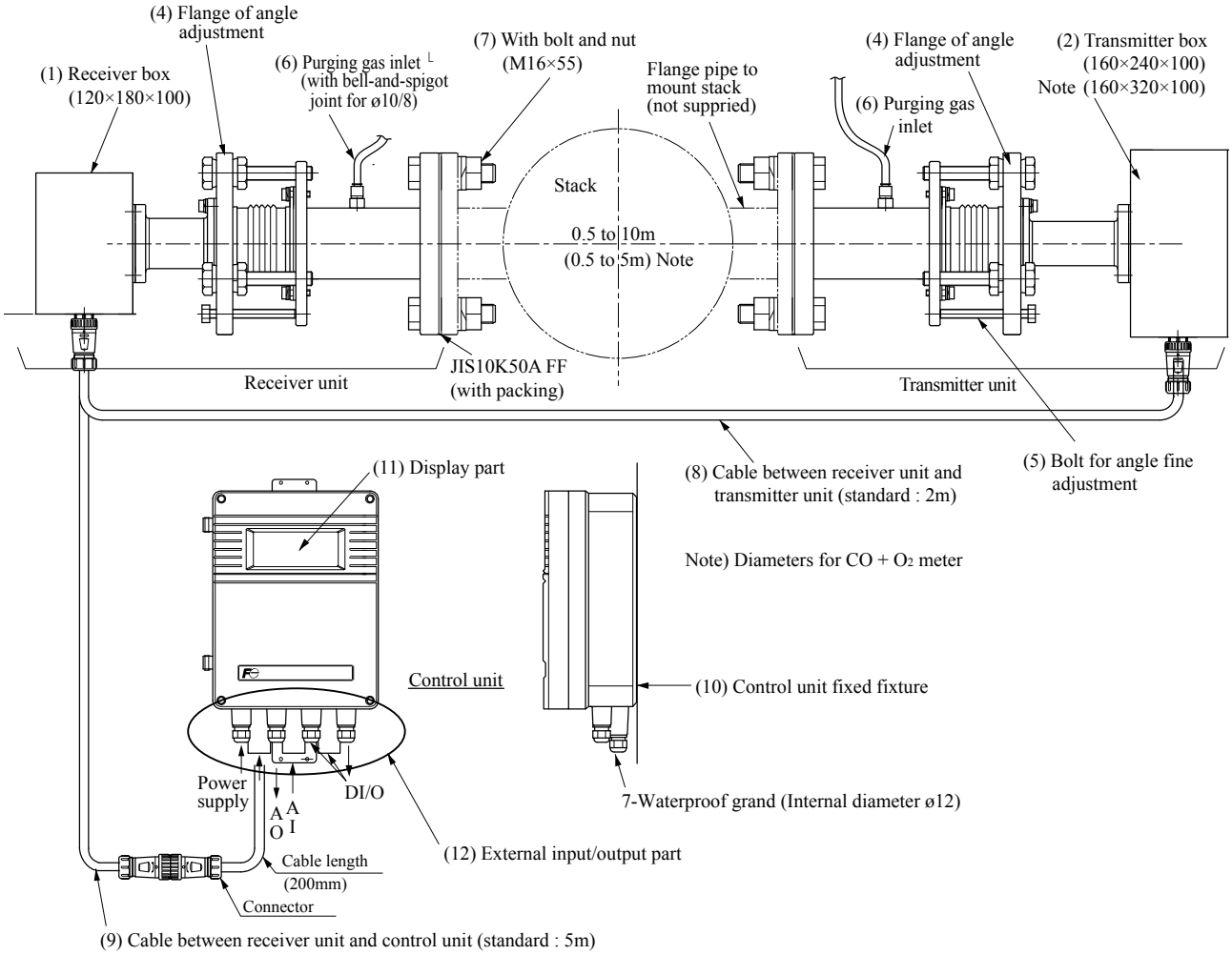

Control unit
Receiver box
Transmitter box
Carton box

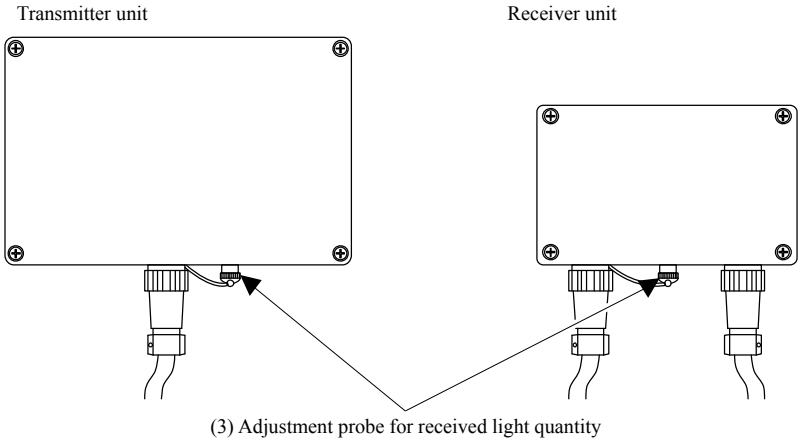

Cable between receiver unit and control unit,
Cable between receiver unit and transmitter unit
Calibration gas cell
Angle adjustment unit
Standard accessories
Hexagonal socket bolt
Bolt, Nut, Spring washer
Flat washer, Bolt for angle fine adjustment
Power supply fuse

# 3. NAME AND EXPLANATION OF EACH PART

## 3.1 Overall composition

The analyzer consists of 3 units; “Transmitter unit” to transmit the laser, “Receiver unit” to receive light, and “Control unit” to display and output signals.



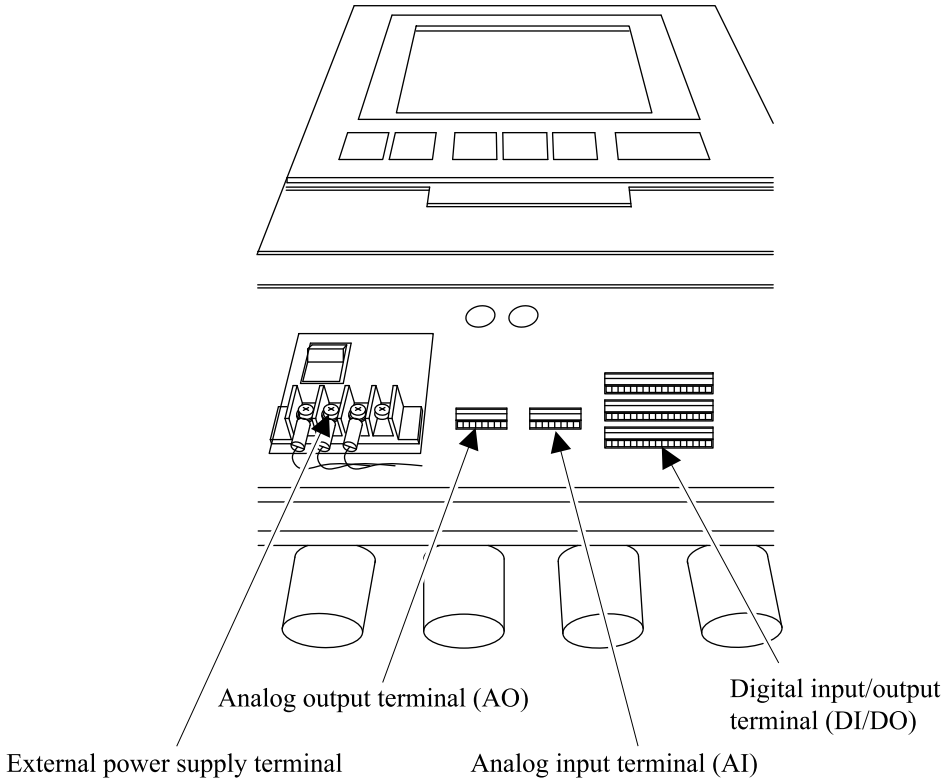



| | Name | Description |
|---|---|---|
| (1) | Receiver box | A photodiode to receive light and a board are built-in. |
| (2) | Transmitter box | Laser element, peltier to control the temperature of laser and a board are built-in. |
| (3) | Adjustment probe for received light quantity | Terminal which checks the level of received light quantity with the voltage value when light axis adjustment is performed. It is provided in both the receiver unit and transmitter unit. Connecting the terminal is the BNC connector. |
| (4) | Angle adjustment unit | A unit which adjusts light axis to receive laser light transmitted from transmitter unit via PD of receiver unit. Up to 5° can be angle-tuned. |
| (5) | Bolt for angle fine adjustment | When the stack becomes longer, received light quantity changes greatly by subtle angle-turning. In such cases, light axis adjustment is performed by using the fine adjustment screw. It may not be necessary when the stack (optical path lengths) is short. Use it according to the length of the stack. |
| (6) | Air purge inlet | Inlet for feeding instrumentation air. It is required to prevent lens condensation and eliminate attached dust. Prepare the pipe to connect to joint for tube ϕ10/8. (Use the air for air purge which does not contain oil or mist. Othewise, the oil builtup inside the flowmeter may reduce the flow or oil attached to the lens surface may cause difficulty in light receiring.) |
| (7) | Companion flange | Connects to the companion flange which is mounted on the stack. (This flange should be prepared by users.) |
| (8) | Cable between receiver unit and transmitter unit | Supplies power to transmitter unit, and sends and receives signal between receiver unit and transmitter unit. Up to 25m can be specified. |
| (9) | Cable between receiver unit and control unit | Supplies power to receiver unit, and sends and receives signal between receiver unit and transmitter unit. Up to 100m can be specified. |
| (10) | Control unit fixed fixture | Fixes control unit on the wall. There are two ϕ12 holes as mounting holes at upper part, and 12mm width U-tube hole at lower part. |
| (11) | Display part | Displays the measurement value and alarm. |
| (12) | External input/output part | Input/output part for AC power supply, signal cable to the receiver unit, analog input/output and relay input/output. The hole diameter is ϕ10mm. |

## 3.2 Input/output terminal of control unit (excluding $CO+O_2$ analyzer)

Each input/output signal from the analyzer is connected to board terminal of the control unit.
There are 2 types of the input/output terminal boards. Refer to the same figure that has the same terminal allocation as the product you received.

(1) Input / output terminal 1 (AO 4 points)




### External power supply terminal

| | L | N | PE | |
|---|---|---|---|---|
| | 1 | 2 | 3 | |

Screw diameter: M4

1 100 to 240V AC (50/60Hz) (L)
2 100 to 240V AC (50/60Hz) (N)
3 PE Earth terminal (PE)

### AO terminal

| | | | | | |
|---|---|---|---|---|---|
| 7 | 8 | 9 | 10 | 11 | 12 |
| 1 | 2 | 3 | 4 | 5 | 6 |

Cross sectional area of rated cable: AWG26-16

1 AO1+
2 AO1–
Analog output 1 (AO1)
3 AO2+
4 AO2–
Analog output 2 (AO2)
5 AO3+
6 AO3–
Analog output 3 (AO3)
7 AO4+
8 AO4–
Analog output 4 (AO4)
AO expansion board required
9 Unassigned
10 Unassigned
11 Unassigned
12 Unassigned

AI terminal

| | | | | | |
|---|---|---|---|---|---|
| 7 | 8 | 9 | 10 | 11 | 12 |
| 1 | 2 | 3 | 4 | 5 | 6 |

Cross sectional area of rated cable: AWG26-16

1 AI1+
2 AI1–
3 AI2+
4 AI2–
5 AI3+
6 AI3–
7 AI4+
8 AI4–
9 AI5+
10 AI5–
11 AI6+
12 AI6–

Analog input 1 (AI1)
Analog input 2 (AI2)
Analog input 3 (AI3)
Analog input 4 (AI4)
Analog input 5 (AI5)
Analog input 6 (AI6)

AI expansion board required

DI/DO terminal

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 |
| 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |

Cross sectional area of rated cable: AWG26-16

1 DI1
2 DI1
Remote average value reset (option)

3 DI2
4 DI2
Switching input for remote instantaneous value/average value (option)

5 DI3
6 DI3
Remote hold (option)

7 DI4
8 DI4
9 DI5
10 DI5
Spare

11 Unassigned
12 Unassigned

13 DO1
14 DO1
Low Light Transmission

15 DO2
16 DO2
Analyzer faulty

17 DO3
18 DO3
On Hold / Under Calibration

19 DO4
20 DO4
21 DO5
22 DO5
23 DO6
24 DO6
Beyond the upper/lower limits (Ch.1)

25 DO7
26 DO7
27 DO8
28 DO8
Power OFF

29 DO9
30 DO9
31 DO10
32 DO10
33 DO11
34 DO11
35 DO12
36 DO12
Beyond the upper/lower limits (Ch.2)

Note 1) Unassigned terminals may be connected to the internal circuit.
Do not use them as repeating terminals.

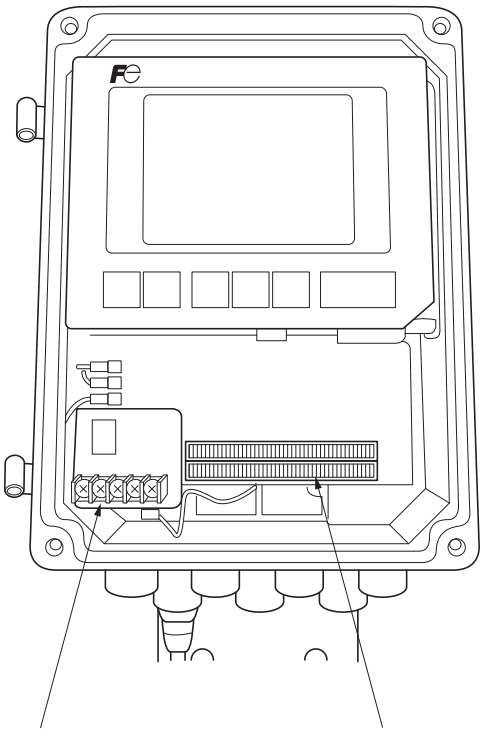
Note 2) Provide relay output of LD failure, LD temperature error, or connection error as analyzer faulty.

Note 3) Do not provide relay output of high gas temperature, air purge (low pressure), box temperature warning, PD over range or AI under.

Note 4) Consult our sales representative to collectively provide relay output of alarm depending on the installation environment.

Note 5) All the alarms except "Connection Error" which indicates communication failure between the receiver unit and the control unit will be activated after at least five minutes from the power off. The alarm of "Low Light Transmission" is activated after 1 minute continuation. Though it takes 6 minutes from just after the power on.

(2) Input / output terminal 2 (AO 2 points)



External power supply connection terminal (M4)

AO terminal / AI terminal / DI/DO terminal (equivalent to M2)

External power supply connection terminal

| | L | N | PE | |
|---|---|---|---|---|
| | 1 | 2 | 3 | |

Screw diameter: M4

1 100 to 240V AC (50/60Hz) (L)
2 100 to 240V AC (50/60Hz) (N)
3 PE

AO terminal

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |

Screw diameter: Equivalent to M2

1 AO1+
2 AO1– Analog output 1

21 AO2+
22 AO2– Analog output 2

AI terminal

| 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |

Screw diameter : Equivalent to M2

3 AI1+
4 AI1– — Analog input 1

5 AI2+
6 AI2– — Analog input 2

7 AI3+
8 AI3– — Analog input 3 (AI expansion board repuired)

23 AI4+
24 AI4– — Analog input 4 (AI expansion board repuired)

25 AI5+
26 AI5– — Analog input 5 (AI expansion board repuired)

27 AI6+
28 AI6– — Analog input 6 (AI expansion board repuired)

DI/DO terminal

| 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |

Screw diameter : Equivalent to M2

9 DO1
10 DO1 — Low Light Transmission

11 DO2
12 DO2 — Analyzer faulty

13 DO3
14 DO3 — On Hold / Under Calibration

15 DO4
16 DO4 — Beyond the upper/lower limits

17 DO5
18 DO5

19 DO6
20 DO6

29 DO7
30 DO7

31 DO8
32 DO8 — Power OFF

33 DI1
34 DI1 — Remote average value reset (option)

35 DI2
36 DI2 — Switching input for remote instantaneous value/average value (option)

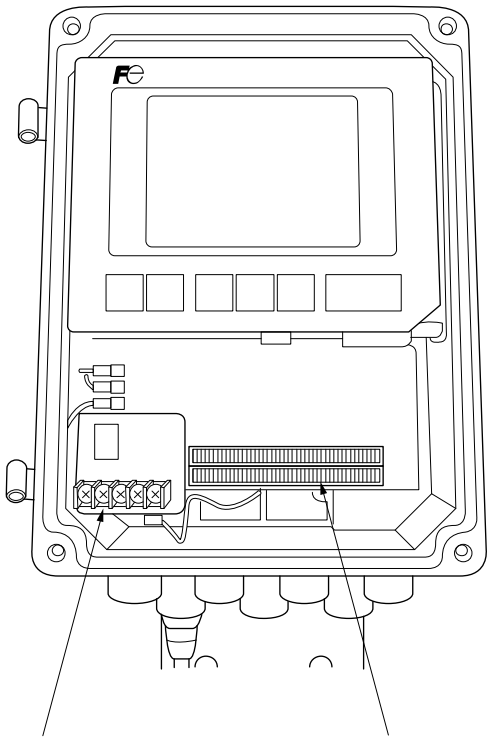
37 DI3
38 DI3 — Remote hold (option)

39 DI4
40 DI4

AO terminal, AI terminal and DI/DO terminal are connected to the corresponding terminal block.

Note 1) Provide relay output of LD failure, LD temperature error, or connection error as analyzer faulty.
Note 2) Do not provide relay output of high gas temperature, air purge (low pressure), box temperature warning, PD over range or AI under.
Note 3) Consult our sales representative to collectively provide relay output of alarm depending on the installation environment.
Note 4) All the alarms except "Connection Error" which indicates communication failure between the receiver unit and the control unit will be activated after at least five minutes from the power off. The alarm of "Low Light Transmission" is activated after 1 minute continuation. Though it takes 6 minutes from just after the power on.

# 3.3 Input/output terminal of control unit ($CO+O_2$ analyzer)



External power supply connection terminal (M4)

AO terminal / AI terminal / DI/DO terminal (equivalent to M3)

External power supply connection terminal

| | L | N | PE | |
|---|---|---|---|---|
| | 1 | 2 | 3 | |

Screw diameter: M4

1 100 to 240V AC (50/60Hz) (L)
2 100 to 240V AC (50/60Hz) (N)
3 PE

AO terminal

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |

Screw diameter: Equivalent to M3

1 AO1+
2 AO1– Analog output 1

3 AO2+
4 AO2– Analog output 2

17 AO3+
18 AO3– Analog output 3

19 AO4+
20 AO4– Analog output 4

AI terminal

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |

Screw diameter: Equivalent to M3

5 AI1+
6 AI1– Analog input 1

21 AI2+
22 AI2– Analog input 2

DI/DO terminal

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |

Screw diameter: Equivalent to M3

7 DO1
8 DO1 Low Light Transmission
9 DO2
10 DO2 Analyzer faulty
11 DO3
12 DO3 On Hold / Under Calibration
13 DI1
14 DI1 Remote average value reset (option)
23 DO4
24 DO4 Beyond the upper/lower limits
25 DO5
26 DO5
27 DO6
28 DO6
29 DI2
30 DI2 Switching input for remote instantaneous value/average value (option)
31 DI3
32 DI3 Remote hold (option)

Note 1) Provide relay output of LD failure, LD temperature error, or connection error as analyzer faulty.
Note 2) Do not provide relay output of high gas temperature, air purge (low pressure), box temperature warning, PD over range or AI under.
Note 3) Consult our sales representative to collectively provide relay output of alarm depending on the installation environment.
Note 4) All the alarms except "Connection Error" which indicates communication failure between the receiver unit and the control unit will be activated after at least five minutes from the power off. The alarm of "Low Light Transmission" is activated after 1 minute continuation, which means 6 minutes after power on.
Note 5) AO terminal, AI terminal and DI/DO terminal are connected to the corresponding terminal block.

# 4. MOUNTING METHOD

| | |
|---|---|
| ⚠ **DANGER** | This analyzer is not explosion-proof. Do not use it in an atmosphere of explosive gas. Otherwise, it can result in serious accidents such as explosion, fire, etc. |

| | |
|---|---|
| ⚠ **CAUTION** | • The analyzer should be installed in a place conforming with the installation requirements noted in this instruction manual. Otherwise, it may cause toppling, dropping, electric shocks, fire or malfunction of the unit.<br>• Request assistance from the professionals or the vendors when mounting, moving, re-mounting and carrying out piping and wiring works associated with these activities. A poor installation may cause accidental tip over, electric shock, injury, etc.<br>• During installation, make sure that the inside of the unit is free from cable chips and other foreign objects. Otherwise, it may cause fire accident or malfunction.<br>• For lifting the analyzer, be sure to wear protective gloves. Bare hands may leave you prone to an injury. If the temperature in the installation location is high, be sure to wear leather gloves. Otherwise, you may suffer a burn.<br>• The analyzer is heavy. It should be transported carefully by two or more persons if manually required. Otherwise, bodily harm may ensue.<br>• Do not look into the transmitter unit or direct the laser beam to the eyes of people while the power is turned ON. Otherwise, the laser beam may damage cornea of the eye.<br>• The laser beam is the invisible infrared light. Do not watch the laser beam directly or scattering light.<br>• Do not watch the laser beam directly with the optical measuring device. Otherwise, it may cause serious damage to your eyes. |

# 4.1 Installation conditions

## 4.1.1 Installation conditions of receiver unit and transmitter unit

Select a location that meets the following conditions.

(1) Ambient temperature : A place where the temperature is within -20 to 55°C and there is no sudden temperature change.

(2) Ambient humidity : A place where the humidity is 90% RH or lower not subjected to condensation.

(3) Measured gas temperature : Refer to "1-1 (4) Measurable component and range" in APPENDIX 1. A place where the stack is not distorted or laser light axis is not deflected by sudden temperature change.

(4) Measured gas pressure : ±10kPa

(5) Measured gas moisture : 50vol% or less (no condensation)

(6) Measured gas velocity : 25m/s or less (However, consultation is necessary for the environment where dust (1g/$Nm^3$ or more) or water (25vol% or more) exists.) (Prevention of dust deposition or dew condensation due to increase in air purge flow rate is required)

(7) Dust : 5 to 15 g/$Nm^3$ or less (depending on the installation environment conditions such as measurable components, device specification, optical light path, particle diameter, and so on)

(8) Companion flange : Prepare the flange diameter selected by the ninth digit of the code symbols. Also, when the purchase specification is provided, prepare the flange diameter described in the specification.

(9) Air purge : Prepare the instrumentation air containing no oil or water. (Pressure: 0.5 to 0.7 MPa or more) If there is a possibility of containing oil or water, install an oil filter or a mist filter. When the instrumentation air cannot be supplied, install a compressor. Prepare $N_2$ for $O_2$ analyzer and $CO+O_2$ analyzer excluding for air purge version (of which $4^{th}$ digit of code symbol is T or V).

(10) Air purge flow rate : 20L/min or more (depending on measured gas temperature, velocity, pressure, moisture or dust) (One-side air purge flow rate (L/min) ≥ Gas velocity (m/s) × 10)

(11) Path lengths (diameter) : 0.5 to 10 m (0.5 to 5 m for $CO+O_2$ analyzer)

(12) Vibration : 0.5G or less (0.2G or less for frequency 20 to 40Hz) (When the measured optical path length is 1m or less)

(13) A place with less corrosive gases

(14) A place accessible for maintenance and check (Refer to "4.2 Mounting dimensions of receiver unit and transmitter unit".)

(15) A place with less electrically induced disturbances such as high electric currents or sparks in the surrounding.

(16) Light axis fluctuation range: Within 0.3°C (When a unit has dust measuring function and the path length is 0.5m).

Note) When there is a possibility of deflecting the laser light axis or reducing the light quantity due to the large vibration acceleration, contact the manufacturer before installation.

Note) When "Box Temperature Warning" is occurred under the influence of gas temperature, mount the reducer to keep the receiver box and the transmitter box away from the stack.

Note) When you measure the high temperature gas of 500°C or more, install a pressure sensor at the place where the air is purged to monitor. Measuring the high temperature gas without air purge may cause damage to the analyzer.

Note) If you install the analyzer which air purge has not been performed, problems such as permanent glass contamination and dust contamination are caused, and it may result in improper operation of the analyzer. Regardless of whether or not the analyzer is operated, perform air purge before installation.

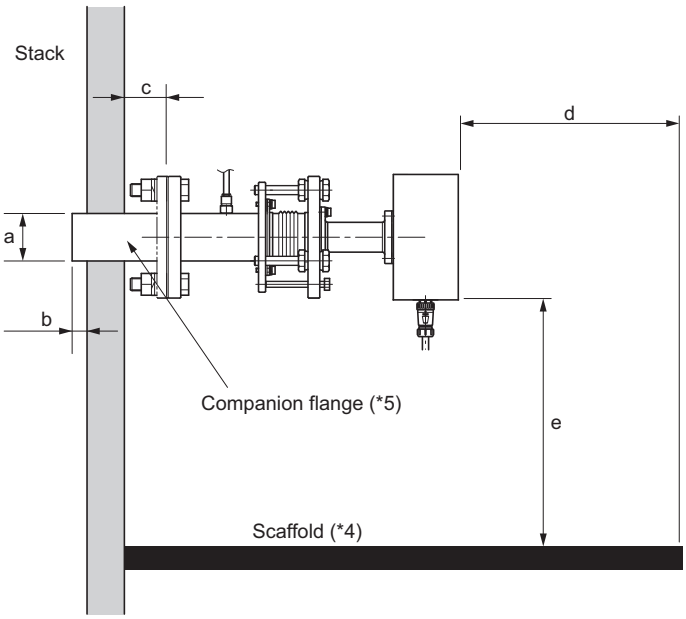
## 4.1.2 Installation conditions of control unit

Select a location that meets the following conditions.

(1) Ambient temperature : –5 to 45°C
(2) Ambient humidity : 90 % RH or less
(3) Power supply : Rated voltage : 100V to 240V AC
Rated frequency : 50Hz/60Hz
(4) Avoid a place that receives heavy vibration.
(5) A place which is clean around the analyzer
(6) A place accessible for maintenance and check
(7) A place with less electrically induced disturbances such as high electric currents or sparks in the surrounding.

## 4.2 Mounting dimensions of receiver unit and transmitter unit

Mount the receiver unit and the transmitter unit in a place which has ample free space for maintenance and check as in the figure below (Fig. 4－1).




a: Inner diameter of ø50mm or more
b: 20 to 70mm (*1)
c: Approximately 200 to 250mm (*2)
d: 400mm or more (*3)
e: 500 to 1500mm (*3)

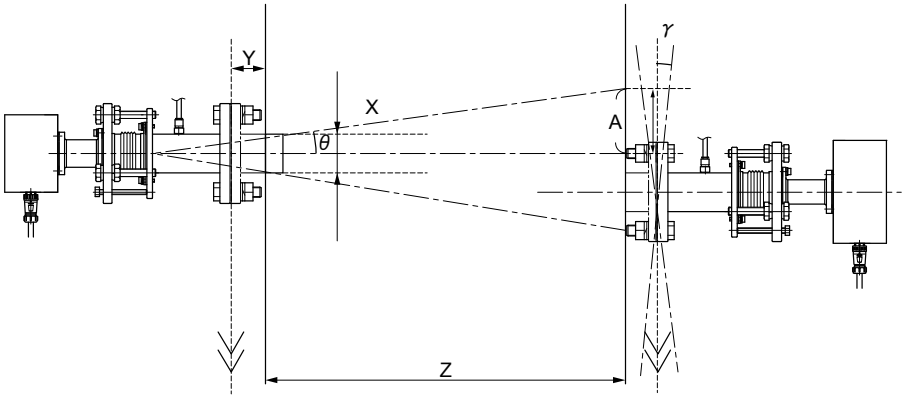
Fig. 4－1

*1: When used in an enviroment with high dust, reserve at least 50mm.
*2: When internal gas temperature is high (500°C or more), reserve the distance of 400mm or more. Note that adjustable angle range narrows down, so mounting angle of companion flange should be adjusted accurately.
*3: Secure sufficient space for installation which permits easy operation.
*4: Scaffold will be required for both the receiver unit and the transmitter unit side.
*5: Use the ball valve where there is a risk of gas injection or where the operator may be exposed to a dangerous situation.
*6: Companion flange and tightening torque should be 118 ±14N•m. (Apply grease before tightening. (Grease containing molybdenum is recommended)

## 4.3 Mounting range of companion flange (in factory range)

Mount the companion flange so that it satisfies the conditions of the following figure (Fig. 4－2). If the conditions below are not satisfied, light cannot be received even if the light axis adjustment is performed by the angle adjustment unit. In such a case, mount the companion flange again.

When θ (angle determined by laser light source and flange diameter) is bigger than 5°, mount the companion flange within the γ angle (≈5°) inside the circle with A radius.
When the distance between laser light source and stack is long, or θ angle is less than 5° because flange diameter is small, both A radius and γ angle will become smaller, and the mounting conditions will be strict.




X: Inner diameter of flange of receiver unit and transmitter unit
Y: Distance between the outer wall of the duct and each flange of the transmitter unit and the receiver unit
Z: Length of stack

$$\theta = \tan^{-1} \frac{X}{2\,(Y + 125)}$$

$$A \fallingdotseq 0.087 \times (Z + Y + 125)$$

$$\tan 5^\circ \fallingdotseq 0.087$$

Fig. 4－2

## 4.4 Preparation article for adjustment test

It is recommended to prepare the following fixtures for the adjustment test before installation.

Fixtures list

(1) Cable between receiver unit and control unit (for calibration)
(2) Cable between receiver unit and transmitter unit (for calibration)
(3) Calibration gas cell
(4) Power supply drum (or power supply extension cable)
(5) Digital multimeter
(6) BNC for light axis adjustment (ZZP＊ZSSTK7P2524C1)
(7) Flow meter (about 2L/min)
(8) $N_2$ Gas cylinder
(9) Gas cylinder corresponding to the span (80 to 100% of span)
(10) Regulator (for gas cylinder) (For HCL/$NH_3$ meter, prepare a SUS regulator. If using a brass regulator, use it only once and then discard it. A brass regulator may get rusty inside, and the rust absorbs gas to disturb accurate measurement.)
(11) Teflon tube (ϕ10/8) a few meters
(12) Rc1/4 × ϕ10/8 joint, two or more
(13) Tools (2 monkeys, measure, cutter, Phillips screwdriver, flat-blade driver, hexagonal wrench, tube cutter)
(14) Plastic sheet

# 4.5 Installation procedure

Install equipments, referring to the following procedure.

| | Item | Page |
|---|---|---|
| (1) | Check that the installation location for each equipment satisfies the contents in “4.1 Installation conditions”. | P.13 |
| | ↓ | |
| (2) | Check that the installation location for the receiver unit and the transmitter unit satisfies the contents in “4.2 Mounting dimensions of receiver unit and transmitter unit”. | P.15 |
| | ↓ | |
| (3) | Check that the companion flange which meets the contents in “4.3 Mounting range of companion flange” is prepared at the installation locations for the receiver unit and the transmitter unit. | P.16 |
| | ↓ | |
| (4) | Check that the installation location for the receiver unit and the transmitter unit has two types of ϕ10/8 tube (for the receiver/transmitter unit) for air purge connection, provided with the flow meter (regulator permitted). | P.23 |
| | ↓ | |
| (5) | Check that the power supply of rated voltage 100 to 240V AC ±10%, and rated frequency 50/60Hz is prepared at the installation location for the control unit. | P.30, 31 |
| | ↓ | |
| (6) | Perform zero calibration, referring to “6.1 Zero calibration”. Note that, if the power is “OFF” for a long time, about 90 minutes of warm up time is necessary after power ON to perform zero calibration. | P.43 to 46 |
| | ↓ | |
| (7) | Record the light quantity value when zero calibration is performed (output value of the probe adjusting the received light quantity (BNC receptor)), referring to “4.6 Checking received light quantity”. | P.19 |
| | ↓ | |
| (8) | Perform span calibration referring to “6.2 Span calibration”. Pay attention to the position and the length of the exhaust tube when you feed dangerous gasses such as hydrogen chloride and carbon oxide. Feed zero gas after span calibration. | P.48, 50 |
| | ↓ | |
| (9) | Mount the angle adjustment unit to the companion flange, and adjust the angle using an optical axis adjusting tool (laser pointer, etc), referring to “4.7.3 Adjustment procedure”. If the furnace is operated, be sure to adjust the angle in a state where air purge is performed after absorbing the inside of furnace. | P.20, 22 |
| | ↓ | |
| (10) | Perform the piping connection to purge air, referring to “4.8 Piping system diagram”. | P.23 |
| | ↓ | |
| (11) | Mount the receiver box and the transmitter box to the angle adjustment unit, referring to “4.9 Assembly of receiver unit and transmitter unit”. | P.24 |
| | ↓ | |
| (12) | Connect the Cable between receiver unit and control unit and the cable between receiver unit and transmitter unit, referring to “4.10 Wiring connection”. | P.25, 26 |
| | ↓ | |
| (13) | Turn ON the control unit. | |
| | ↓ | |

| | | |
|---|---|---|
| (14) | Adjust the light quantity so that the light quantity value becomes the neighborhood of the voltage value of the light quantify which is described in a nameplate. If the angle is adjusted with the furnace operated, it may not become the neighborhood of the light quantity value described in a nameplate due to the effect of dust, etc. (For the analyzer with a dust measuring function, record the voltage value of received light quantity after installation. (refer to 4.6) | P.27 |

↓

| | | |
|---|---|---|
| (15) | Enter the length of the stack, referring to “6.5 Parameter setting”. | P.69 to 71 |

↓

| | | |
|---|---|---|
| (16) | For the analyzer with a dust measuring function, if dust does not exist inside the stack, perform zero adjustment of dust. If you analyze dust manually, measure the average dust concentration. (After the manual analysis, perform matching). | |

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| | | |
|---|---|---|
| (17) | Make a setting of item to be output in reference to “6.8 Selecting analog output”. | |

↓

| | | |
|---|---|---|
| (18) | Make a analog output setting in reference to “6.9 Fine adjustment of analog output value”. | |

↓

| | | |
|---|---|---|
| (19) | Make settings of analog inputs such as, gas temperature and water in reference to “6.7 Analog input”. If there is no analog input, select a fixed value to input a parameter. Make sure to set “Gas temperature", “$O_2$” and “Water”. Otherwise, proper measurement can not be performed. In addition, a gas temperature when furnace stops working differs from the fixed “gas temperature”, an error many be caused in measurement. | |

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| | | |
|---|---|---|
| (20) | If necessary, make a setting of parameter. | |

↓

| | | |
|---|---|---|
| (21) | Establish wiring connection of analog input and analog output. | |

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| | | |
|---|---|---|
| (22) | Establish wiring connection of contact input and contact output. | |

↓

| | | |
|---|---|---|
| (23) | As needed, adjust analog output in reference to “6.9 Fine adjustment of analog output value”. | |

↓

| | | |
|---|---|---|
| (24) | As needed, check alarm output in reference to “6.10 Checking alarm output”. | P.85 |

# 4.6 Checking received light quantity

(1) Remove the probe cap adjusting the received light quantity (BNC receptor) of the receiver unit, and connect it to the digital voltmeter using the BNC cable for light axis adjustment.
(2) Read the DC voltage value.
(3) The voltage value, where zero gas is supplied with the calibration cell connected, becomes the reference light quantity value of light axis adjustment which is performed after the equipment is attached to a companion flange (Factory-set voltage is described on a nameplate which is labeled on covers of the receiver unit, transmitter unit, and control unit).

