Instruction Manual

CROSS STACK LASER GAS ANALYZER

TYPE: ZSS

Fuji Electric Systems Co., Ltd.

INZ-TN1ZSS-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.

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

Issued in November, 2007

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**	• 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. • 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**	• 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. • 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. • 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. • 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. • 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. • The analyzer is heavy. It should be transported carefully by two or more persons if manually required. Otherwise, bodily harm may ensue. • 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. • The laser beam is the invisible infrared light. Do not watch the laser beam directly or scattering light. • Do not watch the laser beam directly with the optical measuring device. Otherwise, it may cause serious damage to your eyes.

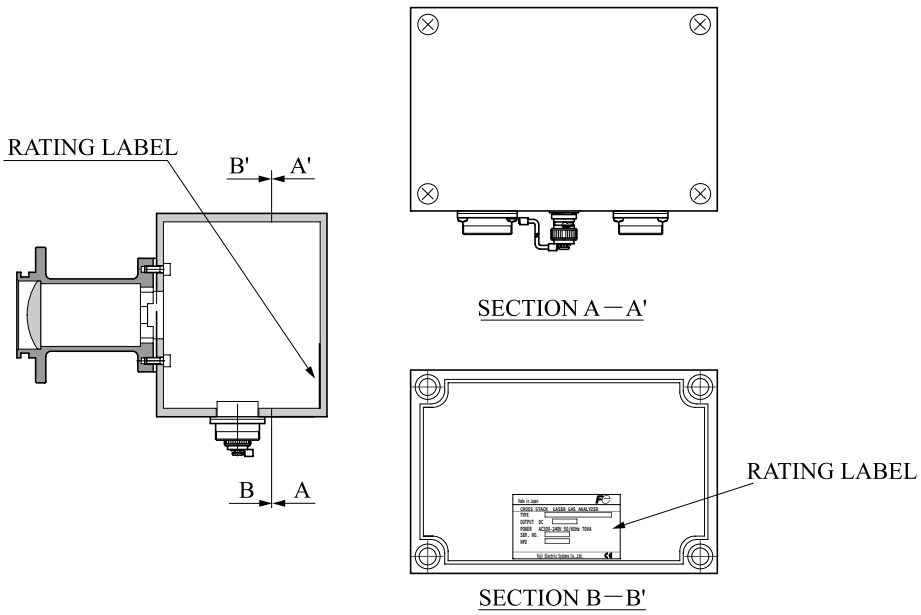
Caution on Wiring	
⚠ CAUTION	• Be sure to connect a ground wire securely to the specified place by performing class D grounding work. Otherwise electric shock or malfunction may result. • If the power supply voltage exceeds the rating, electric shock or damage to the instrument may result. Be sure to use the instrument within the specified rating range. • Be sure to turn off the power before performing wiring work. • Be sure to use a 600V-IV ground wire 2 mm or larger in diameter with sufficient dielectric strength. • 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. • Fasten the input/output wires to the floor or wall, and use a wire protection device.

Caution on operation and use	
⚠ DANGER	• When handling the standard gas such as calibration gas, read the instruction manual of the standard gas carefully, and use the gas correctly. • 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	• Do not touch the switch with a wet hand. Otherwise it may cause electric shock. • 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. • Do not touch the unit terminal block during operation. Otherwise, it may cause electric shock or injury. • 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. • Do not allow water to go into the gas analyzer. Otherwise, electric shock or fire in the instrument may be caused. • Do not smoke nor use a flame near the gas analyzer. Otherwise, it may result in a fire. • Do not use the receiver unit or the transmitter unit as a footstool. Otherwise, it may damage the analyzer, disable the correct measurement, and besides, injury may result when the unit is removed. • The product uses Class I laser. • Do not remove the transmitter unit while the power is ON during operation. Also, do not direct the transmitter unit to people. Otherwise, laser beam can enter eyes of people and damage its cornea. • The laser beam is the invisible infrared light. Do not watch the laser beam directly or scattering light. • Do not watch the laser beam directly with the optical measuring device. Otherwise, it may cause serious damage to your eyes. • Be sure to purge the receiver unit and the transmitter unit. Do not use the analyzer under the environment where high temperature gas is measured and air purging is not performed. Otherwise, the analyzer may be damaged.

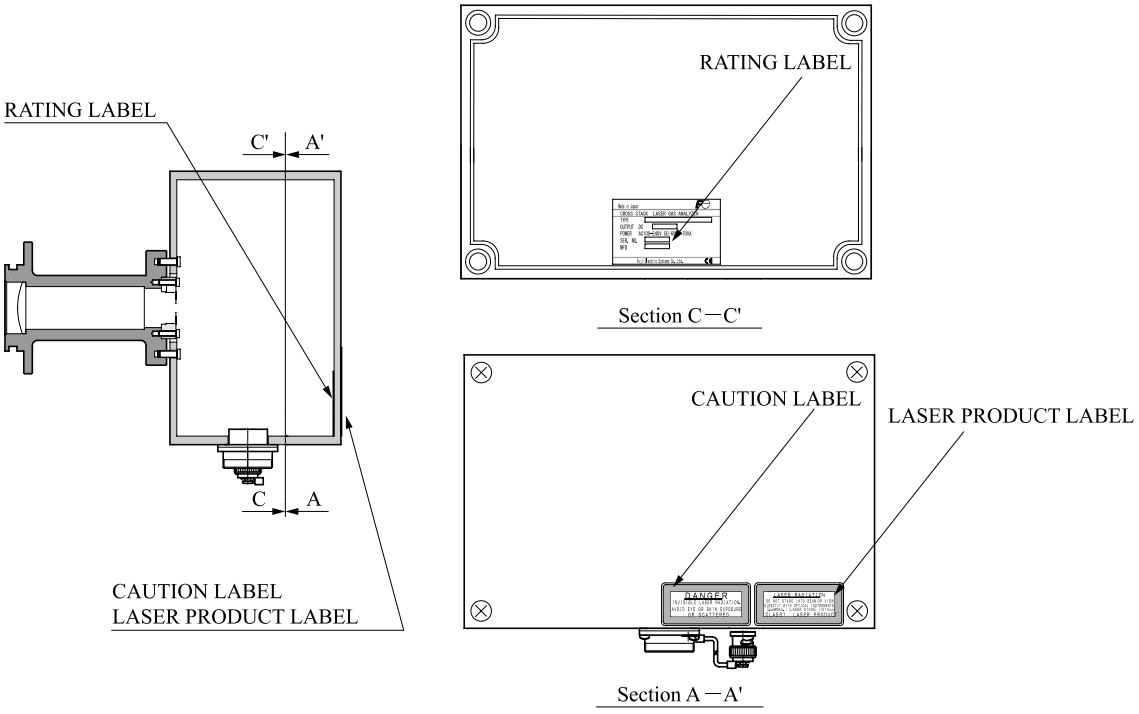
Caution on maintenance and inspection	
⚠ DANGER	• When the analyzer (receiver unit and transmitter unit) is installed on incineration facility, make sure the facility has stopped completely. Installing on the operating facility may cause high temperature gas injection, resulting in burn. • If the analyzer 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. • 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	• Be careful not to drop the analyzer on your foot. Otherwise, it may cause fracture of the bone. • Do not touch the terminal block of each unit of the instrument carelessly during operation. Otherwise, it may cause electric shock. • 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. • 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. • 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. • Do not use replacement parts other than recommended ones. Otherwise, adequate performance will not be provided. Furthermore, an accident or fault may be caused. • Dispose replacement parts such as maintenance parts as incombustibles in accordance with the local waste disposal requirements. • Do not remove the transmitter unit while the power is ON during operation. Also, do not direct the transmitter unit to people. Otherwise, laser beam can enter eyes of people and damage its cornea. • The laser beam is the invisible infrared light. Do not watch the laser beam directly or scattering light. • Do not watch the laser beam directly with the optical measuring device. Otherwise, it may cause serious damage to your eyes.

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.

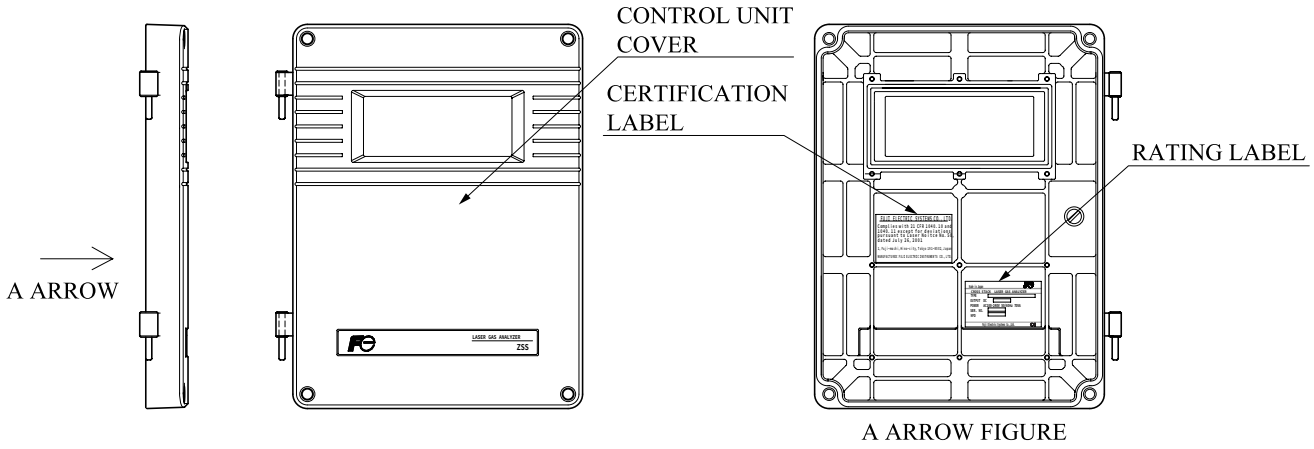
Label positions



Receiver box



Transmitter box



Control unit

Contents

1. GENERAL

1.1 General

Cross-stack laser gas analyzer (ZSS) provides continuous measurement of HCl in-flue gas incineration and NH_3 density of denitration equipment 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. Do not watch the laser beam directly (with an optical measuring device included) or scattering light.

Laser Classification : Class 1 according to IEC/EN60825-1
Protection Class : IP65

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 : 2001 Safety requirements for electrical equipment for measurement , control and laboratory use.
  "Installation Category II"
  "Pollution Degree 2"

- EN61326-1 : 1997, AI : 1998 , A2 : 2001 , A3 : 2003
  Electrical equipment for measurement , control and laboratory use
  — EMC requirements.

CE

- EN55011 : 1998 , A1 : 1999 , A2 : 2002
- EN61000-3-2 : 2000 , A2 : 2005
- EN61000-3-3 : 1995 , A1 : 2001 , A2 : 2005

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 2-2 and 2-3 of “Appendix 2”at the end of this Manual.

2.1 Delivered articles (products and standard accessories)

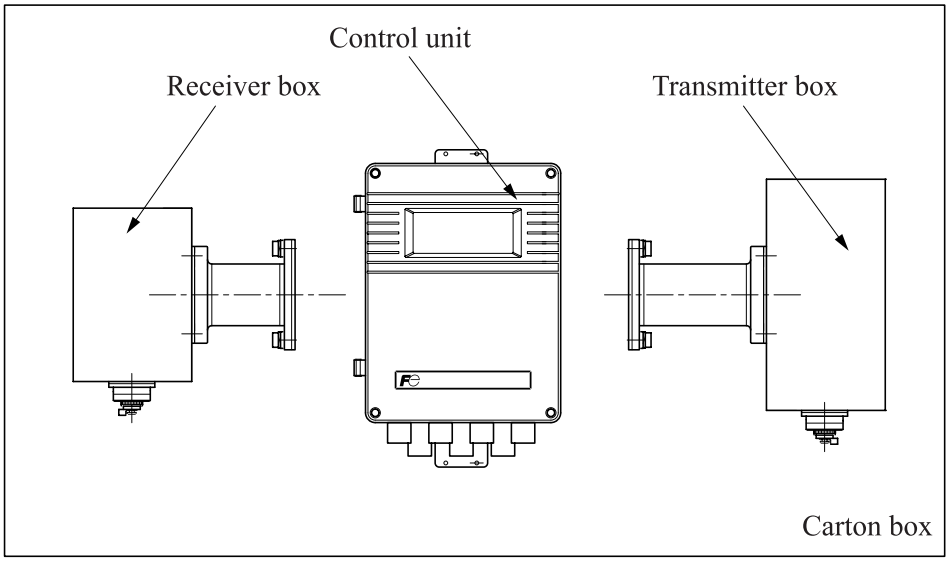
Table 2－1 Products

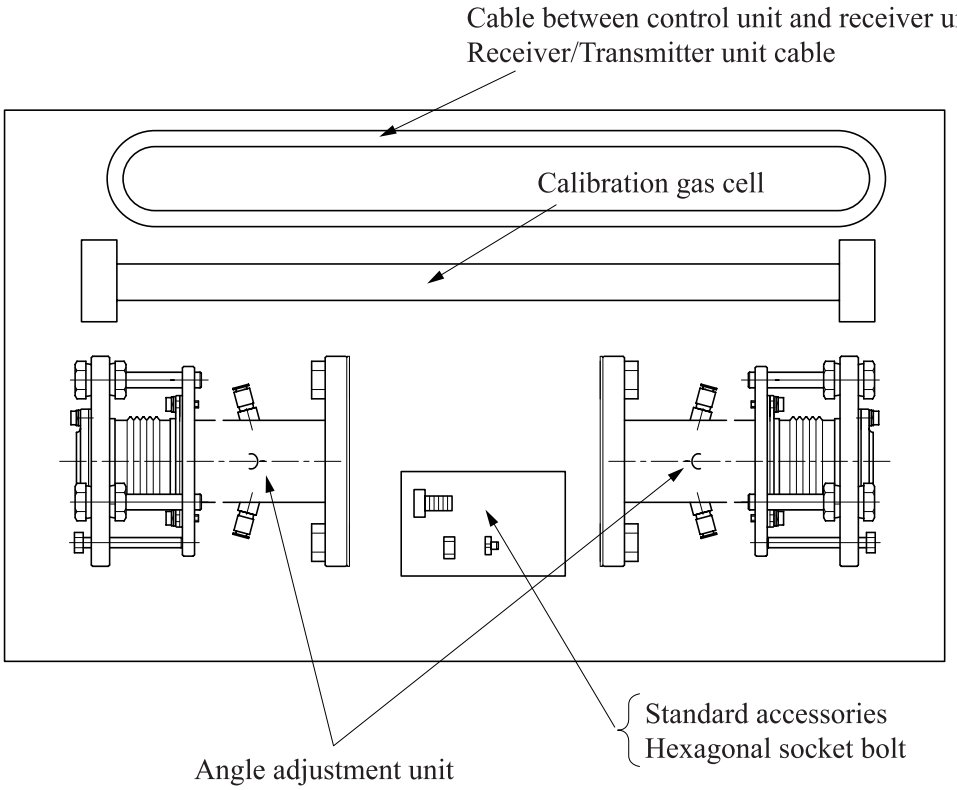
No.	Product name	Quantity
1.	Control unit	1
2.	Receiver box	1
3.	Transmitter box	1
4.	Angle adjustment unit	2
5.	Cable between receiver unit and transmitter unit	1
6.	Receiver/transmitter cable	1
7.	Hexagonal socket bolt	2
8.		
9.		
10.		

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	2
6.	Bolt for angle regulation (*2)	6
7.	Power supply fuse	2
8.	Instruction manual	1
9.		
10.		

*1: When B 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 are connected to the main unit at the time of delivery.

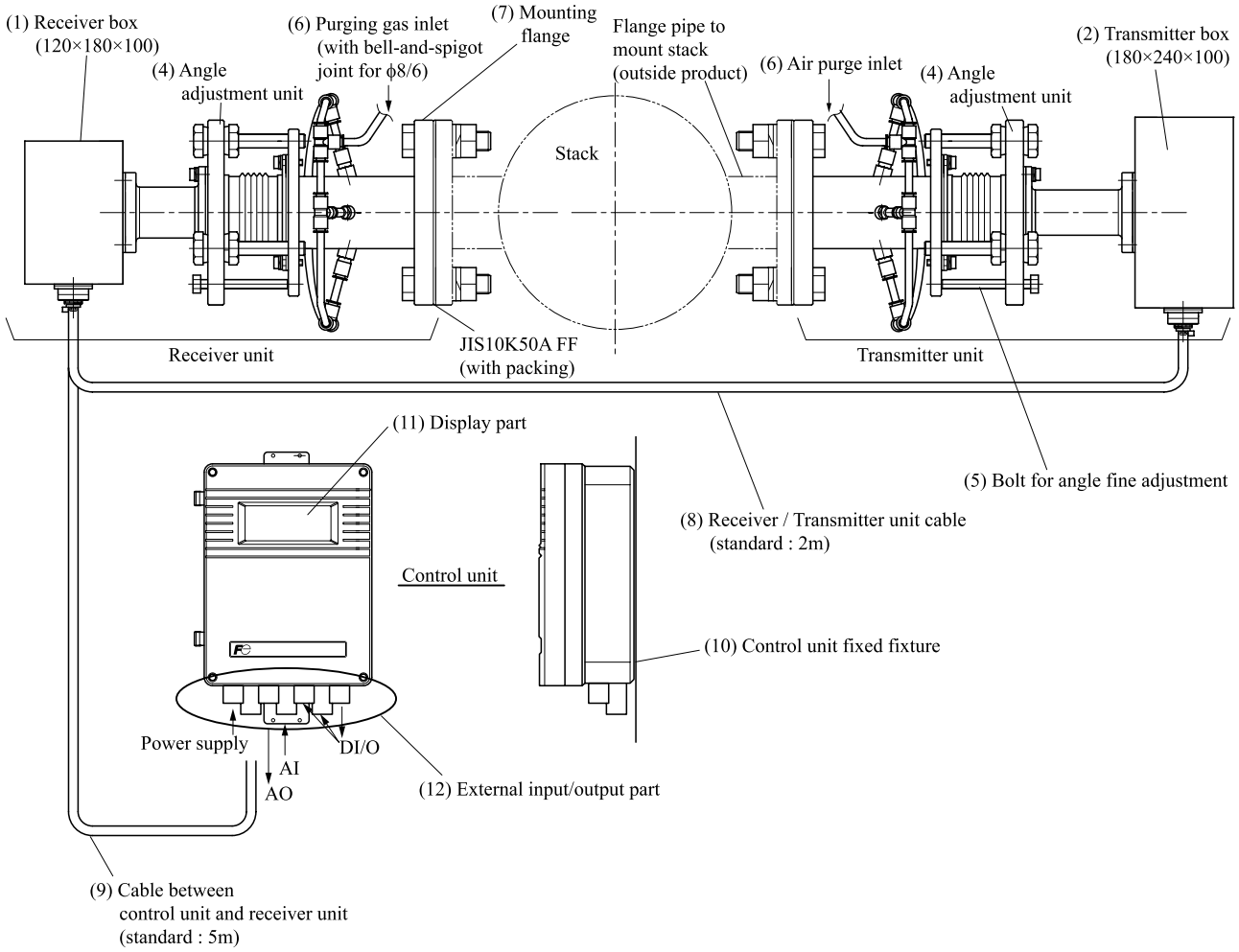

Control unit
Receiver box
Transmitter box
Carton box

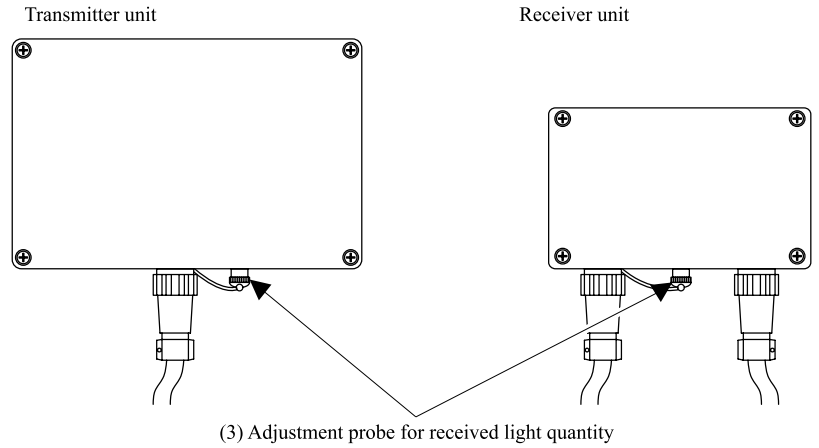

Cable between control unit and receiver unit,
Receiver/Transmitter unit cable
Calibration gas cell
Standard accessories
Hexagonal socket bolt
Angle adjustment unit

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.



