Instructions manual

ZKMX-ZFKX
O_2 zirconia analyser for ATEX area

TYPE: ZPF2 and ZTF2

Fuji Electric France S.A.S.

INF-TN1-ZKMX-ZFKX-E

PREFACE

We are grateful for your purchase of Fuji Electric Oxygen Analyser ATEX.
This document is the general user guide for Fuji Electric Oxygen analyser (ZKMX transmitter type ZTF2). It provides all instructions on how the product should be installed, operated and maintained. It also make suggestions to optimize the analysers performance and lifetime.

It is intended for technically qualified personnel who are appropriately trained and who possess the relevant knowledge in the area of measurement and control technology.

First read this instruction manual carefully until an adequate understanding is acquired, and then proceed to installation, operation and maintenance of the analyser.
Particular attention must be paid to **information, warning texts, and instructions for Ex-proof equipment**. These are indicated by respective pictograms. They serve to safeguard the safety of operators and facilities and help you to avoid operating errors which can cause major injuries and damages.

This manual is an inherent part of the delivery. For reasons of clarity, it is not possible to cover all possible designs of the described system. Please contact us if you wish to set up, operate or maintain the device differently to the instructions given here.

- Read this **instruction manual** and the **technical instructions for ATEX equipment** carefully to get a thorough understanding of how this zirconium oxygen analyser works prior to installing, operating and maintaining the zirconium oxygen analyser.
- The specification of this zirconium oxygen analyser may be subject to change without previous notice for improvements of the product.
- Under no circumstances should this zirconium oxygen analyser be modified without permission.
- If any trouble should occur because of having been modified without permission, we won't be responsible for it anyway.
- This instruction manual should be kept in custody by a person who *actually* operates the zirconium oxygen analyser.
- After reading this manual, it should always be kept in a place which allows the person who operates it to refer to any time as required.
- A due consideration should be given so that this instruction manual is delivered to a final user certainly.

Manufacturer	:	Fuji Electric S.A.R.L
Type	:	Described in the nameplate put on the main body
Date of manufacture	:	Described in the nameplate put on the main body
Product nationality	:	FRANCE

SAFETY ADVICE

These operating instructions use the following symbols as important security device for the user. They are always located within the chapter at points where the information is required. The security advice, especially regarding ex-proof features, must be observed and followed at all times.

Those safety precautions are ranked in 3 levels, “DANGER”, “CAUTION” and “PROHIBITION”.

	TECHNICAL INSTRUCTIONS FOR ATEX EQUIPMENT
 **CAUTION**	If handled wrongly, a dangerous situation may occur, and medium trouble or slight injury may be caused.
 **PROHIBITION**	Items which must not be done are noted.

In this connection, the operator is requested to observe the legal accident prevention regulations for all work at all times, and, according to the given circumstances, do everything to prevent damage to persons and assets.

OPERATION

The Oxygen analyser is composed of the ZKMX transmitter type ZTF2, an electronic data interpreting device which is used in conjunction with the ZFKX probe type ZPF2 for the continuous measurement of the O_2 concentration in combustion flue gases in the superstoichiometric area.
It is assumed that plant planning, mounting, installation, commissioning, maintenance and service work will be carried out by sufficiently trained personnel and that this work will be checked by responsible skilled personnel. If needed, Fuji Electric can be sought to provide training on the analysers.

It must be particularly noted that :

- the operation complies with the technical data and specifications regarding permissible use, mounting, connection, environment and operating conditions (refer to the contract documents, the device user information, rating plates etc.) as well as the provided documentation.
- work will be carried out in accordance with the local, plant-specific circumstances and with regard to the operational risks and directives.
- all the measures required to reliable and safe operation, e.g. for transportation and storage as well as maintenance and service, are maintained.

INTENDED USE

The product described here has left the factory in a flawless, safe and checked condition and it must be maintained exclusively in the manner that is described by the manufacturer. Equally, the proper transportation, professional storage and setup as well as the careful operation and maintenance, are critical for the reliable and safe operation of the device.
Authorized qualified personnel must be used to install and operate this product. They must be familiar with the security advice and warnings specified here and ensure they can be implemented flawlessly. Unqualified persons working on the device or the warning information provided on the device not being observed could result in serious personal injury and / or damage to property.
The device is being used as intended if the device is being used solely for the application specified in the technical description. Auxiliary devices or those from other manufacturers must be recommended or authorized by Fuji Electric.

Provided the safety information and operating directives specified in this manual are observed, this device should not present any risks in terms of damage to property or the health of personnel

HAZARDS FROM ELECTRICAL EQUIPMENT

The equipment can be used in industrial electrical power installations. Always switch off the power when working on mains connections or mains voltage. Reattach any removed Ex-proof protection and protection against accidental contact before connecting the supply voltage.
When working on devices with disabled explosion protection, use external measures to ensure that no explosive atmospheres can occur.
Damage to health or equipment may result from improper use or improper handling. Therefore, to avoid damage, always observe the respective security advice.

PREVENTING MEASURES

If the oxygen analyser is used in conjunction with control and steering technology, the operator must ensure that any breakdown or failure of the analyser device does not cause inadmissible damage or dangerous operating states.
To avoid faults which could cause direct or indirect personal or material damage, the operator must ensure that:

- the responsible maintenance personnel can be reached at any time and as quickly as possible
- the maintenance personnel are trained to correctly respond to faults with the equipment and the associated malfunctions
- in the case of doubt, the faulty equipment can be switched off immediately
- a switch-off does not lead to direct disorders

AVOIDING CONSEQUENCIAL DAMAGES

To avoid consequential damages in the event of failure, which could cause direct or indirect personal or material damage, ensure that qualified personnel can assess the faults and initiate appropriate measures to tackle them.

ENVIRONMENTALLY CORRECT BEHAVIOUR

The Fuji Electric oxygen analysers are designed and constructed in accordance with ecological aspects. The structural components can be separated easily from each other, sorted accordingly and then recycled.

The specifications of this converter will be changed without prior notice for further product improvement.
Modification of this 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 converter.
After reading through the manual, be sure to keep it near at hand for future reference. This instruction manual should be delivered to the end user without fail.

CAUTION ON SAFETY

Prior to operating this analyser, read this "Caution on safety" & "Technical Instruction for ATEX Equipment" carefully.
In the precautions shown here, important contents on safety are included. So, be sure to observe them.
The safety precautions have been ranked into "DANGER" and "CAUTION".

Precautions used in mounting and wiring

- Install this product in a place or room compatible with the conditions set forth in "instruction manual". The use at a place not conforming to the installation conditions may result in an electric shock, a fire and incorrect operation.
- When this product is mounted on a furnace which is under operation, take utmost care with blow-out from the furnace. It might get a burn and/or toxic gas fumes.
- In the case of the wiring work, be careful not to drop foreign matters including wire chips into the junction box. Otherwise, a fire, failure or malfunction may result.
- Connect a power source compatible with the specified rating. Connection of power source different from the rating might cause a fire.
- Before doing the wiring work, be sure to turn off the main power. Otherwise, it may result in getting electric shock.
- Use proper wiring materials according to the rating of apparatus. If a wiring material which is not bearable to the rating is employed, it might cause a fire.
- Never do the work at a place where rain water splashes the product directly.
- A failure to observe this instruction may result in getting an electric shock or failure.

Precautions used in operation, stop, maintenance and check

- In case where combustible gas is contained in the measured gas, check the gas composition and specifications carefully before using. Otherwise, the original performance is not displayed, and there is a danger of explosion.
- Do the work in a condition where the main power has been turned off. If the work is done power on, there is a fear of getting electric shock.
- Never touch the detector by bare hand. Indeed, there is a fear of getting burned. Because the operating temperature of the detector (tip of ceramic heater) is about 800 ℃ probe surface temperature is also high.
- Before cleaning the flow guide tube, turn off the main power and cool the tube down fully. There is a fear of getting a burn.
- Don't use any other renewal part than those designated by the maker. Otherwise, the original performance is not fully displayed and a trouble or failure may result.
- Never do the work at a place where rain water splashes the product directly.
- A failure to observe this instruction may result in getting an electric shock or failure.

Other precaution

- For a failure which cannot be judged even if referring to the instruction manual, be sure to ask the nearest dealer or Fuji Electric' adjustment serviceman for repair. If disassembled without a thought for the outcome, an accident or injury could result.
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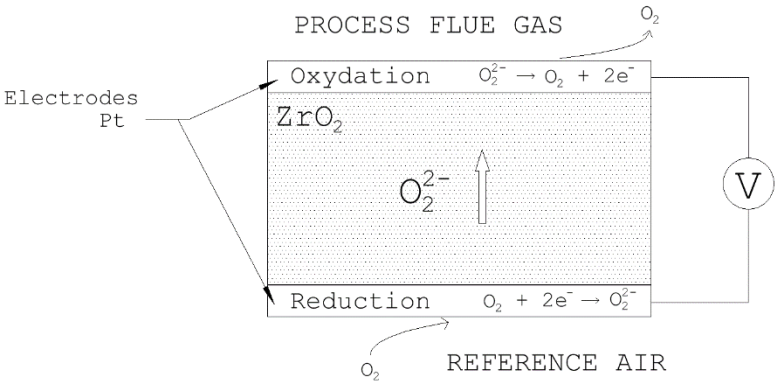
TABLE OF CONTENTS

1. INTRODUCTION

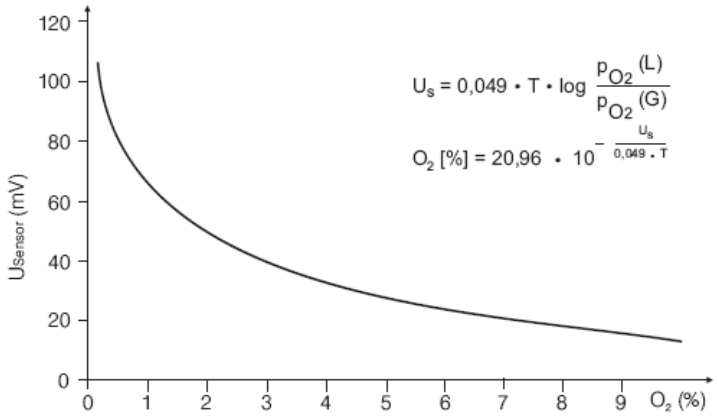
1.1 GENERAL DESCRIPTION OF OXYGEN ZIRCONIUM SENSOR

This zirconia oxygen analyser makes use of conductivity that a solid electrolyte composed mainly of zirconia (ZrO_2) allows only oxygen ion to pass through at high temperature. This is an oxygen sensor which measures an electromotive force produced by difference in oxygen concentration between gas to be measured and reference air based on the principle of oxygen concentration cell.

The O_2 measuring cell functions as an electrochemical concentration cell and generates a direct voltage, which depends upon the absolute temperature T and the logarithm of the O_2 concentration ratio or O_2 partial pressure ratio on the reference electrode and O_2 outer electrode.



If specimen gas is fed to the outer electrode and a reference gas with a known O_2 concentration, such as air (20.96 %), to the inner electrode, at a constant temperature the logarithmic relationship illustrated below occurs between the probe voltage U and the oxygen concentration of the specimen gas.



Sensor characteristic U = f (O_2)

The conversion of the sensor voltage into oxygen concentration is performed by a electronic converter then called “transmitter”.

1.2 INTRODUCTION TO EX-PROOF CERTIFICATION

Some industrial applications may lead to the creation of explosive atmospheres, by normal or accidental phenomena (gas emanation over fuel tanks). In such cases, the explosion risk of the area is characterized by parameters described in the EXPLOSIVITY PARAMETERS Table. Fuji Electric instruments are certified according to European standards applicable for flame-proof enclosed devices.

EXPLOSIVITY PARAMETERS / PARAMETRES D'EXPLOSIVITE		
PARAMETER	**COMMENTS / COMMENTAIRES**	**CLASSIFICATION**
Nature of the explosive substance	Explosive gas or dust in suspension in air	G (Gas) D (Dust)
Explosivity of the substance	Low explosive power Medium explosive power Medium/high explosive power High explosive power	A (Butane, Propane, Methane) B (Ethylene, Butylether) B+H2 (Ethylene, Hydrogen) C (Acethylene, Hydrogen)
Autoignition temperature	Temperature at which the gas or dust ignites without any flame source. The temperature of the environment must remain below the lowest autoignition temperature of all present gas. ATEX system are classified according to their maximum external temperature. *Ex : Ether 160°C ; Paper 233°C ; Gasoil 257°C ; Butane 287°C ; Methanol 455°C ; Hydrogen 571°C*	T1 : 450°C T2 : 300°C T3 : 200°C T4 : 135°C T5 : 100°C T6 : 85°C
Frequency of gas/dust release	The potentially explosive atmospheres are categorized accordingly to the frequency of explosive substances presence and to the normality of this presence. Areas are classified in 3 ZONES/Categories:	ZONE 0 / Cat.1 : Permanent presence ZONE 1 / Cat.2 : Predictable presence ZONE 2 / Cat.3 : Abnormal or short-time presence.