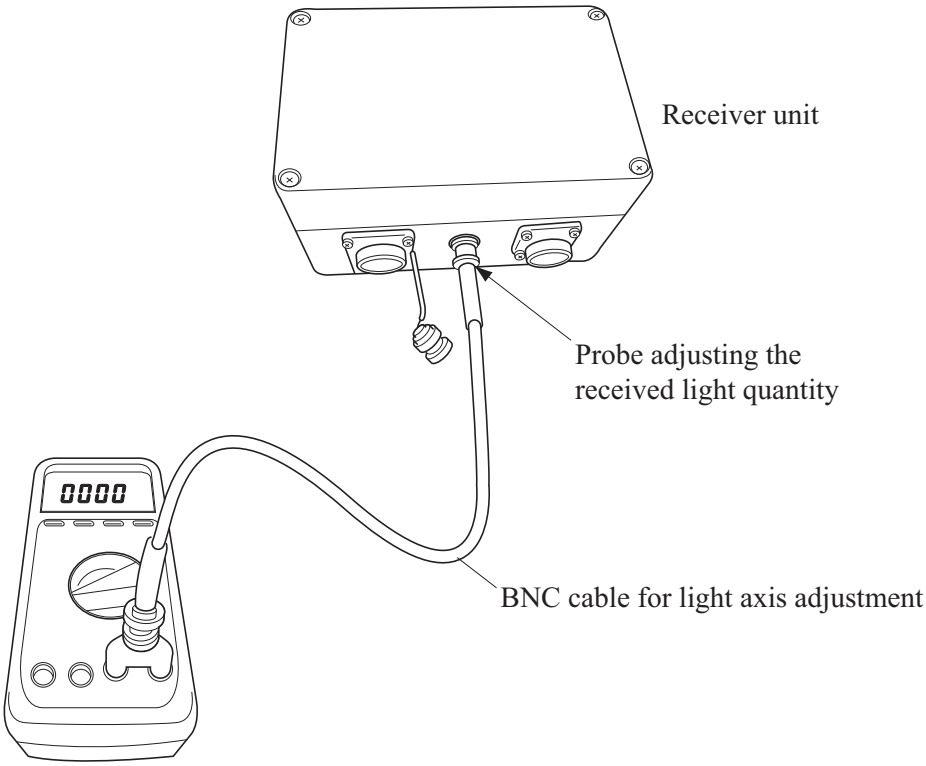



Fig. 4－3

Note 1) CO + $O_2$ analyzer has BNC cables for CO and for $O_2$.
Note 2) Before connecting or removing the BNC cable, make sure that no static electricity has built up on the cable. If any, discharge static electricity.

# 4.7 Angle adjustment

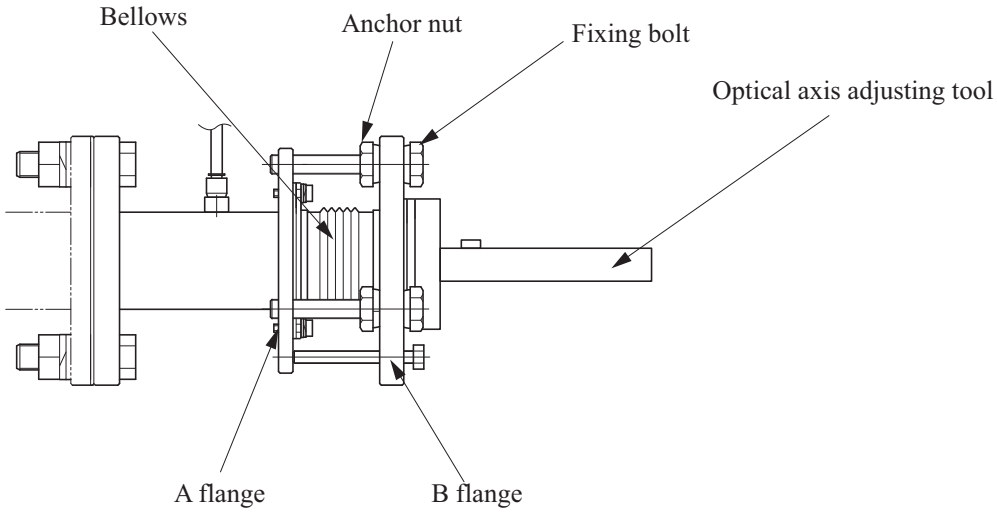



Fig. 4－4

## 4.7.1 How to operate the angle adjustment unit 1

(1) When you tighten the B flange
Turn the fixing bolt and the anchor nut clockwise at the same time. If it is difficult to turn them, slightly loosen the anchor nut first. (approx. one-tenth rotation)

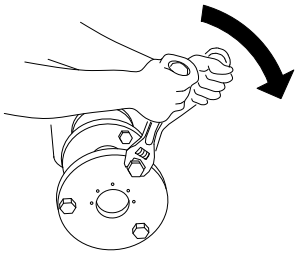


Fig. 4－5

(2) When you loosen the B flange
Turn the fixing bolt and the anchor nut counter-clockwise at the same time. If it is difficult to turn them, slightly loosen the anchor nut first.
(approx. one-tenth rotation)

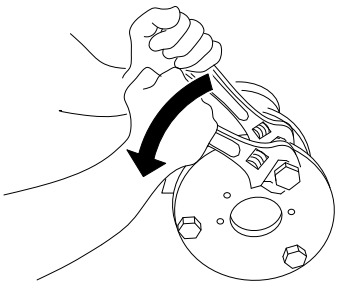


Fig. 4－6

(3) When you fasten B flange
When angle is determined after adjustment in 1) or 2), turn them in the direction opposite to each other to fasten them. Be careful because if the fixing bolt and the anchor nut are too far away from the B flange, the angle will slip.

Note) Pay attention to the insertion angle of the tool. Take utmost care not to turn at the angle which may let the bellows contact with the head of the spanner. Otherwise, it will smash the bellows.

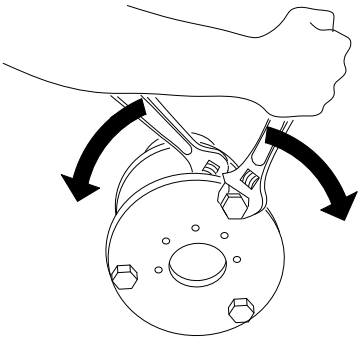
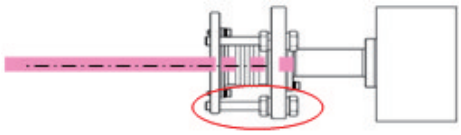


Fig. 4－7

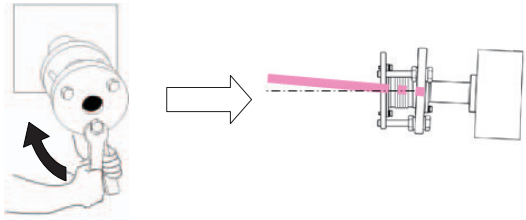
## 4.7.2 How to operate the angle adjustment unit 2

This section describes movement of the optical axis by operating the angle adjustment unit.
Example) When you adjust the fixing bolt and the anchor nut shown in the figure below, encircled with a solid line

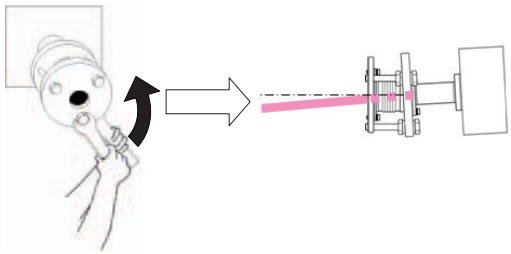
(1) If the flange A and the flange B are parallel, the laser beam points horizontal direction.



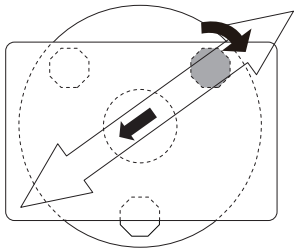
(2) If you screw up the fixing bolt tightly as the figure below, the place where the bolt is screwed up inclines to the right, and the laser beam points upward.



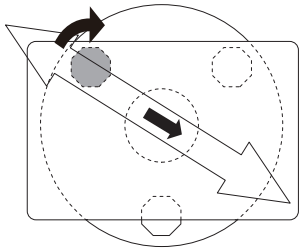
(3) If you loosen the fixing bolt as the figure below, the place where the bolt is loosen parts from the flange A, and the laser beam point downward.



・In the same way, when you adjust the black-out fixing bolt and anchor shown in the figure below as "4.7.2.2-2) and 3)", the light axis moves as follow.



・In the same way, when you adjust the black-out fixing bolt and anchor shown in the figure below as "4.7.2.2-2) and 3)", the light axis moves as follow.



## 4.7.3 Adjustment procedure

### 4.7.3.1 When an optical axis adjusting tool (laser pointer) is used

| ⚠ CAUTION | Do not watch the laser pointer beam directly with the optical measuring device. Otherwise, it may cause serious damage to your eyes. |
|---|---|

(1) When A and B flanges shown in Fig. 4－4 are extremely tilted, adjust them in a flat place so that they are parallel to each other. Refer to “4.7.1 How to operate the angle adjustment unit 1” before mounting the stack unit.
(2) Mount the angle adjustment unit to the companion flange on the stack.
When mounting it, be careful of the direction of the fixing bolts so as to be as shown in Fig. 4－8. Fix them at this time so that the outer circumferences of the companion flange on the stack side and the flange on the angle adjustment unit coincide as much as possible. (Do not yet mount the receiver box and the transmitter box.)
(3) Fix the laser pointer on the transmitter unit side and the laser scope on the receiver unit with the attached hexagonal socket screws. (The laser pointer has two kinds of holes at different distance from the center. Position the laser pointer so that it matches the angle adjustment mechanical section, and fix it with three screws.)
(4) Emit light from the laser pointer, and adjust the angle adjustment unit while referring to “4.7.2 How to operate the angle adjustment unit 2” so that the pointer’s light hits the center of the target.
(5) Then using the attached hexagonal socket screws to fix the laser pointer to the angle adjustment unit on the receiver unit, and the laser scope to the angle adjustment unit on the transmitter unit.
(6) Adjust as well as (4).
(7) When you have finished adjustment, retighten the fixing bolts and nuts lightly. When retightening the bolts and nuts, take care not to move the light axis. Remove the laser pointer and the target.

### 4.7.3.2 When an optional optical axis adjusting tool (laser pointer) is not used

(1) When A and B flanges shown in Fig. 4－4 are extremely tilted, adjust them in a flat place so that they are parallel to each other. Refer to “4.7.1 How to operate the angle adjustment unit 1” before mounting the stack unit.
(2) Mouth the angle adjustment unit to the companion flange on the stack.

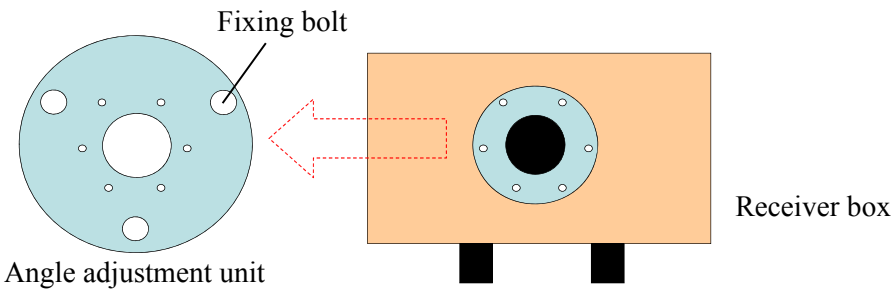
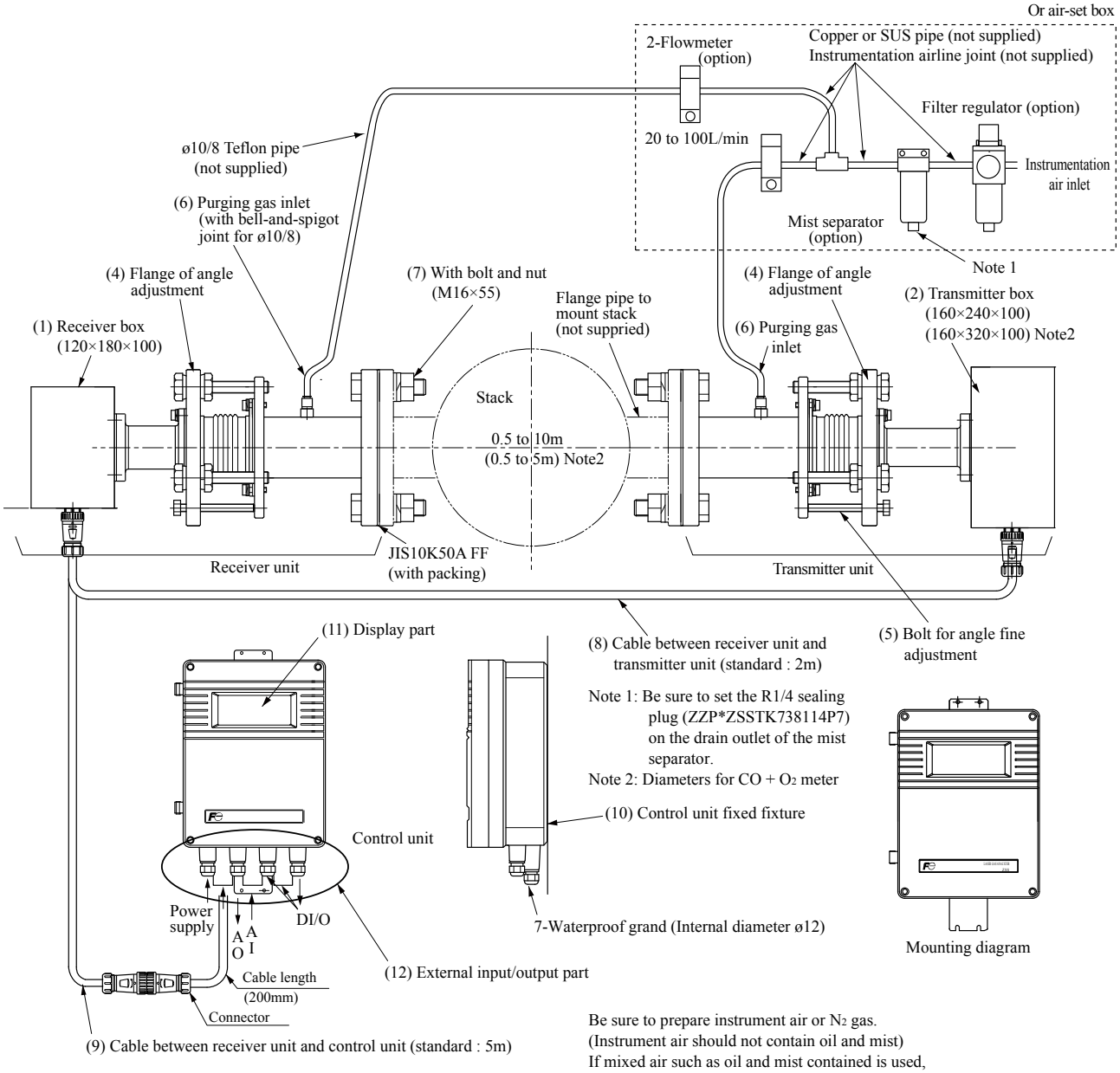



Fig. 4－8

When mounting it, be careful of the direction of the fixing bolts on the angle adjustment unit so as to be as to be shown in Fig. 4－8. Fix them at this time so that the outer circumferences of the companion flange on the stack side and the flange on the angle adjustment unit coincide as much as possible. After fixing them, mount the receiver box and the transmitter box, referring to “4.9 Assembly of receiver unit and transmitter unit”.
(3) Adjust the optical axis, referring to “4.11.2 When an optional optical axis adjusting tool (laser pointer) is not used”.

# 4.8 Piping system diagram




Be sure to prepare instrument air or $N_2$ gas.
(Instrument air should not contain oil and mist)
If mixed air such as oil and mist contained is used, contamination occurs in the pipe of flow meter and purge flow rate falls, which will affect the measurement.
According to above, maintenance is required frequentlyand filter may be installed additionally depending on situation.
Note) Air or nitrogen purge should be performed if the equipment is installed in a flue whether or not it is operated. n case operate the flue without performing purge, it may cause the fatal damage to the optical part.

Fig. 4－9

# 4.9 Assembly of receiver unit and transmitter unit

(1) Prepare “Receiver box or transmitter box” and “Hexagonal socket bolt” as shown in the following figure (Fig. 4－10). (Check that the O-ring is mounted on near the lens (refer to Figure below) of the receiver unit or the transmitter unit)
(2) Mount “Receiver box or transmitter box” on “Angle adjustment unit” so that the cable receptor is positioned down. (Be careful not to touch the lenses of the transmitter box and the receiver box during installation.)
(3) Fix it with the 6 “hexagonal socket bolts”.

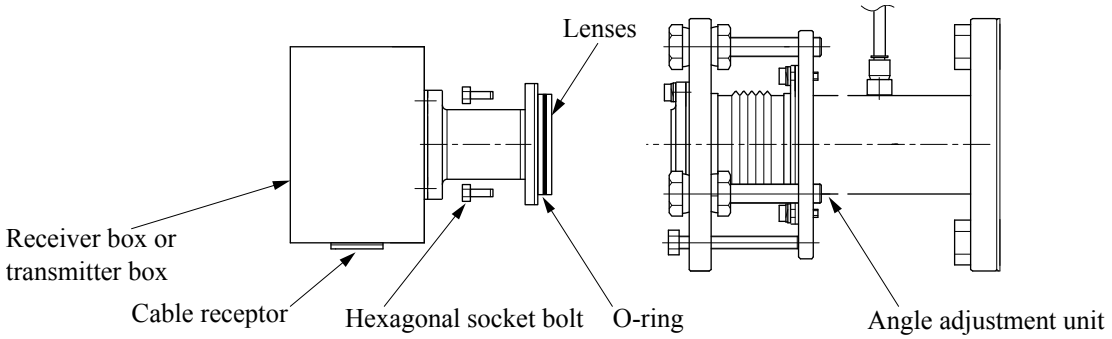



Fig. 4－10

# 4.10 Wiring connection

## 4.10.1 Connecting Receiver / Transmitter cable

The receiver unit and the transmitter unit are connected with the “Cable between receiver unit and transmitter unit”.
Both ends of it are fitted with a female 16-pin connector (waterproof type). The connector has no polarity.
Fix the Cable between receiver unit and transmitter unit to the stack, etc. to prevent the light axis from deflecting by its own weight.

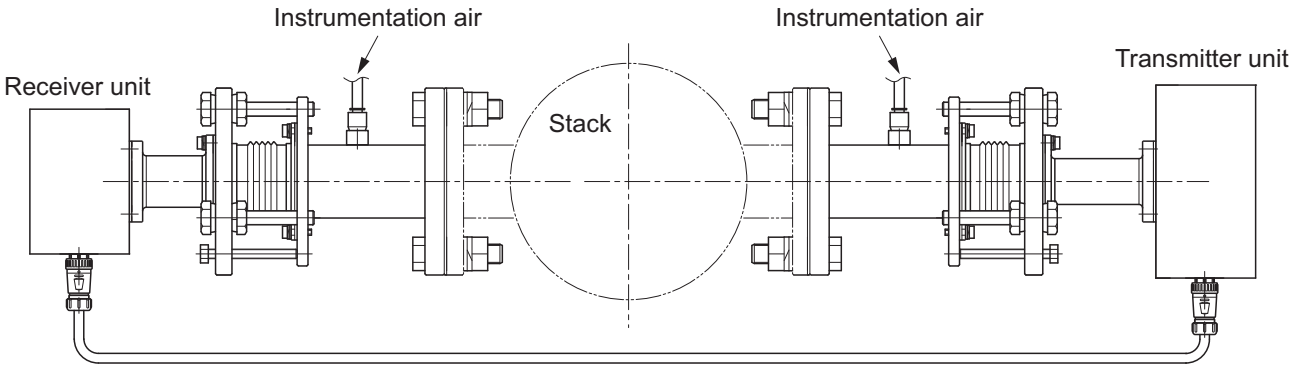



Fig. 4－11

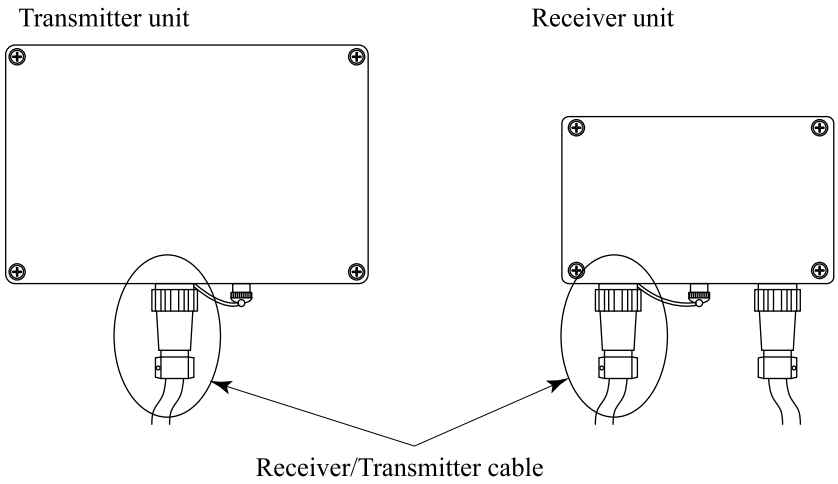



Fig. 4－12

## 4.10.2 Connecting cable between receiver unit and control unit

The receiver unit and the control unit are connected with the “Cable between receiver unit and control unit”. Both ends of it are fitted with a female 10-pin connector (waterproof type). The connector has no polarity. Perform wiring in the way that the cable between receiver unit and control unit is not pulled.

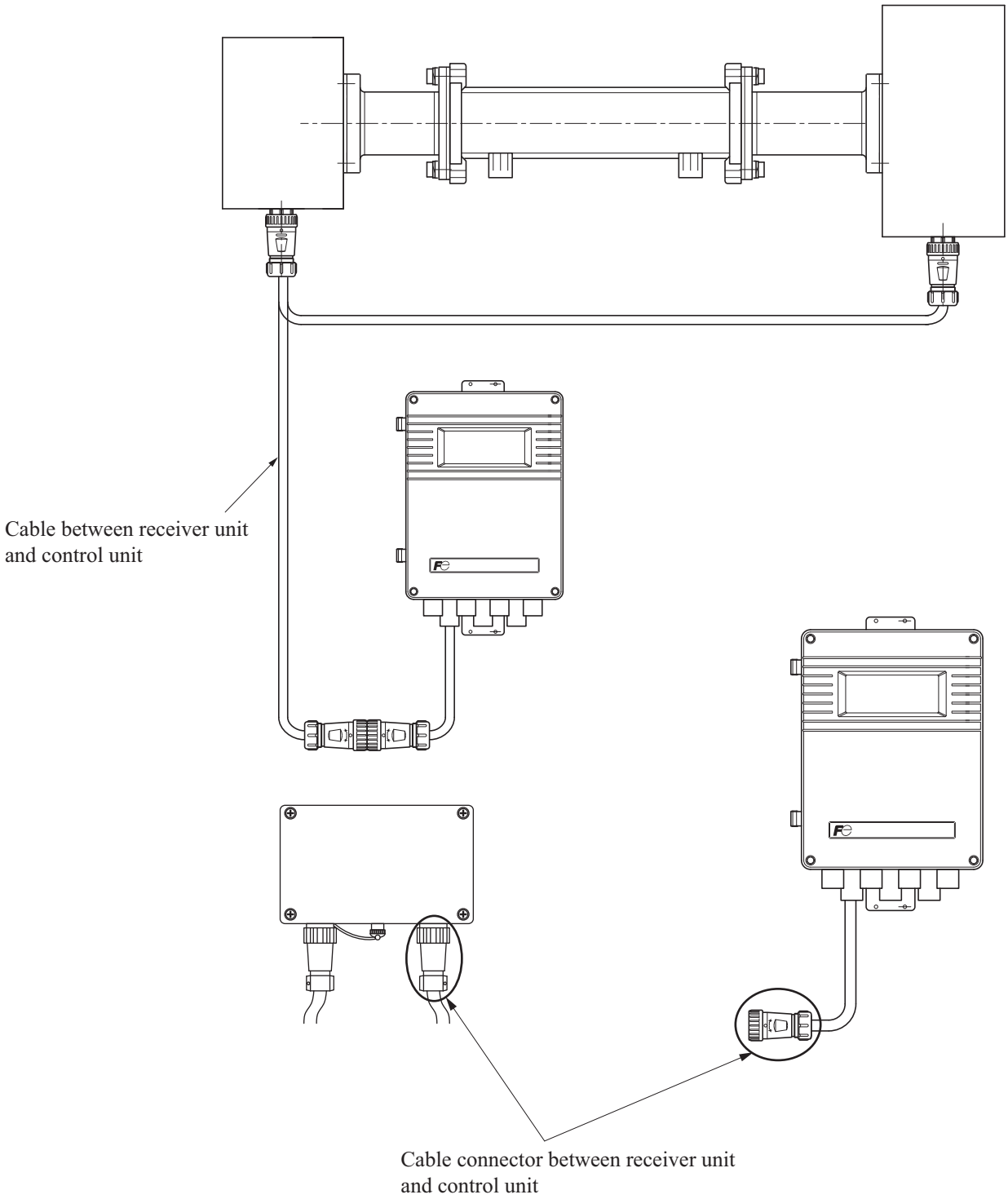



Fig. 4－13

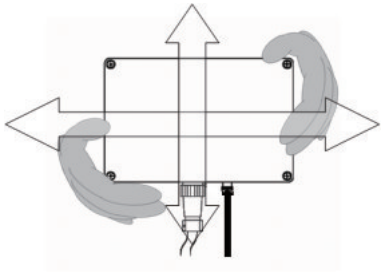
# 4.11 Adjustment of light quantity

Note that if you loosen more than one fixing bolts or anchor nuts at a time to adjust, it takes a lot of time to resetting.

## 4.11.1 When an optional optical axis adjusting tool (laser pointer) is used for angle adjustment

(1) Connect the digital voltmeter using the BNC receptor cable, referring to “4.6 Checking received light quantity”.

(2) The reference light quantity is based on the output in zero calibration or voltage value of light quantity which is described in a nameplate.
If the output is not as much as that measured at the time of calibration before the adjustment, find a position where the received light quantity increases, moving the transmitter box from side to side and up and down slowly. (*1)(*2)(*3)



e.g.) In the case that the quantity of light increases when the whole transmitter box is moved upward.
→ As the quantity of light increases when the light axis turns downward, loosen the fixing bolt in reference to “4.7.2 How to operate the angle adjustment unit 2”.

(3) When the output not as much as that measured at the time of calibration, even if it is at its maximum on the transmitter side, fix the box at the maximum output angle temporarily and adjust the light axis, moving the receiver box similarly.
Do not loosen more than one bolt or loosen fixing bolt and nut widely in both cases of adjustment. Light axis may deflect again.

(4) Move the transmitter unit and the receiver unit from side to side and up and down to adjust until the voltage value of light quantity of digital multimeter becomes smaller in all directions.

(5) Retighten all volts to fix them (If the light quantity decreases at retightening, adjust again).

*1) Received light quantity might not increase to its maximum that was confirmed by “4.6 Checking received light quantity” due to the influences from dust and moisture in the stack unit, etc.

*2) When using the high-speed/AGC version (i.e. the 22th digit of code symbols is "H"), adjust the light axis under the status that the level of AGC is "01" (refer to "5.3 Outline of screen ").

*3) When using CO + $O_2$ analyzer, check the received light quantities at two points, and then adjust them to be maximum.

### 4.11.2 When an optional optical axis adjusting tool (laser pointer) is not used

(1) Connect the digital voltmeter using the BNC receptor cable, referring to “4.6 Checking received light quantity”.

(2) The reference light quantity is based on the output in zero calibration or voltage value of light quantity which is described in a nameplate.
When the quantity of light is completely zero V, move the transmitter box from side to side and up and down slowly to find the position where the received light quantity increases. If you cannot still confirm the quantity of light, loosen the fixing bolts and nuts further, and check reaction of the digital voltmeter while moving the box back and forth slowly.

(3) If you find reaction of light quantity increases, fasten the fixing bolts and nuts temporally, and perform the operation in 2). (*4)

(4) If output is not as much as that measured at the time of calibration even if output is at its maximum on the transmitter side, fix the box at the maximum output angle temporality and adjust the light axis, moving the box on the receiver side similarly. When you can confirm the output at the time of adjusting any of the boxes, do not loosen the fixing bolts and nuts too much, or the light axis can deflect further. Do not loosen more than one bolt or loosen fixing bolt and nut widely in both cases of adjustment. Light axis may deflect again.

(5) Move the transmitter unit and the receiver unit from side to side and up and down to adjust until the voltage value of light quantity of digital multimeter becomes smaller in all directions.

(6) Retighten all volts to fix them (If the light quantity decreases at retightening, adjust again).

*4) Received light quantity might not increase to its maximum that was confirmed by “4.6 Checking received light quantity” due to the influences from dust and moisture in the stack unit, etc.

# 4.12 How to use the bolt for angle fine adjustment (standard accessory)

This bolt is used for adjustment when the light path length in the stack is long and when the quantity of light misses too much at the time of retightening in the procedure in “4.11 Adjustment of light quantity”.
When each retightening is finished, perform fine adjustment by pressing with this bolt.
When you use the fine adjustment screw, set it to the A flange before mounting the receiver and the transmitter boxes on the angle adjustment unit. Beware that the fine adjustment screw cannot be set after mounting these boxes.

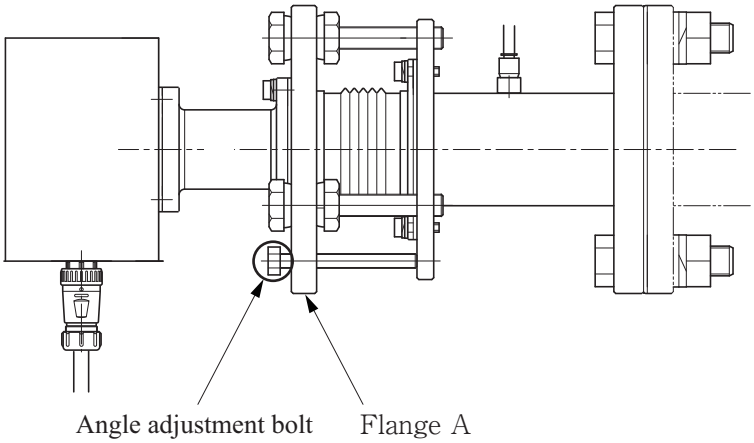



Fig. 4－14

# 4.13 Connecting to control unit

## 4.13.1 AC power connection

AC power connecting terminal is positioned at the lower left of the control unit (see Fig. 4－15.). Use the AC cable for which flame resistance is 600V, 1.25mm$^2$ (16AWG) or more, and the cable out diameter size is ϕ10mm or less.

When connecting the AC cable to the input terminal, the ground cable should be longer than the L, N line. The cable length should be adjusted so that when the AC cable is pulled from the external, the L, N line will be removed from the terminal block first, and the ground cable will be removed last.

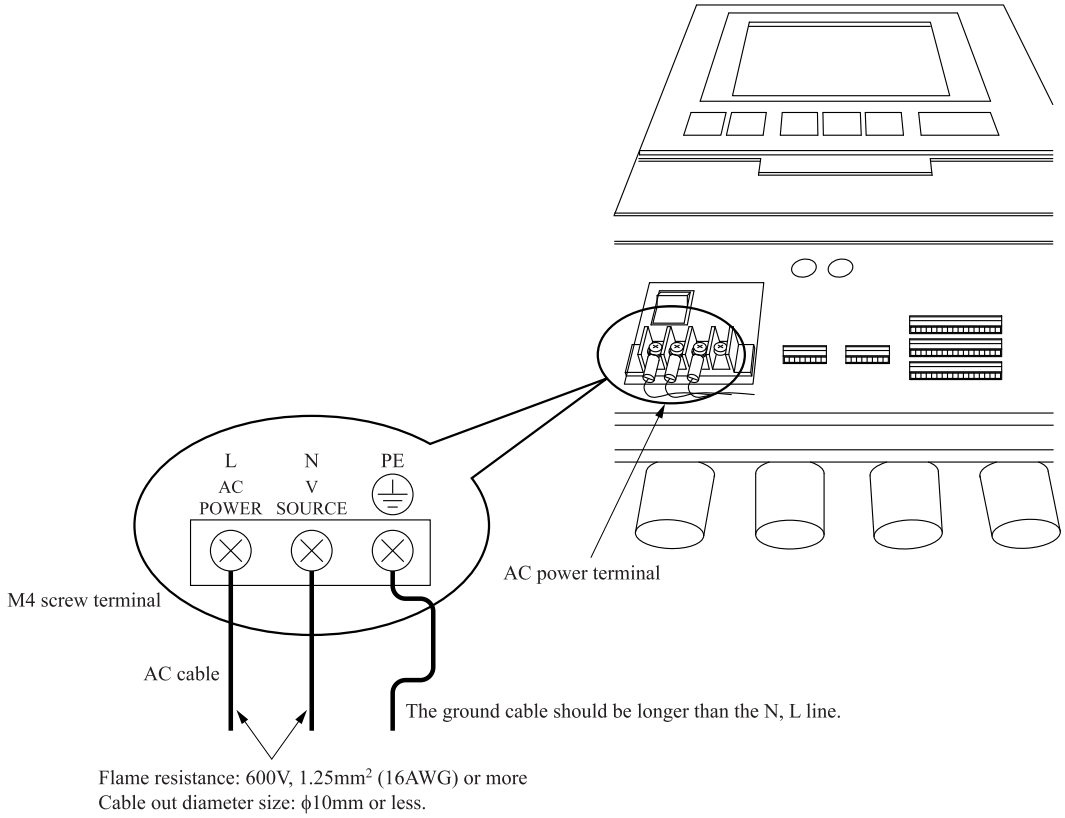
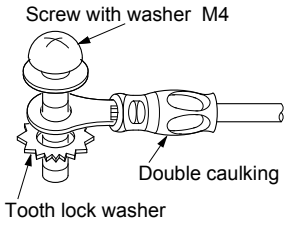


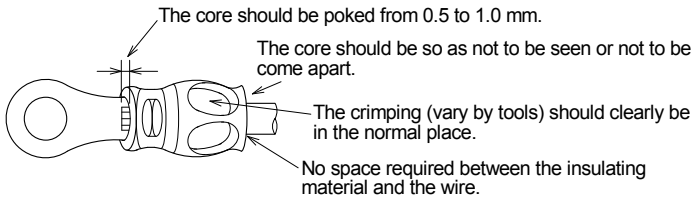

Fig. 4－15

Attach the solderless terminals to the grounding terminals with them between the tooth lock washer and screw with washer. (recommended tightening torque: 1.8 N·m)

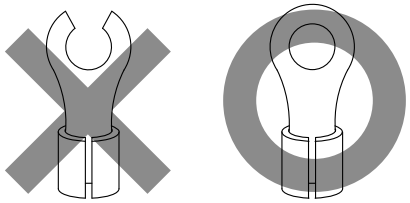



**Note**

- Use the cable more than 0.75mm$^2$ for main ground (earth) line.
- For solderless terminal , doubly caulk the core and the sheath separately.