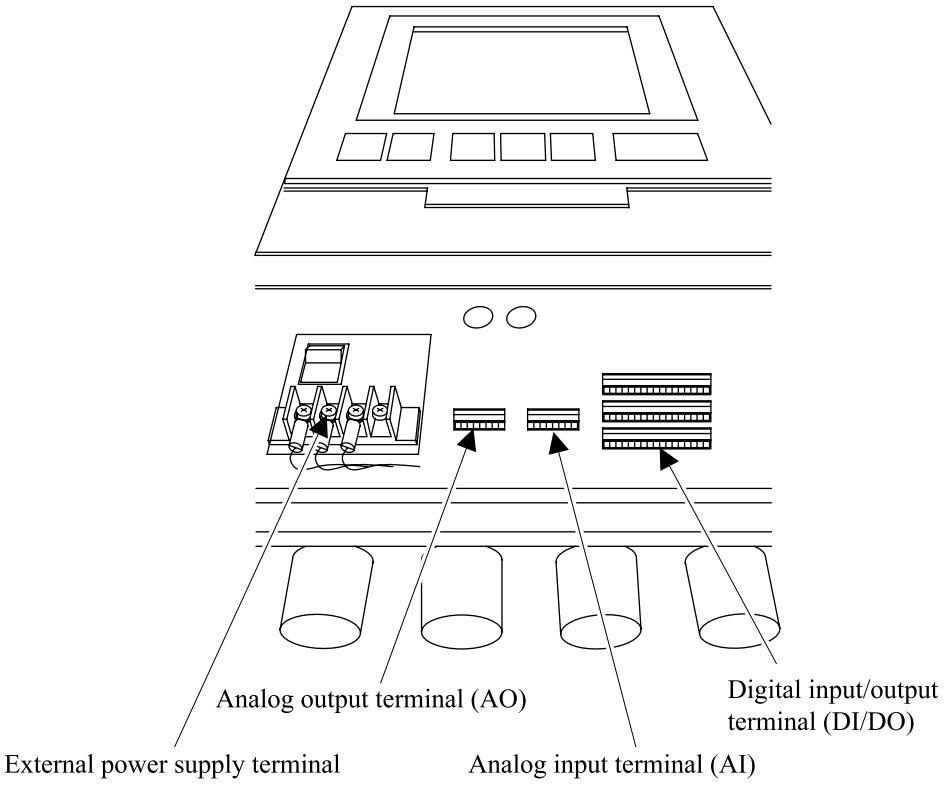


	Name	Description
(1)	Receiver box	A photodiode to receive light and a board are built-in.
(2)	Transmitter box	Laser light source, peltier to control the temperature of laser and a board are built-in.
(3)	Adjustment probe for received light quantity	Terminal which checks the intensity of received light volume when light axis adjustment is performed. It is provided in both the receiver unit and transmitter unit. Connecting the terminal is the BNC receptor.
(4)	Angle adjustment unit	A unit which adjusts light volume to receive laser light transmitted from transmitter unit via PD of receiver unit. Up to 5° can be angle-tuned by the bolt.
(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 bolt for the flange of angle adjustment or the bolt for angle fine adjustment. It may not be necessary when the stack (optical path lengths) is short and less than 2mm. 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, eliminate attached dust and prevent the pipe from being clogged with dust. Prepare the pipe to connect to joint for tube ϕ8/6mm.
(7)	Mounting flange	Connects to the companion flange which is mounted on the stack. The standard flange is JIS 10K50A.
(8)	Receiver / Transmitter unit cable	Supplies power to transmitter unit, and sends and receives signal between receiver unit and transmitter unit. The standard length is 2m and up to 25m can be specified.
(9)	Cable between control unit and receiver unit	Supplies power to receiver unit, and sends and receives signal between receiver unit and transmitter unit. The standard length is 5m and up to 100m can be specified.
(10)	Control unit fixed fixture	Fixes control unit on the wall. There are two ϕ12mm 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

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



External power supply terminal

	L		N	
	1	2	3	

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

AO terminal

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

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+ ┐ AO expansion board
8 AO4– ┘ Analog output 4 (AO4) ┘ required
9 Unassigned
10 Unassigned
11 Unassigned
12 Unassigned

AI terminal

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

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

AI expansion board required

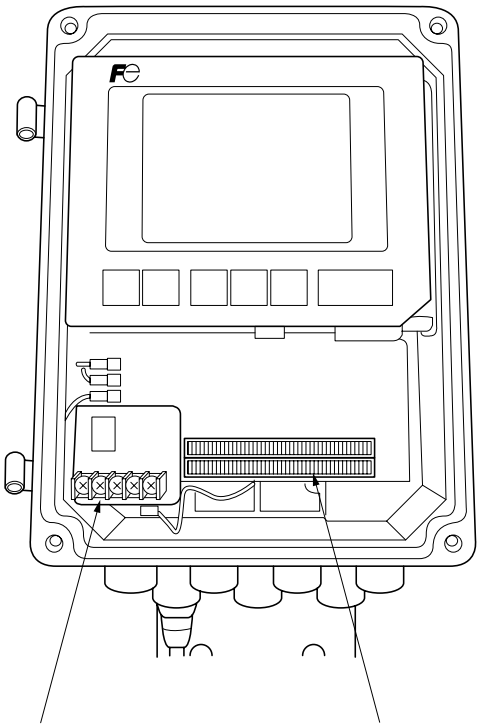
DI/DO terminal

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

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– — Beyond the upper/lower limits (Component 1)
21 DO5+
22 DO5– — Range identification (Component 1)
23 DO6+
24 DO6–
25 DO7+
26 DO7–
27 DO8+
28 DO8– — Power OFF
29 Unassigned
30 Unassigned
31 Unassigned
32 Unassigned
33 Unassigned
34 Unassigned
35 Unassigned
36 Unassigned

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), air purge (high pressure), box temperature warning, PD over range or AI under.
Consult our sales representative to collectively provide relay output of alarm depending on the installation environment.

(2) Input / output terminal 2



External power supply connection terminal

AO terminal / AI terminal / DI/DO terminal

External power supply connection terminal

	L	N		
	1	2	3	

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

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 : 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 : 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 : 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 (Component 1)

17 DO5+
18 DO5– — Range identification (Component 1)

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), air purge (high pressure), box temperature warning, PD over range or AI under.
Consult our sales representative to collectively provide relay output of alarm depending on the installation environment.

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. • 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. • 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. • 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. • The analyzer is heavy. It should be transported carefully by two or more persons if manually required. Otherwise, bodily harm may ensue. • 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. • The laser beam is the invisible infrared light. Do not watch the laser beam directly or scattering light. • 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 : A place where the temperature is 450°C or less, and 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
(6) Measured gas velocity : 10m/s or less
(7) Dust : 5 to 10g/Nm^3 or less (depending on the installation environment conditions)
(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. 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.
(10) Air purge flow rate : 20L/min or more (depending on measured gas temperature, velocity, pressure, moisture or dust)
(11) Path inner lengths (diameter) : 0.5 to 10m
(12) Vibration : 0.5G or less (0.2G or less for frequency 20 to 40Hz)
(When the measured optical path length is 1m)
(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.

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.

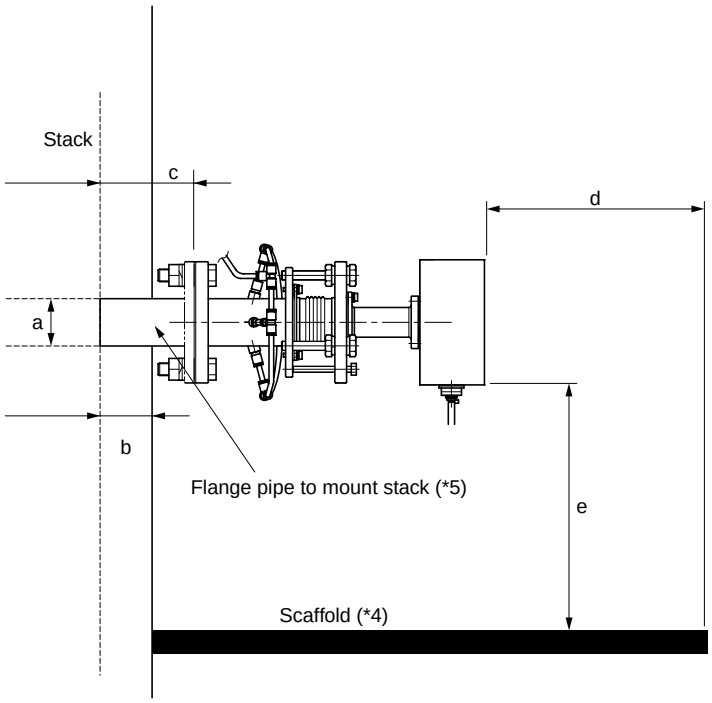
4.1.2 Installation conditions of control unit

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 few 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 ϕ50mm or more
b: 20 to 70mm (*1)
c: Approximately 200 to 250mm (*2)
d: 400mm or more (*3)
e: 500 to 1500mm (*3)

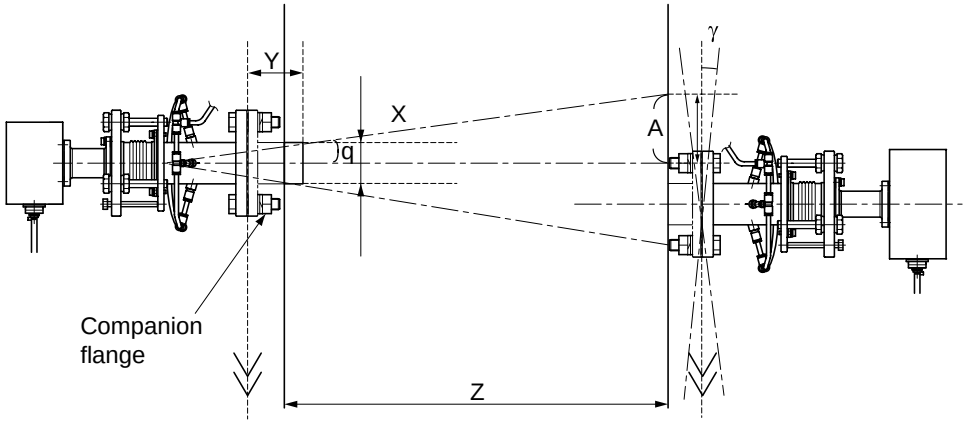
Fig. 4－1

*1: When used in an enviroment with high dust, reserve at least 50mm.
*2: When internal gas temperature is high, reserve the distance of 250mm or more. Note that adjustable angle range narrows down, so mounting angle of flange pipe to mount stack 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 flange provided with the valve where there is a risk of gas injection or where the operator may be exposed to a dangerous situation.

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: Length of flange of receiver uit and transmitter unit
Z: Length of stack

$$\gamma, \theta = \mathrm{ATAN}\ \frac{X}{2\,(Y + 125)}$$

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

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 control unit and receiver unit (for calibration)
(2) Receiver/Transmitter cable (for calibration)
(3) Calibration gas cell
(4) Power supply drum (or power supply extension cable)
(5) Digital voltmeter
(6) Digital voltage cable for connecting the BNC receptor
(7) Flow meter (about 2L/min)
(8) N_2 Gas cylinder
(9) Gas cylinder corresponding to the span
(10) Regulator (for gas cylinder) (For HCL/NH_3 meter, prepare a dedicated regulator.)
(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)

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.11
	↓	
(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.12
	↓	
(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.13
	↓	
(4)	Check that the installation location for the receiver unit and the transmitter unit has two types of ϕ8/6 tube (for the receiver/transmitter unit) for air purge connection, provided with the flow meter (regulator permitted).	P.18
	↓	
(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.22, 23
	↓	
(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.34 to 36
	↓	
(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.15
	↓	
(8)	Perform span calibration referring to “6.2 Span calibration”. Pay attention to the position and the length of the exhaust tube not to aspirate span gas. Feed zero gas after span calibration.	P.37, 38
	↓	
(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 “4.7.2 Adjustment procedure”. If the furnace is operated, be sure to adjust the angle in a state where air purge is performed.	P.16, 17
	↓	
(10)	Perform the piping connection to purge air, referring to “4.8 Piping system diagram”.	P.18
	↓	
(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.18
	↓	
(12)	Connect the Receiver/Transmitter cable and the cable between control unit and receiver unit, referring to “4.10 Wiring connection”.	P.19, 20
	↓	
(13)	Turn ON the control unit.	
	↓	

(14)	Adjust the light quantity so that the light quantity value at the receiver unit becomes the neighborhood of the value recorded in (7). If the angle is adjusted with the furnace operated, it may not become the neighborhood of the light quantity value in (7) due to the effect of dust, etc.	P.21
	↓	
(15)	Enter the length of the stack, referring to “6.5 Parameter setting”.	P.47 to 49
	↓	
(16)	Set the analog output setting, referring to “6.8 Selecting analog output”. Also, set other parameters that are necessary.	P.62

4.6 Checking received light quantity

(1) Remove the probe adjusting the received light quantity (BNC receptor) of the receiver unit or the transmitter unit, and connect it to the digital voltmeter using the digital voltage cable for connecting the BNC receptor.
(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 the equipment.

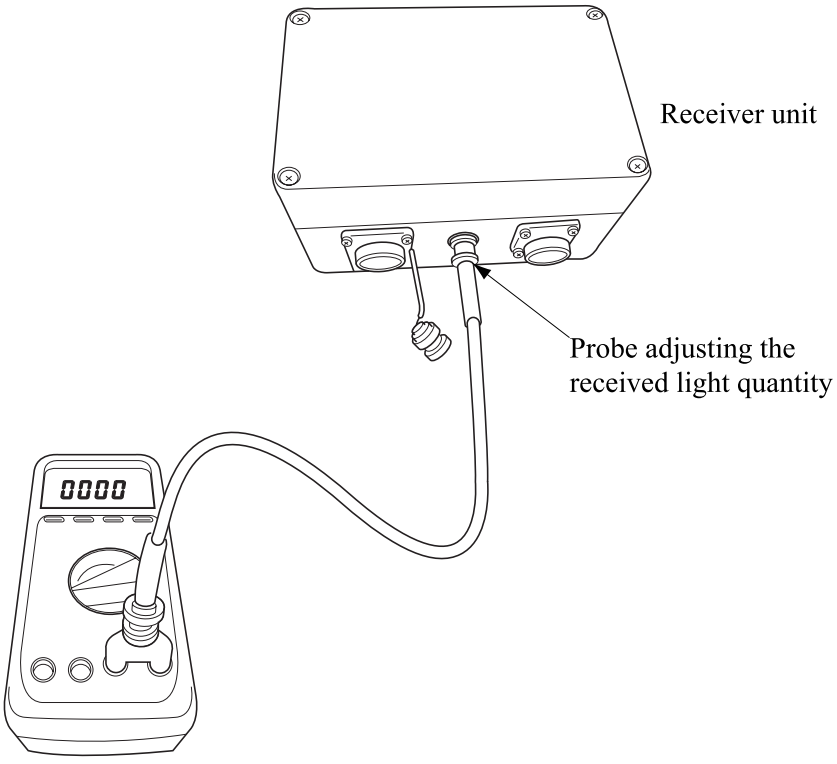


Fig. 4－3

4.7 Angle adjustment

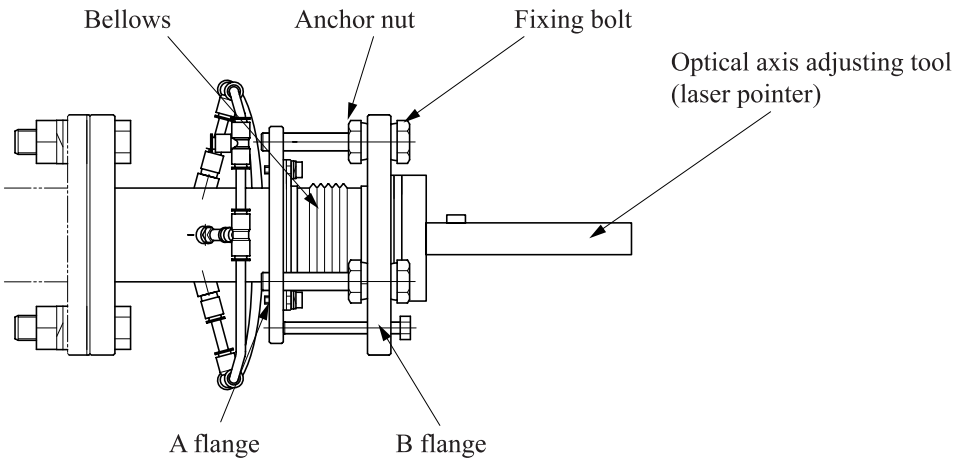


Fig. 4－4

4.7.1 How to operate the angle adjustment unit

(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.

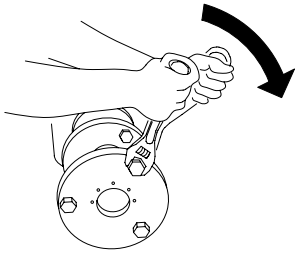


Fig. 4－5

(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.

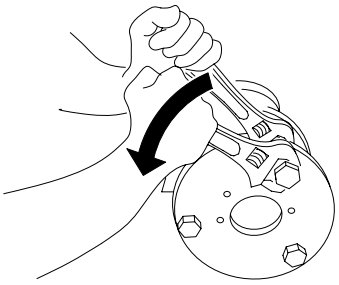


Fig. 4－6

(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.
Pay attention to the insertion angle of the spanner. 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.

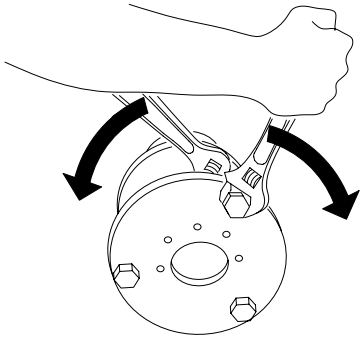


Fig. 4－7

4.7.2 Adjustment procedure

4.7.2.1 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” 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 them so as to be as shown in Fig. 4－8. (If the direction is wrong, the receiver/transmitter box is mounted at a tilt.) 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 as shown below. (Do not yet mount the receiver box and the transmitter box.)

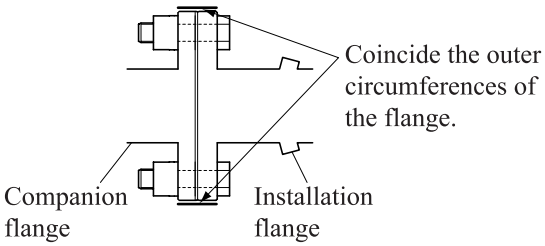


Fig. 4－8

(3) Fix the laser pointer on the transmitter unit side and the laser scope on the receiver unit with the attached hexagonal socket screws.

(4) Emit light from the laser pointer, and adjust the angle adjustment unit while referring to “4.7.1 How to operate the angle adjustment unit” so that the pointer’s light hits the center of the laser scope.

(5) When you have finished adjustment, fasten the fixing bolts and nuts firmly. When retightening the bolts and nuts, take care not to move the light axis. Remove the laser pointer and the target.

4.7.2.2 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” before mounting the stack unit.

(2) Mouth the angle adjustment unit to the companion flange on the stack.

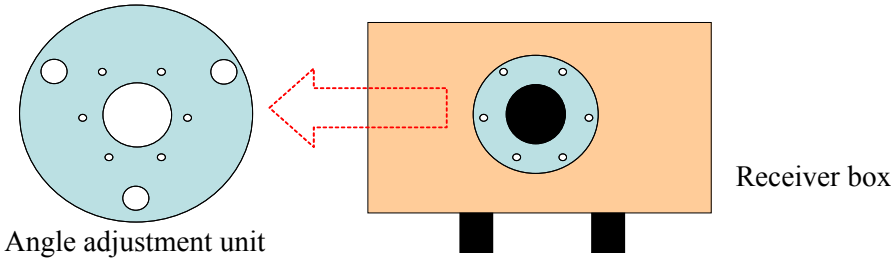
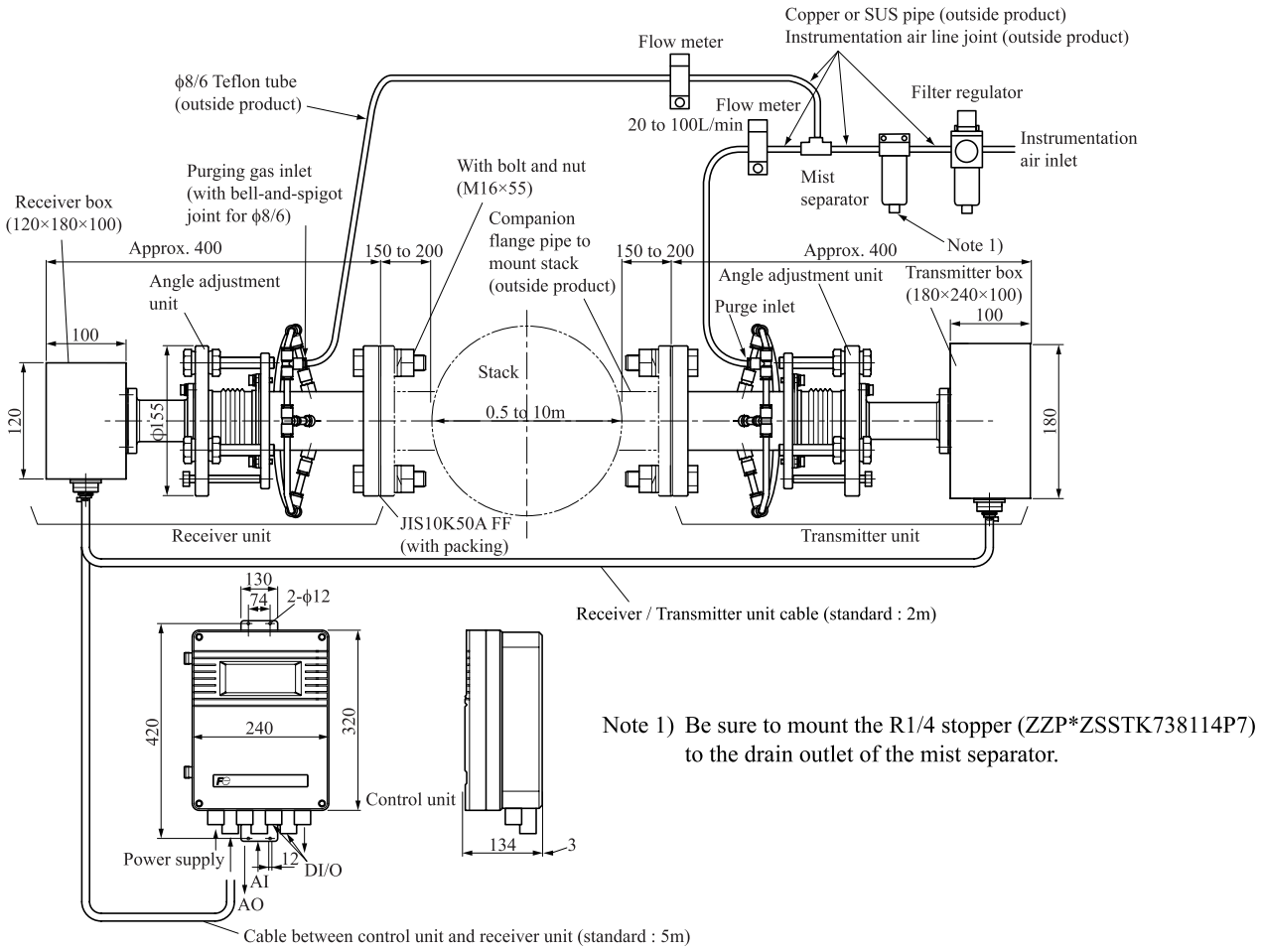


Fig. 4－9

When mounting it, be careful of the direction of them so as to be as to be shown in Fig. 4－9. 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 for angle adjustment”.

4.8 Piping system diagram



Note 1) Be sure to mount the R1/4 stopper (ZZP*ZSSTK738114P7) to the drain outlet of the mist separator.

