Fuji Electric

Instruction Manual

NDIR TYPE INFRARED GAS ANALYZER (Replacement of ZRG)

TYPE: ZKJK-5

INZ-TN5ZKJK-E Fuji Electric Co., Ltd.

PREFACE

Thank you very much for purchasing Fuji's Infrared Gas Analyzer.

- Be sure to read this instruction manual carefully before performing installation, wiring, operation, and maintenance of the analyzer. Improper handling may result in accidents or injury.
- The specifications of this analyzer are subject to change without prior notice for further product improvement.
- Modification of this analyzer is strictly prohibited unless a written approval is obtained from the manufacturer. Fuji will not bear any responsibility for a trouble caused by such a modification.
- The person who actually operates the analyzer should keep this instruction manual.
- After reading through the manual, be sure to keep it near at hand for future reference.
- This instruction manual should be delivered to the end user without fail.

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

Delivered Items

Name	Quantity	Remarks
Analyzer main frame	1 unit	
Fuse	2 pcs	250V AC/3.15A
Cell window mounting tool	1 pc	With mounting block cell
Instruction manual	1 copy	

Issued in December, 2022

Caution on safety

To operate the analyzer properly, be sure to read "Caution on Safety" carefully.

- The descriptions listed here provide important information on safety. Be sure to observe them at all times. Those safety precautions are classified into 3 levels, "DANGER," "CAUTION" and "PROHIBITION."

⚠ DANGER	Improper handling may cause dangerous situations that may result in death or serious injury.
⚠ CAUTION	Improper handling may cause dangerous situations that may result in medium-level troubles, minor injury, or property damage.
⊘ PROHIBITION	Items which must not be done are noted.

Caution on installation and transport of gas analyzer	
⚠ DANGER	• The unit is not of explosion-proof specifications. Do not use it in an atmosphere of explosive gases. Otherwise serious accidents such as explosion or fire may result.
⚠ CAUTION	• Install the analyzer, observing the rules provided in this manual, in a place that endures the weight of the analyzer. Installation in an inadequate place may cause turnover or fall, resulting in injury. • Be sure to wear protective gloves when lifting the analyzer. Lifting it with bare hands may result in injury. • The gas analyzer is heavy. Two or more persons should carry it, while exercising due care. Otherwise unexpected harm to your body or injury may result. • Take care not to let cable chips and other foreign objects enter the unit during installation work. Otherwise fire, failure, or malfunction may result.

Caution on piping	
⚠ DANGER	**Be sure to observe the following precautions while installing piping. Improper piping may result in gas leakage.** **If the leaking gas contains a toxic component, serious accidents may result. If it contains combustible gases, explosion or fire may result.** • Connect pipes correctly referring to the instruction manual. • Discharge the exhaust gas outdoors to prevent it from remaining within the sampling device or indoors. • Relieve the exhaust gas from the analyzer to the atmospheric pressure to prevent buildup of undesirable pressure to the analyzer. Otherwise piping within the analyzer may be disconnected, resulting in gas leakage. • Use pipes and pressure reducing valves to which no oil/grease is attached for piping. Otherwise, fire may result.

Caution on wiring	
⚠ CAUTION	• Be sure to turn off the power before installing wiring. Otherwise electric shock may result. • Be sure to perform class D grounding work. Otherwise, electric shock or failure may result. • Select a proper wiring material that satisfies the ratings of the instrument. Otherwise, electric shock or fire may result. • Be sure to connect a power supply of correct rating. Otherwise, fire may result.

Caution on use	
⚠ DANGER	• Be sure to read the instruction manual for reference gases before handling reference gases such as calibration gas to use them properly.
⚠ CAUTION	• Leaving the analyzer unused for a long time or restarting it after long-term suspension requires procedures different from normal operation or suspension procedures. Be sure to follow the instructions in each instruction manual. Otherwise, intended performance may not be achieved, or accidents or injury may result. • Do not operate the 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 touch the input/output terminals with metal or finger. Otherwise, electric shock or injury may result. • Do not smoke or use flames near the analyzer. Otherwise, fire may result. • Do not allow water to enter the analyzer. Otherwise, electric shock or internal fire may result.

Caution on maintenance and check	
DANGER	• Before performing work with the cover of the analyzer kept open for maintenance and check, be sure to purge completely not only within the analyzer but also measuring gas lines with nitrogen or air. Otherwise, poisoning, fire, or explosion may result due to gas leakage.
CAUTION	**Be sure to observe the following to perform work safely, avoiding electric shock or injury.** • Remove the watch and other metallic objects before work. • Do not touch the instrument wet-handed. • If the fuse is blown, eliminate the cause and replace it with the one of the same capacity and type. Otherwise, electric shock or accidents may result. • Do not use replacement parts other than those specified by the manufacturer. Otherwise, intended performance may not be achieved, or accidents or failures may result. • Dispose replacement parts such as maintenance parts as incombustibles according to the local waste disposal regulations.

Others	
CAUTION	• If the cause of a fault cannot be identified by referring to the instruction manual, be sure to contact your dealer or Fuji's technician in charge of adjustment. Disassembling the instrument carelessly may result in electric shock or injury.

Contents

1. OVERVIEW

This infrared gas analyzer (type: ZKJK) measures the concentration of NO, SO_2, CO_2, CO and CH_4 contained in sampling gas on the principle that different atomic molecules have an absorption spectrum in the wave band of infrared rays, and the intensity of absorption is determined by the Lambert-Beer law.

Since this instrument install external O_2 sensor,it allows measuring up to 3 components simultaneously including O_2 sensor (up to 2 components if O_2 sensor is excluded).

Furthermore, use of a microprocessor or large sized liquid crystal display realizes improvement of operability, accuracy and multi-functions.

This instrument is optimum for measuring combustible gas exhausted from boilers or incinerators, and it is effective for steel gas analysis (blast furnace, steel converter, thermal treatment furnace, sintering (Pellet equipment), coke furnace), storage and maturity of vegetable and fruit, biochemistry (microbe), [fermentation], air pollution [incinerator, exhaust gas desulfurization, denitration], automotive emission (excluding tester), protection against disasters [detection of explosive gas and toxic gas, combustion gas analysis of new building material], growth of plants, chemical analysis [petroleum refinery plant, petroleum chemistry plant, gas generation plant], environment [landing concentration, tunnel concentration, parking lot, building management] and various physical and chemical experiments.

2. NAME and description of each unit

2.1 Name and description of main unit

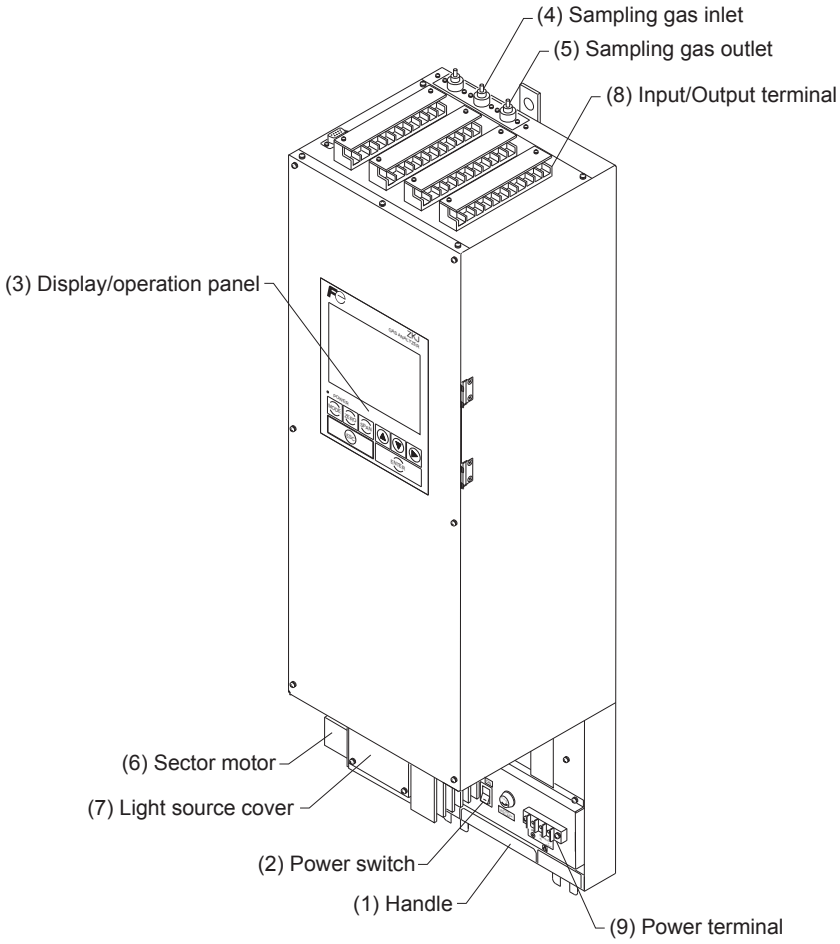


Fig. 2-1

Name	Description	Name	Description
(1) Handle	Used for installing the main unit.	(6) Sector motor	For driving the rotation of secto
(2) Power switch	Used for ON/OFF the analyzer.	(7) Light source cover	Infrared light source is arranged in the cover.
(3) Display/operation panel	Liquid crysral diaplay and keys for setting various functions	(8) Input/Output terminal	For receiving the signal from analyzer and alarm output signal
(4) Sampling gas inlet	For connecting to the measuring gas tube	(9) Power terminal	For connecting the power cable
(5) Sampling gas outlet	Connect to the exhaust line.		

2.2 Input/Output terminal module

This analyzer provide input/output of various signals from the terminal block located on the upper side.

<Input output terminal>

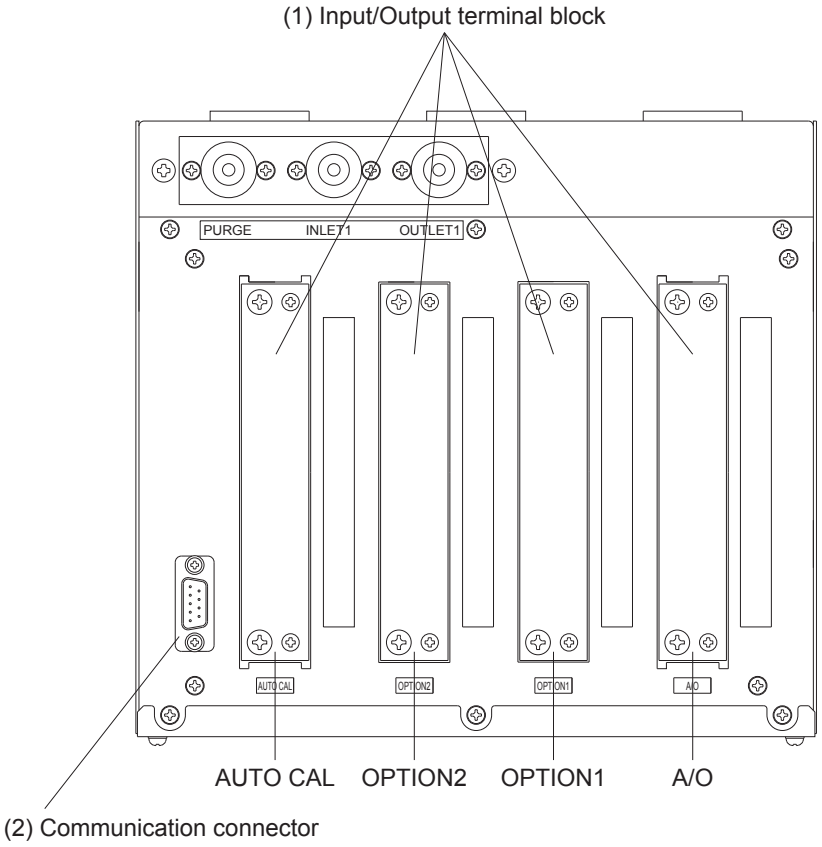


Fig. 2-2

Name	Description	Name	Description
(1) Input/Output terminal block	Input/Output terminal for signals of analog output, range identification contact, alarm contact output, etc.	(2) Communication connector	Connect communication cable. *Please refer to another manual (INZ-TN513327-E) about communication function.

3. INSTALLATION

⚠ 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

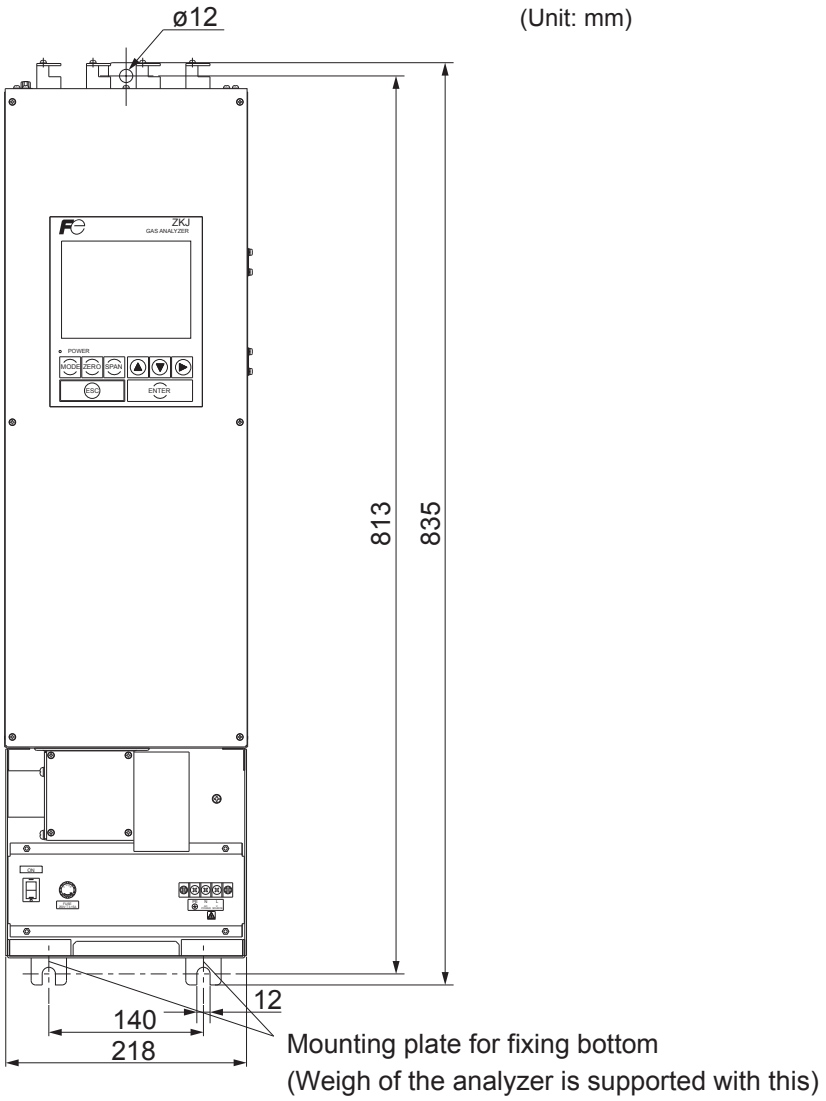
- Entrust the installation, movement or re-installation to a specialist or the supplier. A poor installation may cause accidental tipover, shock hazard, fire, injury, etc.
- The gas analyzer is heavy. It should be installed with utmost care. Otherwise, it may tip over or drop, for example, causing accident or injury.
- For lifting the 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, trouble or malfunction of the unit.

3.1 Installation conditions

To install the analyzer for optimum performance, select a location that meets the followingconditions;

(1) This instrument is system built in type. This instrument should be used while embedded in a panel, locker, or enclosure of steel sheet.
(2) Use this instrument indoors.
(3) A vibration-free place
(4) A place which is clean around the analyzer.
(5) Power supply
Rated voltage : 100V to 240V AC
Operating voltage : 85V to 264V AC
Rated frequency : 50/60 Hz
Power consumption : 250 VA max.
(6) Operation conditions
Ambient temperature : –5˚ to 45˚C
Ambient humidity : 90 % RH or less, no condensation

3.2 Installation of analyzer



Note) Check and maintenance of the analyzer may be carried out with the front cover detached. For installation, the weight of the analyzer should be supported with the bottom of the case.
Do not install the analyzer at the place which is exposed to direct sunlight.
The analyzer should be installed at a place where ambient temperature is within -5 to 45°C and temperature fluctuation during use is minimum.

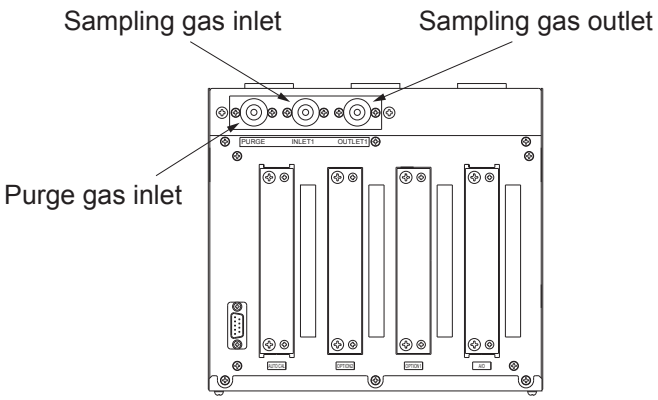
3.3 Piping

Piping should be connected to the gas inlets and outlets of the front panel of the analyzer.

- Use a corrosion resistant tube of Teflon, stainless or polyethylene to connect the instrument to a sampling system. Even if there is a danger of corrosion, refrain from using a tube of rubber or soft vinyl. The instrument provides inaccurate indication due to gas absorption by piping materials.
- Pipe connection port is Rc1/4 female thread. Piping should be cut as short as possible for a quick response. About 4 mm inner diameter is recommended.
- Entry of dust into the instrument may result in defective operation. Use a clean piping or coupling.

Connect the gas tube by the following method.

Upper side diagram

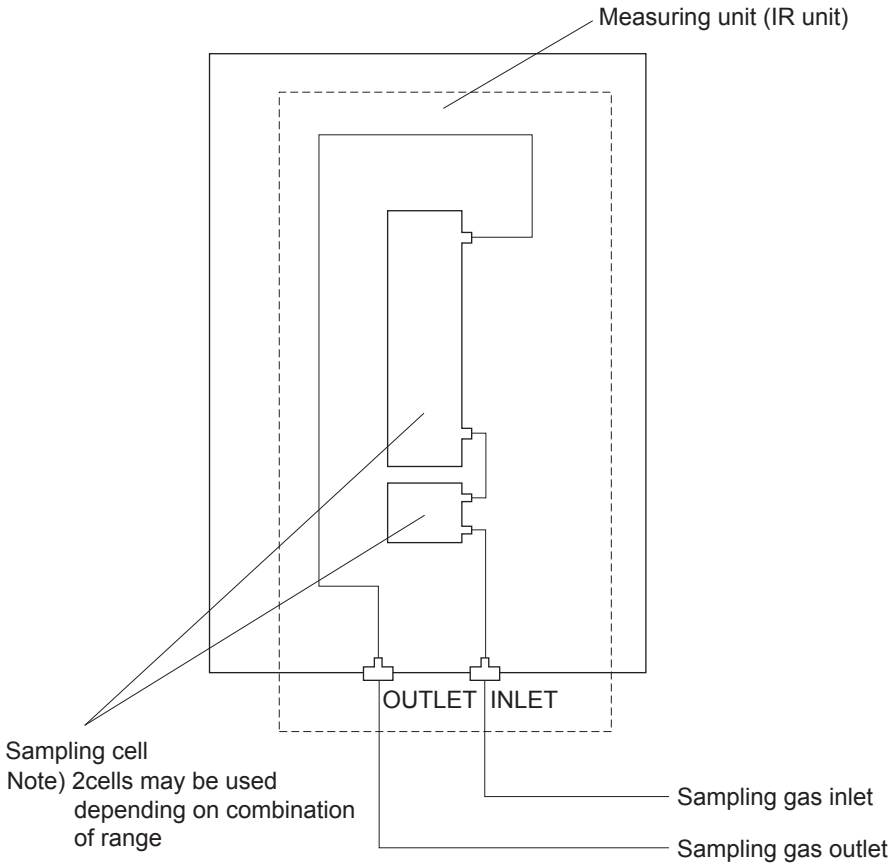


Sampling gas inlet: Attach the gas tube to introduce gas to be measured such as one that has completed dehumidification process and standard gases for zero and span calibration to this inlet.
Gas flow to be introduced should be constant within the range of 0.5 L/min ±0.2 L/min.

Sampling gas outlet: Exhaust measured gas through the outlet. Attach the tube to exhaust measured gas outdoors or to the atmosphere.

Purge gas inlet: It is used for purging the inside of the total gas analyzer . When the analyzer must be purged, refer to Item 3.3.4 Purging of instrument inside.
Use dry gas N_2 or instrumentation air for purge gas. (flow rate of 1L/min or more).

Internal piping diagram

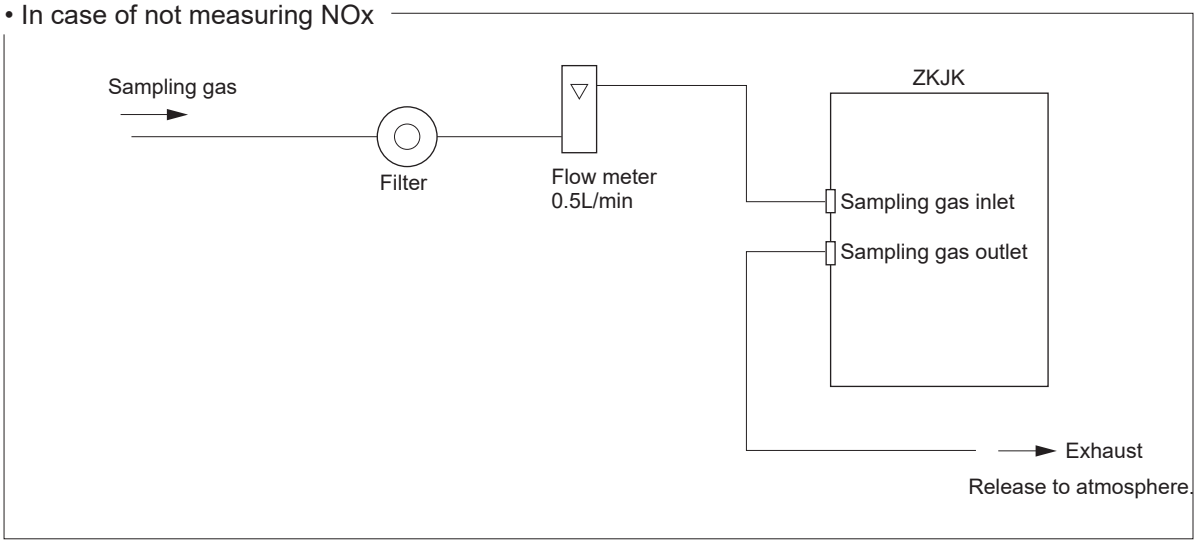


Correspondence of measured components and measuring units

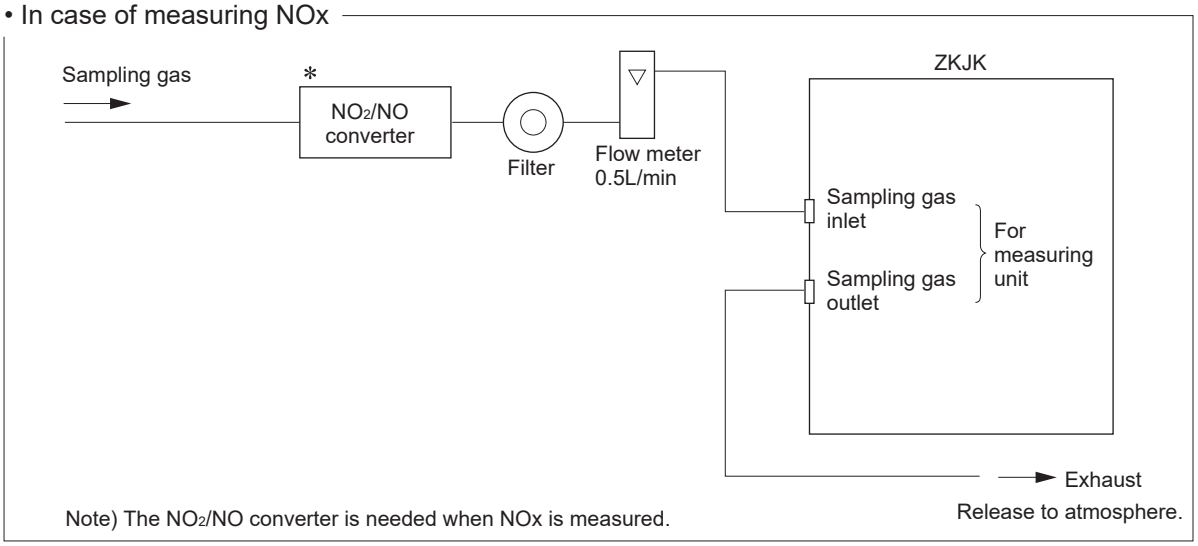
Measured components	Measurering unit
1-component analyzer for NO, SO_2, CO_2, CO, CH_4	Each measured component
2-component analyzer for NO/SO_2, CO_2/CO	NO/SO_2, CO_2/CO

Example of connecting each measuring unit

• In case of not measuring NOx



• In case of measuring NOx



Note) The NO_2/NO converter is needed when NOx is measured.

3.4 Sampling

3.4.1 Conditions of sampling gas

(1) Dust contained in the sampling gas should be completely removed with a filter. For the final stage filter, use a filter that allows removing dust particles of 0.3μm.
(2) Dew point of sampling gas must be lower than the ambient temperature to avoid occurrence of drain in the gas analyzer. If vapor is contained in the sampling gas, dew point should be lowered to 0˚C by using a dehumidifier.
(3) If SO_3 mist is contained in the sampling gas, use a mist filter or cooler to remove SO_3 mist. Other mists should be removed by using a mist filter or cooler.
(4) Corrosive gases such as Cl_2, F_2 and HCl, if they are contained in the sampling gas in considerable amounts, will shorten the life of instruments.
(5) Temperature of sampling gas should be within 0 to 50˚C. Provide a means that prevents entry of hot gas directly into the instrument.

3.4.2 Sampling gas flow

Flow of sampling gas should be 0.5L/min ± 0.2L/min.
Avoid flow fluctuation during measurement.
Observe the flow reading by a flowmeter provided as shown in the example of the sampling system configuration (Item 3.4.6).

3.4.3 Preparation of standard gas

Routine calibration is required by standard gas for keeping this instrument under normal operation condition (once a week). Prepare a standard gas cylinder for zero calibration and span calibration.

	Analyzer without O_2 measurement	Analyzer with external zirconia O_2 sensor
Zero gas	N_2 gas	Dry air
Span gas other than for O_2 measurement	Gas with concentration of 90% or more of full scale	Gas with concentration of 90% or more of full scale
Span gas for O_2 measurement		1 to 2% O_2

3.4.4 Purging of instrument inside

The inside of instrument need not be purged generally except for the following cases.
(1) A combustible gas component is contained in sample gas.
(2) Corrosive gas is contained in the atmospheric air at the installation site.
(3) The same gas as the sample gas component is contained in the atmospheric air at the installation site.