- Use “ ◎ ” type of solderless terminal .



| When noise source is in the vicinity |
|---|
| Avoid installing this analyzer near an electrical apparatus which produces power source noise. (Such as high frequency furnace, electric welder, etc.) If the analyzer must be used near such equipment, a separate power line should be used for avoiding noise.<br>In case noise may enter from a relay, solenoid valve, etc. through power supply, connect a varistor (e.g. ENA211 OKAYA) to the noise source as shown in Fig. 4－16. If the varistor is located away from the noise source, no effect is obtainable. So, locate near the noise source. Also, it is more effective to attach the ferrite core to the power cable near the inlet of the control unit (outside the box). |

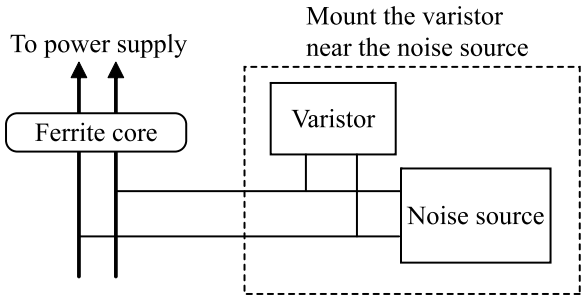



Fig. 4－16

| CAUTION |
|---|
| • Wire the outlet for connecting power supply with the wire diameter of 1.25mm or more.<br>• Connect to the outlet with grounding line (class D grounding). For connection of ground line, use the ground line with the wire diameter of 2mm or more.<br>• For connection of the signal connecting cable, use a shielded wire in order to suppress the influences by noise.<br>• Wire the output contact and the contact input connecting cable with the wire diameter of 1.25mm.<br>• After the AC power cable is connected, put a power terminal cover on.<br>• Do not install the instrument near objects which considerably disturb power waveforms. Do not share their power supplies either. Otherwise, it may cause a display error.<br>• Power supply and output signal lines should be separated from each other.<br>• As the wire is connected to each terminal, use a solderless terminal (for M4).<br>• As the solderless terminal is used for AC power cable and ground line, chose a type of solderless terminal that caulks cores and coverings separately. |

## 4.13.2 Connecting analog input/output

Connect the analog input and output properly, referring to “3.2 Input/output terminal of control unit (excluding $CO+O_2$ analyzer)” or “3.3 Input/output terminal of control unit ($CO+O_2$ analyzer)”. Provide analog output of 4 to 20mA DC, 1 to 5V DC, etc, according to the ordering contents. For connection of the signal cable, use a shielded wire or an insulated converter (LDC-16H01, manufactured by Fuji Electric Technica Co., Ltd. or equivalent) to supress the influences by noise.
Analog input is 4 to 20mA DC. Connect the input signal corresponding to the equipment.

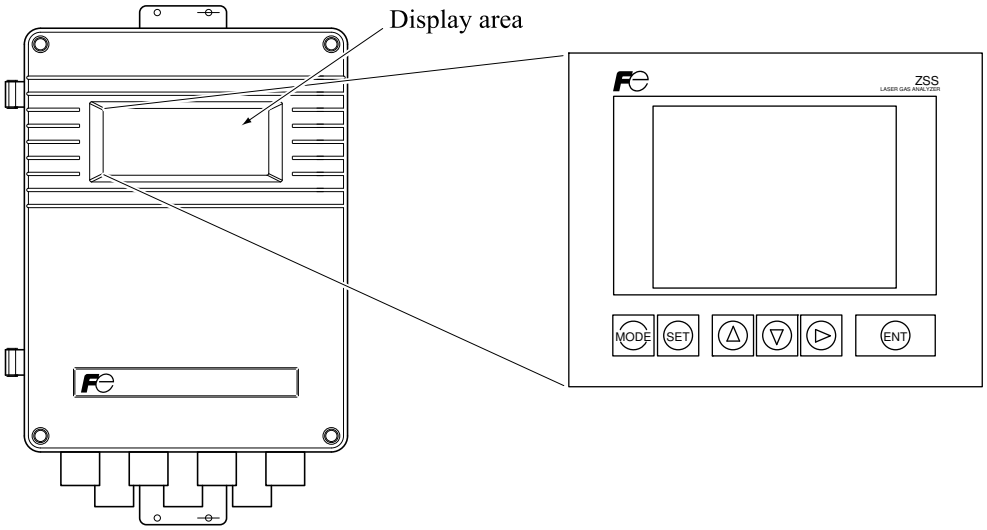
Note) When you connect the analog input to the analog output terminal, the printed circuit board may be damaged. Check the terminal before connecting them.

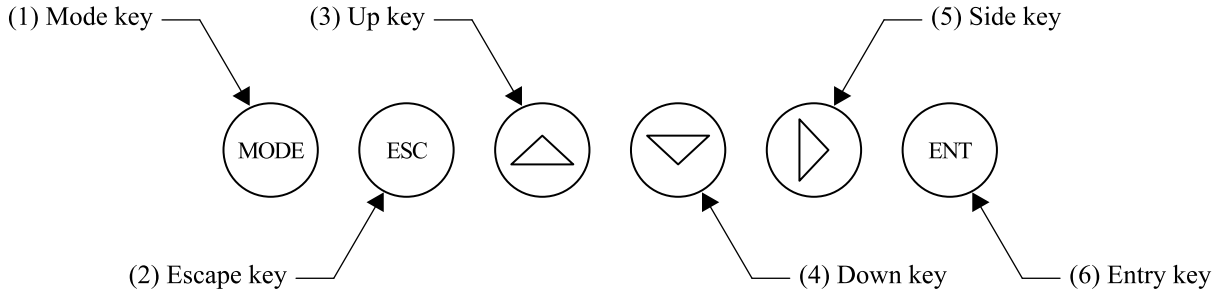
## 4.13.3 Connecting contact input/output

Connect the contact input and output properly, referring to “3.2 Input/output terminal of control unit (excluding $CO+O_2$ analyzer)” or “3.3 Input/output terminal of control unit ($CO+O_2$ analyzer)”. If it is provided with the separately submitted approved drawing, connect the contact input/output as shown in the drawing.
For wiring, use shielded wires of which diameters are 1.25 mm or more.
Unassigned terminals may be connected to the internal circuit. Do not use them as repeating terminals.

# 5. EXPLANATION OF OPERATION PANEL AND SCREEN

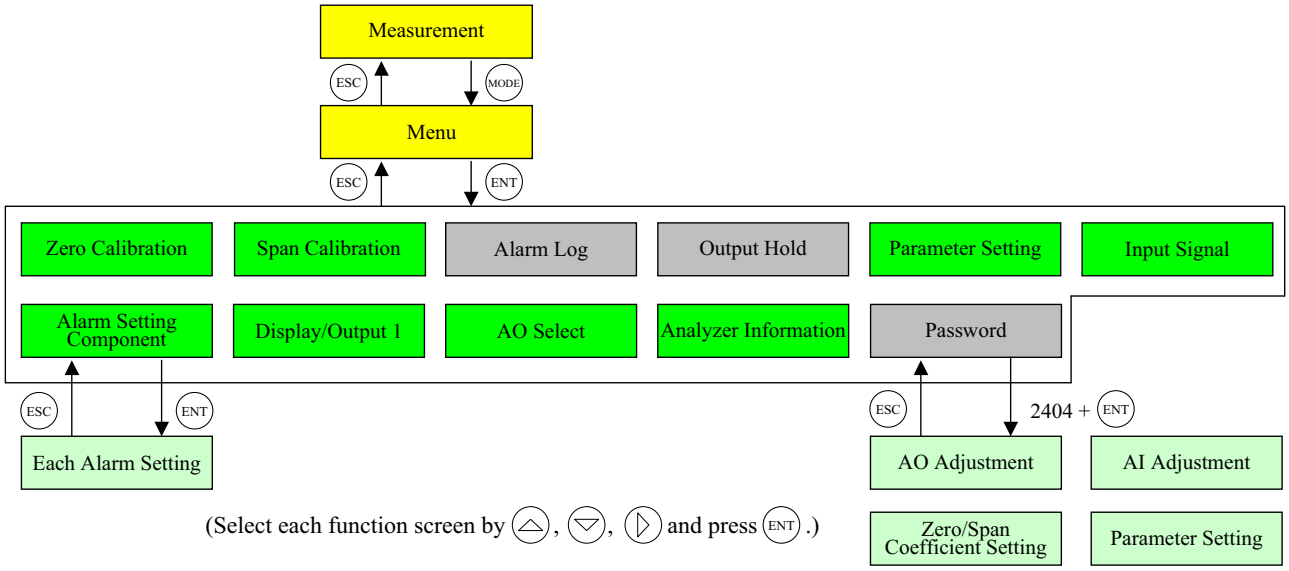
## 5.1 Name and description of operation panel



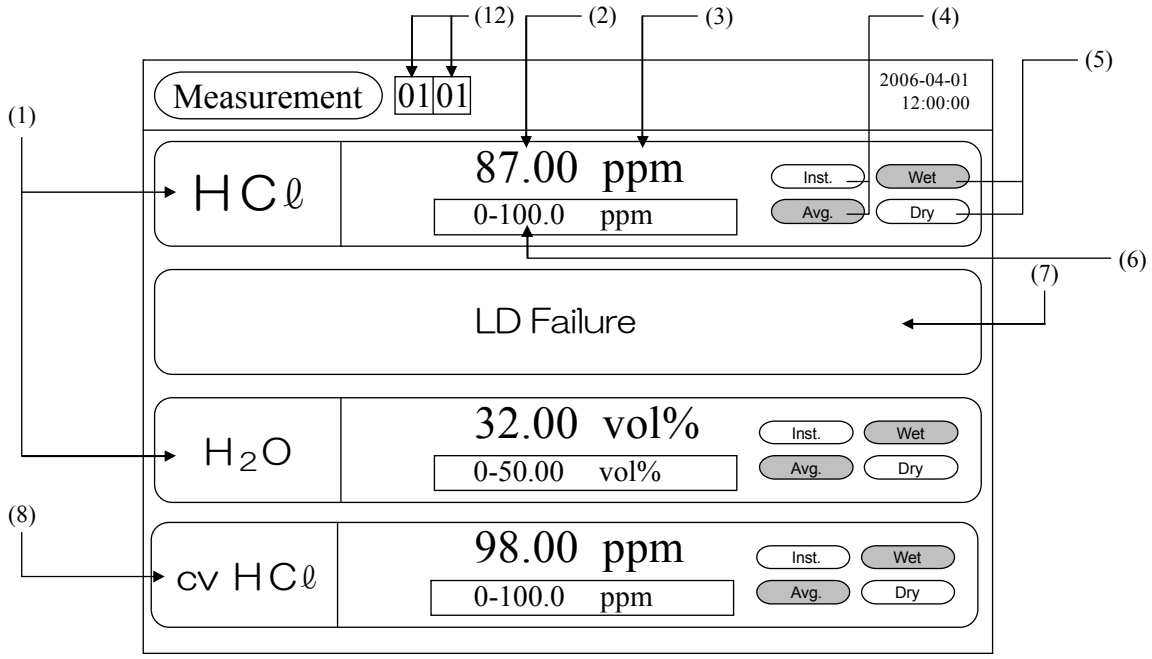

| Name | Description of functions | Name | Description of functions |
|---|---|---|---|
| (1) Mode key | Used to display the menu mode. | (4) Down key | Used to move the cursor, change the selected item and decrease numeral value. |
| (2) Escape key | Used to return to a previous screen or cancel the setting in midway. | (5) Side key | Used to move the cursor and change numeral digit. |
| (3) Up key | Used to move the cursor, change the selected item and increase numeral value. | (6) Entry key | Used for confirmation of selected items or values, and for execution of calibration. |

# 5.2 Screen configuration

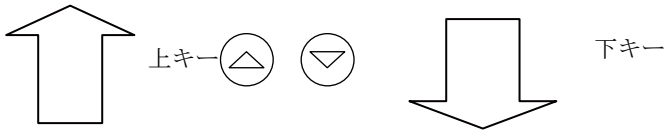


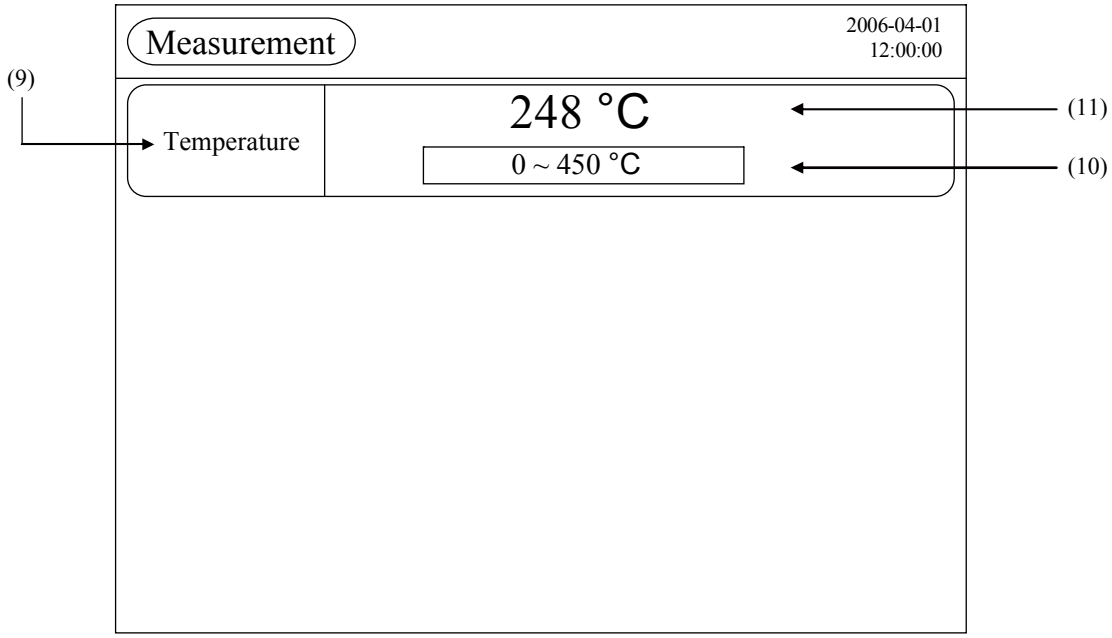
# 5.3 Outline of screen

## 5.3.1 “Measurement” screen (appears when the power is turned ON)




e.g.) Display of HCℓ + $H_2O$ meter




On the MEASURE screen, measurable component, alarm, conversion measurable component, and analog input are displayed beginning at the top. When more than five items are displayed, switch the screen by △ key or ▽ key.

### 5.3.1.1 Name (functions)

(1) Measurable component ····· Displays the gas component to be measured in element symbol.

(2) Concentration value ····· Displays measured value of concentration. The value is highlighted during the hold.

(3) Unit ····· Displays the unit of concentration such as ppm, vol%, etc.

(4) Instantaneous value / Average value ····· Indicates whether the displayed concentration value is instantaneous value or average value. (The highlighted value is displayed.)

(5) Wet / Dry ····· Indicates whether the displayed concentration is wet base or dry base. (The highlighted value is displayed.)
Setting of water is fixed to “Wet”.

(6) Range display ····· Displays the current full scale range.

(7) Alarm ····· Displays all the alarm occurrence. When more than one alarm has occurred, display is switched by 3 seconds.

(8) $O_2$ conversion value ····· If components of the HCl meter is provided with $O_2$ conversion output when ordering, it displays $O_2$ conversion. “Conversion**” is displayed as “Conversion HCl” on the display area. For changeover of instantaneous value/average value or wet/dry, display and analog output can be performed independent of the original conversion on “Display / Output” screen. For the contents of $O_2$ conversion, refer to “5.3.1.2 $O_2$ conversion concentration value”.

(9) Analog input ····· Displays the analog input value which was set at the “Analog Input” screen. Analog input to be displayed are “Temperature”, “Pressure”, “Velocity”, “$O_2$” and “$H_2O$”. They are not displayed when selecting fixed value is selected.

(10) Analog input range ····· Displays the setting range of 4 to 20mA DC which was set at the “Analog Input” screen.

(11) Analog input value ····· Displays the analog input value corresponding to the setting range of 4 to 20mA DC which was set at the “Analog Input” screen.

(12) AGC level ····· Displays current level of AGC. (when using High-speed/AGC version i.e. the 22th digit of type code is "H", or CO + O2 meter i.e. the 4th digit is "V", "U", or "S")

### 5.3.1.2 $O_2$ conversion concentration value

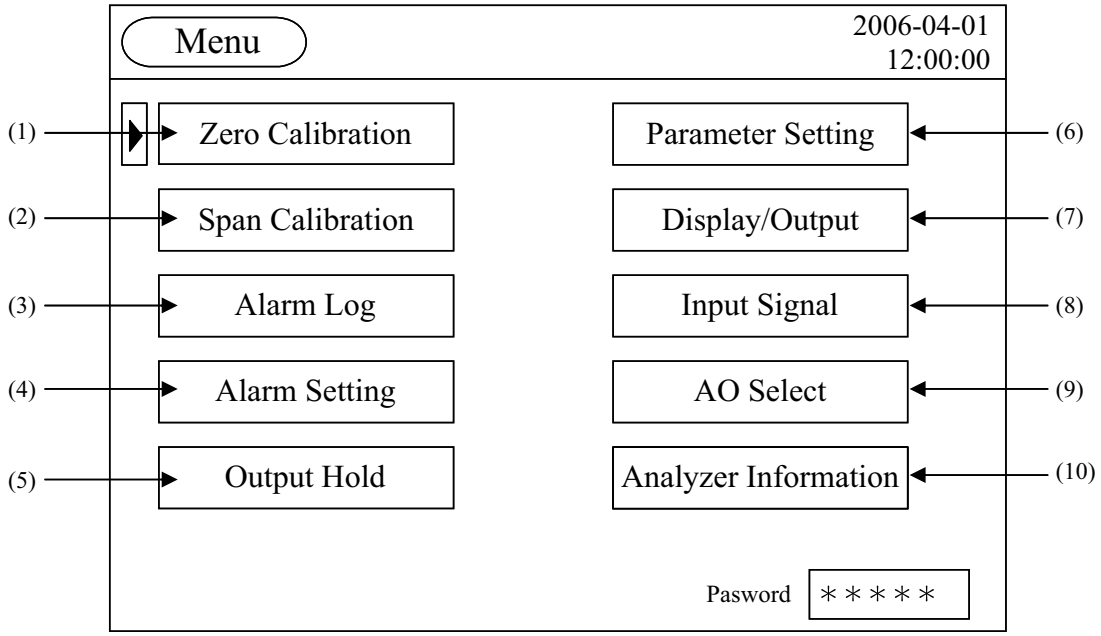
$O_2$ conversion concentration value is calculated from the following equation of measured component (Cs), instantaneous concentration of $O_2$ and $O_2$ correction reference value.

$$\textbf{Conversion output} = \frac{21 - On}{21 - Os} \times Cs$$

- On: Oxygen conversion reference value (%)
  (Value that is set according to application: default value 12%)
- Os: Oxygen concentration (%)
  ($O_2$ analog input value or fixed value that is set at the “Analog Input” screen. In the case $O_2$ input exceeds the limit value, calculate from the limit value. (Default value of the limit value: 20%.))
- Cs: Gas concentration for target component

If you want to change the oxygen conversion reference value and limit value to other than default value, give instructions before delivery or contact our technical service representative.

## 5.3.2 “Menu” screen

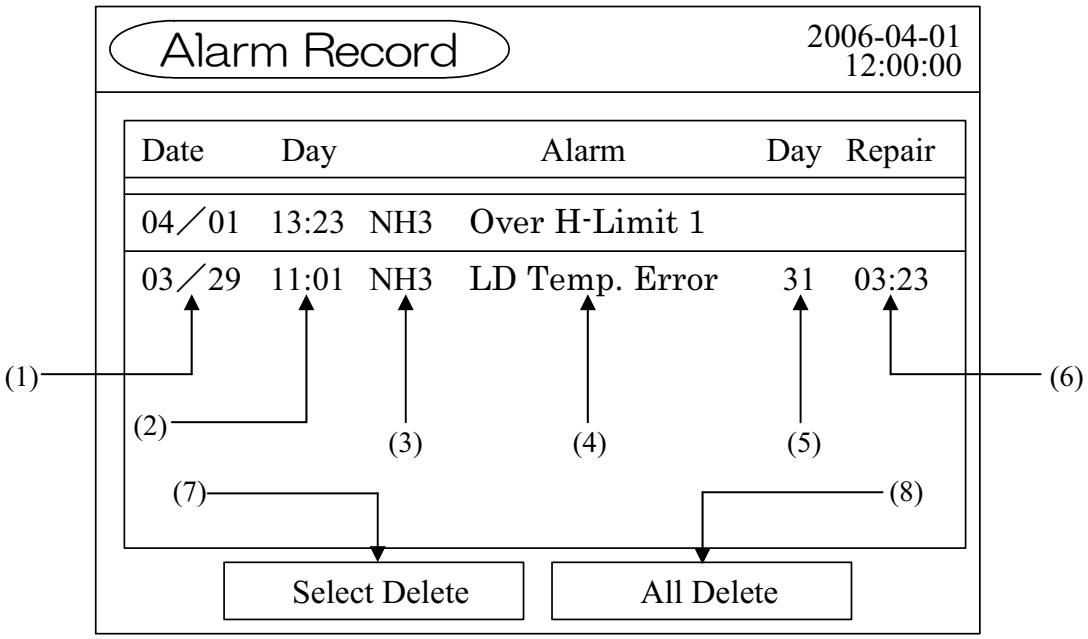



Press the MODE key while the “Measurement” screen is displayed, and the “Menu” screen appears. (It does not appear when pressing the MODE key while other screen is displayed. In that case, Press the ESC key to display the “Measurement” screen, and then press the MODE key.)

### 5.3.2.1 Name (functions)

(1) Zero Calibration ····· Used when zero calibration is performed.
(2) Span Calibration ····· Used when span calibration is performed.
(3) Alarm Log ····· Displays the alarm occurred in the past.
(4) Alarm Setting ····· Used for setting range of upper/lower limit alarm or analog output range of the measurement value.
(5) Output Hold ····· Used for holding analog output.
(6) Parameter Setting ····· Used for setting each parameter.
(7) Display / Output setting ··· Used for setting the measurement value to be displayed on the “Measurement” screen such as switching “Instantaneous value / Average value” or “Wet / Dry”.
(8) Input Signal ····· Used when analog input range or fixed value are set for concentration correction or air purge alarm.
(9) AO Select ····· Used to determine what to output to the analog output terminal.
(10) Analyzer Information ····· Display the calculation information of concentration. (It is user for trouble analysis)

## 5.3.3 “Alarm Record” screen




The screen displays the alarm record occurred in the past. The ten newest errors are logged. The oldest error will be deleted one by one every time a new alarm occurs. New errors are displayed from the top on the screen.
It displays the date, time and component when an alarm occurred, alarm contents, recovery date, and recovery time from the left to right.
If you turn off the power in a state that the alarm is generated, the highlighted time and date when the power was turned off are displayed for “Alarm recovery time” and “Alarm recovery date”.
All the alarms except “Connection Error” which indicates communication failure between the receiver unit and the control unit will be activated after at least five minutes from the power off. The alarm of “Low Light Transmission” is activated after 1 minute continuation. Though it takes 6 minutes from just after the power on.

### 5.3.3.1 Name (functions)

(1) Alarm occurrence date ····· Displays the date when device failure, high gas temperature or alarm occurred.
(2) Alarm occurrence time ····· Displays the time when alarm occurred.
(3) Alarm occurrence component ···· Displays the component and analog input for which alarm occurred.
(4) Alarm contents ····· Displays the contents of alarm.
(5) Alarm recovery date ····· Displays the date when alarm is recovered. Nothing is displayed for the alarm which is not recovered.
(6) Alarm recovery time····· Displays the time when alarm is recovered. Nothing is displayed for the alarm which is not recovered.
(7) Select Delete key····· Deletes the selected alarm.
(8) All Delete key ····· Deletes all alarms.

### 5.3.3.2 Basic Operation

- Moving the cursor

Alarm Record 2006-04-01 12:00:00

| Date | Day | | Alarm | Day | Repair |
|---|---|---|---|---|---|
| 04／01 | 11:23 | HCℓ | Over H -Limit 1 | | |
| 03／29 | 23:14 | HCℓ | LD Temp. Error | 31 | 03:23 |
| 03／25 | 15:23 | Press. | AI Under | 28 | 13:28 |
| 03／20 | 04:41 | Air | Low Air Purge | | |
| 02／18 | 00:08 | Temp. | High Gas Temp. | 20 | 09:44 |
| 01／12 | 11:22 | HCℓ | Low Light Trans. | 27 | 08:11 |

Select Delete | All Delete

Alarm Record 2006-04-01 12:00:00

| Date | Day | | Alarm | Day | Repair |
|---|---|---|---|---|---|
| 04／01 | 11:23 | HCℓ | Over H -Limit 1 | | |
| 03／29 | 23:14 | HCℓ | LD Temp. Error | 31 | 03:23 |
| 03／25 | 15:23 | Press. | AI Under | 28 | 13:28 |
| 03／20 | 04:41 | Air | Low Air Purge | | |
| 02／18 | 00:08 | Temp. | High Gas Temp. | 20 | 09:44 |
| 01／12 | 11:22 | HCℓ | Low Light Trans. | 27 | 08:11 |

Select Delete | All Delete

The cursor is moved.

- Record page change

Alarm Record 2006-04-01 12:00:00

| Date | Day | | Alarm | Day | Repair |
|---|---|---|---|---|---|
| 04／01 | 11:23 | HCℓ | Over H -Limit 1 | | |
| 03／29 | 23:14 | HCℓ | LD Temp. Error | 31 | 03:23 |
| 03／25 | 15:23 | Press. | AI Under | 28 | 13:28 |
| 03／20 | 04:41 | Air | Low Air Purge | | |
| 02／18 | 00:08 | Temp. | High Gas Temp. | 20 | 09:44 |
| 01／12 | 11:22 | HCℓ | Low Light Trans. | 27 | 08:11 |

Select Delete | All Delete

Move the cursor to the bottom and press the key, and the record page is changed.

Alarm Record 2006-04-01 12:00:00

| Date | Day | | Alarm | Day | Repair |
|---|---|---|---|---|---|
| 12／21 | 17:56 | HCℓ | Low Light Trans. | 22 | 11:49 |

Select Delete | All Delete

- Selected alarm deletion

Alarm Record 2006-04-01 12:00:00

| Date | Day | | Alarm | Day | Repair |
|---|---|---|---|---|---|
| 04／01 | 11:23 | HCℓ | Over H -Limit 1 | | |
| 03／29 | 23:14 | HCℓ | LD Temp. Error | 31 | 03:23 |
| 03／25 | 15:23 | Press. | AI Under | 28 | 13:28 |
| 03／20 | 04:41 | Air | Low Air Purge | | |
| 02／18 | 00:08 | Temp. | High Gas Temp. | 20 | 09:44 |
| 01／12 | 11:22 | HCℓ | Low Light Trans. | 27 | 08:11 |

Select Delete | All Delete

Move the cursor to the alarm to be deleted by pressing the ⊿ or the ▽ key.

ENT ESC

Alarm Record 2006-04-01 12:00:00

| Date | Day | | Alarm | Day | Repair |
|---|---|---|---|---|---|
| 04／01 | 11:23 | HCℓ | Over H -Limit 1 | | |
| 03／29 | 23:14 | HCℓ | LD Temp. Error | 31 | 03:23 |
| 03／25 | 15:23 | Press. | AI Under | 28 | 13:28 |
| 03／20 | 04:41 | Air | Low Air Purge | | |
| 02／18 | 00:08 | Temp. | High Gas Temp. | 20 | 09:44 |
| 01／12 | 11:22 | HCℓ | Low Light Trans. | 27 | 08:11 |

Select Delete | All Delete

Press the ENT key, and the “Select Delete” is highlighted.

ENT

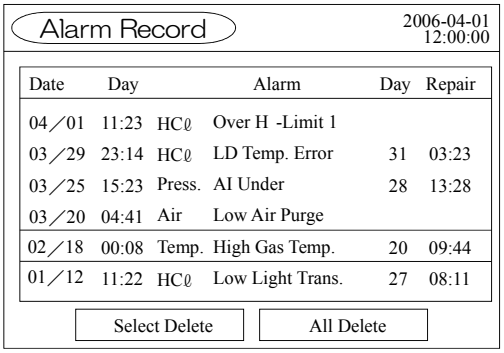
Alarm Record 2006-04-01 12:00:00

| Date | Day | | Alarm | Day | Repair |
|---|---|---|---|---|---|
| 04／01 | 11:23 | HCℓ | Over H -Limit 1 | | |
| 03／29 | 23:14 | HCℓ | LD Temp. Error | 31 | 03:23 |
| 03／20 | 04:41 | Air. | Low Air Purge | | |
| 02／18 | 00:08 | Temp. | High Gas Temp. | 20 | 09:44 |
| 01／12 | 11:22 | HCℓ | Low Light Trans. | 27 | 08:11 |
| 12／21 | 17:56 | HCℓ | Low Light Trans. | 22 | 11:49 |

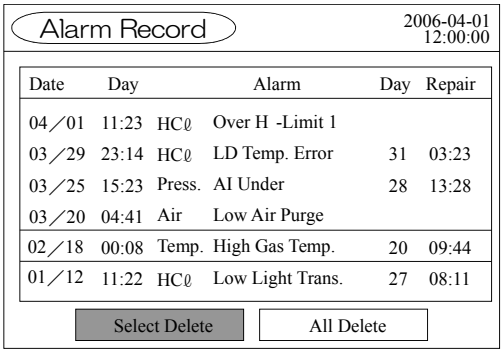
Select Delete | All Delete

The alarm aligned with the cursor is deleted by pressing the ENT key, and old alarm is shifted up.

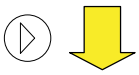
- All alarms deletion

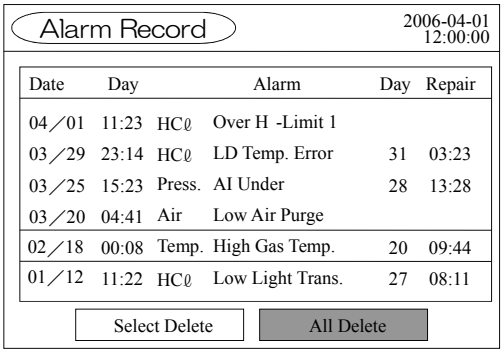



Press the ENT key at the desired place.

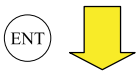



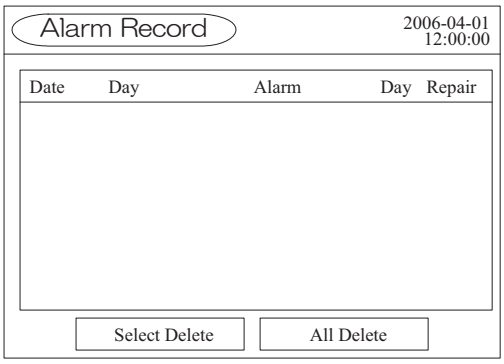

Press the ▷ key and the “All Delete” is highlighted.






Press the ENT key.




All alarms are deleted.

### 5.3.3.3 Alarm types

Following types of alarm are displayed.
All the alarms except “Connection Error” which indicates communication failure between the receiver unit and the control unit will be activated after at least five minutes from the power off. The alarm of “Low Light Transmission” is activated after 1 minute continuation. Though it takes 6 minutes from just after the power on.

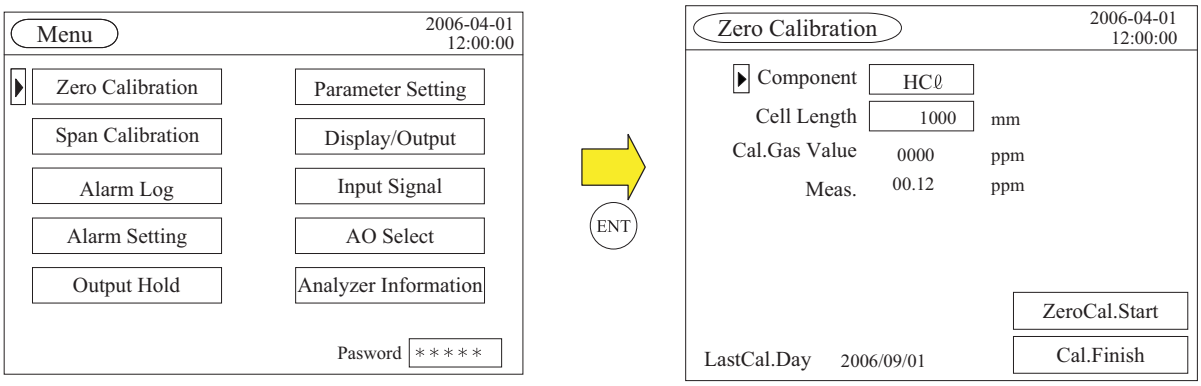
| Alarm display | Alarm contents | Probable causes |
|---|---|---|
| LD Failure | Laser is faulty | • Failure caused by laser durability |
| LD Temp. Error | Peltier which is cooling the laser cannot control the set temperature. | • Peltier failure<br>• Thermocouple failure<br>• The receiver unit and the transmitter unit are used at an installation location exceeding the set range.<br>The unit is used in an environment where the temperature of transmitter unit is higher than 55°C<br>• The unit is used in an environment where gas temperature is beyond the specification. |
| Low Light Trans. | Light quantity required for the measurement cannot be obtained. | • Light quantity is insufficient in an environment with high dust.<br>• Light quantity is insufficient in an environment with high water vapor.<br>• Contamination of window and condensation are caused by insufficient air purge.<br>• Optical path is blocked due to dust.<br>• Optical axis is deflected due to vibration.<br>• Optical axis is deflected due to distortion of a stack.<br>• Optical axis is deflected due to external faults. |
| Connection Error | Communication between receiver unit and transmitter unit does not occur properly. | • Break of wiring<br>• Influence of high frequency noise<br>• Poor contacts of the connector unit<br>• CPU board failure<br>• PD digital board failure |
| High Gas Temp. | It is reported when exceeded gas temperature is detected. | • The actual gas temperature is more than 450°C.<br>• The value set to analog input on the “Analog Input” screen is not correct. |
| Out of Range | It is reported when exceeded gas pressure is detected. | • Actual gas pressure is outside the specification range.<br>• The value of the input range set on the “Analog Input” screen is not correct. |
| AI Under | Input channel on the “Analog Input” screen. | • AI terminal is not connected to the external input device when channel setting is set on the “Analog Input” screen.<br>• AI terminal and setting channel do not match.<br>• Input is not 4 to 20mA DC. |

| Alarm display | Alarm contents | Probable causes |
|---|---|---|
| Box Temp. Warning | It is reported when the temperature in the receiver unit and the transmitter unit exceeds the temperature for normal operation. | • The unit is used at an installation location exceeding the set range.<br>• The unit is used in an environment where gas temperature is beyond the specification.<br>• Insufficient air purge causes rise in temperature.<br>• The distance between the Receiver / Transmitter unit and the stack is not maintained sufficiently. |
| Low Air Purge | It is reported when purge pressure lower than the value set as alarms on the “Analog Input” screen. | • Air purge pressure is lower than alarm setting or the analyzer is not purged.<br>• AI terminal is not connected to the external input device when the air purge pressure is set to channel setting on the “Analog Input” screen. |
| Over H-Limit 1 | It is reported when “Analog Output / Alarm Record” is set to “Over H-Limit 1” or “Over H/L Limit 1” on the “Alarm Setting” screen, and the measured value exceeds the limit alarm of Range 1. | • Concentration beyond the Range 1 limit is measured.<br>• The actual path length is longer than the measured path length set at the “Parameter Setting” screen.<br>• The actual temperature is lower than the temperature (fixed value) set at the “Analog Input” screen. |
| Under L-Limit 1 | It is reported when “Analog Output / Alarm Record” is set to “Under L-Limit 1” or “Over H/L Limit 1” on the “Alarm Setting” screen, and the measured value is less than the limit alarm of Range 1. | • Concentration less than the Range 1 limit is measured.<br>• The actual path length is longer than the measured path length set at the “Parameter Setting” screen.<br>• The actual temperature is lower than the temperature (fixed value) set at the “Analog Input” screen. |
| Over H-Limit 2 | It is reported when “Analog Output / Alarm Record” is set to “Over L-Limit 2” or “Over H/L Limit 2” on the “Alarm Setting” screen, and the measured value exceeds the limit alarm of Range 2. | • Concentration beyond the Range 2 limit is measured.<br>• The actual path length is longer than the measured path length set at the “Parameter Setting” screen.<br>• The actual temperature is lower than the temperature (fixed value) set at the “Analog Input” screen. |
| Under L-Limit 2 | It is reported when “Analog Output / Alarm Record” is set to “Under L-Limit 2” or “Over H/L Limit 2” on the “Alarm Setting” screen, and the measured value is less than the limit alarm of Range 2. | • Concentration beyond the Range 2 limit is measured.<br>• The actual path length is longer than the measured path length set at the “Parameter Setting” screen.<br>• The actual temperature is lower than the temperature (fixed value) set at the “Analog Input” screen. |

# 6. ZERO CALIBRATION AND SETTING

## 6.1 Zero calibration

Select "Zero Calibration" from the "Menu" screen and press the (ENT) key.

