



Instruction Manual

PARAMAGNETIC OXYGEN ANALYZER

TYPE: ZAJ-6



PREFACE

We are grateful for your purchase of Fuji Electric's paramagnetic oxygen analyzer (ZAJ).

- First read this instruction manual carefully until an adequate understanding is acquired, and then proceed to installation, operation and maintenance of the gas analyzer. Wrong handling may cause an accident or injury.
- The specifications of this analyzer will be changed without prior notice for further product improvement.
- Modification of this gas analyzer is strictly prohibited unless a written approval is obtained from the manufacturer. Fuji Electric will not bear any responsibility for a trouble caused by such a modification.
- This instruction manual shall be stored by the person who actually uses the gas analyzer.
- After reading the manual, be sure to store it at a place easier to access.
- This instruction manual should be delivered to the end user without fail.
- If you return the product to us for repair, provide us with a document that indicates the purpose of export is repair, and a certificate that indicates that the equipment includes no substances restricted by RoHS directive or laws and regulations of the exporting country. We are not liable in the cases that the re-export from Japan to you is not permitted due to imperfection of the above documents.

Delivered items

- Oxygen analyzer ZAJ × 1
- Instruction manual × 1
- Fuse (250 V AC, 2A) × 2
- Accessories (orifice × 1, packing × 6, filter × 2)
- Ferrite core × 3

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

Request

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

© Fuji Electric Co., Ltd. 2018

Issued in June, 2018
Rev.1st edition November, 2021
Rev.2nd edition July, 2022

SAFETY INSTRUCTIONS

To operate the analyzer properly, be sure to read carefully.

- The descriptions listed here provide important information on safety. Be sure to observe them at all times. Those safety precautions are classified into three 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 indicated.

Unpacking and returning

 CAUTION	• This product is precision instrument. Handle it with due caution not to give a shock. • If you return the product for repair, pack it with materials that can protect the product from shock during transportation.
---	---

Installation and transport

 CAUTION	• 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.
 DANGER	• For installation, observe the rule given in the instruction manual, and select a place where the weight of analyzer can be supported. Installation in an inadequate place may cause turnover or falling, resulting in injury. • Be sure to wear protective gloves when lifting the analyzer. Lifting it with bare hands may result in injury. • Be sure to fix the cover before transporting the analyzer. Transportation in unstable state may result in injury. • The gas analyzer is heavy. To transport the analyzer, please use a hand cart or equivalent. Prevent from carrying analyzer by hand as much as possible. 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.

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 not contaminated by oils. Otherwise, fire may result.

Wiring	
 CAUTION	• Turn off the power before wiring. Otherwise, electric shock may result. • Perform protective earth ground connection. 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. • Connect a power supply of correct rating. Otherwise, fire may result.

Operation	
 DANGER	• Be sure to read the instruction manual before handling standard 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 for each. Otherwise, intended performance may not be achieved. Also, accidents or injury may result. • Do not operate the analyzer for a long time with its cover left open. Otherwise, dust, foreign matter, etc. may contaminate on internal walls, thereby causing faults. • 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.

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 zero gas. 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 with wet hands. • 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. Besides accidents or failures may result. • Dispose replacement parts such as maintenance parts as combustibles according to the local waste disposal regulations.

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

WARRANTY AND MAINTENANCE

1. Scope of application

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

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

Be sure to use this instrument under the conditions or environment mentioned in this instruction manual. Please consult us for specifications for the following applications:

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

2. Operating conditions and environment

Refer to "Safety instructions" and "9. Specifications".

3. Precautions and prohibitions

Refer to "Safety instructions" and "9. Specifications".

4. Warranty

4-1. Period of warranty

- (1) Warranty period for this product including accessories is one year after delivery.
- (2) Warranty period for the parts repaired by our service providers is six months after the completion of repair.

4-2. Scope of warranty

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

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

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

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

5. Failure diagnosis

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

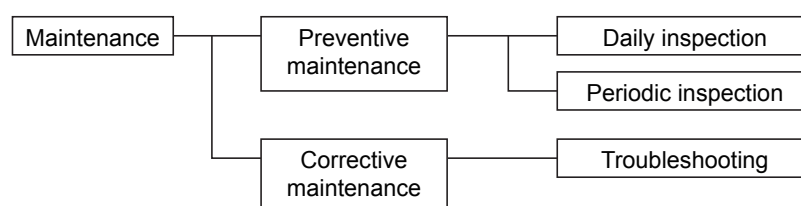
6. Service life

This product, excluding limited-life parts and consumable parts, is designed for a service life of 10 years under a general condition (average ambient temperature of 30°C).

The service life may be shortened depending on operating conditions and environment. To ensure the service life, it is important to perform planned maintenance of the product including limited-life parts and consumable parts.

7. Maintenance plan

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



(1) Daily inspection

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

(2) Periodic inspection

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

(3) Corrective maintenance

Corrective maintenance is a measure to be taken after a trouble has occurred. Refer to "8. Error message". If the measures mentioned in this instruction manual do not solve the problem, please contact our sales office or service office.

8. Limited-life parts and consumable parts

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

(1) Aluminum electrolytic capacitors

- Design life: 5 years under general working conditions (annual average of ambient temperature: 30°C)
- Symptoms when a capacitor loses its capacity: deterioration of power quality, malfunction
- Factors which affect capacitor life: temperature The life is shortened by half when the temperature rises by 10°C. (Arrhenius' law)

-
- Replacement: Estimate the lifetime of capacitor according to your operating environment, and have the capacitor replaced or overhauled at appropriate time, at least once in 10 years. Do not use capacitors beyond its lifetime. Otherwise, electrolyte leakage or depletion may cause odor, smoke, or fire. Please contact Fuji Electric or its service providers when an overhaul is required.

(2) LCD

- Design life: approx. three years for continuous use
- Symptoms of LCD screen's end-of-life: deterioration of display, backlight failure, etc.
- Factors which affect LCD's life: temperature. The life is shortened by half when the temperature rises by 10°C. (Arrhenius' law)
- Replacement: Estimate the lifetime of LCD according to your operating environment, and have the LCD replaced at appropriate time.

9. Spare parts and accessories

Refer to "2. Design" and "7. Maintenance" for details.

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

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

CONTENTS

PREFACE.....	i
SAFETY INSTRUCTIONS	ii
WARRANTY AND MAINTENANCE.....	vi
CONTENTS	ix
1. PRINCIPLE	1
2. DESIGN.....	3
3. INSTALLATION	4
3.1 Requirements	4
3.2 Mounting.....	5
3.3 Piping	6
3.4 Gas sampling.....	9
3.4.1 Sample gas requirements	9
3.4.2 Reference gas	9
3.4.3 Standard gas	10
3.4.4 Purging of instrument inside.....	10
3.4.5 Sampling system	10
3.5 Wiring.....	11
3.5.1 Power source.....	11
3.5.2 Measured value output signal	12
3.5.3 Analog input for interference compensation	12
3.5.4 Digital input	13
3.5.5 Digital output	13
3.5.6 Communication.....	13
3.5.7 Terminals	14
3.5.8 Contact output for calibration	15
4. OPERATION	16
4.1 Set up procedure.....	16
4.1.1 Pipe airtightness test	17
4.1.2 Check of reference gas flow rate.....	18
4.1.3 Check of piping.....	18
4.1.4 Purging of instrument inside.....	18
4.2 Warm-up and operation.....	19
5. DISPLAY AND KEYS	20
5.1 Overview	20
5.2 Menu map	21
5.3 Display	22

6.	SETTING AND CALIBRATION.....	23
6.1	Switching the range.....	23
6.2	Calibration settings	24
6.2.1	Calibration gas concentration	25
6.2.2	Manual zero calibration setting.....	26
6.2.3	Calibration range setting.....	27
6.2.4	Auto calibration component / range.....	29
6.3	Alarm setting.....	30
6.3.1	Alarm value.....	30
6.3.2	Hysteresis.....	32
6.4	Auto calibration setting.....	33
6.4.1	Auto calibration	33
6.4.2	Forced run/termination of auto calibration	34
6.5	Parameter settings	35
6.6	Maintenance mode	38
6.6.1	Sensor input	38
6.6.2	Error Log.....	38
6.6.3	Cal. Log	39
6.6.4	Station No.	39
6.6.5	Password Set	40
6.6.6	Output Adj.....	40
6.6.7	Range Setting.....	41
6.7	Calibration.....	42
6.7.1	Zero calibration.....	42
6.7.2	Span calibration	43
7.	MAINTENANCE	44
7.1	Daily check	44
7.1.1	Zero calibration and span calibration.....	44
7.1.2	Flow rate check: sample gas and purge gas	44
7.1.3	Flow rate check: reference gas.....	44
7.2	Daily check and maintenance procedures	44
7.3	Replacement of fuse.....	45
7.4	Replacement of filter and packing	46
7.5	Replacement of reference gas cylinder	47
7.6	Long-term maintenance	48
8.	ERROR MESSAGE.....	49
9.	SPECIFICATIONS	51
9.1	General specifications	51
9.2	Code symbols.....	53
9.3	Outline diagram.....	54

1. PRINCIPLE

The magnetic force type (pressure detection type) oxygen analyzer measures the oxygen content in sample gases by converting oxygen concentration into pressure depending on the magnetic property of oxygen.

Because this analyzer detects a difference in oxygen concentration between sample gas and reference gas, **a reference gas cylinder is indispensable.**

All gases have positive or negative magnetic susceptibilities as shown in Table 1-1.

Among these gases, O₂, NO and NO₂ have high positive magnetic susceptibilities and are attracted strongly by magnetic field, whereas the others are diamagnetic substances. NO and NO₂ may be contained in combustion gas at negligibly low concentrations.

It is therefore possible to measure O₂ contents in various types of gases by utilizing its magnetic susceptibility. Fig. 1-1 illustrates the principle.

Table 1-1 Relative susceptibilities of various gases

Kind of gas	Relative susceptibility	Kind of gas	Relative susceptibility
Oxygen	+100	Nitrogen	-0.42
Air	+21 (dry air)	Chlorine	-0.13
Carbon dioxide	-0.61	Hydrogen	-0.12
Argon	-0.58	Acetylene	-0.38
Ammonia	-0.58	Nitrous oxide	-0.58
Ethane	-0.83	Nitrogen monoxide	+43.8
Methane	-0.37	Nitrogen dioxide	+28.0

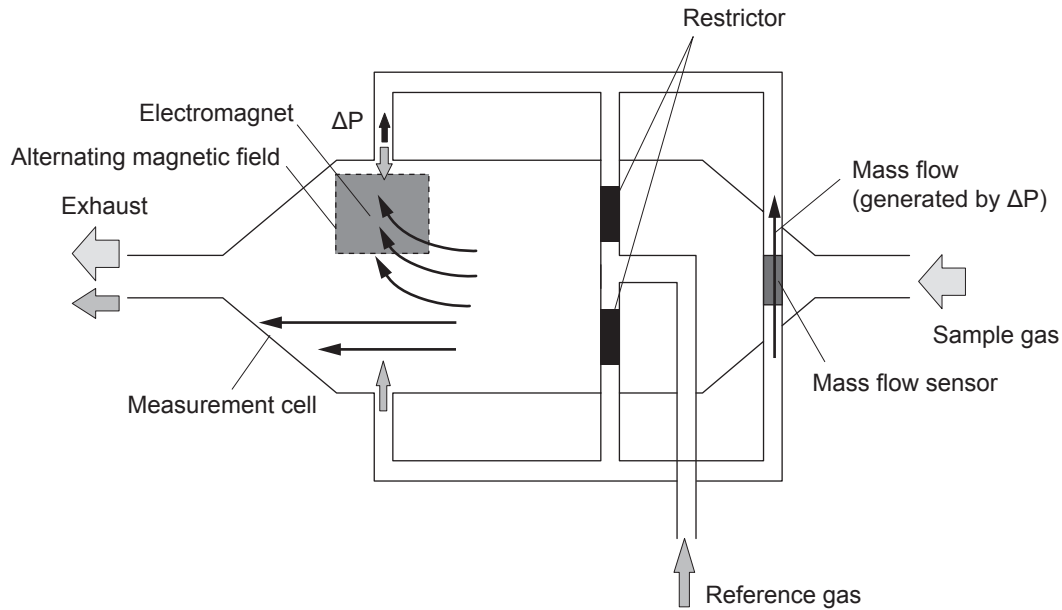


Fig. 1-1 Principle of operation

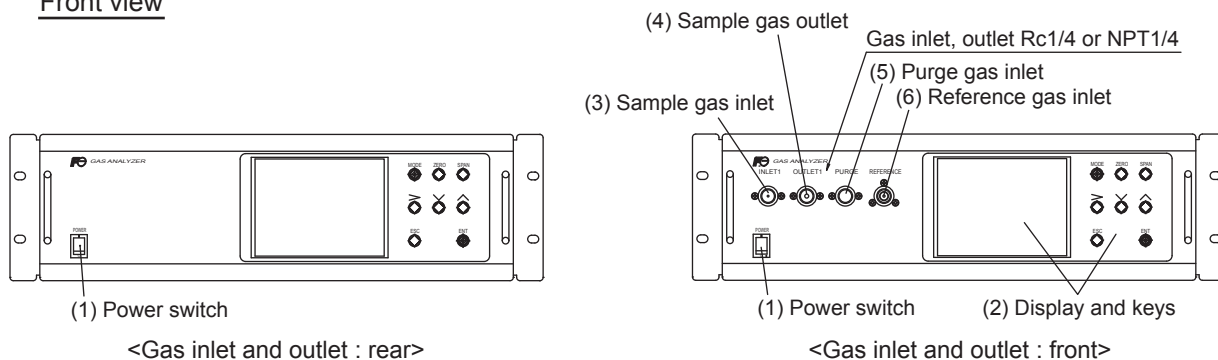
The detector is composed of a sample cell, a reference gas path, and electromagnet. The electromagnet is made up of a magnet core, pole pieces, and a coil. When an alternating current is passed through the coil wrapped around the magnetic core, an alternating magnetic field is generated. The electromagnet is placed one side of the sample cell so that the magnetic field exists only on the side. Because oxygen is attracted by the magnet, oxygen in sample gas moves towards the side where magnetic field exists. This causes the pressure change in the reference gas line through which the reference gas passes. The pressure change is proportional to the oxygen concentration in the sample gas.

The mass flow sensor placed in the reference gas line converts the mass flow caused by the pressure change into an electrical signal. Thus the analyzer delivers the oxygen concentration in the sample gas.

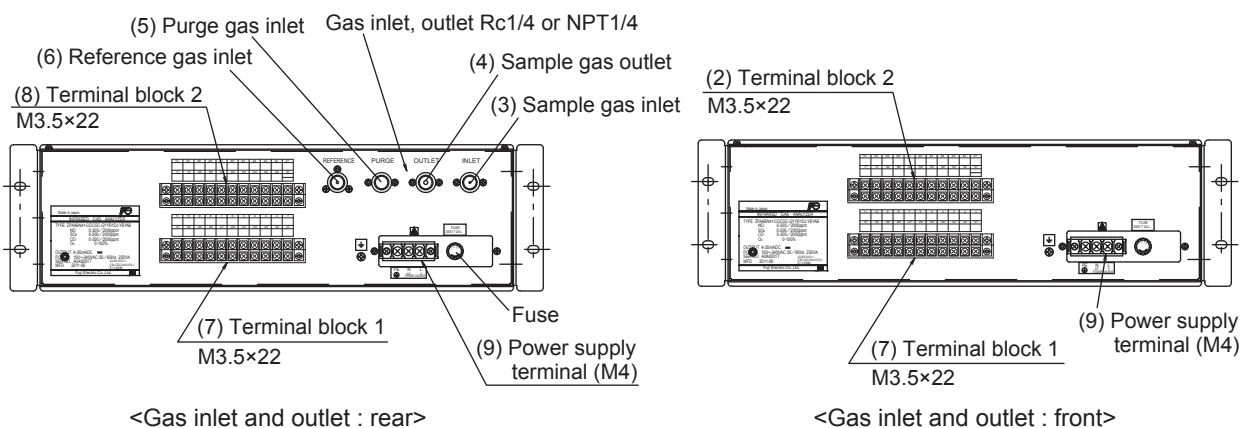
As the mass flow is not affected by the thermal conductivity, viscosity, and specific heat of sample gas, the interference effect is negligible.

