Instruction Manual

CROSS STACK LASER GAS ANALYZER

TYPE: ZSS-8

INZ-TN8ZSSa-E Fuji Electric Co., Ltd.

PREFACE

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

- First read this instruction manual carefully until an adequate understanding is acquired. Then proceed to installation, operation and maintenance of the laser gas analyzer. Improper handling may result in an accident or a failure.
- The specifications of the laser gas analyzer may be changed without prior notice for further product improvement.
- Modification of the laser gas analyzer is strictly prohibited unless a written approval is obtained from the manufacturer. We will not be responsible for any accident attributable to such remodeling without permission. If it becomes necessary to modify the laser gas analyzer, contact the manufacturer in advance.
- This instruction manual shall be stored by the person who actually uses the laser gas analyzer.
- After reading the manual, be sure to keep it at a place easy to access.
- This instruction manual should be delivered to the end user without fail.
- This product falls under Category 9 (monitoring and control instruments) set out in Annex I of the RoHS directive 2011/65/EU, and not for consumer use.
- If you return the product to us for repair, provide us with a document that indicates the purpose of export is repair and a certificate that indicates that the equipment includes no substances restricted by RoHS directive or laws and regulations of the exporting country. We are not liable in the cases that the re-export from Japan to you is not permitted due to imperfection of the above documents.

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

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SAFETY INFORMATION

First of all, read this "Safety information" carefully, and then use the analyzer 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.

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

Wiring	
⚠ CAUTION	(1) Be sure to connect a ground wire securely to the specified place by performing class D grounding work. Otherwise electric shock or malfunction may result. (2) If the power supply voltage exceeds the rating, electric shock or damage to the instrument may result. Be sure to use the instrument within the specified rating range. (3) Be sure to turn off the power before performing wiring work. (4) Be sure to use a 600V-IV ground wire 1.6 mm or larger in diameter with sufficient dielectric strength. (5) Select input/output wires of materials and diameter that satisfy the rating of each device. If a wire which cannot endure the rating is used, electric shock or fire may occur. (6) Fasten the input/output wires to the floor or wall, and use a wire protection device.

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

Maintenance and inspection

⚠ DANGER

(1) When the analyzer (receiver unit and transmitter unit) is installed on incineration facility, make sure the facility has stopped completely. Installing on the operating facility may cause high temperature gas injection, resulting in burn.
(2) If the analyzer is installed or removed from the location higher than operator's height, set up a fence to keep someone from approaching under or near the unit. If the analyzer inadvertently falls off and hits someone, serious injuries may occur, resulting in death.

⚠ CAUTION

(1) Be careful not to drop the analyzer on your foot. Otherwise, it may cause fracture of the bone.
(2) Do not touch the terminal block of each unit of the instrument carelessly during operation. Otherwise, it may cause electric shock.
(3) Before working, take off a wrist watch, finger ring or the like metallic accessories. And never touch the instrument with a wet hand to avoid electric shocks.
(4) If the fuse is blown, eliminate the cause, and then replace it with the one of the same capacity and type as before. Otherwise, it may cause electric shock or accident.
(5) Do not wash or splash water on the switch or electrical parts inside the device. Otherwise it may cause an electric shock, failure, or fire.
(6) Do not use replacement parts other than recommended ones. Otherwise, adequate performance will not be provided. Furthermore, an accident or fault may be caused.
(7) Dispose replacement parts such as maintenance parts as incombustibles in accordance with the local waste disposal requirements.

Handling of laser equipment

⚠ CAUTION

When this product is installed in a flue and as long as no one enters in the flue, this product can be used as Class 1 laser product. However, be sure to follow the instructions below for safety because the product emits laser beam when energized.

- Do not remove the transmitter unit, the receiver unit, or any part of them from the flue without our permission. Otherwise, it may cause a loss of eyesight and/or skin lesion. Consult us if there is a need for removal.
- O_2 analyzer for high temperature and instrument air purge version O_2 analyzer use the Class 3B laser elements. When anyone enters into the flue, this product is regarded as a Class 3B product. In this case, safety measures are required; for example, an entrance detection system, an interlock that stops radiation of laser beam, etc. Consult us for details.

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.

WARRANTY AND MAINTENANCE

1. Scope of application

To use this equipment, the following conditions must be met:

- the use of the equipment incurs no risk of a serious accident even if a failure or malfunction occurs on the equipment, and
- in case of product failure or malfunction, safety measures such as redundant design, prevention of malfunction, fail safe system, foolproof mechanism are provided outside of the equipment.

Be sure to use this instrument under the conditions or environment mentioned in this instruction manual.

Please consult us for specifications for the following applications:

Radiation-related facilities, systems related to charging or settlement, or other usages which may have large impact on lives, bodies, property, or other rights or interests.

2. Operating conditions and environment

Refer to “SAFETY INFORMATION” and “4. INSTALLATION".

3. Precautions and prohibitions

Refer to “SAFETY INFORMATION”.

4. Warranty

4-1. Period of warranty

1) Warranty period for this product including accessories is one year after delivery.

2) Warranty period for the parts repaired by our service providers is six months after the completion of repair.

4-2. Scope of warranty

1) If any failure or malfunction attributable to Fuji Electric occurs in the period of warranty, we shall provide the product after repairing or replacing the faulty part for free of charge at the place of purchase or delivery.

   The warranty does not apply to failure or malfunctions resulting from:

   a) inappropriate conditions, environment, handling or usage that is not instructed in a catalog, instruction book or user's manual, or overuse of the product
   b) other devices not manufactured by Fuji Electric
   c) improper use, or an alteration or repair that is not performed by Fuji Electric
   d) inappropriate maintenance or replacement of expendable parts listed in the instruction book or the catalog
   e) damages incurred during transportation or fall after purchase
   f) any reason that Fuji Electric is not responsible for, including a disaster or natural disaster such as earthquake, thunder, storm and flood damage, or inevitable accident such as abnormal voltage.

2) Regardless of the time period of the occurrence, Fuji Electric is not liable for the damage caused by the factors Fuji Electric is not responsible for, opportunity loss of the purchaser caused by malfunction of Fuji Electric product, passive damages, damage caused due to special situations regardless of whether it was foreseeable or not, and secondary damage, accident compensation, damage to products that were not manufactured by Fuji Electric, and compensation towards other operations.

5. Failure diagnosis

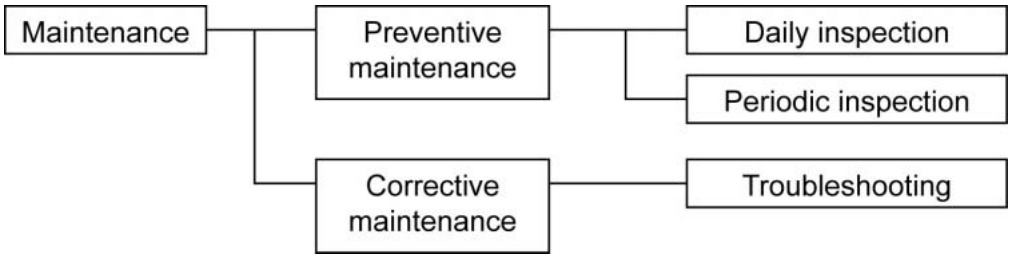
Regardless of the time period of the occurrence, if any failure occurs, the purchaser shall perform a primary failure diagnosis. However, at the purchaser's request, Fuji Electric shall provide the diagnosis service for a fee. In such a case, the purchaser shall be charged for the service.

6. Service life

This product, excluding limited-life parts and consumable parts, is designed to have a service life of 10 years when the average annual ambient temperature is 30°C. To ensure the service life, it is important to perform planned maintenance of the product including limited-life parts and consumable parts.

7. Maintenance plan

Maintenance can be divided into “preventive maintenance” and “corrective maintenance”. Preventive maintenance can further classified into “daily inspection” and “periodic inspection”. Preventive maintenance is achieved through systematic implementation of "daily inspection" and "periodic inspection".



(1) Daily inspection

Be sure to perform daily inspection prior to operation to check for any problem in daily operation. For the specific items of daily inspection, refer to “7. MAINTENANCE”.

(2) Periodic inspection

Periodic inspection is to replace limited-life parts before their service lives are over, thus preventing failure. Inspection interval: 6 months to 12 months. If you are using the instrument under harsh environment, we recommend you to shorten the inspection interval. For the specific items of periodic inspection, refer to “7. MAINTENANCE”.

(3) Corrective maintenance

Corrective maintenance is a measure to be taken after a trouble has occurred. Refer to “7. MAINTENANCE” and “8 TROUBLESHOOTING”. If the measures mentioned in this instruction manual do not solve the problem, please contact our sales office or service office.

8. Limited-life parts and consumable parts

This product contains the following limited-life parts and consumable parts which may affect the service life of the product itself.

(1) Aluminum electrolytic capacitors

- Design life: Design life: 10 years under general working conditions (annual average of ambient temperature: 30°C)
- Symptoms when a capacitor loses its capacity: deterioration of power quality, malfunction
- Factors which affect battery life: temperature. The life is shortened by half when the temperature rises by 10°C. (Arrhenius' law)
- Replacement: Estimate the lifetime of capacitor according to your operating environment, and have the capacitor replaced or overhauled at appropriate time, at least once in 10 years. Do not use capacitors beyond its lifetime. Otherwise, electrolyte leakage or depletion may cause odor, smoke, or fire. Please contact Fuji Electric or its service providers when an overhaul is required.

(2) LCD

- Design life: approximately three years for continuous use
- Symptoms when depleted: the display may have some kind of problem, or the backlight may not work.
- Factors which affect battery life: temperature
  The life is shortened by half when the temperature rises by 10°C. (Arrhenius' law)
- Replacement: Estimate the lifetime according to your operating environment, and replace it at appropriate time.

(3) Backup battery for clock (CR1220)

- The clock does not use the battery during the primary power supply.
- Replacement: when the total time that no primary power is supplied has exceeded five years.

9. Spare parts and accessories

Refer to “2. CHECKING DELIVERED ITEMS” or “7. MAINTENANCE” for details.

10. Period for repair and provision of spare parts after product discontinuation (maintenance period)

The discontinued models (products) can be repaired for five years from the date of discontinuation. Also, most spare parts used for repair are provided for five years from the date of discontinuation. However, some electric parts may not be obtained due to their short life cycle. In this case, repair or provision of spare parts may be difficult even in the above period.

Please contact Fuji Electric or its service providers for further information.

1. DESCRIPTION

1.1 Introduction

Cross-stack laser gas analyzer (ZSS) provides continuous measurement of HCl in flue gas incineration, NH_3 concentration of denitration equipment and heat treat furnace, and O_2, CO, and CO_2 for combustion control within a short response time. The cross-stack configuration eliminates the need for transfer of the preparation measurement gas to the analyzer for proper measurement. Dust resistant construction enables installation upstream of bug filter units and the application for which injection volume of calcium hydroxide is controlled while measuring HCl concentration. The analyzer adopts near-infrared laser as light source. The analyzer targets only one spectrum line among a large number of absorption spectrum lines, and carry out a measurement while controlling the temperature and the driving current of the laser. Since the range of wavelengths to be measured is as narrow as a few nanometers, the analyzer receives 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 Compliance

First read this instruction manual carefully, and then make a plan for periodic inspection to perform appropriate maintenance management.
This analyzer uses the invisible infrared laser (excluding O_2 analyzer). Do not watch the laser beam directly or scattering light.

Laser class: Class 1 (IEC/EN 60825-1)
IP rating : IP65
Measurement category : CAT II
Pollution degree : 2
Altitude : ≤ 2000 m

EC DIRECTIVE COMPLIANCE CE

LVD (2014/35/EU)
- EN 61010-1
- EN 62311
- EN 60825-1

EMC (2014/30/EU)
- EN 61326-1 (Table 2)
- EN 55011 (Group 1 Class A)
- EN 61000-3-2 (Class A)
- EN 61000-3-3
- EN 61326-2-3

RoHS (2011/65/EU)
- EN 50581

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 “APPENDIX 2”at the end of this Manual.

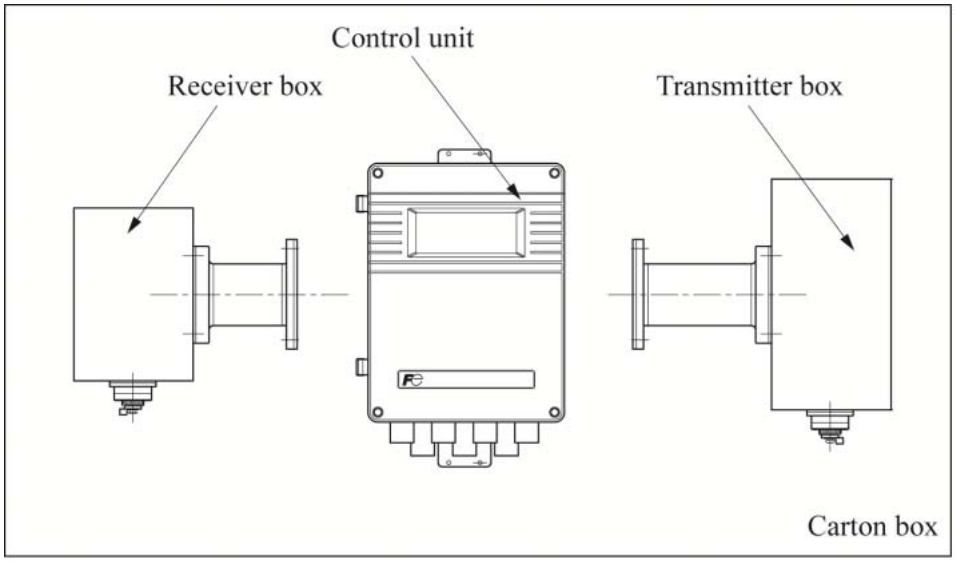
Table 2－1 Products

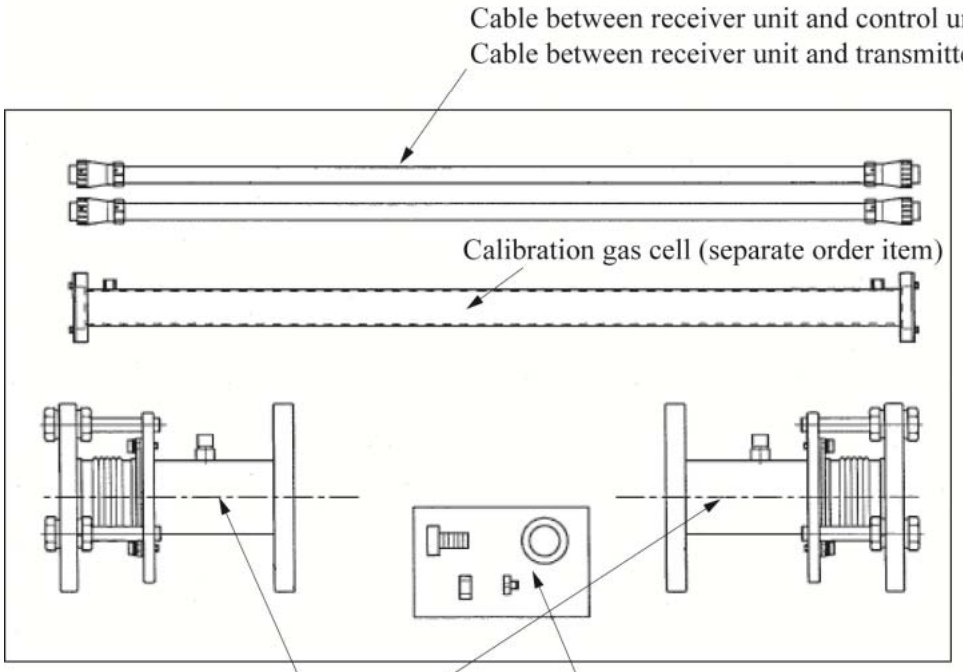
No.	Product name	Quantity
1.	Control unit	1
2.	Receiver box	1
3.	Transmitter box	1
4.	Angle adjustment unit	2
5.	Cable between receiver unit and control unit	1
6.	Cable between receiver unit and transmitter unit	1

Table 2－2 Standard accessories

No.	Product name	Quantity
1.	Bolt (*1)	8 (16)
2.	Nut (*1)	8 (16)
3.	Spring washer (*1)	8 (16)
4.	Flat washer (*1)	8 (16)
5.	Companion flange packing or flange packing specified for use in high temperature	2
6.	Bolt for angle fine adjustment (*2)	6
7.	Power supply fuse (250 V AC/T1A)	2
8.	Instruction manual	1
9.	Bolt for connecting the receiving unit and the transmitter unit	12
10.	Ferrite core (for power cable, outside the transmitter case)	1
11.	Ferrite core (for power cable, inside the transmitter case)	1

*1: When the 9th code is “B”, 16 pieces are provided. For other cases, 8 pieces are provided. The length of the bolts are 55 mm when the 9th code is “A”, and 70 mm when the 9th code is “B”, “C”, or “D”. Inch-sized bolts are not provided.
*2: The bolts may be delivered being attached to the angle adjustment unit.



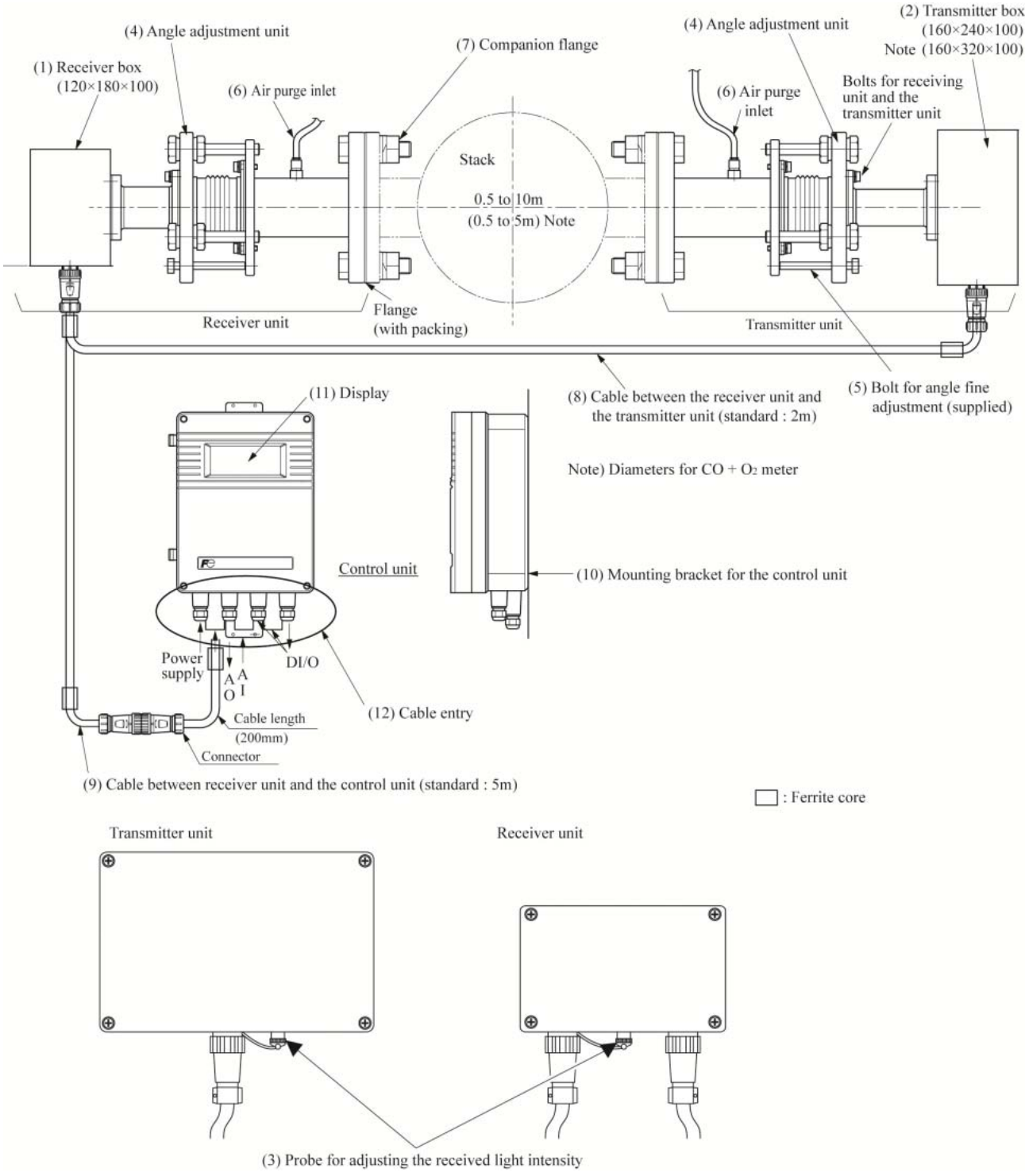


Standard accessories
- Bolts
- Nuts
- Spring washers
- Flat washers
- Companion flange packing or flange packing for use in high temperature
- Bolts for the angle fine adjustment
- Power supply fuse
- Bolts for connecting the receiving unit and the transmitter unit
- Ferrite core

3. NAME AND EXPLANATION OF EACH PART

3.1 Overall composition

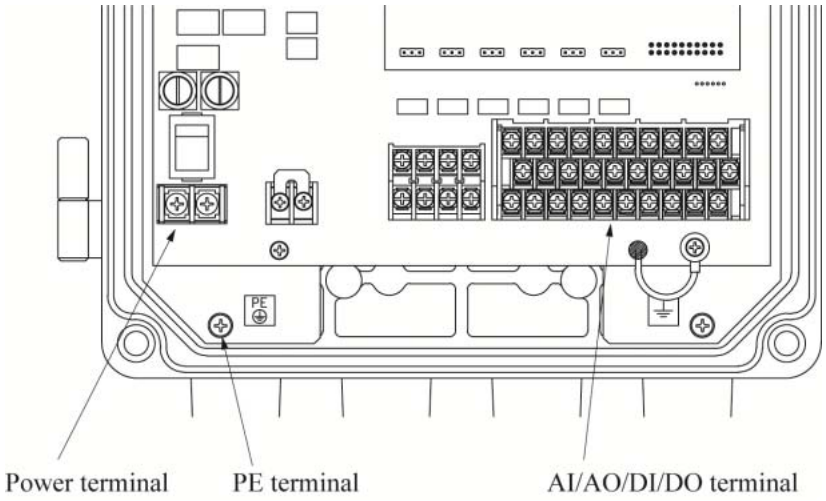
The analyzer consists of 3 units; “Transmitter unit” to transmit the laser, “Receiver unit” to receive light, and “Control unit” to display and output signals.



	Name	Description
(1)	Receiver box	Accommodates a photodiode that receives the laser light, PCB, and others.
(2)	Transmitter box	Accommodates the laser element, a Peltier device that controls the laser temperature, PCB, and others.
(3)	Probe for adjusting the received light intensity	A probe (BNC socket) used to check the received light intensity, in a form of voltage value, based on which the optical axis is adjusted. Both the transmitter unit and the receiver unit have a probe.
(4)	Angle adjustment unit	Used to adjust the light axis of the laser emitted from the transmitter unit. The maximum adjustable angle is 5 degree.
(5)	Bolt for angle fine adjustment	The longer the optical path length is, the more the light intensity is affected by angle adjustment. If the stack diameter is large, therefore, use the bolt for angle fine adjustment to set the optical axis.
(6)	Air purge inlet	Inlet for instrument air or N_2 gas used for purging. The purging is required for preventing water condensation and dust contamination on the lens. *The instrument air used for purging shall not include oil or mist. *For purging line, use the pipe connectable to a 10/8 mm fitting.
(7)	Companion flange	Flanges for connecting the stack and the transmitter unit, and the stack and the receiver unit. *The companion flange shall be prepared by customer.
(8)	Cable between the receiver unit and the transmitter unit	Cable that transmits the electricity to the transmitter unit, and the signals between the receiver unit and the transmitter unit. You can select the cable length up to 25 meters.
(9)	Cable between the receiver unit and the control unit	Cable that transmits the electricity to the receiver unit, and the signals between the receiver unit and the control unit. You can select the cable length up to 100 meters.
(10)	Mounting bracket for the control unit	A bracket for attaching the control unit on the wall or the like. It has two 12-mm diameter holes, and a 12-mm width oval hole.
(11)	Display	Displays the measurement value and alarm.
(12)	Cable entry	10-mm diameter entries for the power cable, signal cable from the receiver unit, AI, AO, DI, and DO.

3.2 Wiring diagram

Input / output terminal



Power terminal

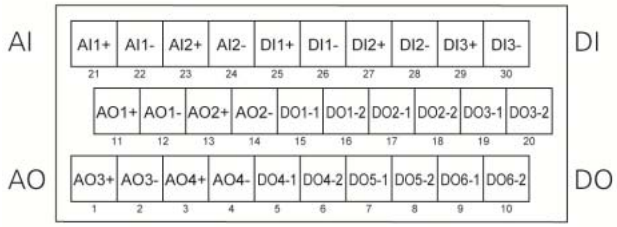
L	N
1	2

M4 screw
1 100-240 V AC, 50/60 Hz (L)
2 100-240 V AC, 50/60 Hz (N)

PE terminal

PE Protective earth
M4 screw

AI/AO/DI/DO terminal



M3 screw
Cross-sectional area of wire: AWG26-16

AO terminals

11	AO1+	Analog output 1 (AO1)
12	AO1–	
13	AO2+	Analog output 2 (AO2)
14	AO2–	
1	AO3+	Analog output 3 (AO3) (AO extension board is required)
2	AO3–	
3	AO4+	Analog output 4 (AO4) (AO extension board is required)
4	AO4–	

DI terminals

25	DI1+	Average resetting signal (option)
26	DI1–	
27	DI2+	Instantaneous/average switching signal (option)
28	DI2–	
29	DI3+	AO holding signal (option)
30	DI3–	

AI terminals

21	AI1+	Analog input 1 (AI1)
22	AI1–	
23	AI2+	Analog input 2 (AI2)
24	AI2–	

DO terminals (Note 3, 4)

15	DO1-1	Light intensity low
16	DO1-2	
17	DO2-1	Device failure (Note 1)
18	DO2-2	
19	DO3-1	During hold/during calibration
20	DO3-2	
5	DO4-1	Overrange/underrange
6	DO4-2	
7	DO5-1	Environmental error (Note 2)
8	DO5-2	
9	DO6-1	Power interruption
10	DO6-2	

Notes:

1) Device failure includes laser temperature error, communication error, and overrange.
2) Environmental error includes gas temperature error, purge air pressure underrange, analog input signal error, and box temperature error.
3) Consult us if you want to use any alarms (relay outputs) dependent on the installation environment.
4) It takes at least 5 minutes until all the alarms except for the communication error start to work. Alarm for "light intensity low" is triggered if the alarm status continues at least 1 minute, which means 6 minutes after the power is turned on.
5) AI terminal, AO terminal, and DI/DO terminal are all on the same board.

4. INSTALLATION

⚠ **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.

4.1 Requirements

4.1.1 Receiver unit and transmitter unit

Select a location that meets the following conditions.

(1) Ambient temperature : A place where the temperature is within -20 to 55°C and there is no sudden temperature change.
(2) Ambient humidity : A place where the humidity is 90% RH or lower not subjected to condensation.
(3) Measured gas temperature : Refer to "1-1 (4) Measurable component and range" in APPENDIX 1. A place where the stack is not distorted or laser light axis is not deflected by sudden temperature change.
(4) Measured gas pressure : ±10kPa
(5) Measured gas moisture : 50vol% or less (no condensation)
(6) Measured gas velocity : 25m/s or less (However, consultation is necessary for the environment where dust (1g/Nm^3 or more) or water (25vol% or more) exists.) (Prevention of dust deposition or dew condensation due to increase of air purge flow rate is required)
(7) Dust : 15 g/Nm^3 or less (depending on the conditions such as measurable components, device specification, optical light path, particle diameter, and so on)
(8) Companion flange : Prepare the flange diameter selected by the 9th digit of the code symbols. 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. Prepare N_2 for O_2 analyzer and CO+O_2 analyzer excluding air purge version (4th digit of code symbol is T or V).
(10) Air purge flow rate : 20L/min or more (depending on measured gas temperature, velocity, pressure, moisture or dust) (One-side air purge flow rate (L/min) ≥ Gas velocity (m/s) × 10)
(11) Path lengths (diameter) : 0.5 to 10 m (0.5 to 5 m for CO+O_2 analyzer)
(12) Vibration : 0.5G or less (0.2G or less for frequency 20 to 40Hz) (When the optical path length is 1m or less)
(13) A place with less corrosive gases
(14) A place accessible for maintenance and check (Refer to "4.2 Mounting dimensions".)
(15) A place with less electrically induced disturbances such as high electric currents or sparks in the surrounding.
(16) Light axis fluctuation: ≤ 0.3°

Notes:

- When there is a possibility of deflecting the laser light axis or reducing the light intensity due to the large vibration acceleration, contact the manufacturer before installation.
- 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.
- When you measure the high temperature gas of 500°C or more, install a pressure sensor on the purge line to monitor the purging status. Measuring the high temperature gas without air purge may cause damage to the analyzer.
- Be sure to keep purging the analyzer once you installed it. Purging is required even you suspend the operation. Leaving the analyzer without purging causes permanent contamination which may result in a malfunction or error.

4.1.2 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) A place where the instrument receives no vibration
(5) A place where the ambient air is clean
(6) A place where has enough space for maintenance work or inspection
(7) A place where induced electrical noise, such as large electrical current or spark, is low
(8) Install a breaker that meets the requirements of IEC60947-1 and IEC60947-3 in the facility in which the analyzer is placed.

Notes:

- The breaker should be installed close enough to the analyzer so that an operator can use it without difficulty.
- The breaker should be identified as the one for this product.
- The breaker must meet the rating of the analyzer.

4.2 Mounting dimensions

Keep purging the analyzer once you install it on a stack.
Otherwise, the contamination of optical surface may result in the analyzer failure.

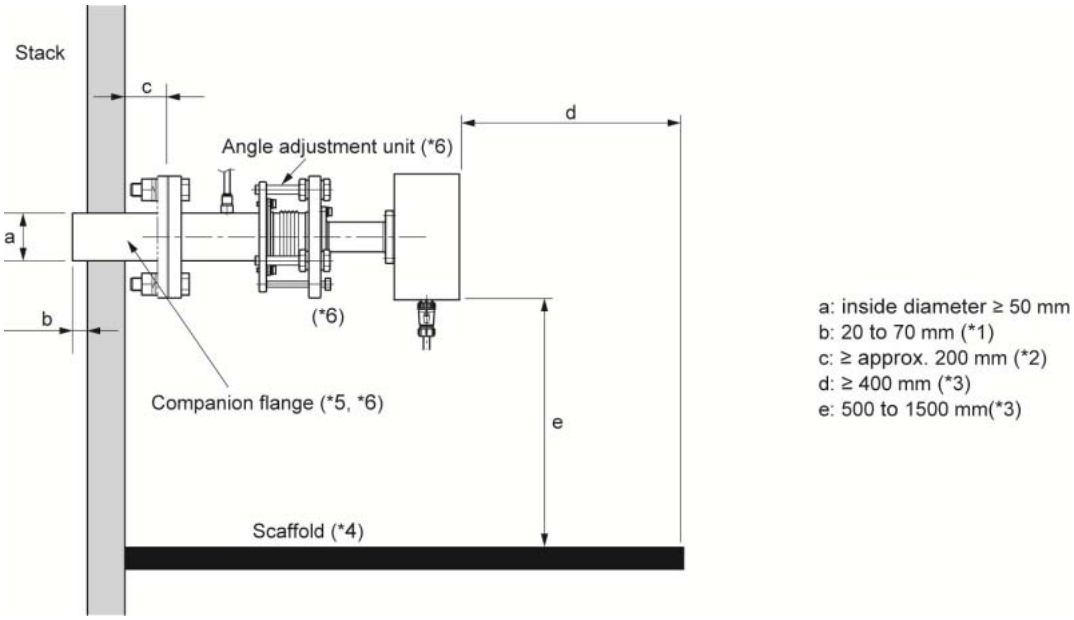


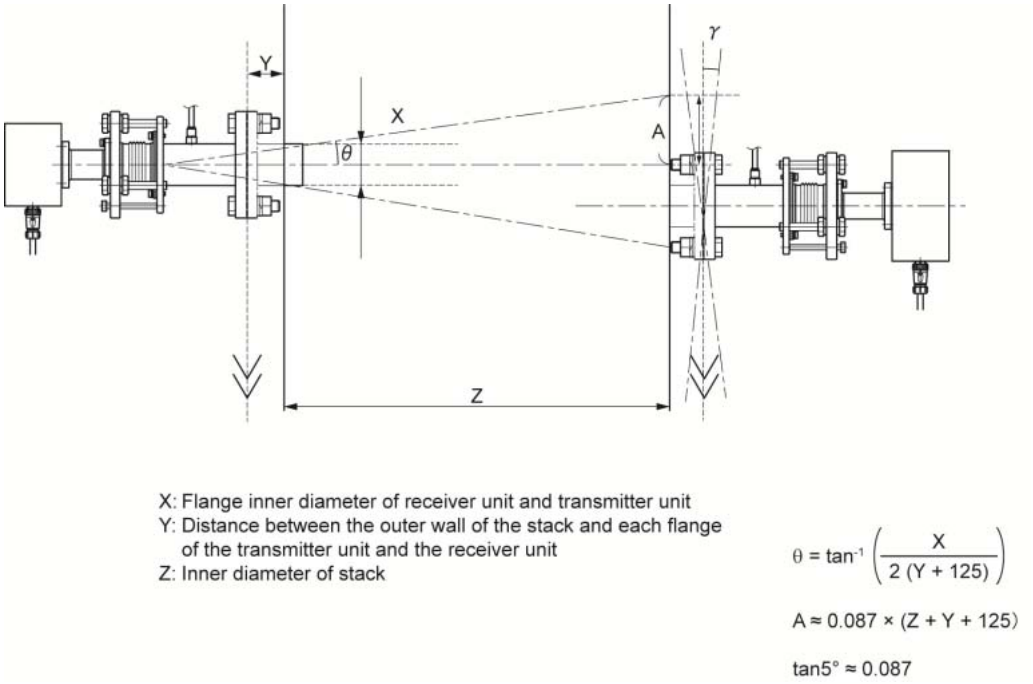
Fig. 4－1

*1: When the flue gas contains a large amount of dust, ensure the minimum length of 50 mm.
*2: When the flue gas temperature is high (400°C or more), ensure the minimum distance of 400 mm.
Note that in that case you have to be even more careful in adjusting the angle of the companion flange because the angle range
within which the companion flange can be adjusted is narrow.
*3: Make sure to install the analyzer in the place where it is easy to operate, and where there is enough clearance.
*4: Scaffold is required for both the receiver unit side and the transmitter unit side.
*5: Use a flanged valve where there is a risk of gas blowout or where the operator may be exposed to a dangerous situation.
*6: Tightening torque for the companion flange shall be 118±14 N·m. When tightening the bolts of the flange or the angle adjustment unit, apply grease to the bolts. (Recommended grease is the one contains molybdenum.)