Fig. 4－10

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. 4－11). (When the O-ring is not mounted to the receiver unit or the transmitter unit, mount the O-ring.)
(2) Mount “Receiver box or transmitter box” on “Angle adjustment unit” so that the cable receptor is positioned down.
(3) Fix it with the 6 “hexagonal socket bolts”.

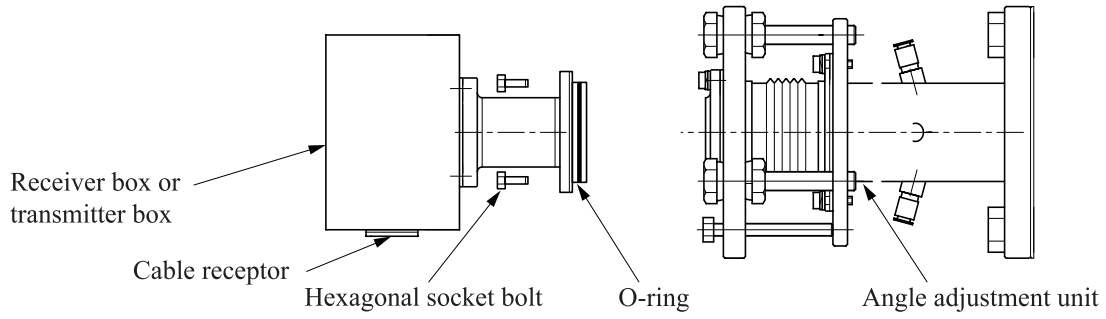


Fig. 4－11

4.10 Wiring connection

4.10.1 Connecting Receiver / Transmitter cable

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

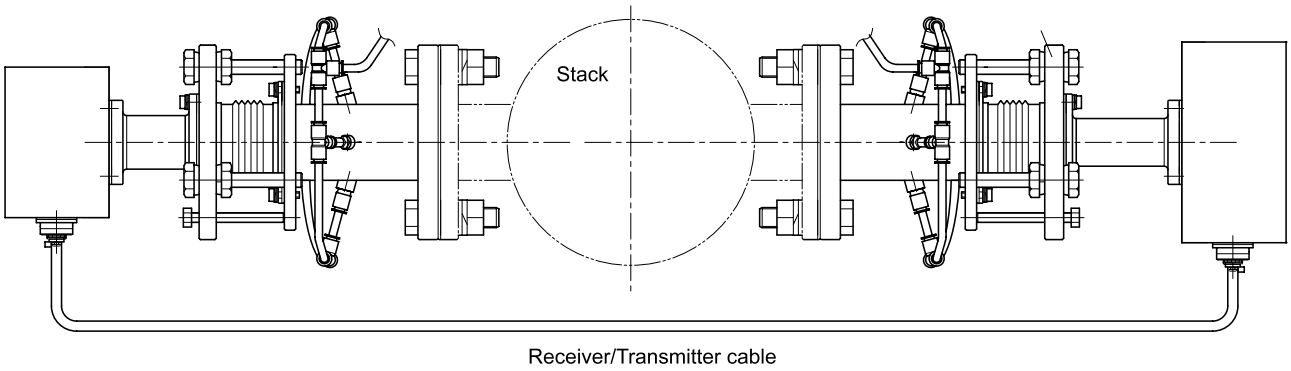


Fig. 4－12

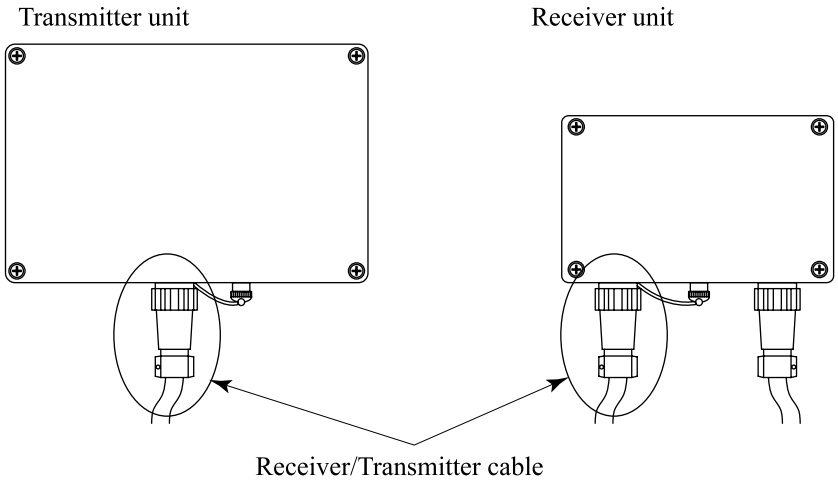


Fig. 4－13

4.10.2 Connecting cable between receiver unit and control unit

The receiver unit and the control unit are connected with the “Cable between control unit and receiver 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.

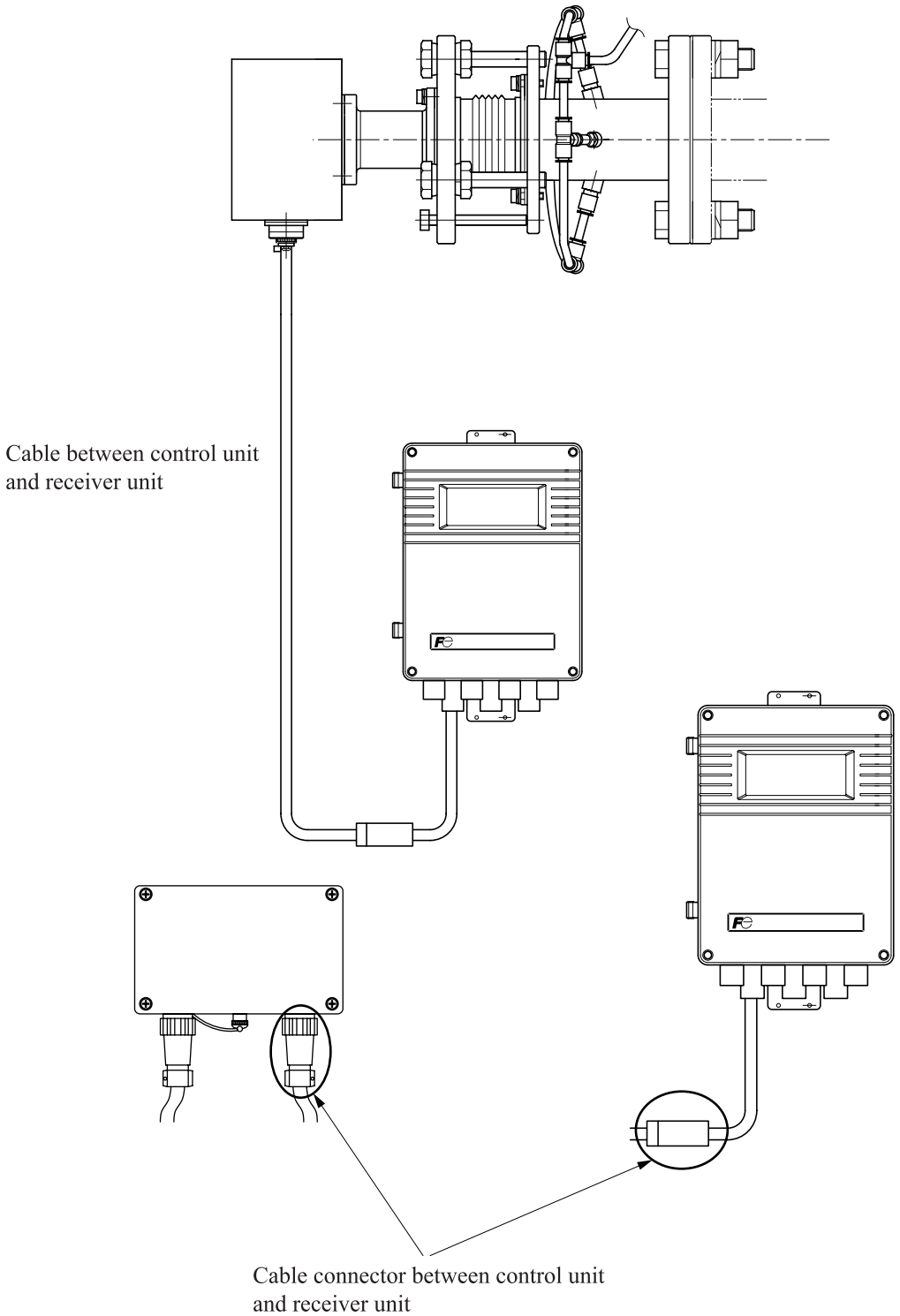


Fig. 4－14

4.11 Adjustment of light quantity

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

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.
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)
EX) 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, adjust the B flange to tilt it in λ form.

(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.

*1) Received light quantity might not increase to its maximum because of the influences from dust and moisture in the stack unit, etc.

4.11.2 When an optional optical axis adjusting tool (laser pointer) is not 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.
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. (*2)

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

(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.

*2) Received light quantity might not increase to its maximum due to the influences from dust and moisture in the stack unit, etc.

4.12 Adjustment of fine adjustment screw (standard accessory)

This screw 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 screw.
When you use the fine adjustment screw, set it to the B 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.

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. 4－4.). 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.

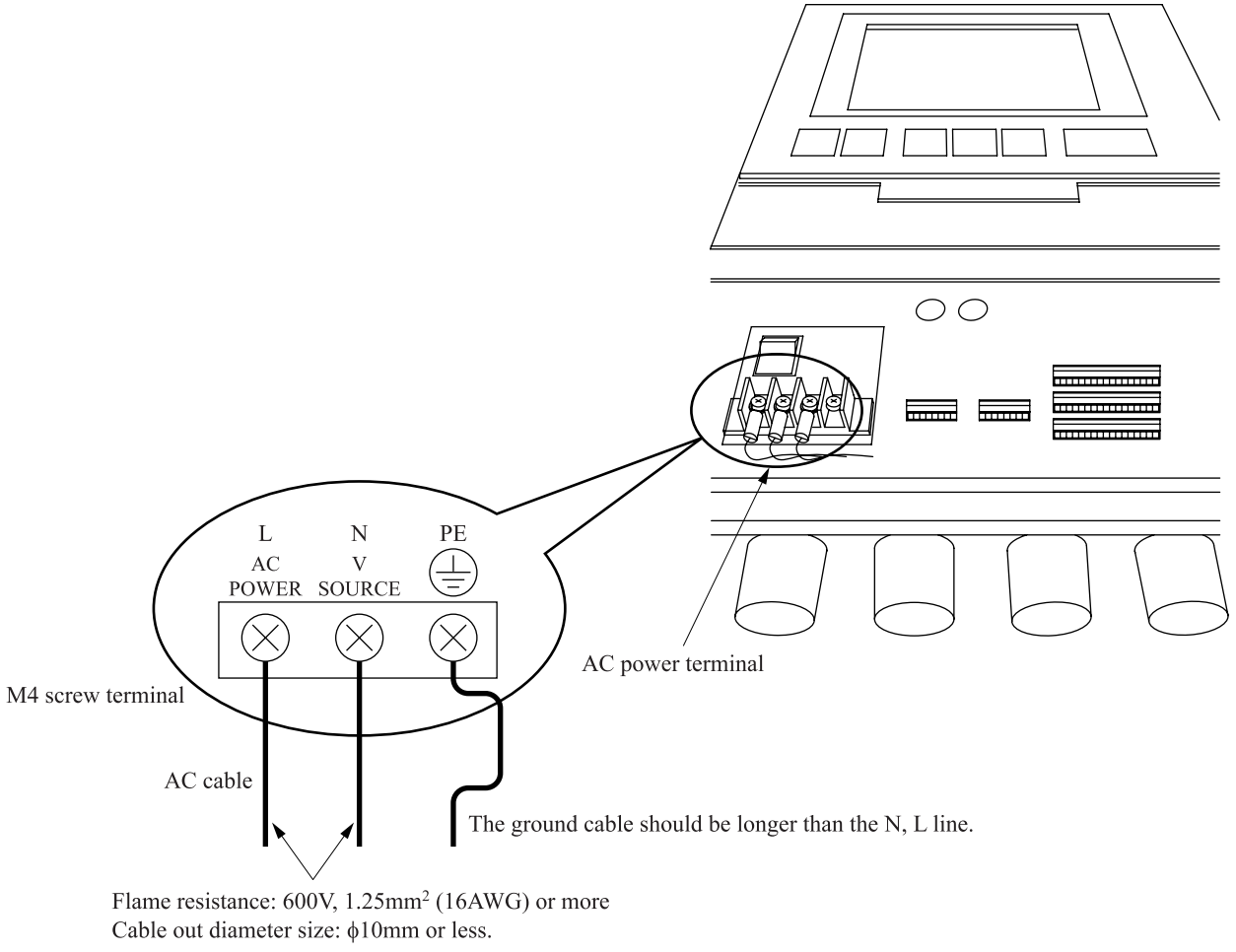


Fig. 4－15

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. 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. 4－5. 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).

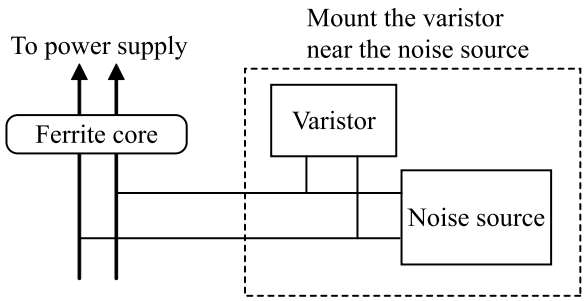


Fig. 4－16

CAUTION
• Wire the outlet for connecting power supply with the wire diameter of 1.25mm or more. • 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. • For connection of the signal connecting cable, use a shielded wire in order to suppress the influences by noise. • Wire the output contact and the contact input connecting cable with the wire diameter of 1.25mm. • After the AC power cable is connected, put a power terminal cover on. • 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. • Power supply and output signal lines should be separated from each other. • As the wire is connected to each terminal, use a solderless terminal (for M4). • 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

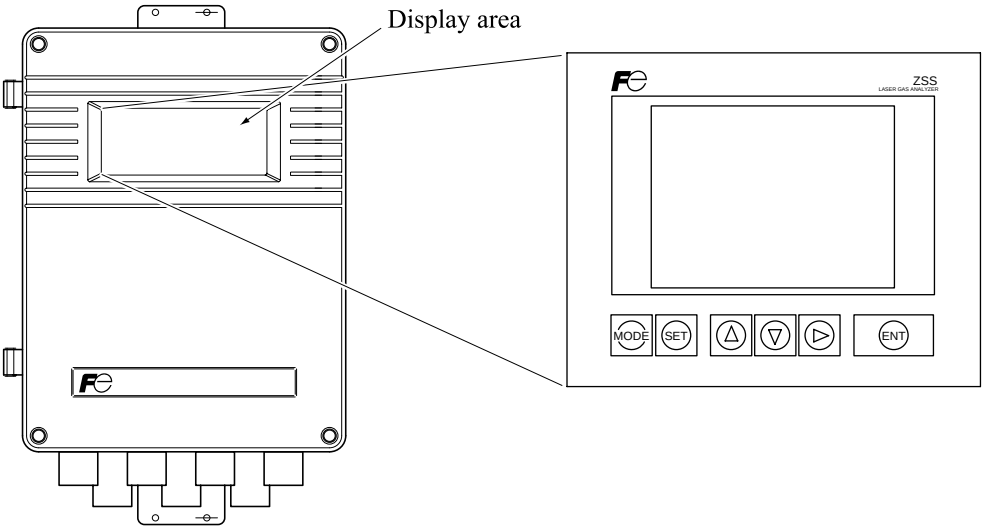
Connect the analog input and output properly, referring to “3.2 Input/output terminal of control unit”. Provide analog output of 4 to 20mA DC, 1 to 5V DC, etc, according to the ordering contents.
Analog input is 4 to 20mA DC. Connect the input signal corresponding to the equipment.

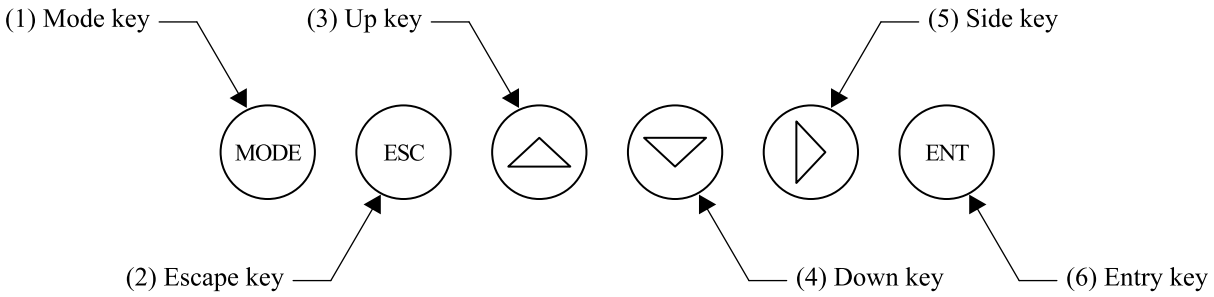
4.13.3 Connecting contact input/output

Connect the contact input and output properly, referring to “3.2 Input/output terminal of control unit”. If it is provided with the separately submitted approved drawing, connect the contact input/output as shown in the drawing.

5. EXPLANATION OF OPERATION PANEL AND SCREEN

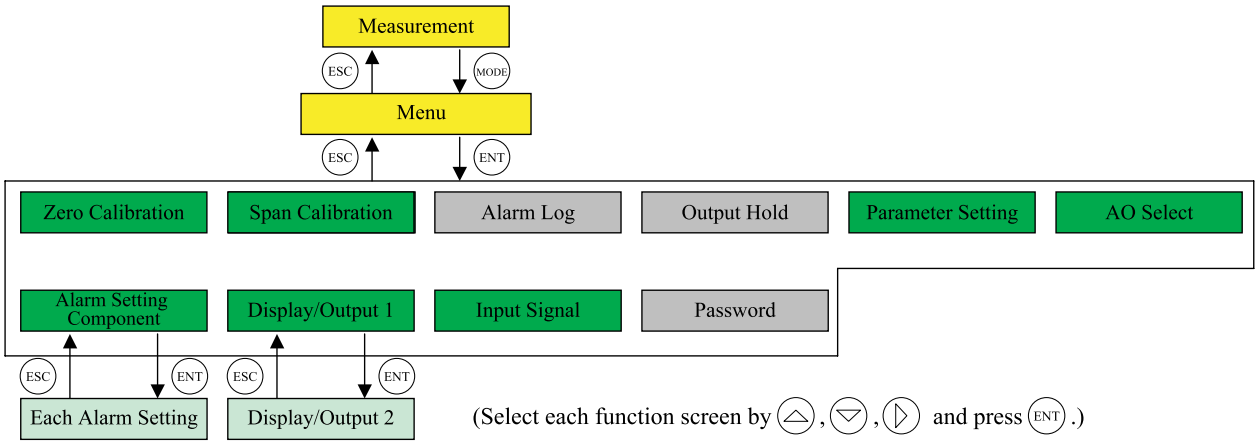
5.1 Name and description of operation panel





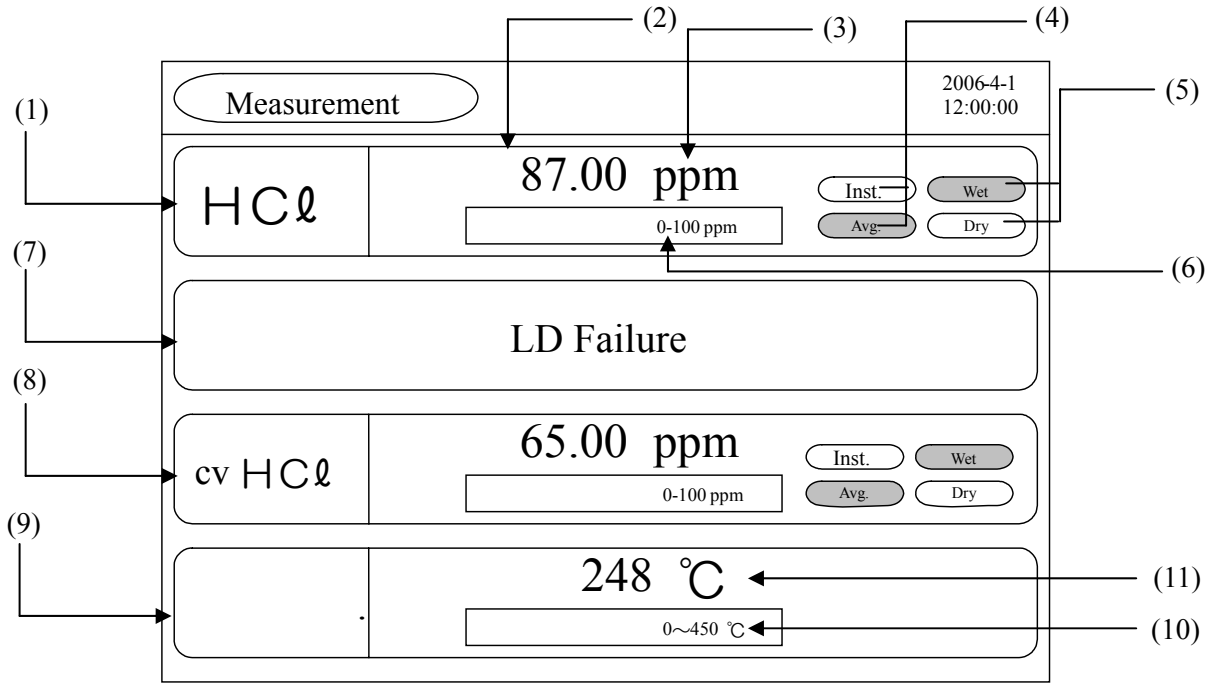
Name	Description of functions	Name	Description of functions
(1) Mode key	Used to display the menu mode.	(4) Down key	Used to move the cursor, change the selected item and decrease numeral value.
(2) Escape key	Used to return to a previous screen or cancel the setting in midway.	(5) Side key	Used to move 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

5.3.1.1 "Measurement" screen (appears when the power is turned ON)



On the MEASURE screen, measurable component, alarm, O_2 conversion measurable component, and external input are displayed beginning at the top. When more than five items are displayed, switch the screen by ▲ key or ▼ key.