2. DESIGN

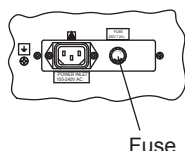
Front view



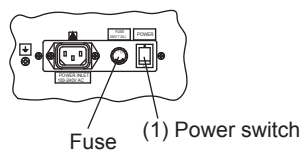
Rear view



AC power socket,
power switch on front panel



AC power socket,
power switch on rear panel



Name	Description
(1) Power switch	Used for ON/OFF the analyzer.
(2) Display and keys	Liquid crystal display and keys for setting various functions.
(3) Sample gas inlet	For connecting the sample gas tube.
(4) Sample gas outlet	For connecting the exhaust line.
(5) Purge gas inlet	For connecting the purge gas tube.
(6) Reference gas inlet	For connecting the reference gas tube.
(7) Terminal block 1	digital I/O and analog I/O terminals
(8) Terminal block 2	digital I/O terminals
(9) Power supply terminal	For the power supply

3. INSTALLATION

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

- For installation, observe the rule given in the instruction manual, and select a place where the weight of analyzer can be supported. Installation in an inadequate place may cause turnover or falling, resulting in injury.
- Be sure to wear protective gloves when lifting the analyzer. Lifting it with bare hands may result in injury.
- Be sure to fix the cover before transporting the analyzer. Transportation in unstable state may result in injury.
- The gas analyzer is heavy. To transport the analyzer, please use a hand cart or equivalent. Prevent from carrying analyzer by hand as much as possible. 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.

3.1 Requirements

Installation site

- Where the analyzer is not exposed to direct sunlight, wind, rain, or radiation heat from high-temperature matter. If you cannot find such a place as above, use a sunshade or a heat shielding plate to protect the analyzer.

- Where the analyzer receives no heavy vibration

Large ambient vibration may impact indication values. Therefore, install it in a location not susceptible to vibration.

We recommend types that have a built-in buffer tank to reduce the impact of ambient vibration.

It may also be possible to reduce it by adopting anti-vibration measures for the installation specifications described on the next page.

- Where the atmosphere is clean

Power supply voltage: Voltage rating: 100 to 240V AC

Allowable range: 85 to 264V AC

Frequency: 50Hz/60Hz (3-pin socket)

Power consumption: ≤ 90 VA

Ambient temperature: -5°C to 45°C

Ambient humidity: $\leq 90\%\text{RH}$

Storage temperature: -20°C to 70°C

Storage humidity: $\leq 95\%\text{RH}$

Maintenance space

If ZAJ is used independently, secure the space shown in the figure below.

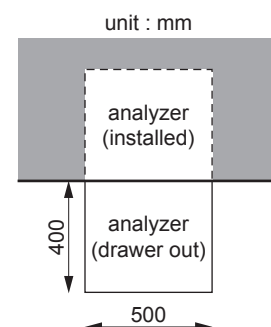
If ZAJ is integrated into a system, follow the instructions of the system.

A switch or a circuit-breaker should be included in the installation.

The breaker should be installed near the analyzer where an operator can access it.

The breaker should be identified as the one for this product.

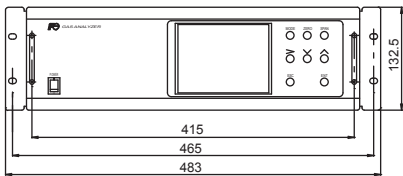
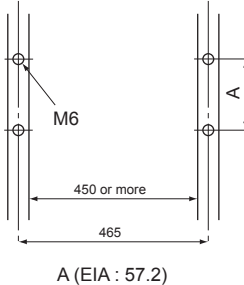
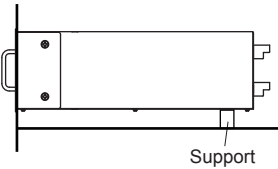
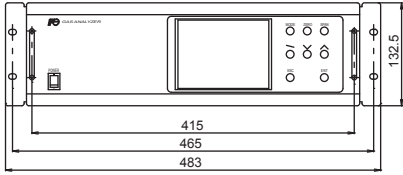
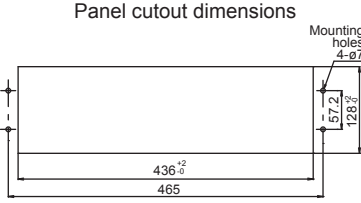
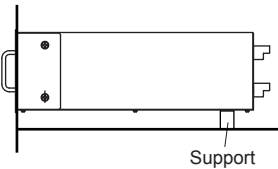
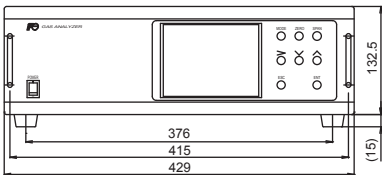
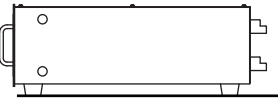
The breaker must meet the rating of the analyzer.



3.2 Mounting

The analyzer is mountable in any of the three ways below depending on type specification.

(Unit: mm)

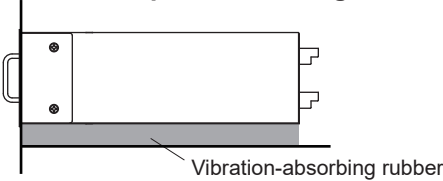
	External dimensions	Mounting dimensions	Side view
19-inch rack mounting			
Panel mounting			
Desk top			

Notes:

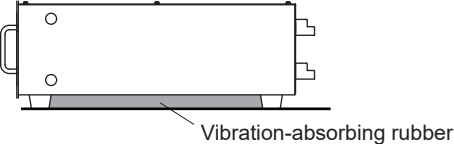
- The analyzer should be installed horizontally.
- 70% or more of the analyzer weight should be supported at the bottom of the casing.
(For panel mounting and 19-inch rack mounting, add a support to the rear part to bear the weight of the analyzer.)

Anti-vibration measures for environments with large vibration
Large ambient vibration will increase indication errors. Therefore, do not install it in areas susceptible to vibration. When ambient vibration and indication fluctuation are large, the impact of such factors can be reduced by placing vibration-absorbing rubber, etc. on the bottom of the main unit as shown in the figure on the left. It may also be possible to mitigate the impact by increasing the response speed time constant (initial setting of 5 seconds) described in “6.5 Parameter settings”.

For rack or panel mounting



For desk-top type



3.3 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.

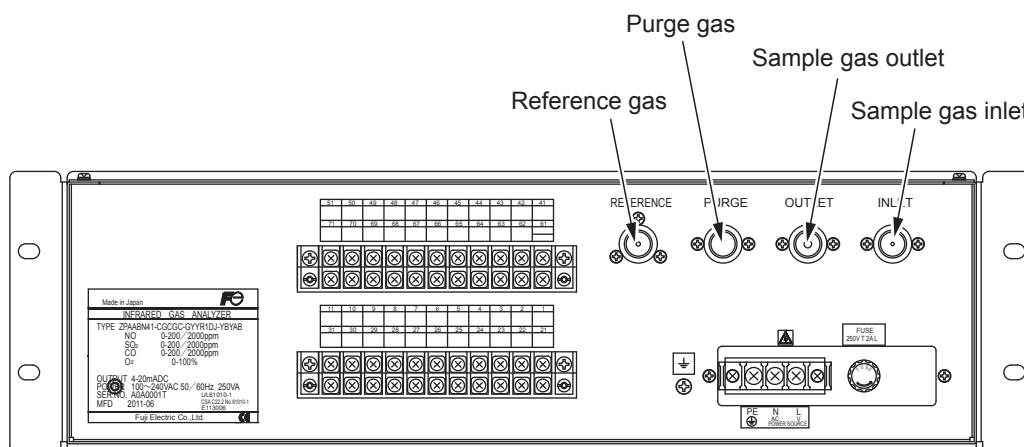
- Connect pipes correctly referring to the instruction manual.
- Discharge the exhaust gas outdoors to prevent it from remaining within the sampling device or indoors.
- Relieve the exhaust gas from the analyzer to the atmospheric pressure to prevent buildup of undesirable pressure to the analyzer. Otherwise, piping within the analyzer may be disconnected, resulting in gas leakage.
- Use pipes and pressure reducing valves to which no oil/grease is attached to the piping. Otherwise, fire may result.

Observe the following when connecting the gas tube.

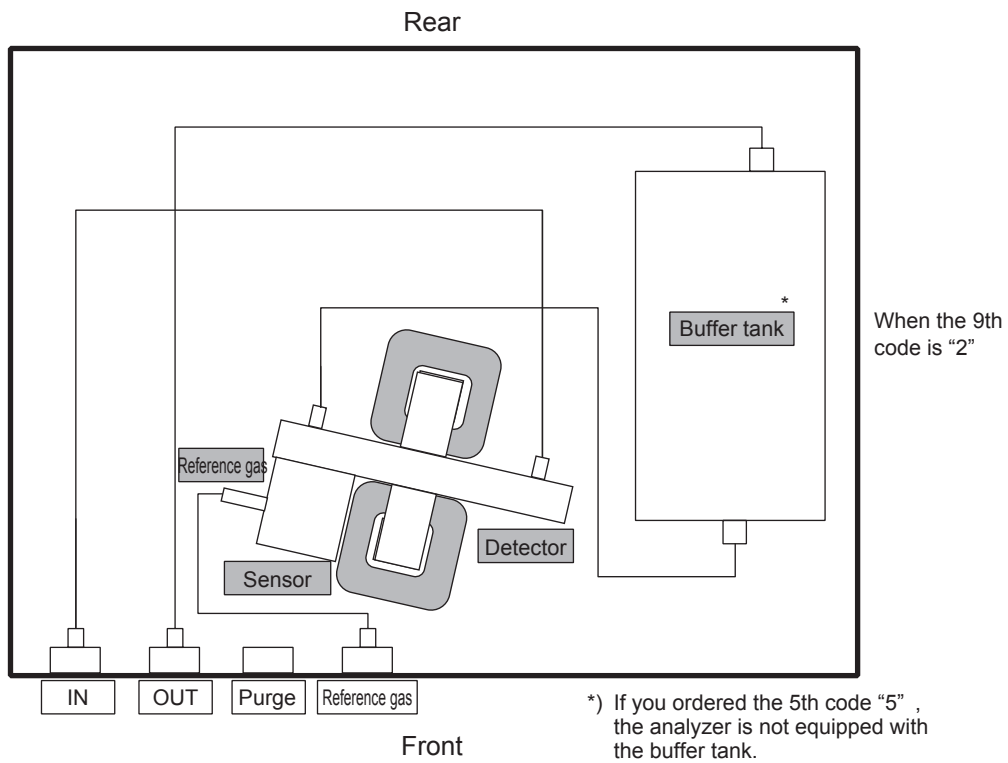
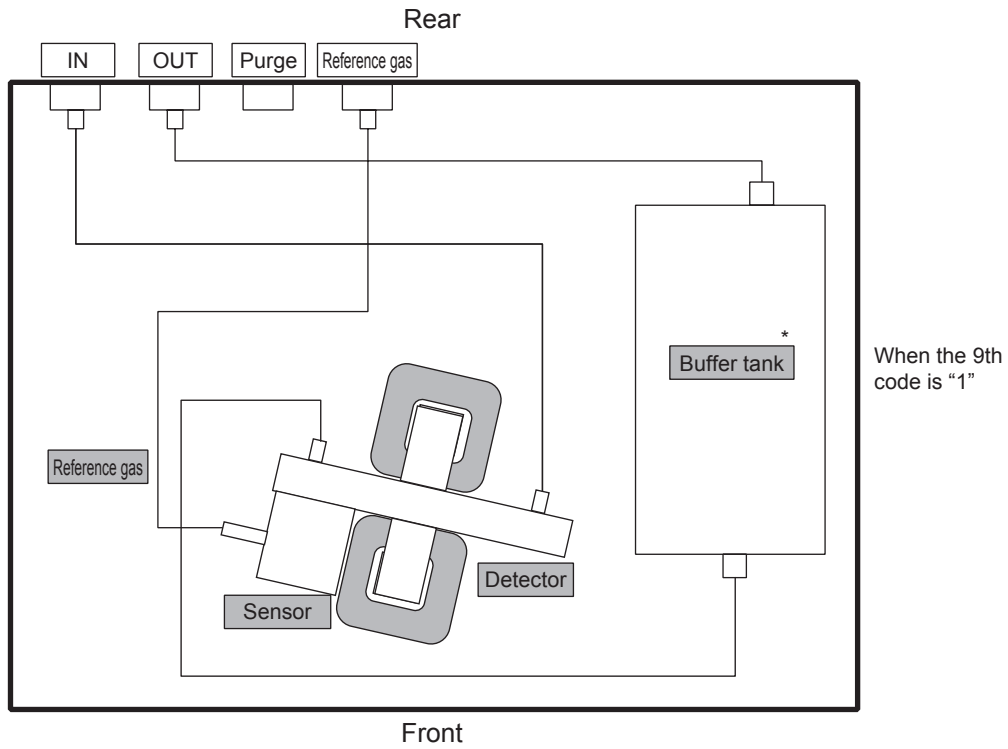
- In order to obtain a quick response from the measuring system, the sample gas line should have a small pipe diameter. The end of exhaust line should be open to the atmosphere.
- If you ordered the analyzer version without buffer tank, be sure to install a buffer tank (ZBH41) in the exhaust line shortly after the analyzer for preventing its output from fluctuating due to external disturbance such as large noise or strong wind.
- The reference gas line should desirably be made of copper (ø6/ø4mm copper pipe) and as short as possible from the gas cylinder. If the gas pipe is long, the reference gas will take a long time to reach the detector at startup and a wait time will be required for setting the zero level as a reference value. If the reference gas pipe is made of vinyl chloride, an indication error may be caused due to oxygen transmission through the pipe.
- A pressure switch of 100 kPa should be provided on the reference gas line so that an alarm signal is issued if reference gas pressure falls abnormally. The reading becomes zero when the reference gas flow stops.
- If an alarm occurs, immediately stop supplying the sample gas, and then purge the sample gas line with the zero gas for about 20 minutes. This is necessary for protecting the detector element. If the reference gas stops flowing into the detector, the sample gas would enter the detector gradually through diffusion and corrode or deteriorate the detector element. After purging, pay attention not to allow corrosive gases to enter the analyzer until the normal reference gas pressure is regained.
- The temperature of the sample gas inlet and outlet becomes equal to the ambient temperature. If the dew point of the sample gas is higher than the ambient temperature, remove moisture from the sample gas by using a dehumidifier, before drawing the sample gas into the analyzer.
- If sample gas contains dust, install a dust filter before flowing the sample gas into the analyzer. For combining the analyzer with an existing gas sampling device, the contaminated pipe after the filter should be replaced with a new one. If the contaminated pipe is used, it may cause a measurement error due to entrance of dust.

- Bear in mind that sample gas must not contain a gas component which chemically affects stainless steel 304 or PTFE.

When sample gas contains a combustible gas component, it is recommended to purge the analyzer with inert gas (N₂ or instrument air, flow rate 1.0 L/min) against the combustible gas component.



- Reference gas inlet: gas pressure shall be 100 kPa, flow rate shall be constant at 1.0 L/min ± 0.2 L/min
- Purge gas inlet: used to purge the analyzer. Purge gas shall be dry N₂ or instrument air that contains no dust or mist. The minimum flow rate shall be 1 L/min.
- Sample gas inlet: Draw the preconditioned sample gas or standard gas for zero and span calibration. The flow rate shall be constant within the following ranges:
 0.5 L/min ± 0.05 L/min (for the ranges < 0–2 vol% O₂)
 0.5 L/min ± 0.2 L/min (for the ranges $\geq$ 0–2 vol% O₂)
- Sample gas outlet: exhaust the sample gas after measurement. Place the pipe end outdoor and to atmosphere. Note that the exhaust gas will be a mix of the sample gas and the reference gas.



