



Instruction Manual

**ZIRCONIA OXYGEN  
ANALYZER CONVERTER  
(SINGLE-CHANNEL TYPE)**

TYPE: ZRM

## PREFACE

We are grateful for your purchase of Fuji Electric's Zirconia Oxygen Analyzer Converter (ZRM).

- First read this instruction manual carefully until an adequate understanding is acquired, and then proceed to installation, operation and maintenance of the analyzer converter. Wrong handling may cause an accident or injury.
- The specifications of this analyzer converter will be changed without prior notice for further product improvement.
- Modification of this analyzer converter 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 analyzer converter.
- 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.

Manufacturer: Fuji Electric Instrumentation 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.



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## CAUTION ON SAFETY

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

- The cautionary descriptions listed here contain important information about safety, so they should always be observed. Those safety precautions are ranked 2 levels; DANGER and CAUTION.

 <b>DANGER</b>	Wrong handling may cause a dangerous situation, in which there is a risk of death or heavy injury.
 <b>CAUTION</b>	Wrong handling may invite a dangerous situation, in which there is a possibility of medium-level trouble or slight injury or only physical damage is predictable.

- Even an undesirable action described in “  **CAUTION** ” may lead to a grave result depending on situation. Be sure to observe DANGER and CAUTION because they are both important for ensuring safety.

<b>Caution on installation and transport of gas analyzer</b>	
 <b>DANGER</b>	<ul style="list-style-type: none"> <li>• 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.</li> </ul>
 <b>CAUTION</b>	<ul style="list-style-type: none"> <li>• 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.</li> <li>• 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.</li> <li>• For installation, observe the rule on it given in the instruction manual and select a place where the weight of gas analyzer can be endured. Installation at an unsuited place may cause turnover or fall and there is a risk of injury.</li> <li>• For lifting the gas analyzer, be sure to wear protective gloves. Bare hands may invite an injury.</li> <li>• Before transport, fix the casing so that it will not open. Otherwise, the casing may be separated and fall to cause an injury.</li> <li>• The gas analyzer is heavy. It should be transported carefully by two or more persons if manually required. Otherwise, body may be damaged or injured.</li> <li>• For installation and maintenance accessible by qualified personnel only.</li> </ul>

### Caution on piping



- If leaked gas contains oxygen at a high concentration, there is a risk of fire.
- Connect pipes correctly referring to the instruction manual. Wrong piping may cause gas leakage.

### Caution on wiring



- The unit must be earthed as specified. Otherwise, it may cause electric shocks, malfunction, etc.
- Be sure to use a power supply of correct rating. Connection of power supply of incorrect rating may cause fire.
- Wiring work must be performed with the main power set to OFF to prevent electric shocks.
- Use wiring materials that match the rating of the unit. Use of wiring materials out of rating may cause fire.
- The supply voltage category of this instrument is II. Relay contact is category I.
- Analog output and digital input of this instrument are Safe Separated (SELV) circuit.
- Establish an external over-current protection device (e.g. circuit-breaker) with a rating of no more than 5A as per the general product specification.
- Connect correctly wiring L (live)/N (neutral) to the power supply terminal.
- Enforce construction of protective earth wiring by all means.
- Install correctly according to regulation of each country, as not being External Disconnection Device for this instrument.

### Caution on use



- During operation, avoid opening the casing and touching the internal parts. Otherwise, you may suffer a burn or shock hazard.
- Avoid touching the detector with bare hand during operation. Otherwise, you may suffer a burn because the detector may have reached a high temperature (about 800°C).
- During operation, avoid removing and placing the detector on or near a combustible material. Otherwise, fire may occur.

### Caution on maintenance and check



- Before maintenance and check, be sure to turn off the main power supply and wait until the detector is cooled adequately. Otherwise, you may suffer a burn.
- Before removing the detector from the flue for maintenance and check, make sure the furnace is stopped. Otherwise, you may suffer a burn.
- Before working, take off a wrist watch, finger ring or the like metallic accessories. And never touch the instrument with a wet hand. Otherwise, you will have a shock hazard.
- If the fuse is blown, eliminate the cause, and then replace it with the one of the same capacity and type as before. Otherwise, shock hazard or fault may be caused.

### Others



- If the cause of any fault cannot be determined despite reference to the instruction manual, be sure to contact your dealer or Fuji Electric's technician in charge of adjustment. If the instrument is disassembled carelessly, you may have a shock hazard or injury.
- Do not use a replacement part other than specified by the instrument maker. Otherwise, adequate performance will not be provided. Besides, an accident or fault may be caused.
- Replacement parts such as a maintenance part should be disposed of as incombustibles.

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# 1. GENERAL DESCRIPTION

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This instruction manual describes the installation, operation and maintenance of the single-channel type converter, so read through it before using the converter. For the detector, flow guide tube and ejector used with the converter, refer to relevant instruction manuals.

## 1.1 Direct insertion type zirconia oxygen analyzer

The direct insertion type zirconia oxygen analyzer consists of a direct insertion type zirconia detector (type ZFK) and single-channel converter (type ZRM).

It is used to measure oxygen concentration in waste gas during combustion for controlling gas combustion.

## 1.2 Confirmation of delivered components

Inspect the external appearance and number of accessories to confirm there is no damage or shortage of parts.

### List of components and accessories

Converter

Accessories of converter

- Power fuse (0.5A)----- 2
- Heater fuse (3A) ----- 2
- Metal fittings (option) ----- 1 set

### CAUTION

Power voltage for the converter must conform to that for the detector (ZFK2 or 5) to be connected. Don't use any power voltage different from the power specifications of the detector.

Because it may result in damage to the detector.

100/115V AC for ZFK  $\frac{2}{5}$  □□ 13-0

200/220V AC for ZFK  $\frac{2}{5}$  □□ 33-0

### 1.3 Confirmation of type of delivered components

Check model name on main nameplate in order to confirm the delivered components meet your specifications.

**(1) Type of converter (Code symbols)**

1	2	3	4	5	6	7	8	9 Digit	Description
Z	R	M	1				1	-	
			1						Configuration
				B E					Output signal 4 to 20mA DC 0 to 1V DC
					Y A B C				Optional function No optional function Communication function Combustion efficiency display function Both of communication and combustion efficiency display function
						1			Power 90 to 220V AC 50/60Hz
								1 2	Mounting method 1 Mounting on panel surface 2 Mounting on pipe

(2) Type of detector (Code symbols)

1	2	3	4	5	6	7	8	9 Digit	Description
Z	F	K					3	0	
			2 5						Application For general use Anti-corrosive (for waste incineration plant)
				Y A					Rainproof cover Without With
					Y A B C D U V W X J K L M N P				Flow guide tube Without With (300mm) With (500mm) With (750mm) With (1000mm) With (300mm) With (500mm) With (750mm) With (1000mm) With (300mm) With (500mm) With (750mm) With (1000mm) With (1500mm) With (2000mm) } Anti-corrosive } With blow down nozzle
						1 3			Power supply 100V/115V AC 50/60Hz 200V/220V AC 50/60Hz
								0	Specification Standard

■ Detector for replacement

Application	Type	Application	Type
General use 100/115V AC Power	ZFK2YY13-0	Anti-corrosive 100/115V AC Power	ZFK5YY13-0
General use 200/220V AC Power	ZFK2YY33-0	Anti-corrosive 200/220V AC Power	ZFK5YY33-0

**(3) Type of exclusive cable connecting converter to detector (Code symbols)**

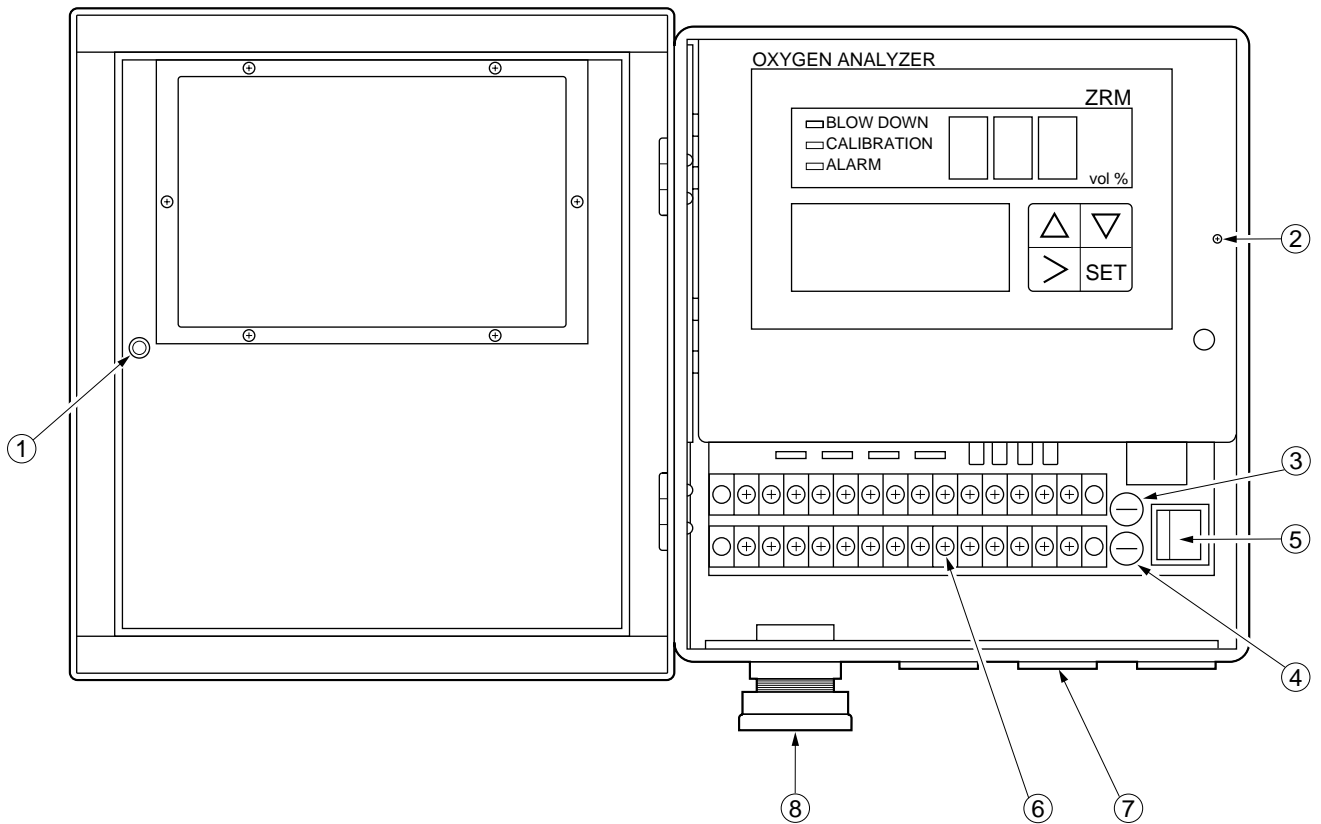
1	2	3	4	5	6	7	8	9 Digit	Description
Z	R	Z					1	-	
			M						Specification For ZRM
				R					Type For thermocouple R
				K					For thermocouple K
					Y	A			Flexible conduit length Without
					Y	B			Cable length 6M
					Y	C			10M
					Y	D			15M
					Y	E			20M
					Y	F			30M
					Y	G			40M
					Y	H			50M
					Y	I			60M
					Y	J			70M
					Y	K			80M
					Y	L			90M
					Y	M			100M
					A	A			Without 6M
					B	B			10M
					C	C			15M
					D	D			20M
									Max. flexible conduit length 20M. Max. cable length 100M.
								0	Termination Without
								1	One end (detector ZFK side)
								2	Both ends

**(4) Type of ejector (Code symbols) (Option)**

1	2	3	4	5	6	7	8 Digit	Description
Z	T	A		1			1	
			1					Temperature of measured gas For high temperature (max. 1590°C) For general use (max. 800°C)
			2					
					B			Insertion length (mm) 500
					C			750
					D			1000
					E			1500
						1		Power supply 100V/115V AC 50/60Hz
						3		200V/220V AC 50/60Hz

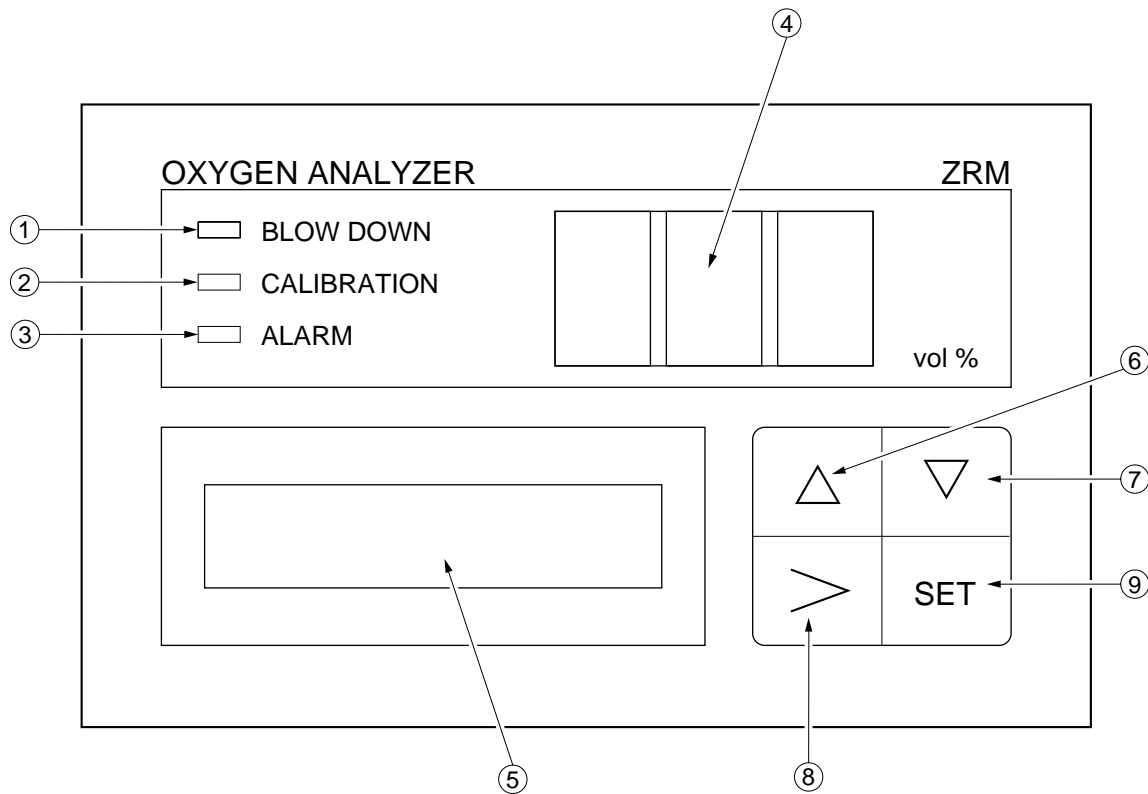
## 2. NAME AND FUNCTION OF EACH PART

### 2.1 Name and function of converter part



No.	Name	Function
	Converter fixing screw	Knob with screw for opening or closing the cover.
	Operation panel fixing screw	Screw for fixing the operation panel to the case.
	Fuse (0.5A)	Fuse for the power supply of the converter.
	Fuse (0.3A)	Fuse for the heater for O <sub>2</sub> detector.
	Power switch	For power ON and OFF.
	Terminal block	Connect cables from external equipments.
	Cable inlet	Use to insert external cable (with rubber bushing).
	Cable gland	Cable inlet to insert the exclusive cable for the detector.

