



Instruction Manual

INFRARED GAS ANALYZAR

TYPE: ZSJ

PREFACE

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

- 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

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.

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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 mm² 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	• 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	• 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. 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)	6	If provided with SO ₂ meter (Note 1) If not provided with SO ₂ meter
	Filter paper for membrane filter (25 sheets) / For spare (fiberglass)	1	
2	Joint for standard gas Rc ¹ / ₄ - ø6 mm	1 unit	
3	Hose band for fixing standard gas cylinder	1 unit	} If gas extractor is provided If heating tubes are provided
4	Viton tube for connecting standard gas 1m ø8/ø5 mm	1	
5	Polyethylene tube for connecting standard gas 6m ø6/ø4 mm	1	
6	Anchor bolt for locker installation (optional) M12 × 160 × 50	4	
7	Injection water bottle	1	
8	Gas extractor flange packing	1	
9	Gas extractor mounting bolt/nut M12 × 60 mm	1 unit	
10	Heating tube support fixture	1 unit	
11	Instruction manual (INZ-TN2ZSJ-E)	1	

(Note 1) Four if there is no zirconia O₂ sensor.

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

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1. OVERVIEW

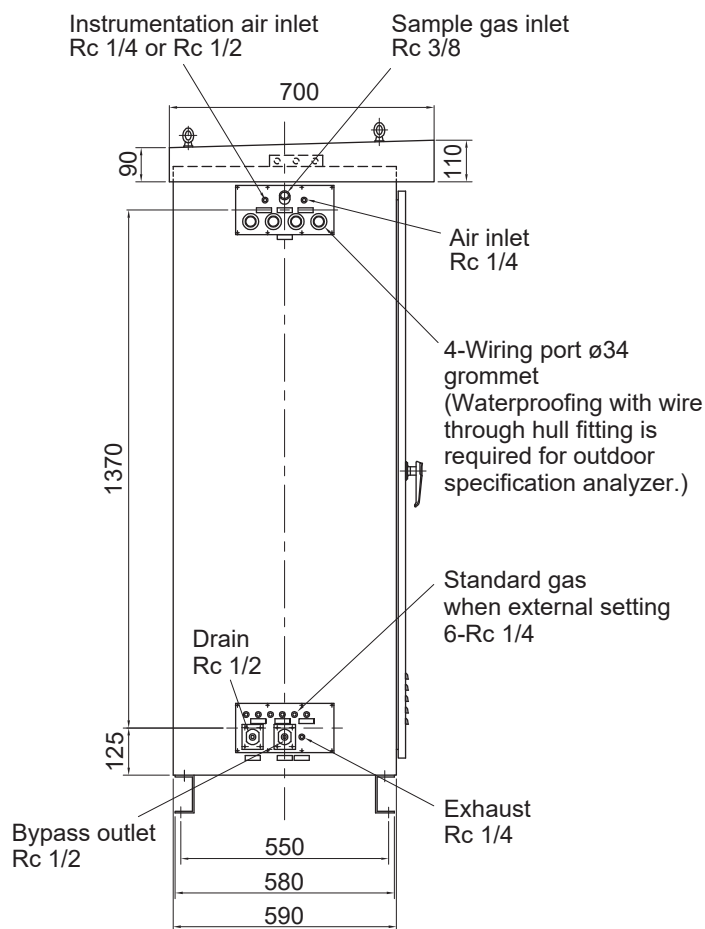
This infrared gas analyzer (ZSJ) is composed of infrared gas analyzer unit, oxygen sensor and gas sampling equipment. It is capable of accurately and continuously measuring concentration of gases such as NO_x, SO₂, CO, CO₂ and O₂ contained in the flue gas generated from a stationary source such as boiler and dust incinerator.

The specification for measurement of CO and O₂ includes the function that deals with dioxin effluent control.

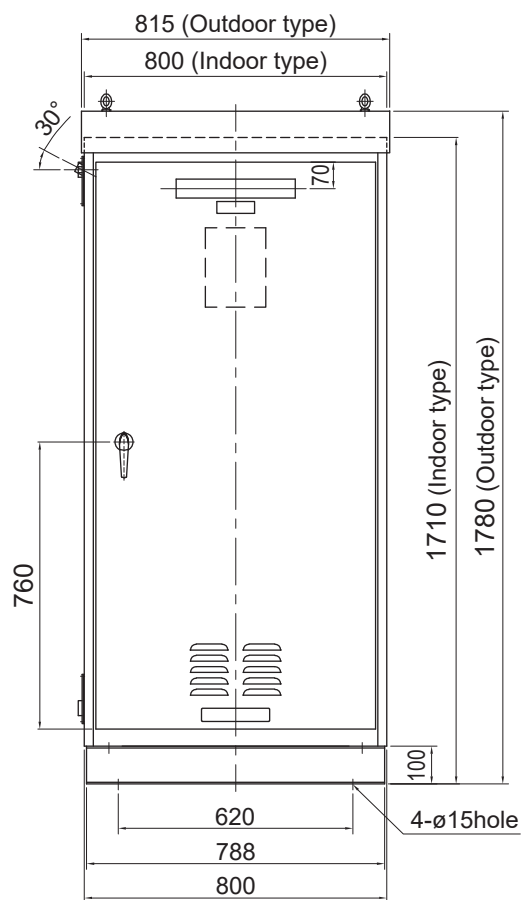
The description in the manual may not exactly match your analyzer somewhere depending on your requirements.

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

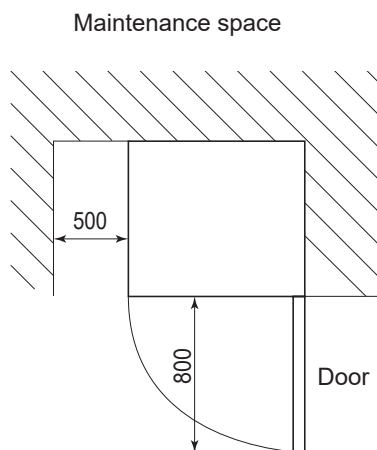
1.1 Outline diagram



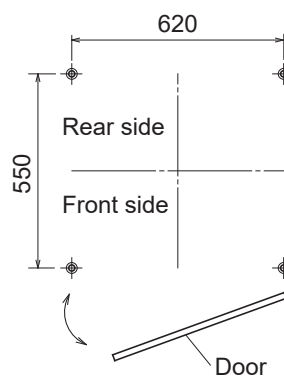
Left side



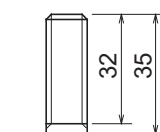
Front



Anchor plan, door open/close diagram



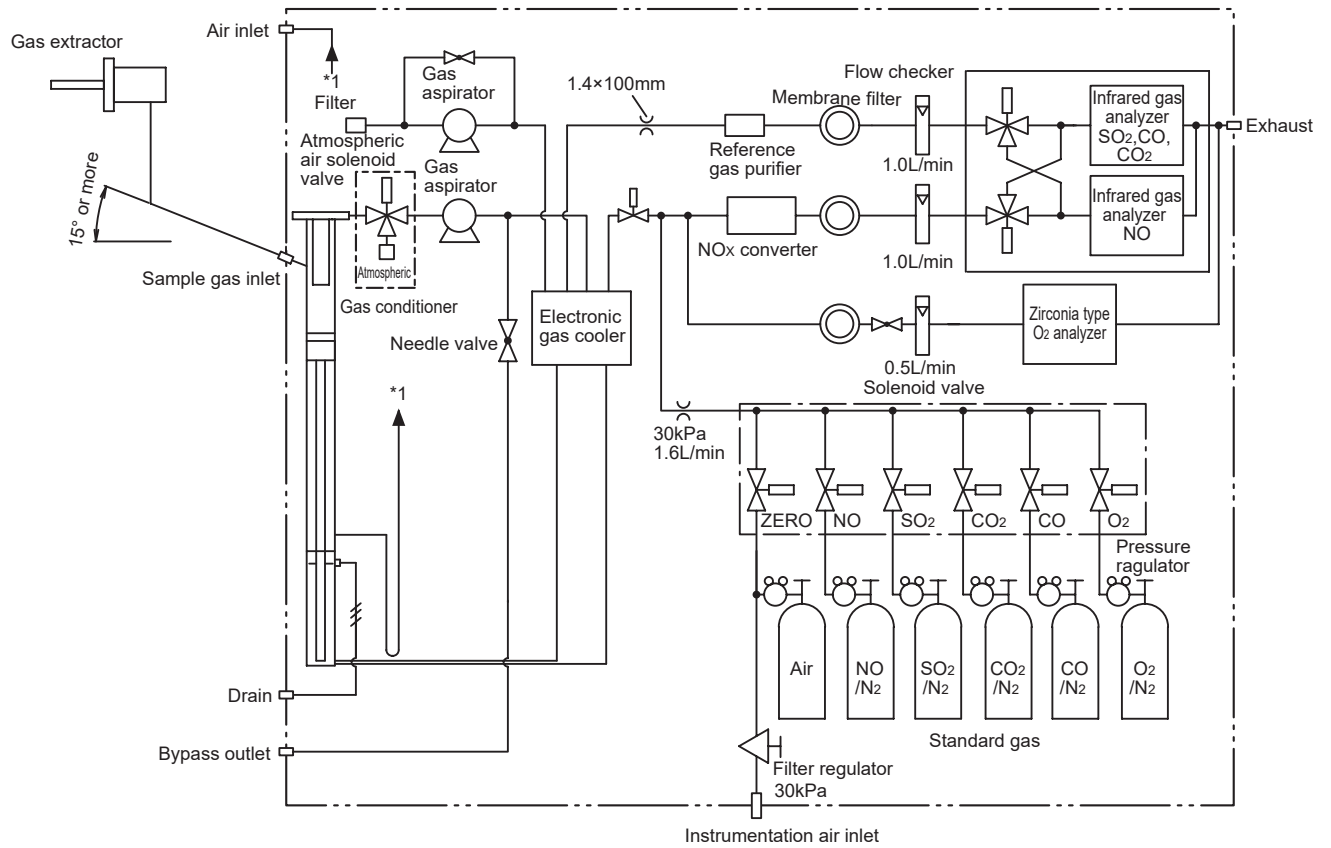
Anchor bolt (option)
(4-M12 $\times$ 160 $\times$ 50)



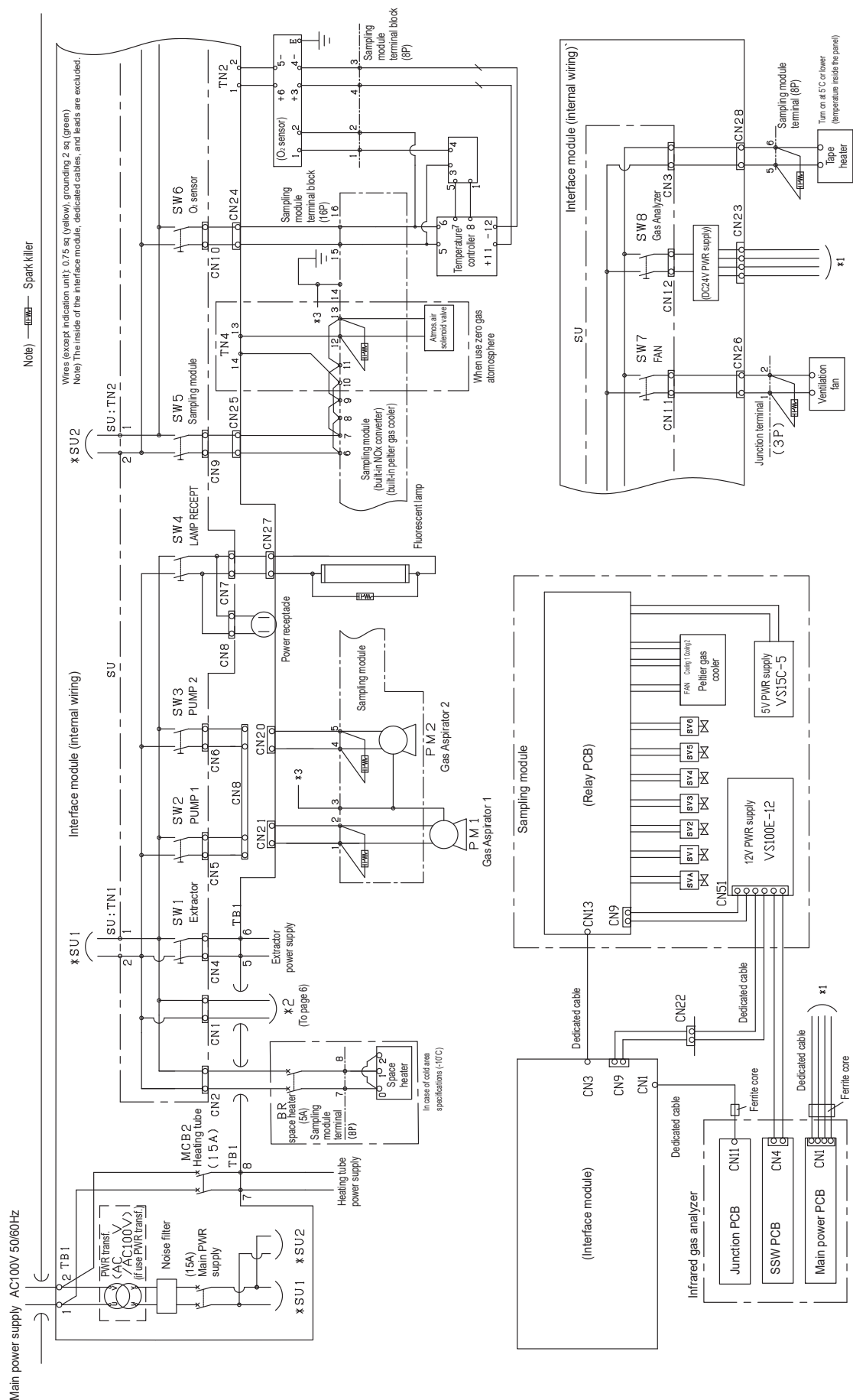
Unit: mm

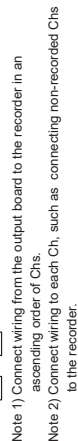
1.2 Sampling system diagram

5-Component Gas Sampling System Diagram (Standard type)

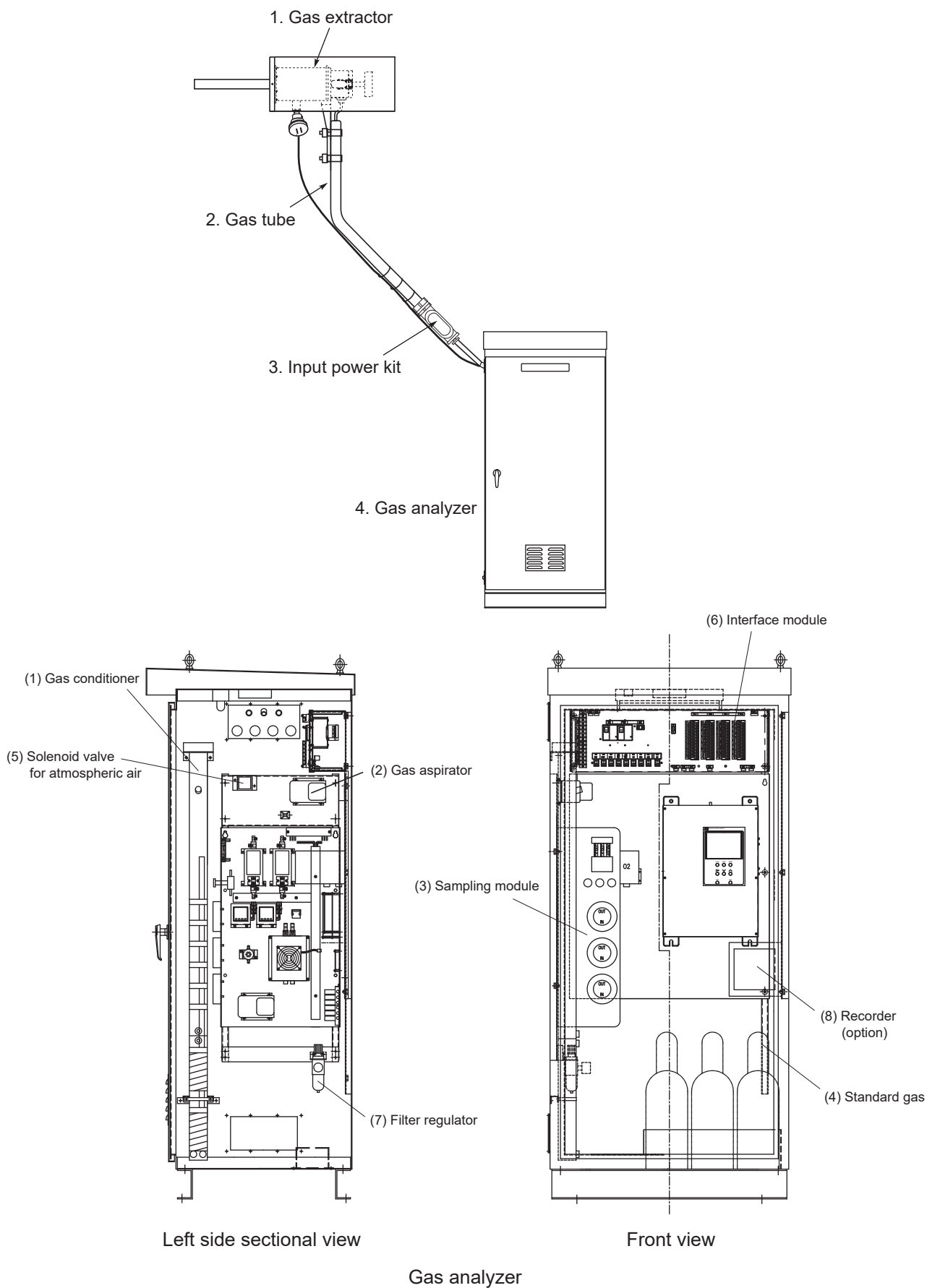


1.3 Wiring connection diagram





1.4 Composition and functions of gas analyzer



Unit name		Description
1. Gas extractor		Collects sample gas efficiently. (A heater and filter are built in.)
Name	Heater	Prevents clogging of the filter. About 250°C
	Filter	Removes dust. Standard 40 µm
2. Gas tube		Lead tube that feeds sample gas to the gas analyzer unit from the gas extractor. Select a Teflon tube or heating tube, depending on the usage environment.
Name	Teflon tube	Standard ø10/ø8 tube
	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		Measures the concentration of the fed sample gas, and outputs electrical signals.
Name	(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 3 L/min
	(3) Sampling module	Peltier gas cooler, solenoid valve for calibration, flowchecker, needle valve, membrane filter, NO ₂ /NO converter and reference gas purifier 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) Filter regulator	Controls the instrumentation air pressure.
	(8) Recorder (option)	Used for recording of analyzer indication.

1.4.1 Composition and description of gas analyzer

1. Interface module

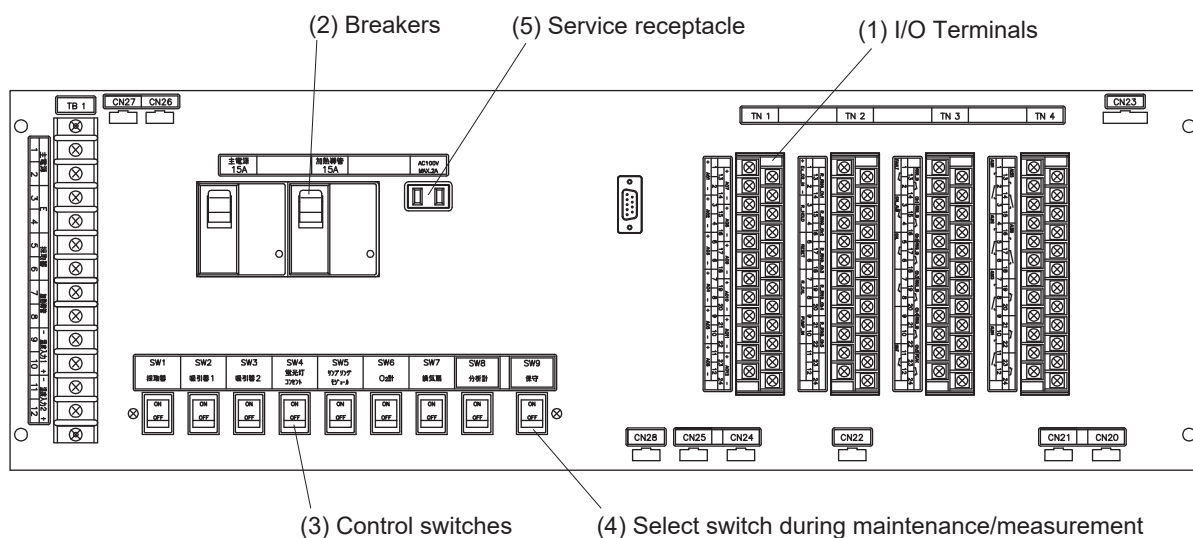


Fig. 1-1

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 Pump1,2; 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, reference gas purifier and for peltier gas cooler O ₂ sensor; power switch for O ₂ sensor FAN; power switch for ventilation fan Gas Analyzer; power switch for gas analyzer unit
	(4) Select switch during maintenance/measurement	Switching during maintenance will hold the signal, conducting the output (DO) during maintenance.
	(5) Service receptacle	100V AC, 50/60 Hz, 2A

2. Analyzer unit

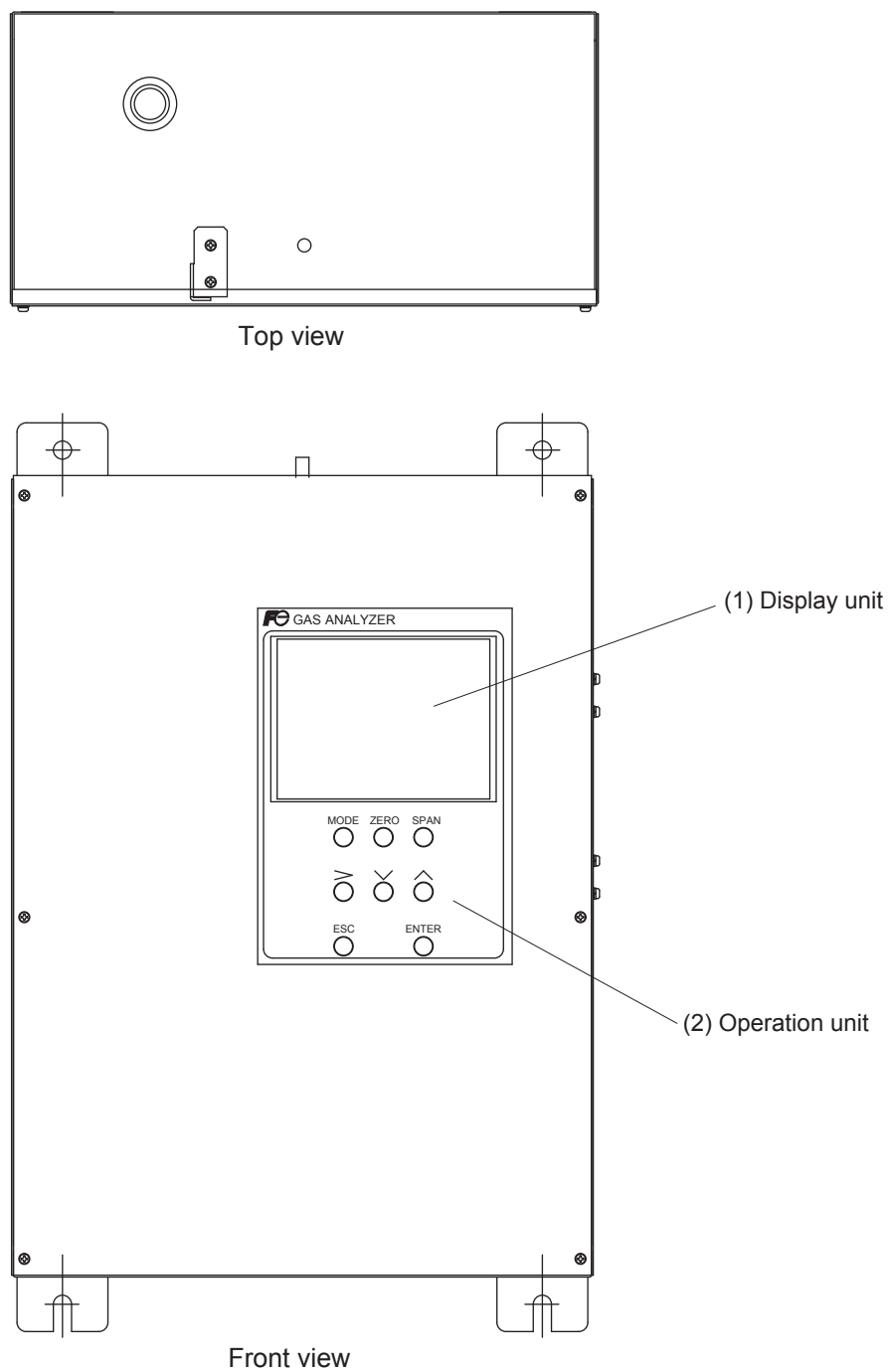
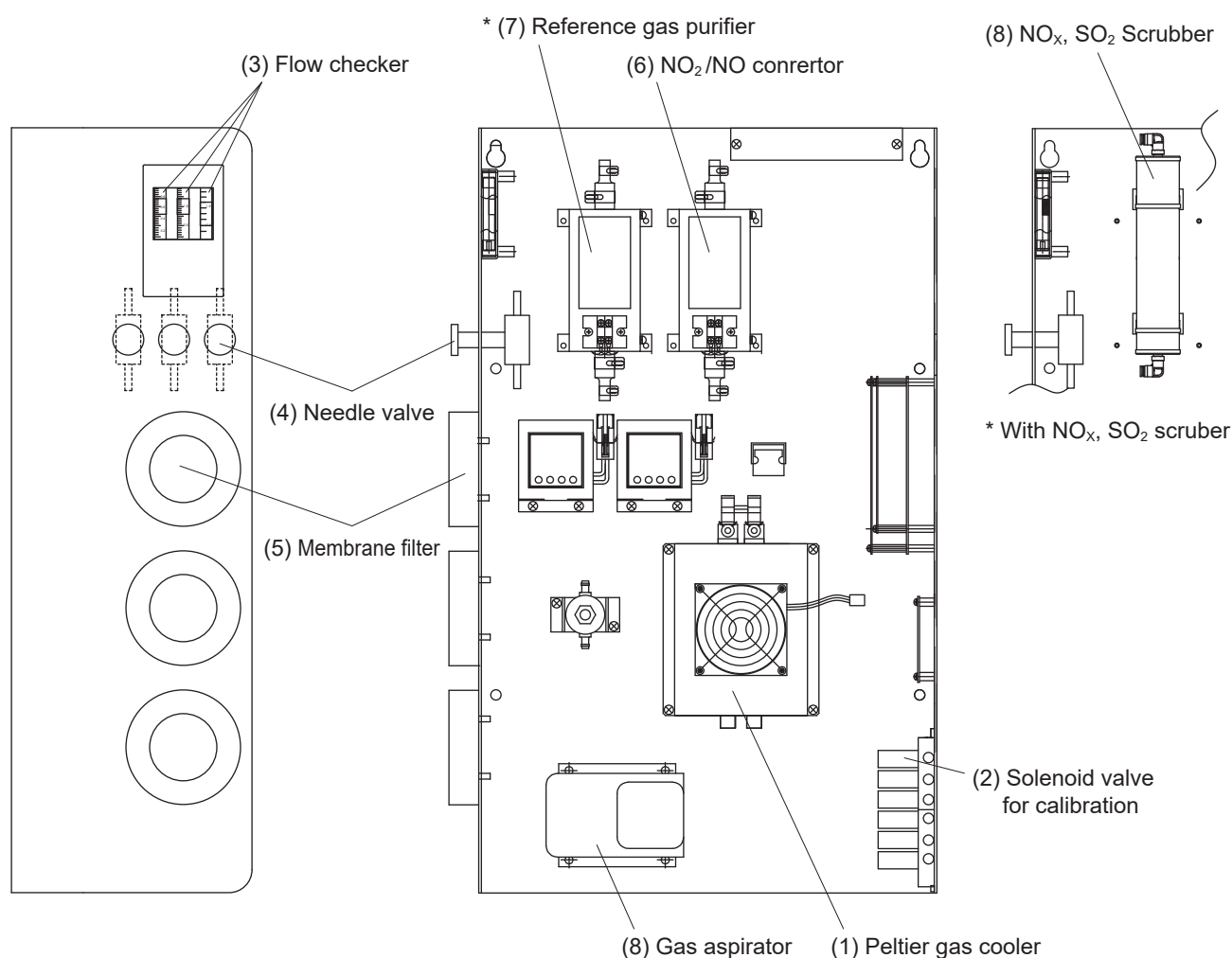