4.3 Mounting range of companion flange

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



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

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

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

$$\tan 5^\circ \approx 0.087$$

Fig. 4－2

4.4 Items required for adjustment test

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

(1) Cable between receiver unit and control unit (for calibration)
(2) Cable between receiver unit and transmitter unit (for calibration)
(3) Calibration gas cell
(4) Power supply drum (or power supply extension cable)
(5) Digital multimeter
(6) BNC for light axis adjustment (ZZP＊ZSSTQ505298)
(7) Flow meter (about 2L/min)
(8) N_2 Gas cylinder
(9) Gas cylinder corresponding to the span (80 to 100% of span)
(10) Regulator (for gas cylinder) (For HCl/NH_3 meter, prepare a stainless steel regulator. If using a brass regulator, use it only once and then discard it. A brass regulator may get rusty inside, and the rust absorbs gas to disturb accurate measurement.)
(11) 10/8 mm PTFE tube, 10 m (we recommend to prepare the tube with some extra length)
(12) Rc1/4 × 10/8 joint, two or more
(13) Tools (2 spanners, measure, cutter, Phillips screwdriver, flat-blade driver, hexagonal wrench, tube cutter)
(14) Plastic sheet (used to prevent the drop of parts and/or tools)

4.5 Setup procedure

		Page
(1)	**Installation site check** Check that the transmitter unit, the receiving unit, and the control unit are installed in a location that meets the requirements. (“4. INSTALLATION”)	P.8
	↓	
(2)	**Installation dimension check** Check that the transmitter unit and the receiver unit are installed in a manner that meets the dimension requirements. (“4.2 Mounting dimensions”)	P.11
	↓	
(3)	**Flange position check** Check that the companion flange for the transmitter unit and for the receiver unit are installed in positions that meet the requirements. (“4.3 Mounting range of companion flange”)	P.12
	↓	
(4)	**Purging line check** Check that one 10/8 mm tube for purging, equipped with a flowmeter or a flow regulator, is prepared for each of the transmitter unit and the receiver unit.	P.19
	↓	
(5)	**Power supply and RS-485 wiring** 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. Check the wiring for RS-485 communication.	P.26, 28
	↓	
(6)	**Zero calibration** *If the analyzer has been turned off for a long time, warm-up the transmitter for about 90 minutes before calibration. (“6.1 Zero calibration”).	P.42 to 45
	↓	
(7)	**Light intensity check** Take a memo of the output value from the probe for adjusting the received light intensity during zero calibration. (“4.6 Received light ”)	P.15
	↓	
(8)	**Span calibration** *If you feed any corrosive gas such as hydrogen chloride and carbon oxide, use the exhaust gas tube long enough and at an adequate position so that no one breathe in the gas. *Flow the zero gas after span calibration. (“6.2 Span calibration”)	P.46, 48
	↓	
(9)	**Angle adjustment** Attach the angle adjustment unit on each companion flange. Adjust the angle of the transmitter unit and the receiver unit. (“4.7.3 Adjustment procedure”)	P.16, 18
	↓	
(10)	**Installation of purging equipment** (“4.8 Piping system diagram”)	P.19
	↓	
(11)	**Installation of the transmitter box and the receiver box** (“4.9 Installation of the transmitter box and the receiver box”)	P.20
	↓	

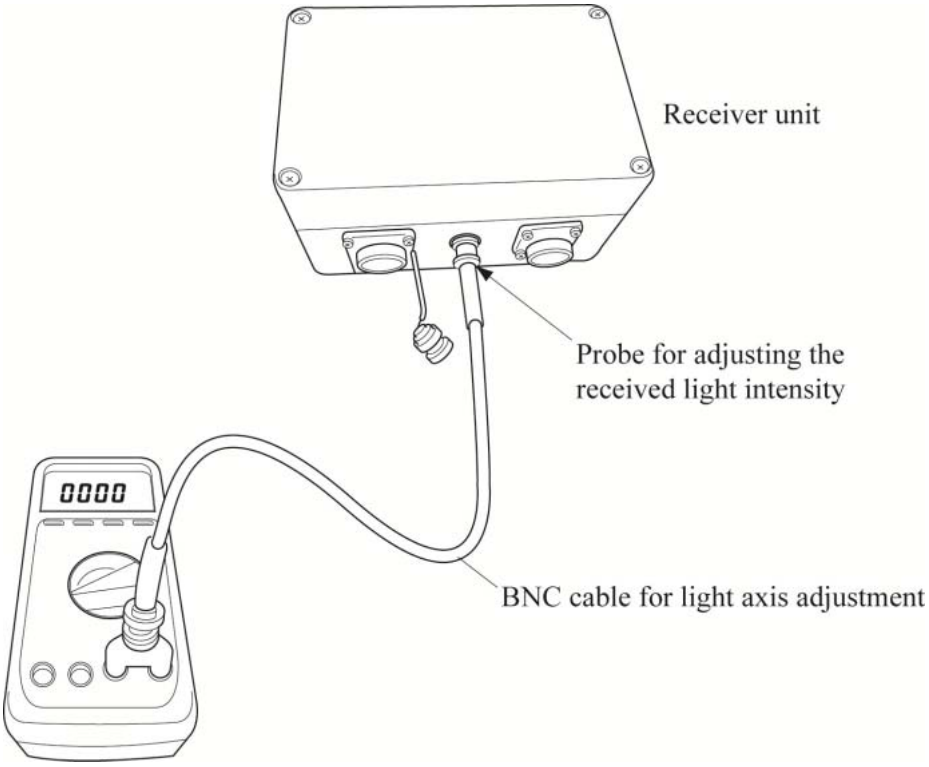
(12)	**Cable connection** Connect the cable between the transmitter unit and the receiver unit, and the cable between the receiver unit and the control unit. (“4.10 Cable connection”)	P.21, 22
	↓	
(13)	**Turning on the control unit**	
	↓	
(14)	**Light intensity adjustment** Adjust the light intensity to as close to the value on nameplate as possible. *This may be difficult when you adjust the angle while the furnace is in operation.	
	↓	
(15)	**Optical path length setting** Enter the optical path length on the control panel. (“6.5 Parameter setting”)	P.63 to 67
	↓	
(16)	**Analog signal wiring**	P.28
	↓	
(17)	**Output item setting** Select the items to be transmitted. (“6.8 Analog output”)	P.63
	↓	
(18)	**Analog signal adjustment** Make a analog output setting in reference to “6.9 Fine adjustment of analog output value”.	P.63 to 67
	↓	
(19)	**Analog input setting** If you use external sensors for gas pressure, gas temperature, gas flow rate, O_2, and /or H_2O, make necessary settings for them. For the items with no external sensor, set the parameter to fixed value. Gas temperature, O_2, and HCl have to be properly set for measurement. If there is a difference between the gas temperature during furnace suspension and the fixed gas temperature, measurement error may occur. (“6.7 Analog input”)	P.63 to 67
	↓	
(20)	**Other parameters setting**	P.83
	↓	
(21)	**Digital signal wiring**	P.28
	↓	
(22)	**Analog signal adjustment (as needed)**	P.84
	↓	
(23)	**Alarm output check (as needed)**	P.87

4.6 Received light intensity check

(1) Remove the cap from the probe (BNC socket) of the receiver unit, and connect the probe and the digital voltmeter using the BNC cable for light axis adjustment.
(2) Read the DC voltage value. The receiver unit emits a voltage about 3 V DC when the light transmittance is 100%.
(3) The voltage value during zero gas is supplied with the calibration cell connected becomes the reference light intensity for light axis adjustment which is performed after the equipment is attached to a companion flange (Factory-set voltage is described on a nameplate on the covers of the receiver unit, transmitter unit, and control unit).

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

- Single laser version



- Dual laser version (CO + O_2 analyzer)

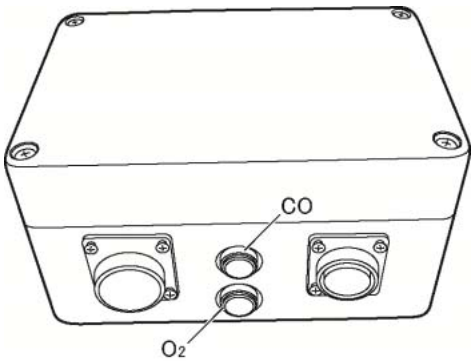


Fig. 4－3

4.7 Angle adjustment

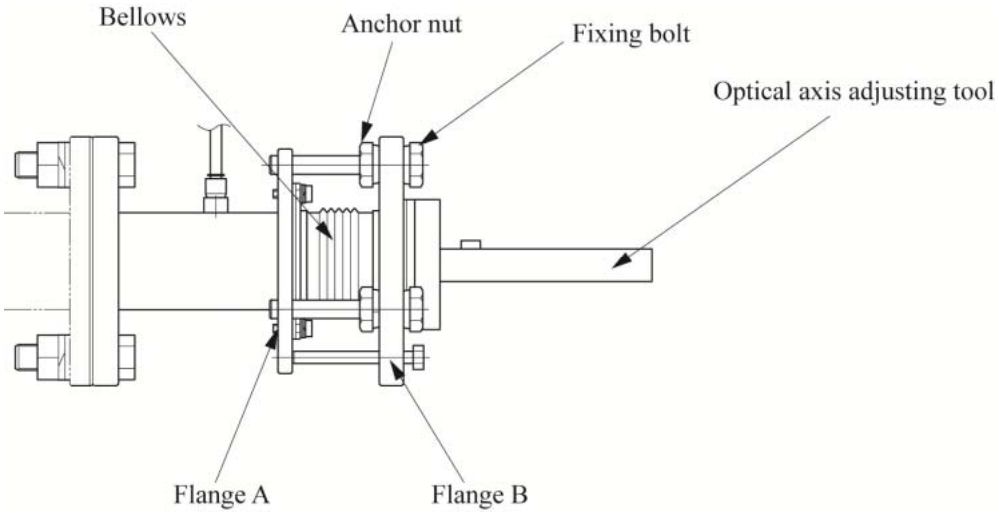


Fig. 4－4

4.7.1 How to use the angle adjustment unit 1

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

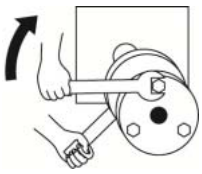


Fig. 4－5

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

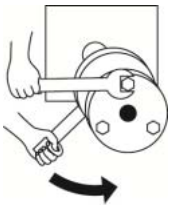


Fig. 4－6

(3) When you fix the flange B
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 flange B, the angle will slip.

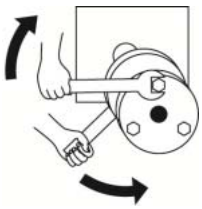


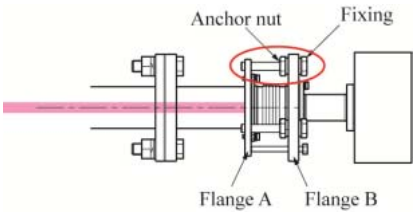
Fig. 4－7

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

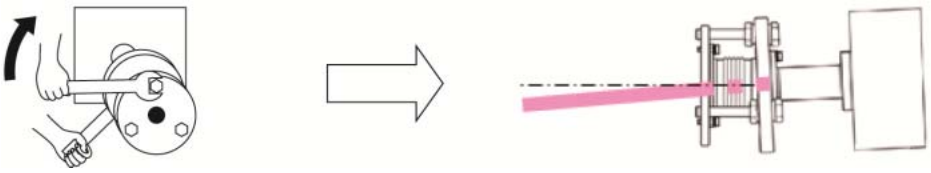
4.7.2 How to use the angle adjustment unit 2

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

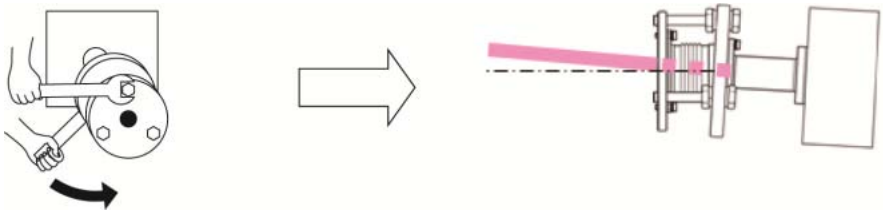
(1) If the flange A and the flange B are parallel, the laser beam points horizontal direction.



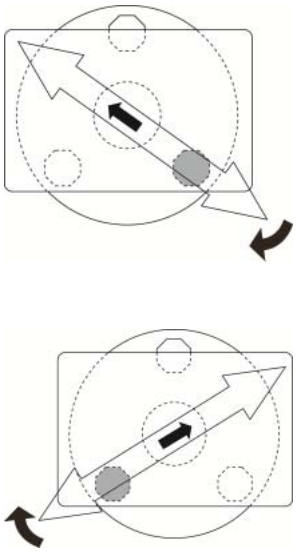
(2) If you screw up the bolt shown in the below figure, the place where the bolt is screwed up moves towards the flange A, and the laser beam faces downward.



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



・In the same way, if you screw up the bolt and nut colored gray in the below figure, the light axis moves as follows.



4.7.3 Adjustment procedure

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

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

(1) When the flanges A and B shown in Fig. 4－4 are extremely tilted, adjust them in a flat place before mounting them to the stack so that they are parallel to each other. Refer to “4.7.1 How to use the angle adjustment unit 1”.
(2) Mount the angle adjustment unit to the companion flange on the stack.
- Make sure the fixing bolts come to the positions shown in Fig. 4－8.
- Mount the angle adjustment unit so that the companion flange and the flanges of the angle adjustment unit are as concentric as possible.
- Do not mount the transmitter box and the receiver box yet.

(3) With the hexagon socket head bolts, attach the laser pointer to the angle adjustment unit of the transmitter side, and the laser scope on the angle adjustment unit of the receiver side. (The laser pointer has two kinds of holes at different distance from the center. Fix it with three bolts.)
(4) Emit light from the laser pointer, and adjust the angle adjustment unit referring to “4.7.2 How to use the angle adjustment unit 2” so that the pointer’s light comes the center of the target.
(5) Using the attached hexagonal socket screws, fix the laser pointer to the angle adjustment unit on the receiver unit, and the laser scope to the angle adjustment unit on the transmitter unit.
(6) Adjust the optical axis in the same way as the step 4.
(7) When you have finished adjustment, retighten the fixing bolts and nuts lightly. Take care not to move the light axis. Remove the laser pointer and the target.

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

(1) When the flanges A and B shown in Fig. 4－4 are extremely tilted, adjust them in a flat place before mounting them to the stack so that they are parallel to each other. Refer to “4.7.1 How to use the angle adjustment unit 1”.
(2) Attach the angle adjustment unit to the companion flange in a manner that:
- Make sure the fixing bolts come to the positions shown in Fig. 4－8.
- Mount the angle adjustment unit so that the companion flange and the flanges of the angle adjustment unit are as concentric as possible.

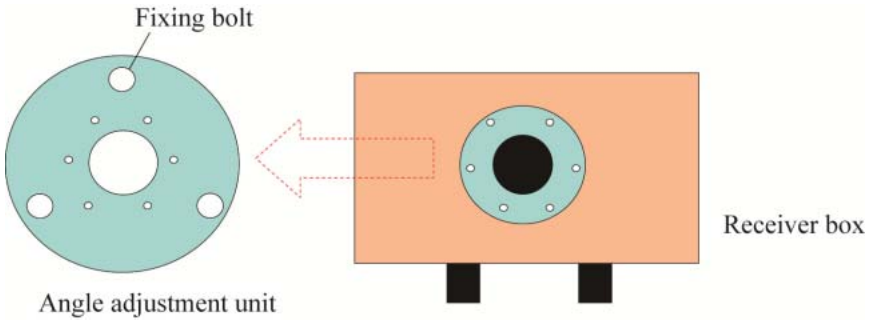
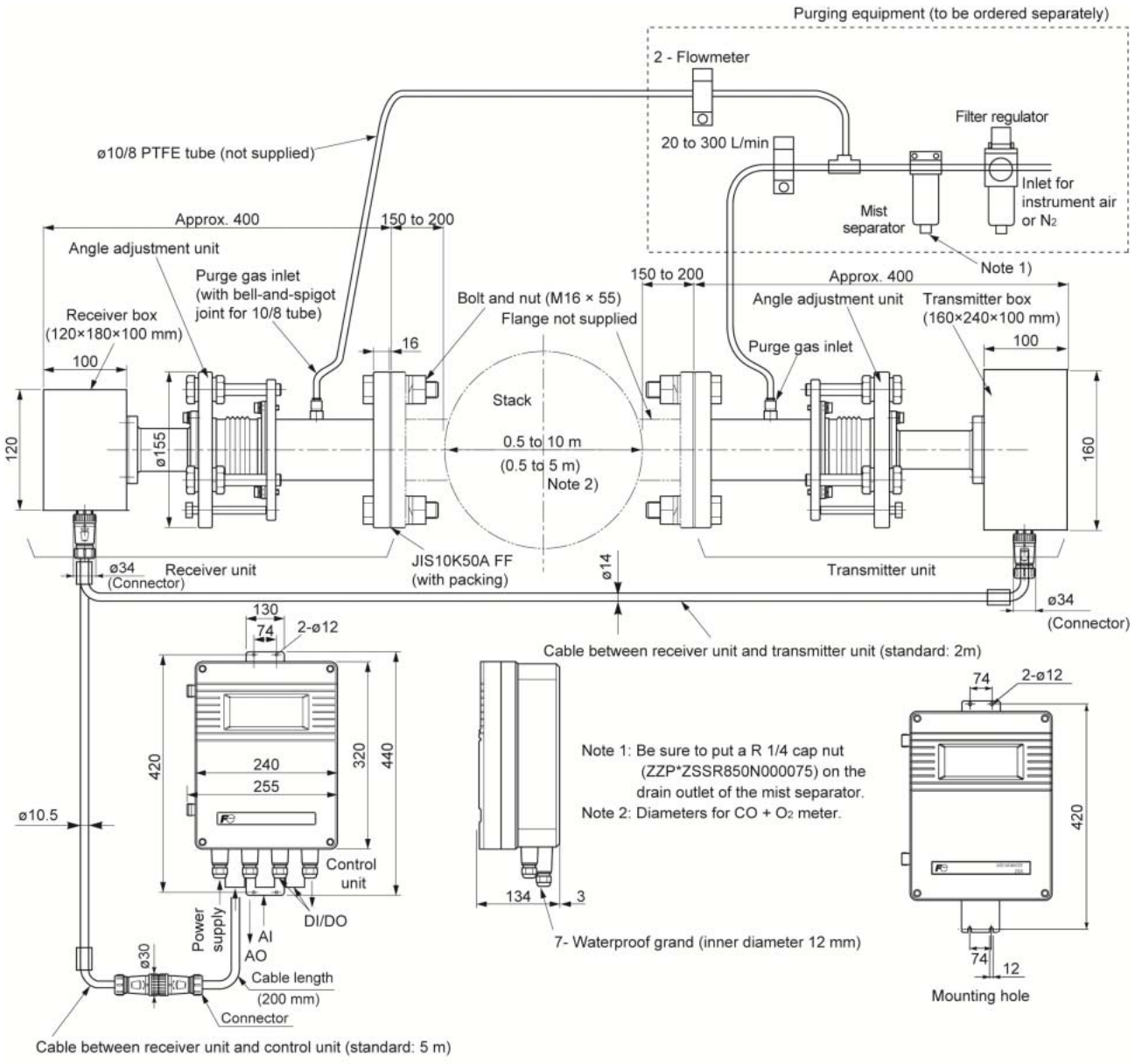


Fig. 4－8

(3) Mount the transmitter box and the receiver box in reference to 4.9 Installation of the transmitter box and the receiver box.
(4) Adjust the light intensity, referring to “4.11.2 When an optional optical axis adjusting tool (laser pointer) is not used”.

4.8 Piping system diagram



Notes:

- For O_2 analyzers other than the instrument air purge version, use N_2. For all the other cases, use instrument air. If you use air that contains oil and/or mist, the purge gas flow decreases due to the contaminant, which adversely affect the measurement. In such a case, frequent maintenance is required, and in some cases you may have to install a filter additionally.
- Once you install the analyzer, you have to purge the equipment with instrument air or N_2 regardless if the analyzer and the furnace are in operation or not. If you operate the furnace without purging, it may cause the fatal damage to the optical part.

Fig. 4－9

4.9 Installation of the transmitter box and the receiver box

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

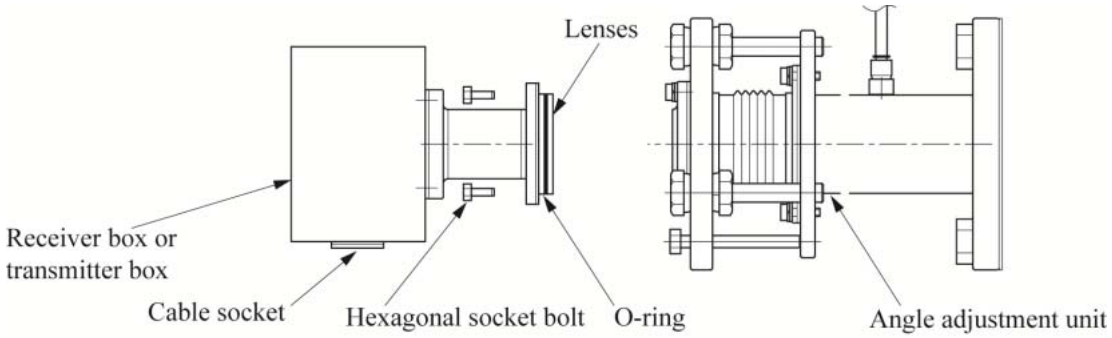


Fig. 4－10

4.10 Cable connection

4.10.1 Between transmitter unit and receiver unit

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

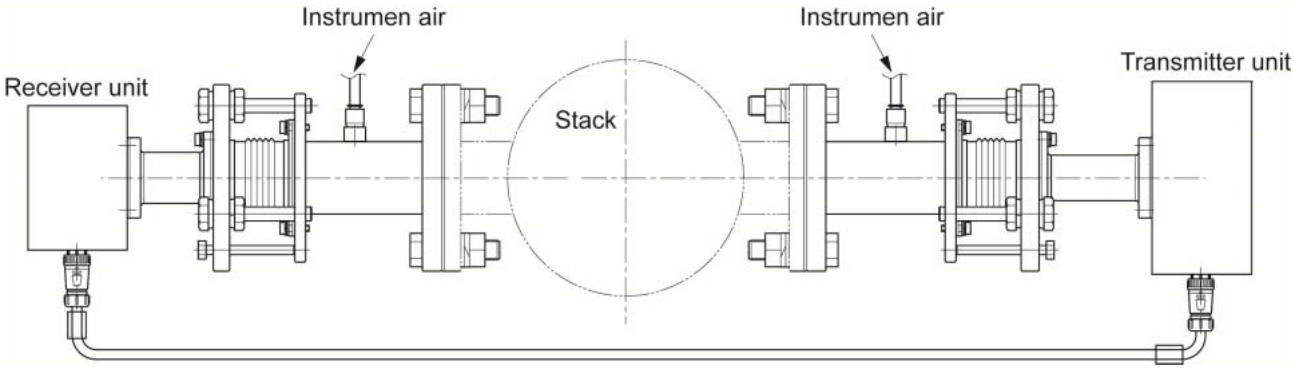


Fig. 4－11

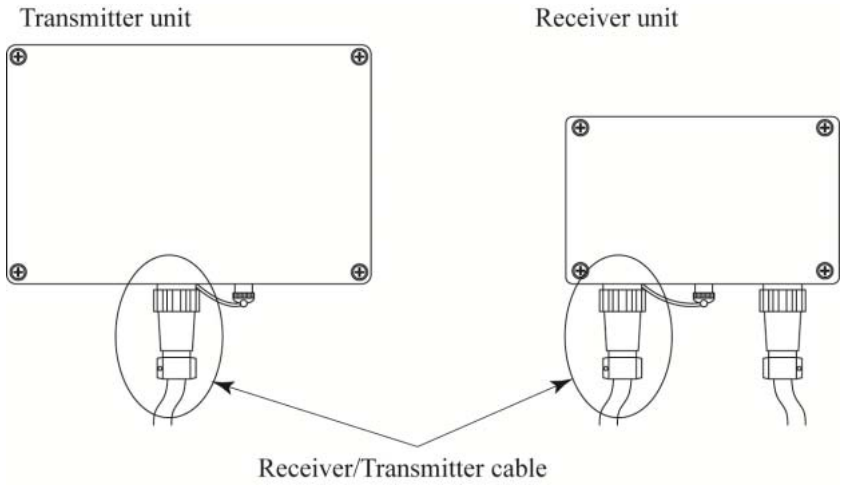


Fig. 4－12

4.10.2 Between receiver unit and control unit

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

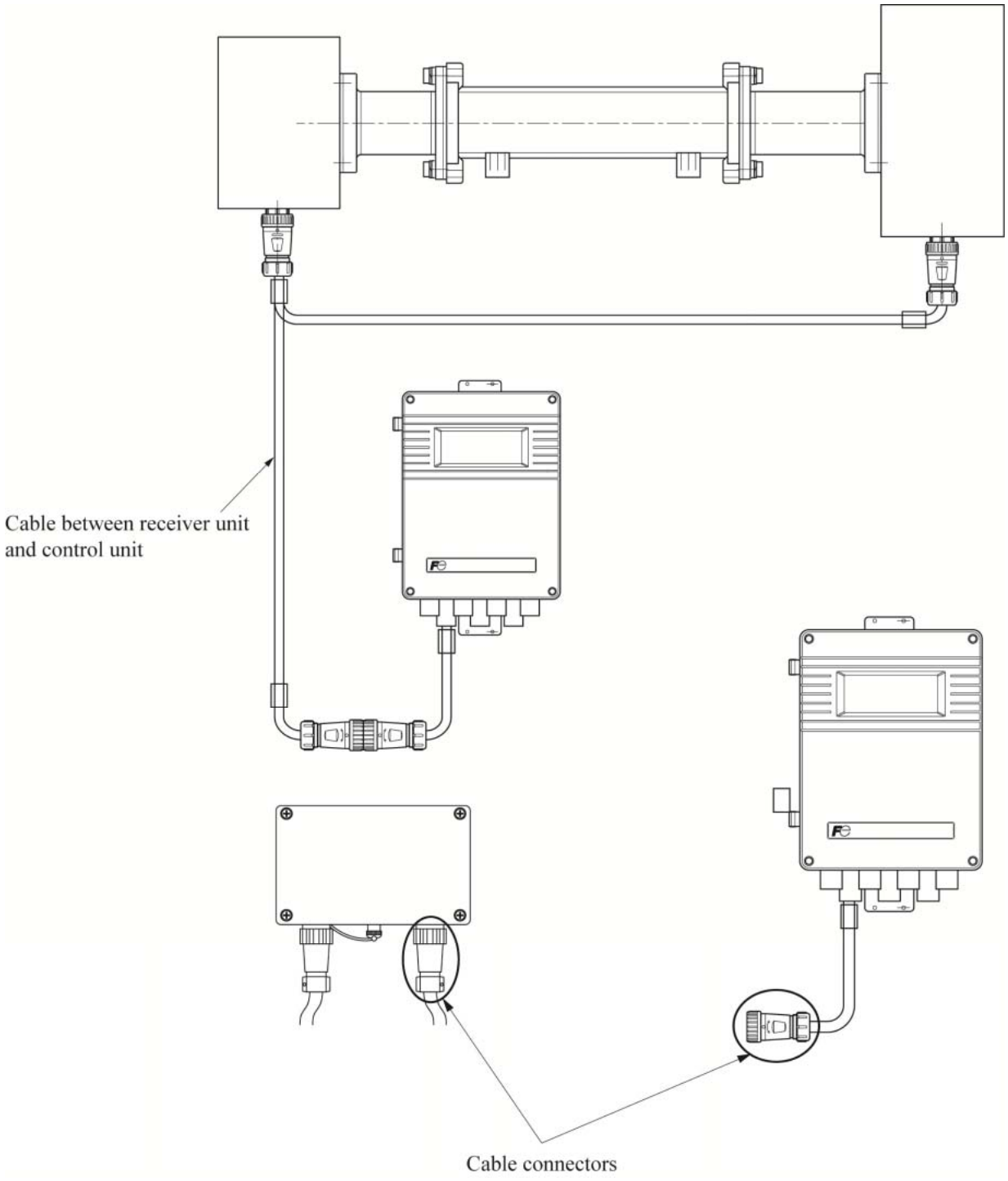


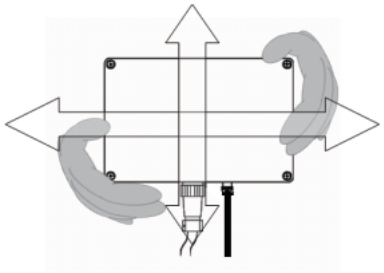
Fig. 4－13

4.11 Light intensity adjustment

Note that if you loosen multiple bolts and nuts at a time, it takes considerable time to re-adjust the angle.

4.11.1 When an optional optical axis adjusting tool (laser pointer) is used

(1) Connect the digital voltmeter using the BNC cable, referring to “4.6 Received light ”.
(2) The reference light intensity is based on the output in zero calibration or voltage value of light intensity which is described in a nameplate.
If the output is not as much as that measured at the time of calibration before the adjustment, find a position where the received light intensity increases, moving the transmitter box from side to side and up and down slowly. (*1)(*2)(*3)



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

(3) If the output voltage is less than the value obtained during a zero calibration despite your adjustment of the transmitter box to make the output maximum, fix the transmitter box and then move the receiver box to adjust the optical axis.
Do not loosen more than one bolt or loosen fixing bolt and nut widely in both cases of adjustment. Light axis may deflect again.
(4) Retighten all volts to fix them (If the light intensity decreases at retightening, adjust again).

*1) Received light intensity might not increase to its maximum that was confirmed by “4.6 Received light ” due to the influences from dust and moisture in the stack.
*2) When using the high-speed/AGC version (i.e. the 22th digit of code symbols is "H"), adjust the light axis under the status that the level of AGC is "01" (refer to "5.3 Outline of screen ").
*3) When using CO + O_2 analyzer, check the received light intensity at two points, and then adjust them to be maximum.
Carry out the adjustment of the O_2 analyzer first and the CO analyzer next because it is easier than the reverse way.

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

(1) Connect the digital voltmeter using the BNC cable, referring to “4.6 Received light ”.
(2) The reference light intensity is based on the output in zero calibration or voltage value of light intensity which is described in a nameplate.
When the light intensity 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 intensity increases. If you cannot still confirm the light intensity, loosen the fixing bolts and nuts further, and check reaction of the digital voltmeter while moving the box back and forth slowly.
(3) If you find reaction of light intensity increases, fasten the fixing bolts and nuts temporally, and perform the operation in 2). (*4)
(4) If output is not as much as that measured at the time of calibration even if output is at its maximum on the transmitter side, fix the box at the maximum output angle temporality and adjust the light axis, moving the box on the receiver side similarly. When you can confirm the output at the time of adjusting any of the boxes, do not loosen the fixing bolts and nuts too much, or the light axis can deflect further. Do not loosen more than one bolt or loosen fixing bolt and nut widely in both cases of adjustment. Light axis may deflect again.
(5) Move the transmitter unit and the receiver unit from side to side and up and down to adjust until the voltage value of light intensity of digital multimeter becomes smaller in all directions.
(6) Retighten all volts to fix them (If the light intensity decreases at retightening, adjust again).

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

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

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

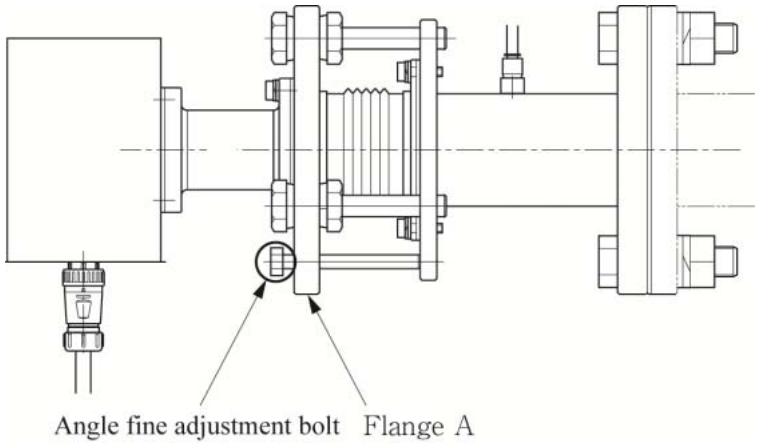


Fig. 4－14

4.13 Connecting to control unit

Do not supply the power until all the wiring work is completed.
To ensure the watertight property of the cable glands, use the cables that have an outer diameter from 6 mm to 10 mm.

4.13.1 AC power connection

AC power connecting terminal is positioned at the lower left of the control unit (see Fig. 4－15.). Use the AC cable that has a flame resistance of 600 V, a cross-sectional area of 1.25 mm^2 (AWG16) or more, and an outer diameter between 6 mm through 10 mm. Connect the grounding wire to the protective earth terminal.

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.
Add a ferrite core both inside and outside of the case. If you install the control unit outside, we recommend taking a measure to protect the ferrite core attached outside the case from deterioration; for example, cover it with plastic tape.