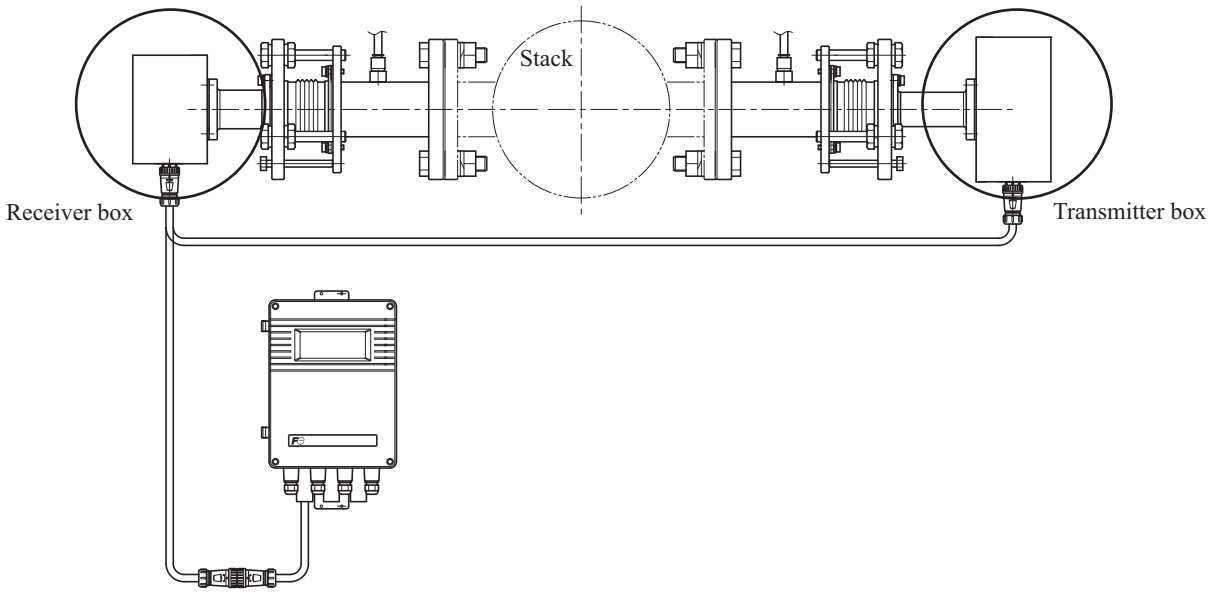



### 6.1.1 Preparation

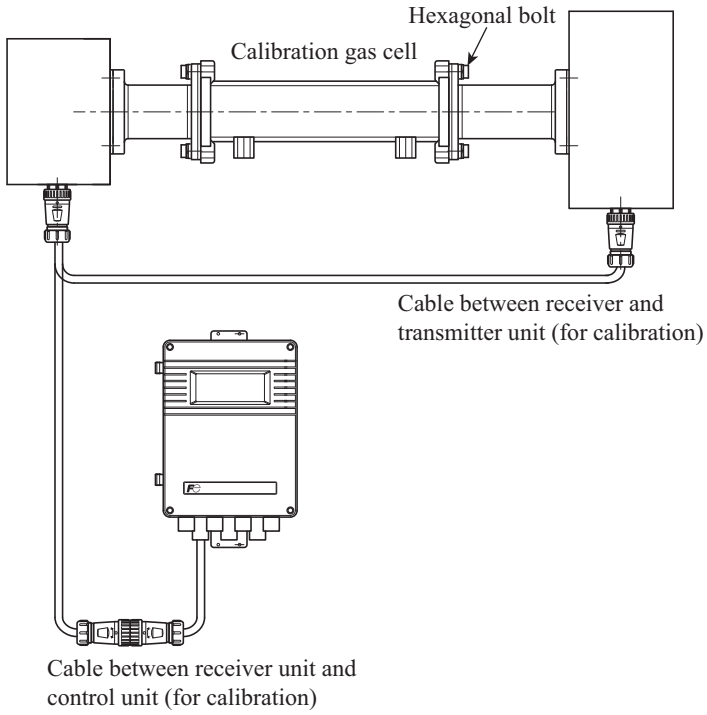
| | |
|---|---|
| ⚠ **CAUTION** | • The laser beam is the invisible infrared light. Do not watch the laser beam directly or scattering light.<br>• Do not watch the laser beam directly with the optical measuring device. Otherwise, it may cause serious damage to your eyes. |

| Parts name | Quantity | Remarks |
|---|---|---|
| Calibration gas cell | 1 | To be ordered separately |
| Cable between receiver unit and transmitter unit | 1 | To be ordered separately |
| Cable between receiver unit and control unit (for calibration) | 1 | To be ordered separately |
| Zero gas ($N_2$) | 1 | To be ordered separately |
| Pressure adjuster | 1 | To be ordered separately |
| Pipe (Teflon tube, etc) | Several m | $\phi$10 × 8 or more |
| Joint (Rc1/8) | 2 | For calibration gas cell |
| Flow meter | 1 | 2L/min or more |
| Thermometer | 1 | 4 to 20mA output, for temperature correction (required for range Hcl and $NH_3$) |
| Pressure gauge | 1 | 4 to 20mA output, for pressure correction (required for low range HCl and $NH_3$) |
| Others (joint, etc) | | |

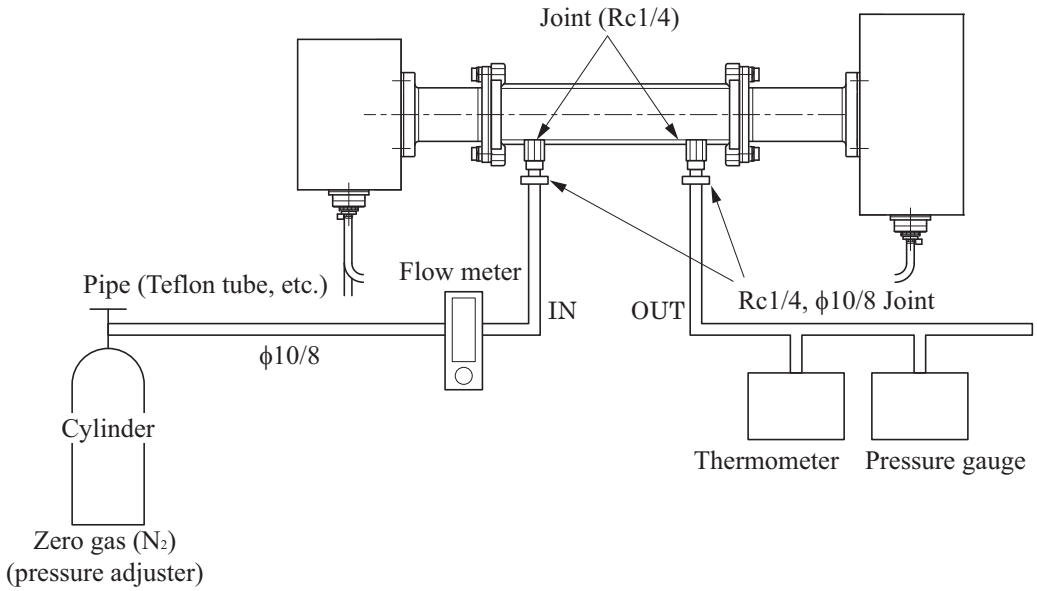
(1) Turn OFF the power.
(2) Remove the receiver box and the transmitter box using the hexagonal wrench. Perform removing when the provided equipment is stopped. Never remove boxes while the equipment is operated. Otherwise, hot temperature gas may blow out.




(3) Mount the removed receiver box and transmitter box using the hexagonal bolt.
(4) If the cable between receiver unit and transmitter unit or the Cable between receiver unit and control unit is fixed and not usable, provide them for calibration.
(5) Wiring should be performed as following figure.

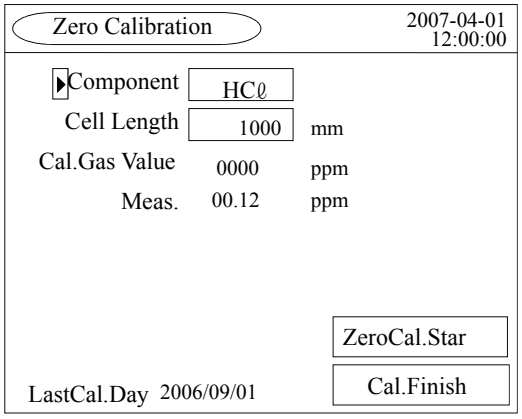


(6) Mount the Rc1/8 joint to the calibration gas cell, and connect one side to the standard gas cylinder ($N_2$).
(7) If necessary, attach a thermometer or a pressure gauge to the outside to connect the output signal (4 to 20mA) to the control unit of Analog Input.
(8) Use a thick and short exhaust tube as much as possible.
(9) Refer to “6.7.1 Setting of 4 to 20mA DC Input (in case of gas temperature)” for setting of Analog Input.
(10) When the pipe is connected, allow the gas to flow.
(11) Flow of sampling gas should be 1.5 to 2.0 L/min.



## 6.1.2 Zero calibration

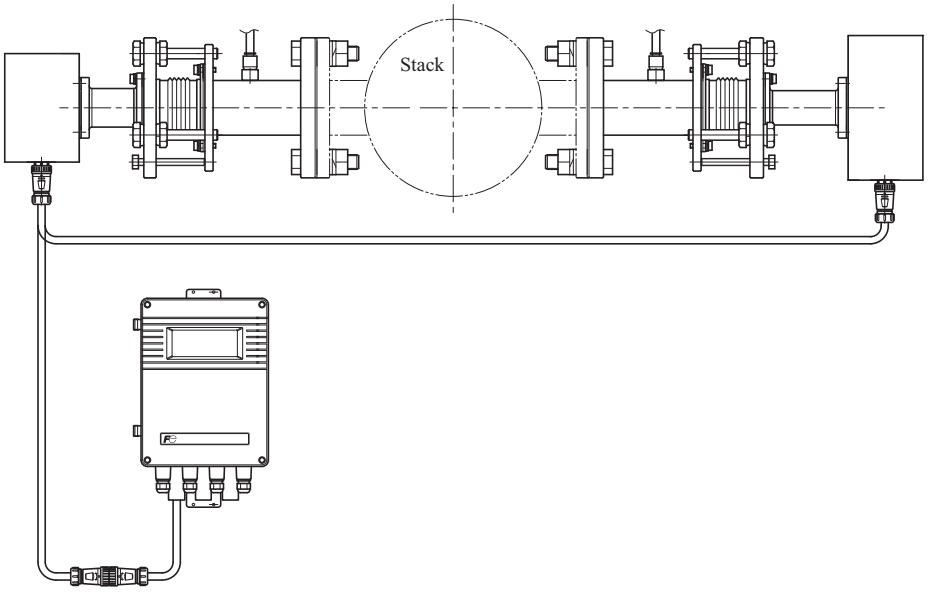
(1) If the power is OFF, turn it ON.
(2) Check if the flow of $N_2$ gas is approximately 1.5 to 2.0 L/min.
(3) Display the "Zero Calibration" screen.
(4) Point the ▶ to "Component", and press the ▷ key.
(5) Press the △ key or the ▽ key to select the measured gas component to be zero-calibrated.
When there is only one component, it is not necessary to select. Note that, gas component and flowing gas are not equivalent.
(6) Point the ▶ to "Cell Length", and press the ▷ key.




(7) Enter the length of calibration gas cell. Standard cell length is 1000mm. (When the range is low concentration, the length of calibration gas cell can be either 500mm or 200mm.)
(8) See the "Meas." and make sure the indication value is stable.
(9) Point the ▶ to "ZeroCal.Start", and press the ENT key to start the zero calibration.
(10) "ZeroCal.Start" blinks for about 30 seconds.
(11) When the calibration is completed, the cursor moves to "Cal.Finish", and the current date is displayed at "LastCal.Day".
(12) After (11), the cursor is movable from "Cal. Finish" by △ key or ▽ key.

## 6.1.3 Zero calibration of dust

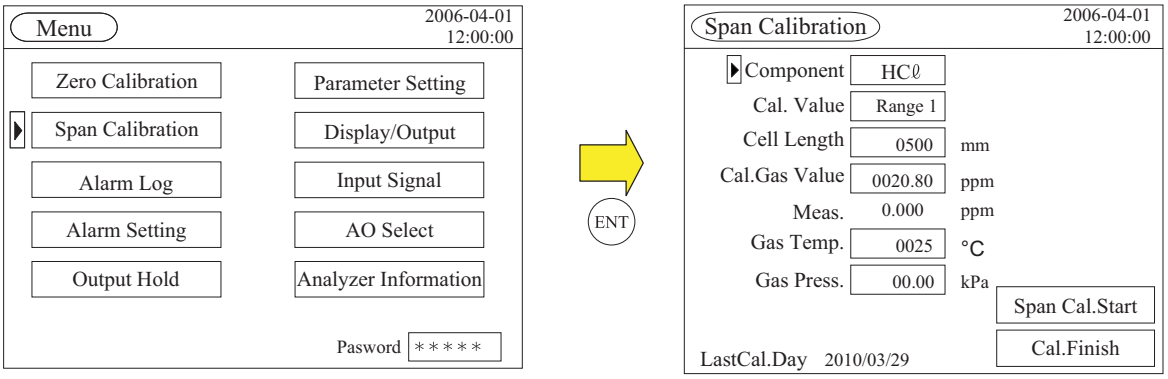
Zero calibration of dust is performed in a state that the receiver unit and the transmitter unit are attached to the stack. Thus, when dust exists in the stack, do not perform the zero calibration, perform only the span calibration.




(1) If the power is off, turn on the power.
(2) Wait more than an hour after the power is turned on to perform calibration, because it takes an hour for warm up.
(3) Display the “Zero calibration” screen.
(4) Point the ▶ to “Component”, and press the ▷ key.
(5) Press the △ key or the ▽ key to select the Dust.
(6) Point the ▶ to “Cell Length”, and press the ▷ key.
(7) Enter the optical path lengths of the stack to be measured (same value as Path Lengths in the “Parameter Setting” screen).
(8) See the “Meas.” on the “Zero Calibration” screen and make sure if the indication value is stable.
(9) Point the ▶ to “ZeroCal.Start”, and press the ENT key to start the zero calibration.
(10) “ZeroCal.Start” blinks for about 30 seconds.
(11) When the calibration is completed, the cursor moves to “Cal.Finish”, and the current date is displayed at “LastCal.Day”.
(12) Press the △ key or ▽ key to move the cursor from “Cal. Finish”.

# 6.2 Span calibration

Select the “Span Calibration” from the “Menu” screen and press the (ENT) key.




## 6.2.1 Preparation

| | |
|---|---|
| ⚠ **DANGER** | If toxic fume, corrosive gas or inert gas is used as calibration gas, be sure that the position of air ventilation or exhaust port is suitable. Oth-erwise you may inhale exhaust gas.<br>Suffocation, brain disorder, circulatory deficit, or contraction of the breathing system may occur, resulting in death. |
| ⚠ **CAUTION** | • The laser beam is the invisible infrared light. Do not watch the laser beam directly or scattering light.<br>• Do not watch the laser beam directly with the optical measuring device. Otherwise, it may cause serious damage to your eyes. |

If you want to change other than zero gas to the span gas, same procedure in “6.1.1 Preparation” is taken.

(1) After zero calibration is carried out, perform the span calibration.
(2) Stop the flow of zero gas, and switch it to span calibration gas.
(3) When using toxic fume, pay attention to the position of the exhaust port in order to avoid inhaling of the exhaust gas.
(4) When pipe connection and exhaust are completed, allow the gas to flow.
(5) Flow of sampling gas should be 1.5L/min.

Note) Use a new regulator as much as possible. Do not use the regulator that was used for alkaline gas like ammonia for acid gas like HCl. Otherwise, gas adsorbs inside the regulator and the indication value may become unstable.
Note) For HCl, when you bring a gas cylinder which has been unused for long period into use or a new gas cylinder, it takes time until the indication value is stabilized. Supply gas for a while until it is stabilized.
Note) When the indication value does not change, even if you supply gas for several tens of minutes, the inside of the regulator may be in rust. Replace it with the new one.

# 6.2.2 About Span check (calibration)

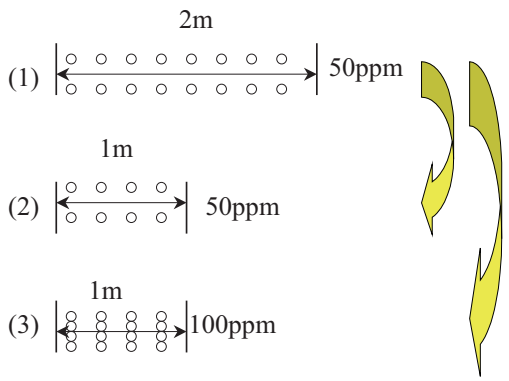
Gas absorption laws
Based on Lambert-Beer Law

$$I(L)=I(0)\exp[-ks \cdot ns \cdot Ls]$$

- I(L) : Received light quantity
- I(0) : Transmitted light quantity
- ks : Coefficient
- ns : Concentration value
- Ls : Optical path lengths (Stack lengths)

Absorption intensity is proportional to gas concentrationmeasured and the lengths where the gas exists (measured optical path lengths or stack length)

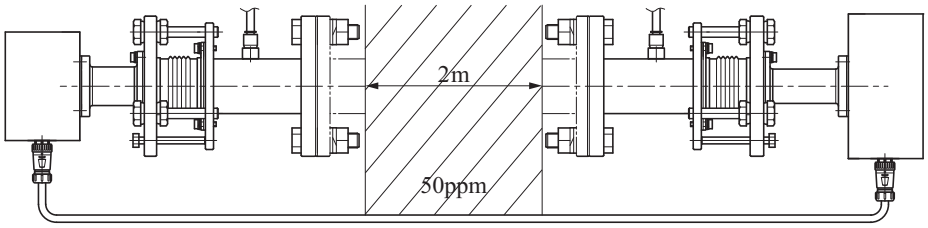
Example: Where the gas concentration is 50ppm and the measured optical path length (stack length) is 2m

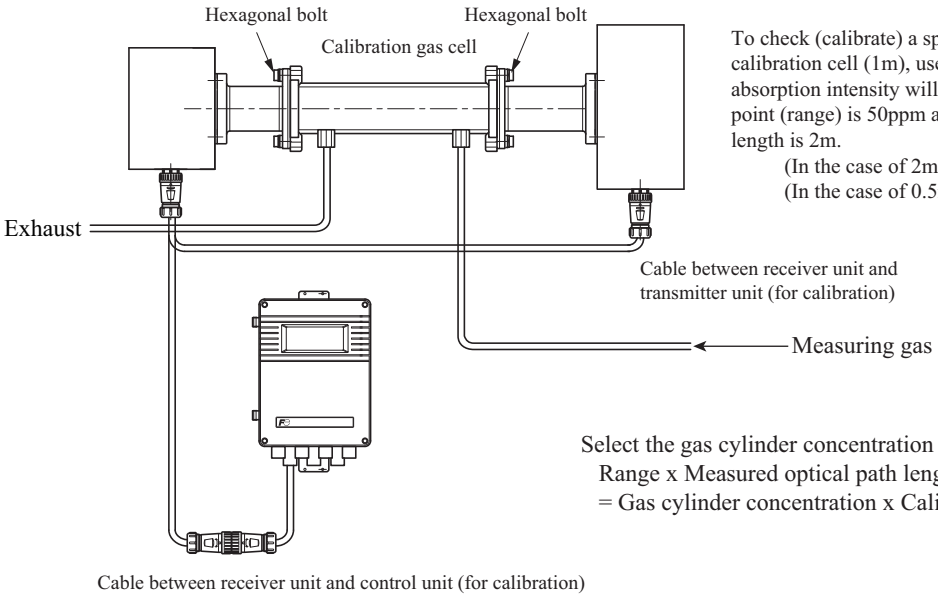



The absorption intensity is twice that of where the gas concentration is 50ppm. and the measured optical path lengths is 1m.

The absorption intensity is equal to that of where the gas concentration is 100ppm and the measured optical path lengths is 1m.

Where the range is 50ppm and the measured optical path length (stack length) is 2m,



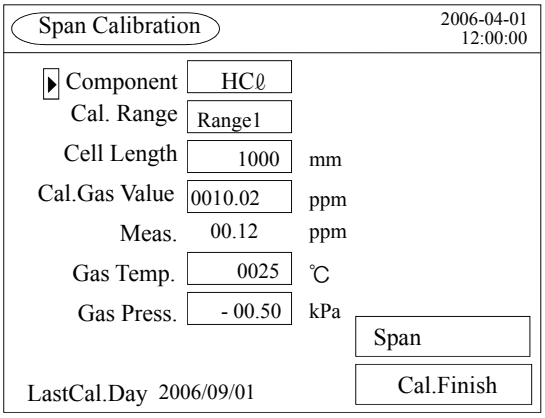




To check (calibrate) a span point by using the standard calibration cell (1m), use 100ppm gas cylinder. So, the absorption intensity will be same as that where the span point (range) is 50ppm and the measured optical path length is 2m.
(In the case of 2m calibration cell: 50ppm)
(In the case of 0.5m calibration cell: 200ppm)

Select the gas cylinder concentration satisfying the following.
Range x Measured optical path length
= Gas cylinder concentration x Calibration cell length

## 6.2.3 Span calibration

(1) If the power is OFF, turn it ON.
(2) Check if the flow of span gas is approximately 1.5 to 2.0 L/min.
(3) Display the “Span Calibration” screen.
(4) Point the ▶ to “Component”, and press the ▷ key.
(5) Press the △ key or the ▽ key to select the measured gas component to be span-calibrated. When there is only one component, it is not necessary to select.

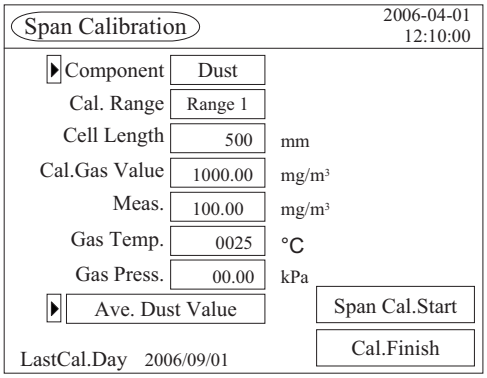


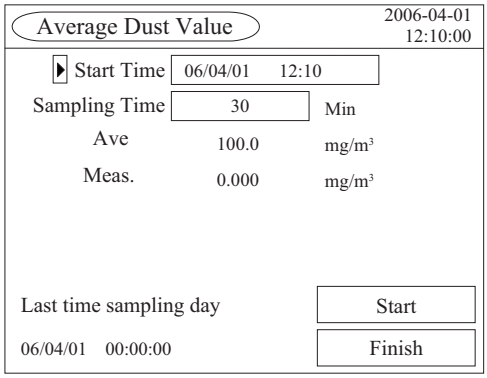

(6) Point the ▶ to “Cell Length”, and press the ▷ key.
(7) Enter the length of calibration gas cell. Standard cell length is 1000mm. (When the range is low concentration, the length of calibration gas cell can be either 500mm or 200mm.)
(8) Point the ▶ to “Cal.Gas Value”, and press the ▷ key.
(9) Enter the concentration displayed on the gas cylinder.
(10) Point the ▶ to “Gas Temp.”, and press the ▷ key.
(11) Connect the thermometer to the pipe. When output signal (4 to 20mA) is entered in the AI terminal of the control unit, read the temperature value on the “Measurement” screen and enter the value. When the range is low concentration, the value may be affected by gas temperature.
(12) Enter the value in “Gas Press.” in the same manner of “Gas Temp”.
(13) See the value of “Meas.” At the “Span Calibration” screen, and make sure that the value is not completely different from that of “Cal.Gas Value”, and the indication value is stable. For easily-absorbed gases such as HCl, it requires a certain length of time to be stabilized. It takes 5 minutes until the gas is stabilized at the earliest, and it may not be stabilized even an hour, depending on the diameter, length of exhaust tube, the gas cylinder and regulator.
(14) Point the ▶ to “Span Cal.Start” and press the ENT key to start span calibration.
(15) “Span Cal.Start” blinks for about 30 seconds.
(16) When the calibration is completed, the cursor moves to “Cal.Finish”, and the current date is displayed at “LastCal.Day”.

## 6.2.4 Measurement of average dust concentration of the same time as the sampling for manual dust analysis conducted

Matching the value obtained by manual analysis is required for measument of dust.
Use “Average Dust Value” screen to measure the dust concentration of the same time as sampling for manual analysis was conducted. When the result of manual analysis is obtained at a later date, perform matching by using the “Span Calibration” screen.
Perform matching to the value obtained by manual analysis in a state that the receiver unit and the transmitter unit are attached to the stack. Calibration cell is not required.

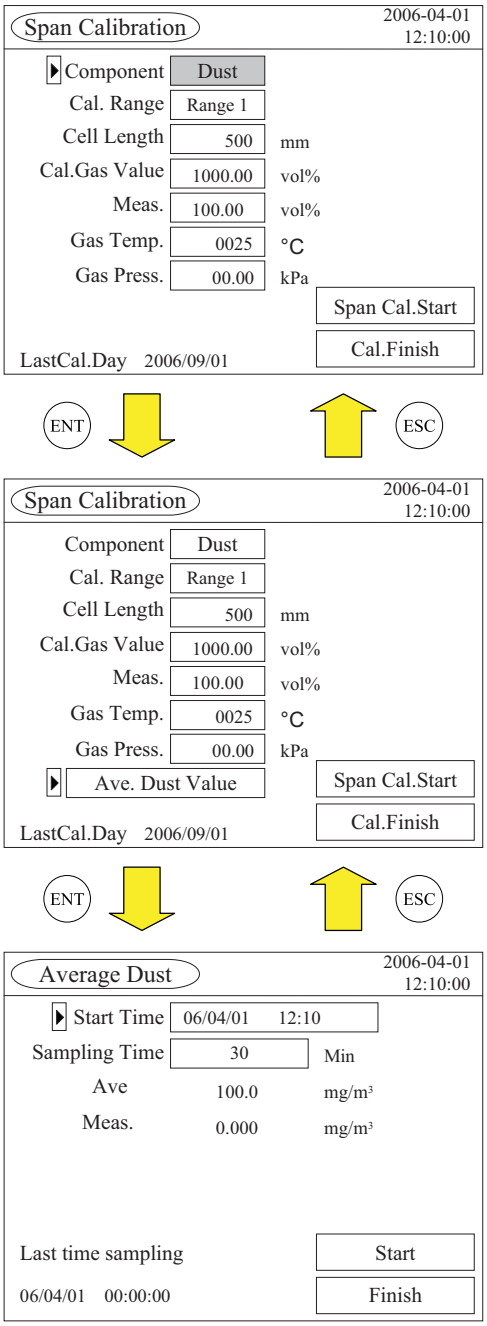
(1) If the power is off, turn on the power.
(2) Wait more than an hour after the power is turned on to perform calibration, because it takes an hour for warm up.
(3) Display the “Span Calibration” screen.
(4) Point the ▶ to “Component”, and press the ▷ key.
(5) Press the △ key or the ▽ key to select Dust, and press the ENT key.
(6) [Ave. Dust Value] appears next to [Span Cal. Start].
(7) Press the △ key or the ▽ key to move the cursor in [Ave. Dust Value], and press the ENT key. The screen then transits to “Average. Dust Value” screen.




(8) There are four methods to measure the average dust concentration.
  1) Measuring the average dust concentration during the period from Start Time (pre-set value) to when the Sampling Time (pre-set value) elapses. (After the input value is set, make sure to press Start key.)
  2) Measuring the average dust concentration during the period from when [Start key] is input (arbitrary-set time) to when the Sampling Time (pre-set value) elapses. (Value earlier than the time displayed in the up right corner of the screen should be set)
  3) Measuring the average dust concentration during the period from Start Time (pre-set value) to when [Finish key] (arbitrary-set time) is input. (After the Start Time is entered, make sure to press the Start key)
  4) Measuring the average dust concentration during the period from when [Start key] (arbitrary-set time) is input to when the [Finish key] (arbitrary-set time) is input. (Value earlier than the time displayed in the up right corner of the screen should be set)
(9) Setting change of [Start Time] or [Sampling Time] during measurement of average dust concentration is not reflected on the display. Press the [Finish key] first, and then press the [Start key] to reflect the change on the display.

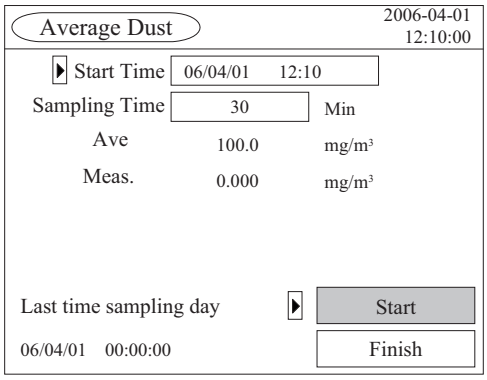
### 6.2.4.1 The measuring procedure of average dust concentration to match the value obtained by manual analysis.



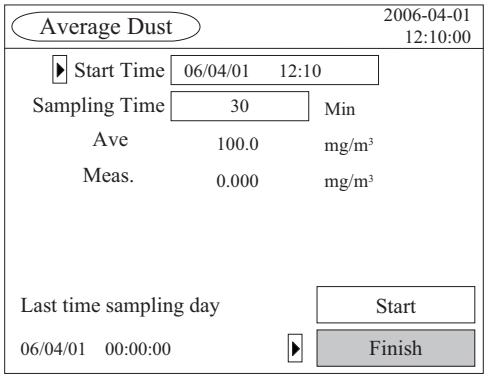

Point the cursor to [Component] on the "Span Calibration" screen to select "Dust", and press the ENT key.

[Ave. Dust Value] key appears on the left of [Span Cal Start]. Press the △ key or the ▽ key to move the cursor into [Ave. Dust Value], and press the ENT key.

Enter the time to start measurement of average dust concentration in [Start Time], and measurement period in [Sampling Time].



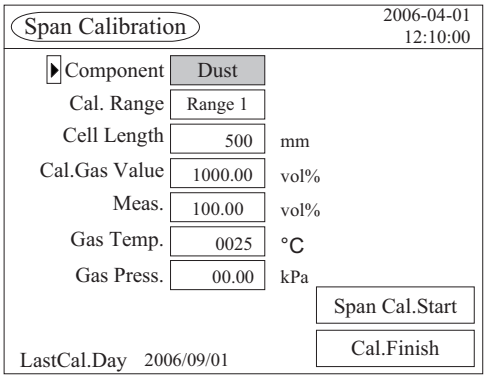

Move the cursor to [Start Time], and press the (ENT) key to fix the setting of [Start Time] and [Sampling Time].
Average dust concentration of the setup condition will be measured.

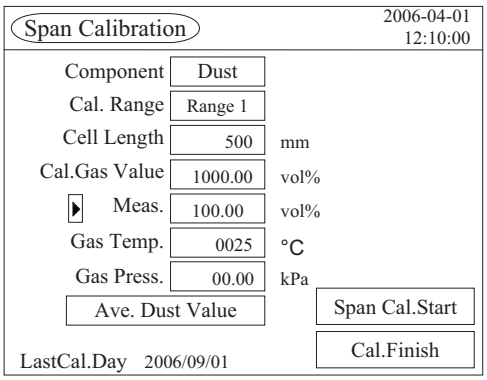

Move the cursor to the [Finish key], and press the (ENT) key to finish measurement.
Average concentration value of the period of time from you press [Start key] to [Finish key] will be displayed.
If you do not press [Finish key], measument will be stoped automatically and the average concentration of specified sampling period starting from [Start Time] will be displayed.

## 6.2.5 Matching a value obtained by manual dust analysis

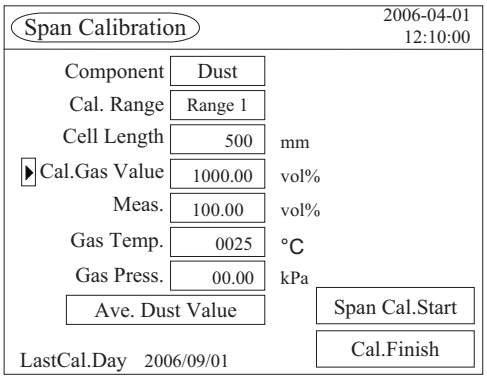
It may take several days until the result of manual analysis is obtained. After the result of manual analysis is obtained, the concentration of dust average value measured while sampling gas for manual analysis was being extracted should be matched.



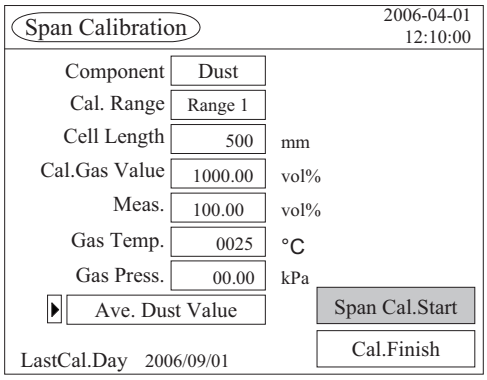

Point the cursor to [Component] on the "Span Calibration" screen to select "Dust", and press the (ENT) key.

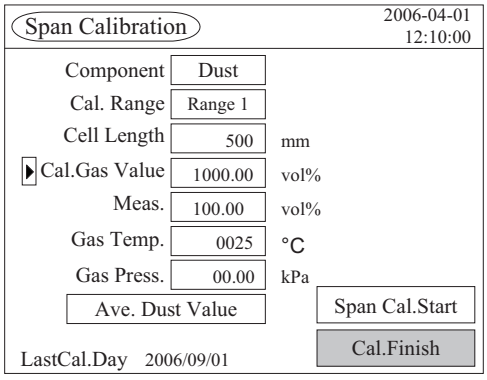

A value then can be entered to [Meas.]. Enter the average value measured by "Average. Dust Value" screen.


Enter the value obtained from manual analysis to Cal. Gas Value.




Move the cursor to [Span Cal. Start], and press the (ENT) key.


Calibration finishes in 2 seconds. Check that the instantaneous value on the “Avg. Dust Value” screen conforms with the result of manual analysis.

## 6.2.6 Method of $H_2O$ calibration

There is no cylinder for span calibration of $H_2O$, thus manual analysis is required.
Calibration is conducted under the condition of installing receiver /transmitter unit.
Calibration cell is not used.

### 6.2.6.1 Required data

Please prepare for following required data for span calibration.

(1) Concentration data of $H_2O$ in exhaust gas by manual analysis.
(2) Measurement result of $H_2O$ concentration conducted by manual analysis and laser gas analyzer under the same condition and at the same start time.

### 6.2.6.2 Preparation for span calibration

Calibration gas concentration should be calculated as following procedure prior to span calibration.