Fig. 1-2

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

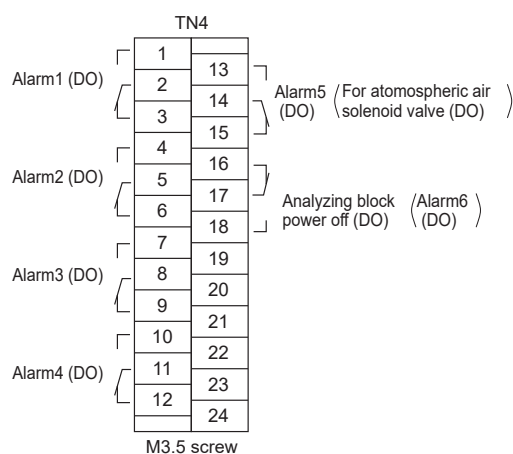
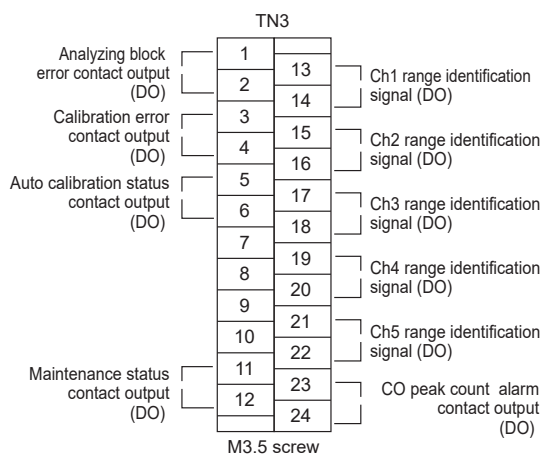
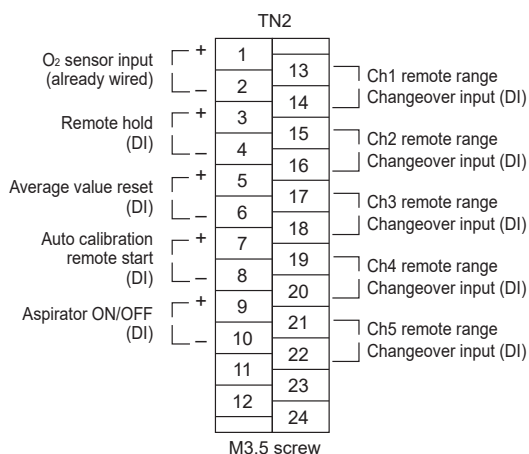
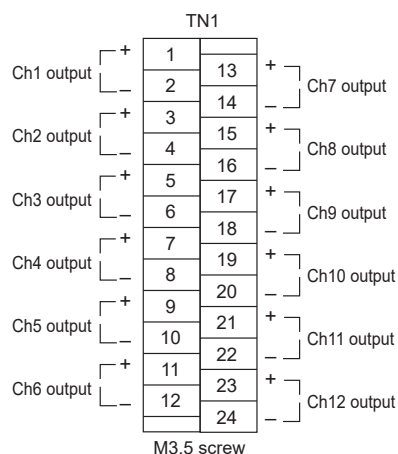
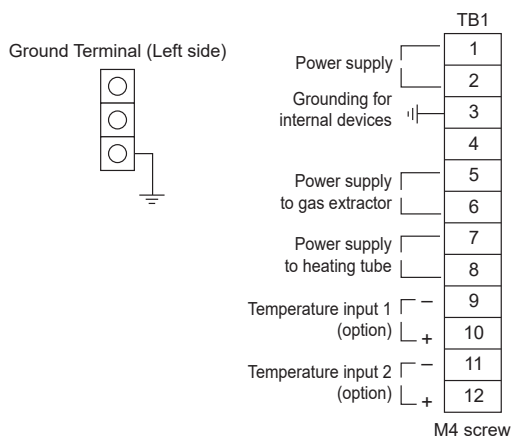
3. Sampling module



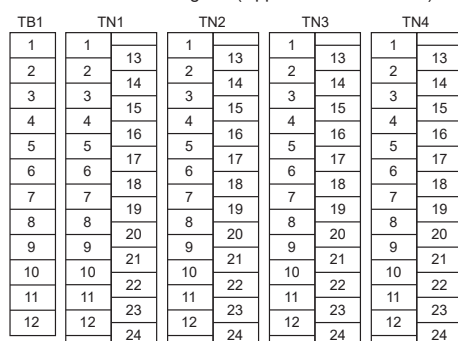
Name of unit	Name	Description
Sampling module	(1) Peltier gas cooler	Remove moisture from the sampling gas. (approx. 5°C)
	(2) Solenoid valve for calibration	Used for lead-in of calibration gas.
	(3) Flow checker	Used to monitor the flow rate of sample gas, reference gas, and calibration gas.
	(4) Needle valve	Used to adjust the flow rate of sample gas and reference gas.
	(5) Membrane filter	Removes fine dust by glass filter paper (0.5μm) and Teflon filter (0.1μm). Upper one is filter 1, and lower one is filter 2.
	(6) NO ₂ /NO convertor	Converts NO ₂ in the sampling gas to NO gas.
	(7) Reference gas purifier	Refines aspirated air into the reference gas.
	(8) NO _x and SO ₂ scrubber	Refines aspirated air into the reference gas.
	(9) Gas aspirator	Aspirates the air to be used as reference gas.

1.4.2 Terminal block

(1) List of terminal blocks

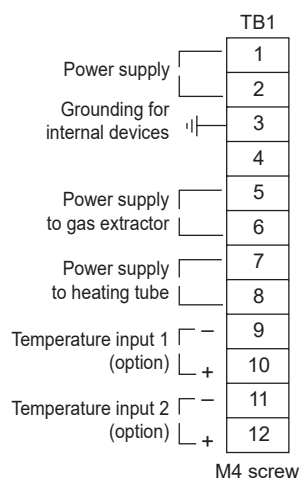


External terminal block diagram (Upper side of main unit)



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

(2) Description of terminal block



Terminal block <TB1>

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

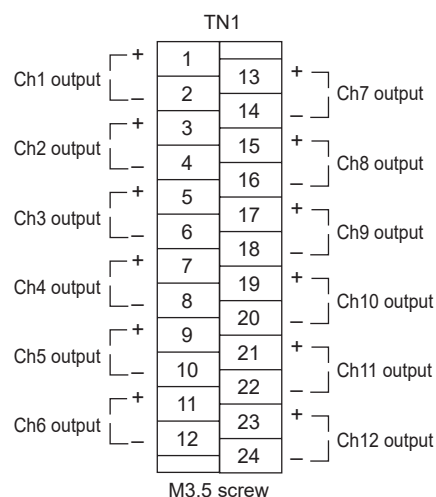
3 : **Ground for internal device. Connect nothing others. Connect the ground for power supply to ground terminal located on upper left side in locker.**

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 1 <TN1>

Terminal block for analog output

Between 1 – 2 : Ch1 output

Between 3 – 4 : Ch2 output

Between 5 – 6 : Ch3 output

Between 7 – 8 : Ch4 output

Between 9 – 10 : Ch5 output

Between 11 – 12 : Ch6 output

Between 13 – 14 : Ch7 output

Between 15 – 16 : Ch8 output

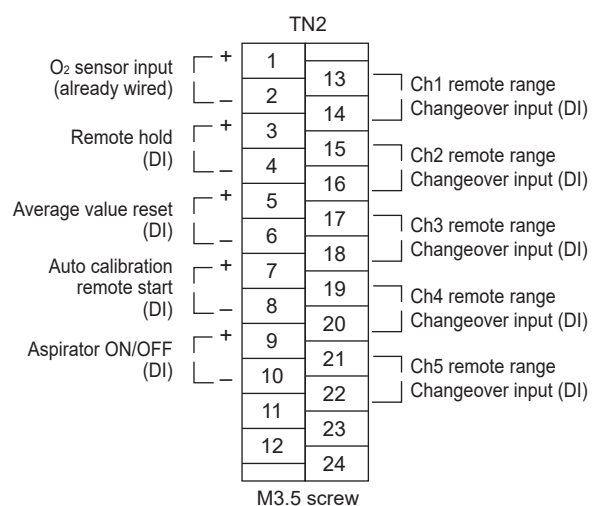
Between 17 – 18 : Ch9 output

Between 19 – 20 : Ch10 output

Between 21 – 22 : Ch11 output

Between 23 – 24 : Ch12 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 O₂ sensor input. (Input for our Zirconia oxygen sensor. Must not be used unless O₂ sensor is added.)

Between 3– 4 : Remote hold input. No hold when open. Output hold when short.

Between 5– 6 : Average value reset input. Shorting the contact input (for 1.5 sec or more.) resets O₂ average and converted average simultaneously. Opening it restarts the average value.

Between 7– 8 : 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 9– 10 : Aspirator ON/OFF contact input. aspirator ON when open. Aspirator OFF when short.

Note: If an NO_x meter and a CO meter are used in mixture, there is a possibility where the reading of the CO meter rises when the aspirator stops running, because minor CO is generated due to chemical changes in the NO₂/NO converter and this CO accumulates. If this phenomenon becomes a problem, hold the output before aspirator stop.

Between 11 – 12 : For internal connection. Must not be wired. (Must not be used as junction terminal.)

Between 13 – 14 : Ch1 remote range changeover input

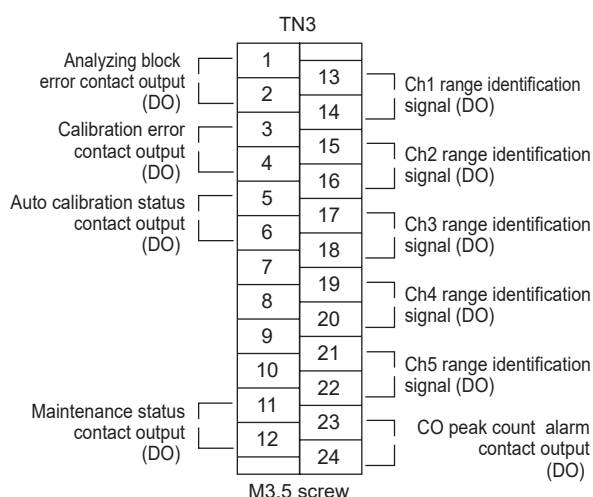
Between 15 – 16 : Ch2 remote range changeover input

Between 17– 18 : Ch3 remote range changeover input

Between 19– 20 : Ch4 remote range changeover input

Between 21– 22 : Ch5 remote range changeover input

Between 23– 24 : For internal connection. Must not be wired. (Must not be used as junction terminal.)



- 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 : Conductive when analyzer unit error is produced. Normally open.

Between 3 – 4 : Calibration error contact output. Conductive when error is produced at zero or span calibration. Normally open.

Between 5 – 6 : Automatic calibration status contact output. Conductive during automatic calibration. Open otherwise.

Between 7 – 10 : For internal connection. Must not be wired. (Must not be used as junction terminal.)

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

Between 13 – 14 : Ch1 range identification signal output

Between 15 – 16 : Ch2 range identification signal output

Between 17 – 18 : Ch3 range identification signal output

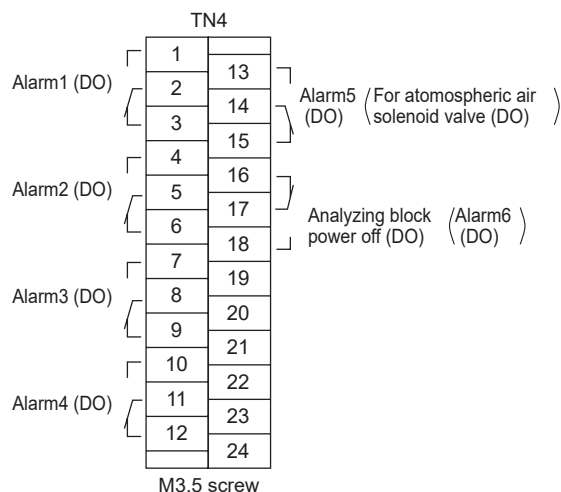
Between 19 – 20 : Ch4 range identification signal output

Between 21 – 22 : Ch5 range identification signal output

Between 23 – 24 : 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."

- 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>

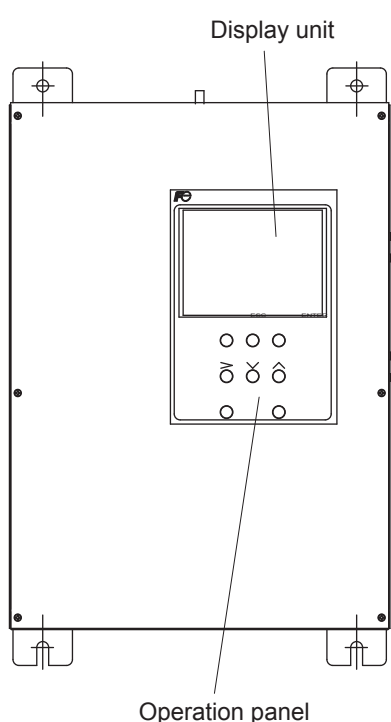
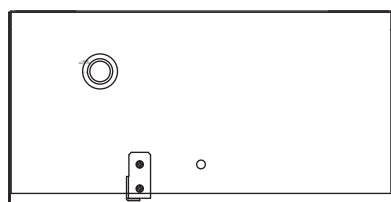
- Between 1 – 3 : Alarm 1 (initial state)
Conductive at 1-2 and open at 2-3 when a measured value exceeds the limit value. Open at 1-2 and conductive at 2-3 otherwise.
- Between 4 – 6 : Alarm 2 (initial state)
Conductive at 4-5 and open at 5-6 when a measured value exceeds the limit value. Open at 4-5 and conductive at 5-6 otherwise.
- Between 7 – 9 : Alarm 3 (initial state)
Conductive at 7-8 and open at 8-9 when a measured value exceeds the limit value. Open at 7-8 and conductive at 8-9 otherwise.
- Between 10 – 12 : Alarm 4 (initial state)
Conductive at 10-11 and open at 11-12 when a measured value exceeds the limit value. Open at 10-11 and conductive at 11-12 otherwise.
- Between 13 – 15 : Alarm 5 (initial state)
Conductive at 13-14 and open at 14-15 when a measured value exceeds the limit value. Open at 13-14 and conductive at 14-15 otherwise.
※ For specification zero gas atmospheric air
Contact output for atmospheric air solenoid valve connection.
(Already wired if atmospheric air is used as zero gas. Must not be wired otherwise.)
- Between 16 – 18 : Analyzing block power off output.
(initial state)
Conductive at 16-17 and open at 17-18 when analyzer unit is energized. Open at 16-17 and conductive at 17-18 when analyzer unit is de-energized.
*Usable as a normal alarm by setting change.
For specification Alarm 6
Conductive at 16-17 and open at 17-18 when a measured valve exceeds the limit valve. Open at 16-17 and conductive at 17-18 otherwise.

- Alarm responds only to an instantaneous value.

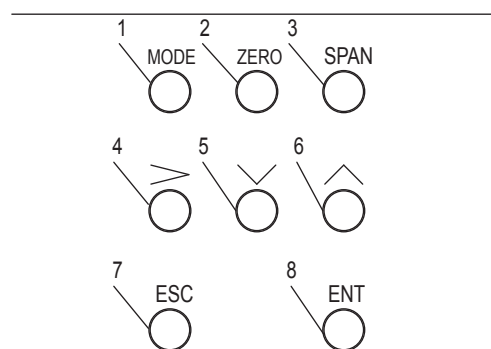
1.5 Description of display and operation panels

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



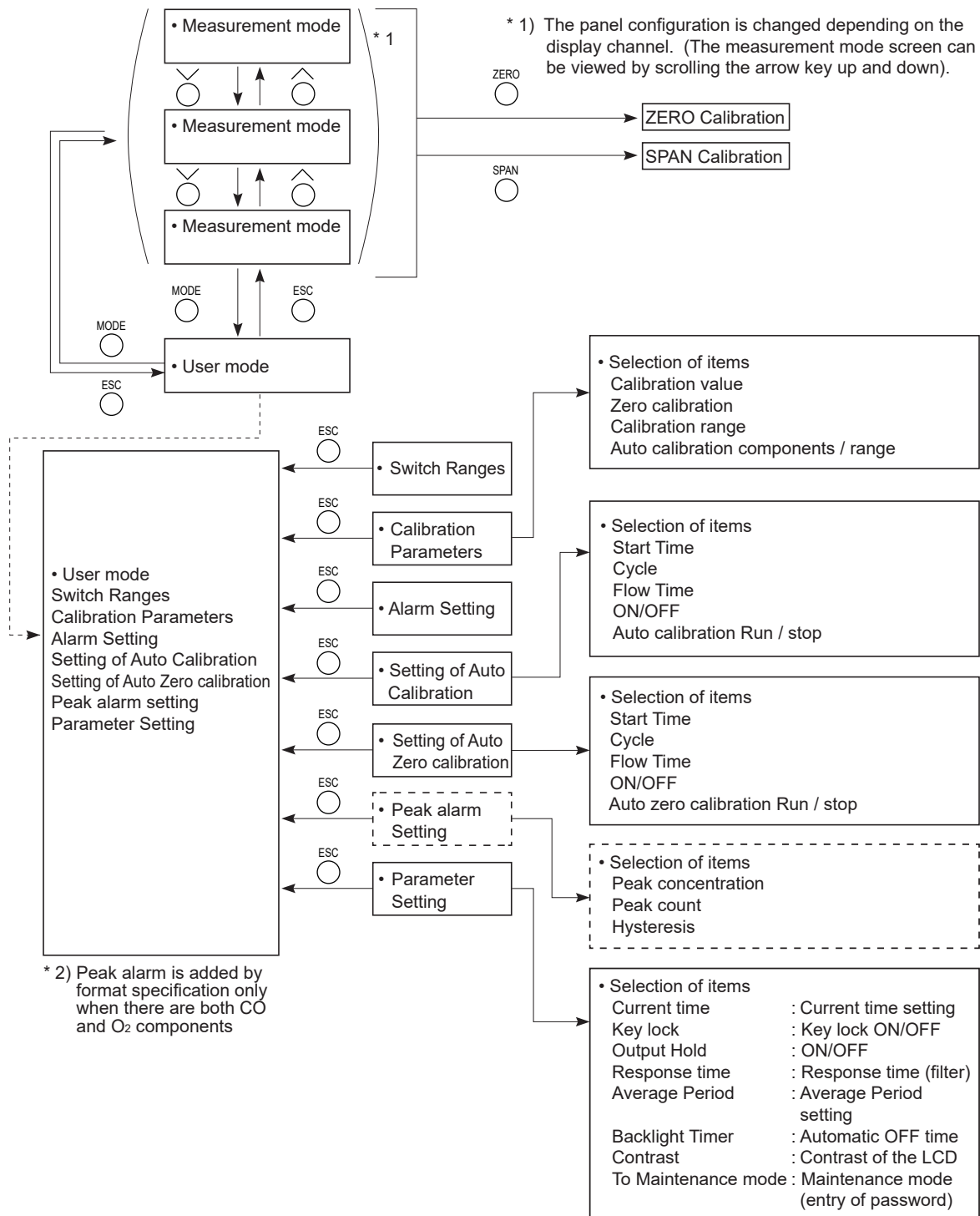
- Display unit: The measurement screen and the setting items are displayed.
- Operation panel: The configuration is as shown in the upper right.



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	SIDE key	Used to change the selected item (by moving the cursor) and digit.
5	DOWN key	Used to change the selected item (by moving the cursor) and to decrease digit.
6	UP key	Used to change the selected item (by moving the cursor) and to increase 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.

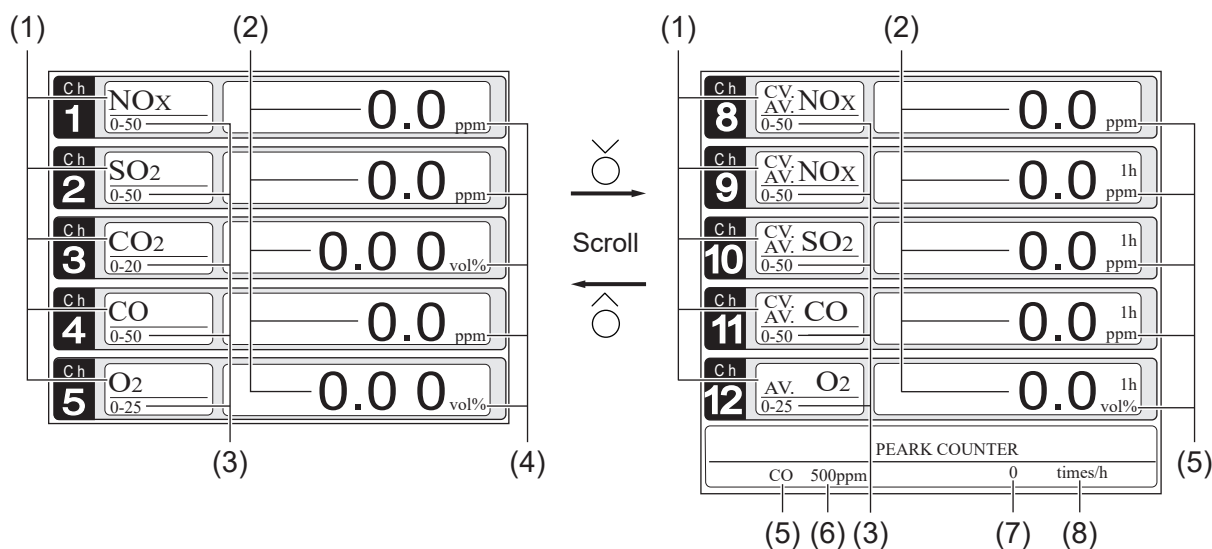
1.5.2 Overview of display and operation panels



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, SO₂, CO₂, CO and O₂ (output: 12 channel).