3.4 Gas sampling

3.4.1 Sample gas requirements

- The dust contained in sample gas should be eliminated completely with filters. The filter at the final stage should be capable of eliminating dust of 0.3 micron.
- The dew point of sample gas must be lower than the ambient temperature for preventing formation of drain in the analyzer. If water vapor is contained in sample gas, use a dehumidifier to lower the dew point of the sample gas down to about 0°C.
- If SO₃ mist is contained in sample gas, the mist should be eliminated with a mist filter, cooler, etc. Eliminate other mist in the same way.
- If a large amount of highly corrosive gas such as Cl₂, F₂ or HCl is contained in sample gas, the service life of analyzer will be shortened.
- Sample gas temperature is allowed within a range from 0 to 50°C.

Sample gas flow rate

< 0–2 vol% O₂ ranges: 0.5 L/min ±0.05 L/min

≥ 0–2 vol% O₂ ranges: 0.5 L/min ±0.2 L/min

See the diagram on the next page where to install a flowchecker.

Sample gas outlet

The pressure of the sample gas outlet shall be atmospheric pressure.

3.4.2 Reference gas

This analyzer requires a reference gas. Select a proper reference gas cylinder as specified below.

Measurement range	Reference gas	Model
0–0.5...100% O ₂	N ₂	ZBM□NY04–01
21–23...100% O ₂	Air (21% O ₂ , balance N ₂)	ZBM□RY04–01
100–98...0% O ₂	100% O ₂	ZBM□SY04–01

It is required that N₂ or air contains no dust, moisture, or mist. If there is a possibility that dust, moisture, or mist exists in the N₂ or air cylinder, install an equipment before the analyzer to eliminate them.

Flow the reference gas with a pressure of 100 kPa and a flow rate of 5–20 mL/min.

Without the reference gas, not only the measurement is unavailable, but the sensing element may corrode due to corrosive matters in the sample gas. Use a pressure alarm to check the status of the reference gas flow.

3.4.3 Standard gas

(1) Zero gas: The same gas as reference gas

- For oxygen reference, use O₂ gas of purity 99.99% or higher in a range less than 10vol% of the full scale and that of purity 99.9% or higher in other ranges.

Production example 1) If you request the production of a span calibration gas in the 100 to 95% O₂ range, please use the gravimetric method to produce a 10 L cylinder with a concentration range of 95 to 96% O₂/N₂ balance or prepare a calibration gas corresponding to a gas produced by the gravimetric method. Please include the manufacturer's inspection report.

Production example 2) If you request the production of a span calibration gas in the 100 to 98% O₂ range, please use the gravimetric method to produce a 10 L cylinder with a concentration range of 98 to 99% O₂/N₂ balance. Please include the manufacturer's inspection report (JCSS certificate).

(2) Span gas: O₂ gas corresponding to 90% or more of full scale + balance N₂

- For air-standard range, the concentration of span gas should be specified within 80 to 100% of the full scale. Be sure to order a 10 L gas cylinder prepared by gravimetric methods and its accuracy in percent O₂. If you fail to order, a considerable calibration error may occur.

3.4.4 Purging of instrument inside

Purging inside the analyzer is required if:

- A combustible gas component is contained in sample gas.
- Corrosive gas exists in the atmospheric air of the installation site.
- The same gas as the sample gas exists in the atmospheric air of the installation site.

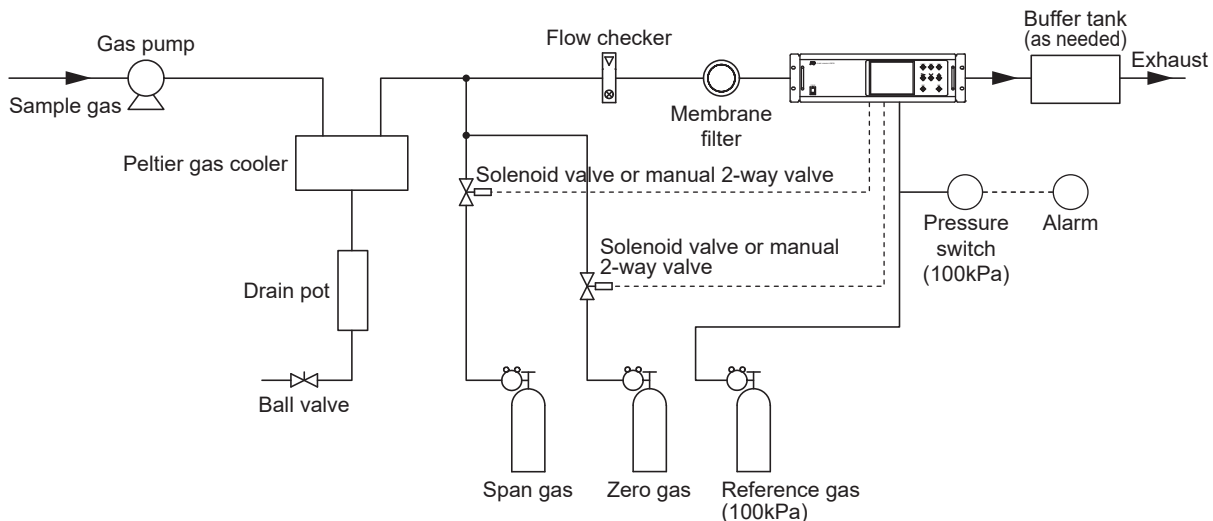
In such cases as above, the inside of analyzer should be purged with instrument air or N₂.

Purging flow rate should be about 1 L/min.

If dust or mist is contained in purging gas, it should be eliminated completely in advance.

3.4.5 Sampling system

The following diagram shows an example of the sampling system. Note that the required configuration vary with the target gas property, background gas, and application.



Example configuration of gas sampling system

3.5 Wiring

⚠ CAUTION

- Turn off the power before wiring. Otherwise, electric shock may result.
- Perform protective earth ground connection. 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.
- Connect a power supply of correct rating. Otherwise, fire may result.

The power terminal and the electrical terminals are on the rear side.

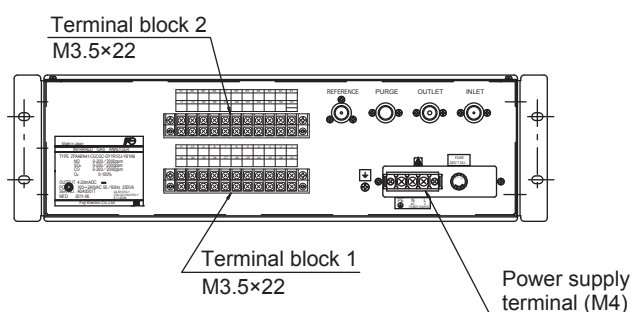


Fig. 3-3 External terminals

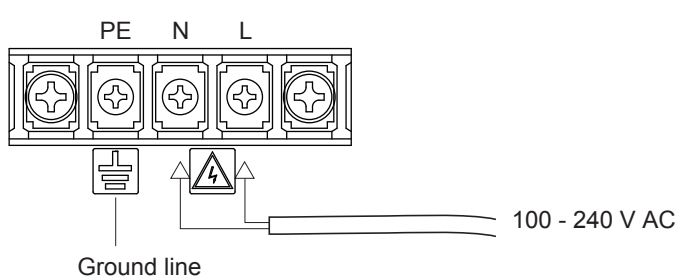
3.5.1 Power source

Power supply terminal: PE, N, L

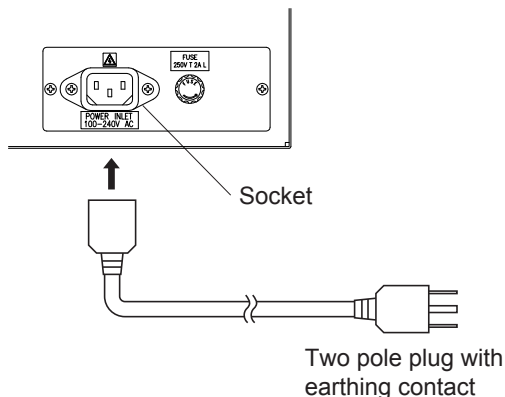
Wire the power supply line and the ground line to the corresponding terminal on the power supply terminal block or the power socket.

- Provide the type D grounding.
- Use M4 solderless terminals.
- Wire diameter: 9.5–10.5 mm

Power terminal (M4 screw)



Power socket



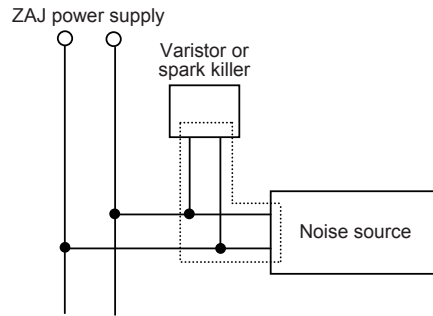
⚠ CAUTION

For M4 power terminals, be sure to put the cover on the terminal block after wiring.

When noise source is in the vicinity

Do not install the analyzer near power noise generating electric equipment (such as high frequency furnace and electric welder). If the analyzer must be used near such equipment, a separate power line should be used for avoiding noise.

If the power source of the analyzer ZAJ receives noise from a relay, a solenoid valve, or other sources, install a variable resistor or a spark killer close enough to the noise source as shown in the figure.



3.5.2 Measured value output signal

AO1: Terminal block 1 (TN1) ① – ②

4–20 mA DC, non-isolated signal

Allowable load: $\leq 550\Omega$

Note

The measured value output signal line is not isolated. We recommend isolating it to eliminate the noise effect.

3.5.3 Analog input for interference compensation

AI1: Terminal block 1 (TN1) ⑳–㉑

If you ordered the version with interference compensation, connect the 1–5 V DC input from an external CH₄ analyzer or a CO₂ analyzer.

Note

The analog input line is not isolated. We recommend isolating it to eliminate the noise effect.

3.5.4 Digital input

- DI1: Terminal block 1 (TN1) ②③–②④ Remote holding (option)
DI2: Terminal block 1 (TN1) ②⑤–②⑥ Remote range / remote start (option)
DI3: Terminal block 2 (TN2) ⑥③–⑥④ Remote start (option)

The digital inputs are volt-free relay contacts. Do not apply voltage on the terminals.

3.5.5 Digital output

- DO1: Terminal block 1 (TN1) ⑤–⑥ Range identification / Auto calibration error (option)
DO2: Terminal block 1 (TN1) ⑦–⑧ Under calibration
DO3: Terminal block 1 (TN1) ⑨–⑩–⑪ Upper limit alarm / zero gas (option)
DO4: Terminal block 1 (TN1) ⑳–㉑ Instrument error
DO5: Terminal block 1 (TN1) ㉓–㉔–㉕ Lower limit alarm / span gas (option)
DO6: Terminal block 2 (TN2) ④⑤–④⑥ Auto calibration error (option)
DO8: Terminal block 2 (TN2) ④⑨–④⑩–④⑪ Zero gas (option)
DO10: Terminal block 2 (TN2) ⑥⑨–⑥⑩–⑥⑪ Span gas (option)

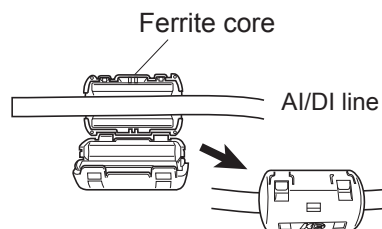
- Relay contact, 250 V AC, 2A (resistive load)

Note

- Install the measured value output line and the digital input line separately from the power line to reduce the noise effect.
- Attach a ferrite core to each of the AI lines, the DI lines, and the DO lines.

Note

Attach the ferrite cores on the analog input line and the digital input line as shown below. Wind the cable round the ferrite core at least once.

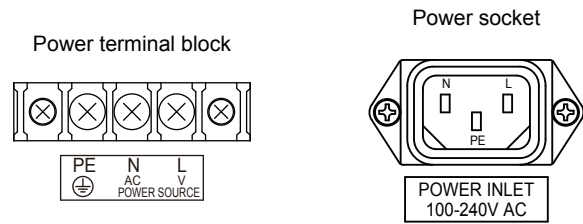


3.5.6 Communication

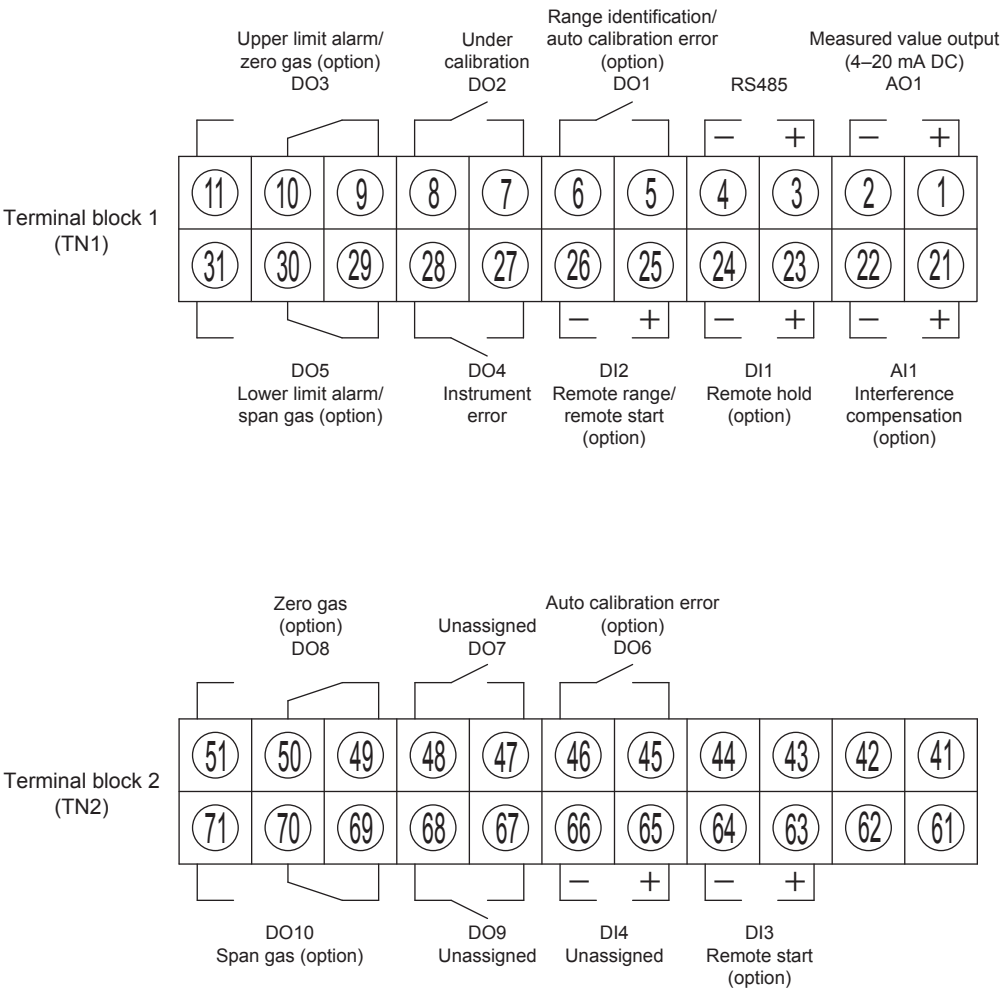
- Terminal block 1 (TN1) ③–④ RS-485 (option)