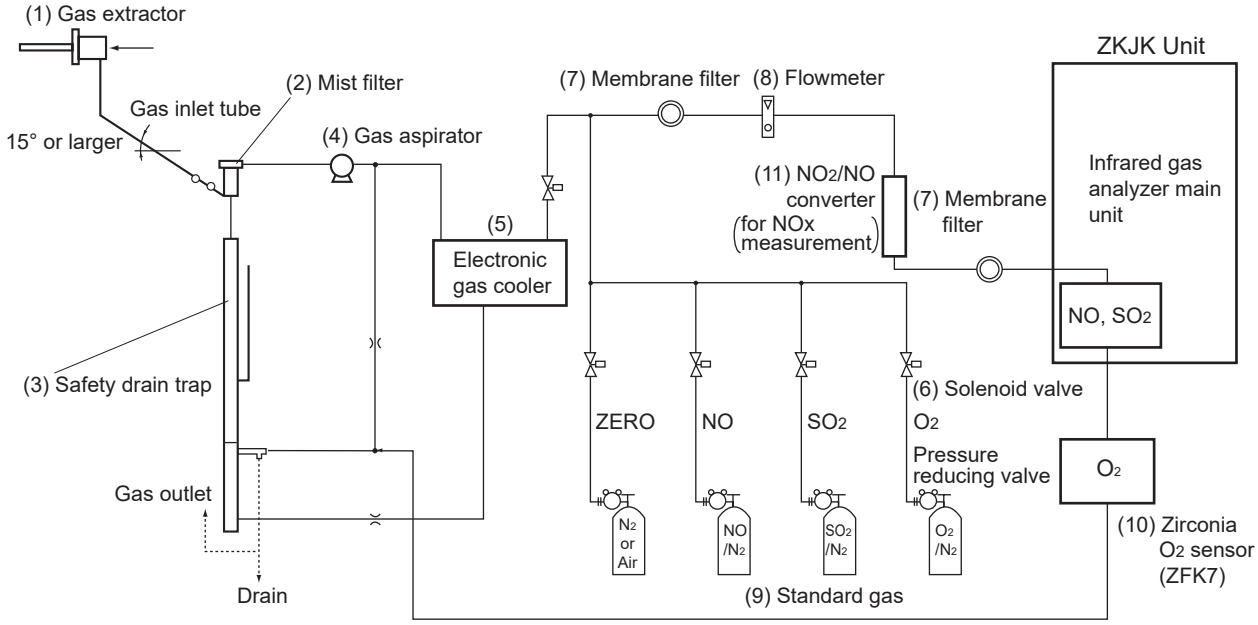
In such cases as above, the inside of analyzer should be purged with the air for instrumentation or N_2.
Purging flow rate should be about 1L/min.
If dust or mist is contained in purging gas, it should be eliminated completely in advance.

3.4.5 Pressure at sampling gas outlet

Pressure at the sampling gas outlet should be adjusted to atmospheric pressure.

3.4.6 Example configuration of gas sampling system

The following illustrates a typical system configuration for five component gas measurement for monitoring combustion exhaust gas from boiler, refuse incinerator, etc.
Contact Fuji Electric for system configuration matching the particular use or further information.

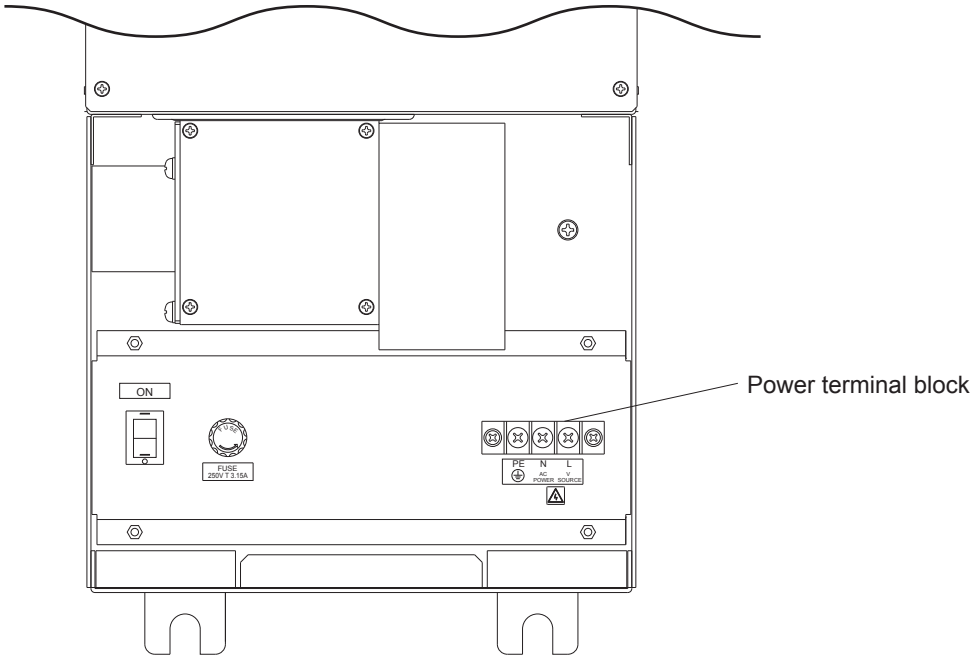


Name	Description	Name	Description
(1) Gas extractor	Gas extractor with a heating type stainless steel filter of standard mesh 40μm	(8) Flowmeter	Adjusts and monitors the flow rate of sampling gas.
(2) Mist filter	Removes drain, mist, and dust.	(9) Standard gas	Reference gas used for calibrating zero and span of the analyzer. Total 6 cylinders required for zero gas air, span gas NO, SO_2, CO, CO_2 and O_2.
(3) Safety drain trap	The safety drain trap divided into two rooms for positive and negative pressure. It monitors and adjusts the sampling gas pressure.		
(4) Gas aspirator	For aspiration of sampling gas Dries the moisture in sample	(10) Zirconia O_2 sensor	External zirconia oxygen sensor used for measuring the oxygen concentration in sample gas.
(5) Electronic gas cooler	gas to a dew point of approx. 2˚C.		
(6) Solenoid valve	Used for introducing calibration gas.	(11) NO_2/NO converter	Added to NOx analyzer. A special catalyst material for efficient conversion of NO_2 gas to NO is used.
(7) Membrane filter	PTFE filter used to eliminate fine dust particles and permit monitoring of dust adhering condition on the front panel of the gas analyzer.		

3.5 Wiring

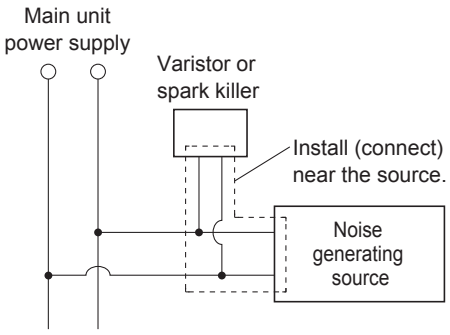
3.5.1 Power terminal block

Power terminal block is provided at under part of the main unit.
Be sure to connect the power supply according to the specification of the cubicle where main unit is installed.



When noise source is in the vicinity

- Avoid installing this instrument near an electrical unit (high frequency furnace or electric welder) that generates much electrical noise. If using the instrument near such a noise generating unit is unavoidable, use a different power line to avoid noise.
- Mount a noise suppressor such as varister or spark killer as shown at right figure to the noise generating unit when noise is generated from relays or solenoid valves. Mount the suppressor near the noise generating source, or it will have no effect.



3.5.2 Input/Output terminal block

(1) Analog output signal (A/O): A/O (1) to (8), (13) to (18)

Output signal : 4 to 20 mADC or 0 to 1 VDC (selected when ordering)
Non-insulated output

Allowable load : 4 to 20 mADC, 550Ω or less
0 to 1 VDC, 100kΩ or more

- Analog output is provided from each terminal corresponding to the channel displayed in the measurement screen.

⚠ CAUTION

All of analog output signals for the instrument are not isolated. It is recommended to isolate signals individually to prevent interference from unnecessary signals or to prevent external interference, especially leading the cable of more than 30 meters or to outdoor.

(2) O_2 sensor input: A/O (11) – (12)

Input signal:
External zirconia O_2 analyzer : Zirconia O_2 sensor signal (Fuji ZFK7 output)
External O_2 analyzer : 0 to 1 VDC (DC input resistor of 1MΩ or more)

- It is used when the external zirconia O_2 analyzer or external O_2 analyzer is specified as order.
- To connect to the output of the external Zirconia analyzer or external O_2 analyzer prepared separately.
- In case of an external O_2 analyzer, input a signal of 0 to 1 VDC with respect to O_2 full scale of the analyzer.

⚠ CAUTION

O_2 sensor input is not isolated. It is recommended to isolate when an external O_2 analyzer is installed apart from this analyzer. Zirconia O_2 sensor Fuji make ZFK7 should be installed at a location that is as close to this instrument as possible.

(3) Contact input (DI): OPTION 1 (1) to (4), (9) to (10), (11) to (14), AUTO CAL (15) to (16)

- It is for a contact input at no voltage. An input is provided when switching to short circuit (on) or open (off).
- No voltage is applied to the terminals.

(4) Contact output (DO): A/O (19) to (20), OPTION 1 (5) to (8), (15) to (20), OPTION 2, AUTO CAL

- Contact rating: 250VAC/2A, load resistance
- An output is for a relay contact output. An output is provided when switching to conductive (on) or open (off).

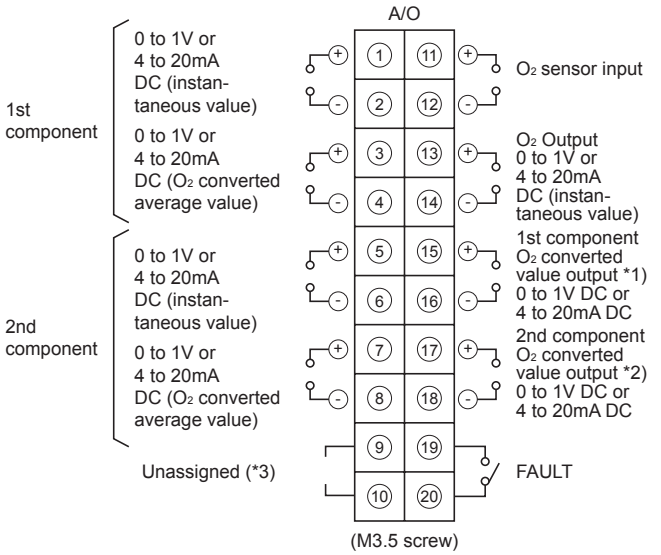
⚠ CAUTION

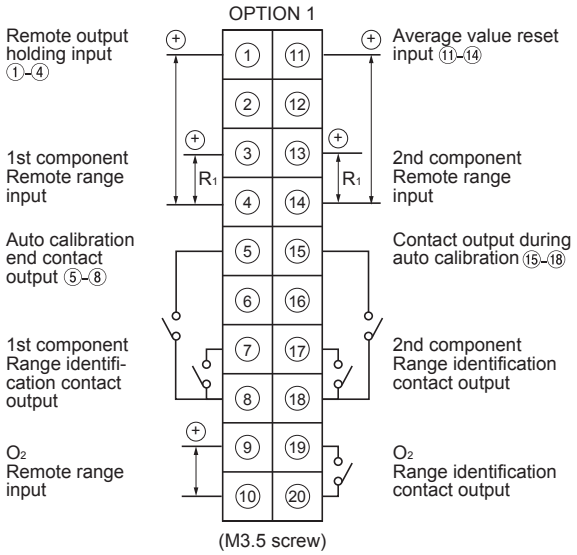
Wiring of analog output signal, O_2 sensor input and contact input should be fixed separately from the wiring of power supply and contact output.

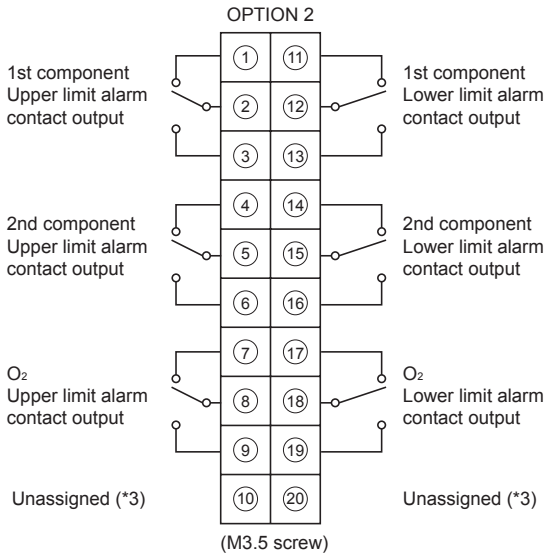
⚠ CAUTION

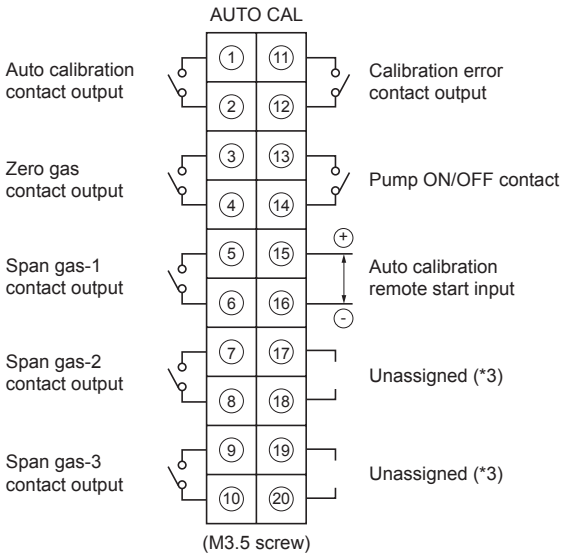
To avoid the effect of noise generated from external units, be sure to ground the analyzer main unit. Continue between the I/O module mounting plate and the panel and connect the panel casing to the same ground as the analyzer.

(5) List of terminal blocks







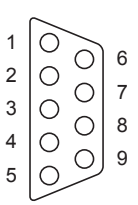


*1) When two analyzers are lined up and installed and first analyzer is used as CO_2/CO sensor, CO converted value is outputted to 1st component O_2 converted value output.

*2) When two analyzers are lined up and installed with O_2 converted value and converted average value, by First analyzer O_2 instantaneous value (0-1V DC: 0-25% range equivalent) is outputted.

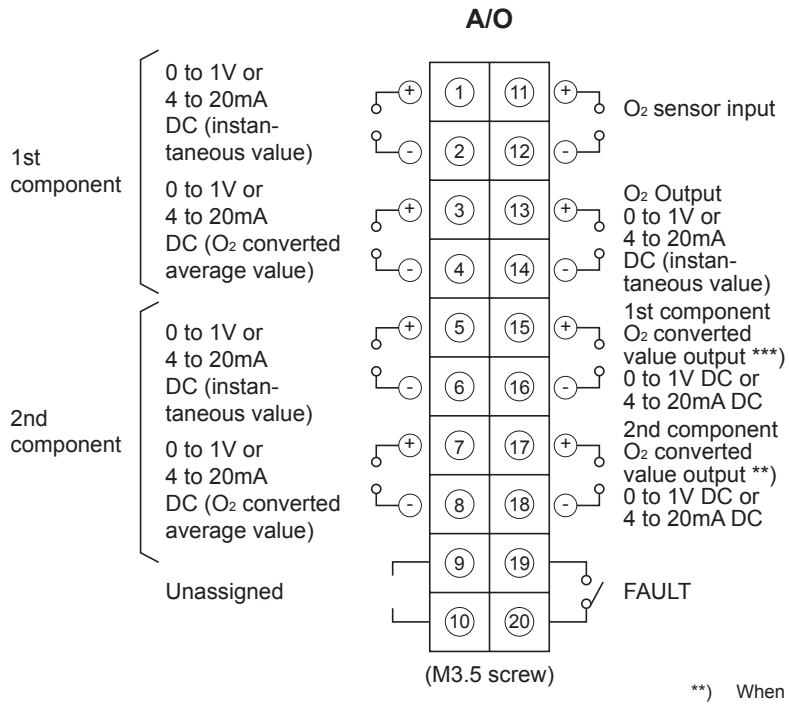
*3) Do not use the terminal for relay.

Connector
<CN2>
For serial communicetion (D-Sub9pin)



For details, reter to another manual about communication function.

(6) Description on terminal block



**) When two analyzers are lined up and installed with O_2 converted value and converted average value, by First analyzer O_2 instantaneous value (0-1V DC: 0-25% range equivalent) is outputted.

***) When two analyzers are lined up and installed and first analyzer is used as CO_2/CO sensor, CO converted value is outputted to 1st component O_2 converted value output.

Terminal block <A/O>

Between 1–2 : 1st component Instantaneous value output

Between 3–4 : 1st component O_2 converted average value output

Between 5–6 : 2nd component Instantaneous value output

Between 7–8 : 2nd component O_2 converted average value output

Between 9–10 : Do not use the terminal for relay.

Between 11–12 : O_2 sensor input

(For input of Fuji's zirconia O_2 sensor or external O_2 sensor.
Must not be used unless external O_2 sensor is provided.)

Between 13–14 : O_2 Instantaneous value output

Between 15–16 : 1st component O_2 converted value output

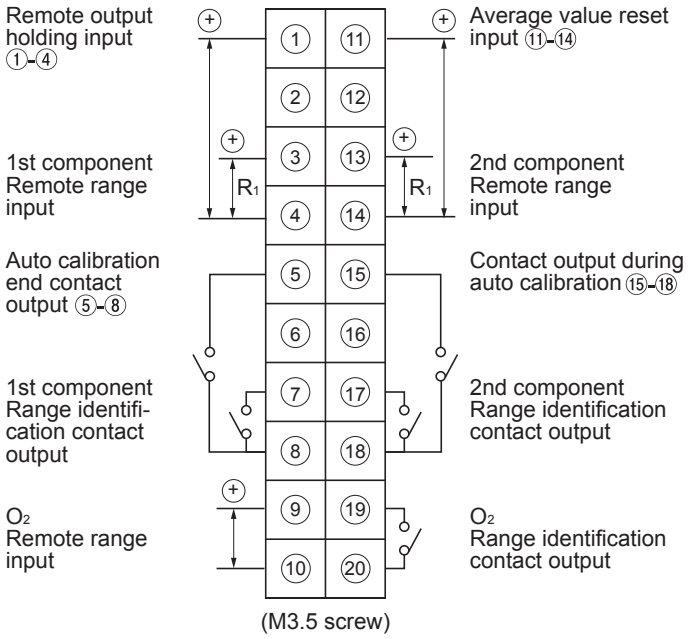
(2nd component O_2 converted value output)

Between 17–18 : 2nd component O_2 converted value output

(O_2 instantaneous value output (0-1V DC))

Between 19–20 : FAULT output

OPTION 1



Terminal block <OPTION1>

Between 1–4 : Remote output hold input

No hold when open Output is hold when short-circuiting Please refer to "Item6.7 parameter setting, Output hold"

Between 3–4 : 1st component remote range input

Action of remote range switch High range is selected when open.

Low range is selected when short-circuiting

Between 5–8 : Auto calibration end contact output

Contact will be conducted for 1.5 seconds after flowing last gas by autocalibration

Between 11–14 : Average value reset input

As short-circuiting the cantact input (for 1.5 sec or more), O_2 average and O_2 converted average are resetted simulteneously. And then average value will be restarted by Opening it. Refert to the "Item 6.7 parameter setting, Reset Av. Output" for details.

Between 15–18 : Auto calibration status contact output

It is conductive during auto calibration. Otherwise it will be open.

Between 7–8 : 1st component range identification contact output

Between 9–10 : O_2 remote range input

Between 13–14 : 2nd component remote range input

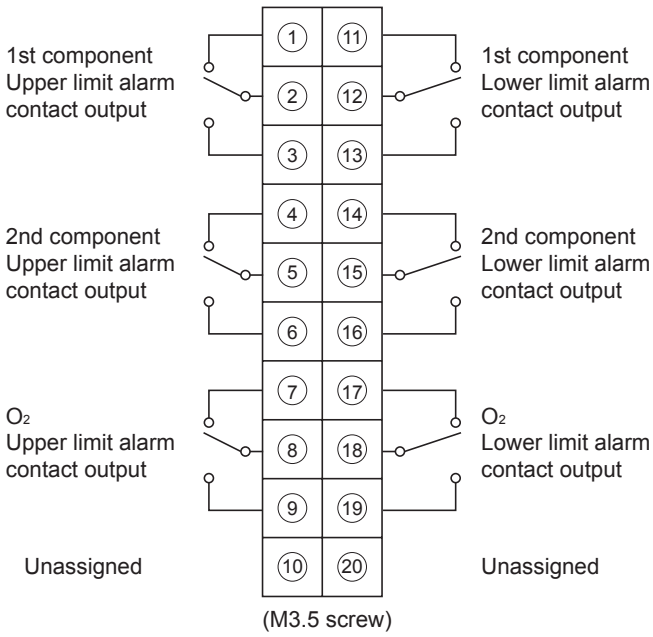
High range is selected when open.

Low range is selected when short-circuiting

Between 17–18 : 2nd component range identification contact output

Between 19–20 : O_2 range identification contact output

OPTION 2



Terminal block <OPTION2>

Between 1, 2 and 3 : 1st component upper limit alarm contact output

When the output exceeds the set value, it is conductive between 1and 2, and open between 2 and 3. otherwise, it is open between 1 and 2 and conductive between 2 and 3.

Between 4, 5 and 6 : 2nd component upper limit alarm contact output

When the output exceeds the set value, it is conductive between 4and 5, and open between 5 and 6. otherwise, it is open between 4and 5 and conductive between 5 and 6.

Between 7, 8 and 9 : O_2 upper limit alarm contact output

When the output exceeds the set value, it is conductive between 7and 8 and open between 8 and 9. otherwise, it is open between 7and 8 and conductive between 8 and 9.

Between 11, 12 and 13 : 1st component lower limit alarm contact output

When the output exceeds the set value, it is conductive between 11and 12 and open between 12 and 13. otherwise, it is open between 12and 13 and conductive between 13 and 14.

Between 14, 15 and 16 : 2nd component lower limit alarm contact output

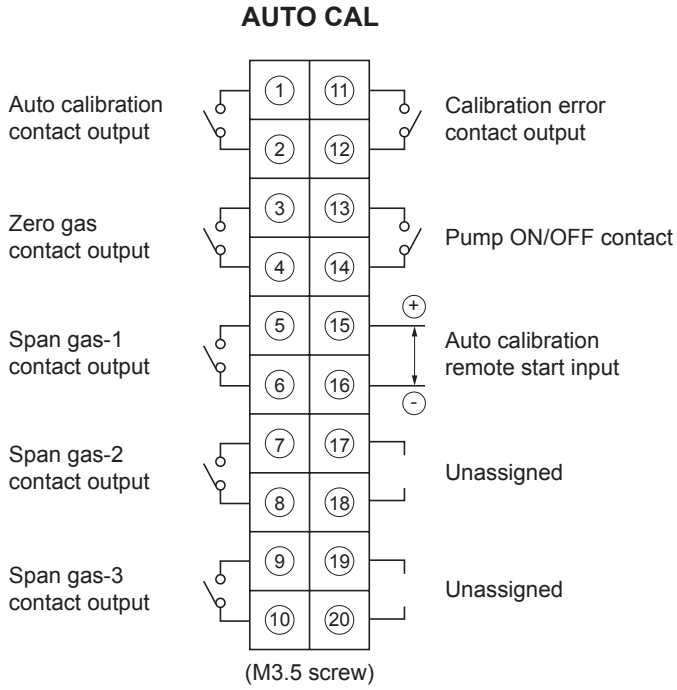
When the output exceeds the set value, it is conductive between 14and 15 and open between 15 and 16. otherwise, it is open between 14and 15 and conductive between 15 and 16.

Between 17, 18 and 19 : O_2 lower limit alarm contact output

When the output exceeds the set value, it is conductive between 17and 18 and open between 18 and 19. otherwise, it is open between 17and 18 and conductive between 18 and 19.

Please refer to the “Item 6.3 alarm setting” for details regarding action of alarm contact.

Between , 10, 20 : Do not use the terminal for relay.



Terminal block <AUTO CAL>

Between 1–2 : Auto calibration status contact outputt
It is conductive during auto calibration. Otherwise it will be open.

Between 3–4 : Contact output for zero gas

Between 5–6 : Contact output for span gas 1

Between 7–8 : Contact output for span gas 2

Between 9–10 : Contact output for span gas 3

Between 11–12 : Calibration error contact output
It is conductive when error occurs during zero calibration or span calibration. It is normally open.

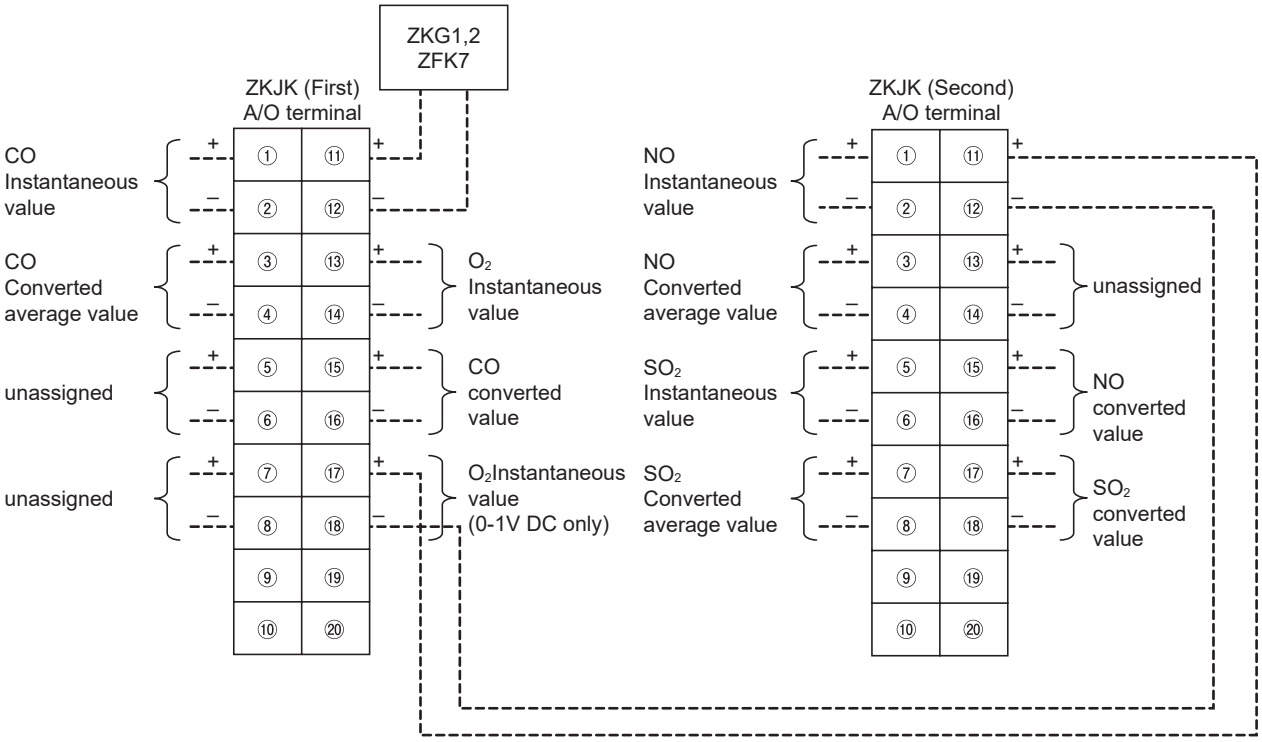
Between 13–14 : Pump ON/OFF contact output
Used when turning ON/OFF the pump. It is open during auto and manual calibration status and conductive during measurement.

Between 15–16 : Auto calibration remote start input
After short-circuiting for 1.5 seconds or more, auto calibration is started by the opening input whether the auto calibration setting is ON/OFF. Please refer to the "Item 6.4 Setting of auto calibration" for details.

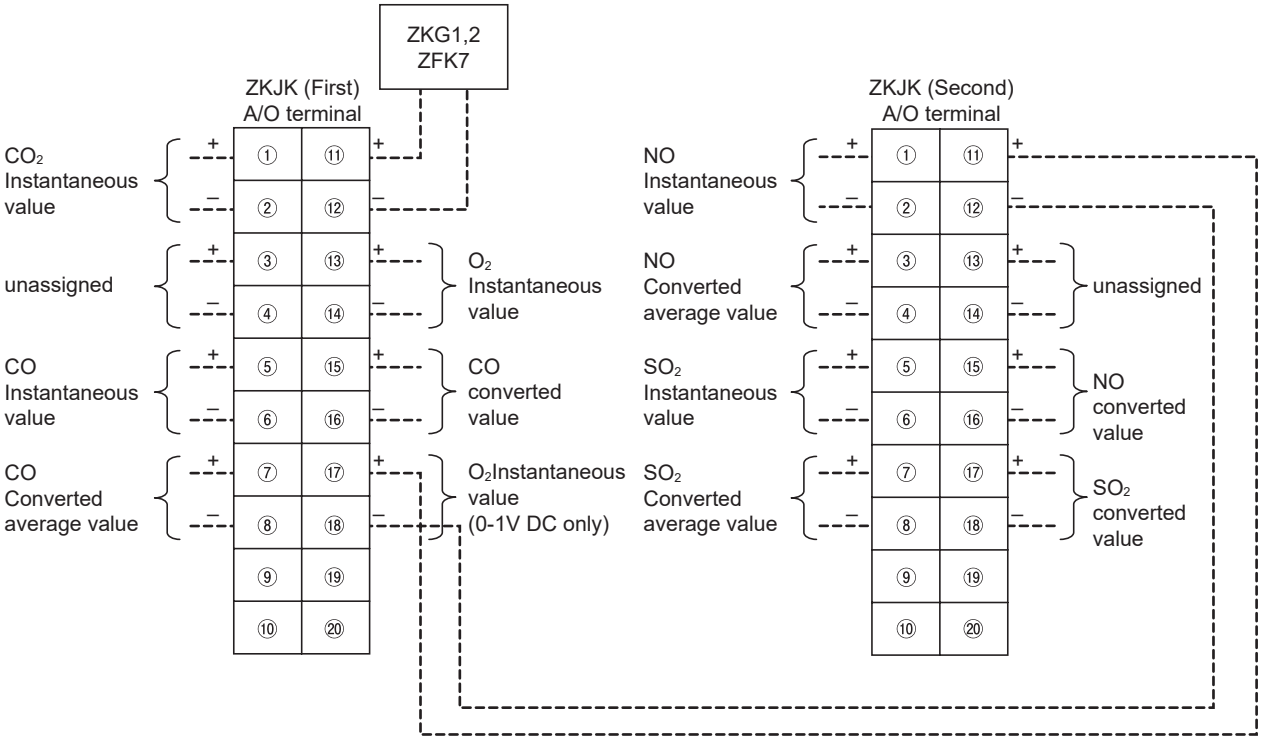
Between 17–20 : Do not use the terminal for relay.