5.3.1.2 Name (functions)

(1) Measurable component ····· Displays the gas component to be measured in element symbol.
(2) Concentration value ····· Displays measured value of concentration.
(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.) Refer to "6.6.1 Setting of instantaneous/average value" to set instantaneous/average value, and "6.5.3 Average value reset" to reset average value.
(5) Wet / Dry ····· Indicates whether the displayed concentration is wet base or dry base. Refer to "6.6.2 Wet/dry setting" and "6.7 Analog input" to set wet/dry.
(6) Range display ····· Displays the current full scale range. (The highlighted value is displayed.)
(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 "5.3.1.3 O_2 conversion concentration value".
(9) Analog input ····· Displays the analog input value which was set at the "AO select" screen. External 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 "AO select" 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 "AO select" screen.

5.3.1.3 O_2 conversion concentration value

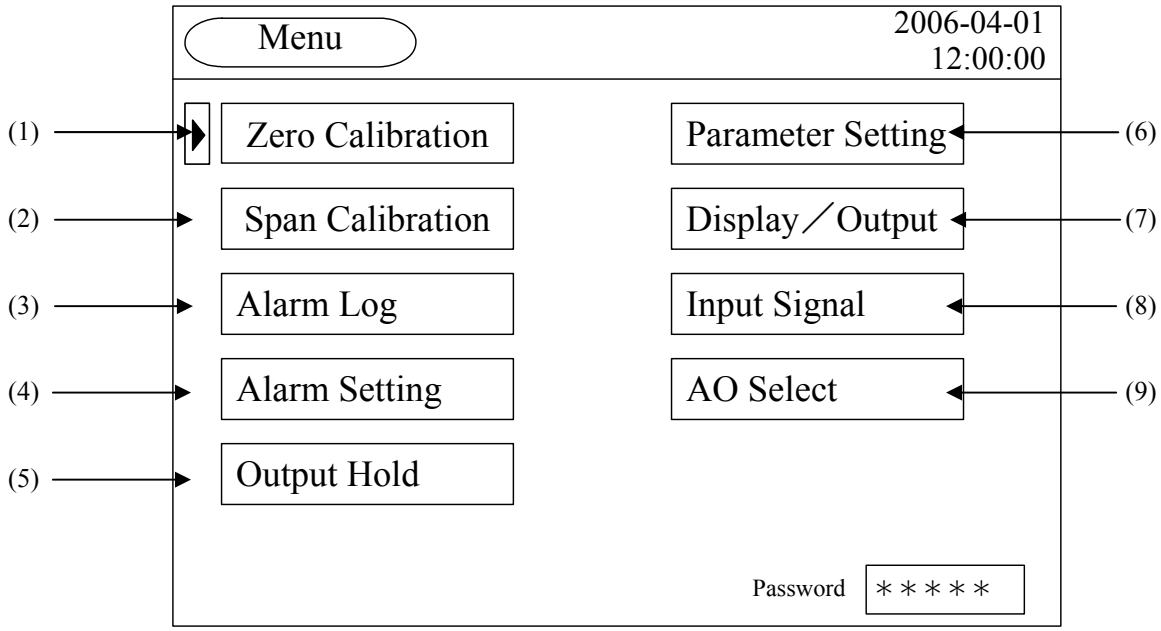
O_2 conversion concentration value is calculated from the following equation of measured component (Cs), instantaneous concentration of O_2 and O_2 correction reference value.

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

- 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 "AO select" 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. After delivery, change is accepted at your expense.

5.3.1.4 “Menu” screen

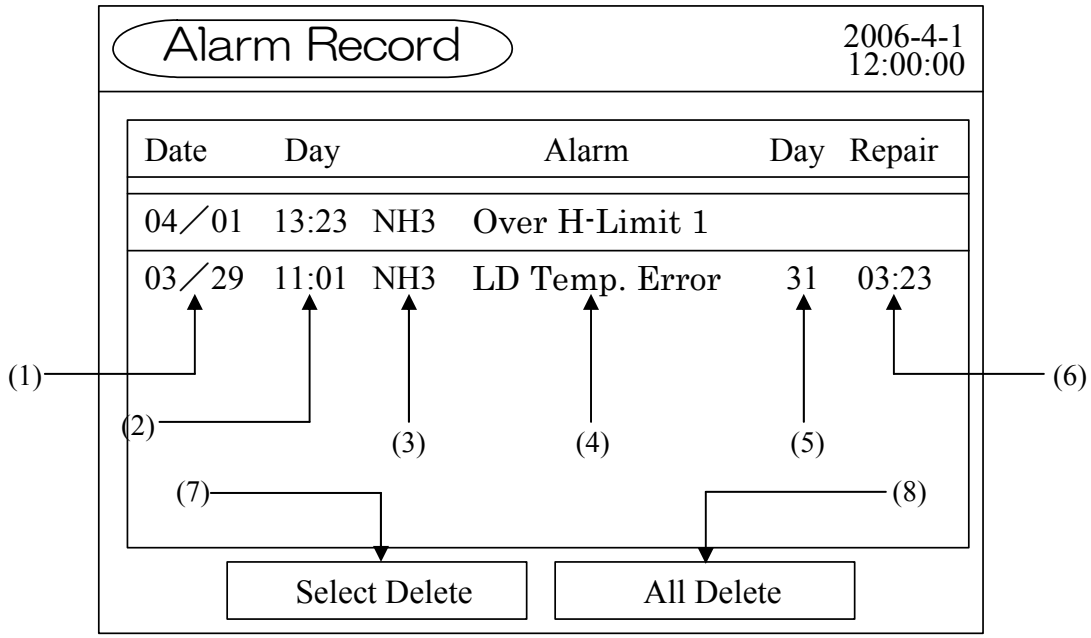


Press the MODE key while the “Measurement” screen is displayed, and the “Menu” screen appears. (It does not appear when pressing the MODE key while other screen is displayed. In that case, Press the ESC key to display the “Measurement” screen, and then press the MODE key.)

5.3.1.5 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 and analog output value to be displayed on the “Measurement” screen such as switching “Instantaneous value / Average value” or “Wet / Dry”.
(8) AO Select····· Used when analog input range or fixed value are set for concentration correction or air purge alarm.
(9) Input Signal····· Used to determine what to output to the analog output terminal.

5.3.1.6 “Alarm Record” screen



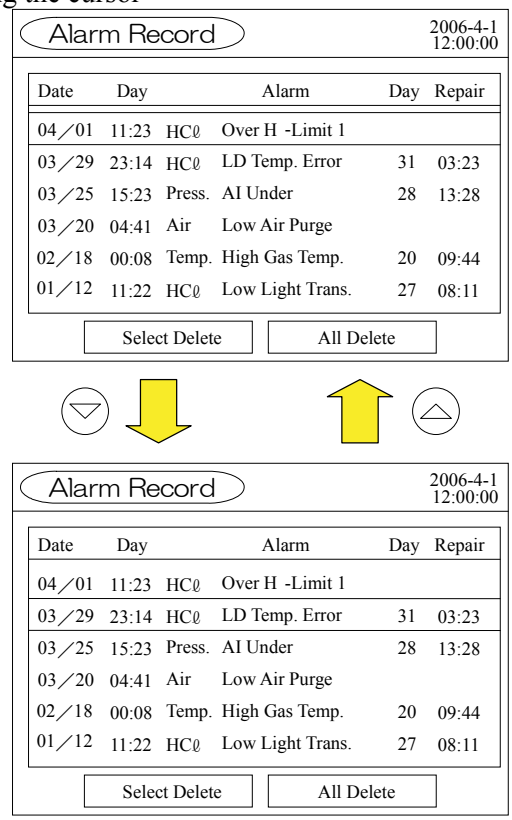
The screen displays the alarm record occurred in the past. The ten newest errors are logged. The oldest error will be deleted one by one every time a new alarm occurs. New errors are displayed from the top on the screen. If the power display supply is turned OFF, the contents in the error log file will be deleted.
It displays the date, time and component when an alarm occurred, alarm contents, recovery date, and recovery time from the left to right.

5.3.1.7 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 external 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.

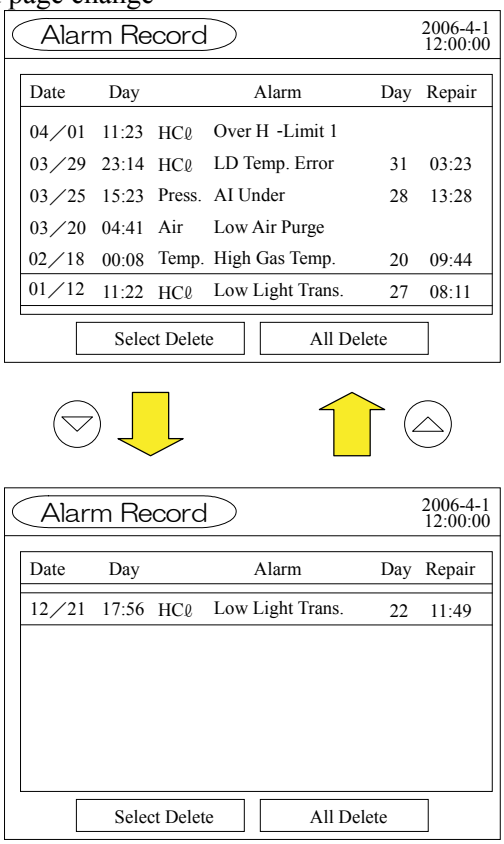
5.3.1.8 Basic Operation

- Moving the cursor



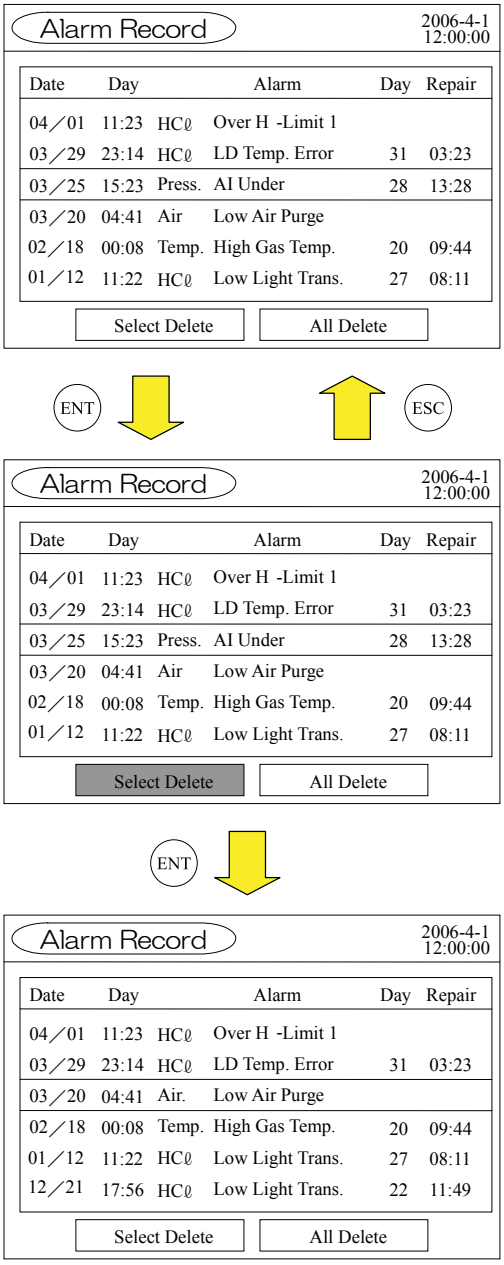
The cursor is moved.

- Record page change



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

- Selected alarm deletion

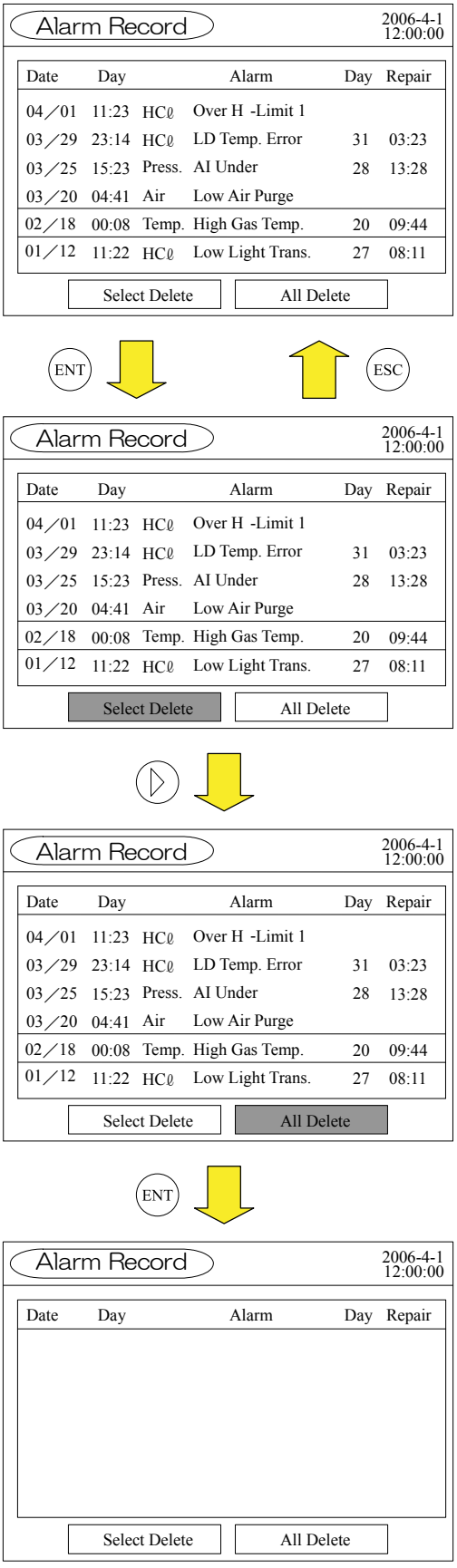


Move the cursor to the alarm to be deleted by pressing the ▲ or the ▼ key.

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

The alarm aligned with the cursor is deleted, 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.

5.3.1.9 Alarm types

Following types of alarm are displayed.

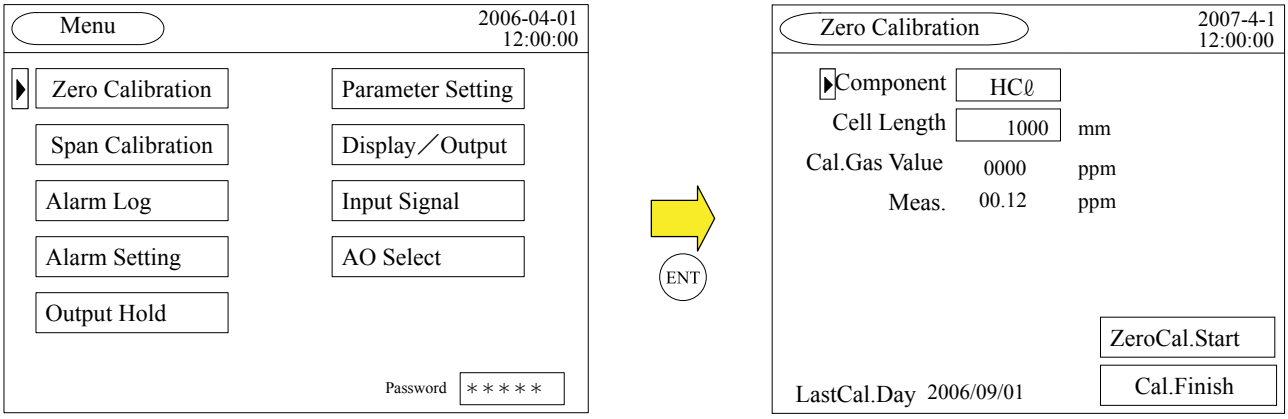
Alarm display	Alarm contents	Probable causes
LD Failure	Laser is faulty	• Failure caused by laser durability
LD Temp. Error	Peltier which is cooling the laser cannot control the set temperature.	• Peltier failure • Thermocouple failure • The receiver unit and the transmitter unit are used at an installation location exceeding the set range. • The unit is used in an environment where gas temperature is beyond the specification.
Low Light Trans.	Light transmission required for the measurement cannot be obtained.	• Light transmission is insufficient in an environment with high dust. • Light transmission is insufficient in an environment with high water vapor. • Contamination of window and condensation are caused by insufficient air purge. • Optical path is blocked due to dust. • Optical axis is deflected due to vibration. • Optical axis is deflected due to distortion of a stack. • Optical axis is deflected due to external faults.
Connection Error	Communication between receiver unit and transmitter unit does not occur properly.	• Break of wiring • Wrong wiring of RS-432 terminal • Poor contacts of the connector unit • CPU board failure • 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. • The value set to analog input on the “AO Select” screen is not correct.
Out of Range	It is reported when exceeded gas pressure is detected.	• Actual gas pressure is outside the specification range. • The value of the input range set on the “AO Select” screen is not correct.
AI Under	Input channel on the “AO Select” screen.	• AI terminal is not connected to the external input device when channel setting is set on the “AO Select” screen. • AI terminal and setting channel do not match. • Input is not 4 to 20mA DC.
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. • The unit is used in an environment where gas temperature is beyond the specification. • Insufficient air purge causes rise in temperature. • The distance between the Receiver / Transmitter unit and the stack is not maintained sufficiently.

Alarm display	Alarm contents	Probable causes
Low Air Purge	It is reported when purge pressure lower than the value set as alarms on the “AO Select” screen.	• Air purge pressure is lower than alarm setting or the analyzer is not purged. • AI terminal is not connected to the external input device when the air purge pressure is set to channel setting on the “AO Select” 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. • The actual path length is longer than the measured path length set at the “Parameter Setting” screen. • 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. • The actual path length is longer than the measured path length set at the “Parameter Setting” screen. • 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. • The actual path length is longer than the measured path length set at the “Parameter Setting” screen. • 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. • The actual path length is longer than the measured path length set at the “Parameter Setting” screen. • 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.

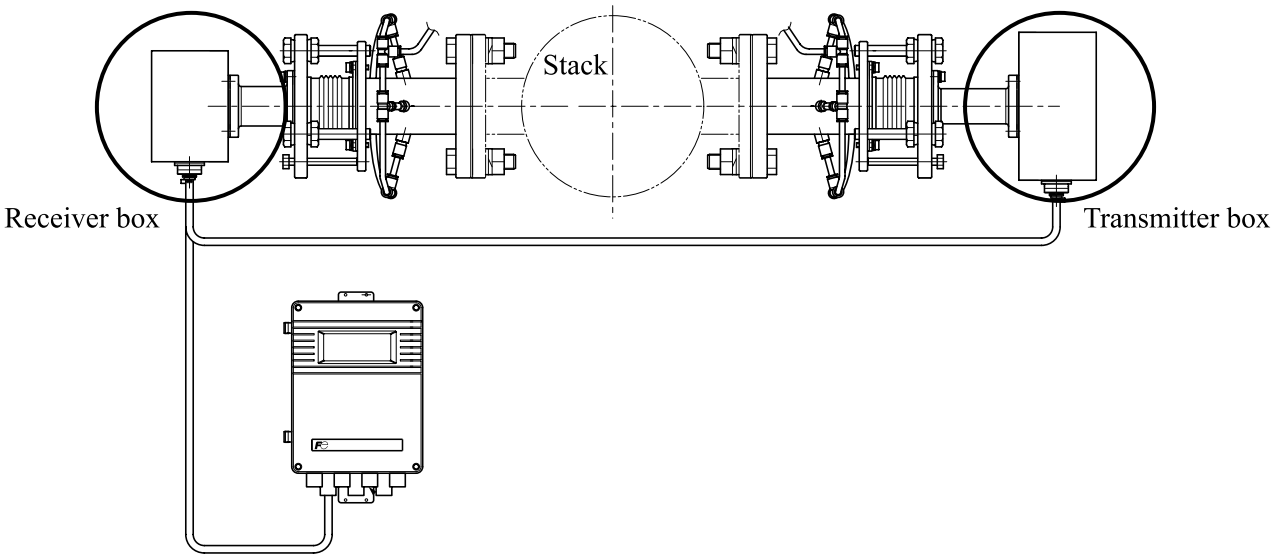


6.1.1 Preparation

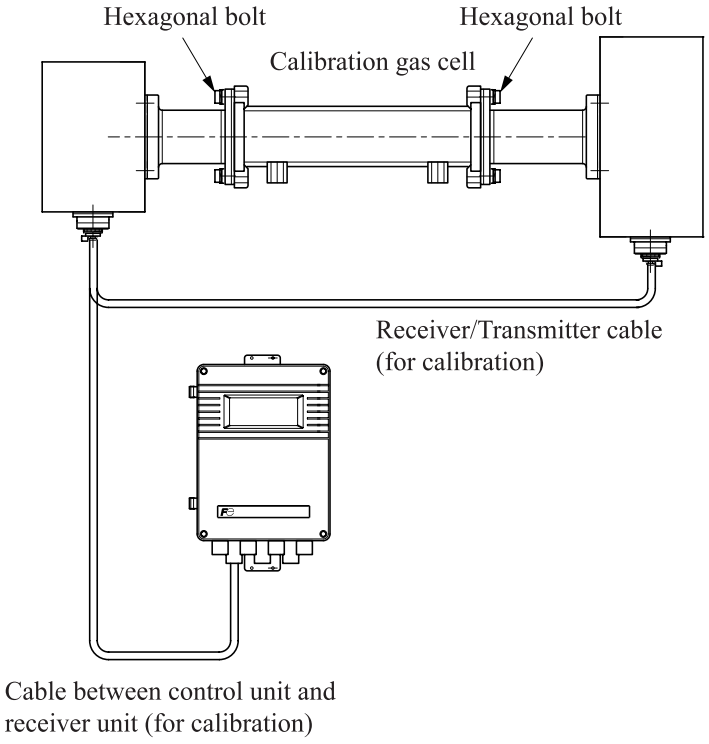
⚠ CAUTION	• The laser beam is the invisible infrared light. Do not watch the laser beam directly or scattering light. • Do not watch the laser beam directly with the optical measuring device. Otherwise, it may cause serious damage to your eyes.