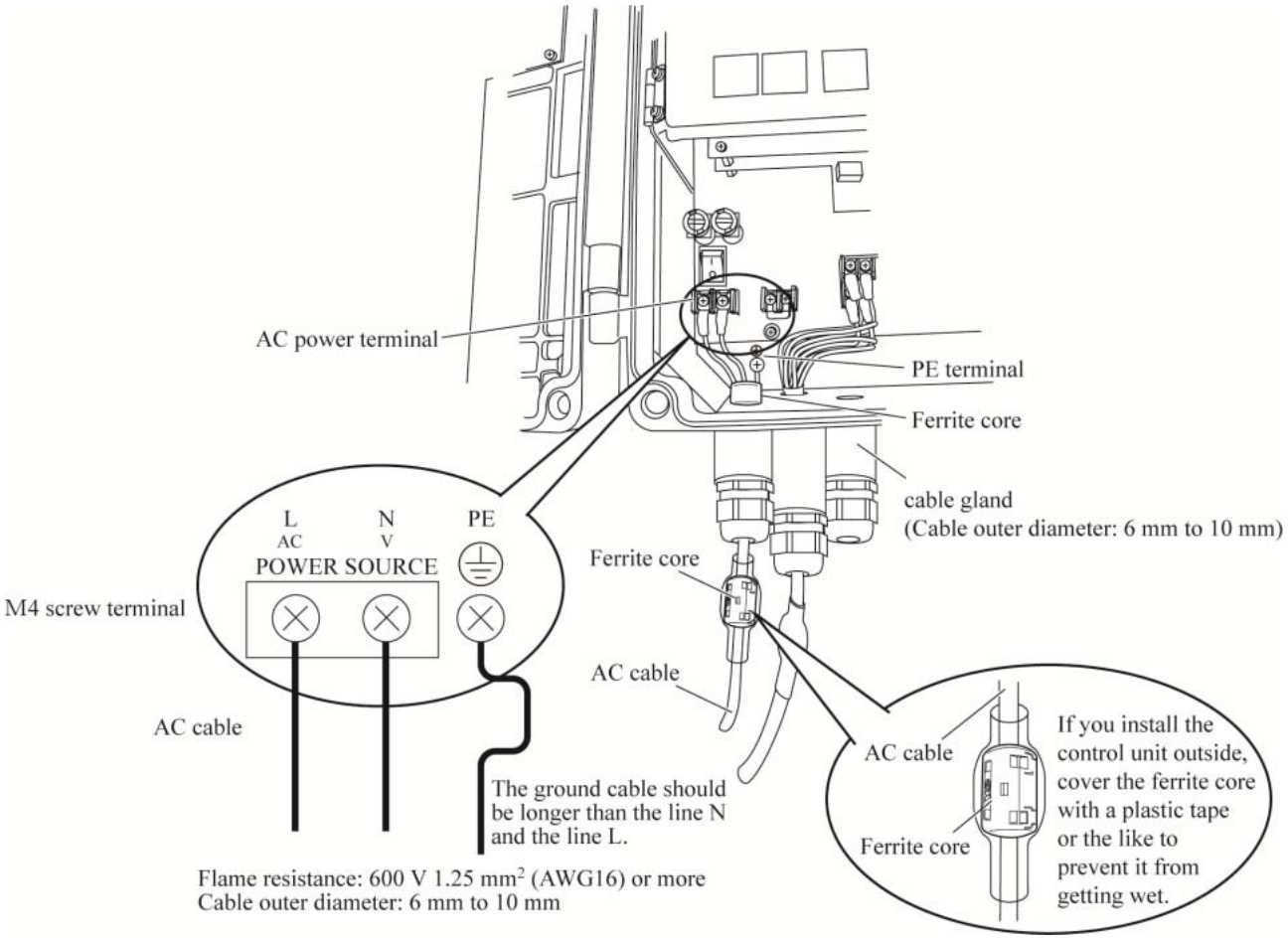
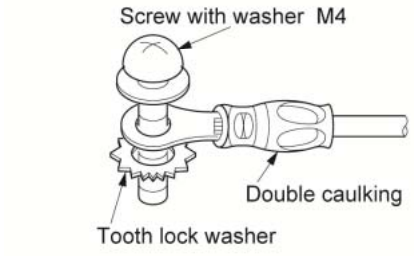


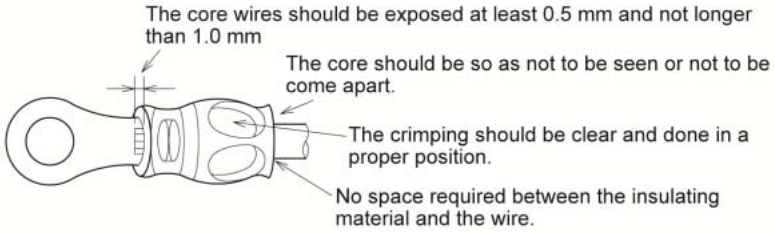
Fig. 4－15

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

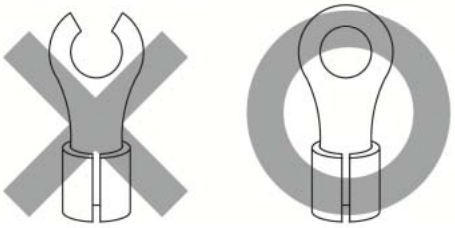


Note

- Use a yellow or green cable of which cross-sectional area is 2 mm^2 or more. for main ground (earth) line.
- For solderless terminal, crimp the core and the sheath separately.



- Use ring-shaped terminal lugs.



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. 4－16. If the varistor is located away from the noise source, no effect is obtainable.

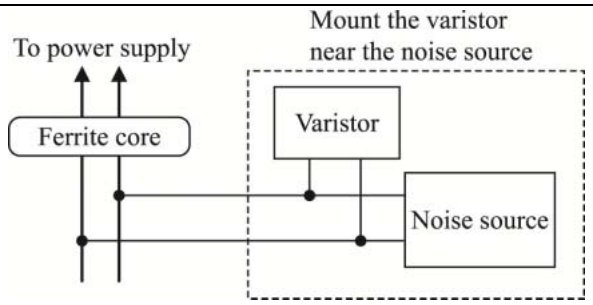


Fig. 4－16

CAUTION

- For power line, use the cables that have a cross-sectional area of 1.25 mm^2 or more.
- Connect the power cable to the socket with the ground slot (class D grounding). For grounding line, use the cable that has a cross-sectional area of 2 mm^2 or more.
- For signal lines, use a shielded wire in order to suppress the influences by noise.
- For the digital contacts and the digital input lines, use cables that have a cross-sectional area of 0.12 mm^2 (AWG26) or more.
- 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.
- Use M4 solderless terminals for terminal connection.
- For the power line and the grounding line, use solderless terminals of the type that core wires and shield lines are crimped separately.

4.13.2 Connecting analog input/output

Connect the analog input and output properly, referring to “3.2 Wiring diagram”. According to your order, 4–20 mA DC or 1–5 V DC analog signal is emitted. For connection of the signal cable, use an insulated converter (WS2DC Series, manufactured by Fuji Electric Technica Co., Ltd. or equivalent) to supress the influences by noise.
Analog input signal shall be 4 to 20mA DC.

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

4.13.3 Connecting digital input/output

Connect the contact input and output properly, referring to “3.2 Wiring diagram”. If it is provided with the separately submitted approved drawing, connect the contact input/output as shown in the drawing. For wiring, use shielded wires of which cross-sectional area are 0.12 mm^2 (AWG26) or more.

4.13.4 RS-485 connection

(1) Open the cover of the control unit. Remove the two screws shown in the below figure.

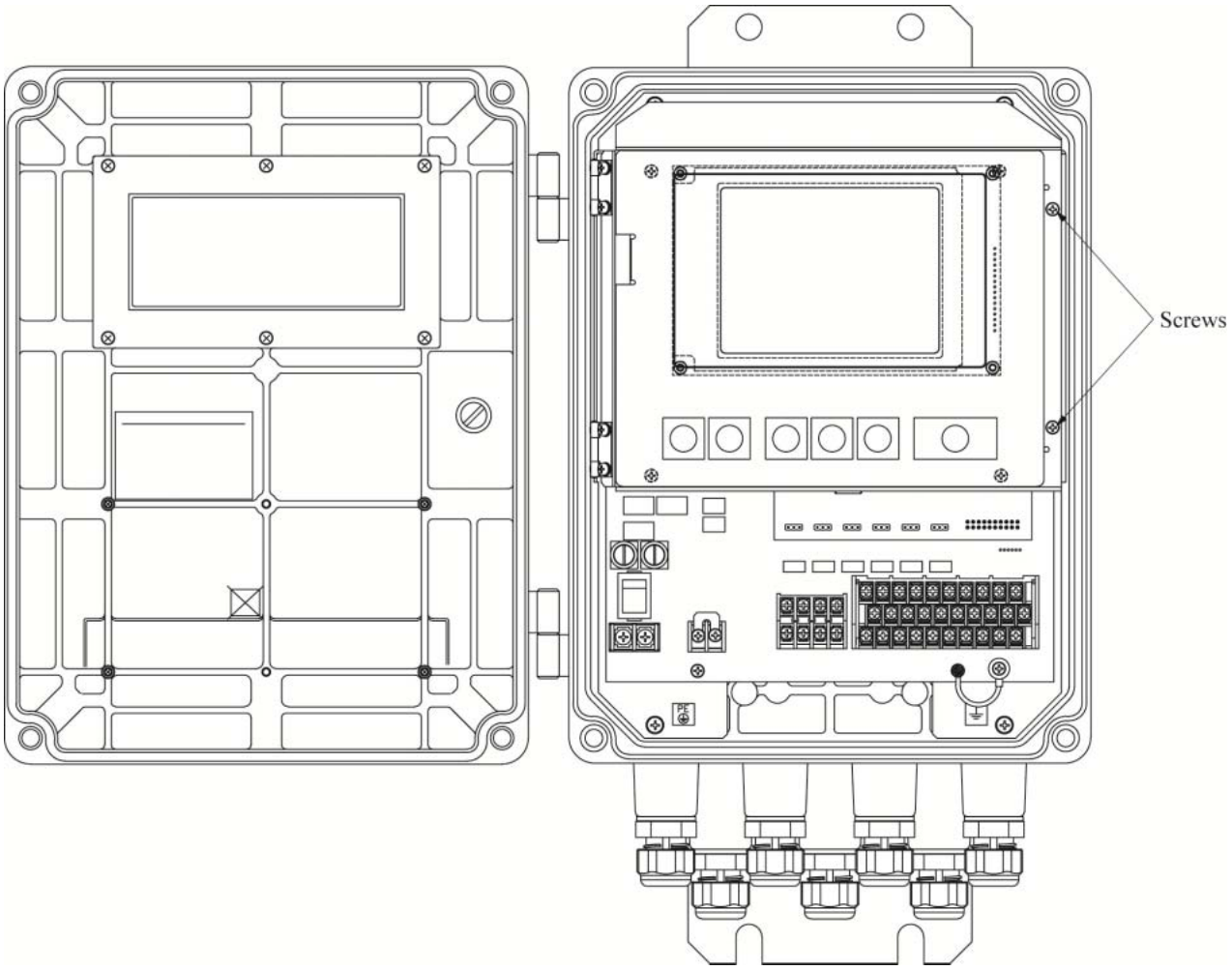


Fig. 4－17

(2) Open the control panel, and you can see the terminal box on the right side of the printed board.

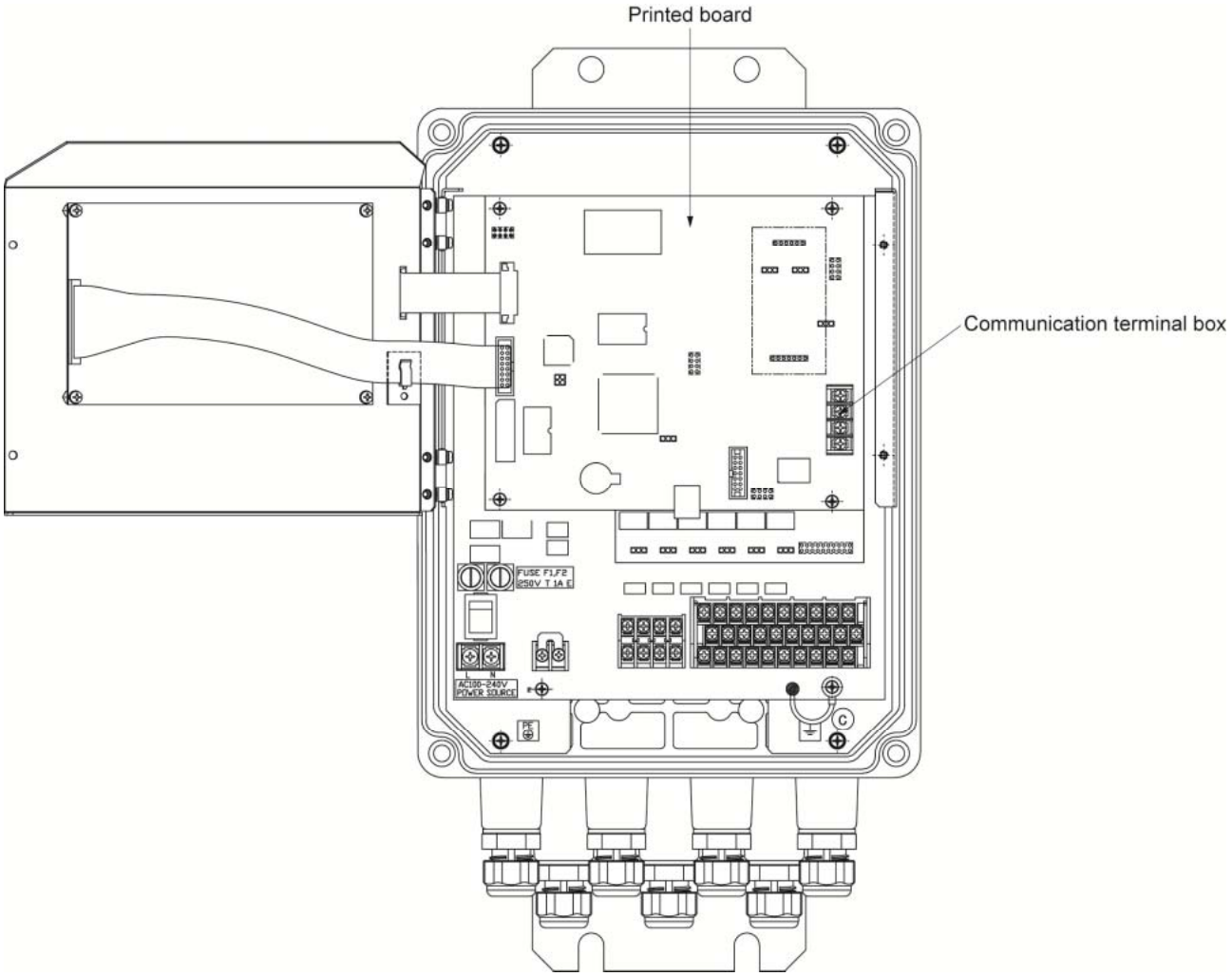


Fig. 4－18

(3) Connect the cables as shown in the figure 4-19.
Cable cross-sectional area shall be between 0.2 mm^2 (AWG24) and 0.12 mm^2 (AWG26).
Terminate both ends of a cable (between ② and ③) by using 100Ω (≥ 1/2W) resistors.
Put the terminal cover back on after you finished wiring.
Do not use an unassigned terminal as a relay terminal.

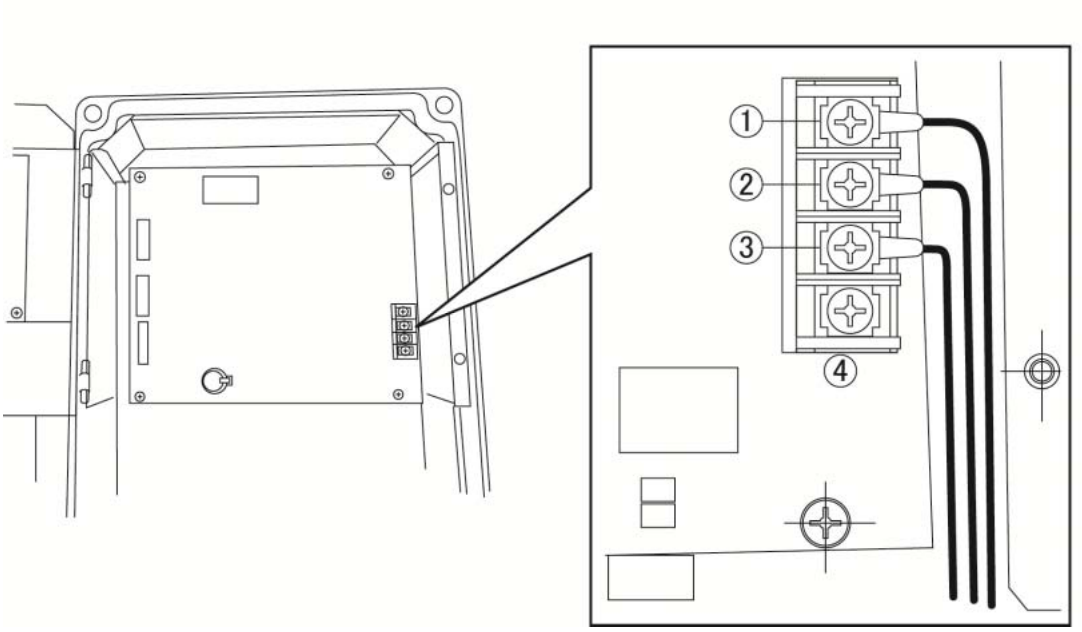
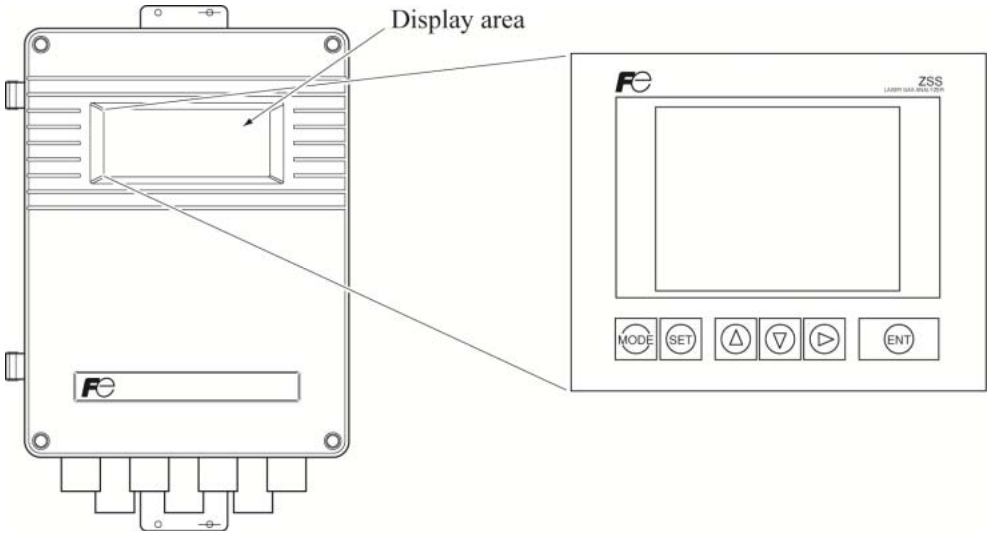


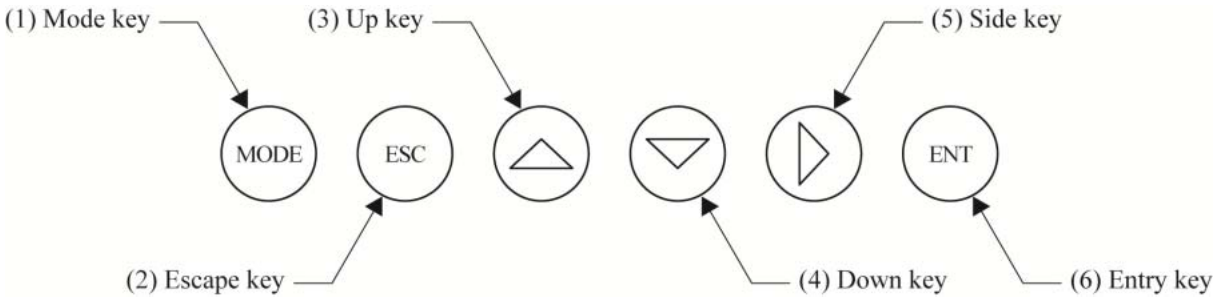
Fig. 4－19

Terminal No.	Signal
1	Ground
2	RTxD+
3	RTxD-
4	NC

5. OPERATION PANEL AND SCREEN

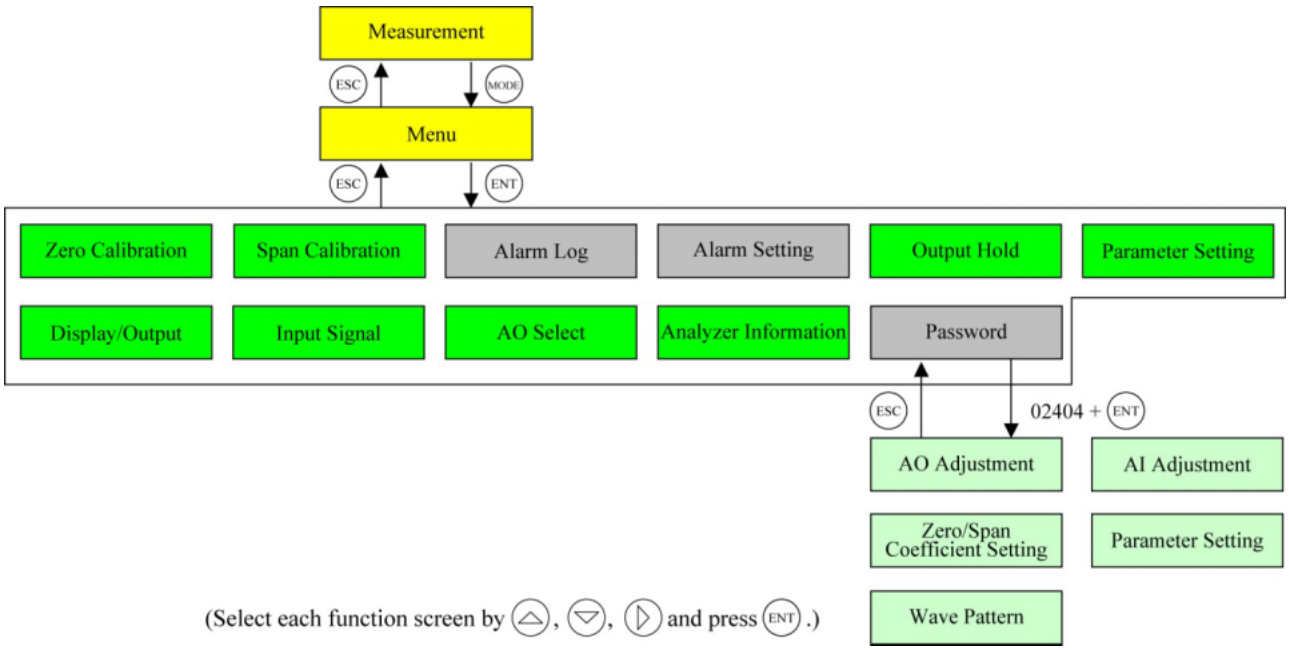
5.1 Operation panel





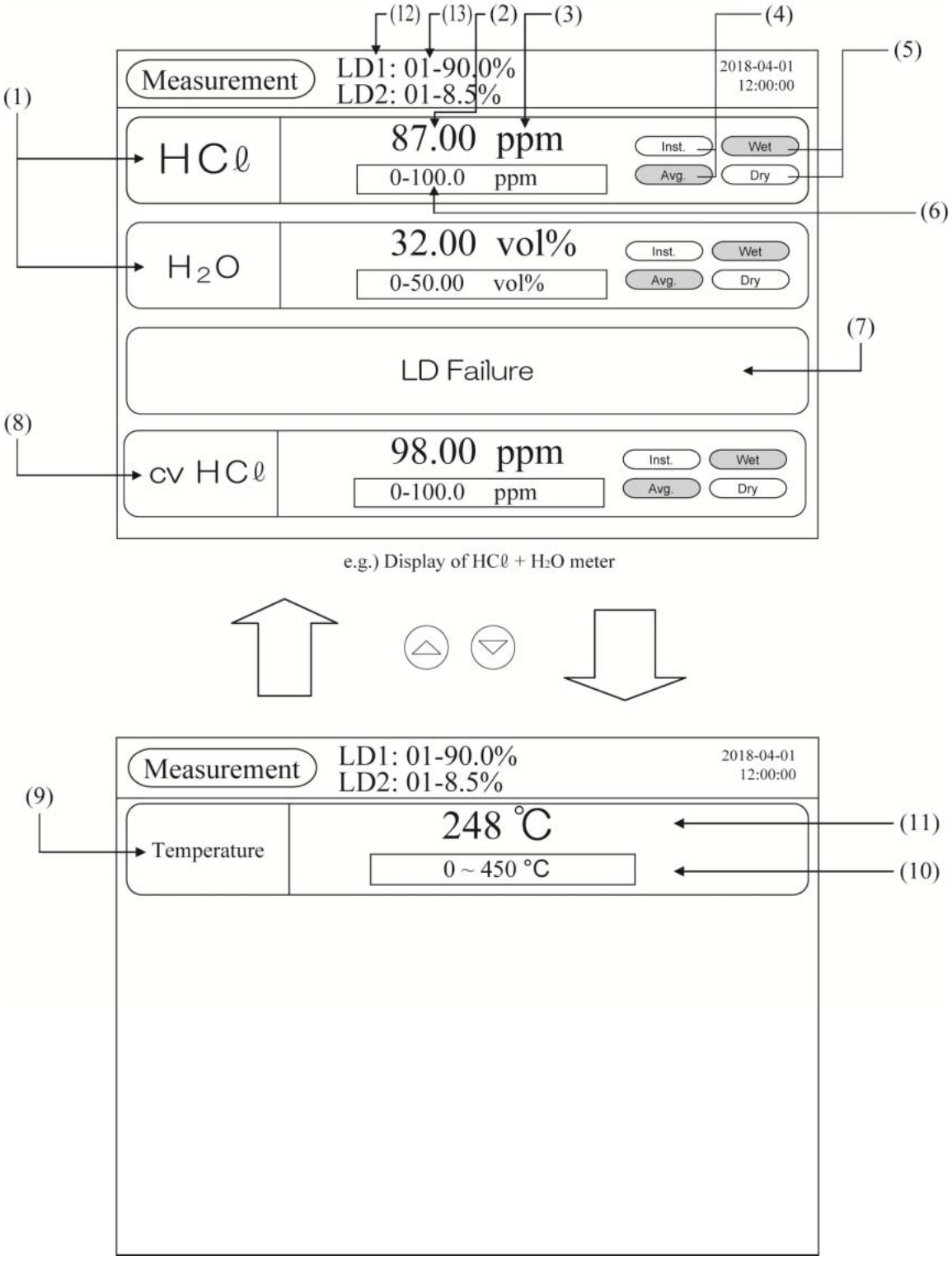
Name	Functions	Name	Functions
(1) Mode key	Used to display the menu mode.	(4) Down key	Used to move the cursor, change the selected item and decrease numeral value.
(2) Escape key	Used to return to a previous screen or cancel the setting in midway.	(5) Side key	Used to move the cursor and change numeral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

5.2 Screen configuration



5.3 Outline of screen

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



e.g.) Display of HCℓ + H_2O meter

On the measurement screen, the display shows the components being measured, alarm, reference-O_2-corrected concentration, and analog input. If there are more than four items to be displayed, use UP, DOWN or ENT to move up, down, or across the screen.

5.3.1.1 Name (functions)

(1) Measured component ····· Displays the gas component to be measured in molecular formula.
(2) Concentration value ····· Displays the measured concentration. The value is reversed during the value is held and during automatic calibration of laser waveform is in operation.
(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 reversed value is displayed.)
(5) Wet / Dry ····· Indicates whether the displayed concentration is wet base or dry base. (The reversed value is displayed.)
H_2O is fixed to "Wet".
(6) Range display ····· Displays the current full scale range.
(7) Alarm ····· Displays all the alarm. When more than one alarm has occurred, display is switched by 3 seconds.
(8) O_2 conversion value ····· If components of the HCl meter is provided with O_2 conversion output when ordering, it displays O_2 conversion. "Conversion**" is displayed as "Conversion HCl" on the display area. For changeover of instantaneous value/average value or wet/dry, display and analog output can be performed independent of the original conversion on "Display / Output" screen. For the contents of O_2 conversion, refer to "5.3.1.2 O_2 conversion concentration value".
(9) Analog input ····· Displays the analog input value which was set at the "Analog Input" screen. Analog input to be displayed are "Temperature", "Pressure", "Velocity", "O_2" and "H_2O". They are not displayed when selecting fixed value is selected.
(10) Analog input range ····· Displays the setting range of 4 to 20mA DC which was set at the "Analog Input" screen.
(11) Analog input value ····· Displays the analog input value corresponding to the setting range of 4 to 20mA DC which was set at the "Analog Input" screen.
(12) AGC level ····· Displays current level of AGC. (when using High-speed AGC version i.e. the 22th digit of type code is "H", or CO + O_2 meter i.e. the 4th digit is "V", "U", or "S")
(13) Light transmission ····· displays the percentage of the light transmitted through gas.

5.3.1.2 O_2 conversion concentration value

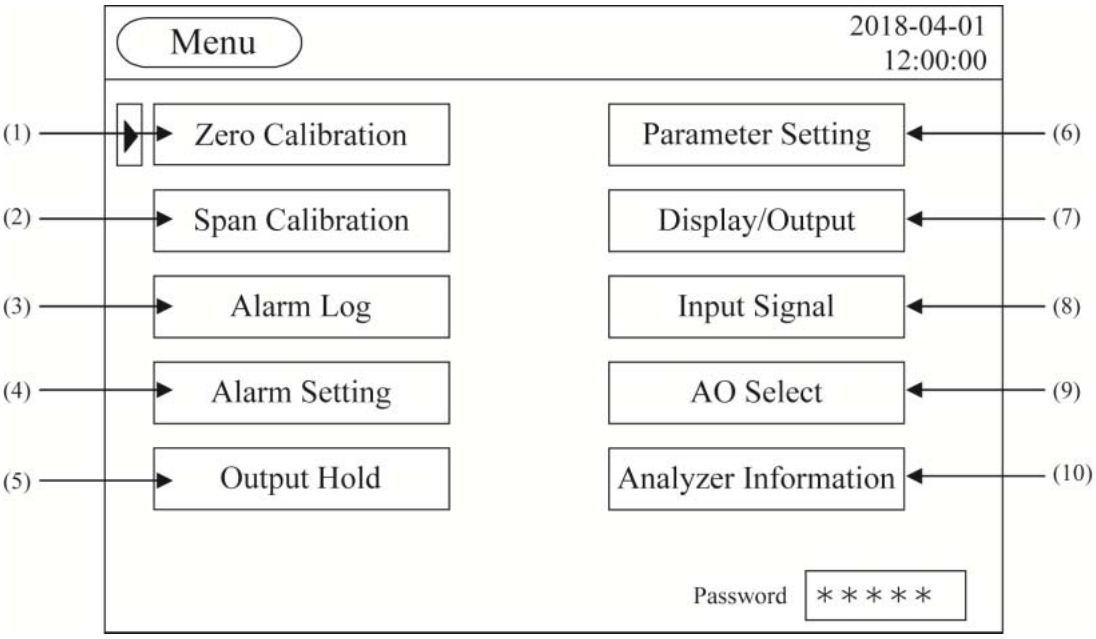
O_2 conversion concentration value is calculated from the following equation of measured component (Cs), instantaneous concentration of O_2 and O_2 correction reference value.

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

- 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 "Analog Input" screen. In the case O_2 input exceeds the limit value, calculate from the limit value. (Default value of the limit value: 20%.))
- Cs: Gas concentration for target component

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

5.3.2 “Menu” screen

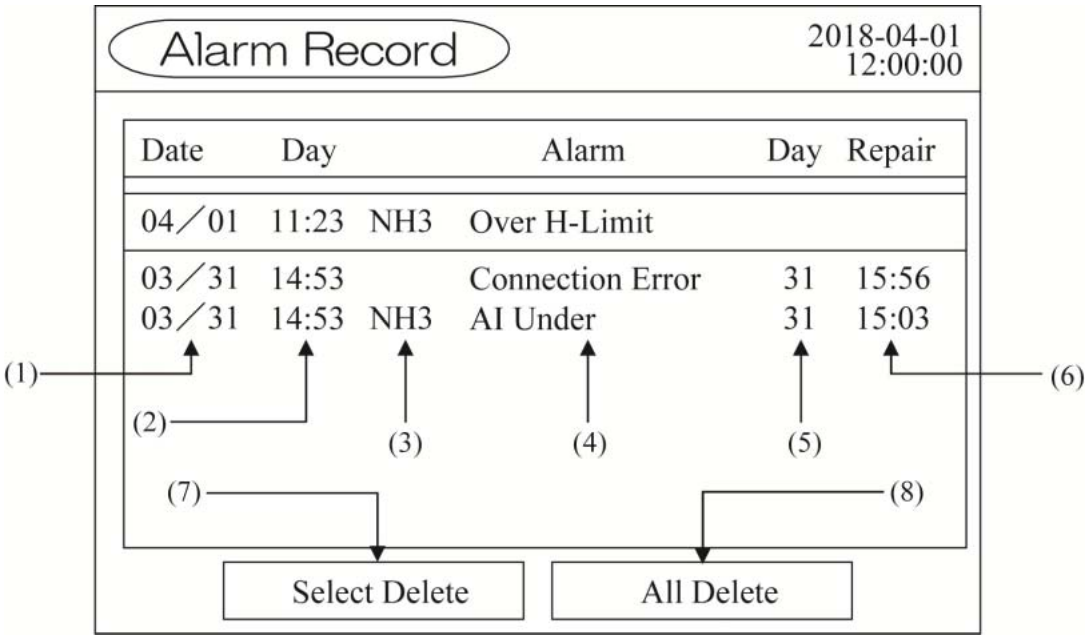


Press the MODE key while the “Measurement” screen is displayed, and the “Menu” screen appears. (It does not appear when pressing the MODE key while other screen is displayed. In that case, Press the ESC key to display the “Measurement” screen, and then press the MODE key.)