3.5.7 Terminals

Power terminal

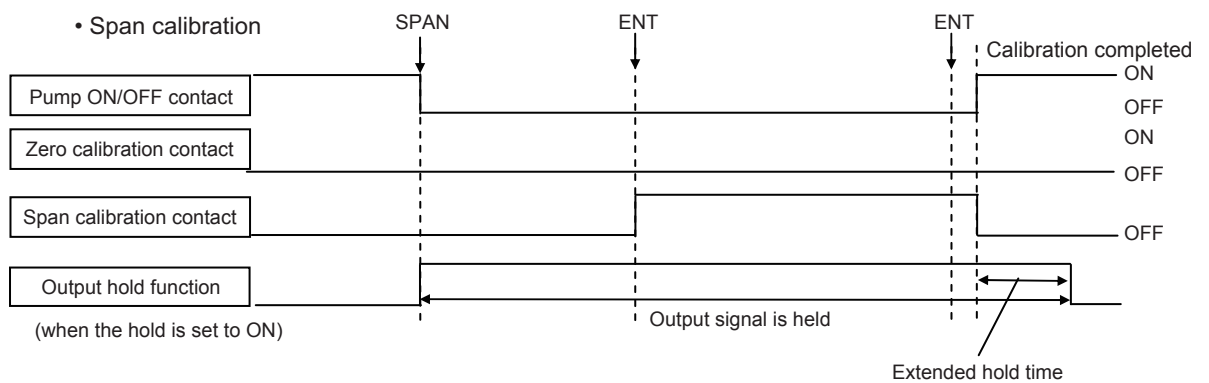
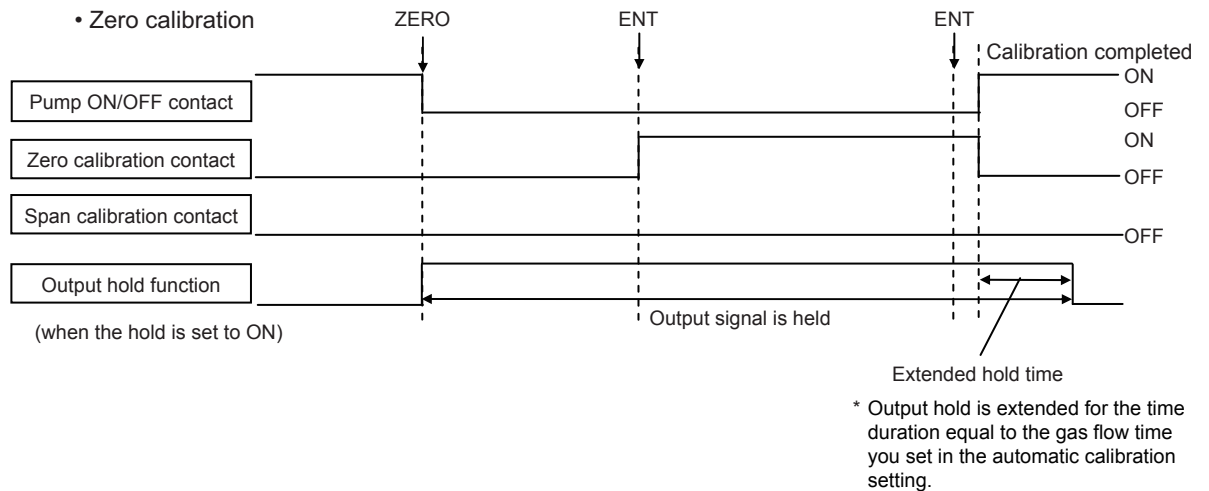


Input/output terminals

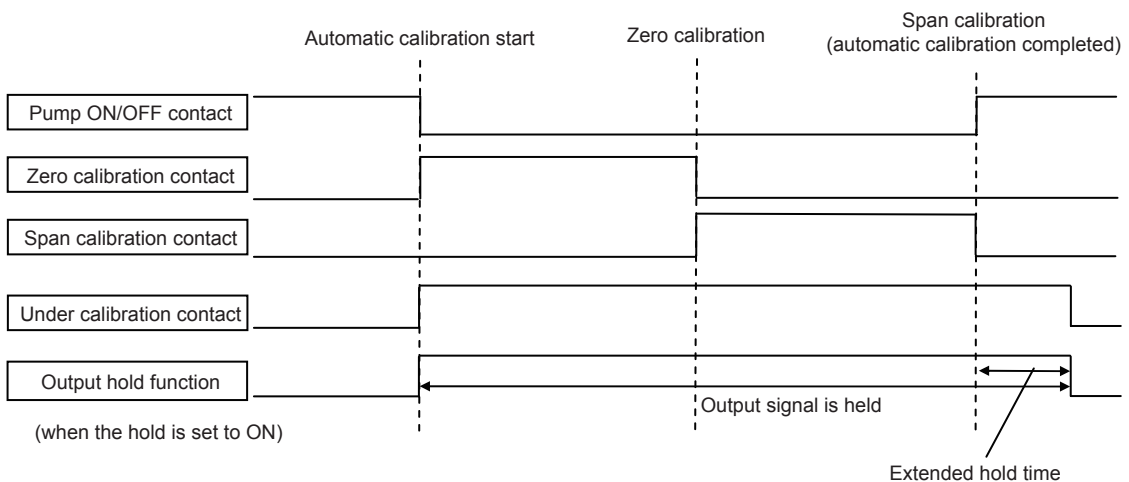


3.5.8 Contact output for calibration

a) Manual calibration

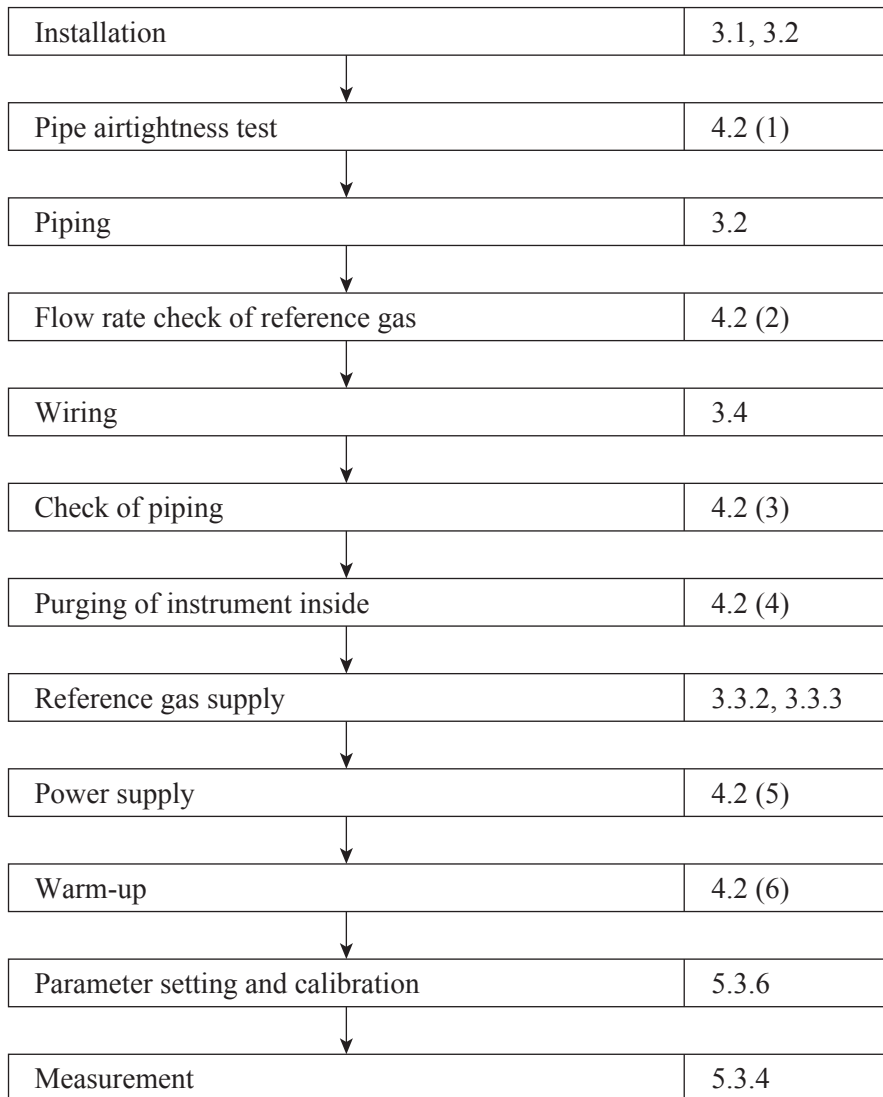


b) Automatic calibration



4. OPERATION

4.1 Setup procedure



4.1.1 Pipe airtightness test

- Sample gas line

- (1) Close the reference gas inlet.
- (2) Connect a U-shaped tube (1.2-meter high) to the sample gas outlet and supply water.
- (3) Apply a pressure of 10 kPa from the sample gas inlet, and then close the inlet.
- (4) After two minutes, check the pressure drop in one minute. If the dropped pressure is not greater than 100 Pa, the sample gas line has enough airtightness.

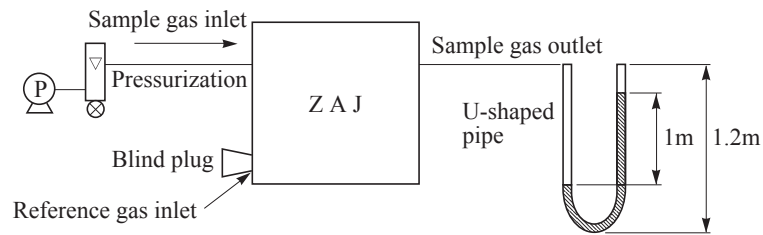


Fig. 4-2 Airtightness test of sample gas line

- Reference gas line

- (1) Open the main valve of reference gas cylinder and adjust the pressure regulator so that pressure becomes 100 kPa. Apply soapy water to each joint and make sure bubbles are not formed.
- (2) After the airtightness test, set the piping back to the normal.
- (3) To replace the air in the reference gas line with the reference gas, flow the reference gas for two minutes with a flow rate of 1 L/min before connecting the reference gas tube to the reference gas inlet.

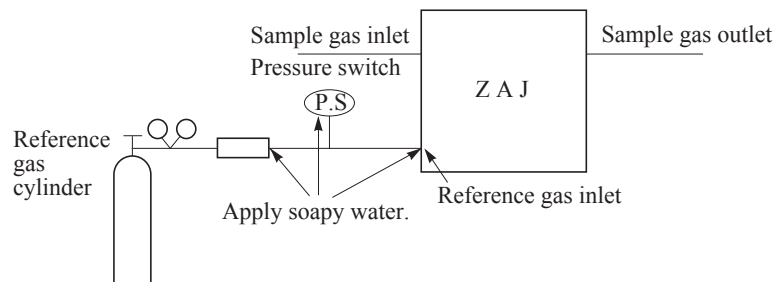


Fig. 4-3 Airtightness test of reference gas line

4.1.2 Check of reference gas flow rate

When the sample gas inlet is closed to prevent the sample gas from entering, only the reference gas is discharged through the sample gas outlet. Therefore, the flow rate of reference gas can be checked.

Connect a pipe to the sample gas outlet and immerse its end in water at a depth of 1 mm as shown in Fig. 4-4. Then, check the formation of bubbles. When the inner diameter of the pipe is 4 mm, one or two bubbles should be discharged in one second.

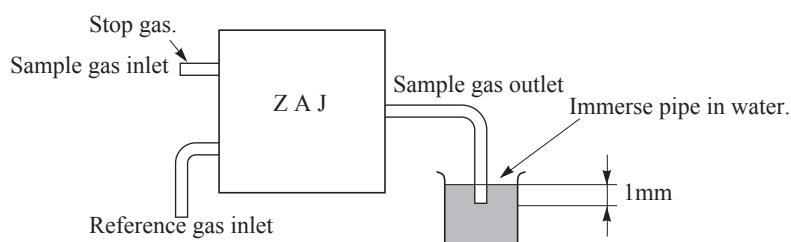


Fig. 4-4 How to measure flow rate of reference gas

4.1.3 Check of piping

Confirm that pipes are connected correctly.

4.1.4 Purging of instrument inside

If the analyzer is installed at a place where the atmospheric air contains combustible gas, corrosive gas or much dust, the inside of the instrument should be purged with N₂ or air (purging flow rate 1.0 L/min).

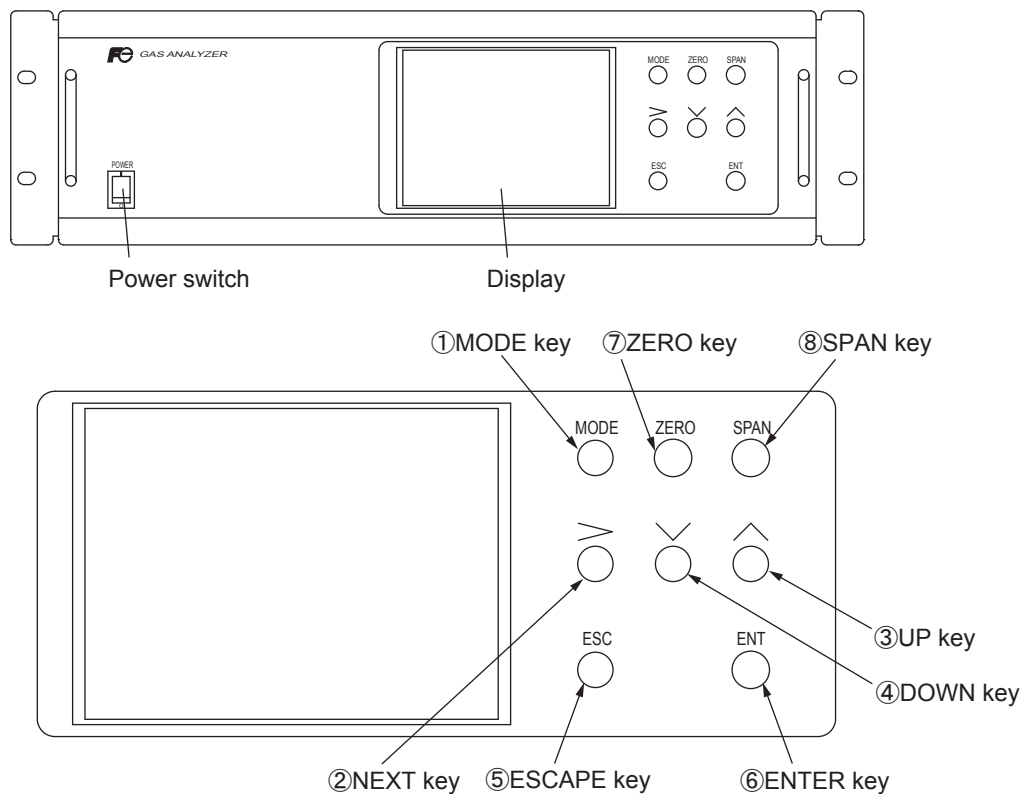
If the atmospheric air contains combustible gas, start purging the analyzer about three hours before you turn on the analyzer.