PRODUCTION QUALITY ASSURANCE SYSTEM

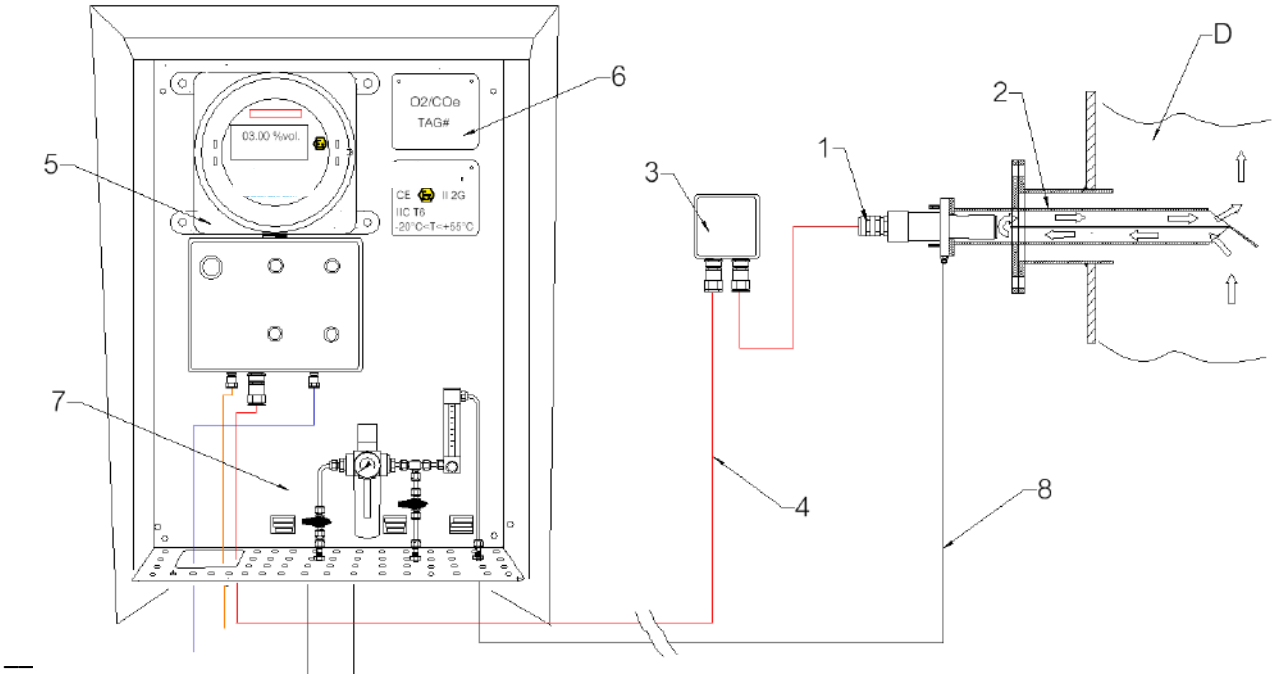
Accordingly to the Directive 94/9/EC of the European Parliament and Council of 23rd March 1994 and Directive 2014/34/EU of the European Parliament and Council of 26th February 2014, **Fuji Electric** operates a production quality assurance system that has been approved by the **LCIE** (notified body number 0081) for the production of equipment and protective systems intended for use in explosive atmospheres. The approved production quality assurance system is referenced N° **LCIE 09 ATEX Q 4011**.

Read carefully the following instructions before commissioning and use of the Oxygen Analyser.
Before installation, check that the model provided corresponds to the intended use.
FUJI ELECTRIC provides all needed information on how to store, install, commission, maintain and shutdown the furnished material.
ANY DEVIATION FROM THE BELOW INSTRUCTIONS INVALIDATES THE ATEX CERTIFICATION OF FUJI ELECTRIC DEVICES.

2 ANALYSER DESCRIPTION

2.1 ANALYSER CONFIGURATION & WORKING PRINCIPLE

The general configuration of the analyser is show non the below sketch :

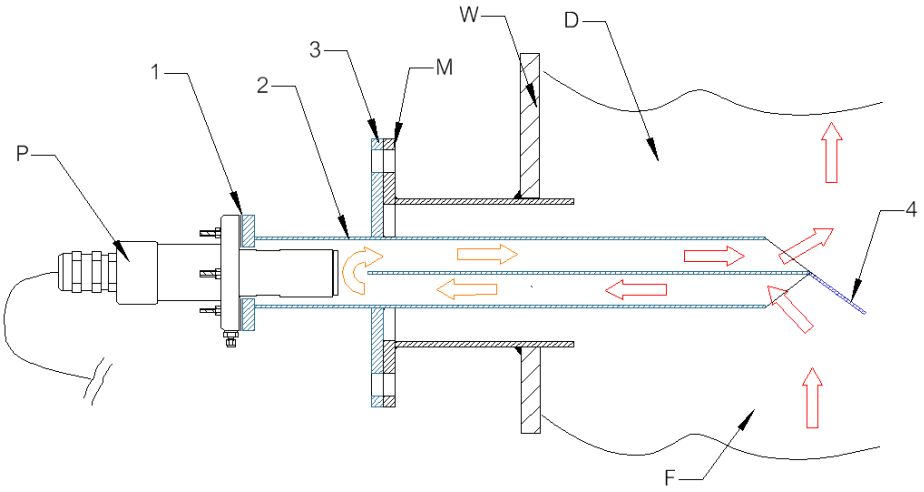


NBR	DESIGNATION
1	ZFKX PROBE TYPE ZPF2 – Mounted on the Deflecting Tube, in contact with process exhaust gas
2	DEFLECTING TUBE – Mounted on the furnace mating flange
3	INTERMEDIARY JUNCTION BOX – To be used if Probe-Converter distance > 2m.
4	SPECIAL ATEX CABLE
5	TRANSMITTER & CUSTOM ASSEMBLY – At remote place with electrical and gas connection to probe
6	LABELING
7	CALIBRATION KIT, CALIBRATION GAS CYLINDERS & STAINLESS STEEL TUBING
8	CALIBRATION LINE

2.1.A ZFKX PROBE TYPE ZPF2

Fuji Electric ATEX analysers are in-situ, which means that they are in direct contact with the flue gas to be analyzed. Instead of putting the probe in the core of the furnace, Fuji Electric found it more convenient to lead the flue gas from the core of the furnace to the probe thanks to an ingenious system called “deflecting tube” on which the probe itself is mounted.

Therefore, the combustion gas flows in the furnace duct and comes towards the end of the deflecting tube. Thanks to a pressure difference phenomenon, the combustion flue gas stream is led inside the tube and flows to the sensor, turns back in the tube and is then rejected to the furnace duct.



1	Probe Mounting Flange	4	Deflecting Plate	F	Flue Gas Flow
2	Deflecting Tube	P	ZIRCONIA PROBE	D	Flue Gas Duct
3	Deflecting Tube Mounting Flange	M	Mating Flange	W	Furnace Wall

Features:

1. Analyzed gas temperature <600°C whatever the temperature of flue gas is.
2. The condensates and solid or liquid unburnt compounds are trapped before reaching the probe. This prevents Zirconium Oxide damage and lengthens the probe lifetime.
3. Response time is optimized due to the flow speed.
4. The probe is mounted outside the furnace. This enables easy maintenance and replacement.

The tube design can be customized to fit the combustion unit at best (Flange, material, insertion length, insulation depending on tube size and flue gas T).

2.1.B TRANSMITTER ASSEMBLY

2 control devices are needed to operate of the analyser:

1. the electronic converter from which the probe is heated, regulated and operated
2. the calibration system which intends to send reference gas to the probe for calibration and maintenance purposes.

Transmitter and calibration system can be installed in a remote location from the probe.

1. Probe and transmitter can be installed at a distance up to 150m. This provides high flexibility for transmitter location.
2. Oxygen values are displayed at ground level on site.
3. Control devices can be installed in an appropriate place regarding the industrial environment.
4. All transmitter functions (calibration, automatic calibration, blow-down) must be operated from the same place.

Fuji Electric transmitter and calibration panel shall be either wall mounted or installed on site on self-standing racks.

2.2 DESCRIPTION OF ANALYSER PARTS

2.2.A EX-PROOF PROBE

The probe is the sensitive device of the system. It is an ATEX and IECEx certified assembly of a zirconium sensor and metallic ex-proof protections.

This assembly is designed for combustion gas analysis in explosive atmospheres and includes sintered flame-arrestors. More precisely, the probe is certified to operate under the following conditions :

For ambient temperature between -20°C and +60°C, the probe can operate in an process environment **Zone 1** (category **2**) which could normally and predictably contain **critical gas** (category **IIB+H2** : explosivity hydrogene) while operating.

In this ambient temperature range, the external surface of the probe remains below 200°C. The probe is thus classified **T3** for gas..

Make sure that the area of operation is classified in compliance with these conditions of use. Please refer to specific instructions for ex-proof equipment.

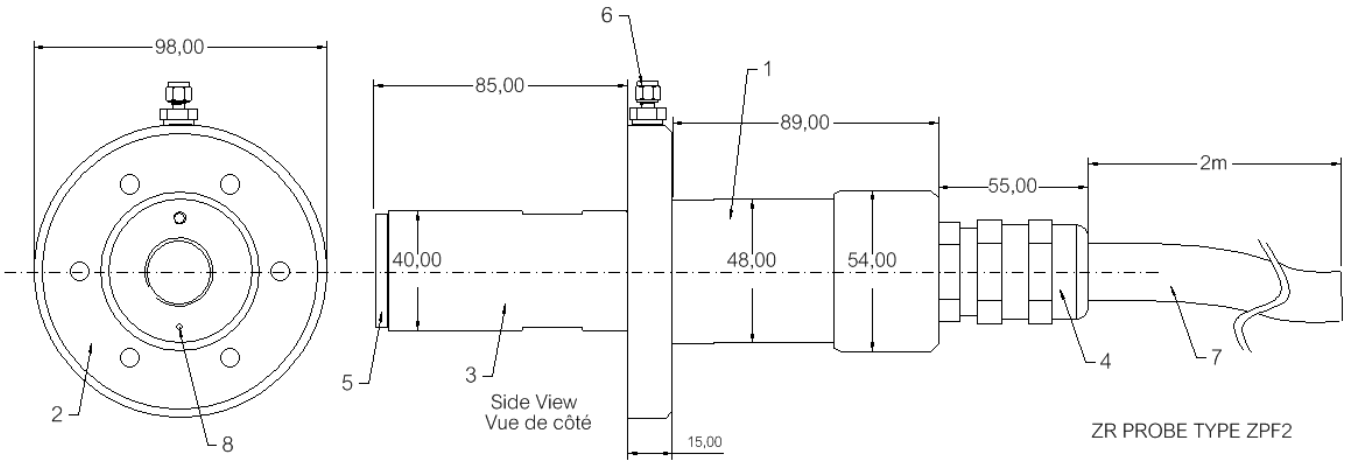
The probe features a full 316L Stainless Steel Body. The oxygen sensor is fixed into the probe body so that the sensitive part is located into the probe nose ((3) on diagram next page). The sensor and the process are separated by a sintered flame-arrestor which is fitted into the probe nose (ref picture). The purpose of this flame-arrestor is to prevent any flame source coming from the inside of the probe from going out and ignite a potentially explosible atmosphere.

In order to prevent the clogging of the flame-arrestor, an Inconel mesh filter is fitted at the extremity of the nose (3). This filter is not a flame-arrestor and can be replaced on site while the probe is energized.