Parts name	Quantity	Remarks
Calibration gas cell	1	To be ordered separately
Receiver/transmitter cable (for calibration)	1	To be ordered separately
Receiver/transmitter cable	1	To be ordered separately
Zero gas (N_2)	1	To be ordered separately
Pressure adjuster (regulator)	1	To be ordered separately
Pipe (Teflon tube, etc)	Several m	ϕ10 × 8 or more
Joint (Rc1/4)	2	For calibration gas cell
Flow meter	1	2L/min or more
Thermometer	1	4 to 20mA output, for temperature correction
Pressure gauge	1	4 to 20mA output, for pressure correction
Others (joint, tools, etc)		

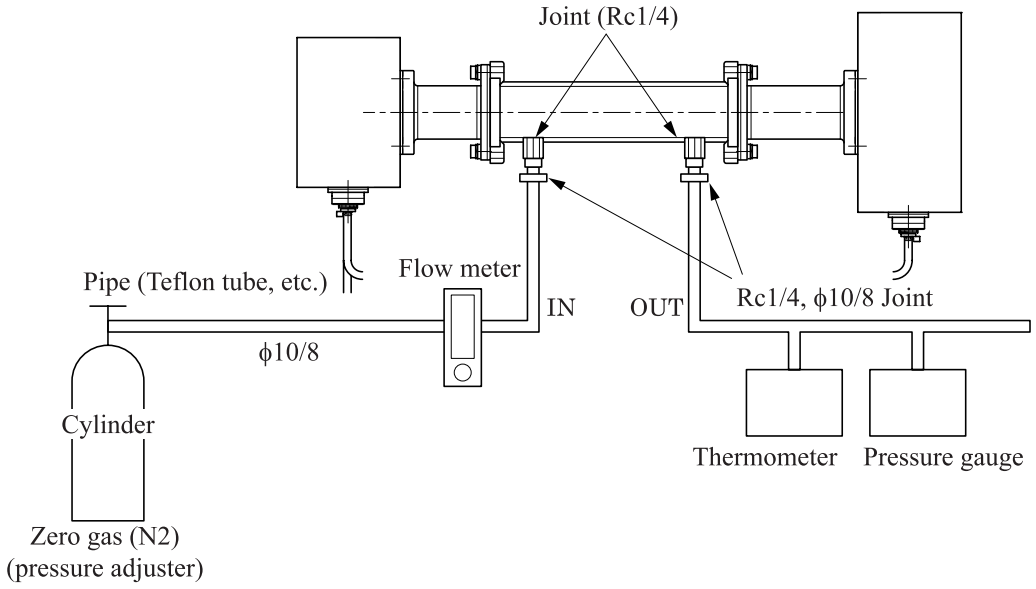
(1) Turn OFF the power.
(2) Remove the receiver box and the transmitter box using the hexagonal wrench. Perform removing when the provided equipment is stopped. Never remove boxes while the equipment is operated. Otherwise, hot temperature gas may blow out.



(3) Mount the removed receiver box and transmitter box using the hexagonal bolt.
(4) Provide the receiver/transmitter cable (for calibration) or the cable between control unit and receiver unit (for calibration).
(5) Wiring should be performed as following figure.

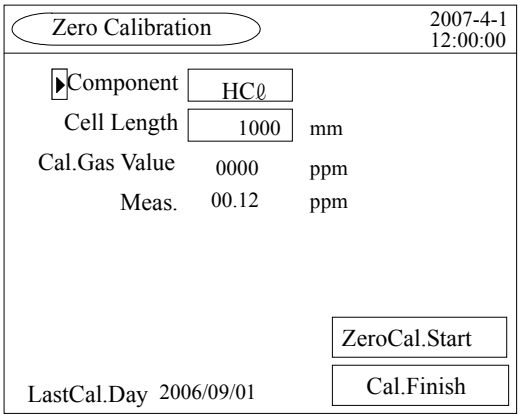


(6) Mount the Rc1/4 joint to the calibration gas cell, and connect one side to the standard gas cylinder (N_2).
(7) When the pipe is connected as shown below, allow the gas to flow.
(8) Flow of sampling gas should be 1.5L/min.
(9) When you mount thermometer and pressure gauge as shown below, connect output of 4 to 20mA DC to analog input terminal of the control unit, referring to "3.2 Input/output terminal of control unit". Also, set analog input, referring to "6.7.1 Setting of 4 to 20mA DC Input (in case of gas temperature)".



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 1.5L/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.

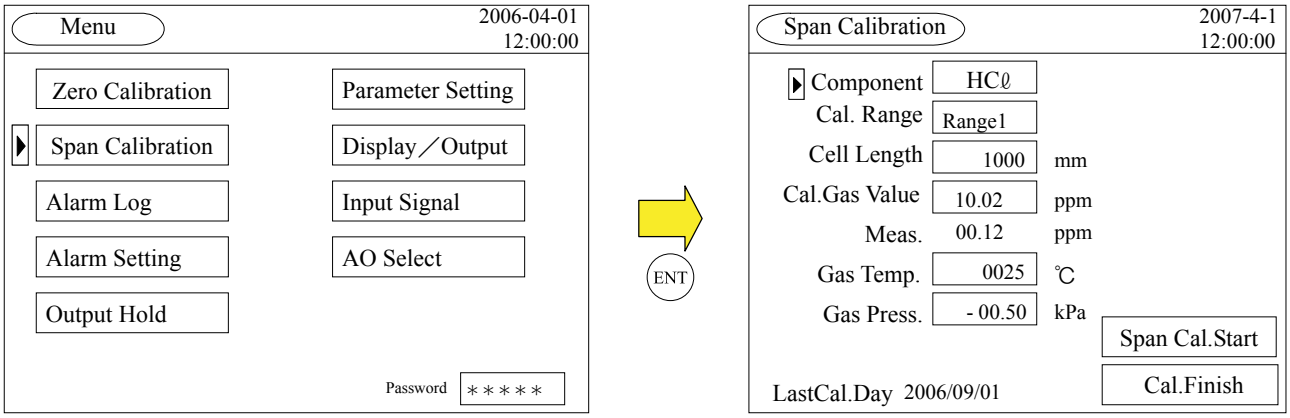


(6) Point the ▶ to "Cell Length", and press the ▷ key.
(7) Enter the length of calibration gas cell. Standard cell length is 1000mm. (When the range is low concentration, the length of calibration gas cell can be either 500mm or 200mm.)
(8) See the "Meas." and make sure if the indication value is stable.
(9) Warm up for about 90 minutes if the analyzer was shutdown for a long time.
(10) Point the ▶ to "ZeroCal.Start", and press the ENT key to start the zero calibration.

(11) “ZeroCal.Start” blinks for about 30 seconds.
(12) When the calibration is completed, the cursor moves to “Cal.Finish”, and the current date is displayed at “LastCal.Day”.

6.2 Span calibration

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



6.2.1 Preparation

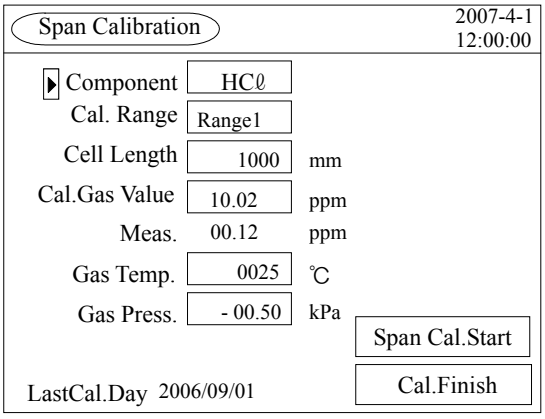
⚠ DANGER	If toxic fume, corrosive gas or inert gas is used as calibration gas, be sure that the position of air ventilation or exhaust port is suitable. Oth-erwise you may inhale exhaust gas. Suffocation, brain disorder, circulatory deficit, or contraction of the breathing system may occur, resulting in death.
⚠ CAUTION	• The laser beam is the invisible infrared light. Do not watch the laser beam directly or scattering light. • 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. For HCl gas or NH_3 gas, use the dedicated regulator. Do not use the regulator that has been used for other gases. Otherwise, the indication value may become unstable, zero may be displayed for longer time after HCl gas is flowed, and it may take longer to be stabilized.
(3) When using toxic fume, pay attention to the position of the exhaust port in order to avoid inhaling of the exhaust gas. For components with high adsorptive property such as HCl gas, piping should be made short and thick.
(4) When pipe connection and exhaust are completed, allow the gas to flow.
(5) Flow of sampling gas should be 1.5L/min.

6.2.2 Span calibration

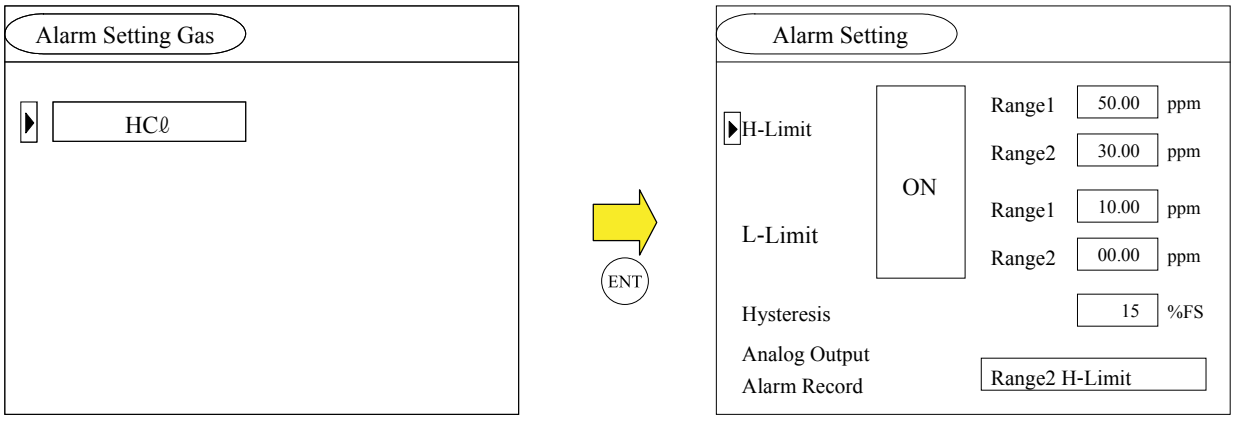
(1) If the power is OFF, turn it ON.
(2) Check if the flow of span gas is approximately 1.5L/min.
(3) Display the "Span Calibration" screen.
(4) Point the ▶ to "Component", and press the ▷ key.
(5) Press the △ key or the ▽ key to select the measured gas component to be span-calibrated. When there is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



(6) When there are two ranges, select either "Range1" or "Range2".
(7) Point the ▶ to "Cell Length", and press the ▷ key.
(8) 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.)
(9) Point the ▶ to "Cal.Gas Value", and press the ▷ key.
(10) Enter the concentration value inscribed on the gas cylinder.
(11) Point the ▶ to "Gas Temp.", and press the ▷ key.
(12) 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.
(13) Enter the value in "Gas Press." in the same manner of "Gas Temp".
(14) 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.
(15) Point the ▶ to "Span Cal.Start" and press the ENT key to start span calibration.
(16) "Span Cal.Start" blinks for about 30 seconds.
(17) When the calibration is completed, the cursor moves to "Cal.Finish", and the current date is displayed at "LastCal.Day".
(18) When there are two ranges, replace the gas cylinder, and repeat the procedure in (6) to (17).
(19) After span calibration is completed, change gas in the gas cylinder to zero gas, and feed it for about 20 minutes.

6.3 Alarm setting

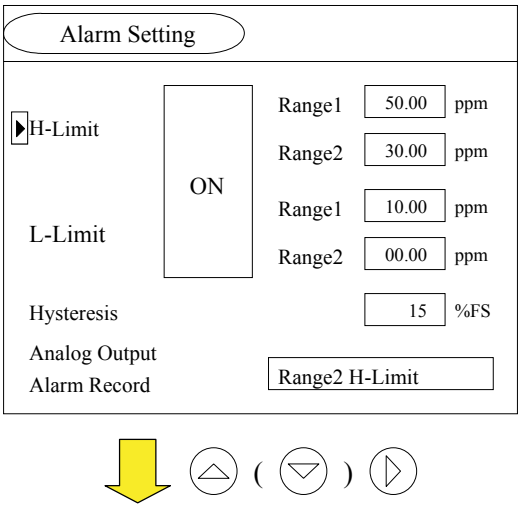
Select “Alarm Setting” from the “Menu” screen, and press the ENT key. On the “Alarm Setting Gas” screen, select the measurable component by moving the ▶ with the △ key and the ▽ key.
Press the ENT key after measurable component is selected. “Alarm Setting” screen is displayed.



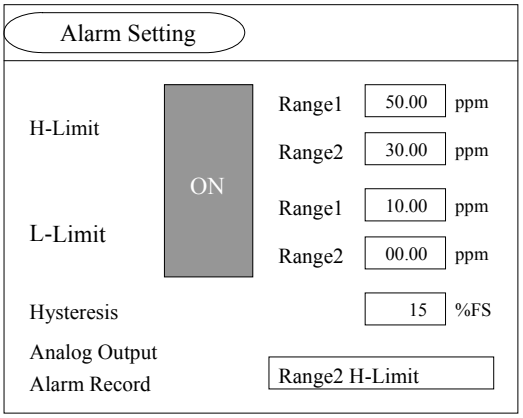
6.3.1 Alarm value ON/OFF

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

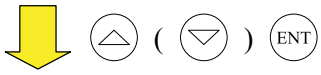
> Note
> When ON is selected, “High/Low limit setting”, “Analog Output / Alarm Record” cannot be set.

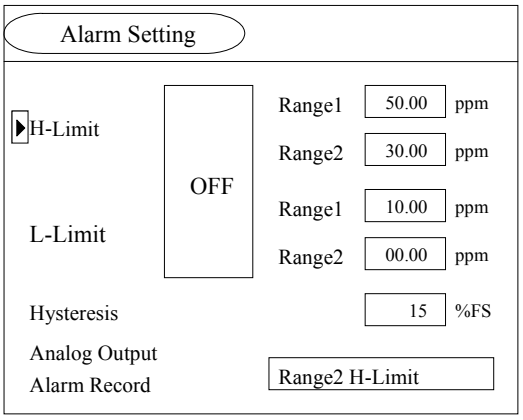


Point the ▶ to “H-Limit” or “L-Limit” by the △ key and the ▽ key, and press the ▷ key.



Select “ON” or “OFF” by the ▲ key or the ▼ key, and press the ▶ key.



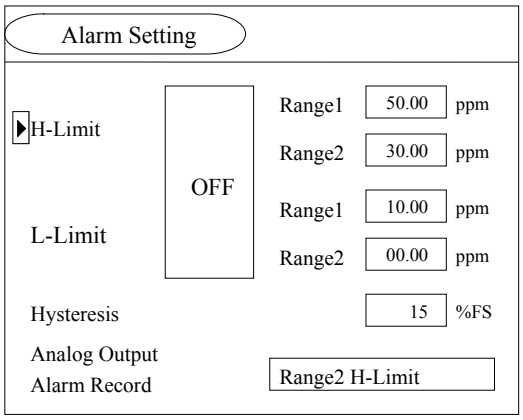


When “OFF” is selected, the cursor returns to the “H-Limit”. When “ON” is selected, the ▶ moves to “Range1” of H-Limit or L-Limit, and set the alarm value. For setting of the alarm values, refer to “6.3.2 Setting of alarm value”.

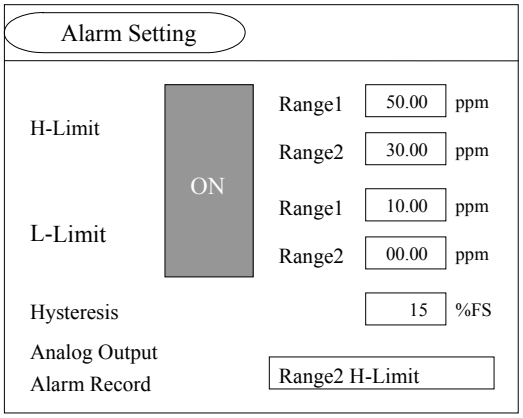
6.3.2 Setting of alarm value

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.

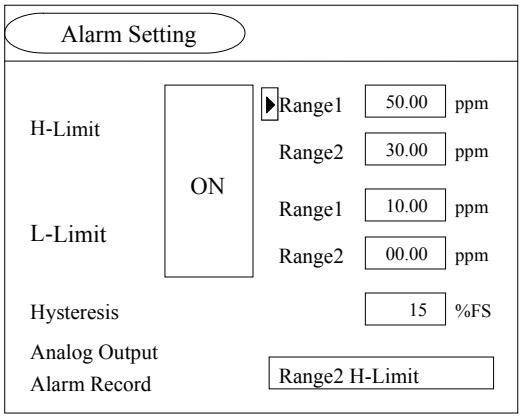
> Note
>
> Point the ▶ to “H-Limit” to change the setting of H-Limit value, and point “L-Limit” to change the setting of the L-Limit value.



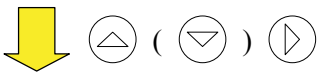
Point the ▶ to “H-Limit” to set the H-limit value, and point “L-Limit” to set the L-Limit value, and then press the ▶ key.

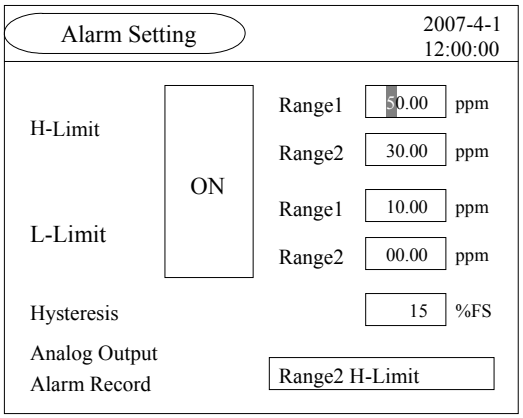


Select “ON” by the ▲ key or the ▼ key, and press the ENT key.

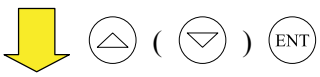


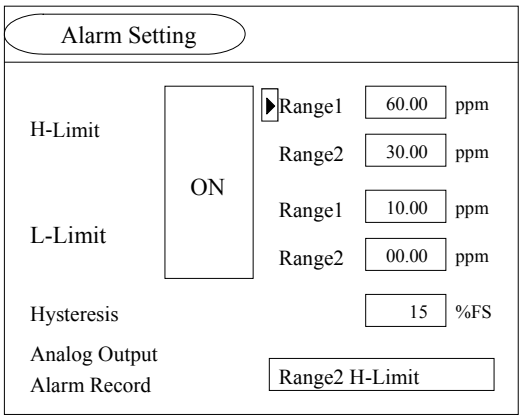
When there are two ranges, select the range by the ▲ key or the ▼ key, and press the ▶ key.





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

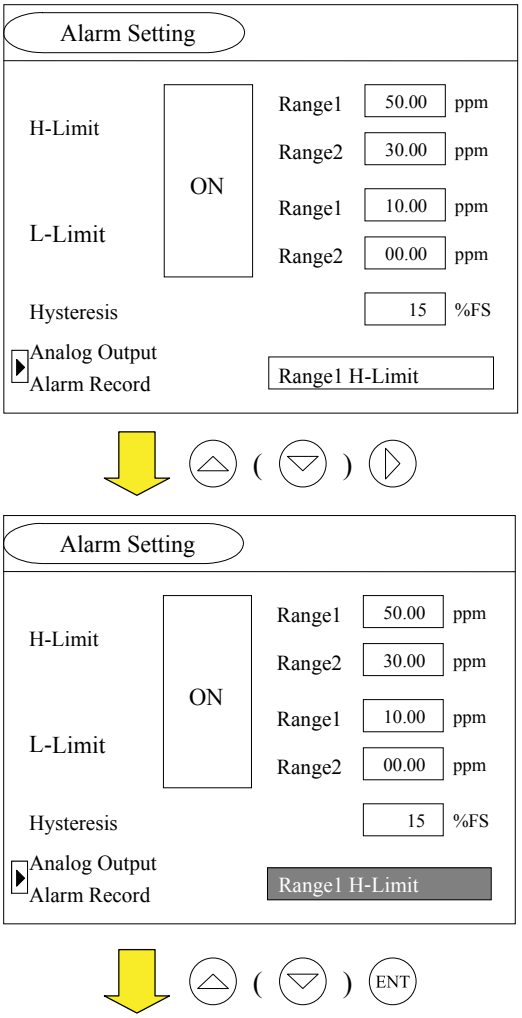
Set the value so that H-Limit is larger than L-Limit, and that (H-Limit – L-Limit) is larger than hysteresis width.

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.

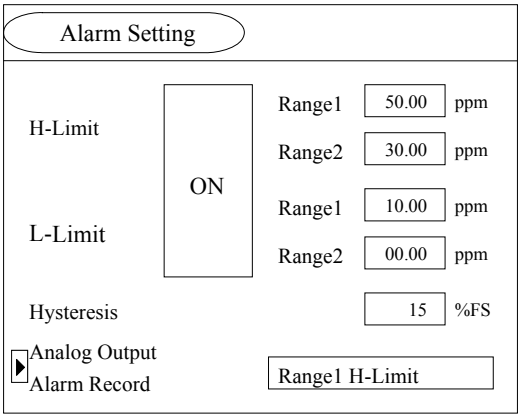
Note

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 outside the range of High/Low limit cannot be performed for 10 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.

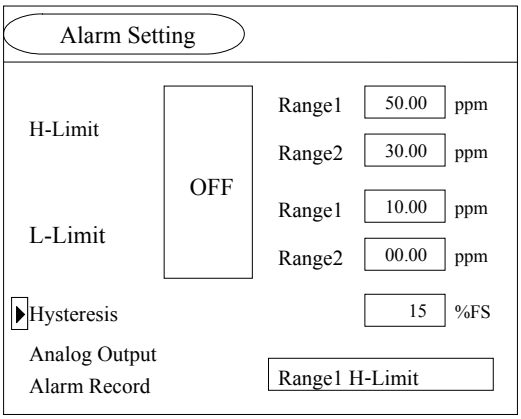


Explanation of alarm range

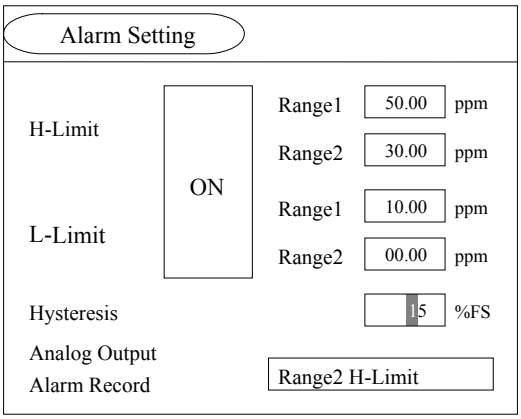
Range1 H-Limit : Alarm output is provided only when a value exceeds the Range1 H-Limit.
Range1 L-Limit : Alarm output is provided only when a value is lower than Range1 L-Limit.
Range1 H/L-Limit : Alarm output is provided when a value exceeds the Range1 H-Limit or it is lower than Range1 L-Limit.
Follow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

6.3.4 Hysteresis setting

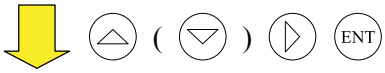
Set the hysteresis to prevent possible chattering of the alarm output near the alarm setting value.