3.5.3 Connecting method/analog output component

Measurment of NO/SO_2/CO/O_2 sensor [Example connection]
(with converted value and converted average value)



Measurment of NO/SO_2/CO_2CO/O_2 sensor [Example connection]
(with converted value and converted average value)



4. OPERATION

4.1 Preparation for operation

(1) Tube and wiring check

Double-check if tubes of the gas sampling and exhaust ports are correctly connected.
Double-check for proper wiring.

4.2 Warm-up operation and regular operation

(1) Operation procedure

1) Turn ON the power switch on the front panel of the analyzer unit.

   The measurement screen appears on the front display panel in 1 or 2 seconds.

2) Wait for about 4 hours until the instrument is warmed up.

   About 4 hours are required until the instrument allows accurate measurement.

⚠ CAUTION

When in warm-up, the concentration reading may be beyond.

- _ _ _ _ upper limit of range or
- _ _ _ _ lower limit of range.

But, it is not an error.

3) Setting of various set values

   Perform the various settings according to “Chapter 6. Setting and Calibration”.

4) Zero calibration and span calibration

   Perform zero calibration and span calibration after warm-up operation.

   Refer to “Chapter 6.9. Manual calibration procedure”.

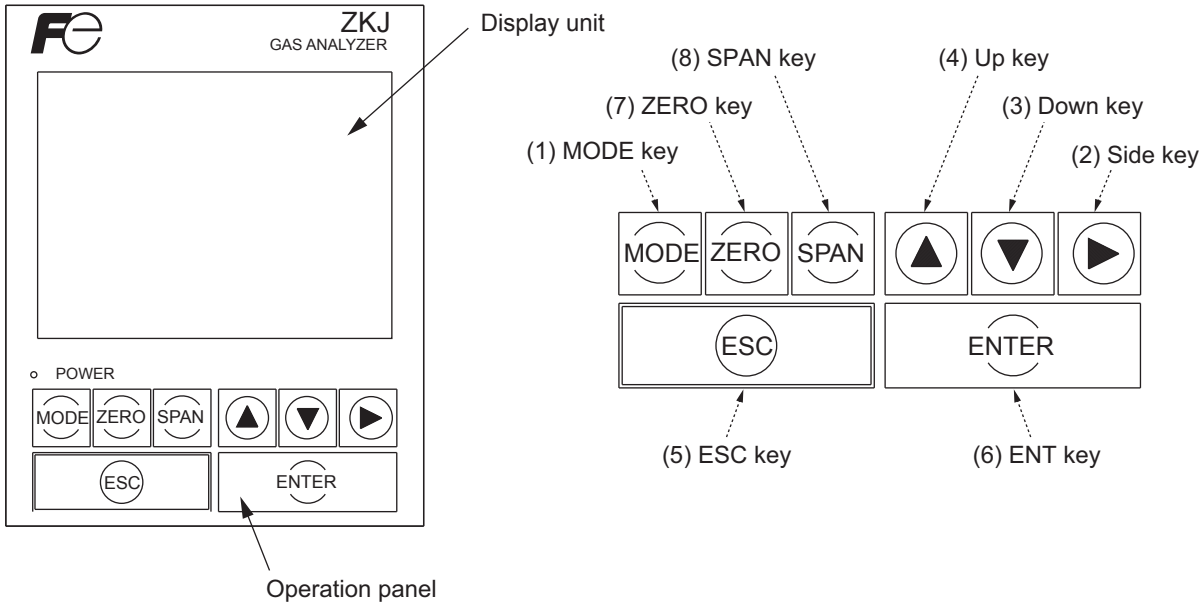
5) Introduction and measurement of measuring gas

   Introduce the measuring gas into the analyzer unit before starting measurement.

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.

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 below.

Fig. 5-1

Name	Description	Name	Description
(1) MODE key	Used to switch the mode.	(5) ESC key	Used to return to a previous screen or cancel the setting mid-way.
(2) SIDE key	Used to change the selected item (by moving the cursor) and numeral digit.	(6) ENT key	Used for confirmation of selected items or values, and for execution
(3) DOWN key	Used to change the selected item (by moving the cursor) and to decrease numeral value.	(7) ZERO key	Used for zero calibration.
(4) UP key	Used to change the selected item (by moving the cursor) and to increase numeral value.	(8) SPAN key	Used for span calibration.

5.2 Overview of display and operation panels

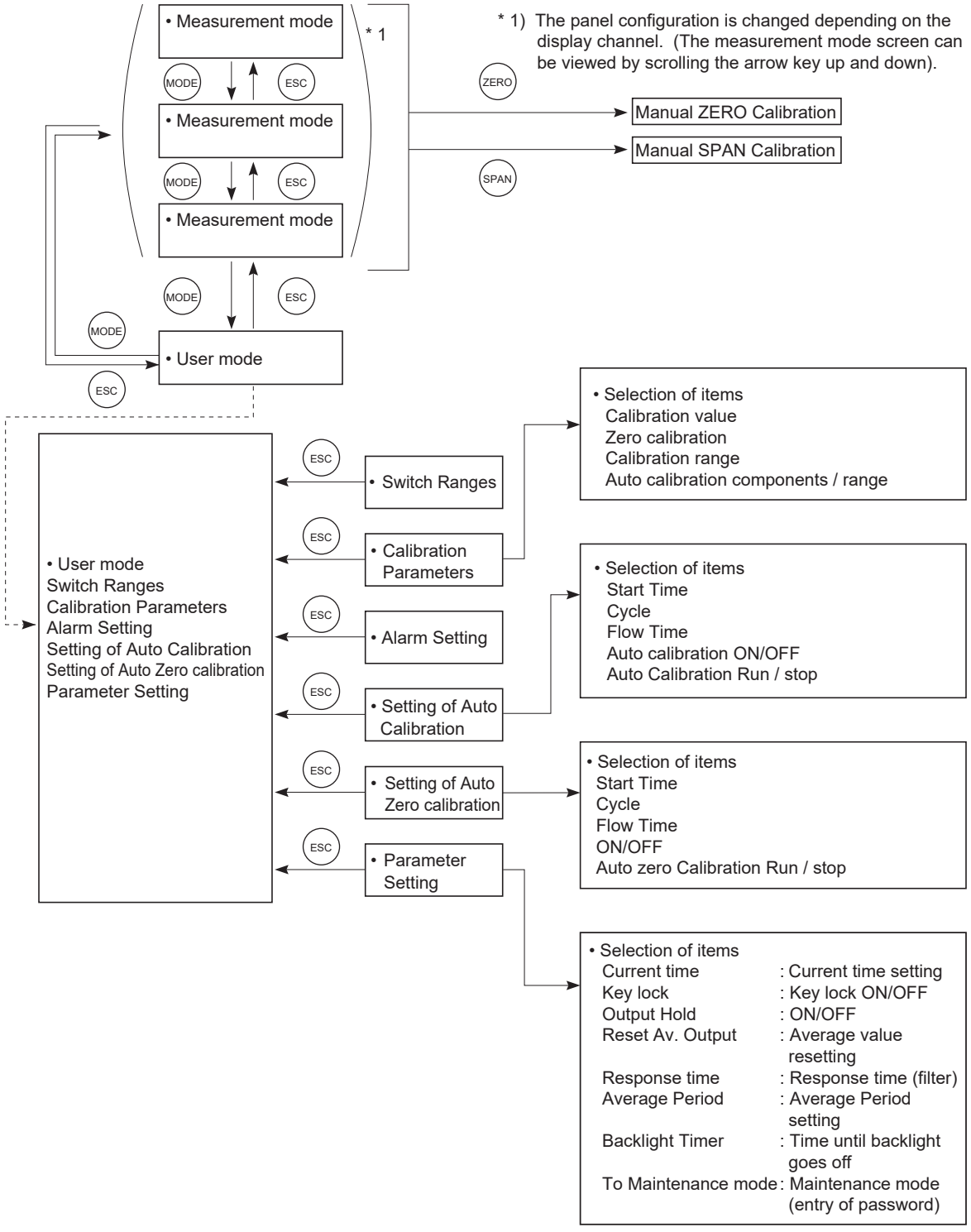


Fig. 5-2

5.3 Outline of display screen

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

The measurement screen depends on the number of components. The following screen configuration as shown as an example is for NO, SO_2 and O_2 (output: 6 channel).

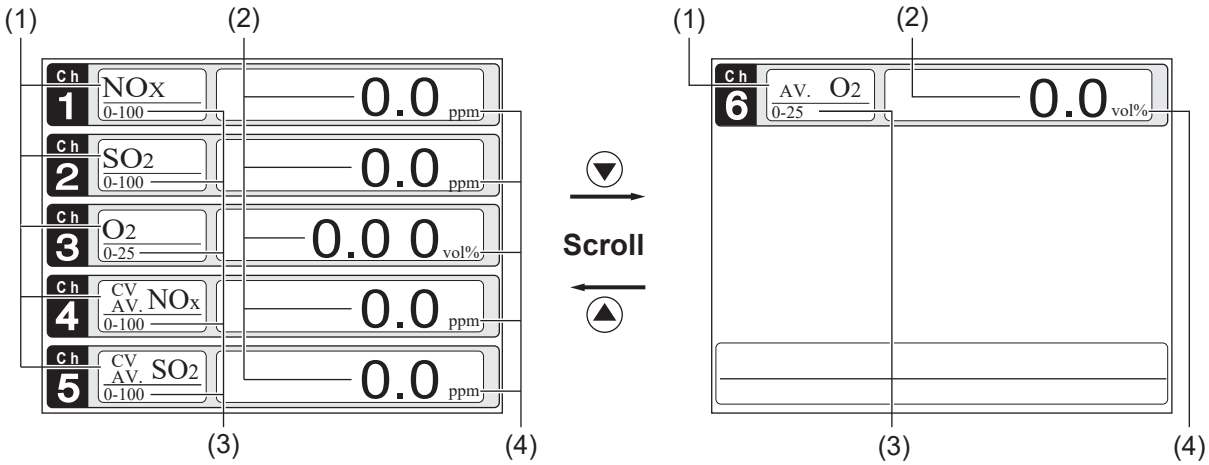


Fig. 5-3 Name and function of measurement mode screen

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

No.	Name	Description
(1)	Component display	Displays component of instantaneous value, converted instantaneous value, converted average value, etc.
(2)	Concentration display	Displays measured value of concentration.
(3)	Range display	Displays measurement range values.
(4)	Unit display	Displays unit with ppm and vol%.

- **Instantaneous value and concentration value:**
  The concentration display of Ch (component) where sampling components such as "CO_2", "CO" or "O_2 are displayed in the component display, indicates current concentration values of the measured components contained in gas that is now under measurement.
- **O_2 conversion concentration values:**
  Ch components where "cv**" is displayed as "cv CO" in the component display are calculated from the following equation, by setting sampling components, O_2 instantaneous/concentration values and O_2 conversion reference value (see item 6.8).

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

On: The value of the O_2 conversion referance value (Value set by application)
Os: Oxygen concentration (%)
Cs: Concentration of relevant measured component.
Note that Os does not exceed the O_2 limit value set in "Other Parameter" in "6.8 Maintenance mode."

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

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

(2) Setting/selection screen

The setting/selection screen is configured as Fig. 5-4:

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

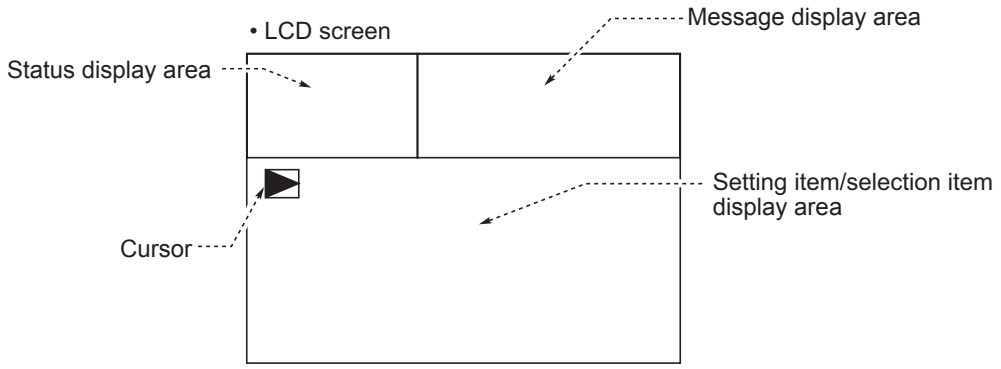


Fig. 5-4

(3) Contents of measured channel (Ch)

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

Code symbol			Contents
5th digit	6th digit	22nd digit	
P	Y	Y	Ch1: NO
A	Y	Y	Ch1: SO_2
D	Y	Y	Ch1: CO_2
B	Y	Y	Ch1: CO
E	Y	Y	Ch1: CH_4
F	Y	Y	Ch1: NO, Ch2: SO_2
G	Y	Y	Ch1: CO_2, Ch2: CO
P	A, B	Y	Ch1: NO, Ch2: O_2
A	A, B	Y	Ch1: SO_2, Ch2: O_2
D	A, B	Y	Ch1: CO_2, Ch2: O_2
B	A, B	Y	Ch1: CO, Ch2: O_2
E	A, B	Y	Ch1: CH_4, Ch2: O_2
F	A, B	Y	Ch1: NO, Ch2: SO_2, Ch3: O_2
G	A, B	Y	Ch1: CO_2, Ch2: CO, Ch3: O_2
P	A, B	A	Ch1: NO, Ch2: O_2, Ch3: Converted NO, Ch4: Converted NO average
A	A, B	A	Ch1: SO_2, Ch2: O_2, Ch3: Converted SO_2, Ch4: Converted SO_2 average
B	A, B	A	Ch1: CO, Ch2: O_2, Ch3: Converted CO, Ch4: Converted CO average
F	A, B	A	Ch1: NO, Ch2: SO_2, Ch3: O_2, Ch4: Converted NO, Ch5: Converted SO_2, Ch6: Converted NO average, Ch7: Converted SO_2 average
G	A, B	A	Ch1: CO_2, Ch2: CO, Ch3: O_2, Ch4: Converted CO, Ch5: Converted CO average

2. In case of using two analyzers installed.

1st analyzer				Second analyzer			
Code symbol			Contents	Code symbol			Contents
5th digit	6th digit	22nd digit		5th digit	6th digit	22nd digit	
B	Y	Y	Ch1: CO	P	Y	Y	Ch1: NO
D	Y	Y	Ch1: CO_2				
E	Y	Y	Ch1: CH_4				
G	Y	Y	Ch1: CO_2, Ch2: CO				
B	Y	Y	Ch1: CO	A	Y	Y	Ch1: SO_2
D	Y	Y	Ch1: CO_2				
E	Y	Y	Ch1: CH_4				
G	Y	Y	Ch1: CO_2, Ch2: CO				
B	Y	Y	Ch1: CO	F	Y	Y	Ch1: NO, Ch2: SO_2
D	Y	Y	Ch1: CO_2				
E	Y	Y	Ch1: CH_4				
G	Y	Y	Ch1: CO_2, Ch2: CO				
B	Y	Y	Ch1: CO	P	A, B	Y	Ch1: NO, Ch2: O_2
D	Y	Y	Ch1: CO_2				
E	Y	Y	Ch1: CH_4				
G	Y	Y	Ch1: CO_2, Ch2: CO				
B	Y	Y	Ch1: CO	A	A, B	Y	Ch1: SO_2, Ch2: O_2
D	Y	Y	Ch1: CO_2				
E	Y	Y	Ch1: CH_4				
G	Y	Y	Ch1: CO_2, Ch2: CO				
B	Y	Y	Ch1: CO	F	A, B	Y	Ch1: NO, Ch2: SO_2 Ch3: O_2
D	Y	Y	Ch1: CO_2				
E	Y	Y	Ch1: CH_4				
G	Y	Y	Ch1: CO_2, Ch2: CO				
D	A, B	Y	Ch1: CO_2	P	A, B	A	Ch1: NO Ch2: O_2 Ch3: Converted NO Ch4: Converted NO average
E	A, B	Y	Ch1: CH_4				
D	A, B	Y	Ch1: CO_2	A	A, B	A	Ch1: SO_2 Ch2: O_2 Ch3: Converted SO_2 Ch4: Converted SO_2 average
E	A, B	Y	Ch1: CH_4				
D	A, B	Y	Ch1: CO_2	F	A, B	A	Ch1: NO Ch2: SO_2 Ch3: O_2 Ch4: Converted NO Ch5: Converted SO_2 Ch6: Converted NO average Ch7: Converted SO_2 average
E	A, B	Y	Ch1: CH_4				
B	A, B	A	Ch1: CO, Ch2: O_2 Ch3: Converted CO Ch4: Converted CO average	P	D	A	Ch1: NO Ch2: Converted NO Ch3: Converted NO average
G	A, B	A	Ch1: CO_2, Ch2: CO, Ch3: O_2 Ch4: Converted CO Ch5: Converted CO average				
B	A, B	A	Ch1: CO, Ch2: O_2 Ch3: Converted CO Ch4: Converted CO average	A	D	A	Ch1: SO_2 Ch2: Converted SO_2 Ch3: Converted SO_2 average
G	A, B	A	Ch1: CO_2, Ch2: CO, Ch3: O_2 Ch4: Converted CO Ch5: Converted CO average				
B	A, B	A	Ch1: CO, Ch2: O_2 Ch3: Converted CO Ch4: Converted CO average	F	D	A	Ch1: NO Ch2: SO_2 Ch3: Converted NO Ch4: Converted SO_2 Ch5: Converted NO average Ch6: Converted SO_2 average
G	A, B	A	Ch1: CO_2, Ch2: CO, Ch3: O_2 Ch4: Converted CO Ch5: Converted CO average				

Example of Code symbol for replacement

[ZRG]

	Component	Example of code symbol
1st analyzer	CO, CO_2, O_2	ZRG6GBB2-0B0ND-FF1F5FY
2nd analyzer	NO, SO_2, O_2	ZRG6FBB2-0B0ND-FF1F5FY

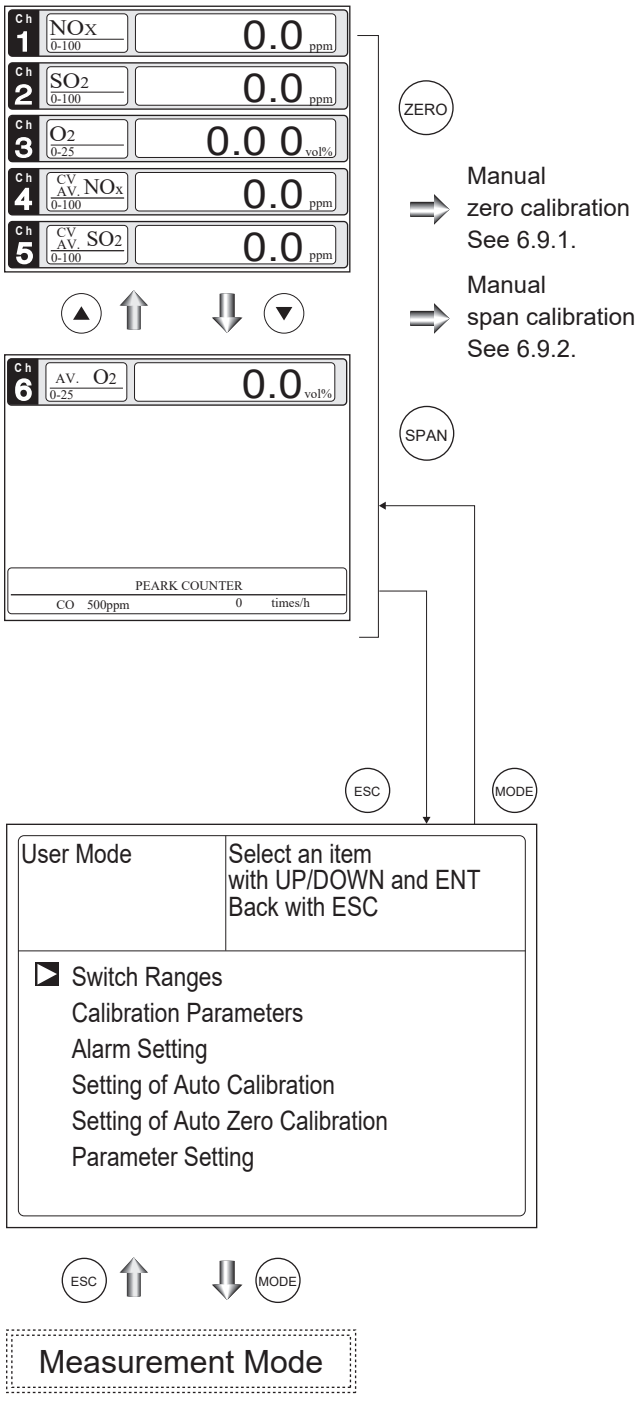
[ZKJK]

	Component	Example of code symbol
1st analyzer	CO, CO_2, O_2	ZKJKG[A]15-YJBFB-FYYYY[VY]-CAB → O_2 range 0-25% fixed → External zirconia O_2 sensor
2nd analyzer	NO, SO_2	ZKJKF[D]15-YJBFB-FYYYYYY-CAB → without external O_2 indication

5.4 Basic operation

- **Measurement mode**

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



- **User mode displays;**

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

  For the setting contents, refer to "Chapter 6. Setting and calibration".

6. SETTING AND CALIBRATION

6.1 Switch of range

6.1.1 Setting of range switch mode

Set the range switch mode as follows.

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

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

(3) The "Channel Selection" screen appears. Move the ▶ cursor by pressing the ▲ or the ▼ key on the channel selection screen that appears, and select Ch (component).

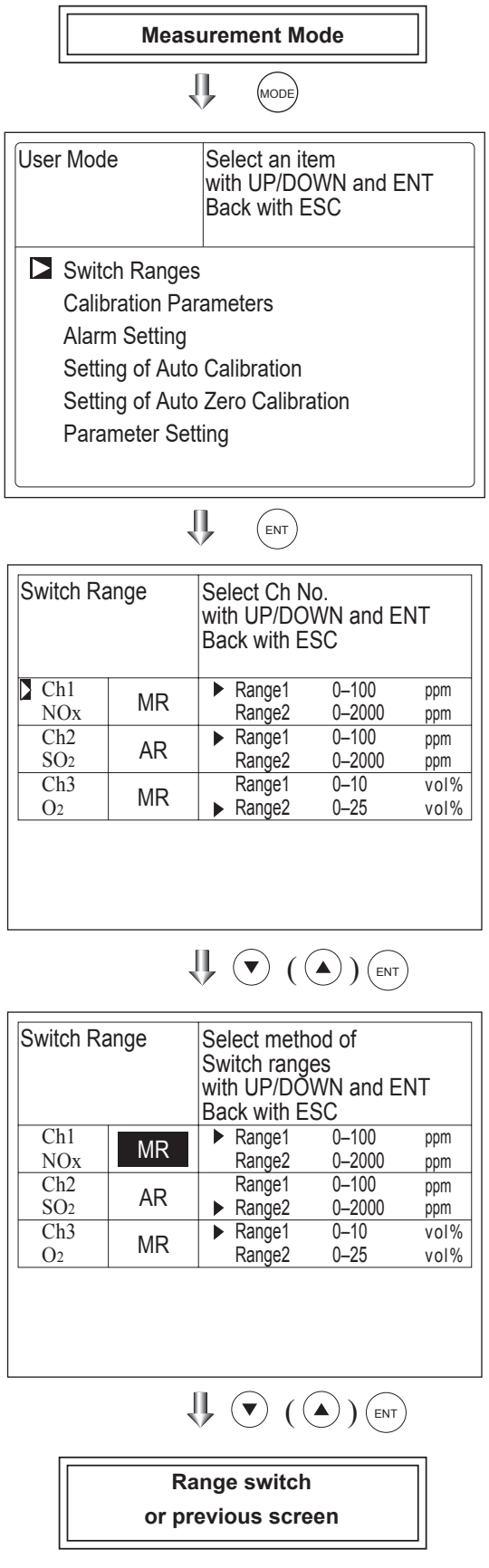
(4) Then press the ENT key.

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

Description of setting

MR: Select a desired range on this screen.
RR : Select a desired range according to the remote range switch contact input.
AR : Automatically switched from Range 1 to Range 2 when the measured concentration exceeds 90% of Range 1. Automatically switched from Range 2 to Range 1 when the measured concentration becomes smaller than 80% of Range 1.
* Operation set for each Ch only can be performed.

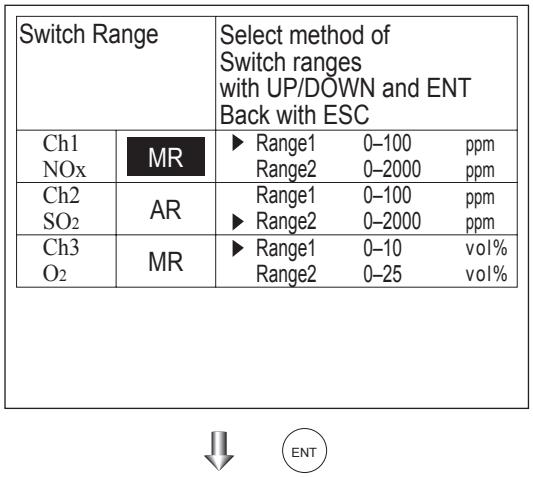
(6) Then press the ENT key to confirm the selection.
If "MR" is selected, the cursor moves to "Range Switch."



6.1.2 Manual range switch

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

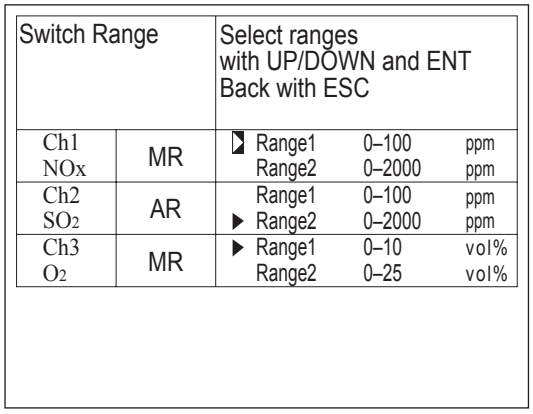
(1) Select "MR" as range switch mode, and then press the ENT key.



⇩ ENT

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

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



⇩ ▼ (▲) ENT

End of Range Switch

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

The range for O_2 conversion value is automatically switched if corresponding instantaneous value range is switched.

To close the setting

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

Range identification contact operation

The range identification contact output corresponding to each Ch (component) is conductive when Range 1 is selected, and open when Range 2 is selected, which is applicable to any of the range switch mode selected.

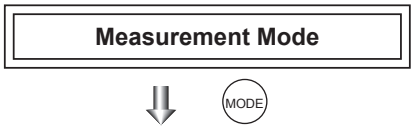
Note that even if the range is switched during the hold of measurement value by remote hold contact input or the hold of measurement value at the time of calibration, the range identification contact output maintains the contact state immediately before the hold. After stop of the hold, the contact state of the current range is resumed.

6.2 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.