(1) After obtaining the $H_2O$ concentration data by manual analysis, confirm the conducting time of manual analysis and the concentration value of $H_2O$.
(2) Be sure to calculate the average value based on recorded $H_2O$ concentration value preliminarily by laser gas analyzer and with the same amount of the time for calculation by manual analysis.
    e.g.: When $H_2O$ measuring time is at 9:00 to 9:30, it is assumed that average value of $H_2O$ concentration is in 30 minutes.
(3) Calculate that coefficient of span calibration is given by following formula using the value of manual analysis in the Item1) and average value of $H_2O$ concentration in the Item2).

$$\text{Coefficient of span calibration} = \frac{\text{Manual analysis in Item1) [vol\%]}}{\text{Average } H_2O \text{ concentration in Item2) [vol\%]}}$$

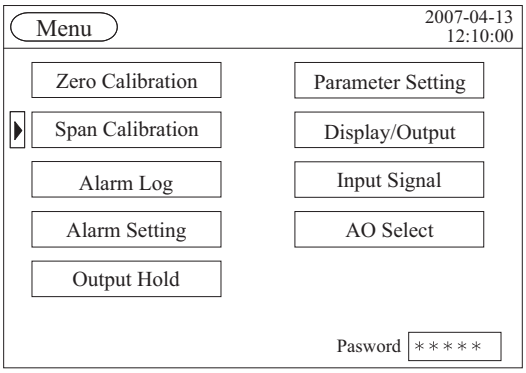
e.g.: When manual value in Item1) is 15[vol%] and average value of $H_2O$ concentration is 10 [vol%] in Item2).

$$\text{Coefficient of span calibration} = \frac{15\ [\text{val\%}]}{10\ [\text{val\%}]} = 1.5$$

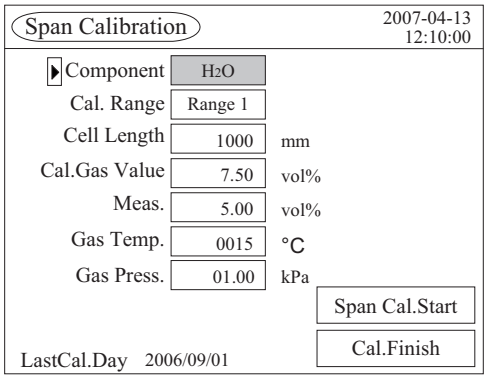
Following procedures should be conducted just before start of span calibration.

(4) Confirm the fluctuation range of measurement value within ±1 [vol%] on span calibration screen of $H_2O$ analyzer and then calculate the intermediate value during fluctuation in about 10 seconds.
(5) Calculate the calibration gas concentration by following formula using average concentration value in Item4) and coefficient of span calibration in Item3).
    Calibration gas concentration = average concentration value in Item4) × coefficient of span calibration in Item3)
    e.g.: When coefficient of span calibration is1.5, and measurement value is 5 [vol%]
    Calibration gas concentration = 5 [vol%] × 1.5 = 7.5 [vol%]

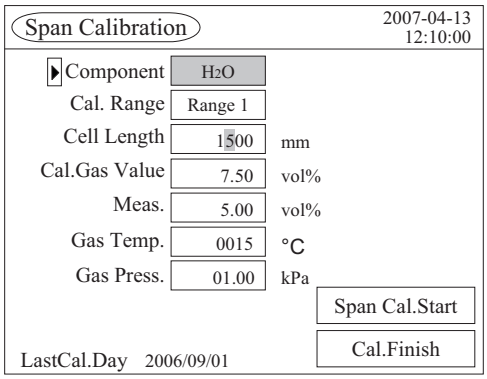
### 6.2.6.3 Procedure of span calibration



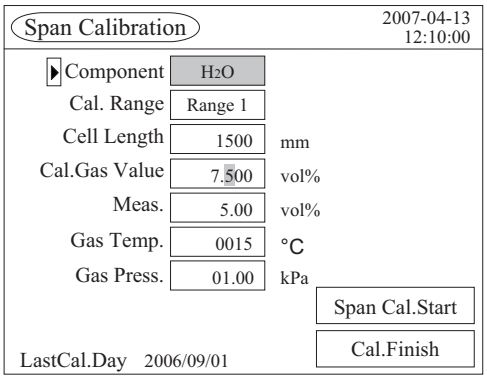

Point the cursor to [span calibration] with ⊿ ▽ ▷ On [Menu mode] and then press ENT.



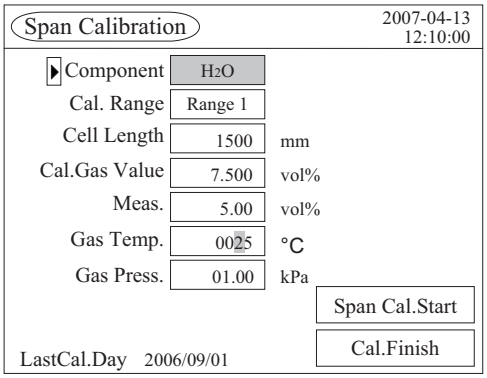

Point the cursor to [Component] with ⊿ ▽ and then let the display part of component selection blink with ▷.
Select the [H2O] with ⊿ ▽ and then press ENT.



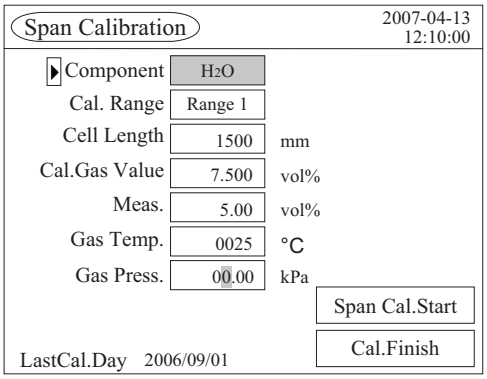

Point the cursor to [Cell Length] with ⊿ ▽ and then let the display part of Cell Length blink with ▷. Input the length of measurement cell with ⊿ ▽ and then press ENT.



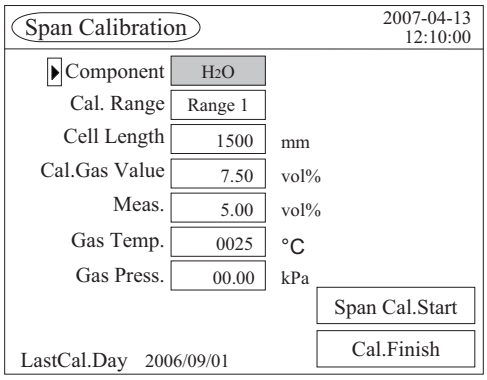

Point the cursor to [cal] with ▲ ▼ and then let the inputting display part of gas concentration blink with ▶.
Input the results of gas concentration from the calculation in procedure 5) of Item 6.2.5.2 with ▲ ▼ and then ENT.



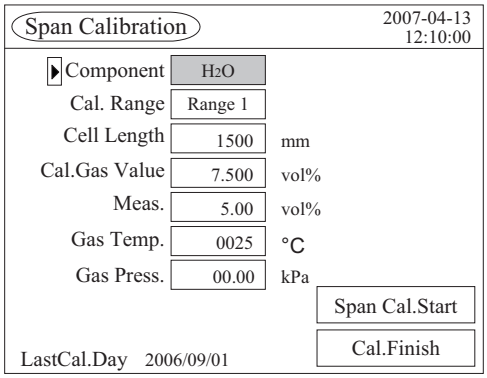

Point the cursor to [Gas Temp] with ▲ ▼ and then let the inputting display part of Gas Temp. blink with ▶.
Input the 25 [°C] with ▲ ▼ and then press ENT.




Point the cursor to [Gas press] with ▲ ▼ and then let the display part of Gas Press blink with ▶. Input the 0.00[kPa] with ▲ ▼ and then press ENT.



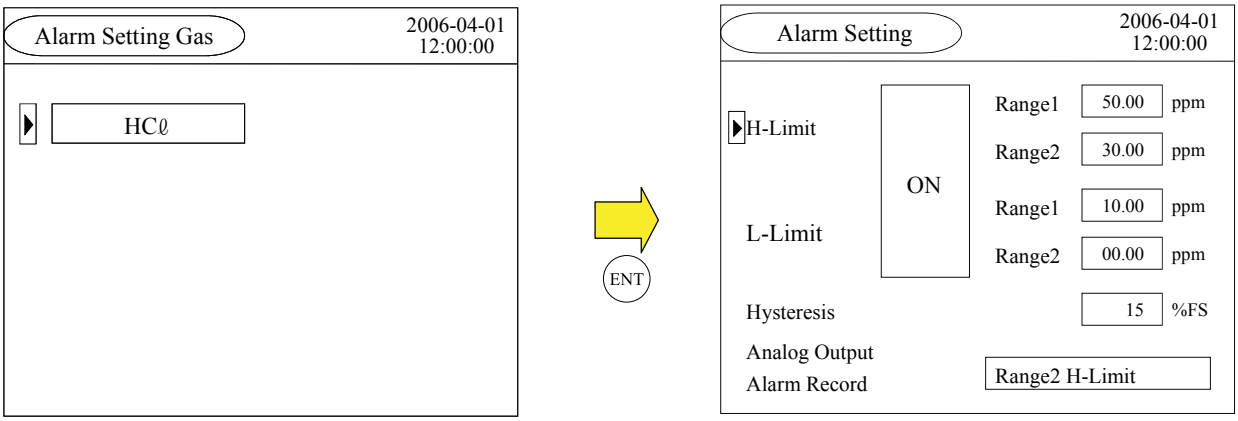

Point the cursor to [Span Cal Start] with ▲ ▼ and then press ENT.




Calibration will be completed in 30 seconds and automatically cursor will be move to [Cal Finish].

# 6.3 Alarm setting

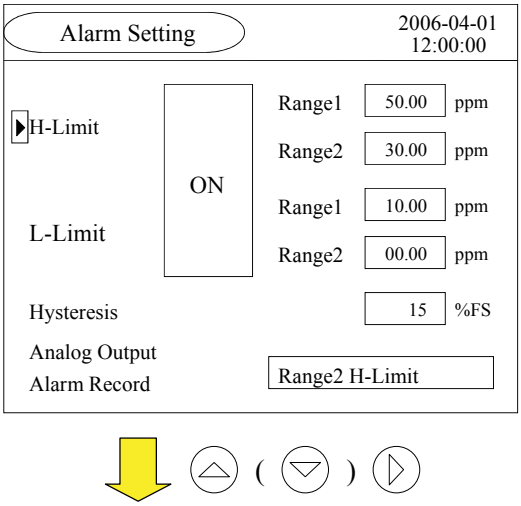
Select “Alarm Setting” from the “Menu” screen, and press the ENT key. On the “Alarm Setting Gas” screen, select the measurable component by moving the ▶ with the △ key and the ▽ key.
Press the ENT key after measurable component is selected. “Alarm Setting” screen is displayed.



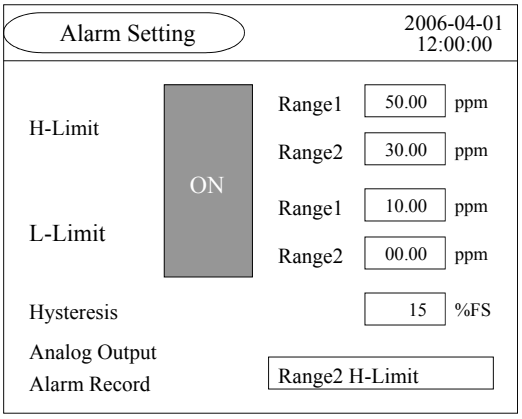

## 6.3.1 Alarm value ON/OFF

ON validates the High/Low limit alarm output setting, alarm display, alarm record for the measured concentration. Select OFF to invalidate.

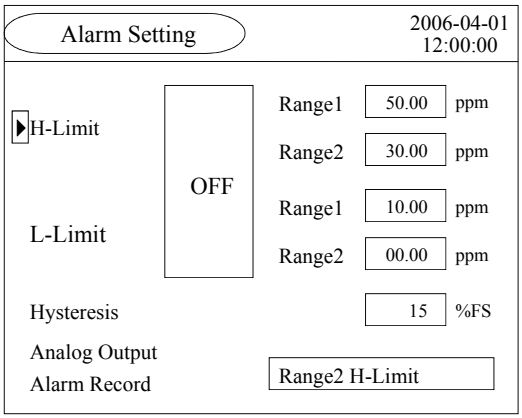
> **Note**
> When ON is selected, “High/Low limit setting”, “Analog Output / Alarm Record” cannot be set.




Point the ▶ to “H-Limit” or “L-Limit” by the △ key and the ▽ key, and press the ▷ key.




Select "ON" or "OFF" by the △ key or the ▽ key, and press the ▷ key.

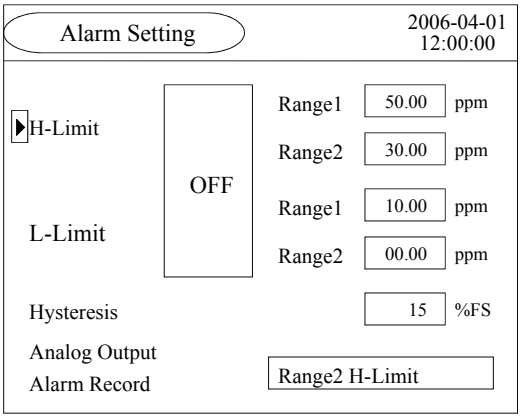

When "OFF" is selected, the cursor returns to the "H-Limit". When "ON" is selected, the ▶ moves to "Range1" of H-Limit or L-Limit.

## 6.3.2 Setting of alarm value

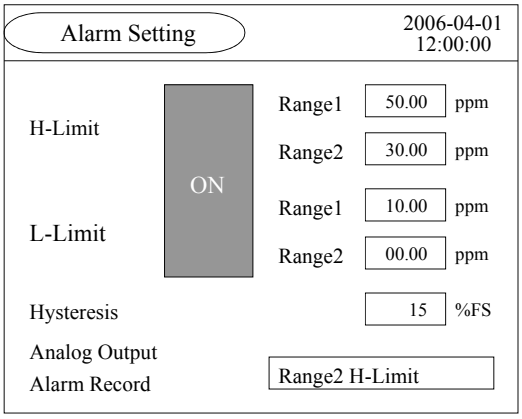
Make a setting of the High/Low limit alarm for the measured concentration. To change the alarm setting, set the Alarm ON/OFF setting to ON, and then change the numeric value.

**Note**

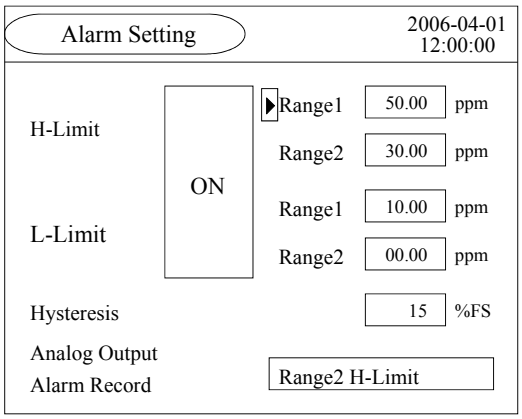
Point the ▶ to "H-Limit" to change the setting of H-Limit value, and point "L-Limit" to change the setting of the L-Limit value.



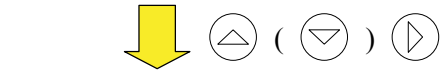

Point the ▶ to "H-Limit" to set the H-limit value, and point "L-Limit" to set the L-Limit value, and then press the ▷ key.

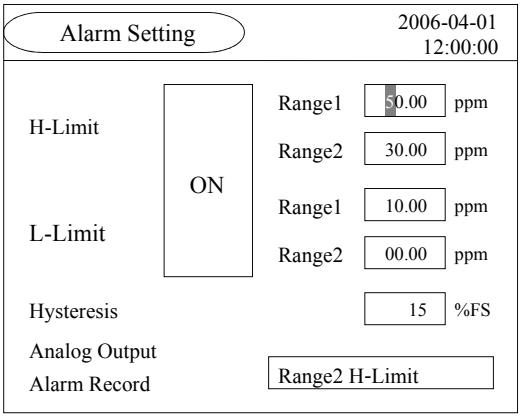



Select "ON" by the ( △ ) key or the ( ▽ ) key, and press the (ENT) key.

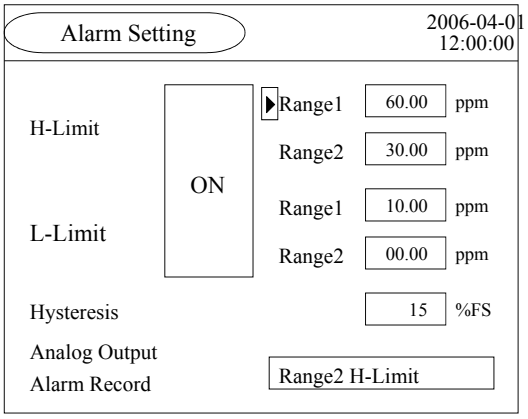




When there are two ranges, select the range by the ( △ ) key or the ( ▽ ) key, and press the ( ▷ ) key.




Change the numeric value by the ( △ ) key or the ( ▽ ) key, and press the (ENT) key.



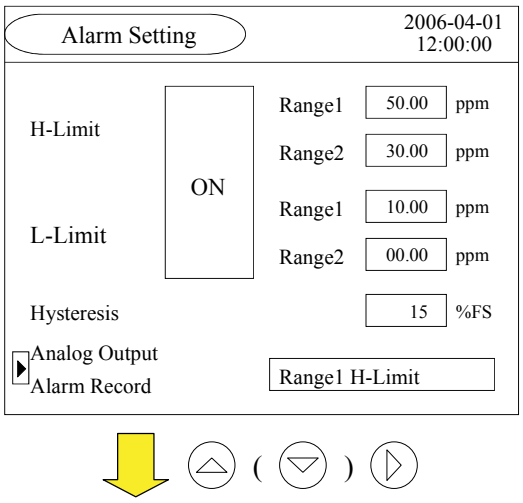

Double-click the ESC key, and the ▶ returns to the previous position.

> **Note**
>
> Set the value so that H-Limit is larger than L-Limit, and that (H-Limit – L-Limit) is larger than hysteresis width.

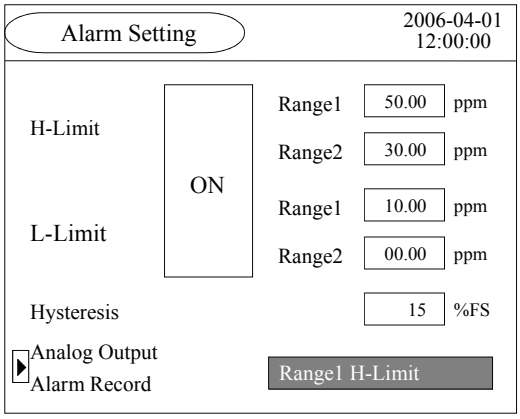
## 6.3.3 Analog output / alarm record

Set the recording range of the external alarm output such as analog output or the alarm record.
Setting range can be selected from “H-Limit”, “L-Limit” and “H/L Limit”. When there are two ranges, the setting range can be selected from the 6 types of Range1 and Range2.

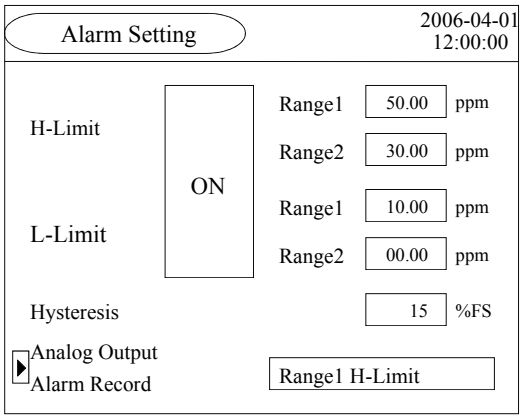
> **Note**
>
> When “OFF” is set to the ON/OFF setting of the alarm value, “Analog Output / Alarm Record” cannot be set. Select “ON” again. The alarm output which is “H-Limit”, “L-Limit” or “H/L Limit” cannot be performed for 5 minutes after turning on the power.




Point the ▶ to “Analog Output / Alarm Record” by the △ key and the ▽ key, and press the ▷ key.




Select output range by the △ key and the ▽ key, and press the ENT key.

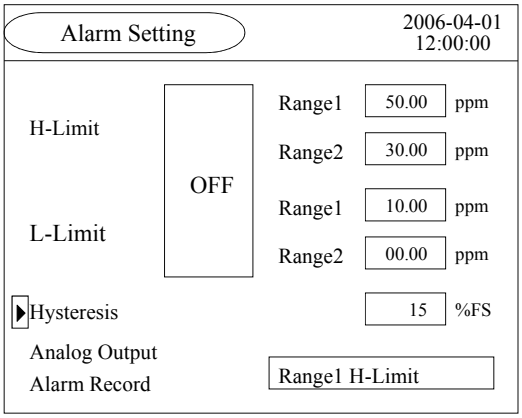




**Explanation of alarm range**

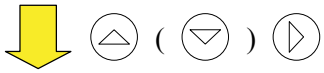
Range1 H-Limit : Alarm output is provided only when a value exceeds the Range1 H-Limit.
Range1 L-Limit : Alarm output is provided only when a value is lower than Range1 L-Limit.
Range1 H/L-Limit : Alarm output is provided when a value exceeds the Range1 H-Limit or it is lower than Range1 L-Limit.
Follow the same procedure for Range2.

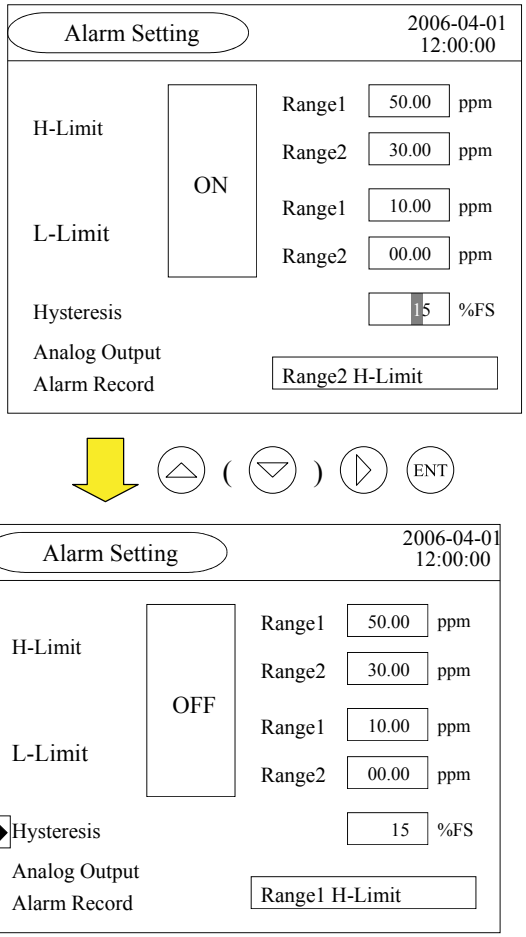
## 6.3.4 Hysteresis setting

Set the hysteresis to prevent possible chattering of the alarm output near the alarm setting value.




Point the ▶ to "Hysteresis" by the △ key or the ▽ key, and press the ▷ key.






Change the numeric value by the △ key or the ▽ key, and move the digit by the ▷ key.

Press the ENT key to make the hysteresis valid.

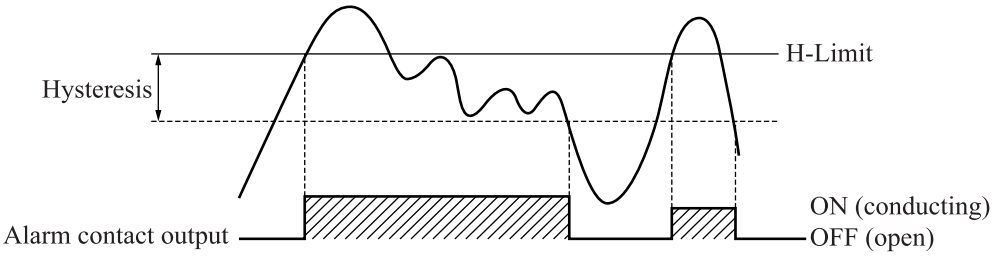
**Setting Range**

0 to 20% FS

%FS: Indicates the rate for which the range width of each component is regarded as 100%.

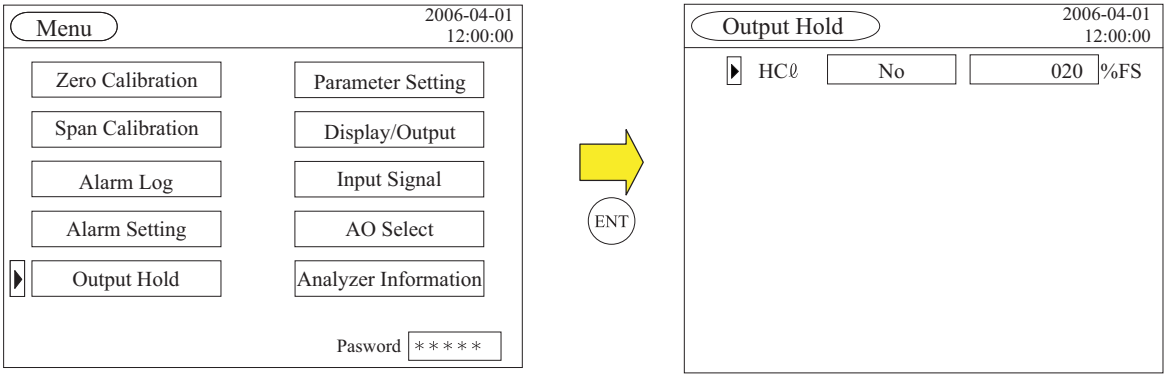
<u>Hysteresis mode (in case of H-Limit)</u>

Alarm output is turned ON when the value exceeds the H-Limit. After alarm output is turned ON and output is reduced by hysteresis set from H-Limit, the alarm is turned OFF.



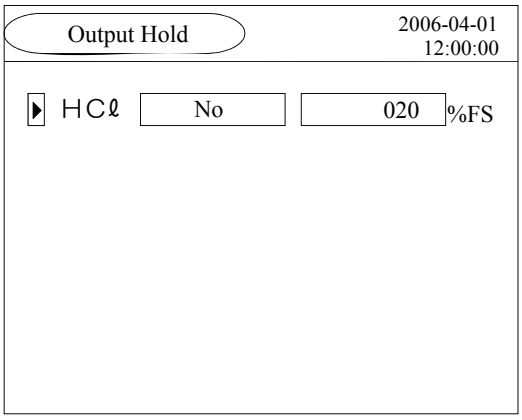
# 6.4 Output hold

Select “Output Hold” from the “Menu” screen, and press the ENT key.

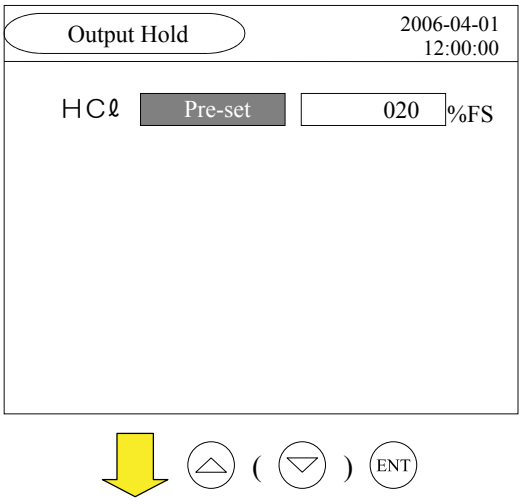



## 6.4.1 Output hold

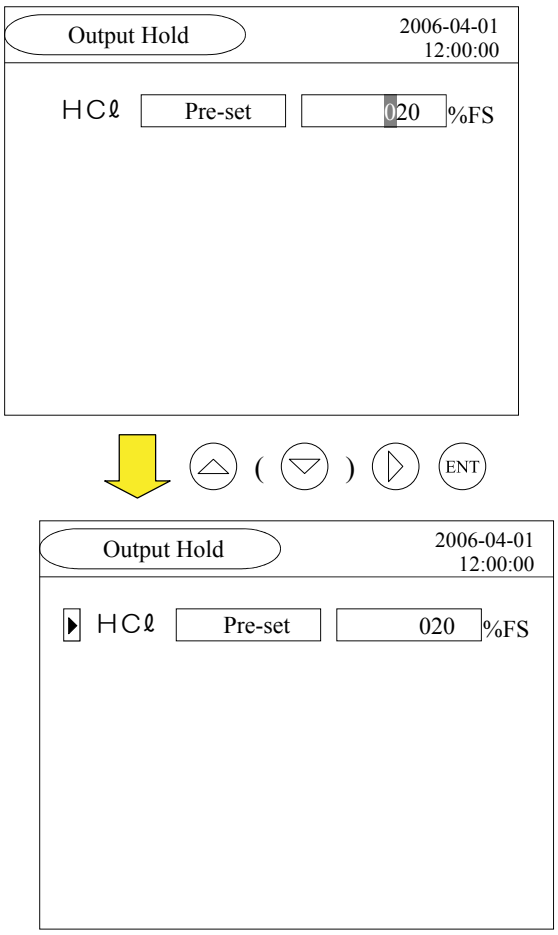
Set output hold to “Last Meas.” or “Pre-set” to hold analog output. (Indication value on the “Measurement” screen is not held. However, it is highlighted during the output hold time.)




Point the ▶ to the measurable component to hold output by the △ key or the ▽ key, and press the ▷ key.




Select either “Last Meas.” or “Pre-set” by the △ key or the ▽ key. Press the ENT key to validate the setting.




When "Last Meas." is selected, cursor returns to the starting position.
When "Pre-set" is selected, numeric value is highlighted. Change the numeric value by the △ key or the ▽ key, and move the digit to the right by the ▷ key.
After the numeric value is changed, press the ENT key.

## Setting Range

"Last Meas." : Holds the value for which "Last Meas." is determined by the ENT key.

"Pre-set" : Holds the %FS value for which range is currently validated.
Example) When range is from 0 to 10ppm, and the set value is 20%FS, the value corresponding to 2ppm is output regardless of the measurement value.

## $O_2$ Conversion Hold

"Last Meas." : Holds the measurement value for which "Last Meas." is determined by the ENT key, and the value calculated by $O_2$ value. When the $O_2$ value is fixed, it holds the value calculated by the fixed value.

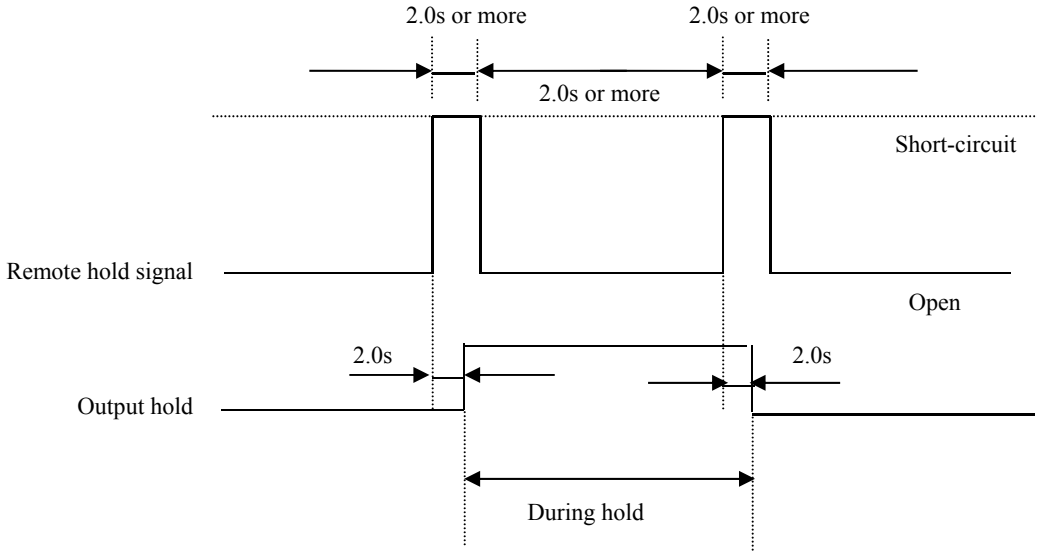
"Pre-set" : Even if $O_2$ analog input is entered, it holds the value calculated by $O_2$ fixed value which is determined by the ENT key.

## Last Meas. of average value

When the average value output is selected and "Last Meas." is clicked, the averaged value is kept holding until determined by the ENT key.

## 6.4.2 Remote hold (DI3 terminal)

Output hold can be performed by remote according to the external contact input (DI3 terminal, option).
The value to hold output is “Last Meas.” only.




Apply rectangular waveform (pulse width: 2.0 sec or more) to a remote hold input terminal to hold analog output. Applying it again cancels the hold.

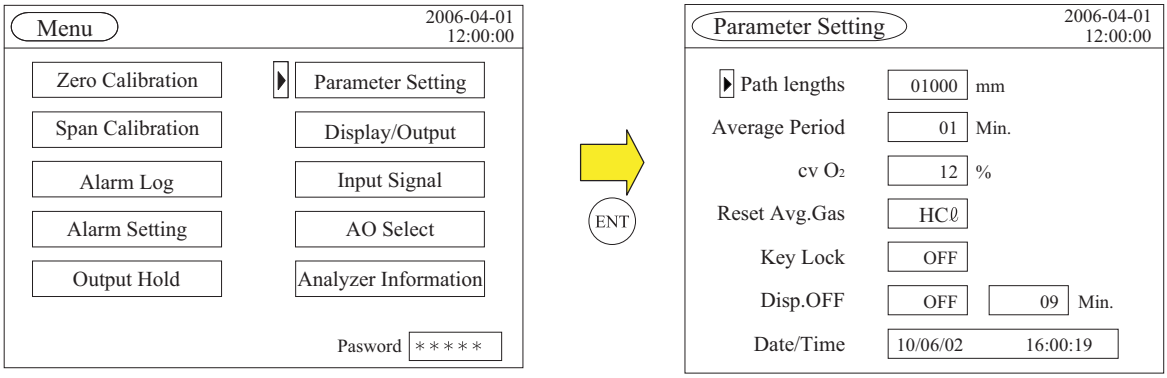
# 6.5 Parameter setting

On the “Parameter Setting” screen, “Path Lengths” related to measurement value and “Average Period” related to average value output are set. Items to be set are as follows.

**Explanation of setting items**

| | |
|---|---|
| “Path Lengths” | : Enters the optical path lengths. |
| “Average Period” | : Sets how many minutes the value is output as an average value of movement in the case of the average value output. |
| “Reset Avg.Gas” | : Resets the average value in the case of the average value output. |
| “Key Lock” | : Any key operation except the key lock OFF cannot be performed. |
| “Disp.Off” | : Sets automatic OFF of the backlight of display unit and the time until backlight. |
| “Date/Time” | : Sets the current year/month/date, hour: minute: second. |

Select the “Parameter Setting” from the “Menu” screen, and press the (ENT) key.