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

No.	Name	Function
(1)	Component display	Displays the component of instantaneous value, corrected instantaneous value, corrected average value, etc.
(2)	Concentration display	Displays the measured value of concentration.
(3)	Range display	Displays the range values.
(4)	Unit display	Displays the unit with ppm or mg/m ³ and vol%.
(5)	Peak alarm component display	Peak alarm component display.
(6)	Peak alarm concentration display	Display of peak value (upper limit setting value) concentration.
(7)	Number of peak alarms	Display of number of times peak value was exceeded.
(8)	Peak alarm unit display	Display of the peak alarm unit times/h.

- **Instantaneous value and concentration value:**

The concentration display of Ch (component) where sampling components such as “CO₂”, “CO” and “O₂” are displayed in the component display, indicates current concentration values of the measured components contained in gas that is now under measurement.

- **O₂ corrected concentration values:**

Ch components in which “cv**” is displayed as “cv CO” in the component display are calculated from the following equation. Refer to Section 3.7 “Maintenance mode - Other parameter”.

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

On: The value of the O₂ correction reference value
(Value set by application)

Os: Oxygen concentration (vol %)

Cs: Concentration of relevant measured component.

However, the value for Os shall not be the limit setting or greater.

The corrected sampling components are NO, SO₂ and CO only.

- **O₂ corrected concentration average value:**

In the Ch (component) and O₂ average value where “^{CV}_{AV} **” is displayed as “^{CV}_{AV} CO” in the component display, a value obtained by averaging O₂ corrected concentration value or O₂ average value in a fixed time is output every 30 seconds.

Averaging time can be changed between 1 to 59 minutes or 1 to 4 hours according to the average time settings (See Section 3.6, Parameter setting).

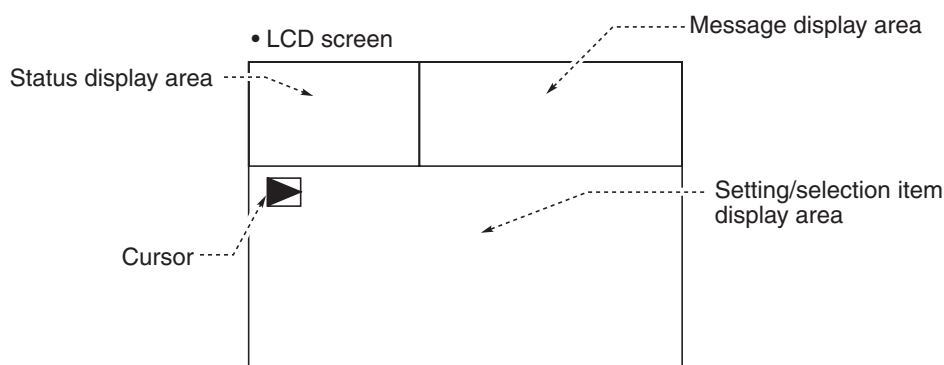
(The averaging set time is displayed as “1h”, for instance, in the range display.)

- * The measurement ranges of O₂ corrected concentration value and O₂ correction concentration average value are the same as that of the measuring components. Also, the measurement range of O₂ average value is the same as that of O₂.

(2) Setting/selection screen

The setting/selection screen is configured as shown below:

- In the status display area, the current display item 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 UP, DOWN and SIDE keys.



(3) Contents of measured channel (Ch)

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

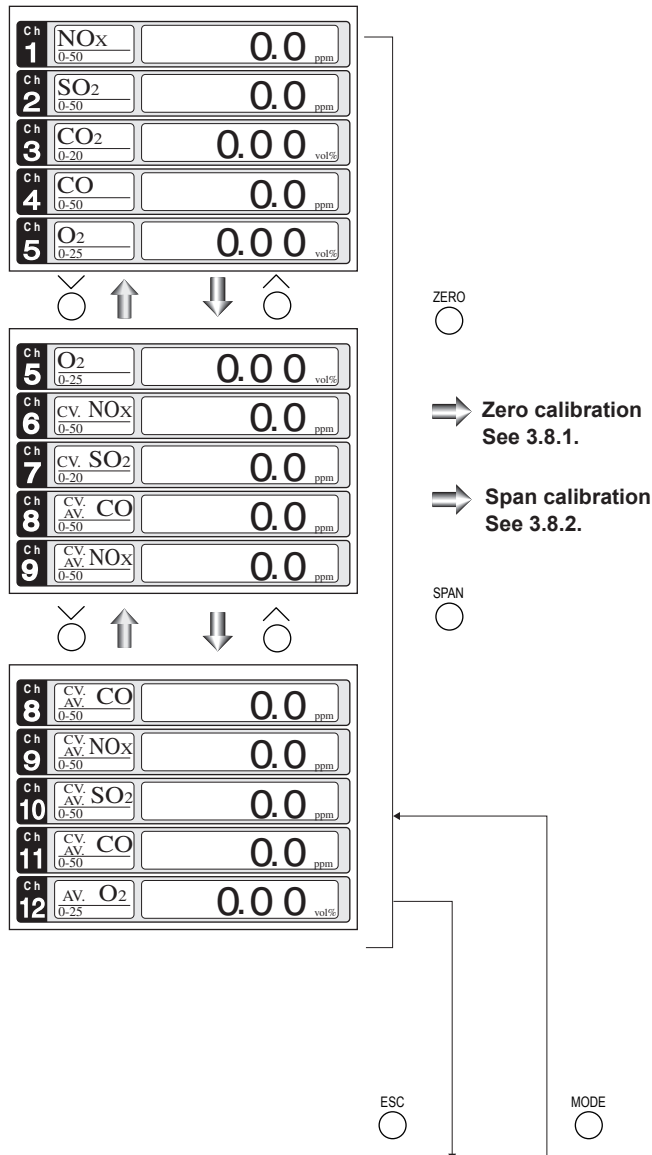
Table 1-1 Correspondence between measurement channel and measured value

Code symbol		
P	0	Ch1:NOx
A	0	Ch1:SO ₂
B	0	Ch1:CO
F	0	Ch1:NOx, Ch2:SO ₂
H	0	Ch1:NOx, Ch2:CO
L	0	Ch1:NOx, Ch2:SO ₂ , Ch3:CO
M	0	Ch1:NOx, Ch2:SO ₂ , Ch3:CO ₂ , Ch4:CO
P	4 to G	Ch1:NOx, Ch2:O ₂ , Ch3:corrected NOx, Ch4:corrected NOx average
A	4 to G	Ch1:SO ₂ , Ch2:O ₂ , Ch3:corrected SO ₂ , Ch4:corrected SO ₂ average
B	4 to G	Ch1:CO, Ch2:O ₂ , Ch3:corrected CO, Ch4:corrected CO average
F	4 to G	Ch1:NOx, Ch2:SO ₂ , Ch3:O ₂ , Ch4:corrected NOx, Ch5:corrected SO ₂ , Ch6:corrected NOx average, Ch7:corrected SO ₂ average
H	4 to G	Ch1:NOx, Ch2:CO, Ch3:O ₂ , Ch4:corrected NOx, Ch5:corrected CO, Ch6:corrected NOx average, Ch7:corrected CO average
L	4 to G	Ch1:NOx, Ch2:SO ₂ , Ch3:CO, Ch4:O ₂ , Ch5:corrected NOx, Ch6:corrected SO ₂ , Ch7:corrected CO, Ch8:corrected NOx average, Ch9:corrected SO ₂ average, Ch10:corrected CO average
M	4 to G	Ch1:NOx, Ch2:SO ₂ , Ch3:CO ₂ , Ch4:CO, Ch5:O ₂ , Ch6:corrected NOx, Ch7:corrected SO ₂ , Ch8:corrected CO, Ch9:corrected NOx average, Ch10:corrected SO ₂ average, Ch11:corrected CO average

1.5.4 Basic operation

• Measurement mode

The measurement mode can display up to 5 channels in a single screen. If 5 channels or more are to be displayed in a single screen, press the  or the  key to scroll the channels one by one.

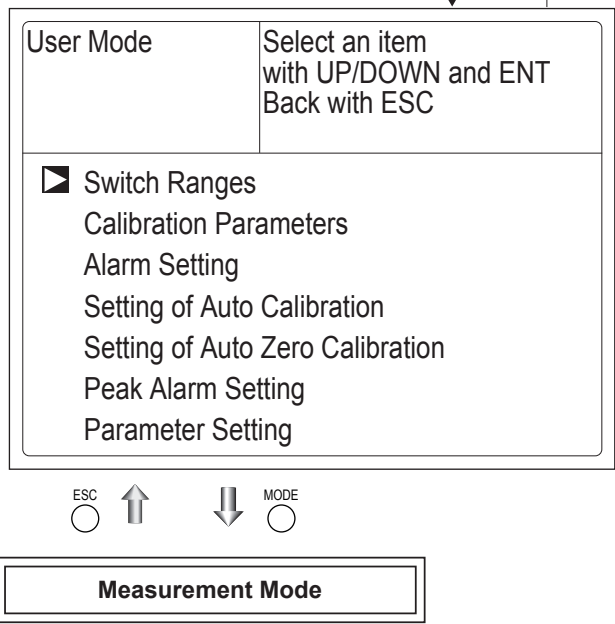


• User mode displays

- Switch Ranges
- Calibration Parameters
- Alarm Setting
- Setting of Auto Calibration
- Setting of Auto Zero Calibration
- Peak Alarm Setting
- Parameter Setting.

Press the  or the  key and move the cursor preceding the each display item. Each display item is displayed by pressing the  key.

For the setting contents, refer to “Chapter 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.

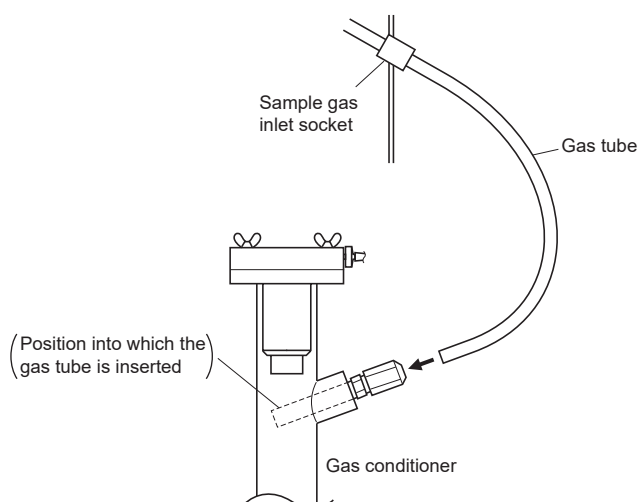
2.1 Installation

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” “Bypass outlet” 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 “4.3.9 How to mount pressure regulator for standard gas cylinder”.

(2) Attach a polyethylene tube ($\phi 6\text{mm}/\phi 4\text{mm}$) 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.

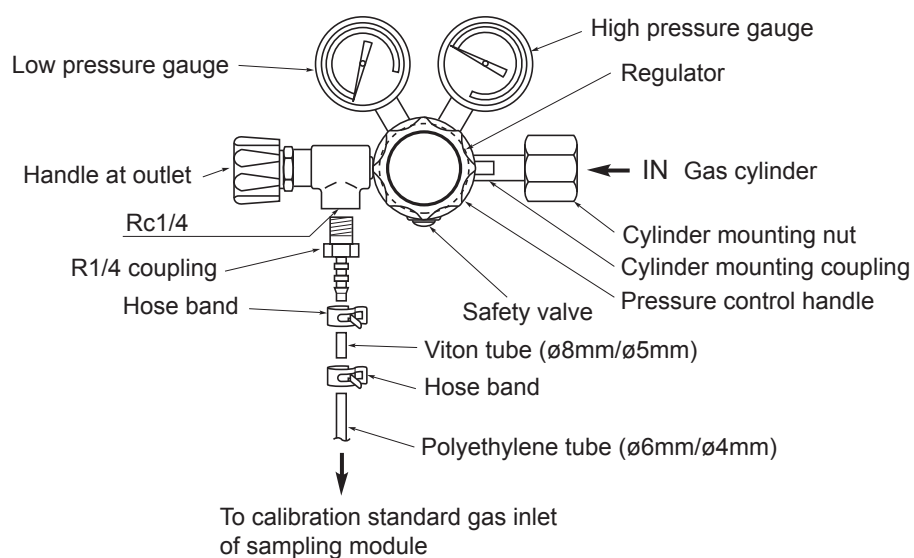
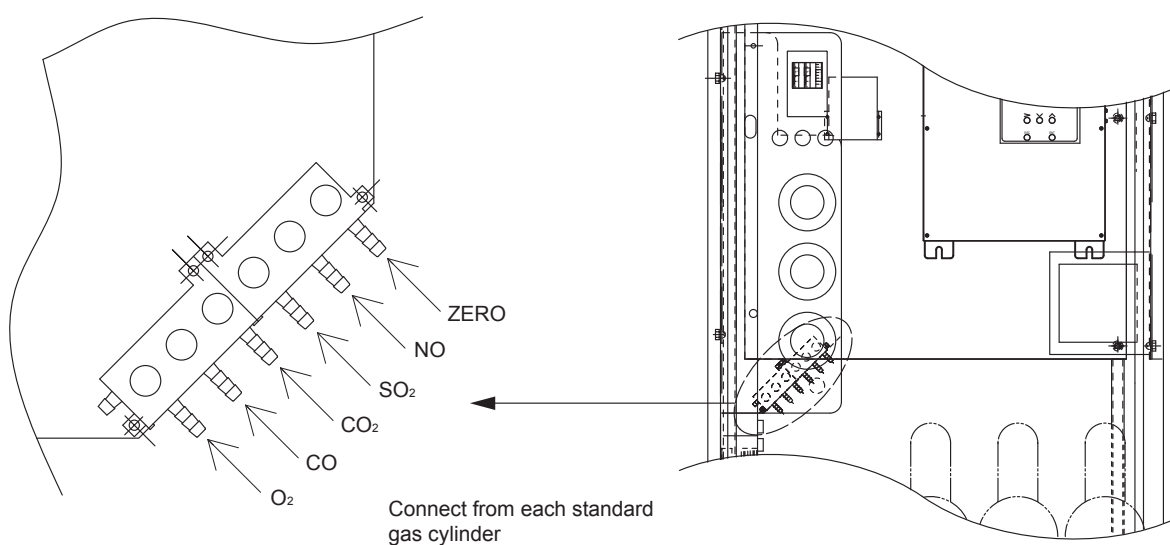


Fig. 2-1

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. 2-2.

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).

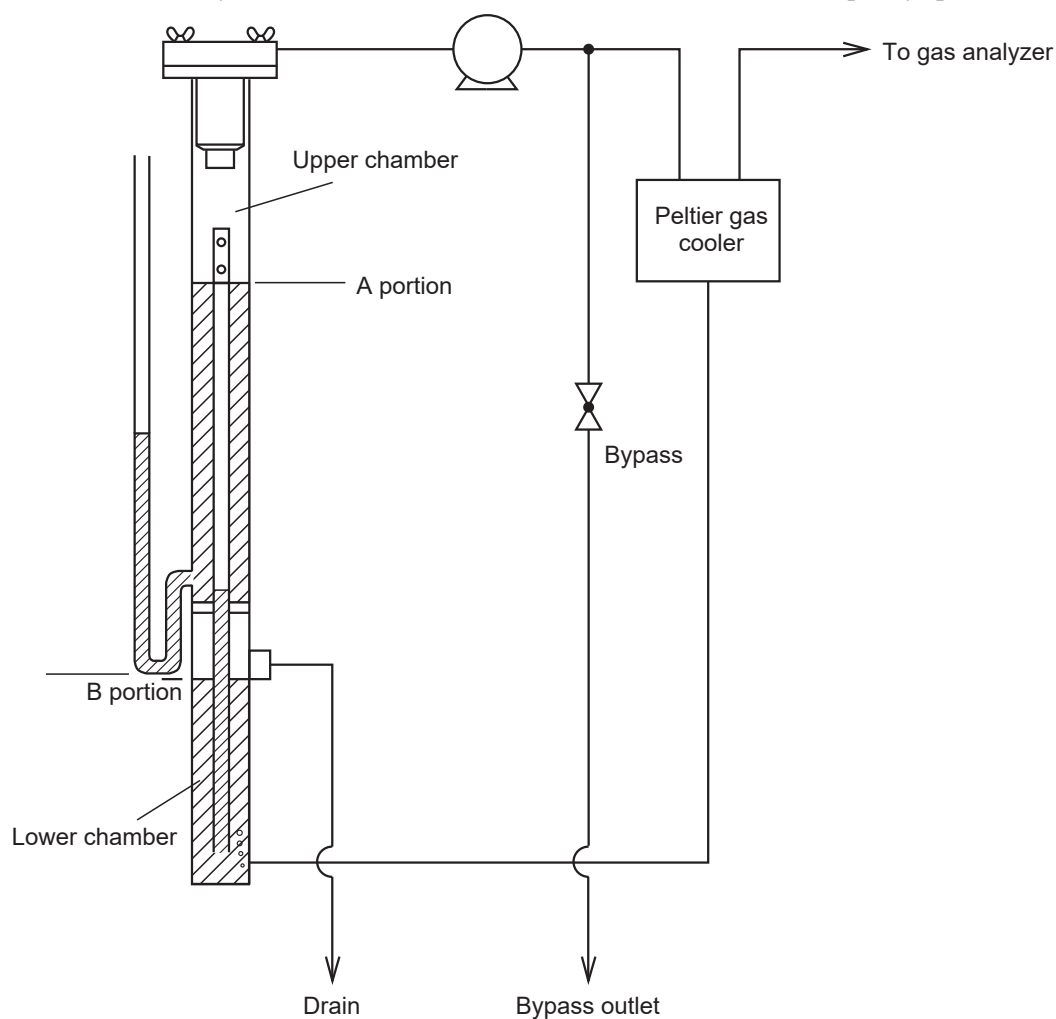


Fig. 2-2

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.

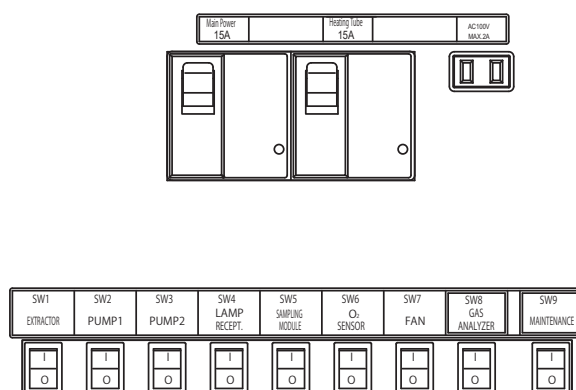


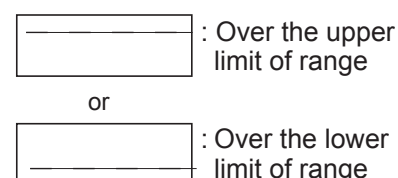
Fig. 2-3

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 the switch except the **GAS ANALYZER** switch. But, the Aspirator switch should be kept OFF. (The fluorescent lamp and space heater should be turned ON as required.)
- (5) Turn "ON" the **GAS ANALYZER** switch.
- (6) Warm-up operation for each device will begin. The time required for warm-up operation is as follows:

Analyzer unit	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
Reference gas purifier	30 min or more

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



But it is not an error.

- (7) After the warm-up, set the switch of the **PUMP1** and **PUMP2** to "ON" to start the operation. Do not turn ON the aspirator during dry heat.
- (8) Check that the upper edge of the flowchecker ball is positioned around a center. If not, turn on and off the needle valve to set the ball in place, as follows.
 - 1) Sample gas: ensure the necessary flow rate by turning on and off the needle valve under the membrane filter. And then, turn on and off the needle valve under the flow checker to set the ball in place.
 - 2) Reference gas: turn on and off the needle valve under the flow checker to set the ball in place.

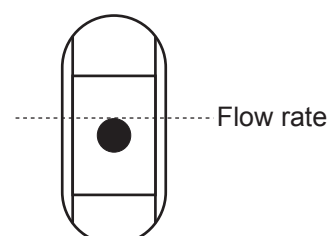


Fig. 2-4 Flow checker

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 aspirator 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 NO_x meter and a CO meter are used in mixture, there is a possibility where the reading of the CO meter rises when the aspirator stops running, because minor CO is generated due to chemical changes in the NO₂/NO converter and this CO accumulates.

**If this phenomenon becomes a problem, hold the output before aspirator 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  key in measurement mode to display the User mode screen.
- (2) Move the cursor to “Switch Ranges” and press the  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 Peak Alarm Setting Parameter Setting	

- (3) In the “Channel Selection” screen that appears, move the  cursor by pressing the  or the  key, and select Ch (component).
- (4) Then press the  key.

ENT


Switch Range		Select Ch No. with UP/DOWN and ENT Back with ESC	
 Ch1 NO _x	MR	 Range1 0-50.00 ppm Range2 0-500.0 ppm	
Ch2 SO ₂	AR	 Range1 0-50.00 ppm Range2 0-500.0 ppm	
Ch3 CO ₂	RR	 Range1 0-10.00 vol% Range2 0-20.00 vol%	
Ch4 CO	MR	 Range1 0-50.00 ppm Range2 0-500.0 ppm	
Ch5 O ₂	MR	 Range1 0-10.00 vol% Range2 0-25.00 vol%	

- (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 less than 80% of Range 1.

* Operation set for each Ch only can be performed.

ENT


Switch Range		Select Ch No. Switch ranges with UP/DOWN and ENT Back with ESC	
Ch1 NO _x	MR	 Range1 0-50.00 ppm Range2 0-500.0 ppm	
Ch2 SO ₂	AR	 Range1 0-50.00 ppm Range2 0-500.0 ppm	
Ch3 CO ₂	RR	 Range1 0-10.00 vol% Range2 0-20.00 vol%	
Ch4 CO	MR	 Range1 0-50.00 ppm Range2 0-500.0 ppm	
Ch5 O ₂	MR	 Range1 0-10.00 vol% Range2 0-25.00 vol%	

- (6) Then press the  key to confirm the selection.
If “MR” is selected, the cursor moves to “Range Switch.”

ENT


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  key.

Switch Range		Select Ch No. Switch ranges with UP/DOWN and ENT Back with ESC		
Ch1 NO _x	MR	▶ Range1	0–50.00	ppm
		Range2	0–500.0	ppm
Ch2 SO ₂	AR	▶ Range1	0–50.00	ppm
		Range2	0–500.0	ppm
Ch3 CO ₂	RR	▶ Range1	0–10.00	vol%
		Range2	0–20.00	vol%
Ch4 CO	MR	▶ Range1	0–50.00	ppm
		Range2	0–500.0	ppm
Ch5 O ₂	MR	▶ Range1	0–10.00	vol%
		Range2	0–25.00	vol%



- (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  key, and the measurement is carried out in the selected range.

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

The ranges for O₂ correction value, O₂ correction average value, and O₂ average value are automatically switched according to the instantaneous value range switch settings. (Same as for “RR” or “AR”.)

Switch Range		Select Ch No. Switch ranges with UP/DOWN and ENT Back with ESC		
Ch1 NO _x	MR	 Range1	0–50.00	ppm
		Range2	0–500.0	ppm
Ch2 SO ₂	AR	▶ Range1	0–50.00	ppm
		Range2	0–500.0	ppm
Ch3 CO ₂	RR	▶ Range1	0–10.00	vol%
		Range2	0–20.00	vol%
Ch4 CO	MR	▶ Range1	0–50.00	ppm
		Range2	0–500.0	ppm
Ch5 O ₂	MR	▶ Range1	0–10.00	vol%
		Range2	0–25.00	vol%



End of Range Switch

To close the setting

Press the  key to end the setting of range switch mode or range switch operation or stop the operation in the middle. 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 closed when Range 1 is active, and open when Range 2 is active, no matter. If the measurement value is held by remote contact input or during calibration routine and range switch conditions are met, the contact will change position only after the hold condition is removed.

3.2 Calibration setting

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

In the “Calibration Parameters” screen that appears, the data shown at right is illustrated.

3.2.1 Setting of calibration concentration

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

- (1) Select < User mode > → < Calibration parameters > → < Calibration value >. “Calibration Value Settings” screen appears as shown at right.
- (2) Select the Ch you want to change by pressing the  or the  key. Press the  key and cursor moves preceding the value.
- (3) Select the concentration item you want to set by pressing the ,  key or the  key (movable within the selected Ch). Then press the  key, and the selected value is highlighted.

Cal. Parameters	Select an item with UP/DOWN and ENT Back with ESC
 Calibration Value About ZERO Calibration About Calibration Range About Calibration Components / Range	



Cal. Settings Cal. Value		Select Ch No. for Setting calibration value	
CH	RANGE	ZERO	SPAN
Ch1	0-50.00ppm	+0000.0	50.00
NOx	0-500.0ppm	+00000	500.0
Ch2	0-50.00ppm	+0000.0	50.00
SO ₂	0-500.0ppm	+00000	500.0
Ch3	0-10.00ppm	+000.00	10.00
CO ₂	0-20.00ppm	+000.00	20.00
Ch4	0-50.00vol%	+0000.0	50.00
CO	0-500.0vol%	+00000	500.0
Ch5	0-10.00vol%	21.00	01.00
O ₂	0-25.00vol%	21.00	01.00



- (4) Then, enter calibration gas concentration values (zero and span). For value entry, press the $\hat{\circ}$ or the $\check{\circ}$ key, and a 1-digit value increases or decreases. By pressing the $\hat{\circ}$ key, the digit moves. After setting, save the entry by pressing the $\overset{\text{ENT}}{\circ}$ key. The saved value becomes valid from the next calibration process.