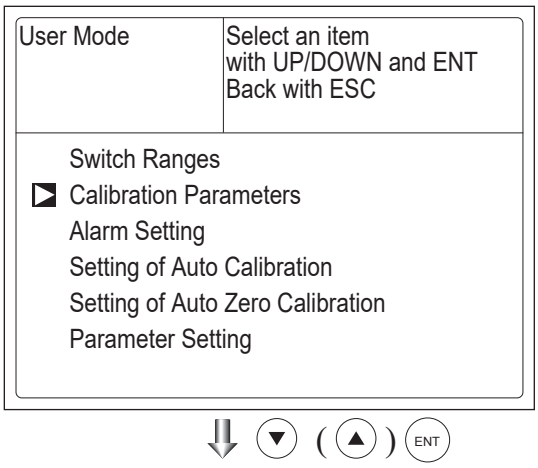
6.2.1 Setting of calibration concentration

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

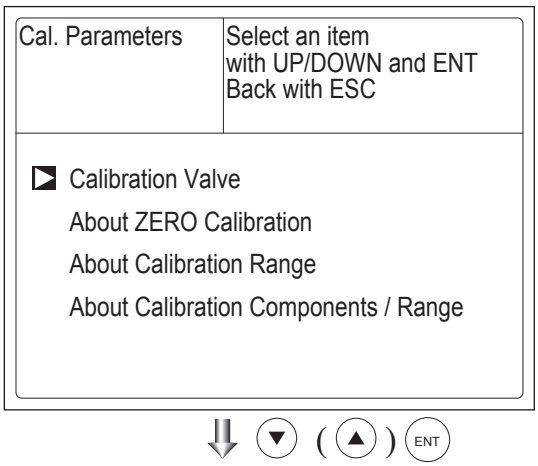


(1) During measurement, press the MODE key to display the User mode.

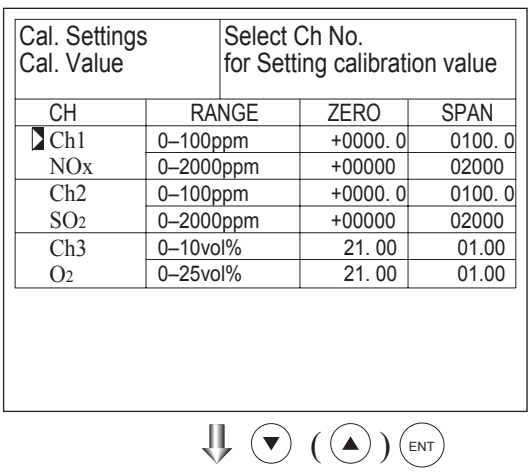
(2) Point the cursor to "Calibration Parameters" by pressing the ▲ or ▼ key. Press the ENT key.



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



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



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

Cal. Settings Cal. Value	Select Setting value		
CH	RANGE	ZERO	SPAN
Ch1	0–100ppm	+0000. 0	0100. 0
NOx	0–2000ppm	+00000	02000
Ch2	0–100ppm	+0000. 0	0100. 0
SO_2	0–2000ppm	+00000	02000
Ch3	0–10vol%	21. 00	01.00
O_2	0–25vol%	21. 00	01.00

⇩ ▼ (▲) ENT

Cursor for setting value

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

Cal. Settings Cal. Value	Set Calibration value		
CH	RANGE	ZERO	SPAN
Ch1	0–100ppm	+0000. 0	0100. 0
NOx	0–2000ppm	+00000	02000
Ch2	0–100ppm	+0000. 0	0100. 0
SO_2	0–2000ppm	+00000	02000
Ch3	0–10vol%	21. 00	01.00
O_2	0–25vol%	21. 00	01.00

⇩ ▼ ▲ ▶ ENT

End of Calibration Concentration Setting

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

To close the setting

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

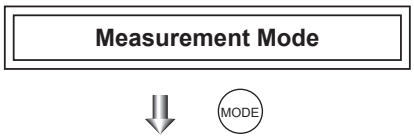
Setting range of values

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

The setting cannot be performed beyond the range.

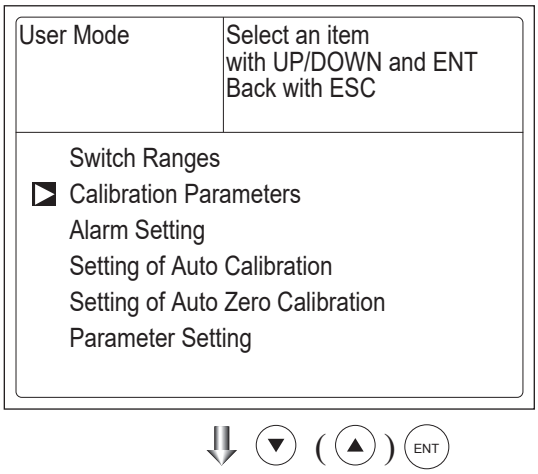
6.2.2 Setting of manual zero calibration

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

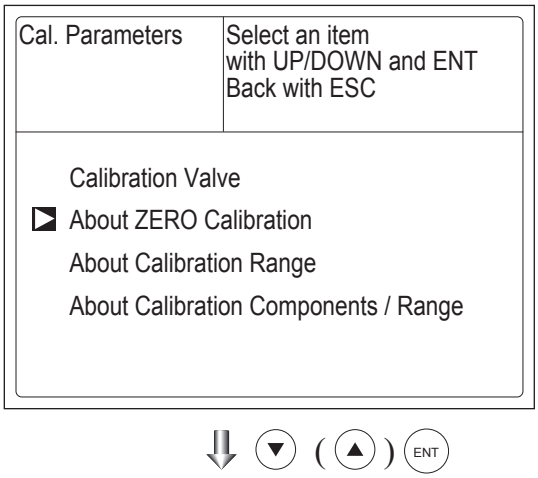


(1) During measurement, press the MODE key to display the User mode.

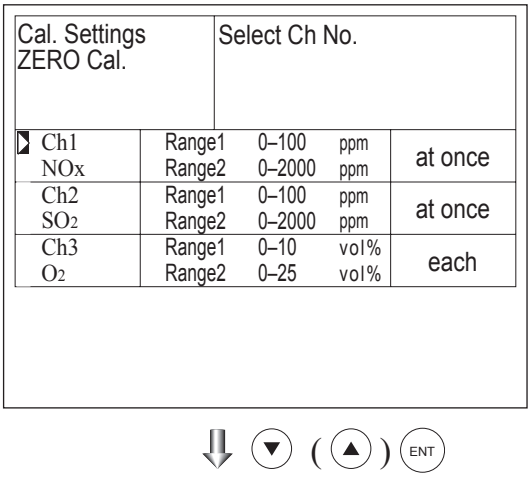
(2) Point the cursor to "Calibration Parameters" by pressing the ▲ or ▼ key. Press the ENT key.



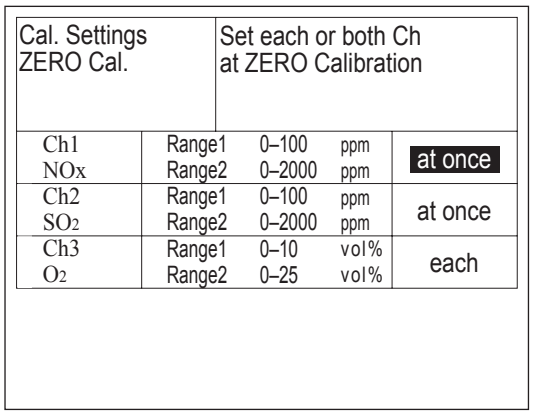
(3) In the "Calibration Parameters" screen that appears, point the cursor to "About ZERO Calibration" by pressing the ▲ or ▼ key. Press the ENT key.



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



(5) In the "Manual ZERO Calibration Selection" screen that appears, select "at once" or "each" by pressing the ▲ or ▼ key. When selecting "at once", the Ch (components) to be set can be zero-calibrated at the same time. When selecting "each", either of the Ch (components) to be selected is zero-calibrated. After setting, press the ENT key.



⇓ ▼ (▲) ENT

End of
Manual Zero Calibration Setting

To close the setting

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

Example

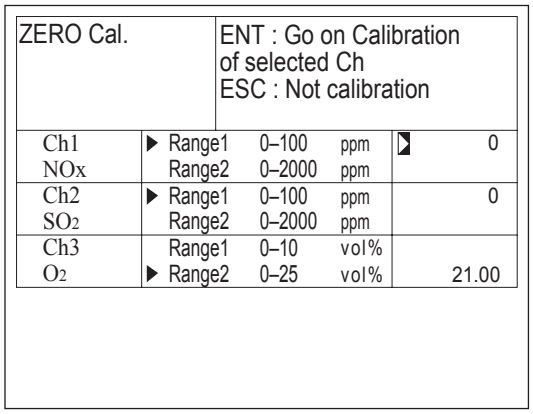
Whether "each" or "at once" can be determined for each Ch (component).

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

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

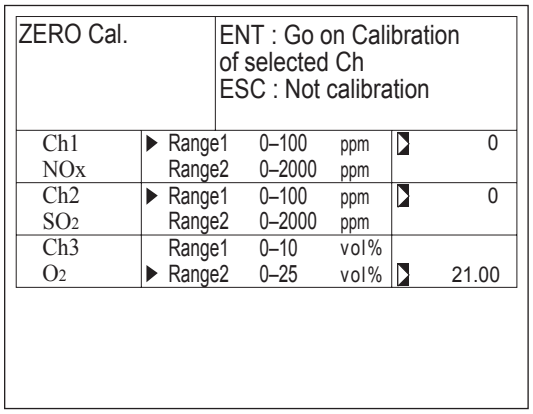
Manual Calibration screen

• When setting all components to "each":



A single cursor will appear.

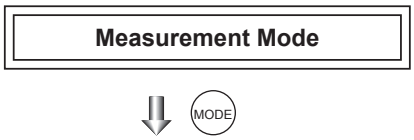
• When setting all components to "at once":



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

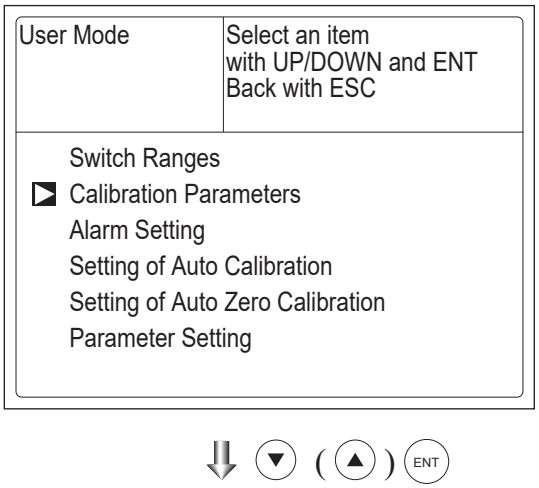
6.2.3 Setting of calibration range

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

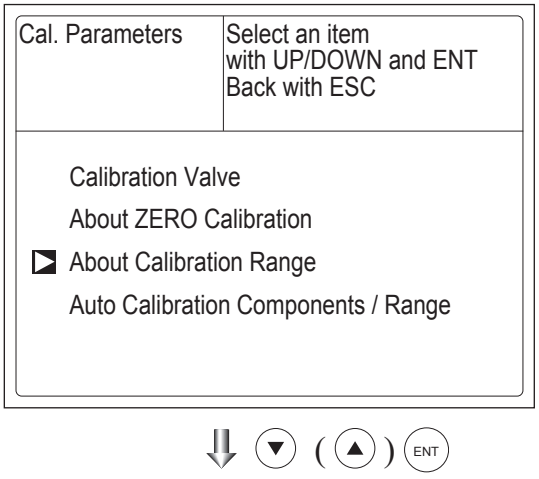


(1) During measurement, press the MODE key to display the User mode.

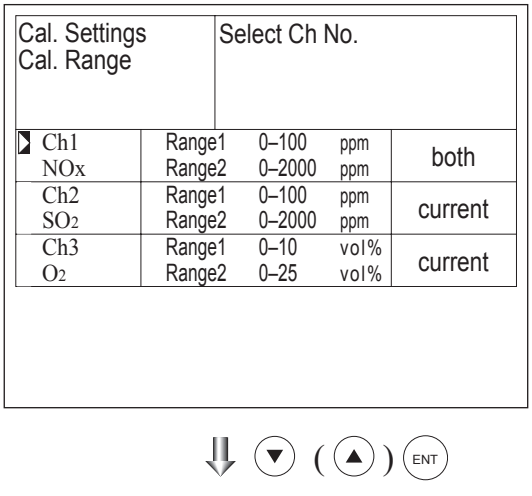
(2) Point the cursor to "Calibration Parameters" by pressing the ▲ or ▼ key. Press the ENT key.



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



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



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

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

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

Cal. Settings Cal. Range				Set calibration range current or both range
Ch1 NOx	Range1 Range2	0–100 0–2000	ppm ppm	both
Ch2 SO_2	Range1 Range2	0–100 0–2000	ppm ppm	current
Ch3 O_2	Range1 Range2	0–10 0–25	vol% vol%	current

⇓ ▼ (▲) ENT

End of Manual Calibtation Setting

To close "Setting of Calibration Range"

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

Example

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

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

⚠ CAUTION

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

Manual Calibration screen

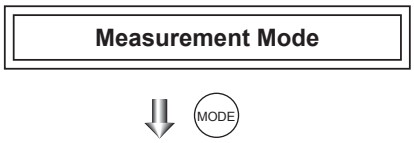
When setting NOx and CO to "both"

ZERO Cal.				ENT : Go on Calibration of selected Ch ESC : Not calibration
Ch1 NOx	▶ Range1 Range2	0–100 0–2000	ppm ppm	0
Ch2 SO_2	▶ Range1 Range2	0–100 0–2000	ppm ppm	0
Ch3 O_2	Range1 ▶ Range2	0–10 0–25	vol% vol%	21.00

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

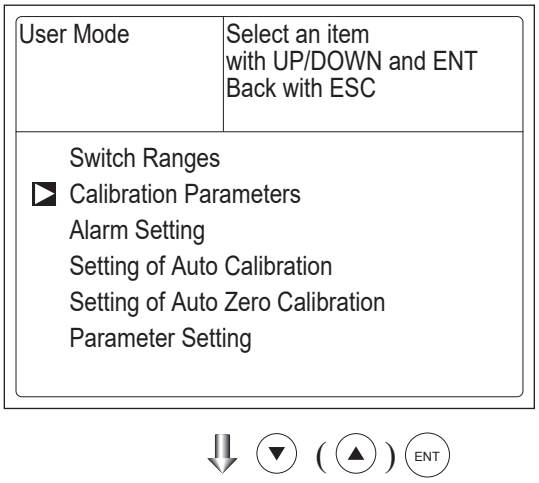
6.2.4 Setting of auto calibration component/range

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

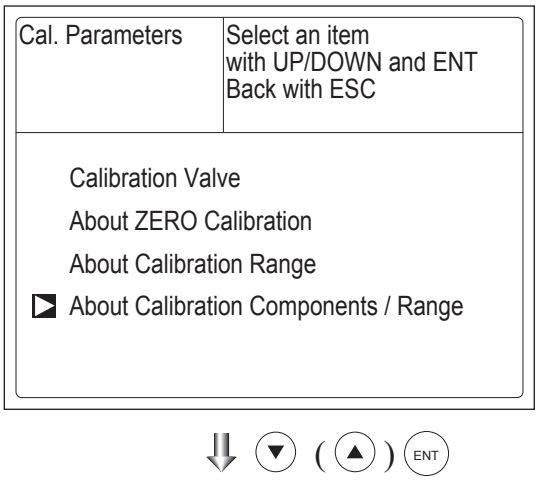


(1) During measurement, press the MODE key to display the User mode.

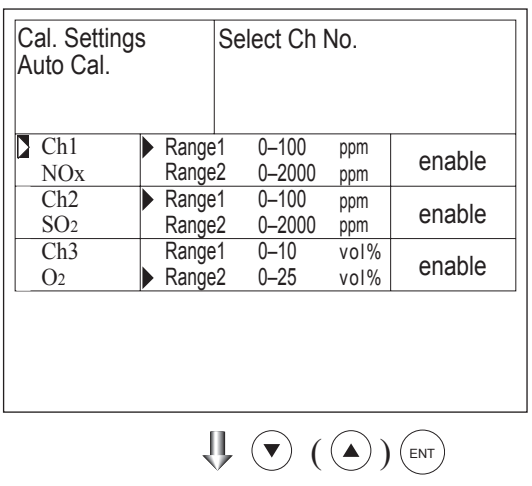
(2) Point the cursor to "Calibration Parameters" by pressing the ▲ or ▼ key. Press the ENT key.



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



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



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

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

To close "Auto Calibration Component/range" setting

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

The range identification contact is interlocked with the range after the switch. However, if the hold setting is set to "ON," the contact status before calibration is maintained.

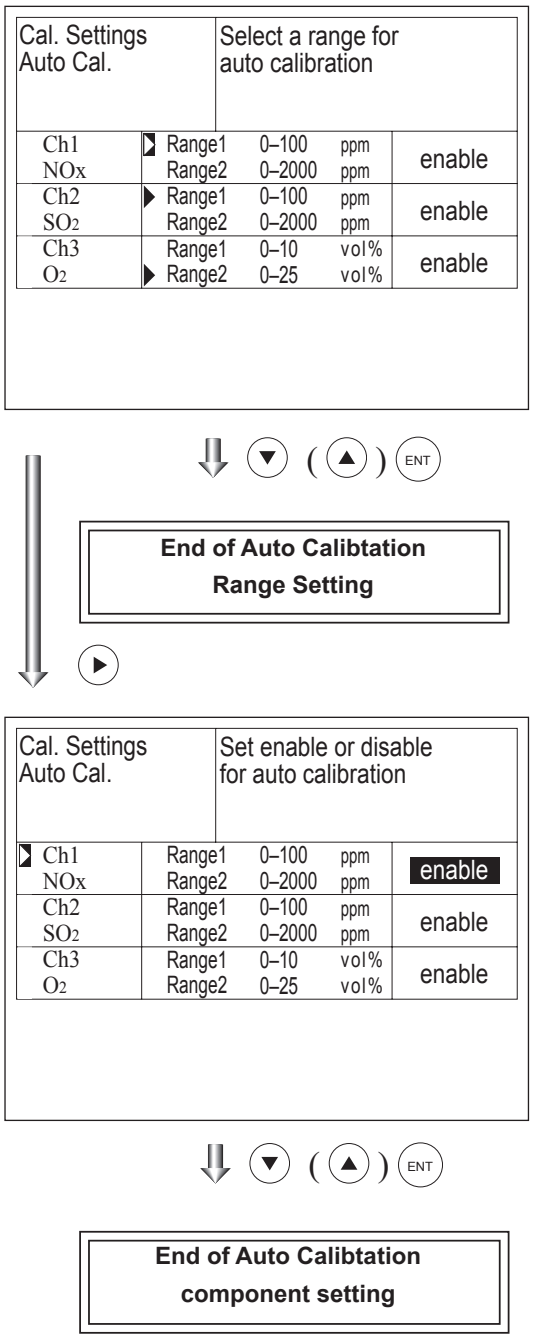
(7) Press the ▶ key in the state described in (5), and the highlight is switched between "enable" and "disable" auto calibration.

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

(9) Then press the ENT key.

To close the setting

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

⚠ CAUTION

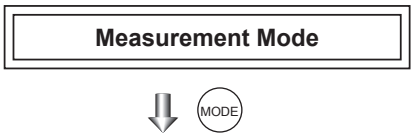
ZERO calibration on auto calibration and auto zero calibration of the component with which "enable" is selected are performed in batch irrespective of the description in "6.2.2 Setting of manual zero calibration."

6.3 Alarm setting

6.3.1 Setting of alarm values

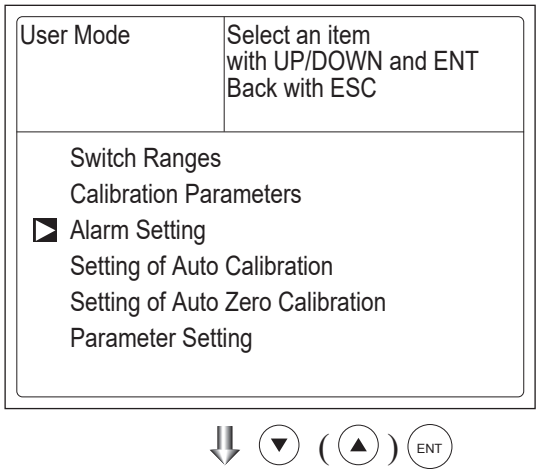
The High/Low limit alarm output setting for the measured concentration can be made during measurement.

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



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

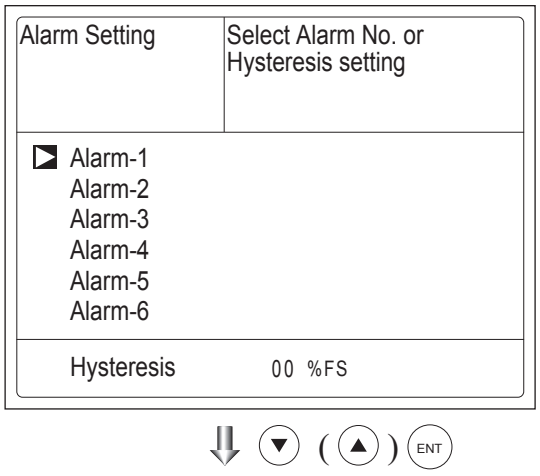
(2) Point the cursor to "Alarm Setting" by pressing the (▲) or (▼) key. Press the (ENT) key.



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

Press the (ENT) key.

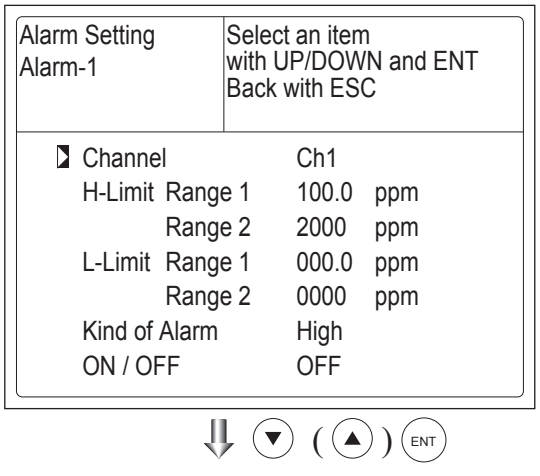
Alarm 1	1st component upper limit alarm
Alarm 2	2nd component upper limit alarm
Alarm 3	O_2 upper limit alarm
Alarm 4	1st component lower limit alarm
Alarm 5	2nd component lower limit alarm
Alarm 6	O_2 lower limit alarm



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

Note

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



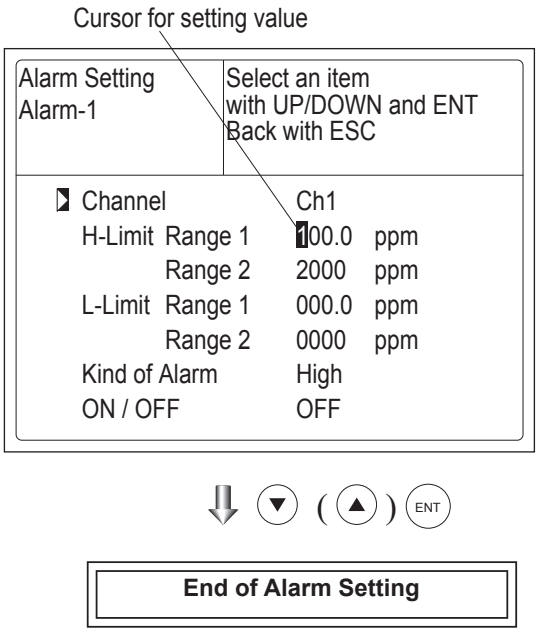
(5) After setting, the alarm setting is now completed by pressing the (ENT) key.

To close the "Alarm Setting"

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

Setting range

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



Description of setting items

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

Channel: Channel setting 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.

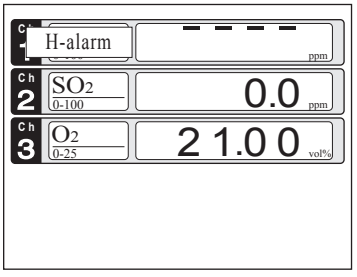
Kind of Alarm: Selects one of High limit alarm, Low limit alarm, and High limit or Low limit alarm, HH limit alarm, and LL limit alarm.
High, HH ... Alarm contact closes when above H-limit alarm.
Low, LL ... Alarm contact closes when below L-limit alarm.
High or Low ... Alarm contact closes when above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

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



⚠ CAUTION

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

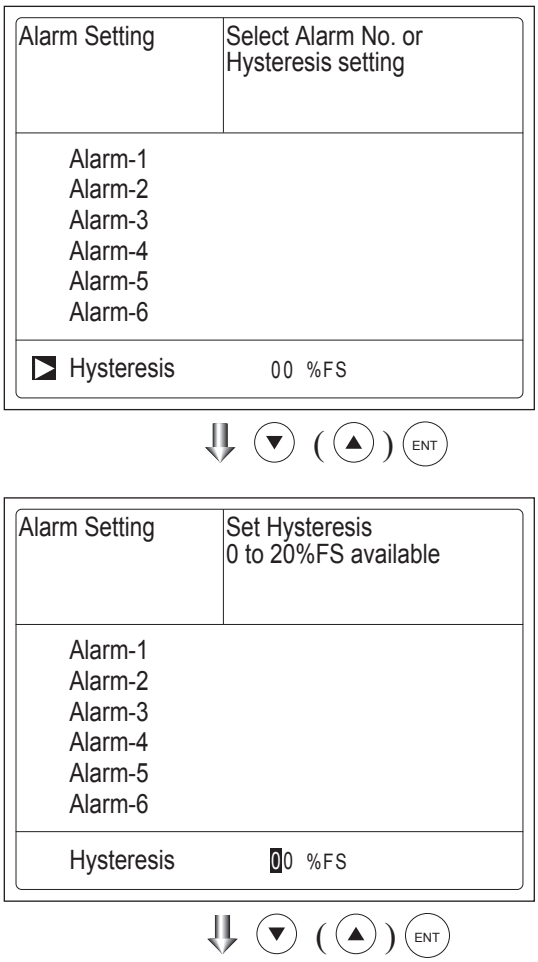
6.3.2 Hysteresis setting

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

(1) In the "Alarm No. Selection" screen that appears, point the cursor to "Hysteresis" by pressing the ▲ or ▼ key. Press the ENT key.

(2) In the "Hysteresis Value Setting" screen that appears, enter hysteresis values.

For the value entry, 1-digit value is increased or decreased by pressing the ▲ or ▼ key, and pressing the ▶ key moves the digit. After setting, press the ENT key.



To close "Hysteresis Setting"

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

Setting range

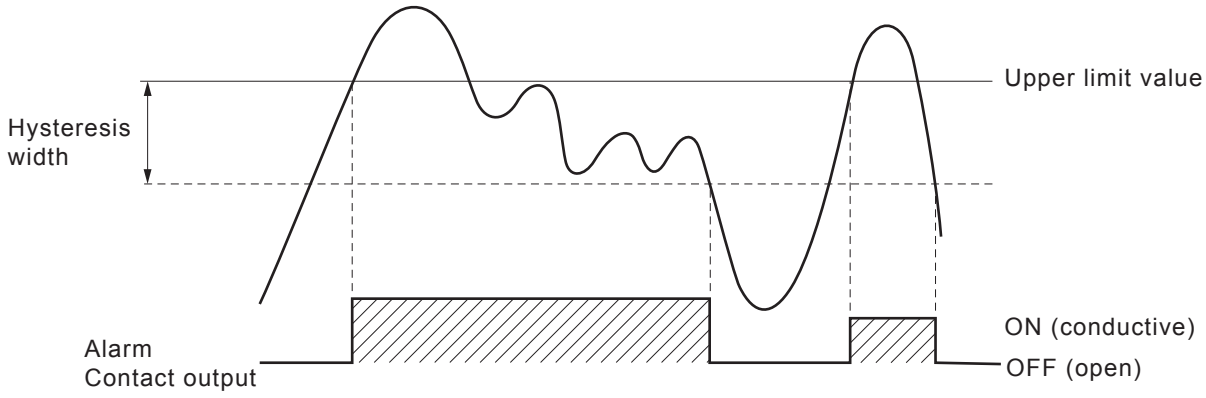
0 to 20% of full scale
[% full scale (FS)] represents the percentage with the width of the range of each component regarded as 100%.

Note

The hysteresis is common to all alarms (components).

Hysteresis (In case of 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.