4.2 Warm-up and operation

- (1) Turn on the power.
- (2) Carry out the warm-up operation for two hours until the indication get stable. The reference gas and the zero gas shall be supplied during warm-up operation.
 - * When you re-start the analyzer, be sure to carry out warm-up operation, and zero and span calibration.
- (3) Calibration gas concentration setting
- (4) Zero calibration
- (5) Span calibration

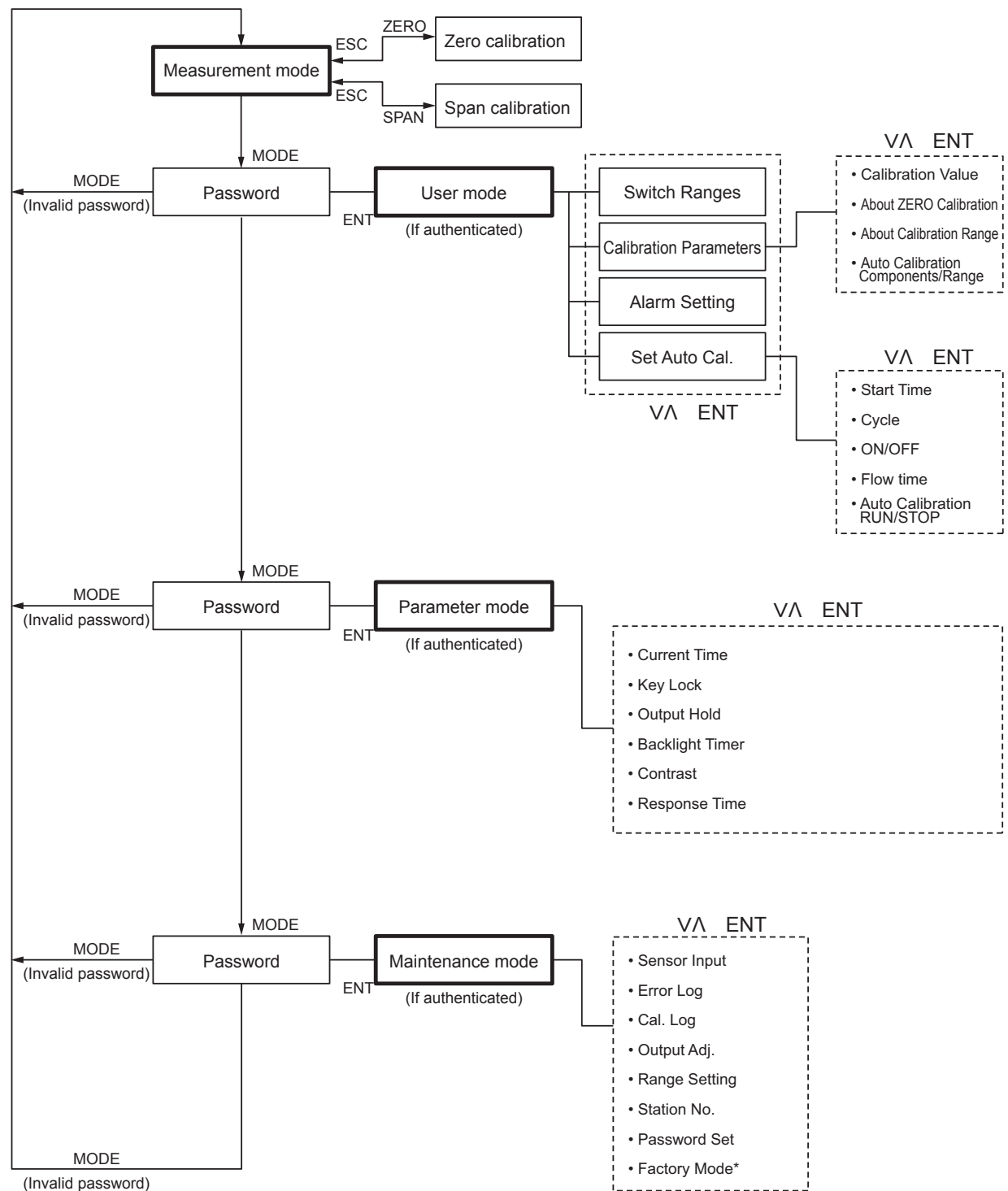
5. DISPLAY AND KEYS

5.1 Overview



Key name	Allows you to:
① MODE key	change the display mode.
② NEXT key	move the cursor or select a digit.
③ UP key	move the cursor or increase a value.
④ DOWN key	move the cursor or decrease a value.
⑤ ESCAPE key	return to the previous screen or cancel the setting change.
⑥ ENTER key	set a value or item, or start a calibration.
⑦ ZERO key	carry out a zero point calibration.
⑧ SPAN key	carry out a span calibration.

5.2 Menu map

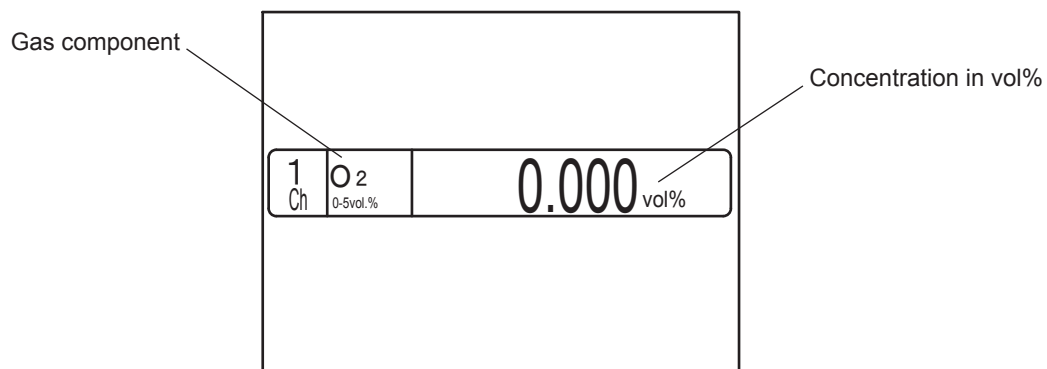


*Factory Mode is for authorized personnel only.

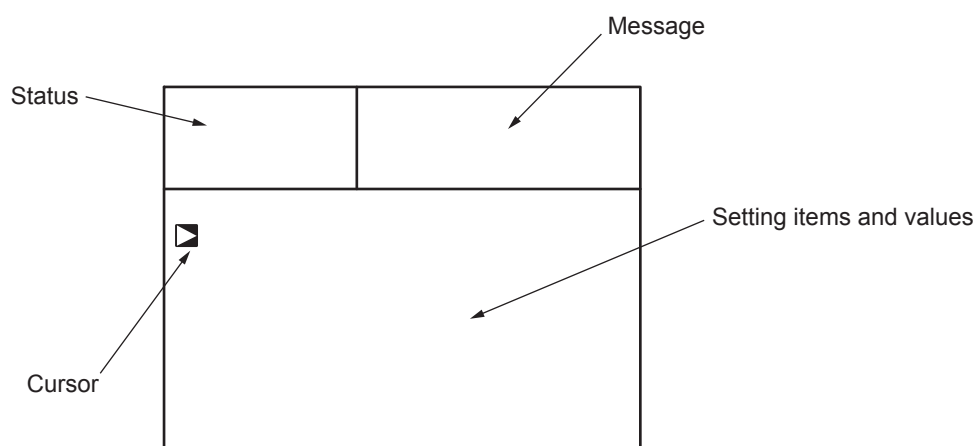
5.3 Display

- Measurement mode

The analyzer always starts in the measurement mode, and the following display appears.



- User mode, Parameter mode, Maintenance mode



6. SETTING AND CALIBRATION

6.1 Switching the range

- (1) In the measurement mode, press the MODE key to enter the user mode.
Select the “Switch Ranges” by using the $\wedge$, $\vee$, or $\gt$ keys, and press the ENT key.

User Mode	Select an item
▣ Switch Ranges Calibration Parameters Alarm Setting Set Auto Cal.	

- (2) On the Switch Ranges screen, press the ENT key, and you can select a range.

Switch Ranges		Select an item with UP/DOWN and ENT Back with ESC
▣ Ch1 O₂	MR	▶ Range1 0- 5.0 vol% Range2 0-25.0 vol%

- (3) Select a range and by using the $\wedge$, $\vee$, or $\gt$ key, and press the ENT key.

Switch Ranges		Select an item with UP/DOWN and ENT Back with ESC
▣ Ch1 O₂	MR	▶ Range1 0- 5.0 vol% Range2 0-25.0 vol%

Notes:

- The contact for the range identification signal is closed when the lower range (the range 1) is selected, and opened when the higher range (the range 2) is selected.
- You cannot switch the range when the remote range changeover is set to ON.

Range switching methods

- MR (Manual) : A user can switch ranges by key operation
- RR (Remote) : Ranges are switched by the remote range changeover input
- AR (Auto) : When the measured value exceeds 90% of the lower range, the range automatically switches to the higher range. When the measured value becomes lower than 80% of the higher range, the range automatically switches to the lower range.

To cancel the operation, press the ESC key. The screen will go back to the previous screen.

6.2 Calibration settings

The calibration gas concentrations vary with the type of range. Set the appropriate values for each of zero gas and span gas in reference to the following instructions.

- Forward range (0–0.5...100 vol% O₂)

Reference gas: N₂

O₂ concentration of zero gas: 0.000 vol%

Span gas concentration: full scale value of your range (the value indicated on the span gas cylinder)

Output: zero gas (0 vol%): 4 mA

span gas (full scale of the range): 20 mA

- Air referenced range (21.0–23.0...100 vol% O₂)

Reference gas: Air

Zero gas concentration: 20.9 vol%

Span gas concentration: full scale value of your range (the value indicated on the span gas cylinder)

Output: zero gas (20.9 vol%): 4 mA

span gas (full scale of the range): 20 mA

- Reverse range (100.0–98.0...0 vol% O₂)

Reference gas: O₂

Zero gas concentration: 100.0 vol%

Span gas concentration: full scale value of your range (the value indicated on the span gas cylinder)

Output: zero gas (100.0 vol%): 4 mA

span gas (full scale of the range): 20 mA

6.2.1 Calibration gas concentration

- (1) In the measurement mode, press the MODE key to enter the user mode. Select the “Calibration Parameters” by using the ^, v, or > keys, and press the ENT key.

User Mode	Select an item
Switch Ranges ☒ Calibration Parameters Alarm Setting Set Auto Cal.	

- (2) Select the “Calibration Value” and press the ENT key.

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

- (3) Select the item you want to edit.
- (4) Change the value by using the ^, v, or > key, and press the ENT key.

Cal. Settings Cal. Value		Select Ch No.	
Ch	RANGE	ZERO	SPAN
☒ Ch1	0- 5.0 vol%	0.000	4.982
O ₂	0-25.0 vol%	00.00	24.85

To cancel the operation, press the ESC key. The screen will go back to the previous screen.

6.2.2 Manual zero calibration setting

*You do not have to edit this menu because this product is single component analyzer, i.e. there is no difference in selecting “each” or “at once”.

- (1) User mode > Calibration Parameters > About ZERO Calibration
- (2) Select the channel you want to set by using the $\wedge$, $\vee$, or $\>$ key, and press the ENT key. The selected item will be inverted.
- (3) Select “each” or “at once”, and press the ENT key.
 - “at once”: all the channels (components) you selected in the “Auto Calibration Component/Range” are calibrated.
 - “each”: allows you to select the channel (component) to calibrate at each zero calibration.

To cancel the operation, press the ESC key. The screen will go back to the previous screen.

6.2.3 Calibration range setting

This menu allows you to set whether to calibrate the current range only or to calibrate both ranges.

- (1) In the measurement mode, press the MODE key to enter the user mode.
Select the “Calibration Parameters”, and press the ENT key.

User Mode	Select an item
Switch Ranges ☒ Calibration Parameters Alarm Setting Set Auto Cal.	

- (2) Select the “About Calibration Range”, and press the ENT key.

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

- (3) In the next screen, press the ENT key.

Cal. Settings Cal. Range		Select Ch No.	
☒ Ch1 O ₂	Range1 Range2	0- 5.0 vol% 0-25.0 vol%	both

- (4) Select “both” or “current”, and press the ENT key.
- “both”: both the range 1 and the range 2 are calibrated in sequence.
 - “current”: only the current range is calibrated.

Cal. Settings Cal. Range		Select Ch No.	
☒ Ch1 O ₂	Range1 Range2	0- 5.0 vol% 0-25.0 vol%	both

To cancel the operation, press the ESC key. The screen will go back to the previous screen.

*If you set the “About Calibration Range” to “both”, use the span calibration gas for the range mainly used, and carry out the calibration with the range normally used.

Manual calibration

Manual calibration screen when the calibration range is set to “both”

ZERO Cal.		UP/DOWN and ENT Back with ESC	
▶ Ch1	Range1 0- 5.0 vol%	▶ 0.000	Two cursors appear.
O ₂	Range2 0-25.0 vol%	▶	

6.2.4 Auto calibration component / range

This menu allows you to set whether to calibrate the current range only or to calibrate both ranges.

- (1) User Mode > Calibration Parameters > Auto Calibration Component/Range
- (2) Press the ENT key once.
- (3) Select the range you want to use in the auto calibration, and then press the ENT key.
 - The range automatically changes to the one you selected when the auto calibration starts, and returns to the original range when the auto calibration has finished.
 - The range identification signal follows the range change. If, however, the hold setting is set to ON, the contact retains the status before calibration.
- (4) Press the ENT key, and the indication of “enable” or “disable” is inverted.
- (5) Select “enable” or “disable” of auto calibration, and press the ENT key.

To cancel the operation, press the ESC key. The screen will go back to the previous screen.

6.3 Alarm setting

6.3.1 Alarm value

(1) User Mode > Alarm Setting

User Mode	Select an item
Switch Ranges Calibration Parameters ▣ Alarm Setting Set Auto Cal.	

(2) Select the alarm you want to set and press the ENT key.

Alarm Setting	Select Alarm No. or Hysteresis setting
▣ Alarm-1 Alarm-2	
Hysteresis	00%FS

(3) Set “ON/OFF” on the bottom to “OFF”.

Alarm Setting Alarm-1	Select an item with UP/DOWN and ENT Back with ESC
▣ Chanel Ch1	
H-Limit Range 1 04.5vol%	
Range 2 22.5vol%	
Range 1 02.3vol%	
Range 2 10.5vol%	
kind o Alarm High H-Limit	
ON/OFF	OFF

(4) Edit the values for the “H-limit” and the “L-limit” of each range, and select the “Kind of Alarm”, and press the ENT key.

To cancel the operation, press the ESC key. The screen will go back to the previous screen.

Setting items

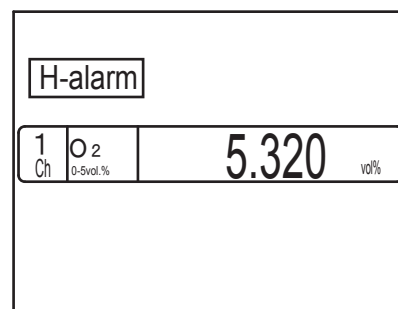
- H-limit: higher concentration limit used for the alarm
- L-limit: lower concentration limit used for the alarm
- Kind of alarm: High, Low, High or Low, HH, LL
 - High, HH: the alarm contact is closed when the measured value has exceeded the H-limit
 - Low, LL: the alarm contact is closed when the measured value has become less than the L-limit
 - High or Low: the alarm contact is closed when the measured value has either exceeded the H-limit or become less than the L-limit
- ON/OFF: enable alarm (ON) or disable alarm (OFF)

*The higher limit must be greater than the lower limit.

Example of alarm

If an alarm occurs, one of the following indication appears on the measurement screen:

H-alarm, L-alarm, HH-alarm, LL-alarm



The analyzer emits no alarm for 10 minutes after start-up.

6.3.2 Hysteresis

Set the hysteresis to prevent the alarm output chattering around the alarm setpoint.

- (1) In the measurement mode, press the MODE key to enter the user mode. Select the alarm setting, and the press the ENT key.

User Mode	Select an item
Switch Ranges Calibration Parameters ▣ Alarm Setting Set Auto Cal.	

- (2) Select “Hysteresis”, and press the ENT key. Edit the value and press the ENT key.