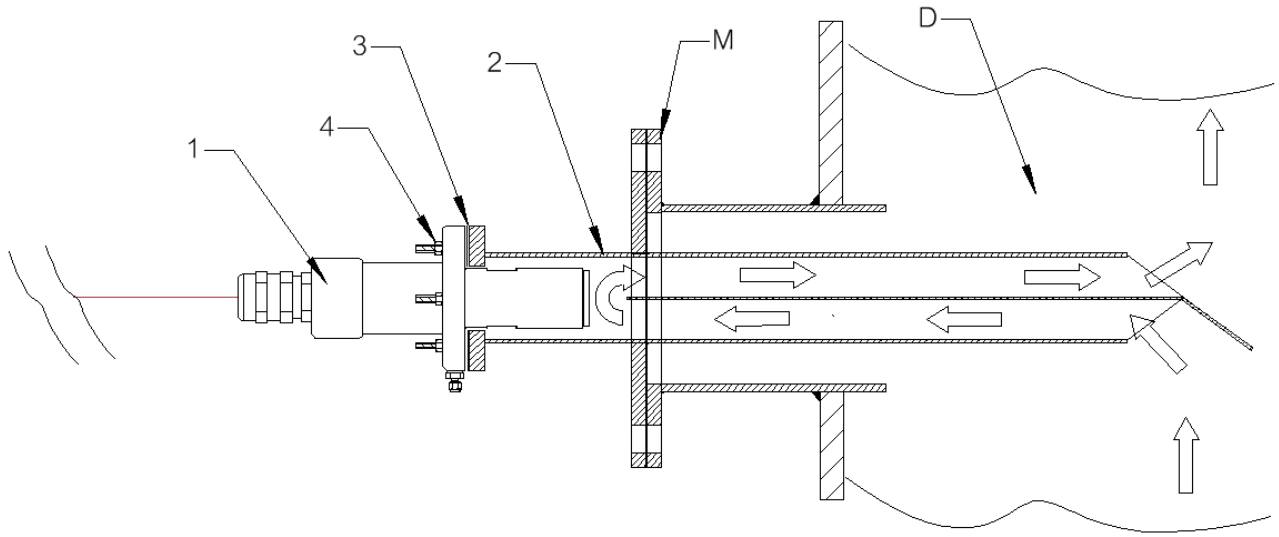
The probe is mounted on the deflecting tube with M5 nuts on a Ø98mm counter flange (3).

The calibration gas inlet (6) is placed on the mounting flange. This connection for 4/6mm Stainless steel tubing aims at sending calibration gas samples for the calibration system to the sensor enclosed in the ex-proof probe.

The probe is connected to 2m of armoured cable through a non-removable barrier cable gland. The cable aims at probe electrical connection to remote converter.



1	Probe Body	5	Probe Inconel Filter*
2	Probe Mounting Flange	6	Calibration Gaz Inlet
3	Probe Flame-Arresting Nose*	7	Connection Cable – 2m
4	Cable Gland for electrical connection to converter – *not removable*	8	Reference air inlet



1	ZFKX PROBE TYPE ZPF2	3	Probe Gasket
2	Deflecting Sampling Tube	4	6 Mounting M5 Nuts
M	Mating Flange	D	Furnace Duct

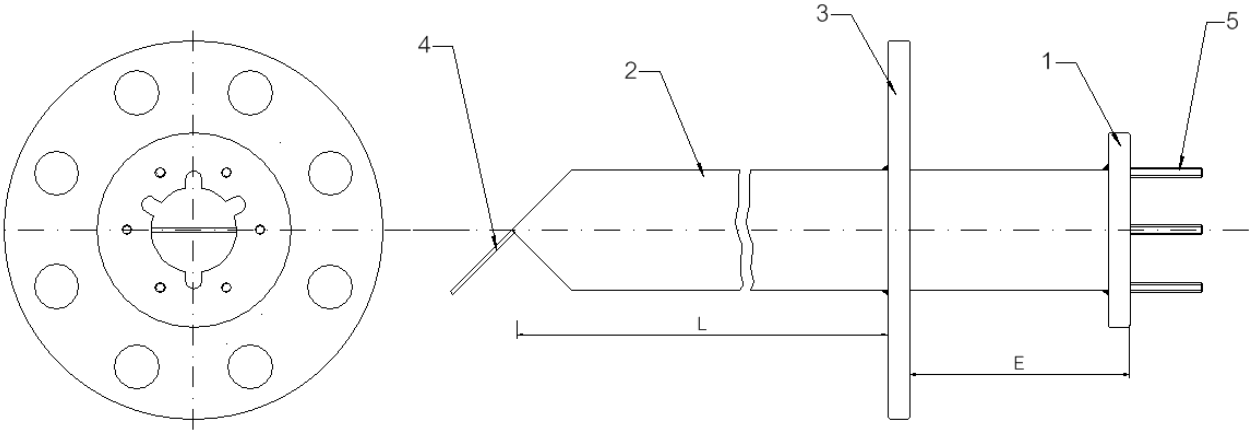
PROBE SPECIFICATIONS

MEASUREMENT PRINCIPLE	Zirconium Oxyde Probe	**APPLICATION**	In situ O2 % measurement in Combustion Flue Gas for process control
IN SITU SAMPLING SYSTEM	Made to order Flow Guide Tube (“Deflecting Tube”) inserted into the flue gas duct. See relevant data sheet	**PROBE FILTERS**	Alumina (50µm) and quartz paper SS316L or Inconel600 Flame arrestor Inconel mesh protective filter
MEASURED GAS T°	120 to +1500ºC depending on deflecting tube material and shape	**MEASURED GAS PRESSURE**	–3 to +3kPa (–306 to +306mmH2O)
RESPONSE TIME	<7s for 90% of final value (from calibration gas inlet)	**DETECTOR MOUNTING**	Horizontal plane to +45º (nose down)
HAZARDOUS AREA CERTIFICATION	II2G Ex db IIB+H2 T3 (Ta :-20°C to +60°C) LCIE 13 ATEX 3045X IECEx LCIE 13.0027X	**PROBE ENCLOSURE**	Dust/rain-proof structure IP65
HEATER POWER SUPPLY	Provided by the converter Rated voltage : 200 to 240VAC (operating 190 to 264V AC) Rated frequency; 50/60Hz	**THERMOCOUPLE**	Type R
CALIBRATION GAS	20,9%vol.O2 in N2 balance (Instr. Air) 1%vol. O2 in N2 balance recommended flowrate : 30-40NL/h	**CALIBRATION GAS INLET**	Φ6mm double ferrule or Φ1/4”NPT-F connector (as specified
REFERENCE AIR INLET	Spontaneous by a sintered metal drain	**COMPATIBLE CONVERTER**	REMOTE CONVERTER TYPE ZIRCONIA TRANMITTER see relevant data sheet
OUTER DIMENSIONS (L × max. dia.)	245mm × 100mm + 2m white cable dia.15.4 mm	**WEIGHT**	Probe : approx. 3kg Flow Guide tube : approx.. 10kg (depends on tube length and flange size)
STORAGE CONDITIONS	Sensing element: –20 to +70ºC Flow Guide Tube: –10 to +100ºC	**FINISH**	Raw Metal

2.2.B DEFLECTING TUBE & ACCESSORIES

OUTLINE DIMENSIONS

In Fuji Electric system, the deflecting tube is designed to lead and cool down the gas from the furnace to the probe (see picture above). The basic mechanical configuration is described on the following sketch :



Nbr	Designation
1	PROBE MOUNTING FLANGE – SS316L
2	FURNACE MATING FLANGE – SS316L
3	PLATE for tube partitioning

Nbr	Designation
4	TUBE – Ø60.3mm
5	PLATE SPOON for fumes deflection

The deflecting tube is custom designed to fit the combustion process and furnace design.
Tubes are made to orders in the Fuji Electric workshop based on specifications requirements and validated on drawings by customer approval (ISO9001 process).

TUBE STANDARD DESIGN

MATERIAL	316L Stainless Steel	Flue gas from 80°C to 800°C
	310 Stainless Steel	Refractory for flue gas from 600 to 1100°C
	Inconel 600	Corrosion Proof, Refractory: up to 950°C
	Kanthal	Refractory: 900 to 1500°C
LENGTH	300 to 2000mm long	The length is designed to reach the optimized sampling point.

The mating flange and the insert tube are not in Fuji Electric scope of supply. We therefore provide tubes with flanges that fit to the on-site mating flanges.

Tube lengths have to be designed to get an appropriate flue gas sample.

ACCESSORIES & CUSTOM DESIGN

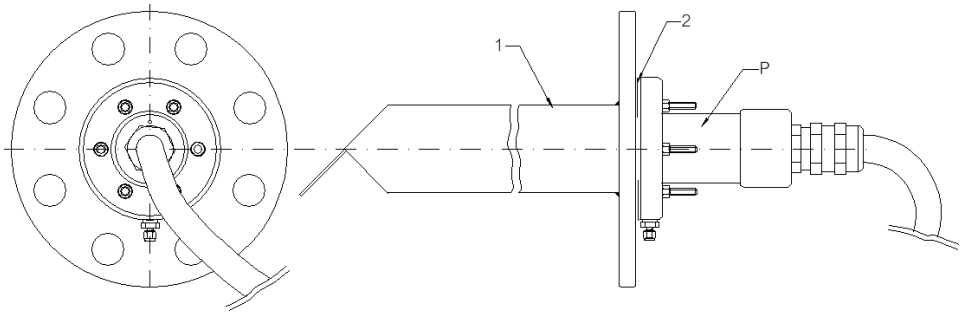
In some difficult applications, the deflecting tube standard configuration may not prevent the probe from clogging or being corroded by the flue gas. In such case, deflecting tubes performance can be improved by adding accessories that can be combined and adapted to fit the process requirements at best. Please refer to Fuji Electric for further information on the accessories.

ACCESSORIES

Accessories can be combined and adapted to fit the process requirements at best

- **TUBE WITHOUT EXTENSION**

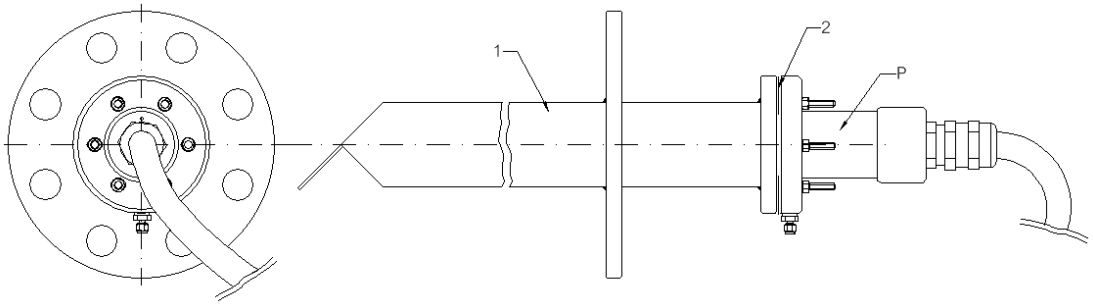
Deflecting tubes without extension are installed to maintain the probe nose at high temperature. It is recommended to limit condensation on low to medium temperature and corrosive combustion processes.



1	Deflecting Tube	2	Probe Gasket
P	ZFKX probe type ZPF2		

- **TUBE WITH EXTENSION**

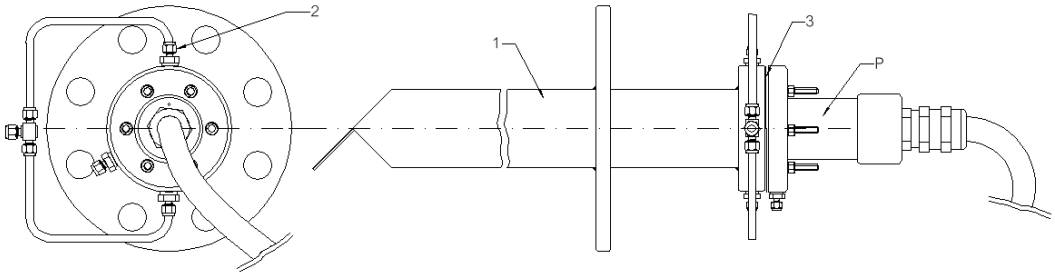
Deflecting tubes with extension are the most convenient to use thanks to separate mounting flanges. It is recommended for high temperature combustion processes.



1	Deflecting Tube	2	Probe Gasket
P	ZFKX probe type ZPF2		

- **BLOW-OFF SYSTEM**

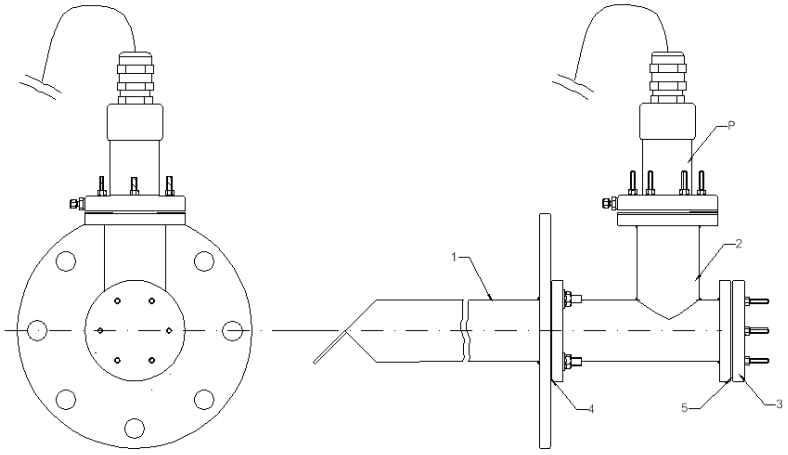
If deflecting tube may get clogged quickly due to significant amounts of dust or solid particles and condensates, pressured air can be pushed into the tube to clean it. Oxygen converters enable automatic and settable blow-off.