6.4 Setting of auto calibration

6.4.1 Auto calibration

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

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

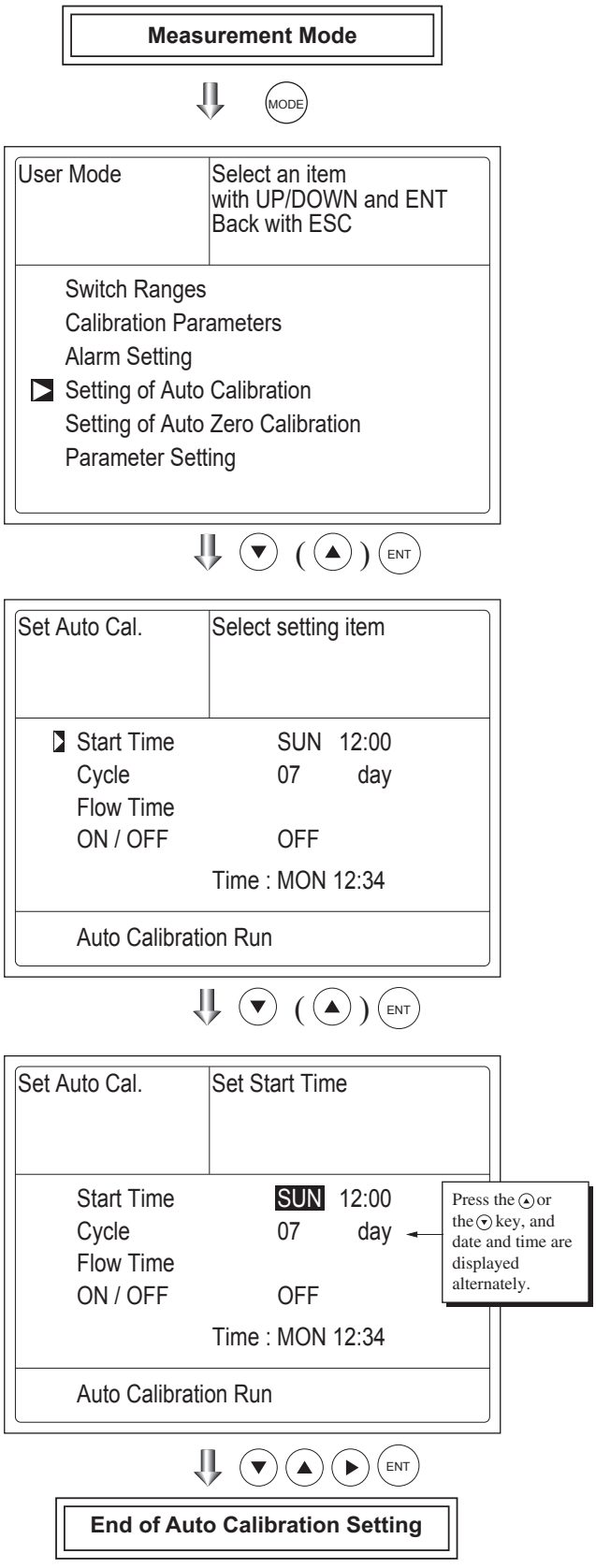
(1) During measurement, press the MODE key to display the User mode.

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

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

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

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



Description of setting items

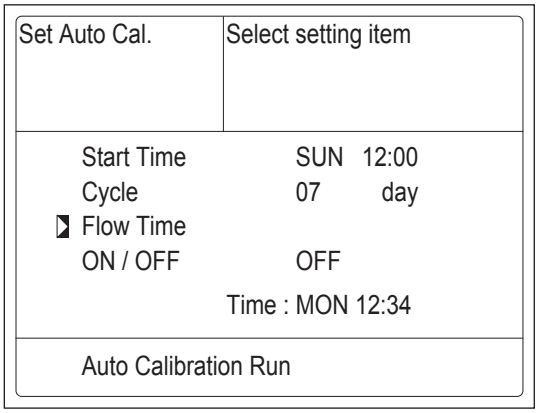
- Start Time : Setting at the first calibration (day of the week, hour, minute)
- Cycle : A period between the start time of one calibration and another (unit : hour/day)
- Flow Time : The time required for replacement by calibration gas
  Time required for replacement of sample gas after the calibration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

To close "Setting of Auto calibration"

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

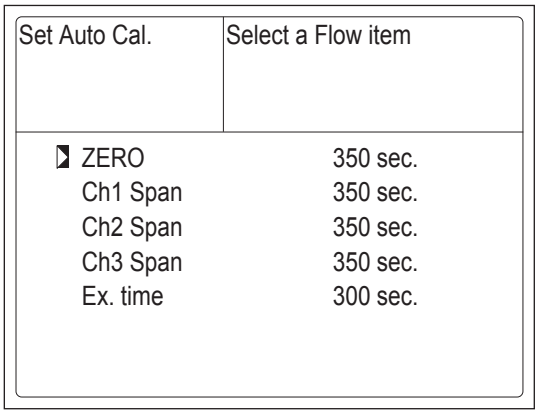
<Gas flow time> setting

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



⇩ ENT

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

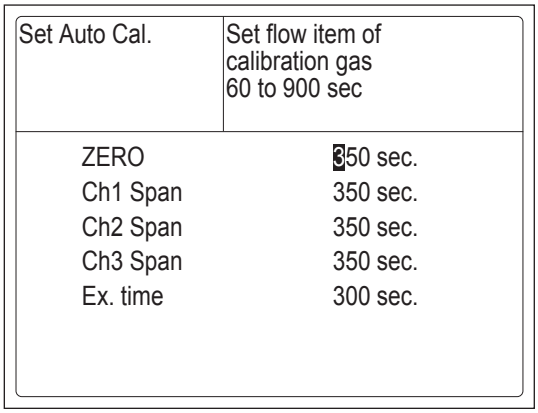


⇩ ▼ (▲) ENT

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

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

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



⇩ ▼ (▲) ▶ ENT

End of Gas flow time Setting

⚠ CAUTION

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.

⚠ CAUTION

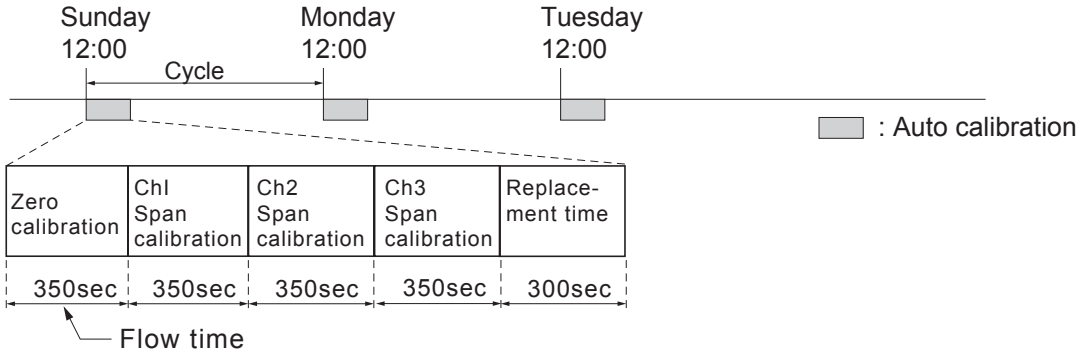
Configure the flow time for zero and span gas about 5 times longer than the response time by referring to the item of "response time" in this manual. (For response time, see Section 6.7.)

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

Example

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

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



(An example of "Ch1: through Ch3: enable", as given in Item 6.2.4 "Auto Calibration Components/range")

Setting range

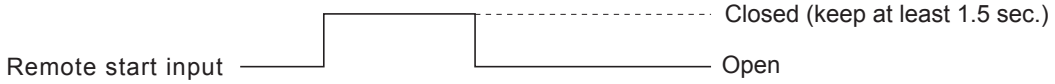
Cycle : 1 to 99 hours or 1 to 40 days (initial value 7days)
Flow time : 60 to 900 sec (initial value 300sec)

⚠ CAUTION

- **When an auto calibration starts, the measurement screen automatically appears.**
- **During auto calibration, any key operation is not permitted other than operations such as key lock ON/OFF and "Forced stop of auto calibration" (see Section 6.4.2.2). When the key lock is set at ON, even the "Forced stop of auto calibration" cannot be performed. To cancel auto zero calibration forcedly, set the key lock to OFF and then execute "Forced stop of 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.**
- **When the hold setting is set to ON, the hold time of auto calibration contact and measurement value output signal are extended after calibration for gas replacement time.**

Remote start

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

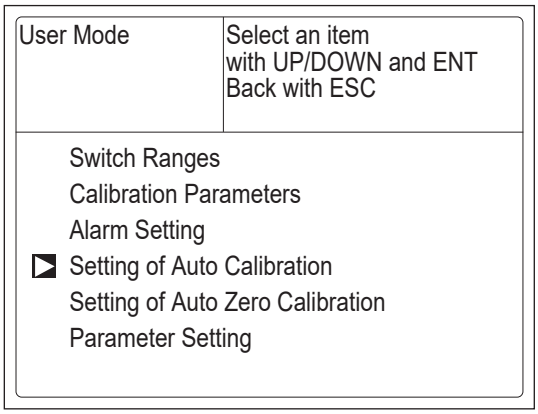


6.4.2 Forced run/stop of auto calibration

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

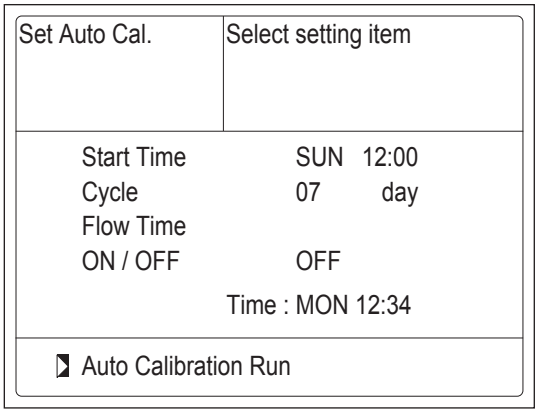
6.4.2.1 Execution of auto calibration (only once)

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



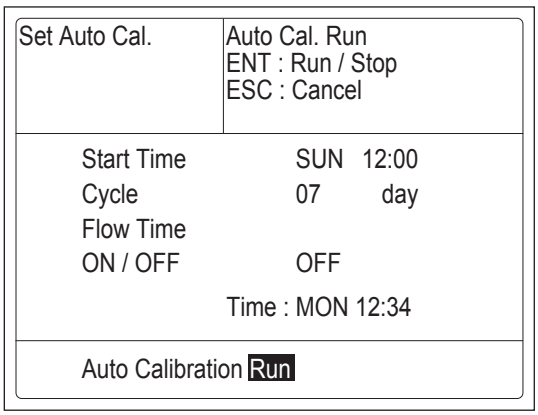
⇓ ▼ (▲) ENT

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



⇓ ▼ (▲) ENT

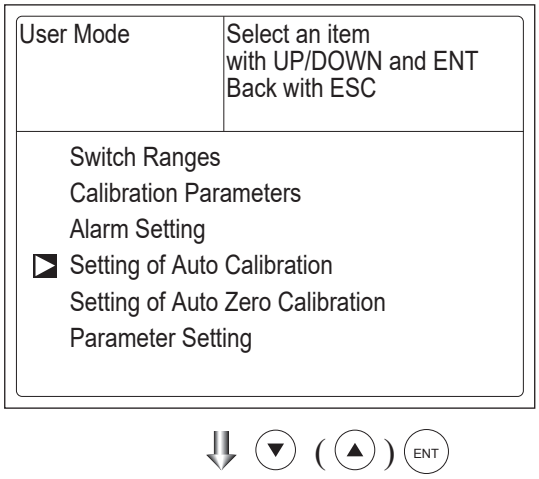
(3) "Run" is highlighted, displaying a message to confirm the execution of auto calibration. Press the ENT key to execute the auto calibration, and press the ESC key to cancel.



6.4.2.2 Forced stop of auto calibration

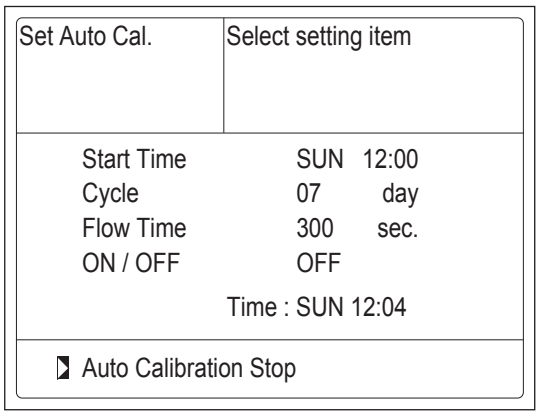
This mode is used to stop the auto calibration forcedly.

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



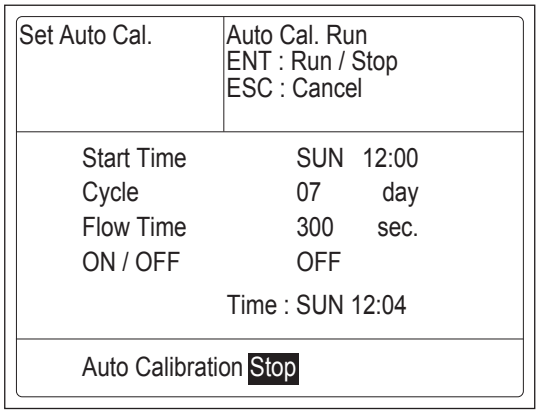
⇓ ▼ (▲) ENT

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



⇓ ▼ (▲) ENT

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



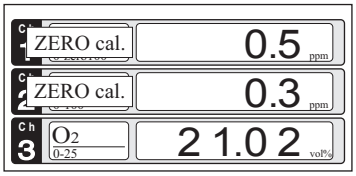
"Auto Calibration" screen

Example

In case where setting the auto calibration components (see Item 6.2.4) to "Ch1: enable" and "Ch2: enable"

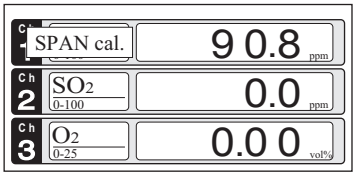
• Zero calibration

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



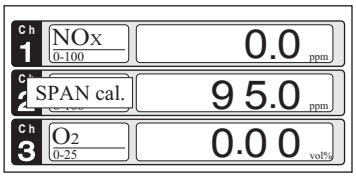
• Ch1 span calibration

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



• Ch2 span calibration

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



⚠ CAUTION

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

6.5 Setting of auto zero calibration

6.5.1 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 6.2.4.

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

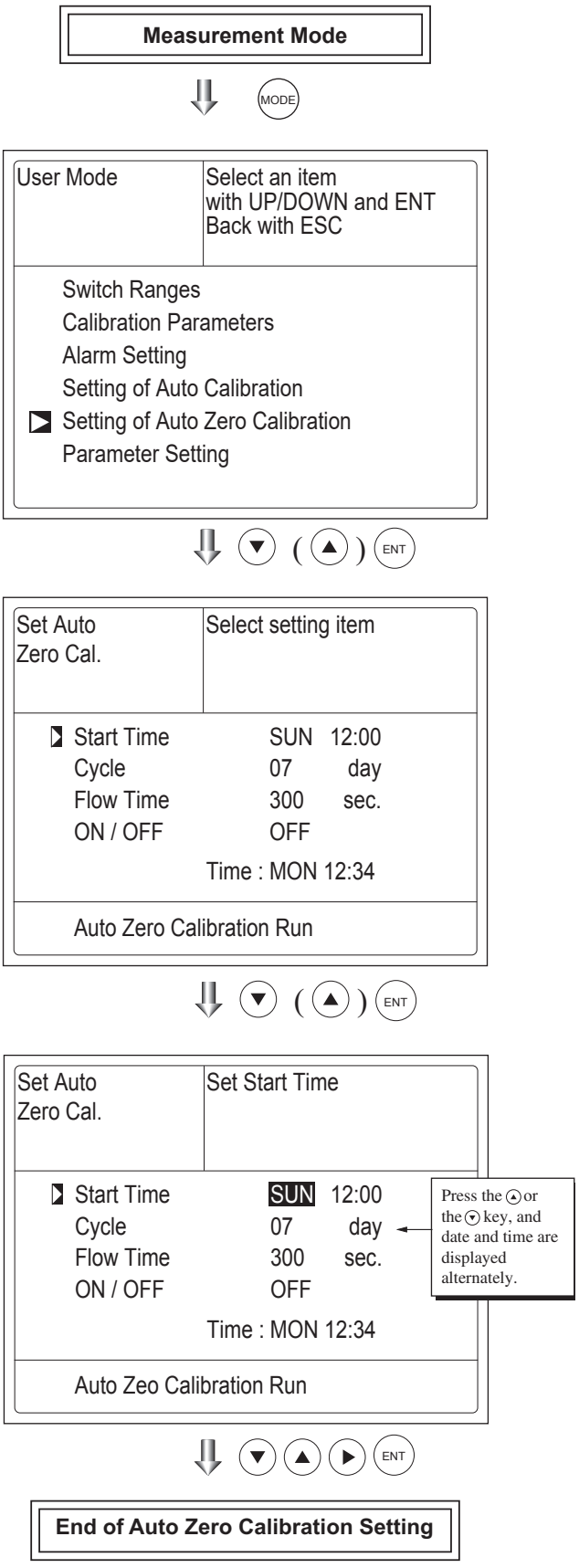
(1) During measurement, press the MODE key to display the User mode.

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

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

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

After setting, press the ENT key, and auto zero 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 another (unit : hour/day)
- Flow Time : The time required for the calibration gas to be replaced in the cell
- ON/OFF : ON/OFF of auto zero calibration

To close "setting of Auto Zero Calibration"

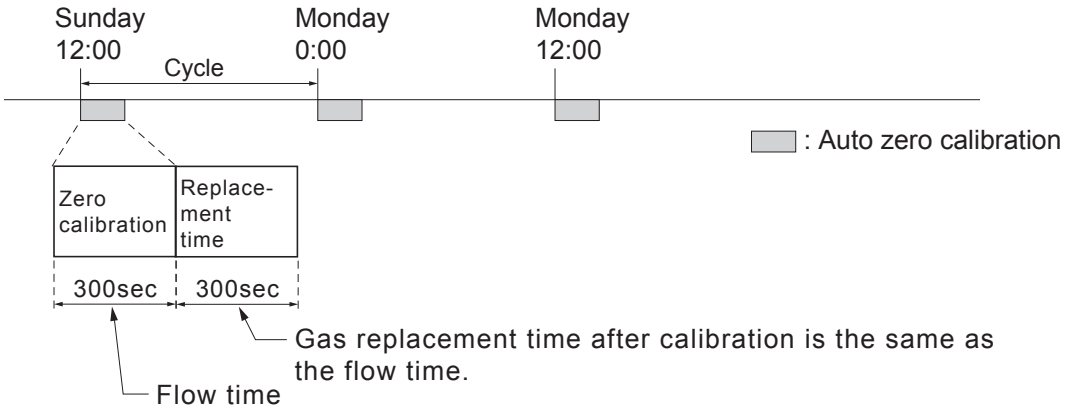
To close the "Setting of Auto Zero Calibration" or cancel this mode midway, press the ESC key. A previous screen will return.

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

Example

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

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



(An example of "Ch1: through Ch3: enable," as given in Item 6.2.4 "Auto Calibration Components/range")

Setting range

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

⚠ CAUTION

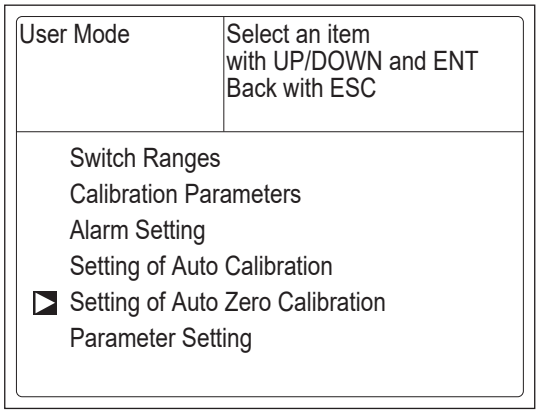
- **When an auto zero calibration starts, the measurement screen automatically appears.**
- **Any operation other than "Stop Auto Zero Calibration" (see Item 6.5.2) is not permitted during auto zero calibration. "Stop Auto Zero Calibration" cannot be performed with the key lock to ON. To cancel auto zero calibration forcedly, set the key lock to OFF and then execute "Stop Auto Zero 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 zero calibration, and then repeat it in the set cycle.**
- **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.**

6.5.2 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.

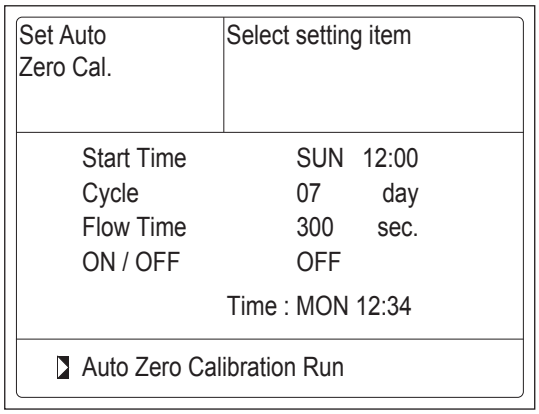
6.5.2.1 Execution of auto zero calibration (just once)

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



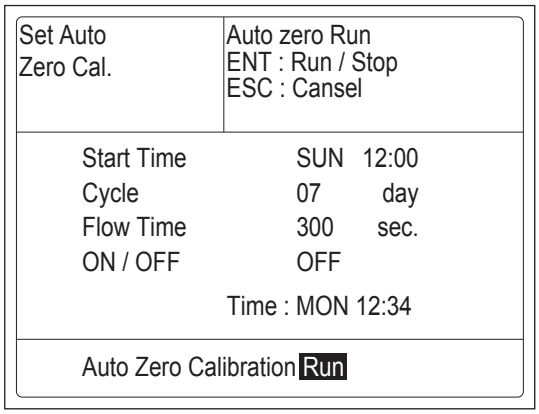
⇓ ▼ (▲) ENT

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



⇓ ▼ (▲) ENT

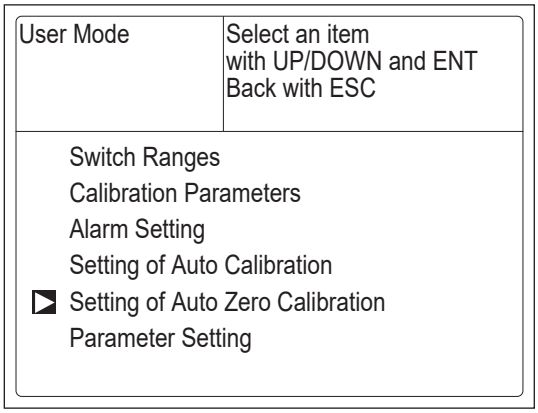
(3) "Run" is highlighted, displaying a message to confirm execution of auto zero calibration. Press the ENT key to execute the calibration, and press the ESC key to cancel.



6.5.2.2 Forced stop of auto zero calibration

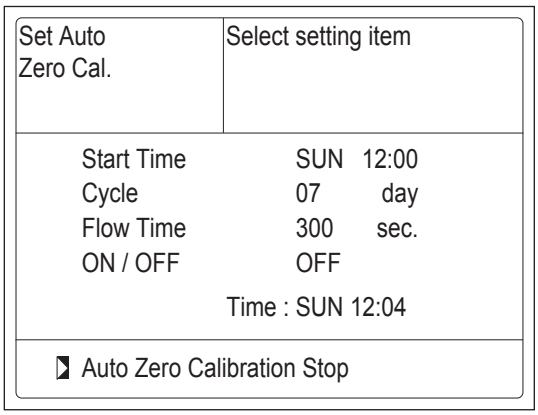
This mode is used to cancel the auto zero calibration forcedly.

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



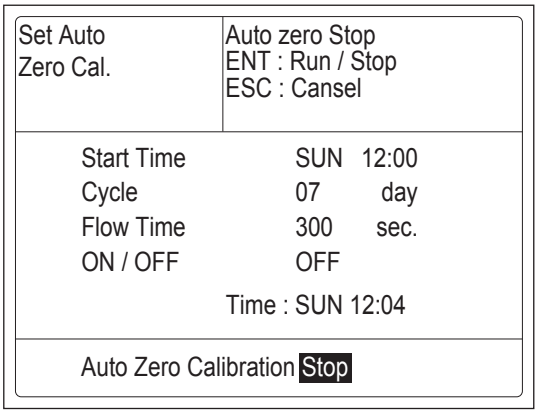
⇓ ▼ (▲) ENT

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



⇓ ▼ (▲) ENT

(3) "Stop" is inverted. A message appears, prompting you to verify that you want to stop auto zero calibration. Press the ENT key to stop the auto zoro calibration and the ESC key to cancel (not stopped).



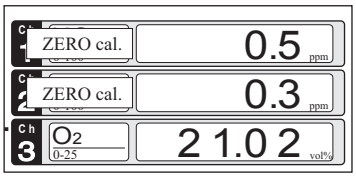
"Auto Zero Calibration" screen

Example

In case where setting the auto calibration components (see Item 6.2.4) to "Ch1: enable" and "Ch2: enable"

• Zero calibration

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



⚠ CAUTION

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

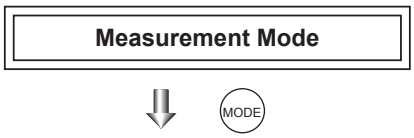
6.6 Parameter setting

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

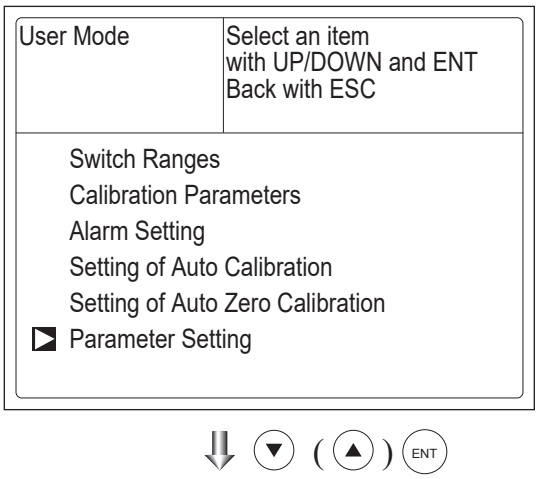
- Current Time : Current year, month, date, day of the week, hour, and minute setting (The display appears in this order.)
  Note: The clock backup time is 2 days. If power is turned on after it is kept off for 2 days or longer, make the time setting again.
- Key Lock : Sets with ON/OFF so that any key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

* For the maintenace mode, see Item 6.8.

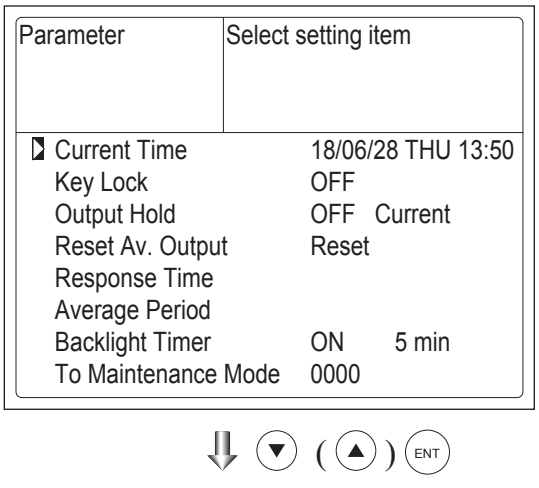


(1) To display the User mode, press the MODE key in the measurement mode.

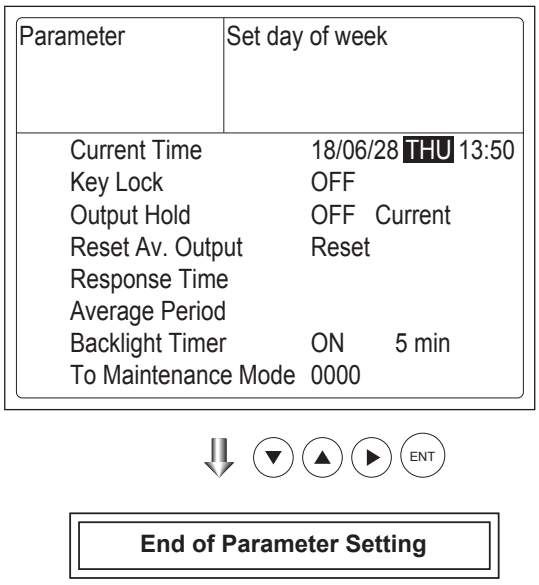
(2) Point the cursor to "Parameter Setting" by pressing the ▲ or ▼ key. Press the ENT key.