5.3.2.1 Name (functions)

(1) Zero Calibration ····· Used for performing zero calibration.
(2) Span Calibration····· Used for performing span calibration.
(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····· Used for setting the measurement value to be displayed on the “Measurement” screen such as switching “Instantaneous value / Average value” or “Wet / Dry”.
(8) Input Signal ····· Used when analog input range or fixed value are set for concentration correction or air purge alarm.
(9) AO Select ····· Used to determine what to output to the analog output terminal.
(10) Analyzer Information····· Display the calculation information of concentration. (It is user for trouble analysis)

5.3.3 “Alarm Record” screen



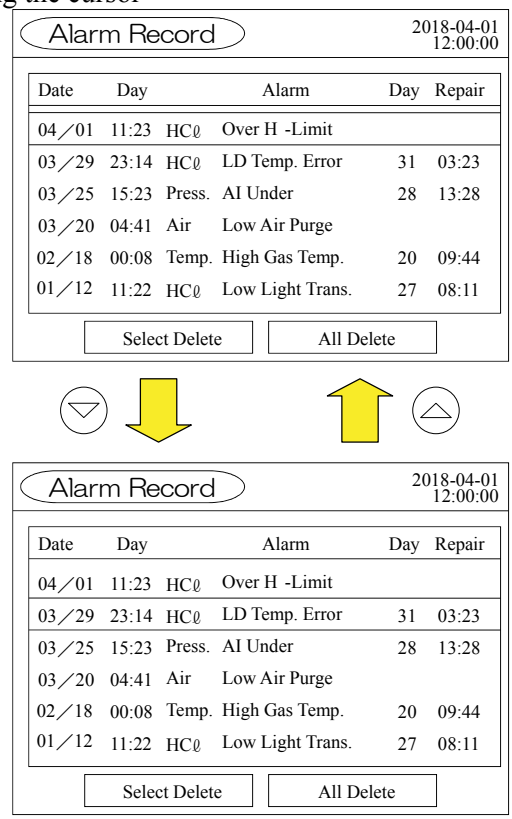
The screen displays the alarm record occurred in the past. The ten newest errors are logged. The oldest error will be deleted one by one every time a new alarm occurs. New errors are displayed from the top on the screen.
It displays the date, time and component when an alarm occurred, alarm contents,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

5.3.3.1 Name (functions)

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

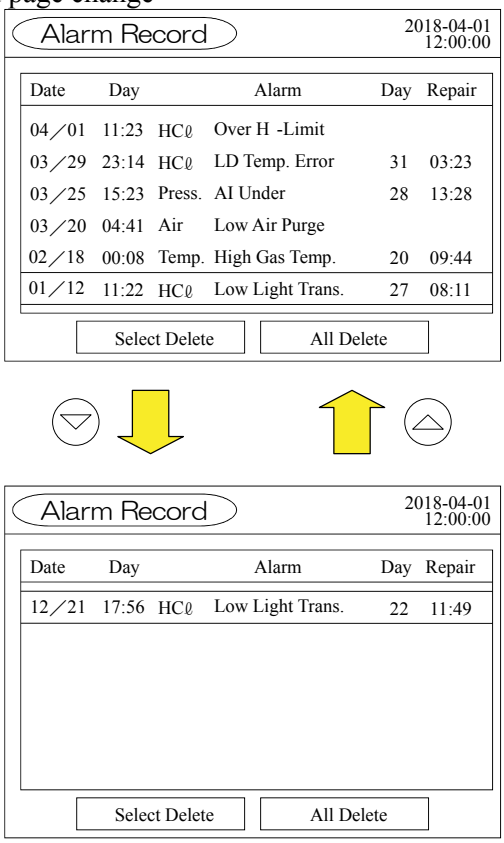
5.3.3.2 Basic Operation

- Moving the cursor



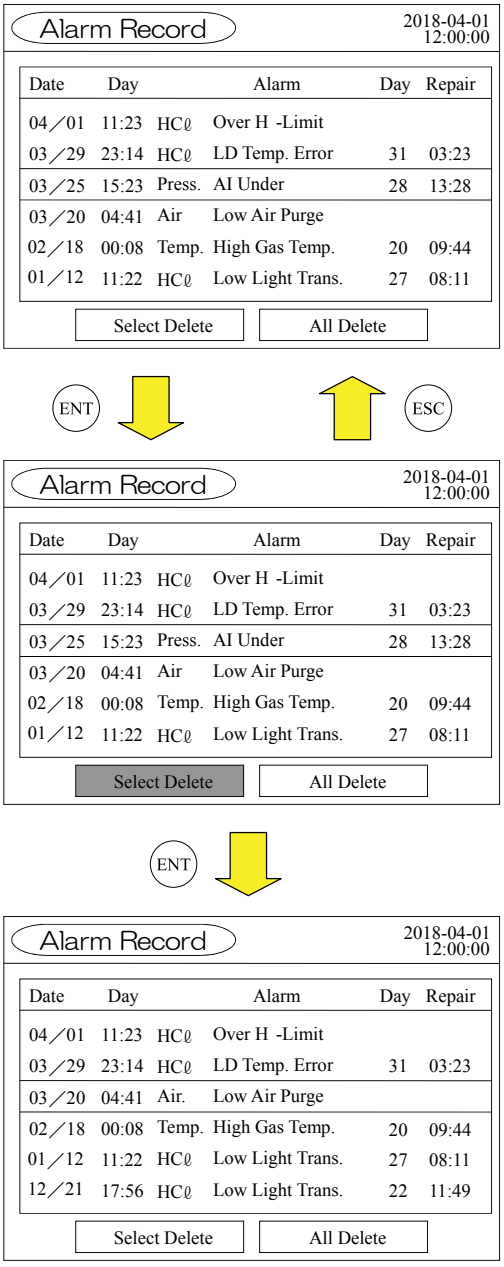
The cursor is moved.

- Record page change



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

- Selected alarm deletion

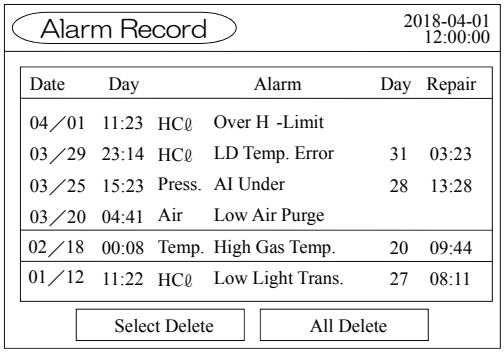


Move the cursor to the alarm to be deleted by pressing the ▲ or the ▼ key.

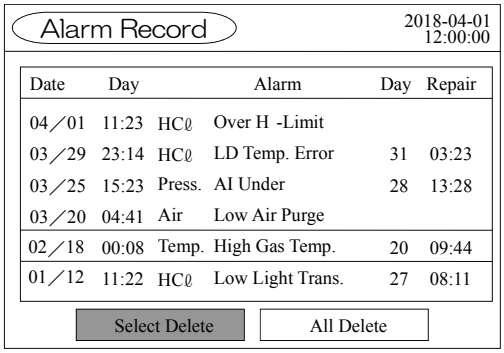
Press the ENT key, and the “Select Delete” is reversed.

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

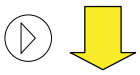
- All alarms deletion

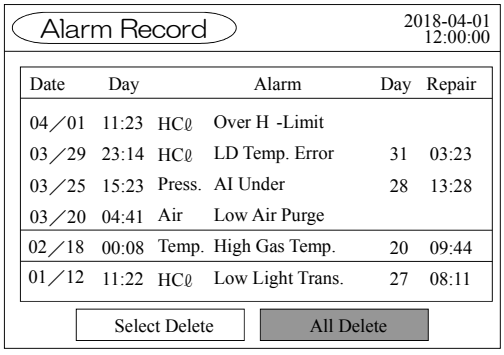


Press the ENT key at the desired place.

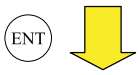


"Select Delete" is reversed.
Press the ▷ key and the "All Delete" is reversed.





Press the ENT key.



All alarms are deleted.

5.3.3.3 Alarm types

All the alarms except for “Connection Error” which indicates communication failure between the receiver unit and the control unit will be activated after at least five minutes from the power on. The alarm of “Low Light Transmission” is is triggered when the low light transmission status is continued for one minute, which means that it takes six minutes after start-up of the analyzer.

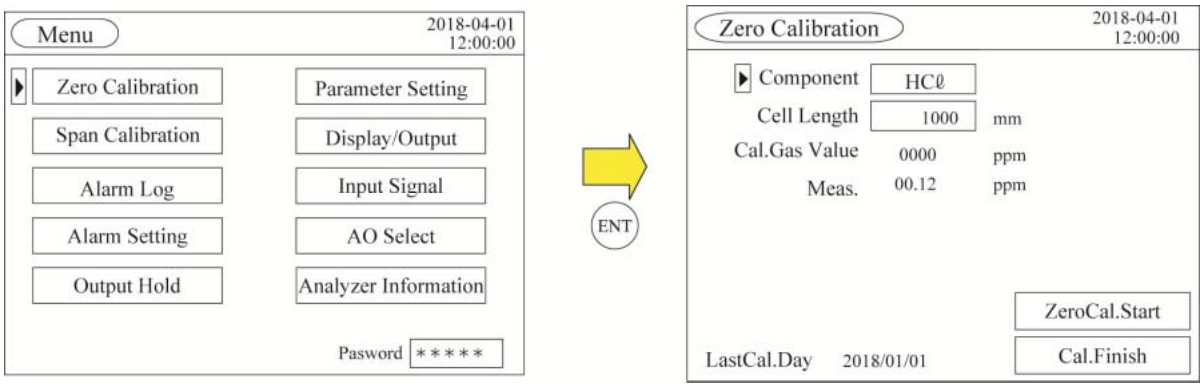
Alarm display	Alarm contents	Probable causes
LD Temp. Error	Peltier which is cooling the laser cannot control the set temperature.	• Peltier failure • Thermistor failure • The receiver unit and the transmitter unit are used at an installation location exceeding the set range. The unit is used in an environment where the temperature of transmitter unit is higher than 55°C • The unit is used in an environment where gas temperature is beyond the specification.
Laser temperature control failure	The analyzer cannot control the laser temperature within the required time.	
Low Light Trans.	Light intensity required for the measurement cannot be obtained.	• Light intensity is insufficient in an environment with high dust. • Light intensity 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.
High Light Trans.	Light quantity is too much for measurement.	• Optical path is too short • Failure of PD analog board
Overrange	Signal input is too much.	• Failure of PD analog board
Connection Error	Communication between receiver unit and control unit does not occur properly.	• Break of wiring • Influence of high frequency noise • Poor contacts of the connector unit • CPU board failure • PD digital board failure
LD communication error	Communication between the transmitter unit and the receiver unit failed.	
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 “Analog Input” screen is not correct.
Out of Range	It is reported when exceeded gas pressure is detected.	• Actual gas pressure is outside the specification range. • The value of the input range set on the “Analog Input” screen is not correct.

Alarm display	Alarm contents	Probable causes
AI Under	The analog input that the control unit received is out of the range which is set in the “Analog Input” screen.	• AI terminal is not connected to the external input device when channel setting is set on the “Analog Input” screen. • AI terminal and setting channel do not match. • Input is not 4 to 20mA DC. • The input value is ≤ -10% of the analog input range. • The input value is ≥ 110% of the analog input range
Box Temp. Warning	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.
Low Air Purge	Purge pressure is lower than the value set for alarms on the “Analog Input” 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 “Analog Input” screen.
Over H-Limit	“Analog Output / Alarm Record” is set to “Over H-Limit” or “Over H/L Limit” on the “Alarm Setting” screen, and the measured value exceeds the higher limit.	• Concentration beyond the Range 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	“Analog Output / Alarm Record” is set to “Under L-Limit” or “Over H/L Limit” on the “Alarm Setting” screen, and the measured value is less than the lower limit.	• Concentration beyond the Range 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. CALIBRATION AND SETTING

6.1 Zero calibration

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

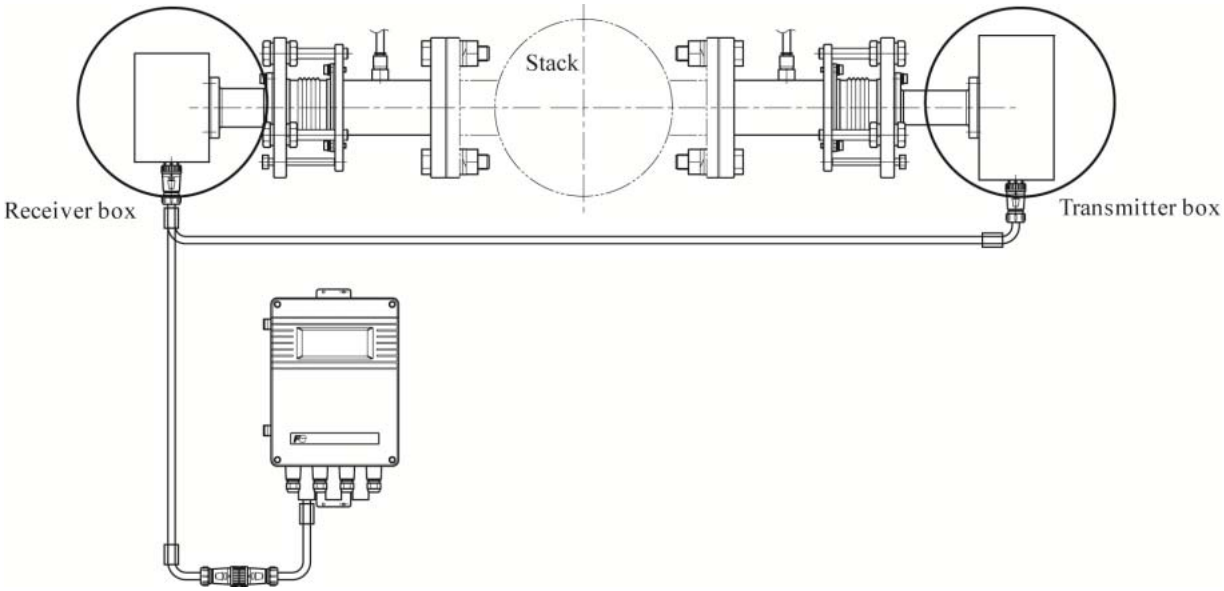


6.1.1 Preparation

⚠ CAUTION	• Do not detach the transmitter unit during calibration while the power is supplied. If you turn the transmitter unit towards a person, the laser beam can damage his/her 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.

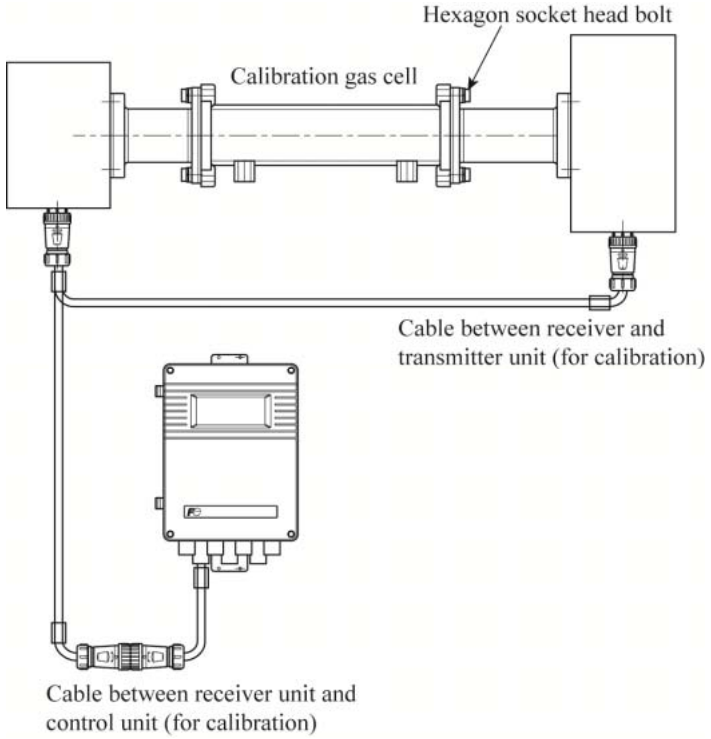
Parts name	Quantity	Remarks
Calibration gas cell	1	To be ordered separately
Cable between receiver unit and transmitter unit	1	To be ordered separately
Cable between receiver unit and control unit (for calibration)	1	To be ordered separately
Zero gas (N_2)	1	To be ordered separately
Pressure regulator	1	To be ordered separately
Pipe (PTFE tube, etc)	Several m	10/8 mm or larger
Joint (Rc1/4)	2	For connecting the zero gas line and the exhaust line to the calibration gas cell
Flow meter	1	2L/min or more
Thermometer	1	4 to 20mA output, for temperature correction (required for range HCl and NH_3)
Pressure gauge	1	4 to 20mA output, for pressure correction (required for low range HCl and NH_3)
Others (joint, etc)		

(1) Turn OFF the power.
(2) Remove the receiver box and the transmitter box using the hexagon wrench. Never remove the boxes while the system into which the analyzer is incorporated is in operation. Otherwise, hot temperature gas may blow out.



(3) Connect the transmitter box and the receiver box to the calibration gas cell by using the hexagon socket head bolts.
*If the cable between the receiver unit and the transmitter unit or/and the cable between the receiver unit and the control unit cannot be used for calibration because they are fixed, prepare the substitute cables for calibration.

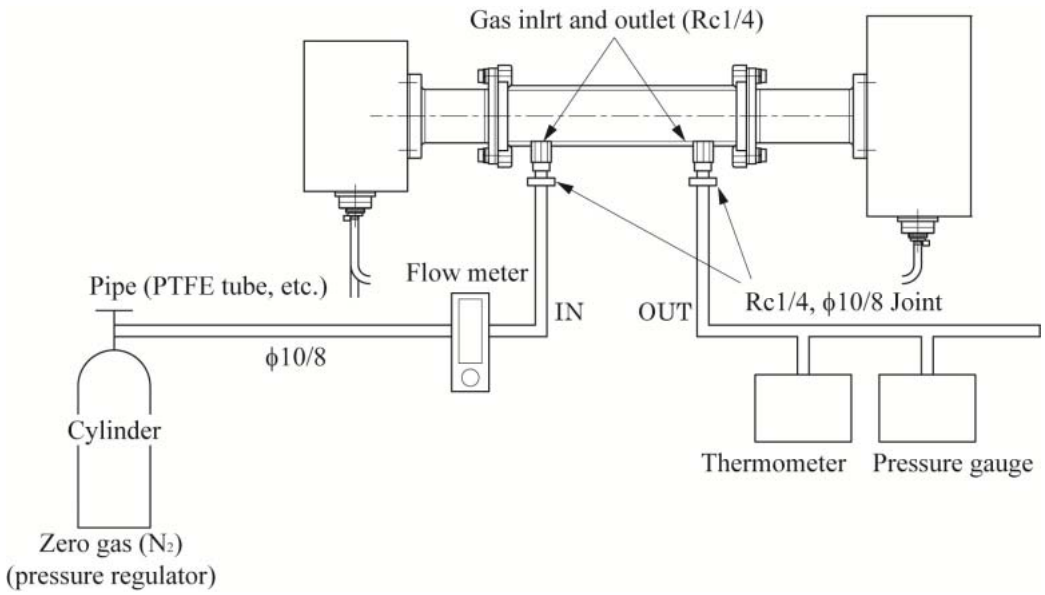
(4) Connect the cables as shown in the following figure.



(5) Attach two Rc1/4″ pipe fittings to the inlet and outlet of the calibration gas cell. Connect the tube from the standard gas (N_2) cylinder to the inlet side.

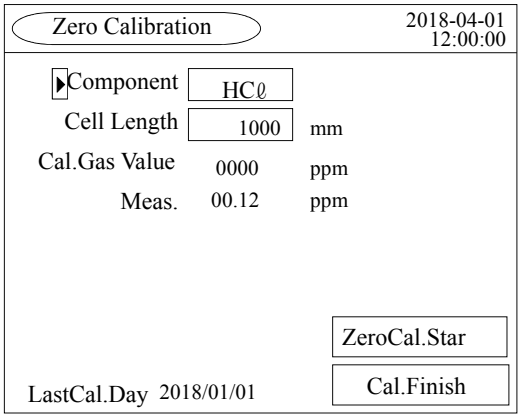
(6) Connect the exhaust gas tube to the outlet side. For exhaust gas line, use a tube as large and short as possible.
*If you use thermometer and/or pressure gauge, attach them on the exhaust gas line, and connect their 4–20mA output to the analog input terminal of the control unit. Make settings for the analog input in reference to 6.7.1 “Analog input setting: sensor input”.

(7) After all the pipes and cables are connected, flow the calibration gas with a flow rate of 1.5 to 2.0 L/min.



6.1.2 Zero calibration

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

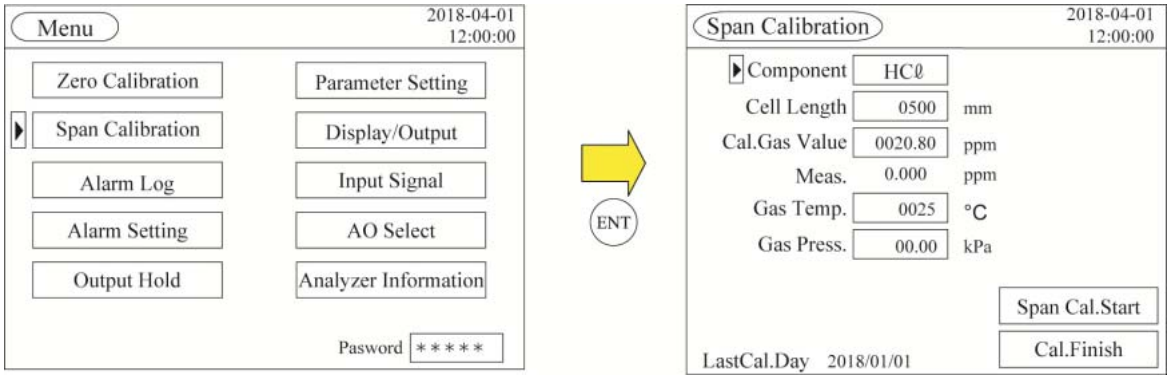


(7) Enter the length of calibration gas cell. Standard cell length is 1000mm. (When the range is low concentration, the length of calibration gas cell can be either 500mm or 200mm.)
(8) See the "Meas." and make sure the indication value is stable.
(9) Point the ▶ to "ZeroCal.Start", and press the ENT key to start the zero calibration.
(10) "ZeroCal.Start" blinks for about 30 seconds.
(11) When the calibration is completed, the cursor moves to "Cal.Finish", and the current date is displayed at "LastCal.Day". When the date is updated, you can move the cursor. If there are two gas components to be calibrated, repeat the steps from 5 to 11.

6.2 Span calibration

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

Note that the span calibration described in this subsection is not available for H_2O analyzer because the H_2O analyzer has no span calibration gas cylinder.



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. Otherwise you may inhale exhaust gas. Suffocation, brain disorder, circulatory deficit, or contraction of the breathing system may occur, resulting in death.
⚠ CAUTION	• Do not detach the transmitter unit during calibration while the power is supplied. If you turn the transmitter unit towards a person, the laser beam can damage his/her 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.

Preparation is basically same as that of zero calibration.

(1) Stop the flow of zero gas, and switch it to span calibration gas.
(2) If you use toxic gas for span calibration, fix the exhaust gas outlet at such a position that no one inhale the toxic gas.
(3) When pipe connection and exhaust are completed, allow the gas to flow with a flow rate between 1.5 to 2.0 L/min.

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

• About Span Calibration

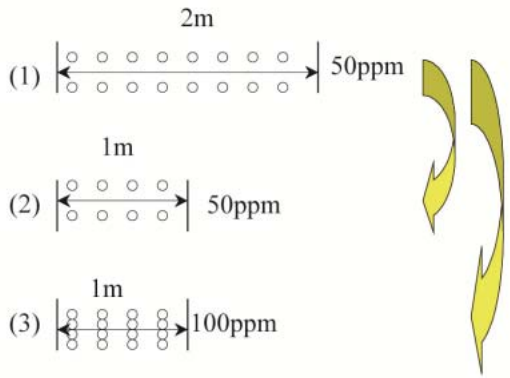
Gas absorption laws
Based on Lambert-Beer Law

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

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

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

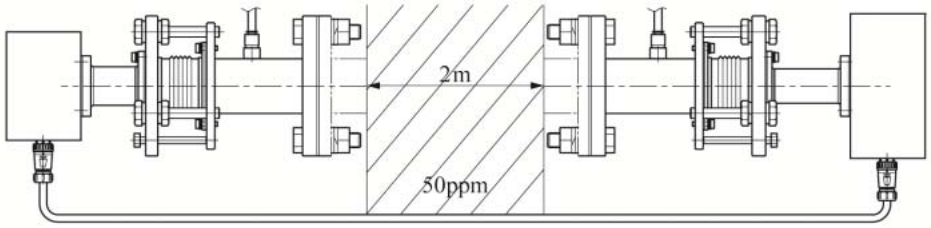
Example: Where the gas concentration is 50ppm and the optical path length (stack length) is 2m

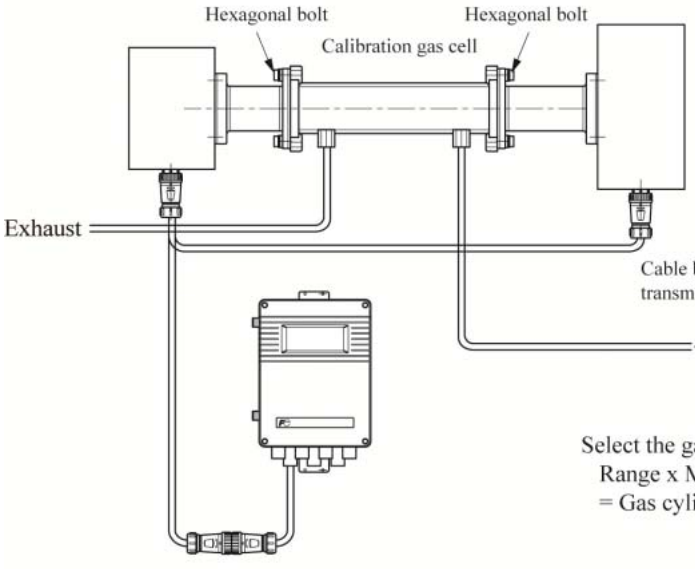


The absorption intensity is twice that of where the gas concentration is 50ppm. and the optical path lengths is 1m.

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

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



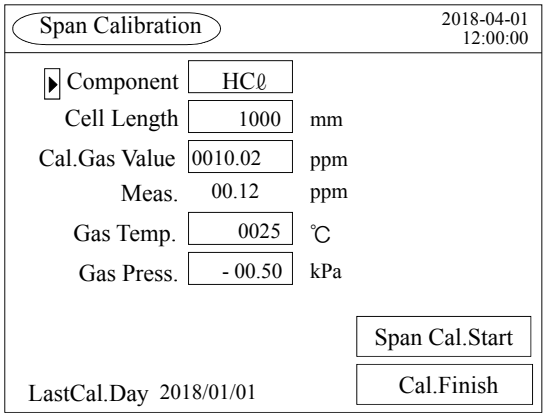


To check (calibrate) a span point by using the standard calibration cell (1m), use 100ppm gas cylinder. So, the absorption intensity will be same as that where the span point (range) is 50ppm and the measured optical path length is 2m.
(In the case of 2m calibration cell: 50ppm)
(In the case of 0.5m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

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

6.2.2 Span calibration

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



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

6.2.3 H_2O calibration by matching with values obtained by manual analysis

This method does not use the calibration cell. Calibration is carried out without uninstalling the receiver unit and the transmitter unit.

6.2.3.1 Required data

(1) H_2O concentration measured by manual analysis
(2) H_2O concentration measured by the laser gas analyzer at the same time as the manual analysis

6.2.3.2 Preparation for span calibration

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

(1) Check the time took for manual analysis and the H_2O concentration measured by the manual analysis.
(2) Average the H_2O concentration values measured by the laser gas analyzer over the same time as manual analysis.
For example, if you carried out the manual analysis from 9:00 to 9:30, average the H_2O concentration measured by the laser gas analyzer from 9:00 to 9:30.
(3) Plug the values obtained in the above steps 1 and 2 into the following equation to calculate the span calibration coefficient.

$$\text{Coefficient of span calibration} = \frac{\text{Manual analysis value in the step 1 [vol\%]}}{\text{Average } H_2O \text{ concentration in the step 2 [vol\%]}}$$

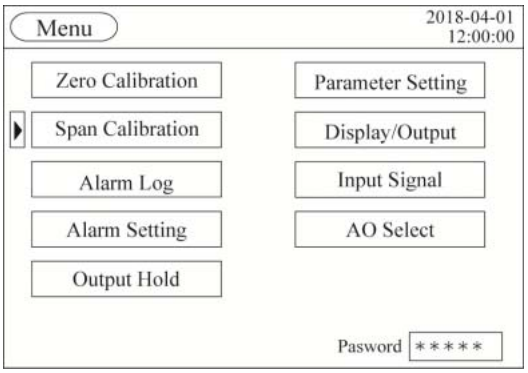
e.g.: When manual value in the step 1 is 15[vol%] and average value of H_2O concentration is 10 [vol%] in the step 2.

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

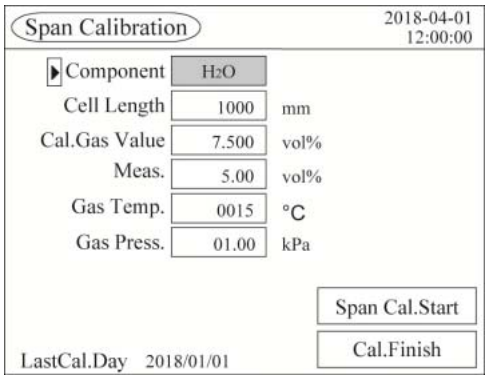
The following procedures should be conducted just before starting the span calibration.

(4) Check on the H_2O span calibration screen that the fluctuation of the measured values is within ±1 vol%. Calculate the mean value of appropriately 10 seconds.
(5) Plug the mean value obtained in the step 4 and the span calibration coefficient in the step 3 into the following equation to obtain the calibration gas concentration.
Calibration gas concentration = Mean concentration × Span calibration coefficient
For example, when the mean value is 5 vol% and the span calibration coefficient is 1.5, the calibration gas concentration is:
5 [vol%] × 1.5 = 7.5 [vol%]

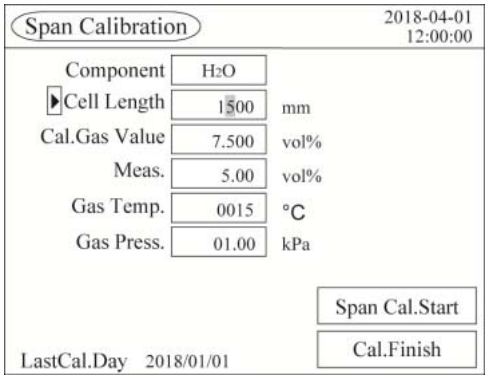
6.2.3.3 Procedure of span calibration



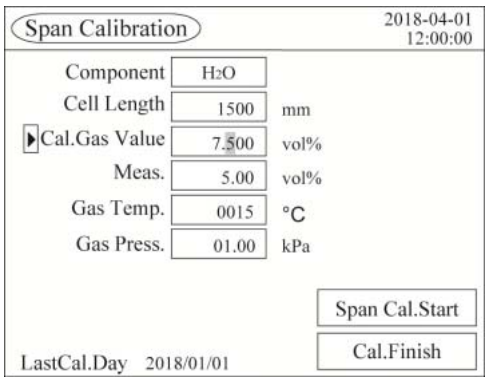
In [Menu] screen, point the cursor to [span calibration] with ▲ ▼ ▶ and then press ENT.



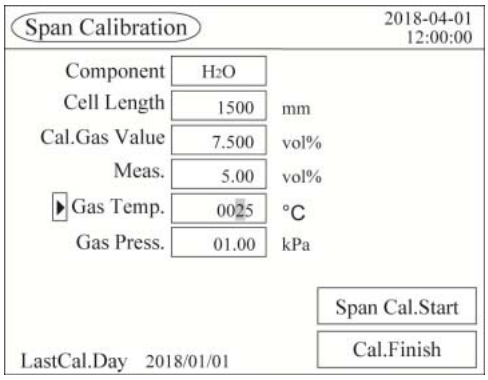
Point the cursor to [Component] with ▲ ▼ and then press the ▶ key to reverse out the cell.
Select the [H_2O] with ▲ ▼ and then press ENT.



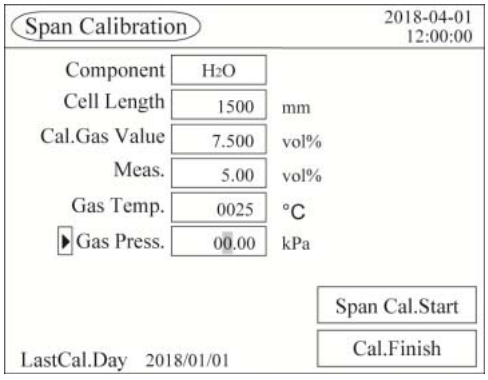
Point the cursor to [Cell Length] with ▲ ▼ and then press the ▶ key to reverse out the cell. Input the length of measurement cell with ▲ ▼ and then press ENT.



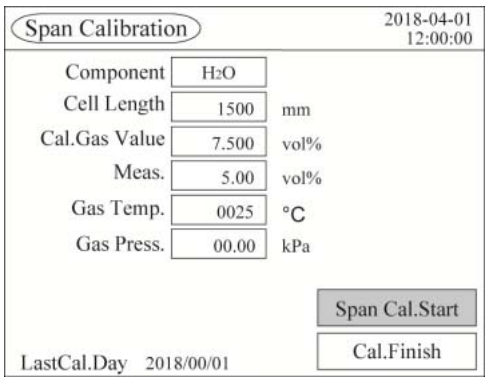
Point the cursor to [Cal Gas Value] with ▲ ▼ and then press the ▶ key to reverse out the cell.
By using the ▲ ▼ keys, enter the calibration gas concentration calculated in 6.2.3.2, and then click the ENT key.