Note) Enter settings that correspond to each range. If zirconia type is used as O₂ sensor, select 21.00 for the field of Zero (when ambient air is used), and select the concentration listed on the cylinder as required.

$\Downarrow$ $\check{\circ}$ $(\hat{\circ})$ $\overset{\text{ENT}}{\circ}$

Cursor for setting value

Cal. Settings Cal. Value		Set calibration value	
CH	RANGE	ZERO	SPAN
Ch1	0-50.00ppm	+0000.0	50.00
NO _x	0-500.0ppm	+00000	500.0
Ch2	0-50.00ppm	+0000.0	50.00
SO ₂	0-500.0ppm	+00000	500.0
Ch3	0-10.00ppm	+000.00	10.00
CO ₂	0-20.00ppm	+000.00	20.00
Ch4	0-50.00vol%	+0000.0	50.00
CO	0-500.0vol%	+00000	500.0
Ch5	0-10.00vol%	21.00	01.00
O ₂	0-25.00vol%	21.00	01.00

$\Downarrow$ $\check{\circ}$ $\hat{\circ}$ $\overset{\text{ENT}}{\circ}$

**End of Calibration
Concentration Setting**

To close the setting

To close the calibration concentration value setting process or cancel this mode midway, press the $\overset{\text{ESC}}{\circ}$ key. A previous screen will return.

Setting range of values

NO_x, SO₂, CO₂, CO, external O₂ measurement and built-in O₂ sensor

Span gas: 1 to 105% of full scale (Full scale (FS) is the same as each range value.)

External Zirconia O₂ measurement

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 if all measurement components should be calibrated simultaneously one by one.

- (1) Select < User mode > → < Calibration parameters > → < Zero calibration >. “Zero Calibration” screen appears as shown at right.
- (2) Select the Ch you want to change by pressing the  or the  key. Press the  key and the setting content is highlighted.
- (3) Select “at once” or “each” by pressing the  or  key.
 - When selecting “at once”, the Ch (components) to be set can be zero-calibrated at the same time.
 - When selecting “each”, the individual Ch (component) as shown at right is selected and zero-calibrated.
 Press the  key after the setting, and the specified calibration is performed.

Cell. Settings ZERO Call.		Set each or both Ch at ZERO Calibration	
Ch1 NO _x	Range1 Range2	0–50.00 ppm 0–500.0 ppm	at once
Ch2 SO ₂	Range1 Range2	0–50.00 ppm 0–500.0 ppm	at once
Ch3 CO ₂	Range1 Range2	0–10.00 vol% 0–20.00 vol%	at once
Ch4 CO	Range1 Range2	0–50.00 ppm 0–500.0 ppm	at once
Ch5 O ₂	Range1 Range2	0–10.00 vol% 0–25.00 vol%	each



**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  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 the zero calibration.

•Setting “at once”

At a manual zero calibration, Ch (components) for which “at once” was selected can simultaneously be zero-calibrated.

Manual Calibration screen

Σ When setting all Ch (components) to “each”:

ZERO Call.		ENT : Go on Calibration of selected Ch ESC : Not calibration		
Ch1 NOx	▶ Range1	0-50.00 ppm	▶	-2.1
	Range2	0-500.0 ppm		
Ch2 SO ₂	▶ Range1	0-50.00 ppm		-0.5
	Range2	0-500.0 ppm		
Ch3 CO ₂	▶ Range1	0-10.00 vol%		0.00
	Range2	0-20.00 vol%		
Ch4 CO	▶ Range1	0-50.00 ppm		0.0
	Range2	0-500.0 ppm		
Ch5 O ₂	Range1	0-10.00 vol%		
	▶ Range2	0-25.00 vol%		21.00

A single cursor will appear.

Σ When setting all Ch (components) to “at once”:

ZERO Call.		ENT : Go on Calibration of selected Ch ESC : Not calibration		
Ch1 NOx	▶ Range1	0-50.00 ppm	▶	0.0
	Range2	0-500.0 ppm		
Ch2 SO ₂	▶ Range1	0-50.00 ppm	▶	0.3
	Range2	0-500.0 ppm		
Ch3 CO ₂	▶ Range1	0-10.00 vol%	▶	0.00
	Range2	0-20.00 vol%		
Ch4 CO	▶ Range1	0-50.00 ppm	▶	-0.1
	Range2	0-500.0 ppm		
Ch5 O ₂	Range1	0-10.00 vol%		
	▶ Range2	0-25.00 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 or auto calibration) should be calibrated with a single range or 2 ranges.

- (1) Select < User mode > → < Calibration parameters > → < Calibration range >. “Calibration Range” screen appears as shown at right.
 - (2) Select the Ch you want to change by pressing the  or the  key. Press the  key and the setting contents is highlighted.
 - (3) 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 when calibration is performed.
 - If “current” is selected, zero or span calibration is performed only for the range displayed when calibration is performed.
- Press the  key after the selection, and the specified calibration is performed.

Cell. Settings Cell. Range		Set calibration range current or both range	
Ch1 NOx	Range1 Range2	0–50.00 ppm 0–500.0 ppm	both
Ch2 SO ₂	Range1 Range2	0–50.00 ppm 0–500.0 ppm	current
Ch3 CO ₂	Range1 Range2	0–10.00 vol% 0–20.00 vol%	current
Ch4 CO	Range1 Range2	0–50.00 ppm 0–500.0 ppm	both
Ch5 O ₂	Range1 Range2	0–10.00 vol% 0–25.00 vol%	current



End of Calibration Range Setting

To close “Setting of Calibration Range”

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

Example

Ch1 NOx	Range 1: 0 to 50 ppm Range 2: 0 to 500 ppm	both
Ch2 SO ₂	Range 1: 0 to 50 ppm Range 2: 0 to 500 ppm	current

Ch1: Range 1 and Range 2 are calibrated together.

Ch2: Only currently displayed range is calibrated.

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 Call.		ENT : Go on Calibration of selected Ch ESC : Not calibration	
Ch1 NOx	▶ Range1 Range2	0–50.00 ppm 0–500.0 ppm	▶ -0.6
Ch2 SO ₂	▶ Range1 Range2	0–50.00 ppm 0–500.0 ppm	▶ 0.4
Ch3 CO ₂	▶ Range1 Range2	0–10.00 vol% 0–20.00 vol%	▶ 0.00
Ch4 CO	▶ Range1 Range2	0–50.00 ppm 0–500.0 ppm	▶ -0.1
Ch5 O ₂	▶ Range1 Range2	0–10.00 vol% 0–25.00 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 for 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. Auto calibration and the manual calibration of the component for which “AR” has been selected as range switch mode are performed in the range selected here.

- (1) Select < User mode > → < Calibration parameters > → < Auto calibration component/range >. “Auto Calibration Component Range” setting screen appears as shown at right.
- (2) Select the Ch you want to change by pressing the  or the  key. Press the  key and the selected cursor is highlighted.
- (3) Select the range to be calibrated mainly by pressing the  or the  key.
- (4) Then press the  key, and calibration is performed in the selected range when auto calibration or auto zero calibration is performed.

“Auto Calibration Component/range” setting

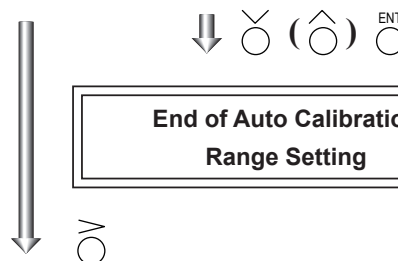
Auto calibration and the manual calibration of the component for which “AR” has been selected as range switch mode are performed in the range selected here. In this case, once the calibration is started, the range is automatically switched, and on completion of the calibration, the original range is resumed.

The range identification contact is interlocked with the range after the switch.

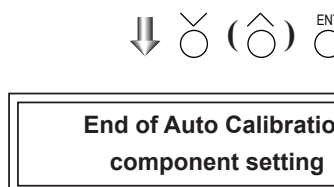
However, if the hold setting is set to “ON,” the contact status before calibration is maintained.

- (5) Press the  key in the state described in (3), and the highlight is switched between “enable” and “disable” auto calibration.
- (6) Select “enable” of “disable” by pressing the  or the  key.
- (7) Then press the  key.

Cell. Settings Auto Cal.		Select a range for auto calibration	
Ch1 NOx	▶ Range1 Range2	0-50.00 ppm 0-500.0 ppm	enable
Ch2 SO ₂	▶ Range1 Range2	0-50.00 ppm 0-500.0 ppm	enable
Ch3 CO ₂	▶ Range1 Range2	0-10.00 vol% 0-20.00 vol%	enable
Ch4 CO	▶ Range1 Range2	0-50.00 ppm 0-500.0 ppm	enable
Ch5 O ₂	▶ Range1 Range2	0-10.00 vol% 0-25.00 vol%	enable



Cell. Settings Auto Cal.		Set enable or disable for auto calibration	
▶ Ch1 NOx	Range1 Range2	0-50.00 ppm 0-500.0 ppm	enable
Ch2 SO ₂	Range1 Range2	0-50.00 ppm 0-500.0 ppm	enable
Ch3 CO ₂	Range1 Range2	0-10.00 vol% 0-20.00 vol%	enable
Ch4 CO	Range1 Range2	0-50.00 ppm 0-500.0 ppm	enable
Ch5 O ₂	Range1 Range2	0-10.00 vol% 0-25.00 vol%	enable



To close the setting

Press the  key to exit automatic calibration component/range setting, and the previous screen appears.

Operation by setting

Auto calibration is performed under the following rules.

1. Zero calibration is performed at the same time, for the Ch (component) in 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) for which “enable” is selected at the time of auto calibration.

Note

ZERO calibration on auto calibration and auto zero calibration of the component for 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 setting can be made. 5 different alarm contact outputs can be used.

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

- (1) Enter the "Setting of Alarm No." screen from the user mode, and the display shown at right appears. Point the cursor to the Alarm No. or hysteresis you want to set by pressing $\hat{\bigcirc}$ or the $\bigcirc$ key. Press the $\bigcirc^{\text{ENT}}$ key.

Alarm Setting	Select Alarm No. or Hysteresis setting
☒ Alarm-1 Alarm-2 Alarm-3 Alarm-4 Alarm-5	
Hysteresis	00 %FS



- (2) Select the alarm 1 to 5 to display the screen shown at right. Operate the $\hat{\bigcirc}$ or the $\bigcirc$ key until the cursor is aligned with a desired item and press the $\bigcirc^{\text{ENT}}$ key.

Alarm Setting Alarm-1	Select an item with UP/DOWN and ENT Back with ESC
☒ Channel Ch1 H-Limit Range 1 50.00 ppm Range 2 500.0 ppm L-Limit Range 1 000.0 ppm Range 2 0000 ppm Kind of Alarm High ON / OFF OFF	



Note

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

The L-limit value alarm is not activated during the L-limit value is set to 0ppm (mg/m³ or vol%).

- (3) After setting, the alarm setting is now completed by pressing the $\bigcirc^{\text{ENT}}$ key.

To close the "Alarm Setting"

To close the "Alarm Setting" or to cancel this mode midway, press the $\bigcirc^{\text{ESC}}$ key. A previous screen will return.

Setting range

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

Cursor for setting value

Alarm Setting Alarm-1	Select an item with UP/DOWN and ENT Back with ESC
☒ Channel Ch1 H-Limit Range 1 <u>50.00</u> ppm Range 2 500.0 ppm L-Limit Range 1 000.0 ppm Range 2 0000 ppm Kind of Alarm High ON / OFF OFF	



End of Alarm Setting

Description of setting items

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

Channel: Channel setting targeted for issuance of alarm.
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.

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

* The H-limit value cannot be set below the L-limit value, and the L-limit value cannot be set above the H-limit value.

If it is desired to set the H-limit value below the L-limit value already stored in the memory, reduce the L-limit value beforehand, and vice versa.

Typical on-screen display when an alarm occurs

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

C		H-alarm	
Ch	2	SO ₂ 0-50	0.0 ppm
Ch	3	CO ₂ 0-20	0.003 vol%
Ch	4	CO 0-50	0.0 ppm
Ch	5	O ₂ 0-25	21.00 vol%

Note

After turning on power, the alarm logic trigger is inactive for 10 minutes.

3.3.2 Hysteresis setting

To prevent chattering of an alarm output near the alarm setting values, adjust 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 key to display the screen shown at right.
- (2) Then, 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 key to make the “Hysteresis” valid.

Alarm Setting	Set Hysteresis 0 to 20%FS available
Alarm-1 Alarm-2 Alarm-3 Alarm-4 Alarm-5	
Hysteresis 00 %FS	



End of Hysteresis Setting

To close "Hysteresis Setting"

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

Setting range

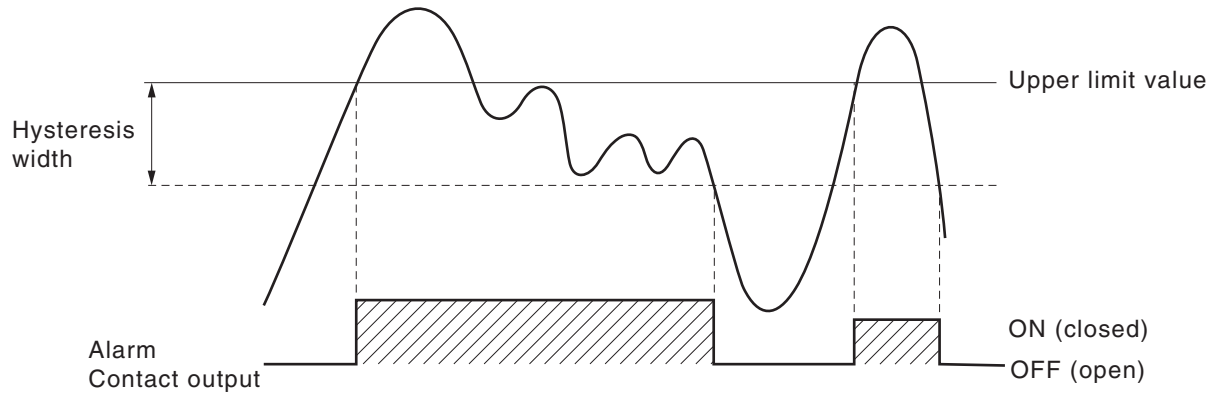
0 to 20% of full scale
[% full scale (% FS)] represents the percentage with the width of the component measurement range regarded as 100%.

Note

The hysteresis is common to all alarms (components).
Hysteresis in peak alarm setting described in Section 3.3.3 should be set separately.

Hysteresis (In case of upper limit alarm)

An alarm output is turned ON if measurement value exceeds the upper 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 upper limit value.



3.3.3 Peak alarm setting

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

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

- (1) Press the  key in the Measurement mode, and the User mode appears.
- (2) Point the cursor to "Setting of Peak Alarm" by pressing the  or  key. Press the  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  key. Press the  key.

↓ 

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 ☒ Peak Alarm Setting Parameter Setting	

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

↓   

Peak Alarm	Select setting item
☒ Peak Alarm OFF Alarm Value 0500 ppm Alarm Count 05 times Hysteresis 00 %FS	

Entering the numeric values or setting the items should be carried out by using the  or  key.

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

↓   

Peak Alarm	Set Peak Alarm ON or OFF
Peak Alarm OFF Alarm Value 0500 ppm Alarm Count 05 times Hysteresis 00 %FS	

Description of setting items

- Peak Alarm : ON/OFF of peak alarm
- Alarm Value : If measuring value exceeds the set alarm value, a peak counter counts 1 time.
- Alarm Count : When the alarm value is exceeded this many times per hour, the peak count alarm is activated (closed).
- Hysteresis : To prevent chattering. A peak is counted only when the measuring value exceeds the alarm value after decreasing by the width of specified hysteresis from the alarm value.

↓   

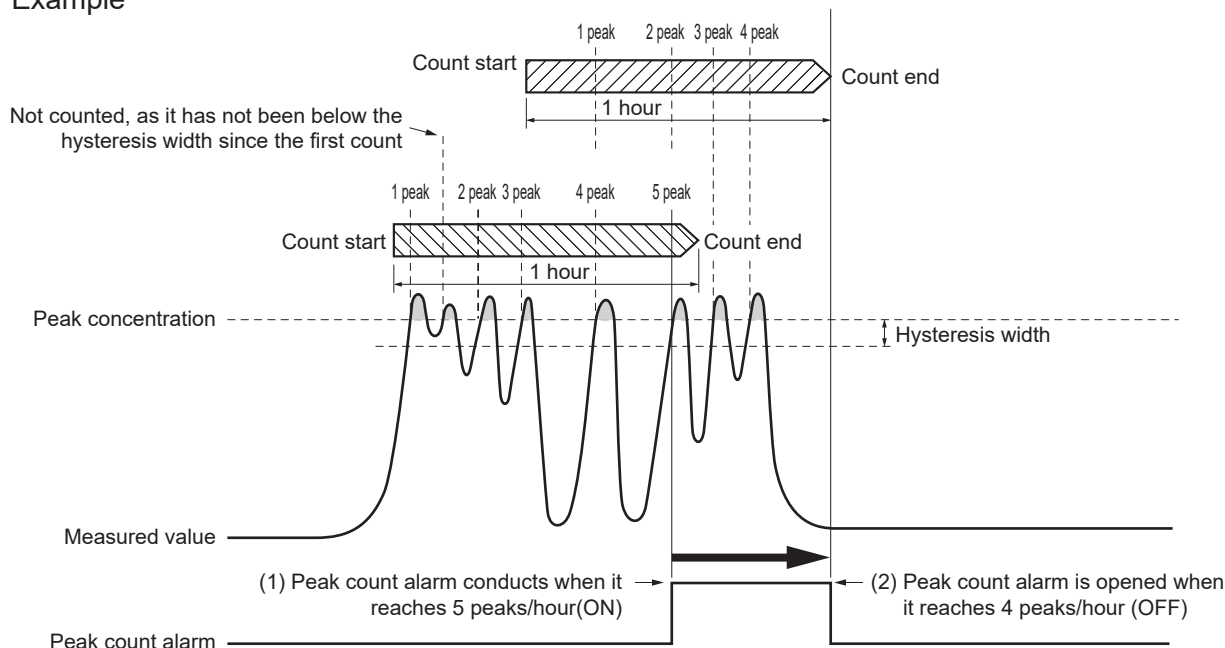
End of Peak Alarm Setting

Setting range

- Alarm value : 10 to 1000 ppm → 5 ppm step (initial value: 500 ppm)
 - Alarm count : 1 to 99 times (per hour) → (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

Example



If CO concentration exceeds the alarm value, counting will begin. If the number of peaks is over the set times per hour, a peak alarm contact output 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 logic 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.

3.4 Setting of auto calibration

3.4.1 Auto calibration

Auto calibration is automatically carried out at the time when zero span calibration are set. Before changing the setting of auto calibration, set the ON/OFF to OFF.

- (1) Enter the "Setting of Auto Calibration" screen from the user mode, and the display shown at right appears. Operate the  or the  key until the cursor is aligned with a desired item and press the  key.

- (2) 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, and the  key to move the cursor to the right.

After setting, press the  key, and auto calibration is carried out by the entered setting value.

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 the next (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  key.
A previous screen will return.

Set Auto Cal.	Select setting item
 Start Time SUN 12:00 Cycle 07 day Flow Time ON / OFF OFF Time : MON 12:34	
Auto Calibration Run	



Set Auto Cal.	Set Start Time
 Start Time SUN 12:00 Cycle 07 day Flow Time ON / OFF OFF Time : MON 12:34	Press the  or the  key, and date and time are displayed alternately.
Auto Calibration Run	



End of Auto Calibration Setting

<Gas flow time> setting

- (1) Press the  key in a state where the cursor is placed preceding "Flow Time," and the flow time setting screen appears.
- (2) Move the cursor to the gas you want to change by pressing the  or the  key, and then press the  key.
- (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  key.
- (5) Press the  key to return to the auto-matic calibration setting screen.

Set Auto Cal.	Set flow item of calibration gas 60 to 900 sec
ZERO	 50 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.



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.

Note

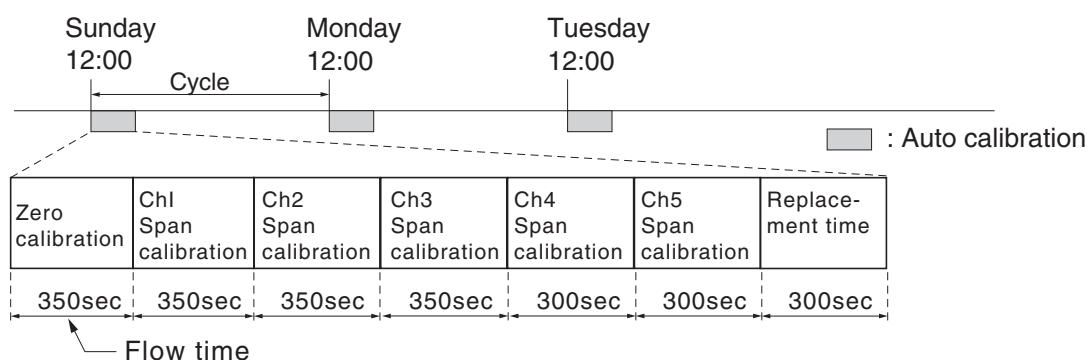
Configure the flow time for zero and span gas about 5 times longer than the response time by referring to the item of "response time" in this manual.(For response time, see Item 3.6.)

Auto calibration status contact output is closed during auto calibration (NO side), 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 “Auto Calibration Components/range”)

Setting range

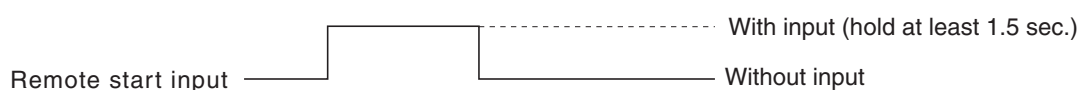
Cycle : 1 to 99 hours or 1 to 40 days (initial value 7 days)
 Flow time : 60 to 900 sec (initial value 300 sec *180s only with CO meter)

Caution

- When an auto calibration starts, the measurement screen appears automatically.
- Any operation other than “Key lock ON/OFF ”and “Stop Auto 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 forcibly, set the key lock to “OFF” and then execute “Stop Auto Calibration”.
- Turn on the power again after it is turned off (including the case of power failure) at the time set as the next start time in auto calibration, 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 remote start input.



3.4.2 Forced run/stop of auto calibration

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

3.4.2.1 Execution of auto calibration (only once)

- (1) In the “Setting of Auto Calibration” screen that appears, point the cursor to “Auto Calibration Run” by pressing the  or the  key. Press the  key.
- (2) “Run” is highlighted, displaying a message to confirm the execution of auto calibration. Press the  key to execute the auto calibration, and press the  key to cancel.

Set Auto Cal.	Auto Cal. Run ENT : Run / Stop ESC : Cancel
Start Time	SUN 12:00
Cycle	07 day
Flow Time	
ON / OFF	OFF
Time : MON 12:34	
Auto Calibration Run	

3.4.2.2 Forced stop of auto calibration

This mode is used to stop the auto calibration forcibly.

- (1) In the “Setting of Auto Calibration” screen that appears, point the cursor to “Auto Calibration Stop” by pressing the  or the  key. Press the  key. (“Auto Calibration Stop” appears when the screen is selected while auto calibration is performed.)
- (2) “Stop” is highlighted, displaying a message to confirm the stop of auto calibration. Press the  key to stop the auto calibration, and press the  key to cancel (not stopped).

Set Auto Cal.	Auto Cal. Run ENT : Run / Stop ESC : Cancel
Start Time	SUN 12:00
Cycle	07 day
Flow Time	300 sec.
ON / OFF	OFF
Time : MON 12:34	
Auto Calibration Stop	

“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.

Ch 1	ZERO cal.	0.5 ppm
Ch 2	ZERO cal.	0.3 ppm
Ch 3	CO ₂ (0-20)	0.000 vol%
Ch 4	CO (0-50)	0.0 ppm
Ch 5	O ₂ (0-25)	21.02 vol%

• Ch1 span calibration

A message, “Span cal.” blinks at Ch1.

Ch 1	SPAN cal.	90.8 ppm
Ch 2	SO ₂ (0-50)	0.0 ppm
Ch 3	CO ₂ (0-20)	0.00 vol%
Ch 4	CO (0-50)	0.0 ppm
Ch 5	O ₂ (0-25)	0.00 vol%

• Ch2 span calibration

A message, “Span cal.” blinks at Ch2.

Ch 1	NO _x (0-50)	0.0 ppm
Ch 2	SPAN cal.	95.0 ppm
Ch 3	CO ₂ (0-20)	0.00 vol%
Ch 4	CO (0-50)	0.0 ppm
Ch 5	O ₂ (0-25)	0.00 vol%

Caution

During auto calibration, any key operation is not permitted other than operations such as key lock ON/OFF and “Forced stop of auto calibration.”

When the key lock is set at “ON”, even the “Auto Calibration Stop” cannot be used.

To stop “Auto Calibration” forcibly, 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 Item 3.2.4.