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



(4) In the Parameter Setting screen that appears, enter the numeric values and set the items. Entering the numeric values or setting the items should be carried out by using the ▲ or ▼ key. To move the cursor to the right, press the ▶ key. After setting, press the ENT key, that the parameter setting is carried out with the value you set.



To close Parameter Setting screen

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

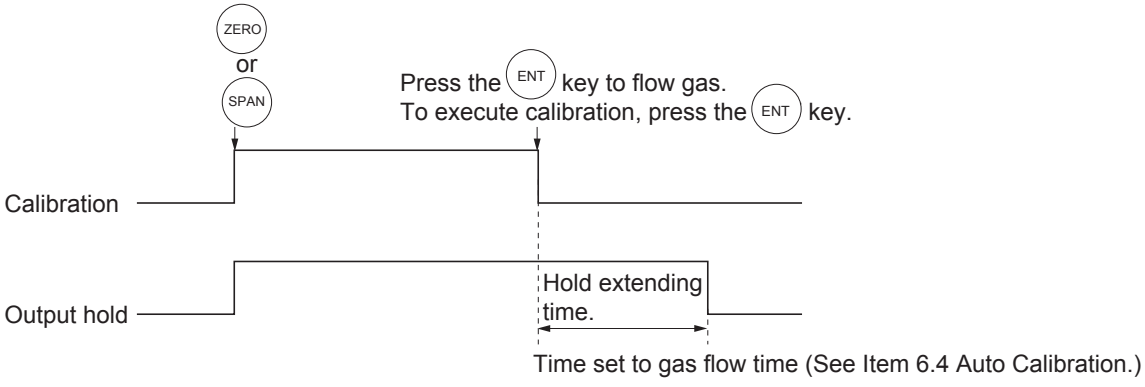
Setting Range

- Hold setting : 0 to 100% FS
- Response time : 1 to 60sec. (Initial value: 15 sec)
- Average period : 1 to 59 min or 1 to 4 hours (Initial value: 1 hour)
  When setting the unit of 1 to 59 minutes is terms of minute or 1 to 4 hours with hour
- Backlight Timer : 1 to 60 min (Initial value: OFF)
- Maintenance mode : 0000 to 9999 (Initial value: 0000)

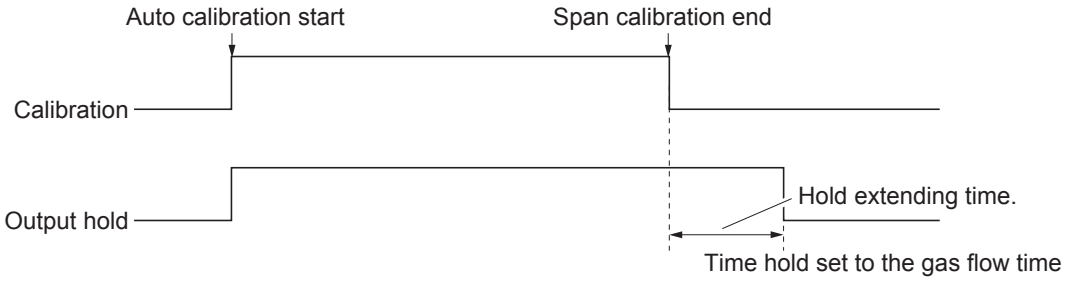
Output Hold

By setting an output hold to ON, an output signal of each channel are held during the calibration (manual calibration and auto calibration) and for the gas flow time (refer to Item 6.4, Setting of Auto Calibration). Regardless of Hold ON/OFF setting, an output signal can be held via an external input.

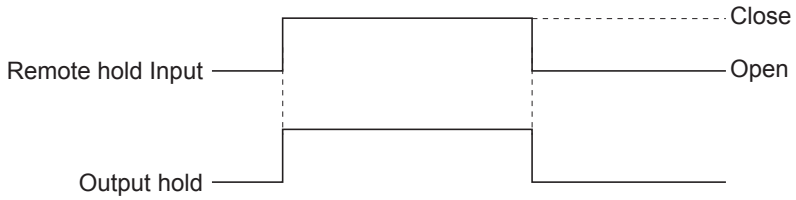
(1) Manual calibration



(2) Auto calibration



(3) External hold



(4) Screen display during Holding

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

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

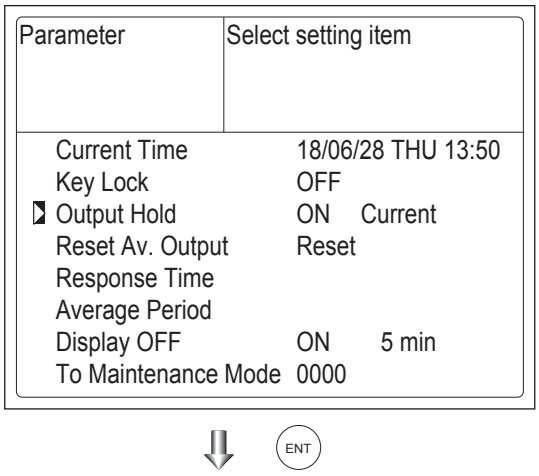
(5) If calibration is cancelled after the calibration gas is supplied regardless of during manual calibration or auto calibration, the holding extending time will be performed.

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

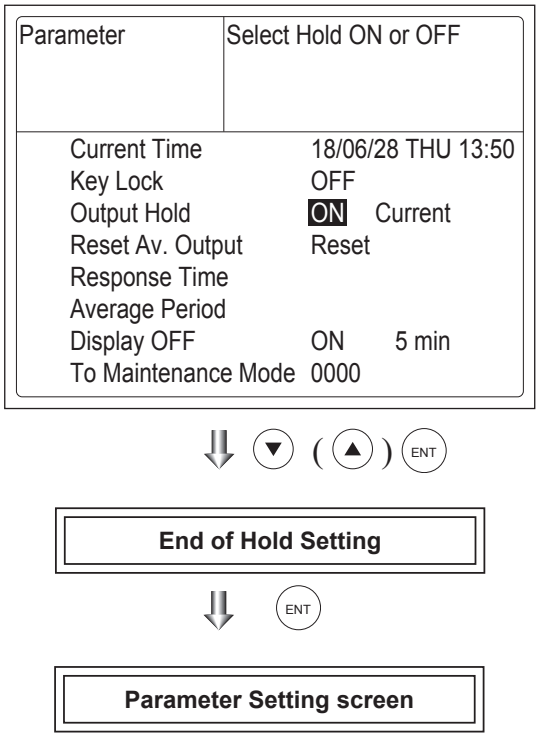
Follow the procedures shown below to make the setting.

(1) Setting for "Current" output hold value

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

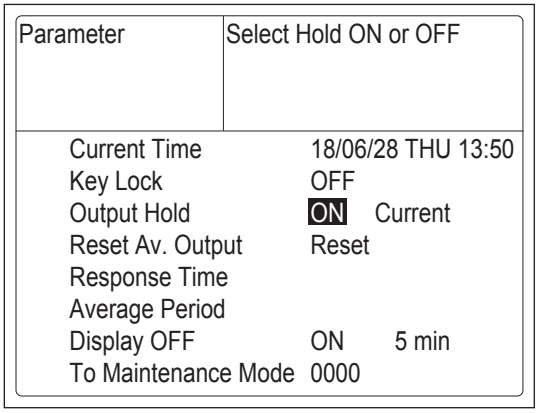


2) "ON" or "OFF" is highlighted. Press the (▲) or the (▼) key to select ON or OFF. Press the (ENT) key to return to (1).

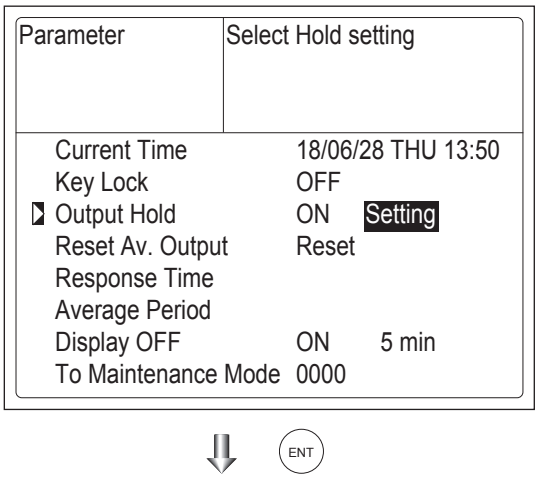


(2) Setting for "Setting" output hold value

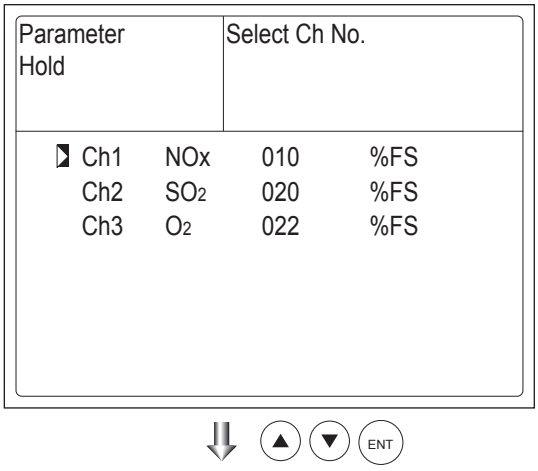
1) Press the ▶ key in a state ON/OFF is highlighted, and "Current" or "Setting" is highlighted. Select "Current" or "Setting" by pressing the ▲ or the ▼ key.



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

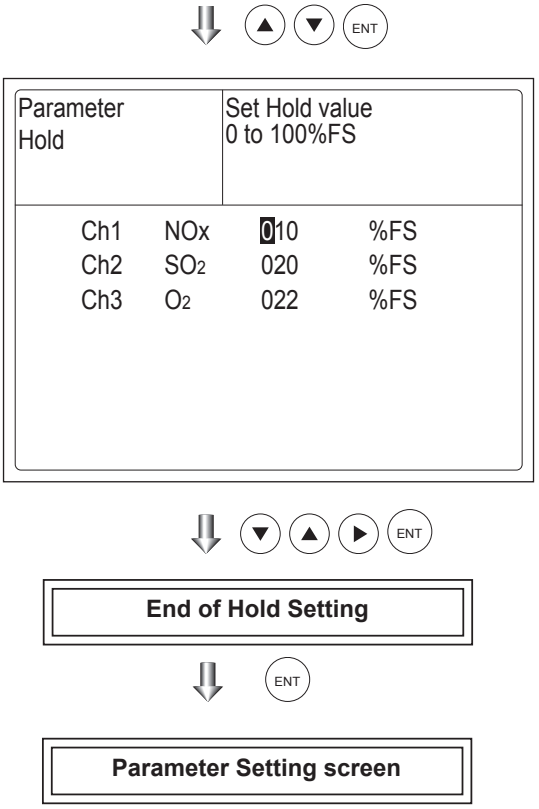


3) On the parameter hold screen that appears, move the cursor next to the Ch (component) you want to make the setting by pressing the ▲ or the ▼ key, and then press the ENT key.



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

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



Meaning of setting

The setting is represents the percentage with each Ch (component) range regarded as 100% for both ranges.
When 0 to 1000 ppm is selected as the range, for example, if 10% FS is selected as hold setting, the output equivalent to 100 ppm is output and held irrespective of the measurement value at that time.

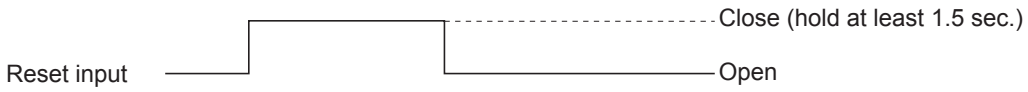
6) Press the ESC key to return to the parameter setting screen.

Description of setting

- Instantaneous value display of the measurement cannot be held. (Output only can be held.)
- If set value is selected for hold, instantaneous O_2 conversion 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.

Average value reset

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



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

Response time

The response time of the electrical system can be changed.

Setting is available by components.

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

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

Parameter Response Time	Select Ch No. 0

▷	Ch1	NOx	10	sec.
	Ch2	SO_2	20	sec.
	Ch3	O_2	22	sec.

Average period

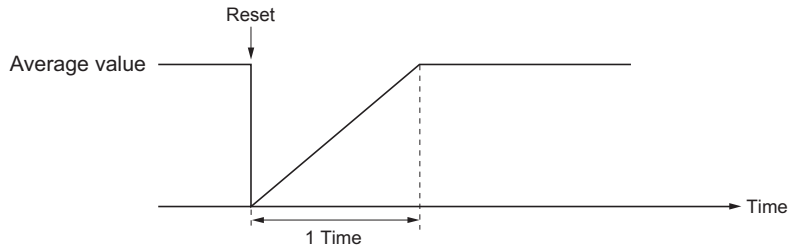
It allows you to set an average period of the average value of O_2 conversion.
It enables you to set an average time of 1 to 59 minutes (1-minute step) or 1 to 4 hours (1-hour step).
Changing the setting resets the average value of O_2 conversion and O_2 average value. (Pressing the ENT validates the resetting only for components whose setting was changed.)

Parameter Average Period	Select Ch No.

▷	Ch6	$\overset{AV.}{CU}$NOx	01	hour
	Ch7	$\overset{AV.}{CU}SO_2$	50	min

Example of average action

In case the average period was set to 1 hour.



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

Backlight Timer

Automatic OFF setting of the backlight of the LCD unit can be made.
When the specified time elapses from when the measurement screen is resumed, the backlight is automatically turned off. Press any key to 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 (ENT) key to confirm the selection.
If OFF is selected, the backlight is not turned off.

Parameter	Select ON or OFF	
Current Time	18/06/28 THU 13:50	
Key Lock	OFF	
Output Hold	ON	Previous value
Reset Av. Output	Reset	
Response Time		
Average Period		
Backlight Timer	ON	5 min
To Maintenance Mode	0000	

Maintenance mode

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

6.7 Maintenance mode

This mode is used for check of sensor input values, display of error log files or setting of passwords, etc. First, enter a password and then use it from the next operation. This mode is displayed by selecting the Maintenance Mode from "Item 6.7 Parameter Setting."

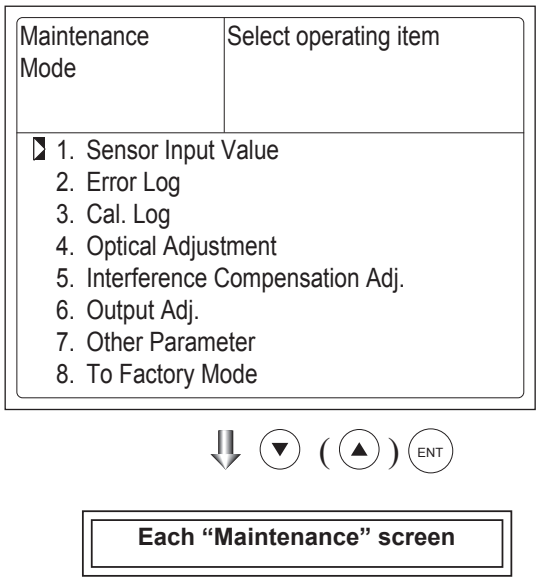
(1) Select the Maintenance mode from the Parameter Setting screen to display the Password Setting screen.

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

(3) Next, each Maintenance screen is displayed.

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

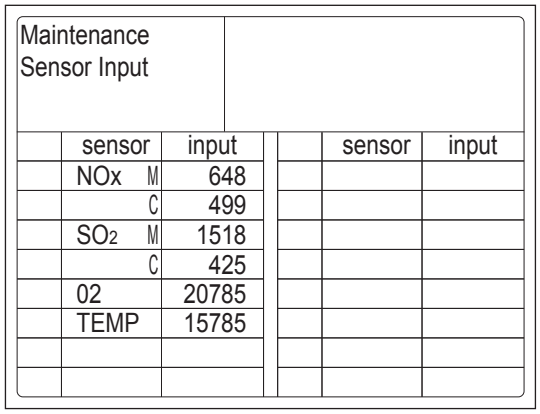
(4) Press the ESC key to return to the Maintenance Mode item selection screen from each screen.



- **Sensor Input Value screen**

Description of Sensor Input Value screen

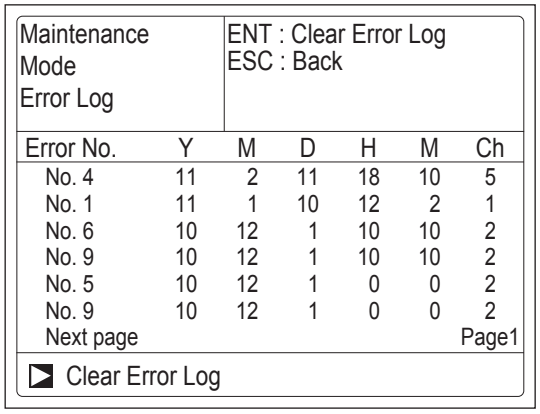
- NOx M : NOx sensor input value
- NOx C : NOx interference compensation sensor input value
- SO_2 M : SO_2 sensor input value
- SO_2 C : SO_2 interference compensation sensor input value
- Temperature : temperature sensor input value
- O_2 : O_2 sensor input value



- Error Log screen

Description of Error Log screen

Error history. Fourteen newest errors are logged. For error number, date and time (year, month, day, period) of occurrence, channel and other details of error, refer to Item 8.1 Error message.
Select Clear Error Log and press the ENT key, and the error log is cleared completely.

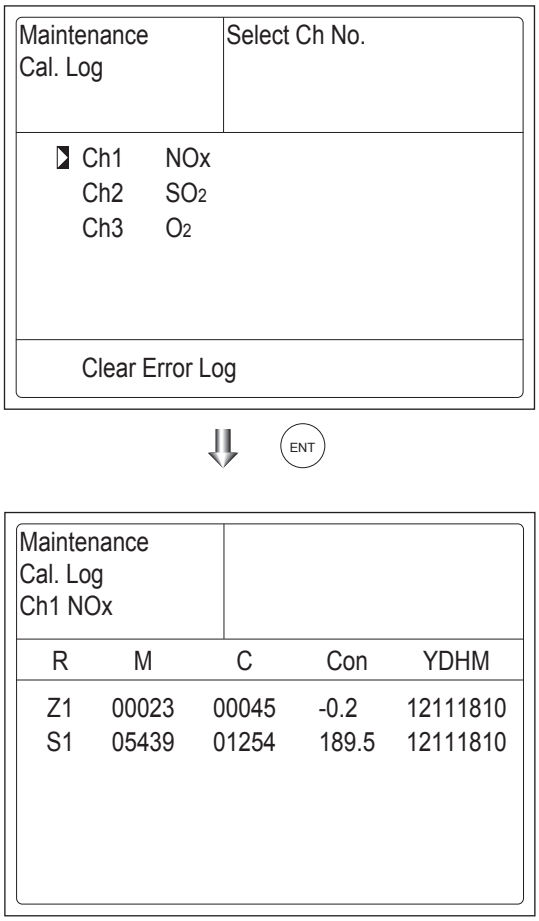


• Calibration Log screen

Description of Calibration Log screen

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

- Z1 : Zero calibration (Z) of Range 1
- S1 : Span calibration (S) of Range 1
- M : Sensor input value of measuring detector at the time of calibration
- C : Sensor input value of the interference compensation detector at the time of calibration
- Con : Concentration value displayed before calibration



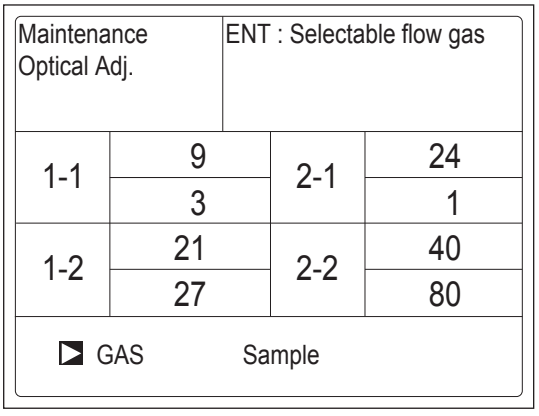
⚠ CAUTION

If the following operation is maladjusted, the measurement may be adversely and excessively affected. Carry out the operation with utmost attention.

• Optical adjustment screen

For details of this item, refer to "Item 7.3.3 Optical zero adjustment method".

Press (ENT) key and turn ON the solenoid valve signal for each calibration gas by using the (▲) or (▼) key.



• Moisture interference adjustment screen

For details of this item, refer to "Item 7.3.4 Moisture interference adjustment method."

Description of moisture interference adjustment screen

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

Move the ▶ cursor to a desired Ch (component) by pressing the ▲ or the ▼ key, and then press the ENT key, and the selected value at right is highlighted.

Check that the gas for moisture interference compensation is flowing, change the moisture interference compensation coefficient using the ▲ or the ▼ key, adjust the value at left so that it becomes near zero, and then press the ENT key to log moisture interference compensation value.

⚠ CAUTION

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

Maintenance		Select Ch No. with UP / DOWN and ENT Back with ESC	
▶ Ch1	NOx	0	1.252
Ch2	SO_2	-33	0.983
ALL			
Valve OFF			

⇓ ▼ (▲) ENT

Maintenance Cal. Log		Adjust with UP / DOWN ENT : Memorized ESC : Back	
Ch1	NOx	0	1.263
Ch2	SO_2	-33	0.983
ALL			
Valve OFF			

• Output adjustment screen

Description of output adjustment screen

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

Move the cursor using the ▲, ▼, or the ▶ key to the output (OUT No. and zero/span) to be adjusted, and then press the ENT key.
The selected value is highlighted. Adjust the value, while watching the output, by pressing the ▲ or the ▼ key. Press the ▶ key to select the next digit.
On completion of the adjustment, press the ENT key.

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

⇓ ▲ ▼ ▶ ENT

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

• Other parameter

Description of each setting screen

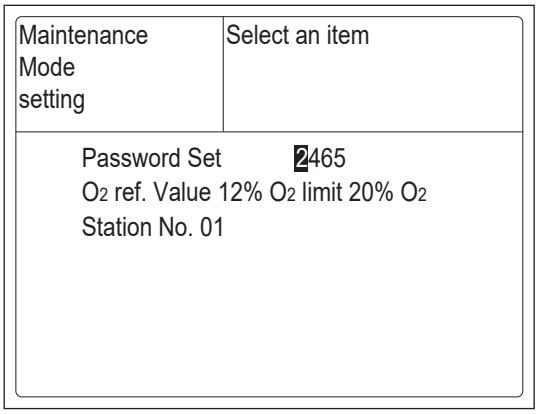
Password Set : Set the password used to move from the parameter setting screen to the maintenance mode. Arbitrary 4-digit number can be selected.

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

Limit : Set the oxygen concentration limit at the time of oxygen conversion calculation. Settable in the range from 01 to 20%.

* Refer to the O_2 conversion concentration value in "5.3 Outline of display screen" for oxygen conversion calculation procedure.

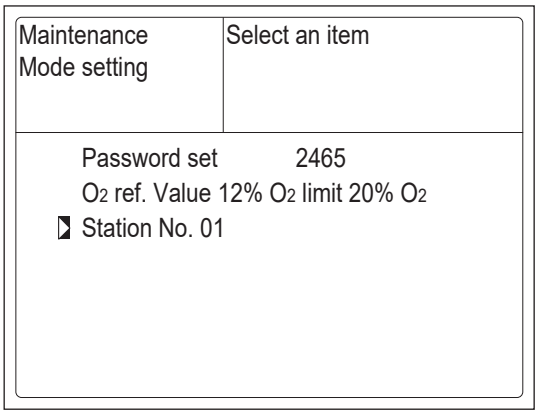
Station No. : Set the station No. for MODBUS communication. Settable in the range from 00 to 31.



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

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

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



⚠ CAUTION

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

6.8 Manual calibration procedure

6.8.1 Manual zero calibration

It is used for zero point adjustment. For zero calibration gas, suited for an application should be used according to "3.4.3 Preparation of standard gas".

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

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

⚠ CAUTION

- **The analyzer simultaneously calibrate the zero point of all the channels (components) that have been set to "at once" in "6.2.2 setting of manual zero calibration".**
- **The analyzer simultaneously calibrate the zero points of both ranges of the channels (components) set to "both" in "6.2.3 setting of calibration range".**

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

Note: For the Ch (component) for which "AR" is selected in "6.1.1 Setting range switch mode," the cursor automatically moves to the range selected in "Settingof auto calibration component/ range" (6.2.4), and calibration is carried out within that range.

To close "Zero Calibration"

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

Measurement Mode

⇓ ZERO

ZERO Cal.	Select Ch No. with UP / DOWN and ENT Back with ESC	
▶ Ch1 NOx	▶ Range 1 0-100 ppm Range 2 0-2000 ppm	0.0
Ch2 SO_2	▶ Range 1 0-100 ppm Range 2 0-2000 ppm	0.0
Ch3 O_2	▶ Range 1 0-10 vol% Range 2 0-25 vol%	20.09

⇓ ▼ (▲)

ZERO Cal.	Select Ch No. with UP / DOWN and ENT Back with ESC	
Ch1 NOx	▶ Range 1 0-100 ppm Range 2 0-2000 ppm	0.0
▶ Ch2 SO_2	▶ Range 1 0-100 ppm Range 2 0-2000 ppm	0.0
Ch3 O_2	▶ Range 1 0-10 vol% Range 2 0-25 vol%	20.09

⇓ ENT

ZERO Cal.	ENT : Go on calibration of selected Ch. ESC : Not calibration	
Ch1 NOx	▶ Range 1 0-100 ppm Range 2 0-2000 ppm	▶ 0.0
Ch2 SO_2	▶ Range 1 0-100 ppm Range 2 0-2000 ppm	▶ 0.9
Ch3 O_2	▶ Range 1 0-10 vol% Range 2 0-25 vol%	▶ 20.09

⇓ ENT

To Measurement screen after executing Manual Zero Calibration

6.8.2 Manual span calibration

It is used to perform a span point adjustment. Supply calibration gas with concentration set to the span value to perform the span calibration. For the span calibration gas for the NO_X, SO_2, CO_2, CO measurement, use the standard gas with a concentration of between 90% and 100% of the range value. For the span calibration gas for the O_2 measurement, use the standard gas with a concentration of between 90% and 100% of the range value when measuring with the built-in O_2 sensor, and use the standard gas of about 2 vol% when measuring with an external zirconia O_2 sensor.

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

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

⚠ CAUTION

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

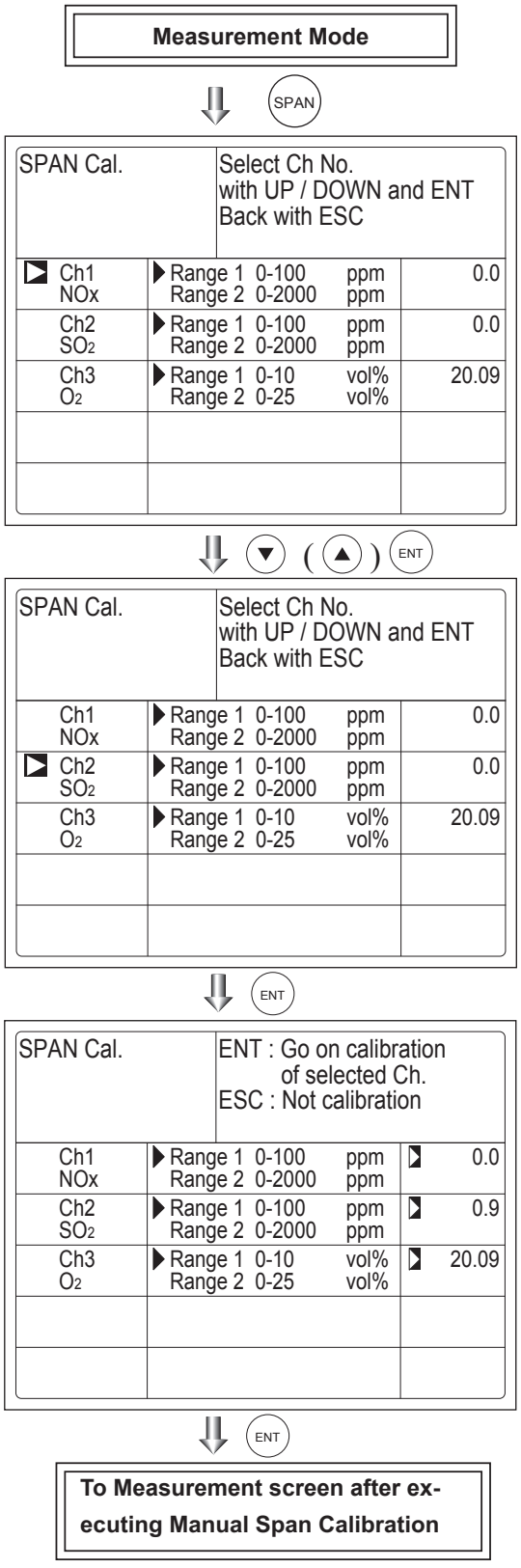
(3) Wait until the indication is stabilized in the state where the calibration gas is supplied. After the indication has been stabilized, press the (ENT) key. Span calibration of Range selected by the cursor is performed.