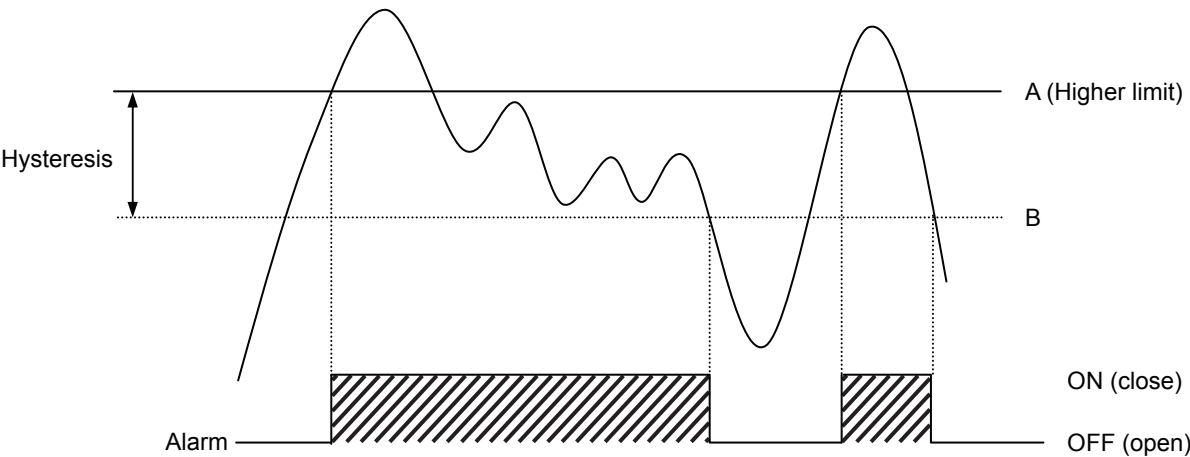
Alarm Setting	Select Alarm No. or Hysteresis setting
Alarm-1 Alarm-2	
▣ Hysteresis	00%FS

To cancel the operation, press the ESC key. The screen will go back to the previous screen.

Setting range: 0–20 %FS

Alarm with hysteresis

The alarm turns on when the measured value exceeds the higher limit (the point A); and it will not turn off until the measured value go down below the point B. The alarm turns on again when the measured value exceeds the limit (the point A).



6.4 Auto calibration setting

6.4.1 Auto calibration

This menu allows you to set the time to start the auto calibration.

Be sure to set the auto calibration to OFF before changing the auto calibration settings.

(1) User Mode > Set Auto Cal.

User Mode	Select an item
Switch Ranges Calibration Parameters Alarm Setting ☑ Set Auto Cal.	

(2) Select “ON/OFF” to OFF. Then, edit each item and press the ENT key.

To cancel the operation, press the ESC key. The screen will go back to the previous screen.

Set Auto Cal.	Select an item
Time:MON 09:43 ☑ Start Time SUN 12:00 Cycle 07 hour ON/OFF Flow Time OFF	
Auto Calibration Run	

Setting items

- Start time: Day and time on which the first calibration is to be carried out
- Cycle: Time from the start of a calibration until the next calibration starts.
Setting range : 1–99 hours or 1–40 days
Initial setting : 7 days
- ON/OFF: On or off of the auto calibration
- Flow Time: Time duration during which the calibration gas flows in the detector
Setting range : 60–599 seconds
Initial setting : 300 seconds

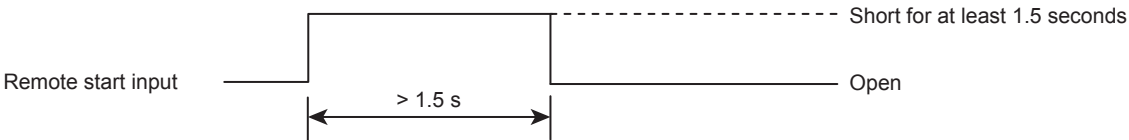
The contact for auto calibration is closed during auto calibration, and when the output hold is set to ON.

Notes:

- When the auto calibration starts, the screen automatically changes to the measurement mode.
- During the auto calibration, no key operation is accepted except for “Auto Calibration Stop (6.4.2)”. If the key lock is set to ON, turn it off and change the “Auto Calibration” from RUN to STOP.

Remote start of automatic calibration

You can remotely start an automatic calibration by shorting the remote start input terminal for at least 1.5 seconds and then opening it, regardless of whether the automatic calibration is set to on or off.



6.4.2 Forced run/termination of auto calibration

- (1) User Mode > Set Auto Cal.
- (2) Select “Auto Calibration” on the bottom, and then press the ENT key.
- (3) Select RUN or STOP as needed, and then press the ENT key.

User Mode	Select an item
Switch Ranges Calibration Parameters Alarm Setting ☑ Set Auto Cal.	

Set Auto Cal.	Select an item
Time:MON 15:47 ☑ Start Time SUN 12:00 Cycle 07 hour ON/OFF Flow Time OFF	
Auto Calibration Run	

6.5 Parameter settings

Setting items

- Current Time: Date, day, and time
- Key Lock: Invalidates any key operation except for cancelling the key lock.
- Output Hold: sets whether or not to hold the output value during calibration
- Backlight Timer: time until the backlight goes to off
 - Setting range : 1–60 min
 - Initial setting : 10 min
- Contrast: LCD contrast
- Response Time: electrical response time
 - Setting range : 1–60 seconds
 - Initial setting : 5 seconds

(1) In the measurement mode, press the MODE key twice. Enter the password, and then press the ENT key.

User Mode	Select an item
☒ Switch Ranges Calibration Parameters Alarm Setting Set Auto Cal.	

(2) In Parameter Mode screen, select an item you want to edit, and press the ENT key. Edit the value by using the $\wedge$ key and/or the $\vee$ key, and press the ENT key.

Parameter Mode	Select an item with UP/DOWN and ENT Back with ESC
☒ Current Time 00/04/14 Key Lock Output Hold Backlight Timer Contrast Response Time SAT OFF ON 17:35 Current 50%	

To cancel the operation, press the ESC key. The screen will go back to the previous screen.

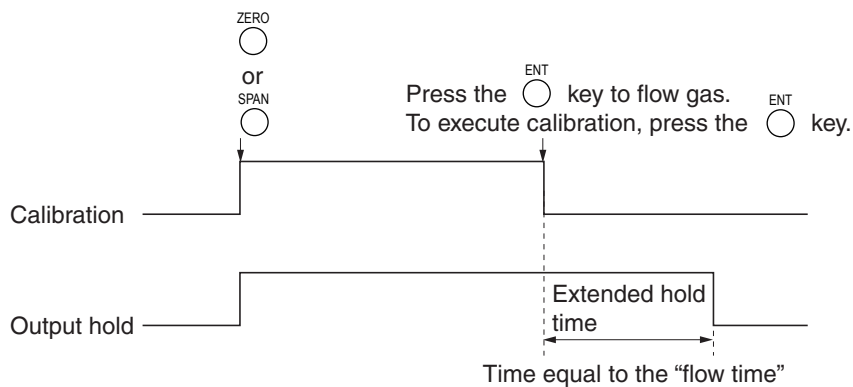
Backlight Timer

The backlight will turn off after the time you set has passed. Pressing any key can turn it on.

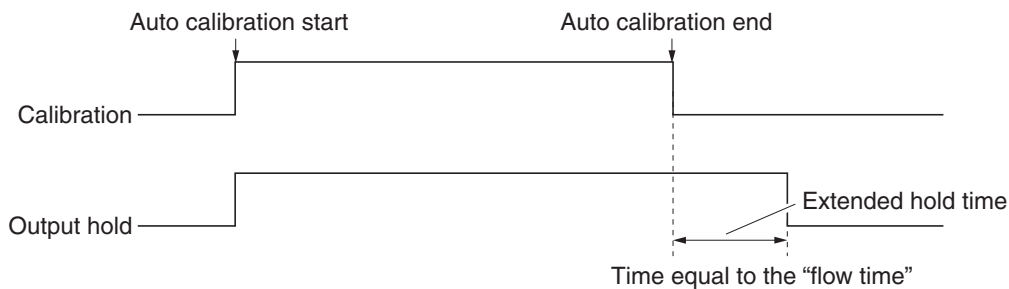
Output Hold

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

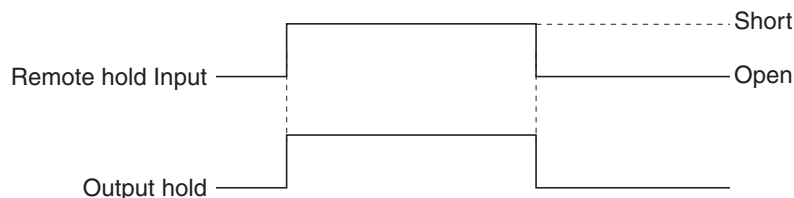
a. Manual calibration



b. Auto calibration



c. Remote hold



d. Display during the output hold

During calibration, the calibration status is indicated. During the hold extension time, the message "Hold ON" blinks on the measurement screen.

e. When the calibration is cancelled

Even if you cancel a calibration after flowing the calibration gas, the output is held during the hold extension time.

Response time

The response time set here is rough value. The initial setting is 5 seconds. If you use the analyzer with a response speed of 2 seconds or shorter, set the value to 1 second.

6.6 Maintenance mode

To enter the maintenance mode, press the MODE key three times in the measurement screen. If you have set the password, you will be required to enter the password.

Maintenance	Input Password to Maintenance Mode
	0000

Maintenance	Select an item with UP/DOWN and ENT Back with ESC
Sensor Input Error Log Cal. Log Output Adj. Range Setting Station No. 00 Password Set 0000	

6.6.1 Sensor input

O₂: input value of O₂ sensor
Temperature: input value of temperature sensor

Maintenance			
Sensor Input			
	Sensor	Input	Value
	O ₂	11256	4.1vol%
	TEMP	16325	35.8°C

6.6.2 Error Log

Error number and date are displayed.
Refer to “8.1 Error messages” for the detail.

Maintenance	ENT:Clear Error Log ESC:Back						
Error Log							
	err No.	YY	MM	DD	HH	MM	Ch
	No.10	13	3	25	10	54	
	No.1	13	3	5	14	08	OPT1
	No.5	13	2	27	6	00	2
	No.9	13	2	27	6	00	2
	No.7	13	1	15	9	00	4
	▼ Next page						Page.1
	Clear Error Log						

6.6.3 Cal. Log

Up to 14 calibration records are displayed. If the calibration records exceeds 14, the oldest one is deleted.

Maintenance Cal. Log	Select Ch No.
CH1 O₂	
Clear Cal. Log	

Maintenance Cal. Log Ch1 O ₂						
R	Count	Con	MM	DD	HH	MM
S1	7602	57.9	3	24	10	18
Z1	599	-0.23	3	24	10	13
S1	5602	98.3	3	17	9	25
Z1	599	0.33	3	17	9	19
S2	13201	18.20	3	5	17	57

6.6.4 Station No.

Set the station number for Modbus communication.

Maintenance mode > Station No.

Edit the value by using the UP and DOWN keys, and press the ENT key.

To cancel the operation, press the ESC key. The screen will go back to the previous screen.

Maintenance	Select an item
Sensor Input Error Log Cal. Log Output Adj. Range Setting Station No. 00 Password Set 0000	

Maintenance	Select an item
Sensor Input Error Log Cal. Log Output Adj. Range Setting Station No. 00 Password Set 0000	

6.6.5 Password Set

(1) Maintenance mode > Password Set

Maintenance	Select an item
Sensor Input Error Log Cal. Log Output Adj. Range Setting Station No. 00 Password Set 0000	

(2) Edit the value by using the UP, DOWN, and NEXT keys, and press the ENT key.

To cancel the operation, press the ESC key. The screen will go back to the previous screen.

Maintenance	Select an item
Sensor Input Error Log Cal. Log Output Adj. Range Setting Station No. 00 Password Set 0000	

6.6.6 Output Adj.

This menu allows you to adjust the analog output. Connect a digital multimeter to the AO terminal, and adjust the zero point to 4 mA and the span to 20 mA

Maintenance Output Adj.	ZERO and SPAN					
OUT	ZERO	SPAN				
1	1900	12500				

(1) Maintenance mode > Output Adj.

(2) Edit the value by using the UP, DOWN, and NEXT keys, and press the ENT key.

Maintenance Output Adj.	ZERO and SPAN					
OUT	ZERO	SPAN				
1	1900	12500				

6.6.7 Range Setting

You can change the ranges within the range you ordered.
You can also select the number of the range to use, between 1 and 2.

(1) Maintenance mode > Range Setting > Ch1

Maintenance	Select an item
Sensor Input Error Log Cal. Log Output Adj. ☒ Range Setting Station No. 00 Password Set 0000	

Maintenance Range Setting	Select Ch No.
☒ CH1 O ₂	
Clear Cal. Log	

(2) Select the item you want to change, and press the ENT key.

- *You cannot change the unit.
- *You can move the decimal point by inverting it and using the UP or DOWN key.

Maintenance Range Setting Ch1 O ₂	Select range or range num
Range type Forward range	
☒ MIN Range	1.000 vol%
Range1	1.000 vol%
Range2	10.00 vol%
MAX range	10.00 vol%
Range num.	2

Set the range 1 and the range 2 within the measurement range of the analyzer. The range 1 must be smaller than the range 2.
The number of range is 1 or 2.

Be sure to carry out the zero calibration and the span calibration after changing the range. If you fail to carry out calibration, the analyzer may not be able to deliver the accurate values.

Maintenance Range Setting Ch1 O ₂	Select range or range num
Range type Forward range	
☒ MIN Range	1.000 vol%
Range1	1.000 vol%
Range2	10.00 vol%
MAX range	10.00 vol%
Range num.	2

6.7 Calibration

6.7.1 Zero calibration

Prepare the standard gas for zero calibration in reference to 3.4 Gas sampling.

- (1) In the measurement screen, press the ZERO key to enter the zero calibration screen.

1	O ₂	0.000 vol%
Ch	0-5vol%	

- (2) Press the ENT key, and the contact for the zero calibration gas is closed and the calibration gas start to flow.

If **User mode > Calibration Parameters > About Calibration Range** is set to “both”, both of the range 1 and the range 2 are calibrated simultaneously.

ZERO Cal.		UP/DOWN and ENT Back with ESC
▣ Ch1	Range1 0- 5.0 vol%	0.000
O ₂	Range2 0-25.0 vol%	

- (3) Wait until the reading get stable, and then press the ENT key to start a calibration of the selected range. The screen returns to the measurement screen when the calibration is finished.

To cancel the operation, press the ESC key. The screen will go back to the previous screen.

ZERO Cal.		UP/DOWN and ENT Back with ESC
▣ Ch1	Range1 0- 5.0 vol%	▣ 0.000
O ₂	Range2 0-25.0 vol%	

6.7.2 Span calibration

Prepare the standard gas that has a concentration of 90–100% of the range.

- (1) In the measurement screen, press the SPAN key to enter the span calibration screen.

1	O ₂	0.000	vol%
Ch	0-5vol.%		

- (2) Press the ENT key, and the contact for the span calibration gas is closed and the calibration gas start to flow.

If **User mode > Calibration Parameters > About Calibration Range** is set to “both”, both of the range 1 and the range 2 are calibrated simultaneously.

SPAN Cal.		UP/DOWN and ENT Back with ESC	
☒ Ch1	Range1 0- 5.0 vol%	4.983	
O ₂	Range2 0-25.0 vol%		

- (3) Wait until the reading get stable, and then press the ENT key to start a calibration of the selected range. The screen returns to the measurement screen when the calibration is finished.

To cancel the operation, press the ESC key. The screen will go back to the previous screen.

SPAN Cal.		UP/DOWN and ENT Back with ESC	
☒ Ch1	Range1 0- 5.0 vol%	☒ 4.983	
O ₂	Range2 0-25.0 vol%		

7. MAINTENANCE

7.1 Daily check

7.1.1 Zero calibration and span calibration

Carry out zero calibration (see 6.7.1 Zero calibration) and then span calibration (see 6.7.2 Span calibration) once a week, as required.

7.1.2 Flow rate check: sample gas and purge gas

Check the flow rate every day, as required.