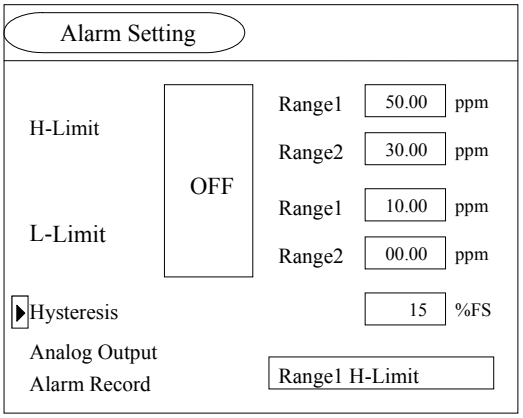


Point the ▶ to "Hysteresis" by the △ key or the ▽ key, and press the ▷ key.



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.





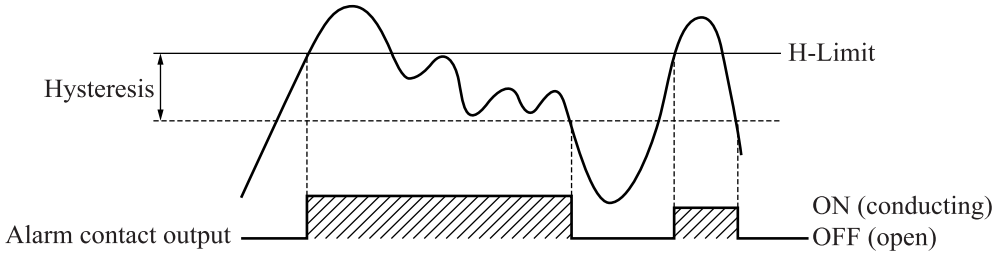
Setting Range

0 to 20% FS

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

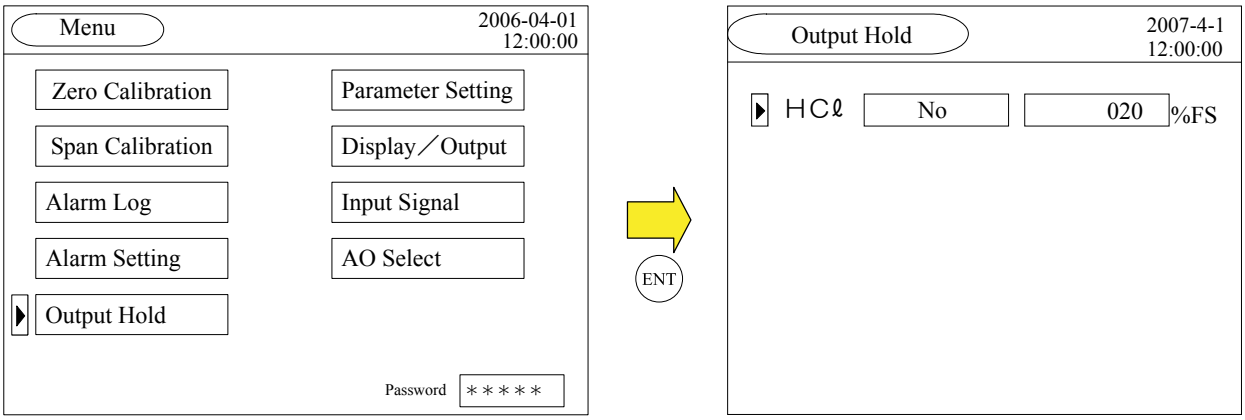
Hysteresis mode (in case of H-Limit)

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.



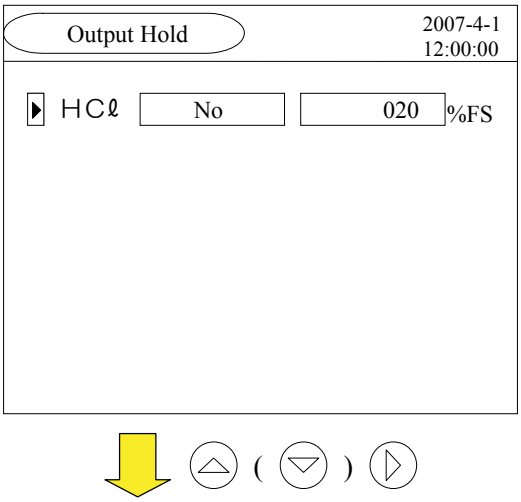
6.4 Output hold

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

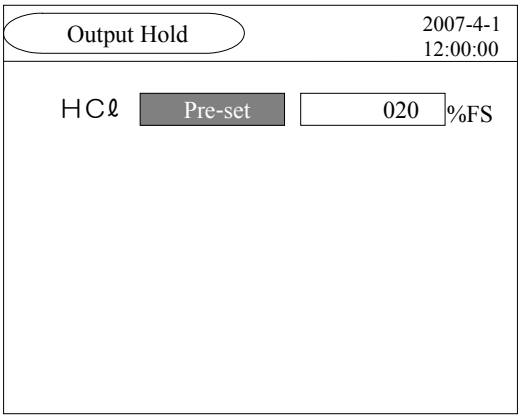


6.4.1 Output hold

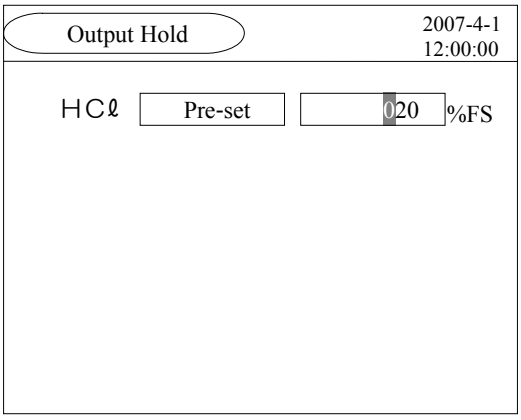
Set output hold to “Last Meas.” or “Pre-set” to hold analog output. (Indication value on the screen is not held.)



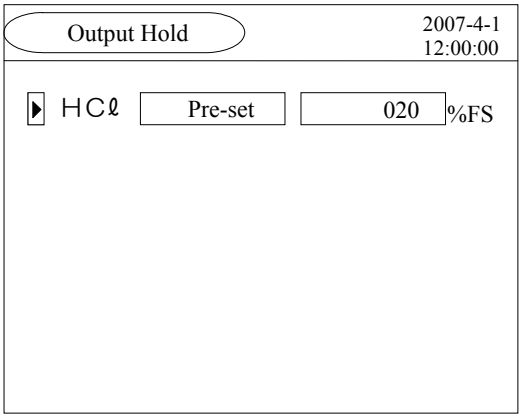
Point the ▶ to the measurable component to hold output by the △ key or the ▽ key, and press the ▷ key.



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



When “No” or “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. Previous set value is kept held even if the range is switched during the hold.

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. Even if O_2 analog input is entered, it holds the value calculated by O_2 value which is determined by the (ENT) key.

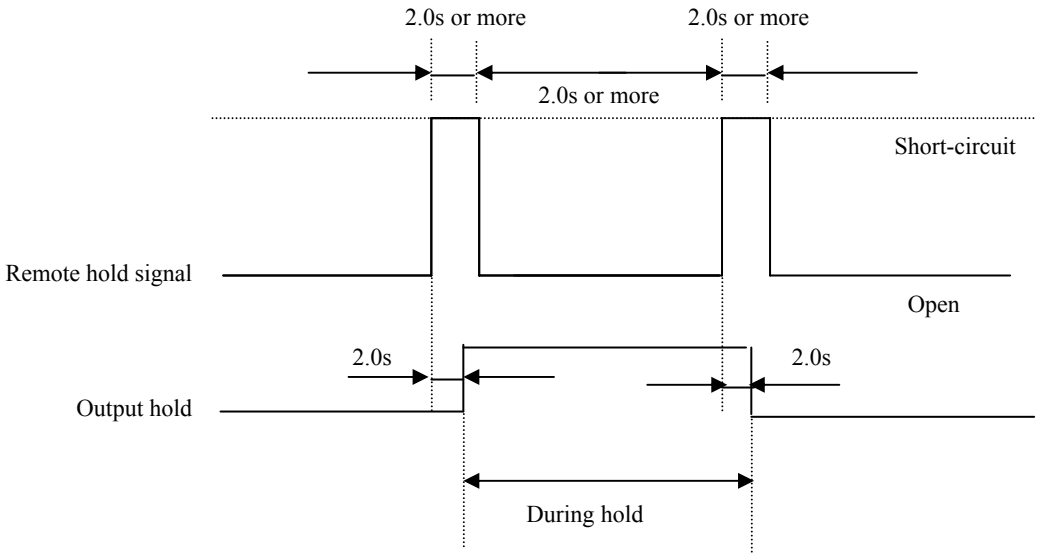
"Pre-set" : Holds the value calculated by %FS value of the currently enabled range and O_2 value. The O_2 value is the same as the last value.

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, pulse interval: 2.0 sec or more) to a remote hold input terminal to hold analog output. Applying it again cancels the hold.

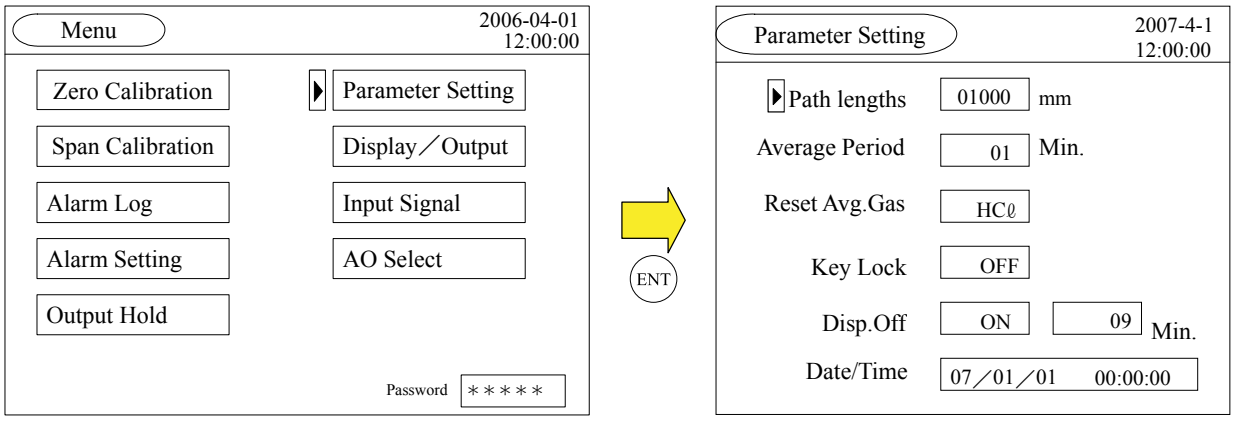
6.5 Parameter setting

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.

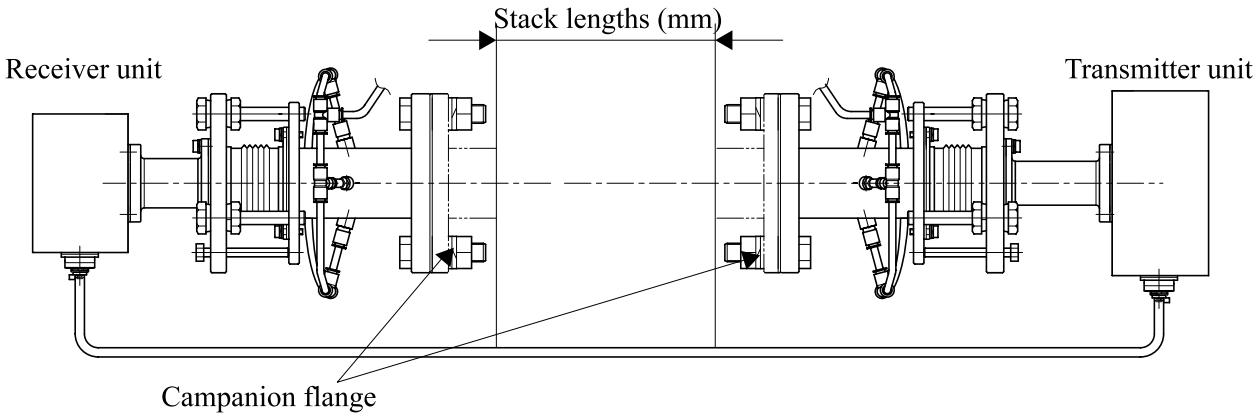


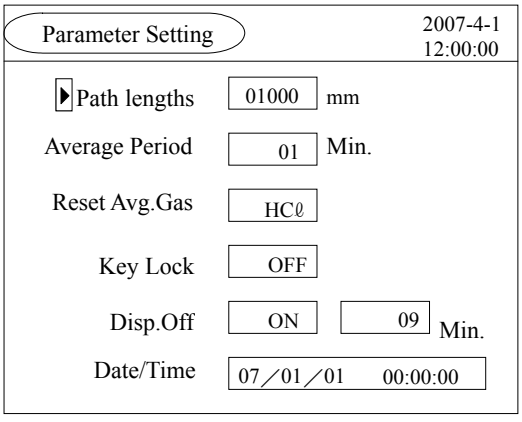
6.5.1 Setting of stack lengths

Enter the lengths of the stack (inner diameter) 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 500 to 15000mm.)

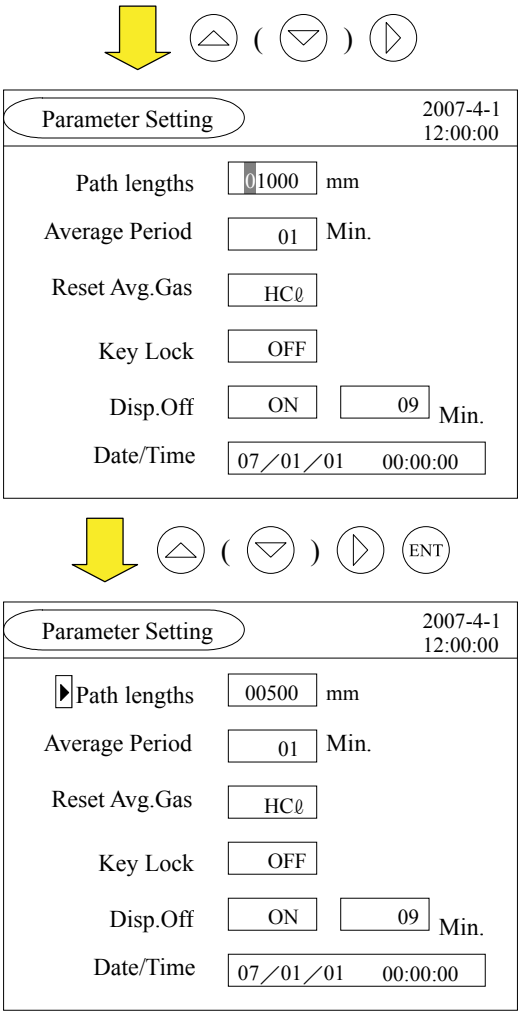
Explanation of concentration output

The analyzer is calculated and output as a standard of the 1m of stack lengths (optical path lengths). Based on Lambert-Beer Law, 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.



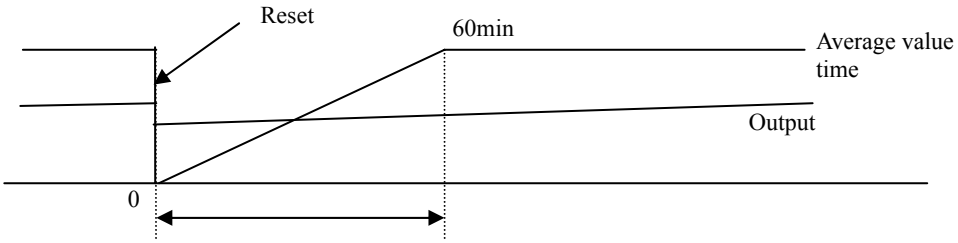
Change the numeric value by the ▲ key or the ▼ key, and move the digits by the ▶ key. Press the ENT key to validate the set input value.

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

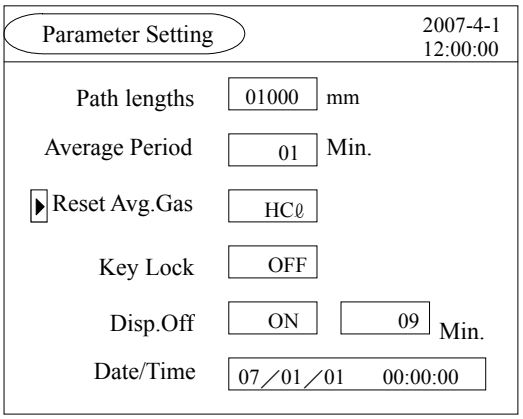
When the moving average time is set to 60 minutes



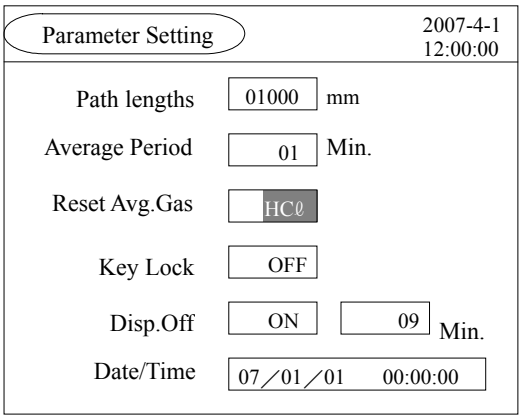
Sampling cycle is once every 1 second.
After reset, output the average value for 60 minutes. Therefore, it takes 60 minutes to obtain the average value which has been set.

6.5.3 Average value reset

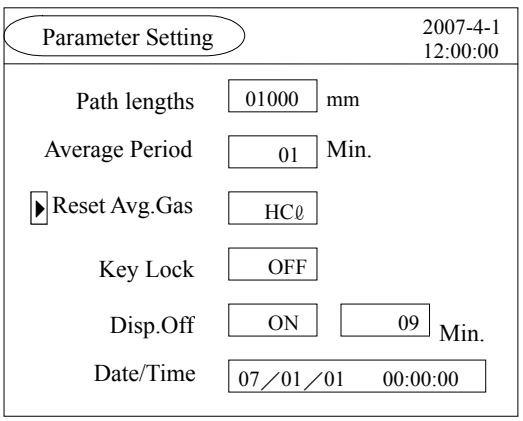
When the indication value and output value are set to the average value in the "6.6.1 Setting of instantaneous/average value", reset the average value to clear the measurement value and the O_2 conversion value. When the indication value and the output value are set to the instantaneous value, nothing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



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

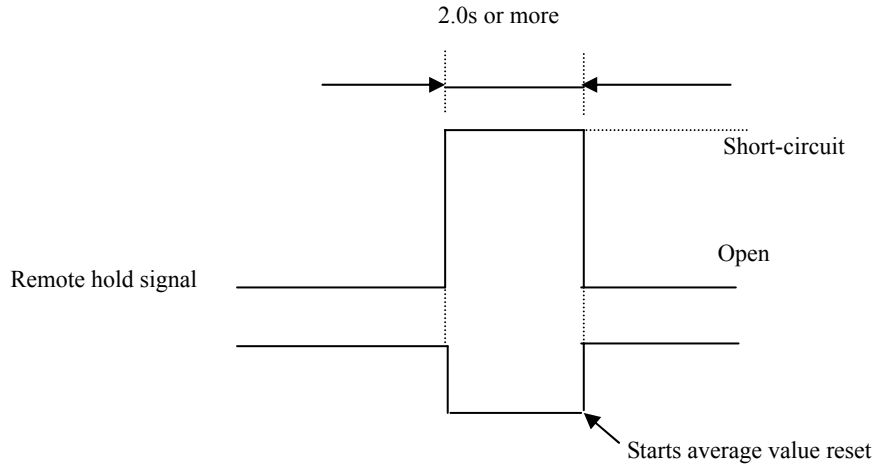


Select the measurable component to be reset by the △ or the ▽ key. When there is only one component, the component is fixed.
Press the ENT key to reset the average value.



Remote average value reset (DI1 terminal)

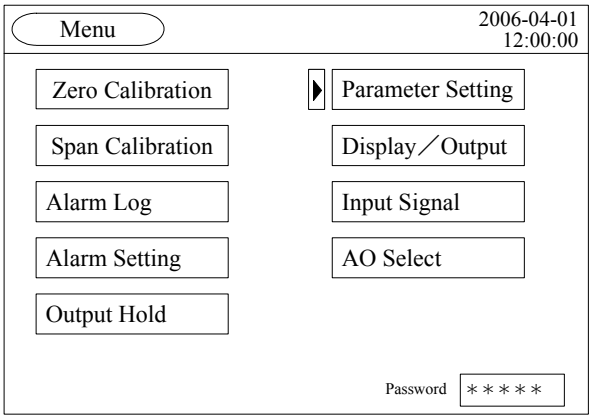
Apply rectangular waveform voltage (pulse width: 2.0 sec or more, pulse interval: 2.0 sec or more) to the input terminal of remote average value reset (DI1 terminal, option) to reset the average value.



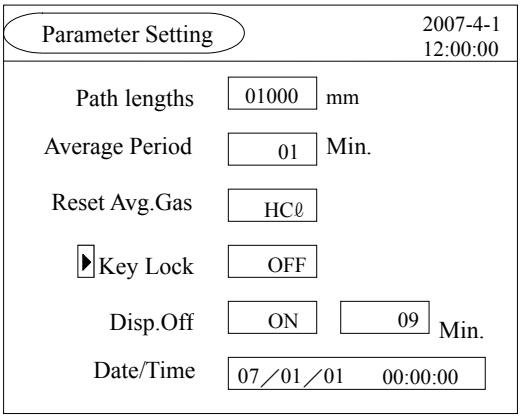
Reset is kept during short-circuit.
When switching the action from short-circuiting to opening, average value action starts.

6.5.4 Key lock

When key lock is ON, any key operation except the key lock OFF cannot be set.