1	Deflecting Tube	2	Blow-off Connectors for pressure air
3	Detector Gasket	P	ZFKX probe type ZPF2

- **T-SHAPE EXTENSION FOR VERTICAL MOUNTING AND TANGENTIAL SAMPLING**

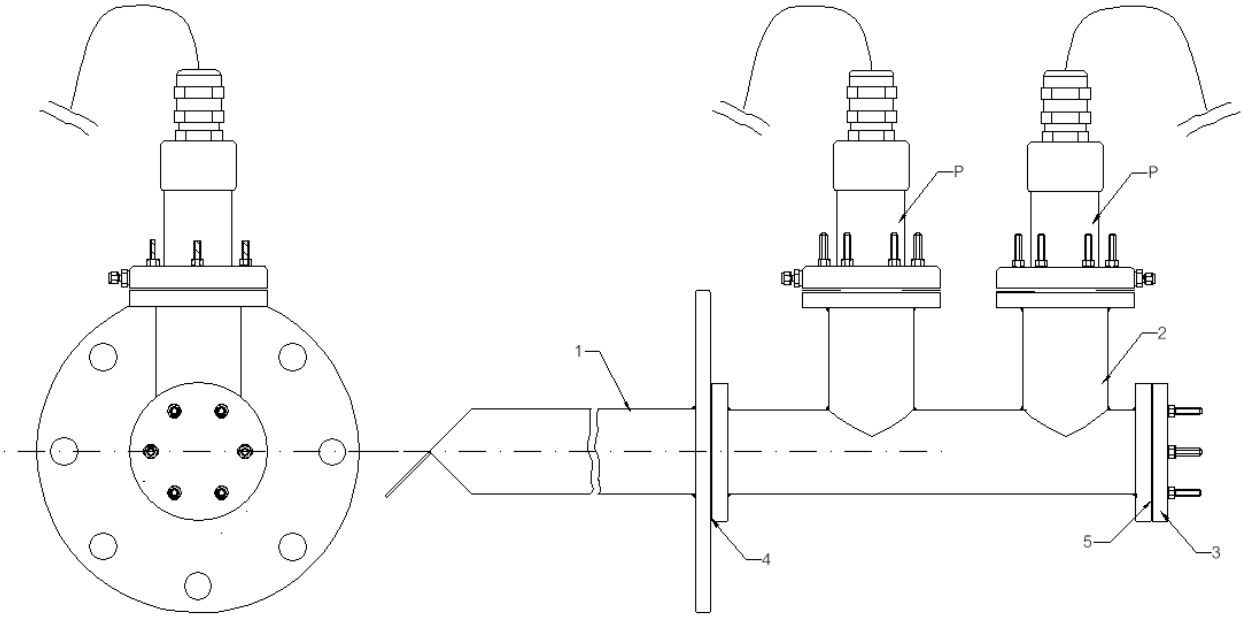
T-shape extensions prevent the probe from getting clogged by solid particles and from chemical deposits and condensates. It is thus very effective when used on dusty and/or corrosive applications. To limit condensation in the extension, it is often recommended to insulate it thermally.



1	Deflecting Tube	2	T-shape extension
3	Deflecting Sampling Tube	4	AT6000 Gasket
5	PF0298 : AT6000 Gasket 6 holes	P	ZFKX probe type ZPF2

- **EXTENSION FOR ANALYSER DUO**

Extensions for analyser duo enable installation of two probes on one single mating flange. It has the same benefits as T-shape extensions.



1	Deflecting Tube	2	T-shape extension for 2 probes
3	Deflecting Sampling Tube	4	AT6000 Gasket
5	PF0298 : AT6000 Gasket 6 holes	P	ZFKX probe type ZPF2

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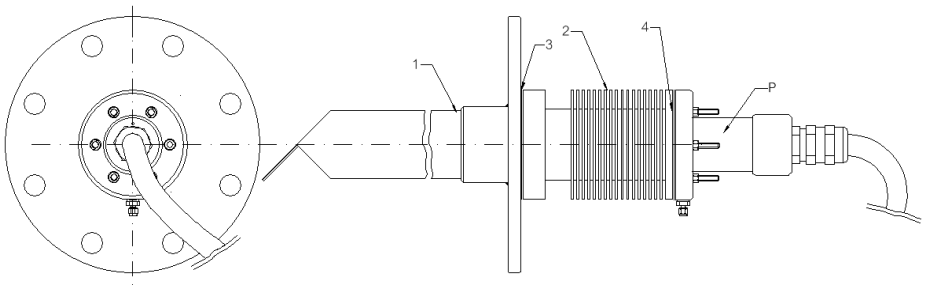
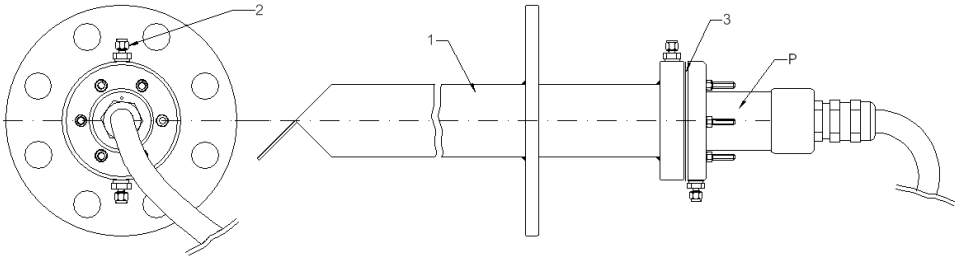
- **COOLING EXTENSION**

Cooling extensions are used on very high temperature application to limit the temperature of the probe. Generally, it is installed on high temperature KANTHAL tubes.



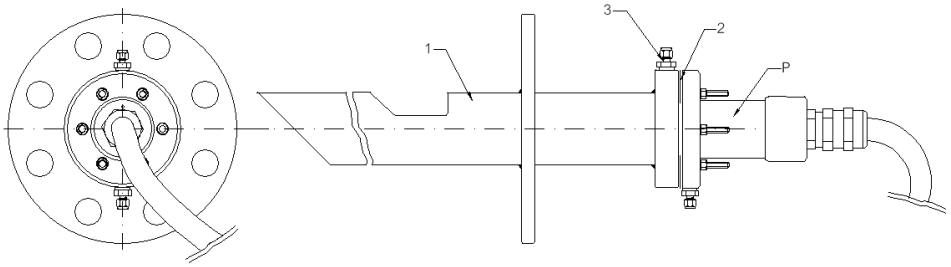
- **FLOW BOOSTER**

When the flue gas flow rate is too low, the pressure difference generated by the deflecting tube may not be sufficient to create a good circulation of flue gas inside the tube. In such case, the flow can be accelerated by injecting pressured air into the tube.



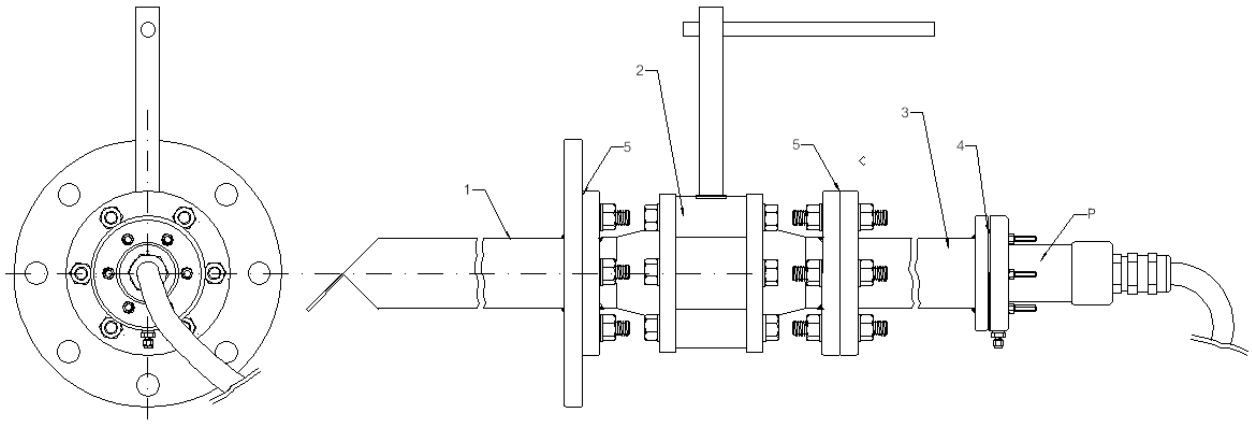
- **FRONT FLOW SAMPLING**

When the flue gas flow comes frontally to the mating tube, adapted deflecting tube must be used. Specific design enables flue deflection in this peculiar installation configuration.



- **SECTION VALVE**

On toxic or dangerous applications, full stainless steel section valves can be installed on deflecting tubes. Probes can be isolated from the flue gas flow for maintenance operations.



TUBE SPECIFICATIONS

SAMPLING PRINCIPLE	Spontaneous deflection by pressure difference	**APPLICATION**	In situ O2 % measurement in Combustion Flue Gas for process control
TUBE OD	60,3mm / 2”NB SCH10		
MEASURED GAS T°	120 to +1500ºC depending on deflecting tube material and shape	**MEASURED GAS PRESSURE**	–3 to +3kPa (–306 to +306mmH2O)
TUBE LENGTH	300mm to 2m	**TUBE MOUNTING**	Horizontal plane to +45º (nose down)
STANDARD FLANGES DIMENSIONS	4’’150#RF	**PRESSURED GAS INLET**	Φ6mm double ferrule or Φ1/4”NPT-F connector (as specified)
WEIGHT	approx.. 10kg depending on tube length and flange size	**FINISH**	Raw Metal
COMPATIBLE PROBE	ZFKX PROBE TYPE ZPF2	**STORAGE CONDITIONS**	Sensing element: –20 to +70ºC Flow Guide Tube: –10 to +100ºC

2.2.C EX-PROOF TRANSMITTER

The Fuji Electric converters have several functions.

First, it ensures the electronic remote control of the probes that are installed on the furnace ports : it provide the power required to heat the sensor up to approximately 800°C and ensure the regulation of this temperature.

Second, it makes the conversion of the data provided by the probe. Indeed, it measures the sensor signal in mV and converts it in oxygen concentration according to the Nernst law. This conversion is performed in a certain concentration range which is settable. Low and high alarms can also be set to give a further interpretation of the converted signal.

Finally, maintenance operations such as calibration, auto-blow-down, probe regeneration etc…. are performed from the converter. These operations have significant influence on the measurement accuracy and on the analyser life-time.

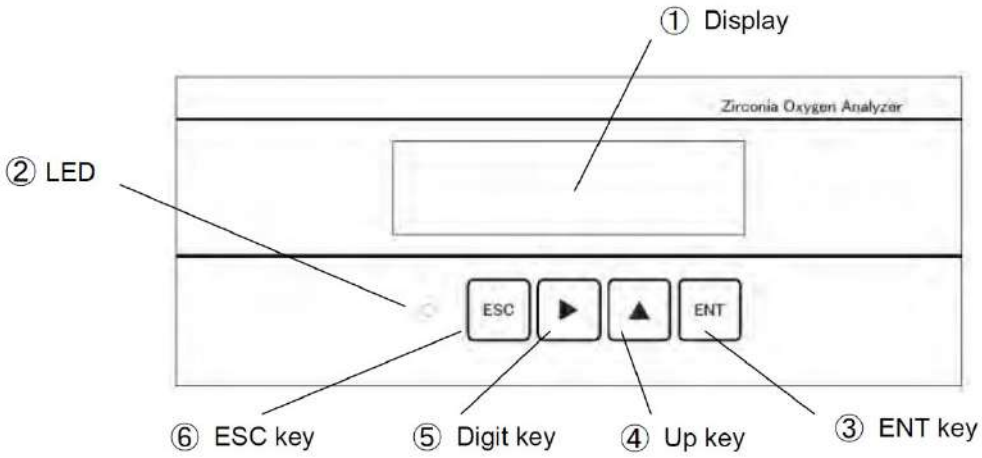
Electronic board is installed in aluminum portholed boxes. A power switch and/or a push button box can be added to the main box in order to manipulate the electronic devices without removing the porthole. The assembly is ex-proof compliant.