## 2.2 Name and function of display and control panel



No.	Name	Function
	Blowdown lamp	Lights when being set at “Auto blowdown”, and flickers under blowdown operation.
	Calibration lamp	Lights when being set at “Auto calibration”, and flickers under calibration operation.
	Alarm lamp	Lights when “Upper limit/Lower limit” or “Fault” occurred.
	Oxygen concentration display	Displays oxygen gas concentration.
	Display	Displays measuring range, contents of setting, etc., and also displays abnormal conditions.
	Up key	} Refer to each operation procedure flow in chapter 6 to 10.
	Down key	
	Cursol key	
	Set key	

### 3. INSTALLATION

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#### CAUTION

- Installation the analyzer safely and securely so that it will not fall.

#### 3.1 Location for installation

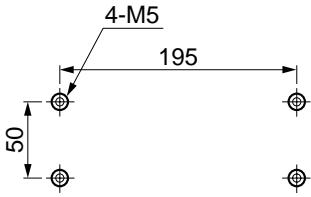
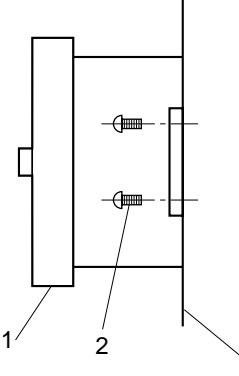
The location for installation should meet the following conditions.

- (1) For installation in restricted areas (i. e. enclose with a fence) only, accessible by qualified persons only.
- (2) Space for routine inspection and wiring available.
- (3) Vibration, dust, dirt and humidity are minimal.
- (4) No direct influence of radiation from heating furnace or the like (converter).
- (5) Non-corrosive atmospheric environment.
- (6) No electric machinery nearby, which may cause noise trouble (such as motor, transformer) or produce electromagnetic and electrostatic induction.
- (7) Ambient temperature within -10 to +50 and ambient humidity less than 90%RH (converter).

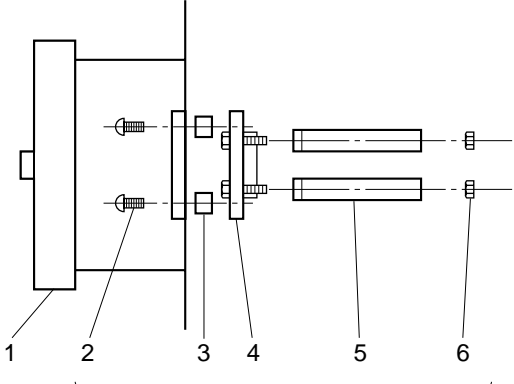
- The supply voltage category of this instrument is II. Relay contact is category I.
- Analog output and digital input of this instrument are Safe Separated (SELV) circuit.
- Establish an external over-current protection device(e.g. circuit-breaker) with a rating of no more than 5A as per the general product specification.
- Connect correctly wiring L(live)/N(neutral) to the power supply terminal.
- Enforce construction of protective earth wiring by all means.
- Install correctly according to regulation of each country, as not being External Disconnection Device for this instrument.
- For installation and maintenance accessible by qualified personnel only.

## 3.2 Installation

### 3.2.1 Panel mounting

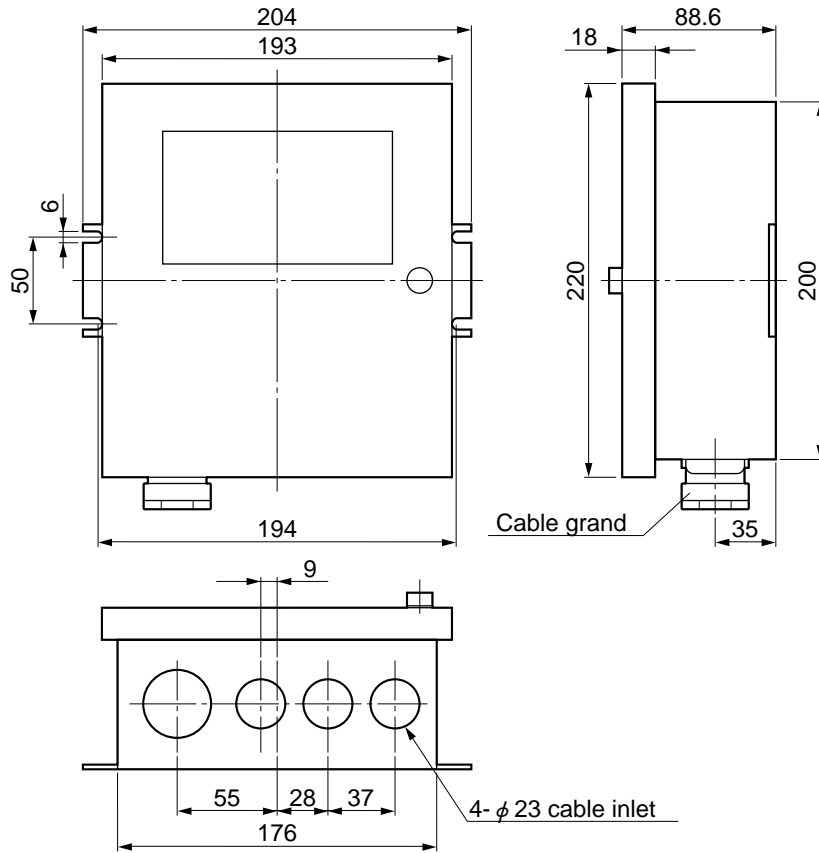
Mounting dimension (unit ; mm)	Mounting method									
	 <table border="1" data-bbox="933 465 1353 772"> <thead> <tr> <th>No.</th> <th>Name</th> <th>Piece</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Converter</td> <td>1</td> </tr> <tr> <td>2</td> <td>Pan head screw M5 × 10 (attached to the converter)</td> <td>4</td> </tr> </tbody> </table>	No.	Name	Piece	1	Converter	1	2	Pan head screw M5 × 10 (attached to the converter)	4
No.	Name	Piece								
1	Converter	1								
2	Pan head screw M5 × 10 (attached to the converter)	4								

### 3.2.2 Pipe mounting

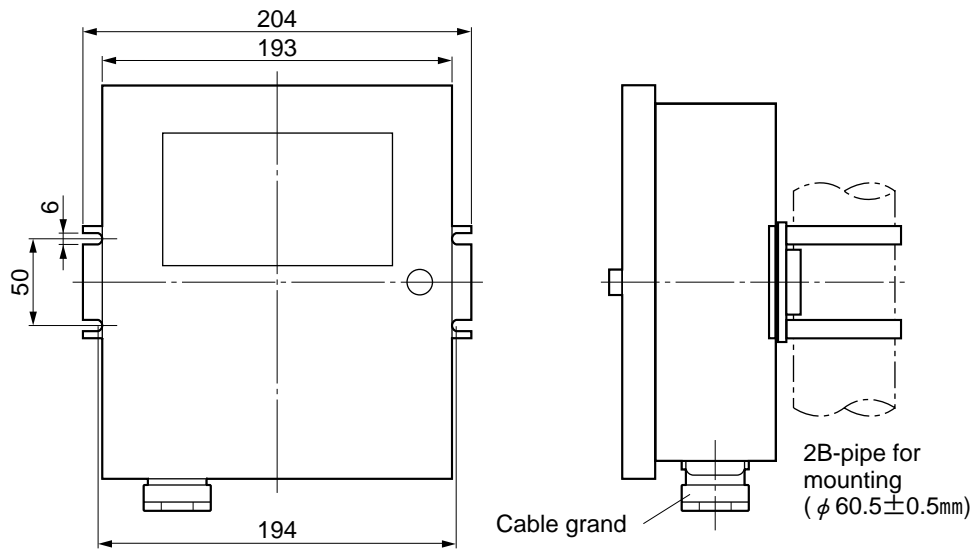
Mounting method																						
 <p data-bbox="331 1444 678 1512">Attached to the converter when specified the pipe mounting</p>	<table border="1" data-bbox="786 1099 1345 1413"> <thead> <tr> <th>No.</th> <th>Name</th> <th>Piece</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Converter</td> <td>1</td> </tr> <tr> <td>2</td> <td>Pan head screw M5 × 10</td> <td>4</td> </tr> <tr> <td>3</td> <td>Ling</td> <td>4</td> </tr> <tr> <td>4</td> <td>Mounting plate for pipe</td> <td>1</td> </tr> <tr> <td>5</td> <td>Band for pipe</td> <td>2</td> </tr> <tr> <td>6</td> <td>Hexagonal screw nut M5</td> <td>4</td> </tr> </tbody> </table>	No.	Name	Piece	1	Converter	1	2	Pan head screw M5 × 10	4	3	Ling	4	4	Mounting plate for pipe	1	5	Band for pipe	2	6	Hexagonal screw nut M5	4
No.	Name	Piece																				
1	Converter	1																				
2	Pan head screw M5 × 10	4																				
3	Ling	4																				
4	Mounting plate for pipe	1																				
5	Band for pipe	2																				
6	Hexagonal screw nut M5	4																				

### 3.3 Outline dimensions of converter

#### 3.3.1 Panel mounting



#### 3.3.2 Pipe mounting



## 4. WIRING AND PIPING

---



### CAUTION

- Wiring work must be carried out with all power supplies turned off. Otherwise, you may suffer electric shock.
- The analyzer should be grounded without fail (Class 3 grounding).

### 4.1 Before wiring

For installation and maintenance accessible by qualified personnel only.

Install correctly according to regulation of each country, as not being External Disconnection Device for this instrument.

Establish an external over-current protection device (e.g. circuit-breaker) with a rating of no more than 5A as per general product specification.

The over voltage category of this instruments is II. But the parts of output terminals is category I.

Analog output and digital input of this instrument are Safe Separated (SELV) circuit.

Make sure that the power voltage for the converter conforms to that for the detector (ZFK2 or 5) to be connected.

For power supply use 600V vinyl insulation wire with AWG18 (34/0.18) or equivalent in quality.

Provide adequate protection of the exclusive cable (6 cores in total), which connects the detector to converter, using wire protection tube, etc.

Separate these cables from the power cable (noise prevention).

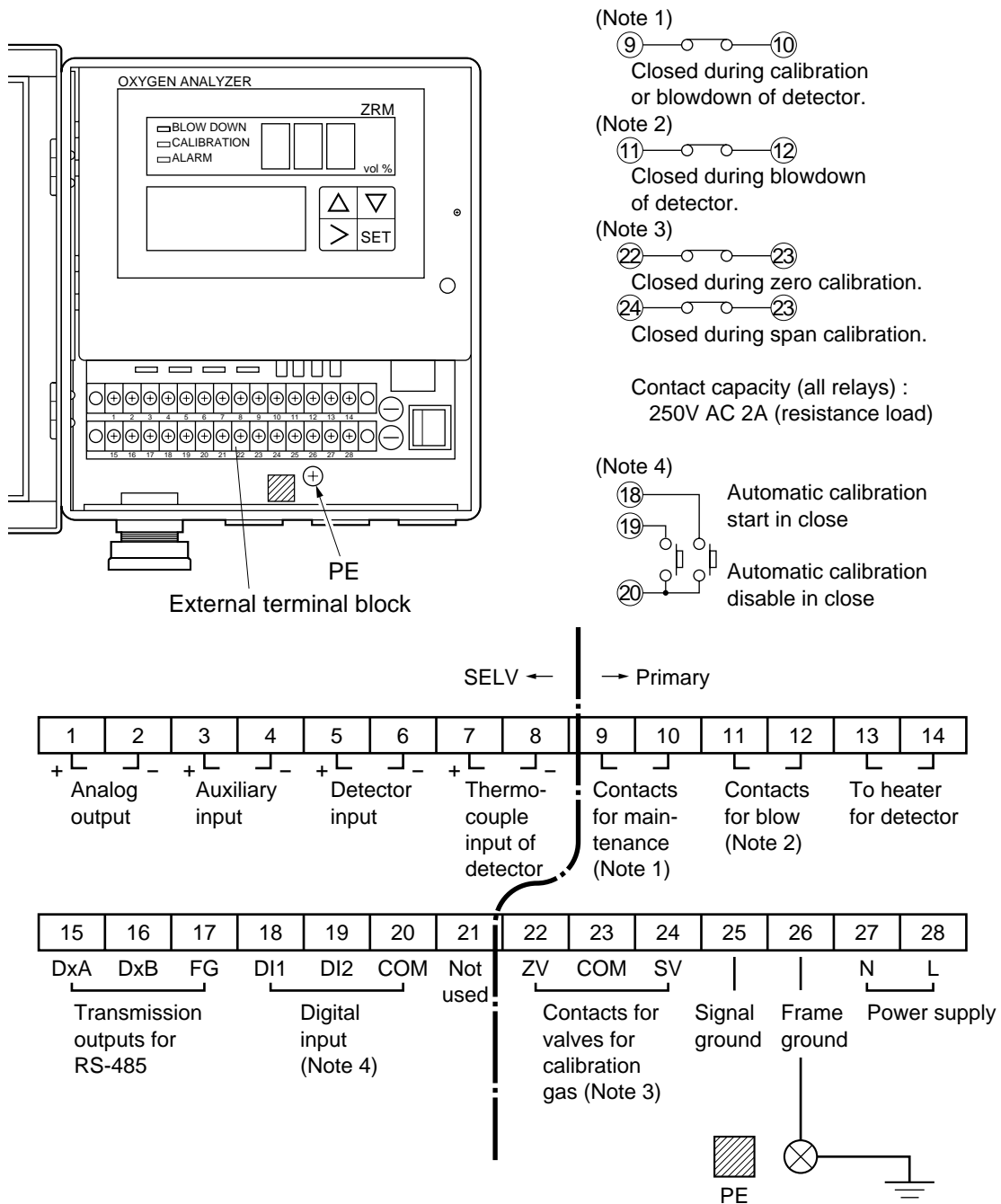
Keep the wire for output signals as far as possible (more than 30cm) from the power line and heavy current lines to prevent induced noise. Use a shielding cable as much as possible and ground the shields as the same point.