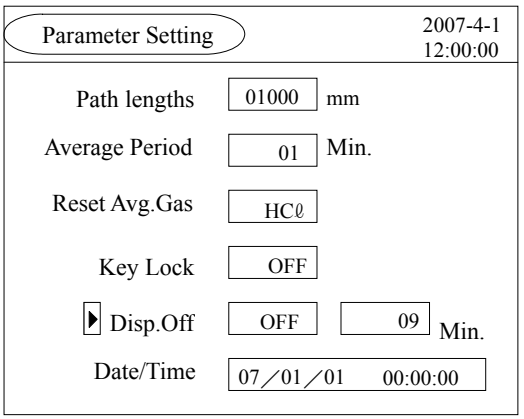
When the key lock is turned ON, any screens except “Parameter Setting” cannot be displayed, even if the item is selected and the (ENT) key is pressed on the “Menu” screen.



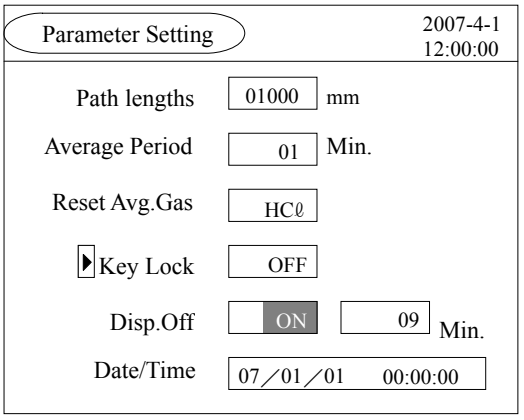
Any items except “Key Lock” cannot be validated, even if the item is selected and the (▷) key is pressed on the “Parameter Setting” screen.

6.5.5 Setting of backlight OFF

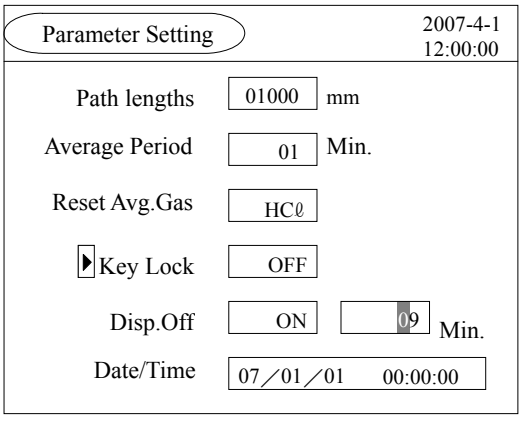
Automatic OFF setting of the backlight of the LCD unit can be made. If the specified time elapses since the measurement screen has been resumed, the backlight is automatically turned off.
Press any key to reset backlight OFF.
Setting range of the light off time is from 1 to 60 minutes.
When you use the analyzer for a long time while the backlight is set to “OFF”, the durability of the LCD (liquid crystal display) shortens, and you may have to replace the LCD. Set the backlight to “ON” if possible.



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



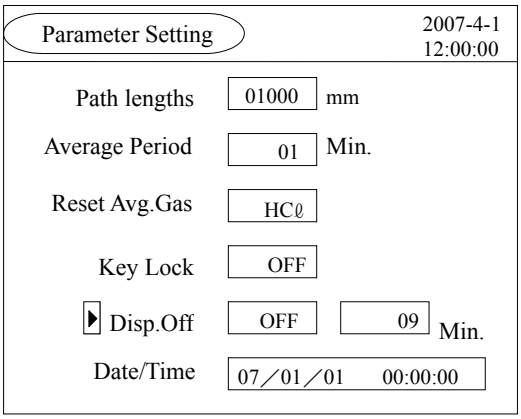
Turn it to “ON” by the △ or the ▽ key, and press the ENT key.



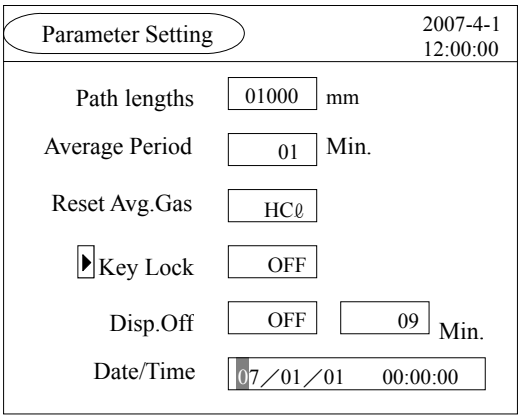
Change the numeric value by the △ key or the ▽ key, and move the digits by the ▷ key. Press the ENT key to validate the set input value.

6.5.6 Time setting

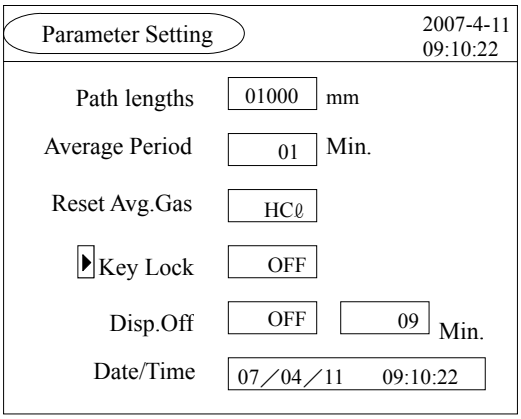
Time setting can be made.



Point the ▶ to "Date/Time" by the △ 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.



6.6 Display/AO setting

Make a setting of “Inst./Avg.” or “Wet/Dry” which displays the measurement value or its external output value displayed on the “Measurement” screen. In case of 2 range specification, range setting is performed.

Explanation of setting items

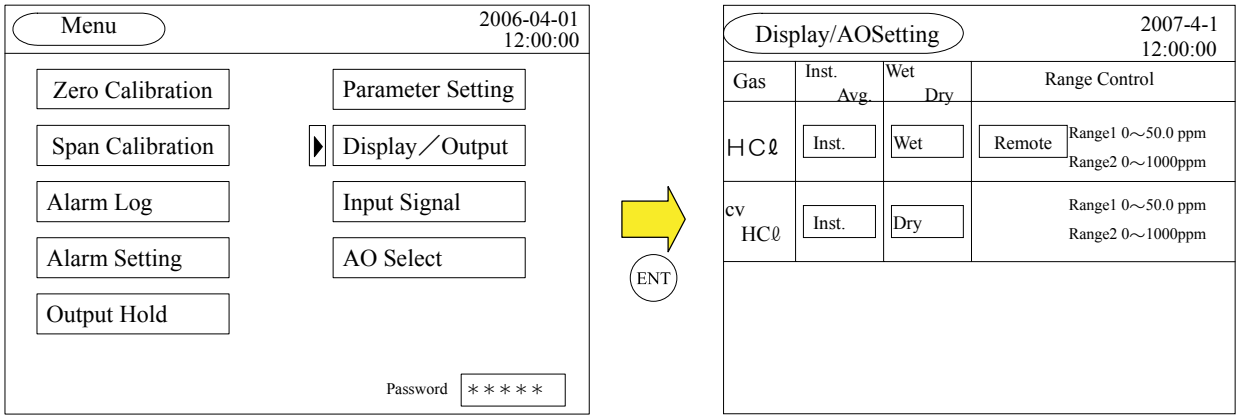
“Inst./Avg.” : Make a setting of “instantaneous value” or “average value” for each measurable component.

“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.

“Range Control” : In case of 2 range specification, the following setting can be selected.

- “Auto” : Automatic range switching
- “Range1”, “Range2” : Fixed range
- “Remote” : Analog input switching

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



6.6.1 Setting of instantaneous/average value

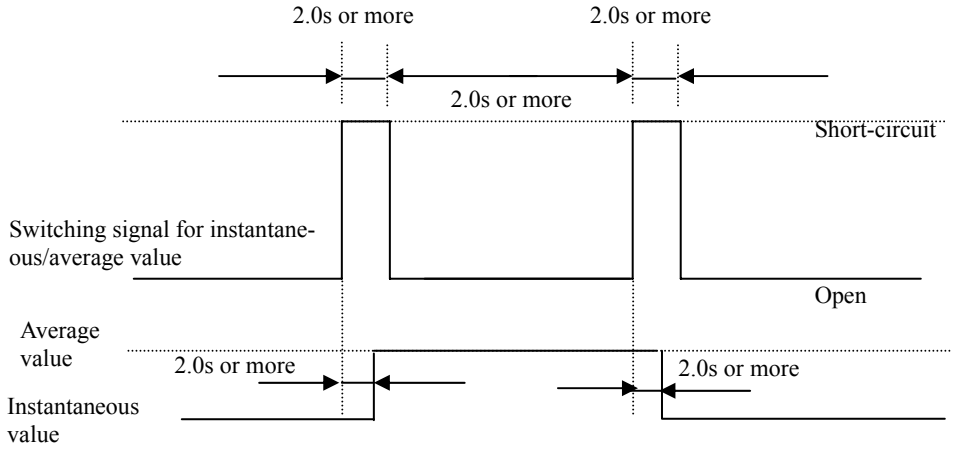
Make a setting of “Instantaneous value” or “Average value” for each measurable component. The setting is reflected on the display on the “Measurement” screen or external output such as analog output.

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 or external output such as analog output.
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, the input switching on the "Analog Input" screen is set to "Fixed", and the dry conversion is performed at the moisture value.
Wet can be converted to Dry using the following expression.

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

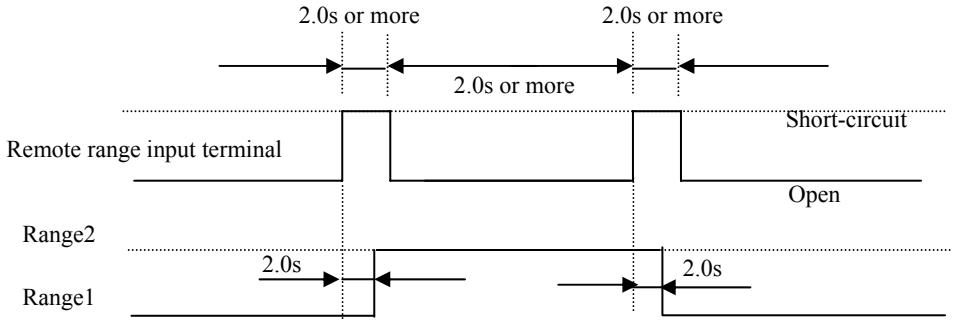
6.6.3 Setting of range switching

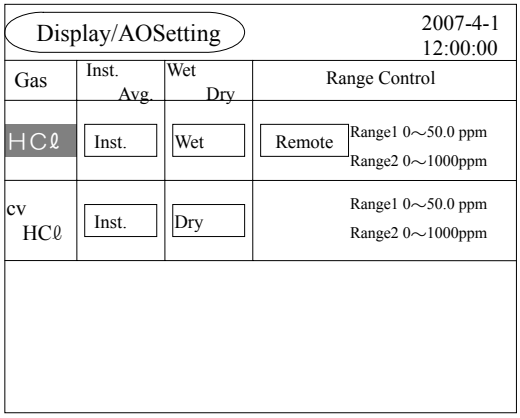
In case of 1 range specification, "Range1" can only be displayed, so the setting is not necessary.
In case of 2 range specification, select one from the following 4 methods.

"Auto" : Range 1 and Range 2 are automatically switched. When the measurement value is more than 90% of Range 1, it is switched to Range 2. When the measurement value is less than 80% of Range 1, Range 2 is switched to Range 1.
"Range1" : Range 1 is fixed.
"Range2" : Range 2 is fixed.
"Remote" : Range 1 and Range 2 are switched by the analog input (DI4).

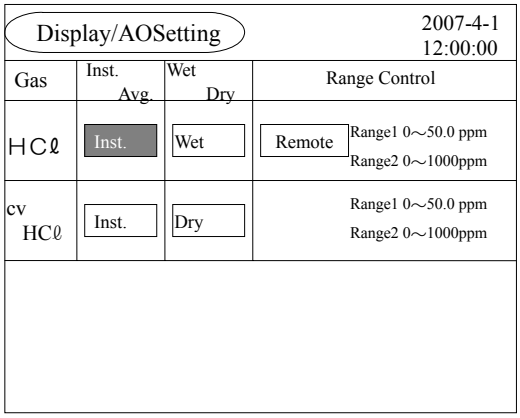
Input switching of the remote range (DI4 terminal)

Apply rectangular waveform (pulse width: 2.0 sec or more, pulse interval: 2.0 sec or more) to the remote range input terminal (DI4 terminal, option), and Range 1 and Range 2 are switched.

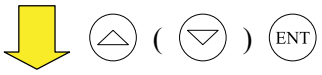


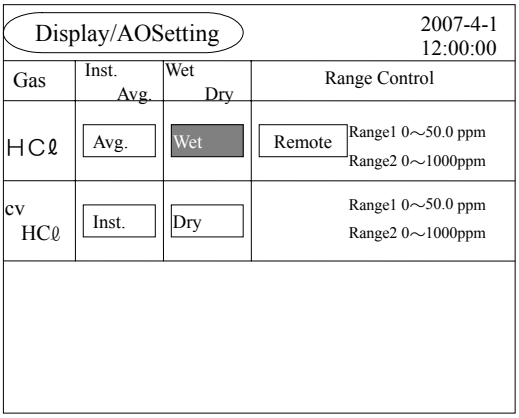


Select the component to be set by the △ key or the ▽ key. Press the ENT key to move the cursor to the “Inst./Avg.” setting.

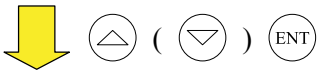


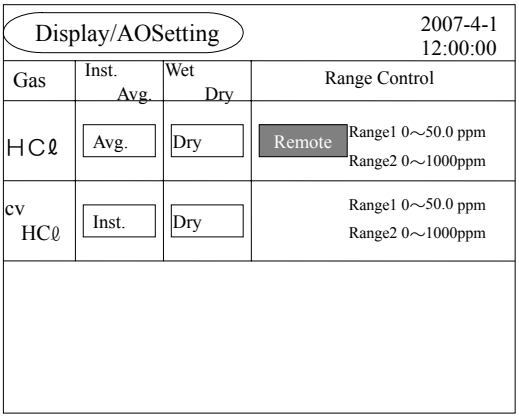
Select “Inst.” or “Avg.” by the △ key or the ▽ key. Press the ENT key to move the cursor to “Wet/Dry” setting.



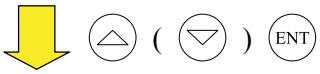


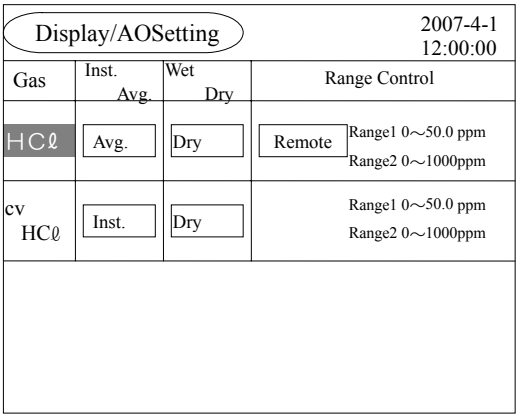
Select “Wet” or “Dry” by the △ key or the ▽ key. Press the ENT key to move the cursor to “Range Control” setting.





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



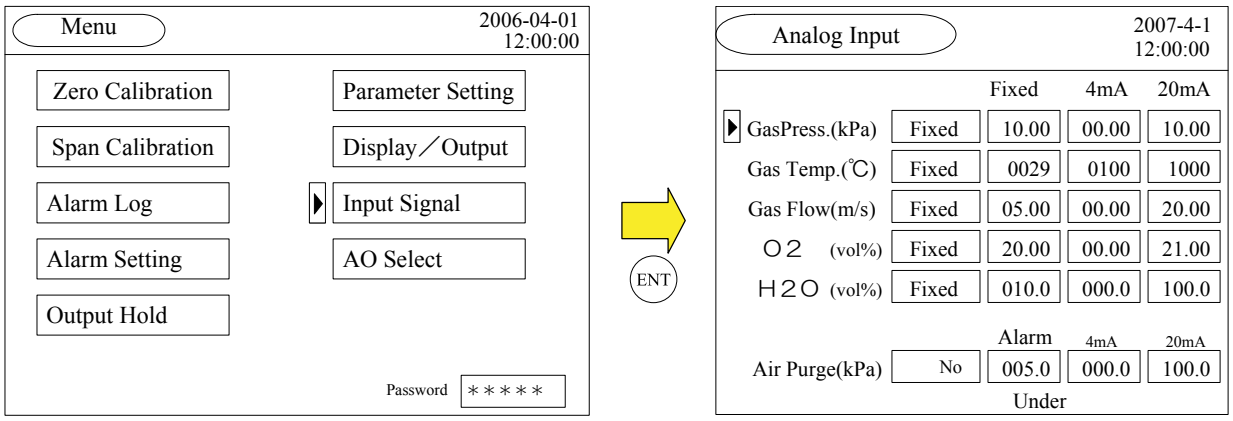


The ESC key can move the cursor backward in the middle of the setting. The setting fixed by the ENT key does not return to the previous setting, even if the cursor is moved by the ESC key.

6.7 Analog input

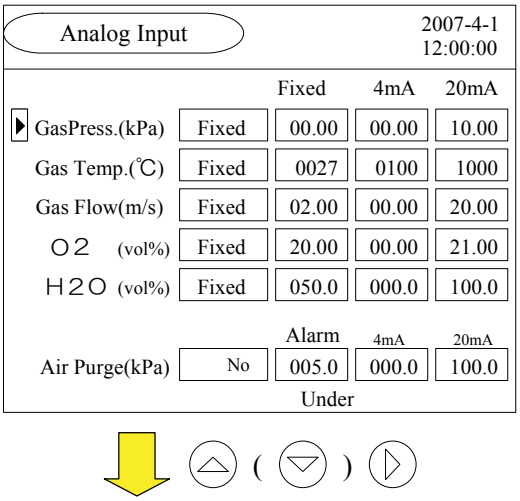
Makes a setting of the analog input related to the measured gas conditions such as gas temperature. Input the sensor signal to the analog input terminal of the control unit, and the measured gas conditions can be calibrated. The sensors to be connected to the analog input terminal are “Thermometer”, “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 are invariant, 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.



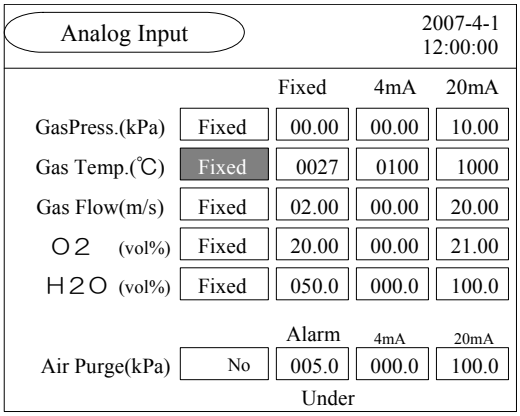
6.7.1 Setting of 4 to 20mA DC Input (in case of gas temperature)

The sensor signal of the thermometer (4 to 20mA output) is connected to AI1 or AI2 of the AI terminal of the control unit. (If an AI expansion board is provided, connect it to either of AI1 to AI6.)
When channel setting (CH1 to CH6 setting) is performed without sensor input signal to the AI terminal, “Analog input signal error” alarm is output.



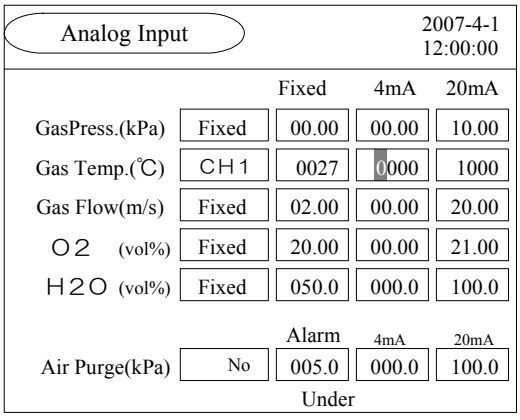
( ) ( )

Select the “Gas Temp.” by the ( ) key or the ( ) key. Press the ( ) key to move the cursor to “Channel” setting.

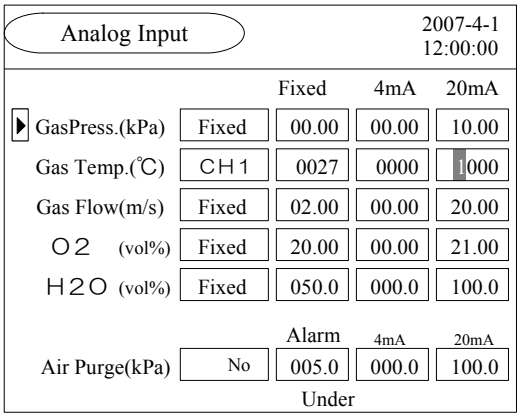


Select the channel (CH1 or CH2) connected to AI terminal by the ▲ key or the ▼ key (select from CH1 to CH6 when AI expansion board is connected), and press the ENT key.

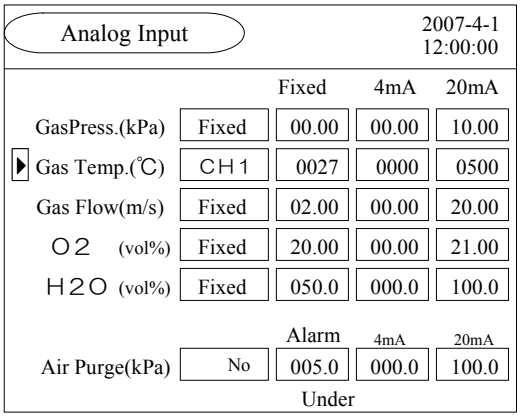
The relations between channels are as follows;
AI1 = CH1, ... AI6 = CH6.



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.



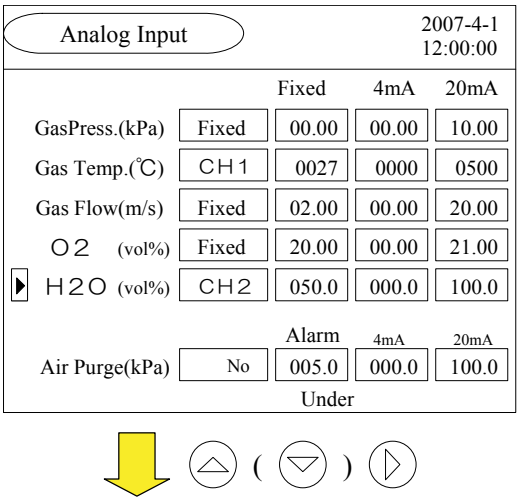
Enter the temperature (°C) corresponding to 20mA DC output of the output signal of the thermometer. Change the numeric value by the ▲ key or the ▼ key, and move the digits by the ▶ key. Press the ENT key to validate the set input value.