The electronic device is enclosed into a flame proof structure which certified to operate under the following conditions:

- For ambient temperature between -20°C and +50°C, the transmitter can operate in an process environment **Zone 1** (category **2**) which could normally or predictably contain **critical gas** (category **IIC**: explosivity hydrogene & acetylene) while operating.
  In this ambient temperature range, the external surface of the transmitter remains below 100°C. The transmitter is thus classified **T5**. For ambient temperature -20°C and +40°C, the external surface of the transmitter remains below 85°C, the transmitter is thus classified **T6**

Make sure that the area of operation is classified in compliance with these conditions of use.

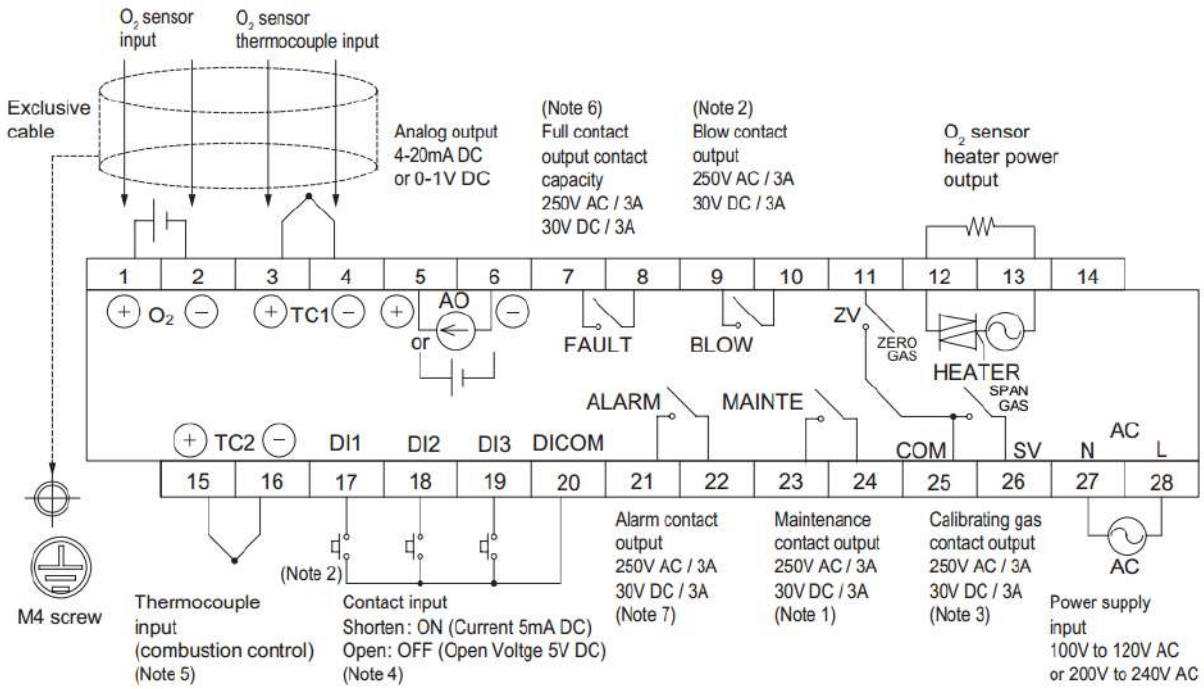
DISPLAY SKETCH



Name	Explanation	Correspondance to ATEX Push Button Box
(1) Display unit	Displays the concentration value and setting values.	
(2) LED	Light Up during power supply.	
(3) ESC key	Used to return to the previous screen or exit the setting.	
(4) Digit key	Used to change the setting values.	
(5) Up key		
(6) ENTER key	Used to determine setting values, start a calibration or validate other operations	

ALLOCATIONS OF TERMINAL BLOCK

External terminal (TM1) / M3 screw



Communication terminal (TM2)

	Terminal number			Remark
	1	2	3	
RS232C	TXD	RXD	GND	Standard
RS485	TRX+	TRX−	GND	Option

(Note 1) 23 — 24 •••• Closed during calibration, blow down, sensor diagnosis, PID auto tuning or sensor recovery of detector.

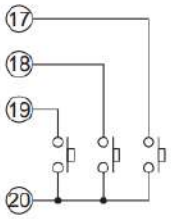
(Note 2) 9 — 10 •••• Closed during blowdown of detector. (option)

(Note 3) 25 — 11 •••• Closed during zero calibration.

25 — 26 •••• Closed during span calibration.

Contact capacity: 250V 3A (resistance load)

(Note 4)



•••• For various contact input (No-voltage contact)

(Note 5) 15 16 •••• R-type thermocouple input

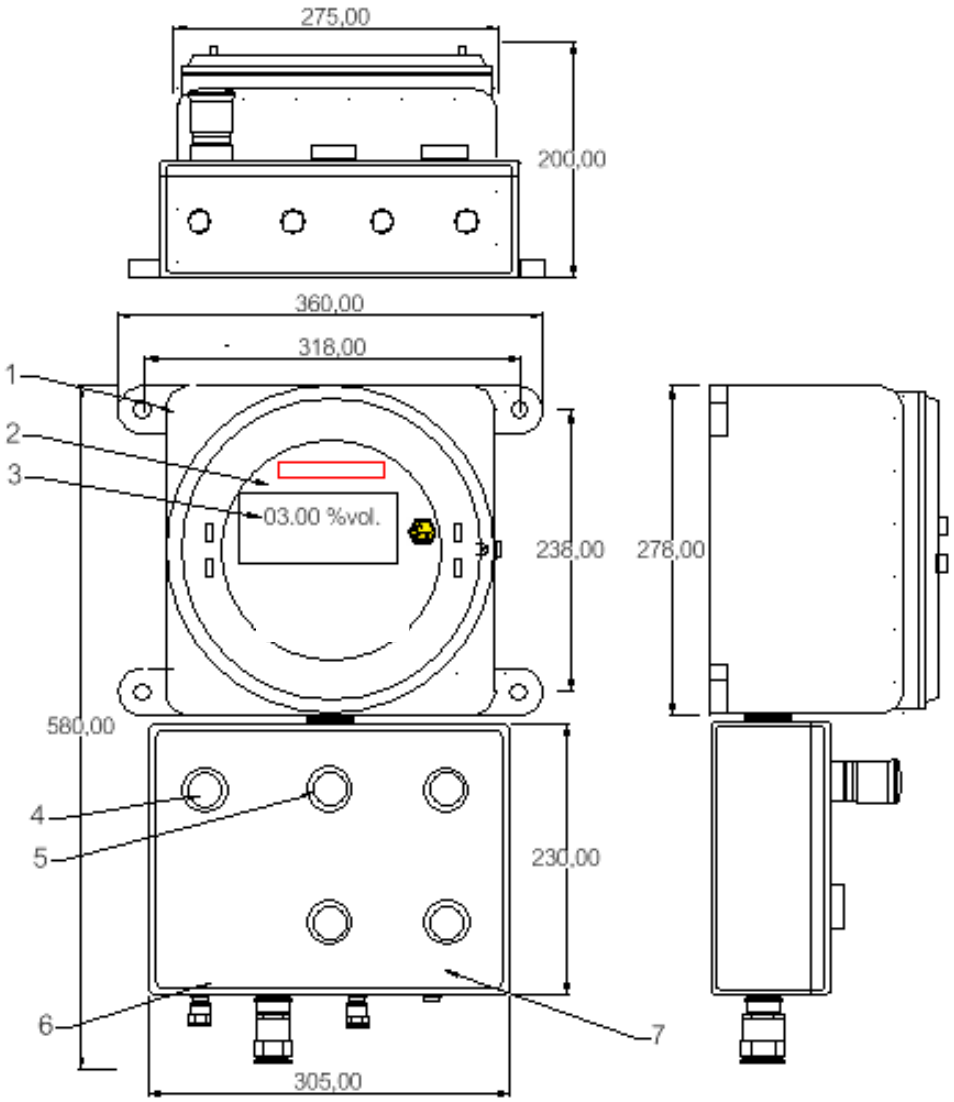
When combustion efficiency display (option) is selected.

(Note 6) 7 — 8 •••• Closed while disconnection of O_2 sensor input or thermocouple input, or heater control temperature error is detected.

(Note 7) 21 — 22 •••• Closed while an oxygen concentration alarm is issued.

DIMENSIONAL SKETCHES

Transmitter Enclosure Dimensional Sketch



Nbr	Designation
1	CAST ALUMINIUM BOX
2	PORTHOLE
3	CONVERTER FRONT
4	POWER SWITCH

Nbr	Designation
5	PUSH BUTTON BOX
6	CABLE GLAND for electrical connection to
7	PLUGS and/or CABLE GLANDS for

SPECIFICATIONS

ENCLOSURE CONFIGURATION	Cast aluminium portholed box + Push Button Box + Power Switch
CERTIFICATION	Ex II 2G Ex d IIC T5 (Ta : -20°C à + 50°C) ; Ex d IIC T6 (Ta :-20°C à +40°C) LCIE 03 ATEX 6126
MEASURED GAS	Oxygen concentration in combustion flue gas
PRINCIPLE	In situ zirconium oxide cell
MEASUREMENT RANGE	2 to 50% O_2 freely adjustable by 0,5%O_2 steps
OUTPUT SIGNAL	4-20mA DC (resistor 500Ω max.) or 0 to 1 Vcc (resistor 100Ω max.) HART Protocol (option)
REPETABILITY	+/-0.5% of full scale
RESOLUTION	
ACCURACY	+/-0.1%vol.O_2
LINEARITY	+/- 2% of full scale
RESPONSE TIME	<7s for 90% of final value
POWER SUPPLY	115V - 230V @ 50/60Hz
POWER CONSUMPTION	15 + 200 VA @ start-up 15 + 50 VA @ operation
WARM-UP TIME	Approx. 15min.
CALIBRATION GAS	**Span : a**tmospheric air. **Zero :** Use between 0.25 to 2 % O_2 Balance N2 **WARNING** : Never use pure Nitrogen
AVAILABLES FUNCTIONS	Automatic Calibration (only if automatic calibration panel available) self-diagnostics function, alarm rich mode (unburned combustible)
ELECTRONIC TREATMENT (Optional)	Tropicalization (Tropicalization certificate supplied)

RECOMMENDATIONS FOR STORAGE

Store the unit in a location that meets the following conditions:

1. Vibration, dust, dirt, and humidity are minimal.
2. A place not subjected to radiated heat from a heating furnace, etc.
3. The atmosphere is non-corrosive.

A place where ambient temperature and humidity are –30 to +70°C and 95% RH or less.

2.2.D CALIBRATION SYSTEM

Gas analysers have to be regularly calibrated to ensure the accuracy of the measurement.

Calibration Principle & Specification

The aim of calibration is to measure the sensor specific response to reference gas samples. These values are then used to adjust the conversion of the probe signal into oxygen concentration. It is a necessary operation to get accurate oxygen measurement.

First, reference gas with known concentrations is sent to the sensor. The gas is sent through stainless steel tubing mounted between the calibration system outlet and the probe calibration gas inlet. When the sample gas reaches the sensor, the conversion equation is adjusted to make the converted value identical to the real sample concentration.

Oxygen analysers have to be calibrated with two calibration gas.

- The SPAN gas for calibrating the high oxygen concentration point. It usually features the ambient air oxygen concentration (20.96%vol.O2). Generally, ambient air itself is used for this calibration point.
- The ZERO gas for calibrating the low oxygen concentration point. Usually, 1%vol.O2 in nitrogen balance is used.

The gas sensors are very sensitive to temperature variations, pressure levels and they can be affected by the impurities that could be transported by industrial instrument air. This is the reason why the quality of calibration gas and the conditions on which they are sent to the probe must be carefully controlled. The flow of calibration gas has to be adjusted in order to prevent the sensor from cooling down, which would distort the calibration process and thus generate wrong converted values. The pressure has also to be carefully controlled not to stress the electrochemical cell and generate the absorption of chemicals into the zirconium layer.

