Instruction Manual

INFRARED GAS ANALYZER

TYPE: ZSU-5

Fuji Electric Co., Ltd.

INZ-TN5ZSUa-E

PREFACE

We are grateful for your purchase of Fuji Electric's Infrared Gas Analyzer, TYPE: ZSU.

- First read this instruction manual carefully until an adequate understanding is acquired, and then proceed to installation, operation and maintenance of the analyzer. Wrong handling may cause an accident or injury.
- The specifications of this analyzer are subject to change without prior notice for further product improvement.
- This instruction manual shall be stored by the person who actually uses the analyzer.
- After reading the manual, be sure to store it at a place easier to access.
- This instruction manual should be delivered to the end user without fail.
- See "Installation Manual" (separate volume) for installation, wiring and piping of this infrared gas analyzer.

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

Issued in August, 2011

1st edition February, 2015

Request

- It is prohibited to transfer part or all of this manual without Fuji Electric's permission in written format.
- Description in this manual is subject to change without prior notice for further improvement.

SCOPE OF WARRANTY

The warranty period for this instrument is one year after the date of delivery. If any failure occurs within the warranty period due to any reasons attributed to Fuji Electric, we will repair the instrument free of charge.
The warranty does not apply to the following:
- If the instrument is altered or repaired not by Fuji Electric
- Any failure caused by wrong operation
- If the instrument is used under conditions beyond its specification
- Any failure caused by an accident that Fuji Electric is not responsible for
- Any failure occurred due to a disaster or natural disaster that Fuji Electric is not responsible for
- Any failure or appearance deterioration resulting from corrosion or rusting
- Sampling probe of gas extractor
- Consumable parts

We shall not be liable for any damages occurred by (i) the product failure, (ii) data loss, (iii) the use of this instrument.

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.

The warranty period for the parts repaired by Fuji Electric or its service providers is six months after repair.

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.

CAUTION ON SAFETY

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

- The cautionary descriptions listed here contain important information about safety, so they should always be observed. Those safety precautions are ranked in 3 levels, "DANGER," "CAUTION" and "PROHIBITION."

⚠ DANGER	Wrong handling may cause a dangerous situation, in which there is a risk of death or heavy injury.
⚠ CAUTION	Wrong handling may invite a dangerous situation, in which there is a possibility of medium-level trouble or slight injury or only physical damage is predictable.
⊘ PROHIBITION	Items which must not be done are noted.

Caution on installation, re-installation and storage of gas analyzer	
⚠ DANGER	• This unit is not explosion-proof type. Do not use it in a place with explosive gases to prevent explosion, fire or other serious accidents.
⚠ CAUTION	• Entrust the installation, movement or re-installation to a specialist or the supplier. A poor installation may cause accidental tipover, electric shock, fire, injury, etc. • The infrared gas analyzer is heavy. It should be installed with utmost care. Otherwise, it may cause accident or injury due to tip over or drop. • For lifting the infrared gas analyzer, be sure to wear protective gloves. Bare hands may invite an injury. • This unit should be installed in a place which conforms to the conditions noted in the instruction manual. Otherwise, it may cause electric shocks, fire or malfunction of the unit. • During installation work, care should be taken to keep the unit free from entry of cable chips or other foreign objects. Otherwise, it may cause fire, failure or malfunction of the unit. • For discharging the exhaust gas, carry out piping up to a position which is not easily accessible by persons so as not to adversely affect the human body.

Caution on wiring	
⚠ CAUTION	• Entrust the wiring to a specialist or the supplier. Poor wiring may cause shock hazard or injury. • Make sure to perform class-D grounding. If the specified grounding is neglected, an electric shock or malfunction may be caused. **Caution to wiring electrician** **For avoiding electric shock, fire and injury, be sure to observe the following.** • Before wiring, be sure to turn off the main power supplies. This is required for preventing an electric shock. • As a ground wire, use 600V-IV wire of 2 mm^2 or thicker having a sufficient dielectric strength. Use of a wrong grounding wire may cause electric shock or malfunction. • Input/output wires should have proper diameters meeting the rated current of the infrared gas analyzer. If a wire which cannot endure the rating is used, a fire may occur. • For connection to input and output terminal blocks, be sure to use solderless terminals. • For branching the output wires, use a terminal block. • Be sure to fasten the input/output wires on the floor, wall, etc. and put guards on the wires. • Do not install the instrument near high frequency heating furnace, electric welding machine or others which considerably disturb the power waveforms. Do not share their power supplies either.

Caution on use	
⚠ DANGER	• If unusual smell or sound has been produced, immediately stop the instrument. Any discharge produced may cause a fire.
⚠ CAUTION	• Corrosion, clogging, pollution of measuring cell may occur, even under the specified gas condition, depending on the actual gas combination and/or the environment. • In the low range between 0 to 200 ppm, initial drift may occur. • 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, the performance may be poor and accidents or injuries may be caused. • Do not operate the infrared gas analyzer for a long time with its door left open. Otherwise, dust, foreign matter, etc. may stick on internal walls, thereby causing faults.

Caution on use	
PROHIBITION	• Do not put stick or finger into the fan (top, peltier gas cooler). You may get hurt by a turning fan. • Do not allow metal, finger or others to touch the input/output terminals in the instrument. Otherwise, electric shock or injury may occur. • Do not smoke nor use a flame near the infrared gas analyzer. Otherwise, a fire may be caused. • Do not allow water to go into the infrared gas analyzer. Otherwise, electric shock or fire in the instrument may be caused.

Caution on maintenance and check	
DANGER	• For correct handling of calibration gas or other reference gases, carefully read instruction manuals of standard gases beforehand. Otherwise, carbon monoxide or other hazardous gases may cause an intoxication particularly. • Before maintenance or checkup, be sure to turn on the ventilator in the infrared gas analyzer. If it is leaky, there is a risk of intoxication. • Before replacing the gas filter of the infrared gas analyzer or maintaining the washer, close the calibration gas valve and, if provided, the valve on the sample gas suction port. Otherwise, intoxication or accident may occur.
CAUTION	• If the fuse is blown, eliminate the cause, and then replace it with the one of the same capacity and type as before. Otherwise, electric shock or failure may be caused. • The door should be locked without fail and the key should be kept so that a third party cannot take them away. Touching the door carelessly may cause electric shock or failure. • Do not use a replacement part other than specified by the instrument maker. Otherwise, adequate performance will not be provided. Besides, an accident or failure may be caused. • Replacement parts such as a maintenance part should be disposed of as incombustibles. For details, follow the local ordinance. • This equipment should be treated as an industrial waste when it is disposed of. **Be sure to observe the following for safe operation avoiding electric shock and injury.** • Remove the watch and other metallic objects before work. • Do not touch the instrument with wet hands.

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 have an electric shock or injury.

Check of what are contained in the package

• Check if all of what are indicated below are contained in the package (See Section 7.2).

(1) Infrared gas analyzer main unit

(2) Gas extractor (if provided)

(3) Gas tubes (Teflon tube, heating tube) (if provided)

(4) Calibration gas (if provided)

(5) Pressure regulator (if provided)

(6) Standard accessories

No.	Article name	Q'ty	Remarks
1	Teflon filter for membrane filter / For spare (Teflon)	2 or 4	If provided with SO_2 meter
	Filter paper for membrane filter (25 sheets) / For spare (fiberglass)	1	If not provided with SO_2 meter
2	Fuse (2A) / For spare	1	
3	Fuse (3.2A) / For spare	1	
4	Joint for standard gas $Rc^1/_4$ – ø6 mm	1 unit	
5	Hose band for fixing standard gas cylinder	1 unit	
6	Viton tube for connecting standard gas 1m ø8/ø5 mm	1	
7	Polyethylene tube for connecting standard gas 6m ø6/ø4 mm	1	
8	Anchor bolt for locker installation (optional) M12 x 160 x 50	4	
9	Injection water bottle	1	
10	Gas extractor flange packing	1	If gas extractor is provided
11	Gas extractor mounting bolt/nut M12 x 60 mm	1 unit	
12	Heating tube support fixture	1 unit	If heating tubes are provided
13	Tool for assembling analyzer cell	1	At the time of CO_2 measurement
14	Instruction manual (INZ-TN5ZSU-E)	1	

(7) Spare parts for one year (if provided) (See Section 5.1)

CONTENTS

1. OVERVIEW

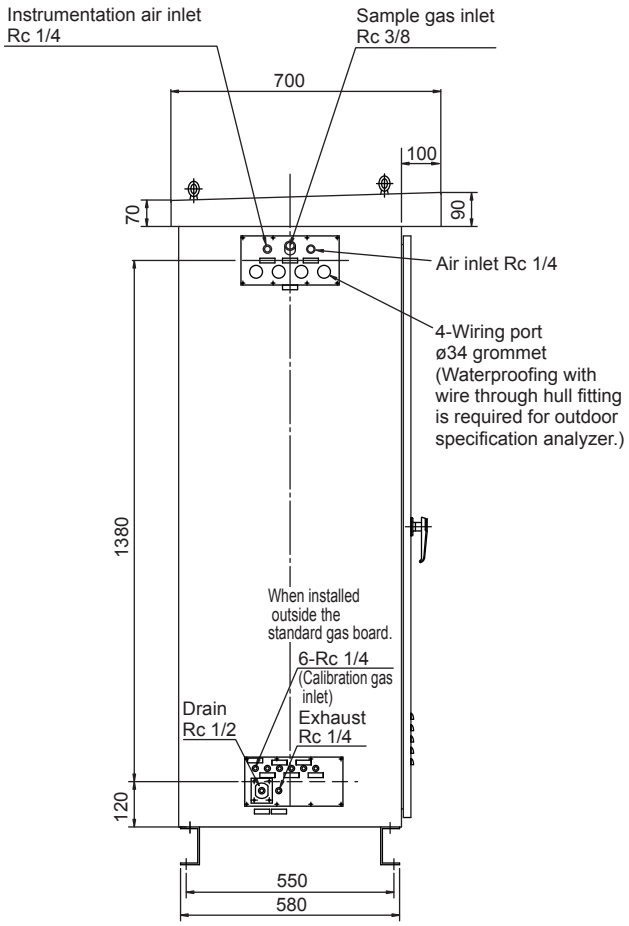
This infrared gas analyzer (ZSU) is composed of infrared gas analyzer unit, oxygen sensor and gas sampling equipment. It is capable of accurately and continuously measuring concentration of gases such as NOx, SO_2, CO, CO_2 and O_2 contained in the flue gas generated from a stationary source such as boiler and dust incinerator.

The specification for measurement of CO and O_2 includes the function that deals with dioxin effluent control.

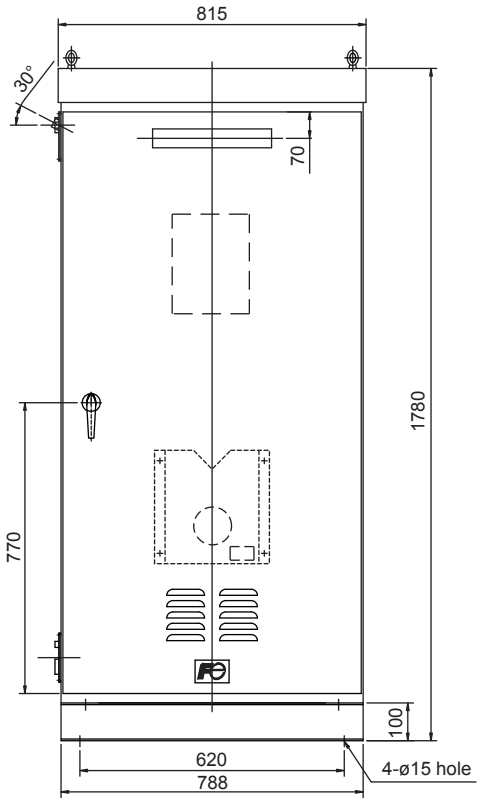
The description in the manual may not exactly match your analyzer somewhere depending on your requirements.

For drawings, piping system, device configuration, specifications, standard accessories, spare/consumable parts, refer to the shipping specifications submitted separately.

1.1 Outline diagram

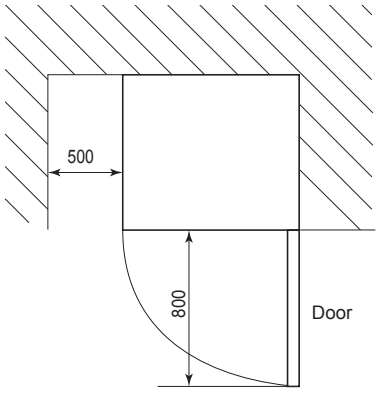


Left side

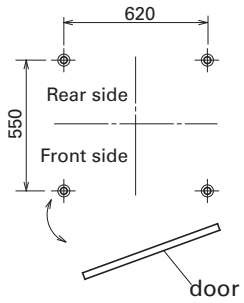


Front

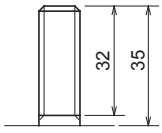
Maintenance space



Anchor plan, door open/close diagram



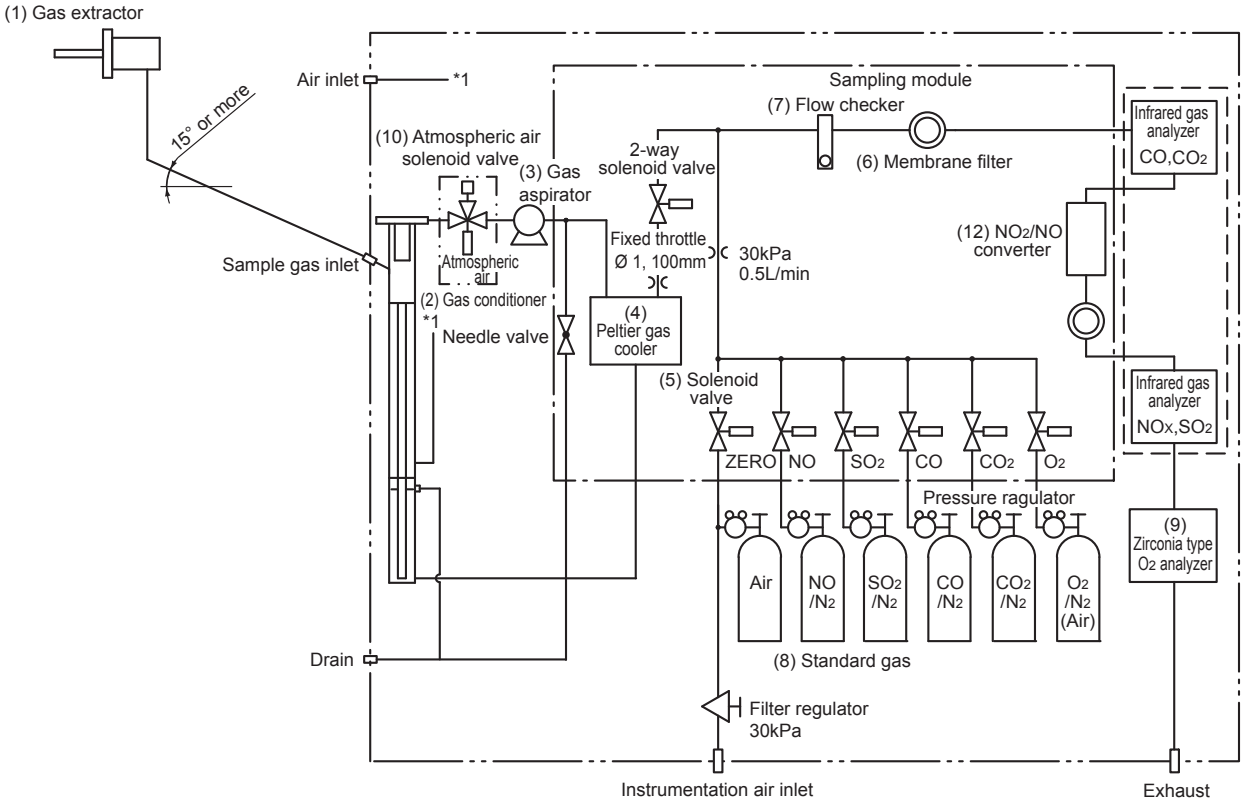
Anchor bolt (option)
(4–M12 × 160 × 50)



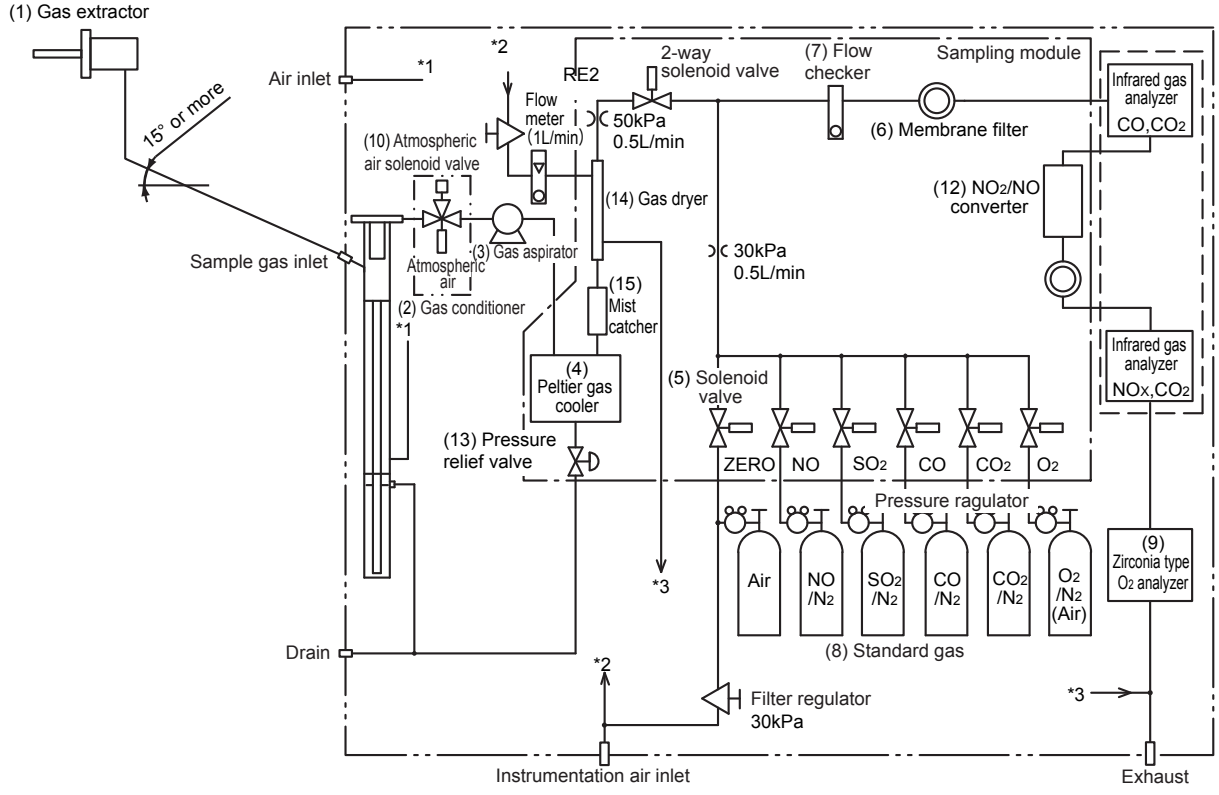
Unit: mm

1.2 Sampling system diagram

(1) 5-component gas sampling system diagram 1 (case of standard type with SO_2 first range of 0 to less than 500 ppm)

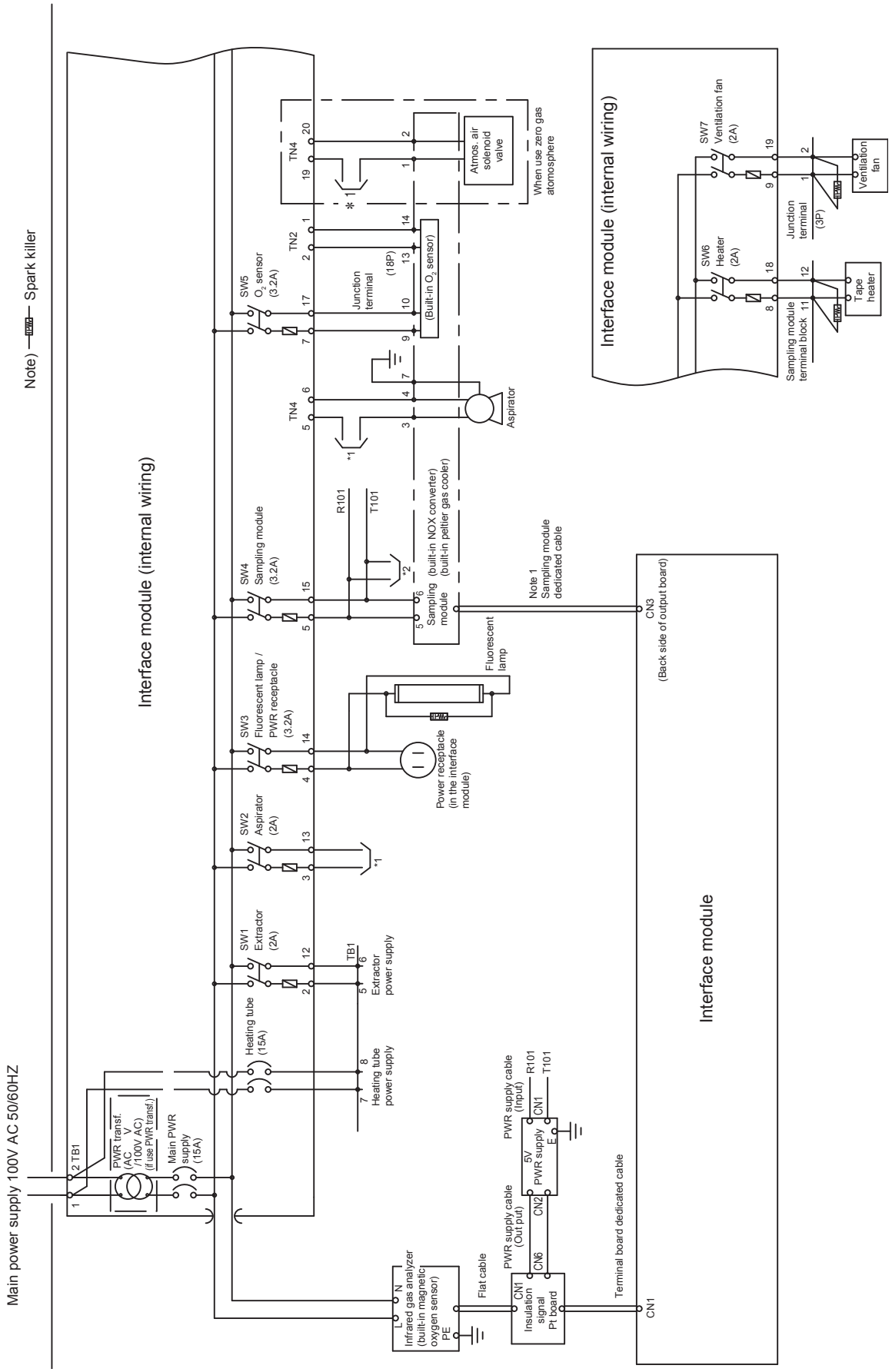


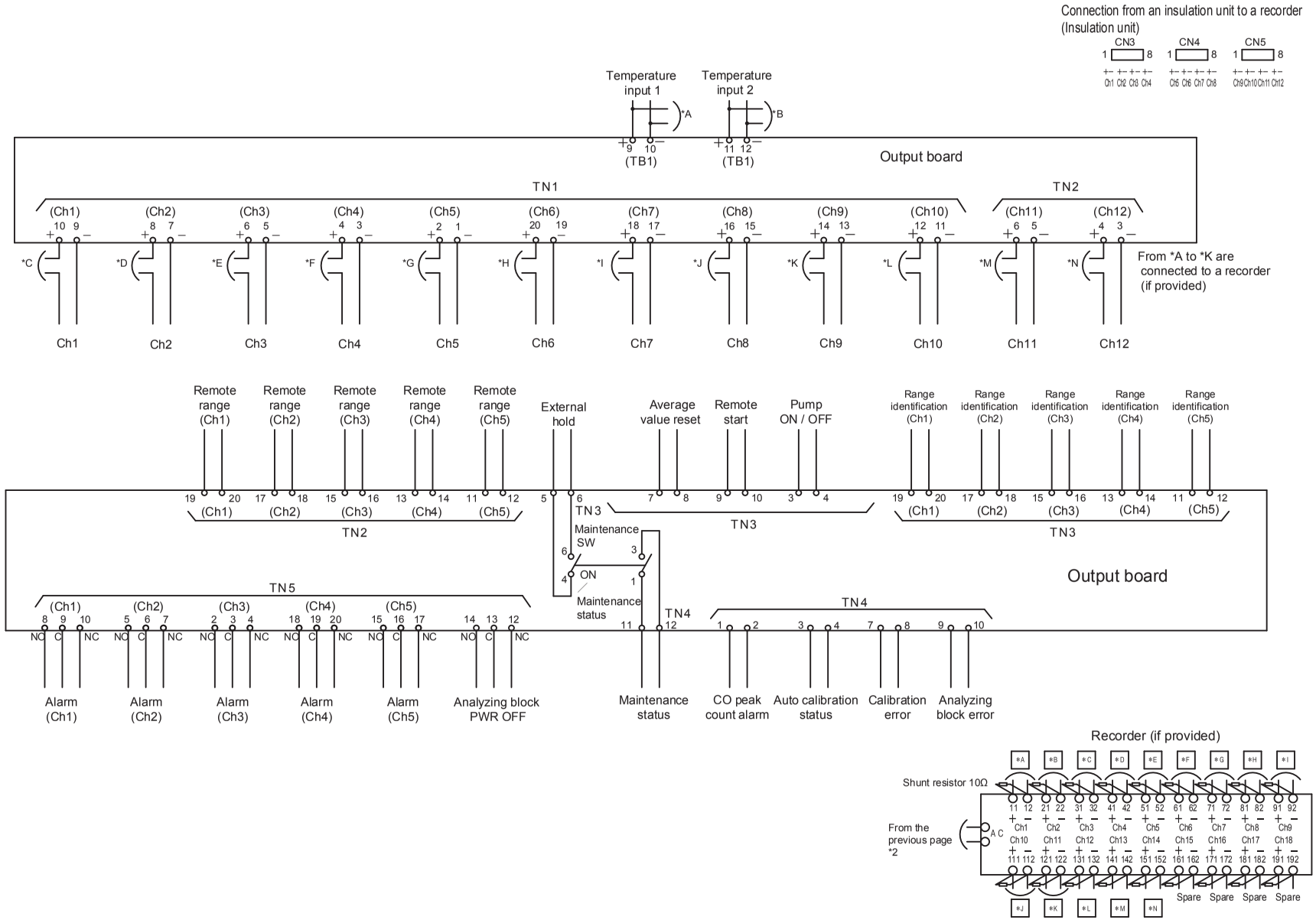
(2) 5-component gas sampling sysem diagram 2 (case of oil/coal boiler or SO_2 first range of 500 ppm or higherr)



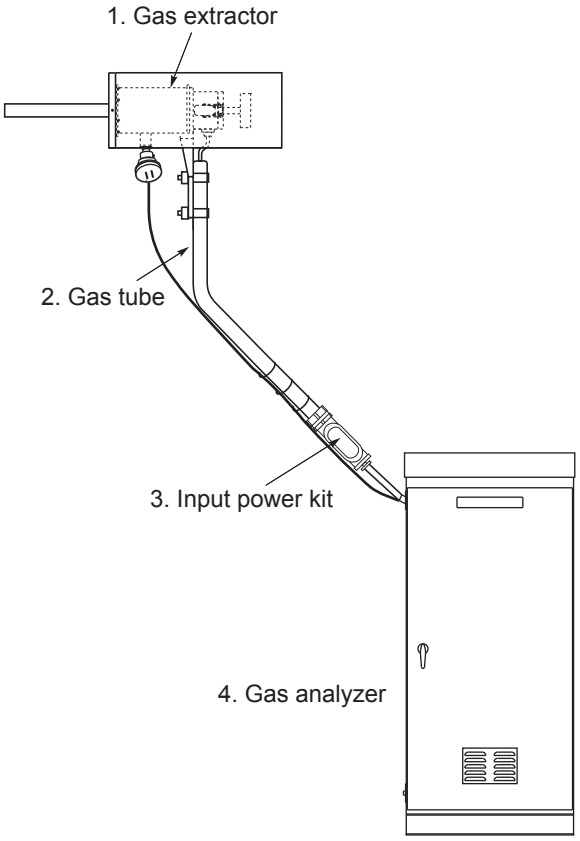
Note) In the case of a gas boiler or of sludge incineration with SO_2 first range of 0 to less than 500 ppm, use the exhaust gas from the O_2 meter outlet, instead of instrumentation air, for gas dryer purge.

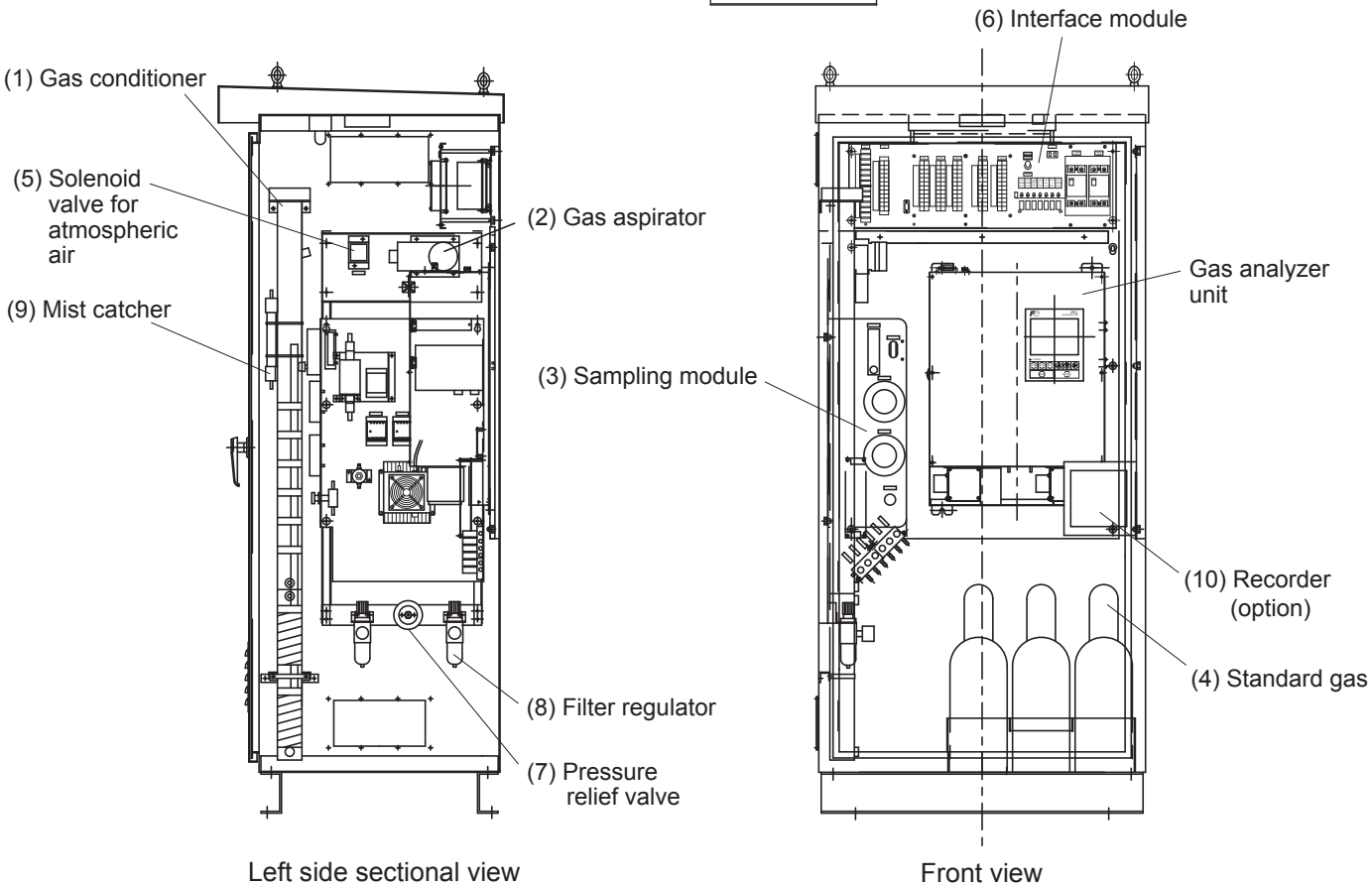
1.3 Wiring connection diagram




Connection from an insulation unit to a recorder
(Insulation unit)
CN3
CN4
CN5
Ch1 Ch2 Ch3 Ch4
Ch5 Ch6 Ch7 Ch8
Ch9 Ch10 Ch11 Ch12
Temperature input 1
Temperature input 2
*A
*B
(TB1)
Output board
TN1
TN2
(Ch1)
(Ch2)
(Ch3)
(Ch4)
(Ch5)
(Ch6)
(Ch7)
(Ch8)
(Ch9)
(Ch10)
(Ch11)
(Ch12)
*C
*D
*E
*F
*G
*H
*I
*J
*K
*L
*M
*N
From *A to *K are connected to a recorder (if provided)
Ch1
Ch2
Ch3
Ch4
Ch5
Ch6
Ch7
Ch8
Ch9
Ch10
Ch11
Ch12
Remote range (Ch1)
Remote range (Ch2)
Remote range (Ch3)
Remote range (Ch4)
Remote range (Ch5)
External hold
Average value reset
Remote start
Pump ON / OFF
Range identification (Ch1)
Range identification (Ch2)
Range identification (Ch3)
Range identification (Ch4)
Range identification (Ch5)
TN3
Maintenance SW
ON
Maintenance status
Output board
TN5
TN4
Alarm (Ch1)
Alarm (Ch2)
Alarm (Ch3)
Alarm (Ch4)
Alarm (Ch5)
Analyzing block PWR OFF
Maintenance status
CO peak count alarm
Auto calibration status
Calibration error
Analyzing block error
Recorder (if provided)
Shunt resistor 10Ω
From the previous page *2
Spare
Spare
Spare
Spare

1.4 Composition and functions of gas analyzer





Gas analyzer

Unit name	Name	Description
1. Gas extractor		Collects sample gas efficiently. (A heater and filter are built in.)
	(1) Heater	Prevents clogging of the filter. About 250°C
	(2) Filter	Removes dust. Standard 40 mm
2. Gas tube		Lead tube that feeds sample gas to the gas analyzer unit from the gas extractor.
	(1) Teflon tube	Standard ø10/ø8 tube
	(2) Heating tube	Used if there is a fear that the drain freezes in a cold area. Also used for measurement of SO_2.
3. Input power kit		Power supply terminal kit for heating tube
4. Gas analyzer unit		Measures the concentration of the fed sample gas, and outputs electrical signals.
	(1) Gas conditioner	Removes drain, dust and mist. Controls the pressure of the sample gas. Dust, drain removed (5µm)
	(2) Gas aspirator	For suction of sample gas. About 2 L/min
	(3) Sampling module	Peltier gas cooler, solenoid valve for calibration, flowchecker, needle valve, purge flowmeter, membrane filter, zirconia oxygen sensor, NO_2/NO converter and gas dryer are built in.
	(4) Standard gas	Gas cylinder for zero and span calibration. 3.4 L
	(5) Solenoid valve for atmospheric air	Used in the case where atmosphere is used as zero calibration gas.
	(6) Interface module	Provided with circuit breaker, various switches and input/output terminals.
	(7) Pressure relief valve	Controls the sample gas pressure.
	(8) Filter regulator	Controls the instrumentation air pressure.
	(9) Mist catcher	Removes SO_3 mist.
	(10) Recorder (option)	Used for recording of analyzer indication.

1.4.1 Composition and description of gas analyzer

1. Interface module

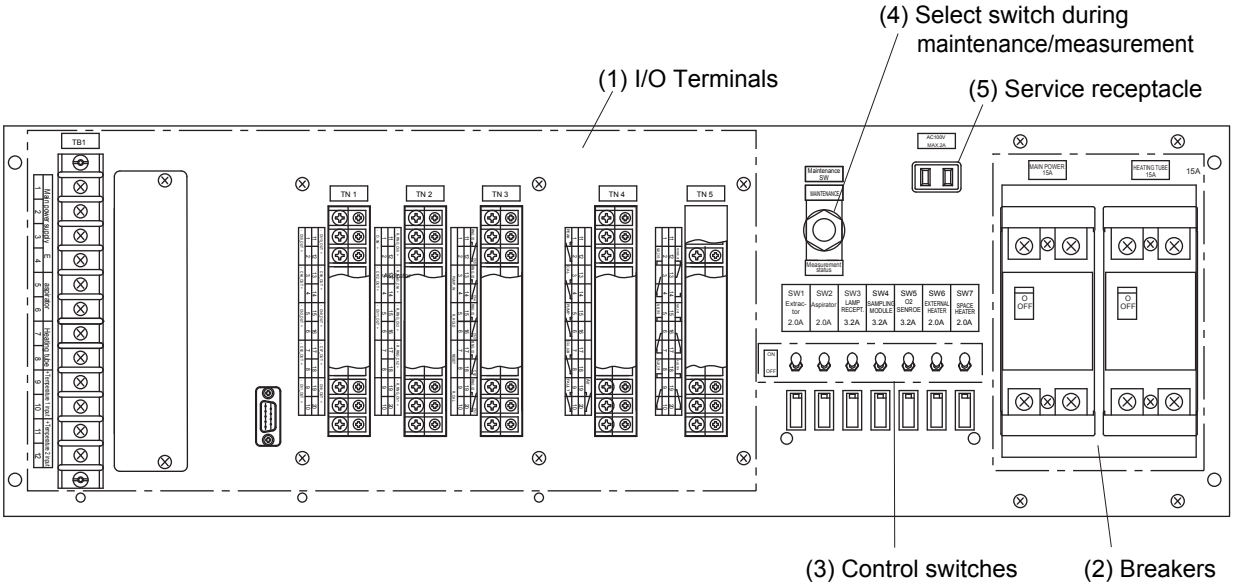
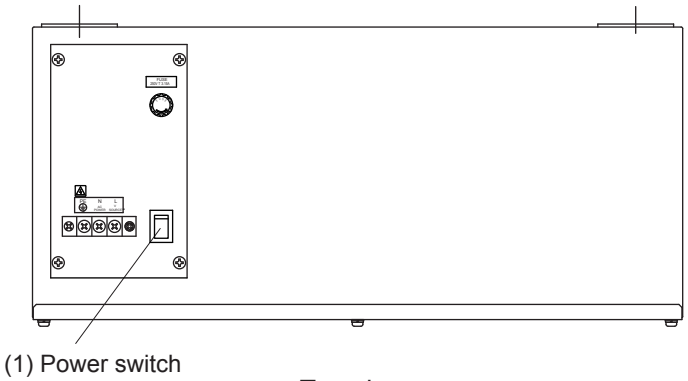


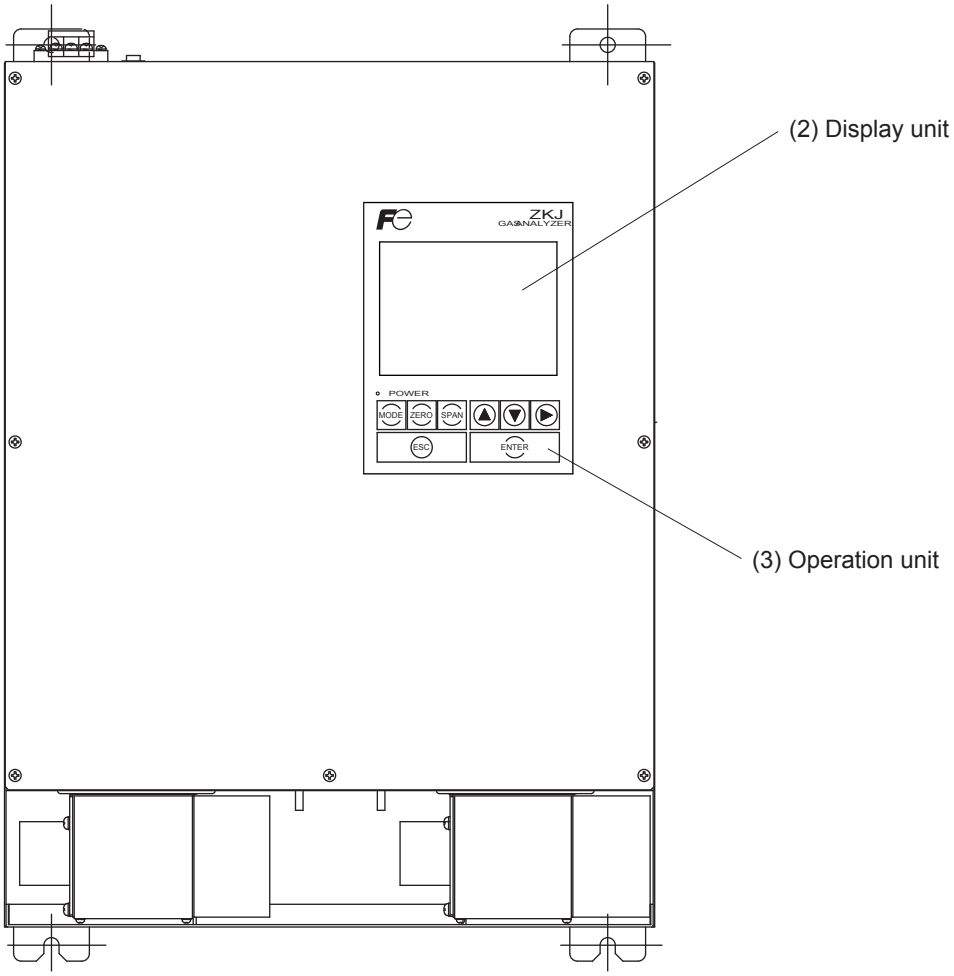
Fig. 1-1

Name of unit	Name	Description
Interface module	(1) I/O Terminals	Power supply terminal, external I/O terminals
	(2) Breakers	Main power supply; circuit breakers for devices Heating tube; circuit breaker for heating tube (option)
	(3) Control switches	Extractor; power switch for gas extractor Aspirator; power switch for gas aspirator LAMP RECEPT.; power switch for fluorescent lamp and service receptacle Sampling module; power switches for driving gas sampling module, for NO_2/NO converter, and for peltier gas cooler O_2 sensor; power switch for O_2 sensor External heater; power switch for heater or space heater (option) FAN; power switch for ventilation fan
	(3) Select switch during maintenance/measurement	Used to hold the output signal by switching during maintenance.
	(4) Service receptacle	100V AC, 50/60 Hz, 2A

2. Analyzer unit



Top view

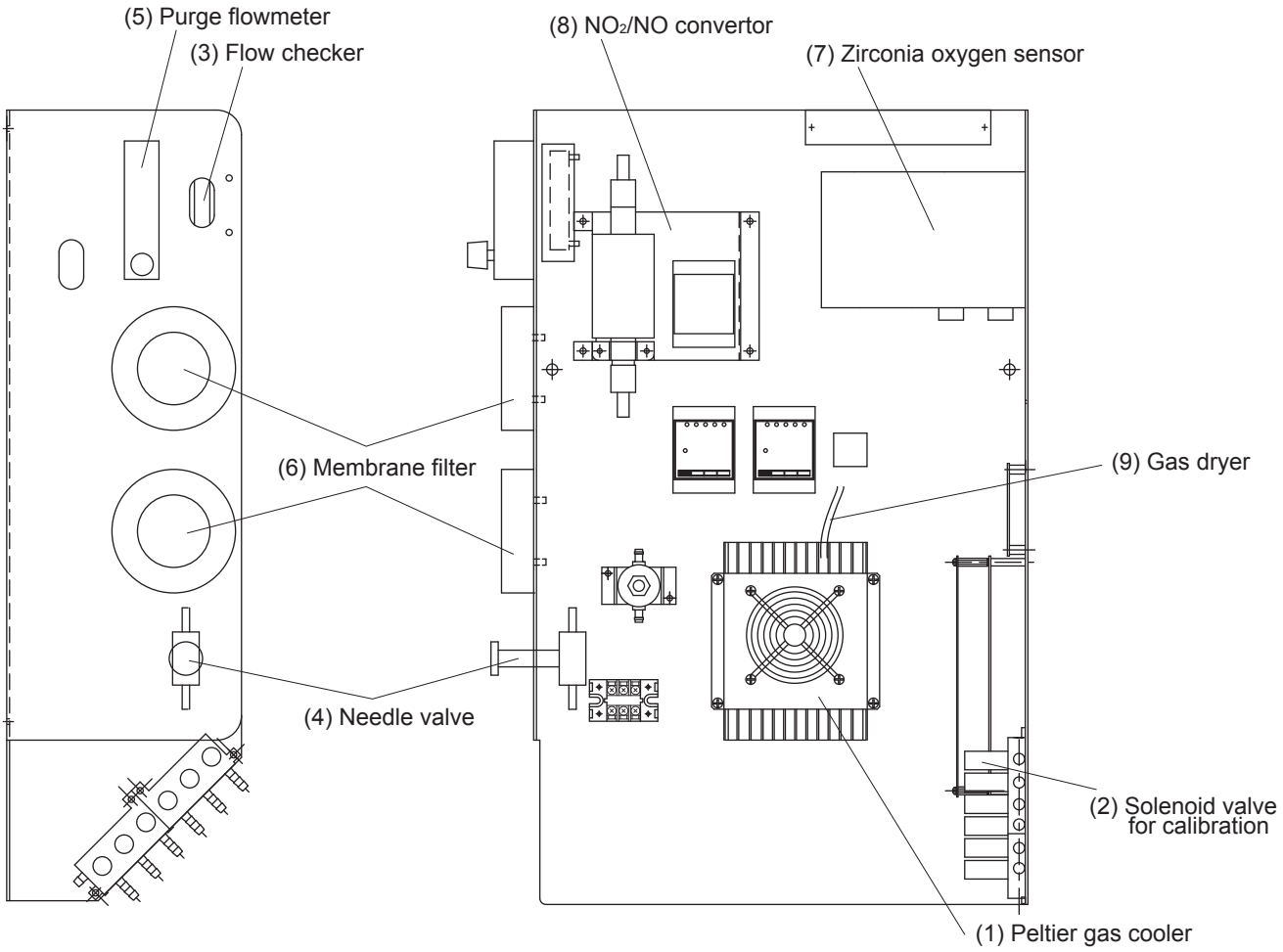


Front view

Fig. 1-2

Name of unit	Name	Description
Analyzer unit	(1) Power switch	Power switch for the gas analyzer unit
	(2) Display unit	Displays components and concentration of the measurement gas, setting of various kinds and operation method.
	(3) Operation unit	Permits setting of various kinds and operation.