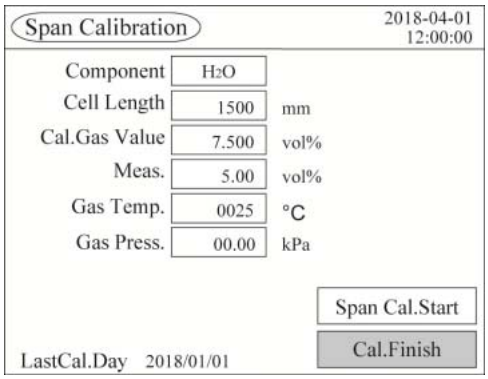
Point the cursor to [Gas Temp] with ▲ ▼ and then press the ▶ key to reverse out the cell.
Input the 25 [°C] with ▲ ▼ and then press ENT.



Point the cursor to [Gas Press] with ▲ ▼ and then press the ▶ key to reverse out the cell. Input the 0.00[kPa] with ▲ ▼ and then press ENT.



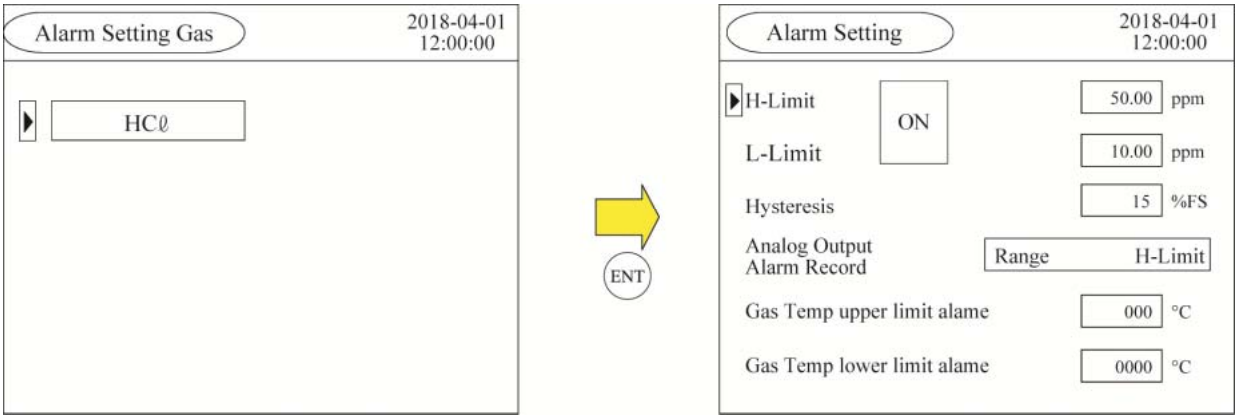
Point the cursor to [Span Cal Start] with ▲ ▼ and then press ENT.



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

6.3 Alarm setting

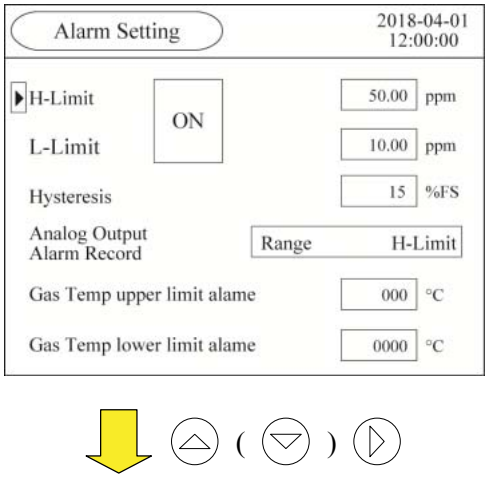
Select “Alarm Setting” from the “Menu” screen, and press the ENT key. On the “Alarm Setting Gas” screen, select a component by moving the ▶ with the △ key and the ▽ key.
Press the ENT key. “Alarm Setting” screen is displayed.



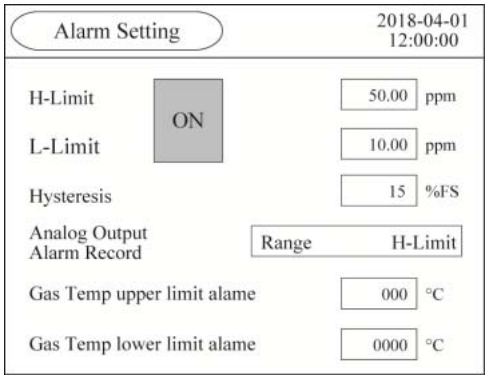
6.3.1 Alarm value ON/OFF

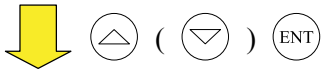
ON validates the High/Low limit alarm output, alarm display, alarm record for the measured concentration. Select OFF to invalidate.

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

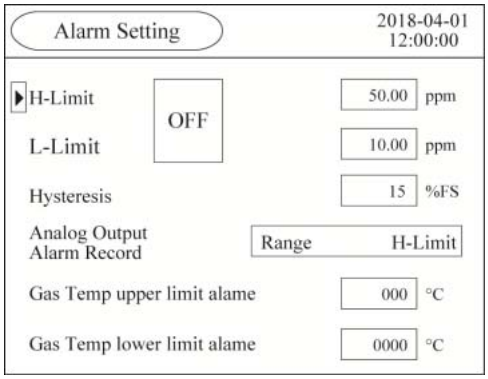


Point the ▶ to “H-Limit” or “L-Limit” by the △ key and the ▽ key, and press the ▷ key.





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



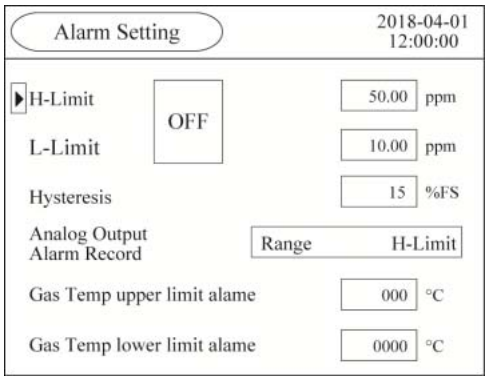
When you press the ENT key, the cursor returns to the initial position.

6.3.2 Setting of alarm value

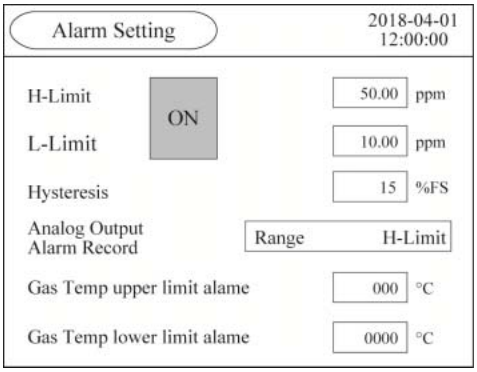
Make a setting of the High/Low limit alarm for the measured concentration. To change the alarm setting, set the Alarm ON/OFF setting to ON, and then change the numeric value.

Note

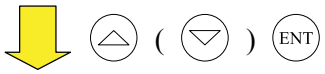
Point the ▶ to “H-Limit” to change the setting of H-Limit value, and point “L-Limit” to change the setting of the L-Limit value.

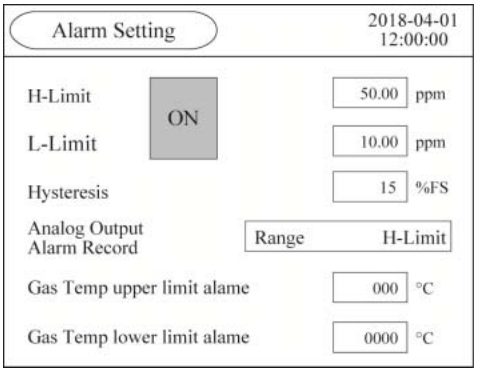


Point the ▶ to “H-Limit” to set the H-limit value, and point “L-Limit” to set the L-Limit value, and then press the key.

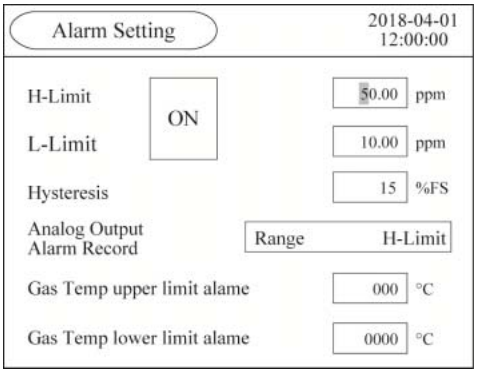


Select “ON” by the △ key or the ▽ key, and press the ENT key.

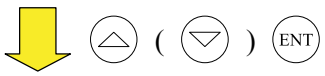


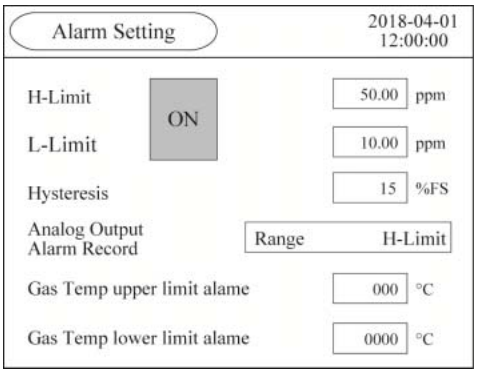


Press the ▷ key.



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





Click the ESC key, and the ▶ returns to the initial position.

Note

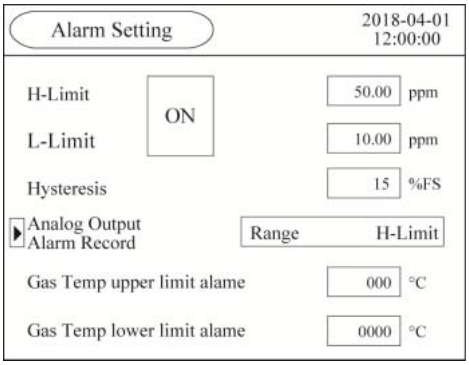
Set the value so that H-Limit is larger than L-Limit, and that (H-Limit – L-Limit) is larger than hysteresis width.

6.3.3 Analog output / alarm record

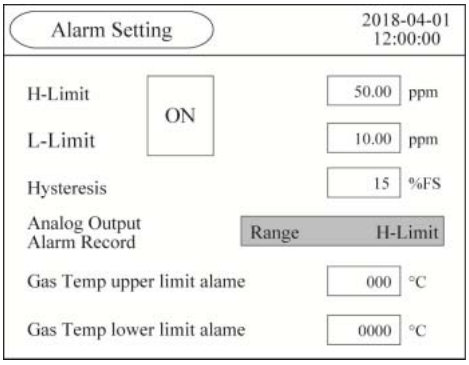
Set the recording range of the external alarm output such as analog output or the alarm record.
Setting range can be selected from “H-Limit”, “L-Limit” and “H/L Limit”.

Note

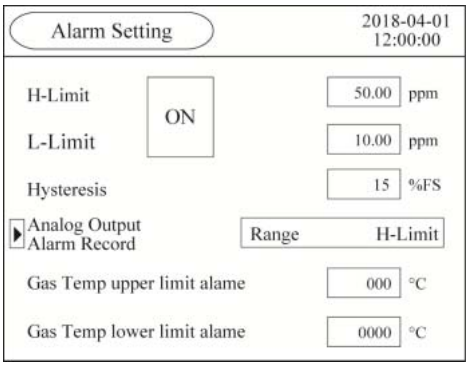
When “OFF” is set to the ON/OFF setting of the alarm value, “Analog Output / Alarm Record” cannot be set. Select “ON” again. The alarm output which is “H-Limit”, “L-Limit” or “H/L Limit” cannot be performed for 5 minutes after turning on the power.



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



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

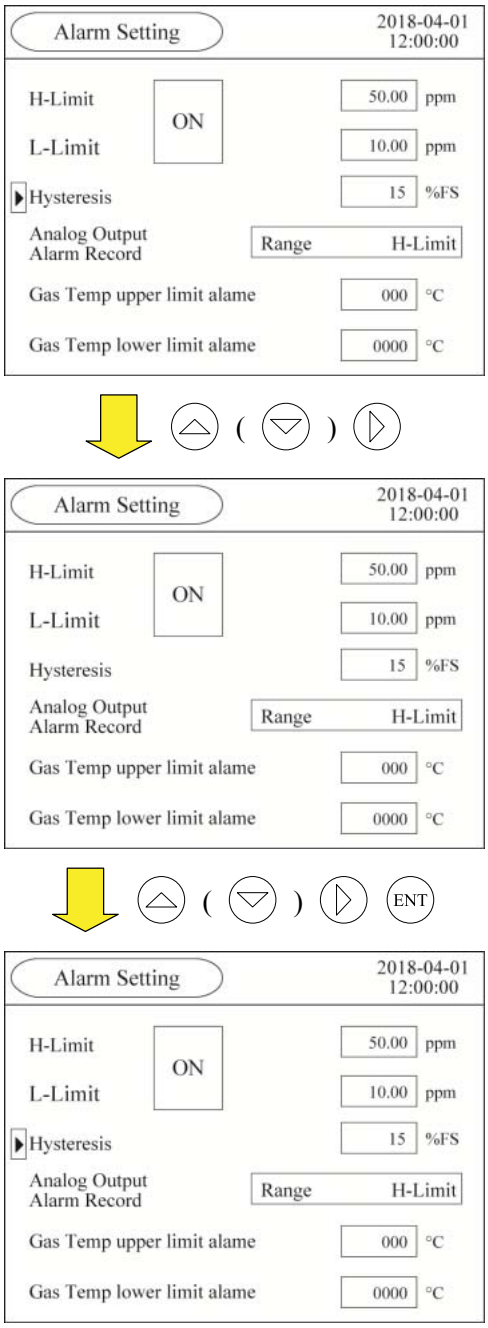


Explanation of alarm range

Range H-Limit : Alarm output is provided only when a value exceeds the Range H-Limit.
Range L-Limit : Alarm output is provided only when a value is lower than Range L-Limit.
Range H/L-Limit : Alarm output is provided when a value exceeds the Range H-Limit or it is lower than Range L-Limit.

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.

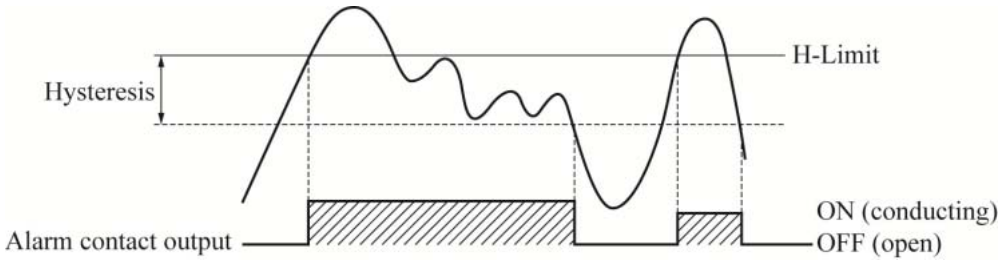
Setting Range

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)

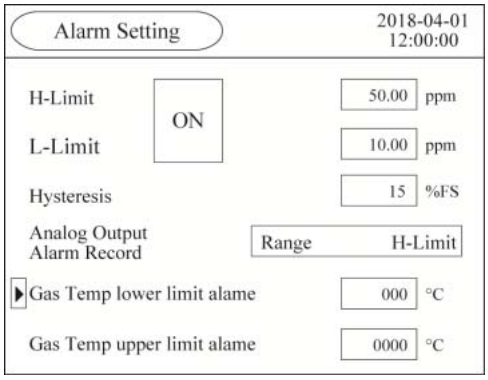
Alarm output is turned ON when the value exceeds the H-Limit. The alarm goes off when the measured value has gone below the hysteresis.



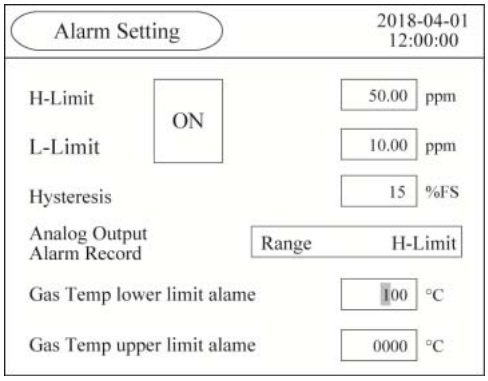
6.3.5 Gas temperature alarm

When the gas temperature is out of the range between the higher limit and the lower limit, the analyzer emits the “High Gas Temp” alarm.

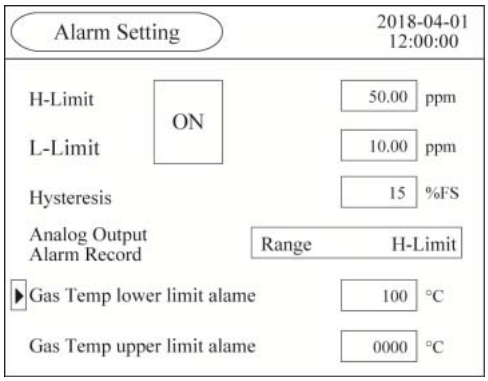
> Note
>
> Set the limit values so that the upper limit is larger than the lower limit.



By using the ▲ ▼ keys, move the cursor to the “Gas Temp upper limit alarm” or the “Gas Temp lower limit alarm”, and press the ENT key.



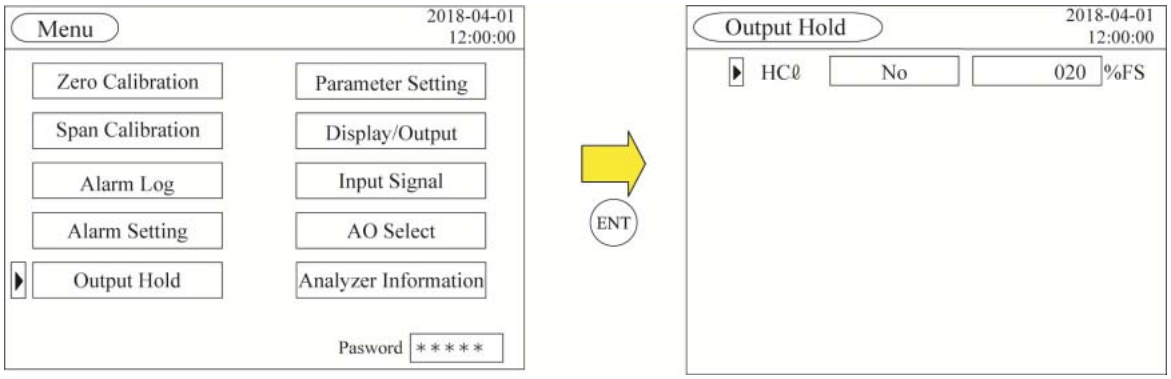
By using the ▲ ▼ keys, change the values and then press the ENT key.



6.4 Output hold

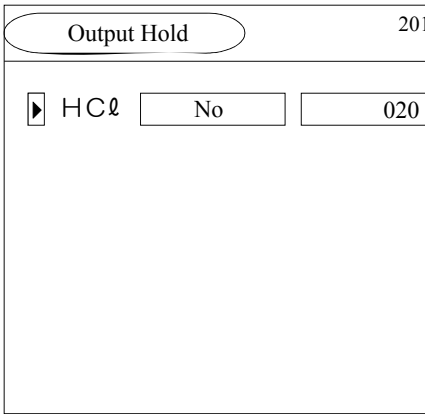
Before a maintenance work, be sure to carry out the setting explained in this subsection to hold the analog output.

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

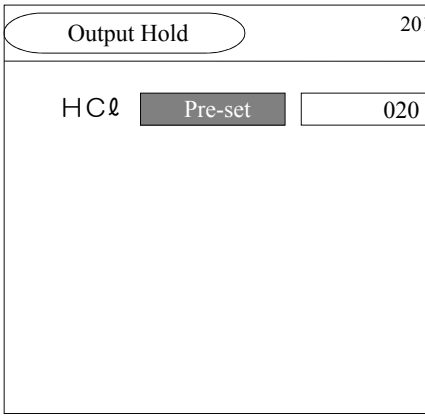


6.4.1 Output hold

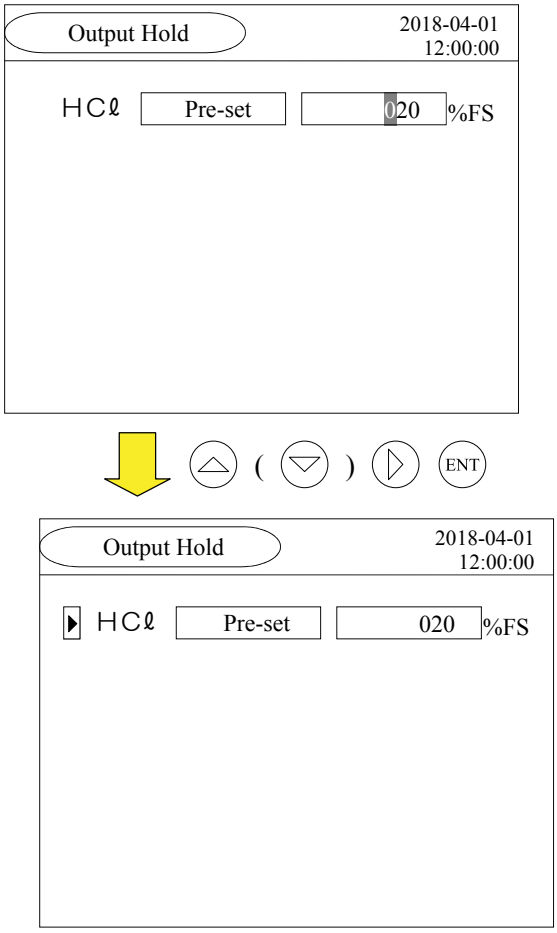
Set output hold to “Last Meas.” or “Pre-set” to hold analog output. (Indication value on the “Measurement” screen is not held. However, it is highlighted during the output hold time.)



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



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



When “Last Meas.” is selected, cursor returns to the starting position.
When “Pre-set” is selected, numeric value is highlighted. Change the numeric value by the ▲ key or the ▼ key, and move the digit to the right by the ▶ key.
After the numeric value is changed, press the ENT key.

Setting Range

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

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

O_2 Conversion Hold

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

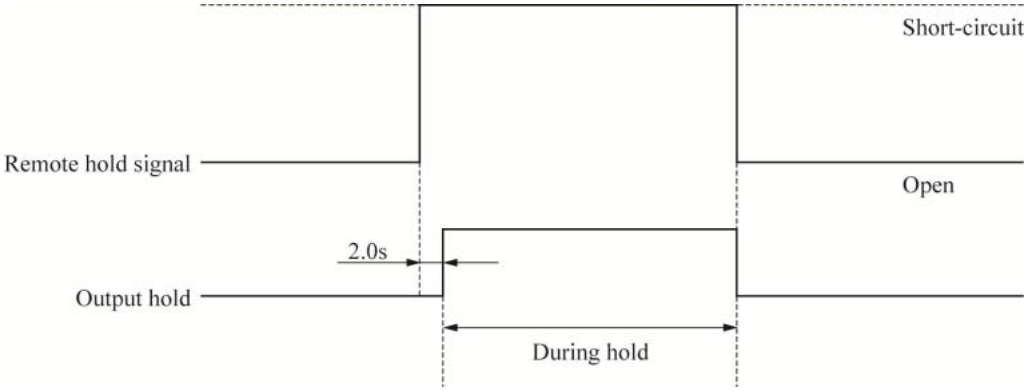
“Pre-set” : Even if O_2 analog input is entered, it holds the value calculated by O_2 fixed value which is determined by the ENT key.

Last Meas. of average value

If you select the “Last Meas” while using the average value output, the analyzer hold the value averaged before you press the ENT key.

6.4.2 Remote hold (DI3 terminal)

You can remotely hold the output by using the external contact output (DI3 terminal, option).
The value to be hold is “Last Meas” only.



By applying a voltage (pulse width 2.0 seconds or more) to the remote hold input terminal, you can hold the analog output. The hold is cancelled when you stop applying the voltage.

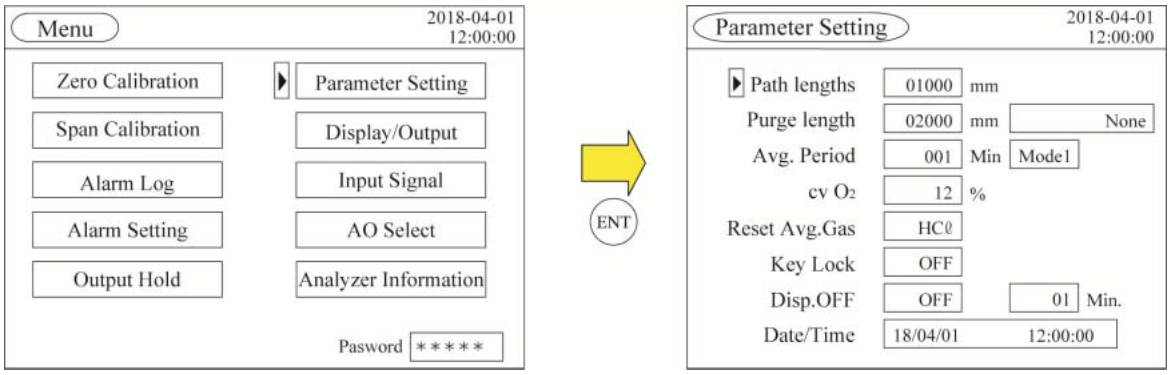
6.5 Parameter setting

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

Setting items

Path length	:	Enter the optical path lengths.
Purge length	:	Enter the total length of the purge length A and the purge length B shown in the figure in 6.5.1. Set whether you use the blast purge or not. The purge length setting is required only for the O_2 measurement for combustion control.
Avg. Period	:	This parameter is for the average value output. Set the time (in minutes) used for calculation of the moving average.
cv O_2	:	Set the reference O_2 concentration used for converting the measured values.
Reset Avg.Gas	:	This parameter is for the average value output. This allows you to reset the average value.
Key Lock	:	No key operation except for the key lock OFF can be performed.
Disp.OFF	:	Set the on or off of the screen timeout function. If you turn on the screen timeout, you also have to set the time (in minutes) until the screen automatically goes off after the last operation.
Date/Time	:	Set the current year/month/date, hour: minute: second.

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

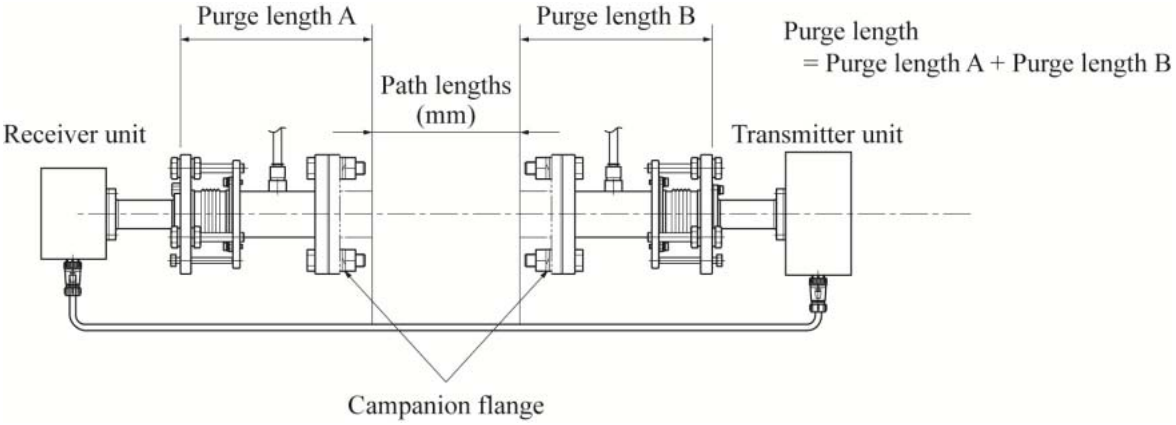


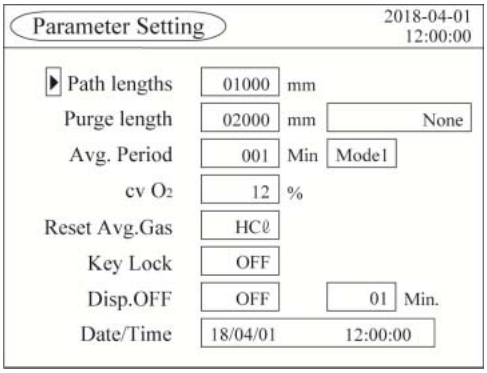
6.5.1 Path length

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

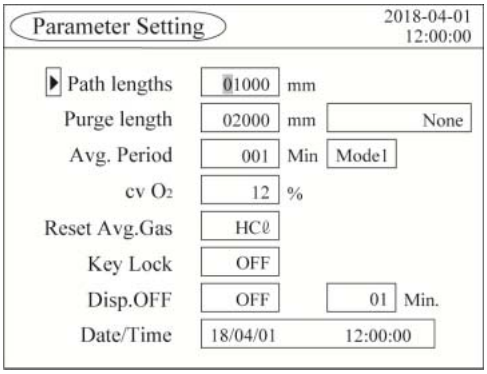
Note

In default setting, the analyzer calculates the gas concentration assuming the optical path length is one meter. Be sure to set the correct path length because the volume of the light absorbed by a gas changes with the optical path length.

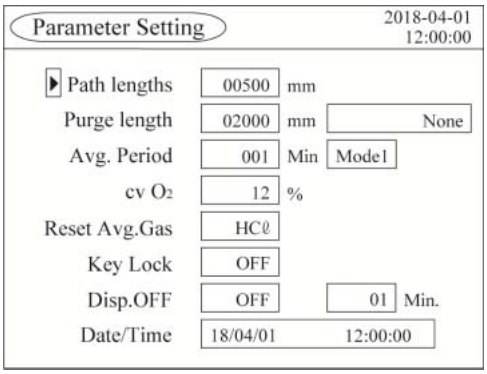




Point the ▶ to "Path lengths" by the △ key and the ▽ key, and press the ▷ key.

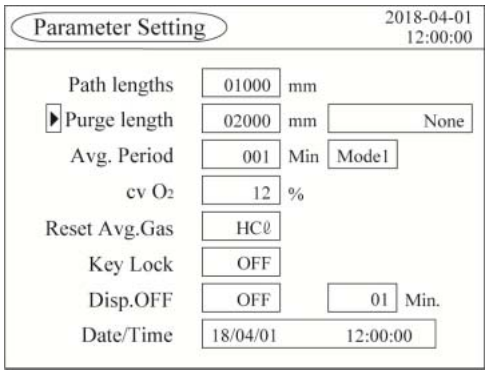


Change the numeric value by the △ key or the ▽ key, and move the digits by the ▷ key. Press the ENT key to validate the set input value.

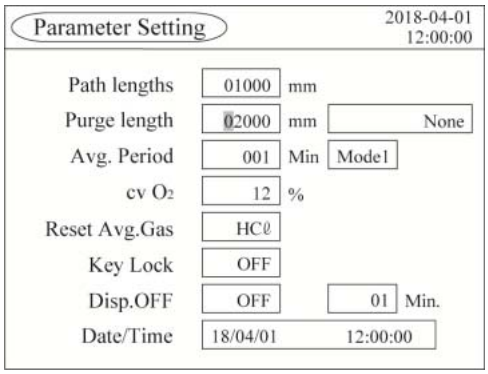


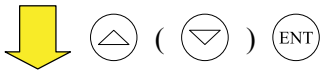
6.5.2 Purge length

The “purge length” setting is required only for the O_2 analyzer for combustion control. In other cases, you do not have to edit this parameter.
Setting range: 100–15000 mm
If you ordered the “blast purge” option, you have to set the “blast purge” column as well.



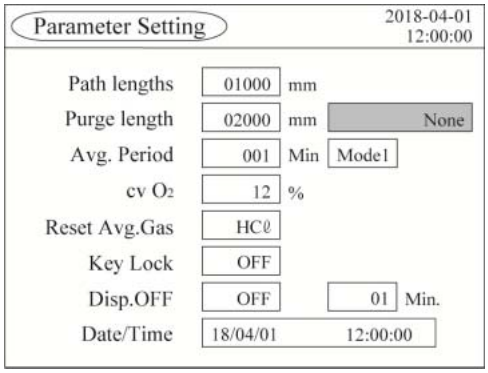
Move the cursor to “Purge Length” by using the ▲ ▼ keys, and press the ▶ key.





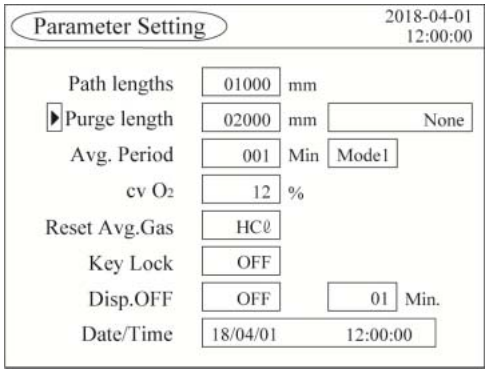
Edit the value by using th ▲ ▼ keys to change the value, and the ▶ key to move to the next digit. Press the ENT key to set the value. (The cursor will move to “Blast Purge”.) The “Purge length” setting is completed.

If you ordered the “blast purge” option, move on to the next step.



Select “Blast Purge” or “None” by using the ▲ ▼ keys, and press the ENT key.

Press the ENT key twice, and the cursor returns to the initial position.

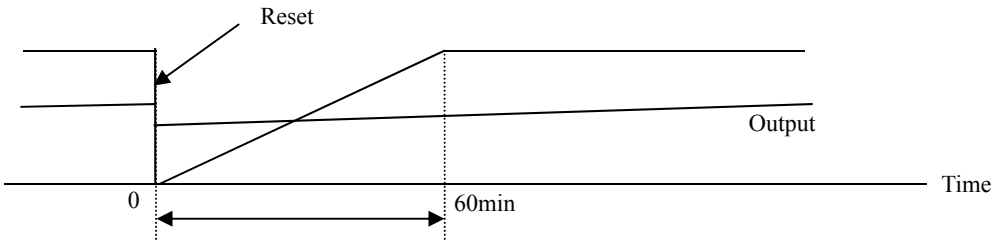

Parameter Setting
2018-04-01
12:00:00
Path lengths
01000
mm
Purge length
02000
mm
None
Avg. Period
001
Min
Mode1
cv O2
12
%
Reset Avg.Gas
HC0
Key Lock
OFF
Disp.OFF
OFF
01
Min.
Date/Time
18/04/01
12:00:00

6.5.3 Moving average time

This parameter is required if you set the indication and the output to the average in "6.6.1 Instantaneous/average value". Setting range is from 1 to 60 minutes. Up to the time you set, the analyzer emit the average value at the time.
The average value is reset when you press the ENT key after changing the setpoint.