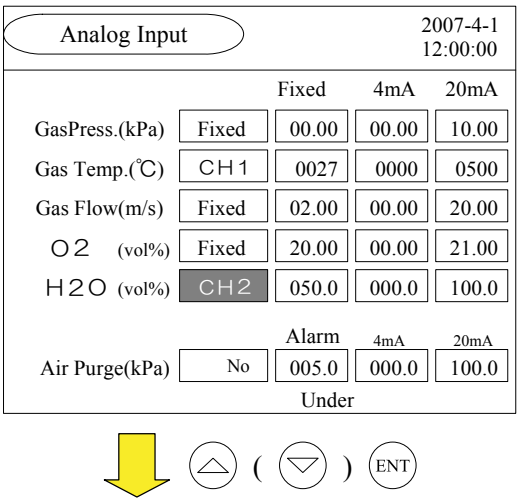
Implement the same procedure as for the sensor setting of pressure gauge, flow meter, oxygen analyzer (O_2) or the moisture meter (H_2O).

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

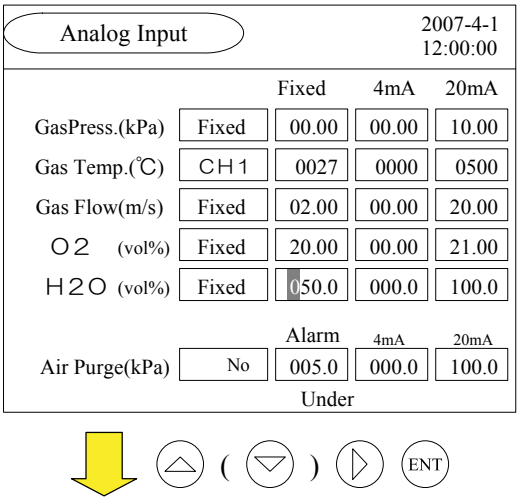
Sets the fixed value to perform the calibration when the value for which the measured gas condition do not change, or the sensors to calibrate are not provided, or the number of calibration input terminals is insufficient. When the actual value differs greatly from the setting value, analog input cannot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



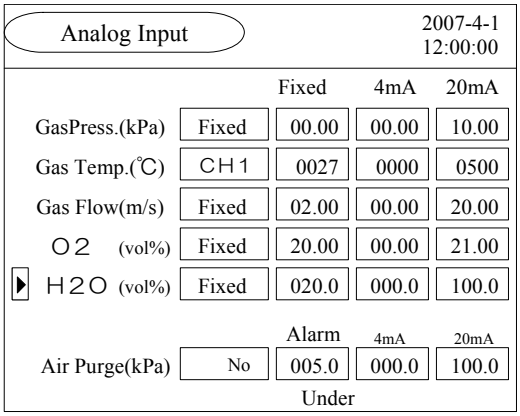
Select "H_2O" by the ▲ key or the ▼ key.
Press the ▶ key to move the cursor to "Channel" setting.



Select "Fixed" by the ▲ key or the ▼ key, and press the ENT key.



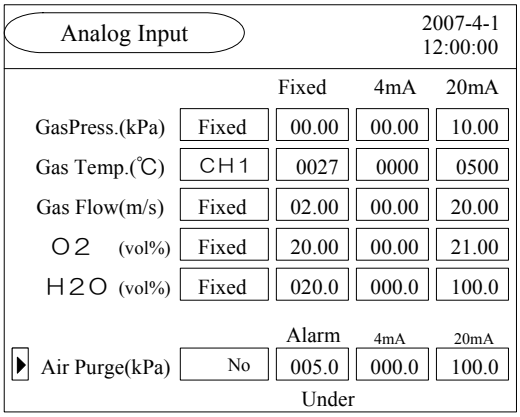
Enter the fixed value.
Change the numeric value by the ▲ key or the ▼ key, and move the digits by the ▶ key. Press the ENT key to validate the set input value.



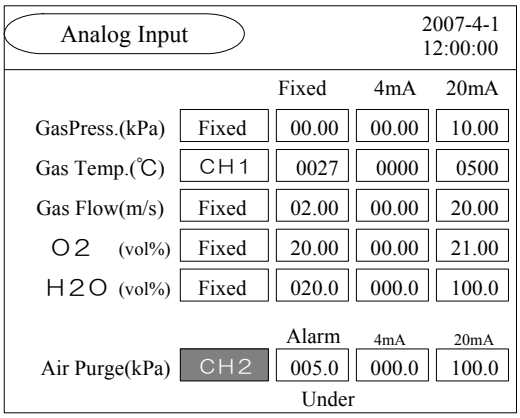
The same procedure can be implemented as for pressure gauge, thermometer or oxygen analyzer (O_2).

6.7.3 Setting of air purge pressure

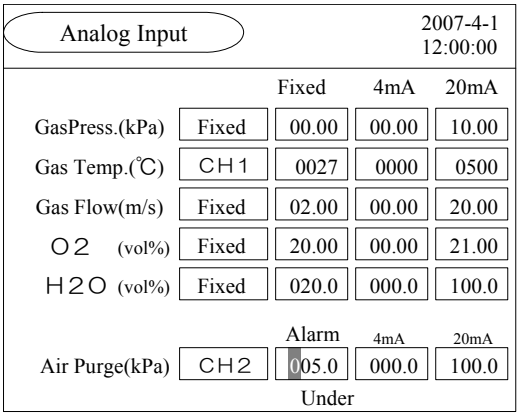
When the air purge pipe is connected to the pressure sensor, connect its signal (4 to 20mA DC output) to the analog input of the control unit. Alarm can be issued when the pressure value lower than the set pressure is detected. Be sure to connect the pressure gauge if the air purge pressure is unstable. 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.



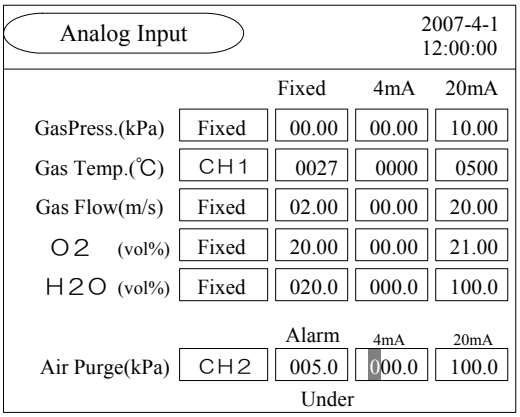
Select "Air Purge" by the ▲ key or the ▼ key. Press the ▶ key to move the cursor to "Channel" setting.



Select the channel (CH1 or CH2) connected to AI terminal by the ▲ key or the ▼ key (select from CH1 to CH6 when AI expansion board is connected), and press the ENT key.
The relations between channels are as follows;
AI1 = CH1, ... AI6 = CH6.



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.

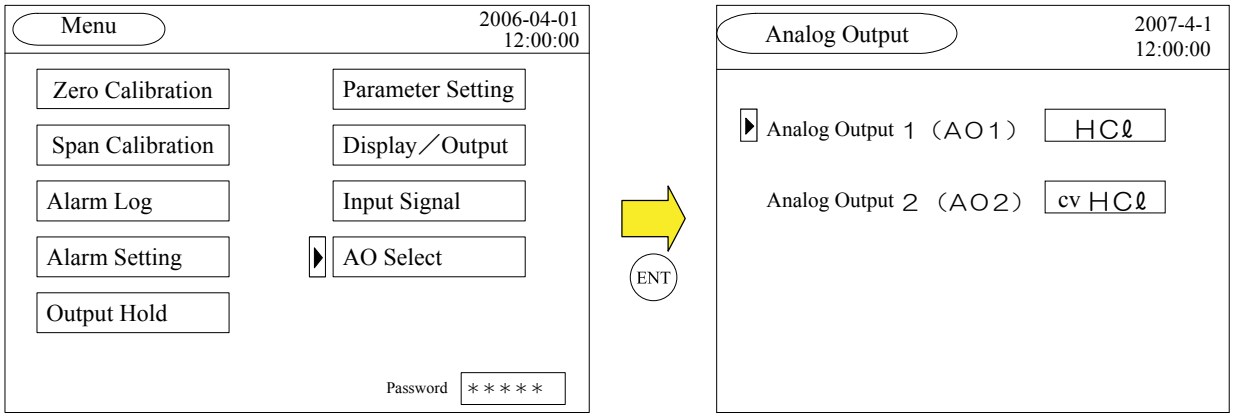


Enter the pressure value corresponding to 4, 20mA DC output in the same manner.

6.8 Selecting analog output

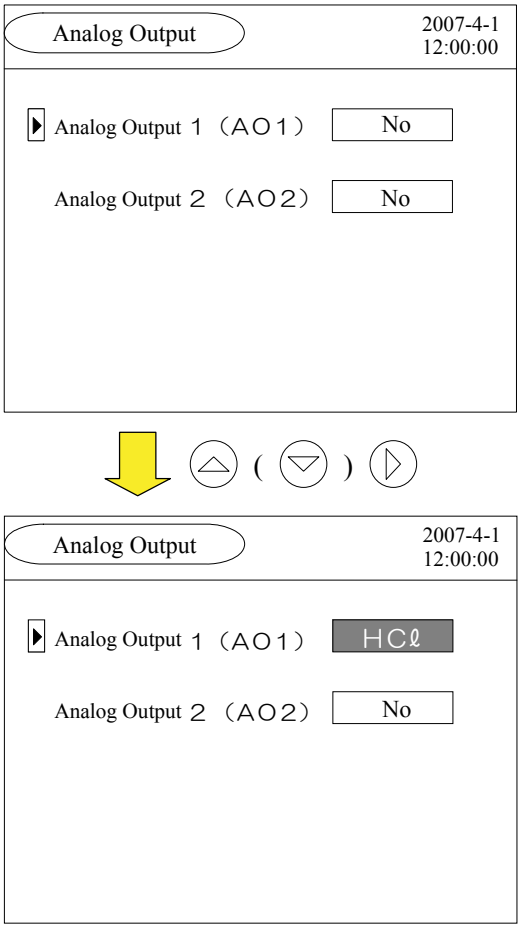
There are two types of analog output (4 to 20mA DC output) as a standard specification. Measurement value and O_2 conversion value can be output individually.
Default value is set to “No”, so be sure to set it after installation.

Select “Analog Output” 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.

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. When you perform maintenance by yourself, add the items or modify intervals as required to suit the installation environment.
However, do not extend the maintenance cycle of each maintenance item.
We do not warrant the damage resulting from the use not observing periodical maintenance.

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 equipment is securely fixed to the stack and there is no vibration.	○		
↓				
Receiver/ transmitter unit	Zero calibration	○		P.34
↓				
Receiver/ transmitter unit	Span calibration	○		P.37
↓				
Receiver/ transmitter unit	Replacement of packing		○	P.65
↓				
Receiver/ transmitter unit	Light axis adjustment	○		P.65
↓				
Receiver/ transmitter unit	Check for air purge flow rate	○		

7.3 Zero calibration

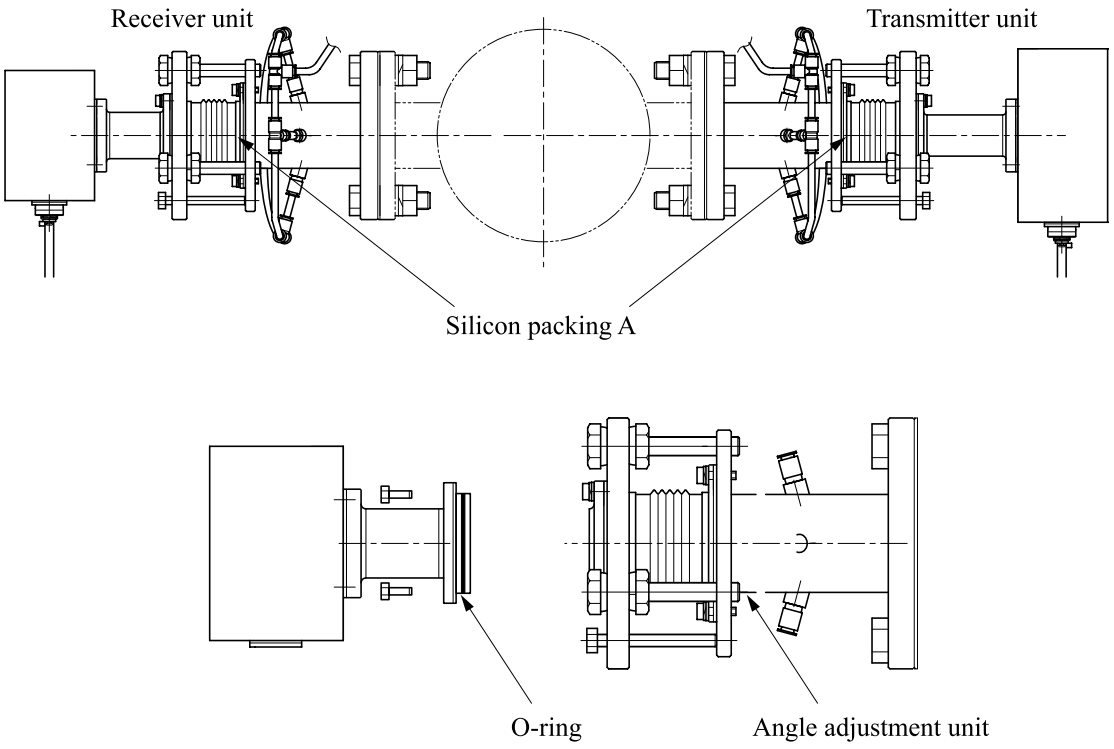
Refer to “6.1 Zero calibration”.

7.4 Span calibration

Refer to “6.2 Span calibration”.

7.5 Replacement of packing

Replace the packing, referring to the following figure.
Replace the receiver packing and silicon packing C every two years.



7.6 Light axis adjustment

Refer to “4.7 Angle adjustment” and “4.11 Adjustment of light quantity”.

7.7 When the device is not used for a long period

If the device is attached to the stack without performing air-purge for a long period, parts such as the receiver and transmitter units might be damaged. When you do not use if for a long period, detach the device from the stack and keep it in a place not exposed to high temperature and risk of corrosion.

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 10g/Nm^3 (according to installation environment conditions).)

→ 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 RS422 in the control unit connected correctly?

→ No (Wire it correctly.)

→ 3) Is any wiring cut off?

→ Yes (Contact the manufacturer.)

→ 4) 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.)

(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.)

APPENDIX 1 SPECIFICATIONS FOR THE CROSS-STACK LASER GAS ANALYZER

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:

Component	Min. measuring range	Max. measuring range
HCl	0 to 10ppm	0 to 1000ppm
NH_3	0 to 15ppm	0 to 1000ppm

(Range of optical path length 1m)
(Range of optical path length 1m) ÷ (Optical path length) = Range

(5) Light source : Near-infrared laser
(6) Laser class : Class M
(7) Outline (W × D × H) mm : Receiver unit (180 × 400 × 200 mm)
Transmitter unit (240 × 400 × 200 mm)
Control unit (135 × 240 × 320 mm)
(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
Control unit: Aluminum
(11) Materials of gas-contacting parts : SUS316, BK7, FKM, PTFE, glass-cloth, silicone
(12) Air purge connection diameter : RC1/4 (tube ϕ8 × 6)
(13) Box finish color : Receiver/Transmitter box: gray
Control unit cover: blue
Control unit case: silver
(14) Power supply : Rated voltage 100 to 240V AC ±10%
Rated frequency 50/60 Hz
(15) Power consumption : Max. rated power: Approximately 70VA 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) Communication functions : USB (for loader), RS-485 (Modbus® protcol)
(19) Cable length : Receiver unit to Transmitter unit : Standard 2m (Maximum 25m)
Receiver unit to control unit : Standard 5m (Maximum 100m)
(20) Analog output : 4 to 20mA DC or 0 to 1V DC × 2 common isolated output (1 to 5V DC, 0 to 5V or 0 to 10V is available.)
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.)
(21) Analog input : 4 to 20mA DC ×6
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.)

(22)	Contact output	:	Relay contact output (contact capacity 24V DC 1A 1a or 1b × 5 (Standard 1a) Insufficient amount of light received, outside the range of upper/lower limits, device faulty, on hold / under calibration, power OFF
(23)	Contact input (option)	:	Photo coupler receiver contact input (operating voltage 12 to 24V DC / 5 to 20mA) × 3 Average value reset signal, switching instantaneous value/moving average value and remote hold
(24)	Alarm output (screen-displayed)	:	LD failure, LD temperature error, high gas temperature, air purge (low pressure), air purge (high pressure), box temperature warning, low light transmission, PD over range, connection error, AI under, Range (H-Limit) or Range (L-Limit)
(25)	Display contents	:	Component, concentration (instantaneous value, average value O_2 correction instantaneous value and O_2 correction average value), alarm (fault status)

2. Contact output contents (1A contact)

(1)	Low light transmission	:	Contact output is performed (off) when the amount of light transmission is insufcient.
(2)	Outside the range of upper/lower limits	:	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)	Device failure	:	Contact output is performed (off) when laser failure, laser temperature control failure, exceeding the amount of light transmission or connection error are occurred.
(4)	On hold	:	While AO output is held by the hold setting, 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	:	Contact output is performed (off) when power is turned off.

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.

4. Standard functions

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

Correction 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 (value changeable by setting; 0 to 19% O_2)

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

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
(4)	Standard flange	:	JIS10K 50A flange (JIS B 2212)
(5)	Air purge	:	Instrument air (compressor must be installed when power supply cannot be provided.) Pressure 0.5 to 0.7MPa or more
(6)	Air purge ow rate	:	20L/min or more (depending on the measured gas temperature, velocity, pressure, moisture and dust)
(7)	Measured gas condition	:	Temperature: 450°C or less Pressure: ±10kPa Moisture: 50vol% or less Velocity: 10m/s or less
(8)	Dust	:	5 to 10g/Nm^3 (depending on the installation environment conditions)
(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.)

6. Performance

(1)	Repeatability	:	±2.0% FS
(2)	Linearity	:	±3.0% FS
(3)	Zero drift	:	±2.0%FS / 6 months (NH_3 ±3.0%FS / 6 months when range is 20ppm or less)
(4)	Interference from other gas components	:	±2.0%FS (The gasses without absorption within the measuring wavelength rage (several tens pm) are not interfered within principle).
(5)	Minimum detectable limit	:	HCl 0.05ppm NH_3 0.15ppm
(6)	Response time (90% FS response)	:	2 seconds or less

7. Scope of delivery

(1) Receiver unit
(2) Transmitter unit
(3) Control unit
(4) Cable between receiver unit and transmitter unit (specified length)
(5) Cable between control unit and receiver unit (specified length)
(6) Standard accessory set, instruction manual

8. Optional items

(1) Spare parts for one year (ZBN1SS11)
(2) Calibration gas cell (Standard length 1m) (*1) (*2)
(3) Receiver/transmitter cable (*1)
(4) Cable between control unit and receiver unit cable (*1)
(5) Standard gas (ZBM), pressure regulator (ZBD)
(6) Recorder (when necessary, Fuji's product type PHR, etc.)
(7) 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.

APPENDIX 2 CODE SYMBOLS

ZSS 4 5 6 7 8 - 9 10 11 12 13 - 14 15 16 17 [ ][ ][ ][Y][1] - [ ][0][ ][0][ ] - [ ][ ][ ][ ]

Digit	Specification		Note	
4	Measurable components	HCl	Note 1	C
		NH_3		W
5	Unit	ppm		1
		mg/m^3		3
6	Measurable range (1st range)	0 to 10ppm	Note 2	V
		0 to 15ppm		0
		0 to 20ppm		1
		0 to 25ppm		T
		0 to 50ppm		A
		0 to 100ppm		B
		0 to 200ppm		C
		0 to 250ppm		D
		0 to 500ppm		E
		0 to 1000ppm		F
7	————	————		Y
8	Modification No.			1
9	Flange rating	JIS10K 50A		A
		JIS10K 100A		B
		PN50/PN10		C
		ANS2 inch/150lbs		D
10	Number of analog output points	2 points		0
11	Number of analog input points	2 points		A
		6 points		B
12	Analog output signal	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, number of contact output	5 output points, No input		0
		5 output points, 4 input points		1
14	Cable length between receiver unit and control unit	5m	Note 3	A
		10m		B
15	Cable length between receiver unit and transmitter unit	2m	Note 4	A
		5m		B
16	Display	Japanese		J
		English		E
17	Compressor for air purge	None		0
		Provided		1

Note1) To place an order for HCl meter, specify standard O_2 concentration for conversion (settable within 0 to 19%, O_2 : integer).
Note2) Specify by the Max/Min range obtained from path length.
Note3) Cable length between receiver unit and control unit : 100m or less
Note4) Cable length between receiver unit and transmitter unit : 25m or less

Appendix 2-1 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	2	According to flange rating
Bolt for angle regulation	6	Hexagonal socket bolt M8 × 70
Power supply fuse	2	
Instruction manual	1	

(* When B is selected for the 9th digit of the code symbols, quantity becomes 16. In other cases, quantity is 8. When B 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.))

Appendix 2-2 Spare parts for one year (ZBN1SS11)

Parts name	Quantity	Remarks (type)
Silicon packing A	2	For bellows (ZZP*ZSSTK7N3508P1)
O-ring	2	(ZZP*ZSSTK7N3505P8)

Appendix 2-3 Calibration/installation fixture list (Option)

Parts name	Quantity	Type
Cable between control unit and receiver unit cable (for calibration)	1	ZZP*ZSSTK4J1271C1
Receiver/transmitter cable (for calibration)	1	ZZP*ZSSTK4J0641C3
Calibration gas cell (*1)	1	ZZP*ZSSTK7N6005P1
Optical axis adjusting tool (laser pointer)	1	ZZP*ZSSTK4J1274C1
IR card (for NH_3)	1	ZZP*ZSSTK7N4505P1
Check cell	1	ZZP*ZSSTK4J2605C1
Filter regulator	1	ZZP*ZSSTK7F9554P2
Mist separator	1	ZZP*ZSSTK7H8049P1
R1/4 stopper (plug) for mist separator	1	ZZP*ZSSTK738114P7
Flow meter (10 to 100L/min) (*2)	1	ZZP*ZSSTK7N4624P1

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

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