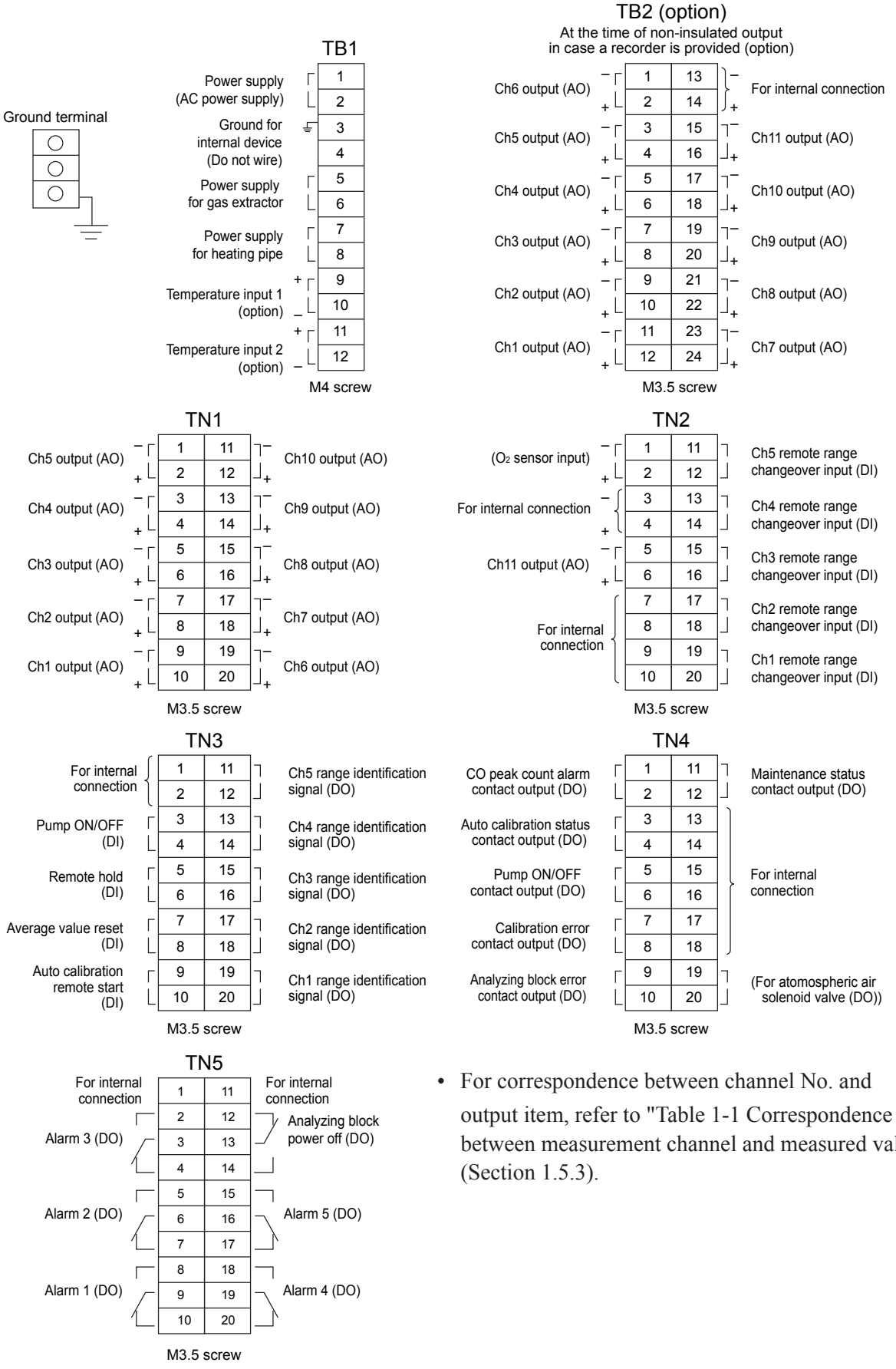
3. Sampling module



Name of unit	Name	Description
Sampling module	(1) Peltier gas cooler	Remove moisture from the sampling gas. (approx. 2°C)
	(2) Solenoid valve for calibration	Used for lead-in of calibration gas.
	(3) Flow checker	Used for checking the gas flow rate of sampling gas/ calibration gas.
	(4) Needle valve	Controls sampling gas flow rate.
	(5) Purge flowmeter	Controls the flow rate of the gas dryer purge air.
	(6) Membrane filter	Removes fine dust by glass filter paper (0.5μm) and Teflon filter (0.1μm)
	(7) Zirconia oxygen sensor	Measures O_2 concentration. (The magnetic oxygen sensor is incorporated in the gas analyzer unit)
	(8) NO_2/NO convertor	Converts NO_2 in the sampling gas to NO gas.
	(9) Gas dryer	Dries the moisture in the sampling gas to dew point −20°C or less.

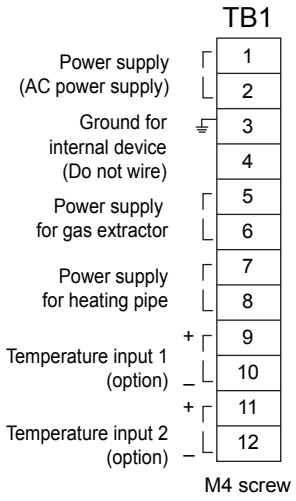
1.4.2 Terminal block

(1) List of terminal blocks



- For correspondence between channel No. and output item, refer to "Table 1-1 Correspondence between measurement channel and measured value" (Section 1.5.3).

(2) Description of terminal block



Terminal block <TB1>

Between 1 – 2 : Terminal block for main power supply input

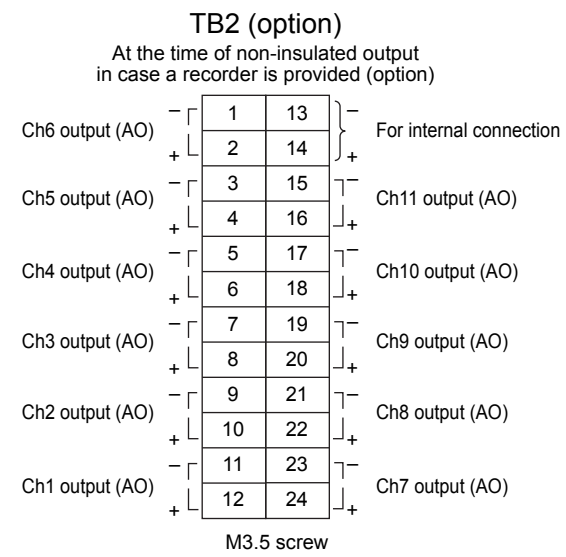
3 : **Ground for internal device. Connect nothing others. Connect the ground for power supply to ground terminal located on upper left side in locker.**

Between 5 – 6 : Terminal block for extractor power supply

Between 7 – 8 : Terminal block for heating pipe power supply

Between 9 – 10 : Temperature input 1

Between 11–12 : Temperature input 2



Terminal block <TB2> (Option)

This terminal block is added for non-isolated output and when the recorder is built-in.

Between 1 – 2 : Ch6 output (AO)

Between 3 – 4 : Ch5 output (AO)

Between 5 – 6 : Ch4 output (AO)

Between 7 – 8 : Ch3 output (AO)

Between 9 – 10 : Ch2 output (AO)

Between 11 – 12 : Ch1 output (AO)

Between 13– 14 : For internal connection. Must not be wired. (Must not be used as junction terminal.)

Between 15– 16 : Ch11 output (AO)

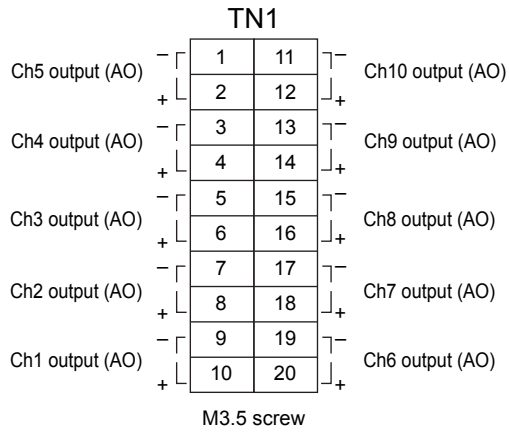
Between 17 – 18 : Ch10 output (AO)

Between 19 – 20 : Ch9 output (AO)

Between 21 – 22 : Ch8 output (AO)

Between 23 – 24 : Ch7 output (AO)

- For correspondence between channel No. and output item, refer to "Table 1-1 Correspondence between measurement channel and measured value" (Section 1.5.3).

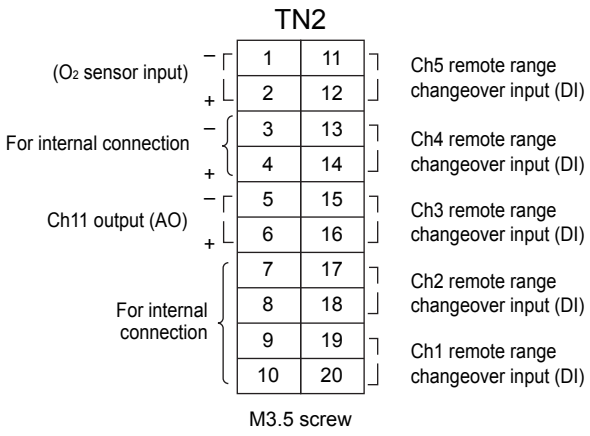


Terminal block 1 <TN1>

Terminal block for analog output

Between 1 – 2 : Ch5 output
Between 3 – 4 : Ch4 output
Between 5 – 6 : Ch3 output
Between 7 – 8 : Ch2 output
Between 9 – 10 : Ch1 output
Between 11 – 12 : Ch10 output
Between 13 – 14 : Ch9 output
Between 15 – 16 : Ch8 output
Between 17– 18 : Ch7 output
Between 19– 20 : Ch6 output

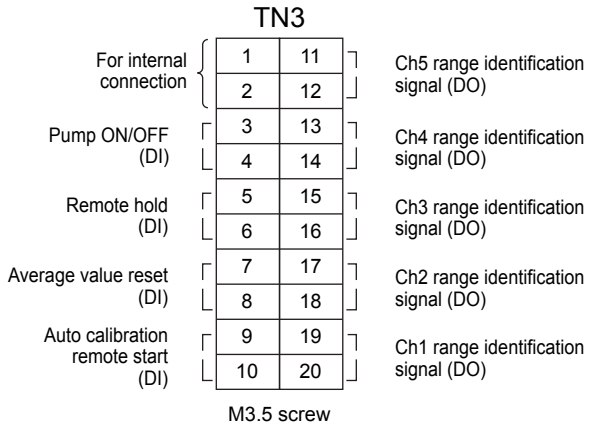
- For correspondence between channel No. and output item, refer to "Table 1-1 Correspondence between measurement channel and measured value" (Section 1.5.3).



Terminal block 2 <TN2>

Between 1– 2 : For O_2 sensor input. (Input for our Zirconia oxygen sensor. Must not be used unless O_2 sensor is added.)
Between 3– 4 : For internal connection. Must not be wired. (Must not be used as junction terminal.)
Between 5– 6 : Ch11 output
Between 7– 10 : For internal connection. Must not be wired. (Must not be used as junction terminal.)
Between 11– 12 : Ch5 remote range changeover input
Between 13 – 14 : Ch4 remote range changeover input
Between 15 – 16 : Ch3 remote range changeover input
Between 17– 18 : Ch2 remote range changeover input
Between 19– 20 : Ch1 remote range changeover input

- When remote range changeover input is open, high range is selected. And when this input is shorted, low range is selected. For details of action, refer to "Remote range action" in "3.7 Parameter setting".
- For correspondence between channel No. and output item, refer to "Table 1-1 Correspondence between measurement channel and measured value".
- The channel No. in a remote range input is effective only when it corresponds to an instantaneous value. The converted value is linked with the range of instantaneous value.



Terminal block 3 <TN3>

Between 1 – 2 : For internal connection. Must not be wired. (Must not be used as junction terminal.)

Between 3 – 4 : Pump ON/OFF contact input. Pump ON when open. Pump OFF when short.

Note: If an NOx meter and a CO meter are used in mixture, there is a possibility where the reading of the CO meter rises when the pump stops running, because minor CO is generated due to chemical changes in the NO_2/NO converter and this CO accumulates. If this phenomenon becomes a problem, hold the output before pump stop.

Between 5 – 6 : Remote hold input. No hold when open. Output hold when short.

Between 7 – 8 : Average value reset input. Shorting the contact input (for 1.5 sec min.) resets O_2 average and converted average simultaneously. Opening it restarts the average value.

Between 9 – 10 : Automatic calibration remote start input. Open input after shorting for at least 1.5 seconds starts the automatic calibration whether automatic calibration setting is ON or OFF.

Between 11 – 12 : Ch5 range identification signal output

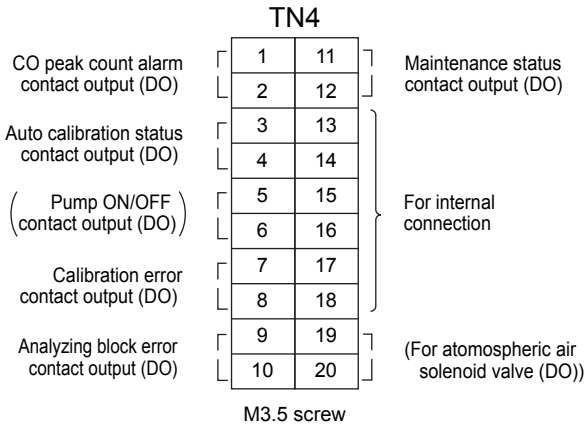
Between 13 – 14 : Ch4 range identification signal output

Between 15 – 16 : Ch3 range identification signal output

Between 17– 18 : Ch2 range identification signal output

Between 19– 20 : Ch1 range identification signal output

- Range identification signal is short at Low range or open at High range.
- The channel No. in a range identification signal is effective only when it corresponds to an instantaneous value. The range of converted value is linked with that of instantaneous value.



Terminal block 4 <TN4>

Between 1 – 2 : Peak count alarm contact output. Conductive at preset peak count or more. Open otherwise. For setting and action, refer to instruction manual "3.6 Peak Alarm Setting."

Between 3 – 4 : Automatic calibration status contact output. Conductive during automatic calibration. Open otherwise.

Between 5 – 6 : Pump ON/OFF contact output. (Used for turning ON/OFF the pump. Already wired. Do not rewire.)

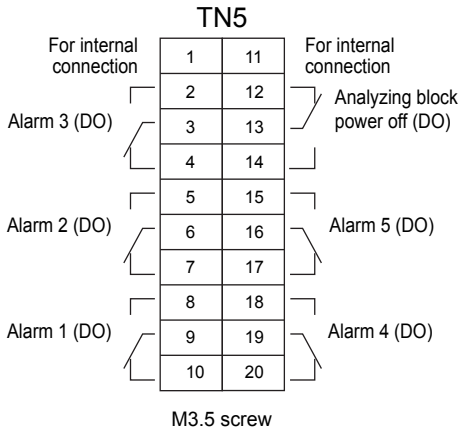
Between 7 – 8 : Calibration error contact output. Conductive when error is produced at zero or span calibration. Normally open.

Between 9 – 10 : Conductive when analyzer unit error is produced. Normally open.

Between 11 – 12 : Conductive when maintenance status switch is ON.

Between 13 – 18 : For internal connection. Must not be wired. (Must not be used as junction terminal.)

Between 19– 20 : Contact output for atmospheric air solenoid valve connection. (Already wired if atmospheric air is used as zero gas. Must not be wired otherwise.)



Terminal block 5 <TN5>

Between 2 – 4 : Alarm 3 (initial state)
Conductive at 2-3 and open at 3-4 when a measured value exceeds the limit value. Open at 2-3 and conductive at 3-4 otherwise.

Between 5 – 7 : Alarm 2 (initial state)
Conductive at 5-6 and open at 6-7 when a measured value exceeds the limit value. Open at 5-6 and conductive at 6-7 otherwise.

Between 8 – 10 : Alarm 1 (initial state)
Conductive at 8-9 and open at 9-10 when a measured value exceeds the limit value. Open at 8-9 and conductive at 9-10 otherwise.

Between 12 – 14 : Analyzing block power off output.
Conductive at 12-13 and open at 13-14 when analyzer unit is energized. Open at 12-13 and conductive at 13-14 when analyzer unit is de-energized.

Between 15 – 17 : Alarm 5 (initial state)
Conductive at 15-16 and open at 16-17 when a measured value exceeds the limit value. Open at 15-16 and conductive at 16-17 otherwise.

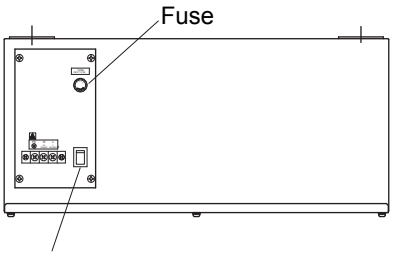
Between 18 – 20: Alarm 4 (initial state)
Conductive at 18-19 and open at 19-20 when a measured value exceeds the limit value. Open at 18-19 and conductive at 19-20 otherwise.

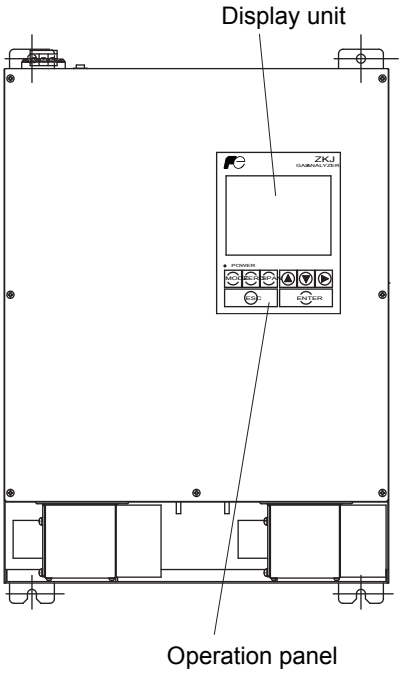
- Alarm responds only to an instantaneous value.

1.5 Description of display and operation panels

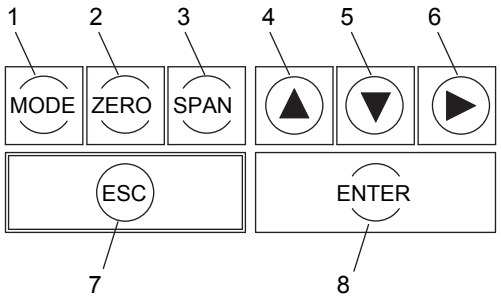
This section describes the display unit and operation panel of the analyzer unit. It also explains the name and description of function on the operation panel.

1.5.1 Name and description of operation panel





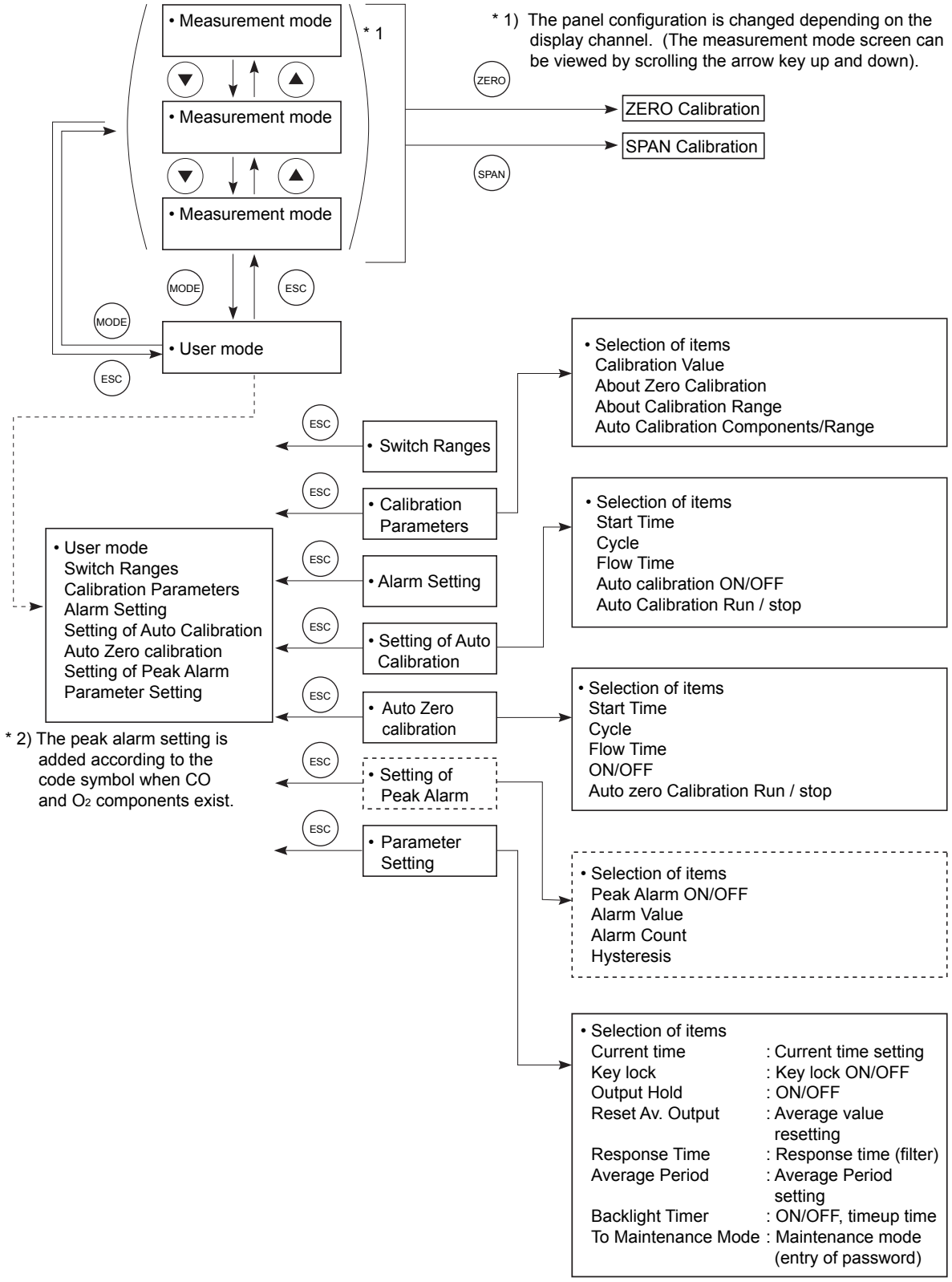
- Display unit: The measurement screen and the setting items are displayed.
- Operation panel: The configuration is as shown in the upper right.



Details of operation key

No	Name	Description
1	MODE key	Used to switch the mode.
2	ZERO key	Used for zero calibration.
3	SPAN key	Used for span calibration.
4	UP key	Used to change the selected item (by moving the cursor) and to increase digit.
5	DOWN key	Used to change the selected item (by moving the cursor) and to decrease digit.
6	SIDE key	Used to change the selected item (by moving the cursor) and digit.
7	ESC key	Used to return to a previous screen or cancel the setting midway.
8	ENT key	Used for confirmation of selected items or values, and for execution of calibration.

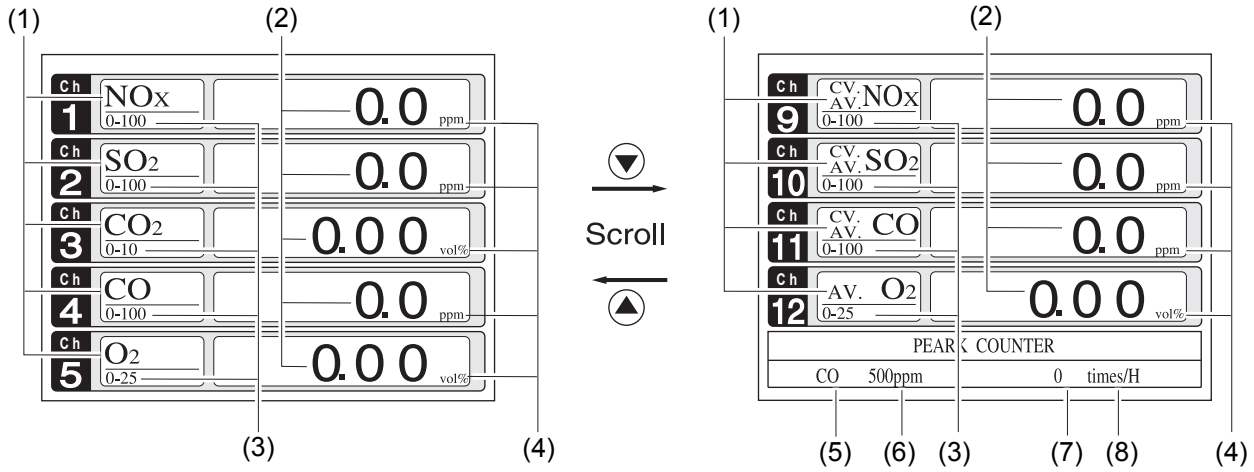
1.5.2 Overview of display and operation panels



1.5.3 Outline of display screen

(1) Measurement mode screen (appears when the power is turned ON)

The measurement screen depends on the number of components. The following screen configuration as shown as an example is for NO, SO_2, CO_2, CO and O_2 (output: 12 channel).



* For outputs of more than 5 channels, scroll the arrow key ▲ or ▼ to view.

No.	Name	Function	No.	Name	Function
(1)	Component display	Displays component of instantaneous value, converted instantaneous value, converted average value, etc.	(5)	Peak alarm component display	Displays peak alarm compornent.
(2)	Concentration display	Displays measured value of concentration.	(6)	Peak alarm concentration display	Displays peak alarm concentration. (Upper limit value)
(3)	Range display	Displays range values.	(7)	Peak alarm times	Displays the alarm times exceeding the peak value.
(4)	Unit display	Displays unit with ppm and vol%	(8)	Peak alarm unit display	Displays units of peak alarm with time/H.

- **Instantaneous value and concentration value:**

  The concentration display of Ch (component) where measured components such as "CO_2," "CO" or "O_2 are displayed in the component display, indicates current concentration values of the measured components contained in gas that is now under measurement.

- **O_2 conversion concentration values:**

  Ch (components) where "cv**" is displayed as "cv CO" in the component display are calculated from the following equation, by setting measured components, O_2 instantaneous/concentration values and O_2 correction reference value (see "Other parameter" in the "3.8 Maintenance mode").

$$\text{Correction output} = \frac{21 - On}{21 - Os} \times Cs$$

On: The value of the O_2 correction referance value (Value set by application)

Os: Oxygen concentration (%)

Cs: Concentration of measured components.

Note that Os does not exceed the O_2 limit value set in "Various setting" in the "3.8 Maintenance mode."

The converted measured components are NO_X, SO_2 and CO only.

- **O_2 conversion concentration average value:**

  In the Ch (component) and O_2 average value where "$^{CV}_{AV}$ **" is displayed as "$^{CV}_{AV}$ CO" in the component display, a value obtained by averaging O_2 conversion concentration value or O_2 concentration value in a fixed time is output every 30 seconds.

  Averaging time can be changed between 1 minute and 59 minutes or 1 hour and 4 hours according to the average time settings (See "3.7 Parameter setting").

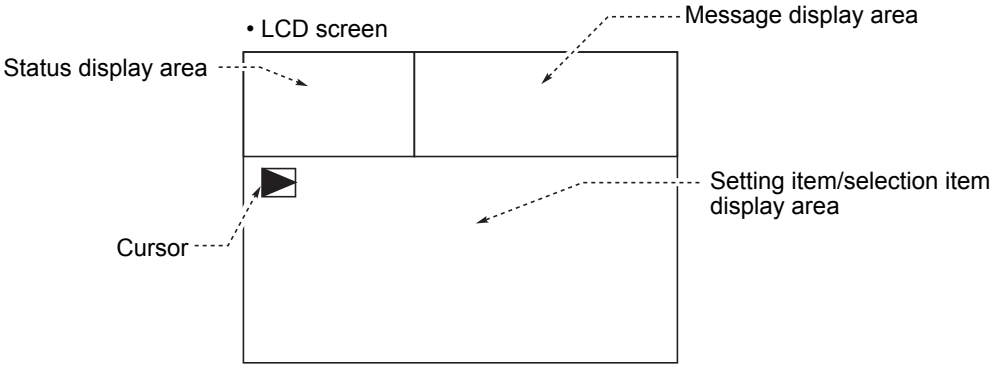
  (The set time is displayed as "1h," in the range display.)

  Note) The measurement ranges of O_2 conversion concentration value and O_2 conversion concentration average value are the same as that of the measuring components. Also, the measurement range of O_2 average value is the same as that of O_2.

(2) Setting/selection screen

The setting/selection screen is configured as shown below:

- In the status display area, the current status is displayed.
- In the message display area, messages associated with operation are displayed.
- In the setting item and selection item display area, items or values to be set are displayed, as required. To work on the area, move the cursor to any item by using the ▲ , ▼ or ▶ key.



Setting and selection screen

(3) Contents of measured channel (Ch)

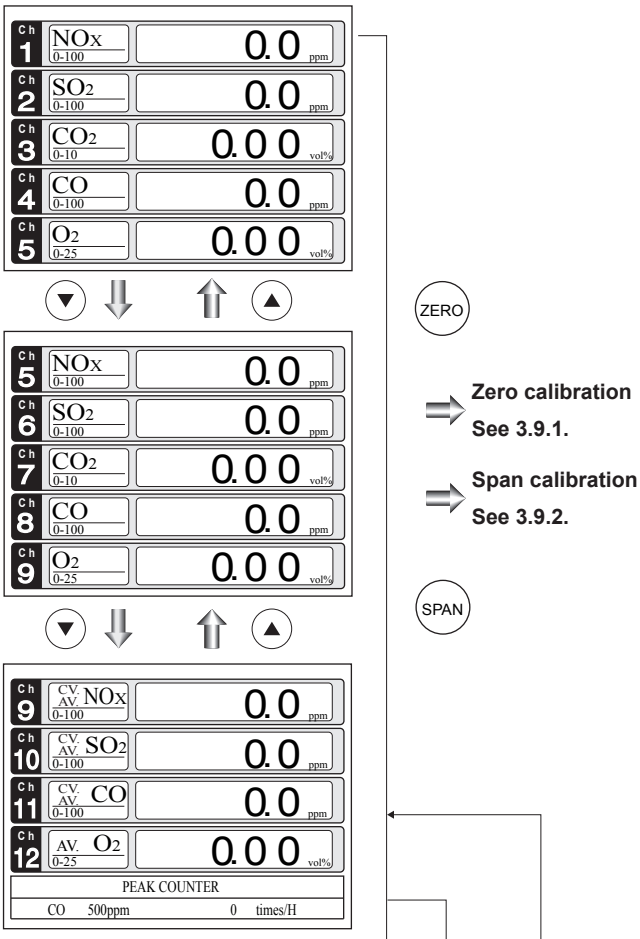
The following table gives measurement channels and their contents according to the symbols.

Table 1-1 Correspondence between measurement channel and measured value

Code symbol		Contents
4th digit	5th digit	
P	0	Ch1: NO_X
A	0	Ch1: SO_2
B	0	Ch1: CO
F	0	Ch1: NO_X, Ch2: SO_2
H	0	Ch1: NO_X, Ch2: CO
L	0	Ch1: NO_X, Ch2: SO_2, Ch3: CO
M	0	Ch1: NO_X, Ch2: SO_2, Ch3: CO_2, Ch4: CO
P	4 to G	Ch1: NO_X, Ch2: O_2, Ch3: Converted NO_X, Ch4: Converted NO_X average
A	4 to G	Ch1: SO_2, Ch2: O_2, Ch3: Converted SO_2, Ch4: Converted SO_2 average
B	4 to G	Ch1: CO, Ch2: O_2, Ch3: Converted CO, Ch4: Converted CO average
F	4 to G	Ch1: NO_X, Ch2: SO_2, Ch3: O_2, Ch4: Converted NO_X, Ch5: Converted SO_2, Ch6: Converted NO_X average, Ch7: Converted SO_2 average
H	4 to G	Ch1: NO_X, Ch2: CO, Ch3: O_2, Ch4: Converted NO_X, Ch5: Converted CO, Ch6: Converted NO_X average, Ch7: Converted CO average
L	4 to G	Ch1: NO_X, Ch2: SO_2, Ch3: CO, Ch4: O_2, Ch5: Converted NO_X, Ch6: Converted SO_2, Ch7: Converted CO, Ch8: Converted NO_X average, Ch9: Converted SO_2 average, Ch10: Converted CO average
M	4 to G	Ch1: NO_X, Ch2: SO_2, Ch3: CO_2, Ch4: CO, Ch5: O_2, Ch6: Converted NO_X, Ch7: Converted SO_2, Ch8: Converted CO, Ch9: Converted NO_X average, Ch10: Converted SO_2 average, Ch11: Converted CO average,

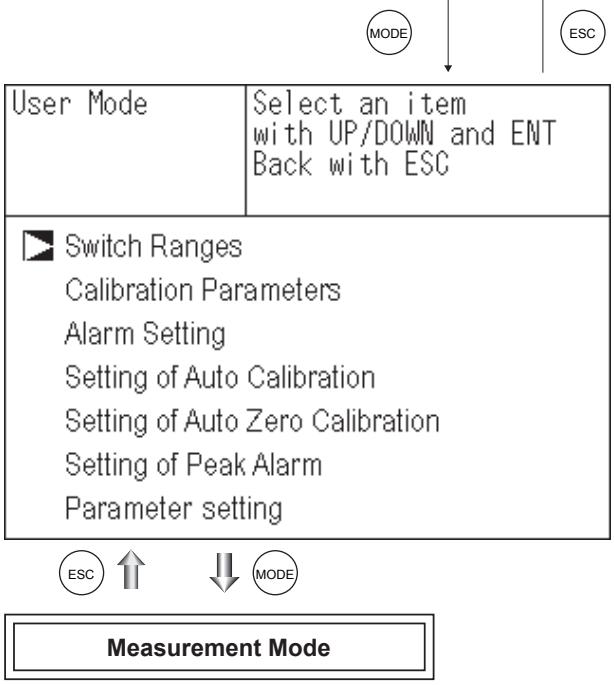
1.5.4 Basic operation

- **Measurement mode**
  The measurement mode can be displayed up to 5 channels in a single screen. If 5 channels or more are to be displayed in a single screen, press the ▲ or ▼ key to scroll the channel one by one.



- **User mode displays**
  Switch Ranges
  Calibration Parameters
  Alarm Setting
  Setting of Auto Calibration
  Setting of Auto Zero Calibration
  Setting of Peak Alarm
  Parameter setting

  For the setting contents, refer to "3. SETTING AND CALIBRATION".



2. BEFORE USE

⚠ DANGER

This unit is not explosion-proof type. Do not use it in a place with explosive gases to prevent explosion, fire or other serious accidents.

⚠ CAUTION

- Entrust the installation, movement or re-installation to a specialist or the supplier. A poor installation may cause accidental tipover, shock hazard, fire, injury, etc.
- The infrared gas analyzer is heavy. It should be installed with utmost care. Otherwise, it may cause accident or injury due to tip over or drop.
- For lifting the infrared gas analyzer, be sure to wear protective gloves. Bare hands may invite an injury.
- This unit should be installed in a place which conforms to the conditions noted in the instruction manual. Otherwise, it may cause electric shocks, fire or malfunction of the unit.
- During installation work, care should be taken to keep the unit free from entry of cable chips or other foreign objects. Otherwise, it may cause fire, failure or malfunction of the unit.

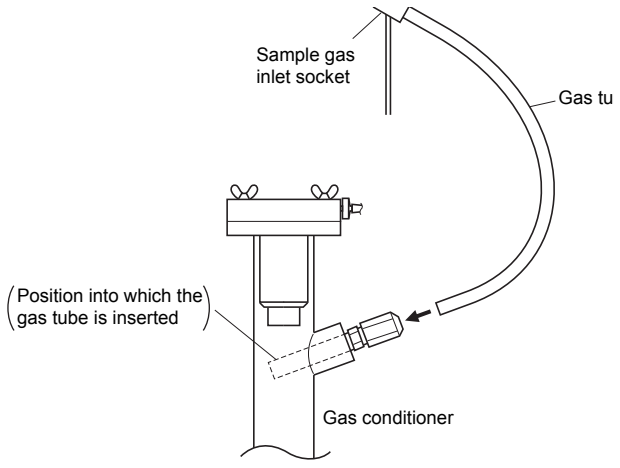
2.1 Installation

Carry out installation, piping and wiring with reference to “Installation Manual” (separate volume) for details.

2.2 Piping in the gas analyzer

2.2.1 Piping for a sample gas

Pull the gas tube directly from the “Sample gas inlet” at the upper part of the side of the locker, without cutting of the pipe. Connect the tube to the gas conditioner at the left side inside the locker. (Insert the gas tube into near the center of the gas conditioner main body)



2.2.2 Exhaust and drain piping

(1) Exhaust treatment

Exhaust gases containing toxic components from “Exhaust” at the lower part of the side of the locker. Install exhaust pipe in a way that gases are exhausted to an appropriate outdoor place.