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

- (1) Enter the "Setting of Auto Zero Calibration" screen from the user mode, and the display shown at right appears. Operate the  or the  key until the cursor is aligned with a desired item and press the  key.
- (2) In the "Setting of Auto Zero Calibration" screen that appears, perform the value entry or the setting. For the value entry or setting change, use the  or the  key and the  key to move the cursor to the right.

Press the ENT key to store the value.

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 the next (unit : hour/day)
- Flow Time : The time required for the calibration gas to be replaced in the sampling 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  key. A previous screen will return.

Set Auto Zero Cal.	Select setting item
Start Time SUN 12:00 Cycle 07 day Flow Time 300 sec. ON / OFF OFF Time : MON 12:34	
Auto Zero Calibration Run	



Set Auto Zero Cal.	Set Start Time
Start Time SUN 12:00 Cycle 07 day Flow Time 300 sec. ON / OFF OFF Time : MON 12:34	Press the  or the  key, and date and time are displayed alternately.
Auto Zero Calibration Run	



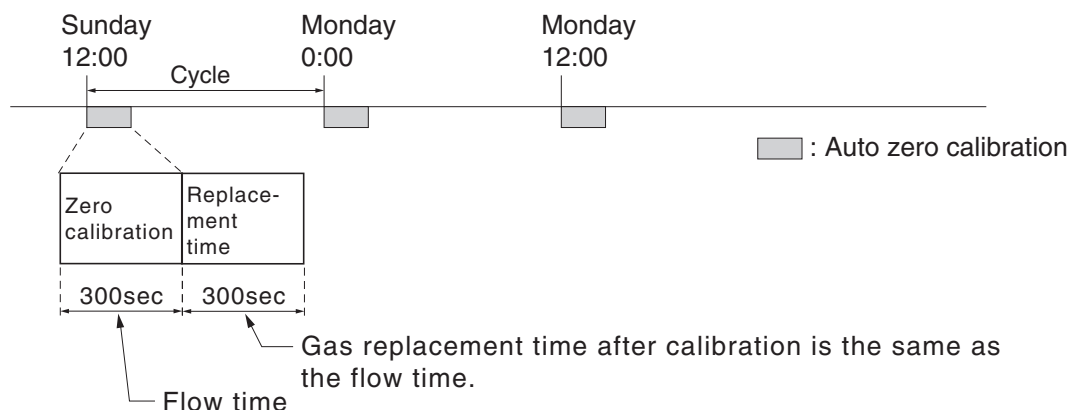
End of Auto Zero Calibration Setting

Auto calibration status contact output is closed during auto zero calibration (NO side), 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 Item 3.2.4 “Setting of auto calibration components/range”)

Setting range

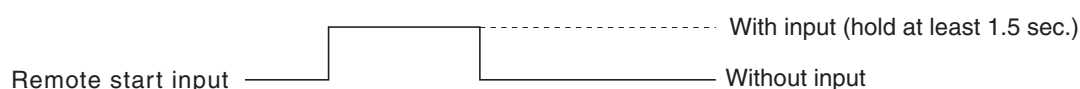
Cycle : 1 to 99 hours or 1 to 40 days (initial value 7 days)
 Flow time : 60 to 900 sec (initial value 300 sec)

Caution

- When an auto zero calibration starts, the measurement screen automatically appears.
- Any operation other than “Key lock ON/OFF ” and “Auto Zero Calibration Stop” (see Section 3.5.2) is not permitted during auto zero calibration. “Auto Zero Calibration Stop” cannot be performed with the key lock set to “ON”. To cancel auto zero calibration forcibly, set the key lock to “OFF ”and then execute “Auto Zero Calibration Stop”.
- 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.
- When the hold setting is set to “ON”, the hold time of auto calibration contact and measurement value output signal is extended after calibration for gas replacement time.

Remote start

Whether the auto zero calibration is set at ON or OFF, an auto zero calibration is available by remote start input.



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.

3.5.2.1 Execution of auto zero calibration (only once)

- (1) In the “Setting of Auto Zero Calibration” screen that appears, point the cursor to “Run” by pressing the  or the  key. Press the  key.
- (2) “Run” is highlighted, displaying a message to confirm execution of auto zero calibration. Press the  key to execute the calibration, and press the  key to cancel.

Set Auto Zero Cal.	Auto zero Run ENT : Run / Stop ESC : Cansel
Start Time	SUN 12:00
Cycle	07 day
Flow Time	300 sec.
ON / OFF	OFF
Time : MON 12:34	
Auto Zero Calibration Run	

3.5.2.2 Forced stop of auto zero calibration

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

- (1) In the “Setting of Auto Zero Calibration” screen that appears, point the cursor to “Stop” by pressing the  or the  key. Press the  key.
(“Auto Zero Calibration Stop” appears when the screen is selected while auto zero calibration is performed.)
- (2) “Stop” is highlighted, displaying a message to confirm the stop of auto zero calibration. Press the  key to stop the auto zero calibration and the  key to cancel (not stopped).

Set Auto Zero Cal.	Auto zero Stop ENT : Run / Stop ESC : Cansel
Start Time	SUN 12:00
Cycle	07 day
Flow Time	300 sec.
ON / OFF	OFF
Time : MON 10:56	
Auto Zero Calibration Stop	

“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.

Ch1	ZERO cal.	0.5	ppm
Ch2	ZERO cal.	0.3	ppm
Ch3	CO ₂ (0-20)	0.00	volt/5%
Ch4	CO (0-50)	0.0	ppm
Ch5	O ₂ (0-25)	21.02	volt/5%

Caution

During auto zero calibration, any key operation is not permitted other than operations such as key lock ON/OFF and “Forced stop of auto calibration.”

When the key lock is set at “ON”, even the “Auto Zero Calibration Stop” cannot be used.

To stop “auto zero calibration” forcedly, set the key lock to “OFF” and then execute “Auto Zero Calibration Stop.”

3.6 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, check the time setting again.
- Key Lock : Invalidates any key operation except canceling the key lock.
- Output Hold : Sets whether Calibration Output is held or not, and the holding value setting.
- 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.
- Contrast : Adjusts contrast of the LCD.
- Maintenance mode : Enters passwords to switch to the Maintenance mode.

* For the maintenance mode, see Section 3.7.

- (1) Enter the “Parameter setting” screen from the user mode, and the display shown at right appears. Operate the  or the  key until the cursor is aligned with a desired item and press the  key.

Parameter	Select setting item
 Current Time	12/01/11 WED 13:50
Key Lock	OFF
Output Hold	OFF Current
Response Time	
Average Period	
Backlight Timer	ON 5 min
Contrast	
To Maintenance Mode	0000



- (2) In the “Parameter Setting” screen that appears, perform the value entry or the setting. For the value entry or setting change, use the  or the  key, and the  key move the cursor to the right.

Parameter	Set day of week
Current Time	12/01/11 WED 13:50
Key Lock	OFF
Output Hold	OFF Current
Response Time	
Average Period	
Backlight Timer	ON 5 min
Contrast	
To Maintenance Mode	0000



To close Parameter Setting screen

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

End of Parameter Setting

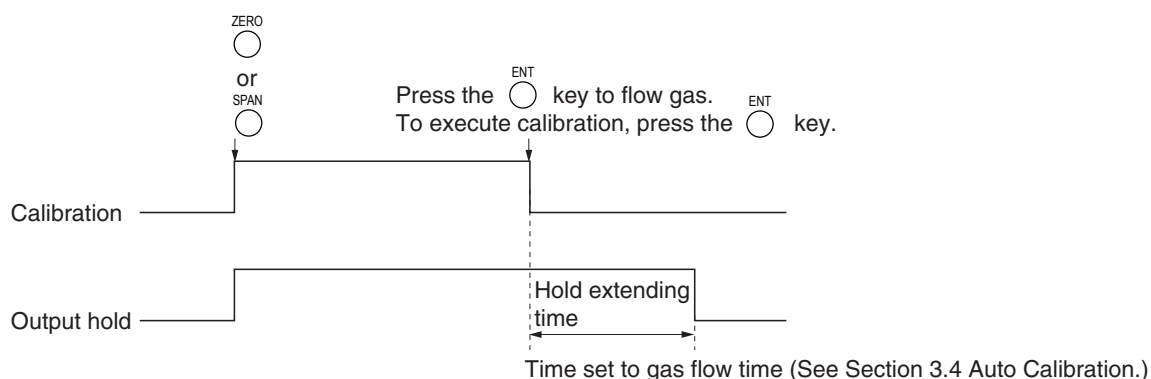
Setting Range

- Hold setting : 0 to 100% FS (Initial value: 0000)
 - Response time : Infrared measured component = 1 through 9 cycles (Initial value: 1 cycle)
O₂ meter = 1 through 60s (Initial value: 15s)
- *The cycle can be set via Maintenance Mode -> Sample Switch Setting.
One cycle (s) is the sum of the reference gas flow time (s) and sample gas flow time (s).
- Average period : 1 to 59 min or 1 to 4 hours (Initial value: 1 hour)
1 to 59 minutes when the unit is set to minute and 1 to 4 hours when it is set to hour.
 - Backlight Timer : 1 to 60 min (Initial value: 5 min)
 - Maintenance mode : 0000 to 9999 (Initial value: 0000)

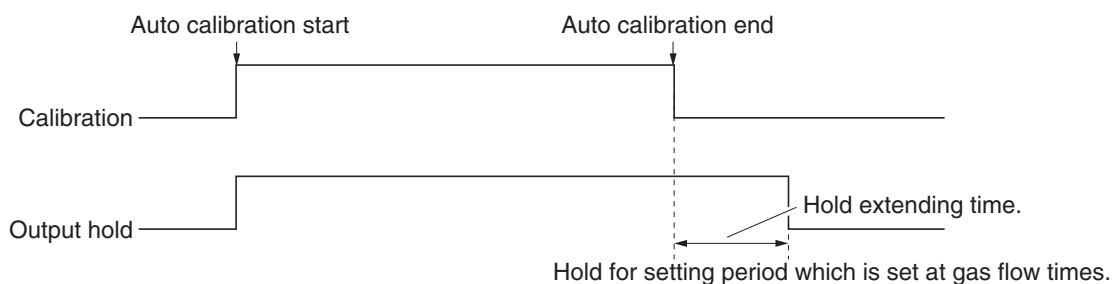
Output Hold

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

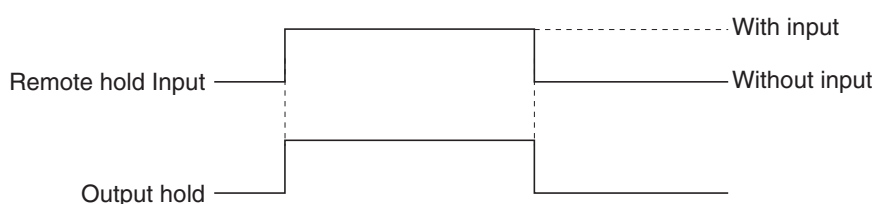
a. Manual calibration



b. Auto calibration



c. Remote hold



d. Screen display during Holding

The “Hold ON” message blinks on the measuring screen.

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

- e. If calibration is cancelled after the calibration gas is supplied regardless of manual or auto operation, the holding extending time will be performed.
- f. 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 set.

- (1) In the “Parameter setting” screen that appears, select “Output Hold”.

“ON” or “OFF” is highlighted by pressing the  key. Press the  or the  key to select ON/OFF. Press the  key to return to (1).

Parameter	Select Hold ON or OFF
Current Time	12/01/11 WED 13:50
Key Lock	OFF
Output Hold	ON Current
Response Time	
Average Period	
Backlight Timer	ON 5 min
Contrast	
To Maintenance Mode	0000



- (2) Where ON/OFF is highlighted, press the  key. “Current” or “Setting” is highlighted. Select “Current” or “Setting” by pressing the  or the  key.

- (3) Press the  key while “Current” is selected to return to (1). Press the  key while “Setting” is selected to go to the parameter hold screen.

“Current”: Holds the value immediately before the hold.

“Setting”: Holds the value arbitrarily set.

Parameter	Select Hold setting
Current Time	12/01/11 WED 13:50
Key Lock	OFF
 Output Hold	ON Setting
Response Time	
Average Period	
Backlight Timer	ON 5 min
Contrast	
To Maintenance Mode	0000



- (4) On the parameter hold screen that appears, move the cursor next to the Ch (component) you want to hold by pressing the  or the  key, and then press the  key.

Parameter Hold	Select Ch No.
 Ch1	NOx 010 %FS
Ch2	SO ₂ 020 %FS
Ch3	CO ₂ 015 %FS
Ch4	CO 012 %FS
Ch5	O ₂ 022 %FS



- (5) 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 digit by pressing the  key.

- (6) After the value is changed, press the  key.

Meaning of setting

The setting is expressed as 1/1 full scale range for both respective ranges.

When 0 to 1000 ppm is selected as the range, and 10% FS is selected as hold setting, the output equivalent to 100 ppm is held irrespective of the measurement value at that time.

- (7) Press the  key to return to the parameter setting screen.

Description of setting

- Instantaneous measurement value that is displayed cannot be held. (Output only can be held.)
- Optional modbus communications "Measurement concentration" register values are held.
- If set value is selected for hold, instantaneous O₂ correction value is calculated and held based on the set value.
- Range identification contact output cannot be switched even if the range is switched during the hold.

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 Hold		Set Hold value 0 to 100%FS	
Ch1	NOx	010	%FS
Ch2	SO ₂	020	%FS
Ch3	CO ₂	015	%FS
Ch4	CO	012	%FS
Ch5	O ₂	022	%FS

↓ 

End of Hold Setting	
----------------------------	--

↓ 

Parameter Setting screen	
---------------------------------	--

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 averaging period of the average values of O₂ correction and O₂ 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 also resets the averaging of O₂ correction and O₂ average value. (Pressing the  key resets averaging only for components whose setting was changed.)

Parameter	Select Ch No.		
Average Period			
 Ch9	AV. NOx	01	hour
Ch10	AV. SO ₂	01	hour
Ch11	AV. CO ₂	01	hour
Ch12	AV. O ₂	01	hour
Reset AV. Output		Reset	

Average value reset

This mode is used to clear all average values O₂ correction average and O₂ average, and restarts averaging. All average values are reset simultaneously. The indication value and output value is 0 ppm, vol% or so at the time of the reset input (based on average period settings).

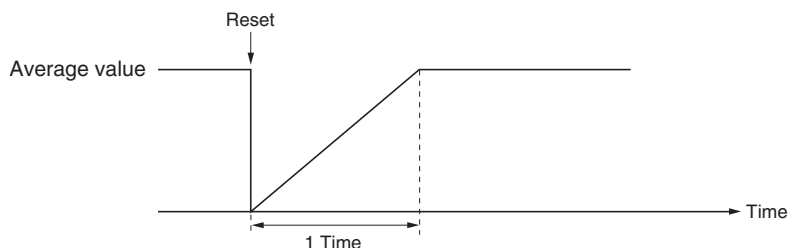


So long as with input, resetting lasts.

At the edge of changing from “with input” to “without input,” the average action restarts.

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 during the measurement screen display, the backlight is automatically turned off. Press any key to reset 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  key to confirm the selection.

If OFF is selected, the backlight is not turned off.

Parameter	Select ON or OFF
Current Time	12/01/11 WED 13:50
Key Lock	OFF
Output Hold	ON Previous value
Response Time	
Average Period	
Backlight Timer	ON 5 min
Contrast	
To Maintenance Mode	0000

Contrast

Contrast of the LCD can be adjusted. The contrast changes by pressing the  or the  key. Adjust to the best contrast and save it by the  key.

Parameter	Select ON or OFF
Current Time	12/01/11 WED 13:50
Key Lock	OFF
Output Hold	ON Previous value
Response Time	
Average Period	
Backlight Timer	ON 5 min
Contrast	
To Maintenance Mode	0000

Maintenance mode

Enter the password and then press the  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 this value before the password is changed.

3.7 Maintenance mode

This mode is used to check 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 “Section 3.6 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  key.
- (3) Next, each Maintenance screen is displayed.

Note) “To Factory Mode” is used for our service engineers only.

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

Maintenance Mode	Select operating item
 1. Sensor Input Value 2. Error Log 3. Cal. Log 4. Output Adj. 5. Other Parameter 6. To Factory Mode	



Each “Maintenance” screen

• Sensor Input Value screen

Description of Sensor Input Value screen

- Input 1 to 4 : NDIR sensor digital value
- Input 5 : O₂ sensor digital value

Maintenance Sensor Input	
Input 1	100821
Input 2	96118
Input 3	102241
Input 4	82856
Input 5	11050
 GAS Sample	

• Error Log screen

Description of Error Log screen

Error history. 14 newest errors are logged.
 For error number, date and time (year, month, day, period) of occurrence, channel and other details of error, refer to Section 6 Error message.
 Select Clear Error Log and press the  key, and the error log is cleared completely.

Maintenance Mode Error Log	ENT : Clear Error Log ESC : Back					
Error No.	Y	M	D	H	M	Ch
No. 4	12	2	11	18	10	5
No. 1	12	1	10	12	2	1
No. 6	11	12	1	10	10	2
No. 9	11	12	1	10	10	2
No. 5	11	12	1	0	0	2
No. 9	11	12	1	0	0	2
Next page					Page1	
 Clear Error Log						

• Calibration Log screen

Description of Calibration Log screen

Past calibration history is displayed.

Sensor input value, concentration value, and the date when zero/span calibration is performed are logged. The 10 newest calibration data are logged by each component.

Move the cursor to Clear Calibration Log and press the  key, and the calibration log is cleared completely.

Z1 : Zero calibration (Z) of Range 1

S1 : Span calibration (S) of Range 1

Cnt : Value of measuring detector at the time of calibration

Con : Concentration value displayed before calibration

Maintenance Cal. Log	Select Ch No.
☒ Ch1 NOx Ch2 SO ₂ Ch3 CO ₂ Ch4 CO Ch5 O ₂	
Clear Error Log	



Maintenance Cal. Log Ch1 NOx			
R	Cnt	Con	YDHM
Z1	485231	-0.27	12111810
S1	441764	51.38	12111810

• 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  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  key.

Maintenance Mode Output Adj.			Adjust OUTPUT ZERO and SPAN		
OUT	Zero	Span	OUT	Zero	Span
1	00600	03700	7	00600	03700
2	00600	03700	8	00600	03700
3	00600	03700	9	00600	03700
4	00600	03700	10	00600	03700
5	00600	03700	11	00600	03700
6	00600	03700	12	00600	03700



Maintenance Mode Output Adj.			Zero / Span adjustment		
OUT	Zero	Span	OUT	Zero	Span
1	00600	03700	7	00600	03700
2	00600	03700	8	00600	03700
3	00600	03700	9	00600	03700
4	00600	03700	10	00600	03700
5	00600	03700	11	00600	03700
6	00600	03700	12	00600	03700

• **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.
- O₂ ref. Value** : Set the oxygen concentration reference value at the time of oxygen correction calculation. Settable in the range from 00 to 19%.
- Limit** : Set the oxygen concentration limit at the time of oxygen correction calculation. Settable in the range from 01 to 20%.
- * Refer to the O₂ correction concentration value in “1.5.3 Outline of display screen” for oxygen correction calculation procedure.
- Station No.** : Set the station No. for MODBUS communication. Settable in the range from 00 to 32.
- Set Sample Switching** : Moves to the screen on which parameters about Sample Switching is changed.

Maintenance Mode setting	Select an item
Password Set 2465 O ₂ ref. Value 12% O ₂ limit 20% O ₂ Station No. 01 Range setting Set Sample Switching	

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  key.

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

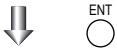
3.7.1 Sample switch setting

Set up the setting for the required operation of sample switch. Set up the gas flow time and interference compensation coefficients.

3.7.1.1 How to change the setting of gas flow time

- (1) When the gas flow time is chosen on the sample switch setting, screen will be appeared as shown on the right.
Selectable a switching time and flow time of the reference gas with   key operation.
Settable the each setting time by pressing  key.
Refer to the “explanation” on the next page regarding setting range.

Maintenance Mode Sample Switch Setting	Select an item
 Gas Flow Time Interference Compensation Coefficient (Measurement) Interference Compensation Coefficient (Calibration)	



Maintenance Mode	Select an item		
Sample Switch Setting			
Gas Flow Time			
▣ Reference Gas	Switching Time	05	s
Reference Gas	Measuring Time	05	s
Reference Gas	Flow Time	10	s
Sample Gas	Switching Time	05	s
Sample Gas	Measuring Time	05	s
Sample Gas	Flow Time	10	s

- (2) When press the ENT key, the cursor will be returned and setting value will be memorized.

Also switching time and measuring time of the sample gas are set automatically based on following relational expression.

Note: This setting time is very important setting when sample switch is carried out.

Do not change the setting time unless it is required.

Maintenance Mode Sample Switch Setting Gas Flow Time	Set gas replacement time. Setting range is from 1 to 30 seconds.		
Reference Gas	Switching Time	05	s
Reference Gas	Measuring Time	05	s
Reference Gas	Flow Time	10	s
Sample Gas	Switching Time	05	s
Sample Gas	Measuring Time	05	s
Sample Gas	Flow Time	10	s



Maintenance Mode Sample Switch Setting Gas Flow Time	Select an item		
▣ Reference Gas	Switching Time	05	s
Reference Gas	Measuring Time	05	s
Reference Gas	Flow Time	10	s
Sample Gas	Switching Time	05	s
Sample Gas	Measuring Time	05	s
Sample Gas	Flow Time	10	s

Explanation

Set up switching time and measuring time of the reference gas and the switching time and measuring time of the sample gas.

Switching time of reference gas : 1 to 30s (Initial value 5 sec)

Flow time of reference gas : 1 to 60s (Initial value 5 sec)

Note) Switching time of the reference gas, measuring time of the sample gas, flow time of the reference gas and flow time of the sample gas are updated automatically based on following relational expression.

Switching time of sample gas (t_1) = Switching time of reference gas (t_3)

Flow time of sample gas (T_s) = Flow time of reference gas (T_r)

Flow time of reference gas (T_r) =

Switching time of reference gas (t_3) + measuring time of reference gas (t_4)

Flow time of sample gas (T_s) =

Switching time of sample gas (t_1) + measuring time of sample gas (t_2)

1 cycle = flow time of reference gas (T_r) + flow time of sample gas (T_s)

3.7.1.2 Interference compensation coefficient (Measurement/Calibration)

- (1) When the interference compensation coefficient is chosen on sample switch setting, the screen will be appeared as shown on the right.

Maintenance Mode Sample Switch Setting	Select an item
▢ Gas Flow Time Interference Compensation Coefficient (Measurement) Interference Compensation Coefficient (Calibration)	



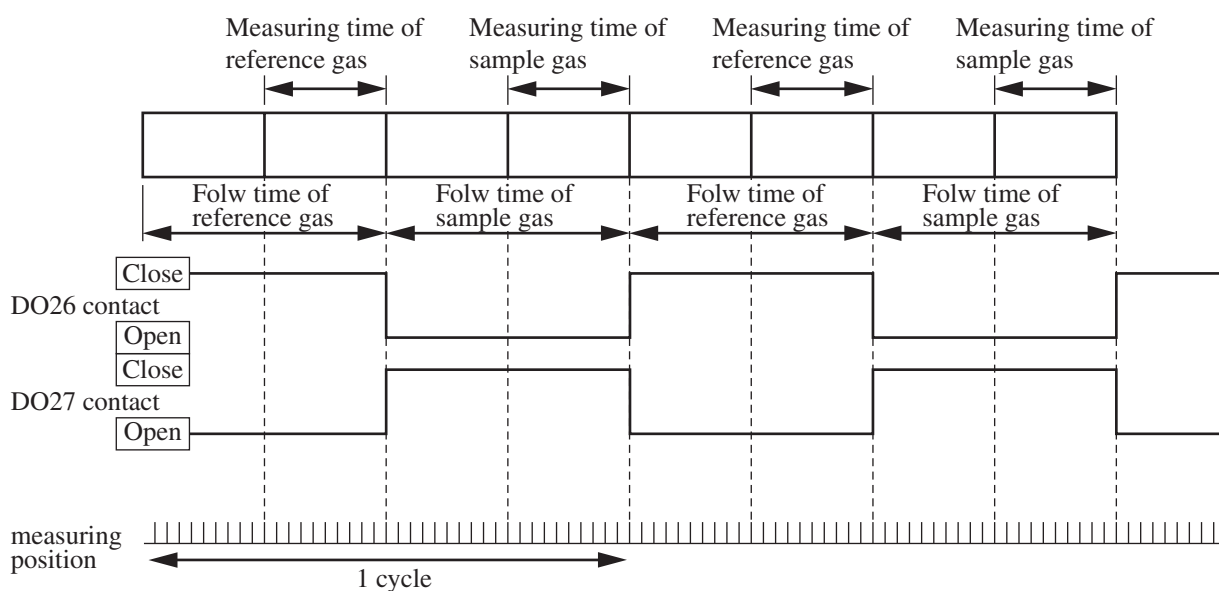
- (2) Select the interference compensation coefficient for each desired Ch. to be set with   key operation. When the  key is pressed, screen will be moved to interference compensation value.

Maintenance Mode Sample Switch Setting Interference Adj.	Select the component to be adjusted.		
▢ Ch1	NOx	44445	1.000000
Ch2	SO ₂	0	1.000000
Ch3	CO	44445	1.000000
Ch4	CO ₂	44445	1.000000

- (3) When  key is pressed after changing the parameter value, the cursor will be returned and setting value will be memorized.