Averaging operation

When the moving average time is set to 60 minutes



Sampling rate: twice per second

Mode 1:

Until the time reaches 60 minutes, the analyzer calculates the average by dividing the available values by the time passed.

*Available values: the values obtained after you reset the average to the each moment.

The quation is:

$$\frac{\Sigma[Measured\ values]}{[Current\ time\ (min)]}$$

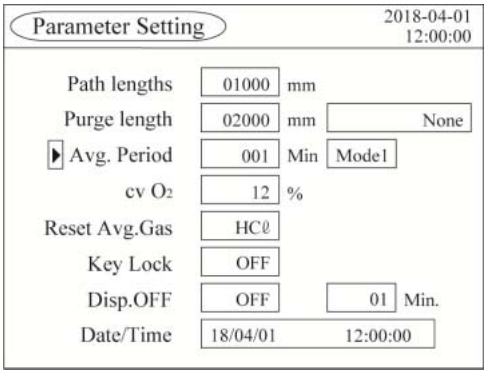
Mode 2:

Until the time reaches 60 minutes, the analyzer calculates the average by dividing the available values by 60 minutes.

The equation is:

$$\frac{\Sigma[Measured\ values]}{60\ (min)}$$

In both modes, it is after 60 minutes that you can obtain the first moving average value for 60 minutes.



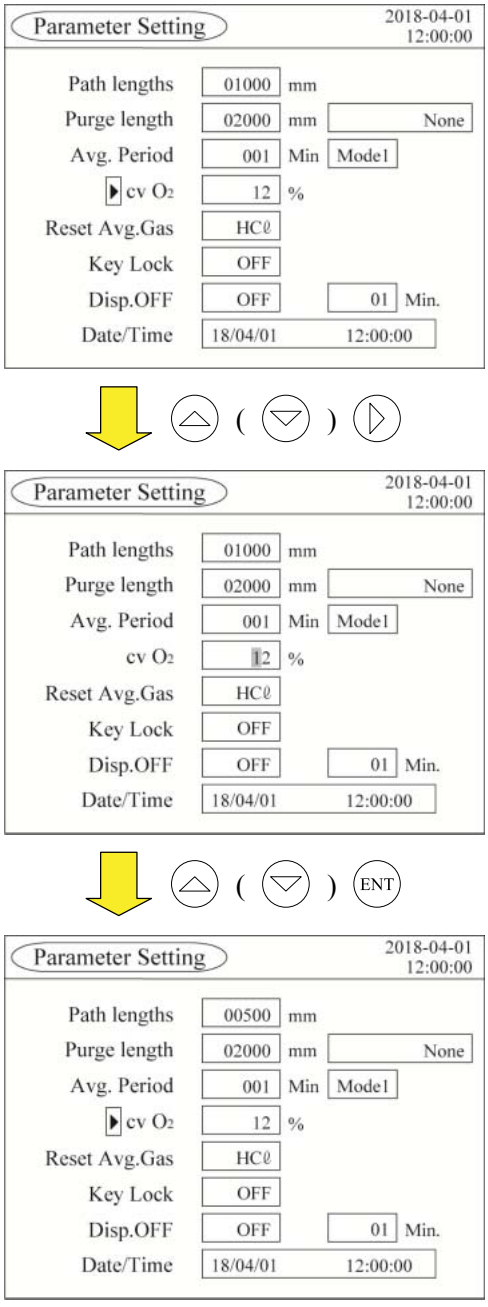
Move the cursor to the “Avg. Period” by using the ▲ ▼ keys, and then press the ▶ key.

Change the value by using the ▲ ▼ keys, and move the digit by using the ▶ key. Press the ENT key to set the value, and the cursor will move to the next column, “Mode 1”.

Select either of “Mode 1” or “Mode 2” by using the ▲ ▼ keys, and press the ENT key. If you press the ENT key twice, the cursor will return to the initial position.

6.5.4 O_2 conversion

This parameter allows you to set the reference O_2 concentration value used for converting the measured values. For the detail of the O_2 conversion, refer to "5.3.1.2 O_2 conversion concentration value".

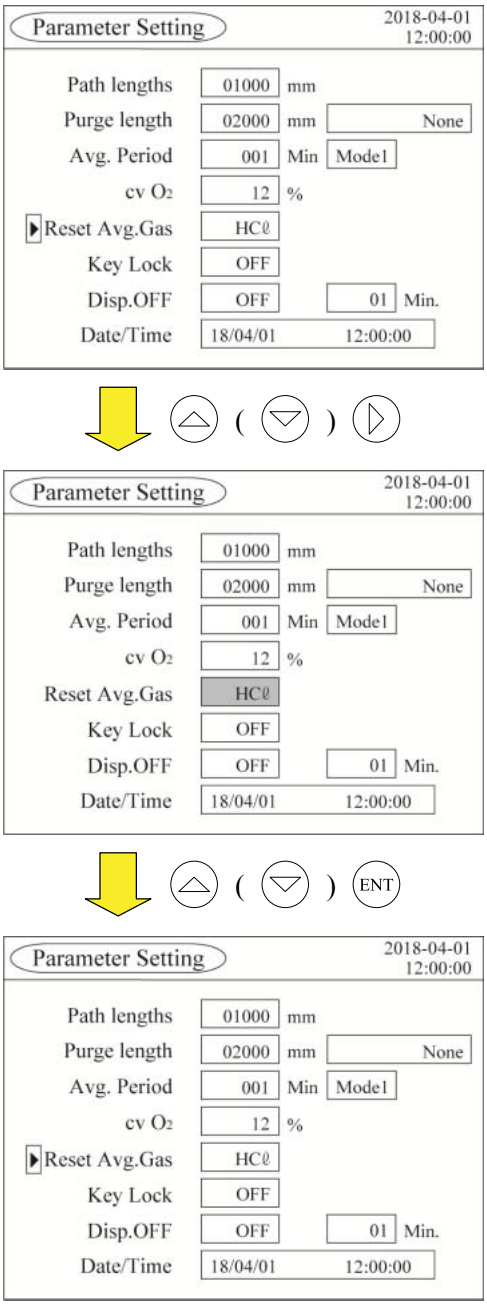


Move the cursor to the "cv O_2" by using the ▲ ▼ keys, and then press the ▶ key.

Change the value by using the ▲ ▼ keys, and move the digit by using the ▶ key. Press the ENT key to set the value.

6.5.5 Average value reset

When the indication value and output value are set to the average value in the “6.6.1 Instantaneous/average value”, resetting the average value works on both the measured value and the O_2 converted value. When the indication value and the output value are set to the instantaneous value, nothing changes even if the average value is reset.



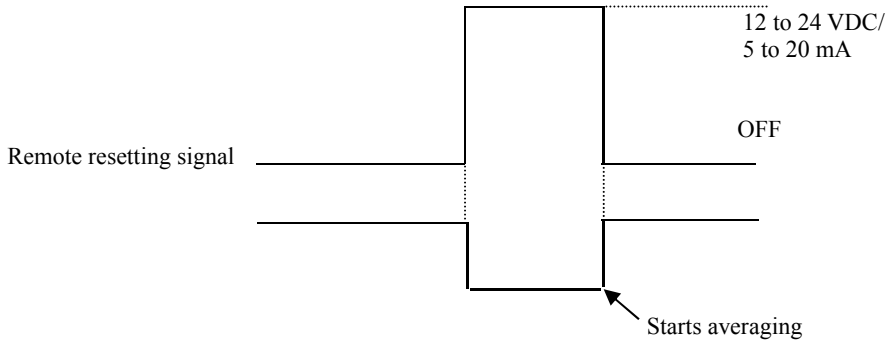
Point the ▶ to “Reset Avg.Gas” by the △ key and or ▽ key, and press the ▷ key.

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)

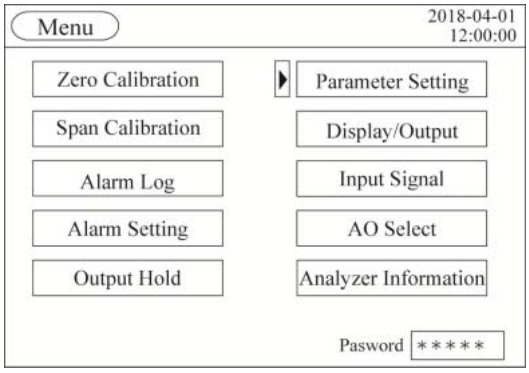
Apply voltage to the input terminal of remote average value reset (DI1 terminal, option) to reset the average value.



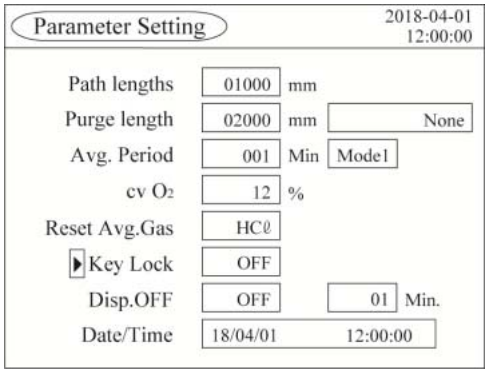
Reset is kept during short-circuit.
When switching the action from short-circuiting to opening, average value action starts.

6.5.6 Key lock

Key lock disables any setting change except for turning off the key lock.



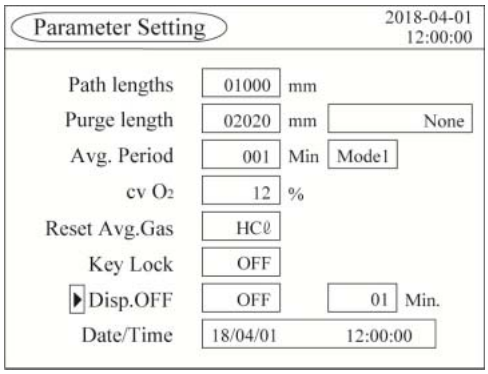
On the “Menu” screen, you cannot enter any screen other than the “Parameter Setting”.



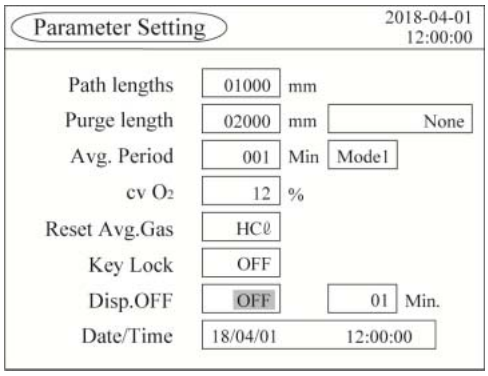
On the “Parameter Setting” screen, you cannot edit any items other than the “Key Lock”.

6.5.7 Backlight timeout

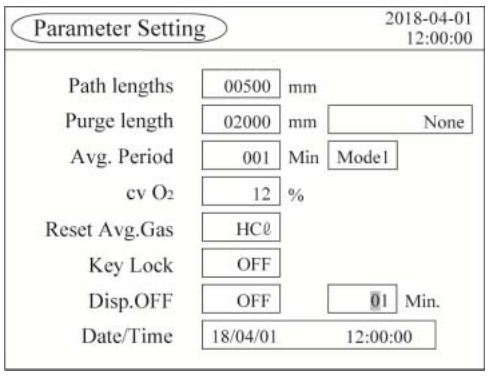
This parameter allows you to set the time until the backlight automatically turns off after the display returns to the measurement screen. The setting range is from 1 to 60 minutes. The maximum time that the backlight can last is approximately 58000 hours.



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



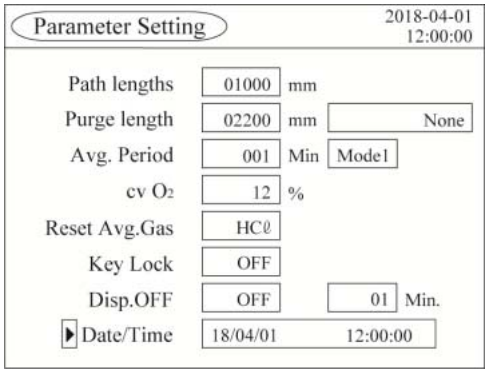
Turn it to "ON" by the △ or the ▽ key, and press the ENT key.



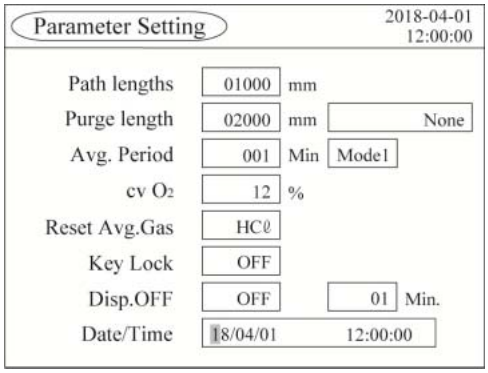
Change the numeric value by the △ key or the ▽ key, and move the digits by the ▷ key. Press the ENT key to validate the set input value.

6.5.8 Time and date

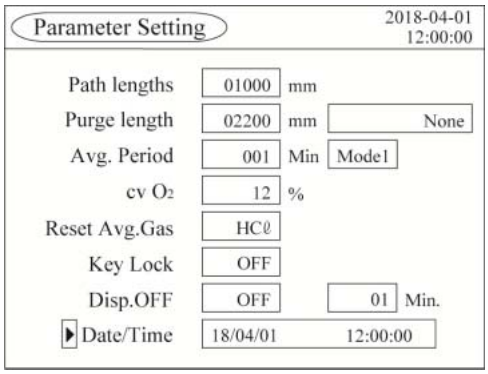
Set the time and date every three months because the time error occurs depending on the ambient temperature.



Move the cursor to the “Date/Time” by using the ▲ ▼ keys, and then press the ▶ key.



Change the value by using the ▲ ▼ keys, and move the digit by using the ▶ key. Press the ENT key to set the value.



6.6 Display/AO setting

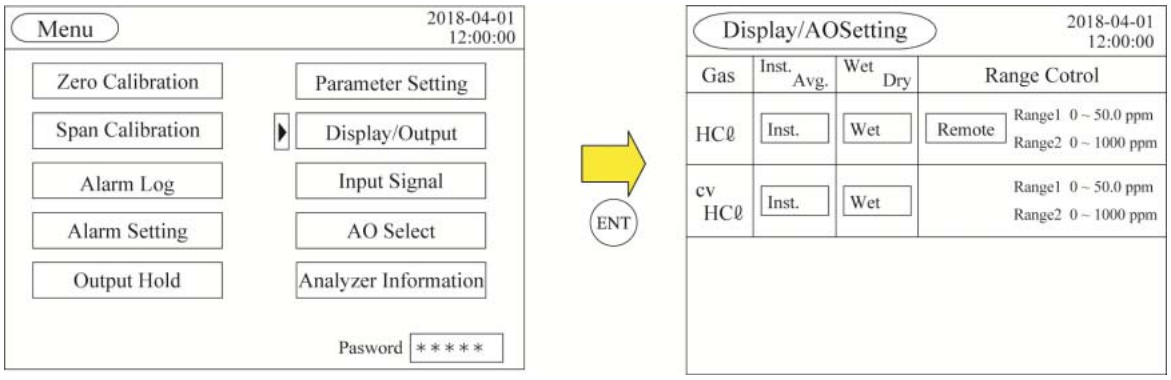
Make a setting of “Inst./Avg.” or “Wet/Dry” of the measurement value displayed on the “Measurement” screen.

Setting items

“Inst./Avg.” : Select “instantaneous value” or “average value” for each measurable component.

“Wet/Dry” : Select “Wet” or “Dry” for each measurable component. When “Dry” is set, H_2O setting of the “Analog Input” is required.

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



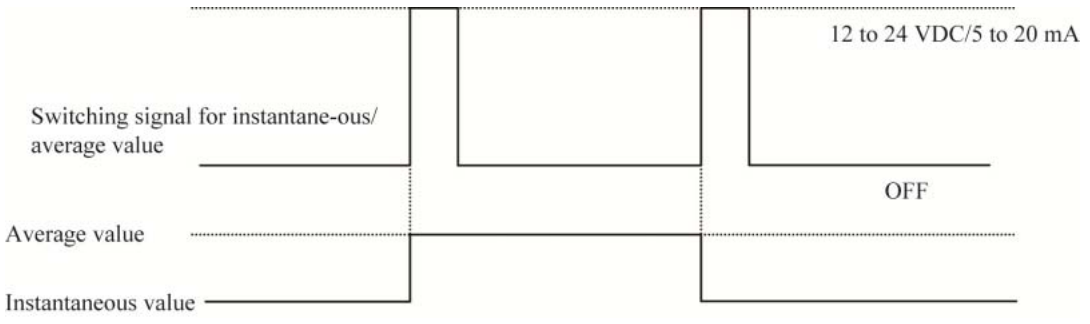
6.6.1 Instantaneous/average value

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

- You can set the instantaneous value and the average value for the O_2 conversion regardless of the setting of measured value.
- If you select the average value, the analyzer provides moving averages obtained based on the time you set in the “Moving average time” of the parameter setting screen.

Remote switching between the instantaneous value and the average value (DI2 terminal)

Applying a voltage to the optional DI2 terminal allows you to switch between instantaneous value and the average value. If the measured value has been set to the instantaneous value and the O_2 conversion to the average value, applying a voltage change the measured value to the average value and the O_2 conversion to the instantaneous value.



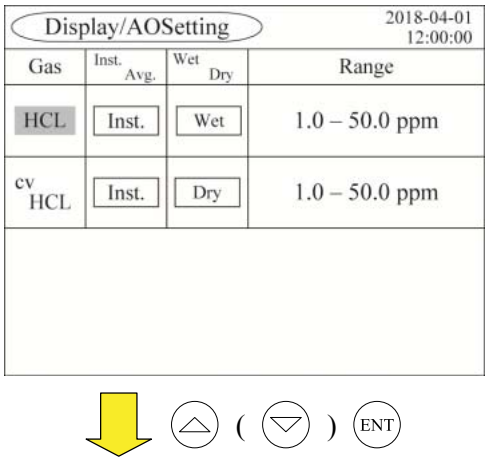
6.6.2 Wet/dry

Make a setting of "Wet" or "Dry" for each measurable component. The setting is reflected on the display on the "Measurement" screen.

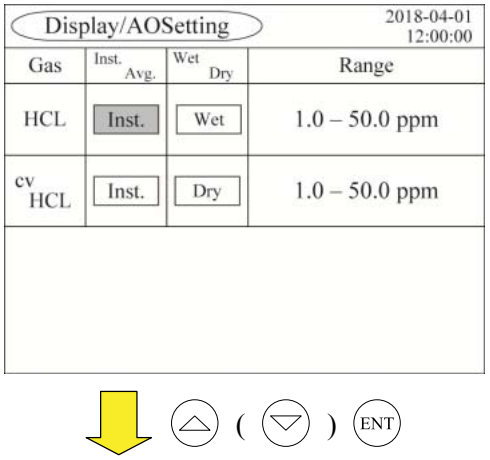
- You can set the O_2 conversion value to whichever of wet or dry, regardless of the setting of measured value.
- This analyzer performs the measurement in wet environment. If you want to obtain dry values, you need to set the values for H_2O, in any way among the followings:
  - If you use an external moisture meter: Connect the 4–20 mA DC output from the moisture meter to the analog input terminal of the ZSS control unit, and set the range with reference to "6.7.1 Analog input setting: sensor input".
  - No moisture meter: On the Display/AO setting screen, set the H_2O value to "fixed". The analyzer will calculate the dry values based on the fixed H_2O concentration.
  - If you use the laser gas analyzer that can measure H_2O: you can select either the H_2O values measured by the laser gas analyzer or the H_2O values provided by an external moisture meter.

Wet can be converted to Dry using the following expression.

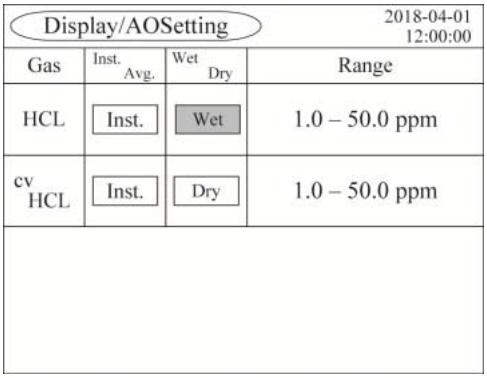
Measurement value (dry) = Measurement value (wet) × 100/ (100 – moisture content (%))



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



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



Select the “Inst” or “Avg” by the ▲ key or the ▼ key. Press the ENT key to move the cursor to “Range Control” setting.

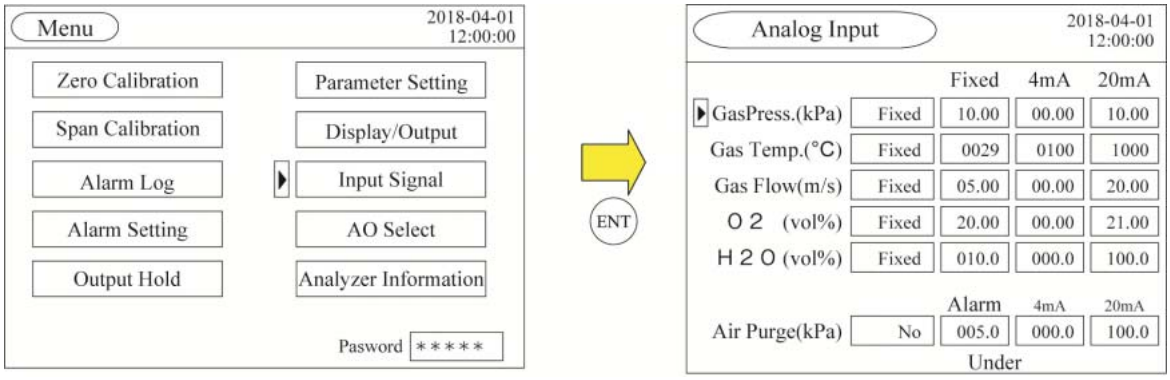
Press the ENT key to move the cursor to the set component.

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

By providing the signals from external sensors to the control unit, you can reflect the changes in gas conditions into the measurement result. The analyzer can accept two 4–20 mA DC inputs from a thermometer, pressure gauge, flowmeter, oxygen analyzer, and/or moisture meter. Wire between each sensor and the analog input terminal of the control unit in reference to “3.2 Wiring diagram”.
Set the parameters of an item with no sensor input to “fixed” and enter a value for each. For items whose change is negligible, you can set the item to a fixed value.
Be sure to make settings for all the items. Otherwise, the analyzer cannot deliver accurate measurement.

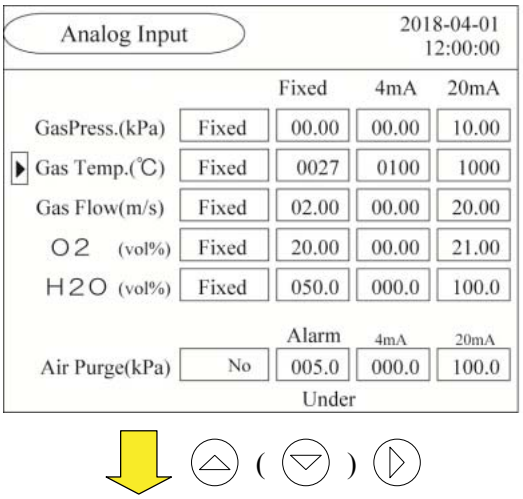
Select “Input Signal” from the “Menu” screen, and press the (ENT) key.



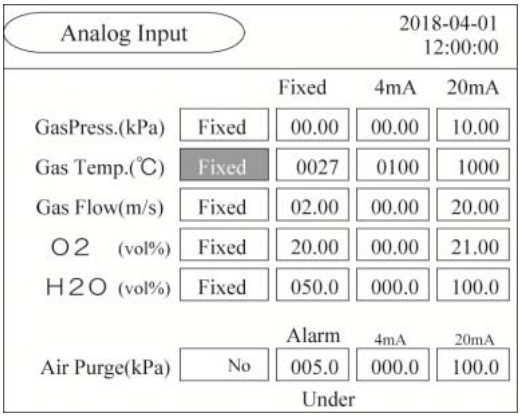
6.7.1 Analog input setting: sensor input

The description here is an example when using a thermometer.

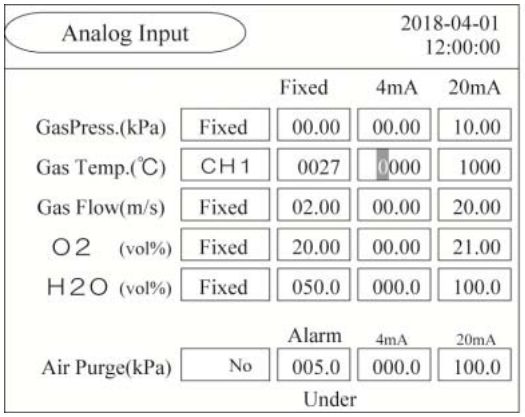
Connect the 4-20 mA DC signal from a thermometer to Ch1 or Ch2 of AI terminal.
If you make a setting but there is no signal input, the analyzer emits an “analog input error” alarm.



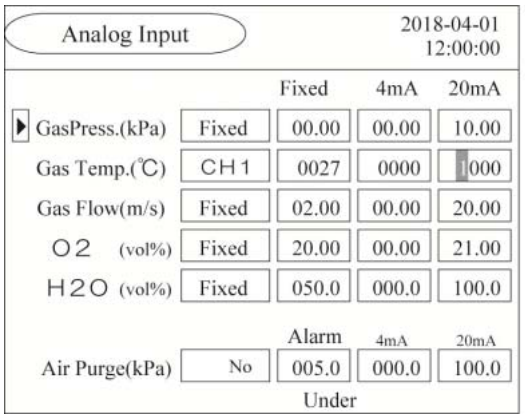
Select the “Gas Temp.” by the (△) key or the (▽) key. Press the (▷) key to move the cursor to “Channel” setting.



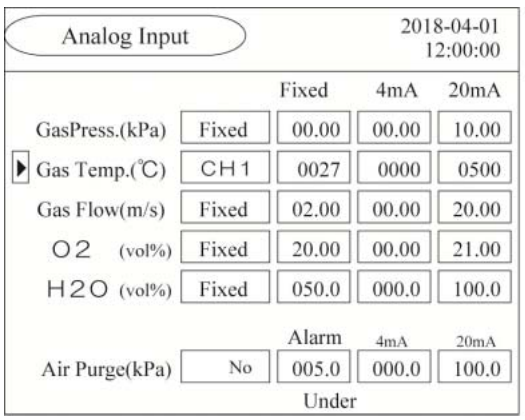
Select the channel (CH1 or CH2) connected to AI terminal by the ▲ key or the ▼ key, and press the ENT key.



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).

O_2 conversion

The analyzer converts the measured concentration into the value in reference to the O_2 concentration provided by an external oxygen analyzer.

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

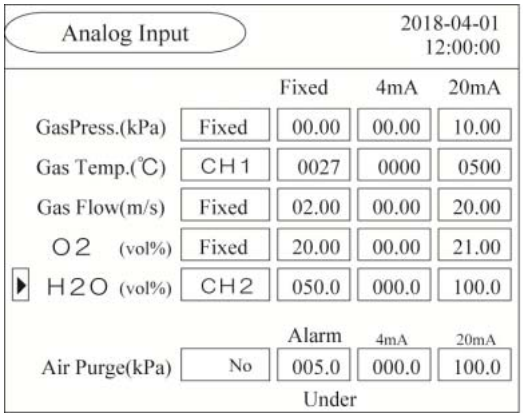
Where:

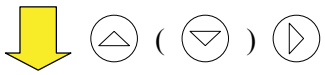
C : converted concentration
Cs : measured gas concentration (%)
Os : Measured O_2 concentration (%)
On : Reference O_2 concentration (%) *Default value is 12%

6.7.2 Analog input setting: fixed value

The description here is an example of the H_2O input.

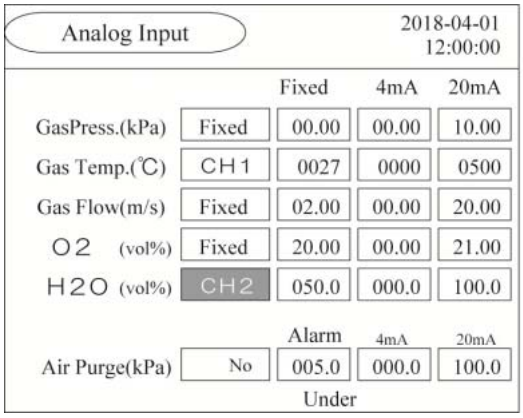
In such cases that the gas conditions do not change, that no external sensor is available, or that no analog input terminals are left, set a fixed value. Note that if there is a large difference between the setpoint and the actual value, the analyzer may not be able to deliver accurate measurement.

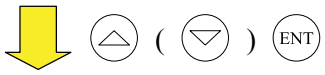




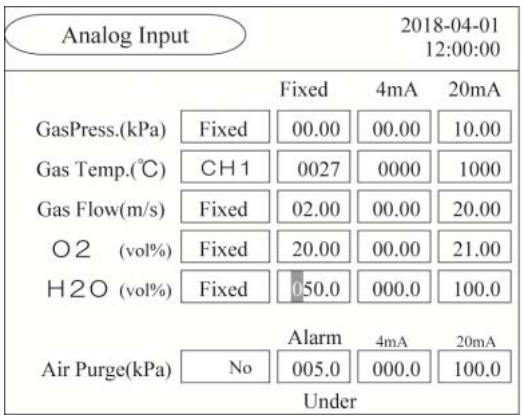
Select "H_2O" by the ▲ key or the ▼ key.

Press the ▶ key to move the cursor to "Channel" setting.



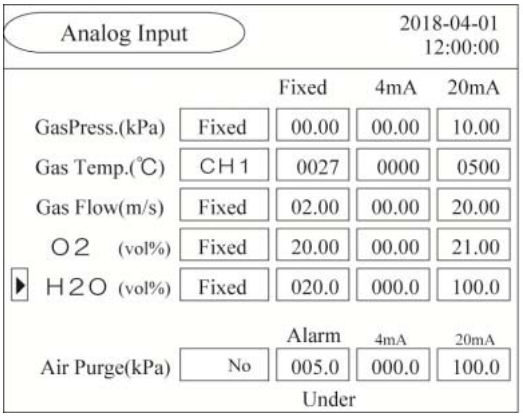


Select "Fixed" by the ▲ key or the ▼ key, and press the ENT key.



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.



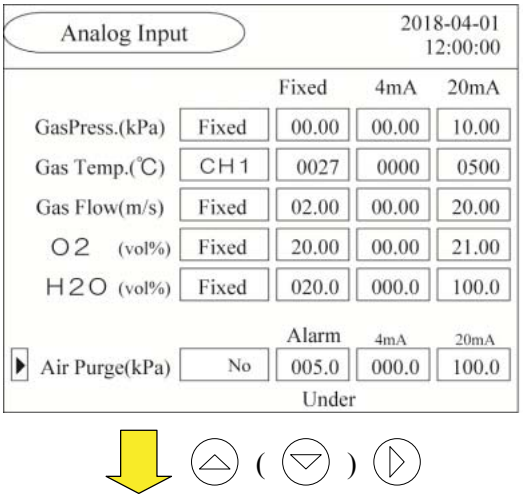
The same procedure can be implemented as for pressure gauge, thermometer or oxygen analyzer (O_2).

6.7.3 Air purge pressure

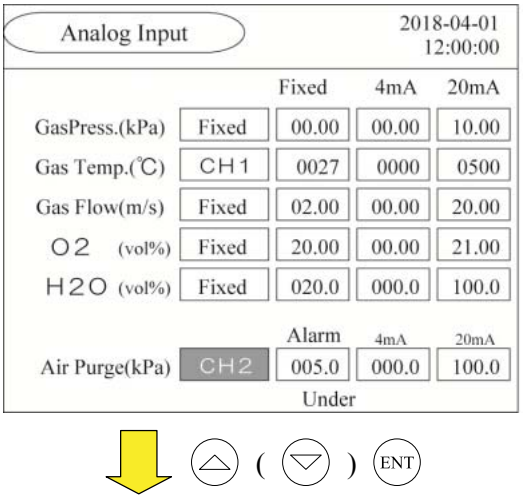
If a pressure gauge is installed on air purge pipe, and connected to the control unit, the analyzer can emit an alarm when the purge pressure is below the setpoint.

- Be sure to install a pressure gauge if the purge pressure is unstable.
- If you measure high-temperature gas without purging the analyzer, the analyzer may get damaged.

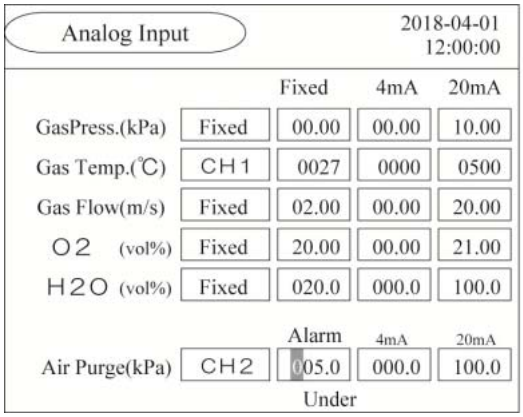
When there is no sensor to be connected, set the air purge pressure to “No”. If you select “CH1” or “CH2” while there is no signal input, the analyzer emits an “analog signal error” alarm.

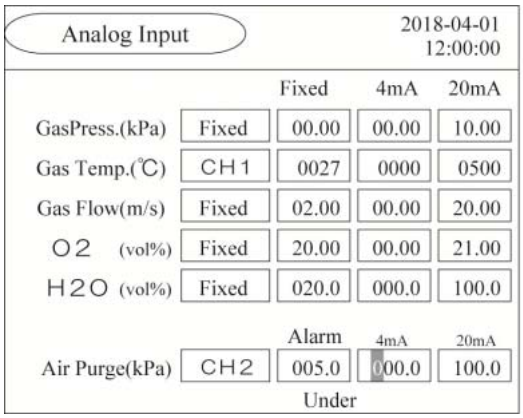


Select “Air Purge” by the △ key or the ▽ key. Press the ▷ key to move the cursor to “Channel” setting.