(2) Drain treatment

Discharge the drain through “Drain” located in the lower part of the side of the locker.
Discharge the exhaust gas to an appropriate outdoor point.
Lay the drain line in such a manner that no drain will stay in the line.

Implement heat insulation treatment, if there is a fear of occurrence of freeze-up in the cold season.

(3) Use corrosion resistant piping material such as Teflon.

2.2.3 Preparation of standard gas

Periodic calibration using standard gas is essential for using this analyzer in the normal state (perform a calibration about once a week).

Prepare a standard gas cylinder for zero and span calibration.

	Case of analyzer without O_2 sensor	Case with magnetic O_2 sensor	Case with zirconia O_2 sensor
Zero gas	N_2 gas or dry air * A standard gas for zero gas is not required for atmosphere calibration specification.	N_2 gas	Dry air or gas of concentration higher than 80% of O_2 range * A standard gas for zero gas is not required for atmosphere calibration specification.
Span gas for other than O_2	Gas of concentration higher than 90% of full scale	Gas of concentration higher than 90% of full scale	Gas of concentration higher than 90% of full scale
Span gas for O_2	————	Gas of concentration higher than 90% of full scale or atmosphere (21%)	1 to 2% O_2 gas

2.2.4 Standard gas cylinder mounting and piping

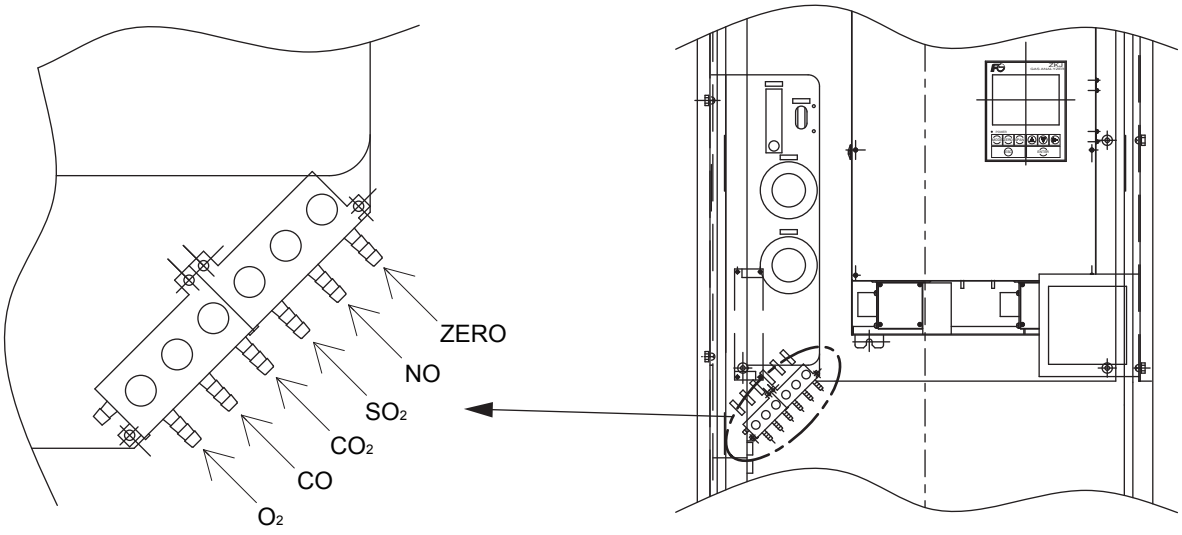
• The number of cylinders depends on the number of components and the type of zero gas.

(1) Install pressure regulators at the gas cylinders.

Note) For detailed installation, see "4.3.10 How to mount pressure regulator for standard gas cylinder".

(2) Attach a polyethylene tube (ø6mm/ø4mm) at the solenoid valve located in the left side of the analyzer. Then, cut the polyethylene tube at a proper length not so as to contact a space heater (option). (See Fig. 2-1).

(3) Install the standard gas cylinder in the lower section of the analyzer locker.



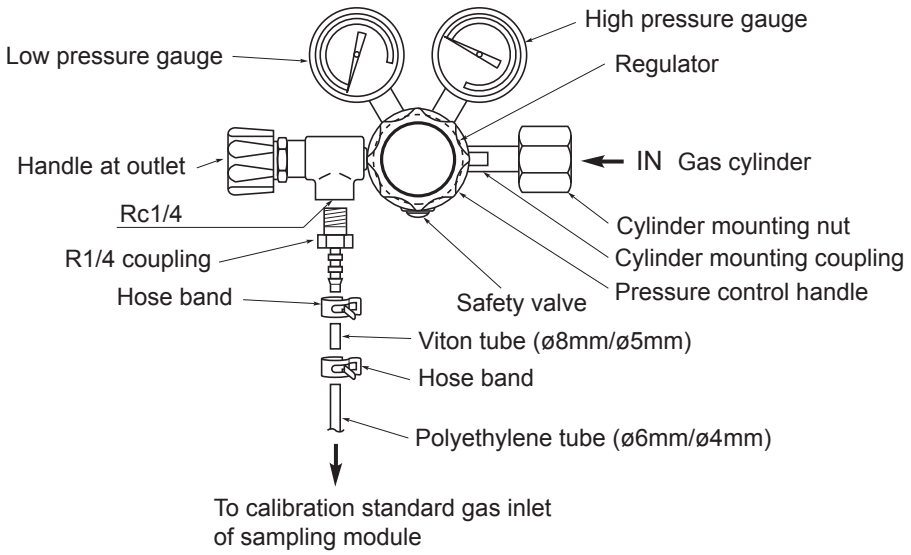


Fig. 2-1

2.3 Running start and stop

2.3.1 Supply of clean water

It is necessary to supply clean water into the gas conditioner. Supply tap water to level A and level B respectively, with reference to Fig. 4-1. (See Section “4.1.3 Points of daily check”.)

Feeding water in the gas conditioner

Remove the head of the gas conditioner (see “4.3.2”) and feed tap water in the gas conditioner to the positions A and B using a water bottle.

When the water level exceeds the specified value (position A) of the upper chamber, water enters into the lower chamber. When water in the lower chamber overflows, the water is discharged from the drain port.

Feed water in a way that the lower chamber is filled with water to full capacity (position B).

2.3.2 Check of wiring

Check once again if the wiring was correctly laid according to the manufacturing specifications.

2.3.3 Check of gas tube, exhaust piping, etc.

Fully check tightness of pipe joints of gas extractor outlet and gas analyzer unit, gas conditioner inlet and exhaust/drain again.

2.3.4 Warm-up operation

Turn on the power to each device, and start regular operation.

Warm-up is required for taking normal measurement.

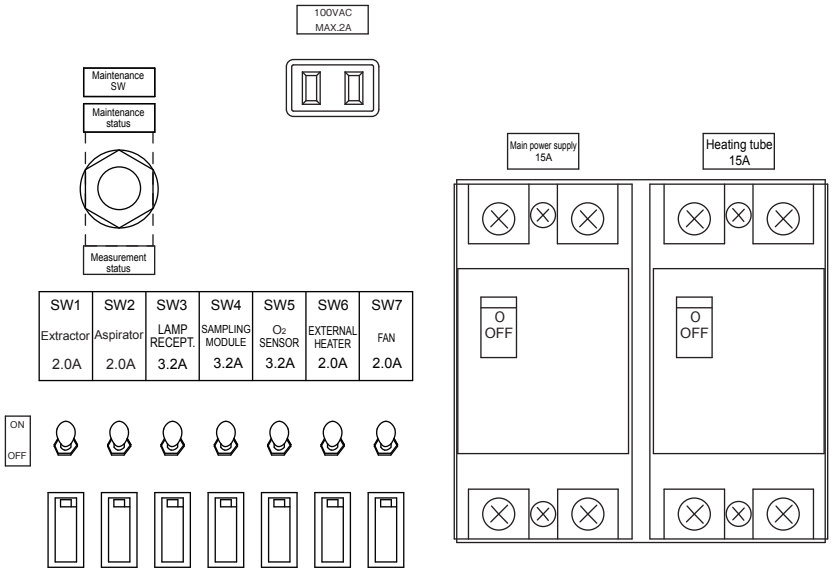


Fig. 2-2

Operation procedures

(1) Turn ON the [Main power] switch on the interface module.

(2) Turn ON the [Extractor] switch on the interface module.

(3) Turn ON the [Heating tube] switch on the interface module. (The switch is not supplied, if a heating tube is not equipped.)

(4) Turn ON all switches on the interface module. But, the Aspirator switch should be kept OFF. (The fluorescent lamp and space heater should be turned ON as required.)

(5) Turn ON the power switch at the left side of the analyzer unit.

(6) Warm-up operation for each device will begin. The time required for warm-up operation is as follows:

Analyzer unit	About 8 hours (normal indication value in about 4 hours)
Gas extractor	About 1 hour
Electronic gas cooler	10 min or more
Heating tube	1 hour or more
NO_2/NO converter (option)	30 min or more

Note) While in warm-up, the concentration display may be as follows.

: Over the upper limit of range

or

: Over the lower limit of range

But it is not an error.

(7) After the warm-up, set the switch of the [Aspirator] to "ON" to start the operation. Do not turn ON the aspirator during dry heat.

(8) Check that the ball of the flow checker is in the center range. If not, turn the by-pass needle valve to adjust it.

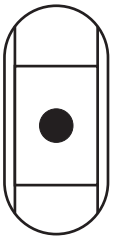


Fig. 2-3 Flow checker

2.3.5 Calibration

Implementation of zero and span calibration

Make sure to implement zero and span calibration of each component before starting normal running. (See "3.2 Calibration setting" for the calibration method).

2.3.6 Shutdown

(1) If start/stop is repeated in short periods (batch furnace, for instance)

Turn "OFF" the pump power only, for stopping running of the gas analyzer. It is because warm-up time is required at the time of reactivation, if the power for the gas analyzer unit, gas sampler, etc. is "OFF."

Note: If an NOx meter and a CO meter are used in mixture, there is a possibility where the reading of the CO meter rises when the pump stops running, because minor CO is generated due to chemical changes in the NO_2/NO converter and this CO accumulates.
If this phenomenon becomes a problem, hold the output before pump stop.
(hold output during maintenance or input remote hold)

(2) Case of shutdown for a long time (over 30 days)

Turn "OFF" the entire power. If the measurement gas is a corrosive gas, we recommend that the power for the gas extractor is kept "ON."

Note: The clock function of the gas analyzer unit is cleared, if the power is "OFF" for a long time. (2 days)
Check the clock of the gas analyzer unit, and set the time again if necessary, at the time of reactivation.

(3) Case of storage for a long time

If the gas analyzer is to be stored for a long time without running after delivery, or if it is wanted to store the analyzer for a certain length of time for a certain reason, pay attention to the following points.

1) Do not store the analyzer at a place involving vibration (0.2 m/s^2 or less).
   There is a possibility where looseness occurs to pipe joints and screws due to vibration.
2) Do not store the analyzer at a place of high temperature and high humidity.
   Store it indoors of a warehouse or the like.
   Allowable storage temperature range: –20˚C to 50˚C
   Allowable storage humidity: 90%RH or less
3) Do not store the analyzer at a dusty place or space with corrosive gases.
   There is a possibility where dust enters pipes.
   Plug the gas and drain connect ports.
4) Drain the water from gas conditioner.

3. SETTING AND CALIBRATION

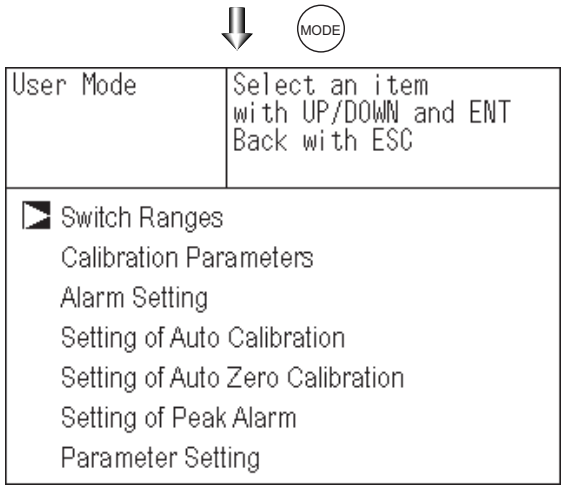
3.1 Switch of range

3.1.1 Setting of range switch mode

Set the range switch mode as follows.

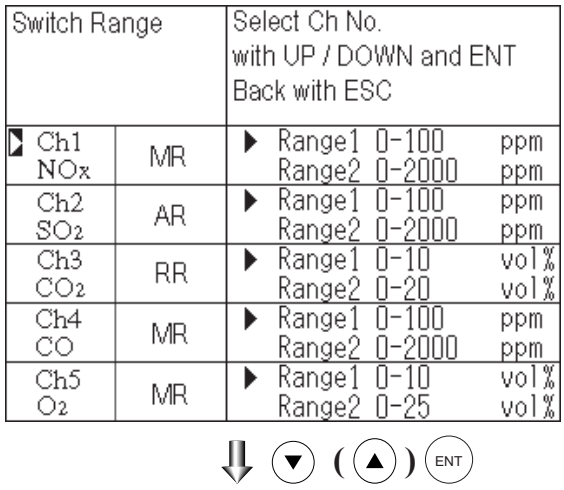
(1) Press the MODE key in measurement mode to display the User mode screen.

(2) Move the cursor to "Switch Ranges" and press the ENT key.

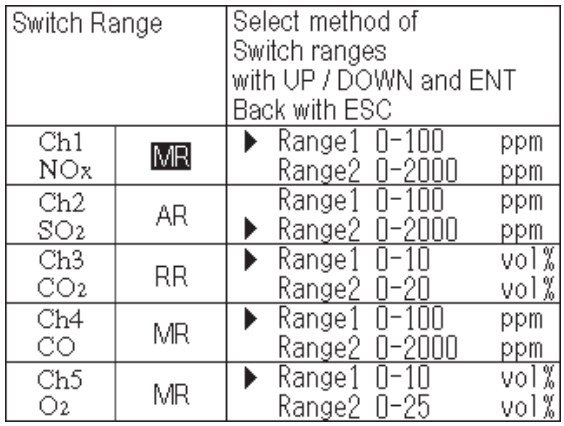


(3) The "Switch Range" screen appears. Move the cursor by pressing the ▲ or the ▼ key on the switch range screen that appears, and select Ch (component).

(4) Then press the ENT key.



(5) Selected range switch mode is highlighted. Press the ▲ or the ▼ key to select a desired switch mode.



Description of setting

MR: Select a desired range on this screen.
RR: Select a desired range according to the remote range switch contact input.
AR: Automatically switched from Range 1 to Range 2 when the measured concentration exceeds 90% of Range 1. Automatically switched from Range 2 to Range 1 when the measured concentration becomes smaller than 80% of Range 1.

* Only operation set for each Ch can be performed.

(6) Then press the ENT key to confirm the selection.

If "MR" is selected, the cursor moves to "Range Switch."

If "RR" or "AR" is selected, the cursor moves to "Ch (component)".

Range switch or previous screen

3.1.2 Manual range switch

The range of the measured component can be switched manually as follows.

(1) Select "MR" as range switch mode, and then press the ENT key.

Switch Range		Select method of Switch ranges with UP / DOWN and ENT Back with ESC
Ch1 NOx	MR	▶ Range1 0-100 ppm Range2 0-2000 ppm
Ch2 SO_2	AR	Range1 0-100 ppm ▶ Range2 0-2000 ppm
Ch3 CO_2	RR	▶ Range1 0-10 vol% Range2 0-20 vol%
Ch4 CO	MR	▶ Range1 0-100 ppm Range2 0-2000 ppm
Ch5 O_2	MR	▶ Range1 0-10 vol% Range2 0-25 vol%

⇓ ENT

(2) Move the highlight of the cursor to range selection, and then select a desired range by pressing the ▲ or the ▼ key. (The ▶ mark indicates the currently selected range.)

(3) Then press the ENT key, and the measurement is carried out in the selected range.

Swtich Range		Select range with UP/DOWN and ENT Back with ESC
Ch1 NOx	MR	▶ Range1 0-100 ppm Range2 0-2000 ppm
Ch2 SO_2	AR	Range1 0-100 ppm ▶ Range2 0-2000 ppm
Ch3 CO_2	RR	▶ Range1 0-10 vol% Range2 0-20 vol%
Ch4 CO	MR	▶ Range1 0-100 ppm Range2 0-2000 ppm
Ch5 O_2	MR	Range1 0-10 vol% ▶ Range2 0-25 vol%

⇓ ▼ (▲) ENT

End of Range Switch

Note) If "RR" or "AR" is selected as range switch mode, this operation cannot be performed.

The range for O_2 conversion value, O_2 conversion average value, and O_2 average value is automatically switched if corresponding instantaneous value range is switched. (Same as the above with "RR" and "AR")

To close the setting

Press the ESC key to end the setting of range switch mode or range switch operation or stop the operation midway, and the setting operation is made invalid and the previous screen appears.

Range identification contact operation

The range identification contact output corresponding to each Ch (component) is conductive when Range 1 is selected, and open when Range 2 is selected, which is applicable to any of the range switch mode selected.
Note that even if the range is switched during the hold of measured value by remote hold contact input or the hold of measured value at the time of calibration, the range identification contact output maintains the contact state immediately before the hold. After stop of the hold, the contact state of the current range is resumed.

3.2 Calibration setting

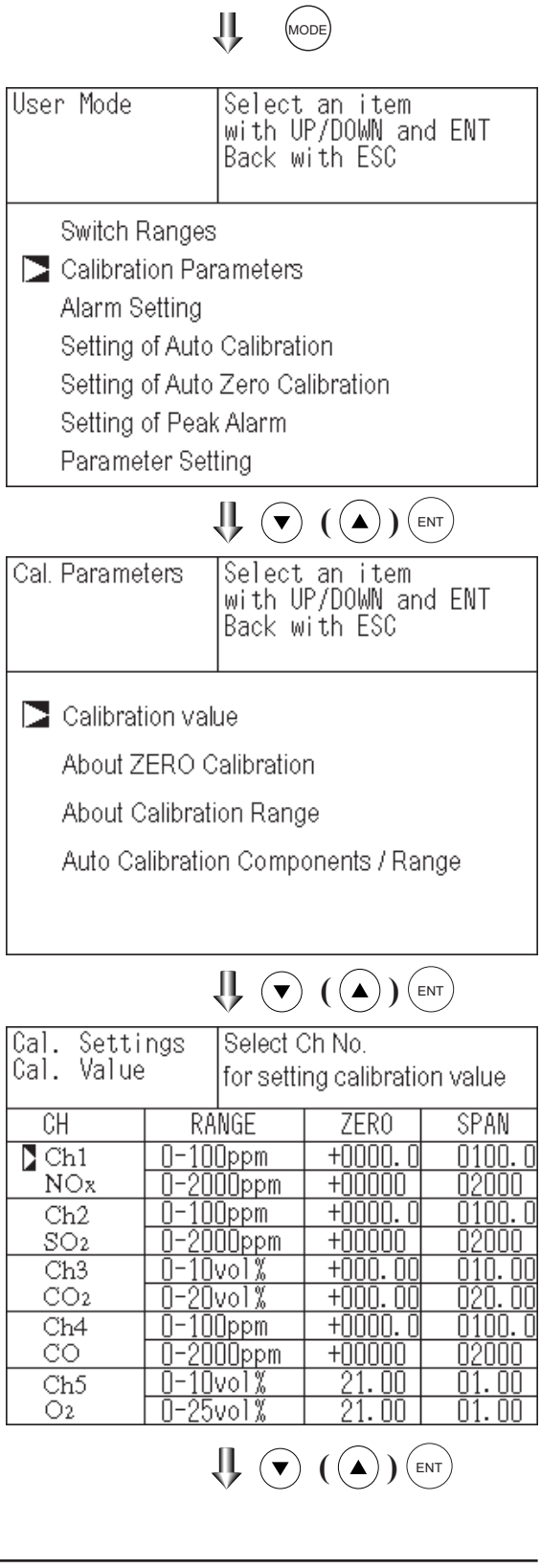
This mode is used to set calibration concentration and actions. The calibration setting involves calibration value, about zero calibration, about calibration range, auto calibration components/range.

3.2.1 Setting of calibration concentration

It allows you to set concentrations of the standard gas (zero and span) of each channel used for calibration.

(1) During measurement, press the MODE key to display the User mode.

(2) Point the cursor to “Calibration Parameters” by pressing the ▲ or the ▼ key. Press the ENT key.



(3) In the “Calibration Parameters” screen that appears, point the cursor to “Calibration Value” by pressing the ▲ or the ▼ key. Press the ENT key.

(4) In the “Calibration Concentration Ch Selection” screen that appears, point the cursor to Ch you want to set by using the ▲ or the ▼ key. Press the ENT key.

(5) In the "Calibration Concentration Selection" screen that appears, select any concentration item you want to set by pressing the ▲, ▼ ▶ key.
Then press the ENT key, and the selected value is highlighted.

Cal. Settings Cal. Value	Select setting value		
CH	RANGE	ZERO	SPAN
Ch1 NOx	0-100ppm	+0000.0	0100.0
	0-2000ppm	+00000	02000
Ch2 SO_2	0-100ppm	+0000.0	0100.0
	0-2000ppm	+00000	02000
Ch3 CO_2	0-10vol%	+000.00	010.00
	0-20vol%	+000.00	020.00
Ch4 CO	0-100ppm	+0000.0	0100.0
	0-2000ppm	+00000	02000
Ch5 O_2	0-10vol%	21.00	01.00
	0-25vol%	21.00	01.00

⇓ ▼ (▲) ENT

(6) In the "Calibration Concentration Value Setting" screen that appears, enter calibration gas concentration values (zero and span). For value entry, press the ▲ or the ▼ key, and a 1-digit value increases or decreases. By pressing the ▶ , the digit moves.
After setting, save the entry by pressing the ENT key. The saved value becomes valid from the next calibration process.

Cursor for setting value

Cal. Settings Cal. Value	Set calibration value		
CH	RANGE	ZERO	SPAN
Ch1 NOx	0-100ppm	+0000.0	0100.0
	0-2000ppm	+00000	02000
Ch2 SO_2	0-100ppm	+0000.0	0100.0
	0-2000ppm	+00000	02000
Ch3 CO_2	0-10vol%	+000.00	010.00
	0-20vol%	+000.00	020.00
Ch4 CO	0-100ppm	+0000.0	0100.0
	0-2000ppm	+00000	02000
Ch5 O_2	0-10vol%	21.00	01.00
	0-25vol%	21.00	01.00

⇓ ▼ ▲ ▶ ENT

End of Calibration Concentration Setting

Note) Enter settings that correspond to each range. If zirconia type is used as O_2 sensor, select 21.00 for the field of Zero (When dry air is used), select 20.83% for the atmospheric specification and select the concentration listed on the cylinder if the air contained in a cylinder is used.

To close the setting

To close the calibration concentration value setting process or cancel this mode midway, press the ESC key.
A previous screen will return.

Setting range of values

NOx, SO_2, CO_2, CO, CH_4, external O_2 analyzer and built-in magnetic O_2 sensor	Span gas: 1 to 105% of full scale (Full scale (FS) is the same as each range value.)
External Zirconia O_2 analyzer	Zero gas: 5 to 25 vol% Span gas: 0.01 to 5 vol%

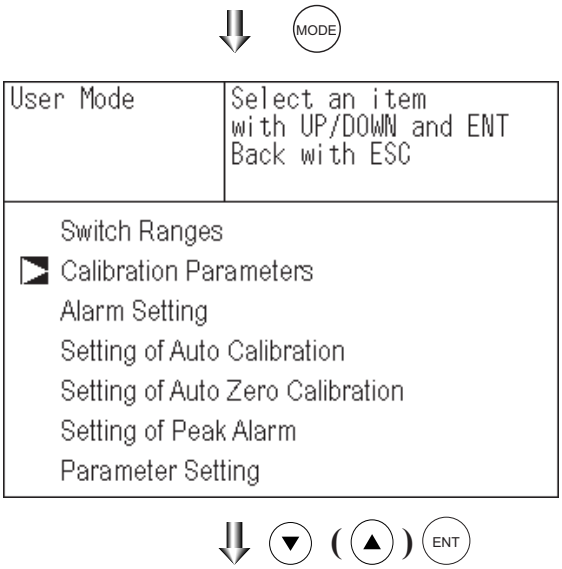
The setting cannot be performed beyond the range.

3.2.2 Setting of manual zero calibration

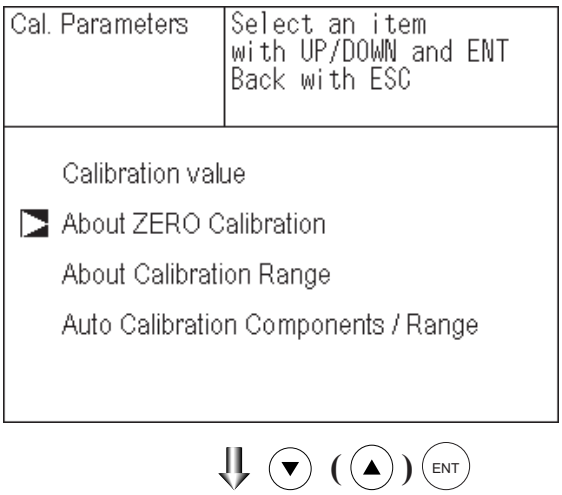
When zero calibration is made manually, set either all measured components should be calibrated simultaneously or each component should be calibrated while selecting one by one.

(1) During measurement, press the MODE key to display the User mode.

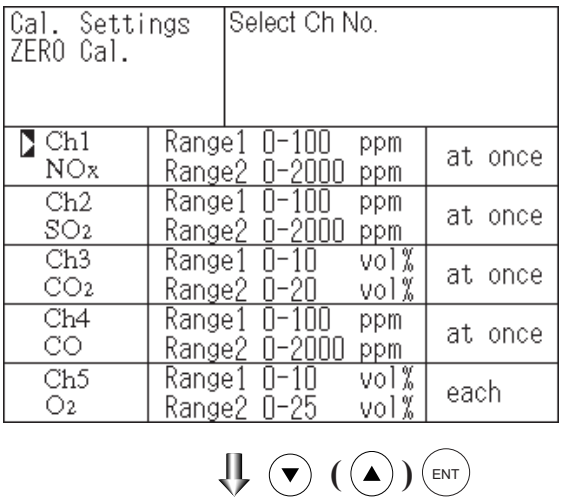
(2) Point the cursor to "Calibration Parameters" by pressing the ▲ or the ▼ key. Press the ENT key.



(3) In the "Calibration Parameters" screen that appears, point the cursor to "About ZERO Calibration" by pressing the ▲ or the ▼ key. Press the ENT key.



(4) In the "Manual ZERO Calibration Ch Selection" screen that appears, point the cursor to Ch (component) you want to set by using the ▲ or ▼ key. Press the ENT key.



(5) In the "Manual ZERO Calibration Selection" screen that appears, select "at once" or "each" by pressing the ▲ or the ▼ key. When selecting "at once," the Ch (components) to be set can be zero-calibrated at the same time. When selecting "each," either of the Ch (components) to be selected is zero-calibrated. After setting, save the entry by pressing the ENT key. The saved value becomes valid from the next calibration process.

Cal. Settings ZERO Cal.	Set each or both Ch at ZERO Calibration	
Ch1 NOx	Range1 0-100 ppm Range2 0-2000 ppm	at once
Ch2 SO_2	Range1 0-100 ppm Range2 0-2000 ppm	at once
Ch3 CO_2	Range1 0-10 vol% Range2 0-20 vol%	at once
Ch4 CO	Range1 0-100 ppm Range2 0-2000 ppm	at once
Ch5 O_2	Range1 0-10 vol% Range2 0-25 vol%	each

⇓ ▼ (▲) ENT

End of
Manual Zero Calibration Setting

To close the setting

To close the manual zero calibration setting or to cancel this mode midway, press the ESC key. A previous screen will return.

Example

Whether "each" or "at once" can be determined for each Ch (component).

•Setting "each"
Select the Ch (component) on the manual zero calibration screen and then perform zero calibration.

•Setting "at once"
At a manual zero calibration, zero of Ch (components) for which "at once" was selected can simultaneously be calibrated.
*** When the cylinder air or atmospheric air is used for the zero gas, select "At once."**

Manual Calibration screen

• When setting all components to "each":

ZERO Cal.	ENT : Go on Calibration of selected Ch ESC : Not calibration	
Ch1 NOx	▶Range1 0-100 ppm Range2 0-2000 ppm	-2.1
Ch2 SO_2	▶Range1 0-100 ppm Range2 0-2000 ppm	-0.5
Ch3 CO_2	▶Range1 0-10 vol% Range2 0-20 vol%	0.00
Ch4 CO	▶Range1 0-100 ppm Range2 0-2000 ppm	0.0
Ch5 O_2	Range1 0-10 vol% ▶Range2 0-25 vol%	21.00

A single cursor will appear.

• When setting all components to "at once":

ZERO Cal.	ENT : Go on Calibration of selected Ch ESC : Not calibration	
Ch1 NOx	▶Range1 0-100 ppm Range2 0-2000 ppm	-2.1
Ch2 SO_2	▶Range1 0-100 ppm Range2 0-2000 ppm	-0.5
Ch3 CO_2	▶Range1 0-10 vol% Range2 0-20 vol%	0.00
Ch4 CO	▶Range1 0-100 ppm Range2 0-2000 ppm	0.0
Ch5 O_2	Range1 0-10 vol% ▶Range2 0-25 vol%	21.00

Cursors will appear at all components where "at once" is set.

3.2.3 Setting of calibration range

This mode is used to set if the range of each Ch (component) at the zero or span calibration (manual calibration or auto calibration) should be calibrated with a single range or 2 ranges.

(1) During measurement, press the MODE key to display the User mode.

(2) Point the cursor to "Calibration Parameters" by pressing the ▲ or the ▼ key. Press the ENT key.

⇓ MODE

User Mode	Select an item with UP/DOWN and ENT Back with ESC

Switch Ranges
▶ Calibration Parameters
Alarm Setting
Setting of Auto Calibration
Setting of Auto Zero Calibration
Setting of Peak Alarm
Parameter Setting

⇓ ▼ (▲) ENT

(3) In the "Calibration Parameters" screen that appears, point the cursor to "About ZERO Calibration" by pressing the ▲ or the ▼ key. Press the ENT key.

Cal. Parameters	Select an item with UP/DOWN and ENT Back with ESC

Calibration value
▶ About ZERO Calibration
About Calibration Range
Auto Calibration Components / Range

⇓ ▼ (▲) ENT

(4) In the "Calibration Range Ch Selection" screen that appears, point the cursor to the Ch you want to set by pressing the ▲ or the ▼ key. Press the ENT key.

Cal. Settings Cal. Range	Select Ch No.	
▶ Ch1 NOx	Range1 0-100 ppm Range2 0-2000 ppm	both
Ch2 SO_2	Range1 0-100 ppm Range2 0-2000 ppm	current
Ch3 CO_2	Range1 0-10 vol% Range2 0-20 vol%	current
Ch4 CO	Range1 0-100 ppm Range2 0-2000 ppm	both
Ch5 O_2	Range1 0-10 vol% Range2 0-25 vol%	current

⇓ ▼ (▲) ENT

(5) On the "calibration range selection" screen that appears, select "both" or "current" by pressing the ▲ or the ▼ key.

- If "both" is selected, zero or span calibration is performed with Range 1 and Range 2 of the selected Ch interlocked.
- If "current" is selected, zero or span calibration is performed only for the range displayed when calibration of selected Ch is performed.

Press the ENT key after the selection, and the specified calibration is performed.

Cal. Settings Cal. Range	Set calibration range current or both range	
Ch1 NOx	Range1 0-100 ppm Range2 0-2000 ppm	both
Ch2 SO_2	Range1 0-100 ppm Range2 0-2000 ppm	current
Ch3 CO_2	Range1 0-10 vol% Range2 0-20 vol%	current
Ch4 CO	Range1 0-100 ppm Range2 0-2000 ppm	both
Ch5 O_2	Range1 0-10 vol% Range2 0-25 vol%	current

⇓ ▼ (▲) ENT

End of Manual Calibtation Setting

To close "Setting of Calibration Range"

To close "Setting of Calibration Range" or to cancel this mode midway, press the ESC key. A previous screen will return.

Example

Ch1 NOx	Range 1: 0 to 100 ppm Range 2: 0 to 2000 ppm	both
Ch2 SO_2	Range 1: 0 to 100 ppm Range 2: 0 to 2000 ppm	current

Ch1: Range 1 and Range 2 are calibrated together with zero and span calibration.
Ch2: Only currently displayed range is calibrated with zero and span calibration.

Note

To perform calibration for "both," set the same calibration gas concentration for both ranges.

Manual Calibration screen

When setting NOx and CO to "both"

ZERO Cal.	ENT : Go on calibration of selected Ch ESC : Not calibration	
Ch1 NOx	▶Range1 0-100 ppm Range2 0-2000 ppm	-0.6
Ch2 SO_2	▶Range1 0-100 ppm Range2 0-2000 ppm	0.4
Ch3 CO_2	▶Range1 0-10 vol% Range2 0-20 vol%	0.00
Ch4 CO	▶Range1 0-100 ppm Range2 0-2000 ppm	-0.1
Ch5 O_2	Range1 0-10 vol% ▶Range2 0-25 vol%	21.00

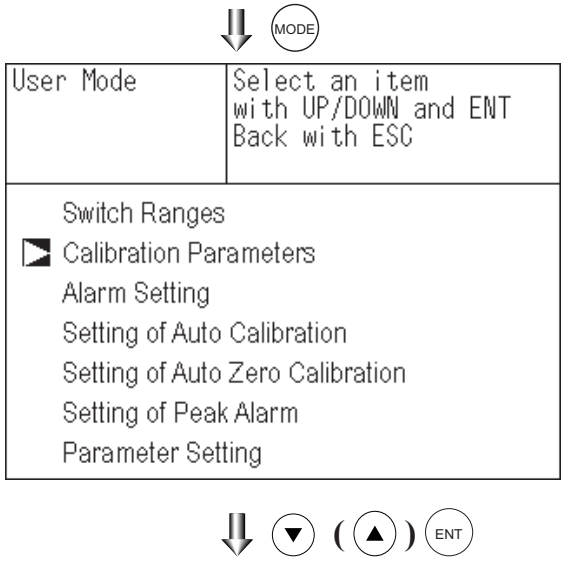
Two cursors will appear in both ranges (Ch1 and Ch4).

3.2.4 Setting of auto calibration component/range

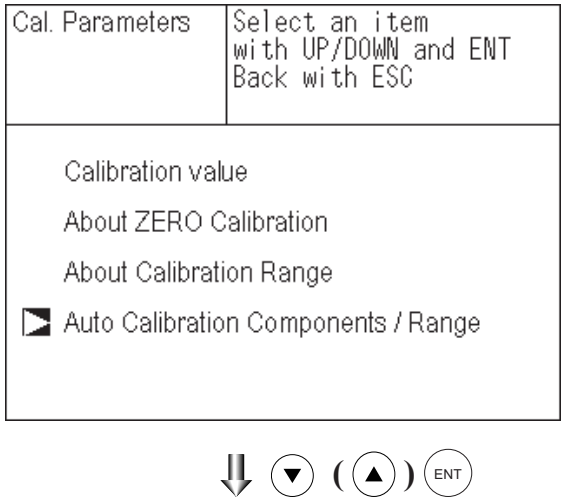
Select the Ch (component) and the range with which auto calibration is to be performed. The Ch for which "AR" has been selected as range switch mode is calibrated in the range set here even when manual calibration is performed.

(1) During measurement, press the MODE key to display the User mode.

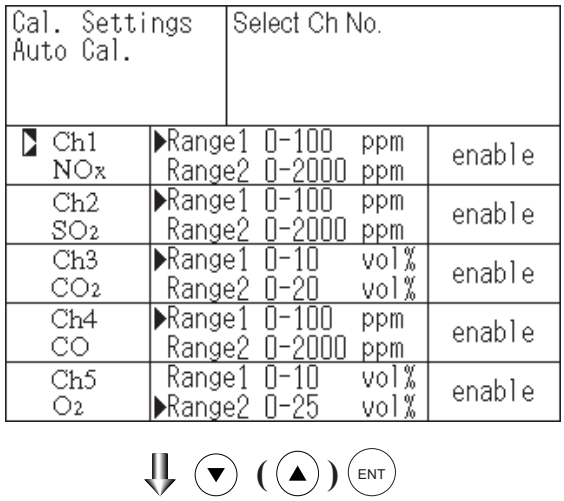
(2) Point the cursor to "Calibration Parameters" by pressing the ▲ or the ▼ key. Press the ENT key.



(3) In the "Calibration Parameters" screen that appears, point the cursor to "Auto Calibration Components / Range" by pressing the ▲ or the ▼ key. Press the ENT key.



(4) In the "Auto Calibration Components / Range" selection screen that appears, point the cursor to the Ch you want to set by pressing the ▲ or the ▼ key. Press the ENT key.



(5) The cursor next to the range of the selected Ch (component) is highlighted. Select the range to be calibrated mainly by pressing the ▲ or the ▼ key.

(6) Then press the ENT key, and calibration is performed in the selected range.

To close "Auto Calibration Component/range" setting

Auto calibration and the manual calibration of the component with which "AR" has been selected as range switch mode are performed in the range selected here. In this case, once the calibration is started, the range is automatically switched, and on completion of the calibration, the original range is resumed.
The range identification contact is interlocked with the range after the switch. However, if the hold setting is set to "ON," the contact status before calibration is maintained.

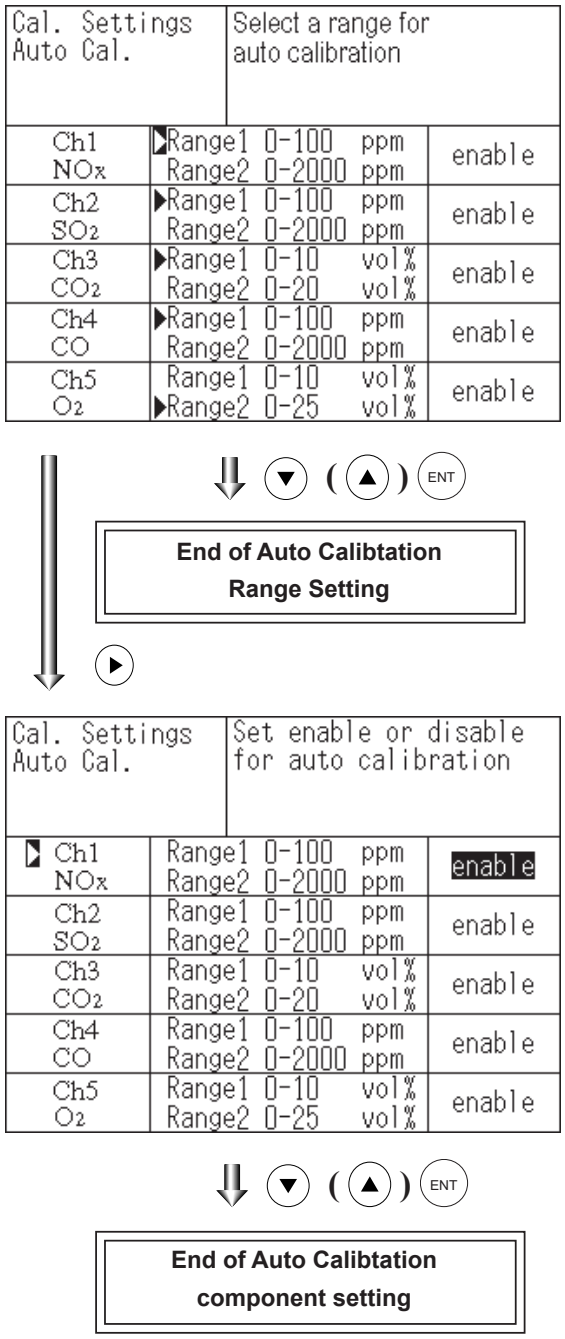
(7) Press the ▶ key in the state described in (5), and the highlight is switched between "enable" and "disable" auto calibration.

(8) Select "enable" of "disable" by pressing the ▲ or the ▼ key.

(9) Then press the ENT key.

To close the setting

To close setting of "Auto calibration component/range" or to cancel this mode midway, press the ESC key. A previous screen will return.



Operation by setting

Auto calibration is performed under the following rules.

1. Zero calibration is performed at the same time, for the Ch (component) with which "enable" is selected at the time of auto calibration and auto zero calibration.
2. Span calibration is performed in the order from smallest Ch No., for the Ch (component) with which "enable" is selected at the time of auto calibration.

Note

ZERO calibration on auto calibration and auto zero calibration of the component with which "enable" is selected are performed in batch irrespective of the description in "3.2.2 Setting of manual zero calibration."

3.3 Alarm setting

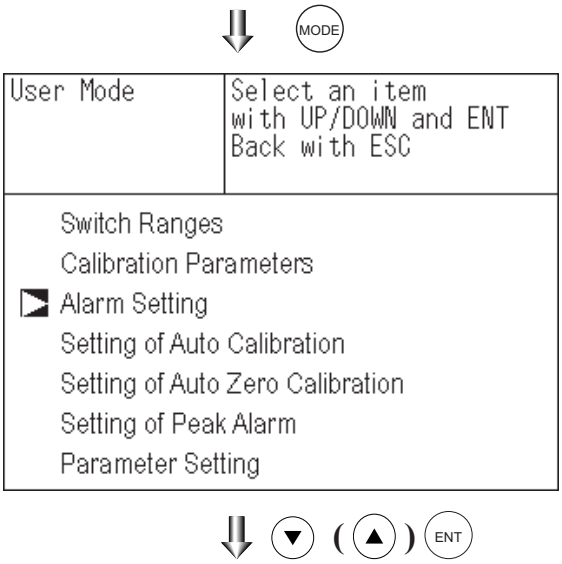
3.3.1 Setting of alarm values

The High/Low limit alarm output setting for the measured concentration and power off alarm output (alarm 6 only) setting can be made during measurement. Arbitrary 6 alarm contact outputs can be used.