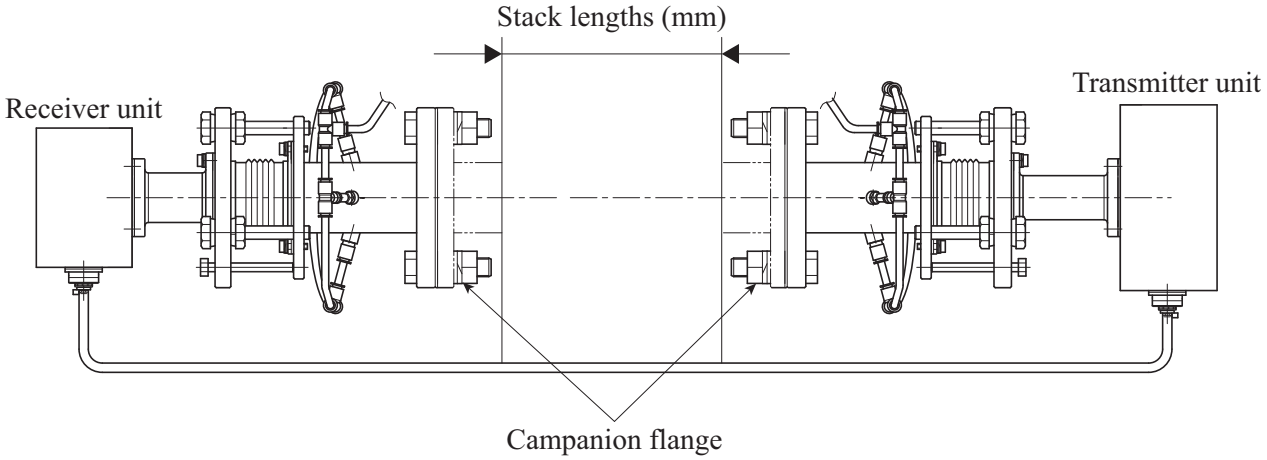


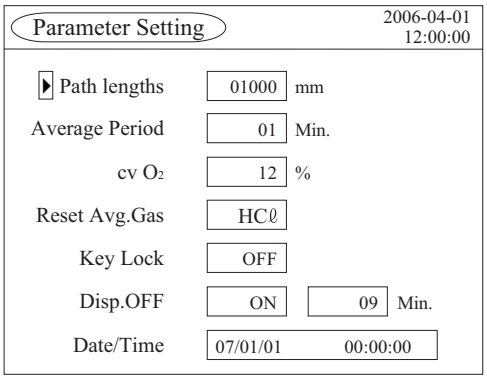

## 6.5.1 Setting of stack lengths

Enter the lengths of the stack where the receiver unit and the transmitter unit are attached. It does not include the lengths of companion flange. This value has a direct effect on the measurement value, so be sure to enter correctly. Otherwise, measurement value will not be properly displayed or output. Enter the value in the millimeter. (Input range is from 100 to 15000mm.)

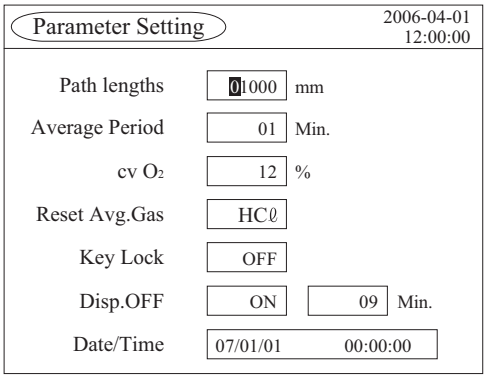
**Explanation of concentration output**

The analyzer is calculated and output as a standard of the 1m of stack lengths (optical path lengths). Absorption concentration varies depending on the stack lengths, so be sure to enter the stack lengths correctly.

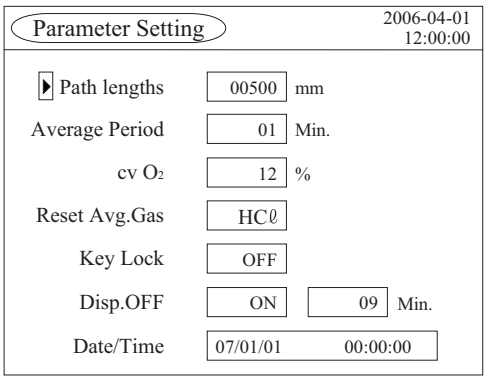



Point the ▶ to "Path Lengths" by the △ key and the ▽ key, and press the ▷ key.




Change the numeric value by the △ key or the ▽ key, and move the digits by the ▷ key. Press the ENT key to validate the set input value.



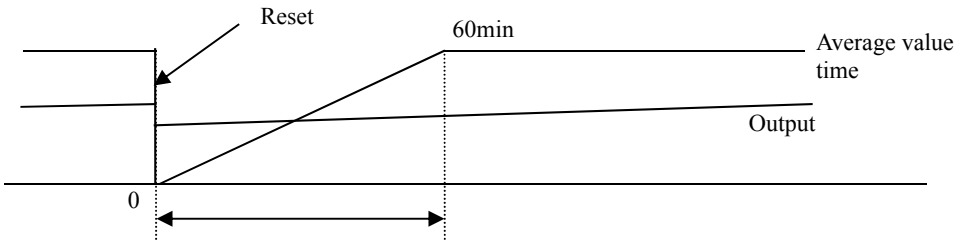
## 6.5.2 Setting of moving average time

When the indication value and output value are set to the average value in the “6.6.1 Setting of instantaneous/average value”, set how many minutes the value should be held as a moving average value.
Setting range is from 1 to 60 minutes. When it is less than the moving average time, output the moving average value during that period.

Change the setting to reset the average value. (The value is reset when pressing the (ENT) key.)

Averaging operation

When the moving average time is set to 60 minutes

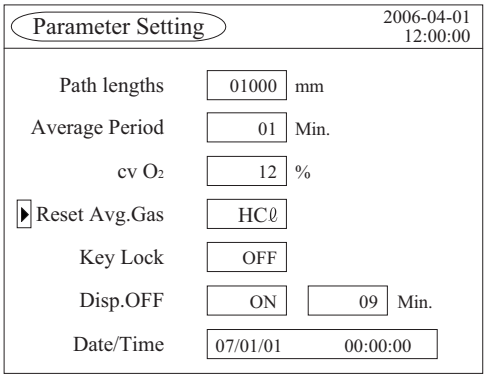



Sampling cycle is once every 1 second.

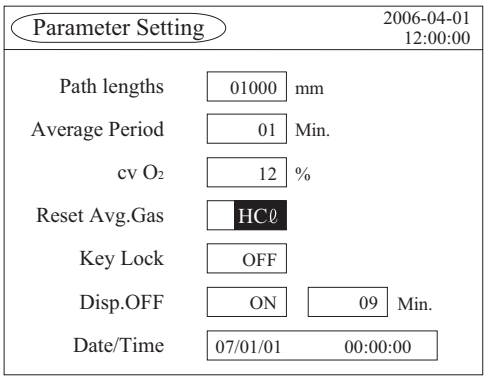
After reset, output the average value for 60 minutes. Therefore, it takes 60 minutes to obtain the average value which has been set.

## 6.5.3 Average value reset

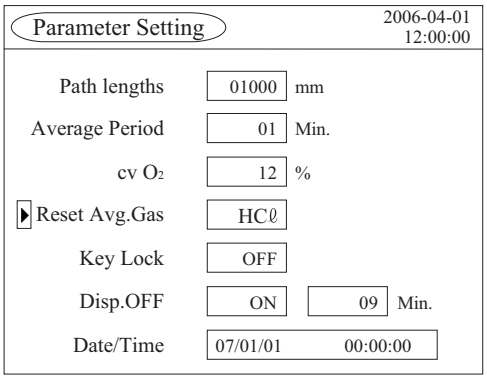
When the indication value and output value are set to the average value in the "6.6.1 Setting of instantaneous/average value", reset the average value to clear the measurement value and the $O_2$ conversion value. When the indication value and the output value are set to the instantaneous value, nothing is changed even if average value is reset.




Point the ▶ to "Reset Avg.Gas" by the △ key and or ▽ key, and press the ▷ key.

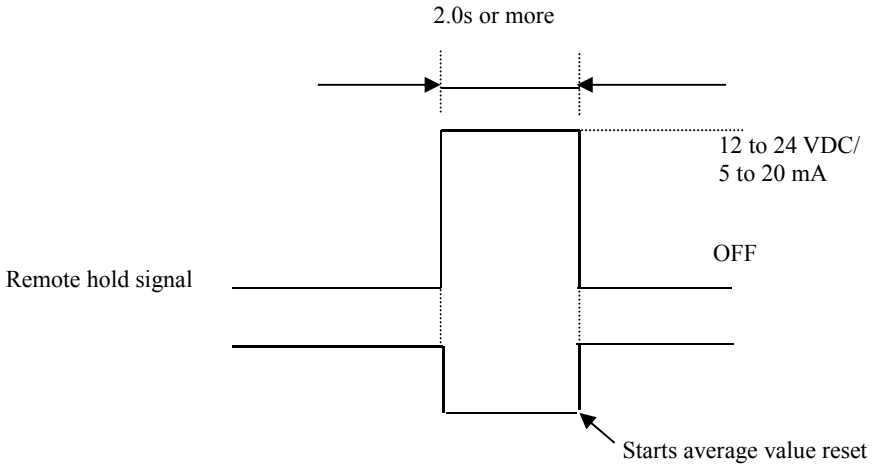



Select the measurable component to be reset by the △ or the ▽ key. When there is only one component, the component is fixed.
Press the ENT key to reset the average value.



Remote average value reset (DI1 terminal)

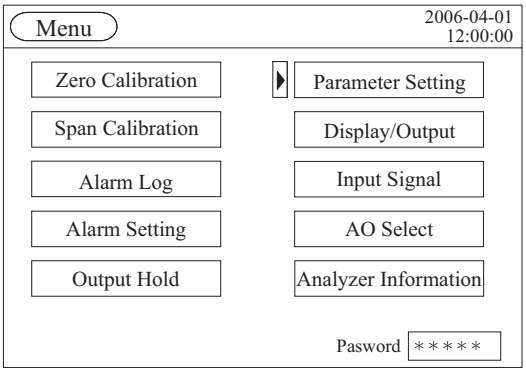
Apply rectangular waveform voltage (pulse width: 2.0 sec or more) to the input terminal of remote average value reset (DI1 terminal, option) to reset the average value.



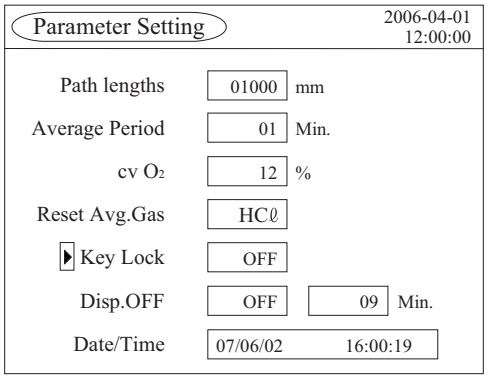

Reset is kept during short-circuit.
When switching the action from short-circuiting to opening, average value action starts.

## 6.5.4 Key lock

Key lock disables the settings other than key lock OFF.
When the key lock is turned ON,



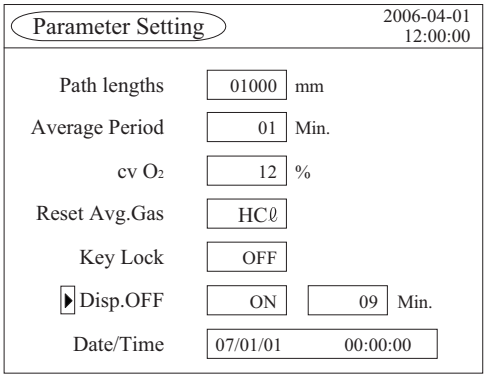

Any screens except “Parameter Setting” cannot be displayed, even if the item is selected and the (ENT) key is pressed on the “Menu” screen.



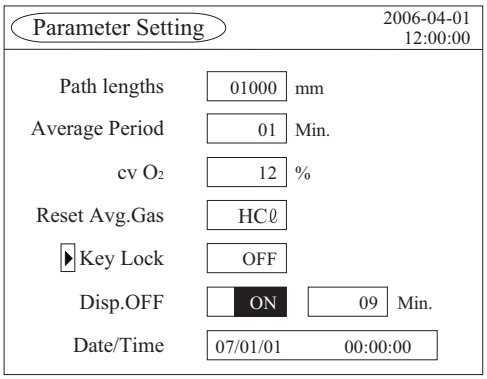

Any items except “Key Lock” cannot be validated, even if the item is selected and the (▷) key is pressed on the “Parameter Setting” screen.

## 6.5.5 Setting of backlight OFF

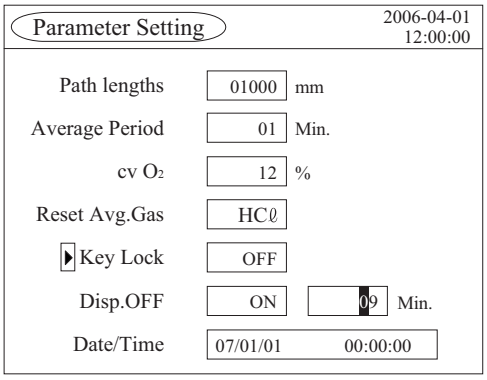
Automatic OFF setting of the backlight of the LCD unit can be made. If the specified time elapses since the measurement screen has been resumed, the backlight is automatically turned off.
Continuous lighting time of LCD (liquid crystal display) is approximately 58000 hours.
Press any key to reset backlight OFF.
Setting range of the light off time is from 1 to 60 minutes.




Point the ▶ to "Disp.Off" by the △ or the ▽ key, and press the ▷ key.




Turn it to "ON" by the △ or the ▽ key, and press the ENT key.




Change the numeric value by the △ key or the ▽ key, and move the digits by the ▷ key. Press the ENT key to validate the set input value.

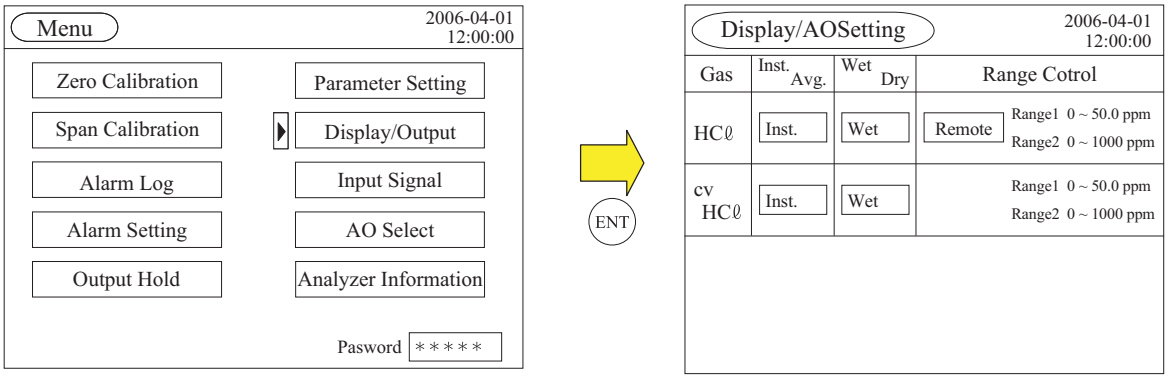
# 6.6 Display/AO setting

Make a setting of “Inst./Avg.” or “Wet/Dry” of the measurement value displayed on the “Measurement” screen.

Explanation of setting items

| | |
|---|---|
| “Inst./Avg.” | : Make a setting of “instantaneous value” or “average value” for each measurable component. |
| “Wet/Dry” | : Make a setting of “Wet” or “Dry” for each measurable component. When “Dry” is set, $H_2O$ setting of the “Analog Input” is required. |

Select “Display/AOSetting” from the “Menu” screen, and press the (ENT) key.

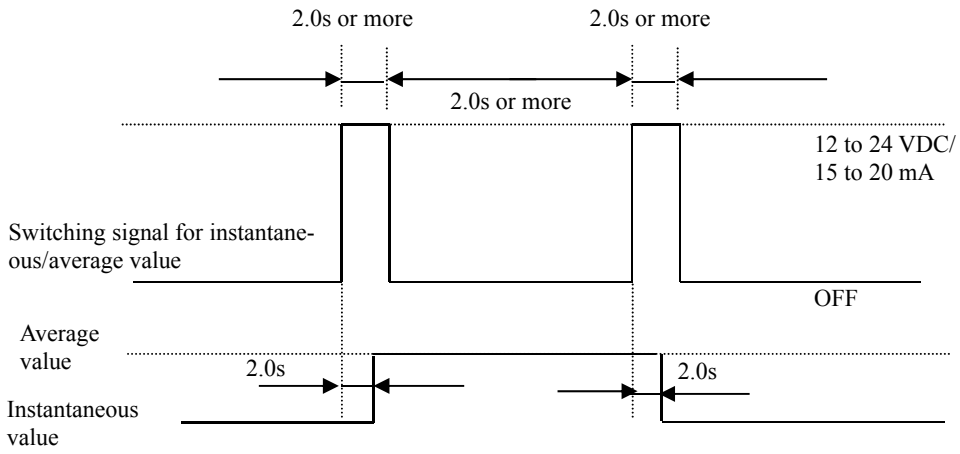



## 6.6.1 Setting of instantaneous/average value

Make a setting of “Instantaneous value” or “Average value” for each measurable component. The setting is reflected on the display on the “Measurement” screen.
$O_2$ conversion value can be arbitrarily selected even if the previous measurement value is set as instantaneous value (or average value).
When the average value is set, moving average processing is performed at the time set at “Average Period” on the “Parameter Setting” screen.

Input switching of the remote instantaneous/average value (DI2 terminal)

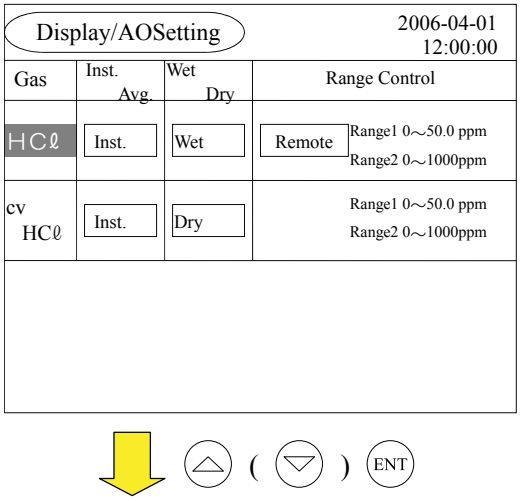
Apply rectangular waveform (pulse width: 2.0 sec or more, pulse interval: 2.0 sec or more) to the input terminal of remote average value to switch the instantaneous value and the average value.
If the previous measured value is set as instantaneous value, and $O_2$ correction value is set as average value, the previous measured value becomes the average value, and the $O_2$ correction value becomes the instantaneous value after pulse input.




## 6.6.2 Wet/dry setting

Make a setting of "Wet" or "Dry" for each measurable component. The setting is reflected on the display on the "Measurement" screen.
$O_2$ conversion value can be arbitrarily selected even if the previous measurement value is set to wet (or dry).
The analyzer is available in the "Wet" environment. When "Dry" is set, $H_2O$ setting on the "Analog Input" screen is required. When the moisture meter is provided, input its output signal (4 to 20mA DC output) to the analog input of the control unit, and set the range, referring to "6.7.1 Setting of 4 to 20mA DC Input (in case of gas temperature)". When the moisture meter is not provided, by setting the input switching on the "Analog Input" screen to "Fixed", the dry conversion is performed at the moisture value.
When the laser gas analyzer measures moisture, dry conversion can be set by either of measured moisture value or moisture value of "Input Signal".
Wet can be converted to Dry using the following expression.

**Measurement value (dry) = Measurement value (wet) × 100/ (100 – moisture content (%))**




Select the component to be set by the △ key or the ▽ key. Press the ENT key to move the cursor to the "Inst./Avg." setting.

| Display/AOSetting | | | 2006-04-01 12:00:00 |
|---|---|---|---|
| Gas | Inst. Avg. | Wet Dry | Range Control |
| HCℓ | Inst. | Wet | Remote Range1 0～50.0 ppm Range2 0～1000ppm |
| cv HCℓ | Inst. | Dry | Range1 0～50.0 ppm Range2 0～1000ppm |

Select “Inst.” or “Avg.” by the △ key or the ▽ key. Press the ENT key to move the cursor to “Wet/Dry” setting.

△ ( ▽ ) ENT

| Display/AOSetting | | | 2006-04-01 12:00:00 |
|---|---|---|---|
| Gas | Inst. Avg. | Wet Dry | Range Control |
| HCℓ | Avg. | Wet | Remote Range1 0～50.0 ppm Range2 0～1000ppm |
| cv HCℓ | Inst. | Dry | Range1 0～50.0 ppm Range2 0～1000ppm |

Select the “Range Control” setting by the △ key or the ▽ key. Press the ENT key to move the cursor to “Range Control” setting.

△ ( ▽ ) ENT

| Display/AOSetting | | | 2006-04-01 12:00:00 |
|---|---|---|---|
| Gas | Inst. Avg. | Wet Dry | Range Control |
| HCℓ | Avg. | Dry | Remote Range1 0～50.0 ppm Range2 0～1000ppm |
| cv HCℓ | Inst. | Dry | Range1 0～50.0 ppm Range2 0～1000ppm |

Press the ENT key to move the cursor to the set component.

△ ( ▽ ) ENT

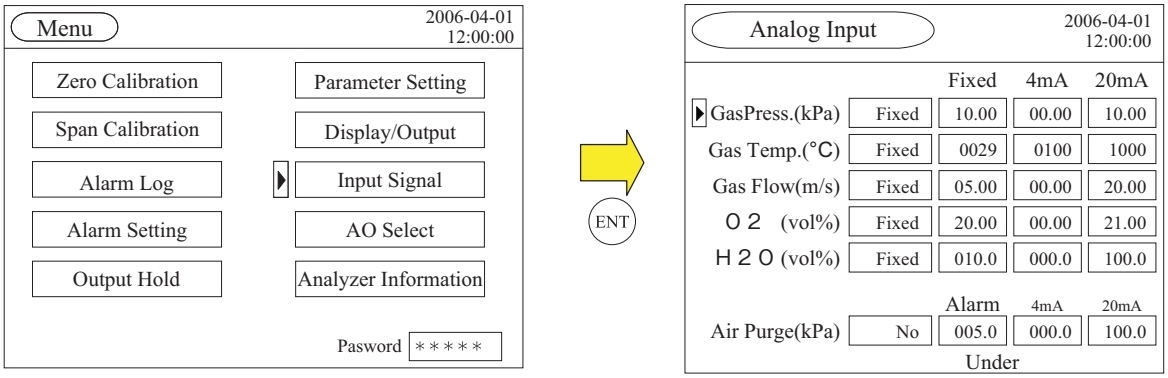
| Display/AOSetting | | | 2006-04-01<br>12:00:00 |
|---|---|---|---|
| Gas | Inst.<br>Avg. | Wet<br>Dry | Range Control |
| HCℓ | Avg. | Dry | Remote<br>Range1 0～50.0 ppm<br>Range2 0～1000ppm |
| cv<br>HCℓ | Inst. | Dry | Range1 0～50.0 ppm<br>Range2 0～1000ppm |

The (ESC) key can move the cursor backward in the middle of the setting. The setting fixed by the (ENT) key does not return to the previous setting, even if the cursor is moved by the (ESC) key.

# 6.7 Analog input

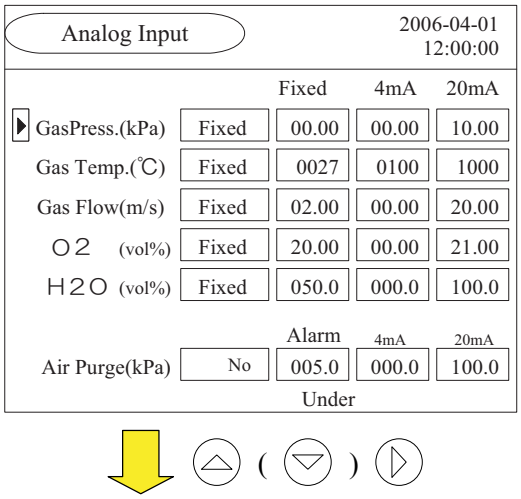
Makes a setting of the analog input related to the measured gas conditions such as gas temperature. Input the sensor signal to the analog input terminal of the control unit, and the measured gas conditions can be calibrated. The sensors to be connected to the analog input terminal are “Thermometer”, “Pressure gauge”, “Flow meter”, “Oxygen analyzer ($O_2$)” or “Moisture meter ($H_2O$)” with 4 to 20mA DC output. For connecting the sensor, refer to “3.2 Input/output terminal of control unit”.
If the calibration is not performed, the measurement value may not be output correctly.
When the measured gas conditions varies little, calibration can be performed with the fixed value at the fixed value setting.
2 channels are selected for the analog input terminal. The channel can be increased up to 6 by mounting the additional board. Set the measured gas conditions with no sensor input to the fixed value setting, and enter the fixed value.

Select “Input Signal” from the “Menu” screen, and press the ENT key.




## 6.7.1 Setting of 4 to 20mA DC Input (in case of gas temperature)

The sensor signal of the thermometer (4 to 20mA output) is connected to Ch1 or Ch2 of the AI terminal of the control unit. (If an AI expansion board is provided, connect it to either of Ch1 to Ch6.)
When channel setting (4 to 20 mA DC input setting) is performed without sensor input signal to the AI terminal, “Analog input signal error” alarm is output.




Select the “Gas Temp.” by the △ key or the ▽ key. Press the ▷ key to move the cursor to “Channel” setting.

| Analog Input | | | | 2006-04-01 12:00:00 |
|---|---|---|---|---|
| | | Fixed | 4mA | 20mA |
| GasPress.(kPa) | Fixed | 00.00 | 00.00 | 10.00 |
| Gas Temp.(℃) | Fixed | 0027 | 0100 | 1000 |
| Gas Flow(m/s) | Fixed | 02.00 | 00.00 | 20.00 |
| O2 (vol%) | Fixed | 20.00 | 00.00 | 21.00 |
| H2O (vol%) | Fixed | 050.0 | 000.0 | 100.0 |
| | | Alarm | 4mA | 20mA |
| Air Purge(kPa) | No | 005.0 | 000.0 | 100.0 |
| | | Under | | |

Select the channel (CH1 or CH2) connected to AI terminal by the △ key or the ▽ key, and press the ENT key.

| Analog Input | | | | 2006-04-01 12:00:00 |
|---|---|---|---|---|
| | | Fixed | 4mA | 20mA |
| GasPress.(kPa) | Fixed | 00.00 | 00.00 | 10.00 |
| Gas Temp.(℃) | CH1 | 0027 | 0000 | 1000 |
| Gas Flow(m/s) | Fixed | 02.00 | 00.00 | 20.00 |
| O2 (vol%) | Fixed | 20.00 | 00.00 | 21.00 |
| H2O (vol%) | Fixed | 050.0 | 000.0 | 100.0 |
| | | Alarm | 4mA | 20mA |
| Air Purge(kPa) | No | 005.0 | 000.0 | 100.0 |
| | | Under | | |

Enter the temperature (°C) corresponding to 4mA DC output of the output signal of the thermometer. Change the numeric value by the △ key or the ▽ key, and move the digits by the ▷ key. Press the ENT key to validate the set input value.

| Analog Input | | | | 2006-04-01 12:00:00 |
|---|---|---|---|---|
| | | Fixed | 4mA | 20mA |
| ▶ GasPress.(kPa) | Fixed | 00.00 | 00.00 | 10.00 |
| Gas Temp.(℃) | CH1 | 0027 | 0000 | 1000 |
| Gas Flow(m/s) | Fixed | 02.00 | 00.00 | 20.00 |
| O2 (vol%) | Fixed | 20.00 | 00.00 | 21.00 |
| H2O (vol%) | Fixed | 050.0 | 000.0 | 100.0 |
| | | Alarm | 4mA | 20mA |
| Air Purge(kPa) | No | 005.0 | 000.0 | 100.0 |
| | | Under | | |

Enter the temperature (°C) corresponding to 20mA DC output of the output signal of the thermometer. Change the numeric value by the △ key or the ▽ key, and move the digits by the ▷ key. Press the ENT key to validate the set input value.

| Analog Input | | | | 2006-04-01 12:00:00 |
|---|---|---|---|---|
| | | Fixed | 4mA | 20mA |
| GasPress.(kPa) | Fixed | 00.00 | 00.00 | 10.00 |
| ▶ Gas Temp.(℃) | CH1 | 0027 | 0000 | 0500 |
| Gas Flow(m/s) | Fixed | 02.00 | 00.00 | 20.00 |
| O2 (vol%) | Fixed | 20.00 | 00.00 | 21.00 |
| H2O (vol%) | Fixed | 050.0 | 000.0 | 100.0 |
| | | Alarm | 4mA | 20mA |
| Air Purge(kPa) | No | 005.0 | 000.0 | 100.0 |
| | | Under | | |

Implement the same procedure as for the sensor setting of pressure gauge, flow meter, oxygen analyzer ($O_2$) or the moisture meter ($H_2O$).

$O_2$ conversion

Calculate $O_2$ conversion from the set value of input signal for the oxygen ($O_2$) analyzer.
The calculation formula is as follow.

$$\text{Conversion } C = (21 - On) / (21 - Os) \times Cs$$

C : Converted concentration
Os : Measured $O_2$ concentration
On : Standard $O_2$ concentration for conversion (If not specified at order: 12%)

## 6.7.2 Setting of analog input (fixed value) (in case of $H_2O$)

Sets the fixed value to perform the calibration when the measured gas condition do not change, or the sensor inputs to calibrate are not provided, or the number of calibration input terminals is insufficient. When the actual value differs greatly from the setting value, analog input may not be measured correctly.

Analog Input 2006-04-01 12:00:00

| | | Fixed | 4mA | 20mA |
|---|---|---|---|---|
| GasPress.(kPa) | Fixed | 00.00 | 00.00 | 10.00 |
| Gas Temp.(℃) | CH1 | 0027 | 0000 | 0500 |
| Gas Flow(m/s) | Fixed | 02.00 | 00.00 | 20.00 |
| O2 (vol%) | Fixed | 20.00 | 00.00 | 21.00 |
| ▶ H2O (vol%) | CH2 | 050.0 | 000.0 | 100.0 |
| | | Alarm | 4mA | 20mA |
| Air Purge(kPa) | No | 005.0 | 000.0 | 100.0 |
| | | Under | | |

Select "$H_2O$" by the △ key or the ▽ key. Press the ▷ key to move the cursor to "Channel" setting.

Analog Input 2006-04-01 12:00:00

| | | Fixed | 4mA | 20mA |
|---|---|---|---|---|
| GasPress.(kPa) | Fixed | 00.00 | 00.00 | 10.00 |
| Gas Temp.(℃) | CH1 | 0027 | 0000 | 0500 |
| Gas Flow(m/s) | Fixed | 02.00 | 00.00 | 20.00 |
| O2 (vol%) | Fixed | 20.00 | 00.00 | 21.00 |
| H2O (vol%) | CH2 | 050.0 | 000.0 | 100.0 |
| | | Alarm | 4mA | 20mA |
| Air Purge(kPa) | No | 005.0 | 000.0 | 100.0 |
| | | Under | | |

Select "Fixed" by the △ key or the ▽ key, and press the ENT key.

Analog Input 2006-04-01 12:00:00

| | | Fixed | 4mA | 20mA |
|---|---|---|---|---|
| GasPress.(kPa) | Fixed | 00.00 | 00.00 | 10.00 |
| Gas Temp.(℃) | CH1 | 0027 | 0000 | 1000 |
| Gas Flow(m/s) | Fixed | 02.00 | 00.00 | 20.00 |
| O2 (vol%) | Fixed | 20.00 | 00.00 | 21.00 |
| H2O (vol%) | Fixed | 050.0 | 000.0 | 100.0 |
| | | Alarm | 4mA | 20mA |
| Air Purge(kPa) | No | 005.0 | 000.0 | 100.0 |
| | | Under | | |

Enter the fixed value.
Change the numeric value by the △ key or the ▽ key, and move the digits by the ▷ key. Press the ENT key to validate the set input value.

| Analog Input | | | | 2006-04-01 12:00:00 |
|---|---|---|---|---|
| | | Fixed | 4mA | 20mA |
| GasPress.(kPa) | Fixed | 00.00 | 00.00 | 10.00 |
| Gas Temp.(℃) | CH1 | 0027 | 0000 | 0500 |
| Gas Flow(m/s) | Fixed | 02.00 | 00.00 | 20.00 |
| O2 (vol%) | Fixed | 20.00 | 00.00 | 21.00 |
| ▶ H2O (vol%) | Fixed | 020.0 | 000.0 | 100.0 |
| | | Alarm | 4mA | 20mA |
| Air Purge(kPa) | No | 005.0 | 000.0 | 100.0 |
| | | Under | | |

The same procedure can be implemented as for pressure gauge, thermometer or oxygen analyzer ($O_2$).

## 6.7.3 Setting of air purge pressure

When the air purge pipe is connected to the pressure sensor, connect its signal (4 to 20mA DC output) to the analog input of the control unit. Alarm can be issued when the pressure value lower than the set pressure is detected. Be sure to connect the pressure gauge if the air purge pressure is unstable. If it is not measured in an environment where high temperature gas can be measured, the analyzer may be damaged.
When the sensor is not provided, select “No” for channel setting. When the channel setting (4 to 20mA DC input setting) is performed in an environment without sensor input signal, “Analog input signal error” alarm is output.

| Analog Input | | | | 2006-04-01 12:00:00 |
|---|---|---|---|---|
| | | Fixed | 4mA | 20mA |
| GasPress.(kPa) | Fixed | 00.00 | 00.00 | 10.00 |
| Gas Temp.(℃) | CH1 | 0027 | 0000 | 0500 |
| Gas Flow(m/s) | Fixed | 02.00 | 00.00 | 20.00 |
| O2 (vol%) | Fixed | 20.00 | 00.00 | 21.00 |
| H2O (vol%) | Fixed | 020.0 | 000.0 | 100.0 |
| | | Alarm | 4mA | 20mA |
| ▶ Air Purge(kPa) | No | 005.0 | 000.0 | 100.0 |
| | | Under | | |

Select “Air Purge” by the △ key or the ▽ key. Press the ▷ key to move the cursor to “Channel” setting.

| Analog Input | | | | 2006-04-01 12:00:00 |
|---|---|---|---|---|
| | | Fixed | 4mA | 20mA |
| GasPress.(kPa) | Fixed | 00.00 | 00.00 | 10.00 |
| Gas Temp.(℃) | CH1 | 0027 | 0000 | 0500 |
| Gas Flow(m/s) | Fixed | 02.00 | 00.00 | 20.00 |
| O2 (vol%) | Fixed | 20.00 | 00.00 | 21.00 |
| H2O (vol%) | Fixed | 020.0 | 000.0 | 100.0 |
| | | Alarm | 4mA | 20mA |
| Air Purge(kPa) | CH2 | 005.0 | 000.0 | 100.0 |
| | | Under | | |

Select the channel (CH1 or CH2) connected to AI terminal by the △ key or the ▽ key, and press the ENT key.

| Analog Input | | | | 2006-04-01 12:00:00 |
|---|---|---|---|---|
| | | Fixed | 4mA | 20mA |
| GasPress.(kPa) | Fixed | 00.00 | 00.00 | 10.00 |
| Gas Temp.(℃) | CH1 | 0027 | 0000 | 0500 |
| Gas Flow(m/s) | Fixed | 02.00 | 00.00 | 20.00 |
| O2 (vol%) | Fixed | 20.00 | 00.00 | 21.00 |
| H2O (vol%) | Fixed | 020.0 | 000.0 | 100.0 |
| | | Alarm | 4mA | 20mA |
| Air Purge(kPa) | CH2 | 005.0 | 000.0 | 100.0 |
| | | Under | | |

Enter the purge pressure value to output alarm. Change the numeric value by the △ key or the ▽ key, and move the digits by the ▷ key. Press the ENT key to validate the set input value.