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





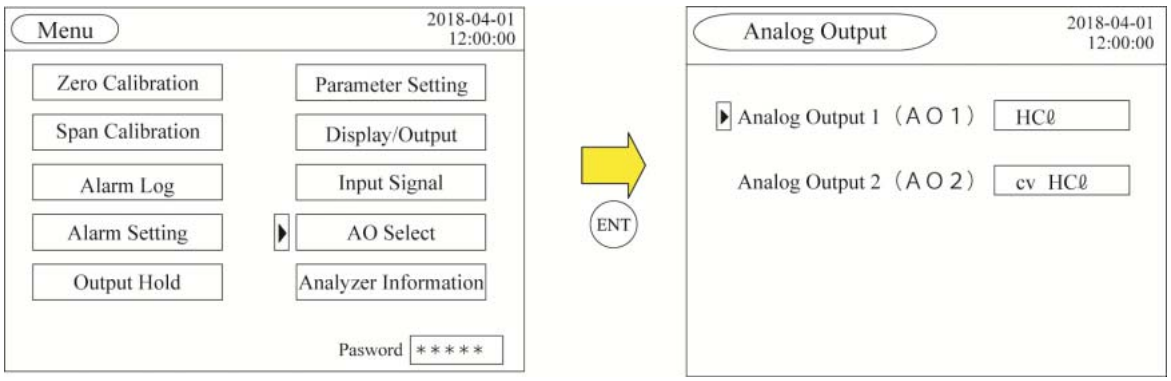
Enter the purge pressure value to output alarm. Change the numeric value by the key or the key, and move the digits by the key. Press the ENT key to validate the set input value.

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

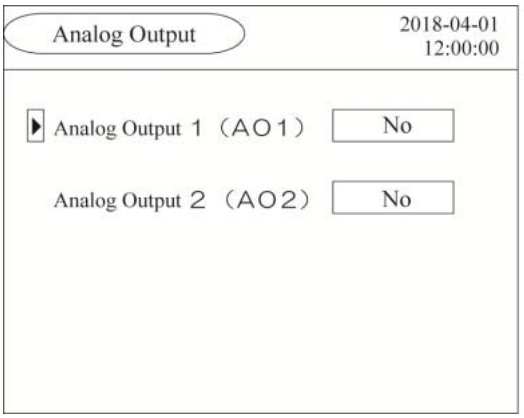
6.8 Analog output

There are two analog outputs (4 to 20mA DC output) as a standard specification. This allows you to emit the measured value and the O_2 conversion value individually. For each of them you can set the average value or the instantaneous value separately. In addition to the measured value and the O_2 conversion value, the transmittance is available as the analog output.
Default value is set to “No”, so be sure to set it after installation.

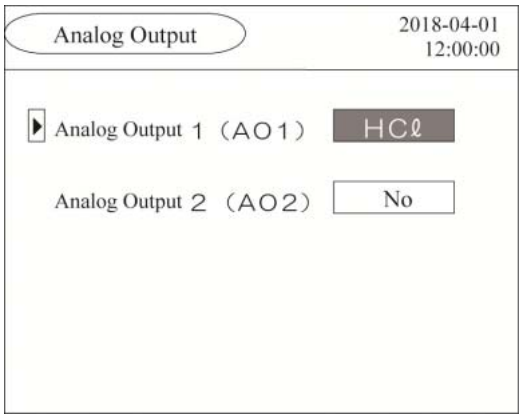
Select “AO Select” from the “Menu” screen, and press the (ENT) key.



When the number of the components to be measured is one, “Component” or “No” can be selected. When there is O_2 conversion output, “O_2 Conversion” is also selectable.



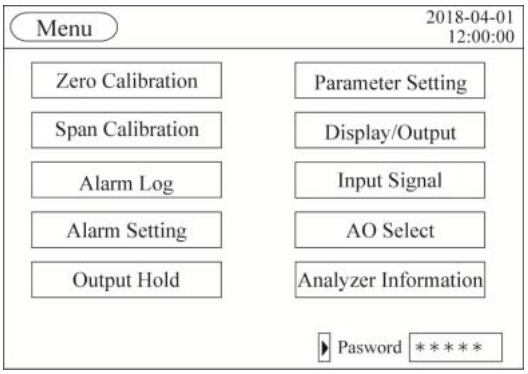
Select the analog terminal to be output by the (△) or the (▽) key. Press the (▷) key to move the cursor to “Output Component” setting.



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

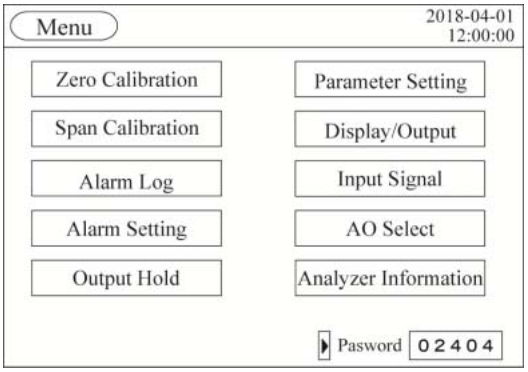
6.9 Fine adjustment of analog output value

The analog output values may slightly deviate from appropriate values due to load resistance. In such a case, adjust the analog output by the following method.

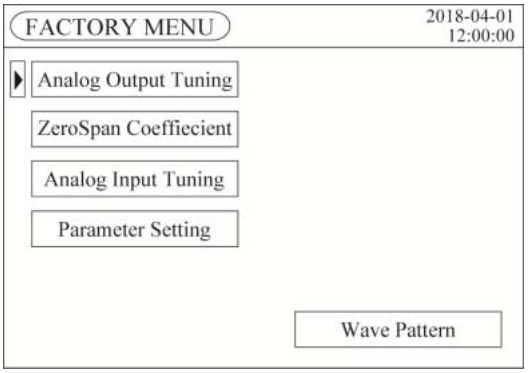


Point the cursor to "Password" in the bottom left of the “Menu” screen by the △ key or the ▽ key.

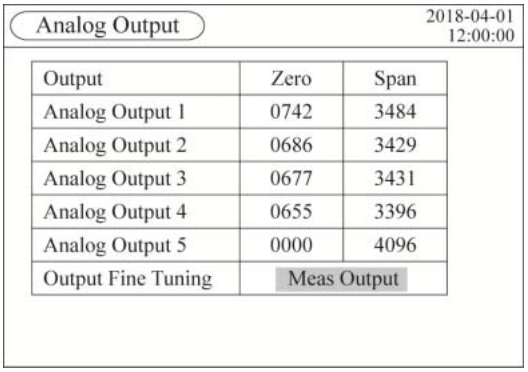
Press the ENT key to change the display to “00000”.



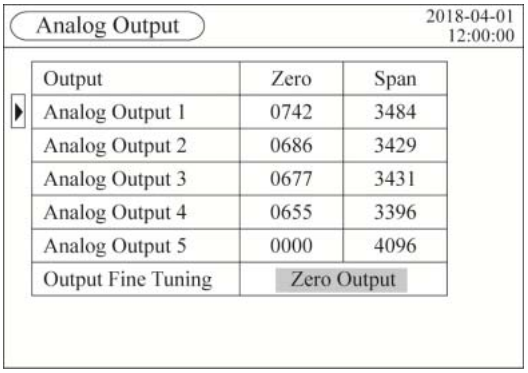
Enter “02404” to the Password. Select the digits by the ▷ key, and press the △ key or the ▽ key to move the cursor to “Password”.



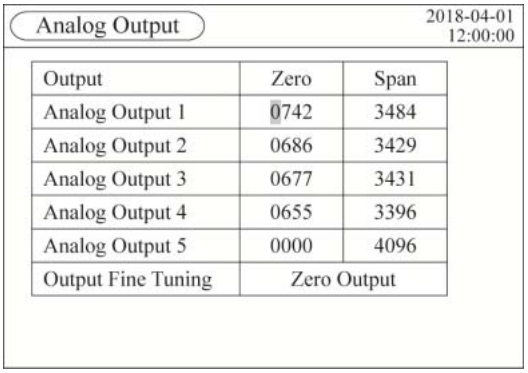
Press the ENT key to display the “Factory Menu” screen.
Point the cursor to “Analog Output Tuning” by the △ key or the ▽ key, and press the ENT key.



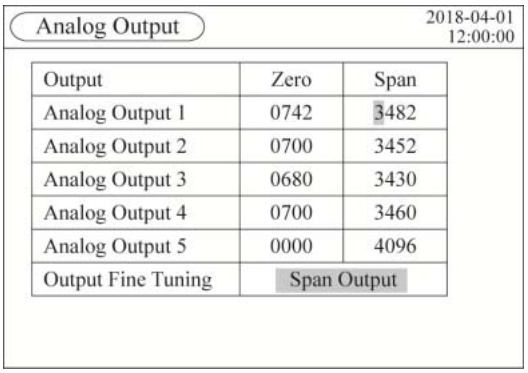
This device has the simulation output function. Point the cursor to “Output Fine Tuning” at the bottom and press the ENT key. Select an item from “Meas Output”, “Zero Output”, “Half Output”, or “Span Output” by the ▽ key or the △ key, and press the ENT key.



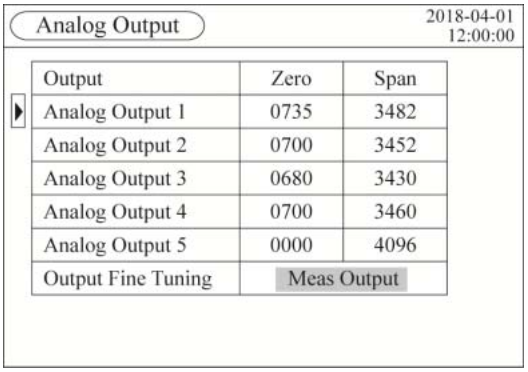
Selected analog output adjustment is performed on all outputs.
Point the cursor to the analog output to be adjusted while "Zero output" is selected for Analog fine adjustment, and press the ENT key.



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



Press the MODE key, and the “output fine tuning” will change to “Span Output” and the cursor will move to numeric values on the first row of the span.
Edit the value by using the △ ▽ keys.



Press the ESC key twice, and the cursor will return to the initial position and the “output fine tuning” will change back to “Meas Output”.

6.10 Digital Output

Follow the instructions to check if the digital output relays properly work, and/or if the wiring has been done appropriately.

6.10.1 Checking the digital output by using the alarm

The terminal number and the initial setting of each relay are shown in parenthesis.

(1) Light intensity low (DO1, SPST-NO)

Remove the receiver box or the transmitter box to generate a “light intensity low” alarm. Do not look into the transmitter box. Otherwise, it may cause serious damage to your retinae or cornea. The “light intensity low” alarm starts after about a minute during operation and about six minutes right after the start-up. After you check the alarm output, attach the receiver box or the transmitter box to the angle adjustment unit where they were.

(2) Device failure (DO2, SPST-NO)

Turn off the power, and disconnect the cable between the receiver unit and the control unit. Turn on the power again, and the “connection error” appears on the screen and a “device error” alarm is emitted. After you check the alarm output, turn off the power, connect the cable, and turn on the power again.

(3) During hold / during calibration (DO3, SPST-NO)

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

(4) Overrange/underrange (DO4, SPST-NO)

Set the range limit so that the current measured value is beyond the upper or lower limit, in reference to “6.3 Alarm setting”. After you check that the overrange/underrange alarm is emitted, set the alarm to OFF or change the setting to the appropriate one.

(5) Environmental error (DO5)

Edit the analog input setting to channel 1 or channel 2 while no sensor is connected to the AI terminal. “AI Under”, which means the analog input error, appears on the screen, and an environmental error alarm is emitted.

(6) Power interruption (DO6, closed during power interruption)

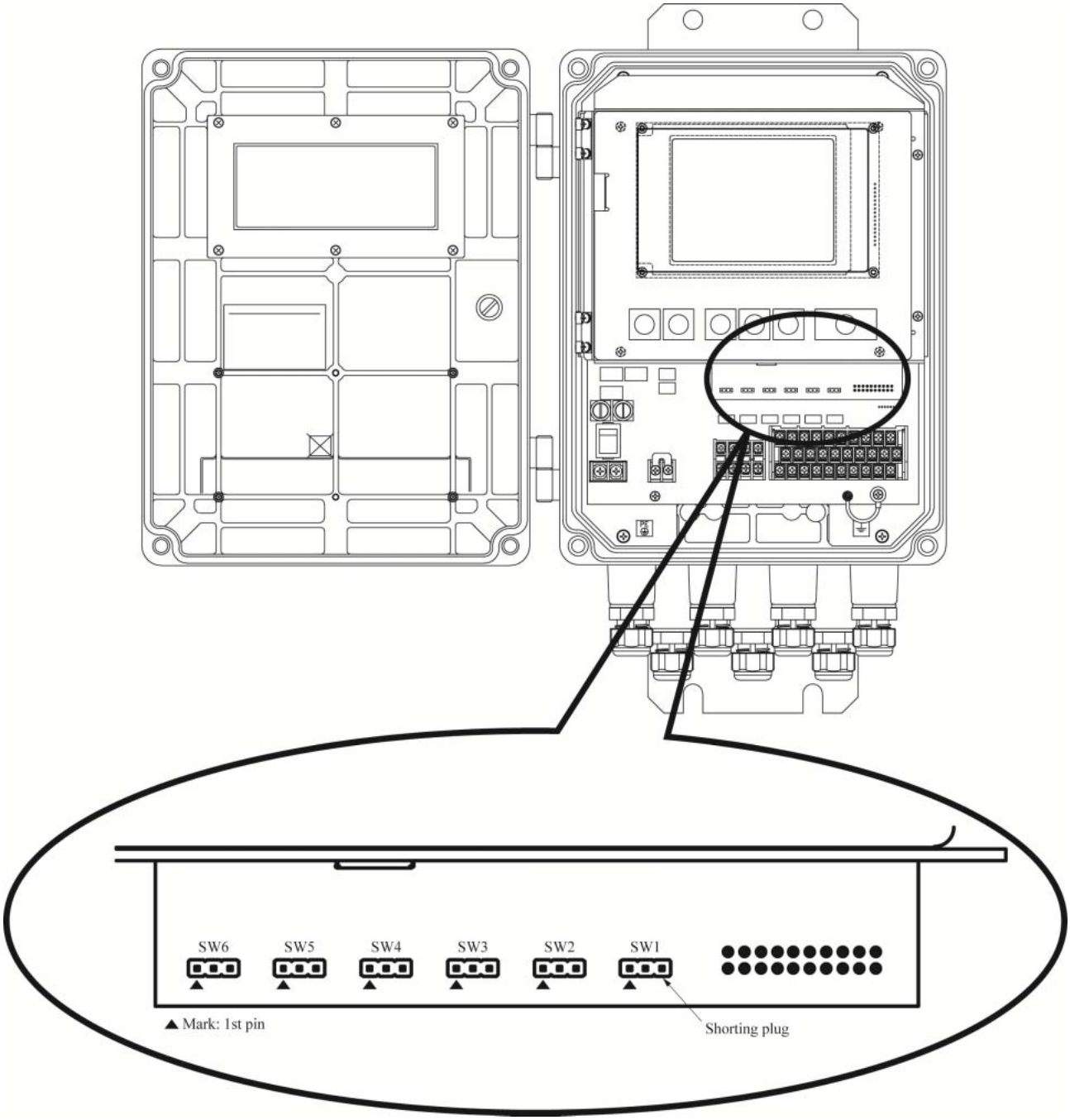
De-energize the analyzer and check the output. In the default setting, the contact is closed when no power is supplied, and opened when the power is supplied.

6.10.2 Changing the relay contact

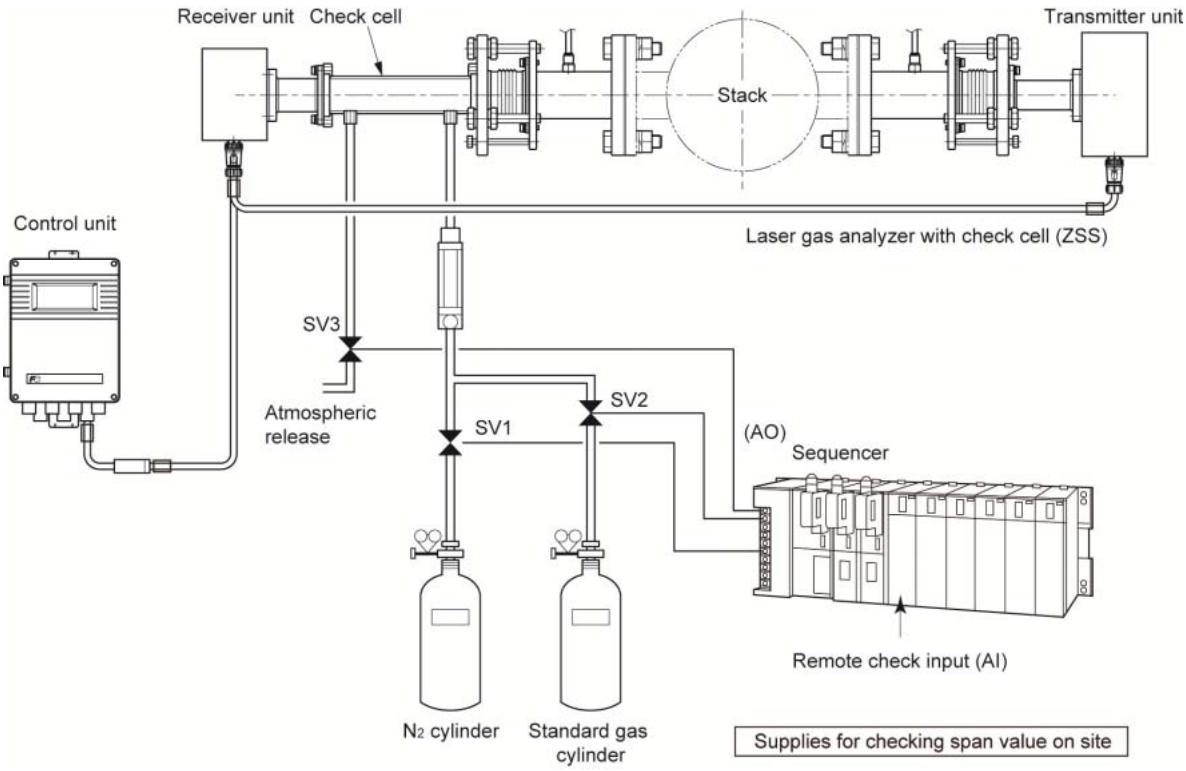
Open the cover of the control unit. Change the position of the shorting plug for the switch.

	Function	Between 1 and 2	Between 2 and 3
SW1…SW6	Digital output change	SPST-NC	SPST-NO

SW1: DO1 (Light intensity low)
SW2: DO2 (Device failure)
SW3: DO3 (During hold / during calibration)
SW4: DO4 (Overrange/underrange)
SW5: DO5 (Environmental error)
SW6: DO6 (Power interruption)

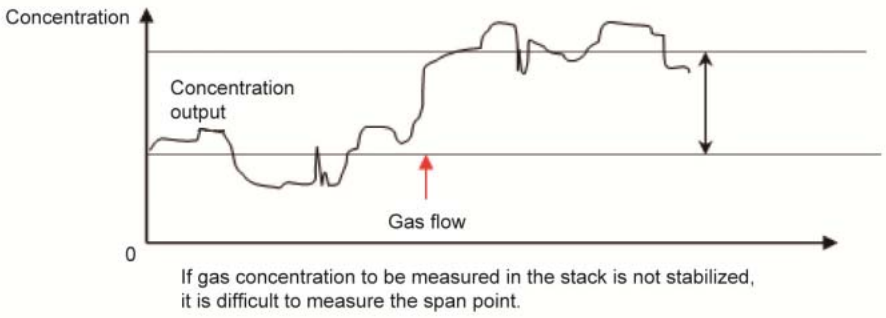


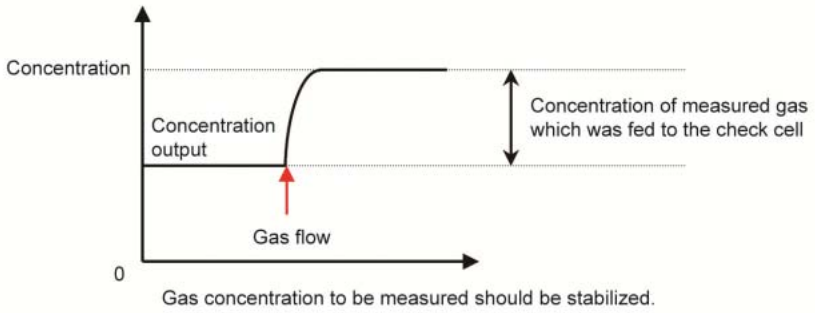
6.11 Check cell



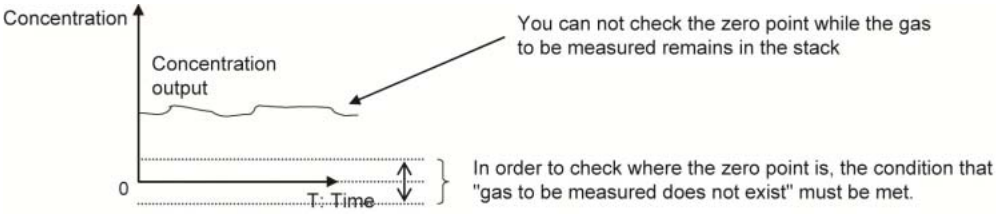
6.11.1 Usage

The check cell is intended to be used to check a deviation of the span point without removing the device from the stack. However, if the gas concentration inside the stack is not stable, the check is unavailable.





You cannot check the zero point as far as the measured gas exists in the stack.



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

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

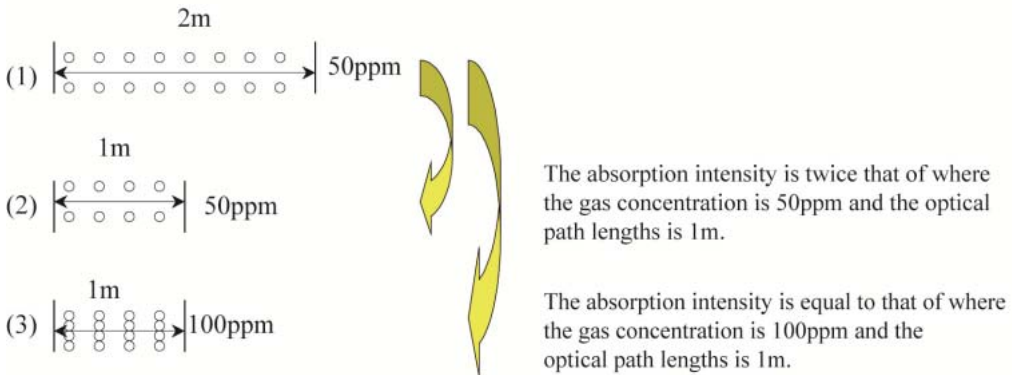
Gas absorption laws
Based on Lambert-Beer Law

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

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

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

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



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

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

6.11.3 Operation method

(1) Remove the cap from the gas inlet and the outlet of the check cell. Connect the inlet side to the N_2 gas cylinder.

(2) Feed N_2 gas to the check cell to obtain the concentration of the target gas inside the stack.

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

(4) After the indication value become stable, check the difference from the span point.

(5) Fill the check cell with N_2 gas.

(6) Put on the caps so that the measured gas component does not come into the check cell.

7. MAINTENANCE

7.1 Maintenance list

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

Table 7－1

	Maintenance cycle		
	6-month	1-year	3-year
Light axis adjustment	✓		
Zero calibration	✓		
Span calibration	✓		
Replacement of O-ring and packing		✓	
LCD replacement			✓

7.2 Maintenance procedure

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

Table 7－2

		Maintenance cycle		Page
		6 months	1 year	
Control unit	Check that no error or alarm is displayed.	○		
↓				
Receiver/ transmitter unit	Check that the mounting flange is securely fixed to the stack and there is no vibration.	○		
↓				
Receiver/ transmitter unit	Zero calibration	○		P.42
↓				
Receiver/ transmitter unit	Span calibration	○		P.46
↓				
Receiver/ transmitter unit	Replacement of O-ring and packing		○	P.93
↓				
Receiver/ transmitter unit	Light axis adjustment	○		
↓				
Receiver/ transmitter unit	Check of air purge flow rate	○		

7.3 Zero calibration

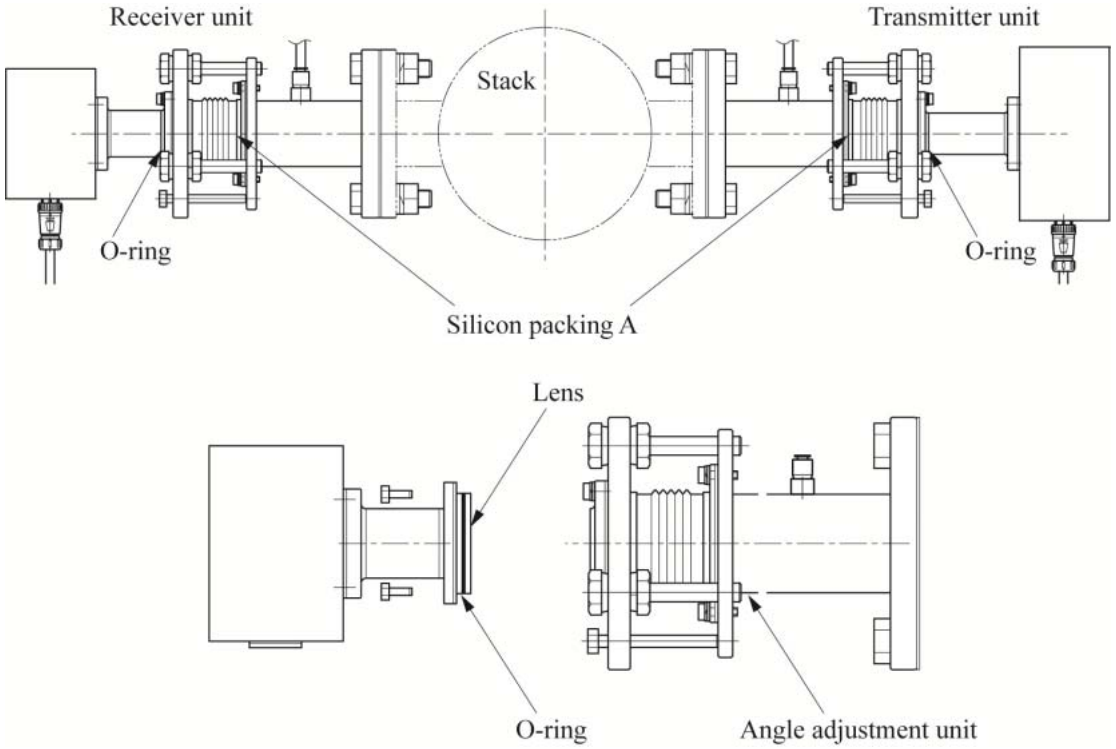
Refer to “6.1 Zero calibration”.

7.4 Span calibration

Refer to “6.2 Span calibration”.

7.5 Replacement of O-ring and packing

Replace the O-ring and silicon packing A annually.



Notes:

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

8. TROUBLESHOOTING

(1) "Low Light Trans" alarm

1) Does the gas temperature when you carry out the measurement differ from the temperature at the time of light axis adjustment?
   → If yes, the stack might have been deformed by temperature change, which resulted in deflection of the light axis. Re-adjust the light axis.
2) Have you been using the analyzer for years, or, is the analyzer connected to a flange installed long time ago?
   → If yes, the companion flange may have corroded and deformed due to the weight of the equipment. Take measures, for example, adding a support for the flange.
3) Does the sample gas contain a large amount of dust?
   → The dust amount must meet the requirements of the sample gas. Note that the dust requirements vary with the target gas, analyzer specification, optical path length, particle size of dust, and other conditions.
4) Is there condensation on the lenses of the transmitter unit and the receiver unit?
   → If yes, increase the amount of purge air to prevent condensation.
5) Does the lenses get dirty because of deficient purge, or, does the optical path is interrupted by dust?
   → If yes, increase the purge air flow rate to prevent the lenses from getting dirty.
6) Is the lens(es) of the transmitter unit and/or the receiver unit broken?
   → If yes, contact us. The lenses can be broken by physical shock or by temperature beyond the allowable range. Be sure to use the analyzer under the specified environment.
7) Is the analyzer installed in the place where has a vibrational frequency of 20–40 Hz?
   → If yes, contact us. We need to take some measures, for example, changing the length of the system to suppress the resonant frequency.
8) In other cases, contact us.

(2) "LD Temp" error

1) Is the analyzer installed in the environment beyond the requirements?
   → If yes, take necessary measures to meet the requirements.
2) Is the gas temperature beyond the range?
   → See Appendix 1 to check the allowable gas temperature, and take measures to meet the requirements, for example, change the position of the analyzer.
3) In other cases, the analyzer may have failed. Contact us.

(3) "Connection Error"

1) Is there poor contact around connector due to inappropriate wiring?
   → If yes, redo the wiring.
2) Is there disconnection of wire?
   → Contact us.
3) In other cases, the CPU board and/or the PD digital board may have failed. Contact us.

(4) "High Gas Temp" alarm

1) Is the gas temperature beyond the range?
   → See Appendix 1 to check the allowable gas temperature, and take measures to meet the requirements, for example, change the position of the analyzer.
2) Are the H/L limits used for the gas alarm properly set?
   → Set the limits to appropriate values in the alarm setting screen.

(5) Gas pressure "Out of Range" alarm

1) Is the gas pressure beyond the range of allowable gas pressure?
   → Take necessary measures to keep the gas pressure within ±10 kPa.
2) Is the analog input setting for the gas pressure appropriate?
   → Make an appropriate setting for gas pressure in the analog input screen.

(6) "AI Under" alarm

1) Did you set the analog input to CH1 or CH2 while no sensor is connected to the AI terminal?
   → Set the analog input to the fixed value or connect the sensor to the AI terminal.
2) Did you set the channel corresponds to the AI terminal being used?
   → Check if the channel you set match the AI terminal number.
3) Is it 4–20 mA DC signal that is provided?
   → The analyzer accepts 4–20 mA DC signal only. Voltage input is not accepted.
4) The input signal is ≤-10% or ≥110% of the input range.
   → Check the input signal is within the allowable range.

(7) "Box Temp.Warning"

1) Are you using the analyzer in the environment beyond the specification?
   → Be sure to use it under the specified environment.
2) The gas temperature is beyond the allowable range.
   → See Appendix 1 for the sample gas requirements. If necessary, change the position of the analyzer or take other measures so that the gas temperature falls within the allowable range.
3) The air purge flow rate is deficient.
   → Increase the flow rate.
4) In other cases, contact us because some measures need to be taken such as extending the distance from the stack to the analyzer.

(8) "Low Air Purge" alarm

1) Did you set the analog input to CH1 or CH2 while no sensor is connected to the AI terminal?
   → Set the analog input to the fixed value or connect the sensor to the AI terminal.
2) Is the air purge pressure lower than the alarm setting, or no purging air is provided.
   → Make sure the purging system is working and the air purge pressure is efficient.

(9) The analyzer does not work even when you turn on the power.

1) The supplied voltage is lower than the rating.
   → Supply the voltage at which the product is rated.
2) There is poor contact or disconnection of wire.
   → Check the wiring and cable connection.
3) In other cases, contact us because the analyzer may have failed.

(10) The measurement results differ from the manual analysis.

1) The setting of the optical path length is not correct.
   → Set the correct value for the stack length, i.e. optical path length, because it considerably affects the measurement results.
2) The actual gas temperature differs from the analog input for the gas temperature.
   → Modify the analog input setting so that the analyzer can calculate the concentration based on the correct gas temperature.
3) The actual gas pressure differs from the analog input for the gas pressure.
   → Modify the analog input setting so that the analyzer can calculate the concentration based on the correct gas pressure.
4) The light intensity is extremely low.
   → Adjust the light axis.
5) In NH3 analyzer: the sample gas contains a considerable amount of interference gas that has small molecule weight (e.g. H_2) and/or that has large molecule weight (e.g. CO_2).
   → The pressure broadening compensation is required. Contact the distributor where you purchased the product or our sales office.
6) In CH_4 analyzer: The sample gas contains a considerable amount of H_2O.
   → The moisture compensation is required. Contact the distributor where you purchased the product or our sales office.
7) The measurement principle of the equipment you use for manual analysis is different from that of the laser gas analyzer ZSS.
   → ZSS measures the concentration of a component in the state of gas, which means it cannot detect complex molecules or dissolved molecules. Therefore, the measurement result of ZSS may be different from that of the analyzers using ion-selective electrode or other principles.
8) The measurement points differs between ZSS and the manual analysis.
   → ZSS obtains the mean gas concentration over the stack diameter, while the manual analysis or a sampling system measures the gas concentration at the center of the stack. When the gas concentration in a stack is uneven, therefore, the measurement results of the above two differs each other.
9) Due to the difference in the measurement principle
   →ZSS measures a specific component while the manual analysis and the ion-selective electrode may measure the ionized matter as a whole. Therefore, if the sample gas contains other gas than the target of measurement, the measurement result of ZSS differs with that of the manual analysis or the ion-selective electrode.

(11) The measured value is beyond the range.

1) The sample gas actually has a concentration beyond the range.
   → Check the concentration by the manual analysis or other methods.
2) The stack diameter is too long for the product specification or longer than the value you set.
   → When the setpoint for the optical path length is longer than the actual length, the analyzer delivers a higher concentration than actual. Set the parameter to the correct length.
3) In other cases, contact us.

(12) The readings does not increase when you flow the gas from cylinder for span calibration.

1) The gas cylinder is new or not used for some time.
   → It takes a while until a gas flows from a cylinder, especially the gas is HCl. Make the flow rate a little high and let it flow for a while.
2) The regulator is rusty inside.
   → If the regulator is rusty, the gas won't flow because HCl is absorbed. Replace the regulator.