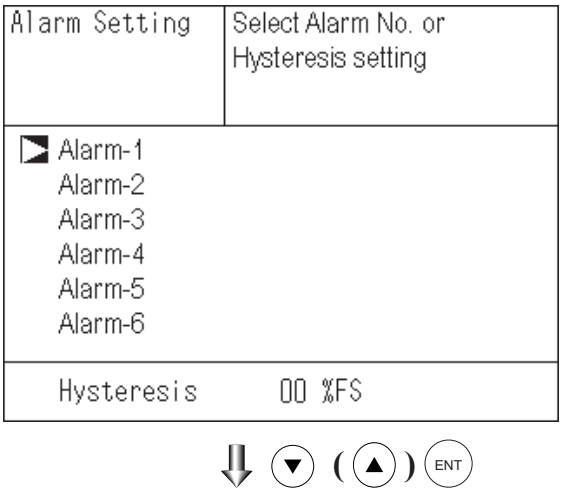
To change alarm setting, set the alarm ON/OFF setting to OFF, and then change the value.

(1) During measurement, press the MODE key to display the User mode.

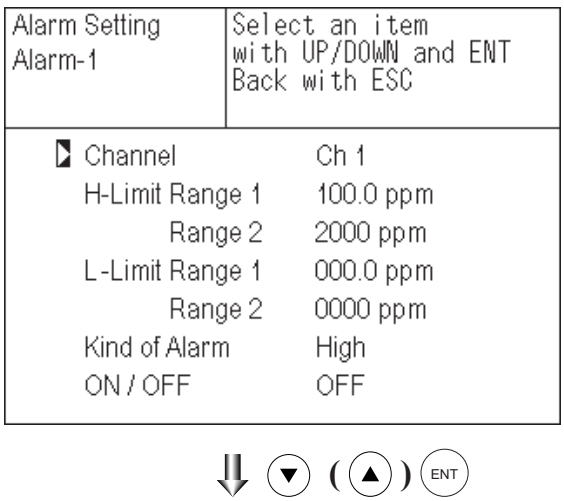
(2) Point the cursor to "Alarm Setting" by pressing the ▲ or the ▼ key. Press the ENT key.



(3) After the Alarm Setting screen has appeared, point the cursor to the Alarm No. you want to set by pressing ▲ or the ▼ key .
Press the ENT key.



(4) After the Alarm Setting screen has appeared, operate the ▲ or the ▼ key until the cursor is aligned with a desired item and press the ENT key.



Note

Set the values so that H-limit value > L-limit value and that (H-limit value − L-limit value) > hysteresis.

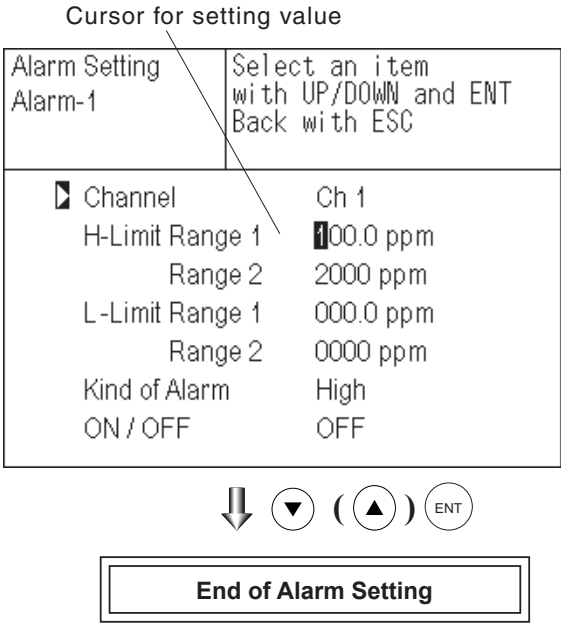
(5) After setting, the alarm setting is now completed by pressing the (ENT) key.

To close the "Alarm Setting"

To close the "Alarm Setting" or to cancel this mode midway, press the (ESC) key.
A previous screen will return.

Setting range

0% to 100% FS (Settable in each range).



Description of setting items

The alarm contact assigned the same number as the alarm is operated accordingly.

Channel: Channel setting for alarm (Power off alarm can be selected for alarm 6.)
One Ch No. can be selected for multiple alarms.

H-Limit value: Sets the high limit value (concentration) of alarm.

L-Limit value: Sets the low limit value (concentration) of alarm.

Kind of Alarm: Selects one of High limit alarm, Low limit alarm, and High limit or Low limit alarm, HH limit alarm, and LL limit alarm.
High, HH ... Alarm contact closes when above H-limit alarm.
Low, LL ... Alarm contact closes when below L-limit alarm.
High or Low ... Alarm contact closes when above H-limit value or below lower limit value.

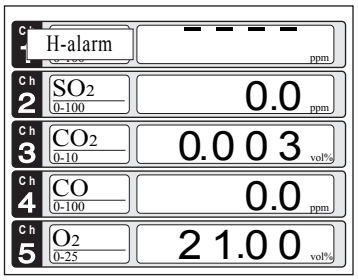
If "Power" is selected for Channel, the contact is closed at all times while the power is on irrespective of the setting made here. (Alarm-6 only)

ON/OFF: Enables the alarm function if set at ON, or disables the alarm function if set at OFF.

* The High limit value cannot be set below the Low limit value, and the Low limit value cannot be set above the High limit value.
If it is desired to set the High limit value below the Low limit value already stored in the memory, reduce the Low limit value beforehand, and vice versa.

Typical on-screen display when an alarm occurs

When an High limit alarm occurs, the "H-alarm" message comes on in the field of relevant Ch (component).
("L-alarm" for Low limit alarm, "HH-alarm" for HH limit alarm, and "LL-alarm" for LL limit alarm)



Note

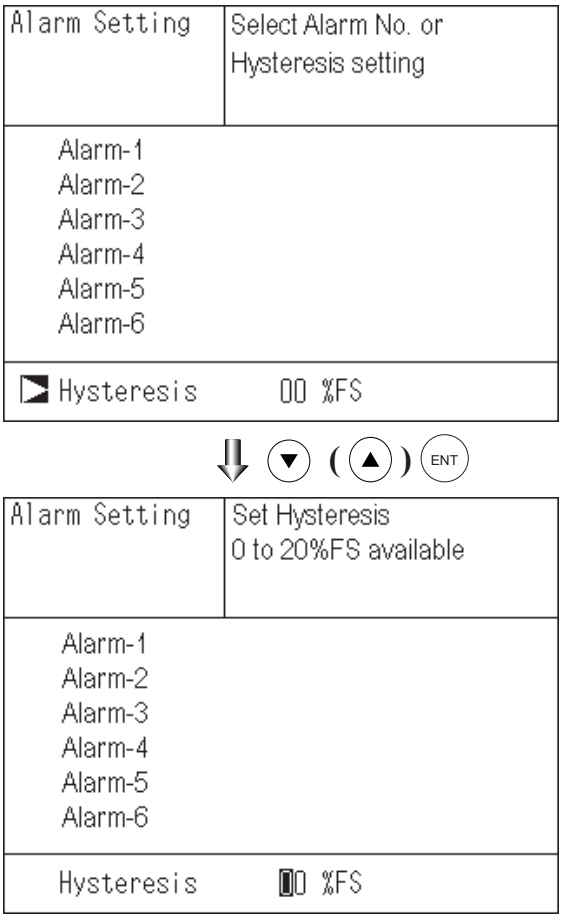
For 10 minutes after turning on power, the alarm judgment is inactive.

3.3.2 Hysteresis setting

To prevent chattering of an alarm output near the alarm setting values, set the value of hysteresis.

(1) In the "Alarm Setting" screen that appears, point the cursor to "Hysteresis" by pressing the ▲ or the ▼ key. Press the ENT key.

(2) In the "Hysteresis Value Setting" screen that appears, enter hysteresis values.
For the value entry, 1-digit value is increased or decreased by pressing the ▲ or the ▼ key, and pressing the ▶ key moves the digit. After setting, press the ENT key.



To close "Hysteresis Setting"

To close the "Hysteresis Setting" or cancel the mode midway, press the ESC key. A previous screen will return.

Setting range

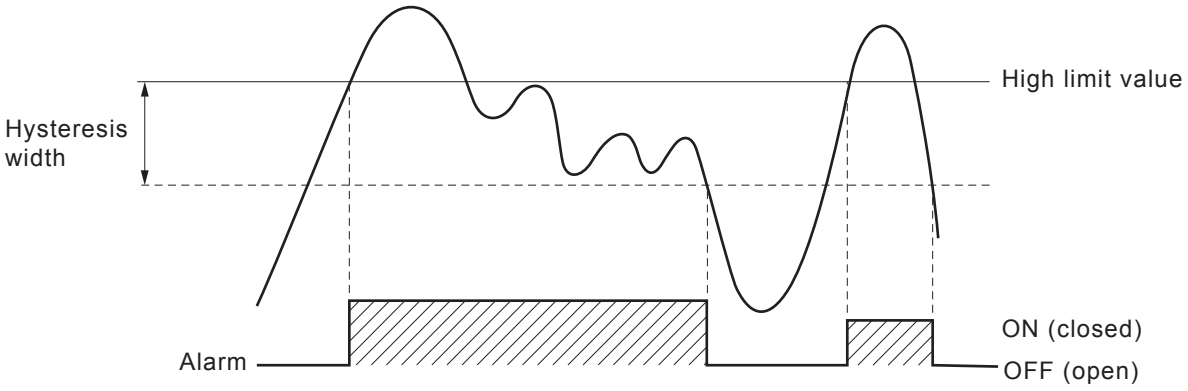
0 to 20% of full scale
[% full scale (FS)] represents the percentage with the width of the range of each component regarded as 100%.

Note

The hysteresis is common to all alarms (components).

Hysteresis (In case of High limit alarm)

An alarm output is turned "ON" if measurement value exceeds the High limit value as shown below. Once the alarm output has been turned "ON", it is not turned "OFF" as long as the indication does not fall below the hysteresis width from the High limit value. If indication exceeds the High limit value, alarm switches from "OFF" to "ON".



3.4 Setting of auto calibration

3.4.1 Auto calibration

Auto calibration is automatically carried out at the time when zero calibration and span calibration are set.

Before changing the setting of auto calibration, set the ON/OFF to OFF.

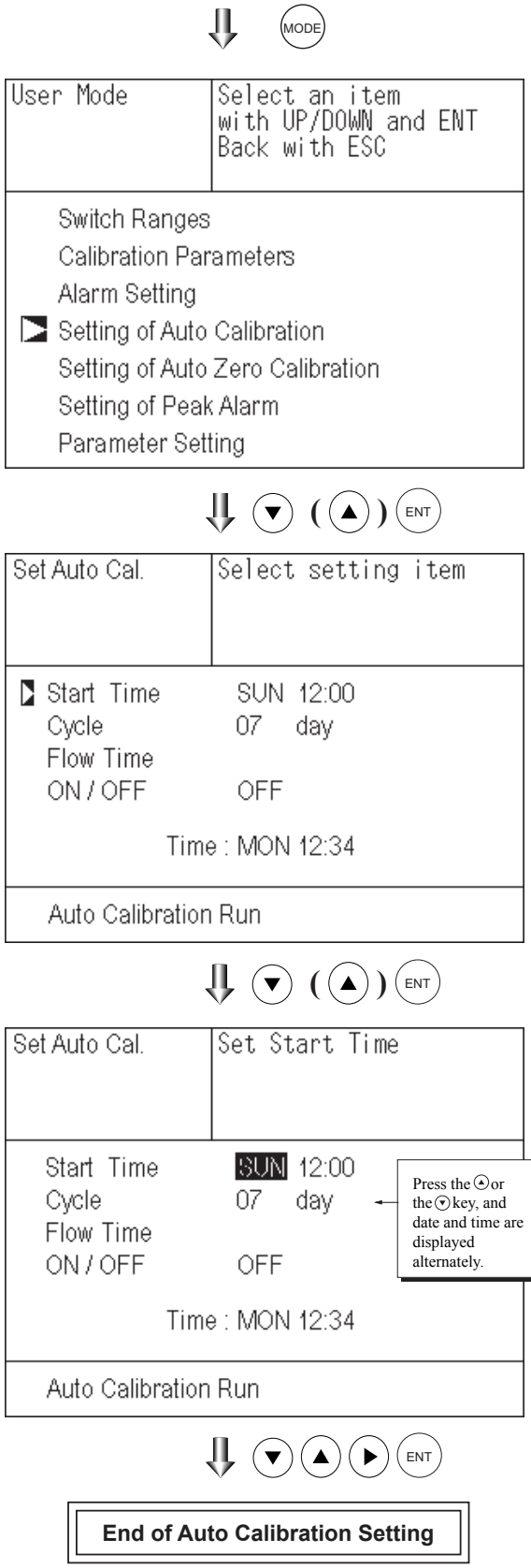
(1) During measurement, press the MODE key to display the User mode.

(2) Point the cursor to "Setting of Auto Calibration" by pressing the ▲ or the ▼ key. Press the ENT key.

(3) In the "Setting of Auto Calibration" screen that appears, point the cursor to any item you want to set by pressing the ▲ or the ▼ key. Press the ENT key.

(4) In the "Setting of Auto Calibration" screen that appears, perform the value entry or the setting. For the value entry or setting change, use the ▲ or the ▼ key. To change the setting, use the ▶ key to move the cursor to the right.

After setting, save the entry by pressing the ENT key. The saved value becomes valid.



Description of setting items

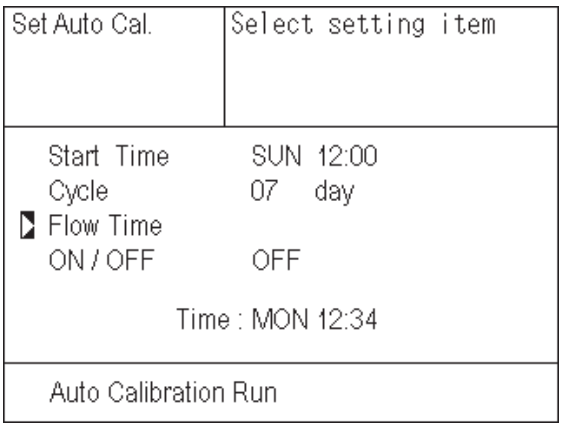
- Start Time : Setting at the first calibration (day of the week, hour, minute)
- Cycle : A period between the start time of one calibration and another (unit : hour/day)
- Flow Time : The time required for replacement by calibration gas
  Time required for replacement of sample gas after the calibration is completed (Set by calibration gas. See the next page.)
- ON/OFF : ON/OFF of auto calibration

To close "Setting of Auto calibration"

To close the "Setting of Auto calibration" or cancel this mode midway, press the ESC key.
A previous screen will return.

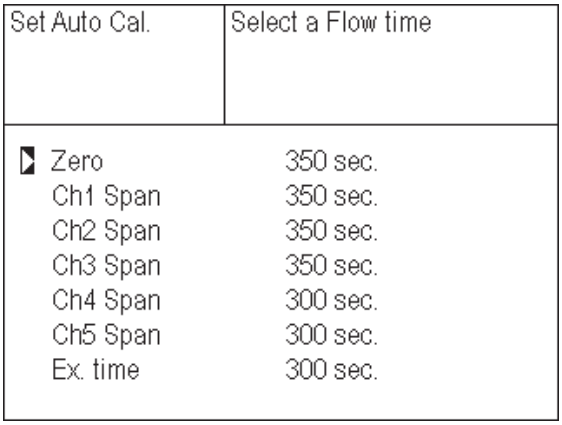
<Gas flow time> setting

(1) Press the ENT key in a state where the cursor is placed next to "Flow Time," and the flow time setting screen shown at right appears.



⇓ ENT

(2) On the flow time setting screen that appears, move the cursor to the gas you want to change the setting by pressing the ▲ or the ▼ key, and then press the ENT key.

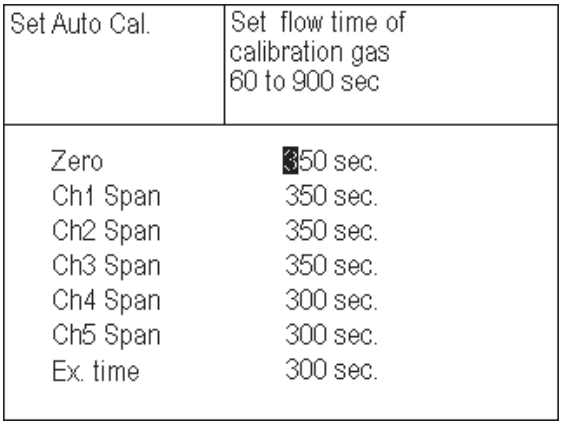


⇓ ▼ (▲) ENT

(3) The highlighted value can be changed. Change the value by pressing the ▲ or the ▼ key, and then move the cursor to the right by pressing the ▶ key.

(4) After changing the value, press the ENT key.

(5) Press the ESC key to return to the automatic calibration setting screen.



⇓ ▼ (▲) ENT

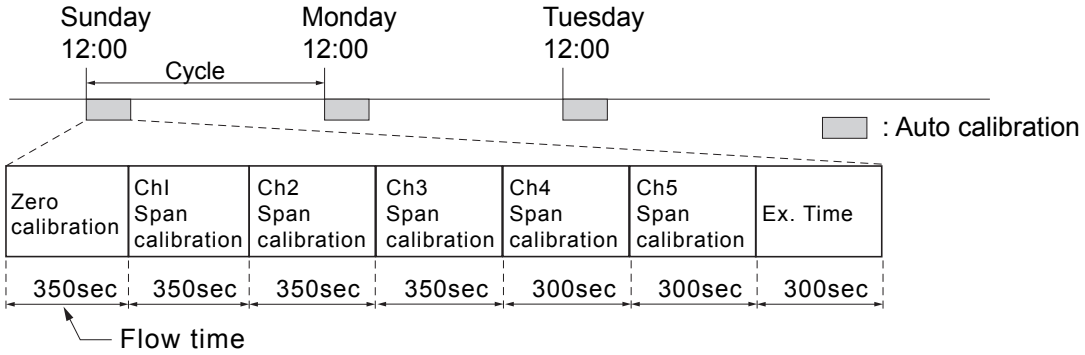
Note) Only the Chs used are displayed on this screen. The Ex. time is the output signal hold extension time after the completion of calibration. It is valid only when the hold setting is set to "ON." The Ex. time set here is also the hold extension time at the time of manual calibration.

Auto calibration status contact output is closed during auto calibration (including Ex. time), and is open in other cases.

Example

Start Time	SUN	12:00
Cycle	1	day
Flow Time	Zero	350 sec
	Ch1 Span	350 sec
	Ch2 SPan	350 sec
	Ch3 SPan	350 sec
	Ch4 SPan	300 sec
	Ch5 SPan	300 sec
	EX. time	300 sec
ON/OFF	ON	

In case where auto calibration is carried out at the above setting.



(An example of "Ch1: through Ch5: enable", as given in Section "3.2.4 Setting of auto calibration component/range".)

Setting range

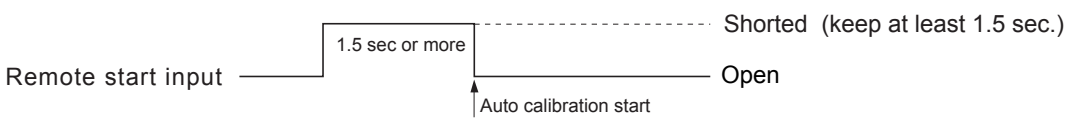
Cycle : 1 to 99 hours or 1 to 40 days (initial value 7days)
Flow time : 60 to 900 sec (initial value 300sec)

Caution

- **When an auto calibration starts, the measurement screen automatically appears.**
- **Any operation other than "Forced stop of auto zero calibration" (see Section 3.4.2) is not permitted during auto calibration. "Stop Auto Calibration" cannot be performed with the key lock to ON. To cancel auto calibration forcedly, set the key lock to OFF and then execute "Stop Auto Calibration".**
- **When the power is turned on after it is turned off (including the case of power failure), the next auto calibration is carried out at the time set as the next start time, and then repeat it in the set cycle.**

Remote start

Whether the auto calibration is set at ON or OFF, an auto calibration is available by keeping the remote start input closed for at least 1.5 seconds.

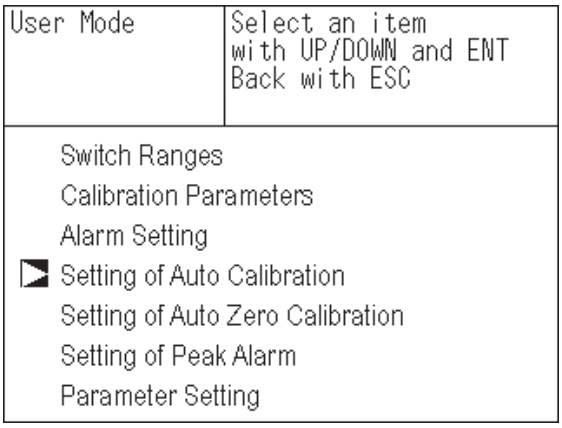


3.4.2 Forced run/stop of auto calibration

Auto calibration can be performed just once or forcibly stopped while the calibration is performed.

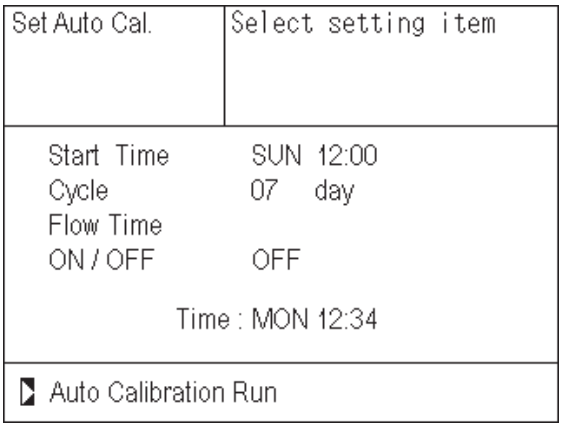
[1] Execution of auto calibration (only once)

(1) Display the User mode screen. Move the cursor to "Setting of Auto Calibration" by pressing the ▲ or the ▼ key, and then press the ENT key.



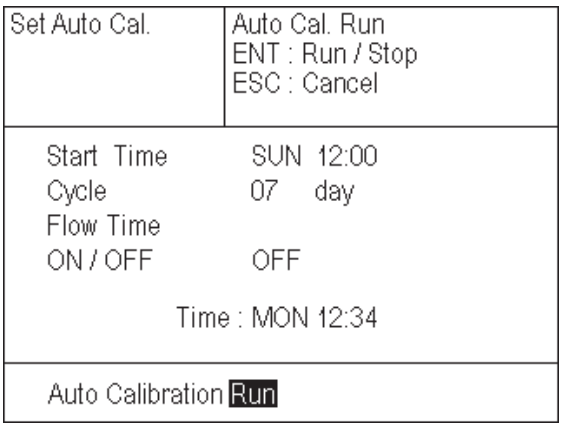
▼ (▲) ENT

(2) In the "Setting of Auto Calibration" item selection screen that appears, point the cursor to "Auto Calibration Run" by pressing the ▲ or the ▼ key. Press the ENT key.



▼ (▲) ENT

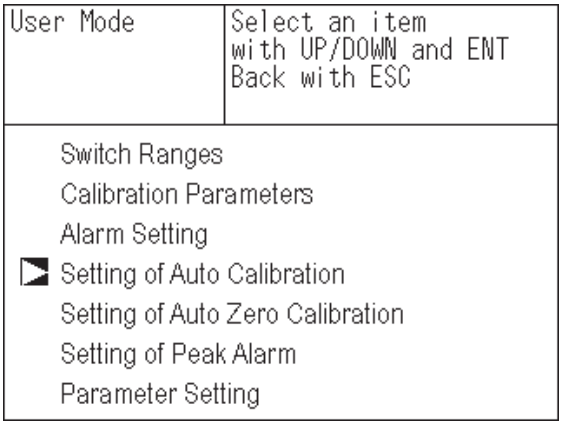
(3) "Run" is highlighted, displaying a message to confirm the execution of auto calibration. Press the ENT key to execute the auto calibration, and press the ESC key to cancel.



[2] Forced stop of auto calibration

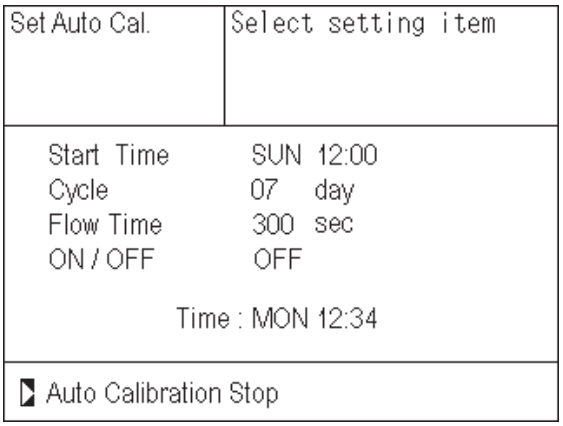
This mode is used to stop the auto calibration forcedly.

(1) In the User mode that is displayed, point the cursor to "Setting of Auto Calibration" by pressing the ▲ or the ▼ key. Press the ENT key.



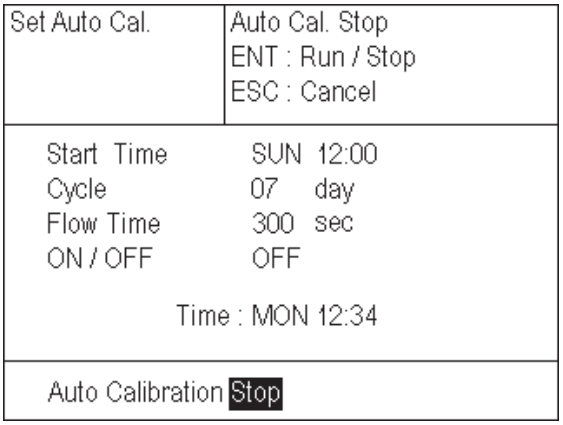
⇓ ▼ (▲) ENT

(2) In the "Setting of Auto Calibration" item selection screen that appears, point the cursor to "Auto Calibration Stop" by pressing the ▲ or the ▼ key. Press the ENT key.
("Auto Calibration Stop" appears when the screen is selected while auto calibration is performed.)



⇓ ▼ (▲) ENT

(3) "Stop" is highlighted, displaying a message to confirm the stop of auto calibration. Press the ENT key to stop the auto calibration, and press the ESC key to cancel (not stopped).



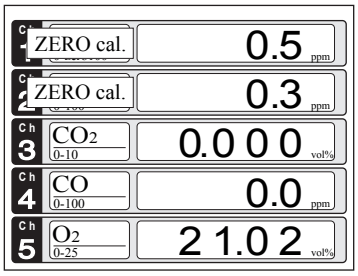
"Auto Calibration" screen

Example

In case where setting the auto calibration components (see Section 3.2.4) to "Ch1: enable" and "Ch2: enable"

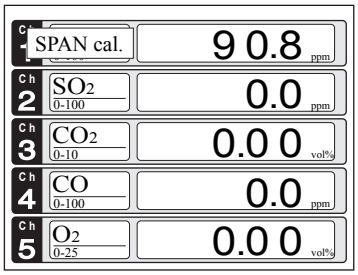
• Zero calibration

A message, "Zero cal." blinks at Ch1 and Ch2.



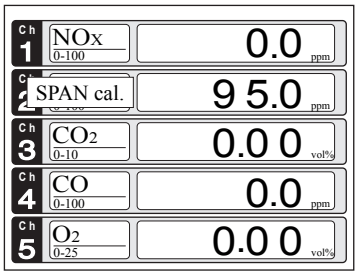
• Ch1 span calibration

A message, "Span cal." blinks at Ch1.



• Ch2 span calibration

A message, "Span cal." blinks at Ch2.



Caution

During auto calibration, any key operation is not permitted other than operations such as key lock ON/OFF and "Stop Auto Calibration."
When the key lock is set at "ON," even the "Auto Calibration Stop" cannot be used.
To stop "Auto Calibration" forcedly, set the key lock to "OFF" and then execute "Auto Calibration Stop."

3.5 Setting of auto zero calibration

3.5.1 Auto zero calibration

Auto zero calibration is automatically carried out at the time when zero calibration is set. Components for which a calibration is to be made are determined by setting of auto calibration component in Section 3.2.4.

Before changing the setting of auto zero calibration, set the ON/OFF to OFF.

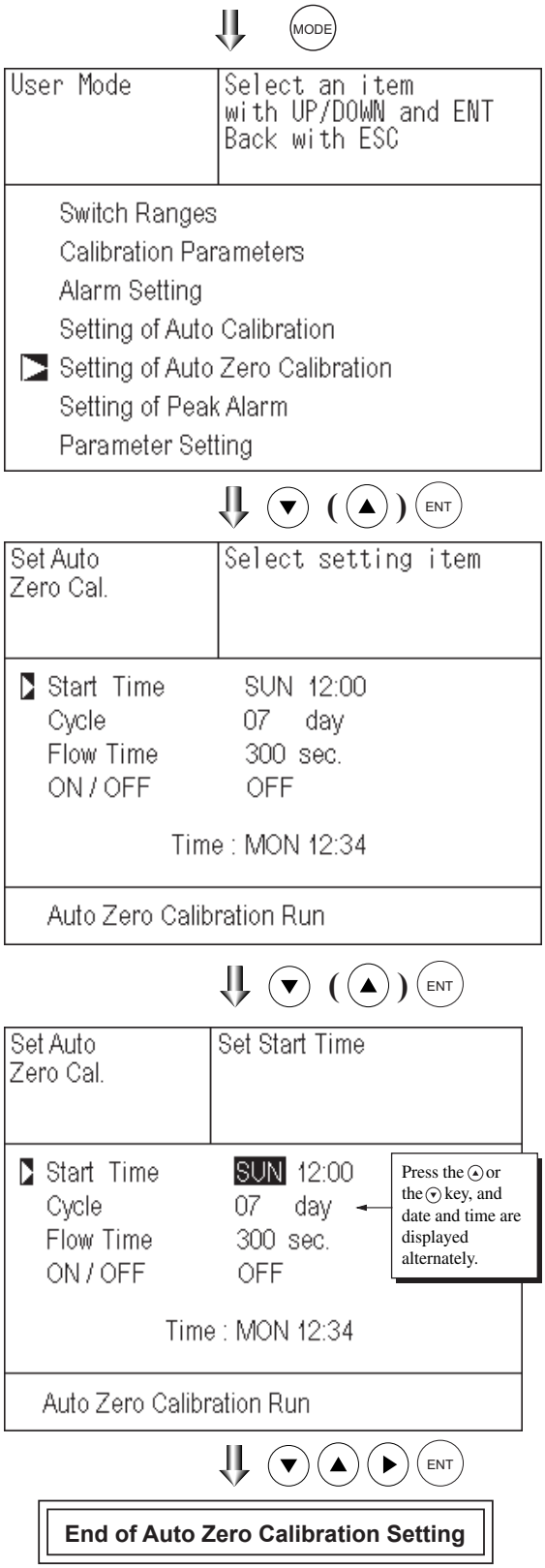
(1) During measurement, press the MODE key to display the User mode.

(2) Point the cursor to "Setting of Auto Zero Calibration" by pressing the ▲ or the ▼ key. Press the ENT key.

(3) In the "Setting of Auto Zero Calibration" screen that appears, point the cursor to any item you want to set by pressing the ▲ or the ▼ key. Press the ENT key.

(4) In the "Auto Zero Calibration Parameter Setting" screen that appears, perform the value entry or the setting. For the value entry or setting change, use the ▲ or the ▼ key. To change the setting, use the ▶ key to move the cursor to the right.

After setting, save the entry by pressing the ENT key. The saved value becomes valid.



Description of setting items

- Start Time : Setting at the first calibration (day of the week, hour, minute)
- Cycle : A period between the start time of one calibration and another (unit : hour/day)
- Flow Time : The time required for the calibration gas to be replaced in the cell
- ON/OFF : ON/OFF of auto zero calibration

To close "setting of Auto Zero Calibration"

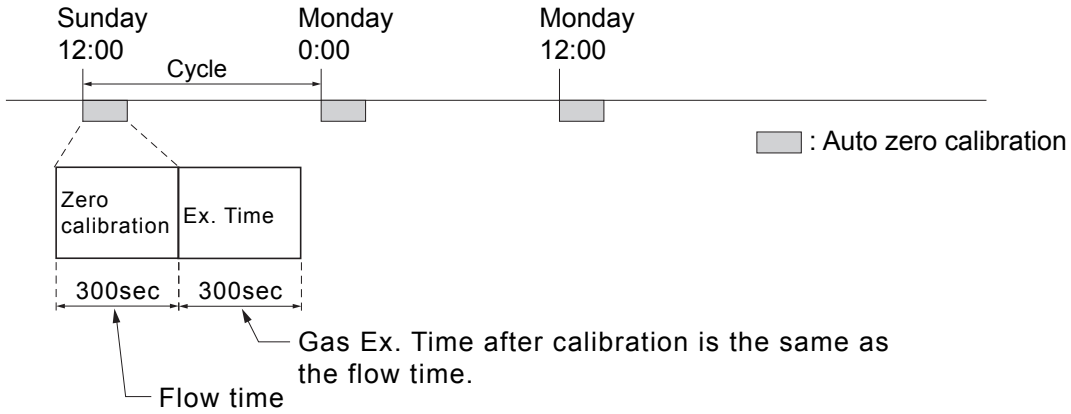
To close the "Setting of Auto Zero Calibration" or cancel this mode midway, press the ESC key. A previous screen will return.

Auto calibration status contact output is closed during auto zero calibration, and is open in other cases.

Example

Start time	SUN	12:00
Cycle	12	hour
Flow time	300	sec
ON/OFF	ON	

In case where auto zero calibration is carried out at the above setting.



(An example of “Ch1: through Ch5: enable,” as given in Section “3.2.4 Setting of auto calibration component/range”.)

Setting range

Cycle : 1 to 99 hours or 1 to 40 days (initial value 7days)
Flow time : 60 to 900 sec (initial value 300sec)

Caution

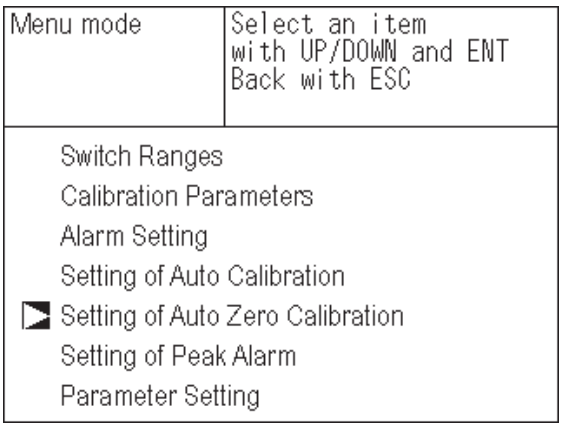
- **When an auto zero calibration starts, the measurement screen automatically appears.**
- **Any operation other than "Forced stop of auto zero calibration" (see Section 3.5.2) is not permitted during auto zero calibration. “Forced stop of auto zero calibration” cannot be performed with the key lock to “ON.” To cancel auto zero calibration forcedly, set the key lock to “OFF” and then execute “Forced stop of auto zero calibration”.**
- **If the auto calibration period and auto zero calibration period have overlapped, the auto calibration is retained, ignoring the auto zero calibration of that period.**
- **Only when the hold setting is set to "ON", for gas Ex. time after calibration , hold of auto calibration contact and measured value output signal is extended.**

3.5.2 Forced run/stop of auto zero calibration

Auto zero calibration can be performed just once, or auto zero calibration can be forcibly stopped during calibration.

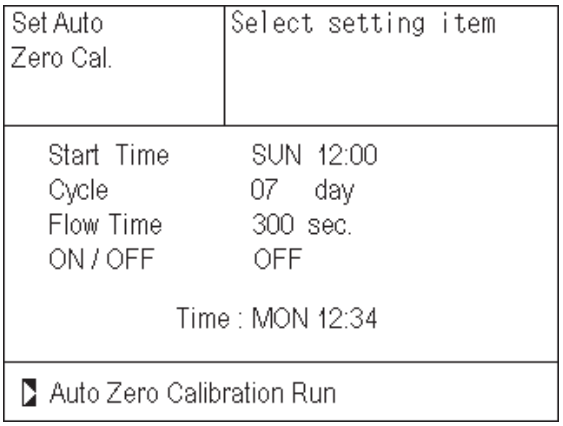
[1] Execution of auto zero calibration (just once)

(1) Have the menu mode displayed. Move the cursor to "Setting of Auto Zero Calibration" by pressing the ▲ or the ▼ key, and then press the ENT key.



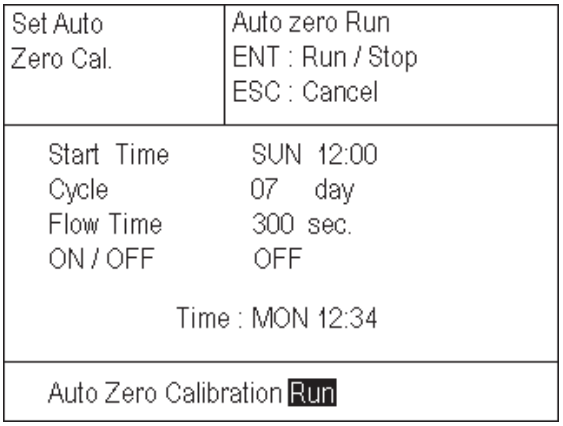
⇓ ▼ (▲) ENT

(2) In the "Setting of Auto Zero Calibration" item selection screen that appears, point the cursor to "Auto Zero Calibration Run" by pressing the ▲ or the ▼ key. Press the ENT key.



⇓ ▼ (▲) ENT

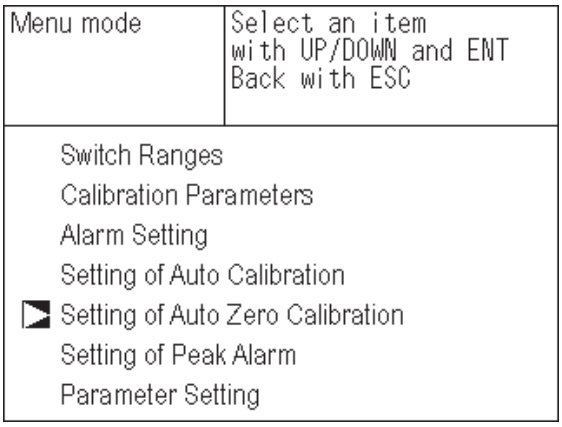
(3) "Run" is highlighted, displaying a message to confirm execution of auto zero calibration. Press the ENT key to execute the calibration, and press the ESC key to cancel.



[2] Forced stop of auto zero calibration

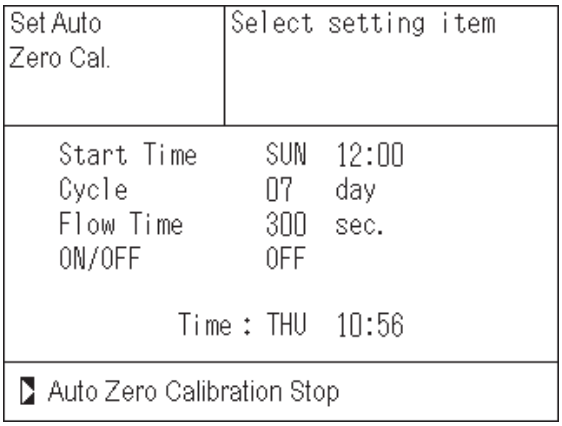
This mode is used to cancel the auto zero calibration forcedly.

(1) In the Menu Mode that is displayed, point the cursor to "Setting of Auto Zero Calibration" by pressing the ▲ or the ▼ key. Press the ENT key.



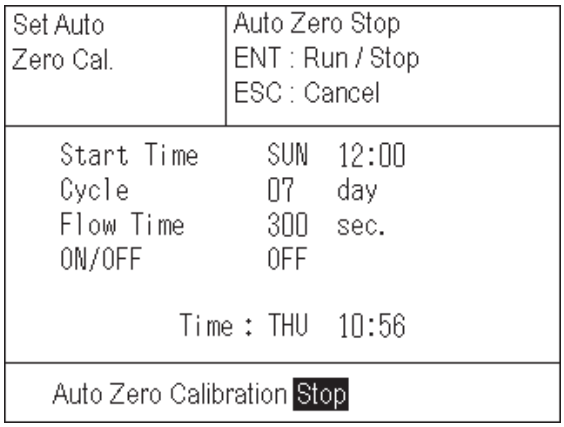
▼ (▲) ENT

(2) In the "Setting of Auto Zero Calibration" item selection screen that appears, point the cursor to "Auto Zero Calibration Stop" by pressing the ▲ or the ▼ key. Press the ENT key.
("Auto Zero Calibration Stop" appears when the screen is selected while auto zero calibration is performed.)



▼ (▲) ENT

(3) "Stop" is highlighted, displaying a message to confirm the stop of auto calibration. Press the ENT key to stop the auto zoro calibration and the ESC key to cancel (not stopped).



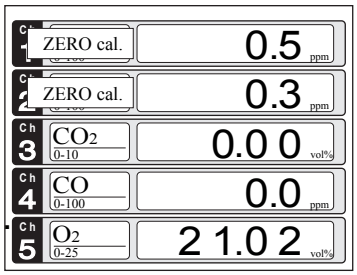
"Auto Zero Calibration" screen

Example

In case where setting the auto calibration components (see Section 3.2.4) to "Ch1: enable" and "Ch2: enable"

• Zero calibration

A message, "Zero cal." blinks at Ch1 and Ch2.