Sample gas flow rate for < 0–2 vol% O₂ range: 0.5 L/min ±0.05 L/min

Sample gas flow rate for ≥ 0–2 vol% O₂ range: 0.5 L/min ±0.2 L/min

Purge gas flow rate: about 1 L/min

7.1.3 Flow rate check: reference gas

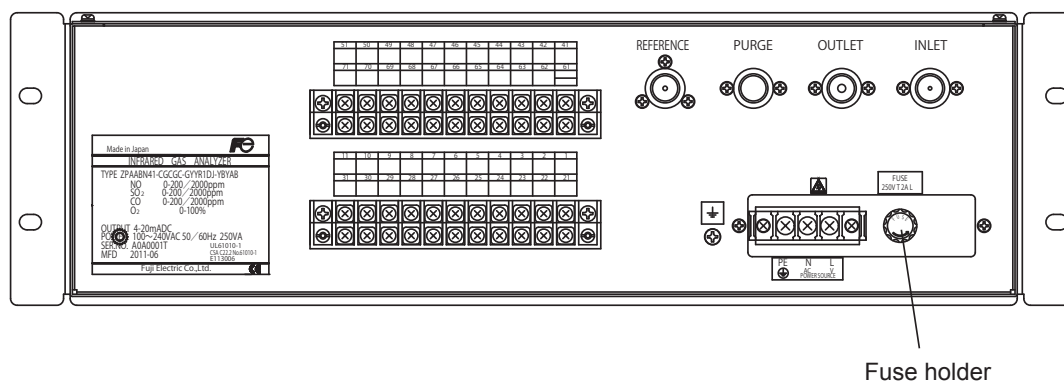
Check the reference gas flow rate every six month, following the instructions of 4.1.2 Check of reference gas flow rate. If the flow rate is less than required regardless the reference gas pressure is properly set, the sintered metal filter in the reference gas line may be clogged. Replace the filter.

7.2 Daily check and maintenance procedures

Table 7.1 Maintenance and check table

Cycle	Item to be checked	Symptom	Cause	Remedy
Daily	Readings	Too low	Dust contamination in sampling cell	Clean the cell, and check the sampling devices.
			Air entered into the sampling line	Repair the crack or gap of the sampling line.
	Flow rate of sample gas (and purge gas if used)	Deviation from the specification	—	Adjust the flow rate with valve or the like
Weekly	Zero point	Deviation from zero point	—	Zero adjustment
	Span point	Deviation from span point	—	Span adjustment
Half yearly	Flow rate of reference gas	Deviation from the specification	Sintered metal filter is clogged	Replace the filter
Every 5 years	Analyzer	—	—	See 7.6 Long-term maintenance

7.3 Replacement of fuse

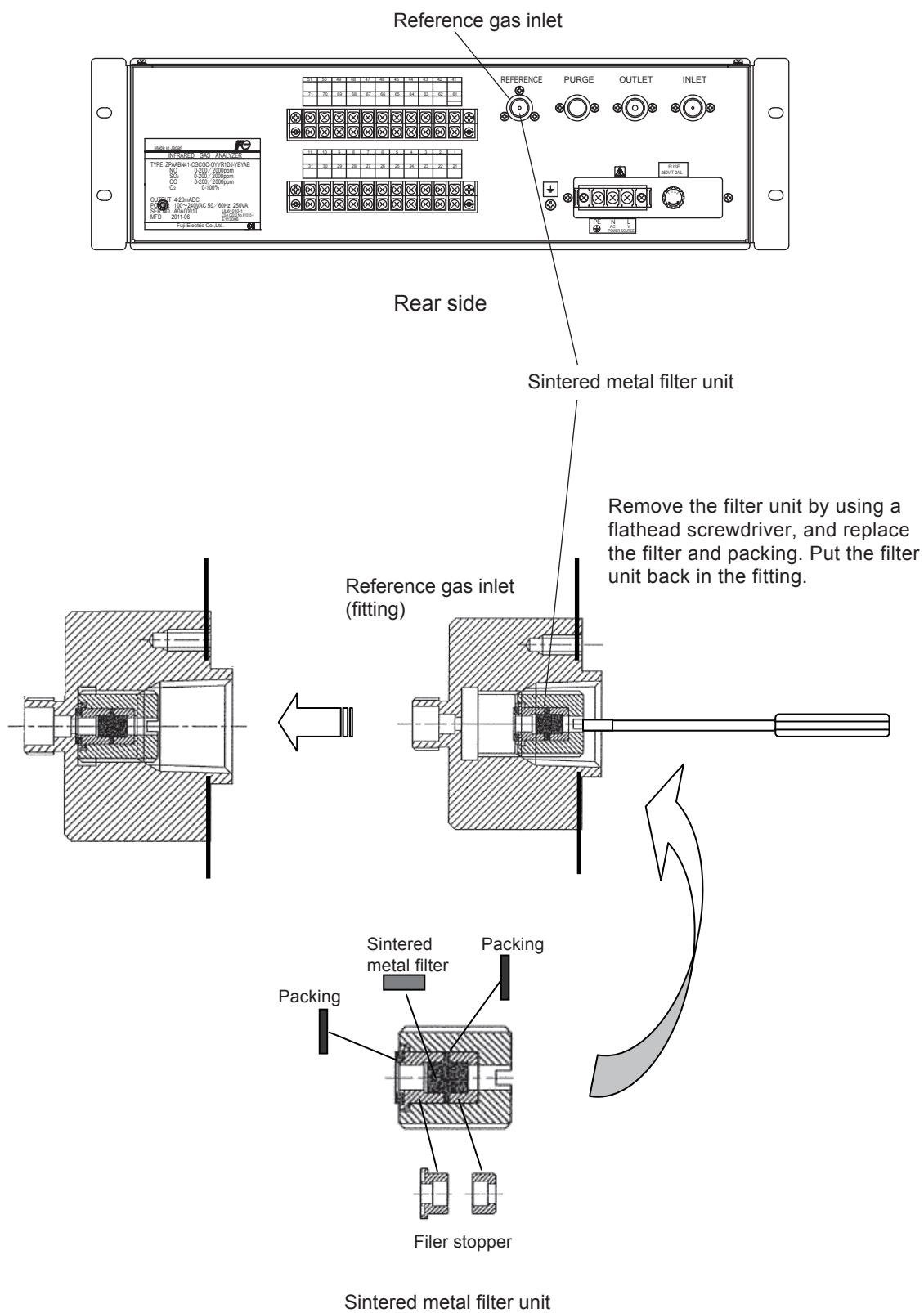


Rear side

*Be sure to remove the cause of fuse breakout before replacement.

- (1) Turn off the analyzer.
- (2) Turn the fuse holder cap counterclockwise and pull it out. Remove the fuse out of the holder.
- (3) Attach the new fuse (250 V AC, 3.15A, time-delay fuse), and put the fuse holder cap back on.
- (4) Turn on the analyzer, and check that it properly works.

7.4 Replacement of filter and packing

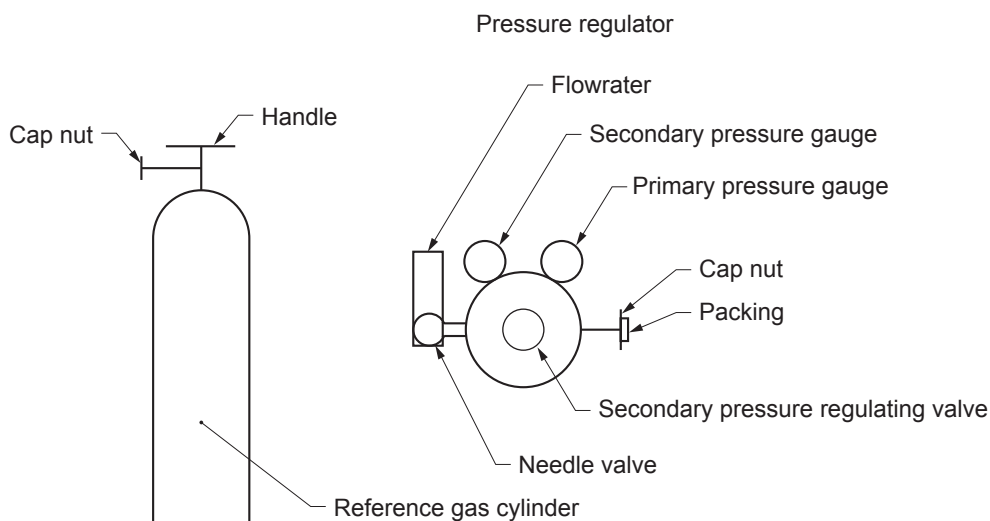


7.5 Replacement of reference gas cylinder

When replacing the reference gas cylinder, prevent dust from entering the pipe. If the fitting is dusty, remove dust completely before replacing the cylinder.

How to install the new cylinder

- (1) Check that the handle of the cylinder is closed, and remove the cap nut.
- (2) Connect the pressure regulator and the cylinder by using the cap nut (make sure it has a packing) of the pressure regulator.
- (3) Check that the secondary pressure regulating valve is turned hard to the left (which means no pressure is applied) and the outlet needle valve is turned hard to the right (which means it is closed), and then open the handle of the cylinder.
- (4) Turn the secondary pressure regulating valve to the right, and set it to a pressure of 20–30 kPa. Gradually open the needle valve to flow the gas.



- For connection with the analyzer, use the fitting and the tube that match the outlet of the pressure regulator. The outlet of the pressure regulator is Rc1/4 internal thread.
- Make sure that the pipes are firmly joined together.
- Keep the gas cylinder from direct sunlight and rain.
- Close the handle of the cylinder after use.

7.6 Long-term maintenance

Draw a maintenance plan in reference to the table below.

Recommended replacement cycle

- The recommended replacement cycles in the table are reference values. The replacement cycle may vary according to the environment, sample gas conditions, and others.
- The recommended replacement cycles are not warranty period.

Installation requirements

- Ambient temperature: -5°C to -45°C
- Humidity: $\leq 90\%$ RH
- Corrosive gas: not allowed
- Radiant heat, direct sunlight, wind and rain: not allowed
- Dust: below the environmental standard
- Vibration: not allowed

Sample gas requirements

- Temperature: 0°C to 40°C
- Moisture: below the level that saturation occurs at 2°C
- Dust: 100 $\mu\text{g}/\text{Nm}^3$ with a particle size of 0.3 μm
- Mist: not allowed
- Corrosive component: not allowed

No.	Parts name	Q'ty	Recommended replacement cycle (yrs.)	Year										
				Delivered year	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year	8th year	9th year	10th year
1	Display	1	3				○			○			○	
2	Main power supply*1	1	5						○					○
3	Power supply for coil*1	1	5						○					○
4	O ring for detector	2	2			○		○		○		○		○
5	Sampling cell	1	8									○		
6	Detector	1	8									○		
7	Orifice	1	2			○		○		○		○		○
8	Filter	2	2			○		○		○		○		○
9	Packing	4	3				○			○			○	
10	Fuse	1	2			○		○		○		○		○

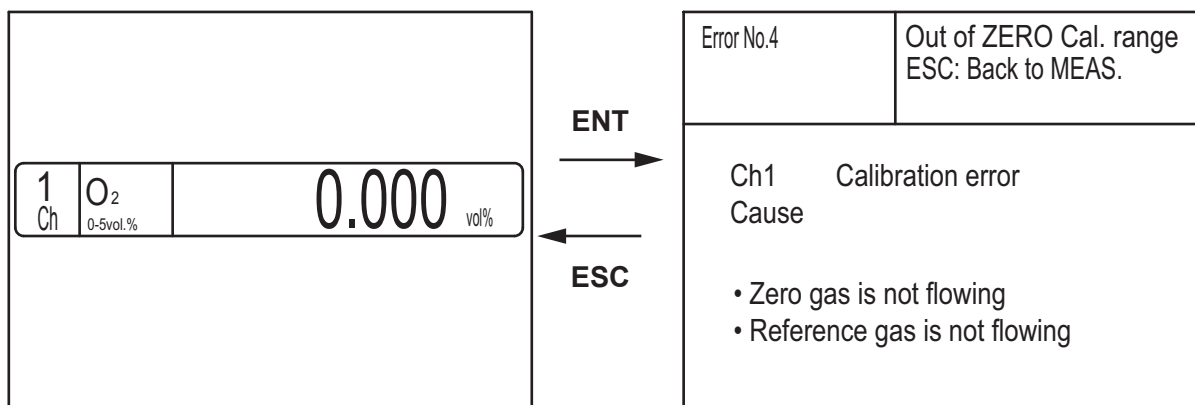
*1: In the case where the analyzer is installed in a cabinet, the life of the power supply may get shorter than five years. We recommend replacing them in three years.

When the ambient temperature is 30°C, keep the temperature rise inside the cabinet within 10°C.

8. ERROR MESSAGE

Error No.	Detail	Causes
1	Electromagnet error	Electromagnet circuit failure
2	Sensor error	• Sensor element failure • Sensor circuit failure • Amplifier circuit failure
3	Temperature error	• Analyzer inside temperature is too high • Temperature sensor failure • A/D conversion circuit error
4	Zero calibration unavailable	• Zero gas is not supplied • Detector failure
5	Calibrated zero point is over 50% of full scale	
6	Span calibration unavailable	• Span gas is not supplied • Calibration concentration setting does not match the cylinder concentration • Zero calibration is carried out in an improper way. • Detector sensitivity is deteriorated
7	Calibrated span point (difference between the indication and calibration concentration) is over 50% of full scale	
8	Measured value fluctuates too much during zero and span calibration	• Calibration gas is not supplied • Time for flowing calibration gas is short
9	Auto calibration error	• Error No.4, to 8 occurred during auto calibration
10	Output cable connection error	• Cable disconnection • Interface circuit error

Display and operation upon error



The error indication disappears by pressing the ESC key. If the cause of error is not eliminated, the error indication appears again

If some errors occurs, you can check them one by one by pressing the NEXT key.

Error log

All the errors are stored in the error log. You can check them from:

Maintenance mode > Error Log

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

- Up to 14 errors can be saved and displayed. The oldest one will be deleted when a new error occurs.
- Error log is not lost even if you turn off the analyzer.

How to clear the error log

In the Error Log screen, select the “Clear Error Log” on the bottom, and press the ENT key.

9. SPECIFICATIONS

9.1 General specifications

SPECIFICATIONS

Measuring range:

Measuring range: Freely settable

Measuring range (vol% O ₂)	Reference gas
0 ~ 0.5 ... 100	N ₂ (100% vol% N ₂)
21 ~ 23 ... 100	Air (21 vol% O ₂)
100 ~ 98 ... 0	O ₂ (100 vol% O ₂)

Numbers of range: 2 ranges

Measuring system: Paramagnetic pressure type

Output signal: 4 to 20mA DC (load 550Ω max.)

Repeatability: Within ± 1% of full scale

Zero drift: Within ± 1.5% of full scale/week

Span drift: Within ± 1.5% of full scale/week

Flow rate of sample gas:

0.5L/min ± 0.05L/min (in ranges below 2 vol% O₂)

0.5L/min ± 0.2L/min (in 2 vol% O₂ or higher ranges)

Response time (90% response: *Indication start-up time):

2s or less

*The time (= 1sec.) required for gas replacement in the internal piping is not included.

Linearity: Within ± 1% of full scale

Reading fluctuation:

≤ ±2.0% FS for 0–2% or lower ranges

≤ ±1.5% FS for ranges above 0–2%

Sample gas temperature: 0 to 40°C

Pressure loss:

Approx. 1.3kPa (at sample gas flow rate 0.5L/min)

Reference gas: N₂, O₂ gas or air

Reference gas pressure:

70 kPa (Apply pressure of a magnitude described to the reference gas inlet.)

*Reference gas is supplied at the above pressure to allow for flow rates of 5 to 20mL/min.

Purging gas (dry air or N₂) flow rate: 1L/min, N₂ gas or air (flowed for purging corrosive ambient gas)

Gas inlet/outlet dimensions: Rc1/4 or NPT1/4

Materials of gas-contacting parts:

Teflon and 304 stainless steel

Warmup time: Approx. 2 hours

Display:

Liquid crystal display, concentration indication (4 digits), range indication (4 digits)

Output hold:

Output hold is possible during calibration.