APPENDIX 1 SPECIFICATIONS

1-1 Specifications

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

Measurable Component	Component		Min.measuring range Note 1)	Max.measuring range Note 1)	Measured gas temperature	Purge gas	4th digit
1-component analyzer	HCl		10 ppm	5000 ppm	400°C or less	Air	C
	NH_3		15 ppm	5000 ppm	450°C or less		W
	CO (High level)		2.0 vol%	100 vol%	300°C or less		A
	CO (Low level)		200 ppm	1 vol%	400°C or less		M
	CO_2		2.0 vol%	100 vol%	300°C or less		G
	CH_4		100 ppm	100 vol%	300°C or less		R
	O_2		10 vol%	100 vol%	300°C or less	N_2	P
	O_2 (High temperature)		4 vol%	50 vol%	1200°C or less		Q
	O_2 (Instrument air purge) Note 2)		25 vol%	100 vol%	400 to 1200°C	Air	T
2-component analyzer	$HCl+H_2O$ (50 vol%) Note 2)		50 ppm (HCℓ)	1000 ppm (HCℓ)	130 to 400°C	Air	F
	NH_3+H_2O (50 vol%) Note 2)		50 ppm (NH_3)	1000 ppm (NH_3)	450°C or less		X
	$CO+CO_2$		2.5 vol%	100 vol%	300°C or less		K
2-laser 2-component analyzer	$CO+O_2$ (Instrument air purge)	CO	200 ppm	2 vol%	400 to 1200°C	Air	V
		O_2	25 vol%	100 vol%			
	$CO+O_2$ (High temperature)	CO	200 ppm	2 vol%	1200°C or less	N_2	U
		O_2	5 vol%	50 vol%			
	$CO+O_2$	CO	2 vol%	50 vol%	300°C or less		S
		O_2	10 vol%	100 vol%			

Note 1) Min. and Max. measuring range in the above table are for measuring path length (stack length) of 1m. See below on the ranges for other path lengths.
Note 2) Consult us if you select the O_2 (air purge) version or the H_2O measuring version.

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

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

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

(5) Light source : Near-infrared semiconductor laser
(6) Laser class : Class 1 (high temperature version and air purge version of O2 analyzer fall under CLASS 3B)
(7) Outline (W × D × H) mm : As specified on the Outline Diagram.
(8) Mass : Receiver/Transmitter unit: Approximately 10kg
Control unit: Approximately 8kg
(9) Structure : Outdoor use type, dustproofing/rainproofing structure (IP65)
(10) Material : Receiver/Transmitter unit: Aluminum, SUS316
Control unit: Aluminum

(11)	Materials of gas-contacting parts	:	SUS316, BK7, FKM, PTFE, glass-cloth, silicone
(12)	Air purge connection diameter	:	Rc1/4 (tube ϕ10 × 8)
(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 Operating voltage 90 to 264 V AC Rated frequency 50/60 Hz
(15)	Power consumption	:	Max. rated power: Approximately 80VA or less
(16)	Calibration interval	:	Once every six months (Maintenance cycle may vary depending on the operating environment.)
(17)	Indicator (control unit)	:	LCD with back light
(18)	Cable length	:	Receiver unit to Transmitter unit : Standard 2m (Maximum 25m) Receiver unit to control unit : Standard 5m (Maximum 100m)
(19)	Analog output	:	4 to 20mA DC or 1 to 5V DC × 2 (4) Non-isolated output Allowable load: 4 to 20mA DC 550Ω or less, 1 to 5V DC 500kΩ or more (Transmits the measured value and the O2-corrected value, and/or the transmittance (%T). User can switch between average values and instantaneous values.)
(20)	Analog input	:	4–20 mA DC, 2 points Measured gas pressure, measured gas temperature, measured gas velocity, O2 concentration, water concentration, or air purge pressure * Analog inputs are used for the concentration compensation, the O2 correction, and the alarm output.
(21)	Digital output	:	6 points, SPST-NO (standard) or SPST-NC Relay contact, contact capacity 24 V DC, 1 A Low light transmission, device failure, during hold / during calibration, H/L limit, environmental error, power interruption
(22)	Digital input (option)	:	3 points Voltage input, received by photocoupler (operating voltage 12–24 V DC, current 5–20 mA) Average value reset, switchover between instantaneous value and moving average value, remote hold
(23)	Alarm output (screen-displayed)	:	LD failure, LD temperature error, high gas temperature, air purge (low pressure), out of range box temperature warning, low light transmission, PD over range, connection error, AI under, over H-limit or under L-Limit.
(24)	Display contents	:	Component, concentration (instantaneous value, average value O_2 correction instantaneous value and O_2 correction average value), alarm (fault status)

1-2 Digital output contents

(1)	Low light transmission	:	Contact is opened or closed when the intensity of the light reached the receiver is deficient.
(2)	Device failure	:	Contact is opened or closed when any of the followings occurs: Laser temperature error, light intensity high,communication error
(3)	During hold/during calibration	:	Contact is opened or closed during the analog output is held (to the last value or the user-defined value) and during calibration.
(4)	H/L limit	:	Contact is opened or closed when the measured value has gone beyond the high limit or below the low limit.
(5)	Environmental error		Contact is opened or closed when the gas temperature is outside the range, air purge pressure is too low, analog input signal is abnormal, and/or box temperature is abnormal.
(6)	Power interruption	:	Contact is opened or closed during the power supply to the analyzer is interrupted.

1-3 Digital input contents (option)

(1)	Average value reset signal	:	Output of converted average value is started from the initial state by applying rectangular-wave voltage (with a minimum pulse width of two seconds) to the input terminal of average value resetting. Output is reset by inputting and restarted by opening.
(2)	Switchover between instantaneous value and 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 (with a minimum pulse width of two seconds) 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 voltage to the remote hold input terminal. The hold is cancelled by opening the relay contact.

1-4 Standard functions

(1) O_2 correction :

Conversion of measured CO gas concentrations into values at standard O2 concentration

Conversion formula:

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

C: Converted concentration

Cs: Measured concentration of sample gas

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

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

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

1-5 Installation environment

(1)	Ambient temperature	:	-20°C to +55°C (receiver unit and transmitter unit) -5°C to +45°C (control unit)
(2)	Ambient humidity	:	≤ 90% RH
(3)	Optical path length (stack inner diameter)	:	0.5 m to 5 m * Consult us if the distance between the transmitter unit and the receiver unit is beyond 5 m.
(4)	Standard flange	:	JIS10K 50A flange (JIS B 2212)
(5)	Purge gas	:	Instrument air (If not available, a compressor is required. The air shall contain neither oil nor mist.) Use N2 if the target gas contains explosive gas or combustible gas, and for O2 analyzers other than the instrument air purge version.
(6)	Purge gas fl ow rate	:	≥ 20 L/min (depending on measured gas velocity)
(7)	Measured gas condition	:	Temperature: as specified in "1-1 (4) Measurable component and range" of APPENDIX 1. Pressure: ±10kPa Moisture: 50vol% or less (or should not be saturated water vapor) Velocity: 25m/s or less (However, consultation is necessary for the environment where dust (1g/Nm_3 or more) or water (25vol% or more) exists.) (Prevention of dust deposition or dew condensation due to increase in air purge flow rate is required)
(8)	Dust (when the optical path length is 1 m):	:	Standard version: ≤ 5 g/m3 (N) Dust resistant version: O2 measurement: ≤ 10 g/m3 (N) Low level CO: ≤ 20 g/m3 (N) Others: ≤ 15 g/m3 (N)
(9)	Vibration	:	0.5G or less (0.2G or less when the frequency range is 20 to 40Hz) (When the optical path length is 1m.)
(10)	Mounting angle	:	Horizontally ±5 degree or less (No dew condensation should accumulate on the window.)
(11)	Light axis fluctuation range	:	Within 0.3 degree (When the path length is 0.5m)

1-6 Performance

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

APPENDIX 2 CODE SYMBOLS

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

Digit	Specification		Note	Code
4	Components	CO		A
		CO (low-level)		M
		HCl		C
		HCl + H_2O	Note 1, 3	F
		CO_2		G
		CO + CO_2		K
		O_2		P
		O_2 (High temperature)		Q
		O_2 (Air purge)		T
		ppm CO + O_2 (Air purge)	Note 2	V
		ppm CO + O_2 (High temperature)		U
		vol% CO + O_2		S
		CH_4	Note 2	R
		NH_3		W
		NH_3 + H_2O (50 vol%)	Note 1, 5	X
5	Unit	ppm		1
		mg/m^3		3
		vol%		5
		ppm (1st comp), vol% (2nd comp)		7
		vol% (1st comp), vol% (2nd comp)		9
6	Measuring range (1st component)	0 to 2	Note 4,6,7,8	K
		0 to 2.5		Q
		0 to 4		S
		0 to 5		L
		0 to 10		V
		0 to 15		0
		0 to 20		1
		0 to 25		T
		0 to 50		A
		0 to 100		B
		0 to 200		C
		0 to 250		D
		0 to 400		J
		0 to 500		E
		0 to 1000		F
		0 to 2000		G
		0 to 5000		H
		0 to 6000		M
		Others		X
7	Measuring range (2st component)	None	Note 4,5,6,7,8	Y
		0 to 2		K
		0 to 2.5		Q
		0 to 4		S
		0 to 5		L
		0 to 10		V
		0 to 15		0
		0 to 20		1
		0 to 25		T
		0 to 50		A
		0 to 100		B
		0 to 200		C
		0 to 250		D
		0 to 400		J
		0 to 500		E
		0 to 1000		F
		0 to 2000		G
		0 to 5000		H
		0 to 6000		M
		Others		X
9	Flange rating	10K 50A (JIS B 2212)		A
		10K 100A		B
		DN50/PN10		C
		ANSI #150 2B		D
10	Number of analog output points	2 points		0
		4 points		1
11	Number of analog input points	2 points		A

Digit	Specification		Note	Code
12	Analog output	4 to 20mA DC		1
		1 to 5V DC		5
13	DI/DO	6 output points, No input		0
		6 output points, 3 input points		1
14	Cable length between receiver and control unit	5m	Note 9	A
		10m		B
		20m		C
		30m		D
		40m		E
		50m		F
		80m		G
		100m		H
		Others		X
15	Cable length between receiver and transmitter	2m	Note 10	A
		5m		B
		10m		C
		15m		D
		20m		E
		25m		F
		Others		X
16	Language	Japanese		J
		English		E
		Chinese		C
17	–	–		0
18	Optical path length (ones place)	0m	Note 11, 12	0
		1m		1
		2m		2
		3m		3
		4m		4
		5m		5
		6m		6
		7m		7
		8m		8
		9m		9
19	Optical path length (tenths place)	0.0m	Note 11, 12	0
		0.1m		1
		0.2m		2
		0.3m		3
		0.4m		4
		0.5m		5
		0.6m		6
		0.7m		7
		0.8m		8
		0.9m		9
20	Optical path length (hundredths place)	0.00m	Note 11, 12	0
		0.05m		5
		(Used only when 10m is specified)		9
21	–	–		N
22	High-dust version (High-speed AGC)	No		N
		Yes		H

Note 1) Consult us when selecting H_2O or CH4 measurement.
Note 2) Only use where gas temperature is 400℃ or more.
Note 3) Only use where gas temperature is 130℃ or more.
Note 4) Specify the measuring range within the limit calculated based on the optical path length.
Note 5) For single component analyzer, select "Y". For two-component analyzer, select a range for the second component.
Note 6) Specify the same range for CO and CO_2.
Note 7) The measuremet range for a) HCL of the CHL + H_2O analyzer and b) NH_3 of the NH_3 + H_2O analyzer should be specified in the 6th code. As the measurement range for H_2O is fixed to 50 vol%, select "A" in the 7th code.
Note 8) When using CO + O_2 measurement, select a "CO" in the 6th digit, and a "O_2" in the 7th digit.
Note 9) Cable length between receiver and control unit: when you select the code "X", available length is 10 m or longer.
Note 10) Cable length between receiver and transmitter: when you select the code "X", available length is 5 m or longer.
Note 11) When the optical path length is 10 m, select "9" in 18th, 19th, and 20th codes.
Note 12) The optical path length for the CO + O_2 analyzer shall be the range between 0.5 and 5 m.

List for Combinations of Measureable Components, Units and Measurement ranges

Component		Measuring range
CO		0 ~ 2, 2.5, 4, 5, 10, 15, 20, 25, 50 vol%
HCl		0 ~ 10, 15, 20, 25, 50, 100, 200, 250, 400, 500, 1000, 2000, 5000 ppm or mg/m^3
CO_2		0 ~ 2, 2.5, 4,5, 10, 15, 20, 25, 50 100 vol%
O_2		0 ~ 4, 5, 10, 15, 20, 25, 50, 100 vol%
O_2 (For use in high temp.)		0 ~ 4, 5, 10, 15, 20, 25, 50 100 vol%
O_2 (For air purge)		0 ~ 25, 50, 100 vol%
CH_4		0 ~ 100, 200, 250, 400, 500, 1000, 2000, 5000 ppm or mg/m^3 0 ~ 2, 2.5, 4, 5, 10, 15, 20, 25, 50 vol%
NH_3		0 ~ 15, 20, 25, 50, 100, 200, 250, 400, 500, 1000, 2000, 5000 ppm or mg/m^3
$HCL+H_2O$	1st comp.: HCl	0 ~ 50, 100, 200, 250, 400, 500, 1000 ppm or mg/m^3
	2nd comp.: H_2O	50 vol%
NH_3+H_2O	1st comp.: NH_3	0 ~ 50, 100, 200, 250, 400, 500, 1000 ppm or mg/m^3
	2nd comp.: H_2O	50 vol%
$CO+CO_2$	1st comp.: CO	0 ~ 2.5, 4, 5, 10, 15, 20, 25, 50 ,100 vol%
	2nd comp.: CO_2	0 ~ 2.5, 4, 5, 10, 15, 20, 25, 50 ,100 vol%
$CO+O_2$ (ppmCO+Air purge)	1st comp.: CO	0 ~ 200, 250, 400, 1000, 2000, 5000, 6000 ppm, 2vol%
	2nd comp.: O_2	0 ~ 25, 50, 100 vol%
$CO+O_2$ (ppmCO+High temperature O_2)	1st comp.: CO	0 ~ 200, 250, 400, 1000, 2000, 5000, 6000 ppm, 2vol%
	2st comp.: O_2	0 ~ 5, 10, 15, 20, 25, 50 vol%
$CO+O_2$ (vol%$CO+O_2$)	1st comp.: CO	0 ~ 4, 5, 10, 15, 20, 25, 50 vol%
	2st comp.: O_2	0 ~ 10, 15, 20, 25, 50, 100 vol%

Scope of delivery

- Receiver box
- Transmitter box
- Control unit
- Angle adjustment mechanical section (required 2 units, one for receiver and the other for transmitter)
- Cable between receiver unit and transmitter unit (specified length)
- Cable between receiver unit and control unit (specified length)
- Standard accessory set, instruction manual

Optional items

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

*1: One set of the cables and calibration gas cell are necessary for installation and annual maintenance.

*2: The length of the calibration gas cell may vary with measurement ranges.

Standard accessories

Name	Quantity	Specification
Bolt	8 (16)	M16 × 55 (70) *2, stainless steel
Nut	8 (16)	M16, stainless steel
Spring washer	8 (16)	M16, stainless steel
Flat washer	8 (16)	M16, stainless steel
Companion flange packing or flange packing specified for use in high temperature	2	According to flange specifications
Bolt for angle fine adjustments	6	Hex socket bolt M8 × 70
Power supply fuse	2	AC250V / T1A
Connecting bolt between receiving unit and transmitter unit	12	Hex socket bolt M5 × 12
Ferrite core (for power cable,outside the transmitter case)	1	E04SR211132
Ferrite core (for power cable,inside the transmitter case)	1	E04SRS200917S

Notes:
1. When the 9th code is “B”, 16 pieces are provided. For other cases, 8 pieces are provided.
2. When the 9th code is “A”, the bolt length is 55 mm. When the 9th code is “B, “C”, or “D”, the bolt length is 70 mm. Inch-sized bolts are not supplied.

Spare parts for one year (ZBN1SS12)

Parts name	Quantity	Remarks (type)
Silicone packing A	2	For bellows (ZZP*ZSSTQ505205P1)
O-ring	2	(ZZP*ZSSR8552850)

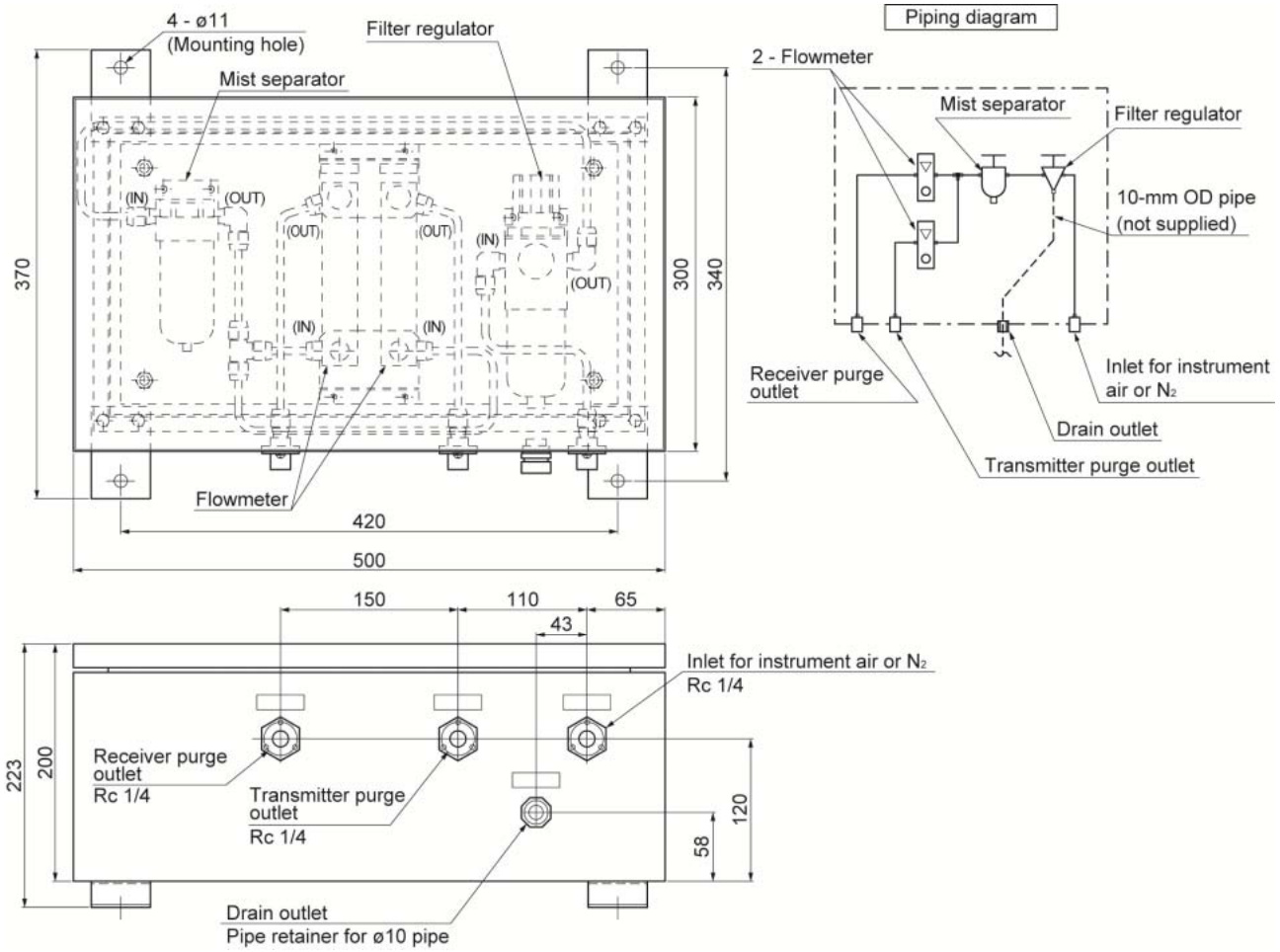
NECESSARY ITEMS TO BE ORDERED SEPARATELY

1. Purging equipment

Purging equipment is indispensable for the laser gas analyzer to remove dust and mist from the transmitter unit and the receiver unit. We offer the following three types:
A set of equipment in a box, a set of equipment without box, or each single equipment.

1.1 A set of purging equipment in a box

Item	Model
Purging equipment in a box: flowmeter scale 4–50 L/min	ZZP*ZSSTQ505307C2
Purging equipment in a box: flowmeter scale 20–100 L/min	ZZP*ZSSTQ505307C1
Purging equipment in a box: flowmeter scale 30–300 L/min	ZZP*ZSSTQ505307C3



1.2 A set of purging equipment without box

Item	Model	Remarks
Purging equipment without box: flowmeter scale 4–50 L/min	ZZP*ZSSTQ505299C2	With PTFE tube
Purging equipment without box: flowmeter scale 20–100 L/min	ZZP*ZSSTQ505299C1	
Purging equipment without box: flowmeter scale 30–300 L/min	ZZP*ZSSTQ505299C3	

1.3 Purging equipment

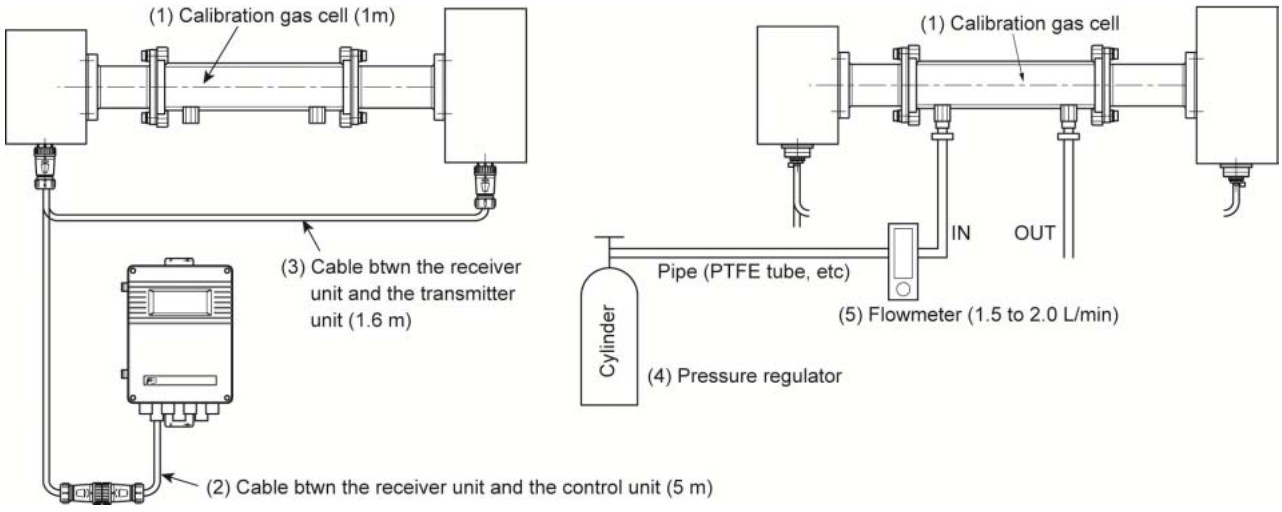
Item	Q'ty	Model
Flowmeter with 4–50 L/min scale	2	ZZP*ZSSTQ505309P2
Flowmeter with 20–100 L/min scale	2	ZZP*ZSSTQ505309P1
Flowmeter with 30–300 L/min scale	2	ZZP*ZSSTQ505308P1
Filter regulator	1	ZZP*ZSSTQ505311P1
Mist separator	1	ZZP*ZSSTQ505310P1
R 1/4 cap nut for mist separator	1	ZZP*ZSSR850N000075

2. Zero/span calibration equipment

To carry out calibration, remove the angle adjustment unit, and install the following equipment, and then flow the zero gas or span gas.

	Item	Q'ty	Model
(1)	Calibration gas cell (for HCl, NH3, CO, CO2, CO + CO2, CH4)*1	1	ZZP*ZSSTQ404735C1
	Calibration gas cell (for HCl + H2O, NH3 + H2O, O2)*1	1	ZZP*ZSSTQ404736C1
(2)	Cable btwn the receiver unit and the control unit (5 m)	1	ZZP*ZSSTQ404686C2
(3)	Cable btwn the receiver unit and the transmitter unit (1.6 m)	1	ZZP*ZSSTQ404685C3
(4)	Pressure regulator	1	ZBD6
(5)	Flowmeter (1.5–2.0 L/min)	1	ZBD4

*1: The standard length of the calibration gas cell is 1 m. Consult us if a low concentration gas cylinder is difficult to obtain.

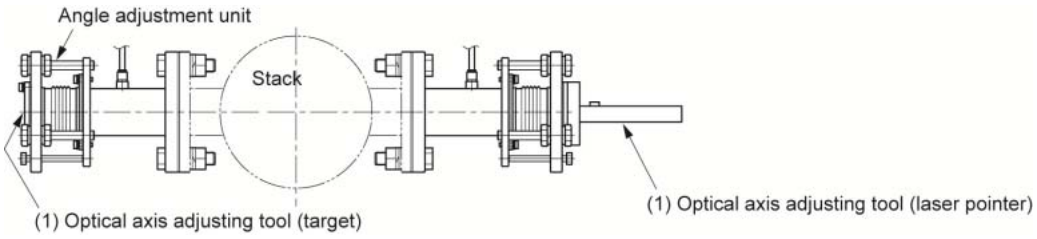


3. Optical axis adjusting tool

You can adjust the optical axis by aiming the laser pointer to the center of the target.

3.1 Optical axis adjusting tool

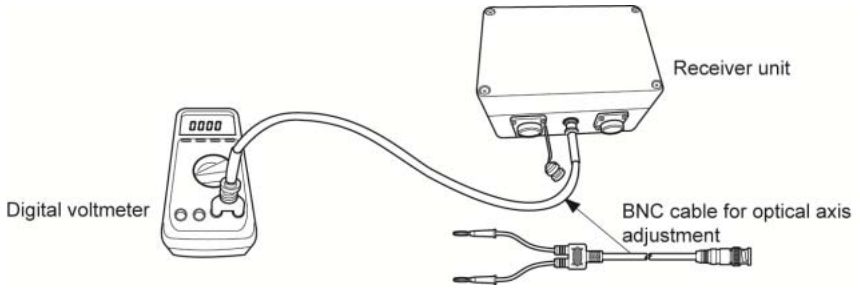
	Item	Q'ty	Model
(1)	Optical axis adjusting tool (laser pointer)		
	Optical axis adjusting tool (target)	1 set	ZZP*ZSSTQ404743C1



3.2 BNC cable for optical adjustment

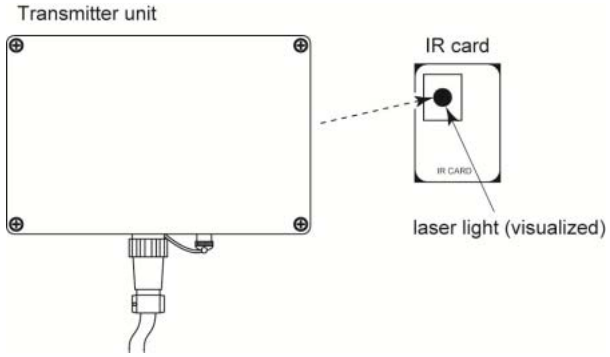
After installing the transmitter unit, the receiver unit, and the control unit, connect a digital voltmeter through the BNC cable to the transmitter unit or the receiver unit. Adjust the optical axis so that the voltage indicated on the voltmeter becomes the relevant value.

Item	Q'ty	Model
BNC cable for optical adjustment	1	ZZP*ZSSTQ505298C1



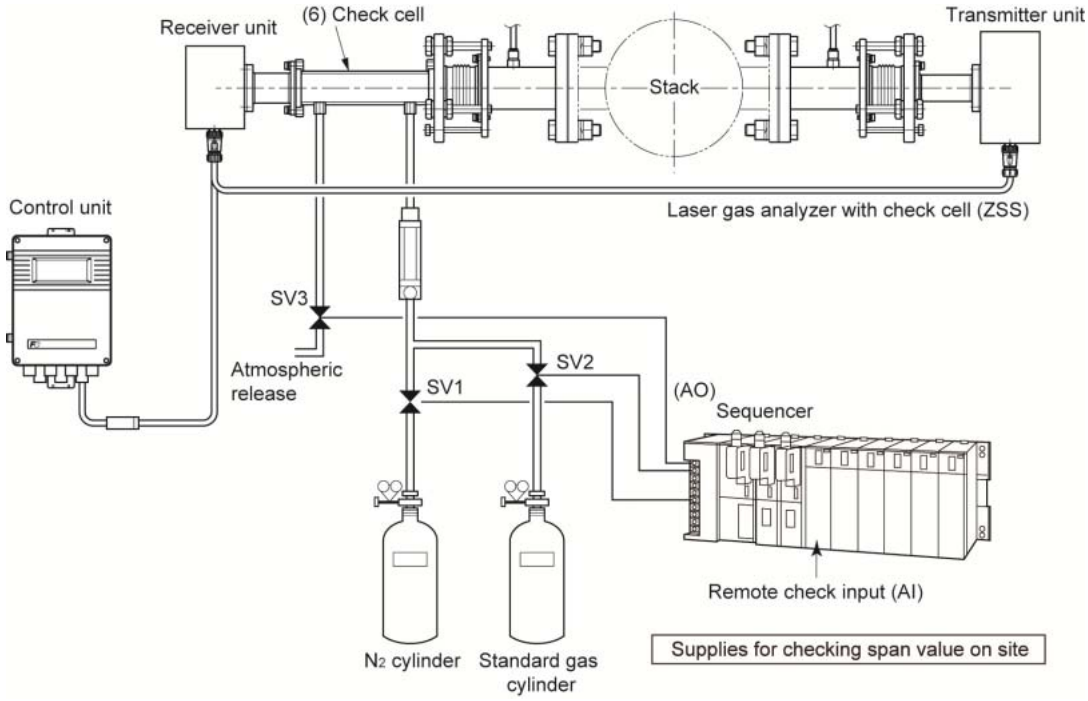
4. IR card (IR visualizer) for NH_3

Item	Q'ty	Model
IR card (for NH3)	1	ZZP*ZSSTQ505315P1

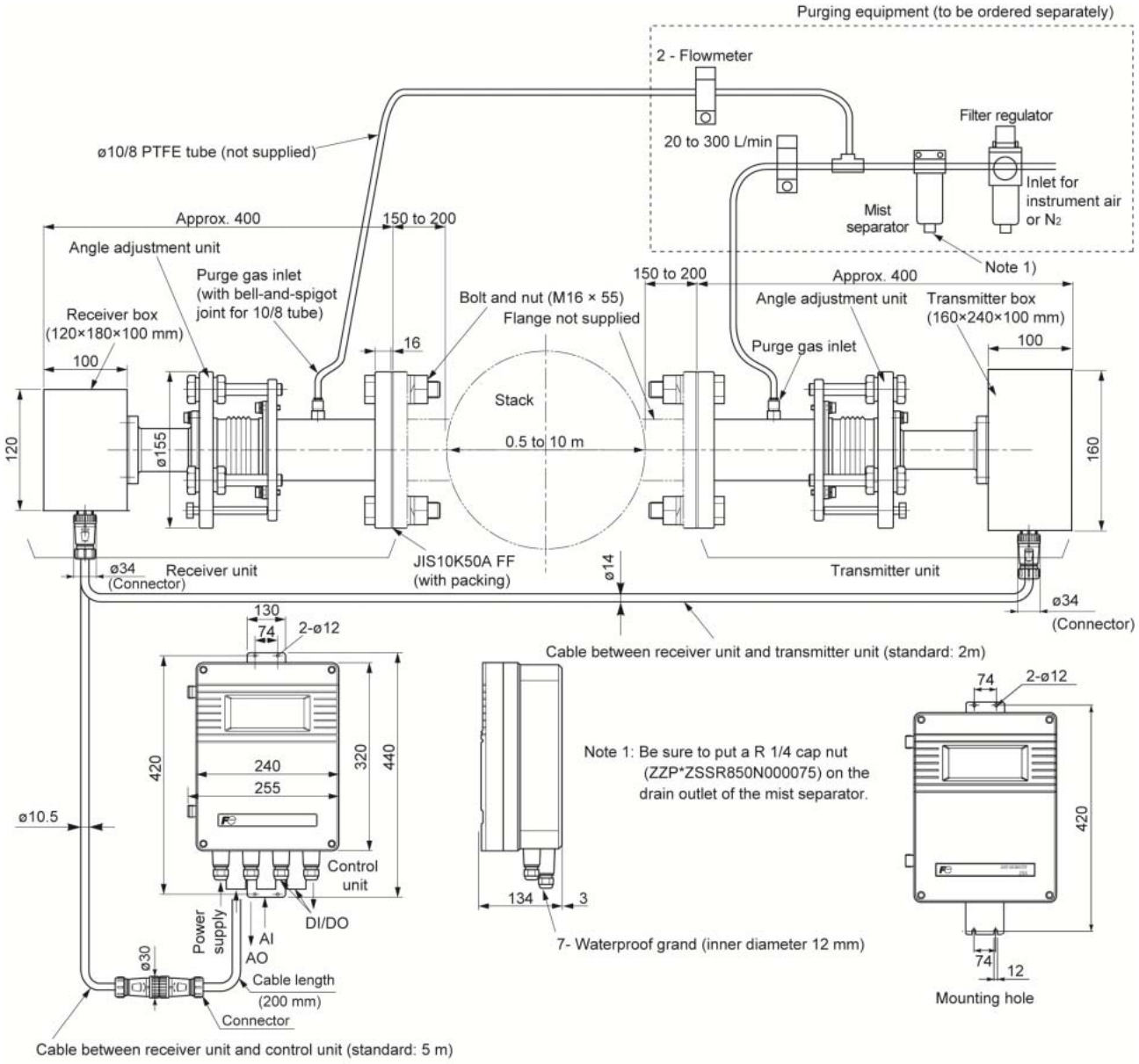


5. Check cell

Item	Q'ty	Model
Check cell	1	ZZP*ZSSTQ404742C1



DIMENSIONS (IN MM)



Notes:

- For O_2 analyzers other than the instrument air purge version, use N_2. For all the other cases, use instrument air. If you use air that contains oil and/or mist, the purge gas flow decreases due to the contaminant, which adversely affect the measurement. In such a case, frequent maintenance is required, and in some cases you may have to install a filter additionally.
- Once you install the analyzer, you have to purge the equipment with instrument air or N_2 regardless if the analyzer and the furnace are in operation or not. If you operate the furnace without purging, it may cause the fatal damage to the optical part.

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