3.7.1.3 Explanation of sample switch method

Flow time of reference gas and sample gas are switched by sample switch method at the following timing.



Switching time of reference gas : 1 to 30s (Initial value 5 sec)

Measuring time of reference gas : 1 to 60s (Initial value 5 sec)

Note) Switching time of the reference gas, measuring time of the sample gas, flow time of the reference gas and flow time of the sample gas are updated automatically based on following relational expression.

Switching time of sample gas (t_1) = Switching time of reference gas (t_3)

Flow time of sample gas (T_s) = Flow time of reference gas (T_r)

Flow time of reference gas (T_r) =

Switching time of reference gas (t_3) + measuring time of reference gas (t_4)

Flow time of sample gas (T_s) =

Switching time of sample gas (t_1) + measuring time of sample gas (t_2)

1 cycle = flow time of reference gas (T_r) + flow time of sample gas (T_s)

3.8 Calibration

3.8.1 Zero calibration

It is used for zero point adjustment. Proper zero gas, suitable for the application, should be used. Refer to Section 2.2.3 “Preparation using standard gas”.

- (1) Press the  key on the Measurement screen to display the Manual Zero Calibration screen.
- (2) Select the Ch (component) to be calibrated by pressing the  or the  key. After selection, press the  key, and zero gas will be supplied.

Note

For the Ch (components) in which “both” is set in the calibration range setting (see Section 3.2.4) - zero calibration is carried out on both ranges.

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

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

To close "Zero Calibration"

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



ZERO Cal.		Select Ch No. with UP / DOWN and ENT Back with ESC	
 Ch1 NOx	▶ Range 1 0-50.00 ppm Range 2 0-500.0 ppm		0.0
 Ch2 SO ₂	▶ Range 1 0-50.00 ppm Range 2 0-500.0 ppm		0.0
 Ch3 CO ₂	▶ Range 1 0-10.00 vol% Range 2 0-20.00 vol%		0.00
 Ch4 CO	▶ Range 1 0-50.00 ppm Range 2 0-500.0 ppm		0.0
 Ch5 O ₂	▶ Range 1 0-10.00 vol% Range 2 0-25.00 vol%		20.09



ZERO Cal.		Select Ch No. with UP / DOWN and ENT Back with ESC	
 Ch1 NOx	▶ Range 1 0-50.00 ppm Range 2 0-500.0 ppm		0.0
 Ch2 SO ₂	▶ Range 1 0-50.00 ppm Range 2 0-500.0 ppm		0.0
 Ch3 CO ₂	▶ Range 1 0-10.00 vol% Range 2 0-20.00 vol%		0.00
 Ch4 CO	▶ Range 1 0-50.00 ppm Range 2 0-500.0 ppm		0.0
 Ch5 O ₂	▶ Range 1 0-10.00 vol% Range 2 0-25.00 vol%		20.09



ZERO Cal.		ENT : Go on calibration of selected Ch. ESC : Not calibration	
Ch1 NOx	▶ Range 1 0-50.00 ppm Range 2 0-500.0 ppm		0.0
Ch2 SO ₂	▶ Range 1 0-50.00 ppm Range 2 0-500.0 ppm		0.9
Ch3 CO ₂	▶ Range 1 0-10.00 vol% Range 2 0-20.00 vol%		0.34
Ch4 CO	▶ Range 1 0-50.00 ppm Range 2 0-500.0 ppm		1.1
Ch5 O ₂	▶ Range 1 0-10.00 vol% Range 2 0-25.00 vol%		20.09



**To Measurement screen after
executing Manual Zero Calibration**

3.8.2 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, SO₂, CO₂, CO measurement, use the standard gas with a concentration of 90 to 100% of its measuring range value.

For the span calibration gas for the O₂ measurement, use the standard gas with a concentration of 90 to 100% of its measuring range value when measuring with the built-in O₂ sensor, and use the standard gas of 1 to 2 vol% when measuring with an external zirconia O₂ sensor.

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

↓ 

SPAN Cal.		Select Ch No. with UP / DOWN and ENT Back with ESC	
☒ Ch1 NO _x	▶ Range 1 0-50.00 ppm Range 2 0-500.0 ppm		0.0
Ch2 SO ₂	▶ Range 1 0-50.00 ppm Range 2 0-500.0 ppm		0.0
Ch3 CO ₂	▶ Range 1 0-10.00 vol% Range 2 0-20.00 vol%		0.00
Ch4 CO	▶ Range 1 0-50.00 ppm Range 2 0-500.0 ppm		0.0
Ch5 O ₂	▶ Range 1 0-10.00 vol% Range 2 0-25.00 vol%		20.09

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

Note

For the Ch (components) in which “both” is set in the calibration range setting (Refer to Section 3.2.4) - span calibration is completed for both ranges.

- (3) Wait until the indication is stable. After the indication has been stabilized, press the  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 range switch mode,” the cursor automatically moves to the range selected in “Setting of auto calibration component/range” (3.2.4), and calibration is carried out within that range.

To close "Span Calibration"

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

↓   

SPAN Cal.		Select Ch No. with UP / DOWN and ENT Back with ESC	
Ch1 NO _x	▶ Range 1 0-50.00 ppm Range 2 0-500.0 ppm		0.0
☒ Ch2 SO ₂	▶ Range 1 0-50.00 ppm Range 2 0-500.0 ppm		0.0
Ch3 CO ₂	▶ Range 1 0-10.00 vol% Range 2 0-20.00 vol%		0.00
Ch4 CO	▶ Range 1 0-50.00 ppm Range 2 0-500.0 ppm		0.0
Ch5 O ₂	▶ Range 1 0-10.00 vol% Range 2 0-25.00 vol%		20.09

↓ 

SPAN Cal.		ENT : Go on calibration of selected Ch. ESC : Not calibration	
Ch1 NO _x	▶ Range 1 0-50.00 ppm Range 2 0-500.0 ppm	☒	0.0
Ch2 SO ₂	▶ Range 1 0-50.00 ppm Range 2 0-500.0 ppm	☒	0.9
Ch3 CO ₂	▶ Range 1 0-10.00 vol% Range 2 0-20.00 vol%	☒	0.34
Ch4 CO	▶ Range 1 0-50.00 ppm Range 2 0-500.0 ppm	☒	
Ch5 O ₂	▶ Range 1 0-10.00 vol% Range 2 0-25.00 vol%	☒	20.09

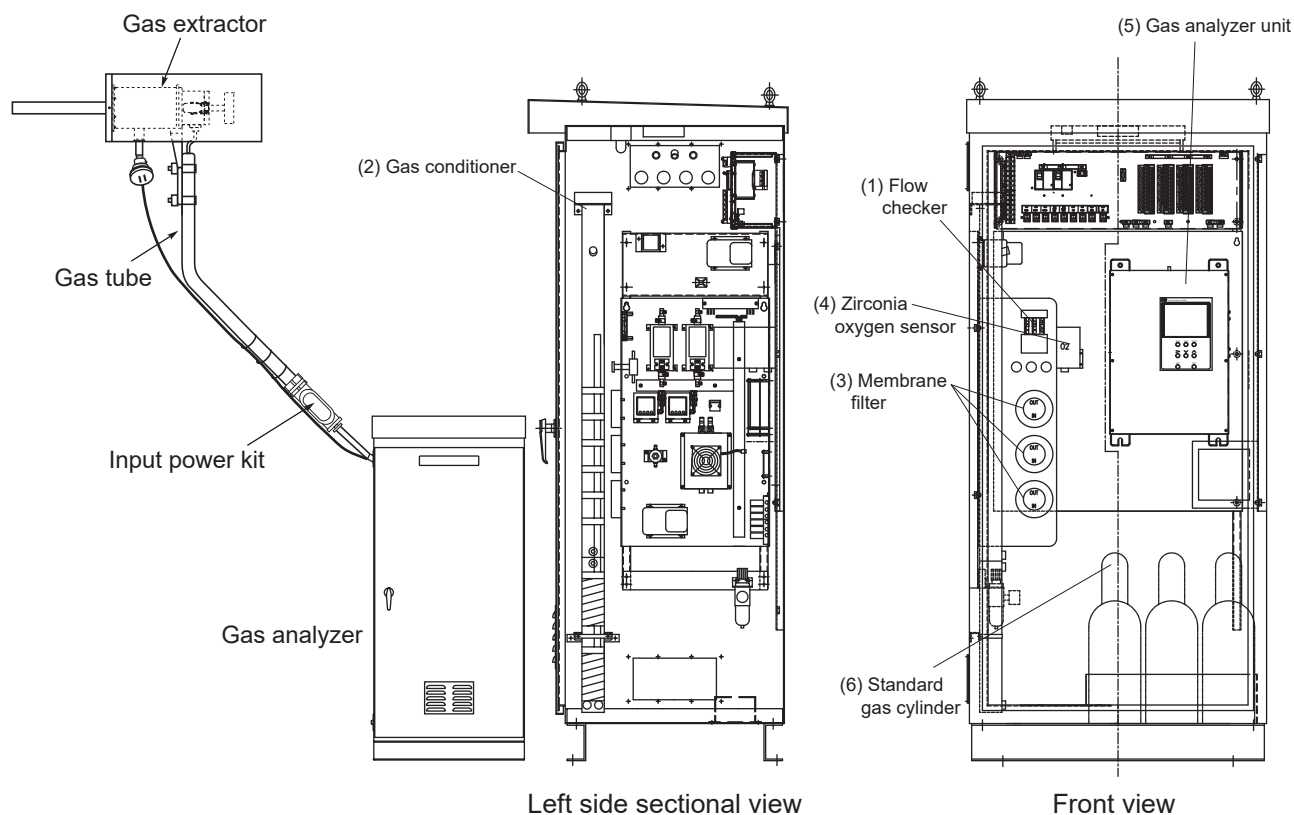
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**To Measurement screen after
executing Manual Span Calibration**

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)	Standard gas	Check the residual pressure.	2 MPa or higher.	

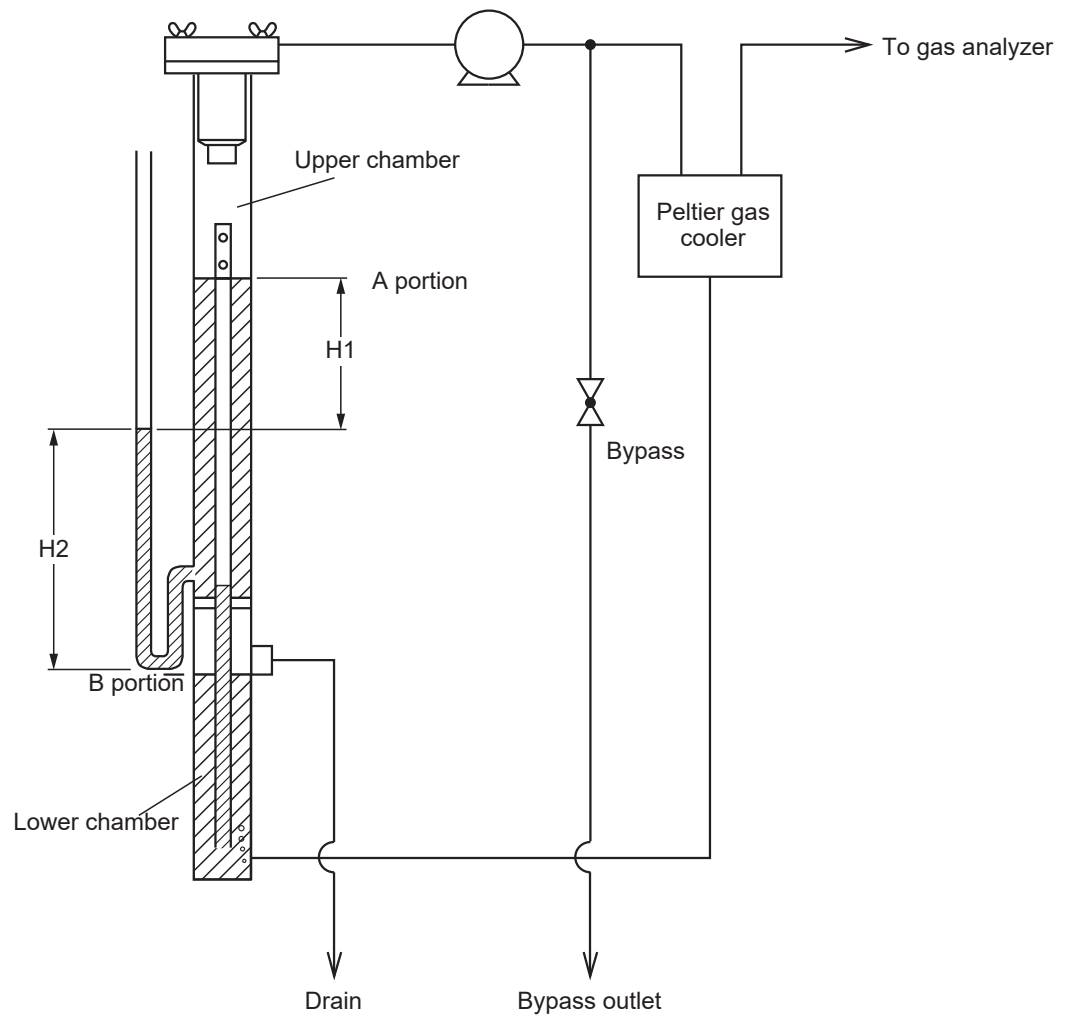
4.1.2 Details of daily check items

Check should be performed daily about the following items:

Maintenance & check items	Maintenance & check procedures
(1) Checking the sample flow rate (2) Checking the gas conditioner	(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 “2.3.4 Warm-up operation” for the adjustment method.) Adjustable Check the gas conditioner for bubbling. No bubbling Normal Unadjustable Check the gas conditioner for bubbling. No bubbling (Refer to “6.1 Troubleshooting” for the check method.) Check the following items: ▪ Gas aspirator ▪ Mist filter ▪ Peltier gas cooler 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
(3) Check of the water level in the air suction tube of gas conditioner	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.)

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 $800^{\circ}\text{C} \pm 5^{\circ}\text{C}$, 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, and measurement range. ▪ If the value is extremely lower than the expected value: → Check the zero, span, gas conditioner (in the case of anything other than oxygen concentration), airtight, gas dissolution, and measurement range. ▪ If no value is indicated. → Check the zero, span, power supply, and fuse.
(7) Standard gas	1. Check the residual pressure. Primary pressure: 2MPa or higher
(8) Gas extractor	Shall be heated. (Be careful about the handle for filter replacement since it is heated to high temperatures (about 60°C).)
(9) Recorder (option)	Refer to the instruction manual of the recorder.

4.1.3 Points of daily check



H1: Sample negative pressure degree

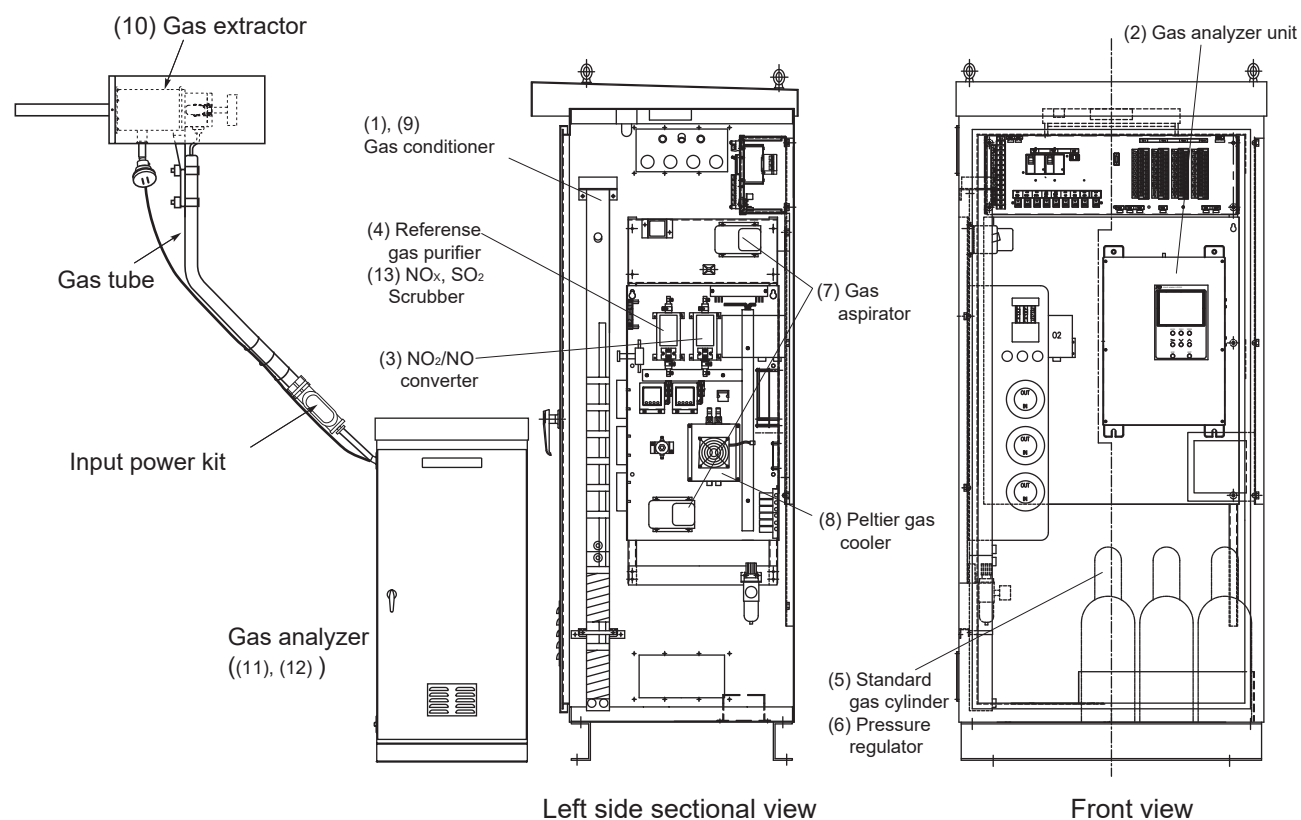
H2: 50mm or greater; Sound

: 50mm or less; Extractor filter and external tube must be checked

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.	See Section 4.2.2 for details.
(2)	Gas analyzer unit	Calibrate Inspected and maintained by the manufacturer.	
(3)	NO ₂ /NO converter (if provided)	Replace the catalyst.	
(4)	Reference gas purifier	Replace the catalyst.	
(5)	Standard gas	Check the filling pressure and warranty period.	
(6)	Pressure regulator	Check for leakage.	
(7)	Gas aspirator	Replace the diaphragm and valve.	
(8)	Peltier gas cooler	Check the temperature control action.	
(9)	Gas conditioner filter	Check the O ring.	
(10)	Gas extractor	Check the flange, filter, and O ring.	
(11)	Capillary	Replace.	
(12)	Tubing	Wash and replace.	
(13)	NO _x and SO ₂ scrubber (if provided)	Replace.	

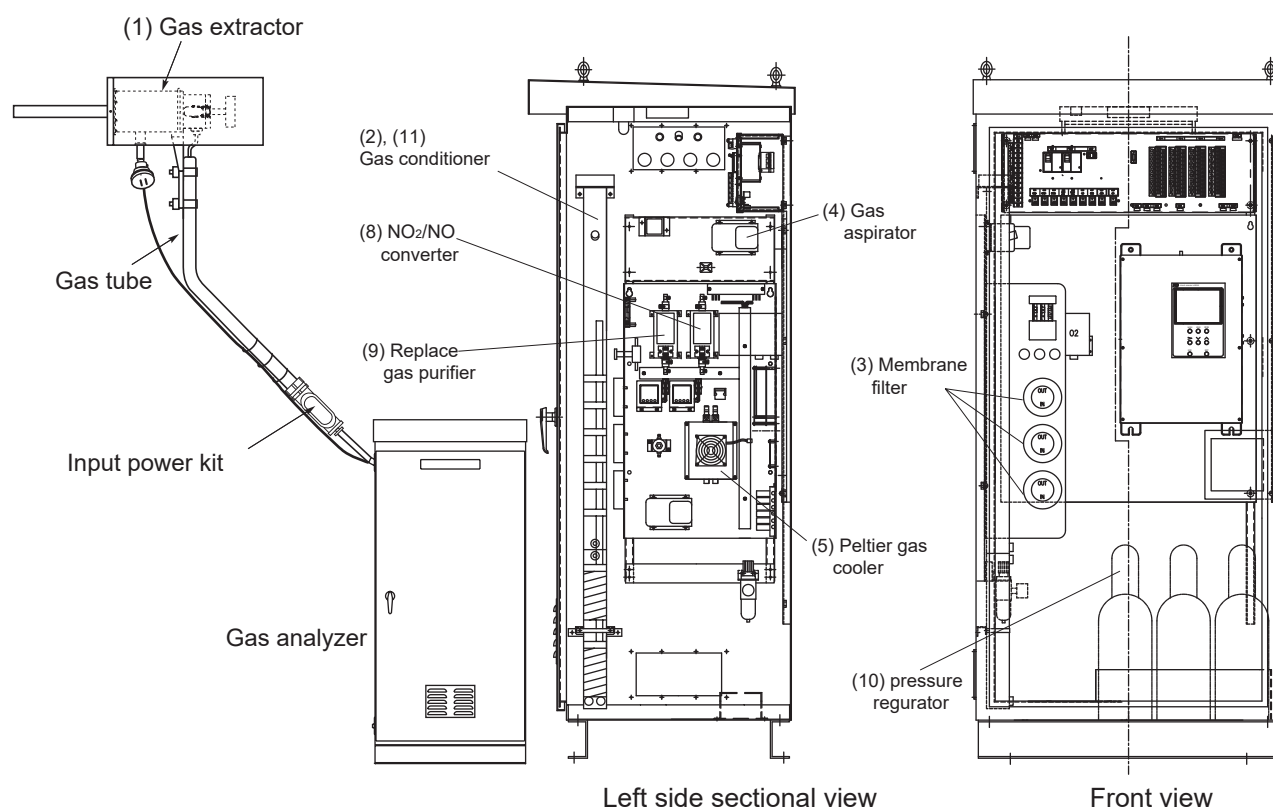
4.2.2 Details of periodical check items

Check should be performed periodically about the following items:

Maintenance & check items	Recommended cycle	Maintenance & check procedures
Manual calibration of analyzer	Once/week	1. Perform zero/span calibration (See Section 3.8).
Filling pressure of standard gas (3.4L cylinder)		1. If filling pressure is 1MPa or less, replace the standard gas cylinder (See Section 4.3.9).
Warranty period of standard gas		1. If the primary pressure gauge (right) for the Pressure regulator drops to 2MPa, 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 4.3.9)
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 4.3.10).
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).
Capillary		1. Replace if clogged (See Section 4.3.6).
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).
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.
Catalyst of NO ₂ /NO converter (if provided)	Once/ 6 months	1. Replacement (NO ₂ , once/6months at 7 ppm or lower)
Reference gas purifier	Once/year	1. Replacement
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.
Peltier gas cooler		1. Check the operation of the fan. 2. Check the temperature. (See Section 4.3.5).
Contamination of piping or leaks		1. Wash it clean or replace.
Water in the gas conditioner		If water in the gas conditioner is dirty, clean.
Analyzer unit		1. Regardless of any phenomena that occurred, ask the manufacturer to perform inspection and maintenance.
NO _x and SO ₂ scrubber inspection (if provided)		1. Replaced when all catalysts become brown or once a year.

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.	—
(6)	4.3.6	Capillary	Replace.	1 year
(7)	4.3.7	Ventilation filter	Clean.	—
(8)	4.3.8	NO ₂ /NO converter (if provided)	Replace the catalyst.	6 months
(9)	4.3.8	Replace gas purifier	Replace the catalyst.	1 year
(10)	4.3.9	Pressure regulator	Check the mounting method.	6 months
(11)	4.3.10	Replace of water in the gas conditioner	Replace.	1 year

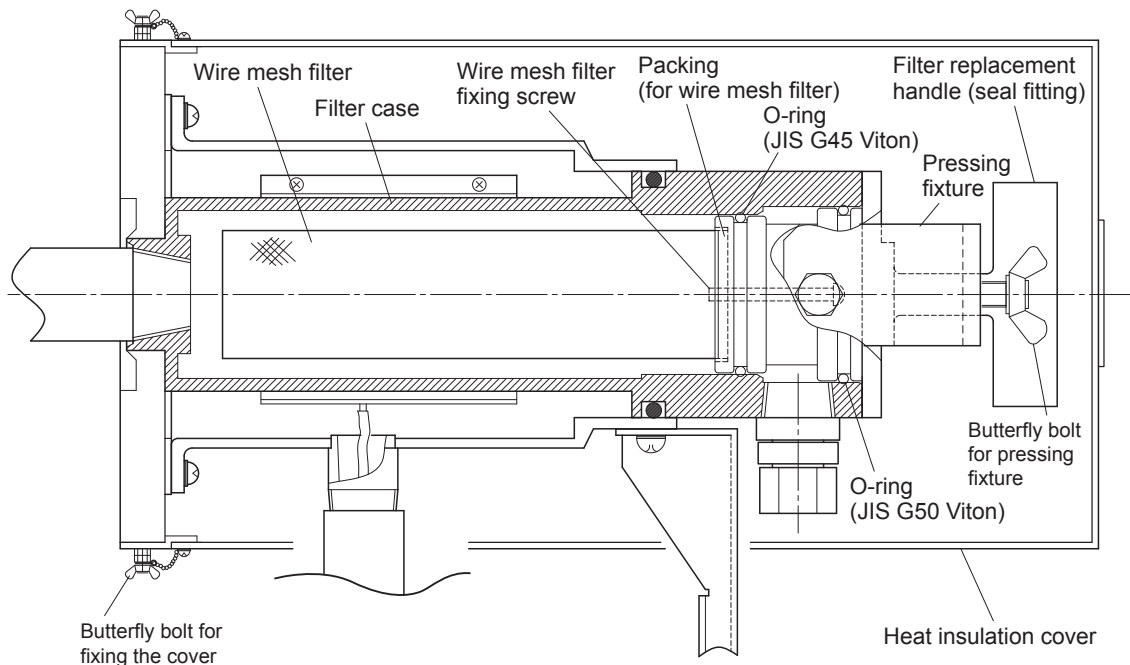
4.3.1 Maintenance of gas extractor

(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” **PUMPI** 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 grease. Mount the wire mesh filter in the sequence that is opposite to what is described above.