Caution

During auto zero calibration, any key operation is not permitted other than operations such as key lock ON/OFF and "Stop Auto Zero Calibration."
When the key lock is set at "ON," even the "Stop Auto Zero Calibration" cannot be used.
To stop "auto zero calibration" forcedly, set the key lock to "OFF" and then execute "Auto Zero Calibration Stop."

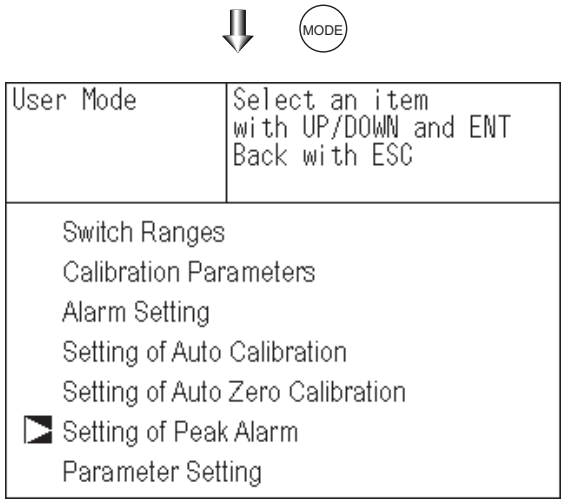
3.6 Peak alarm setting

When the number of peaks CO concentration exceeds the upper limit value during measurement exceeds the set number, an alarm is provided.

The peak alarm and this setting screen appear only when an option is added.

(1) Press the MODE key in the Measurement mode, and the User mode appears.

(2) Point the cursor to "Setting of Peak Alarm" by pressing the ▲ or the ▼ key. Press the ENT key.

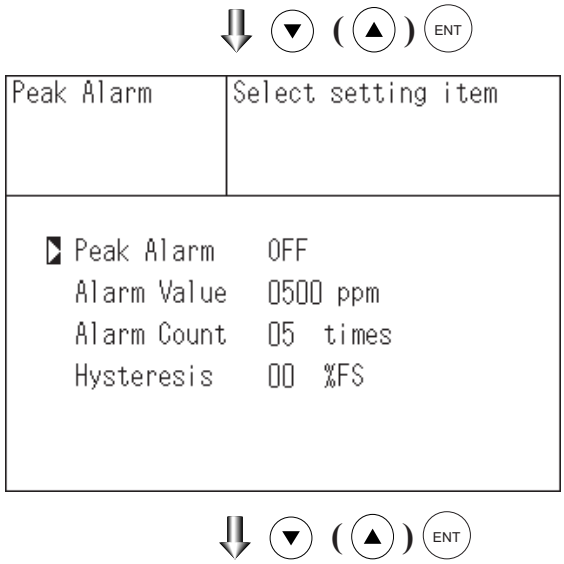


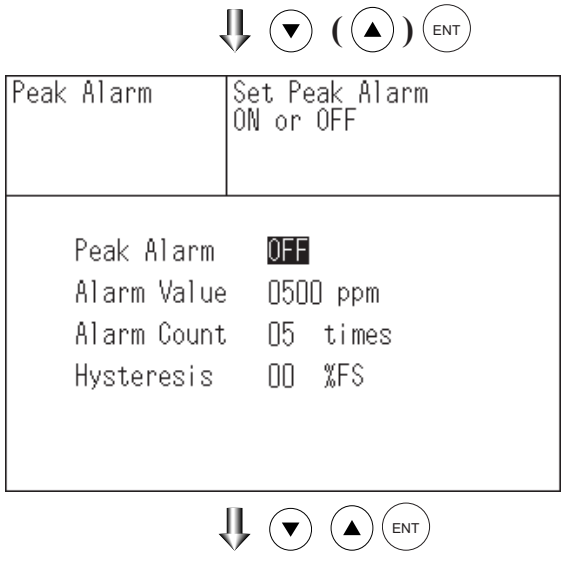
(3) In the "Peak Alarm Setting" item selection screen that appears, point the cursor to any item you want to set by pressing the ▲ or the ▼ key. Press the ENT key.

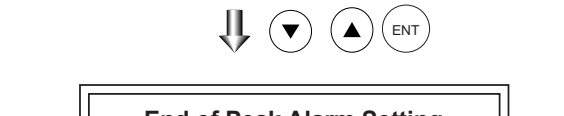
(4) Then, enter numeric values and perform the setting.

Entering the numeric values or setting the items should be carried out by pressing the ▲ or the ▼ key.

After setting, press the ENT key, and the set values are saved.







End of Peak Alarm Setting

Description of setting items

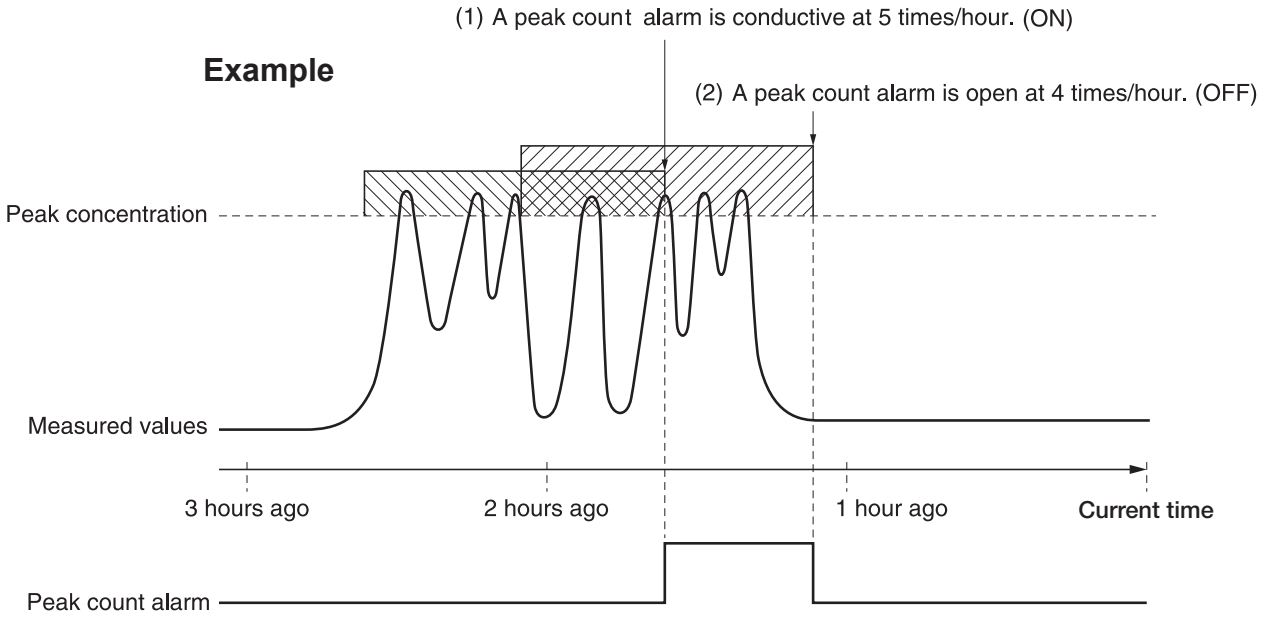
- Peak Alarm : ON/OFF of peak alarm
- Alarm Value : If measured value exceeds the set alarm value, a peak counter counts 1 time.
- Alarm Count : When a peak in excess of the setting time occurs, a peak count alarm output is provided.
- Hysteresis : It can prevent chattering near the set alarm value. When reading exceeds the set alarm value, alarm counter counts once. After one count, if the reading does not fall for hysteresis width set by the set alarm value, even if it exceeds the set alarm value again, the alarm counter does not count it. If reading falls for hysteresis width set by the set alarm value, and it exceeds the set alarm value again, alarm counter counts 2 times.

Setting range

- Alarm value : 10 to 1000 ppm → 5 ppm step (initial value: 500 ppm)
- Alarm count : 1 to 99 times → (initial value: 5 times)
- Hysteresis : 0 to 20 % of full scale → (initial value: 0% of full scale)

[% full scale] represents the percentage with the CO range regarded as 100%.

Action of peak alarm



If CO instantaneous value exceeds the alarm value, counting will begin. If the number of peaks is over the set times per hour, a peak count alarm becomes closed (ON). If it is less than the set times per hour, it is open (OFF).

Since 5 times of peaks /hour is marked at (1) ▨ section from the above graph, the peak count alarm is turned "ON." Since peaks of more than 5 times per 1 hour occur at the interval between (1) and (2) ▨ , the peak count alarm remains "ON." Since at (2), peaks are reduced to 4 times per hour, it is turned "OFF."

Like the hysteresis of the alarm setting , the hysteresis prevents possible chattering when measured gas is fluctuated near the alarm value.

* For 10 minutes after the power is turned ON, a peak alarm counting is not carried out.

Releasing peak count alarm

To release the peak count alarm, set the peak alarm to "OFF."
Turning "ON" the peak alarm initiates counting from 0.

3.7 Parameter setting

It allows you to carry out the parameter setting such as time, key lock, etc., as required. Items to be set are as follows:

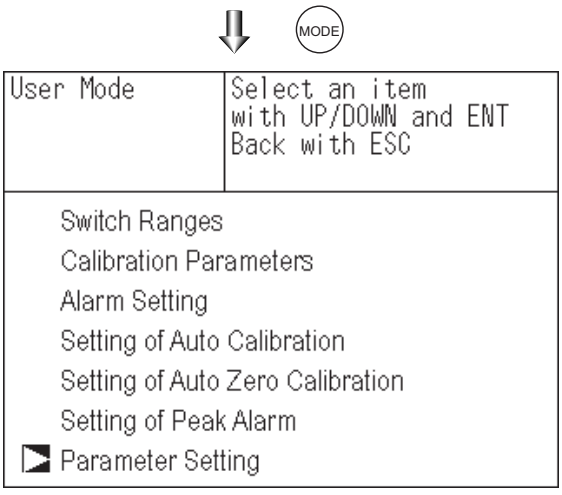
Description of setting items

- Current Time : Current year, month, date, day of the week, hour, and minute setting (The display appears in this order.)
  Note: The clock backup time is 2 days. If power is turned on after it is kept off for 2 days or longer, make the time setting again.
- Key Lock : Sets with ON/OFF so that any key operation except the key lock OFF cannot be performed.
- Output Hold : Sets whether Calibration Output is held or not, and the holding value setting.
- Reset Av. Output : Resets the average value.
- Response Time : Sets the response time of electrical system.
- Average Period : Sets the moving average time.
- Backlight Timer : Sets automatic OFF of the backlight of display unit and the time until backlight out.
- To Maintenance Mode : Enters passwords to switch to the Maintenance mode.

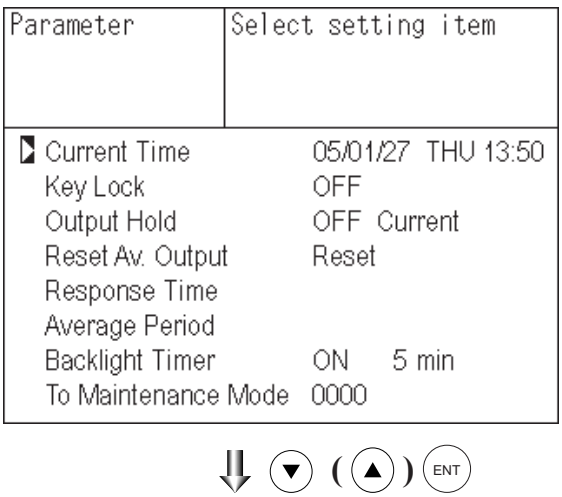
* For the maintenace mode, see "3.8 Maintenance mode."

(1) To display the User mode, press the MODE key in the measurement mode.

(2) Point the cursor to "Parameter Setting" by pressing the ▲ or ▼ key. Press the ENT key.



(3) In the "Parameter Setting" screen that appears, point the cursor to any item you want to set by pressing the ▲ or ▼ key. Press the ENT key.



(4) Enter a numerical value and change the setting by pressing the ▲ or ▼ key, and then move the cursor rightward by pressing the ▶ key.
Parameter setting is executed by the entered set value when the ENT key is pressed.

Parameter	Set day of week
Current Time	05/01/27 THU 13:50
Key Lock	OFF
Output Hold	OFF Current
Reset Av. Output	Reset
Response Time	
Average Period	
Backlight Timer	ON 5 min
To Maintenance Mode	0000

⇓ ▼ ▲ ▶ ENT

End of Parameter Setting

To close Parameter Setting screen

To close the "Parameter Setting" screen or cancel this mode midway, press the ESC key.
A previous screen will return.

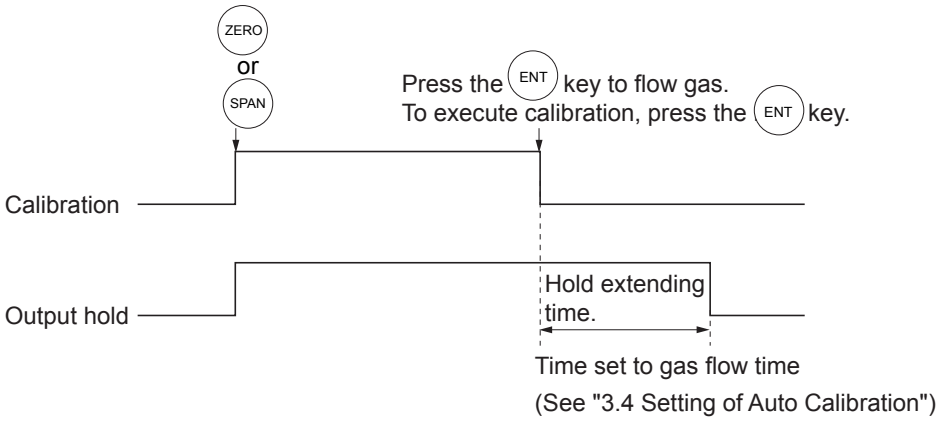
Setting Range

- Hold setting : 0 to 100% FS
- Response Time : 1 to 60sec. (Initial value: 15 sec)
- Average Period : 1 to 59 min or 1 to 4 hours (Initial value: 1 hour)
  When minute is set for the unit: 1 to 59
  When hour is set for the unit: 1 to 4
- Backlight Timer : 1 to 60 min (Initial value: OFF)
- Maintenance mode : 0000 to 9999 (Initial value: 0000)

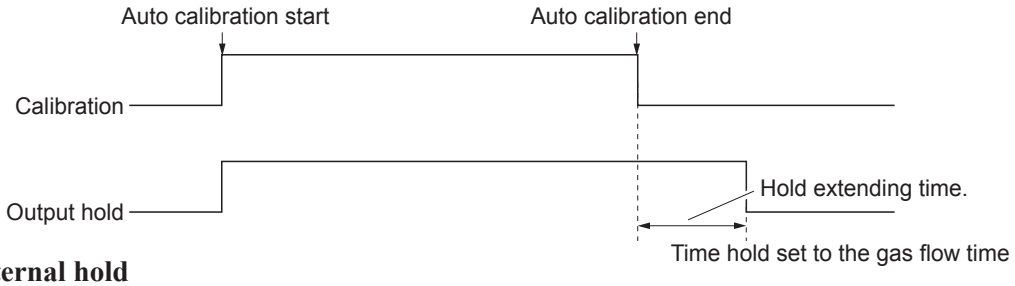
Output Hold

By setting an output hold to "ON," an output signal of each channel (component) is held during the calibration (manual calibration and auto calibration) and for the gas flow time (refer to "3.4 Setting of Auto Calibration"). Regardless of Hold ON/OFF setting, an output signal can be held via an external input.

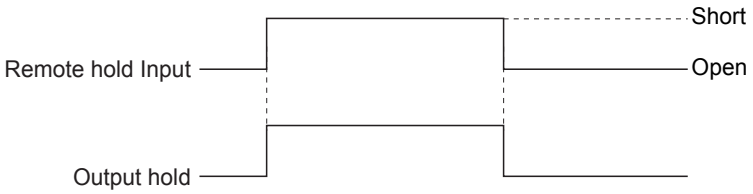
(1) Operation during manual calibration



(2) Operation during auto calibration



(3) External hold



(4) Screen display during Holding

The “on Hold” message blinks on the measurement screen.

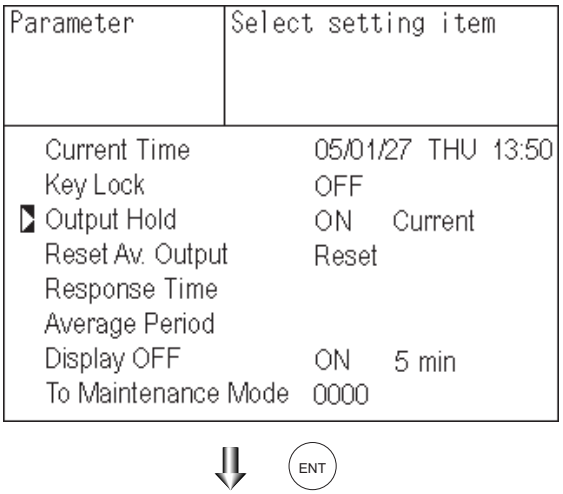
Since the screen displays the process of calibration during calibration, “on Hold” is not displayed even if the output signal is held until the hold extending time.

(5) If calibration is canceled after calibration regardless of during the manual calibration or auto calibration, the output of hold extending time is held.

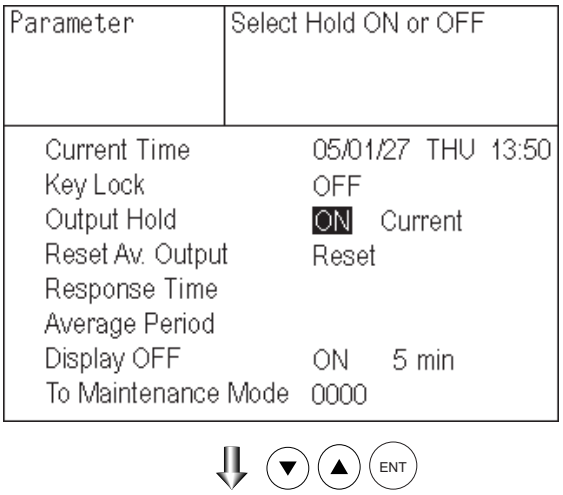
(6) You can select the value for hold from the value immediately before entering output hold, "current," and arbitrary value, "setting."

Follow the procedures shown below to make the setting.

1) Press the ENT key in a state where the cursor is placed next to Hold.

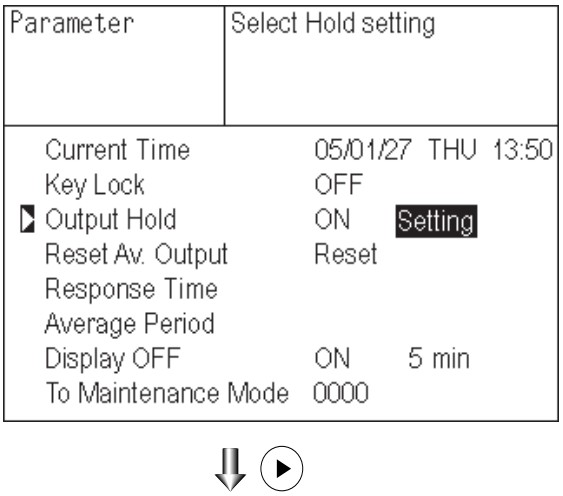


2) "ON" or "OFF" is highlighted. Press the ▲ or the ▼ key to select ON or OFF. Press the ENT key to register.

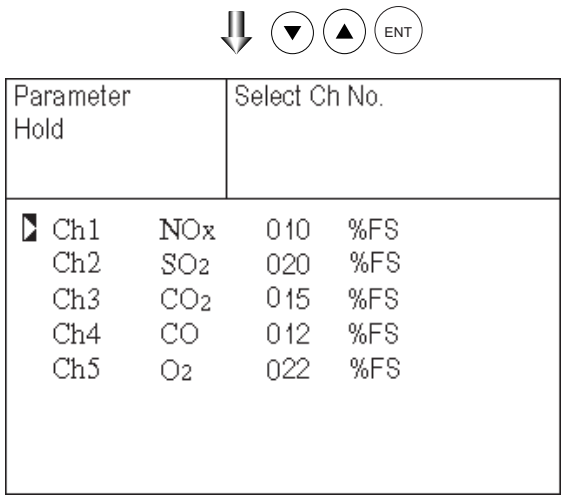


3) Press the ▶ key in a state ON/OFF is highlighted, and "Current" or "Setting" is highlighted. Select "Current" or "Setting" by pressing the ▲ or the ▼ key.

4) Press the ENT key while "Current" is selected to return to (1). Press the ENT key while "Setting" is selected to go to the setting entering screen.
"Current": Holds the value immediately before the hold.
"Setting": Holds the value arbitrarily set.

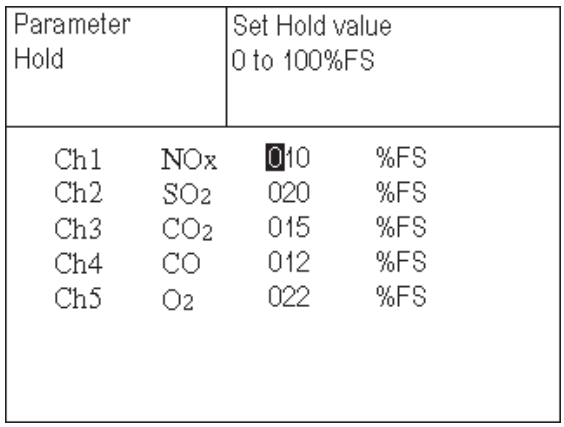


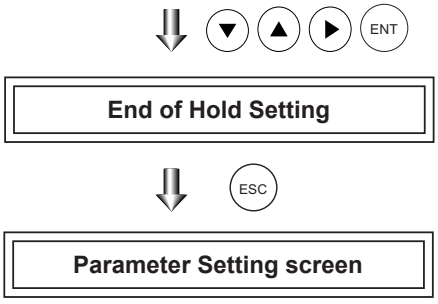
5) On the parameter hold screen that appears, move the cursor next to the Ch (component) you want to make the setting by pressing the ▲ or the ▼ key, and then press the ENT key.



6) The value is highlighted, indicating that the value can be changed. Change the value by pressing the ▲ or the ▼ key, and then move the cursor to the right by pressing the ▶ key.

7) After the value is changed, press the ENT key.





Meaning of setting

The setting is expressed in % against the range for both ranges.
When 0 to 1000 ppm is selected as the range, for example, if 10% FS is selected as hold setting, the output equivalent to 100 ppm is output and held irrespective of the measured value at that time.

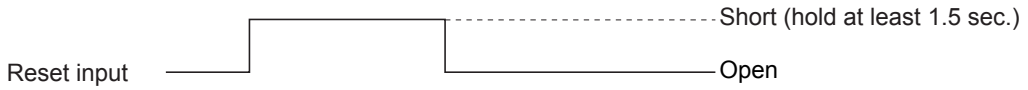
8) Press the ESC key to return to the parameter setting screen.

Description of setting

- Instantaneous value display of the measurement cannot be held. (Only output can be held)
- If set value is selected for hold, instantaneous O_2 converted value is calculated based on the set value and held.
- Range identification contact output cannot be switched even if the range is switched during the hold.

Average value reset

This mode is used to clear all average values O_2 converted average and O_2 average, and restarts averaging. All average values are reset at a time. The indication value and output value is 0 ppm, vol% or so at the time of the reset input (Refer to the average period).



So long as short, resetting lasts.
At the edge of changing from shorting to opening, the average action restarts.

Response time

The response time of the electrical system can be changed.

Setting is available by components.

Note) It does not provide exact seconds for the setting time, but it gives a guide of the setting time.

The setting value can be modified as requested by the customer.

Parameter Response Time	Select Ch No.

Ch1	NOx	10	sec.
Ch2	SO_2	20	sec.
Ch3	CO_2	15	sec.
Ch4	CO	12	sec.
Ch5	O_2	22	sec.

Average period

It allows you to set an average period of the average value of O_2 converted and O_2 average.

It enables you to set an average time of 1 to 59 minutes (1-minute step) or 1 to 4 hours (1-hour step).

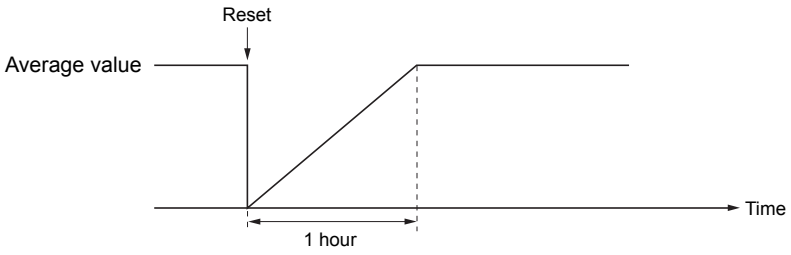
Changing the setting resets the average value of O_2 converted and O_2 average value. (Pressing the ENT key validates the resetting only for components whose setting was changed.)

Parameter Average Period	Select Ch No.

Ch9	$\overline{CU}$ NOx	01	hour
Ch10	$\overline{CU}$ SO_2	01	hour
Ch11	$\overline{CU}$ CO_2	01	hour
Ch12	$\overline{AV}$. O_2	01	hour

Example of average action

In case the average period was set to 1 hour.



- Sampling occurs every 30 seconds.
- Every 30 seconds, the average for last 1 hour (time setting) is output.
- At the instant of resetting, zero is assumed for all past values. It means that the average value will not be correct for 1 hour after resetting.

Backlight Timer

Automatic OFF setting of the backlight of the LCD unit can be made.

When the specified time elapses from when the measurement screen is resumed, the backlight is automatically turned off. Press any key to return from backlight OFF.

Only when "ON" is selected, the time until auto "OFF" is displayed. Press the ▶ key in this state, and the time setting can be changed by pressing the ▲ or the ▼ key. Press the ENT key to confirm the selection. If "OFF" is selected, the backlight is not turned off.

Parameter	Select ON or OFF

Current Time	05/01/27 THU 13:50	
Key Lock	OFF	
Output Hold	ON	Previous value
Reset Av. Output	Reset	
Response Time		
Average Period		
Backlight Timer	ON	5 min
To Maintenance Mode	0000	

Maintenance mode

Enter the password and then press the ENT key to enter the maintenance mode. The password can be set by the password setting in maintenance mode. Default password setting at the time of delivery from the factory is "0000." You can enter the maintenance mode with the value before it is changed.

3.8 Maintenance mode

This mode is used for check of sensor input values, display of error log files or setting of passwords, etc. First, enter a password and then use it from the next operation. This mode is displayed by selecting the Maintenance Mode from "3.7 Parameter Setting."

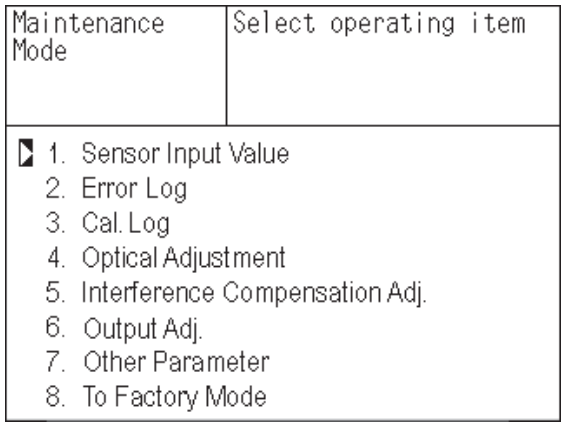
(1) Select the Maintenance mode from the Parameter Setting screen to display the Password Setting screen.

(2) Enter the password, and the Maintenance Mode item selection screen will be displayed. Point the cursor to the item you want to set by pressing the ▲ or the ▼ key and press the ENT key.

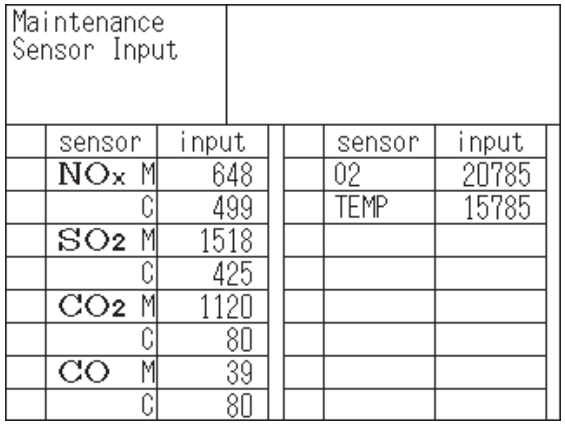
(3) Next, each Maintenance screen is displayed.

Note) "To Factory Mode" is used for our service engineers only. Refrain from using this mode.

(4) Press the ESC key to return to the Maintenance Mode item selection screen from each screen.



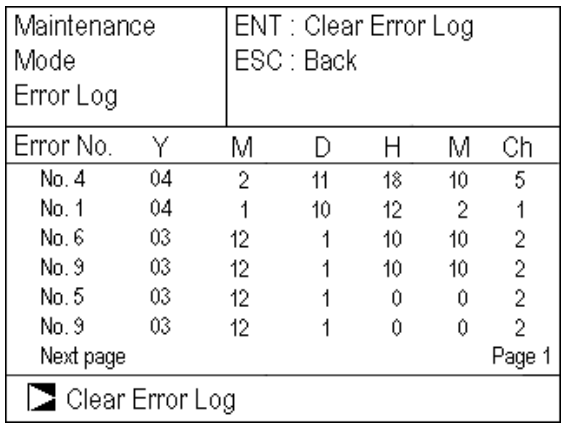
- **Sensor Input Value screen**



Description of Sensor Input Value screen

- NOx M : NOx sensor input value
- NOx C : NOx interference compensation sensor input value
- SO_2 M : SO_2 sensor input value
- SO_2 C : SO_2 interference compensation sensor input value
- CO_2 M : CO_2 sensor input value
- CO_2 C : CO_2 interference compensation sensor input value
- CO M : CO sensor input value
- CO C : CO interference compensation sensor input value
- Temperature : temperature sensor input value
- O_2 : O_2 sensor input value

- **Error Log screen**



Description of Error Log screen

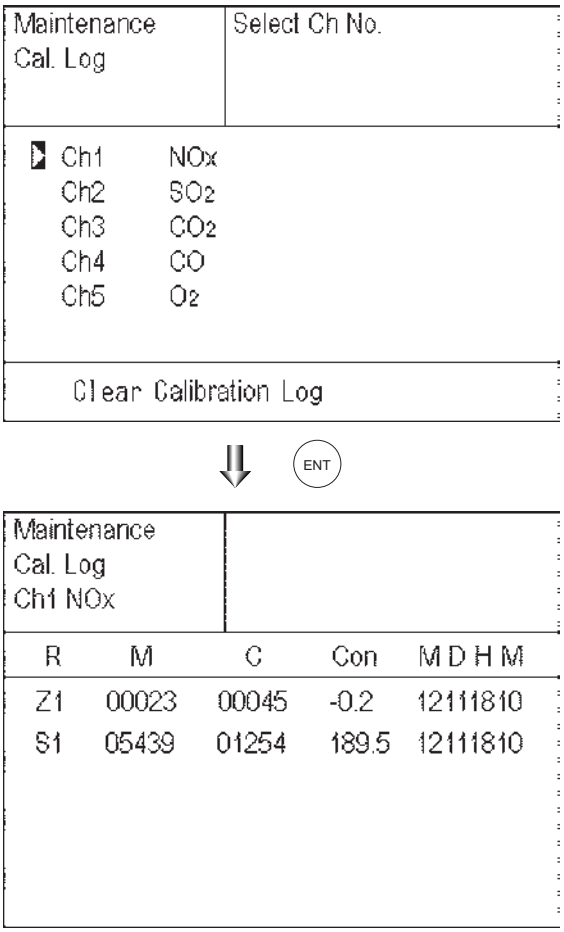
Error history. Fourteen newest errors are logged. For error number, date and time (year, month, day, time) of occurrence, channel and other details of error, refer to "6.2 Troubleshooting for analyzer unit" Select Clear Error Log and press the ENT key, and the error log is cleared completely.

- **Calibration Log screen**

Description of Calibration Log screen

Past calibration history.
Sensor input value, concentration value, and the date when zero/span calibration is performed are logged. The 10 newest calibration data is logged by each component.
Move the cursor to Clear Calibration Log and press the ENT key, and the calibration log is cleared completely.

Z1 : Zero calibration (Z) of Range 1
S1 : Span calibration (S) of Range 1
M : Value of measuring detector at the time of calibration
C : Value of the interference compensation detector at the time of calibration
Con : Displayed concentration value before calibration

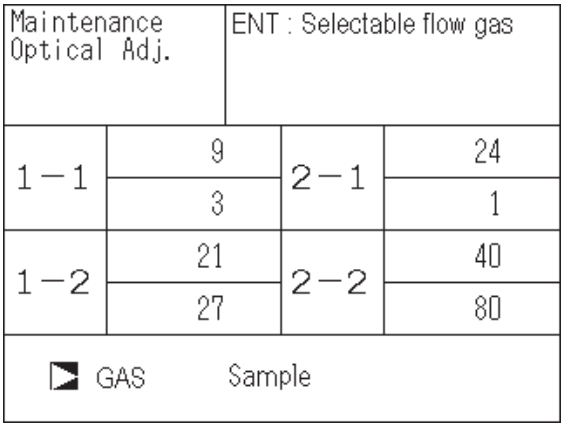


Caution

If the following operation is performed incorrectly, it may be an obstacle to the measurement.

- **Optical adjustment screen**

For details of this item, refer to "4.4.2 Optical balance adjustment and moisture interference adjustment of gas analyzer unit."
Press ENT key and turn "ON" the solenoid valve driving signal for each calibration gas by using the ▲ or the ▼ key.



- **Moisture interference adjustment screen**

  For details of this item, refer to "4.4.2 Optical balance adjustment and moisture interference adjustment of gas analyzer unit."

Description of moisture interference adjustment screen

In values on the left side of screen, the moisture interference for each component is already compensated.
The figures at right are interference compensation coefficients.

Move the ▶ cursor to a desired Ch (component) by pressing the ▲ or the ▼ key, and then press the ENT key, and the selected value at right is highlighted.
Check that the gas for moisture interference adjustment is flowing, change the moisture interference compensation coefficient using the ▲ or the ▼ key, adjust the value at left so that it becomes near zero, and then press the ENT key to log moisture interference compensation value.

Caution

Since an interference compensation detector is not provided if the 1st range is beyond 0 to 10 vol%, no interference adjustment can be performed (no need).

Maintenance		Select Ch No. with UP / DOWN and ENT Back with ESC	
▶ Ch1	NOx	10	1.252
Ch2	SO_2	-33	0.983
Ch3	CO_2	13	0.000
Ch4	CO	20	1.922
ALL			
Valve OFF			

⇓ ▼ ▲ ENT

Maintenance		Adjust with UP / DOWN ENT : Memorized ESC : Back	
Ch1	NOx	0	1.263
Ch2	SO_2	-33	0.983
Ch3	CO_2	13	0.000
Ch4	CO	20	1.922
ALL			
Valve OFF			

- **Output adjustment screen**

Description of output adjustment screen

Analog output adjustment screen.
Connect the digital multi meter to the output terminal corresponding to the number of OUT to be adjusted, and adjust the value so that 4mA or 0V is output at zero and 20mA or 1V is output at span.

Move the cursor using the ▲, ▼, or the ▶ key to the output (OUT No. and zero/span) to be adjusted, and then press the ENT key.

The selected value is highlighted. Adjust the value, while watching the output, by pressing the ▲ or the ▼ key. Press the ▶ key to select the next digit.

On completion of the adjustment, press the ENT key.

Maintenance Mode Output Adj.			Adjust OUTPUT ZERO and SPAN		
OUT	Zero	Span	OUT	Zero	Span
1	01245	11845	7	01900	12500
2	01245	11845	8	01900	12500
3	01245	11845	9	01900	12500
4	01245	11845	10	01900	12500
5	01245	11845	11	01900	12500
6	01245	11845	12	01900	12500

Maintenance Mode Output Adj.			Zero / Span adjustment		
OUT	Zero	Span	OUT	Zero	Span
1	01245	11845	7	01900	12500
2	01245	11845	8	01900	12500
3	01245	11845	9	01900	12500
4	01245	11845	10	01900	12500
5	01245	11845	11	01900	12500
6	01245	11845	12	01900	12500

- **Other parameter**

Description of each setting screen

Password Set : Set the password used to move from the parameter setting screen to the maintenance mode. Arbitrary 4-digit number can be selected.

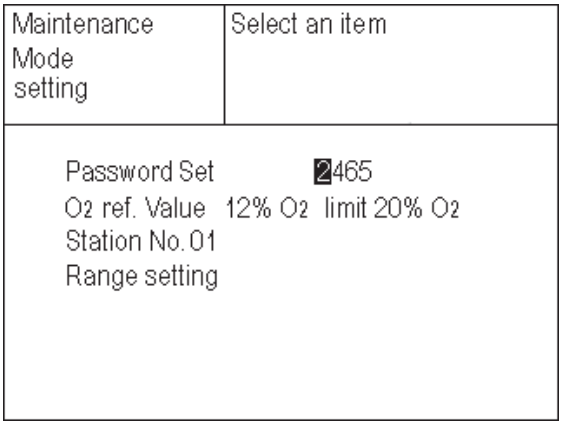
O_2 ref. Value : Set the oxygen concentration reference value at the time of oxygen converted calculation. Settable in the range from 00 to 19%.

Limit : Set the oxygen concentration limit at the time of oxygen converted calculation. Settable in the range from 01 to 20%. (Initial value:17%)

* Refer to the O_2 conversion concentration value in "1.5.3 Outline of display screen" for oxygen converted calculation procedure.

Station No. : Set the station No. for MODBUS communication. Settable in the range from 00 to 32.

Range setting : Moves to the screen on which measurement range is changed.



Press the ▲ or the ▼ key to move the cursor to the item whose setting is to be changed.

The values for password, oxygen correction, limit, and station No. are highlighted.

Press the ▲ or the ▼ key to change the value to desired one, and then press the ENT key.

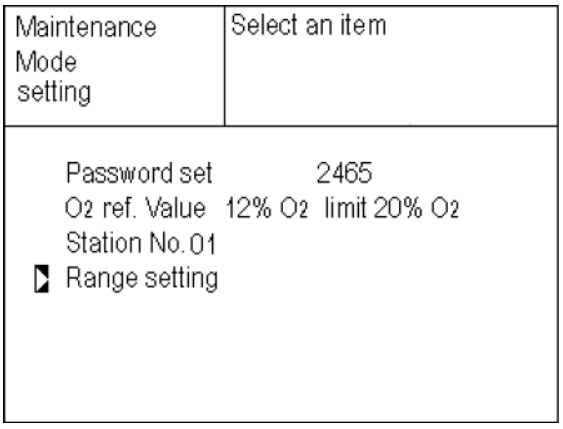
Note: Pay attention not to forget the password. Otherwise you cannot enter the maintenance mode.

<How to set/change the range>

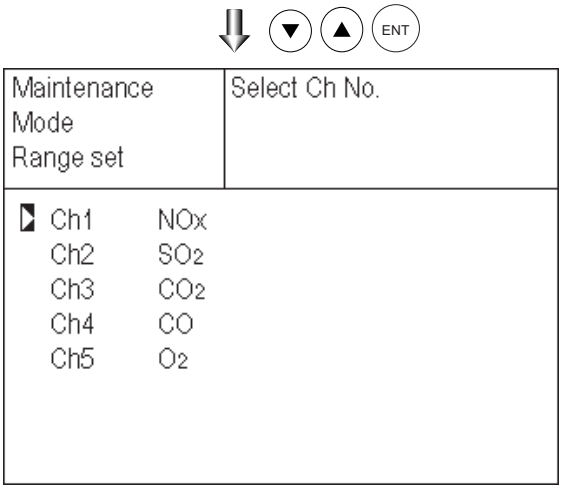
The measurement range can be arbitrarily selected in the minimum and the maximum range specified at the time of purchase. The range to be used can be selected 1 or 2.

* This setting is permitted in the case of "Without examination under Measurement Law." This setting screen is not displayed in the case of "With examination under Measurement Law."

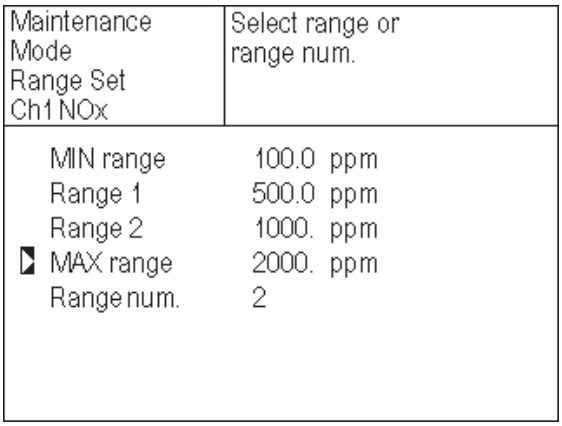
(1) Move the cursor to the item to be set by pressing the ▲ or the ▼ key, and then press the ENT key.



(2) Move the cursor to the Ch (component) whose setting is to be changed by pressing the ▲ or the ▼ key, and then press the ENT key.



(3) Move the cursor to the item whose setting is to be changed by pressing the ▲ or the ▼ key, and then press the ENT key.