**Caution :Connection of wiring to the external terminals, exclusive use of ring crimp lugs with proper insulating sleeve.**

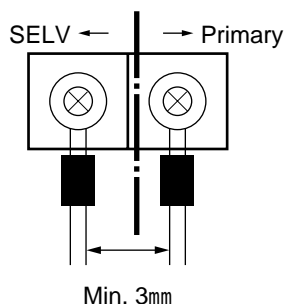
Connect correctly wiring L (live)/N (neutral) to the power supply terminal.

Enforce construction of protective earth wiring by all means.

## 4.2 Wiring to each terminal



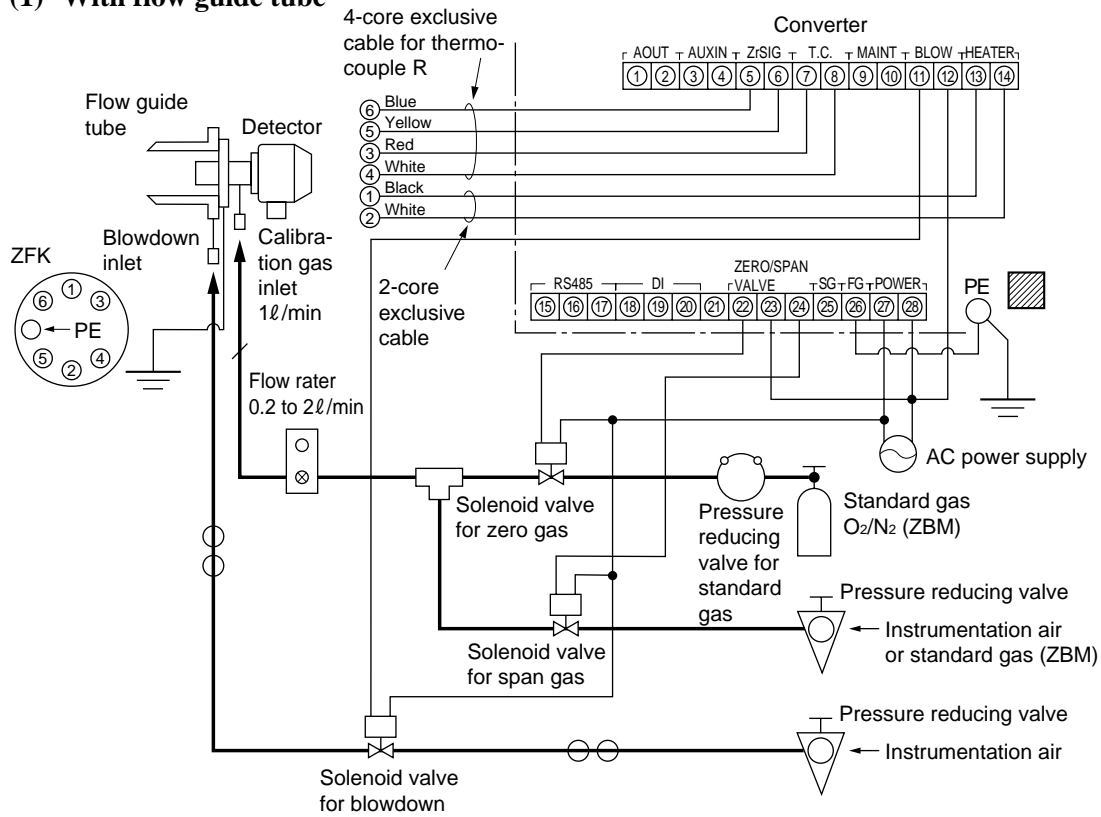
- Wiring screws on the terminal block are M3 screws.
- Connection of wiring to the external terminals, exclusive use of ring crimp lugs with proper insulating sleeve.



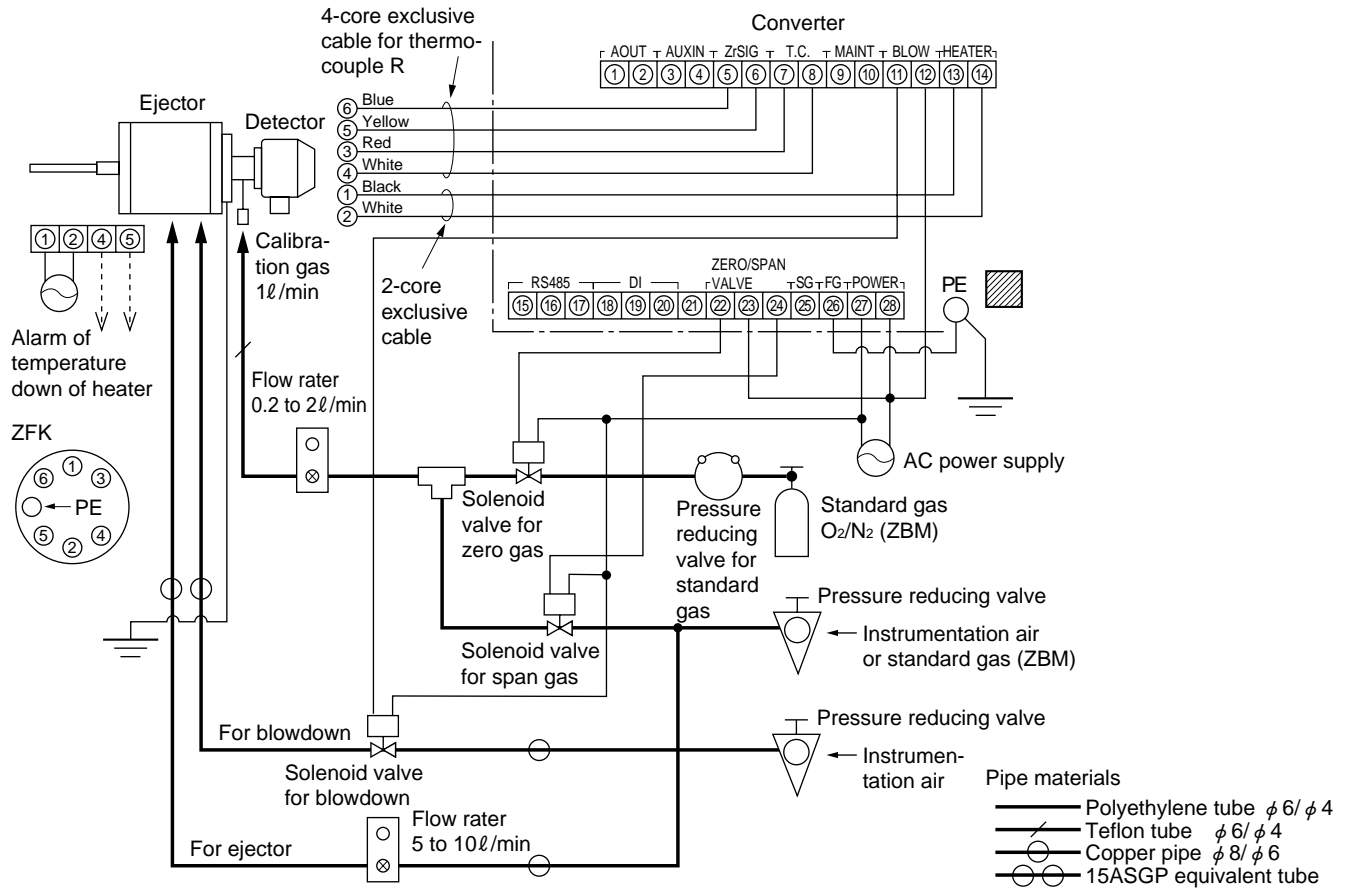
Reinforced insulation must be maintained over safe separation on termination of wires/crimps.

## 4.3 Wiring and piping diagram

### (1) With flow guide tube



### (2) With ejector



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## 4.4 Handling of standard gas (An article on separate order)

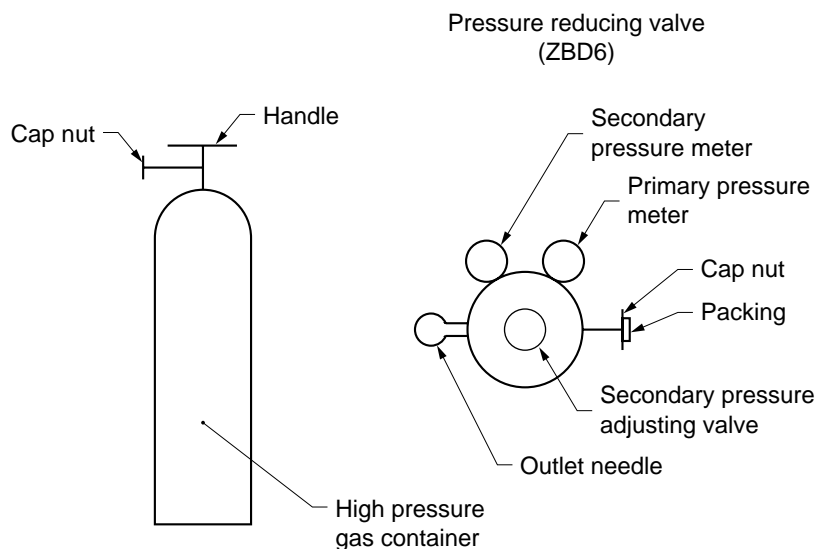
### (1) Handling

Make sure the handle is closed on the high pressure gas container, then detach the cap nut.

Attach the high pressure gas container using the cap nut with packing of the pressure reducing valve.

Make sure the secondary pressure adjusting valve is turned fully counterclockwise (pressure not applied) and the outlet needle is turned fully clockwise (closed), then open the handle.

Turn the secondary pressure adjusting valve clockwise and set to the normal value of 20 to 30 kPa {0.204 to 0.306kgf/cm<sup>2</sup>}, then open the outlet needle slowly to allow the gas to flow.



### (2) Piping

The gas outlet of the pressure reducing valve is of Rc 1/4 (PT1/4 internal thread). Prepare a joint and tube ( $\phi$  6/  $\phi$  4 teflon tube, etc.).

### (3) Caution

Fasten securely, so there is no gas leakage from the pressure reducing valve connection nor from threaded part of the joint.

Store high pressure gas containers in a place protected from direct sunlight and rain.

After use, be sure to close the handle.

## 5. PREPARATION FOR OPERATION

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Preparation can be performed after installation or on the bench.

Note) For using the detector ZFK5, setting of detector temperature needs to be changed from 800 to 750 . So refer to “11. How to change the setting of converter ZRM depending on detector type.”

Wiring check (Refer to 4.2, 4.3)



Confirmation of the power supply specifications (Confirm the specifications of the main power supply and voltage.)



Piping check (Refer to 4.3)



Power ON

Open the front cover of the converter and turn ON the power switch located in the lower right corner.



Fuji Electric  
Oxygen Analyzer

The message shown left appears on the LCD screen.



MEASURE  
0 to 25.0 vol%O<sub>2</sub>

After about 3 seconds a message denoting “Measurement mode” appears on the LCD screen and LEDs are lit as shown left.

2 1. 0



Warmup (After 15 minutes from power ON, accurate measurement data may be obtained.)



Parameter setting and key operation procedures

Parameter settings at shipment (initialization) are tabulated on page 5-3 and key operation procedures are described in a flow diagram on page 5-4.

Refer to chapter 10 for changing parameters.



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### Calibration

At the first operation, perform manual calibration after warmup using a calibration gas.  
Refer to chapter 7 for calibration procedures.



### Automatic calibration

Automatic calibration may be performed at specified time intervals.  
Refer to 7.3 for automatic calibration settings.



### Blowdown

A flow guide tube blowdown feature prevents the flow guide tube from clogging due to dust in the gas stream.  
Refer to chapter 8 for operation procedures