⚠ CAUTION

For the Ch (component) for which "AR" is selected in "6.1.1 Setting range switch mode," the cursor automatically moves to the range selected in "Setting of auto calibration component/range" (6.2.4), and calibration is carried out within that range.

To close "Span Calibration"

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



7. MAINTENANCE

7.1 Daily check

(1) Zero calibration and span calibration

(1) Perform zero calibration. For the calibration procedures, refer to "Section 6.9.1 Manual zero calibration. "

(2) Then, perform span calibration. For the calibration procedures, refer to "Section 6.9.2 Manual span calibration. "

(3) Zero calibration and span calibration should be carried out once a week, as required.

(2) Flow rate check

(1) Sampling gas flow and purge gas flow are as follows:

- Sampling gas flow: 0.5L/min±0.2L/min
- Purge gas flow: About 1L/min

(2) Check and maintenance should be carried out every day, as required.

7.2 Daily check and maintenance procedures

Table 7.1 Maintenance and check table

	Parts to be checked	Phenomena	Causes	Remedy
Daily check	Indication value	Indication values are lowered. Indication values are higherd.	(1) Dust is mixed in sampling cell.	(1) Clean the sampling cell. In addition, check sampling devices, especially gas filter.
			(2) Air is absorbed midway in the sampling pipe.	(2) Find out cause of leak and repair.
	Sample gas flow rate (Flow rate of purging gas is included if purging is used)	Standard flow is beyond the specified flow rate of 0.5L/min, 0.3 to 0.7L/min.	———	Adjust by needle valve of flow rater.
Weekly check	Zero point of gas analyzer	It is deflected.	———	Adjust.
	Span point of gas analyzer	It is deflected.	———	Adjust.
Yearly check	Gas analyzer	Regardless of any phenomena	———	Overhaul.

7.3 Maintenance of analyzer unit

7.3.1 Cleaning method for sample cell (pipe cell)

This section is strictly factory adjusted. Handle it with utmost attention.
If it is absolutely required, contact us.

(1) Turn off the power switch, stop the sample gas, and allow the zero gas to flow for several minutes to purge the cell interior.

Loosen the setscrew (6 pieces) from the top cover and remove it.

(2) Remove the internal gas inlet tube.

(3) Loosen both right and left screws for cell holding plate.

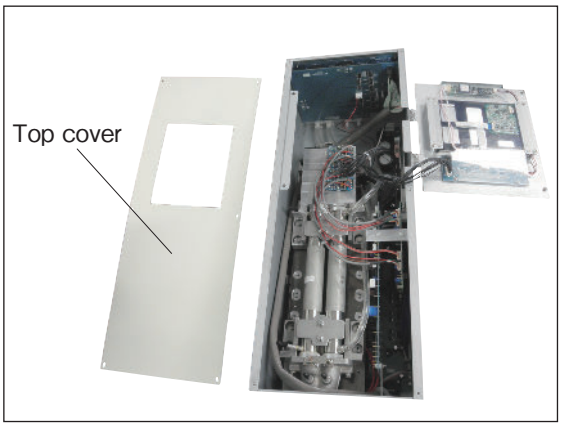
• Remove the sample cell only.

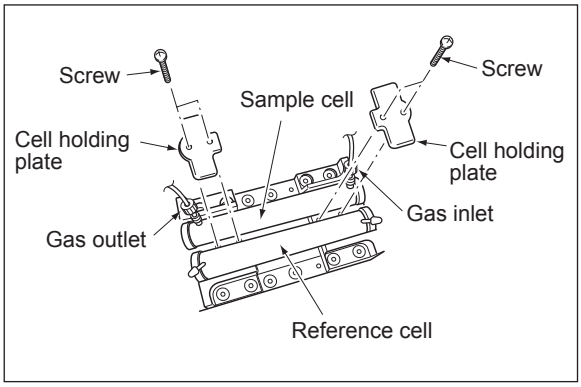
(4) Turn to the left the sample cell window and remove it from the sample cell (see Fig. 7-1).

(5) For cleaning the window and cell inside surface, first eliminate coarse dust by soft brush or the like and then wipe them by soft rag.

The window is easy to get scratched. Pay utmost attention so as not to damage it.

(6) After the end of sample cell cleaning, mount the cell in place and proceed to running.
After cleaning sample cell, be sure to perform optical zero adjustment (see Item 7.3.3) and moisture interference compensation adjustment (see Item 7.3.4).





⚠ CAUTION

If the window or the cell interior is very dirty, use a soft cloth moistened with absolute alcohol.
A slightly corroded infrared transmission window or sample cell can be remedied by gently rubbing with chromium oxide powder on cleaning cloth but an excessively corroded one must be replaced.
When cleaning, do not exert an excessive stress.

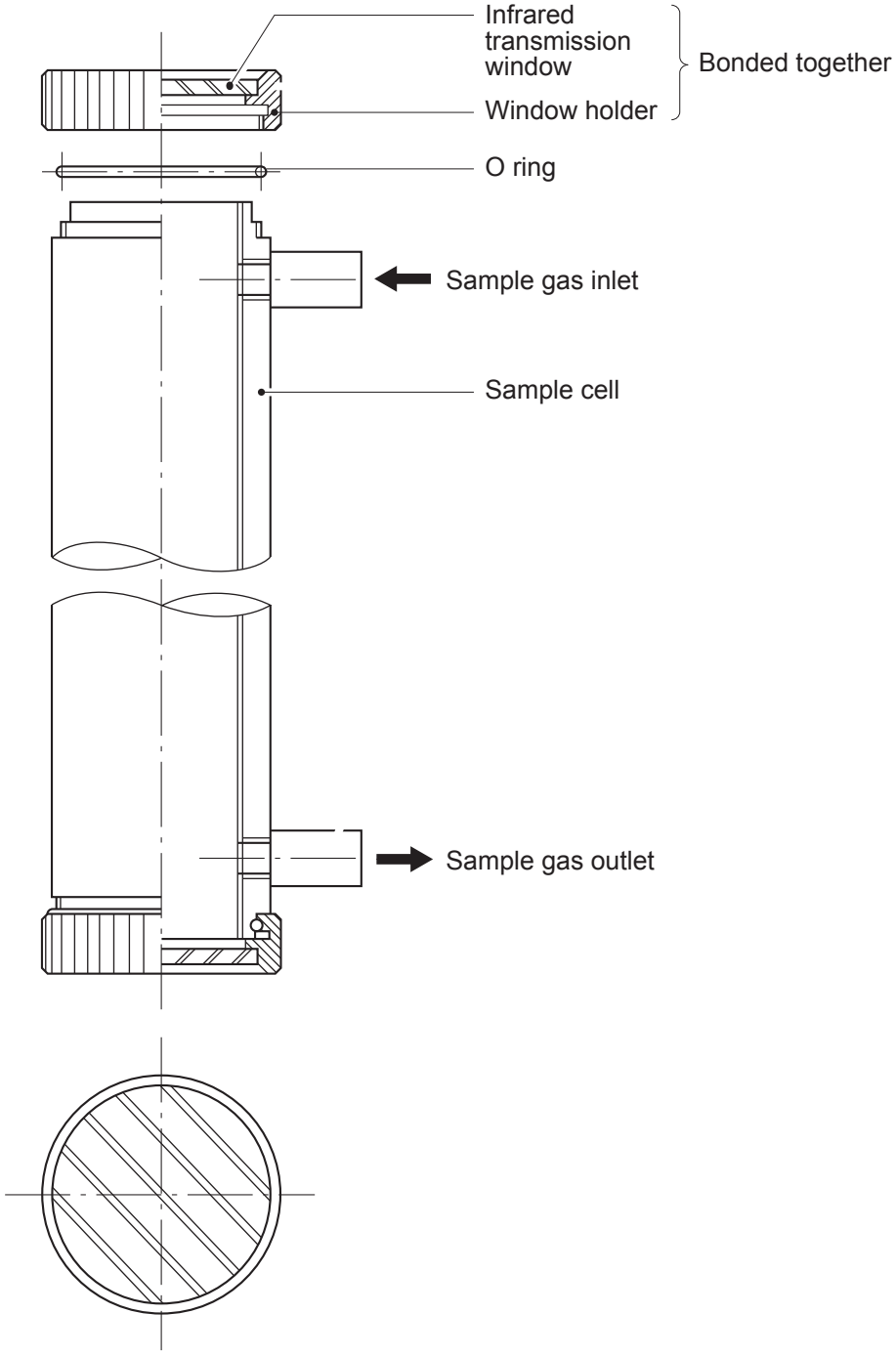


Fig. 7-1 Structure of sample cell (pipe cell)

7.3.2 Cleaning method for sample cell (block cell)

(1) Turn off the power switch, stop the sample gas, and allow the zero gas to flow for several minutes to purge the cell interior.

Loosen the setscrew (6 pieces) from the top cover and remove it.

(2) Remove the internal gas inlet tube.

(3) Loosen the 2 detector set bolts.

Note) The distribution cell, block cell and detector are fastened by the same bolts.

(4) Using the furnished cell mounting tool, turn the window fixture to the left and remove it from the cell.

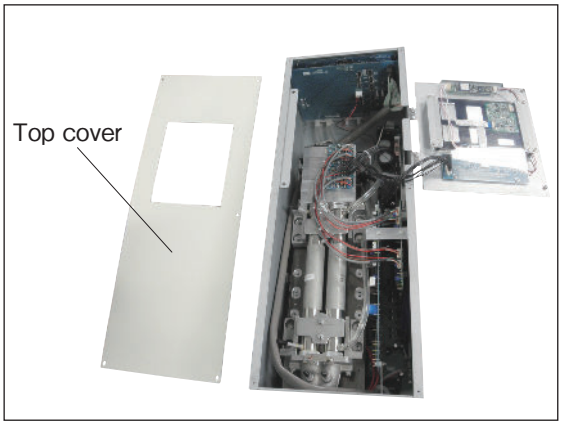
(See the structure of sample cell (block cell) in Fig. 7-2.)

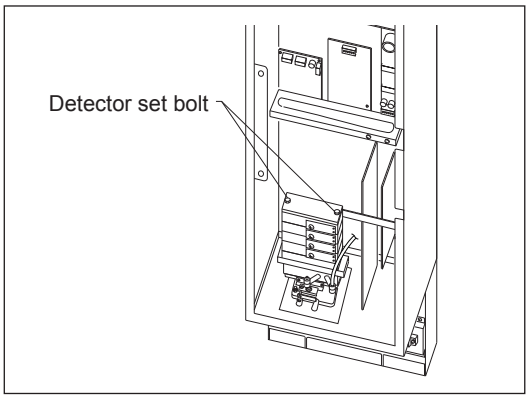
(5) For cleaning the infrared transmission window and cell inside surface, first eliminate coarse dust by soft brush or the like and then wipe them by soft rag.

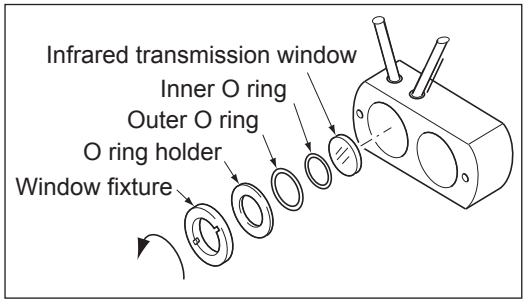
The window is easy to get scratched. Pay utmost attention so as not to damage it.

(6) After the end of sample cell cleaning, mount the cell in place and proceed to running.

After cleaning sample cell, be sure to perform optical zero adjustment (see Item 7.3.3) and moisture interference compensation adjustment (see Item 7.3.4).

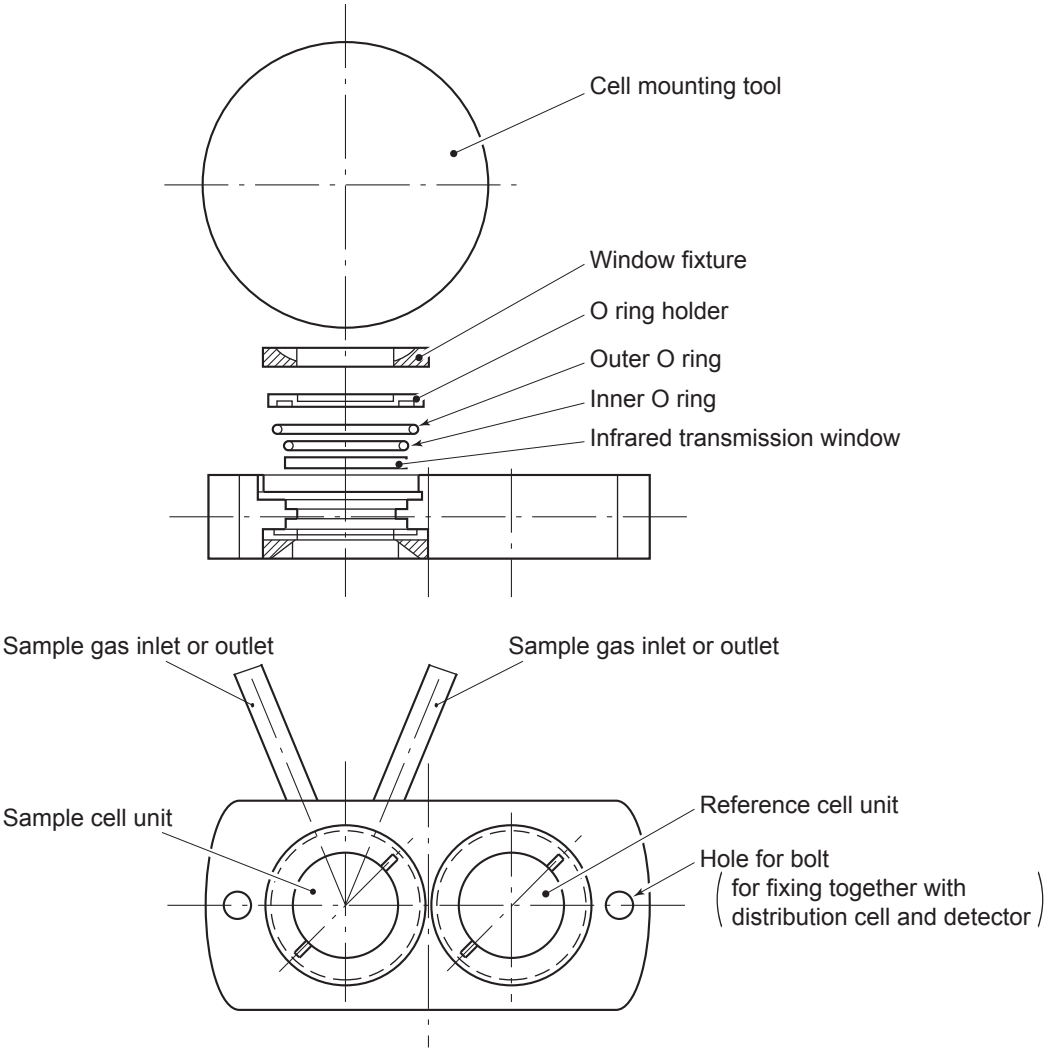






⚠ CAUTION

If the window or the cell interior is very dirty, use a soft cloth moistened with absolute alcohol. A slightly corroded infrared transmission window or sample cell can be remedied by gently rubbing with chromium oxide powder on cleaning cloth but an excessively corroded one must be replaced.
When cleaning, do not exert an excessive stress.



Structure of sample cell (of 32, 16, 8, 4, 2 mm long)
(sample cell and reference cell are integrated)

Note) Use the dedicated cell mounting tool (furnished).

Fig. 7-2 Structure of sample cell (block cell)

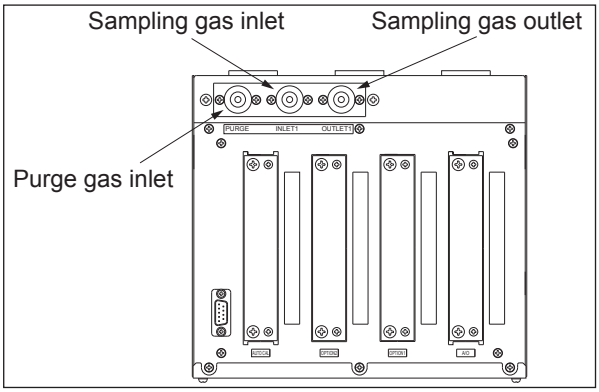
7.3.3 Optical zero adjustment method (optical balance adjustment)

⚠ CAUTION

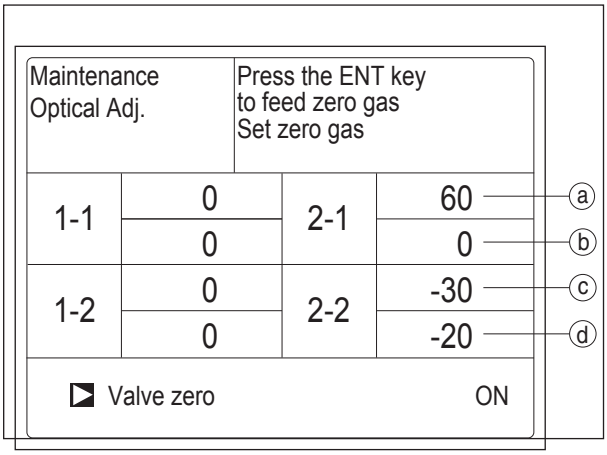
If the following operation is maladjusted, the measurement may adversely be affected.
If you are not trained for adjustment, do not carry out this operation but contact the distributor or our service engineer.

The adjustment is performed at reassembly after removing the sample cell, etc. for cleaning, etc.

(1) Remove the top cover. Allow dry N_2 or air to flow through the analyzer unit sample gas inlet until the reading stabilizes. The sample gas is introduced directly to the INLET of analyzer unit through the gas cylinder.



(2) Proceed to an optical adjustment in the maintenance mode. The display on the operation panel of the main unit is as illustrated on the right. Balance adjustment is not required if the display falls within ±100.



<Correspondence between measurement detector and indicated position>

No. of components to be measured		ⓐ	ⓑ	ⓒ	ⓓ
1-component meter		Main	Comp	–	–
2-component analyzer	NO/SO_2	NO Main	NO Comp	SO_2 Main	SO_2 Comp
	CO_2/CO	CO_2 Main	CO_2 Comp	CO Main	CO Comp

*1 O_2 is excluded from the number of components.
*2 "Main" is signal input value from the main detector of each component.
"Comp" is signal input value from interference compensation detector of each component.
If low range exceeds the range of 0 to 10vol%, detector signal of "comp" is not usable.

Sensor values of which are not included in measuring components should be ignored.

(3) Carry out the adjustment in the procedure in (4) and subsequent.

• Adjust the values of ⓐ to ⓓ in 2-1 and 2-2 to become as close to 0 as possible within ±100 range.

Note) Before moving the beam adjustment plate, loosen the detector set volt (Do not loose too much, for proper adjustment loose the detector set volt slightly)

(4) Operate the optical zero adjustment knob to change the value displayed at ⓐ.

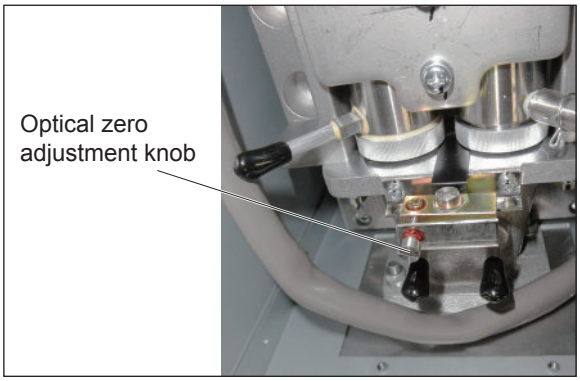
(5) Move the beamadjustment plate sideview to change the value displayed at ⓑ.

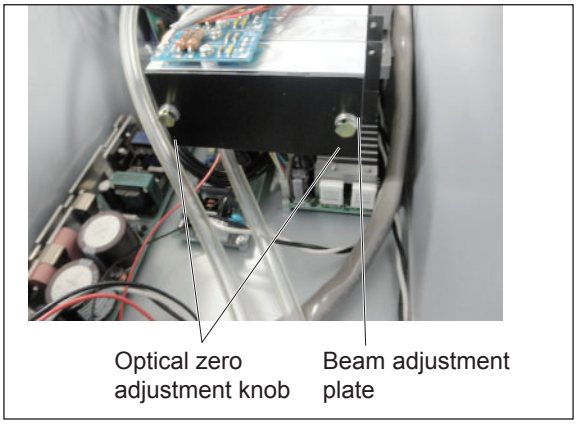
(6) Move the beam adjustment plate sidewise to change the value displayed at ⓒ.

(7) Move the beam adjustment plate sidewise to change the value displayed at ⓓ.

(8) Repeat the procedures in (4) to (7) to make all the displayed values come close to 0 as possible within ±100 range.

*** Adjust the beam adjustment plate which is the nearest to the zero adjustment knob first, and sequentially.**





(9) After the optical balance adjustment, mount the top cover of the analyzer unit, then carry out a moisture interference compensation adjustment, and perform zero and span calibrations.

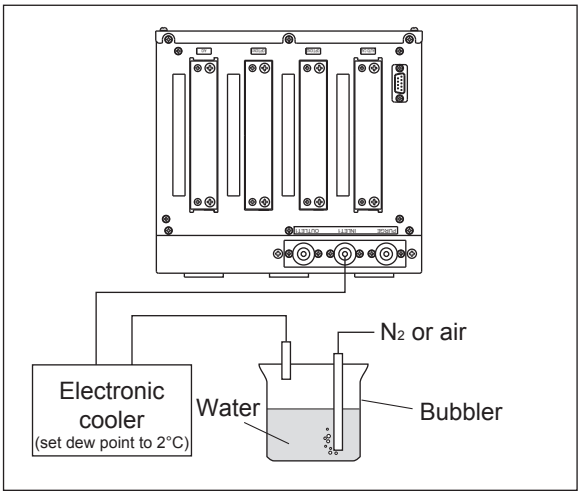
7.3.4 Moisture interference compensation adjustment method

⚠ CAUTION

If the following operation is maladjusted, the measurement may adversely be affected. If you are not trained for adjustment, do not carry out this operation but contact the distributor or our service engineer.

Proceed to an adjustment if excessively (beyond ± 2% FS) affected by moisture inteference. After the end of optical balance adjustment, be sure to carry out moisture inteference compensation adjustment.

(1) After warm-up, select the low range, allow dry gas (N_2, air) to flow at 0.5 L/min and carry out zero calibration.



(2) Display the moisture interference compensation screen of the analyzer unit (see "6.8 Maintenance mode"). Set the dew point to 2℃ by using an electronic cooler, and introduce bubbled N_2 or air gas to the analyzer (shown on the figure).

(3) On the screen, select a desired Ch (component) by pressing the (ENT) key, adjust the value at right by pressing the (▲) or the (▼) key so that the value at left falls within ±10 (make it as close to 0 as possible), and then press the (ENT) key to fix the value. (Exiting by "(ESC)" cancels the adjustment.) Or, selecting the "ALL" and pressing the "(ENT)" key, zeroes all components integrally.

(First, adjust all components by selecting ALL and then perform fine adjustment for components one by one using UP and DOWN keys.)

* If any components exceed the range of 0 to 10vol%, no adjustment can be performed (No interference compensation is required).

(4) After the end of adjustment for all components, return the piping to the original status and carry out zero and span calibrations.

Moisture interference Compensation Adj.		Select Ch No. with UP/ DOWN and ENT Back with ESC	
▶ Ch1	NOx	10	1.252
Ch2	SO_2	-33	0.983
ALL			
Valve OFF			

⇓ (ENT)

Moisture interference Compensation Adj.		Adjust with UP/ DOWN ENT : Memorized ESC : Back	
Ch1	NOx	10	1.252
Ch2	SO_2	-33	0.983
ALL			
Valve OFF			

7.4 Long-term maintenance products

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

Gas analyzer annual inspection plan sheet

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

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

• Installation condition

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

• Sample gas conditions

1) Temperature: +60˚C to +800˚C
2) Pressure: −3 to +3 kPa
3) Moisture content: 30% or less
4) Dust: 0.1 g/Nm^3 or less
5) Components: 0 to 500 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	Recommended replacement period (year)	Year										
					Delivered year	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year	8th year	9th year	10th year
Gas analyzer unit	NO_X, SO_2	Infrared light source (semi-sealed)	1	5						○					○
		Reference cell	1	5						○					○
		Measuring cell	1	5						○					○
		Distributing cell	1	5						○					○
		Interference filter	1	5						○					○
		Sector motor	1	2			○		○		○		○		○
		Sector motor power supply unit	1	5						○					○
		Switching power supply	1	3				○			○			○	
		LCD indicator	1	3				○			○			○	
		Main unit	1	10											○
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		○	○	○	○	○	○	○	○	○	○

8 Error message

If errors occur, the following contents are displayed.

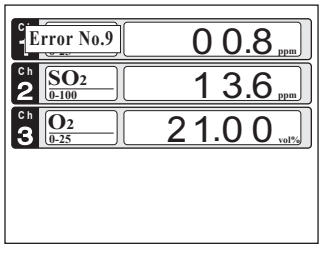
Error display	Error contents	Probable causes
Error No.1	Motor rotation detection signal faulty	• Motor rotation is faulty or stopped. • Motor rotation detector circuit is faulty. Note) Sector motor is a consumption part. It is recommendable to exchange the motor once two years.
Error No.4	Zero calibration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

When errors No. 1 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.

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



ENT

ESC

Display of error contents

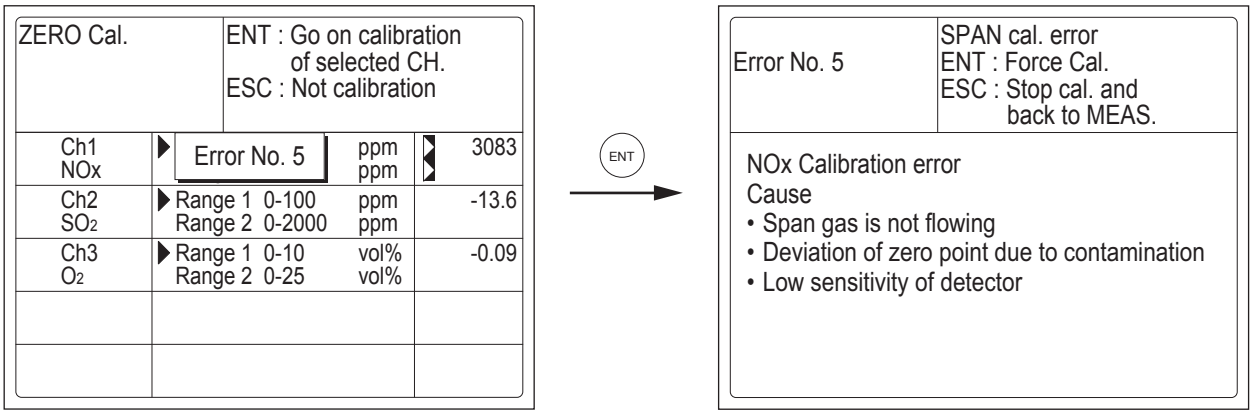
Error No. 9	Auto Cal. error ESC : Back to MEAS.

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

• Press the (ESC) key to delete the error display.
• If the (ESC) key is pressed without removing the cause of an error, the error will be displayed again.
• If you hear abnormal sound from the motor and also the error No. 1 is displayed, the error No.1 disappears by power-cycling the gas analyzer.

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

In case of Error No. 5 and No. 7

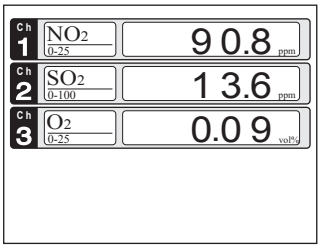


• Pressing (ESC) delete the error display.