△ ( ▽ ) ▷ ENT

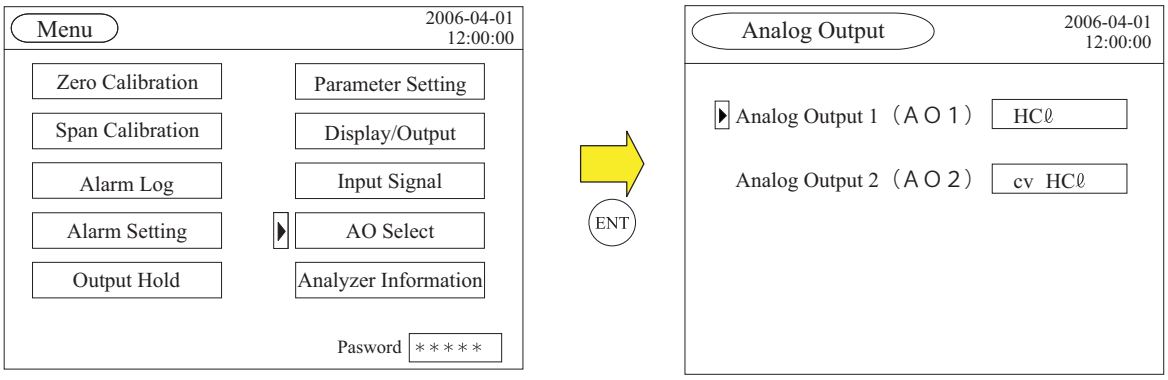
| Analog Input | | | | 2006-04-01 12:00:00 |
|---|---|---|---|---|
| | | Fixed | 4mA | 20mA |
| GasPress.(kPa) | Fixed | 00.00 | 00.00 | 10.00 |
| Gas Temp.(℃) | CH1 | 0027 | 0000 | 0500 |
| Gas Flow(m/s) | Fixed | 02.00 | 00.00 | 20.00 |
| O2 (vol%) | Fixed | 20.00 | 00.00 | 21.00 |
| H2O (vol%) | Fixed | 020.0 | 000.0 | 100.0 |
| | | Alarm | 4mA | 20mA |
| Air Purge(kPa) | CH2 | 005.0 | 000.0 | 100.0 |
| | | Under | | |

Enter the pressure value corresponding to 4, 20mA DC output in the same manner.

# 6.8 Selecting analog output

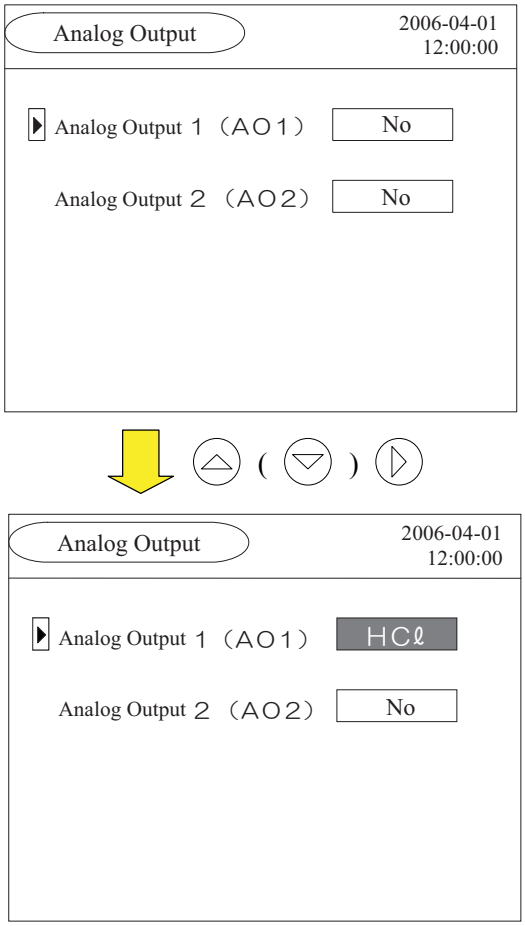
There are two types of analog output (4 to 20mA DC output) as a standard specification. Measurement value and $O_2$ conversion value can be output individually. Both of average value and instantaneous value can be output arbitrary.
Default value is set to “No”, so be sure to set it after installation.

Select “AO Select” from the “Menu” screen, and press the (ENT) key.




## 6.8.1 Setting of analog output

When the measurable component is 1, “Component” or “No” can be selected. When there is $O_2$ conversion output, “$O_2$ Conversion” is also selectable.

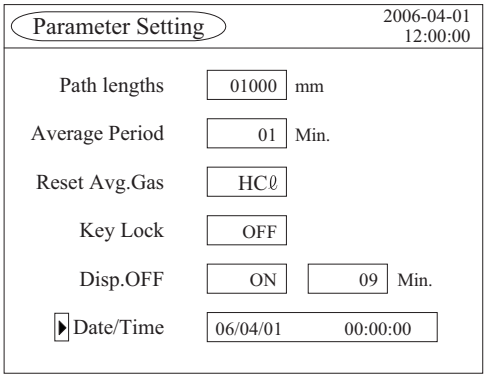



Select the analog terminal to be output by the (△) or the (▽) key. Press the (▷) key to move the cursor to “Output Component” setting.

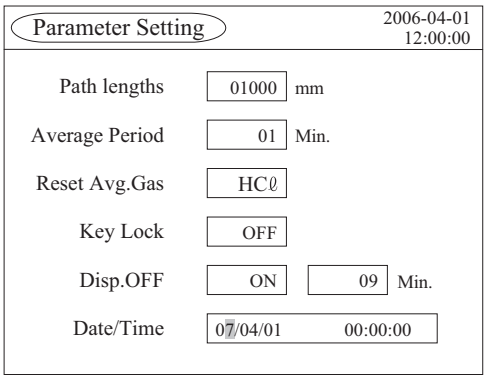
Select the component to be output by the (△) or the (▽) key. Press the (ENT) key to validate the set input value.

## 6.8.2 Time setting

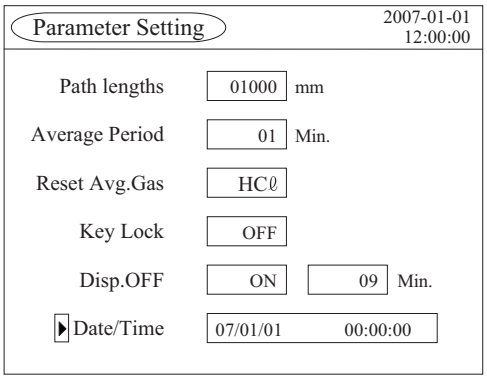
Date and time setting can be made.




Point the cursor to "Date/Time" by the △ key or the ▽ key, and press the ▷ key.

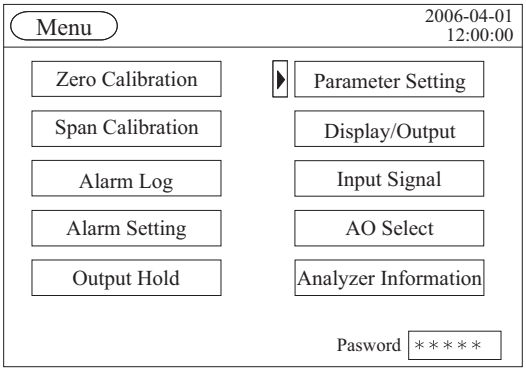



Change the numeric value by the △ key or the ▽ key, and move the digits by the ▷ key. Press the ENT key to validate the set time.



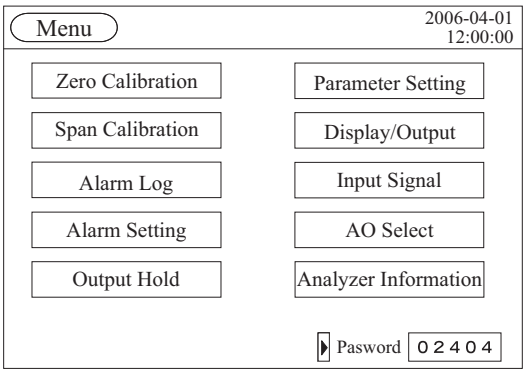
# 6.9 Fine adjustment of analog output value

This section explains the fine adjustment method of analog output. Since a slight discrepancy of analog output value may be caused, perform adjustment according to the following method.

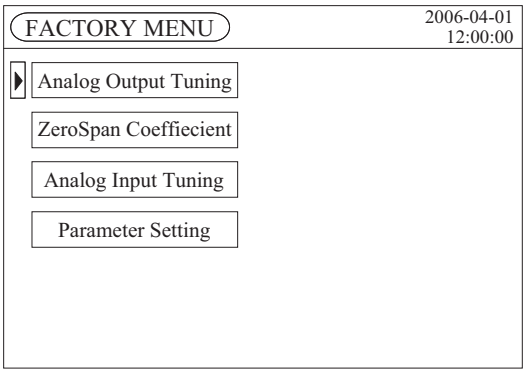



Point the cursor to "Password" in the bottom left of the “Menu” screen by the ⊿ key or the ▽ key.

Press the ENT key to change the display to “00000”.




Enter “02404” to the Password. Select the digits by the ▷ key, and press the ⊿ key or the ▽ key to move the cursor to “Password”.




Press the ENT key to display the “Factory Menu” screen.
Point the cursor to “Analog Output Tuning” by the ⊿ key or the ▽ key, and press the ENT key.

FACTORY MENU 2006-04-01 12:00:00

| Output | Zero | Span |
|---|---|---|
| Analog Output 1 | 0742 | 3484 |
| Analog Output 2 | 0686 | 3429 |
| Analog Output 3 | 0677 | 3431 |
| Analog Output 4 | 0655 | 3396 |
| Analog Output 5 | 0000 | 4096 |
| Output Fine Tuning | Zero Output | |

This device has the simulation output function. Point the cursor to “Output Fine Tuning” at the bottom ENT key. Select an item from “Meas Output”, “Zero Output”, “Half Output”, or “Span Output” by the ▽ key or the △ key, and press the ENT key.

First, select “Zero Output”.

Analog Output 2006-04-01 12:00:00

| Output | Zero | Span |
|---|---|---|
| Analog Output 1 | 0742 | 3484 |
| Analog Output 2 | 0686 | 3429 |
| Analog Output 3 | 0677 | 3431 |
| Analog Output 4 | 0655 | 3396 |
| Analog Output 5 | 0000 | 4096 |
| Output Fine Tuning | Zero Output | |

Selected analog output adjustment is performed on all outputs.

Point the cursor to the analog output to be adjusted while "Zero output" is selected for Analog fine adjustment, and press the ENT key.

Analog Output 2006-04-01 12:00:00

| Output | Zero | Span |
|---|---|---|
| Analog Output 1 | 0742 | 3484 |
| Analog Output 2 | 0686 | 3429 |
| Analog Output 3 | 0677 | 3431 |
| Analog Output 4 | 0655 | 3396 |
| Analog Output 5 | 0000 | 4096 |
| Output Fine Tuning | Zero Output | |

The cursor then moves to 4-digit numeric value in the “Zero” column, press the ▽ key or the △ key to adjust the output.

For the “Span” column, change the item of Analog fine adjustment to “Span output”, and make adjustment in the same way as “Span”.

# 6.10 Checking alarm output

## 6.10.1 Low Light Transmission (1 a contact output)

Remove the receiver box or the transmitter box to generate “Low light Transmission” alarm.
At this time, do not look into the transmitter box. Otherwise, it may cause serious damage to your retinae or cornea. It takes about a minute until “Low Light Transmission” alarm is generated.
If this is done just after the power off, it takes about 6 minutes.
After you confirm the alarm output, attach the receiver box or the transmitter box to the angle adjustment unit where they were.

## 6.10.2 Analyzer faulty (1 a contact output)

Turn off the power, and remove the connector of the cable between the receiver unit and the control unit. If the power is turned on in the state above, “Connection Error” alarm is generated, and “Analyzer faulty” alarm is then generated.
After you confirm the alarm output, turn off the power, connect the cable, and turn on the power.

## 6.10.3 On Hold / Under Calibration (1 a contact output)

Hold the output in reference to “6.4 Output hold”. Check the operation output on hold/under calibration. After checking it, release hold.

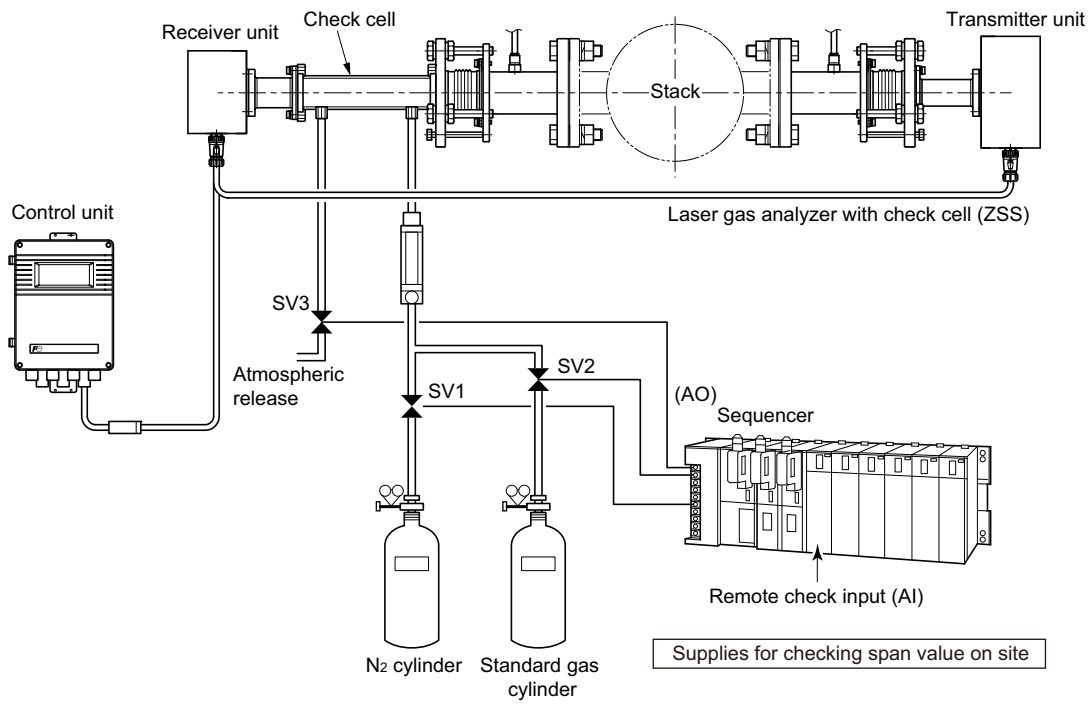
## 6.10.4 Beyond the upper/lower limits (1 a contact output)

Set the alarm so that the current measured value is beyond the upper or lower limit to generate the alarm, in reference to “6.3 Alarm setting”.
After checking the operation, set the alarm to OFF or change the setting to the appropriate one.

## 6.10.5 Power OFF (Closed contact output during power OFF)

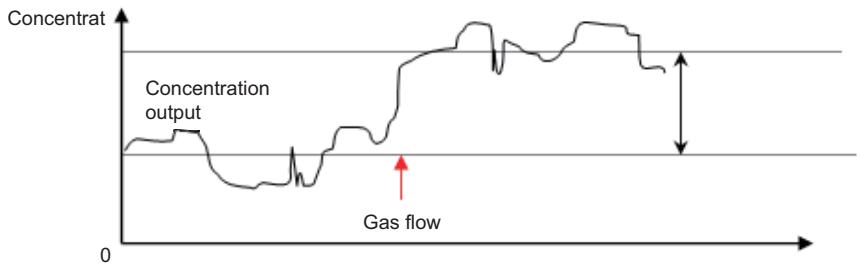
Turn OFF the power, and then check the operation output of Power OFF.

# 6.11 How to use the check cell

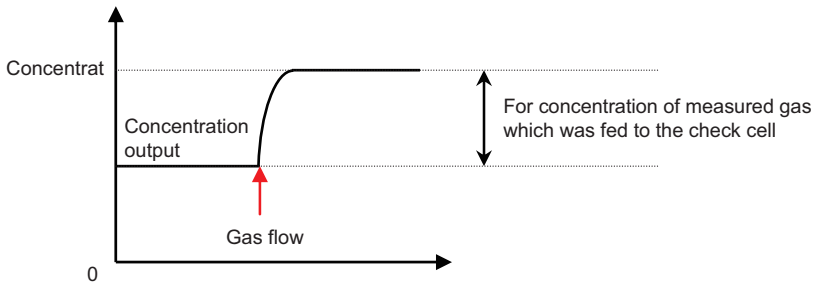



## 6.11.1 Example of use of check cell

The check cell is intended to be used to check a discrepancy of the span point without removing the device from the stack. However, if the gas inside the stack is not stabilized, check can not be conducted.

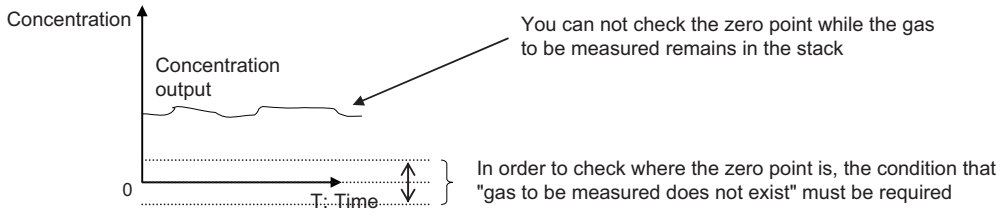



If gas concentration to be measured in the stack is not stabilized, it is difficult to measure the span point.




Gas concentration to be measured should be stabilized.

You can not check the zero point except when the gas inside the stack measured does not remain.




## 6.11.2 Concentration of the gas which is fed to the check cell and gas concentration fluctuation

Based on the Lambert-Beer Law, absorption intensity is proportional to gas concentration and the lengths where the gas exists (measured optical path lengths or stack length).

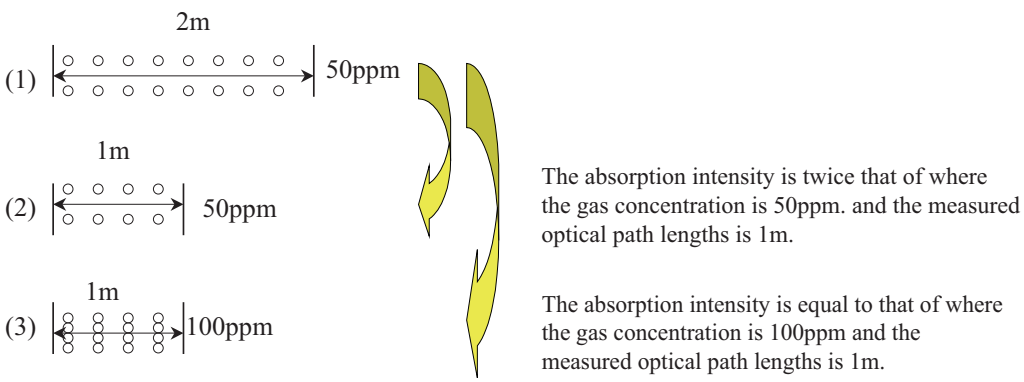
Gas absorption laws
Based on Lambert-Beer Law

$$I(L)=I(0)\exp[-ks \cdot ns \cdot Ls]$$

- I(L) : Received light quantity
- I(0) : Transmitted light quantity
- ks : Coefficient
- ns : Concentration value
- Ls : Optical path lengths (Stack lengths)

Absorption intensity is proportional to gas concentrationmeasured and the lengths where the gas exists (measured optical path lengths or stack length)

Example: Where the gas concentration is 50ppm and the measured optical path length (stack length) is 2m




Since the check cell length is 0.25m, the gas concentration to be fed is calculated from the following equation.
Required gas cylinder concentration
= (Measuring range - Measured gas concentration inside the stack (should be stabilized)) × 4
(Ex. Where the measuring range is 0 to 50 ppm, and the gas concentration inside the stack is 10ppm)
Required gas cylinder concentration = (50 - 10) × 4
= 160ppm

Feeding the gas of 160ppm to the check cell is similar to feeding the gas at the span point.
Discrepancy of the span point can be checked by studying difference between the concentration output at this time and 50ppm.

## 6.11.3 Operation method

(1) Remove the stopper at gas inlet and outlet of the check cell, and then connect with $N_2$ gas cylinder.

(2) Feed $N_2$ gas to the check cell to obtain the measured gas concentration inside the stack.

(3) Feed the gas, which was obtained by “6.11.2 Concentration of the gas which is fed to the check cell and gas concentration fluctuation”, to the check cell.

(4) After the indication value is stabled, obtain the measured value to check the discrepancy of the span point.

(5) Feed $N_2$ gas to the check cell so that the environment where $N_2$ gas exists inside the check cell is created.

(6) Attach the stopper so that the measured gas component does not come into the check cell.

# 7. MAINTENANCE

## 7.1 Maintenance list

To maintain the desired accuracy, we recommend you to perform periodical maintenance and inspection, referring to Table 7－1.

Table 7－1

| Items | Maintenance cycle | |
|---|---|---|
| | 6 months | 1 year |
| Light axis adjustment | ○ | |
| Replacement of packing | | ○ |
| Zero calibration | ○ | |
| Span calibration | ○ | |

## 7.2 Maintenance procedure

To operate the instrument properly and keep it in favorable operation status, it is essential to perform maintenance and inspection periodically.
Note that the Table 7－2 provides the guideline for maintenance items and intervals, assuming standard gas, operation, and installation environment. Only qualified personnel who have been trained by Fuji Electric should perform maintenance works.
Do not extend the cycle of replacement parts.
Note that any troubles resulting from failure to replace parts or perform maintenance periodically are not included in warranty.

Table 7－2

| Locations | Maintenance items | Maintenance cycle | | Contents |
|---|---|---|---|---|
| | | 6 months | 1 year | |
| Control unit | Check that contents of error or error alarm are not displayed. | ○ | | |
| ↓ | | | | |
| Receiver/ transmitter unit | Check that the mounting flange is securely fixed to the stack and there is no vibration. | ○ | | |
| ↓ | | | | |
| Receiver/ transmitter unit | Zero calibration | ○ | | P.43 |
| ↓ | | | | |
| Receiver/ transmitter unit | Span calibration | | ○ | P.48 |
| ↓ | | | | |
| Receiver/ transmitter unit | Replacement of O-ring and packing | | ○ | P.94 |
| ↓ | | | | |
| Receiver/ transmitter unit | Light axis adjustment | ○ | | |
| ↓ | | | | |
| Receiver/ transmitter unit | Check for air purge flow rate | ○ | | |

## 7.3 Zero calibration

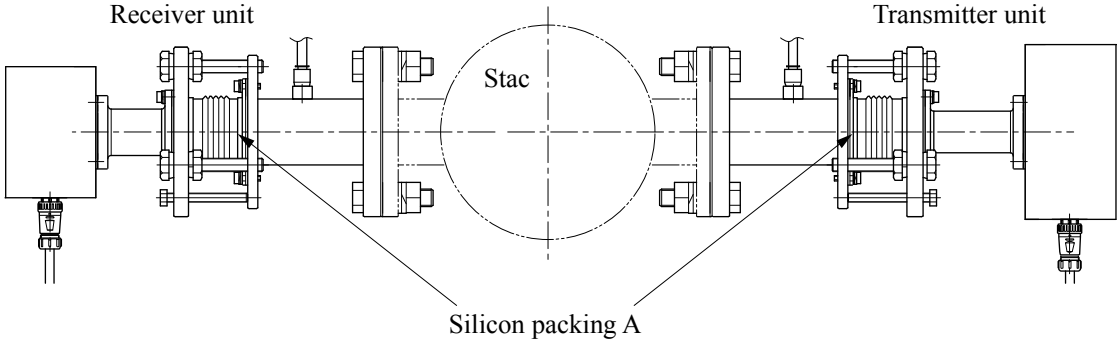
Refer to “6.1 Zero calibration”.

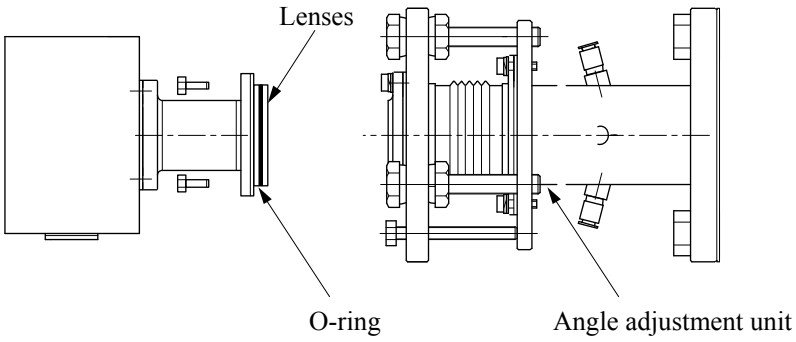
## 7.4 Span calibration

Refer to “6.2 Span calibration”.

## 7.5 Replacement of O-ring and packing

Replace the packing, referring to the following figure.
Replace the O-ring and silicon packing A annually.




Note) When replacing packing, be careful not to touch the lenses of the transmitter box and the receiver box.
Note) Use a dry cloth (microfiber cloth is recommended) to clean the lenses. Do not use organic solvents such as alcohol or thinner.

# 8. TROUBLESHOOTING

**(1) "Low Light Transmission" alarm is occurred.**

→ 1) When the light axis is adjusted, do the gas temperature and the temperature differ from each other too much?

→ Yes (The stack might have been deformed by the temperature, resulting in deflection of light axis. Re-adjust the light axis.)

→ 2) Has the device attached to the flange been used for a long period or set long before?

→ Yes (The companion flange might be rusty and might have been distorted by the weight of the device. Take such counter-measures as supporting the companion flange.)

→ 3) Is the device installed in dusty environment?

→ Yes (Install it in an environment where dust quantity is 5 to 40g/Nm$^3$. (according to installation environment conditions) such as measurable components, device specification, optical light path, particle diameter, and so on)

→ 4) Is there condensation on the lens because of high moisture?

→ Yes (Increase the quantity of air purge so as not to form condensation on the lens.)

→ 5) Is the air purge rate insufficient and are the lenses dirty? Or is the measuring light path blocked by dust?

→ Yes (Increase the air purge rate so as not to get the lenses dirty.)

→ 6) Are the lenses on the receiver and transmitter units broken?

→ Yes (If the lens was damaged by a physical impact, contact the manufacturer. If it was broken by such influences as temperature, check if the device is used in the environment allowed by the specifications and use it in a proper environment. )

→ 7) Is the device installed in a place where frequency fluctuates widely between 20 and 40Hz?

→ Yes (Contact the manufacturer. Counter-measures should be taken such as altering the resonance frequency by changing the device length.)

→ 8) Other

→Yes (Contact the manufacturer.)

**(2) "LD Failure" alarm is occurred.**

→ 1) Is laser emitted?

→ No (In the case of ammonia meter, use an IR card and the like to check if light is emitted. If it has been used for more than 10 years, its life span might have expired. Contact the manufacturer.)

**(3) "LD Temperature Error" alarm is occurred.**

→ 1) Is the device installed and used in a place, which does not meet the specifications?

→ Yes (Use the device in the environment, which meets the specifications.)

→ 2) Is the device used in environment where temperature is out of the specified range?

→ Yes (The specified temperature for this device is 450°C or less. Take counter-measures such as changing a place to install it.)

→ 3) Other

→ Yes (The device might be out of order. Contact the manufacturer.)

**(4) "Connection Error" alarm is occurred.**

→ 1) Is any wire forcibly bent, causing a contact failure in the connector unit?

→ Yes (Review the wiring.)

→ 2) Is any wiring cut off?

→ Yes (Contact the manufacturer.)

→ 3) Others

→ Yes (The device (DPU board, PD digital substrate) might be out of order.)

**(5) "High Gas Temperature" alarm is occurred.**

→ 1) Is the device used in environment, where the gas temperature is out of the specified range?

→ Yes (The specified gas temperature for this device is 450°C or less. Take counter-measures such as changing a place to install it.)

→ 2) Is the analog input setting range of temperature in the "Analog Input" screen correct?

→ No (Input the setting range of analog input correctly.)

**(6) "Gas Pressure (H-Limit)" alarm is occurred.**

→ 1) Is the device used in a place where the gas pressure is out of the specified range?

→ Yes (The specified gas pressure for this device is ±10kPa. Take counter-measures such as changing a place to install it.)

→ 2) Is the analog input setting range of temperature in the "Analog Input" screen correct?

→ No (Input the setting range of analog input correctly.)

**(7) "AI Under" alarm is occurred.**

→ 1) Is an external input device is connected to the AI terminal while the channel setting is selected in the "Analog Input" screen?

→ Yes (Change the setting to the fixed value or input analog input signal.

→ 2) Do the AI terminal and the setting channel match each other?

→ No (Check the analog input terminal number and the set channel.)

→ 3) Is the input DC4/20Ma?

→ No (Is the analog input set at the voltage input?)

**(8) "Box Temperature Warning" alarm is occurred.**

→ 1) Is the device installed and used in a place, which meets the specifications?

→ No (Use the device in environment, which meets the specifications.)

→ 2) Is the device used in environment where gas temperature meets the specified range?

→ No (The specified gas temperature for this device is 450°C or less. Take counter-measures such as changing a place to install it.)

→ 3) Is the air purge flow rate sufficient?

→ No (Increase the air purge flow.)

→ 4) Others

→ Yes (Counter-measures should be taken such as extending the distance from the stack to the device. Contact the manufacturer.)

**(9) "Air Purge (Low Pressure)" alarm is occurred.**

→ 1) Is the AI terminal connected to an external input device while the purge pressure is set to the channel setting in the "Analog Input" screen?

→ No (Setting should be a fixed value, or input an analog input signal.)

→ 2) Is air purge pressure as high as the alarm setting, or is it purged?

→ No (Increase the air purge pressure, and perform air purge.)

**(10) Not operating even with the power turned on**

→ 1) Is the input voltage lower than the voltage rating?

→ Yes (Supply the specified input voltage.)

→ 2) Do the connectors contact properly? Are the wires connected securely?

→ No (Check the wiring and connector units, and connect them properly.)

→ 3) Others

→ Yes (The device might be out of order. Contact the manufacturer.)

**(11) Different from the manual analysis value**

→ 1) Is the length of stack input correctly?

→ No (The length of stack = the length of measuring light path influences the measured concentration much. Input a correct value.)

→ 2) Is the gas temperature different from the input value (analog input, fixed value) ?

→ Yes (Input the correct temperature of the measuring gas into the device.)

→ 3) Is the gas pressure different from the input value (analog input, fixed value)?

→ Yes (Input the correct pressure of the measuring gas.)

→ 4) Is the receiving light quantity extremely small?

→ Yes (Adjust the light axis.)

→ 5) Does a component like low-molecular-weight hydrogen or high-molecular-weight carbon dioxide exist in the ammonia meter as a gas containing a high proportion of other components?

→Yes (Influence of pressure broadening needs to be corrected. Contact the agency where you purchased the product or our sales representative.)

→ 6) Does a gas in the hydrogen chloride meter contain high moisture content?

→Yes (Moisture compensation is required. Contact the agency where you purchase the product or our sales representative.)

→ 7) Do you compare ZSS with an other equipment employing the other principle?

→Yes (ZSS is the analyzer to measure gas concentration of component being measured. Therefore, it does not react on complex molecules with other molecules or molecules which are dissolved in mist. Thus, you should take care if you compare with data obtained by other measuring method like the ion electrode method.)

→ 8) Different measurement point may be the cause.

→Yes (Manual analysis or sampling type analyzer analyzes concentration in the center of stack where the gas is sampled, while ZSS analyzes average concentration from edge to edge of the stack. Thus, non-uniformity of concentration distribution in the stack makes difference in concentration.)

→ 9) Difference of measurement principle (sample being measured) may be the cause.

→Yes (Measuring object of manual analysis or ion electrode method may be entire ionizable substance like a chloride ion, while the measuring object of ZSS is specific to substances like hydrogen chloride. Thus, if components other than those which are measuring objects of ZSS are contained, difference is made in concentration.)

**(12) The measured value is over the range.**

→ 1) Is the measuring gas is a concentration value, which is over the range?

→ Yes (Check it, conducting manual analysis and the like.)

→ 2) Is the length is longer than the specifications?

→ Yes (When the measuring light path length is longer, compared with the specifications, the measuring concentration becomes higher.)

→ 3) Others

→ Yes (Contact the manufacturer.)

**(13) Even if the cylinder gas is supplied for the span calibration, the indication value does not increase.**

→ 1) Are you using the new cylinder or the one not used for long time?

→Yes (If not used for long time, hydrogen chloride gas does not flow from the cylinder. Flow the a generous amount of gas for a while.)

→ 2) Is the inside of the regulator in rust?

→Yes (Rust inside the regulator absorbs hydrogen chloride gas, and the gas does not flow. Replace it with the new one.)

# APPENDIX 1 SPECIFICATIONS FOR THE CROSS-STACK LASER GAS ANALYZER

**1-1 Specifications**

(1) Measurement principle : Non-dispersive infrared absorbance system (NDIR)
(2) Measuring method : Cross-stack system (path system)
(3) Object of setup : Incineration facilities, denitration equipment, etc.
(4) Measurable component and range:

| Measurable Component | Component | | Min.measuring range Note 1) | Max.measuring range Note 1) | Measured gas temperature | Purge gas |
|---|---|---|---|---|---|---|
| 1-component analyzer | HCl | | 10 ppm | 5000 ppm | 400°C or less | Air |
| | $NH_3$ | | 15 ppm | 5000 ppm | 450°C or less | |
| | CO | | 2.0 vol% | 50 vol% | 300°C or less | |
| | CO (High temperature) | | 10 vol% | 50 vol% | 1200°C or less | |
| | $CO_2$ | | 2.0 vol% | 50 vol% | 300°C or less | |
| | $CO_2$ (High temperature) | | 10 vol% | 50 vol% | 1200°C or less | |
| | $CH_4$ | | 100 ppm | 50 vol% | 300°C or less | |
| | $O_2$ | | 4 vol% | 100 vol% | 300°C or less | $N_2$ |
| | $O_2$ (High temperature) | | 4 vol% | 50 vol% | 1200°C or less | |
| | $O_2$ (Air purge) | | 25 vol% | 100 vol% | 400 to 1200°C | Air |
| 2-component analyzer | $HCl+H_2O$ (50 vol%) Note 2) | | 50 ppm (HCℓ) | 1000 ppm (HCℓ) | 130 to 400°C | Air |
| | $NH_3+H_2O$ (50 vol%) Note 2) | | 50 ppm ($NH_3$) | 1000 ppm ($NH_3$) | 130 to 450°C | |
| | $CO+CO_2$ | | 2.5 vol% | 50 vol% | 300°C or less | |
| | $CO+CO_2$ (High temperature) | | 10 vol% | 50 vol% | 1200°C or less | |
| 2-laser 2-component analyzer | $CO+O_2$ (Air purge) | CO | 200 ppm | 2 vol% | 400 to 1200°C | Air |
| | | $O_2$ | 25 vol% | 100 vol% | | |
| | $CO+O_2$ (High temperature) | CO | 200 ppm | 2 vol% | 1200°C or less | $N_2$ |
| | | $O_2$ | 5 vol% | 50 vol% | | |
| | $CO+O_2$ | CO | 4 vol% | 50 vol% | 300°C or less | |
| | | $O_2$ | 10 vol% | 100 vol% | | |

Note 1) Min. and Max. measuring range in the above table are for measuring path length (stack length) of 1m. See below on the ranges for other path lengths.
Note 2) Consult us when selecting $H_2O$ analyzer.