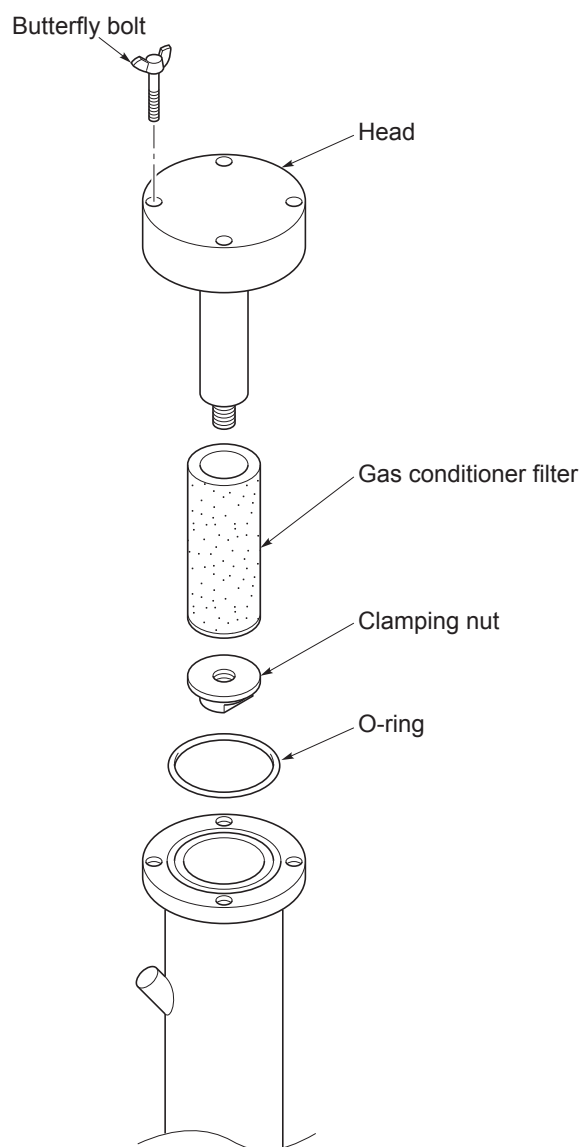


(2) How to clean the wire mesh filter

- (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.



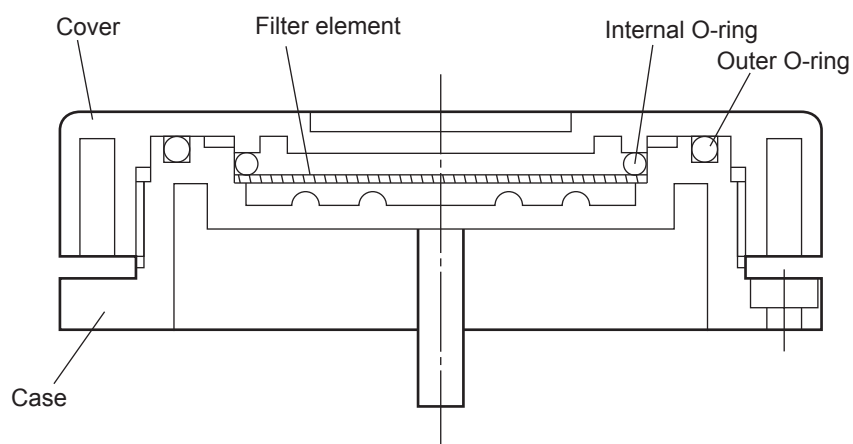
CAUTION

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

* Gas conditioner filter : Filter diameter about 5 μm

4.3.3 How to replace membrane filter

- (1) Turn OFF the PUMP1,2 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/diaphragm of diaphragm type gas aspirator

- (1) Turn the switch for **PUMP 1** and switch for **PUMP 2** on the interface module “OFF” and disconnect the inlet/outlet pipes connected to the aspirators.
- (2) Remove 4 screws to separate cap A and cap B, which will release the valve.
- (3) Use your hand to rotate the diaphragm counterclockwise and remove it.
- (4) Rotate the new diaphragm clockwise until it stops to install.

Note) When installing, make sure that the diaphragm is perfectly engaged with the thread of the arm rod.

Note that it may cause malfunction if used without engagement.

- (5) Place the valve on cap B by rotating it by 90° (valve previously rotated and used shall be replaced). After making sure that the directions of the fitting marks on cap A and cap B are correct, tighten 4 screws.

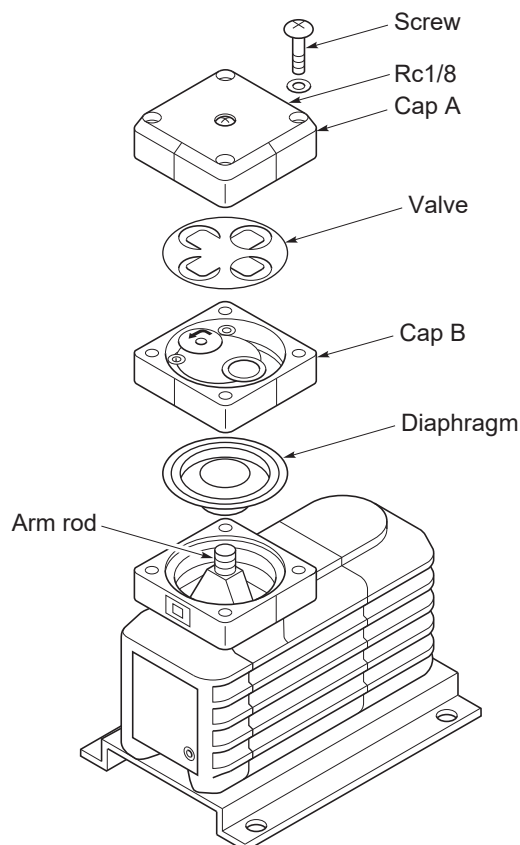
Note) Since a combination valve is used, re-insert the pin under the valve from the initial hole to another hole when installing.

- (6) The aspirator will operate when the switch for **PUMP 1** and switch for **PUMP 2** on the interface module are turned “ON.” At this time, make sure that there is no abnormal sound, and use your hand to check that the valve is operating properly (air is sucked from the IN side and discharged from the OUT side).

In case of any abnormality, re-perform the same procedure from the beginning.

- (7) Once you have checked that the aspirator is operating properly, turn the switch for **PUMP 1** and switch for **PUMP 2** on the interface module “OFF” and return the pipes to complete the process.

Note) When returning the pipes, do not apply excessive force to the Rc1/8 screw thread part.

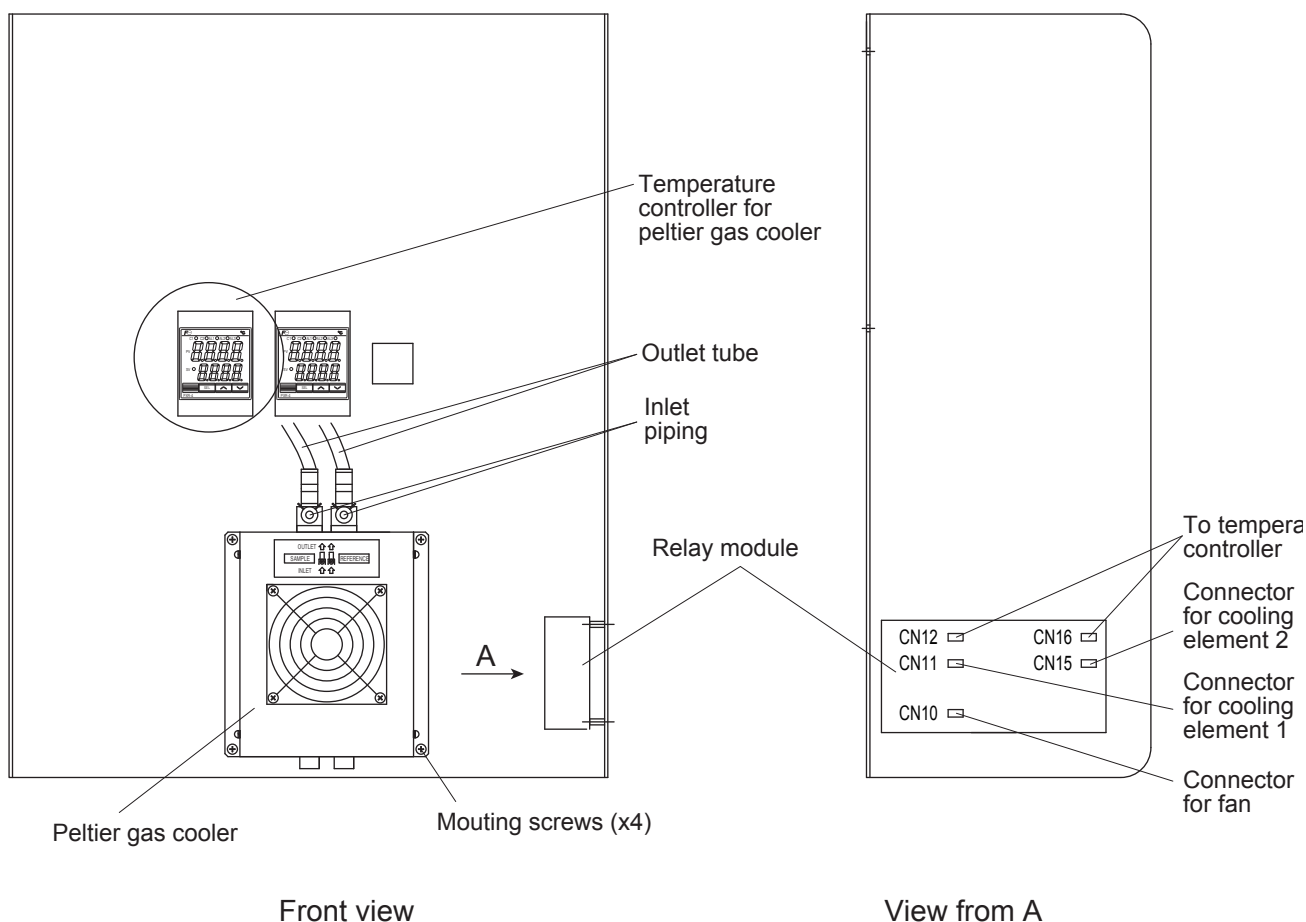


4.3.5 How to replace peltier gas cooler

- (1) Turn “OFF” the **PUMP1** and **PUMP2** 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 and drain tubes below the sampling module.
- (4) Detach the peltier gas cooler connectors (× 5) 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.
- (7) For cooling element, be sure to insert the longer connector to connector 1 (CN15) and the shorter one to connector 2 (CN11).

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.**

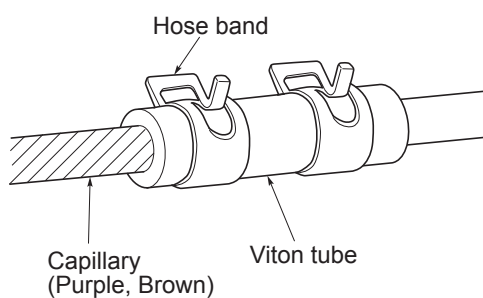
When ambient temperature is beyond the range of specification, cooling temperature may increase.

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

4.3.6 How to replace capillary

This is fixed to the Viton tube or rubber joint with hose bands, so remove the hose bands and replace the capillary.

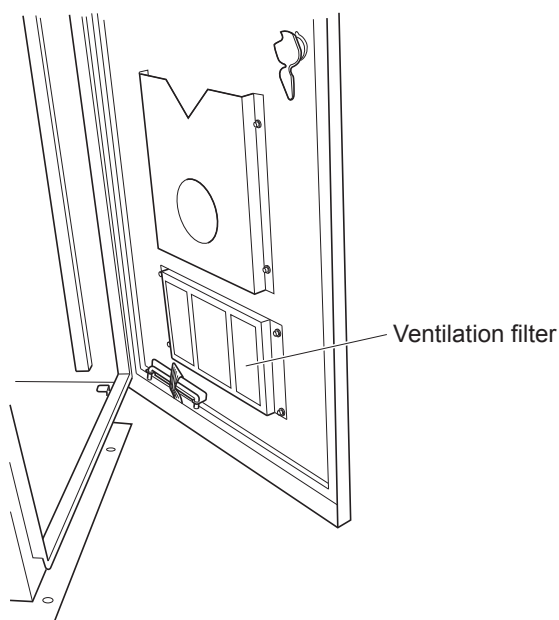
Note 1) Cut the capillary under (2) to the appropriate length (length at the time of delivery) to be used.



4.3.7 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.



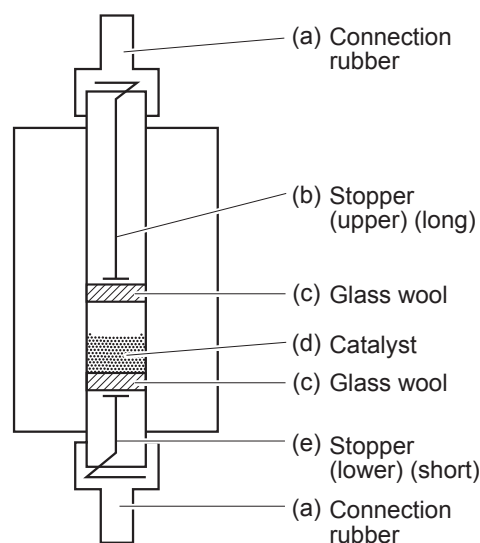
4.3.8 Maintenance procedure for NO₂ / NO converter

How to replace the catalyst

⚠ CAUTION

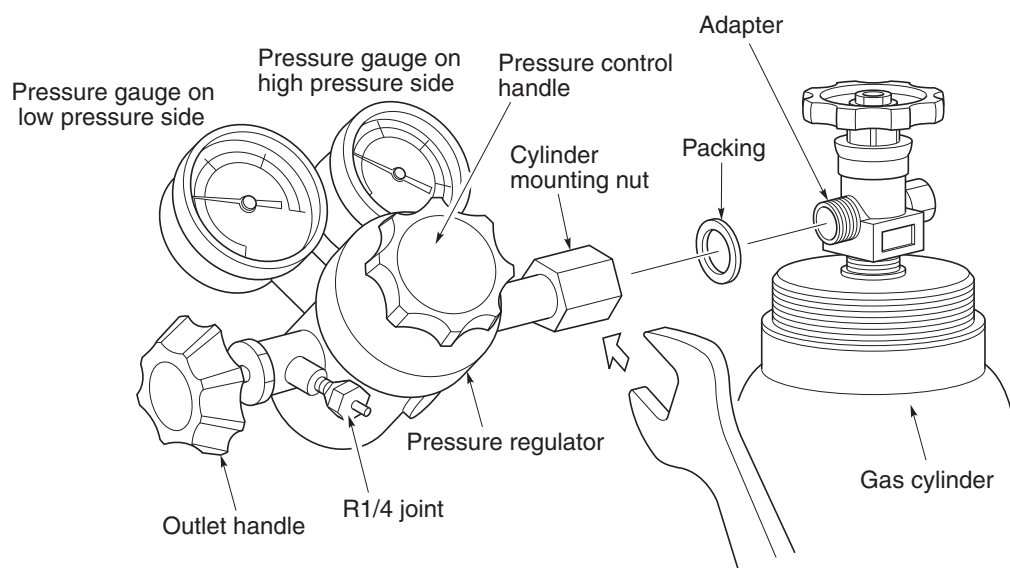
- To reduce the risk of personal injury from hot converter, take care when replacing catalyst to avoid touching the converter unit.

- (1) Turn “OFF” the **PUMP1** switch on the interface module. For the reference gas purifier, turn “OFF” the **PUMP2** switch.
- (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.
- (11) Manually flow zero standard gas for about 20 min.
- (12) Connect the tube to the output side.
- (13) Turn “OFF” the **PUMP1** (**PUMP2**) switch on the interface module.



4.3.9 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 the pressure gauge on the low pressure side reads 30 kPa.
- (7) Open the outlet handle to release gas.
- (8) Adjust the pressure of the low pressure side to 30 kPa again to match the pressure to the prescribed value.



4.3.10 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 Moisture interference adjustment of gas analyzer unit

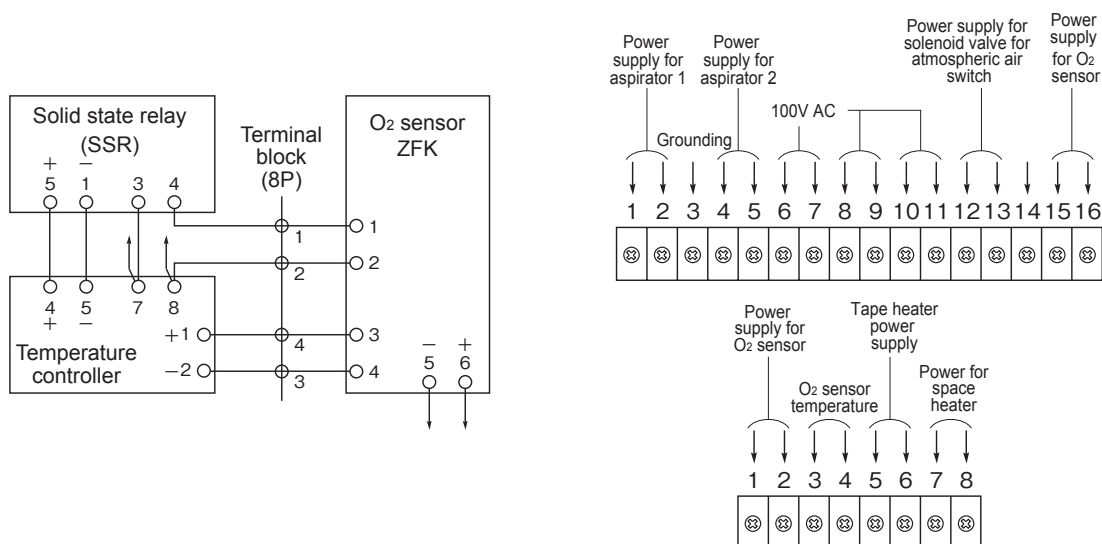
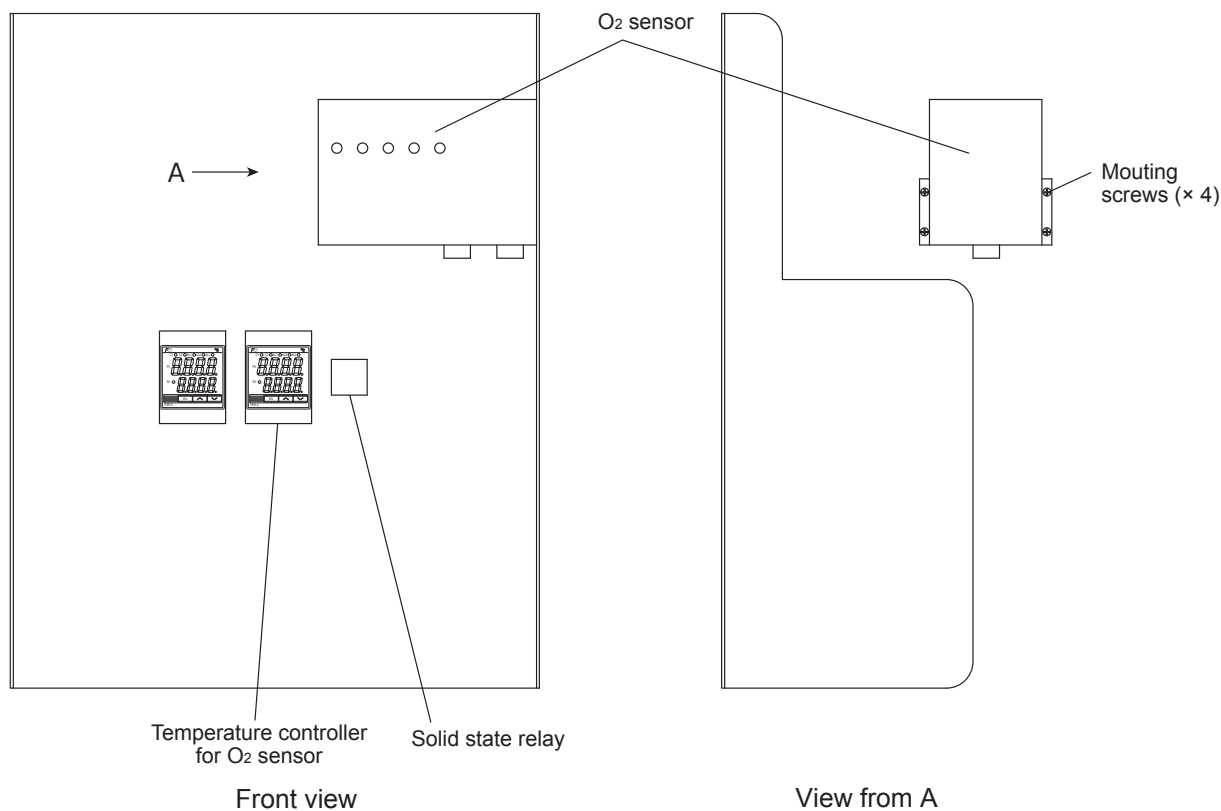
Only fully trained persons can execute the works of these adjustments. If such adjustment is required, therefore, please contact our adjustment engineer.

(1) 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 $0 \text{ ppm} \pm 2\% \text{ FS}$ during atmosphere suction.

4.5 How to replace zirconia O₂ sensor



- (1) Turn "OFF" the **PUMP1** switch on the interface module.
 - (2) Turn "OFF" the **O₂ sensor** switch on the interface module.
 - (3) Remove O₂ sensor tube and the four mounting screws.
 - (4) Remove the cover of the O₂ sensor and remove the six wires connected to the terminal of the O₂ sensor.
 - (5) For assembly, reverse the work above.
- Use care about wiring installation.

4.6 Replacement of magnetic O₂ sensor

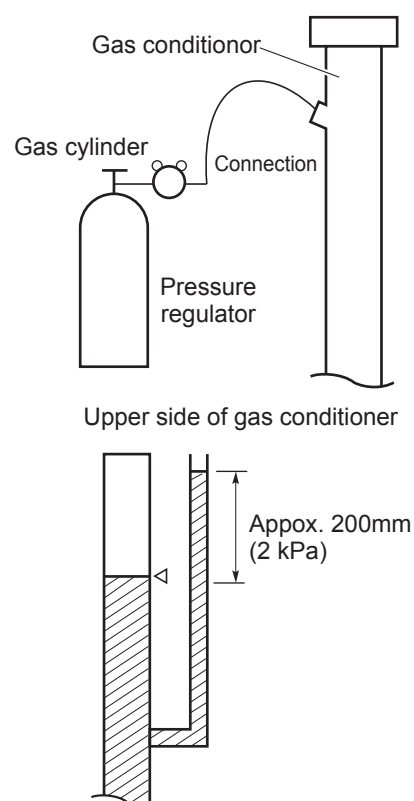
Only fully trained persons can execute the work of this replacement. If such replacement is required, therefore, please contact our adjustment engineer.

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 piping 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

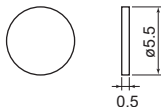
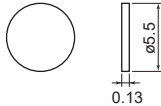
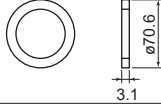
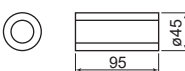
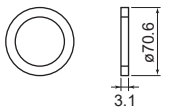
- Do not use replacement parts other than recommended ones. Otherwise, it could result in accident or damage to the instrument.
- Useless replacement parts for maintenance should be disposed of as non-combustible matter.