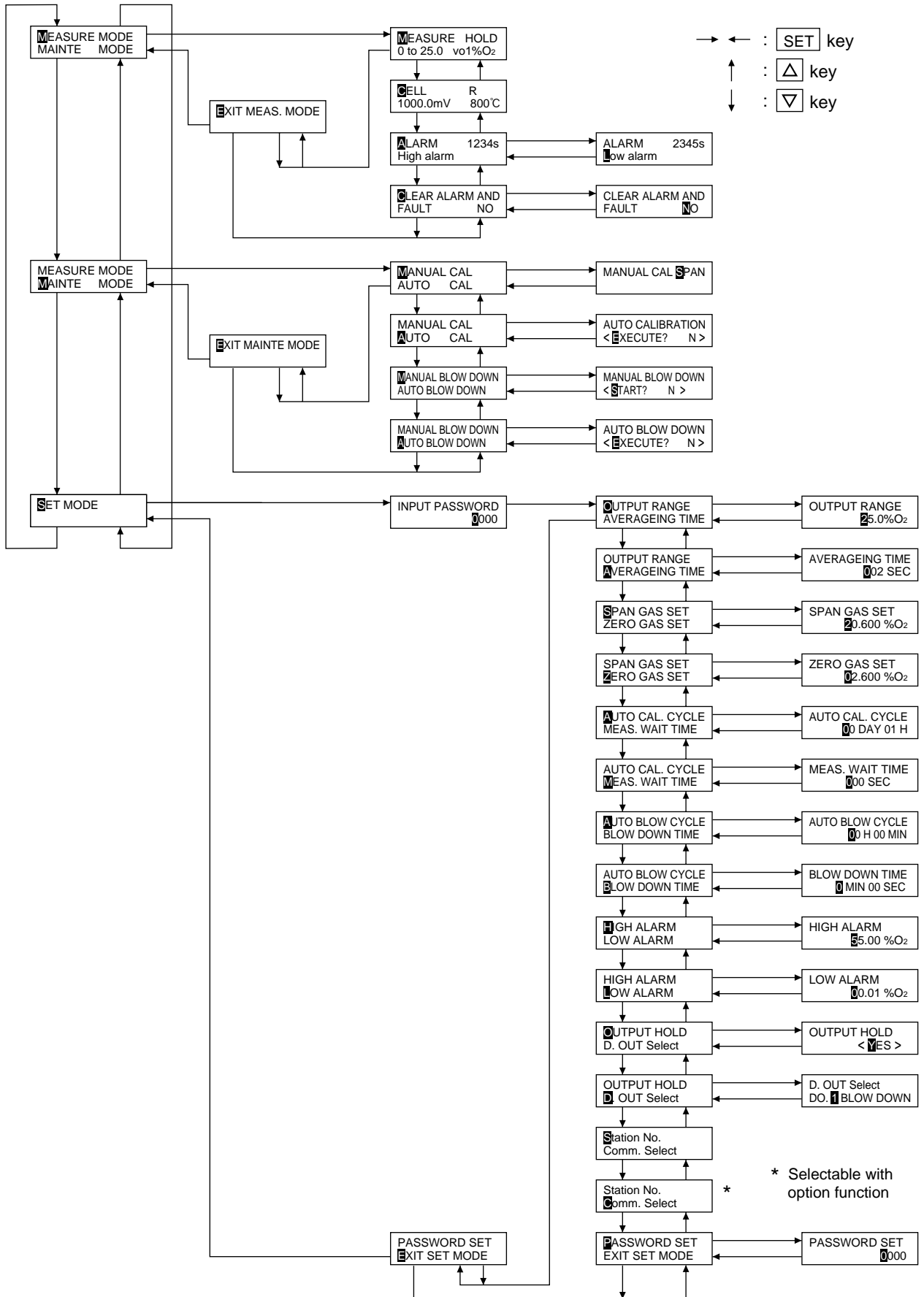


## Operation

**Parameter settings at shipment (initialization)**

Parameter	Displayed message	Range	Initial value of parameter	Reference page
Output range	OUTPUT RANGE 25.0%O <sub>2</sub>	2.0 to 50.0 %O <sub>2</sub> in 0.5% steps	25.0 %O <sub>2</sub>	10-4
Moving average interval	AVERAGING TIME 002 SEC	0 to 300 sec. in 1 sec. step	2 sec.	10-4
Calibration gas concentration (span gas)	SPAN GAS SET 20.600 %O <sub>2</sub>	8.000 to 23.000%O <sub>2</sub> in 0.001%O <sub>2</sub> steps	20.600 %O <sub>2</sub>	10-5
Calibration gas concentration (zero gas)	ZERO GAS SET 01.010 %O <sub>2</sub>	0.010 to 50.000%O <sub>2</sub> in 0.001%O <sub>2</sub> steps	01.010 %O <sub>2</sub>	10-5
Cycle interval for automatic calibration	AUTO CAL. CYCLE 00 DAY 00 H	00 day 00 hour to 90 day 60 hour	00 day 00 hour	10-6
Waiting time for measurement	MEAS. WAIT TIME 000 SEC	0 to 300 sec. in 1 sec. steps	10 sec.	10-6
Cycle interval for automatic blowdown	AUTO BLOW CYCLE 00 H 00 MIN	00 hour 00 min. to 99 hour 60 min.	00 hour 00 min.	10-7
Blowdown time	BLOW DOWN TIME 0 MIN 30 SEC	0 min. 00 sec. to 9 min. 60 sec.	0 min. 30 sec.	10-7
High oxygen concentration alarm	HIGH ALARM 55.00 %O <sub>2</sub>	0.10 to 55.00 %O <sub>2</sub>	55.00 %O <sub>2</sub>	10-8
Low oxygen concentration alarm	LOW ALARM 00.01 %O <sub>2</sub>	0.01 to 55.00 %O <sub>2</sub>	0.01 %O <sub>2</sub>	10-8
Output hold	OUTPUT HOLD <NO>	YES or NO	NO (Not hold)	10-10
Selection of contact outputs	D.Out Select DO.1 MAINTENANCE	DO.1 to DO.4  BLOW DOWN MAINTENANCE ZERO VALVE SPAN VALVE HIGH ALARM LOW ALARM H/L ALARM FAULT NONE	DO.1 BLOW DOWN (Terminal No. ①①-①②)  DO.2 MAINTENANCE (Terminal No. ⑨-⑩)  DO.3 ZERO VALVE (Terminal No. ②②-②③)  DO.4 SPAN VALVE (Terminal No. ②④-②⑤)	10-9
Password	PASSWORD SET 0000	0000 to 9999	0000	10-10

### Key operation flow diagram (outline)



## 6. OPERATION START AND SHUTDOWN

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### 6.1 Starting

After correct wiring and piping has been completed, turn the power switch in the converter ON, and measuring operation will begin.

Note : 15 min. of warmup time is necessary after power ON.

#### Caution of before starting

Furnace operation should only be started after 15 min. or more of warmup time has elapsed.  
When a detector is to be installed in a furnace already in operation, take care to blow out harmful gas from the furnace and then install the fully warmed up detector quickly.

### 6.2 Shutdown

#### (1) When a process (furnace etc.) is to be shutdown for a short time i.e. a week or so

It is strongly recommended to keep the detector in operation to avoid possible deterioration of platinum electrodes in the detector and destruction of the wet sensor element (depending on the condition in furnace and/or ambient conditions) due to power ON-OFF.

In case of the detector with an ejector (option), shutdown the air source.

#### (2) When a process (furnace etc.) is to be shutdown for a long time

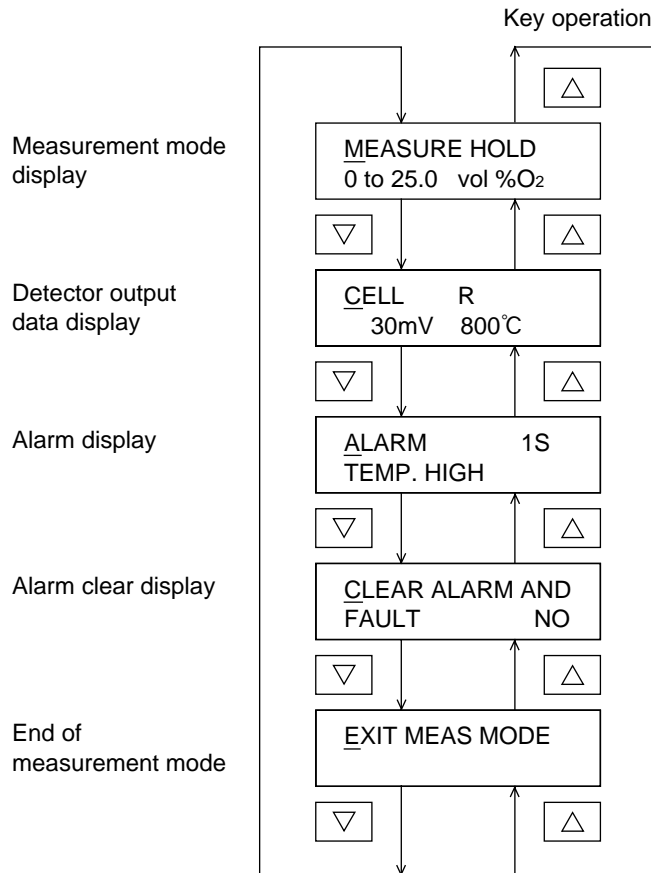
Turn OFF the power switch of the instrument after gas in the furnace has been replaced completely by ambient air.

### 6.3 Measurement during operation

While the instrument is operating, the following displays can be changed.

- Measurement mode display
- Data display of output voltage and temperature of the detector
- Alarm display
- Alarm clear display

Note : If no key is operated for more than 10 min. during operation, the instrument returns to “Measurement mode display” automatically.



When setting outputs to “HOLD”, “HOLD” is displayed.

The output voltage and temperature of the connected detector. (Refer to the tables of detector standard output.)

R stands for a type of thermocouple.

Numerals at upper right on the screen show the time in second when alarm (or fault) occurred.

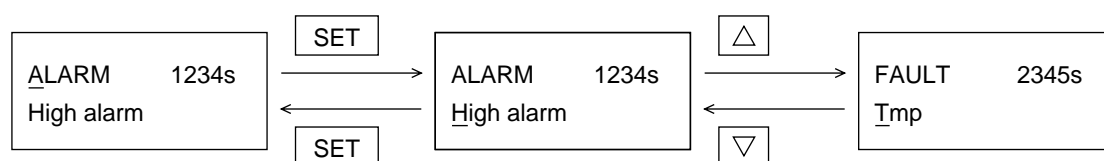
Note) When no keys are used for more than 10 minutes during operation, the image “Measurement mode display” appears automatically.

#### Caution

In case detector voltage rises beyond 200 mV (corresponding to 0.0023% O<sub>2</sub>) during measurement, “RICH MODE” is displayed and the concentration indicating LED indicates detector output voltage.

## 6.4 Confirmation of alarm condition

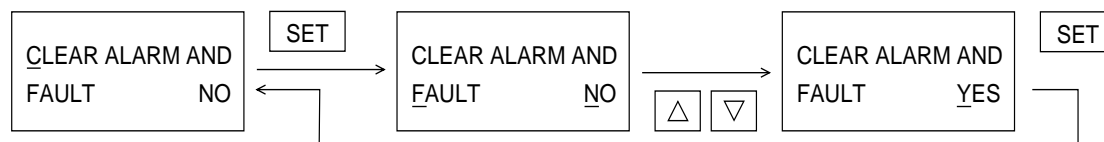
Alarm lamp “ALARM” on the operation panel is lit red when an alarm (or a fault) has been occurred. Operate the alarm display screen as shown below to investigate the alarm condition.



Alarm display screen in the measurement mode

Confirmation screen of ..... When two or more alarms are occurred, confirm each alarm condition by operating the  or  key.

- 1) Within 7 minutes after turning on power supply, alarm (or fault) is disabled.
- 2) Up to 16 alarms (or faults) are stored in memory in the order of the time of occurrence. The data stored in memory are cleared by the following operation.



### Alarm condition display by LC display

Display message	Alarm condition
TEMP. FAULT !	The temperature of the detector element is without 750 to 850 (or 700 to 800 )
CALIB. FAULT !	Calibration was not successful. (The indication is not stable yet at the time of 7 minutes later than the time when the valve for calibration gas has been opened.)
Zero Cal Fault	Zero point calibration was not successful. (No calibration 2 minutes after the start of calibration.)
Span Cal Fault	Span point calibration was not successful. (No calibration 2 minutes after the start of calibration.)
High alarm	O <sub>2</sub> gas concentration is higher than the set value.
Low alarm	O <sub>2</sub> gas concentration is lower than the set value.
CELL FAULT !	Output voltage of the detector is higher than 1.2V.

---

## 6.5 Oxygen detector standard output voltage

O <sub>2</sub> concentration (%)	Output voltage (mV)	O <sub>2</sub> concentration (%)	Output voltage (mV)	O <sub>2</sub> concentration (%)	Output voltage (mV)
0.01	168.15	5.0	31.20	25.0	-4.266
0.1	117.41	10.0	15.93	30.0	-8.284
0.5	81.94	15.0	6.991	40.0	-14.623
1.0	66.67	20.0	0.651	50.0	-19.54
1.5	57.73	20.6	0		
2.0	51.39	21.0	-0.4238		

## 7. CALIBRATION

---

In order to maintain good accuracy, proper calibration using calibration gas is necessary.

The following 3 methods of calibration are provided.

- Manual calibration (Refer to 7.2)
- Automatic calibration (Refer to 7.3)
- Automatic calibration with remote start (Refer to 7.4)

### 7.1 Preparation

- Wiring/piping check

Wiring and piping work should be made correctly referring to Item. 4.3. At this time, the main plug of standard gas should be left open. Since high pressure is present at piping connections, use blind-nut type joints and take special care with regard to air-tightness. Calibration gas flow should be  $1.5 \pm 0.5 \ell / \text{min}$ .

- Setting of calibration gas concentration

Referring to Chapter 10 “Setting”, set the oxygen concentration in standard gas cylinder to be used.

- Contact output check

Referring to Chapter 10 “Setting”, check to make sure that the contact functions of the external terminals block are allocated for ZERO VALVE and SPAN VALVE.

## 7.2 Manual calibration

### Description

- Span/zero is calibrated once by key operation.
- Calibration must be made in the order of span and zero.
- At the start of calibration, the CALIBRATION lamp on the operation panel begins to blink, indicating that calibration operation is under way. The lamp is always ON during auto-calibration.
- For calibration, allow calibration gas to flow into the detector. When the detector output signals is stabilized, calibrating operation is started to complete the processing.
- When the converter is set in output signal hold mode during calibration, the output signal is held at a value prior to calibration. The holding time is extended to the time designated for the next measurement even after the completion of calibration.

Operation	Performing span calibration	
Key operation	Description	Displayed message(LCD)
	Display the message shown at right referring to the key operation flow diagram.	<div style="border: 1px solid black; padding: 5px; width: fit-content;">           MANUAL CAL.            AUTO CAL.         </div>
<div style="border: 1px solid black; padding: 2px; display: inline-block;">SET</div> <input type="checkbox"/> <input type="checkbox"/>	Press <div style="border: 1px solid black; padding: 2px; display: inline-block;">SET</div> key, then the message at right appears. For zero calibration, select “ZERO” message with <input type="checkbox"/> or <input type="checkbox"/> key.	<div style="border: 1px solid black; padding: 5px; width: fit-content;">           MANUAL CAL. <u>S</u>PAN         </div>
<div style="border: 1px solid black; padding: 2px; display: inline-block;">SET</div> <input type="checkbox"/> or <input type="checkbox"/>	Press <div style="border: 1px solid black; padding: 2px; display: inline-block;">SET</div> key, display the screen for starting calibration. Select Y with <input type="checkbox"/> or <input type="checkbox"/> key.	<div style="border: 1px solid black; padding: 5px; width: fit-content;">           MANUAL CAL. SPAN            &lt;START ? <u>N</u>&gt;         </div>
<div style="border: 1px solid black; padding: 2px; display: inline-block;">SET</div>	<p>By pressing the <div style="border: 1px solid black; padding: 2px; display: inline-block;">SET</div> key, calibration is started. Open the main plug of the standard gas cylinder to allow the calibration gas to flow into the detector. When the signal is stabilized, calibrating operation is started to complete the calibration. At the completion, close the main plug of the gas cylinder.</p> <p>Note) When the wiring and piping of the standard gas and solenoid valve have been finished, the flow of gas is controlled by the solenoid valve.</p>	<div style="border: 1px solid black; padding: 5px; width: fit-content;">           MANUAL CAL. SPAN            &lt;START ? <u>Y</u>&gt;         </div>

### How to interrupt

#### (1) Before calibration start

MANUAL CAL. SPAN  
 <START ? Y>

Press the 

SET

 key to start interrupt the calibration operation during the message at left is displayed.