(ENT) Calibrated forcedly

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

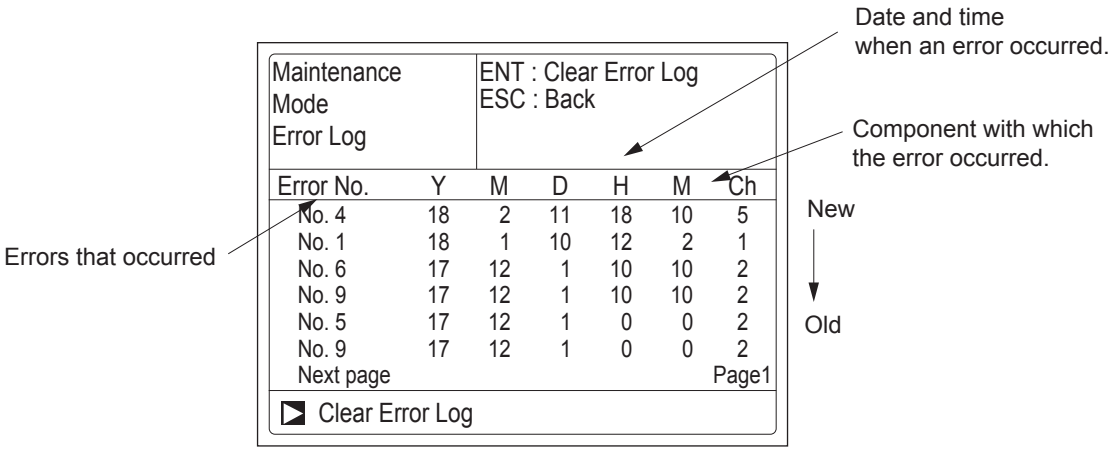
(ESC)



Error log file

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

Error log screen



*Up to 14 errors can be saved in the error history; the oldest error will be deleted one by one every time a new occurs.

*If the power supply is turned OFF, the contents in the error log file will not be lost or damaged.

Deletion of error history

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

9. SPECIFICATIONS

9.1 General specifications

1. Standard specifications

Principle of measurement:

NO, SO_2, CO_2, CO, CH_4;
Non-dispersion infrared-ray absorption method
Single light source and double beams (double-beam system)
O_2 ; Exclusive zirconia O_2 sensor (externally installed). Model: ZFK7

Measurable gas components and measuring range:

	Minimum range	Maximam range
NO	0 - 100ppm	0 - 5000ppm
SO_2	0 - 100ppm	0 - 10vol%
CO_2	0 - 100ppm	0 - 100vol%
CO	0 - 100ppm	0 - 100vol%
CH_4	0 - 200ppm	0 - 100vol%
O_2 (External Zirconia)	0 - 10vol%	0 - 25vol%

- Max. 3 components measurement including O_2.
- Measuring range ratio ≤ 1:5 (O_2 sensor)
  ≤ 1:25
  (except for O_2 sensor)
- Measuring ranges are changeable between the specified minimum and maximum range
  Settable one range or two ranges

*For measurable components and possible combinations of measuring ranges, refer to Tables 1-(1) to (3).

Measured value indication:

Digital indication in 4 digits
(LCD with back light)
- Instantaneous value of each component
- Instantaneous value after O_2 conversion (only in NO, SO_2, CO sensor with O_2 sensor)
- Average value after O_2 conversion (only in NO, SO_2, CO sensor with O_2 sensor)

Analog output signals:

4 to 20mA DC or 0 to 1V DC,
non-isolated output ; 7 points max.
Analog output corresponds to measured value indication in 1:1.
max.load 550Ω. for 4 to 20 mA DC
min.load 100kΩ. for 0 to 1V DC
* Refer to Table 2, for the channel No. of displayed values and analog output signals.

Analog input signal:

For signal input from externally installed O_2 sensor.
Signal requirement;
(1) Signal from Fuji's Zirconia O_2 sensor (TYPE: ZFK7)
(2) 0 to 1V DC from an O_2 sensor
Input section is not isolated.
(Depend on O_2 input signal, measured concentration indication and O_2 conversion.)

Relay contact output:

1a contact (250V AC/2A, resistive load)
Instrument error, calibration error, range identification, auto calibration status, pump ON/OFF.
solenoid valve drive signal for auto calibration, auto calibration end.
1c contact (250V AC/2A, resistive load selectable 6 outputs)
High/Low limit alarm contact output.
* All relay contacts are isolated mutually and from the internal circuit.

Contact input: No-voltage contact (ON/0V, OFF/5V DC, 5mA flowing at ON)
* For ZRG (ON/5V, OFF/0V)
Remote range switch, auto calibration remote start, remote holding, average value reset.
Isolated from the internal circuit with photocoupler. Contact inputs are not isolated from one another.

Power supply: Voltage rating ; 100V to 240V AC
Allowable range; 85V to 264V AC
Frequency ; 50Hz/60Hz
Power consumption; 250VA max.

Operating conditions:

Ambient temperature ; -5°C to 45°C
Ambient humidity ; 90% RH max., non-condensing

Storage conditions:

Ambient temperature; -20°C to 60°C
Ambient humidity ; 95% RH max., non-condensing

Dimensions (H × W × D):

Analyzer main unit;
835 × 218 × 202mm

Mass: Approx. 16 kg

Finish color: Front panel; Off-white (Munsell 10Y7.5/0.5 or equivalent)

Enclosure: Steel casing, for indoor use

Material of gas-contacting parts:

Gas inlet/outlet; Teflon
Sample cell; SUS304,chloroprene rubber
Infrared-ray transmitting window; CaF_2
O_2 sensor sample cell : SUS316
Internal piping; Toaron, Teflon

Gas inlet/outlet: Rc1/4 or ø6 hose end

Purge gas flow rate: 1L/min (when required)

2. Standard Functions

Output signal holding:

Output signals are held during manual and auto calibrations by activation of holding (turning “ON” its setting).
The values to be held are the ones just before start calibration mode or setting value.
It is selectable.
Indication of instantaneous values will not be held.

Remote output holding:

Output signal is held at the latest value or setting value by short-circuiting the remote output holding input terminals.
Holding is maintained while the terminals are short-circuited. Indication of instantaneous values will not be held.

Switch ranges :

The switch ranges is available in manual, auto, and remote modes. Only preset switch method is effective.

Manual: Allows range to switch by key operation.

Auto: Allows range to switch from low to high range when 90%FS or more is available in the low range.
Allows range to switch from high to low range when 80%FS or less is available in the low range.

Remote: No-voltage contact input (for measurable components)
Allows range to switch via an external signal when remote range switch input is received.
When the contact input terminals for each component are short-circuited, the first range is selected, and it is switched to the second range when the terminals are open.

Range identification signal:

The present measuring range is identified by a contact signal.
The contact output terminals for each component are short-circuited when the first range is selected, and when the second range is selected, the terminals are open.

Auto calibration:

Auto calibration is carried out periodically at the preset cycle.
When a standard gas cylinder for calibration and a solenoid valve for opening/closing the gas flow line are prepared externally by the customer, calibration will be carried out with the solenoid valve drive contacts for zero calibration and each span calibration turned on/off sequentially at the set auto calibration timing.

Auto calibration cycle setting:

Auto calibration cycle is set.
Setting is variable within 1 to 99 hours (in increments of 1 hour) or 1 to 40 days (in increments of 1 day).

Gas flow time setting:

The time for flowing each calibration gas in auto calibration is set.
Settable within 60 to 900 seconds (in increments of 1 second)

Auto calibration remote start:

Auto calibration is carried out only once according to an external input signal.
Calibration sequence is settable in the same way as the general auto calibration.
Auto calibration is started by opening the auto calibration remote start input terminals after short-circuiting for 1.5 seconds or longer.

Auto zero calibration:

Auto zero calibration is carried out periodically at the preset cycle.
This cycle is independent on “Auto calibradion” cycle.
When zero calibration gas and solenoid valve for opening/closing the calibration gas flow line are prepared externally by the customer, zero calibration will be carried out with the solenoid valve drive contact for zero calibration turned on/off at the set auto zero calibration timing.

Auto zero calibration cycle setting:

Auto zero calibration cycle is set.
Setting is variable within 1 to 99 hours (in increments of 1 hour) or
Setting is variable within 1 to 40 days (in increments of 1 day)

Gas flow time setting:

The timing for flowing zero gas in auto zero calibration is set.
Settable 60 to 900 seconds (in increments of 1 second)

High/Low limit alarm:

Alarm contact output turns on when measurement value reach to the preset high or low limit alarm value.
Contacts close when the channel value of each channel becomes larger than the high alarm limit value or smaller than the low alarm limit value.

Instrument error contact output:

Contacts close at occurrence of analyzer error No. 1, 3 or 10.

Calibration error contact output:

Contacts close at occurrence of manual or auto calibration error (any of errors No. 4 to 9).

Auto calibration status contact outputs:

Contacts close during auto calibration.

Pump ON/OFF contact output:

During measurement, this contact close. While calibration gas is flowing, this contact open. This contact is connected in power supply of pump, and stop the sample gas while calibration gas flowing.

Average value reset:

Average value after O_2 conversion is started under preset condition by opening the average value reset input terminals after short-circuiting for 1.5 seconds or longer.
Reset is carried out by short-circuiting.
Restart is carried out by opening.

Auto calibration interlocking function:

When these two products are lined up and installed, output the auto calibration synchronized signal to second product.
Contact output during auto calibration:
While auto calibration is carried out, this contact is closed.
Auto calibration end contact output:
Contact is closed for 1.5 seconds after finishing to flow the gas of auto calibration.

3. Optional function

O_2 conversion: Conversion of measured NO, SO_2 and CO gas concentrations into values at standard O_2 concentration

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

C : Sample gas concentration after O_2 conversion
Cs : Measured concentration of sample gas
Os : Measured O_2 concentration (Limit settable, 1 to 20%O_2)
On: Standard O_2 concentration (value changeable by setting; 0 to 19%O_2)

Average value after O_2 conversion :

The result of O_2 conversion or instantaneous O_2 value can be outputted as an average value in the preset period of time.
Used for averaging is the moving average method in which sampling is carried out at intervals of 30 seconds.
(Output is updated every 30 seconds. It is the average value in the determined period of time just before the latest updating.)
Averaging time is settable within 1 to 59 minutes (in increments of 1 minute) or 1 to 4 hours (in increments of 1 hour).

Communication function:

RS-232C (9pins D-sub)
Half-duplex bit serial
Start-stop synchronization
Modbus™ protcol
Contents: Read/Wright parameters
Read measurement concentration and instrument status
Remark: When connecting via RS-485 interface, a RS-232C ⟷ RS-485 converter should be used.

4. Performance

Repeatability : ±0.5% of full scale
Linearity : ±1% of full scale
Zero drift : ±1% of full scale/week
(±2% of full scale/week; range be tween 0 to 100ppm and 0 to 200ppm)
Span drift : ±2% of full scale/week
Response time (for 90% FS response) :
15 sec electrical response
Within 60 seconds including replacement time of sampling gas (when gas flow rate is 0.5L/min)
Gas replacement time depends on the number of measuring components and measuring range

5. Standard Requirements for Sample Gas

Flow rate : 0.5L / min ±0.2L / min
Temperature : 0 to 50°C
Pressure : 10 kPa or less (Gas outlet side should be open to the atmospheric air.)
Dust : 100μg/Nm^3 or less in particle size of 1μm or less
Mist : Unallowable
Moisture : Below a level where saturation occurs at 2°C (condensation unallowable).
Corrosive component:
1 ppm or less
Standard gas for calibration:
Zero gas ; Dry N_2
Span gas ; Each sample gas having concentration 90 to 100% of its measuring component range (recommended).
Gas beyond concentration 100%FS is unusable.
In case a zirconia O_2 analyzer is installed externally and calibration is carried out on the same calibration gas line:
Zero gas ; Dry air or atmospheric air (provided without CO_2 sensor)
Span gas ; Except O_2 measurement, each sample gas having concentration 90 to 100% of its measuring range. For O_2 sensor, O_2 gas of 1 to 2vol%.

6. Installation Requirements

- Indoor use. (Select a place where the equipment does not receive direct sunshine, draft/rain or radiation from hot substances. If such a place cannot be found, a roof or cover should be prepared for protection.)
- Avoide a place where receives heavy vibration
- Select a place where atmospheric air is clean

7. EC Directive Compliance

The product conforms to requirement of the Low Voltage Directive and EMC directive.
It conforms to following standards for product safety and electromagnetic compatibility ;

EN61010-1 : 2001, EN62311 : 2008
Safety requirements for electrical equipment for measurement, control and laboratory use.
EN61326-1~2006
EN61326-2-3 : 2006, EN61000-3-2 : 2006, A1: 2009, A2: 2009,
EN61000-3-3 : 2008
Electrical equipment for measurement, control and laboratory use – EMC requirements.

*The product mounted in a steel enclosure conforms to the requirements of EMC directive.

ZRG ⟷ ZKJK differences

	ZRG	ZKJK
Contact input	DC5V	No-voltage contact
Zirconia O_2 analyzer	ZFK3, 4	ZFK7
Average value	Calculation is always carried out even during holding.	Calculation is suspended during holding
Calibration error contact	Auto calibration status error	Calibration status error (Auto/manual)

9.2 Code symbols

Basic type: ZKJK□□□5-Y□□□□-□YYYY□□-□□□

Digit	Description		note
4	<Custom specifications> Replecement of ZRG type		
5	<Measurable component (NO, SO_2, CO_2, CO, CH_4)>		
	1st component	2nd component	
	NO		
	SO_2		
	CO_2		
	CO		
	CH_4		
	NO	SO_2	
	CO_2	CO	
	Others		
6	<Measurable component (O_2)> None External zirconia type O_2 sensor (ZFK7 type) External O_2 analyzer without external indication (input the signal for O_2 conversion externally)		note 1 note 2, 9
7	<Gas inlet/outlet> Rc1/4 (with purging inlet) Teflon ø6 (none purging inlet)		
8	<Revision code>		
9	–		
10	<Indication> In Japanese In English		
11	<Measuring range> 1st component.1st range 0-100ppm 0-200ppm 0-250ppm 0-500ppm 0-1000ppm		note 3
	0-2000ppm 0-5000ppm 0-1% 0-2% 0-5%		
	0-10% 0-20% 0-50% 0-100% Others		
12	<Measuring range> 1st component.2nd range None 0-200ppm 0-250ppm 0-500ppm 0-1000ppm		note 3
	0-2000ppm 0-5000ppm 0-1% 0-2% 0-5%		
	0-10% 0-20% 0-50% 0-100% Others		

Digit	Description	note	1 2 3 4 5 6 7 8	9 10 11 12 13	14 15 16 17 18 19 20	21 22 23 ← Digit No. of code
			Z K J K 5	- Y	- Y Y Y Y	-
13	<Measuring range> 2nd component.1st range	note 3				
	None			Y		
	0-100ppm			B		
	0-200ppm			C		
	0-250ppm			D		
	0-500ppm			E		
	0-1000ppm			F		
	0-2000ppm			G		
	0-5000ppm			H		
	0-1%			J		
	0-2%			K		
	0-5%			L		
	0-10%			M		
	0-20%			N		
	0-50%			P		
	0-100%			R		
	Others			Z		
14	<Measuring range> 2nd component.2nd range	note 3				
	None				Y	
	0-200ppm				C	
	0-250ppm				D	
	0-500ppm				E	
	0-1000ppm				F	
	0-2000ppm				G	
	0-5000ppm				H	
	0-1%				J	
	0-2%				K	
	0-5%				L	
	0-10%				M	
	0-20%				N	
	0-50%				P	
	0-100%				R	
	Others				Z	
15	–				Y Y	
16						
17	–				Y Y	
18						
19	<O_2 sensor range>					
20	Minimun range / Maximum range					
	None / None	note 4			Y Y	
	0-10% / 0-25%				M V	
	0-25% / None	note 5, 9			V Y	
	Others				Z Z	
21	<Output>					
	4 to 20mA DC					A
	0 to 1V DC					B
	4 to 20mA DC + communication function					C
	0 to 1V DC + communication function					D
22	<O_2 conversion>	note 6				
	None	note 7				Y
	With O_2 conversion output					A
23	<Ajustment>					
	For combustion exhaust gas					B
	Others	note 8				Z

Note 1 a) when “B” is specified at the 6th digit, O_2 sensor signal should be set as 0-1VDC linear corresponding to full scale.
b) External zirconia O_2 sensor and external O_2 analyzer are not included in the scope of supply.

Note 2 When two products are lined up and installed, please refer to the corresponding table for measured value to specify the digit for second product. (Please also refer to note 9)

Note 3 Please refer to the appendix, for possible combination of measuring components and range in the data sheet.

Note 4 When "Y", "D" is specified at the 6th digit, Only "YY" should be selected.

Note 5 When two products are lined up and installed, Only "VY" should be selected for both products. (Please also refer to note 9)

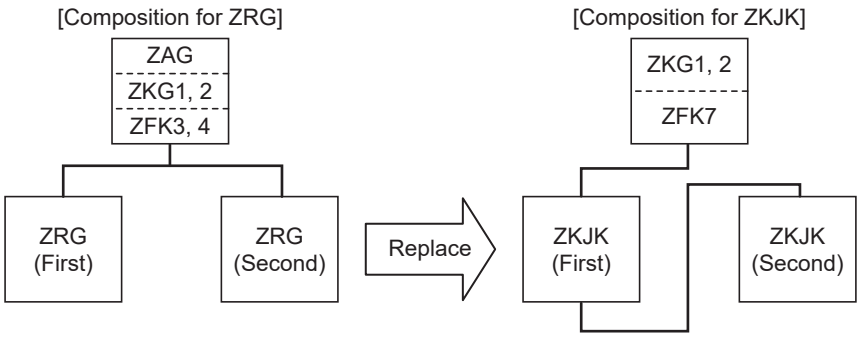
Note 6 Only measuring value of NO, SO_2, CO are calculated as O_2 calculation, O_2 converted average value are outputted at the same time.

Note 7 When "Y" is specified at the 6th digit, Only "Y" should be selected.

Note 8 When "Z" is specified at the 23rd digit, gas composition table of actual measured gas has to be sent to Fuji with your purchase order.

Note 9 Precaution to observe when performing installation of two analyzers with external O_2 analyzer

• When two ZKJK are lined up side by side and installed with external O_2 analyzer, Be sure to observe connection of external O2 analyzer shown following diagram on the right side. (with converted value/converted average value)
In this case O_2 indication can not be conducted with second ZKJK (due to limitation of measurement)
Please refer to "Connecting method/analog output component" for connection to the terminal.



*First analyzer: This analyzer is connected to O_2 signal directly and indicate O_2 indication.
Second analyzer: This analyzer is connected to O_2 instantaneous value from first analyzer and could not indicate O_2 indication.

• O_2 range is fixed 0-25%.
• With these connection component for second analyzer should be NO sensor, SO_2 sensor or NO/SO_2 sensor.
Please refer to the "correspondence table for measured value" "Code symbols" for details.
• When ZRG is replaced, two analyzers should be replaced at the same time.

9.3 Measurable component and range – availability check table –

(*) Range code shows settable combination of the maximum range rate.

(1) Single component analyzer (NO, SO_2, CO_2, CO, CH_4)

☆ : NO Measuring range　□ : SO_2 Measuring range　◎ : CO_2 Measuring range

○ : CO Measuring range　△ : CH_4 Measuring range

1st range \ 2st range		C	D	E	F	G	H	J	K	L	M	N	P	R
		0 ~ 200ppm	0 ~ 250ppm	0 ~ 500ppm	0 ~ 1000ppm	0 ~ 2000ppm	0 ~ 5000ppm	0 ~ 1%	0 ~ 2%	0 ~ 5%	0 ~ 10%	0 ~ 20%	0 ~ 50%	0 ~ 100%
B	0 ~ 100ppm	☆□◎○	☆□◎○	☆□◎○	☆□◎○	☆□◎○								
C	0 ~ 200ppm		☆□◎○△	☆□◎○△	☆□◎○△	☆□◎○△	☆□◎○△							
D	0 ~ 250ppm			☆□◎○△	☆□◎○△	☆□◎○△	☆□◎○△							
E	0 ~ 500ppm				☆□◎○△	☆□◎○△	☆□◎○△	□◎○△						
F	0 ~ 1000ppm					☆□◎○△	☆□◎○△	□◎○△	□◎○△					
G	0 ~ 2000ppm						☆□◎○△	□◎○△	□◎○△	□◎○△				
H	0 ~ 5000ppm							□◎○△	□◎○△	□◎○△	□◎○△			
J	0 ~ 1%								□◎○△	□◎○△	□◎○△	◎○△		
K	0 ~ 2%									□◎○△	□◎○△	◎○△	◎○△	
L	0 ~ 5%										□◎○△	◎○△	◎○△	◎○△
M	0 ~ 10%											◎○△	◎○△	◎○△
N	0 ~ 20%												◎○△	◎○△
P	0 ~ 50%													◎○△
R	0 ~ 100%													

(2) Double-component analyzer (NO/SO_2)

○ : Double-component analyzer Measuring range (1st range)

NO \ SO_2		B	C	D	E	F	G	H
		0 ~ 100ppm	0 ~ 200ppm	0 ~ 250ppm	0 ~ 500ppm	0 ~ 1000ppm	0 ~ 2000ppm	0 ~ 5000ppm
B	0 ~ 100ppm	○	○	○	○	○	○	○
C	0 ~ 200ppm	○	○	○	○	○	○	○
D	0 ~ 250ppm	○	○	○	○	○	○	○
E	0 ~ 500ppm	○	○	○	○	○	○	○
F	0 ~ 1000ppm	○	○	○	○	○	○	○
G	0 ~ 2000ppm	○	○	○	○	○	○	○

*** 2nd range: Max. NO (0-200ppm), SO_2 (0-5000ppm), Selectable range up to 25 times of 1st. range**

(3) Double-component analyzer (CO_2/CO)

①~⑤ : Double-component analyzer Measuring range (1st range)

CO_2 \ CO		B	C	D	E	F	G	H	J	K	L	M	N	P	R
		0 ~ 100ppm	0 ~ 200ppm	0 ~ 250ppm	0 ~ 500ppm	0 ~ 1000ppm	0 ~ 2000ppm	0 ~ 5000ppm	0 ~ 1%	0 ~ 2%	0 ~ 5%	0 ~ 10%	0 ~ 20%	0 ~ 50%	0 ~ 100%
B	0 ~ 100ppm	①	①	①	①	①	①	①							
C	0 ~ 200ppm	①	①	①	①	①	①	①							
D	0 ~ 250ppm	①	①	①	①	①	①	①							
E	0 ~ 500ppm	①	①	①	①	①	①	①							
F	0 ~ 1000ppm	①	①	①	①	①	①	①							
G	0 ~ 2000ppm	①	①	①	①	①	①	①							
H	0 ~ 5000ppm	①	①	①	①	①	①	①	③	③	③				
J	0 ~ 1%								③	④	④				
K	0 ~ 2%								③	④	④				
L	0 ~ 5%								③	④	④				
M	0 ~ 10%	②	②	②	②	②	②	②				⑤	⑤	⑤	⑤
N	0 ~ 20%	②	②	②	②	②	②	②				⑤	⑤	⑤	⑤
P	0 ~ 50%											⑤	⑤	⑤	⑤
R	0 ~ 100%											⑤	⑤	⑤	⑤

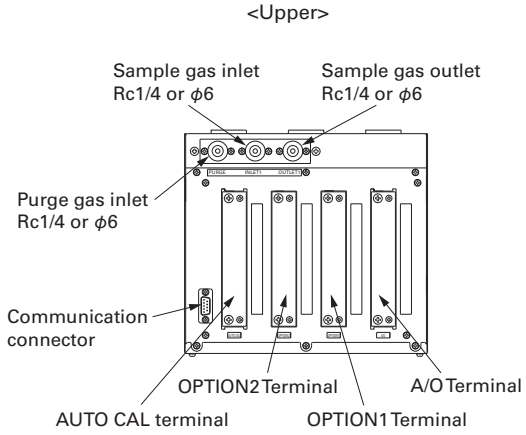
*** Max. measuring range as 2nd range is following. Selectable range up to 25times of 1st range.**

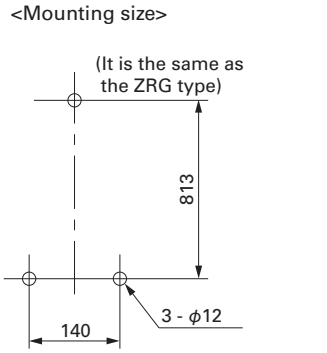
① : CO (0-5000ppm), CO_2 (0-5000ppm)　② : CO (0-5000ppm), CO_2 (0-20%)

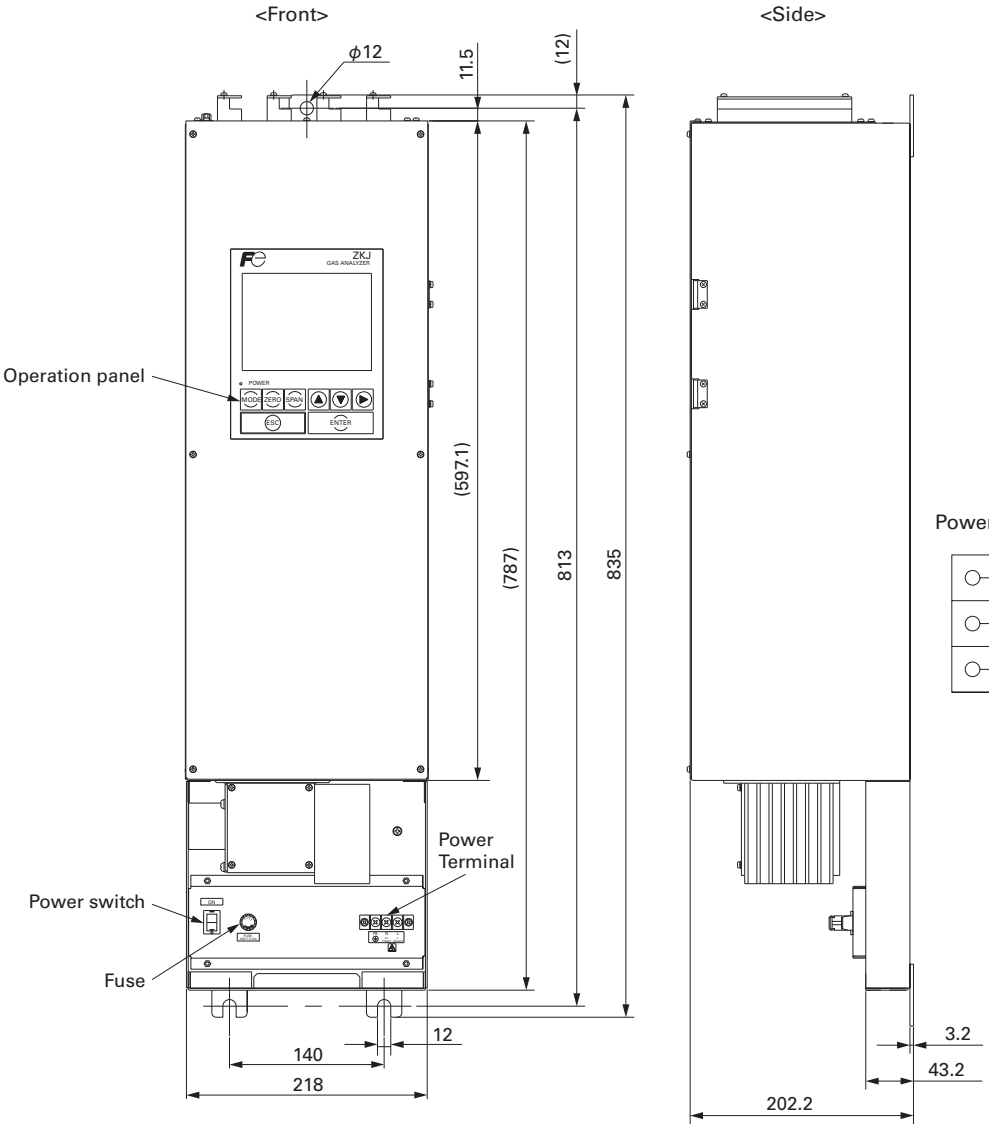
③ : CO (0-50%), CO_2 (0-20%)　④ : Selectable range up to 25 times.　⑤ : CO (0-100%), CO_2 (0-100%)

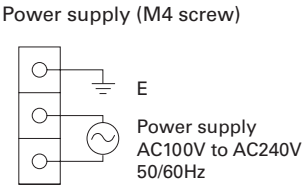
9.4 Outline diagram

<Analyzer main unit>









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