SPECIFICATIONS

NUMBER OF GAS INLETS	1 for Zero (1%O2) + 1 for Span (20.9%O2) calibration gas (usually instrument air)
NUMBER OF GAS OUTLETS	1 for each probe to be calibrated + 1 for each blowdown system (optional)
SPAN GAS SPECIFICATION	Usually 1% O_2 in N_2 balance
ZERO GAS SPECIFICATION	Usually Instrument Air (20,9% O_2)
Calibration gas Flowrate	Approx. 30L/h
CONNECTIONS	4/6mm OD or ¼''OD
INSTRUMENTS	**1 Instrument air filter (dryer, oil separator) reducer with pressure gauge for span calibration gas** **Pressure max.** : 10bar ; **Connections** : 1/4" G
	1 Calibration gas flow meter **Connections** : ¼"NPT internal thread ; **Flow Range** : 0-60 L/h **Cert**.: ATEX Directive 2014/34/EU for instruments in EX-areas
Tubing & Fittings	**Tubing size** : ¼" or 6mm OD SS 316L – 1mm thickness ; **Fittings supplier** : Swagelock or equivalent

3. INSTALLATION

CAUTION ON SAFETY

BEFORE MOUNTING, make sure that the area classification corresponds to the analyser (probe & transmitter) markings :

Type ZPF2	**Type ZTF2**
II 2 G	II 2G
Ex db IIB+H2 T3 (Ta :-20°C to +60°C)	Ex d IIC T6 (Ta : -20°C à + 55°C)
LCIE 13 ATEX 3045X	LCIE 13 ATEX 3066 X
IECEx LCIE 13.0027X	

Besides, make sure that the metallic structure is intact :

- No mechanical distortion
- No additional hole in the structure (see corresponding drawing)
- No damage on threads

Do not make any further transformation (ex : machinery, drillings)

Do not dismantle the device

Except for the probe-end filter, make sure that all threaded parts are properly screwed together (min 5 complete threads).

Make sure that all the assembly screws are present and properly fixed.

Refer to mounting procedure for proper installation

The probe must be protected from any mechanical damage.

ATEX material must be handled mounted and maintained by qualified operators

This unit should be installed in a place which conforms to the conditions noted in the instruction manual.
Otherwise, it may cause electric shocks, fire or malfunction of the unit.

During installation work, care should be taken to keep the unit free from entry of cable chips or other foreign objects.
Otherwise, it may cause fire, trouble or malfunction of the unit.

For installation, observe the rule given in the instruction manual and select a place where the weight of converter can be endured. Installation at an unsuited place may cause turnover or fall and there is a risk of injury.

Be sure to wear gloves when handling the unit.
Bare hands may get an injury.

3.1. INSTALLATION OF PROBE SIDE

3.1.1. LOCATION

CAUTION
Install this product at a place compatible with the following conditions. The use of it at a place not conforming the installation conditions specified in this manual could cause an electric shock, a fire or incorrect operation.

It is recommended to mount the detector by selecting the places shown below:

- Place where there is a space which allows doing daily check and wiring work
- Place where there is little vibration, dust and humidity
- Place where peripheral air environment is non-corrosive.
- Place where there are no electric appliances producing noise trouble (e.g., motor, transformer and appliances bringing about electromagnetic induction trouble and electrostatic induction trouble) nearby the detector
- Place where ambient temperature and humidity are -20 to +60°C and less than 95%RH.

Make sure the classification of the mounting area is compliant to this certification.

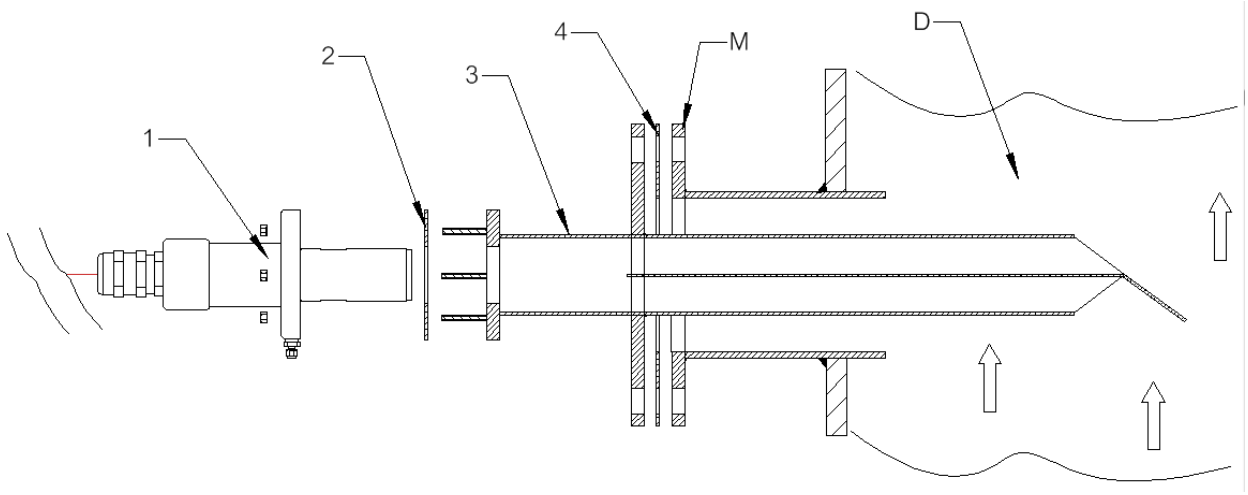
3.1.2. INSTALLATION PROCEDURE

The probe and deflecting tube are delivered separately. Any leakage in the mounted assembly would potentially lead to a mistaking measurement by injecting parasite ambient air into the probe environment. To ensure an appropriate sealing, all the necessary gaskets for tube and probe mounting are furnished with the material.

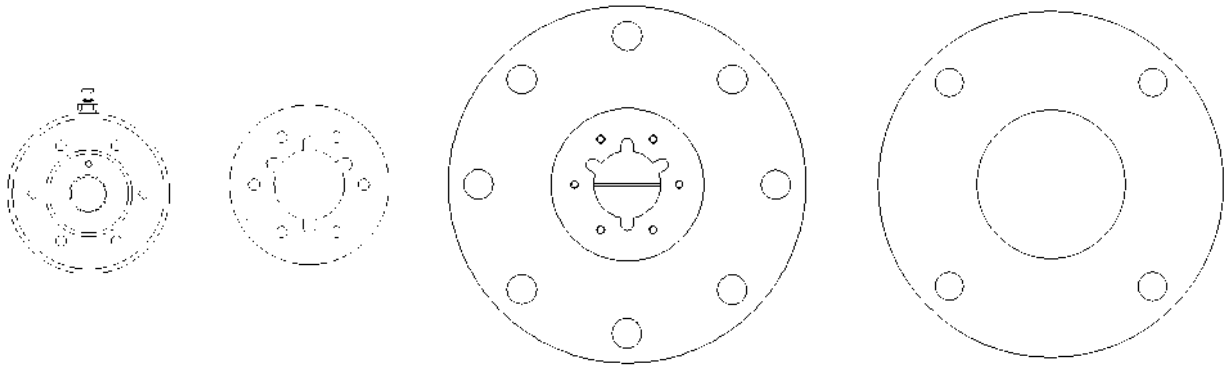
Particular care must be taken to ensure the perfect sealing of the assembly and the correct orientation of the bypass flowguide tube.

To install Fuji Electric Analyser on your furnace duct, proceed to the following operations :

1. Mount the Deflecting tube on the mating flange (ref to section **2.2.B**). Sealing must be ensured with provided mating flange gasket
2. Mount the probe on the deflecting tube (ref to section **2.2.A**). Sealing must be ensured with provided detector gasket. WARNING: If the plant is running, the probe must be heated up before being mounted on deflecting tube.
3. Connect the probe calibration gas connection to calibration panel (refer to section **3**)
4. Wire the probe to the transmitter (refer to section **4**)



1	2	3	4
ZFKX PROBE TYPE ZPF2	DETECTOR GASKET	DEFLECTING SAMPLING TUBE	MATING FLANGE GASKET



M: Furnace mating Flange
D: Furnace Duct

MOUNTING OF BY PASS FLOW GUIDE TUBE

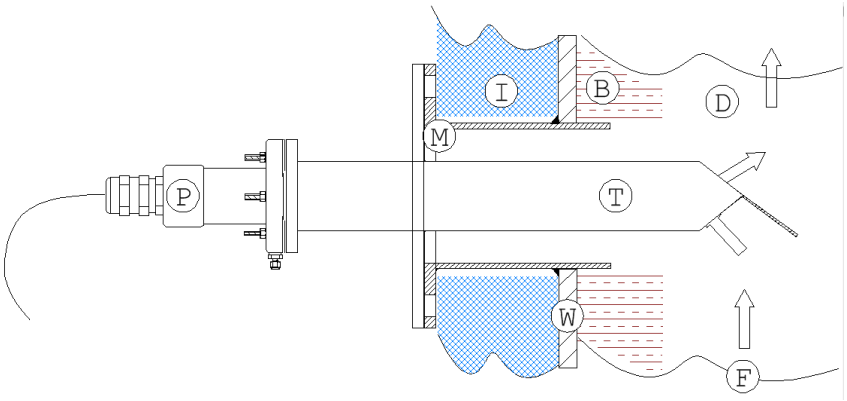
ATTENTION:
Do not forget to put the furnished gasket between mating flange and deflecting tube.

On the following sketches, the letters define the following parts:

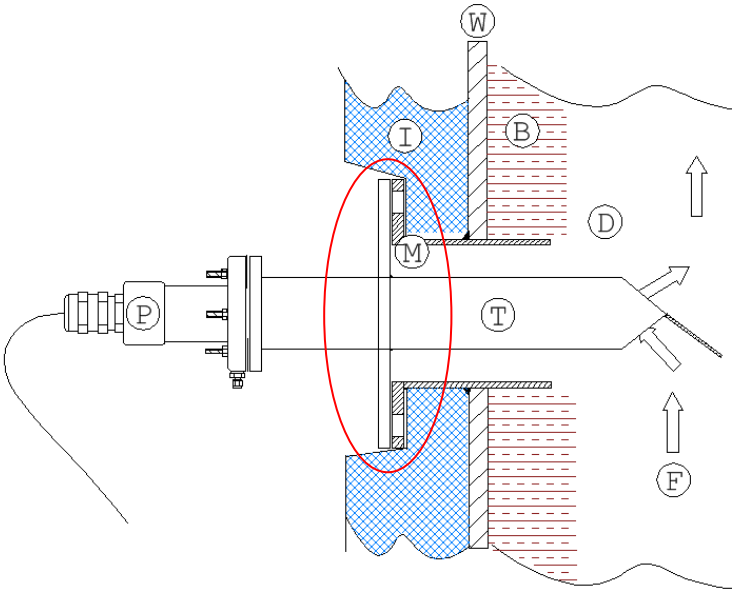
LETTER	CORRESPONDING PART
P	ZFKX probe type ZPF2
T	Deflecting Tube
M	Mating Flange (Not in Fuji Electric scope of supply)
I	Insulation layer
W	Furnace Wall
B	Bricklaying
D	Flue Gas Duct
F	Flue Gas Flow

Recommended mounting of Mating Flange

The mating flange shall be mounted outside the insulation layer of the furnace to prevent excessive heat on mounting flanges. The extension between mating flange and probe mounting flange can be adapted depending on the flue gas temperature.



If the mating flange is mounted inside the insulation layer or even on the furnace wall, the accessibility for maintenance operation may be difficult and the flange gasket may be damaged by excessive heat.



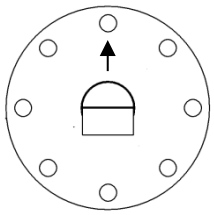
Direction of tongue and position plate of flow guide tube

The flange of flow tube has mounting holes at 8 locations. These holes are available for regulating an inflow into the flow guide and mounting the tube correctly in the flowing direction of gas and it is enough if mounted at 4 locations.

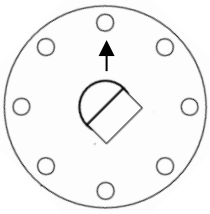
→ : Flue gas direction

① When exhaust gas temperature is under 200°C and gas flowing velocity is low

As illustrated below, set the partition plate inside the flow guide tube at a right angle to the gas flow and mount the tube so that the tongue turns to an upstream direction relative to the gas flow.

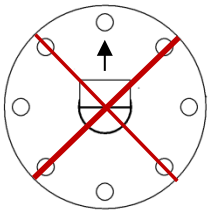


② When exhaust gas temperature is 200°C or higher and gas flowing velocity is fast. As illustrated below, till the partition plate inside the flow guide tube 45° to the gas flow and mount the tube so that the tongue turns to a down-steam direction relative to gas flow.