#### (2) During calibration operation

MANUAL CAL. SPAN  
 <START ? N>

The message as shown left during calibration operation. Select N with  or  key and press 

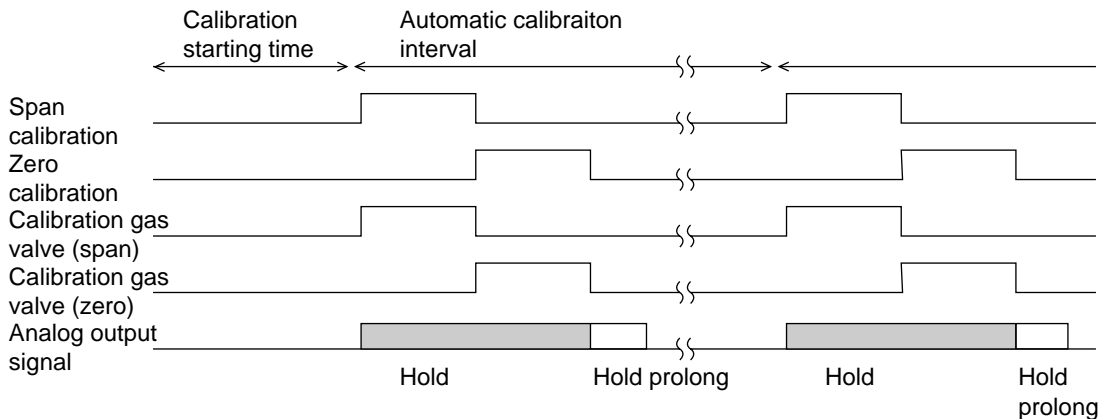
SET

 key to interrupt the calibration operation.

### 7.3 Automatic calibration

**Description**

- Calibration is performed at time intervals set in advance.
- The solenoid valve is driven by contact signal from the terminal block to feed the standard gas for automatic calibration with span gas and zero gas.
- At the start of automatic calibration, the lamp “CALIBRATION” on the operation panel is ON. This lamp blinks during calibration.
- When the converter is set in output signal hold mode during calibration, the output signal is held at a value prior to calibration. The holding time is extended to the time designated for the next measurement even after the completion of calibration.
- For automatic calibration, it is necessary to set automatic calibration cycle (Item 10.5), calibration gas concentration (Item 10.3) and contact output (Item 10.11)



Operation	Start automatic calibration after 5 hours and 30 minutes.	
Key operation	Description	Displayed message (LCD)
	<p>*Check to make sure that “Calibration inhibition contact input” is “Open”. (No.19 and 20 terminals)</p> <p>Display the message shown at right referring to the key operation flow diagram (outline).</p>	<div style="border: 1px solid black; padding: 5px; width: fit-content;">           MANUAL CAL.  <u>A</u>UTO CAL.         </div>
<input type="button" value="SET"/>	Press <input type="button" value="SET"/> key twice, then the message shown at right appears.	<div style="border: 1px solid black; padding: 5px; width: fit-content;">           AUTO CALIBRATION            &lt;EXECUTE ? <u>N</u>&gt;         </div>
<input type="button" value="Y"/> <input type="button" value="N"/>	Select Y by pressing <input type="button" value="Y"/> or <input type="button" value="N"/> key.	<div style="border: 1px solid black; padding: 5px; width: fit-content;">           AUTO CALIBRATION            &lt;EXECUTE ? <u>Y</u>&gt;         </div>
<input type="button" value="SET"/>	Press <input type="button" value="SET"/> key, then the message shown at right appears.	<div style="border: 1px solid black; padding: 5px; width: fit-content;">           START DELAY TIME            00h 00min         </div>

Operation	Start automatic calibration after 5 hours and 30 minutes.	
Key operation	Description	Displayed message (LCD)
<div style="border: 1px solid black; padding: 2px; display: inline-block;">&gt; <input type="text"/> <input type="text"/></div>  <div style="border: 1px solid black; padding: 2px; display: inline-block;">SET</div>	<p>Set the time required for the first calibration using the keys <input type="text"/>, <input type="text"/> and <input type="text"/>.</p> <p>By pressing the <input type="text"/> key, the lamp "CALIBRATION" on the operation panel is ON and, at the same time, the automatic calibration timer start operating. At this time, the data shown at right is displayed by the liquid crystal element. The first calibration is started 5 hours and 30 minutes later.</p>	<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;">START DELAY TIME 05h 30min</div> <div style="border: 1px solid black; padding: 5px;">MANUAL CAL. <u>A</u>AUTO CAL.</div>

### How to interrupt

#### (1) Before calibration start

AUTO CALIBRATION  
<EXECUTE ? N>

At the operation step , select N with  or  key and press  key on the screen shown at left, then interrupt the calibration.

#### (2) During calibration operation

AUTO CALIBRATION  
<CANCEL ? Y>

At the operation step , select CANCEL with  or  key after pressing  key once, and press  key, then the automatic calibration operation is canceled.

---

## 7.4 Automatic calibration with remote start

Automatic calibration is started by the contact input of external terminal block. Set the calibration cycle referring to Chapter 10.

For remote calibration, wiring and piping work should be performed for the standard gas cylinder and solenoid valve as explained in Chapter 4. Then, set the contact output for ZERO VALVE and SPAN VALVE.

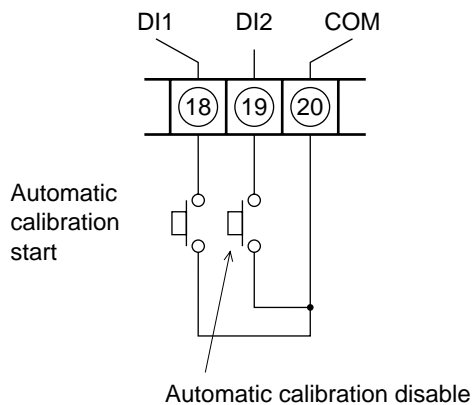
Check that the calibration disable contact input is open.

(No. 19 and 20 terminals)

Close the calibration start contact input for more than 1 second.

(No. 18 and 20 terminals)

The first automatic calibration is now started and, at the same time, the lamp “CALIBRATION” on the operation panel turns ON. This lamp goes off at the completion of automatic calibration.



The external terminal block No. 18, 19 and 20 are used for contact input. By closing No. 18-19, automatic calibration is started and, by closing No. 19-20, it is disabled.

As in the case of automatic calibration with key operation in Item 7.3, calibration cycle and contact output should be selected. Also, the piping and wiring for the standard gas cylinder and solenoid valve should be completed.

## 8. BLOWDOWN

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In order to prevent the flow guide tube from being clogged with dust contained in gas being measured, dust deposits in the flow guide tube is removed by blowing compressed air such as instrumentation air, etc. When utilizing this blowdown function, a flow guide tube with blowdown nozzle is required. There are the following 2 different methods for blowdown.

- Manual blowdown
- Automatic blowdown (cyclic operation)

### 8.1 Preparation for blowdown

- Wiring/piping check  
Perform wiring and piping correctly referring to Item.4.3. Since high pressure is applied to the piping, be sure to use blind-nut type joints at connections. Special care should be taken with regard to air-tightness.
- Setting of blowdown time  
Referring to Chapter 10 “Setting”, set blowdown time.
- Contact output check  
Referring to Chapter 10 “Setting”, check to make sure that the contact functions of the external terminals block are allocated for BLOWDOWN.

## 8.2 Manual blowdown

### Description

- Using key operation, perform blowdown only once.
- Using contact signal from the terminal block, drive the solenoid valve on the outside. Then, remove dust by blowing compressed air such as instrumentation air, etc. into the flow guide tube.
- At the start of blowdown, the “BLOWDOWN” lamp on the operation panel begins to blink, indicating that blowdown operation is under way. In the case of automatic blowdown, this lamp keeps lighting.
- When output signal is set in hold mode during blowdown operation, it is held at a value prior to the start of blowdown operation. The holding time is extended to the time designated for the next measurement even after the completion of blowdown operation.

Operation	Performing manual blowdown	
Key operation	Description	Displayed message (LCD)
	Display the message shown at right referring to the key operation flow diagram.	
<input type="button" value="SET"/>	Press <input type="button" value="SET"/> key, then the message at right appears.	
<input type="button" value="Y"/> <input type="button" value="N"/>	Select Y with <input type="button" value="Y"/> or <input type="button" value="N"/> key.	
<input type="button" value="SET"/>	Press the <input type="button" value="SET"/> key. The blowdown contact of the external terminal block is closed to start blowdown operation. When preset blowdown time is expired, the blowdown contact is closed and the blowdown operation is completed.	

### How to interrupt

#### (1) Before blowdown

Press the  key to interrupt the blowdown operation during the message at left is displayed.

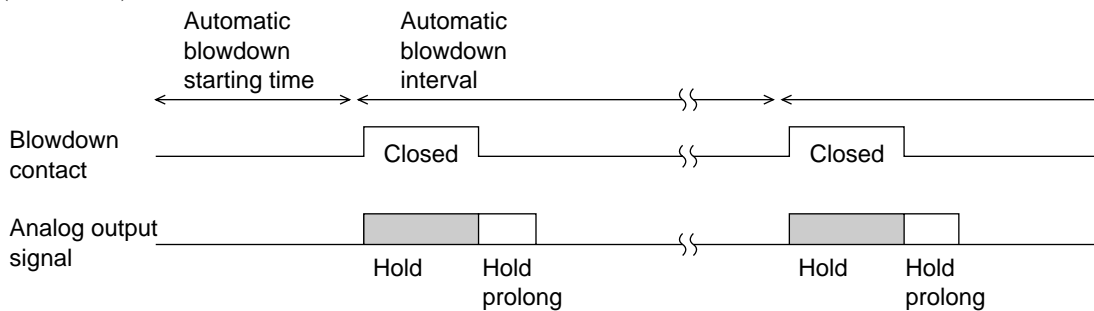
#### (2) During blowdown

The message as shown left during blowdown operation. Select N with  or  key and press  key to interrupt the blowdown operation.

### 8.3 Automatic blowdown

#### Description

- Blowdown operation is performed at time intervals set in advance.
- Using contact signal from the terminal block, drive the solenoid valve and remove dust by blowing instrumentation air, etc. into the flow guide tube with blowdown nozzle.
- At the start of automatic blowdown, the lamp “BLOWDOWN” on the operation panel is ON. This lamp blinks during blowdown operation.
- During blowdown operation, when output signal is set in hold mode, it is held at the value prior to the start of blowdown operation.
- To perform automatic blowdown, automatic blowdown cycle (Item 10.7) and blowdown time (Item 10.8) should be set in advance.



Operation	Start automatic blowdown after 1 hours and 20 minutes.	
Key operation	Description	Displayed message (LCD)
	Display the message shown at right referring to the key operation flow diagram (outline).	<div style="border: 1px solid black; padding: 5px; text-align: center;">           MANUAL BLOW DOWN  <u>A</u>UTO BLOW DOWN         </div>
<input type="button" value="SET"/>	Press <input type="button" value="SET"/> key twice, then the message show at right appears.	<div style="border: 1px solid black; padding: 5px; text-align: center;">           AUTO BLOW DOWN            &lt;EXECUTE ? <u>N</u>&gt;         </div>
<input type="button" value="Y"/> <input type="button" value="N"/>	Select Y by pressing <input type="button" value="Y"/> or <input type="button" value="N"/> key.	<div style="border: 1px solid black; padding: 5px; text-align: center;">           AUTO BLOW DOWN            &lt;EXECUTE ? <u>Y</u>&gt;         </div>
<input type="button" value="SET"/>	Press <input type="button" value="SET"/> key, then the message show at right appears.	<div style="border: 1px solid black; padding: 5px; text-align: center;">           START DELAY TIME            00h 00min         </div>
<input type="button" value="&gt;"/> <input type="button" value="0"/> <input type="button" value="0"/>	Set the time required for the first blowdown operation using the keys <input type="button" value="&gt;"/> , <input type="button" value="0"/> , and <input type="button" value="0"/> .	<div style="border: 1px solid black; padding: 5px; text-align: center;">           START DELAY TIME            01h 20min         </div>
<input type="button" value="SET"/>	By pressing the <input type="button" value="SET"/> key, the lamp “BLOWDOWN” on the operation panel is ON and, at the same time, the blowdown timer start operating. At this time, the data shown at right is displayed by the LCD. The first blowdown is started 1 hours and 20 minutes later.	<div style="border: 1px solid black; padding: 5px; text-align: center;">           MANUAL BLOW DOWN  <u>A</u>UTO BLOW DOWN         </div>

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### How to interrupt

(1) Before automatic blowdown start

AUTO BLOW DOWN  
<EXECUTE ? Y>

At the operation step     , select N with  or  key and press  SET key on the screen shown at left, then interrupt the blowdown operation.

(2) During automatic blowdown operation

AUTO BLOW DOWN  
<CANCEL ? Y>

At the operation step     , CANCEL with  or  key after pressing  SET key once, and press  SET key, then the automatic blowdown operation is canceled.

## 9. MAINTENANCE AND CHECK

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### 9.1 Check

In order to keep the instrumentation operating in good condition, perform the following periodical maintenance and check.

Perform maintenance and check once every year or 2, or at time of furnace check.

	Items for check	Recommended interval, method of checking, remedy for abnormalities, etc.
Daily check	Zero, span calibration	Calibrate once every week (Refer to Chapter 7 "Calibration")
	Deterioration of packings and O-rings	If deteriorated, replace with new ones.
	Check for loose cable ground	Retighten or replace the packing.
	Check the remain pressure in the calibration gas cylinder	Check the amount using primary pressure.
Yearly check	Clogging or corrosion of flow guide tubes	Remove the flow guide tube from the furnace wall, remove the detector and wash the flow guide tube with water.
	Clogging or corrosion of ejector type sampling prove	Remove the ejector from the furnace wall, disassemble the prove and wash it with water.
	Clogging of air outlet of ejectors	Remove the ejector from the furnace wall and clean the air outlet located in the heat insulation layer of the furnace wall.

---

**List of parts for periodical change (consumption articles)**

No.	Name	Period of change	Code to order
1	Ceramic filter	2 to 6 months (dependig on dust content in process gas	*ZZPZFK3-A090
2	O-ring for detector	Once a year	*ZZPZFK3-A100

**List of spare parts**

No.	Name	Code to order
3	Detector	ZFK YY 3
4	Ceramic filter	*ZZPZFK3-A090
5	Flow guide tube	*ZZPZFK3-A01

**Expendable item**

The contrast of LCD (liquid crystal display) indicator becomes deteriorated after using for about 7 years.