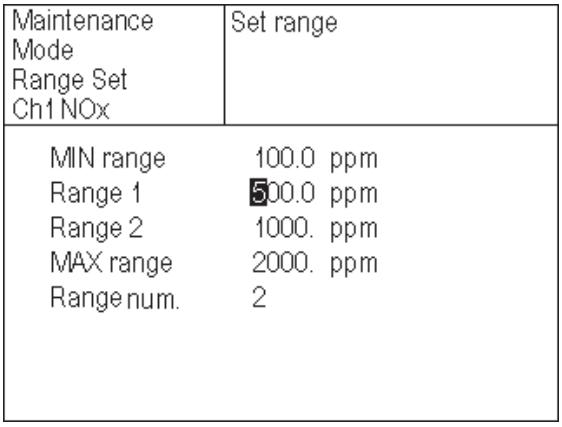


Settable range

The value for range 1 and range 2 must fall within the range from the MIN and the MAX range (including the MIN and the MAX range), and at the same time range 1 must be smaller than range 2.
The number of ranges is 1 or 2.

(4) Press the ▲ or the ▼ key to change the value. Press the ▶ key to select the next digit. In a state where the decimal point is highlighted, press the ▲ or the ▼ key, and the decimal point position can be changed.

(5) When necessary change is made, press the ENT key.



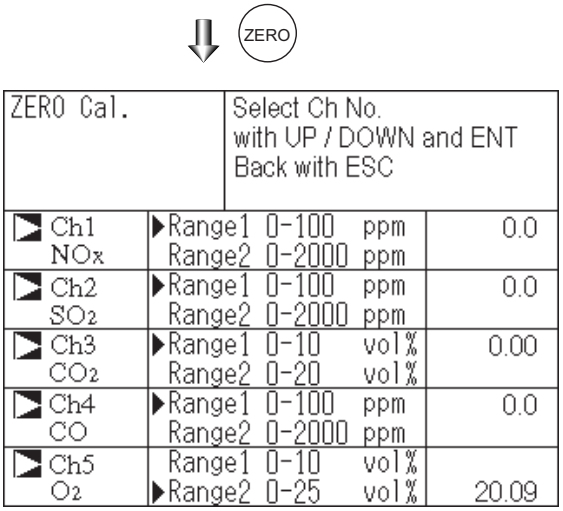
End of range setting / change

3.9 Calibration

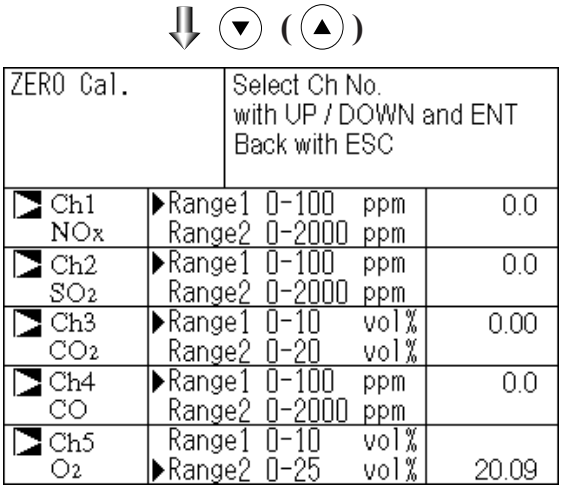
3.9.1 Zero calibration

It is used for zero point adjustment. For zero calibration gas, suited for an application should be used according to "2.2.3 Preparation of standard gas."

(1) Press the ZERO key on the Measurement screen to display the Manual Zero Calibration screen.



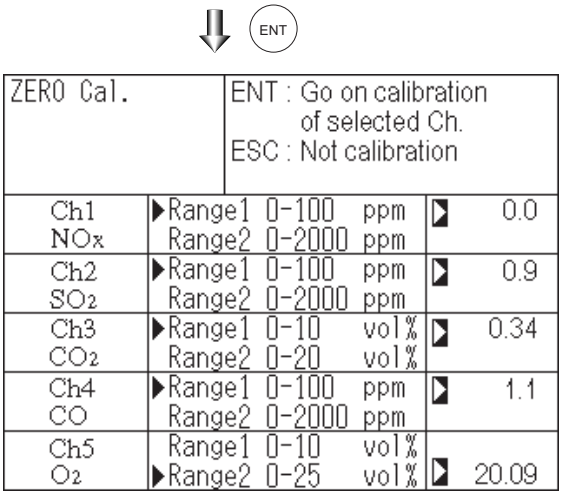
(2) Select the Ch (component) to be calibrated by pressing the ▲ or ▼ key. After selection, press the ENT key, and zero gas will be supplied.



Caution

For the Ch (components) that is set to "both" in the "Zero Calibration" of the Calibration Setting mode, zero calibration is also carried out at the same time.

(3) Wait until the indication is stabilized with the zero gas supplied. After the indication has been stabilized, press the ENT key. Zero calibration in range selected by the cursor is carried out.



Note: For the Ch (component) for which "AR" is selected in "3.1.1 Setting of range switch mode" the cursor automatically moves to the range selected in "3.2.4 Setting of auto calibration component/range", and calibration is carried out within that range.

To Measurement screen after executing Manual Zero Calibration

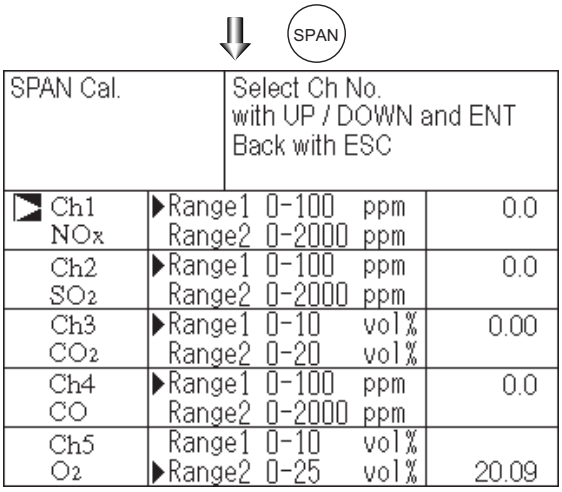
To close "Zero Calibration"

To close the "Zero Calibration" or cancel this mode midway, press the ESC key. A previous screen will return.

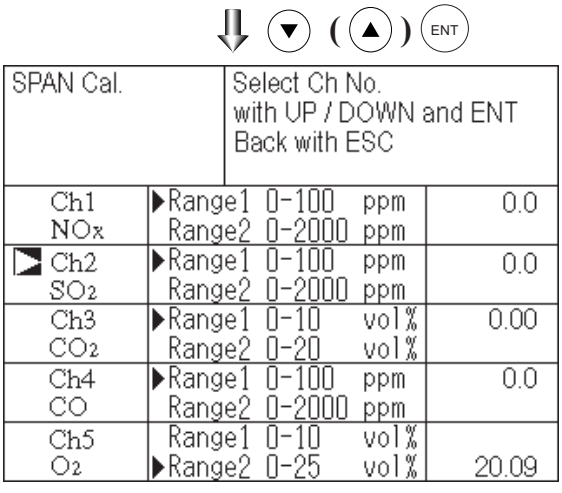
3.9.2 Span calibration

It is used to perform a span point adjustment. Supply calibration gas with concentration set to the span value to perform the span calibration. For the span calibration gas for the NO_X, SO_2, CO_2, CO analyzer , use the standard gas with a concentration of 90% or more of the range value.
For the span calibration gas for the O_2 analyzer , use the standard gas with a concentration of 90% or more of the range value when measuring with the built-in magnetic O_2 meter, and use the standard gas of about 1 to 2 vol% when measuring
with an external zirconia O_2 analyzer.

(1) Press the SPAN key on the Measurement screen to display the Manual Span Calibration screen.



(2) Select Ch (component) to be calibrated by pressing the ▲ or ▼ key and press the ENT key. The calibration gas is supplied.

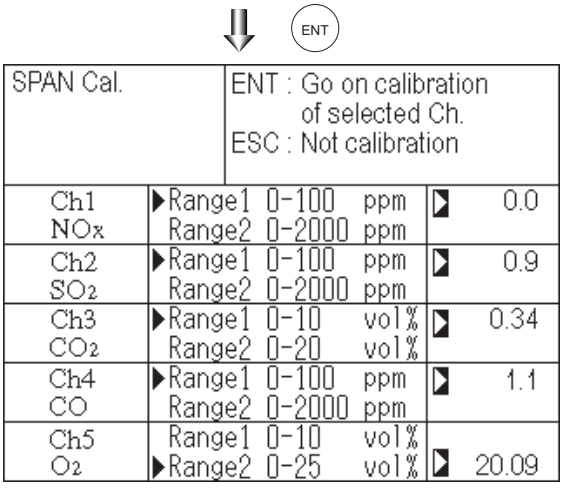


Caution

When "both" from "Calibration Range" of the Calibration Setting mode is set, span calibration is performed together with 2 Ranges.

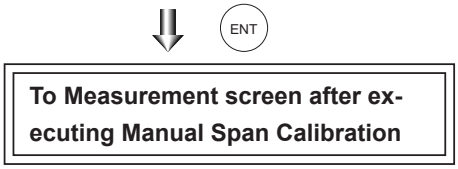
(3) Wait until the indication is stabilized in the state where the calibration gas is supplied. After the indication has been stabilized, press the ENT key. Span calibration of Range selected by the cursor is performed.

Note: For the Ch (component) for which "AR" is selected in "3.1.1 Setting of range switch mode" the cursor automatically moves to the range selected in "3.2.4 Setting of auto calibration component/range", and calibration is carried out within that range.



To close "Span Calibration"

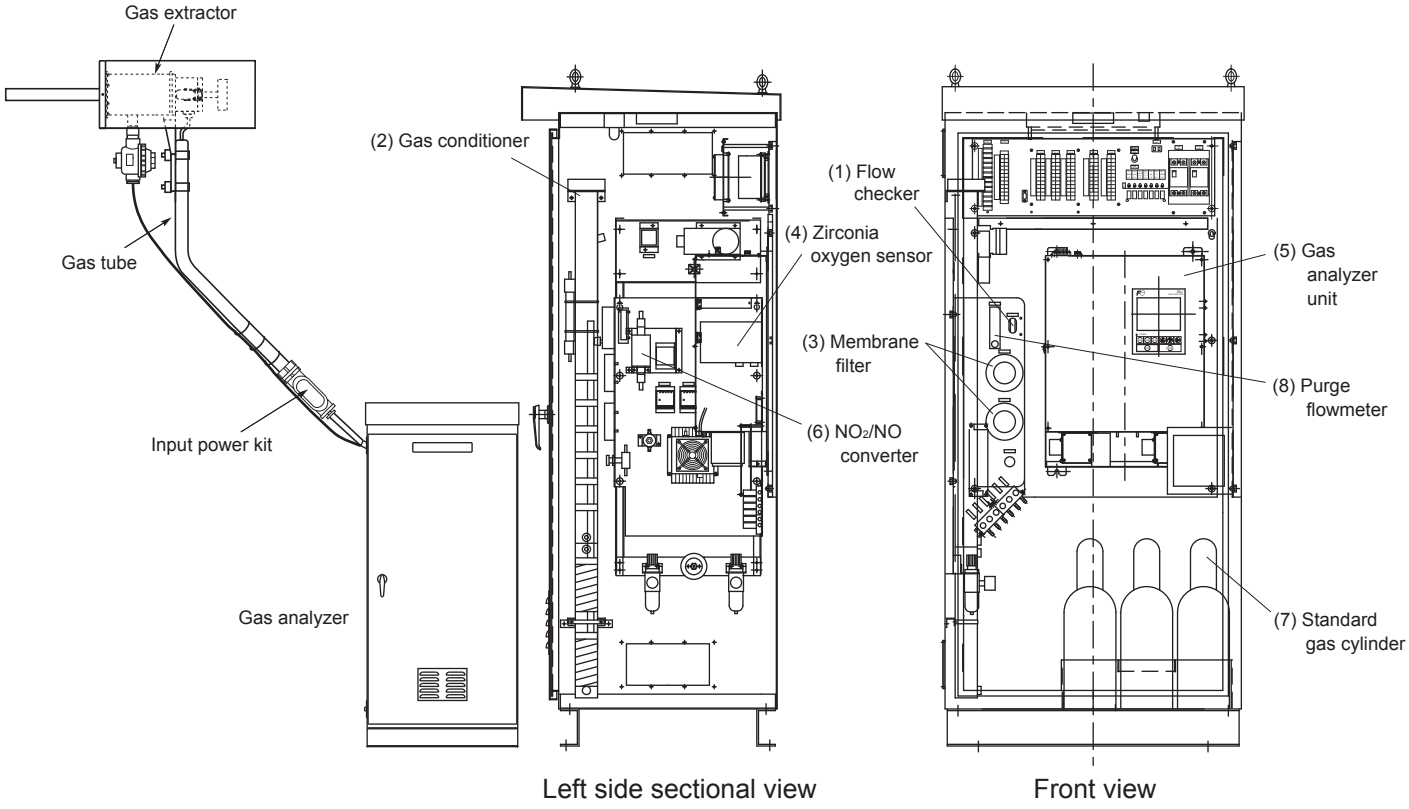
To close the "Span Calibration" or cancel this mode midway, press the ESC key.
A previous screen will return.



4. MAINTENANCE AND CHECK

4.1 Daily check (Check should be performed daily.)

4.1.1 Check point



	Unit name	Description	Criteria for judgment	
(1)	Flow checker	Flow rate check.	The value is in the center range.	See Section 4.1.2 for details.
(2)	Gas conditioner	Check the water level in the air suction tube.	Reference height 50 mm or higher.	
(3)	Membrane filter	Check for contamination.	No contamination shall be observed.	
(4)	Zirconia oxygen sensor	Check the temperature.	800°C ±5°C	
(5)	Gas analyzer unit	Check the reading.	Shall be of the normal level.	
(6)	NO_2/NO converter	Check the temperature.	220°C ±5°C	
(7)	Standard gas	Check the residual pressure.	1 MPa or higher.	
(8)	Purge flowmeter (when equipped with gas dryer)	Check the flow rate.	1 L/min ±0.2 L/min	

4.1.2 Details of daily check items (for the standard version)

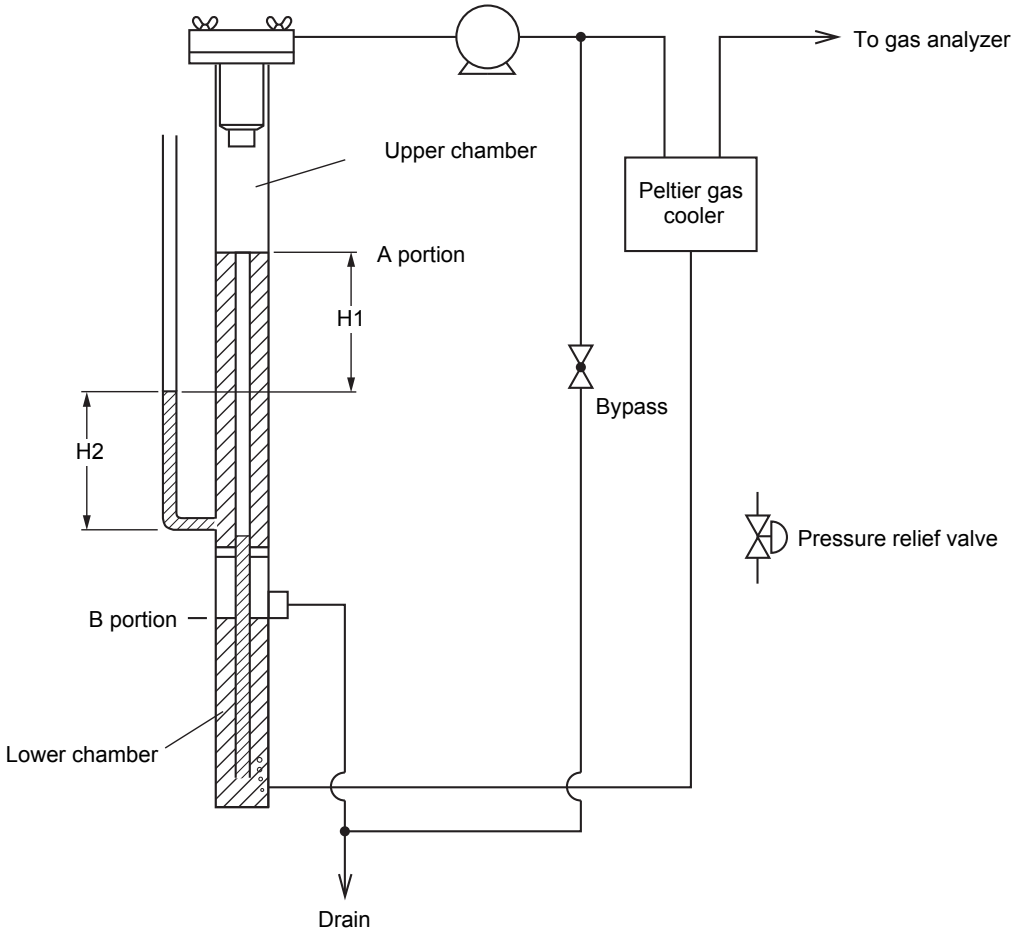
Check should be performed daily about the following items:

<table>
<tr><th>Maintenance & check items</th><th>Maintenance & check procedures</th></tr>
<tr><td>(1) Checking the sample flow rate
(2) Checking the gas conditioner</td><td>(1) The flow rate measured by the flow checker shall be in the specified range (center range).
(2) There shall be no bubbling in the gas conditioner.

1) If the flow rate measured by the flow checker is not in the specified range in (1):
Adjust the flow rate so that it is in the specified range with a needle valve. (Refer to “2.3.5 Warm-up operation” for the adjustment method.)
Adjustable → Check the gas conditioner for bubbling.
Unadjustable → Check the gas conditioner for bubbling.
No bubbling → Normal
No bubbling → (Refer to “6.1 Troubleshooting ” for the check method.) Check the following items:
▪ Gas aspirator
▪ Mist filter
▪ Peltier gas cooler
▪ Sampling devices and joints
Bubbling is observed. → (Refer to “6.1 Troubleshooting” for the check method.) Check the following items:
▪ Flowmeter
▪ Membrane filter
▪ Peltier gas cooler
▪ Zirconia oxygen analyzer
▪ Gas conditioner
▪ Piping
▪ Capillary
▪ Sampling equipment, couplings</td></tr>
<tr><td>(3) Check of the water level in the air suction tube of gas conditioner</td><td>1. H2 must be 50 mm or higher. (See Fig. 4-1.)
2. If H2 is less than 50 mm: (See Fig. 4-1.) Check of the gas extractor filter and gas tube is required.
→ • Clean the wire mesh filter of the gas extractor, if clogged. (See “4.3.1 Maintenance of gas extractor.”)
→ • Check the gas tube for clogging. (Remove the tube, and eliminate clogging by feeding compressed air or water through the tube.)
→ • Check gas extractor joint for clogging. (Disconnect joint and eliminate clogging.)</td></tr>
</table>

Maintenance & check items	Maintenance & check procedures
4) Check of the membrane filter	1. Visually check membrane filter for contamination. (1) If the membrane filter is much clogged (See Section 4.3.3.); → • If the contamination is excessive, check pre-stage filters such as the gas extractor, wire mesh filter, and mist filter.(See Section 4.3.1 and Section 4.3.2.) Then replace the membrane filter.
(5) Check of the zirconia oxygen sensor outlet tube	1. Check that sensor temperature is 800°C ±5°C, or check if the outlet tube is clogged with deposits of crystal if SO_2 concentration in sample gas is high. Note) Use care since the sample outlet is as high as at 50°C.
(6) Check the analyzer	Check the analyzer if the measured value is not normal. (Refer to "6.1 Troubleshooting" for the check method.) ▪ If the value is extremely higher than the expected value: → Check the zero, span, sample cell, gas conditioner (in the case of oxygen concentration), airtight (in the case of oxygen concentration), and measurement range. ▪ If the value is extremely lower than the expected value: → Check the zero, span, gas conditioner (in the case of other than oxygen concentration), airtight (in the case of other than oxygen concentration), gas dissolution, and measurement range. ▪ If no value is indicated. → Check the zero, span, power supply, and fuse.
(7) Check of temperature controller for NO_2/NO converter (if provided)	1. Make sure the temperature is controlled at approx. 220°C ±5°C.
(8) Standard gas	1. Check the residual pressure. Primary pressure: 1MPa or higher
(9) Purge flow rate (when the gas drier is provided)	The flowmeter in (9) shall be 1 L/min ±0.2 L/min.
(10) Gas extractor	Shall be heated. (Be careful about the handle for filter replacement since it is heated to high temperatures (about 60°C).)
(11) Recorder (option)	Refer to the instruction manual of the recorder.

4.1.3 Points of daily check



H1: Sample negative pressure degree

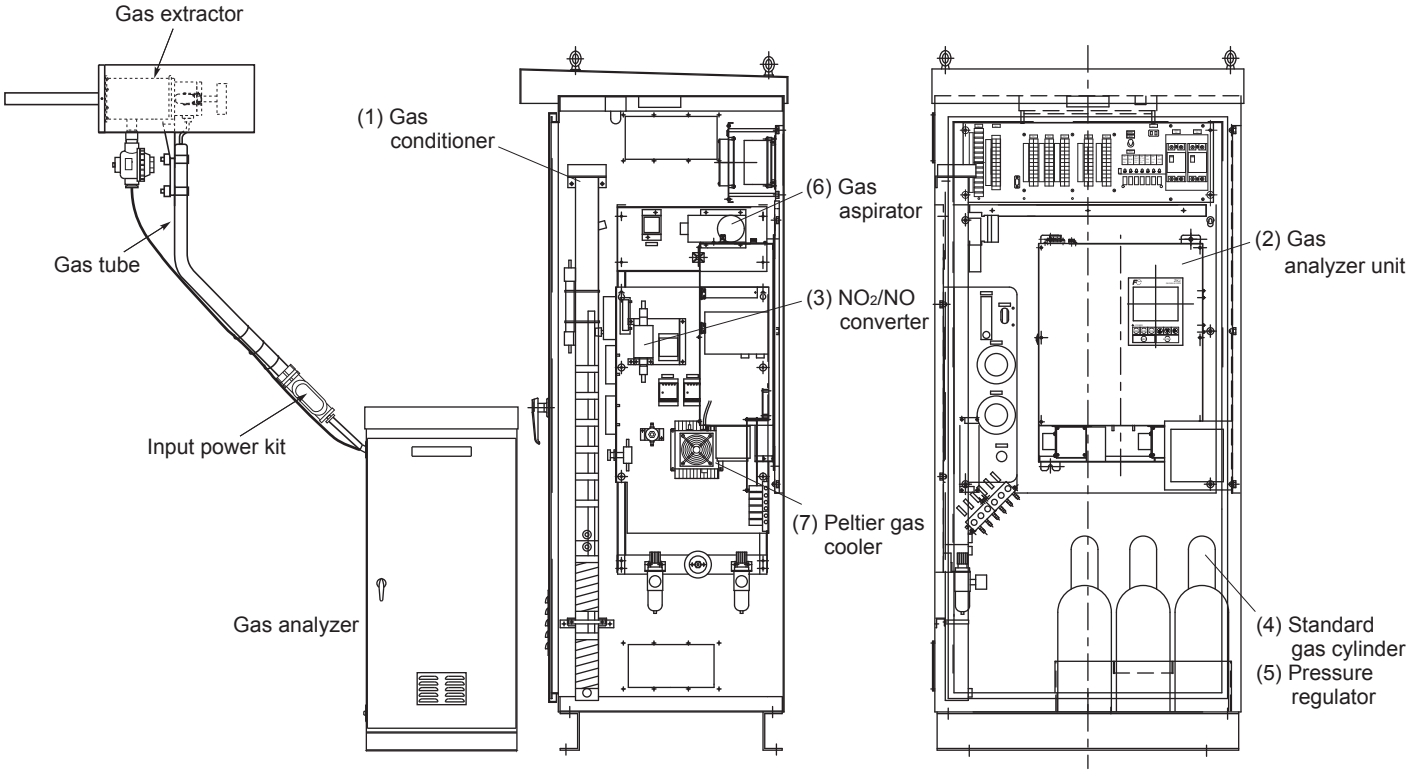
(1) It is satisfactory if H_2 is 50 mm or higher.

(2) Check of the extractor filter and the external tube is required, if H_2 is less than 50 mm.

Fig. 4-1

4.2 Periodical check

4.2.1 Points of periodical check



	Unit name	Description of check	
(1)	Gas conditioner	Check the water level and water quality.	See Section 4.2.2 for details.
(2)	Gas analyzer unit	Calibrate and overhaul.	
(3)	NO_2/NO converter (if provided)	Replace the catalyst.	
(4)	Standard gas	Check the filling pressure and warranty period.	
(5)	Pressure regulator	Check for leakage.	
(6)	Gas aspirator	Replace the diaphragm, wash or replace the valve.	
(7)	Peltier gas cooler	Check the temperature control action and the fan.	
(8)	Gas conditioner filter	Check the filter and the O ring.	
(9)	Gas extractor	Check the flange, filter, and O ring.	
(10)	Capillary	Replace.	
(11)	Tubing	Wash and replace.	
(12)	Mist catcher	Replace the catcher.	

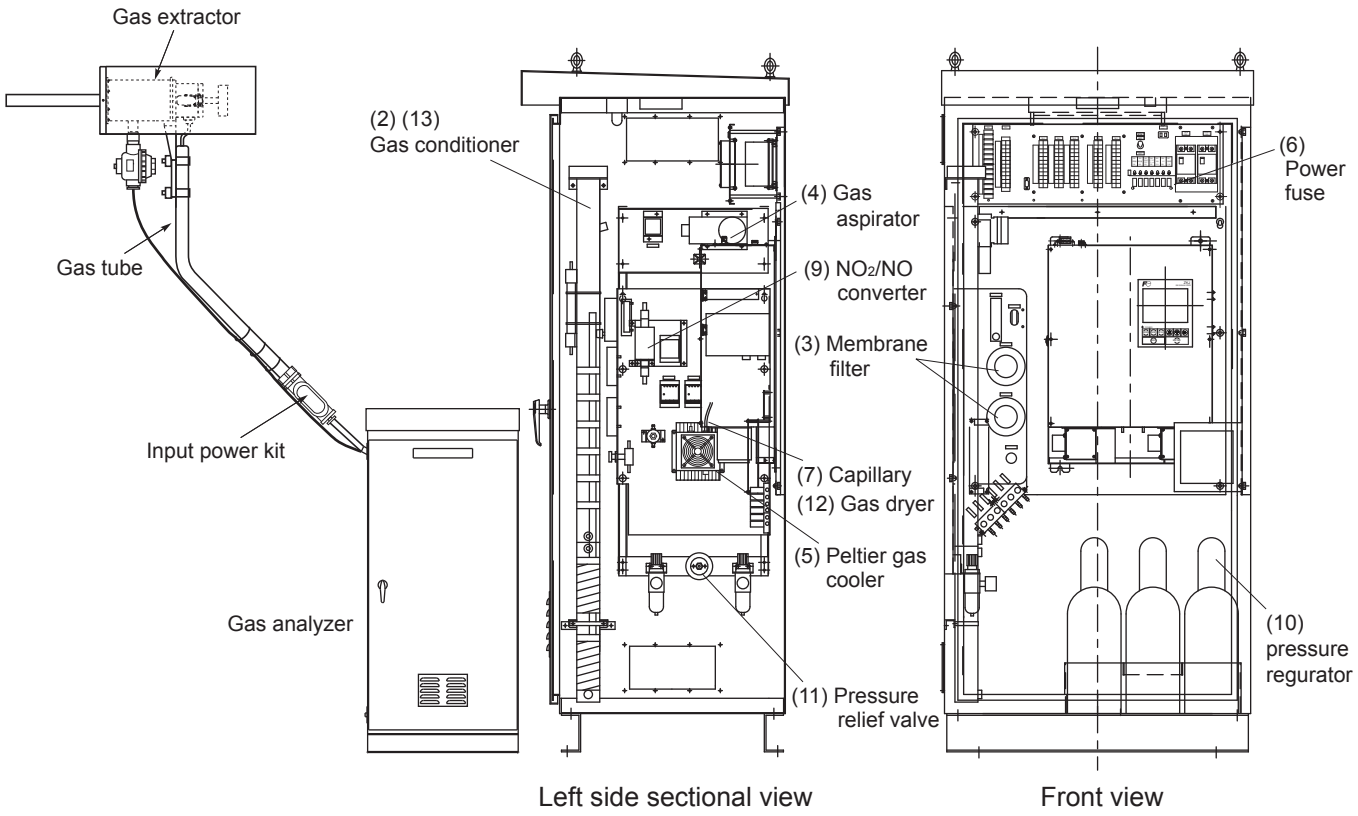
4.2.2 Details of periodical check items

Check should be performed periodically about the following items:

	Maintenance & check items	Recommended cycle	Maintenance & check procedures
(2)	Manual calibration of analyzer	Once/week	1. Perform zero/span calibration (See Section 3.9).
(4)	Filling pressure of standard gas (3.4L cylinder)		1. If filling pressure is 1MPa or less, replace the standard gas cylinder (See Section 4.3.10).
	Warranty period of standard gas		1. If the primary pressure gauge (right) for the Pressure regulator drops to 1.5MPa, please order a standard gas cylinder. If the pressure gauge is 1MPa or less, please replace the standard gas cylinder with a new one. (See section 4.3.10)
(1)	Water level of gas conditioner	Once/month	1. If the water level is below A and B of the gas conditioner (See Fig. 4-1), supply water by supplied water bottle (See Section 4.3.13).
(12)	Mist catcher	Once/ 4 months	1. Replace.
(8)	Gas conditioner filter and O-ring	Once/ 6 months	1. Replace gas conditioner filter every 6 months or if it turns black (See Section 4.3.2). 2. Replace O-ring at the gas conditioner filter every 6 months or if it cracks (See Section 4.3.2).
(10)	Capillary		1. Replace if clogged (See Section 4.3.7).
(6)	Diaphragm type gas aspirator		1. Wash the diaphragm clean by water if foreign matter is attached, or replace (See Section 4.3.4). 2. Turn valves by 90° before using them if they are dirty, or replace valves after they are used once (see Section 4.3.4).
(5)	Leaks through Pressure regulator		1. Set the secondary pressure (pressure gauge on the left) to about 29 kPa, and close the stop valve of the standard gas cylinder. Read and record the primary pressure gauge (pressure gauge on the right). After maintaining the condition for about one hour, check the primary gauge (pressure gauge on the right). If the value of the gauge is not reduced, there is no leakage. If leakage is found, retighten the connection or replace the packing. Note: Before performing the above operation, check that automatic calibration does not start during the leakage inspection.
(9)	Metal mesh filters and O ring for gas extractor	Once/year	1. Replace O-ring once a year or if it cracks (See Section 4.3.1). 2. If the metal filter is dirty, wash it clean (See Section 4.3.2) or replace the filter (See Section 4.3.1).
	Gas extractor flanges		If leaks are found via flanges, retighten or replace.
(7)	Peltier gas cooler		1. Check the operation of the fan. 2. Check the temperature. (See Section 4.3.5).
(11)	Contamination of piping or leaks		1. Wash it clean or replace.
(1)	Water in the gas conditioner		If water in the gas conditioner is dirty, clean.
(2)	Analyzer unit		1. Regardless of any phenomena that occurred, overhaul.
(3)	Catalyst of NO_2/NO converter (if provided)		1. Replacement (NO_2, once/year at 7 ppm or lower)

4.3 Details of maintenance procedure for sampling equipment

Refer to “5. SPARE PARTS” for part list.



	Refer to	Unit name	Check/Replacement	Criterion/Period
(1)	4.3.1	Gas extractor	Replace the wire mesh filter and packing. Clean the wire mesh filter.	1 year
(2)	4.3.2	Gas conditioner	Replace the gas conditioner filter.	6 months
(3)	4.3.3	Membrane filter	Replace the filter.	2 to 6 months
(4)	4.3.4	Gas aspirator	Replace the valve and diaphragm.	6 months
(5)	4.3.5	Peltier gas cooler	Check the cooling temperature and replace.	1 year
(6)	4.3.6	Power fuse	Replace.	—
(7)	4.3.7	Capillary	Replace.	1 year
(8)	4.3.8	Ventilation filter	Clean.	—
(9)	4.3.9	NO_2/NO converter (if provided)	Replace the catalyst.	1 year
(10)	4.3.10	Pressure regulator	Check the mounting method.	6 months
(11)	4.3.11	Pressure relief valve (if provided)	Set the pressure.	—
(12)	4.3.12	Gas dryer (if provided)	Carry out maintenance.	—
(13)	4.3.13	Replace of water in the gas conditioner	Replace.	1 year

4.3.1 Maintenance of gas extractor

(1) How to remove the wire mesh filter

⚠ DANGER

- Make sure to wear heat-resistant gloves for execution of work. If any work is executed with bare hands or wearing cotton gloves, burn injury may result.
- Watch out spout of gas, if the flue internal pressure is positive. Personal injury and burn injury may result.

(1) Turn "OFF" the EXTRACTOR switch on the interface module.

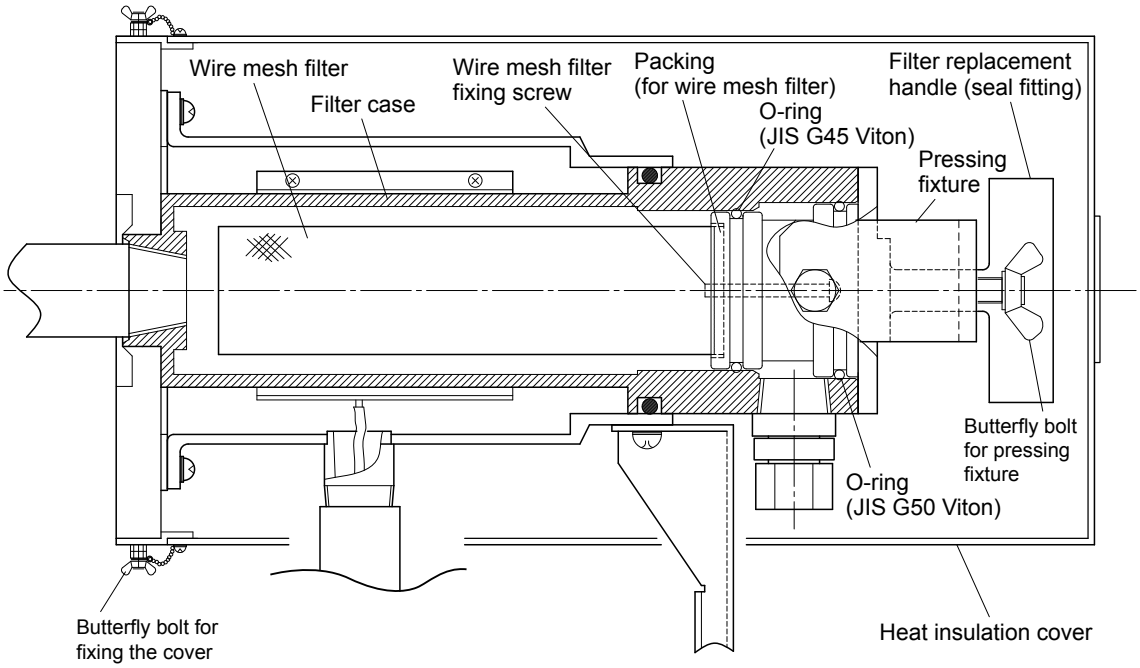
(2) Turn "OFF" ASPIRATOR switch on the interface module.

(3) Remove the heat insulation cover (by removing butterfly bolts on the flange side), after assuring that the temperature of the gas extractor has been lowered sufficiently.

(4) Loosen the butterfly bolt for fixing the pressing fixture and move the pressing fixture by about 90 ° (Be careful about a spout of gas). Hold the handle for filter replacement and pull out it together with the filter unit.

(5) Remove the wire mesh filter fixing screw on the handle side, and then remove the wire mesh filter from the seal fitting.

(6) Before installation, replace the packing and O-ring, and then apply the O-ring with greace. Mount the wire mesh filter in the sequence that is opposite to what is described above.



(2) How to clean the wire mesh filter

(1) Immerse the wire mesh filter in the heated state in the water as much as possible, to allow exfoliation of the dust attached to the filter.

(2) Wash the filter by applying compressed air and water from the surface side and back side of the filter.

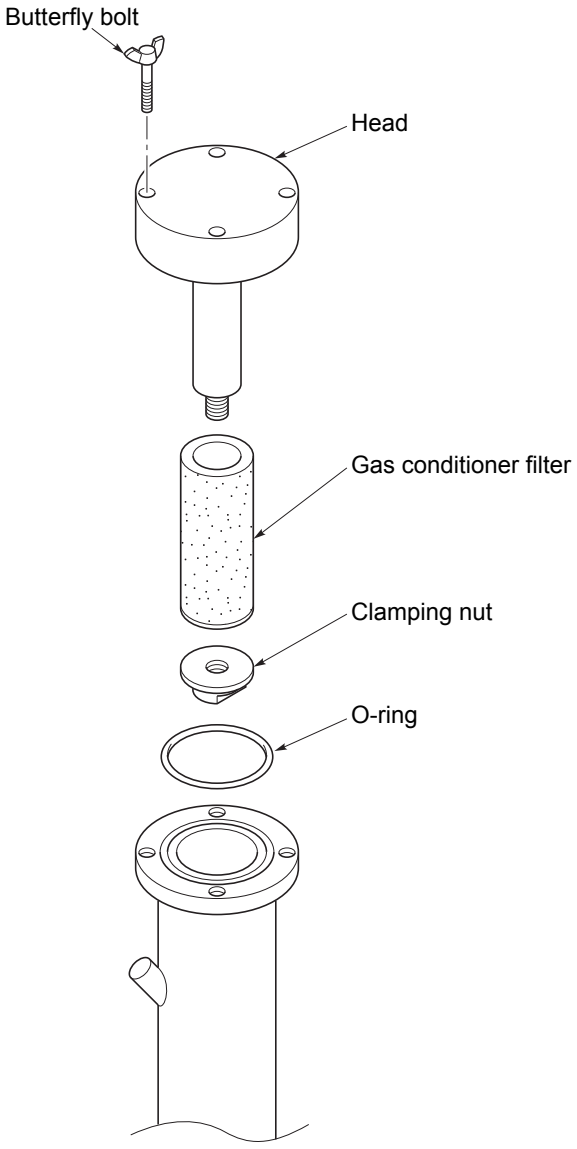
(3) Dry the filter well and mount it.

4.3.2 How to replace gas conditioner filter

(1) Loosen the butterfly bolt and extract the head from the container.

(2) Then loosen the clamping nut and remove the contaminated gas conditioner filter.

(3) Mount a new gas conditioner and a new O-ring (applied with grease), and assemble them in the reverse order of the above.



⚠ CAUTION

Check if dust or the like does not attach on the O-ring or the seal surface.

* Gas conditioner filter : Filter roughness about 5 μm

4.3.3 How to replace membrane filter

(1) Turn OFF the ASPIRATOR switch.

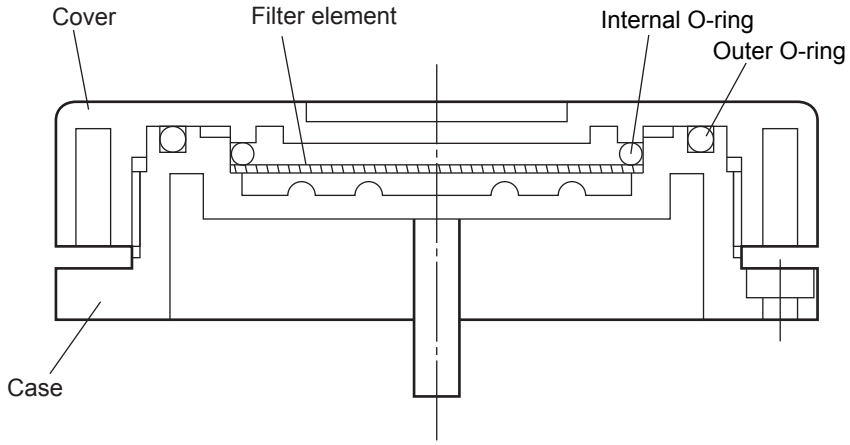
(2) Turn the cover of the membrane filter counterclockwise to remove it.

(3) After detach the cover and replace the filter by removing internal O-ring.

(4) Wipe off dust deposited in the case by clean cloth. Use case to prevent dust from getting into the gas outlet.

(5) For assembly after filter replacement, reverse the above procedures.

(6) Apply vacuum grease to the O-ring every 6 months.



Membrane filter

4.3.4 How to replace valve and diaphragm of diaphragm type gas aspirator

(1) Turn "OFF" the power to the ASPIRATOR switch on the interface module. Detach the pipes from the inlet and outlet connected to the aspirator.

(2) Remove 4 screws to separate cap A and cap B from the valve.

(3) Turn the diaphragm counterclockwise with hands and remove it.

(4) Install new diaphragm by allowing it to turn clockwise until it stops.

Note) Confirm that new diaphragm is fully engaged with the thread of arm lot. Otherwise it will lead to the cause of trouble.

(5) Fit the valve to cap B while turning it by 90˚. (Replace the valve used by turning last time) Confirm that cap A is aligned with cap B with matching mark. Then, tighten 4 screws.

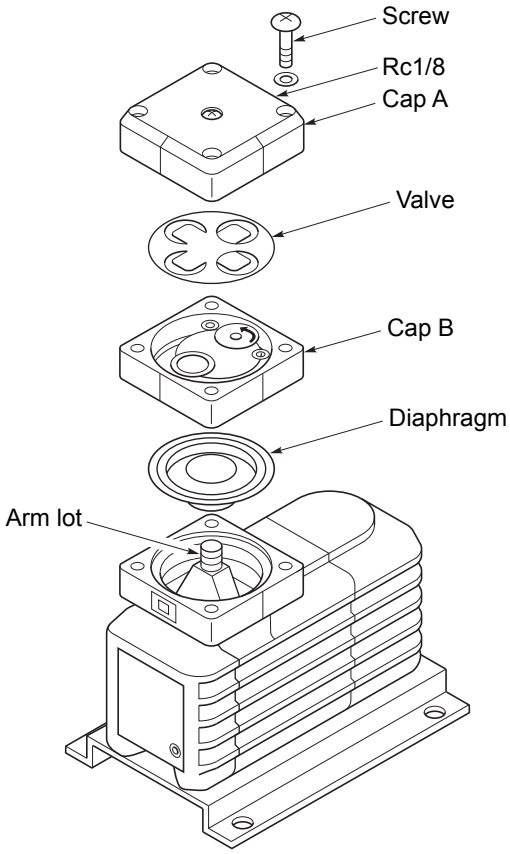
Note) Use of multiple valve allows changing from the hole in which the pin under the valve is first inserted to another one.