CAUTION:

If the deflecting tube is mounted so that the plate goes in the direction of the flow, the system will not work, the measurement will not be representative and will have extremely slow variations.



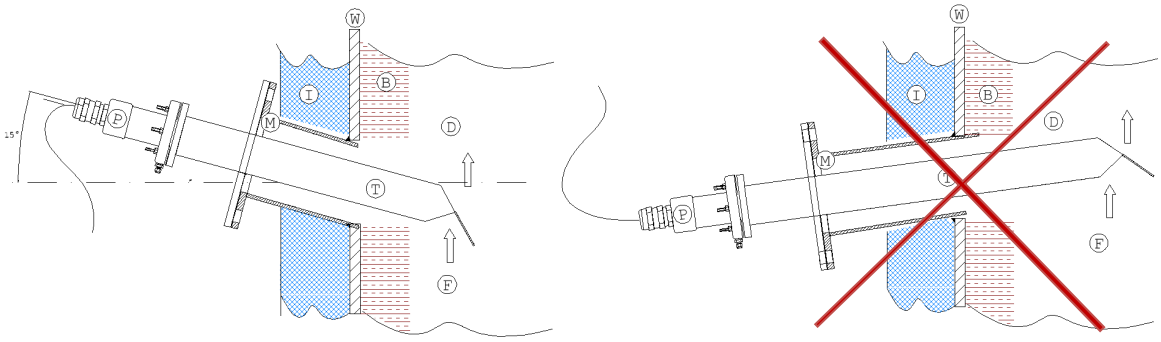
Insertion angle of flow guide tube

According to the temperature of exhaust gas and the amount of dust, the recommended angle of the flow guide tube differs. In any case, the deflecting tube must not be mounted with negative angle. Water condensates may drown and thus damage the sensor irreparably.

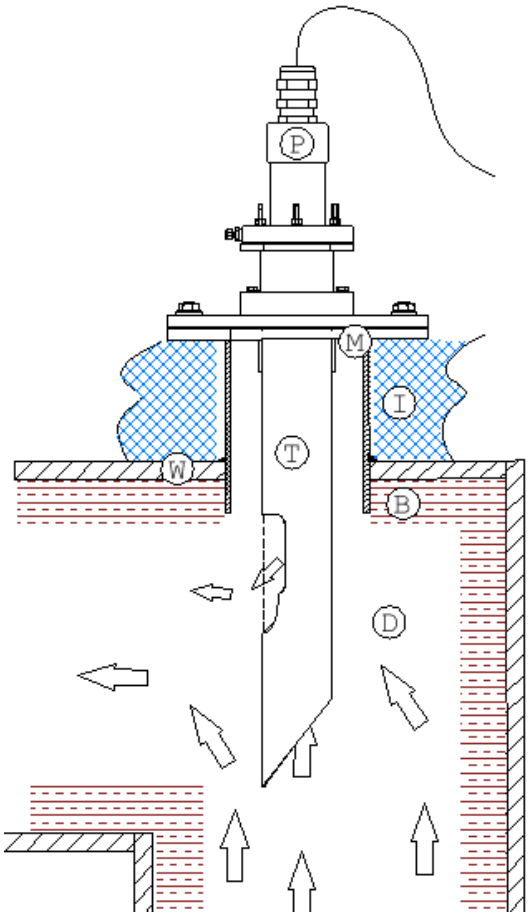
With reference to the following conditions, install a mating flange.

1. When exhaust gas temperature is under 200°C and amount of dust is under 0.2g/Nm.
   The insertion angle shall be within a range of 0 to +45°. For low temperature flue gas, the tube extension can be isolated or even reduced to prevent condensates inside this extension.
2. When exhaust gas temperature is high and amount of dust is low (under 0.2g/Nm^3), the deflecting tube can eventually be mounted with low negative angle if necessary (-10° to +45°). Generally, this negative angle configuration is not recommended because of condensate

3. When amount of dust is over 0.2g/Nm^3, the insertion angle must be positive within a range of +10° to +45°. It is recommended to use an extension for vertical mounting (see page 11) which prevent the probe from solid deposits and condensates.



4. If flue gas has to be sampled in parallel to the flow (Angle superior to +45°), Fuji Electric provides special deflecting tube with flow boosting system that enable high angle sampling. Please refer to Fuji Electric catalog to get an appropriate deflecting tube regarding your application.



MOUNTING OF THE PROBE

Fuji Electric probe is an ATEX certified assembly of a zirconium sensor and metallic ex-proof protections. This assembly includes 3 sintered flame-arrestors. To ensure proper installation, operation and maintenance of the detector, refer to technical instruction for ATEX equipment.

CAUTION

When mounting the detector on a furnace which is under operation, take utmost care about the blowout from the furnace; otherwise, there is a fear of getting a burn.

Since the detector is made of porcelain of zirconia, there is a case where it breaks due to drop or impact. So, be sufficiently careful.

Use a plain washer for the mounting screw and mount on the flange of flow guide tube at 6 locations.

- Keep the temperature of detector flange below 100°C, regardless of exhaust gas temperature
- Do not forget the gasket between probe and flow guide tube to ensure the sealing.

3.2. INSTALLATION OF CONVERTER AND CALIBRATION KIT

3.2.1. LOCATION

Analysers transmitter and calibration systems are designed to be installed remotely from the probe. End-users can thus choose a location which provides good accessibility and protection.

It is recommended to mount the detector by selecting the places shown below:

- Place where space is available for periodic inspection and wiring work
- A place not subjected to radiated heat from a heating furnace, etc.
- Place where the flue gas flow is significant >0.5m.s^{-1}
- Place where there is a space which allows doing daily check and wiring work
- Place where vibration, dust and humidity are minimized
- Place where peripheral air environment-corrosiveness is minimized.
- Place where ambient temperature and humidity are -20 to +50°C and less than 95%RH.
- Place where the material marking corresponds to the area classification
- Away from electrical devices that may cause noise trouble (such as motor and transformer), and equipment that may cause electromagnetic or electrostatic induction trouble.

To ease the wiring and maintenance operations, secure at least 100 mm of space between the converter and nearby wall. Also secure a space of opening the front cover for wiring work and maintenance.

Secure a cable wiring space under the case.

Above all, end-user must ensure that the installation area classification complies with the device markings in terms of ambient temperature and gas classification.

3.2.2. PROCEDURE

Transmitters and calibration systems shall be installed **wall-mounted** or **self-standing** depending on space availability on-site.

If a specific panel is provided on site transmitters and calibration systems can be delivered separately. Customer will then have to mount the devices on the panel and make all wiring and piping work.

If a panel is required, transmitters and calibration panel are delivered together, assembled and eventually wired on the panel. Customer just has to make the last wiring work to make the analyser ready to use.

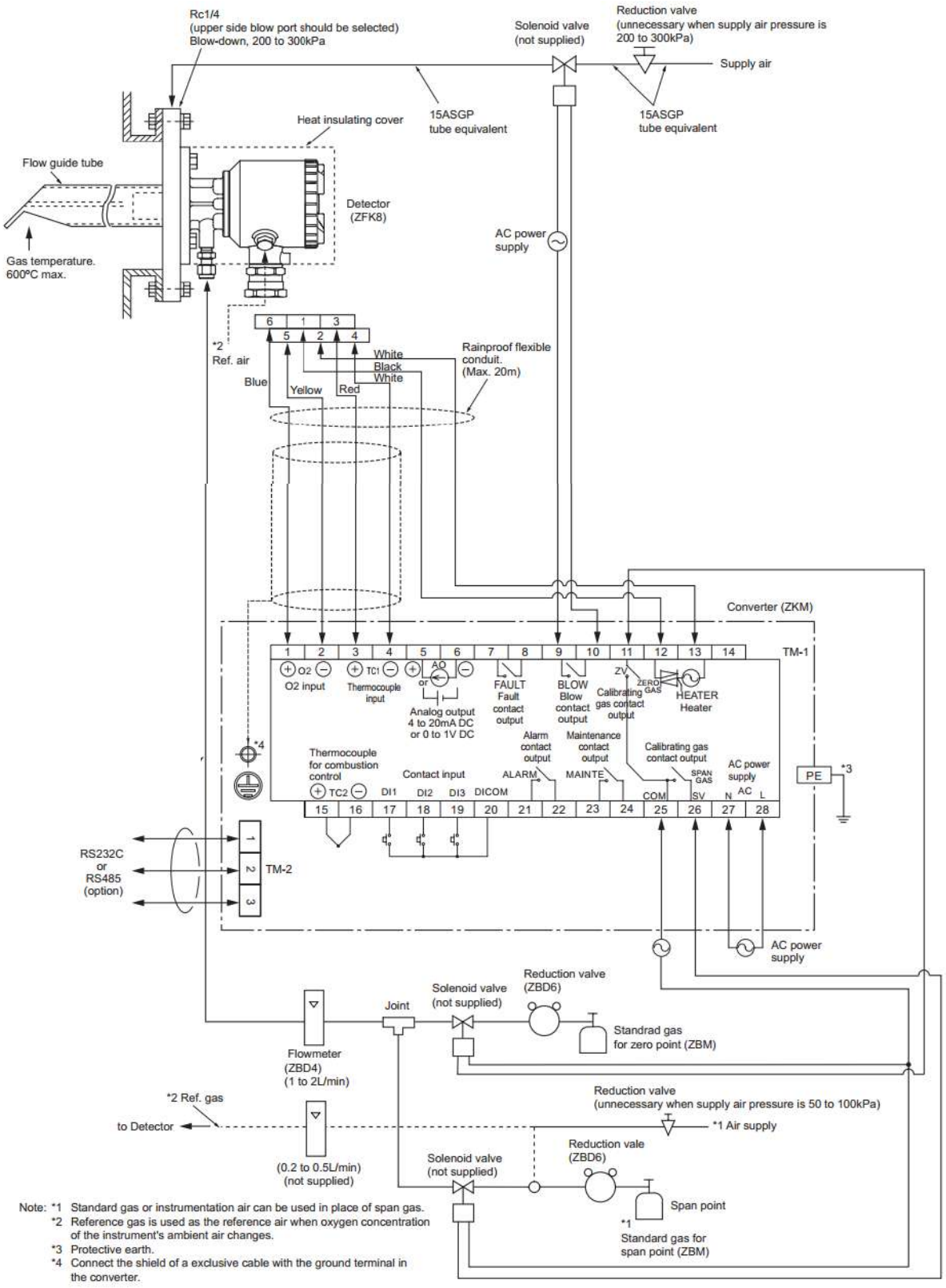
If there are no available space for wall-mounting the analysers, transmitter and calibration systems can be delivered on self-standing racks. Devices are completely assembled and tested. Customer will have to make final piping and wiring job to make the analyser ready to use.

Please refer to **3.1.2** to get some further information on CONTROL DEVICES ASSEMBLY.

4. CONNECTION BETWEEN PROBE SIDE & TRANSMITTER SIDE

4.1. GENERAL CONNECTION DIAGRAM

Probe, Converter and calibration system must be connected according to the wiring diagram. Specific Wiring Diagrams are delivered with the material, please refer to these wiring diagrams.



Note: *1 Standard gas or instrumentation air can be used in place of span gas.
*2 Reference gas is used as the reference air when oxygen concentration of the instrument's ambient air changes.
*3 Protective earth.
*4 Connect the shield of a exclusive cable with the ground terminal in the converter.

4.2. WIRING

CAUTION

: Wiring work must be carried out with all power supplies turned off. Otherwise electric shock may result.

: Be sure to ground Probe and Converter. (Class D grounding)

BEFORER WIRING, power voltage for the converter must conform to that for the detector to be connected

The wiring must be done POWER OFF after transmitter mounting on a proper structure (ex : shelter, skid)

Refer to the Wiring diagram to ensure a proper wiring.

To ensure a perfect sealing, tighten cable glands with the appropriate tool.

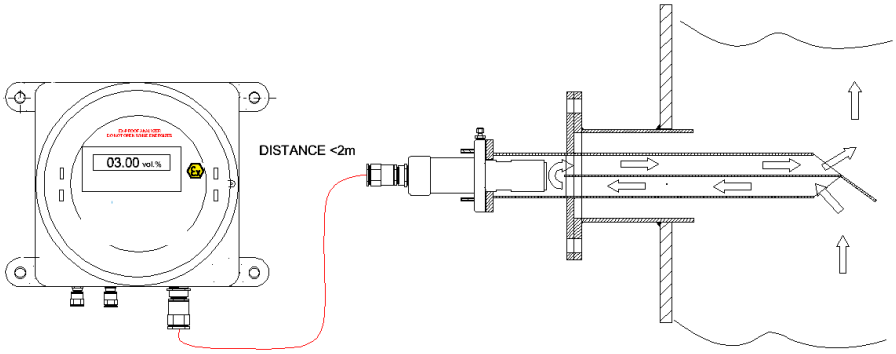
Ensure that the probe in correctly connected to the ground by the specific screw.