In such a case, the indicator needs to be replaced with a new one.

For replacement, contact our service station.

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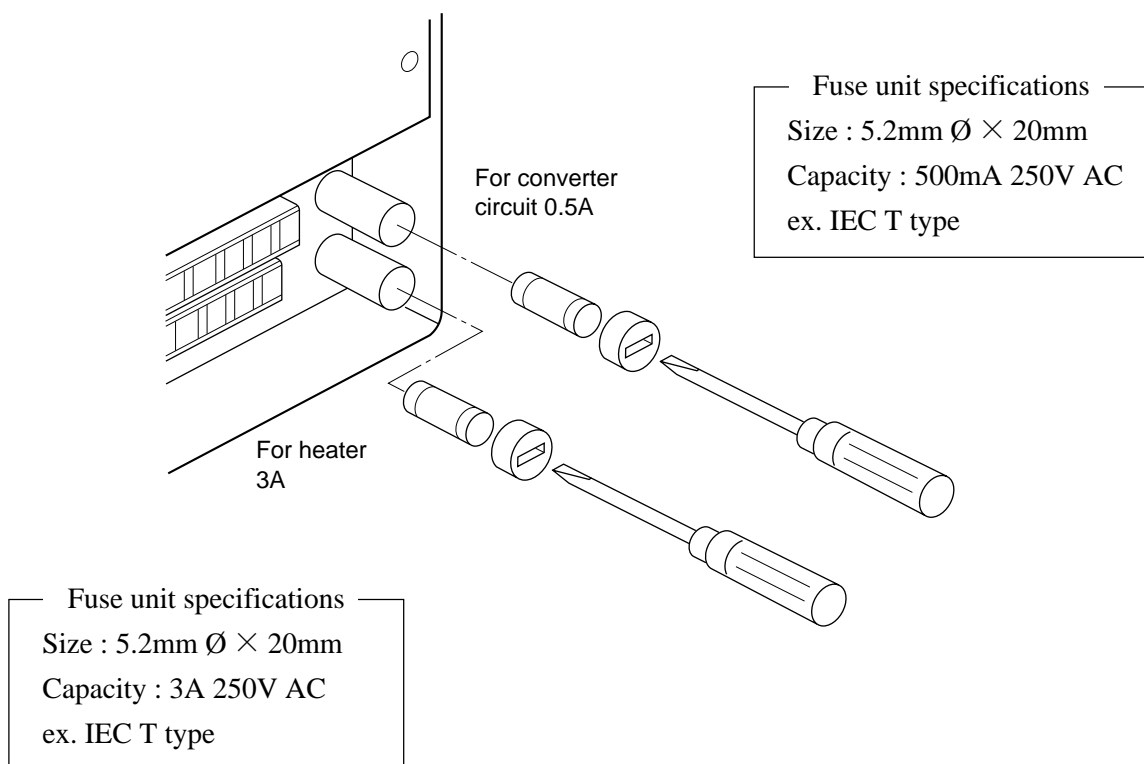
## 9.2 Fuse replacement

When a fuse blows, turn off the power switch, and replace the fuse after investigating the cause and making any necessary repairs.

Open the front cover of the converter. Two fuses are located at lower right. The upper fuse is for protection of the converter circuit and the lower one is for protection of the heater. Take care that these fuses are different each other in the rated current.

For replacement, use a vessel style (flat-blade) screwdriver or coin. Push down the cap on the fuse holder and rotate about 1/4 turn counterclockwise (90°) until the cap is removed from the fuse holder. Then, replace the fuse with a new one.

Next, push in the cap and rotate about 1/4 turn (90°) clockwise until it is fitted to the fuse holder.



### 9.3 Troubleshooting

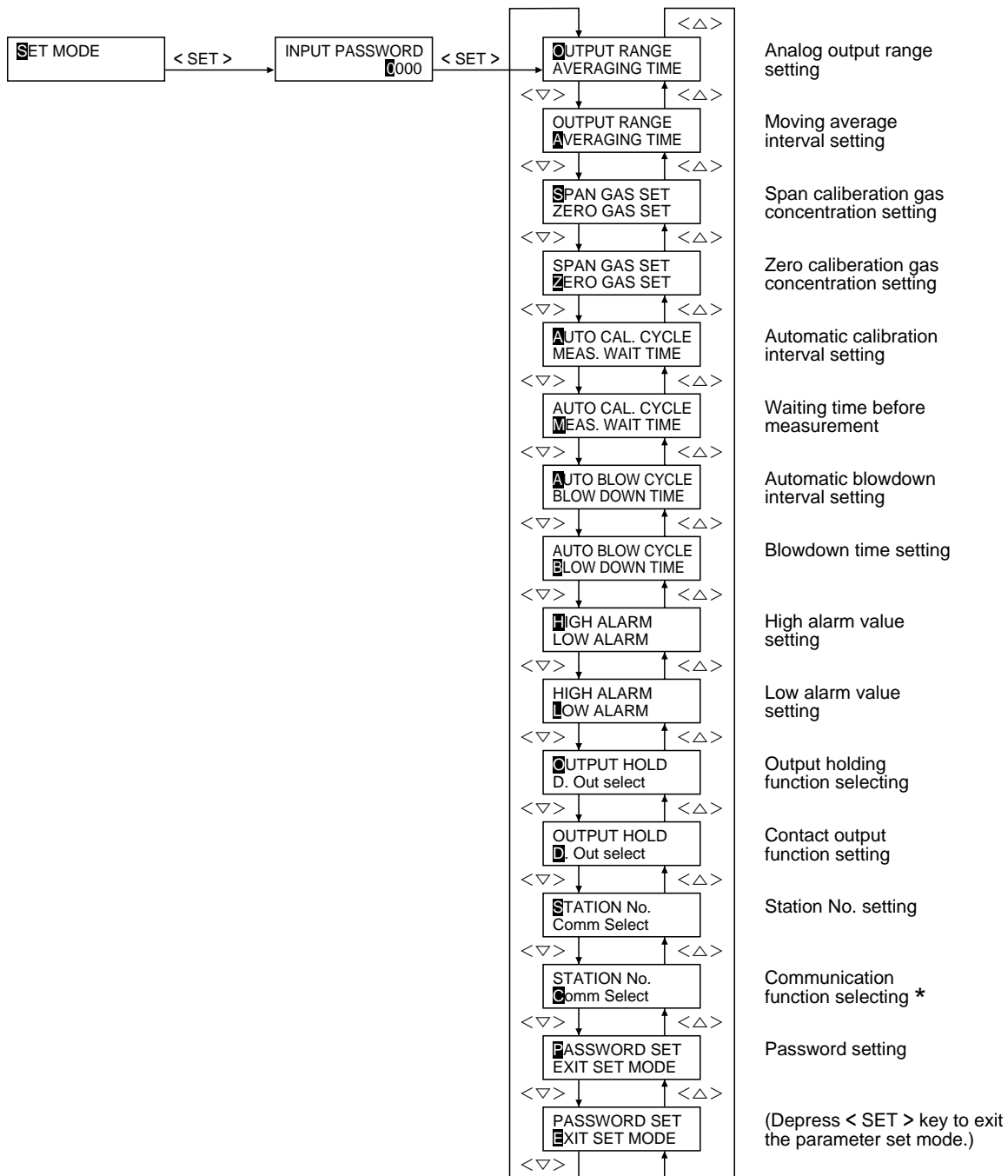
Symptoms	Probable causes	Checking methods	Remedy
No display	Converter fuse blown out	Check the fuse and supply voltage specification.	Replace fuse Check power supply voltage
Indication does not change or slow response	Filter and/or flow guide tube clogged	Visual check of filter and flow guide tube for contamination or clogging. Check for loosen and gas leaks at piping connections and mounting place of detector.	Clean or replace filter Tighten pipe connections
	Detector element deterioration	Change over between zero and span gas and check if 5 minutes or longer is needed for 90% response.	Replace detector element
	Decrease in flow velocity of exhaust gas	Check response to process gas after shutting down calibration gas. Move the direction (mounting position) of "arrow" of the flow guide slightly.	Increase process gas flow into the flow guide tube
Temperature alarm continues for more than 20 min. after power switched ON	Break of wiring	Ohmic check of wiring	Replace
	Wrong wiring	Wiring check	Correct wiring
	Lower power supply voltage	Check of supply voltage specification	Check supply voltage
	Break of thermocouples	Ohmic check	Replace detector element
	Blown heater fuse	Ohmic check of fuse	Replace fuse
	Break in detector heater	Check heater resistance 50 to 55Ω for 115V, 200 to 250Ω for 220V (Excluding wiring resistance)	Replace detector element
Automatic calibration is not possible	Difference between calibration gas concentration and its setting	Check the set value for calibration gas concentration.	Set proper value (Refer to 10.3 and 10.4)
	Wrong parameters setting	Check automatic calibration intervals.	Set proper parameters
	Contact input for "Auto calibration disable" is closed.	Check that the line between the terminals and is not shorted.	Correct wiring

Symptoms	Probable causes	Checking methods	Remedy
Zero and/or span alarm	Difference between calibration gas concentration and its setting or misconnection between zero and span gas	Check the set value for calibration gas concentration.	Set correct values
		Check piping	Correct piping
Indication too high or too low	Loose flange and its surroundings	Check for gas leaks in detector and mounting part of flow guide tube flange.	Tighten mounting screws Replace O-ring
	Deteriorated O-rings	Check for leaks from the outside.	Seal
	Detector malfunction	Check for gas leaks at calibration gas inlet. Check detector element voltage (mV) for higher or lower than other detector when flowing zero gas	Tighten connectors Replace detector element
	Abnormal detector element temperature	Refer to check items for detector temperature alarm described above. (P.9-4)	Replace detector element
	Indication difference between dry and wet base measurement	Oxygen concentration is higher in dry base.	Normal

# 10. SETTING AND OPERATING OF PARAMETER

## (1) Setting parameters and flow diagram of parameter setting procedures

A flow diagram below shows how to enter the parameter set mode, how to select the parameter to be set and how to exit from the parameter set mode.



\* Settable only when option communication function is provided.

**(2) How to enter “Set mode”**

Prior to entering “Set mode”, the correct password must be input.

Note : Refer to 10.13 for password setting procedure.

(The password is set as 0000 at shipment.)

Example : Operation		Entering the password 1234 (In case the password 1234.)	
Key operation	Description	Displayed message	
<input type="checkbox"/> or <input type="checkbox"/> or <input type="checkbox"/> SET	Press keys (repeatedly if necessary) to display the Mode selection screen as shown at right.	MEASURE MODE MAINTEN. MODE	
<input type="checkbox"/> or <input type="checkbox"/>	Press key to move the cursor to “SET MODE” shown at right.	SET MODE	
<input type="checkbox"/> SET	Press <input type="checkbox"/> SET key to display the password input screen.	INPUT PASSWORD 0000	
<input type="checkbox"/>	Set “1” as shown at right.	INPUT PASSWORD 1000	
<input type="checkbox"/> > <input type="checkbox"/>	Move the cursor to the next digit and set “2” by pressing <input type="checkbox"/> key.	INPUT PASSWORD 1200	
<input type="checkbox"/> > <input type="checkbox"/>	Move the cursor to the 3rd digit and set “3” by pressing <input type="checkbox"/> key.	INPUT PASSWORD 1230	
<input type="checkbox"/> > <input type="checkbox"/>	Move the cursor to the 4th digit and set “4” by pressing <input type="checkbox"/> key.	INPUT PASSWORD 1234	
<input type="checkbox"/> SET	Press <input type="checkbox"/> SET key, then the mode turns to the “SET MODE”.	OUTPUT RANGE AVERAGING TIME	

**Password**

Note : If a wrong password is used, operation returns to the “Mode selection” state ( in the above table).

If the operator forgets the correct password, use 6284 to enter the “Set mode”.

**(3) Setting range of each item**

Setting range for some items have been determined. If an input outside the setting range is used, a message “Error ! Try again” blinks 3 times.

In such a case, input a correct value once again after the display back to the original.

## 10.1 Procedure for setting analog output range

### Description

- In this mode, the full scale values are set for analog outputs.
- Available setting range is 2.0 to 50.0% O<sub>2</sub>, 0.5% O<sub>2</sub> step.
- The 3rd digit (the right of decimal point) is set to 0 or 5.

Operation (example)	Setting analog output range 0 to 27.5% (when it was set to 0 to 5.0% prior to setting)	
Key operation	Description	Displayed message (LCD)
	Display the image at right referring to the outline of key operation.	<div style="border: 1px solid black; padding: 2px;">OUTPUT RANGE AVERAGING TIME</div>
<input type="button" value="SET"/>	Press the <input type="button" value="SET"/> key.	<div style="border: 1px solid black; padding: 2px;">OUTPUT RANGE 05.0% O<sub>2</sub></div>
<input type="button" value="0"/> <input type="button" value="5"/> <input type="button" value="&gt;"/>	Set to 27.5 by pressing the <input type="button" value="0"/> , <input type="button" value="5"/> and <input type="button" value="&gt;"/> keys.	<div style="border: 1px solid black; padding: 2px;">OUTPUT RANGE 27.5% O<sub>2</sub></div>
<input type="button" value="SET"/>	Press the <input type="button" value="SET"/> key.	<div style="border: 1px solid black; padding: 2px;">OUTPUT RANGE AVERAGING TIME</div>

## 10.2 Procedure for setting moving average time

### Description

- The moving average time of measured value is set. When 0 is set, it becomes instantaneous value.
- Average setting range is 0 to 300 sec.
- This method is used to delay output signal response.

Operation (example)	Setting moving average time to 15 sec. (when it was set to 2 sec. prior to setting)	
Key operation	Description	Displayed message (LCD)
	Display the image at right referring to the outline of key operation.	<div style="border: 1px solid black; padding: 2px;">OUTPUT RANGE <u>A</u>VERAGING TIME</div>
<input type="button" value="SET"/>	Press the <input type="button" value="SET"/> key.	<div style="border: 1px solid black; padding: 2px;">AVERAGING TIME 002 SEC</div>
<input type="button" value="0"/> <input type="button" value="5"/> <input type="button" value="&gt;"/>	Set to 15 by pressing the <input type="button" value="0"/> , <input type="button" value="5"/> and <input type="button" value="&gt;"/> keys.	<div style="border: 1px solid black; padding: 2px;">AVERAGING TIME 015 SEC</div>
<input type="button" value="SET"/>	Press the <input type="button" value="SET"/> key.	<div style="border: 1px solid black; padding: 2px;">OUTPUT RANGE <u>A</u>VERAGING TIME</div>

### 10.3 Procedure for setting span calibration gas concentration

**Description**

- Span calibration gas concentration is set. Normally, the air (atmospheric) is used for setting.
- When using the air, 20.6%O<sub>2</sub> is set.
- Available setting range is 9.000 to 23.000%O<sub>2</sub>.