(6) Turn ON the power to the ASPIRATOR switch on the interface module to energize the aspirator. Check that no abnormal noise is heard and valve is normally actuating by touching with hands (Air is sucked in the IN side and discharged from the OUT side).

If anything is wrong, repeat the same steps again.

(7) After checking that the aspirator is properly operated, turn OFF the ASPIRATOR switch and return the pipe to the original place. Now, the work is completed.

Note) When returning the pipe in position, use care to avoid applying excessive force to Rc1/8 screws.



4.3.5 How to replace peltier gas cooler

(1) Turn “OFF” the ASPIRATOR switch on the interface module.

(2) Turn “OFF” the SAMPLING MODULE switch on the interface module.

(3) Remove the peltier gas cooler tube, the gas inlet/outlet tube (ø8/ø5, ø5/ø3 Viton tube) and drain tubes below the sampling module.

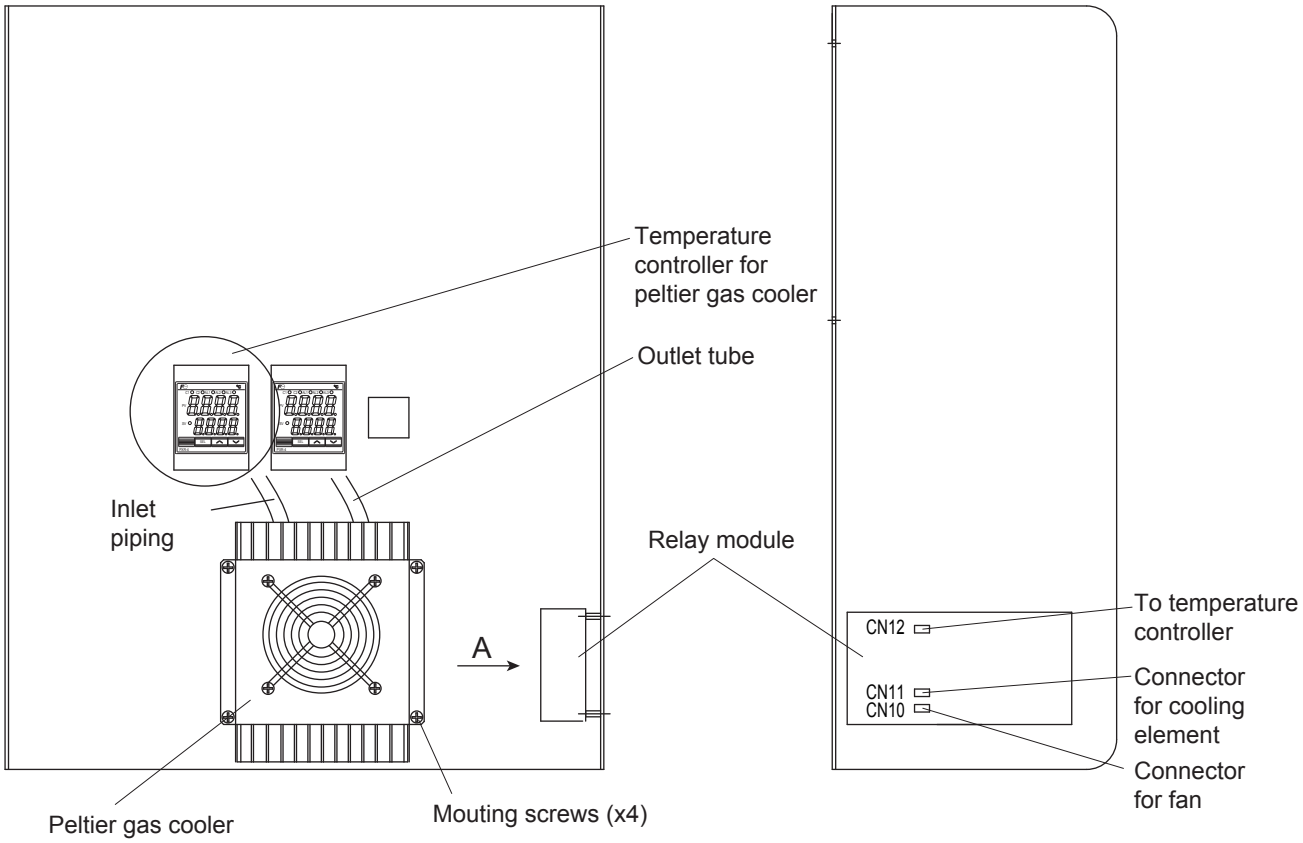
(4) Detach the peltier gas cooler connectors (× 3) and solderless terminal.

(5) Remove mounting screws (× 4) and then remove the peltier gas cooler.

(6) For mounting the cooler, reverse the above steps.

Be careful not to reverse the connection of the gas inlet/outlet piping and the connectors for the fan and the cooling element.

Note) Replace the cooler and the temperature controller as a set.



*** At a normal action, the display of temperature controller indicates between 1˚C and 5˚C.**

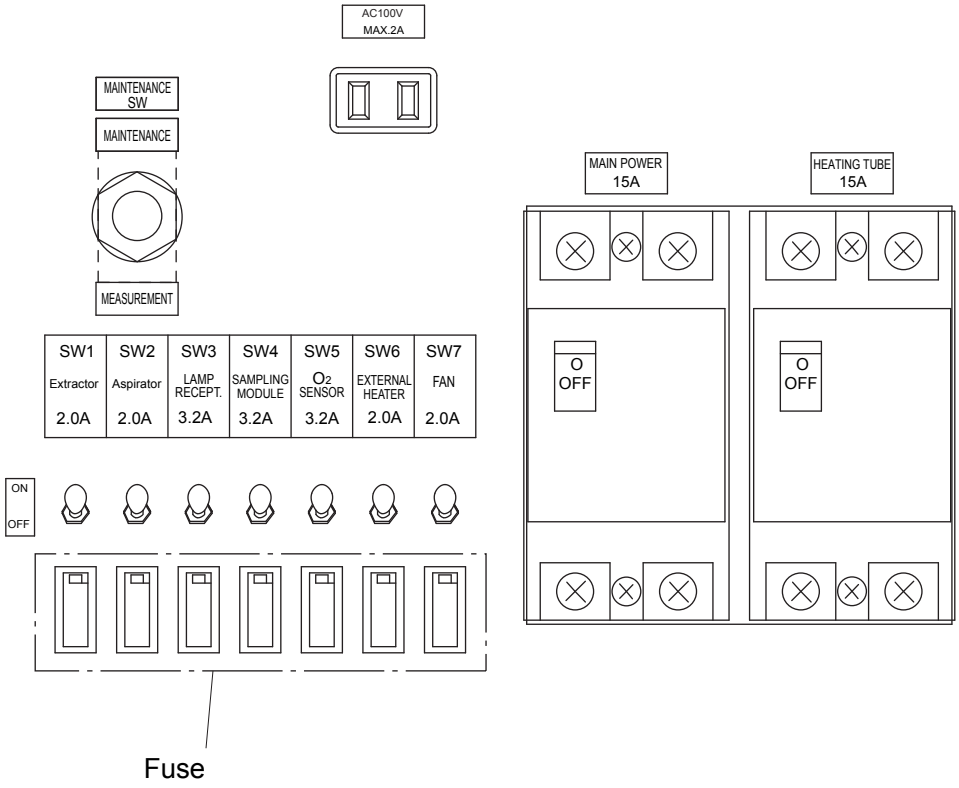
When ambient temperature is beyond the range of specification, cooling temperature may increase.

In such a case, take measures to prevent from temperature raise.

*** When build-in gas dryer is installed, display of temperature may indicate higher than the setting temperature due to increasing flow rate to the cooler, but this is not an error. Gas dryer remove the moisture to dew-point 2˚C or less.**

4.3.6 How to replace power fuse

If any power fuse is blown out, turn OFF the switch and replace as shown below: (For the type of fuses, see "5.1 Spare parts for 1-year measurement."



4.3.7 How to replace capillary

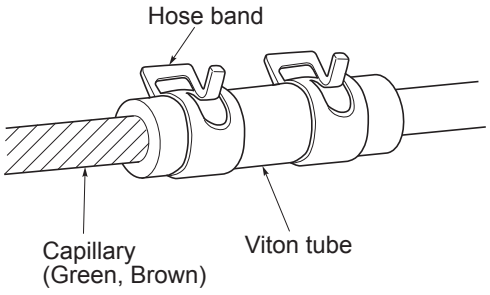
The following capillaries are available for this instrument.

(1) ø0.5 mm × approx. 200 mm (Green): Calibration gas line (inside of sampling module) (for 30 kPa/0.5 L)

(2) For 50 kPa/0.5 L (Green): Gas dryer outlet (if provided with gas dryer)

(3) ø1 × 100 mm (Brown): Peltier gas cooler outlet

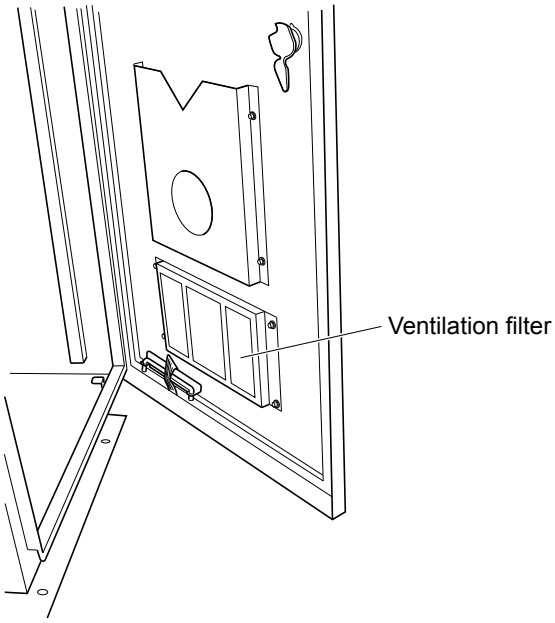
Viton tube is fixed with hose bands. To replace the capillary, remove the hose bands.



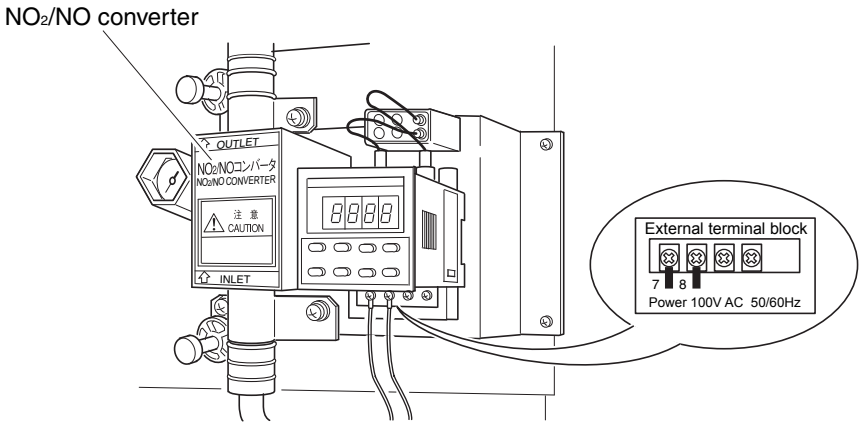
4.3.8 How to replace ventilation filter

The ventilation filter is located on the backside of the front face door of the gas analyzer.

Periodically or when contaminated, remove the ventilation filter, wash it with water, dry it, and then mount it as before.



4.3.9 Maintenance procedure for NO_2 / NO converter



How to replace the catalyst

⚠ CAUTION

• To reduce the risk of personal injury from hot converter, take care when replacing catalyst to avoid touching the converter unit.

(1) Turn "OFF" the [ASPIRATOR] switch on the interface module.

(2) Turn "OFF" the [SAMPLING MODULE] switch on the interface module.

(3) Prepare a catalyst receiver (such as a cup) underneath the converter.

(4) After half an hour, remove (a), (b) and (c), and pull (e) downward.
- Remove (a) while moving gradually from the clearance.
- Remove (e), and (c) and (d) will fall simultaneously.
- If it does not fall, use a long bar to remove all components from the pipe

(5) Attach (c) to the tip of (e) and insert it together with (a) from under the ceramic pipe.

(6) Inject one pack of new catalyst from the top.

(7) Attach (c) to the tip of (b) and insert from the top.

(8) Install (a).

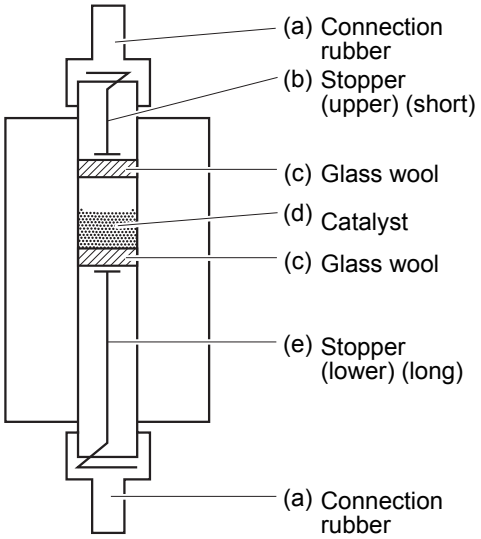
(9) Connect the tube to the input side only.

(10) Turn "ON" the [SAMPLING MODULE] switch on the interface module, and check that temperature is stabilized at 220.

(11) Manually flow zero standard gas for about 20 min.

(12) Connect the tube to the output side.

(13) Turn "ON" the [ASPIRATOR] switch on the interface module.



4.3.10 How to mount pressure regulator for standard gas cylinder

(1) Before mounting a pressure regulator to the gas cylinder, clean the gas cylinder adapter. Entry of dust into the pressure regulator may result in gas leaks.

(2) If packing is not inserted in the mounting nut for the cylinder or it is damaged, replace it with supplied spare one.

(3) Use a spanner of a proper size, fasten the cylinder mounting nut to the gas cylinder. Mount supplied outlet to the outlet, and install piping according to "1.2 Sampling system diagram".

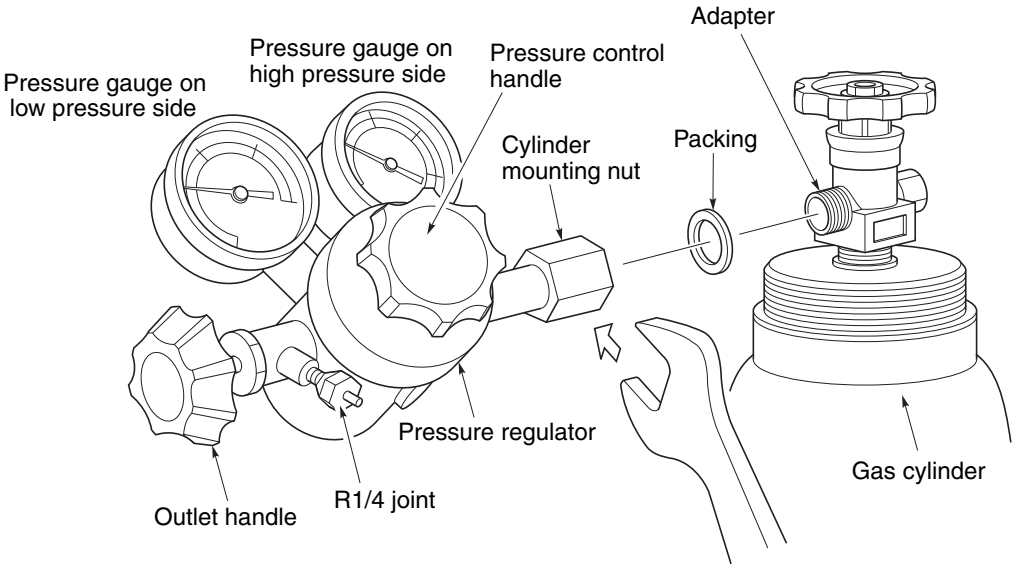
(4) Loosen the pressure control handle and then tighten the output handle.

(5) Open a valve of the gas cylinder, and the pressure gauge on the high pressure side indicates a pressure of the gas cylinder by flowing gas into the pressure regulator.

(6) Turn the pressure control handle clockwise to increase the secondary pressure; adjust the pressure control handle so that a pressure gauge on the low pressure side reads 30 kPa.

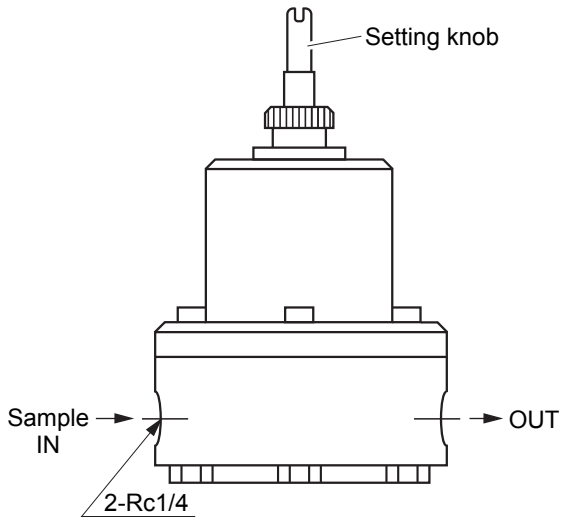
(7) Open the outlet controls to release gas.

* Refer to the material attached to the panel for details.



4.3.11 Setting of pressure relief valve

The pressure relief valve has been designed to have the pressure on the primary side kept at about 49 kPa and discharge sample gas at about 2 L/min together with the drain, when the pressure of 50 kPa or higher is applied to the inlet. Turning the setting knob clockwise increases the set pressure, and turning it counterclockwise decreases the value. Avoid adjusting the pressure relief valve since it is adjusted before shipping. (It is highly dangerous if drain is not discharged.)



4.3.12 Maintenance of gas dryer

The gas dryer is used for SO_2 measurement (first range 500 ppm or higher), sludge incineration or for measurement of boiler exhaust gases.

Since the gas dryer is free of moving parts and no consumption occurs, it can normally be run without maintenance if the precautions for its use are carefully observed.

(1) Check, at least once every month, if purge gas is flowing by an appropriate rate.
Check the flow rate by the purge flowmeter, in case of instrumentation air purge.
Check the flow rate by the flowmeter in the sampling module, in case of return gas purge.

(2) Completely release the internal compressed air at the time of removal.

(3) Be careful not to allow entry of foreign matters at the time of removal and mounting.

(4) Never attempt to disassemble the gas dryer. (The gas dryer cannot be disassembled.)

(5) Be careful not to apply pressure of over 0.05 MPa to purge gas inlet/outlet.

(6) If the purge gas inlet/outlet taper tightening joint is twisted by one turn or more, plugging may result due to wrenching of the internal hollow film.

(7) Use tap water or acid fluid for washing the interior of the gas dryer.
Use of detergent or alkali fluid is banned. (The dehumidifying performance drastically drops, if alkali fluid is used.)

4.3.13 Change of water in gas conditioner

[1] Water drainage

(1) Disconnect the suction tube of the air suction inlet on the gas conditioner, and drain the water.

(2) Disconnect the tube of the cooler side, which is connected to the bottom of the the gas conditioner, and drain the water.

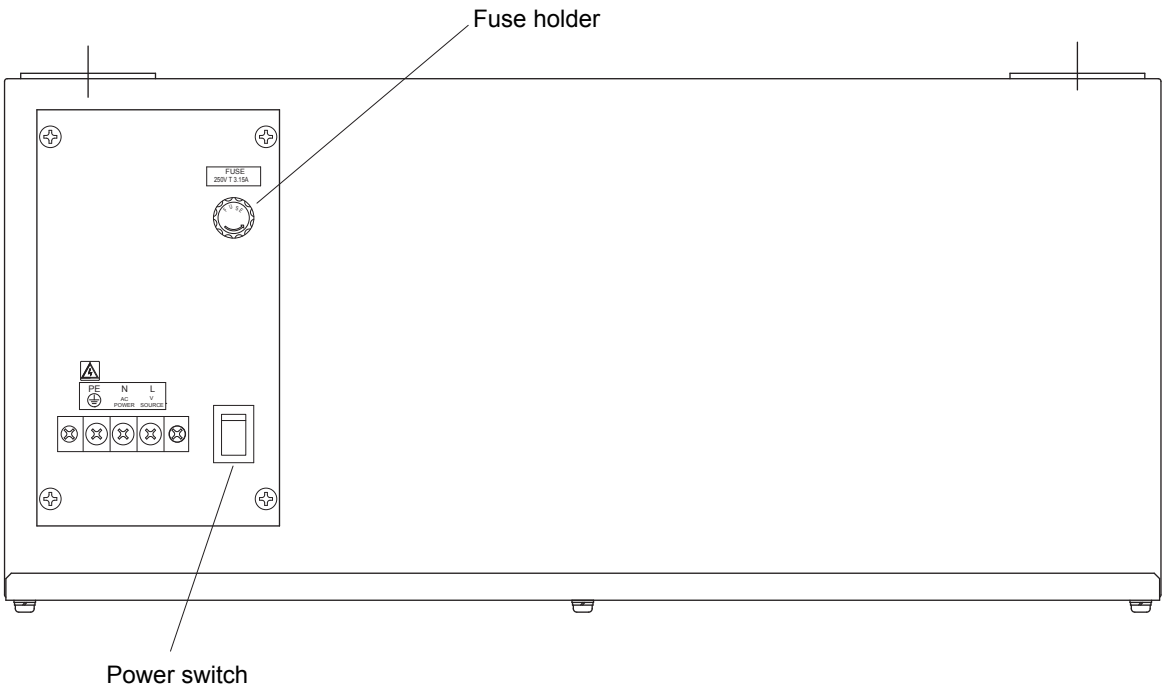
(3) Connect tubes stated in items (1) and (2) above as before.

[2] Water supply

Supply water in accordance with instructions given in “2.3.1 Supply of clean water.”

4.4 Maintenance of gas analyzer unit

4.4.1 Replacement of fuse on analyzer unit



Top view of the analyzer unit

Note) Prior to the following work, be sure to repair blown down fuse (short, etc), if any.

(1) Turn "OFF" the main power supply switch to the analyzer.

(2) Turn the fuse holder cap (shown in the figure above) counterclockwise and pull it out, and the cap will be removed. Remove a fuse out of the holder. Replace it with a new one. (250 V AC/3.15 A, slow-blow type).

(3) Mount the fuse holder cap in the reverse procedure. Turn ON the power supply switch. The work will be completed if the analyzer is normally worked.

4.4.2 Optical balance adjustment and moisture interference adjustment of gas analyzer unit

Only fully trained persons can execute the works of these adjustments. If such adjustment is required, therefore, please contact our adjustment engineer.

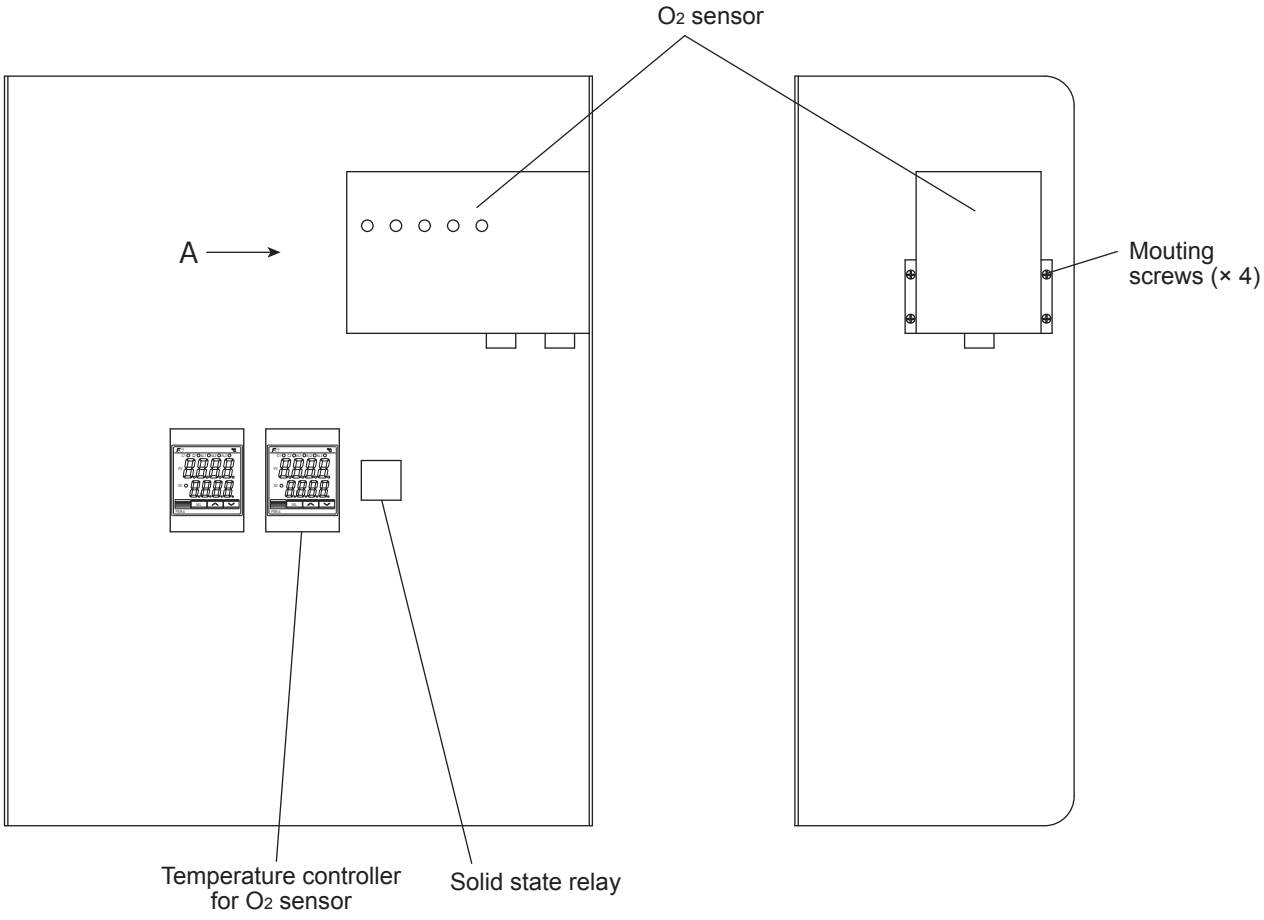
(1) Optical balance of infrared gas analyzer unit

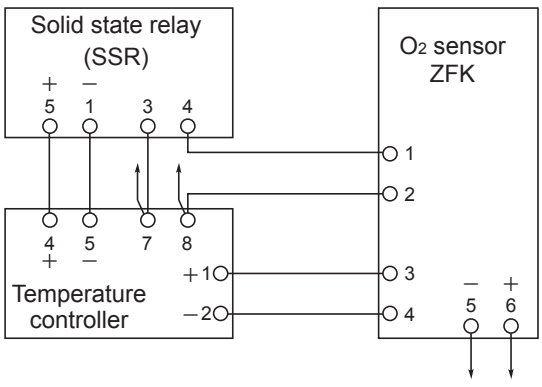
Deviance in the optical balance occurs to the infrared gas analyzer unit due to contamination to the measuring cell caused by secular factors in a long run. Washing of the cell and readjustment of optical balance are required to eliminate this deviance.

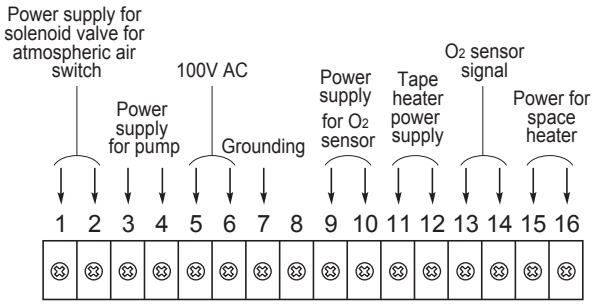
(2) Moisture interference adjustment

The infrared gas analyzer unit measures target components using a specific wavelength region for each measured component. But since the wavelength of water is present as overlapped in all the wavelength regions, moisture interference adjustment is required.
The gas analyzer is adjusted within 0 ppm ± 2% FS during atmosphere suction.

4.5 How to replace zirconia O_2 sensor







(1) Turn “OFF” the ASPIRATOR switch on the interface module.

(2) Turn “OFF” the O_2 sensor switch on the interface module.

(3) Remove O_2 sensor tube and the four mounting screws.

(4) Remove the cover of the O_2 sensor and remove the six wires connected to the terminal of the O_2 sensor.

(5) For assembly, reverse the work above.

Use care about wiring installation.

4.6 Replacement of magnetic O_2 sensor

Only fully trained persons can execute the work of this replacement. If such replacement is required, therefore, please contact our adjustment engineer.

4.7 Air tight test

When restarting the analyzer that has been shut down for a long period, perform air tight test according to the following procedures:

[1] Piping inside panel

(1) Seal exhaust, drain, and open ports.

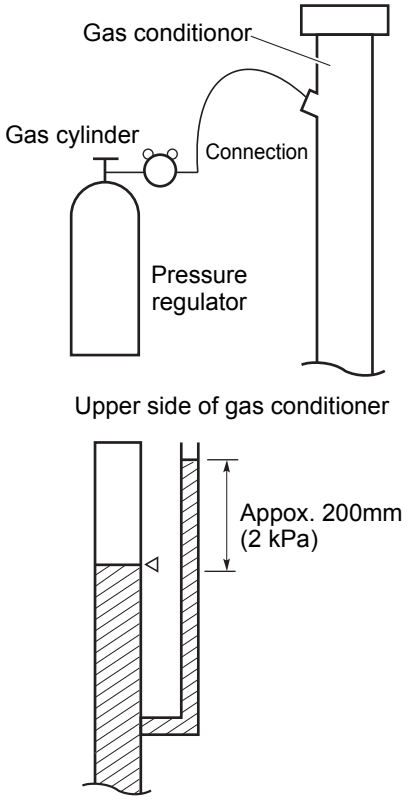
(2) Connect standard gas to the gas conditioner inlet. (Make connection in the state where the pressure is zero.)

(3) Supply the standard gas slowly until a pressure gauge indicates about 2 kPa. Then, close the pressure regulator needle valve.

(4) Check if the water level in the air suction tube of the upper side gas conditioner has risen by about 200 mm.

(5) After wait for 1 minute, assure that water level is not fluctuated.

(6) To identify the leaks, check the connection using soap water.



[2] Piping outside panel

Check that pipng joints are securely tightened. Apply pressure from the gas extractor outlet side as needed, and check a water level in the gas conditioner using the same procedure as (1).

Note) If the air tightness is poor, conduct a test for each section to find the faulty point, and then remedy. If the faulty point is upstream the aspirator, air may be sucked in the gas tube, thereby lowering the indication.

5. SPARE PARTS

⚠ CAUTION

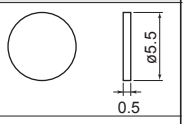
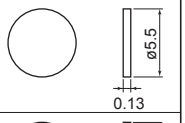
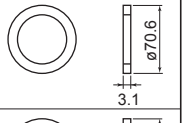
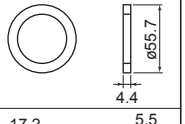
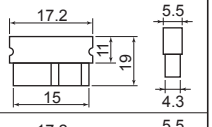
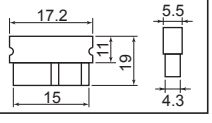
- Do not use replacement parts other than recommended ones. Otherwise, it could result in accident or damage to the instrument.
- Useless replacement parts for maintenance should be disposed of as non-combustible matter.

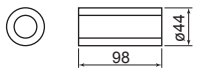
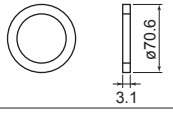
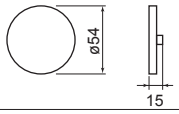
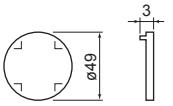
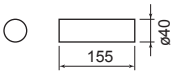
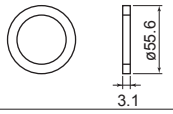
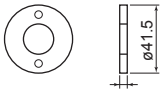
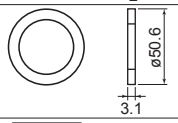
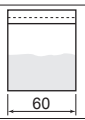
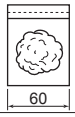
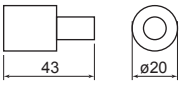
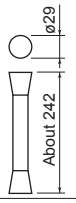
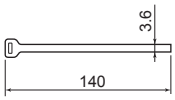
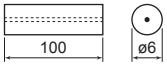
5.1 Spare parts for 1-year measurement

(1) Designation of type of spare parts

1	2	3	4	5	6	7	8	Description
Z	B	N	4	S			2	
					U			(Application) Dust incinerator, gas boiler
					1			Oil/coal boiler, sludge incinerator
						0		(Gas extractor) Without (NOx analyzer) Without (SO_2 analyzer) Without
						1		(Gas extractor) With (NOx analyzer) Without (SO_2 analyzer) Without
						2		(Gas extractor) Without (NOx analyzer) With (SO_2 analyzer) Without
						3		(Gas extractor) With (NOx analyzer) With (SO_2 analyzer) Without
						A		(Gas extractor) Without (NOx analyzer) Without (SO_2 analyzer) With (less than 500 ppm)
						B		(Gas extractor) With (NOx analyzer) Without (SO_2 analyzer) With (less than 500 ppm)
						C		(Gas extractor) Without (NOx analyzer) With (SO_2 analyzer) With (less than 500 ppm)
						D		(Gas extractor) With (NOx analyzer) With (SO_2 analyzer) With (less than 500 ppm)
						E		(Gas extractor) Without (NOx analyzer) Without (SO_2 analyzer) With (500 ppm or more)
						F		(Gas extractor) With (NOx analyzer) Without (SO_2 analyzer) With (500 ppm or more)
						G		(Gas extractor) Without (NOx analyzer) With (SO_2 analyzer) With (500 ppm or more)
						H		(Gas extractor) With (NOx analyzer) With (SO_2 analyzer) With (500 ppm or more)

(2) List of spare parts for 1-year measurement

	Name	Type or Parts number	Q'ty	Application	Remarks	Sketch
1	Membrance filter Filter paper	TK701837C6 (1 bag)	1 bag of 25 sheets	Other than SO_2 analyzer For sampling module	Glass filter paper 0.5 μm	
2	Membrance filter Teflon filter	TK7H6750P1 (1)	4	When SO_2 analyzer is included. For sampling module	Teflon 0.1 μm	
3	O-ring for membrane filter	8553765 (1)	2	For sampling module	G65	
4	Rubber ring for membrane filter	TK733572P1 (1)	2	For sampling module	Chloroprene	
5	Fuse	75718N9 (1)	4	For interface module	2A	
6	Fuse	75718N10 (1)	4	For interface module	3.2A	

	Name	Type or Parts number	Q'ty	Application	Remarks	Sketch
7	Filter element for gas conditioner	TK7H8043P1 (1)	2	For gas conditioner	Polyethylene filter roughness: approx. 5 µm with gaskets on both sides	
8	O-ring for gas conditioner	8553765 (1)	2	For gas conditioner	G65	
9	Gas aspirator diaphragm	TK725417P5 (1)	1	For gas aspirator	Viton	
10	Gas aspirator valve	TK725417P6 (1)	1	For gas aspirator	Viton	
11	Capillary	TK729264C2 (1)	1	For sampling tube (if provided with gas dryer)	50 kPa/0.5 L Green	 Length varies with each lot.
12	Metal mesh filter for gas extractor	TK7H8439P1 (1)	1	For gas extractor (if provided with gas extractor)	SUS316 40 µm	
13	O-ring for gas extractor	8553850 (1)	1	For gas extractor (if provided with gas extractor)	Viton G50	
14	Wire mesh filter packing for gas extractor	TK7M3289P1 (1)	1	For gas extractor (if provided with gas extractor)	Viton	
15	O-ring for gas extractor	TK7N0816P20 (1)	1	For gas extractor (if provided with gas extractor)	Viton G45	
16	Catalyst for NO_2/NO converter	TK726891C1 (1 bag)	1 bag	For NO_2/NO converter (if provided with NOx analyzer)	Carbon beads 2 cc	 Powder
17	Glass wool for NO_2/NO converter	TK726890C1 (1 bag)	1 bag	For NO_2/NO converter (if provided with NOx analyzer)	Glass wool About 0.5 g	
18	Joint for NO_2/NO converter	TK7G6890P1 (1)	2	For NO_2/NO converter (if provided with NOx analyzer)		
19	Mist catcher	ZBBB3V03 (1)	3	For mist catcher (if provided with mist catcher)		
20	Tie-wrap for mist catcher	85119N11 (1)	6	For mist catcher (if provided with mist catcher)		
21	Capillary	TK729264C4 (1)	1	For sampling tube (if provided without gas dryer)	ø1 x 100mm Brown	

5.2 Maintenance components in a long-term

Create a long-term maintenance component procurement plan based on the “Infrared gas analyzer annual inspection plan sheet” indicated below.

Gas analyzer annual inspection plan sheet

• The recommended replacement period of components varies depending on the installation condition.

1) The recommended replacement period is a standard criterion, and it varies depending on the environment of the field, conditions of measuring gas and other factors.
2) The recommended replacement period is not the warranty period.

• Installation condition

1) Ambient temperature: −5˚C to +40˚C
2) Humidity: 90%RH or less
3) Corrosive gases: None
4) No radiated heat, direct sunlight or rain/wind
5) Dust: No more than environmental standard
6) Vibration: None

• Sample gas conditions

1) Temperature: +60˚C to +800˚C
2) Pressure: −3 to +3 kPa
3) Moisture content: 30% or less
4) Dust: 0.1 g/Nm^3 or less
5) Components: 0 to 1000 ppm NO_X, 0 to 500 ppm SO_2, 0 to 2000 ppm CO, 0% to 15% CO_2, 0% to 21%O_2, 0 to 100 ppm HCℓ, residue N_2

Please consult with us regarding gas analyzer maintenance service.

We will provide assured service by the servicing personnel specified by us.

Infrared gas analyzer annual inspection plan sheet

Generic name	Article name	Component name	Q'ty	With/ without	Recommended replacement period (year)	Year										
						Delivered year	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year	8th year	9th year	10th year
Gas analyzer unit	NO_x, SO_2	Infrared light source (semi-sealed)	1	□	5						○					○
		Reference cell	1	□	5						○					○
		Measuring cell	1	□	5						○					○
		Distributing cell	1	□	5						○					○
		Interference filter	1	□	5						○					○
		Sector motor	1	□	2			○		○		○		○		○
		Sector motor power supply unit	1	□	5						○					○
		Switching power supply	1	□	3				○			○			○	
		LCD indicator	1	□	3				○			○			○	
		Main unit	1	□	10											○
	CO_2, CO	Infrared light source (sealed)	1	□	5						○					○
		Reference cell 1		□	5						○					○
		Measuring cell 1		□	5						○					○
		Distributing cell 1		□	5						○					○
		Sector motor	1	□	2			○		○		○		○		○
		Sector motor power supply unit	1	□	5						○					○
		Switching power supply	1	□	3				○			○			○	
		LCD indicator	1	□	3				○			○			○	
		Main unit	1	□	10											○
	O_2 sensor	Temperature controller	1	□	3				○			○			○	
Sampling equipment		Gas extractor (standard)	1	□	5						○					○
		Gas conditioner	1	□	5						○					○
		Diaphragm type gas aspirator (ZBG8)	1	□	3				○			○			○	
		Peltier gas cooler	1	□	5						○					○
		Peltier gas cooler fan	1	□	2			○		○		○		○		○
		Membrane filter	1	□	5						○					○
		NO_2/NO converter	1	□	10											○
		NO_2/NO converter temperature controller	1	□	3				○			○			○	
		Flowmeter	1	□	10											○
		Corrosion-resistant solenoid valve	1	□	5						○					○
		Diaphragm type gas aspirator (ZBG5)		□	3				○			○			○	
		Gas dryer		□	2			○		○		○		○		○
		Pressure relief valve (ZBD)		□	10											○
		Gas extratctor (for blow-back)		□	5						○					○
		Motor valve (sampling line)		□	3				○			○			○	
		Motor valve (purge line)		□	5						○					○
		Heating tube (m)		□	10											○
		Drain separator (with drain pots)		□	10											○
Others		Ventilation fan in panel	1	□	2			○		○		○		○		○
		Insulating converter		□	5						○					○
		Calibration cylinder (with public inspection agency examined article)		□	1		○	○	○	○	○	○	○	○	○	○
		Pressure regulator		□	7								○			
		Filter regulator		□	5						○					○
		Calibration cylinder solenoid valve		□	5						○					○
		Sequencer		□	7								○			
Expenses for overhaul of gas analyzer unit at our shop					5						○					
Expenses for meter examination (by JQA)					8									○		
Expenses for consumable for annual inspection					1		○	○	○	○	○	○	○	○	○	○
Expenses for annual inspection					1		○	○	○	○	○	○	○	○	○	○

*Recommended replacement cycle for this gas analyzer is 10 years.

6. TROUBLESHOOTING

⚠ CAUTION

- When you find it difficult to judge failures in spite of referring to the instruction manual, avoid disassembling the instrument without consulting our sales agent or service engineers. Otherwise, it may result in electrical shock or personal injury.