- **Calculation method of measuring range for optical path length other than 1m**

Measuring range = [Min. or Max. range ÷ path length in Table 1]

| | |
|---|---|
| Ex. 1) HCl analyzer, path length 5m<br>Max. range: 5,000ppm ÷ 5m = 1,000ppm<br>Min. range: 10ppm ÷ 5m = 2ppm<br>Therefore, measuring range is between 0 to 2 ···1,000ppm | Ex. 2) HCl analyzer, path length 0.5m<br>Max. range: 5,000ppm ÷ 0.5m = 10,000ppm<br>Min. range: 10ppm ÷ 0.5m = 20ppm<br>Therefore, measuring range is between 0 to 20 ···10,000ppm |

(5) Light source : Near-infrared semiconductor laser
(6) Laser class : Class 1 (high temperature version and air purge version of O2 analyzer fall under CLASS 3B)
(7) Outline (W × D × H) mm : As specified on the Outline Diagram.
(8) Mass : Receiver/Transmitter unit: Approximately 10kg
Control unit: Approximately 8kg
(9) Structure : Outdoor use type, dustproofing/rainproofing structure (IP65)

| | | | |
|---|---|---|---|
| (10) | Material | : | Receiver/Transmitter unit: Aluminum, SUS316<br>Control unit: Aluminum |
| (11) | Materials of gas-contacting parts | : | SUS316, BK7, FKM, PTFE, glass-cloth, silicone |
| (12) | Air purge connection diameter | : | RC1/4 (tube $\phi$10 × 8) |
| (13) | Box finish color | : | Receiver/Transmitter box: gray<br>Control unit cover: blue<br>Control unit case: silver |
| (14) | Power supply | : | Rated voltage 100 to 240V AC<br>Operating voltage 90 to 264 V AC<br>Rated frequency 50/60 Hz |
| (15) | Power consumption | : | Max. rated power: Approximately 75VA or less (dual-beam version $CO+O_2$ analyzer: 80 VA or less) |
| (16) | Calibration interval | : | Once every six months (Maintenance cycle may vary depending on the operating environment.) |
| (17) | Indicator (control unit) | : | LCD with back light |
| (18) | Cable length | : | Receiver unit to Transmitter unit : Standard 2m (Maximum 25m)<br>Receiver unit to control unit : Standard 5m (Maximum 100m) |
| (19) | Analog output | : | 4 to 20mA DC or 0 to 1V DC × 2 (4) Non-isolated output number in parentheses is optional (1 to 5V DC, 0 to 5V or 0 to 10V is available.)<br>Allowable load: 4 to 20mA DC 550Ω or less, 0 to 1V DC 100kΩ or more (Output measurement value and $O_2$ correspondingvalue. Average value and instantaneous value are switchable by the settings.) |
| (20) | Analog input | : | 4 to 20mA DC ×6<br>Measured gas pressure, measured gas temperature, measured gas velocity, $O_2$ gas concentration, water concentration, air purge pressure (Measurement concentration correction, $O_2$ conversion or alarm output is performed according to the input signal.) |
| (21) | Contact output | : | Relay contact output (contact capacity 24V DC 1A 1a or 1b × 5)<br>Low light ramsmission, Beyond the upper/lower limits, Analyzer faulty, On hold / under calibration, Power OFF |
| (22) | Contact input (option) | : | Photo coupler receiver contact input (operating voltage 12 to 24V DC / 5 to 20mA) × 3<br>Average value reset signal, switching instantaneous value/moving average value and remote hold |
| (23) | Alarm output (screen-displayed) | : | LD failure, LD temperature error, high gas temperature, air purge (low pressure), out of range box temperature warning, low light transmission, PD over range, connection error, AI under, over H-limit or under L-Limit. |
| (24) | Display contents | : | Component, concentration (instantaneous value, average value $O_2$ correction instantaneous value and $O_2$ correction average value), alarm (fault status) |

### 1-2 Contact output contents

| | | | |
|---|---|---|---|
| (1) | Low light transmission (1 a contact) | : | Contact output is performed (off) when the amount of light transmission is insufcient. |
| (2) | Beyond the upper/lower limits (1 a contact) | : | According to the preset upper or lower limit alarm value, contact output is performed (off) when it becomes lower than alarm upper/lower limit. |
| (3) | Analyzer faulty (1 a contact) | : | Contact output is performed (off) when laser faulty, laser temperature error PD over range or connection error is occurred. |
| (4) | On hold/Under calibration (1 a contact) | : | While AO output is held by the hold setting or calibration is performed manually, the values, output (off) of which are held, are the ones just before the holding or arbitrary set values. Contact output is performed (off) under calibration. |
| (5) | Power OFF (1 b contact) | : | Contact output is performed (off) when power is turned off. |

### 1-3 Contact input contents (option)

| | | | |
|---|---|---|---|
| (1) | Average value reset signal | : | Output of converted average value is started from the initial state by applying rectangular-wave voltage (pulse width 2 sec or more) to the input terminal of the average value resetting. Output is reset by inputting and restarted by opening. |
| (2) | Switching instantaneous value/moving average value | : | Switching to and from the instantaneous value and the average value of the analog output is performed by applying rectangular wave voltage (pulse width 2 sec or more) to the input terminal for switching between the instantaneous value and the moving average values. |
| (3) | Remote hold | : | The analog output is held by applying rectangular wave voltage (pulse width 2 sec or more) to the remote hold input terminal, and restarted by applying it again. |

### 1-4 Standard functions

(1) $O_2$ correction : Conversion of measured HCl gas concentrations into values at standard $O_2$ concentration

Conversion formula:

$$\mathbf{C = \frac{21 - On}{21 - Os} \times Cs}$$

C: Converted concentration

Cs: Measured concentration of sample gas

Os: Measured $O_2$ concentration (Upper limit settable 1 to 20% $O_2$)

On: Standard $O_2$ concentration for conversion (value changeable by setting; 0 to 19% $O_2$)

The result of calculation is indicated and output in an analog output signal.

**1-5 Installation environment**

| | | | |
|---|---|---|---|
| (1) | Ambient temperature | : | –20 to 55°C (Receiver unit/Transmitter unit), –5 to 45°C (control unit) |
| (2) | Ambient humidity | : | 90% R.H. or less |
| (3) | Measurable optical path length (stack diameter) | : | 0.5 to 10m ($CO+O_2$: 0.5 to 5 m) |
| (4) | Standard flange | : | JIS10K 50A flange (JIS B 2212) |
| (5) | Air purge | : | Instrument air (compressor must be installed when power supply cannot be provided.) (Oil or mist should not be contained), $N_2$ for $O_2$ analyzer excluding air purge version<br>Pressure 0.5 to 0.7MPa or more 1.0 MPa or less |
| (6) | Air purge flow rate | : | 20L/min or more (depending on the measured gas and velocity) |
| (7) | Measured gas condition | : | Temperature: as specified in "1-1 (4) Measurable component and range" of APPENDIX 1.<br>Pressure: ±10kPa<br>Moisture: 50vol% or less (or should not be saturated water vapor)<br>Velocity: 25m/s or less (However, consultation is necessary for the environment where dust (1g/$Nm_3$ or more) or water (25vol% or more) exists.) (Prevention of dust deposition or dew condensation due to increase in air purge flow rate is required) |
| (8) | Dust | : | Standard: 5 g/$Nm^3$ or less<br>High-speed/dust-proof/AGC: $O_2$ analyzer: 10 g/$m^3$ or less<br>: Excluding $O_2$ analyzer: 15 g/$m^3$(N) or less |
| (9) | Vibration | : | 0.5G or less (0.2G or less when the frequency range is 20 to 40Hz) (When the optical path length is 1m.) |
| (10) | Mounting angle | : | Horizontally ±5 degree or less (No dew condensation should accumulate on the window.) |
| (11) | Light axis fluctuation range | : | Within 0.3 degree (When the path length is 0.5m) |

**1-6 Performance**

| | | | |
|---|---|---|---|
| (1) | Repeatability | : | ±1.0% FS (depending on measurable component and range)<br>*$CO+O_2$: ±2.0%FS |
| (2) | Linearity | : | ±1.0% FS (depending on measurable component and range)<br>*CO+O2: ±3.0%FS |
| (3) | Zero drift | : | ±2.0%FS / 6 months (depending on measurable component and range)<br>*CO+O2: ±4.0%FS |
| (4) | Interference from other gas components | : | ±2.0%FS |
| (5) | Minimum detectable limit | : | 1% of the minimum range |
| (6) | Response time (90% FS response) | : | 5 seconds or less |
| (7) | Warm up time | : | 90 minutes or less |

# APPENDIX 2 CODE SYMBOLS

| | 4 | 5 | 6 | 7 | 8 | | 9 | 10 | 11 | 12 | 13 | | 14 | 15 | 16 | 17 | 18 | 19 | 20 | | 21 | 22 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ZSS | | | | | 6 | - | | | | | | - | | | | 0 | | | | - | N | |

| Digit | Specification | | Note | Code |
|---|---|---|---|---|
| 4 | Measurable components | CO | | A |
| | | CO (High temperature) | | B |
| | | HCl | | C |
| | | HCl+$H_2O$ (50 vol%) | Note 1 | F |
| | | $CO_2$ | | G |
| | | $CO_2$ (High temperature) | | H |
| | | CO+$CO_2$ | Note 2 | K |
| | | CO+$CO_2$ (High temperature) | Note 2 | L |
| | | $O_2$ | | P |
| | | $O_2$ (High temperature) | | Q |
| | | $O_2$ (Air purge) | | T |
| | | ppm CO + $O_2$ (Air purge) | | V |
| | | ppm CO + $O_2$ (High temperature) | | U |
| | | vol% CO + $O_2$ | | S |
| | | $CH_4$ | | R |
| | | $NH_3$ | | W |
| | | $NH_3$ + $H_2O$ (50 vol%) | Note 1 | X |
| 5 | Unit | ppm | | 1 |
| | | mg/m$^3$ | | 3 |
| | | vol% | | 5 |
| | | ppm (1st comp), vol% (2nd comp) | | 7 |
| | | vol% (1st comp), vol% (2nd comp) | | 9 |
| 6 | Measuring range (1st components) | 0 to 2 | Note 3, 4 | K |
| | | 0 to 2.5 | | Q |
| | | 0 to 4 | | S |
| | | 0 to 5 | | L |
| | | 0 to 10 | | V |
| | | 0 to 15 | | 0 |
| | | 0 to 20 | | 1 |
| | | 0 to 25 | | T |
| | | 0 to 50 | | A |
| | | 0 to 100 | | B |
| | | 0 to 200 | | C |
| | | 0 to 250 | | D |
| | | 0 to 400 | | J |
| | | 0 to 500 | | E |
| | | 0 to 1000 | | F |
| | | 0 to 2000 | | G |
| | | 0 to 5000 | | H |
| | | 0 to 6000 | | M |
| | | Others | | X |
| 7 | Measuring range (2nd components) | 0 to 2 | Note 3, 4 | K |
| | | 0 to 2.5 | | Q |
| | | 0 to 4 | | S |
| | | 0 to 5 | | L |
| | | 0 to 10 | | V |
| | | 0 to 15 | | 0 |
| | | 0 to 20 | | 1 |
| | | 0 to 25 | | T |
| | | 0 to 50 | | A |
| | | 0 to 100 | | B |
| | | 0 to 200 | | C |
| | | 0 to 250 | | D |
| | | 0 to 400 | | J |
| | | 0 to 500 | | E |
| | | 0 to 1000 | | F |
| | | 0 to 2000 | | G |
| | | 0 to 5000 | | H |
| | | 0 to 6000 | | M |
| | | Others | | X |
| | | None | | Y |
| 9 | Flange rating | 10K 50A (JIS B 2212) | | A |
| | | 10K 100A | | B |
| | | DN50/PN10 | | C |
| | | ANSI #150 2B | | D |
| 10 | Number of analog output points | 2 points | | 0 |
| | | 4 points | | 1 |
| 11 | Number of analog input points | 2 points | | A |
| | | 6 points (Unselctable for CO + $O_2$) | | B |

| Digit | Specification | | Note | Code |
|---|---|---|---|---|
| 12 | Analog output | 4 to 20mA DC | | 1 |
| | | 0 to 20mA DC | | 2 |
| | | 0 to 1V DC | | 3 |
| | | 0 to 5V DC | | 4 |
| | | 1 to 5V DC | | 5 |
| 13 | Contact output/ input | 5 output points, No input | | 0 |
| | | 5 output points, 3 input points | | 1 |
| 14 | Cable length between receiver and control unit | 5m | | A |
| | | 10m | | B |
| | | 20m | | C |
| | | 30m | | D |
| | | 40m | | E |
| | | 50m | | F |
| | | 80m | | G |
| | | 100m | | H |
| | | Others | | X |
| 15 | Cable length between receiver and transmitter | 2m | | A |
| | | 5m | | B |
| | | 10m | | C |
| | | 15m | | D |
| | | 20m | | E |
| | | 25m | | F |
| | | Others | | X |
| 16 | Display and operation manual | Japanese | | J |
| | | English | | E |
| | | Chinese | | C |
| 17 | – | – | | 0 |
| 18 | Measuring optical path length (unit: 1m) | 0m | | 0 |
| | | 1m | | 1 |
| | | 2m | | 2 |
| | | 3m | | 3 |
| | | 4m | | 4 |
| | | 5m | | 5 |
| | | 6m | | 6 |
| | | 7m | | 7 |
| | | 8m | | 8 |
| | | 9m | | 9 |
| 19 | Measuring optical path length (unit: 0.1m) | 0.0m | | 0 |
| | | 0.1m | | 1 |
| | | 0.2m | | 2 |
| | | 0.3m | | 3 |
| | | 0.4m | | 4 |
| | | 0.5m | | 5 |
| | | 0.6m | | 6 |
| | | 0.7m | | 7 |
| | | 0.8m | | 8 |
| | | 0.9m | | 9 |
| 20 | Measuring optical path length (unit: 0.01m) | 0.00m | | 0 |
| | | 0.05m | | 5 |
| | | (Used only when 10m is specified) | | 9 |
| 21 | – | – | | N |
| 22 | High-dust, High-speed, AGC | None | | N |
| | | Provided | Note 5 | H |

Note 1) Consult us when selecting $H_2O$ measurement.

Note 2) Specify the same range for CO and $CO_2$. If different range is desired for CO and $CO_2$, specify the "X" at 6 digit and give a description of each range.

Note 3) When using CO + $O_2$ measurement, select a "CO mearsuring range" in the 6th digit, and a "$O_2$ measuring range" in the 7th digit.

Note 4) Specify the range within the max./min. range calculated from optical path length.

Note 5) Select "H" for $O_2$ analyzer for high dust, high-speed, and combustion control.

**List for Combinations of Measureable Components, Units and Measurement ranges**

| Component | | Measuring range |
|---|---|---|
| CO | | 0 ~ 2, 2.5, 4, 5, 10, 15, 20, 25, 50 vol% |
| CO (For use in high temp.) | | 0 ~ 10, 15, 20, 25, 50 vol% |
| HCl | | 0 ~ 10, 15, 20, 25, 50, 100, 200, 250, 400, 500, 1000, 2000, 5000 ppm or mg/m³ |
| $CO_2$ | | 0 ~ 2, 2.5, 4,5, 10, 15, 20, 25, 50 vol% |
| $CO_2$ (For use in high temp.) | | 0 ~ 10, 15, 20, 25, 50 vol% |
| $O_2$ | | 0 ~ 4, 5, 10, 15, 20, 25, 50, 100 vol% |
| $O_2$ (For use in high temp.) | | 0 ~ 4, 5, 10, 15, 20, 25, 50 vol% |
| $O_2$ (For air purge) | | 0 ~ 25, 50, 100 vol% |
| $CH_4$ | | 0 ~ 100, 200, 250, 400, 500, 1000, 2000, 5000 ppm or mg/m³ |
| $NH_3$ | | 0 ~ 15, 20, 25, 50, 100, 200, 250, 400, 500, 1000, 2000, 5000 ppm or mg/m³ |
| $CO+CO_2$ | 1st comp.: CO | 0 ~ 2.5, 4, 5, 10, 15, 20, 25, 50 vol% |
| | 2nd comp.: $CO_2$ | 0 ~ 2.5, 4, 5, 10, 15, 20, 25, 50 vol% |
| $CO+CO_2$ (For use in high temp.) | 1st comp.: CO | 0 ~ 10, 15, 20, 25, 50 vol% |
| | 2nd comp.: $CO_2$ | 0 ~ 10, 15, 20, 25, 50 vol% |
| $CO+O_2$ (Air purge) | 1st comp.: CO | 0 ~ 200, 250, 400, 1000, 2000, 5000, 6000 ppm, 2vol% |
| | 2nd comp.: $O_2$ | 0 ~ 25, 50, 100 vol% |
| $CO+O_2$ (High temperature) | 1st comp.: CO | 0 ~ 200, 250, 400, 1000, 2000, 5000, 6000 ppm, 2vol% |
| | 2st comp.: $O_2$ | 0 ~ 5, 10, 15, 20, 25, 50 vol% |
| $CO+O_2$ | 1st comp.: CO | 0 ~ 4, 5, 10, 15, 20, 25, 50 vol% |
| | 2st comp.: $O_2$ | 0 ~ 10, 15, 20, 25, 50, 100 vol% |

**Scope of delivery**

- Receiver unit
- Transmitter unit
- Control unit
- Cable between receiver unit and transmitter unit (specified length)
- Cable between receiver unit and control unit (specified length)
- Standard accessory set, instruction manual

**Optional items**

- Spare parts for one year (ZBN1SS12)
- Calibration gas cell (*1) (*2)
- Cable between receiver unit and transmitter unit (*1)
- Cable between receiver unit and control unit (*1)
- Standard gas (ZBM), pressure regulator (ZBD)
- Recorder (when necessary, Fuji's product type PHR, etc.)
- Others

*1: Although there is no need to arrange the item for each equipment, there must be at least 1 item for each installation location.

*2: The length of calibration gas cell might be changed by measuring range.

**Standard accessories**

| Name | Quantity | Specification |
|---|---|---|
| Bolt | 8 (16) | M16×55 (70) SUS (*) |
| Nut | 8 (16) | M16 SUS (*) |
| Spring washer | 8 (16) | M16 SUS (*) |
| Flat washer | 8 (16) | M16 SUS (*) |
| Companion flange packing or flange packing specified for use in high temperature | 2 | According to flange rating |
| Bolt for angle fine adjustments | 6 | Hexagonal socket bolt M8 × 70 |
| Power supply fuse | 2 | |

(* When B is selected for the 9th digit of the code symbols, quantity becomes 16. In other cases, quantity is 8. When B, C or D is selected for the 9th digit of the code symbols, the length of the bolt becomes 70mm. In other cases, it is 55mm. (inch bolt is not supplied.))

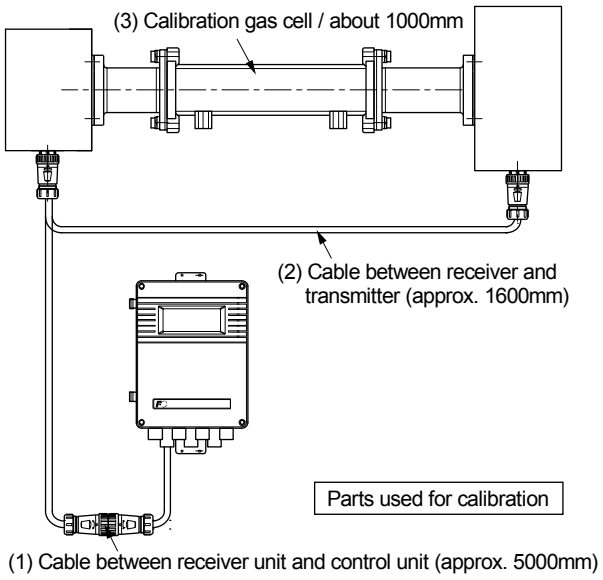
**Spare parts for one year (ZBN1SS11)**

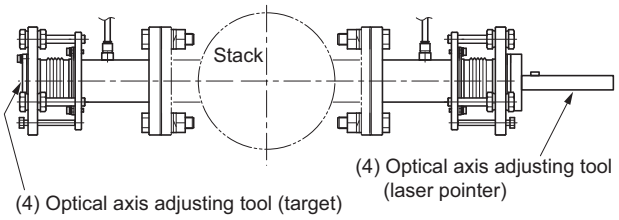
| Parts name | Quantity | Remarks (type) |
|---|---|---|
| Silicon packing A | 2 | For bellows (ZZP*ZSSTK7N3508P1) |
| O-ring | 2 | (ZZP*ZSSTK7P2530P5) |

**Calibration/installation fixture list (Option)**

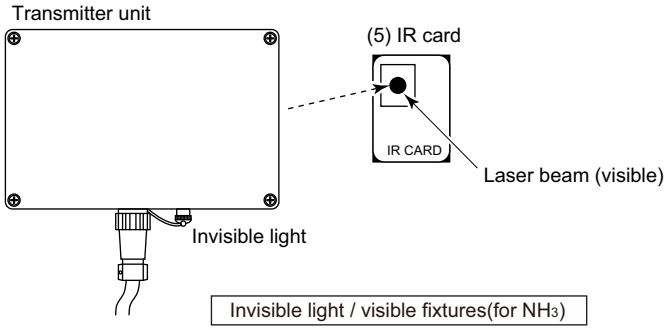
| | Parts name | Quantity | Type |
|---|---|---|---|
| (1) | Cable between receiver unit and control unit (for calibration) | 1 | ZZP*ZSSTK4J1271C2 |
| (2) | Cable between receiver unit and transmitter unit (for calibration) | 1 | ZZP*ZSSTK4J0641C3 |
| (3) | Calibration gas cell (*3) (HCl, $NH_3$, CO,$CO_2$, CO+$CO_2$,$CH_4$) | 1 | ZZP*ZSSTK4J3676C1 |
| | Calibration gas cell (*3) (HCl+$H_2O$, $NH_3$+$H_2O$, $O_2$, CO+$O_2$) | | ZZP*ZSSTK4J5026C1 |
| (4) | Optical axis adjusting tool (laser pointer, target) | 1 | ZZP*ZSSTK4J1274C1 |
| (5) | IR card (for $NH_3$) | 1 | ZZP*ZSSTK7N4505P1 |
| (6) | Check cell | 1 | ZZP*ZSSTK4J2605C1 |
| (7) | Filter regulator | 1 | ZZP*ZSSTK7N7466P1 |
| (8) | Mist separator | 1 | ZZP*ZSSTK7H8049P1 |
| (9) | R1/4 stopper (plug) for mist separator | 1 | ZZP*ZSSTK738114P7 |
| (10) | Flow meter (20 to 100L/min) (*4) | 1 | ZZP*ZSSTK7N4624P1 |
| | Flow meter (4 to 50L/min) (*4) | 1 | ZZP*ZSSTK7N4624P2 |
| | Flow meter (30 to 300L/min) (*4) | 1 | ZZP*ZSSTK7N8849P1 |
| (11) | Air-set box (20 to 100L/min) | 1 | ZZP*ZSSTK7N6685C1 |
| | Air-set box (4 to 50L/min) | 1 | ZZP*ZSSTK7N6685C2 |
| | Air-set box (30 to 300L/min) | 1 | ZZP*ZSSTK7N6685C3 |
| (12) | Air purge mechanism (20 to 100L/min) | 1 | ZZP*ZSSTK7P1433C1 |
| | Air purge mechanism (4 to 50L/min) | 1 | ZZP*ZSSTK7P1433C2 |
| | Air purge mechanism (30 to 300L/min) | 1 | ZZP*ZSSTK7P1433C3 |
| (13) | BNC cable for optical axis adjustment | 1 | ZZP*ZSSTK7P2524C1 |

* 3: Standard length 1m (200mm or 500mm when the measuring range is low concentration)
* 4: Usually, 2 units are required to adjust air purge for the receiver unit and the transmitter unit seperately.

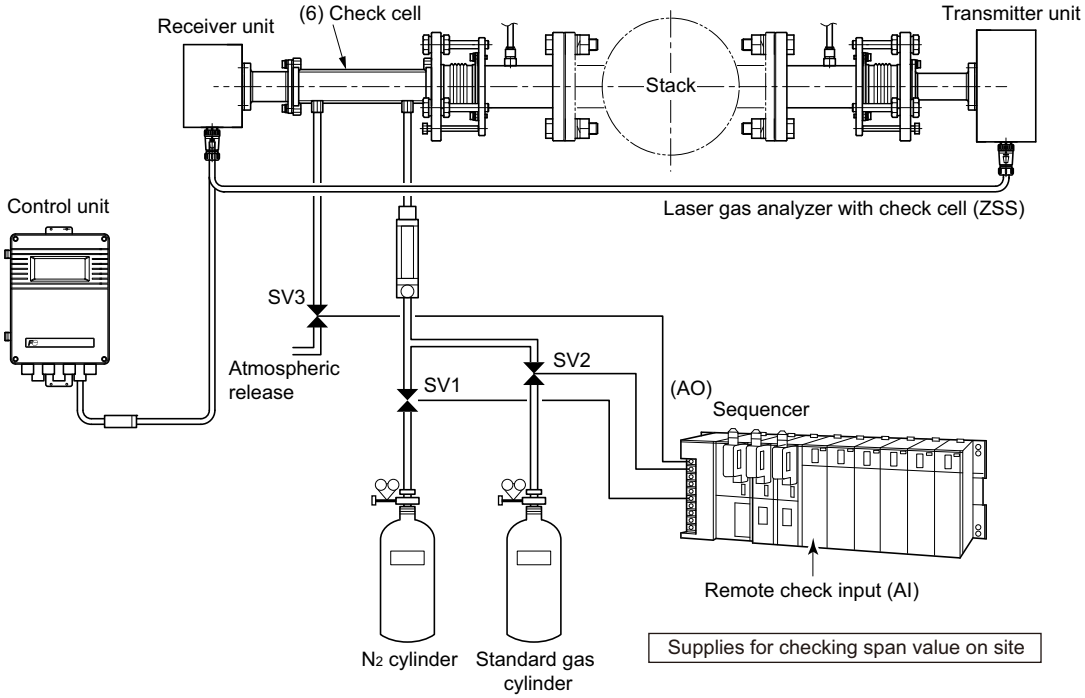





Parts for adjusting the optical axis

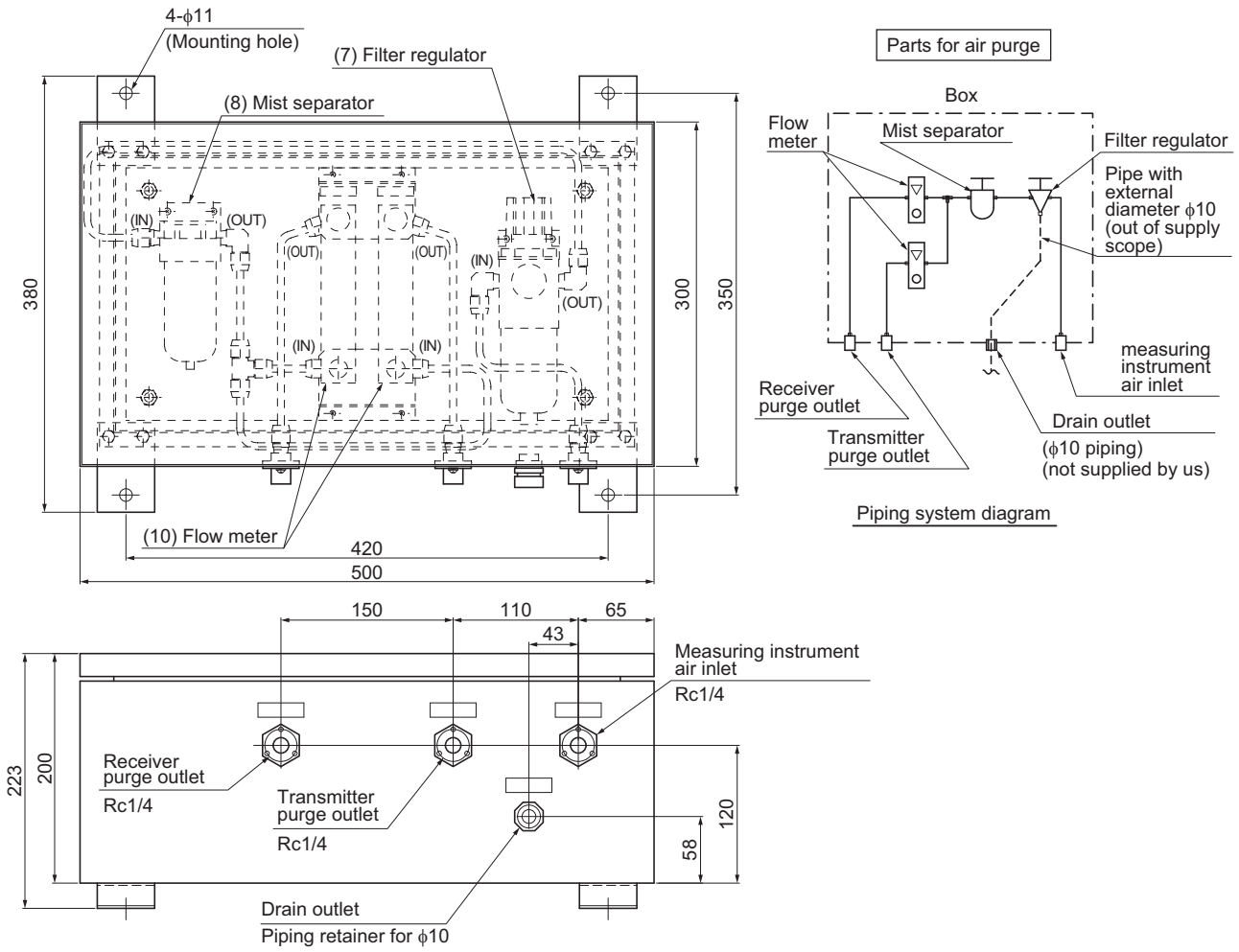



Invisible light / visible fixtures(for $NH_3$)

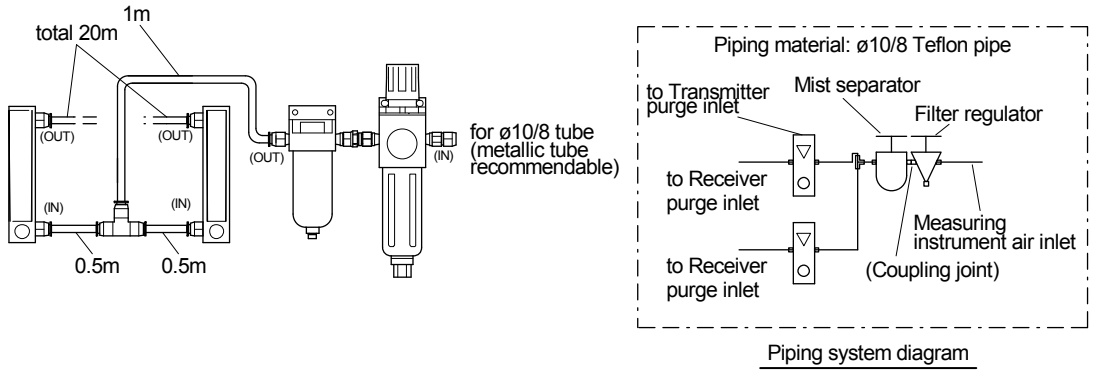



Supplies for checking span value on site

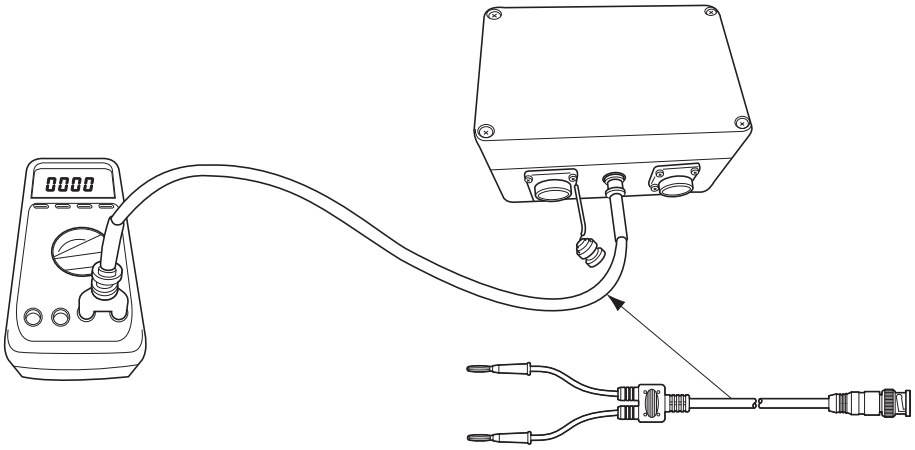
(11) Air set box



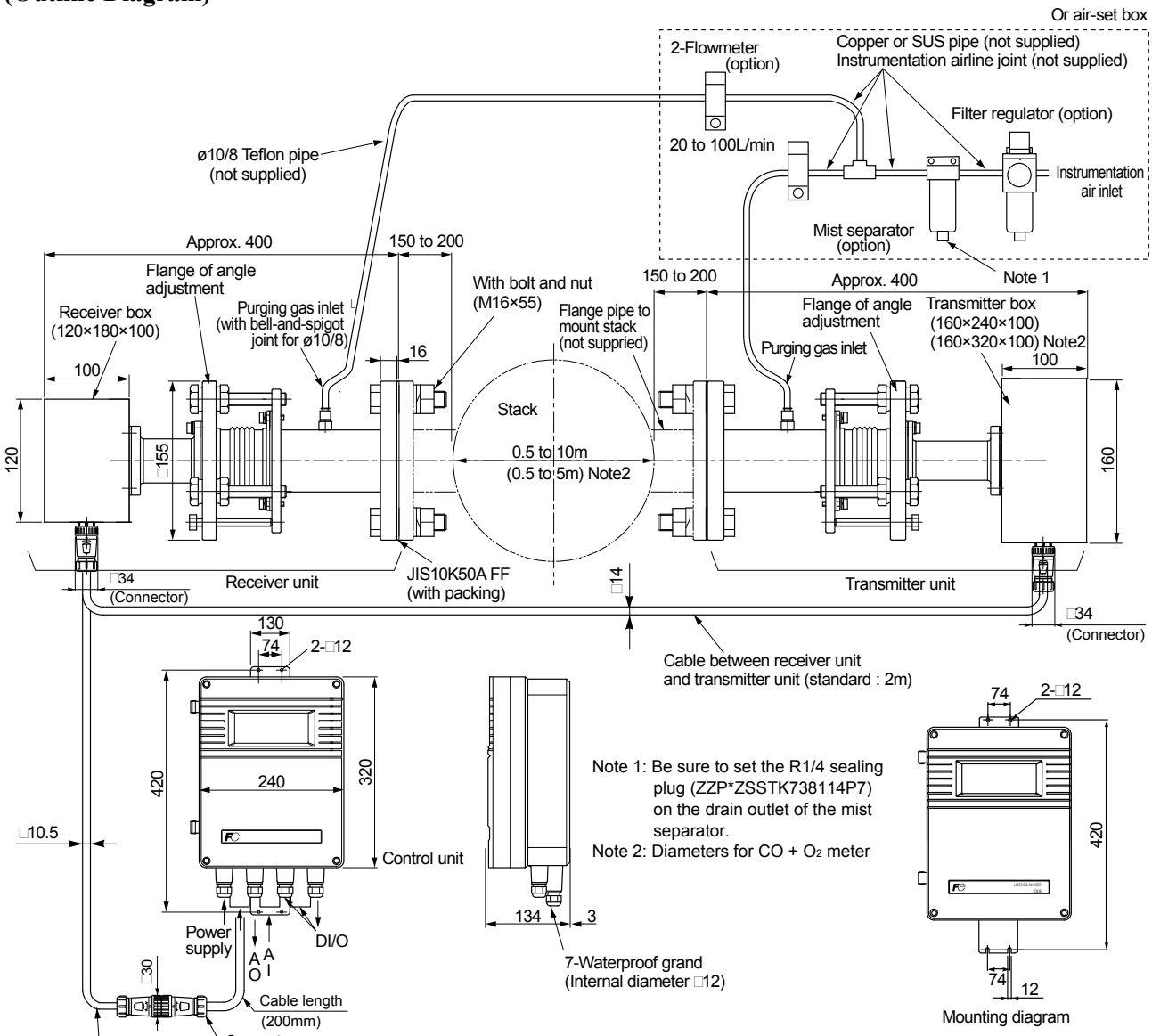

(12) Air purge mechanical part



(13) BNC cable for optical axis adjustment



## (Outline Diagram)




Be sure to prepare instrument air or $N_2$ gas.
(Instrument air should not contain oil and mist)
If mixed air such as oil and mist contained is used, contamination occurs in the pipe of flow meter and purge flow rate falls, which will affect the measurement.
According to above, maintenance is required frequentlyand filter may be installed additionally depending on situation.
Note) Air or nitrogen purge should be performed if the equipment is installed in a flue whether or not it is operated. If you operate the furnace without purging, it may cause the fatal damage to the optical part.

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