Operation (example)	Setting span calibration gas concentration to 20.600%O <sub>2</sub> (when it was set to 21.000%O <sub>2</sub> prior to setting)	
Key operation	Description	Displayed message (LCD)
	Display the image at right referring to the outline of key operation.	<div style="border: 1px solid black; padding: 2px;">SPAN GAS SET ZERO GAS SET</div>
<input type="button" value="SET"/>	Press the <input type="button" value="SET"/> key.	<div style="border: 1px solid black; padding: 2px;">SPAN GAS SET 21.000 %O<sub>2</sub></div>
<input type="button" value="0"/> <input type="button" value="6"/> <input type="button" value="&gt;"/>	Set to 20.600 by pressing the <input type="button" value="0"/> , <input type="button" value="6"/> and <input type="button" value="&gt;"/> keys.	<div style="border: 1px solid black; padding: 2px;">SPAN GAS SET 20.600 %O<sub>2</sub></div>
<input type="button" value="SET"/>	Press the <input type="button" value="SET"/> key.	<div style="border: 1px solid black; padding: 2px;">SPAN GAS SET ZERO GAS SET</div>

### 10.4 Procedure for setting zero calibration gas concentration

**Description**

- Zero calibration gas concentration is set. Set to the value shown on calibration gas cylinder.
- Gas of less than 2.0%O<sub>2</sub> should be used as zero gas.
- Available setting range is 0.010 to 50.000%O<sub>2</sub>.

Operation (example)	Setting zero calibration gas concentration to 1.010%O <sub>2</sub> (when it was set to 2.000%O <sub>2</sub> prior to setting)	
Key operation	Description	Displayed message (LCD)
	Display the image at right referring to the outline of key operation.	<div style="border: 1px solid black; padding: 2px;">SPAN GAS SET ZERO GAS SET</div>
<input type="button" value="SET"/>	Press the <input type="button" value="SET"/> key.	<div style="border: 1px solid black; padding: 2px;">ZERO GAS SET 02.000 %O<sub>2</sub></div>
<input type="button" value="0"/> <input type="button" value="1"/> <input type="button" value="0"/> <input type="button" value="1"/> <input type="button" value="&gt;"/>	Set to 1.010 by pressing the <input type="button" value="0"/> , <input type="button" value="1"/> , <input type="button" value="0"/> , <input type="button" value="1"/> , and <input type="button" value="&gt;"/> keys.	<div style="border: 1px solid black; padding: 2px;">ZERO GAS SET 01.010 %O<sub>2</sub></div>
<input type="button" value="SET"/>	Press the <input type="button" value="SET"/> key.	<div style="border: 1px solid black; padding: 2px;">SPAN GAS SET ZERO GAS SET</div>

## 10.5 Procedure for setting automatic calibration interval

### Description

- Automatic calibration interval is set. Automatic calibration is not effected when it is set to 00 day and 00 hour.
- Standard calibration cycle is about 7 to 30 days.
- Available setting range is 00 day and 00 hour to 90 days and 60 hours.

Operation (example)	Setting automatic calibration interval to 07 days and 12 hours (when it was set to 00 day 00 hour prior to setting)	
Key operation	Description	Displayed message (LCD)
	Display the image at right referring to the outline of key operation.	<u>A</u> UTO CAL. CYCLE MEAS. WAIT TIME
<input type="button" value="SET"/>	Press the <input type="button" value="SET"/> key.	AUTO CAL. CYCLE 00 DAY 00 H
<input type="button" value="0"/> <input type="button" value="7"/> <input type="button" value="&gt;"/>	Set to 07 DAY 12H by pressing the <input type="button" value="0"/> , <input type="button" value="7"/> and <input type="button" value="&gt;"/> keys.	AUTO CAL. CYCLE 07 DAY 12 H
<input type="button" value="SET"/>	Press the <input type="button" value="SET"/> key.	<u>A</u> UTO CAL. CYCLE MEAS. WAIT TIME

## 10.6 Procedure for setting waiting time before measurement

### Description

- By setting output hold to ON, analog output is held during calibration and blowdown. But if measurement is made immediately, correct measurement is not possible because calibration gas or blowdown air is still present. So, output hold extension time needs to be set.
- Available setting range is 0 to 300 seconds, 60 seconds is standard.

Operation (example)	Setting measurement standby time to 30 sec. (when it was set to 0 sec. prior to setting)	
Key operation	Description	Displayed message (LCD)
	Display the image at right referring to the outline of key operation.	<u>A</u> UTO CAL. CYCLE MEAS. WAIT TIME
<input type="button" value="SET"/>	Press the <input type="button" value="SET"/> key.	MEAS. WAIT TIME 0000 SEC
<input type="button" value="0"/> <input type="button" value="3"/> <input type="button" value="0"/> <input type="button" value="&gt;"/>	Set to 030 by pressing the <input type="button" value="0"/> , <input type="button" value="3"/> , <input type="button" value="0"/> and <input type="button" value="&gt;"/> keys.	MEAS. WAIT TIME 030 SEC
<input type="button" value="SET"/>	Press the <input type="button" value="SET"/> key.	<u>A</u> UTO CAL. CYCLE MEAS. WAIT TIME

## 10.7 Procedure for setting blowdown interval

### Description

- Automatic blowdown interval is set. Automatic blowdown is not effected when set to 00 hour and 00 minute.
- Available setting range is 00 hour 00 minute to 99 hours and 60 minutes.
- It should be set longer than the total of blowdown time (Chapter 10.8) and measurement standby time (Chapter 10.6).

Operation (example)		Setting automatic blowdown interval to 6 hours and 30 minutes (when it was set to 00 hour and 00 minute)	
Key operation	Description	Displayed message (LCD)	
	Display the image at right referring to the outline of key operation.	<div style="border: 1px solid black; padding: 2px;"> <u>A</u>UTO BLOW CYCLE BLOW DOWN TIME         </div>	
<input type="button" value="SET"/>	Press the <input type="button" value="SET"/> key.	<div style="border: 1px solid black; padding: 2px;">           AUTO BLOW CYCLE 00 H 00 MIN         </div>	
<input type="button" value="0"/> <input type="button" value="6"/> <input type="button" value="&gt;"/>	Set to 06H 30MIN by pressing the <input type="button" value="0"/> , <input type="button" value="6"/> and <input type="button" value="&gt;"/> keys.	<div style="border: 1px solid black; padding: 2px;">           AUTO BLOW CYCLE 06 H 30 MIN         </div>	
<input type="button" value="SET"/>	Press the <input type="button" value="SET"/> key.	<div style="border: 1px solid black; padding: 2px;"> <u>A</u>UTO BLOW CYCLE BLOW DOWN TIME         </div>	

## 10.8 Procedure for setting blowdown time

### Description

- Blowdown time is set.
- Available setting range is 0 minute and 00 second to 9 minutes and 60 seconds.

Operation (example)		Setting blowdown time to 1 minute (when it was set to 30 seconds prior to setting)	
Key operation	Description	Displayed message (LCD)	
	Display the image at right referring to the outline of key operation.	<div style="border: 1px solid black; padding: 2px;">           AUTO BLOW CYCLE BLOW DOWN TIME         </div>	
<input type="button" value="SET"/>	Press the <input type="button" value="SET"/> key.	<div style="border: 1px solid black; padding: 2px;">           BLOW DOWN TIME 0 MIN 30 SEC         </div>	
<input type="button" value="0"/> <input type="button" value="1"/> <input type="button" value="&gt;"/>	Set to 01MIN 00 by pressing the <input type="button" value="0"/> , <input type="button" value="1"/> and <input type="button" value="&gt;"/> keys.	<div style="border: 1px solid black; padding: 2px;">           BLOW DOWN TIME 1 MIN 00 SEC         </div>	
<input type="button" value="SET"/>	Press the <input type="button" value="SET"/> key.	<div style="border: 1px solid black; padding: 2px;"> <u>A</u>UTO BLOW CYCLE BLOW DOWN TIME         </div>	

## 10.9 Procedure for setting oxygen gas concentration high-alarm value

### Description

- High-alarm value is set. High-alarm is occurred when measured value is higher than this value.
- Available setting range is 0.10 to 55.00%O<sub>2</sub>.

Operation (example)		Setting high-alarm value to 30.00%O <sub>2</sub> (when it was set to 55.00%O <sub>2</sub> prior to setting)	
Key operation	Description	Displayed message (LCD)	
	Display the image at right referring to the outline of key operation.	<div style="border: 1px solid black; padding: 2px;">HIGH ALARM LOW ALARM</div>	
SET	Press the SET key.	<div style="border: 1px solid black; padding: 2px;">HIGH ALARM 55.00 %O<sub>2</sub></div>	
□ □ >	Set to 30.00 by pressing the □ , □ and > keys.	<div style="border: 1px solid black; padding: 2px;">HIGH ALARM 30.00 %O<sub>2</sub></div>	
SET	Press the SET key.	<div style="border: 1px solid black; padding: 2px;">HIGH ALARM LOW ALARM</div>	

## 10.10 Procedure for setting oxygen gas concentration low-alarm value

### Description

- Low-alarm value is set. Low-alarm is occurred when measured value is lower than this value.
- Available setting range is 0.01 to 55.00%O<sub>2</sub>.

Operation (example)		Setting low-alarm value to 1.00%O <sub>2</sub> (when it was set to 0.01%O <sub>2</sub> prior to setting)	
Key operation	Description	Displayed message (LCD)	
	Display the image at right referring to the outline of key operation.	<div style="border: 1px solid black; padding: 2px;">HIGH ALARM LOW ALARM</div>	
SET	Press the SET key.	<div style="border: 1px solid black; padding: 2px;">LOW ALARM 00.01 %O<sub>2</sub></div>	
□ □ >	Set to 01.00 by pressing the □ , □ and > keys.	<div style="border: 1px solid black; padding: 2px;">LOW ALARM 01.00 %O<sub>2</sub></div>	
SET	Press the SET key.	<div style="border: 1px solid black; padding: 2px;">HIGH ALARM LOW ALARM</div>	

## 10.11 Procedure for selecting contact output function

Description																																			
<ul style="list-style-type: none"> <li>Function allocated to contact output (DO.1 to DO.4) is selected.</li> <li>It is set to the following prior at shipment.               <table border="0" style="margin-left: 20px;"> <tr> <td>DO.1</td><td>BLOWDOWN</td><td>DO.2</td><td>MAINTENANCE</td></tr> <tr> <td>DO.3</td><td>ZERO VALVE</td><td>DO.4</td><td>SPAN VALVE</td></tr> </table> </li> <li>Contact output corresponding to the terminal No. on the external terminal block are as shown below.               <table border="0" style="margin-left: 20px;"> <tr> <td>DO.1</td><td>-</td><td>, DO.2</td><td>-</td><td>, DO.3</td><td>⑳-㉓,</td><td>DO.4</td><td>㉔-㉗</td></tr> </table> </li> <li>Allocated functions are as shown below.               <table border="0" style="margin-left: 20px;"> <tr> <td>Blowdown</td><td>Blowdown solenoid valve contact</td></tr> <tr> <td>MAINTENANCE</td><td>ON at maintenance operation (ON during maintenance mode or setting mode operation)</td></tr> <tr> <td>ZERO VALVE</td><td>Zero gas solenoid valve contact</td></tr> <tr> <td>SPAN VALVE</td><td>Span gas solenoid valve contact</td></tr> <tr> <td>HIGH ALARM</td><td>ON at high-alarm</td></tr> <tr> <td>LOW ALARM</td><td>ON at low-alarm</td></tr> <tr> <td>H/L ALARM</td><td>ON at high-alarm or low-alarm</td></tr> <tr> <td>FAULT</td><td>ON at fault</td></tr> <tr> <td>NONE</td><td>No allocation</td></tr> </table> </li> </ul>		DO.1	BLOWDOWN	DO.2	MAINTENANCE	DO.3	ZERO VALVE	DO.4	SPAN VALVE	DO.1	-	, DO.2	-	, DO.3	⑳-㉓,	DO.4	㉔-㉗	Blowdown	Blowdown solenoid valve contact	MAINTENANCE	ON at maintenance operation (ON during maintenance mode or setting mode operation)	ZERO VALVE	Zero gas solenoid valve contact	SPAN VALVE	Span gas solenoid valve contact	HIGH ALARM	ON at high-alarm	LOW ALARM	ON at low-alarm	H/L ALARM	ON at high-alarm or low-alarm	FAULT	ON at fault	NONE	No allocation
DO.1	BLOWDOWN	DO.2	MAINTENANCE																																
DO.3	ZERO VALVE	DO.4	SPAN VALVE																																
DO.1	-	, DO.2	-	, DO.3	⑳-㉓,	DO.4	㉔-㉗																												
Blowdown	Blowdown solenoid valve contact																																		
MAINTENANCE	ON at maintenance operation (ON during maintenance mode or setting mode operation)																																		
ZERO VALVE	Zero gas solenoid valve contact																																		
SPAN VALVE	Span gas solenoid valve contact																																		
HIGH ALARM	ON at high-alarm																																		
LOW ALARM	ON at low-alarm																																		
H/L ALARM	ON at high-alarm or low-alarm																																		
FAULT	ON at fault																																		
NONE	No allocation																																		

Operation (example)		Allocation of FAULT function to DO.2 (when it was set to BLOW DOWN prior to setting)	
Key operation	Description	Displayed message (LCD)	
	Display the image at right referring to the outline of key operation.	<div style="border: 1px solid black; padding: 5px;">OUTPUT HOLD D. Out Select</div>	
<input type="button" value="SET"/>	Press the <input type="button" value="SET"/> key.	<div style="border: 1px solid black; padding: 5px;">D. Out Select DO.1 MAINTENANCE</div>	
<input style="width: 20px; height: 20px; border: 1px solid black;" type="button" value=" "/> <input style="width: 20px; height: 20px; border: 1px solid black;" type="button" value=" "/>	Select DO.2 by pressing the <input style="width: 20px; height: 20px; border: 1px solid black;" type="button" value=" "/> and <input style="width: 20px; height: 20px; border: 1px solid black;" type="button" value=" "/> keys.	<div style="border: 1px solid black; padding: 5px;">D. Out Select DO.2 BLOW DOWN</div>	
<input type="button" value="SET"/>	Press the <input type="button" value="SET"/> key.	<div style="border: 1px solid black; padding: 5px;">D. Out Select DO.2 BLOW DOWN</div>	
<input style="width: 20px; height: 20px; border: 1px solid black;" type="button" value=" "/> <input style="width: 20px; height: 20px; border: 1px solid black;" type="button" value=" "/>	Select FAULT by pressing the <input style="width: 20px; height: 20px; border: 1px solid black;" type="button" value=" "/> and <input style="width: 20px; height: 20px; border: 1px solid black;" type="button" value=" "/> keys.	<div style="border: 1px solid black; padding: 5px;">D. Out Select DO.2 FAULT</div>	
<input type="button" value="SET"/>	Press the <input type="button" value="SET"/> key.	<div style="border: 1px solid black; padding: 5px;">D. Out Select DO.2 FAULT</div>	
<input style="width: 20px; height: 20px; border: 1px solid black;" type="button" value=" "/> <input style="width: 20px; height: 20px; border: 1px solid black;" type="button" value=" "/>	Select EXIT by pressing the <input style="width: 20px; height: 20px; border: 1px solid black;" type="button" value=" "/> and <input style="width: 20px; height: 20px; border: 1px solid black;" type="button" value=" "/> keys.	<div style="border: 1px solid black; padding: 5px;">D. Out Select EXIT</div>	
<input type="button" value="SET"/>	Press the <input type="button" value="SET"/> key.	<div style="border: 1px solid black; padding: 5px;">D. Out Select EXIT</div>	
	Setting has now been completed. However, for validating the setting, turn off the main power supply, and then turn it on.	<div style="border: 1px solid black; padding: 5px;">OUTPUT HOLD D. Out Select</div>	

## 10.12 Selection of output hold functions

### Description

- When output hold is set to YES, analog output signal is held in the preceding value during calibration and blowdown operation.
- When calibration at output hold “YES”, the oxygen concentration being displayed is fixed to the value of calibration gas concentration which has been set in Chapter 10.3 and 10.4.