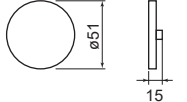
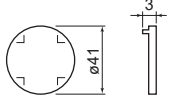
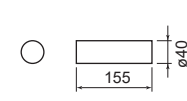
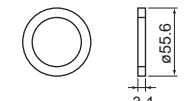
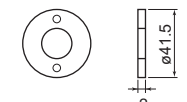
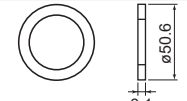
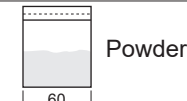
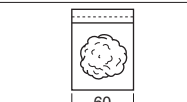
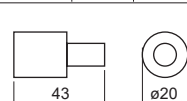
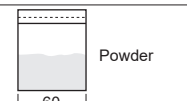
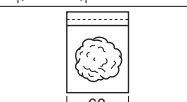
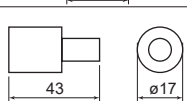
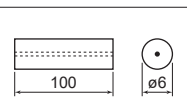
5.1 Spare parts for 1-year measurement

(1) Designation of type of spare parts

1	2	3	4	5	6	7	8	Description
Z	B	N	1	S	J		2	(Gas extractor) (NOx analyzer) (SO ₂ analyzer) (CO analyzer)
						0		Without Without Without With
						1		With Without Without With
						2		Without With Without With
						3		With With Without With
						A		Without Without With With
						B		With Without With With
						C		Without With With With
						D		With With With With
						J		Without Without Without Without
						K		With Without Without Without
						L		Without With Without Without
						M		With With Without Without
						N		Without Without With Without
						P		With Without With Without
						Q		Without With With Without
						R		With With With Without

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

	Name	Type or Parts number	Q'ty	Application	Remarks	Sketch
1	Membrane 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	Membrane filter Teflon filter	TK7H6750P1 (1)	6	When SO ₂ analyzer is included. For sampling module	Teflon 0.1 μm	
3	O-ring for membrane filter	8553765 (1)	3	For sampling module	G65	
4	Rubber ring for membrane filter	TK733572P1 (1)	3	For sampling module	Chloroprene	
5	Filter element for gas conditioner	TK7H8043P1 (1)	2	For gas conditioner	Polyethylene 5 μm With gaskets on both ends	
6	O-ring for gas conditioner	8553765 (1)	2	For gas conditioner	G65	

	Name	Type or Parts number	Q'ty	Application	Remarks	Sketch
7	Gas aspirator diaphragm	TK725417P5 (1)	2	For gas aspirator	Viton	
8	Gas aspirator valve	TK725417P6 (1)	2	For gas aspirator	Viton	
9	Metal mesh filter for gas extractor	TK7H8439P1 (1)	1	For gas extractor (if provided with gas extractor)	SUS316 40 µm	
10	O-ring for gas extractor	8553850 (1)	1	For gas extractor (if provided with gas extractor)	Viton G50	
11	Wire mesh filter packing for gas extractor	TK7M3289P1 (1)	1	For gas extractor (if provided with gas extractor)	Viton	
12	O-ring for gas extractor	TK7N0816P20 (1)	1	For gas extractor (if provided with gas extractor)	Viton G45	
13	Catalyst for NO2/NO converter	TK726891C1 (1 bag)	1 bag	For NO2/NO converter (if provided with NOx analyzer)	Carbon beads 2 cc	
14	Glass wool for NO2/NO converter	TK726890C1 (1 bag)	1 bag	For NO2/NO converter (if provided with NOx analyzer)	Glass wool About 0.5 g	
15	Joint for NO2/NO converter	TK7P7541P1 (1)	2	For NO2/NO converter (if provided with NOx analyzer)		
16	Catalyst for reference gas purifier	TK726891C6 (1 bag)	1 bag	For reference gas purifier (if provided with reference gas purifier)	Activated alumina 2cc	
17	Glass wool for reference gas purifier	TK726890C1 (1 bag)	1 bag	For reference gas purifier (if provided with reference gas purifier)	Glass wool about 0.5g	
18	Joint for reference gas purifier	TK7P7541P1 (2)	2	For reference gas purifier (if provided with reference gas purifier)		
19	Capillary	TK729264C4 (1)	1	For sampling tube	ø1.4 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 $+40^{\circ}\text{C}$
 - 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: $+60^{\circ}\text{C}$ to $+800^{\circ}\text{C}$
 - 2) Pressure: -5 to $+5$ 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, 5% 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		Infrared light source	1 to 2	☐	8									☐		
		Sector motor	1 to 2	☐	5						☐					☐
		O-ring for sampling cell	1 to 5	☐	2			☐		☐		☐		☐		☐
		Detector	1 to 4	☐	8								☐			
		LCD	1	☐	3				☐			☐			☐	
		Solenoid Valve	2	☐	3				☐			☐			☐	
		Main power PCB	1	☐	5						☐				☐	
		Light source power PCB	1	☐	5						☐				☐	
	O2 sensor	Temperature controller	1	☐	3				☐			☐			☐	
Sampling equipment		Gas extractor (standard)	1	☐	5						☐					☐
		Gas conditioner filter	1	☐	5						☐					☐
		Peltier gas cooler	1	☐	7								☐			
		Peltier gas cooler fan	1	☐	2			☐		☐		☐		☐		☐
		Membrane filter	1	☐	5						☐					☐
		NO2/NO converter	1	☐	10											☐
		Refererce gas purifier	1	☐	10											☐
		Corrosion-resistant solenoid valve	1	☐	5						☐					☐
		Diaphragm type gas aspirator (ZBG5)		☐	3				☐			☐			☐	
		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			☐		☐		☐		☐
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		☐	☐	☐	☐	☐	☐	☐	☐	☐		

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 3.8 “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 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 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 separately.)

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 3.8 “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.
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

If errors occur, the following contents are displayed.

Error display	Error contents	Probable causes
Error No.1	Light source/motor rotation is faulty.	• Infrared light source is faulty. • Sector motor is not properly run or is stopped. • Amplifier circuit is faulty.
Error No.2	Detector failure	• Detector voltage circuit is faulty. • Detection element is broken or faulty. • Amplifier circuit is faulty.
Error No.3	A/D error	• A/D conversion circuit is failure.
Error No.4	Zero calibration is not within.	• Zero gas is not supplied. • Zero error due to dirty cell. • Detector is faulty.
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 error 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.	• DIO circuit is failure. • Internal wiring to the DIO circuit is broken.

When errors No. 1 to No. 3 and No. 10 occur, analyzing block error contact output is closed.

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

<Troubleshooting at the occurrence of error>

When error No.1 occurs, remove the top cover of the analyzer and check the LED on the light source power board. If LED light is turned off, this has been caused by disconnection of the light source.

When errors No. 1 to No. 3 and No. 10 occurs, the analyzer is faulty. Contact your dealer or our sales office.

When errors No. 4 to No. 8 occurs, the calibration procedure may be incorrect.

Check the following items, and if error still occurs, contact us as shown above.

- (1) Is the calibration gas supplied in the analyzer?
- (2) Does the calibration operation match the supplied gas? (For example, zero calibration is performed while flowing the span gas.)
- (3) Does the supplied gas concentration match the gas concentration set at the calibration concentration setting?

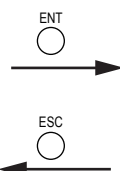
Also, when errors No. 5 and No. 7 occurs, you can perform calibration forcibly, following the procedure shown below. Use it as fault recovery when calibration fails and calibration contents are missed.

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

Measurement screen

Ch	Error No.9	00.8	ppm
2	SO ₂ (0-50)	13.6	ppm
3	CO ₂ (0-20)	0.000	vol%
4	CO (0-50)	0.0	ppm
5	O ₂ (0-25)	21.00	vol%



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

Display of error contents

Error No. 9	Auto Cal. error ESC : Back to MEAS.
SPAN NOx Calibration error Cause	
• Calibration gas is not flowing • Gas flowing time is short • Setting conc. is different from gas conc. • Dirt in sample cell	

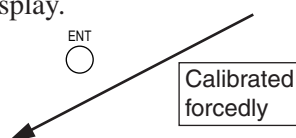
- When more than one error occurs, pressing the  key moves to another error display.

In case of Error No. 5 and No. 7

ZERO Cal.		ENT : Go on calibration of selected CH. ESC : Not calibration	
Ch1 NOx	▶ Error No. 5	ppm	3083
Ch2 SO ₂	▶ Range 1 0-50.00 Range 2 0-500.0	ppm	-13.6
Ch3 CO ₂	▶ Range 1 0-10.00 Range 2 0-20.00	vol%	-0.09
Ch4 CO	▶ Range 1 0-50.00 Range 2 0-500.0	ppm	-0.09
Ch5 O ₂	▶ Range 1 0-10.00 Range 2 0-25.00	vol%	-0.09



- Pressing  deletes the error display.



Calibration is continued. Unless another calibration error occurs, calibration is carried out to the end, the Measurement screen returns.

Error No. 5	SPAN cal. error ENT : Force Cal. ESC : Stop cal. and back to MEAS.
NOx Calibration error Cause	
• Span gas is not flowing • Deviation of zero point due to contamination • Low sensitivity of detector	



Ch	NO ₂ (0-50)	90.8	ppm
2	SO ₂ (0-50)	13.6	ppm
3	CO ₂ (0-20)	0.000	vol%
4	CO (0-50)	0.0	ppm
5	O ₂ (0-25)	0.09	vol%

7. SPECIFICATION

7.1 Specification

Standard Specifications

Measuring system:

- NO_x, SO₂, CO and CO₂ ; Ndir type infrared
- O₂ ; Zirconia type, magnetic type

Measurable component and min./max. measurement range:

- NO_x ; 0 to 50 ppm/0 to 5000 ppm
- SO₂ ; 0 to 50 ppm/0 to 5000 ppm
- CO ; 0 to 50 ppm/0 to 5000 ppm
- CO₂ ; 0 to 10 %/0 to 20%
- O₂ ; 0 to 10 %/0 to 25%

Number of measurement ranges:

- 2 Maximum range ratio: 1:10 (Refer to 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, SO₂, CO, CO₂ and O₂)
- Three instantaneous values (NO_x, SO₂, CO) after O₂ correction when provided with O₂ sensor
- Three average values (NO_x, SO₂, CO) after O₂ correction when provided with O₂ sensor
- Allowable load resistance: 550 Ω or less

Contact output:

- (1) Each SPST 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 SPDT 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:

- Non-voltage contact (1.5 sec or longer)
- Auto calibration start, average value resetting
- Non-voltage contact (Status hold)
- Range changeover (1st range when contact closes), output hold, remote aspirator OFF (OFF when contact closes)

Indication:

- LCD with back light for indicating:
 - Instantaneous values (NO_x, SO₂, CO, CO₂ and O₂)
 - O₂ corrected instantaneous values (NO_x, SO₂, CO) after O₂ correction when provided with O₂ sensor
 - O₂ corrected average values (NO_x, SO₂, CO) after O₂ correction when provided with O₂ sensor
 - O₂ average value when provided with O₂ sensor
 - Peak count value (when provided with CO, O₂ analyzer)
 - Parameter assignment

Fluorescent lamp in cubicle:

- Standard equipment

Recorder (option):

- Paperless recorder (Fuji Electric's type PHR) mounted

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 pipe)
- Power supply voltage: 100 V AC, 50/60 Hz
- Power consumption: Approx 100 VA
- Sampling pipe: Refer to Code Symbols for materials and length of the pipe.
 - 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 800°C or lower.
- * Titanium is used for 1000°C or lower.
- * SiC is used for 1300°C 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 -5°C or lower
 - (2) SO₂ of 0 to 50 ppm or 0 to 100 ppm
 - (3) Tube length 10 m or longer in SO₂ measurement (Power supply voltage: 100 V AC, 50/60 Hz, power consumption: 36 VA/m)

Rated operating conditions:

- Ambient temperature: -5 to 40°C (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. 900 VA (excluding gas extractor and heating tube)

Storage condition:

- Ambient temperature; -20 to 60°C (Water within the drain pot should be drained before storage.)
- Ambient humidity; 95%RH or lower

Dry air:

- Dew point; -20°C DP or lower
- Pressure; 100 kPa to 400 kPa
- Dust and mist; None

External dimensions (H x W x D):

- Indoor type; 1710 × 800 × 615 mm
- Outdoor type; 1780 × 815 × 700 mm

Mass:

- Approx. 300 kg (excluding standard gas)

Cubicle finish color:

- Munsell 5Y7/1 semi-gloss

Cubicle structure:

- Indoor or outdoor installation, of selfstanding type, single-swing front door, plate thickness 2.3 mm standard (both cubicle and door)

Other:

- Six standard gas cylinders (3.4 L) accommodatable

Measurement Law type approval No.:

- SAN181(NO_x analyzer)
- SAS182(SO₂ analyzer)
- SAC182(CO analyzer)
- SE171(Zirconia O₂ sensor)
- SF172(Magnetic O₂ sensor)

2. Standard Functions

Function	Description
O ₂ Correction	- Conversion of measured NO_x, SO₂ and CO gas concentrations into values at standard O₂ concentration Calculating equation : $C = \frac{C_s (21 - O_N)}{21 - O_s}$ C : Sample gas concentration after O₂ correction C_s : Measured concentration of sample gas O_s : Measured O₂ concentration O_N : Standard O₂ concentration (4% for petroleum fuel, 5% for gas fuel, 6% for coal fuel, 12% for garbage 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
Average Value after O ₂ Correction, O ₂ average value	- NO_x, SO₂ and CO values are averaged after O₂ correction, and the result is indicated and output in 4 to 20 mA 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 O₂ 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 sample 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 overshootings 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)

Performance

Repeatability:

±0.5% of full scale

Zero drift:

±1.0% of full scale or lower/week

Max. ±2.0% of full scale/month on Zirconia O₂ sensor

Span drift:

Max. ±2.0% of full scale/week

Max. ±2.0% of full scale/month on Zirconia O₂ sensor

Linearity:

Max. ±1.0% of full scale

Response time:

For 90% indication (after extracting sample gas through the inlet)

NO_x : 120 sec or shorter

SO₂ : 240 sec or shorter

CO : 120 sec or shorter

CO₂ : 120 sec or shorter

O₂ : 120 sec or shorter

Sample gas flow rate:

Approx. 3L/min

Standard Requirements for Sample Gas

Temperature:

Standard : 60 to 800°C

Non standard: 1000°C (titanium probe)

1300°C (SiC probe)

Dust:

100 mg/Nm³ or less

Pressure:

-5k to +5kPa

Components:

SO₂ : 500 ppm or less

NO_x : 1000 ppm or less

CO₂ : 0 to 15%

CO : 2000 ppm or less

O₂ : 1 to 21%

HCL : 100 ppm or less

The remaining : N₂, H₂O

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
- (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/probe set
- Specified gas inlet tube set
- Standard accessories

ITEMS TO BE PREPARED SEPARATELY

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

7.2 Code symbols

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Description
Z	S	J					2													Measuring gas component <4th digit>
			P																	NOx
			A																	SO ₂
			B																	CO
			F																	NOx, SO ₂
			H																	NOx, CO
			L																	NOx, SO ₂ , CO
			M																	NOx, SO ₂ , CO, CO ₂
				0																(O ₂ SENSOR) (O ₂ correction value) <5th digit>
																				Without
				4																Zirconia 4% (Oil fuel)
				5																Zirconia 5% (Gas fuel)
				6																Zirconia 6% (Coal fuel)
				C																Zirconia 12% (Refuse incinerator)
				D																Magnetic 4% (Oil fuel)
				E																Magnetic 5% (Gas fuel)
				F																Magnetic 6% (Coal fuel)
				G																Magnetic 12% (Refuse incinerator)
																				NOx measuring range <6th and 7th digit>
																				Select your code in the Table1
																				Revision code <8th digit>
																				SO ₂ measuring range <9th and 10th digit>
																				Select your code in the Table1 (Note1)
																				CO measuring range <11th and 12th digit>
																				Select your code in the Table1 (Note1)
																				O ₂ measuring range <13th digit>
																				Without
																				25%
																				10/25%
																				CO ₂ measuring range <14th digit>
																				Without
																				10/20%
																				10%/ Without
																				20%/ Without
																				(Cubicle structure) (Ambient temperature)<15th digit>
																				Indoor structure -5 to 40°C
																				Outdoor Structure -5 to 40°C
																				Indoor structure -10 to 40°C
																				Outdoor structure -10 to 40°C
																				(Display screen) (Inspection) (Recorder)<16th digit>
																				Japanese With With (Note2)
																				English With (Note2)
																				Japanese Without With (Note2)
																				English Without With (Note2)
																				Japanese With Without
																				English With Without
																				Japanese Without Without
																				English Without Without
																				Power supply <17th digit>
																				100V AC 50Hz
																				100V AC 60Hz
																				110V AC 50Hz
																				110V AC 60Hz
																				115V AC 50Hz
																				115V AC 60Hz
																				200V AC 50Hz
																				200V AC 60Hz
																				230V AC 50Hz
																				230V AC 60Hz
																				(Zero gas) (External drain separator) <18th digit>(Note4)
																				Instrumentation air Without
																				Air Without
																				Standard gas Without
																				Instrumentation air With (Note3)
																				Air With (Note3)
																				Standard gas With (Note3)
																				*Order standard gas (type ZSY) separately

Measuring Range List

Unit: ppm

Measuring range	Code
Without	YY
50/100	AB
50/200	AC
50/250	AD
50/500	AE
50/Without	AY
100/200	BC
100/250	BD
100/500	BE
100/1000	BF
100/Without	BY
200/500	CE
200/1000	CF
200/2000	CG
200/Without	CY
250/500	DE
250/1000	DF
250/2000	DG
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

Note1) When "L", "M" is specified at 4th digit, it may not be available depending on measurable combination of SO₂ and CO. Regarding available range combination, please refer to Availability check table on the next page.

Note2) Recorder type : PHR. Regarding recording contents, be sure to specify them separately.

Note3) Specify this code when the downward inclination of the sample inlet 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%.

Note4) Specify code 3 or 6 at 18th digit when Measurement Act inspection and/or CO₂ meter is selected (when "M" is specified at 4th digit).

Note5) When the sampling pipe length exceeds 1,500 mm, the pipe support needs to be prepared.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	Description
Z	S	J					2	-													(Gas extractor) (Tube material) (Tube length) (Extraction point temperature) <19th 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 1200mm 800°C or lower
J																					With SUS316 1500mm 800°C or lower
K																					With SUS316 2000mm 800°C or lower (Note 5)
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
Y																					(Kind of sample inlet tube) (Length) <20th digit>
A																					Without Without
B																					ø10/ø8 Teflon tube 5m
C																					ø10/ø8 Teflon tube 10m
D																					ø10/ø8 Teflon tube 15m
E																					ø10/ø8 Teflon tube 20m
F																					ø10/ø8 Teflon tube 25m
G																					ø10/ø8 Teflon tube 30m
H																					ø10/ø8 Teflon tube 50m
J																					Heating tube 10m
K																					Heating tube 15m
L																					Heating tube 20m
M																					Heating tube 25m
Z																					Non-standard specification <21st digit>
																					Other non-standard specifications

Measurable Component and Range -Availability Check Table-

SO₂,CO of the 3-Components analyzer (NO_x, SO₂, CO) and 4-Components analyzer (NO_x, SO₂, CO, CO₂)

		Measurable component	CO										
		Code	AB, AC, AD, AE, AY	BC, BD, BE, BF, BY	CE, CF, CG,CY	DE, DF, DG,DY	EF, EG, EY	EH	FG, FY	FH	GY	GH	HY
Measurable component	Code	Range Range	50 / "Without" to 500	100 / "Without" to 1000	200 / "Without" to 2000	250 / "Without" to 2000	500 / "Without" to 2000	500/5000	1000 / "Without" to 2000	1000/5000	2000/ Without	2000/5000	5000/ Without
SO ₂	AB, AC, AD, AE, AY	50 / "Without" to 500	○	○	○	○	○		○		○		
	BC, BD, BE, BF, BY	100 / "Without" to 1000	○	○	○	○	○		○		○		
	CE, CF, CG,CY	200 / "Without" to 2000	○	○	○	○	○		○		○		
	DE, DF, DG,DY	250 / "Without" to 2000	○	○	○	○	○		○		○		
	EF, EG, EY	500 / "Without" to 2000	○	○	○	○	○	○	○	○	○	○	○
	EH	500/5000			○	○	○	○	○	○	○	○	○
	FG, FY	1000/ "Without" to 2000	○	○	○	○	○	○	○	○	○	○	○
	FH	1000/5000			○	○	○	○	○	○	○	○	○
	GY	2000/Without	○	○	○	○	○	○	○	○	○	○	○
	GH	2000/5000			○	○	○	○	○	○	○	○	○
	HY	5000/Without					○	○	○	○	○	○	○

○: Combination is available.

STANDARD GAS CODE SYMBOLS

1	2	3	4	5	6	7	8	9	10	11	Description
Z	S	Y					2				NO _x measurement first range <4th digit>,ppm
			0								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
			A								Without
			1								50
			2								100
			3								200
			4								250
			5								500
			6								1000
			7								2000
											5000
			0								CO measurement first range <6th digit>,ppm
			A								Without
			1								50
			2								100
			3								200
			4								250
			5								500
			6								1000
			7								2000
											5000
			Y								CO ₂ measurement first range <7th digit>,ppm
			A								Without
			B								5
			C								10
											20
			0								O ₂ span gas <9th digit>
			1								Without
			2								1.8 to 2% O ₂ / N ₂
			3								10% O ₂ / N ₂
											AIR
			Y								Zero gas <10th digit>
			A								Without
			B								Air cylinder (without certificate)
			C								Air cylinder (with certificate Japanese official organization)
			D								N ₂ cylinder (without certificate)
											N ₂ cylinder (with certificate)
			Y								Official certificate <11th digit>
			A								Without
			B								NO _x
			C								SO ₂
			D								CO
			E								NO _x , SO ₂
			F								NO _x , CO
			G								NO _x , SO ₂ , CO
			H								NO _x , O ₂
			I								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

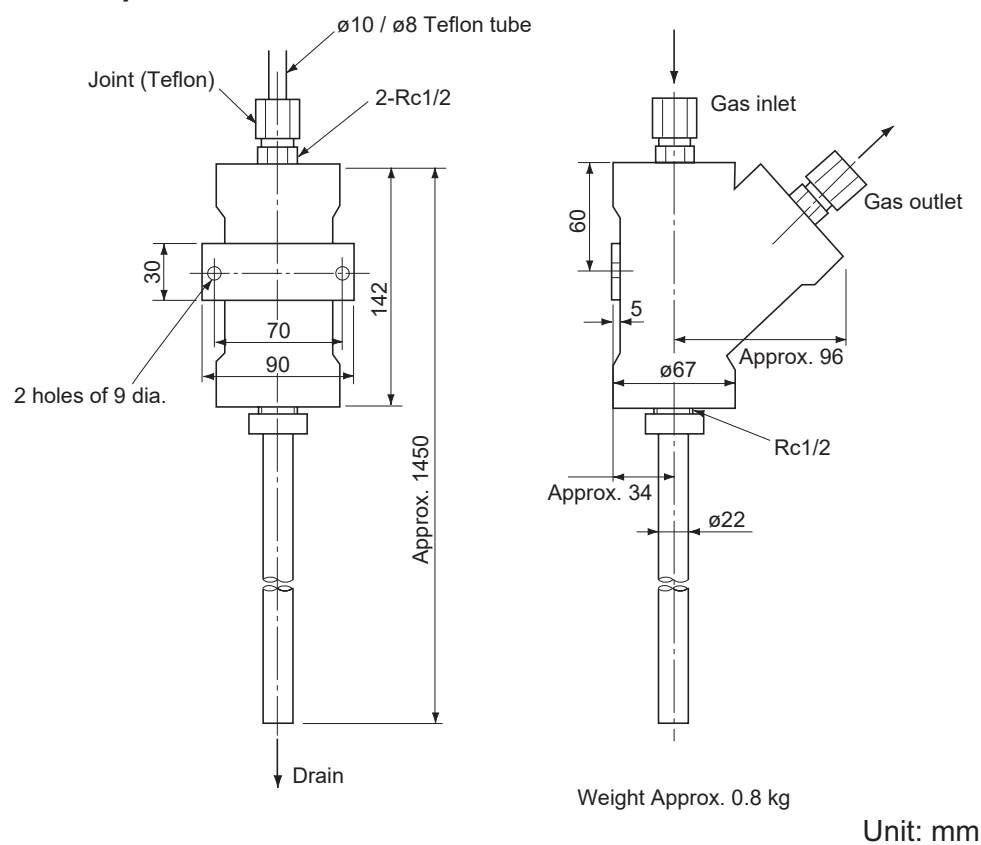
Note: Select "1" for the 9th digit and "A" or "B" for the 10th digit for zirconia type O₂ sensor.
For the magnetic type O₂ sensor, select "2" or "3" for the 9th digit according to the selection of the first range, and select "C" or "D" for the 10th digit.

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

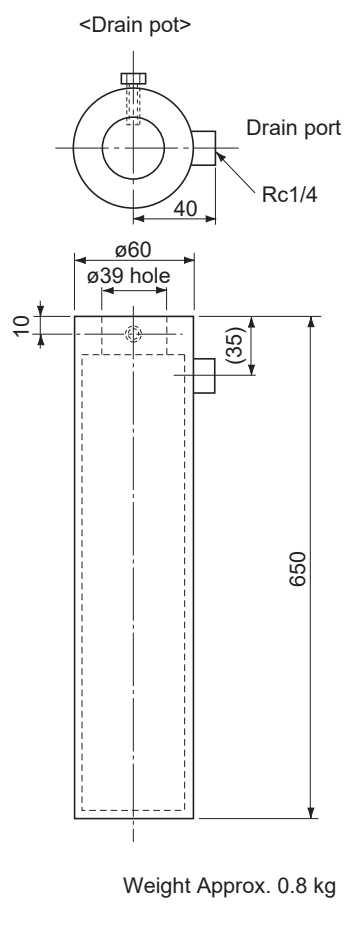
7.3.1 Gas extractor



7.3.2 Drain separator



7.3.3 Drain pot





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