6.1 Troubleshooting

Problem	Check item	Check description	Measures
The flow rate of the sample gas is low.	Gas aspirator	▪ Check for abnormal sound or vibration.	▪ Retighten the screws or replace the aspirator.
		▪ Check if it operates normally. (Remove the IN and OUT pipes, and check that air is suctioned from the IN side and exhausted from the OUT side by hand.)	▪ Cleaning ▪ Replace the consumables such as valves and diaphragms. (See Section 4.3.4 "How to replace valve and diaphragm of diaphragm type gas aspirator.")
	Gas conditioner filter	▪ Check if the filter is clogged. (Visually check if the filter is dirty.)	▪ Cleaning ▪ Replace the filter (See Section 4.3.2 "How to replace gas conditioner filter.")
	Peltier gas cooler	▪ Check if the temperature is controlled properly. (Visually check if the indicated value of the temperature controller is in the range of 1°C to 5°C.)	▪ Replacement
		▪ Check if the gas path is clogged. (Remove the IN and OUT pipes and visually check if the joint is clogged with foreign matter.)	▪ Cleaning or replacement
	Flow checker	▪ Check if the needle valve of the flow checker main unit is fully opened.	▪ Adjustment
		▪ Check if the gas path is clogged. (Visually check if the gas path is clogged with foreign matter.)	▪ Cleaning or replacement
	Membrane filter	▪ Check if the filter is clogged. (Visually check if the filter is dirty.)	▪ Cleaning ▪ Replace the filter. (See Section 4.3.3 "How to replace membrane filter.")
	Zirconia O_2 sensor	▪ Check if the area around the outlet joint is clogged.	▪ Cleaning or replacement
	Gas conditioner	▪ Check if the water level decreased.	▪ Feed water in the gas conditioner. (See Section 2.3.1 "Supply of clean water.")

Problem	Check item	Check description	Measures
The flow rate of the sample gas is low.	Pipes and fixed throttles	▪ Check if they are bent or clogged.	▪ Cleaning or replacement
	Sampling equipment and joints	▪ Check if a gas is leaked. (Use a gas detector or refer to Section "4.7 Air tight test")	▪ Replace the sampling equipment main unit. ▪ Retighten the joints.
The value is extremely higher than the expected value.	Zero and span	▪ Check if the zero or span deviates. (Inject a standard gas to check the zero and span concentrations.)	▪ Zero and span calibration (See Section 3.9 "Calibration.")
	Sampling cell	▪ Check if the inside of the cell is dirty. (Check if heavy dirt or water is attached to the membrane filter.)	▪ Clean or replace the cell. (Please contact our engineering staff.)
	Gas conditioner (in the case of oxygen)	▪ Check if the H2 (see Figure 4-1 in Section 4.1.3 "Points of daily check") is 50 mm or more.	▪ Clear the clog (dust) of the gas extractor or gas tube or melt their frozen parts.
	Pipes and joints in the stages preceding the gas conditioner filter and the diaphragm aspirator (in the case of oxygen)	▪ Check if the proper airtight is set. (See Section "4.7 Air tight test")	▪ Replace the O-ring (in the gas conditioner filter and the gas extractor). ▪ Retighten the joints.
	Measurement range	▪ Check if the proper measurement range is selected.	▪ Switch to the proper measurement range. (See Section 3.1 "Switch of range.")
The value is extremely lower than the expected value.	Zero and span	▪ Check if the zero or span deviates. (Inject a standard gas to check the zero and span concentrations.)	▪ Zero and span calibration (See Section 3.9 "Calibration.")
	Gas conditioner (in the case of a component other than oxygen)	▪ Check if the H2 (see Fig. 4-1 in Section 4.1.3 "Points of daily check") is 50 mm or more.	▪ Clear the clog (dust) of the gas extractor or gas tube or melt their frozen parts.
	Pipes and joints in the stages preceding the filter of the gas conditioner and the diaphragm aspirator (in the case of a component other than oxygen)	▪ Check if the proper airtight is set. (See Section "4.7 Air tight test")	▪ Replace the O-ring (in the filter of the gas conditioner and the gas extractor). ▪ Retighten the joints.
	Gas dissolution (in the case of SO_2)	▪ Check if the drain stops at a part of the conduit (due to sag, back draft, clogging, etc.).	▪ Clear the clog or repair the sag. Set the pipe so that the slope is 15° or more to prevent drain stopping. (See Section 2-1 "Piping diagram" in the Installation manual submitted seperately.)

Problem	Check item	Check description	Measures
No value is indicated.	Zero and span	▪ Check if the zero or span deviates. (Inject a standard gas to check the zero and span concentrations.)	▪ Zero and span calibration (See Section 3.9 “Calibration”)
	Power supply	▪ Check if the proper power supply voltage is applied. ▪ Check if the switches are set to “ON” as required.	▪ Apply the proper power supply voltage. ▪ Set the switches to “ON” as required.
	Fuse	▪ Check if the fuse is blown.	▪ Replace the fuse. (See Section 4.3.6 “How to replace power fuse” or 4.4.1 “Replacement of fuse on analyzer unit”)
Drain is not discharged.	Drain pipe	▪ Check if the inside of the pipe is frozen	▪ Keep the pipe warm.

6.2 Troubleshooting for analyzer unit

Error message

If errors occur, the following contents are displayed.

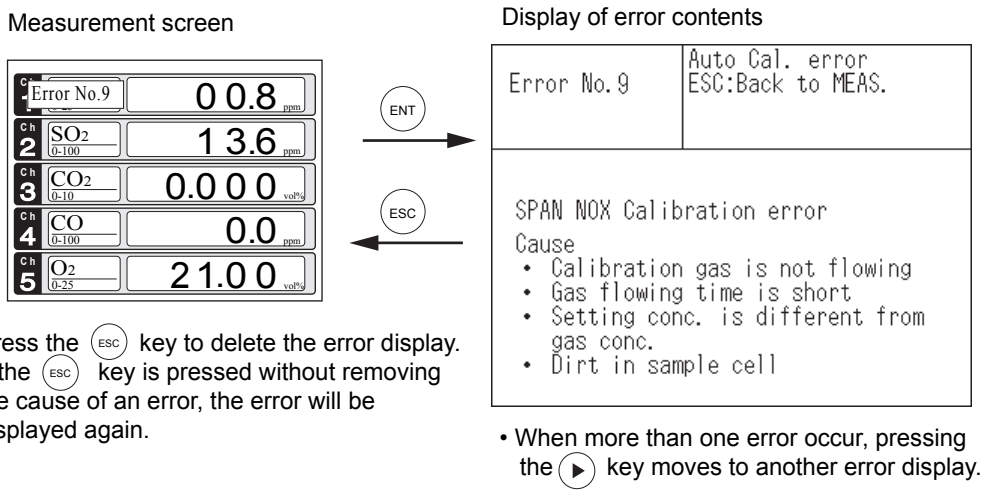
Error display	Error contents	Probable causes
Error No.1	Motor rotation detection signal faulty	• Motor rotation is faulty or stopped. • Motor rotation detector circuit is faulty.
Error No.4	Zero calibration is not within the allowable range.	• Zero gas is not supplied. • Zero is deflected much due to dirty cell. • Detector is faulty. • Optical balance is maladjusted.
Error No.5	Amount of zero calibration (indication value) is over 50% of full scale.	
Error No.6	Span calibration is not within the allowable range.	• Span gas is not supplied. • Calibrated concentration setting does not match cylinder concentration. • Zero calibration is not performed normally. • Span is deflected much due to dirty cell. • Detector sensitivity has deteriorated.
Error No.7	Amount of span calibration (difference between indication value and calibrated concentration) is over 50% of full scale.	
Error No.8	Measured values fluctuate too much during zero and span calibration.	• Calibration gas is not supplied. • Time for flowing calibration gas is short.
Error No.9	Calibration is abnormal during auto calibration.	• Error corresponding to No. 4 to No. 8 occurred during auto calibration.
Error No.10	Output cable connection is improper.	• Wiring is detached between analyzer and interface module. • Wiring is disconnected between analyzer and interface module

When error No. 1 or No. 10 occurs, analyzing block error output contact is closed.

When an error from No. 4 to No. 9 occurs, calibration error contact output is closed.

Screen display and operation at the occurrence of error

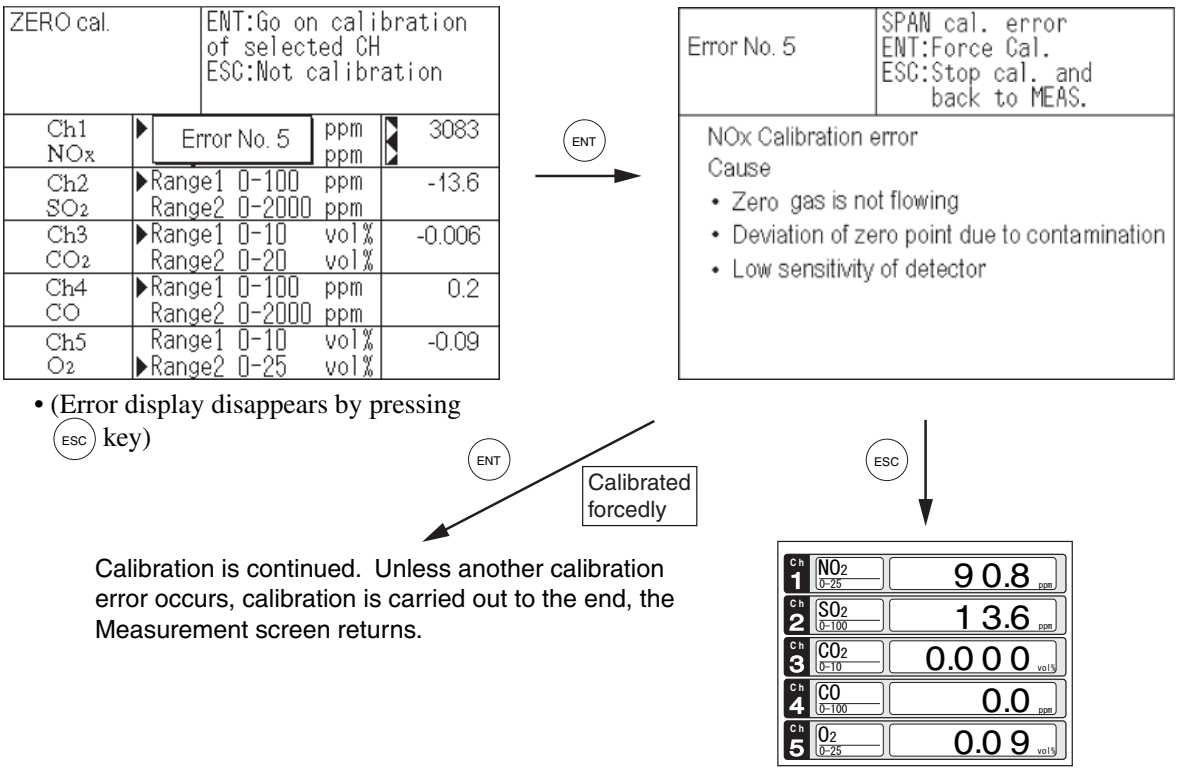
In case of Error No. 1 to No. 4, No. 6, No. 8 to No. 10



• Press the (ESC) key to delete the error display.
• If the (ESC) key is pressed without removing the cause of an error, the error will be displayed again.

• When more than one error occur, pressing the (▶) key moves to another error display.

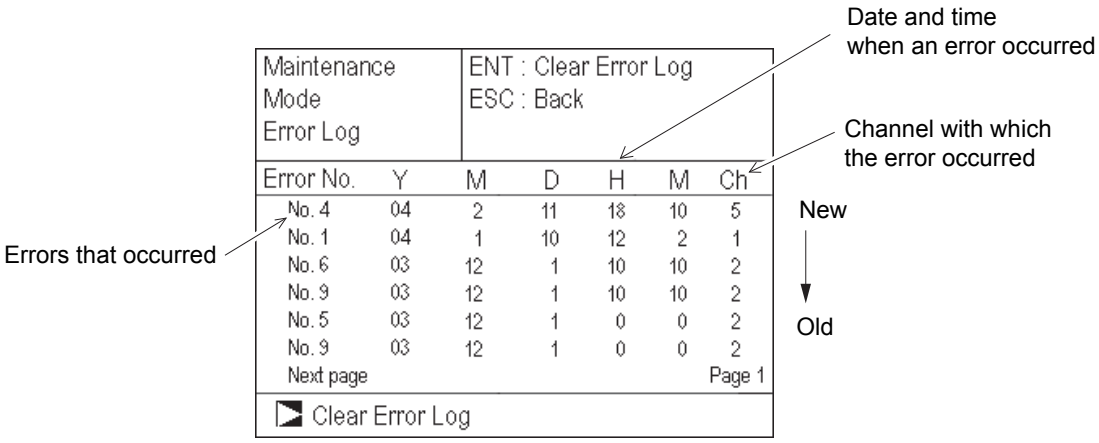
In case of Error No. 5 and No. 7



Error log file

If error occurs, the history is saved in an error log file. The error log file exists in the maintenance mode.

Error log screen



* Up to 14 errors can be saved in the error history; the oldest error will be deleted one by one every time a new occurs.
* If the power supply is turned OFF, the contents in the error log file will not be lost.

Deletion of error history

Press the ENT key on the above screen, and the "Error Log Clear" will be highlighted. Further pressing the ENT key will clear the error history.

7. SPECIFICATION

7.1 Specification

1. Standard Specifications

•Measurement principle :
NOx, SO_2, CO and CO_2 ; Ndir type infrared
O_2 ; Zirconia type, magnetic type

•Measured component and min./max. measurement range :
NO_X ; 0 to 50ppm/0 to 5000ppm
SO_2 ; 0 to 50ppm/0 to 5000ppm
CO ; 0 to 50ppm/0 to 5000ppm
CO_2 ; 0 to 10%/0 to 20%
O_2 ; 0 to 10%/0 to 25%
N_2O and CH_4 can be measured as an optional feature.

•Measurement ranges :
2 ranges, Max. range ratio: 1:25 (Refer to "7.2 Code symbols")

•Warm-up time : Within 4 hours after power-on

•Analog output signals :
Simultaneous output of signals of 4 to 20 mA DC each (non-isolated or isolated depending on customer's code selection)
- Five instantaneous value outputs (NO_X, SO_2, CO, CO_2 and O_2)
- O_2 converted instantaneous value: 3 points (Nox, SO_2, CO) *When O_2 sensor is provided
- O_2 converted average value: 3 points (Nox, SO_2, CO) *When O_2 sensor is provided
- Allowable load resistance :
  550 Ω or less (750 Ω or less for isolated output)

•Contact output : (1) Each 1a contact (contact capacity 250 V AC, 2 A or 30 V DC, 3 A) for:
- Range identification of each component (Close/1st range) , analyzing block error, calibration error, auto calibration status, maintenance status,and CO peak count alarm

(2) Each 1c contact (contact capacity 250V AC, 1 A or 30 V DC, 1 A) for:
- Concentration alarm for each component's instantaneous value (H, L, HL settable), analyzing block power off

•Contact input : No-voltage contact (1.5 sec or longer)
- Auto calibration start, average value resetting
  No-voltage contact (Status holded)
- Range changeover (1st range when contact closes), output hold, remote pump OFF (OFF when contact closes)

•Indication : LCD with back light for indicating:
(Life of LCD back light is 50,000hrs, back light auto off function is equipped)
- Instantaneous values (NO_X, SO_2, CO, CO_2 and O_2)
- O_2 corrected instantaneous values (NO_X, SO_2, CO) after O_2 correction when provided with O_2 sensor
- O_2 corrected average values (NO_X, SO_2, CO) after O_2 correction when provided with O_2 sensor
- O_2 average value when provided with O_2 sensor
- Peak count value (when provided with CO, O_2 analyzer)
- Parameter assignment

•Fluorescent lamp in cubicle :
Standard equipment

•Recorder (option) :
Paperless recorder (Fuji Electric's type PHR) mounted
Relief to EDS10-74.

• Gas extractor : Electrical heating type (filter built in)
- Wire mesh filter : 40μm mesh of SUS 316 stainless steel
- Flange : JIS 5K 65AFF
- Mass: Approx. 9 kg (excluding gas sampling tube)
- Power supply voltage: 100 V AC, 50/60 Hz
- Power consumption: Approx 100 VA
- Gas sampling tube: Refer to Code Symbols for materials and length of the gas sampling tube.
  SUS 316 (length 300, 400, 600, 800, 1000 mm),or titanium (length 600, 800, 1000 mm),or SiC (length 700, 900 mm)
  * SUS 316 is used for 800ºC or lower.
  *Titanium is used for 1000ºC or lower.
  * SiC is used for 1300ºC or lower.

•Sample inlet tube :
ø10 / ø8 Teflon tube or heating tube (max. 30 m)
*The heating tube needs to be specified in the following cases.
(1) Ambient temperature –6ºC or lower
(2) SO_2 of 50 or 100 ppm
(3) Tube length 10 m or longer in SO_2 measurement
(Power supply voltage: 100 V AC, 50/60 Hz, power consumption: 36 VA/m)

•Rated operating conditions :
- Ambient temperature: –5 to 40ºC (depending on customer's code selection)
- Ambient humidity: 90% RH or less
- Power supply voltage: 100, 110, 115, 200 or 230 V AC ±10%
  (depending on customer's code selection)
- Frequency: 50 or 60 Hz ±0.5 Hz
- Power consumption: Max. 600 VA (excluding gas extractor and heating tube)

•Storage condition:
- Ambient temperature; –20 to 60ºC (Water within the drain pot should be drained before storage.)
- Ambient humidity; 95%RH or lower

•Dry air : (Required for a oil/coal boiler or when the first range of the SO_2 meter for gas dryer purging is 500 ppm or higher.)
Dew point; –20ºC DP or lower
Pressure; 100 kPa to 400 kPa
Dust and mist; None

•External dimensions (H x W x D) :
Indoor type; 1710 x 800 x 615 mm
Outdoor type; 1780 x 815 x 700 mm

•Mass : Approx. 300 kg (excluding standard gas)

•Cubicle finish color :
Munsell 5Y7/1 semi-gloss

• Cubicle structure :
Indoor or outdoor installation, of self-standing type, single-swing front door,plate thickness 2.3 mm standard (both cubicle and door)

• Other : Six standard gas cylinders (3.4 L) accommodatable
Note: Fluctuation in the operation period of 4 hours from the end of warm-up time is within ±2%FS.

• Measurement Law type approval No.:
SAN991-1 (NOx analyzer)
SAS992-1 (SO_2 analyzer)
SAC992-1 (CO analyzer)
SE981 (Zirconia O_2 sensor)
SF011 (Magnetic O_2 sensor)

2. Standard Functions

Function	Description
O_2 Conversion	• Conversion of measured NO_X, SO_2 and CO gas concentrations into values at reference O_2 concentration Calculating equation : $C = \frac{Cs\ (21-O_N)}{21-O_S}$ C : Converted concentration Cs : Measured concentration of measurement gas Os : Measured O_2 concentration On : Reference O_2 concentration (4% for petroleum fuel, 5% for gas fuel, 6% for coal fuel, 12% for refuse incinerator) Setting range: 0 to 19% • The result of conversion is indicated and output in a signal of 4 to 20 mA DC.
Auto Calibration	• The gas analyzer is automatically calibrated. • Auto calibration cycle settable range: 1 to 99 hours (1-hour step) or 1 to 40 days (1-day step) • Auto calibration gas injection time settable range: 60 to 599 seconds (in 1-sec step) • Auto/manual calibration error contact output: Provided when calibration quantity exceeds 50% of full scale. • Contact output during auto calibration and maintenance: Provided during calibration gas flow and replacement. Also provided during maintenance. • Auto calibration remote start contact input: Calibration starts at opening after short-circuit for 1.5 sec or longer. • Standard gas consumption: Approx. 1 year with 3.4L cylinder in a calibration cycle of 7 days
O_2 converted average value O_2 average value	• O_2 converted average value of NO_X, SO_2, CO components is calculated, and the results are displayed and output in 4 to 20mA DC. • Averaging time is settable by key operation at the front of analyzing block. Settable range: 1 to 59 minutes or 1 to 4 hours (factory-set at 1 hour)
Remote Output Hold	• The output signal values are collectively held according to external contact input. • Output is held during short-circuit.
Average Value Resetting Input	• Output and indication of average value after O_2 conversion are reset according to external contact input. • Output and indication are reset at short-circuit for 1.5 sec or longer.
Automatic range changeover	• Automatically changed from low range to high range, and from high range to low range. Low → High: Changed at 90% point of the low range High → Low: Changed at 80% point of the high range
Remote range Changeover Input	• Low or high range is selectable for each measured component via external contact input. • High range is selected for open-circuit, and low range for short-circuit.
Range Identification Contact Output	• Identification between low and high ranges is output through a contact. • When the contact is closed, low range is selected.
Concentration Alarm Contact Output	• Instantaneous value alarm is settable for each sample component. High, Low, High or Low is settable (by keys at the front of analyzing block). • Contact output hysteresis is also settable. • Contact is 1c type.
CO Instantaneous Value Peak Count Alarm Contact Output	• Alarm is issued and indicated when CO instantaneous value has exceeded the set limit by the set number of times. Settable number of times: 1 to 99, alarm settable range: 10 to 1000 ppm (5 ppm step) • The number of exceeding times per hour is indicated.
Analyzing Block Error Contact Output	• Contact output is provided when the analyzing block is abnormal.
Temperature Input Signal	• K thermocouple input x 2 (for recorder available at option)

3. Performance

- Repeatability : ±0.5% of full scale
- Zero drift : ±1.0% of full scale or lower/week
  (±2.0% of full scale/week when the range is less than 200 ppm)
  Max.±2.0% of full scale/month on O_2 sensor
- Span drift : Max. ±2.0% of full scale/week
  Max. ±2.0% of full scale/month on O_2 sensor
- Linearity : Max. ±1.0% of full scale
- Response time : For 90% response from inlet
  NO_X : 120 sec or shorter
  SO_2 : 240 sec or shorter
  CO : 120 sec or shorter
  CO_2 : 120 sec or shorter
  O_2 : 120 sec or shorter
- Sample gas flow rate :
  Approx. 2L/min

4. Requirements for standard measurement gas

- Temperature : Standard : 60 to 800ºC
  Non standard : 1000ºC (titanium probe)
  1300ºC (SiC probe)
- Dust : 100 mg/Nm^3 or less
- Pressure : –3k to +3kPa
- Components :

SO_2	500 ppm or less
NO_X	1000 ppm or less
CO_2	0 to 15%
CO	2000 ppm or less
O_2	1 to 21%
HCL	100 ppm or less
The remaining	N_2, H_2O

5. Installation Requirements

(1) Selection of a place which does not receive direct sunlight or radiation from hot substances
If such a place cannot be found, a roof or cover should be prepared for protection.
(2) Avoidance of a place under heavy vibration 0.2m/S_2 or less
(3) Selection of a place where atmospheric air is clean

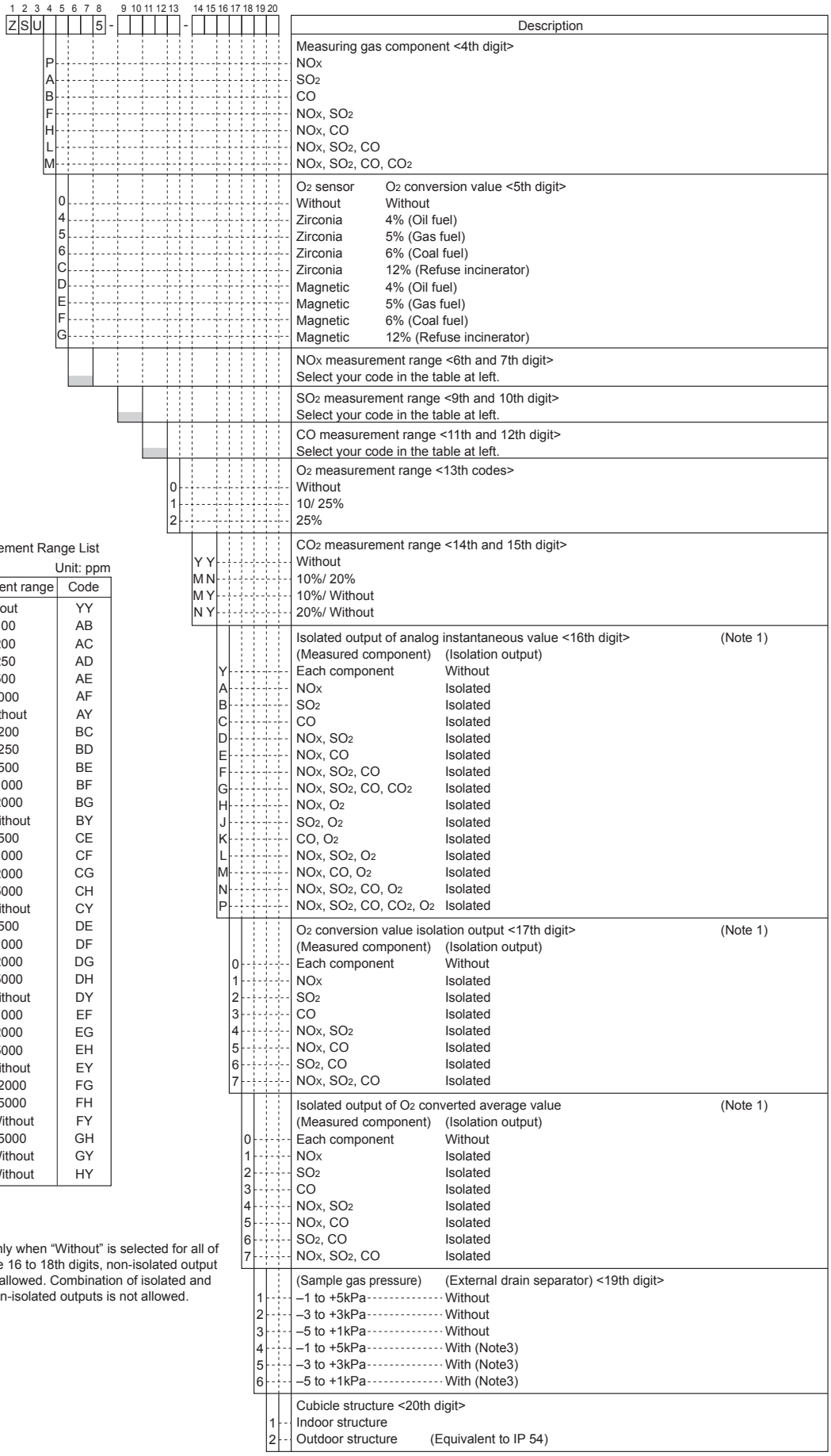
SCOPE OF DELIVERY

- Gas analyzer system
- Specified external drain separator/drain pot
- Specified gas extractor/insertion tube set
- Specified gas tube set
- Standard accessories

ITEMS TO BE PREPARED SEPARATELY

1. Standard gas and pressure regulator
   (Refor to ZSY of CODE SYMBOLS)
2. Recorder (when necessary) type PHR
3. Individual inspection by measurement law
4. Spare parts for 1 year (Refer to "5.1 Spare parts for 1-year measurement
5. Waterproof gland for outdoor wiring port (A25A),
   Order No.: 8641625
6. Anchor bolt

7.2 Code symbols

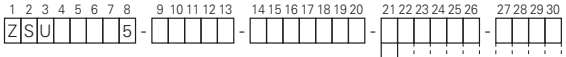


Measurement Range List

Unit: ppm

Measurement range	Code
Without	YY
50/100	AB
50/200	AC
50/250	AD
50/500	AE
50/1000	AF
50/Without	AY
100/200	BC
100/250	BD
100/500	BE
100/1000	BF
100/2000	BG
100/Without	BY
200/500	CE
200/1000	CF
200/2000	CG
200/5000	CH
200/Without	CY
250/500	DE
250/1000	DF
250/2000	DG
250/5000	DH
250/Without	DY
500/1000	EF
500/2000	EG
500/5000	EH
500/Without	EY
1000/2000	FG
1000/5000	FH
1000/Without	FY
2000/5000	GH
2000/Without	GY
5000/Without	HY

Note 1) Only when “Without” is selected for all of the 16 to 18th digits, non-isolated output is allowed. Combination of isolated and non-isolated outputs is not allowed.



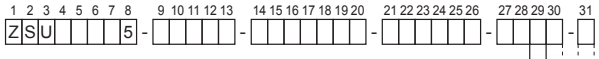
Description
Pipe and cable inlets <21th digit>
(Piping port) (Cabling port) (Piping port for external installation of gas cylinder)
A: Top left / Top left / Without
C: Top left / Top left / With 3 inlets on lower left side
D: Top left / Top left / With 6 inlets on lower left side
Ambient temperature <22nd digit>
2: Standard (–5 to 40°C)
3: For cold climate (–10 to 40°C)
Instrument nameplate / Tag plate / Display screen Instruction manual <23rd digit>
A: Standard / Without / Japanese
B: Standard / With / Japanese
E: Standard / Without / English
F: Standard / With / English
Recorder <24th digit> Recorder (type PHR) available at option
0: Without
1: With (6-point recording: recording contents 1) **(Note 2)**
2: With (6-point recording: recording contents 2) **(Note 2)**
3: With (6-point recording: recording contents 3) **(Note 2)**
4: With (6-point recording: recording contents 4) **(Note 2)**
5: With (6-point recording: recording contents 5) **(Note 2)**
6: With (6-point recording: recording contents 6) **(Note 2)**
Z: With (other recording contents) **(Note 2)**
Power supply <25th digit>
A: 100V AC 50Hz
B: 100V AC 60Hz
C: 110V AC 50Hz
D: 110V AC 60Hz
E: 115V AC 50Hz
F: 115V AC 60Hz
G: 200V AC 50Hz
H: 200V AC 60Hz
J: 230V AC 50Hz
K: 230V AC 60Hz
Application <26th digit>
A: Standard type, refuse, industrial waste incineration, etc.
B: Gas boiler
C: Sludge incineration
D: Oil/coal boiler
Offical certificate (Japanese regulation) <27th digit>
Y: Without
A: NO_X
B: SO_2
C: CO
D: NO_X, SO_2
E: NO_X, CO
F: NO_X, SO_2, CO
G: NO_X, O_2
H: SO_2, O_2
J: CO, O_2
K: NO_X, SO_2, O_2
L: NO_X, CO, O_2
M: NO_X, SO_2, CO, O_2
(Zero gas) <28th digit>
1: Instrumentation air
2: Atmospheric air
3: Standard gas
(Note 4) Order standard gas (type ZSY) separately.

Recording contents	Code 1	Code 2	Code 3	Code 4	Code 5	Code 6
NO_X instantaneous value			○			○
Average value	○	○	○			○
O_2 conversion			○			○
SO_2 instantaneous value			○		○	
Average value	○		○		○	
O_2 conversion					○	
CO instantaneous value		○		○		
Average value	○	○		○		
O_2 conversion				○		
O_2 instaneous value	○	○	○	○	○	○
Combustion temperature	○	○		○		
Dust collection chamber temperature	○	○		○		

Note 2) The contents to be recorded with a 6-point recorder are assigned and connected as specified in the above table for its delivery.
Recorder type PHR
* If other contents are desired, customer must specify them separately.

Note 3) Specify this code when the downward inclination of the gas tube from the gas extraction point to the analyzer gas inlet is less than 15° or when moisture content of the sample gas is higher than 30%.

Note 4) Specify code 3 when measurement law and/or CO_2 analyzer is selected.



			Description			
			Gas extractor	Tube material	Tube length	Extraction point temperature <29th digit>
Y			Without	Without	Without	———
1			With	Without	Without	———
A			With	SUS316	300mm	800°C or lower
B			With	SUS316	400mm	800°C or lower
C			With	SUS316	600mm	800°C or lower
E			With	SUS316	800mm	800°C or lower
G			With	SUS316	1000mm	800°C or lower
H			With	SUS316	1200 mm	800°C or lower
J			With	SUS316	1500 mm	800°C or lower
K			With	SUS316	2000 mm	800°C or lower
P			With	Titanium	600mm	1000°C or lower
Q			With	Titanium	800mm	1000°C or lower
R			With	Titanium	1000mm	1000°C or lower
D			With	SiC	700mm	1300°C or lower
F			With	SiC	900mm	1300°C or lower
			Kind of gas tube		Length <30th digit>	
	Y		Without		Without	
	A		ø10 / ø8mm Teflon tube		5m	
	B		ø10 / ø8mm Teflon tube		10m	
	C		ø10 / ø8mm Teflon tube		15m	
	D		ø10 / ø8mm Teflon tube		20m	
	E		ø10 / ø8mm Teflon tube		25m	
	F		ø10 / ø8mm Teflon tube		30m	
	G		ø10 / ø8mm Teflon tube		50m	
	H		Heating tube		10m	
	J		Heating tube		15m	
	K		Heating tube		20m	
	L		Heating tube		25m	
	M		Heating tube		30m	
			Non-standard specifications <31st digit>			
		Z	Other non-standard specifications			

STANDARD GAS CODE SYMBOLS

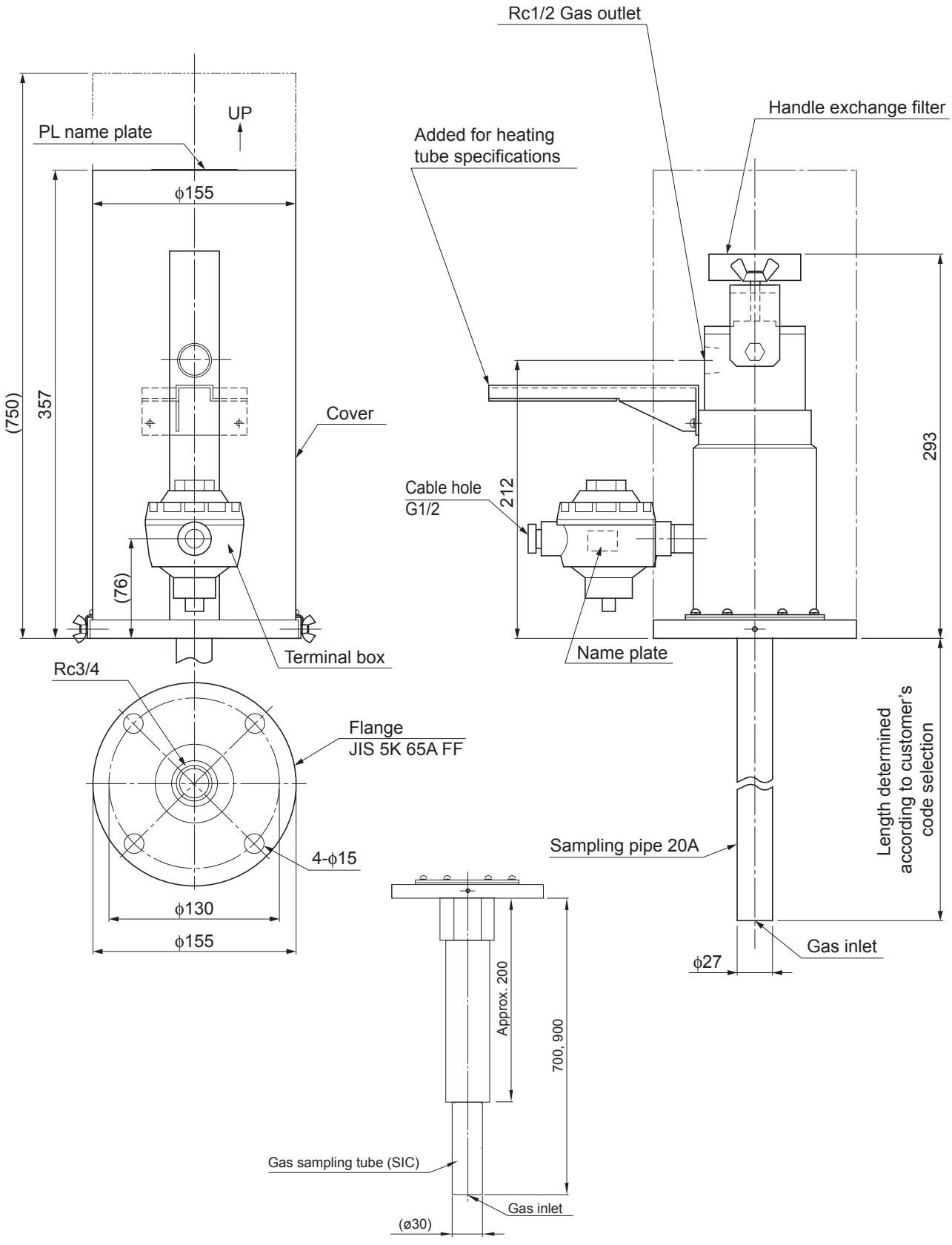
1 2 3 4 5 6 7 8 9 10 11	Description
Z S Y	
0	NO_x measurement first range <4th digit>,ppm Without
A	50
1	100
2	200
3	250
4	500
5	1000
6	2000
7	5000
0	SO_2 measurement first range <5th digit>,ppm Without
A	50
1	100
2	200
3	250
4	500
5	1000
6	2000
7	5000
0	CO measurement first range <6th digit>,ppm Without
A	50
1	100
2	200
3	250
4	500
5	1000
6	2000
7	5000
Y	CO_2 measurement first range <7th digit>, % Without
A	5
B	10
C	20
0	O_2 span gas <9th digit> Without
1	1.8 to 2% O_2 / N_2
2	10% O_2 / N_2 Note)
3	AIR
Y	Zero gas <10th digit> Without
A	Air cylinder (without certificate)
B	Air cylinder (with certificate Japanese offical organization)
C	N_2 cylinder (without certificate)
D	N_2 cylinder (with certificate Japanese official organization)
Y	Offical certificate <11th digit> Without
A	NO_x
B	SO_2
C	CO
D	NO_x, SO_2
E	NO_x, CO
F	NO_x, SO_2, CO
G	NO_x, O_2
H	SO_2, O_2
J	CO, O_2
K	NO_x, SO_2, O_2
L	NO_x, CO, O_2
M	NO_x, SO_2, CO, O_2

Note: Select “1” for the 9th digit and “A” or “B” for the 10th digit for zirconia type O_2 sensor.
For the magnetic type O_2 sensor, select “2” or “3” for the 9th digit according to the selection of the first range, and select “C” or “D” for the 10th digit.

Scope of Delivery: standard gas (3.4L) with pressure regulator

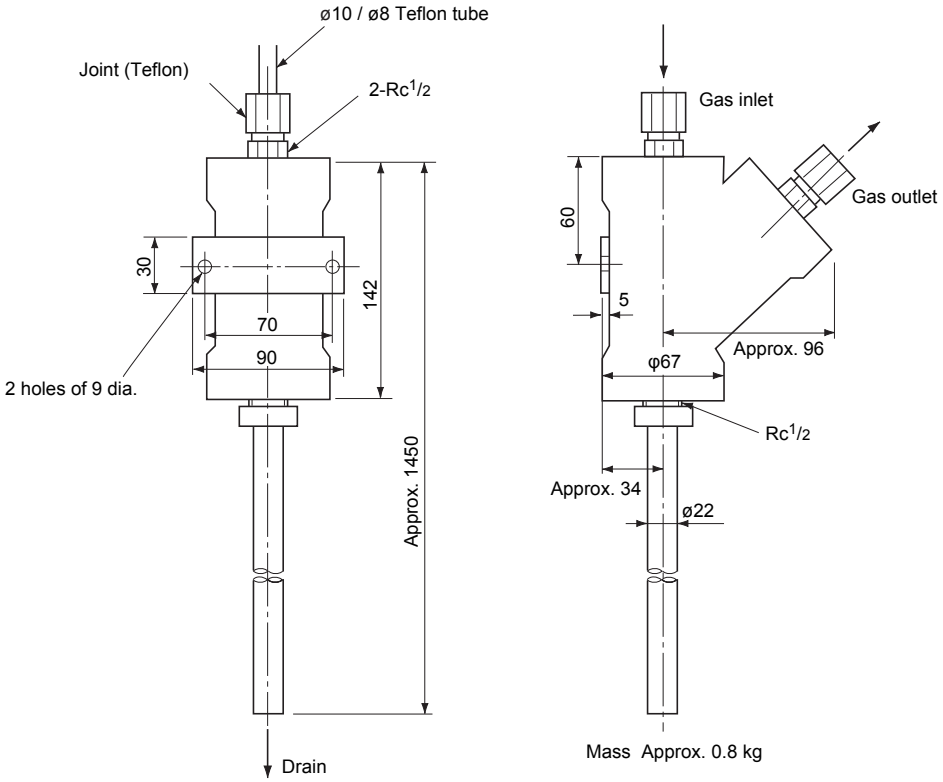
7.3 External view

7.3.1 Gas extractor



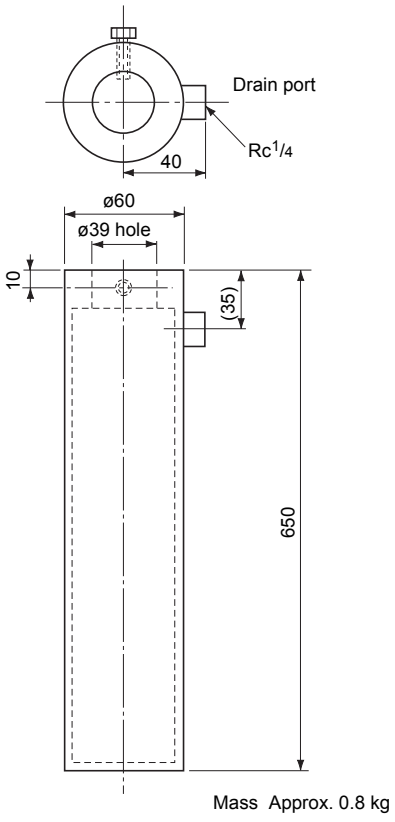
Unit: mm

7.3.2 Drain separator



Unit: mm

7.3.3 Drain pot



Unit: mm

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