Operation (example)	Setting output hold to YES (when it was set to NO prior to setting)	
Key operation	Description	Displayed message (LCD)
<input type="checkbox"/>	Display the image at right referring to the outline of key operation.	
<input type="checkbox"/>	Press the <input type="checkbox"/> key.	
<input type="checkbox"/> <input type="checkbox"/>	Set to YES by pressing the <input type="checkbox"/> and <input type="checkbox"/> keys.	
<input type="checkbox"/>	Press the <input type="checkbox"/> key. Note) When output hold is set to YES, HOLD is displayed on the measurement mode display.	

## 10.13 Procedure for setting password

### Description

- In this mode, the password necessary to enter “SET MODE” is set.

Operation (example)	Setting password to 1234 (When it was set to 0000 prior to setting)	
Key operation	Description	Displayed message (LCD)
<input type="checkbox"/>	Display the image at right referring to the outline of key operation.	
<input type="checkbox"/>	Press the <input type="checkbox"/> key.	
<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	Set to 1234 by pressing the <input type="checkbox"/> , <input type="checkbox"/> and <input type="checkbox"/> keys.	
<input type="checkbox"/>	Press the <input type="checkbox"/> key.	

## 11. HOW TO CHANGE THE SETTING OF CONVERTER ZRM DEPENDING ON DETECTOR TYPE

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Described here is the method of changing the setting of converter when the detector to be connected is other than standard (ZFK2 with R thermocouples).

Detector types which require change of setting and the contents of change:

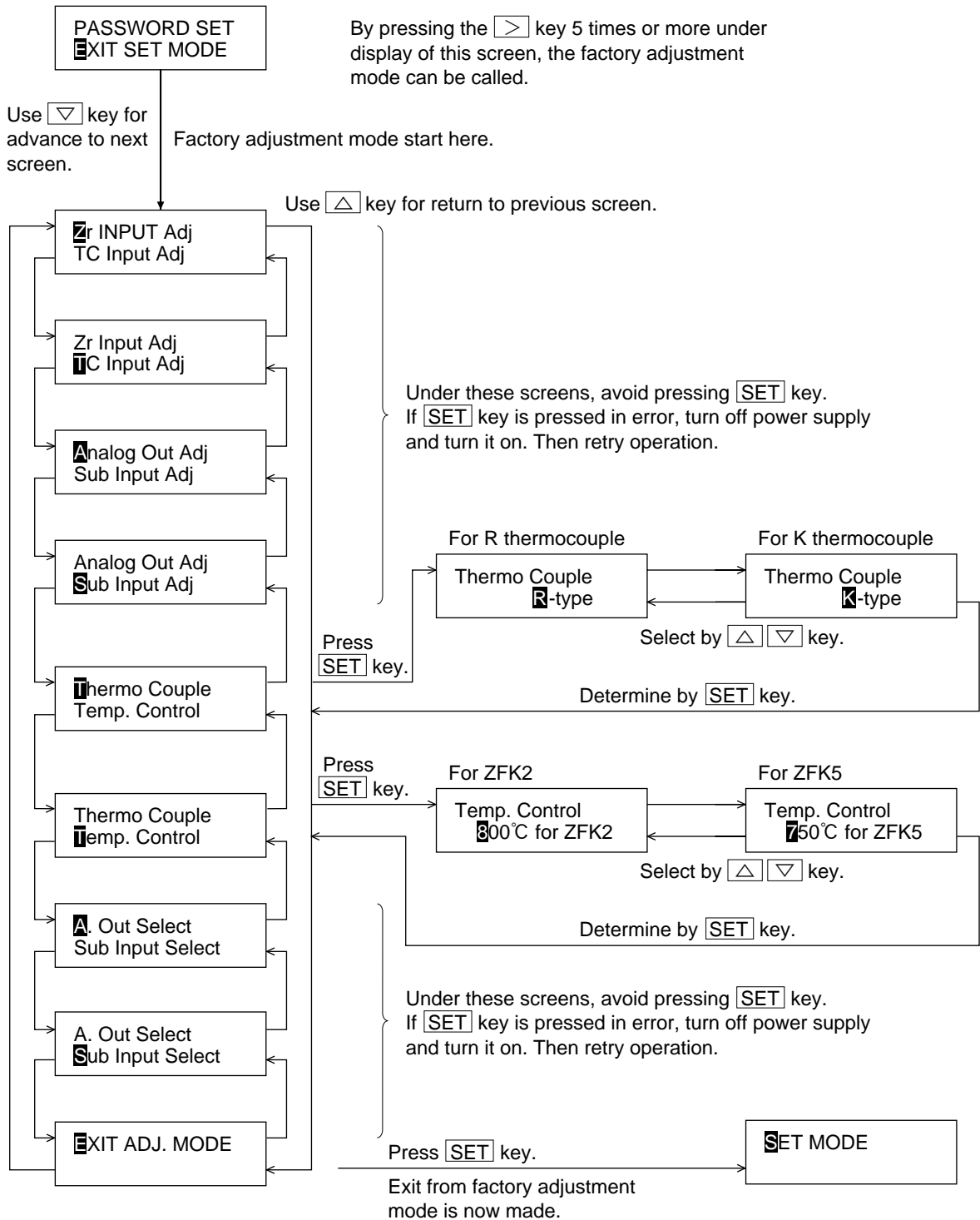
- ZFK5                   -   for corrosion resistance  
----- Change detector temperature to 750   (Temp. Control).
- ZFK2B               -   with K thermocouple  
----- Change thermocouple type to K (Thermo. Couple).
- ZFK2C               -   with K thermocouple  
----- Change thermocouple type to K (Thermo. Couple).

### **Caution**

A wrong operation may alter the factory-adjustment value to disable measurement. Therefore, carry out operations while observing the cautionary instructions.

**<Procedure for transition to factory adjustment mode>**

Move on to the screen for terminating the SET mode.



## 12. SPECIFICATION

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### General

- Measuring gas : Oxygen in non-combustible gas
- Measuring method : Direct inserting type zirconia method
- Measuring range : 0 to 2 ..... 50vol% O<sub>2</sub> (selectable in 0.5% O<sub>2</sub> steps)
- Oxygen concentration : DC4 to 20mA (allowable load resistance 500Ω max.)  
output signal : 0 to 1V DC (output resistance 100Ω max.)  
Input-output isolation, linear characteristic versus oxygen concentration
- Repeatability : ±0.5% FS
- Linearity : ±2% FS
- Response speed : Within 7 sec for 90% response (from calibration gas inlet)
- Power supply : 100, 150 or 220V AC, 50/60Hz
- Power consumption : 15VA + 50VA in normal operation  
15VA + 200VA at startup
- Warmup-time : 15 minutes approx.
- Cable : Maximum length between detector and converter 100m (To be ordered separately)

### Oxygen detector (type ZFK2, 5), Ejector (type ZTA)

- Measuring instrument : General purpose ZFK2  
Anti-corrosive type ZFK5
- Measured gas temperature : -20 to 1590°C  
-20 to 600°C for flow guide tube type  
(general purpose type, anticorrosive type)  
-20 to 800°C or 1590°C for ejector type
- Measured gas pressure : -3 to +3kPa {-300 to +300mmH<sub>2</sub>O}
- Flow guide tube : Two types available, the one without blowdown nozzle and the one with blowdown nozzle  
Flange : JIS 5K 65A RF  
Insertion length (according to specifications):  
0.3, 0.5, 0.75, 1.0m (without blowdown nozzle)  
0.3, 0.5, 0.75, 1.0, 1.5, 2.0m (with blowdown nozzle)
- Ejector (for general purpose) : Probe for introducing measured gas into detector  
Flange : JIS 10K 65A RF  
Insertion length (according to specifications):  
0.5, 0.75, 1.0, 1.5m
- Ambient temperature : -20 to 60°C for cable section  
-5 to 100°C for ejector  
125°C max. for detector flange surface with power ON
- Structure : Drip-proof (with rainproof cover)
- Filter : Alumina (filtration accuracy 50μ) and quartz paper
- Material of gas-contacting parts : General purpose detector : Zirconia, SUS316, SUS304, platinum  
Anti-corrosive detector : Zirconia, titanium, platinum, SUS316  
(flow guide tube)  
Ejector : SIC, SUS316, SUS304
- Detector mounting : Horizontal ±45°, surrounding air should be clean.

- 
- Outline dimensions : (L × max. dia.) 210 × 100m (detector)
  - Mass : Detector, approx. 1.6kg  
Ejector, approx. 1.5kg (insertion length 1m)  
Flow guide tube of 1m (general purpose type), approx. 5kg
  - Finish color : Munsell N9.5 (silver) and SUS metallic color
  - Ejector air input : 5 to 10 ℓ /min.
  - Blow down air input : 200 to 300kPa {2 to 3kgf/cm<sup>2</sup>}
  - Ejector exhaust gas processing :  
Returned to furnace or flue
  - Heater temperature drop alarm output (ejector type) :  
Alarm output when below 100°C, mechanical type thermostat, 1 make contact of 200V AC, 2A

### Oxygen converter (type ZRM)

- Display : 3-digit LED, 16 digit × 2 lines LCD and 3 lamps
- Output signal hold : Output signal hold during calibration and blowdown is possible
- Contact output : 4 points, contact specification: 1 make contact of 250V AC 2A  
Selectable for each contact following functions  
During maintenance\*  
H/L alarm  
High alarm  
Low alarm  
For solenoid valve:  
For zero gas\*  
For span gas\*  
For blowdown\*  
Note; Items marked by \* are set at shipment.
- Contact input : No-voltage contact, ON at 1kΩ or less  
1 for automatic calibration start  
1 for automatic calibration inhibition
- Transmission function (Optional) : RS-485 interface  
Transmission system : half duplex, bit serial  
Synchronous system : start-stop synchronous  
Singing system : binary, data length :  
8 bit parity : odd/even/non stop bit: 1 or 2 bits  
Transmission speed : 1,200 to 19,200BPS  
Transmission distance : 500m max.
- Calibration method : a. One-touch calibration with calibration key  
b. Automatic calibration (standard)  
Calibration interval ; 00 day 00 hour to 90 days 60 hours
- Calibration gas : • Setting range for zero gas; 0.010 to 50.000% O<sub>2</sub>  
span gas; 8.000 to 23.000% O<sub>2</sub>  
• Recommended concentration of calibration gas :  
zero gas; 0.25 to 2.0% O<sub>2</sub>  
span gas; 20.6 to 21.0% O<sub>2</sub> (air)

- 
- Detector blowdown : Standard  
Blowdown interval; 00 hour 00 minute to 99 hours 60 minutes.  
Blowdown time; 0 minute 00 second to 9 minutes 60 seconds.
  - Structure : Dust-proof and rain proof type (avoid direct sunlight)
  - Mounting method : Mounting on panel surface, or pipe stand (as specified)
  - Finish color : Munsell 5Y8/1
  - Outline dimensions (H × W × D) : 220 × 193 × 89mm
  - Mass : Approx. 3.5kg
  - Ambient temperature : -10 to 50°C
  - Ambient humidity : 90%RH or less
  - Power source : 90 to 230V AC 50/60Hz

Note • The supply voltage category of this instrument is II. Relay contact is category I.  
• Analog output and digital input of this instrument are Safe Separated (SELV) circuit.

## Configuration of devices

The configuration of devices differs according to the conditions of the gas to be measured.  
Select a suitable combination using the following table for reference.

Measured gas				Component devices					
Temperature	Application	Dust	Gas flow	Detector type	Converter type	Ejector type	Solenoid valve	Flow-meter ZBD422	Flow-meter ZBD424
600°C or less	General purpose	Little	With	ZFK2□A to D	ZRM	—	—	○	—
		Much	With	ZFK2□J to P	ZRM	—	○**	○	—
		Little	Without	ZFK2□Y	ZRM	ZTA2	—	○	○
		Much	Without	ZFK2□Y	ZRM	ZTA2	○**	○	○
	Anti-corrosive (for waste incinerator)	Little	With	ZFK5□U to X	ZRM	—	—	○	—
		Much*	With	ZFK5□J to P	ZRM	—	○**	○	—
800°C or less	General purpose	Little	With	ZFK2□Y	ZRM	ZTA2	—	○	○
			Without						
	General purpose	Much	With	ZFK2□Y	ZRM	ZTA2	○**	○	○
			Without						
1590°C or less	General purpose	Little	With	ZFK2□Y	ZRM	ZTA1	—	○	○
			Without						
	General purpose	Much	With	ZFK2□Y	ZRM	ZTA1	○**	○	○
			Without						

Note (\*) : Automatic blow down is prohibited (to protect flow guide tube from corrosion).

Note (\*\*): For blowdown

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