Moving average time: 0 to 99.9s

Contact output:

SPST-NO contact, contact capacity: 250 V AC, 2A (resistive load)

Contact is closed during calibration and instrument failure

Power supply:

Voltage rating: 100 to 240V AC

Allowable range: 85 to 264V AC

Frequency: 50/60Hz

Power consumption: Approx. 90VA

Ambient temperature: -5 to +45°C

Ambient humidity: Less than 90% RH

Allowable (max.) external vibration:

1.0 m/s² (0 to 30 Hz)

0.5 m/s² (30 to 100 Hz)

Enclosure: Steel, for indoor use

External dimension (H×W×D):

Rack mount type 133 × 483 × 433mm

Flush mount type 132 × 483 × 433mm

Desk-top type 148 × 429 × 433mm

Mass: Approx. 9.5kg

Finish color: Front panel: Cool gray

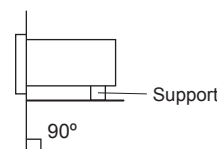
Casing : steel

Installation condition:

- The instrument must be protected from direct sunlight and heat radiation from objects at high temperature.
- The instrument must be installed in a clean atmosphere free from corrosive or combustible gas.
- The instrument must be free from severe external vibrations. When fast response time is required, it should be used in a place free from vibration.

Mounting method:

Mounting on 19-inch rack, flush mounting on panel or desk top mounting



Note: At least 70% of the weight of the instrument must be supported by the bottom of the case. When mounting the instrument on a panel or 19-inch rack, add a support under rear side of the instrument.

EU Directive Compliance CE

LVD:

EN 61010-1

EN 62311

EMC:

EN 61326-1 (Table 2)

EN 61000-3-2 (Class A)

EN 61000-3-3

EN 61326-2-3

RoHS:

EN IEC63000

OPTIONAL SPECIFICATION

Alarm output:

Upper limit alarm: SPDT contact
Contact capacity: 250 V AC, 2A
(resistive load)

Lower limit alarm: SPDT contact
Contact capacity: 250 V AC, 2A
(resistive load)

Remote range changeover:

Range can be changed by external signal

Range identification signal output:

Contact output: SPST-NO contact
Contact capacity: 250 V AC, 2A (resistive load)

Output hold:

Each output can be held by external input signal

Communicating function:

RS-485 (MODBUS)

Half-duplex bit serial, start-stop synchronization

Contents: Parameter settings (read/write), measured values (read), instrument status (write)

Remark : When connecting via RS-232C interface, an RS-232C ↔ RS-485 converter should be used.

Automatic calibration:

Zero/span calibration is performed automatically at a preset cycle.

Calibration gas is supplied while driving the external electromagnetic valve.

Calibration gas density setting range:

Zero gas: 0.00 to 99.99%O₂ (0.01%O₂ step)

Span gas: 0.00 to 99.99%O₂ (0.01%O₂ step)

Calibration start:

Built-in timer or remote start signal

Output hold during calibration: Possible

Calibration gas flow time:

Configurable between 60 to 599 seconds

Calibration cycle:

1 to 99 hours (in hours) or 1 to 40 days (in days)

Contact output:

Calibration: SPST-NO contact

Contact capacity: 250V AC, 2A (resistance load)

Calibration error: SPST contact

Contact capacity: 250V AC, 2A (resistance load)

Contact output for solenoid valve: SPST contact

Contact capacity: 250V AC, 2A (resistance load)

Remote start:

Remote start input signal.

Interference correction by interference gas measured value input:

The analyzer measures the concentration of the interference gas you selected, and calculates O₂ concentration based on the change of the interference gas concentration.

External interference gas measured value input:

1 to 5 V DC, 1range

Interference gas fluctuation range:

Reference concentration ± 20% F.S.

O₂ gas concentration correcting range:

Reference concentration ± 20% F.S.

Correction accuracy: ±10% F.S.

Requires factory adjustment.

Details of measurement gas will be checked when receiving an order.

9.2 Code symbols

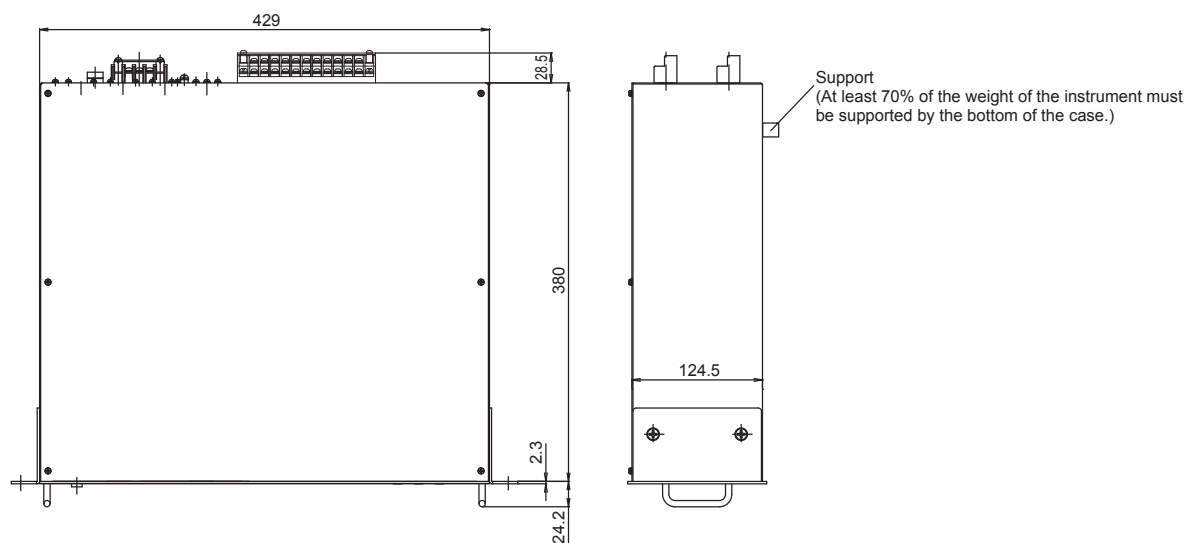
Digit			Specifications									
4	-	-										
5	Measuring range (Note 1)	Min. range 5 / Max.range 100 vol% O ₂ (Without buffer tank) Min. range 5 / Max.range 100 vol% O ₂ (With buffer tank) Min. range 0.5 / Max.range 100 vol% O ₂ (With buffer tank)										
6	Response time	2sec/90%										
7	Connecton dimension	Rc1/4 NPT1/4										
8	Revision code	-										
9	Gas inlet, outret	Rear Front										
10	Display	Japanese English Chinese										
11	Option 1	Without Automatic calibration Alarm output, remote renge, range identification Communication function (RS-485) A+B A+C B+C A+B+C										
12	Construction	<Mounting> <Power switch> <Power terminal> Desk-top type Front Terminal block Desk-top type Front AC Inlet Rack/panel mount Front Terminal block Rack/panel mount Front AC inlet Rack/panel mount Rear AC inlet										
13	Option 2	Without Interference gas compensation (Note2)										

Note 1) Factory default measurement range: 0 to 5/25 vol% O₂.

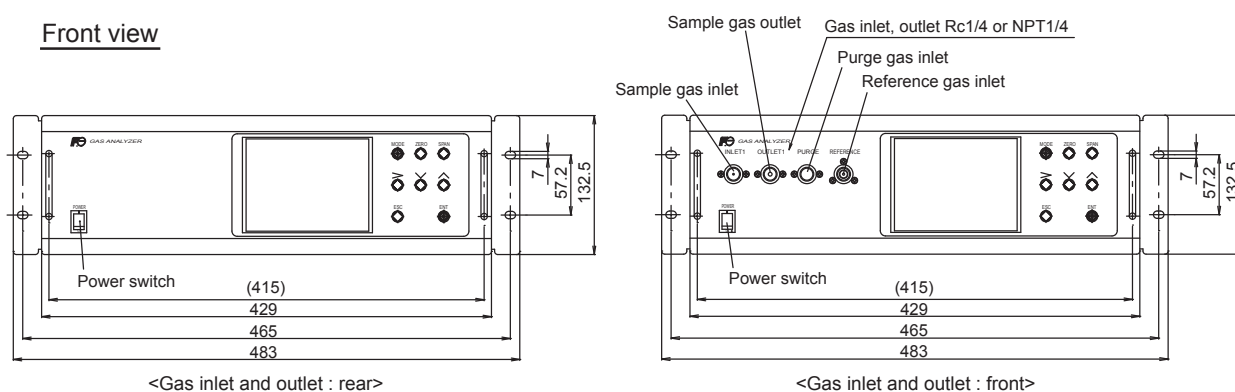
- Note 2) • If you order the product version with the interference compensation function, fill in the table for checking sample gas component attached on the last page.
- An additional analyzer is required for measuring interference gas (CO₂ or CH₄).
 - Input signal is 1 to 5V DC.
 - Requires factory adjustment.
 - Reverse range such as 100 to 0 %, and atmospheric air standard range are not available.

9.3 Outline diagram (Unit : mm)

Rack/panel mount type



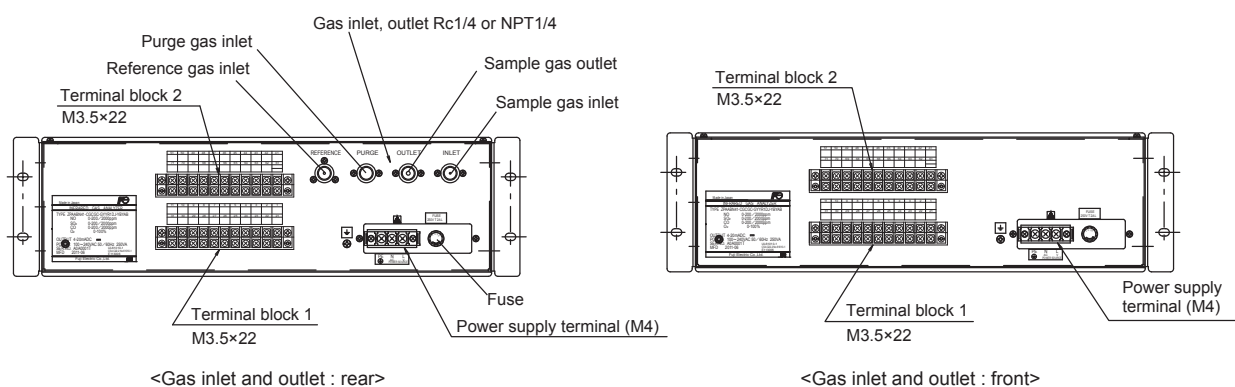
Front view



<Gas inlet and outlet : rear>

<Gas inlet and outlet : front>

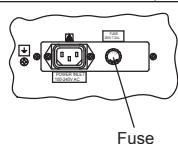
Rear view



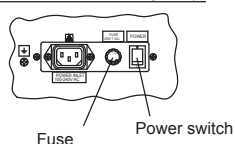
<Gas inlet and outlet : rear>

<Gas inlet and outlet : front>

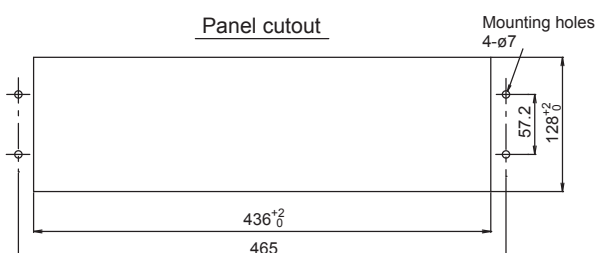
Power inlet
(power switch on front panel)



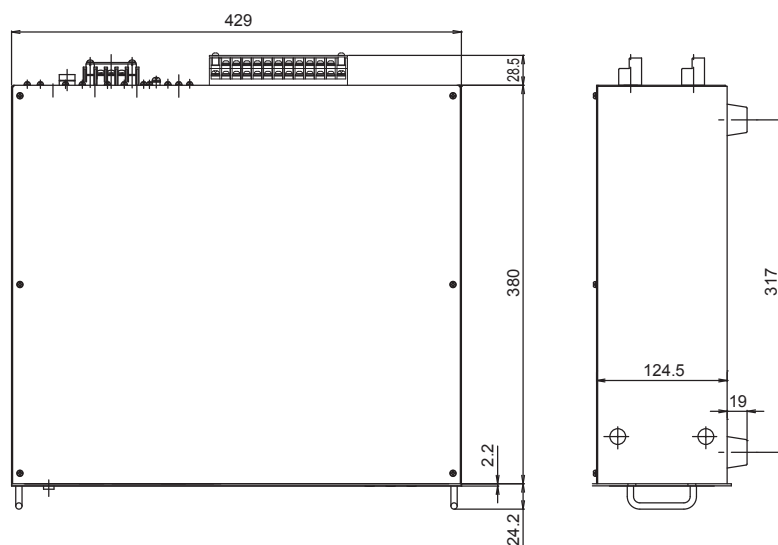
Power inlet
(power switch on rear panel)



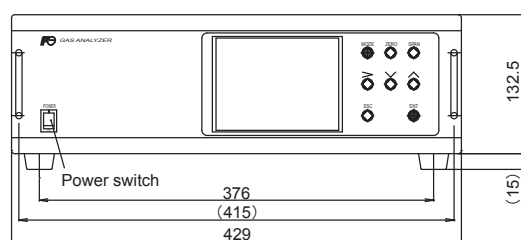
Panel cutout



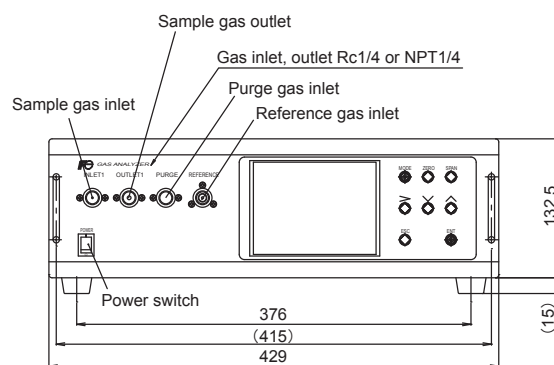
Desk-top type



Front view

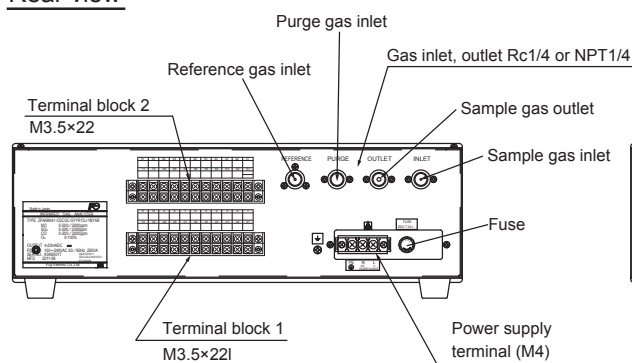


<Gas inlet and outlet : rear>

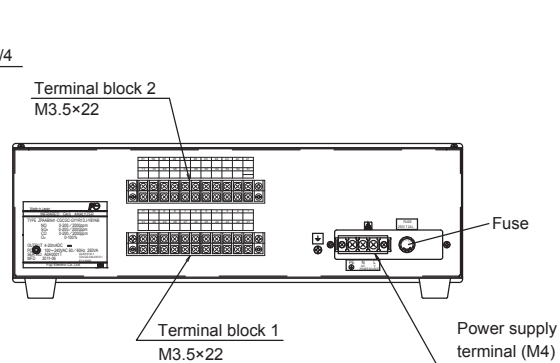


<Gas inlet and outlet : front>

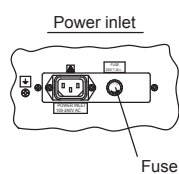
Rear view



<Gas inlet and outlet : rear>



<Gas inlet and outlet : front>





Gate City Ohsaki, East Tower, 11-2, Osaki 1-chome, Shinagawa-ku, Tokyo 141-0032, Japan
Phone: +81-3-5435-7111
www.fujielectric.com
www.fujielectric.com/products/instruments/