For the probe, ensure that the aluminum junction cap is properly screwed back and fixed by a brake screw.

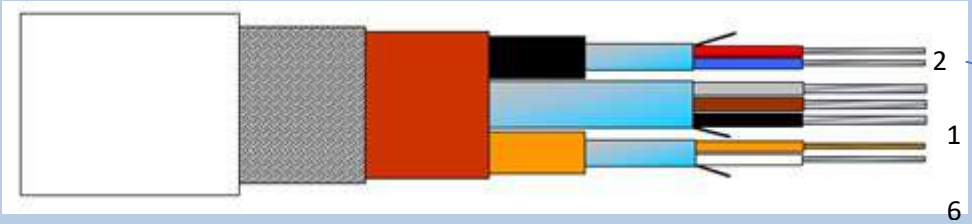
For the transmitter, ensure that the windowed porthole is properly screwed back and fixed by a brake screw.

The Cable Gland mounting is a critical operation to ensure the product will be Ex-proof. It must be performed by qualified persons only.

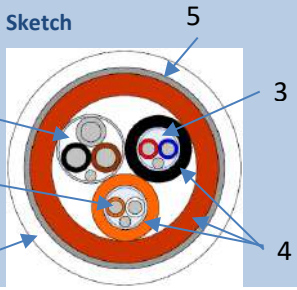
The ZFKX PROBE TYPE ZPF2 includes 2m of armored cable for high temperature (white colour).
Consequently, it can be wired directly to the corresponding converter if it is installed less than 2m away from the probe.



Probe cable specifications (white colour)

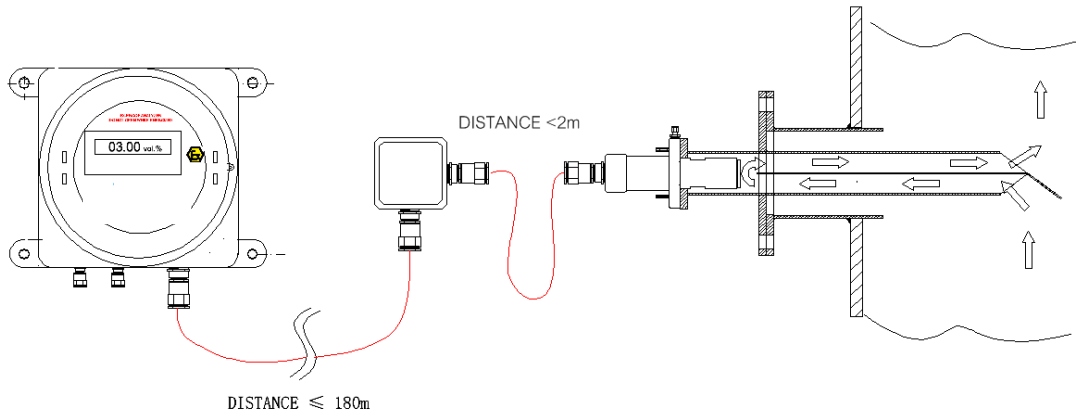


Sketch

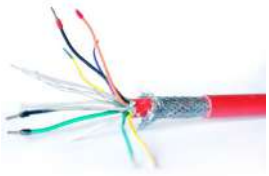
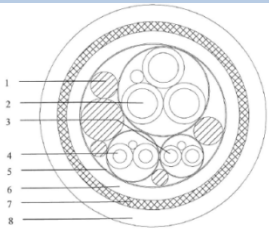


1	**2 conducting cables 0.5mm² - *Thermocouple S*** *Orange (+) & white (-)* *Cu/Ni core ; FEP isolation* *Assembled under aluminium/polyester tape with a continuity cable*	**4**	**Intermediate sheath high temperature**
2	**3 conducting cables 1.5mm² - Alimentation du réchauffeur de la sonde** *Tinned copper core; FEP Isolation* *Assembled under aluminium/polyester tape with a continuity cable* -Brown : Ground connection -Grey & Black : Probe heater power supply	**5**	**Armoured protection : Tinned copper**
3	**2 conducting cables 0.5mm² – Probe signal** *Blue & Red : Probe signal* *Tinned copper core ; FEP Isolation* *Assembled under aluminium/polyester tape with a continuity cable*	**6**	**External FEP sheath**

If the converter is installed remotely, the probe has to be wired to an intermediary junction box.



Use Fuji Electric ex-proof compliant cable (red colour) to connect the oxygen transmitter to the junction box. This cable is designed for Fuji Electric analysers:

Picture of bare ATEX cable	Sketch
	

1	**Filling Stems**	**5**	**Protective Tape**
2	**3 conducting cables 2.5mm²:** **-Green : Ground connection** **-Black & White : Probe heater power supply** *Soft copper core ; Polyester isolation* *Assembled under aluminium/polyester tape with a continuity cable*	**6**	**P.V.C intermediate sheath**
3	**2 conducting cables 0.5mm² - *Yellow & Green : Thermocouple R*** *Soft Cu/Ni core ; P.V.C isolation* *Assembled under aluminium/polyester tape with a continuity cable*	**7**	**Armoured protection : galvanized-steel plait**
4	**2 conducting cables 0.5mm² - *Orange & Black : Probe signal*** *Soft tinned Cu core ; P.V.C isolation* *Assembled under aluminium/polyester tape with a continuity cable*	**8**	**External P.V.C sheath**

CAUTIONS:

In the case of the wiring work, be careful not to drop foreign matters including wire chips inside the junction box. Otherwise, this might cause a fire, failure or incorrect operation.

Connect a power source compatible with the rating. Connection of a power source not conforming to the rating may cause a fire.

Before proceeding with the wiring work, be sure to turn off the main power supply.

Under no circumstances the work must be done at a place where water splashes the product directly.

The wiring work in ex-proof classified area must be performed by qualified persons only.

Any damage or break of the ATEX cable would consequently distort the thermocouple and damage the sensor

4.2.1. TRANSMITTER SIDE WIRING

On transmitter side, power supply wiring and special cable wiring must be performed.

Use armored cable compliant to ATEX application for power supply wiring
All wiring operations must be done POWER OFF
To connect the power supply cable, remove the 4 screws of the power switch box and unscrew the ex-proof cable gland. Make sure these screws and cable gland are carefully mounted again after the wiring job. Connect the ground wire

To connect the special cable, unscrew the enclosure porthole and main cable gland. Make sure these porthole and cable gland are carefully mounted again after wiring job.

Cables must be fixed to the installation in order to prevent any mechanical damage or excessive draw that could damage the probe cable gland.
It is necessary to provide adequate protection of the exclusive cable, which connects the detector to converter, using wire protection tube, etc. Separate these cables from the power cable (noise prevention).

It is recommended to 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. Also, wherever possible use a shielded cable and earth one point of the shield.

4.2.2. PROBE WIRING

Please refer to corresponding wiring diagram to wire the probe to the intermediary junction box and converter

MOUNTING ATEX CABLE GLAND

CAUTION:

The Cable Gland mounting is a critical operation to ensures the ex-proof feature of the product. It must be performed by qualified persons only.

4.3. PIPING

CAUTION:

Any leak in gas connections may cause measurement faults and inefficient calibration procedures.

Piping refers to the connection between the gas distribution system (transmitter side) to the probe and deflecting tube accessories (probe side).

It is recommended to use Ø4-Ø6mm 316L stainless steel tubing.

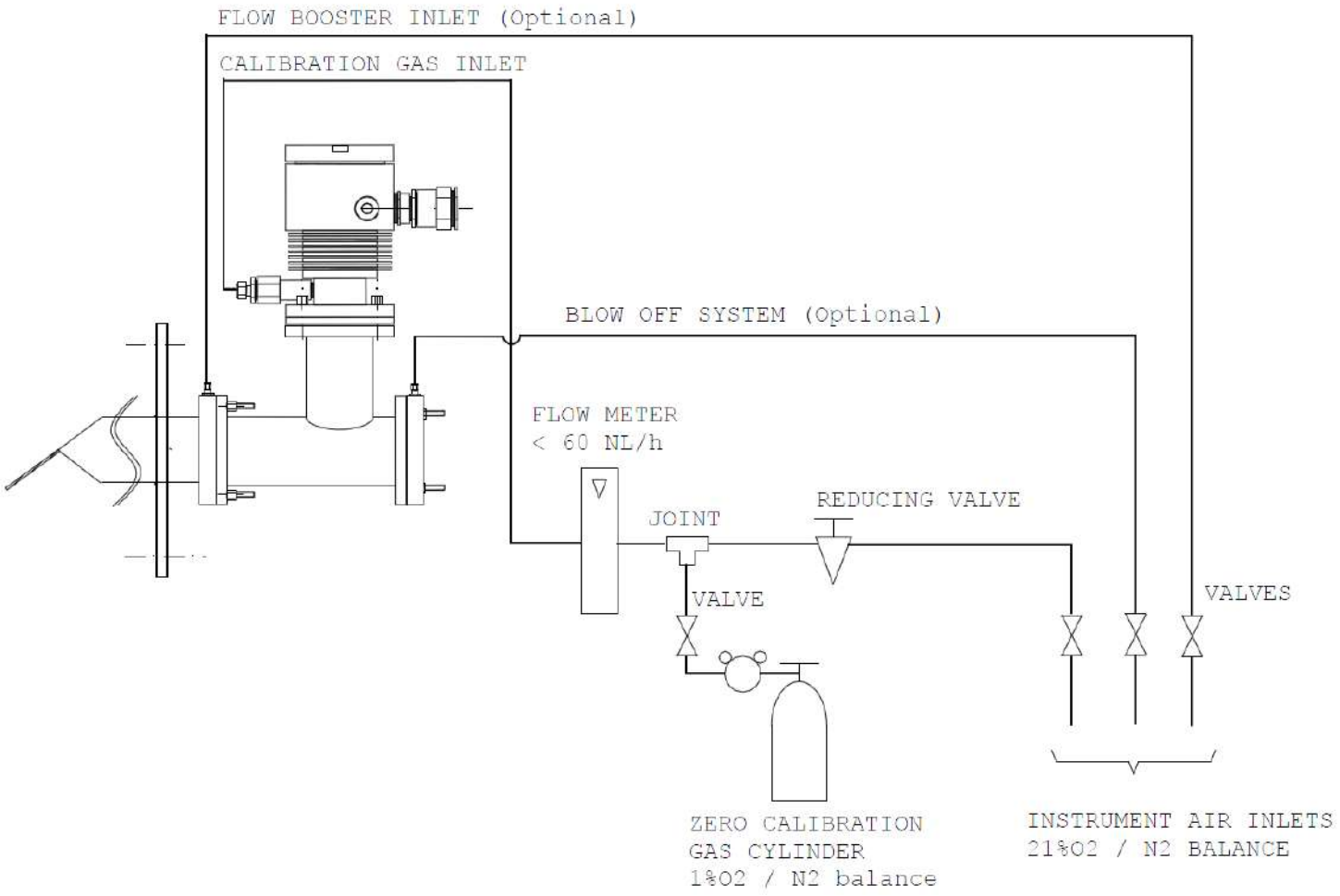
The length is determined regarding the distance between probe and transmitter and the way the tube will reach the probe.

The installation and connection of the pipe is performed by end-user.

Any leak in gas connections may cause measurement faults and inefficient calibration procedures.

Refer to the general connection diagram to pipe the system properly.

Use Ø4-Ø6mm stainless steel tubing and refer to below diagram for proper pneumatic connection of analyser system.



5. COMMISSIONING & SHUTDOWN

5.1. COMISSIONING

Preparation can be performed after installation or on the bench. The commissioning steps are shown below:

Wiring check

⇩

Confirmation of the power supply specifications (Please check the main power supply and the power supply voltage specification of the detector.)

⇩

Power ON.
Open the front flap. Turn “ON (–)” the main power switch.

OXYGEN ANALYSER VER ∗.∗∗ YY/MM

The message shown left appears on the LCD screen.

WARM-UP HEATER 234 °C

After about 6 seconds, the display is automatically switched to the warming-up screen.

⇩

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

⇩

Parameter setting and key operation procedures
Key operation procedures are described in part 8

⇩

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

⇩

Auto calibration (option)
Automatic calibration may be performed at specified time intervals.
Refer to part 6.1 for automatic calibration settings.

⇩

Blowdown (option)
A flow guide tube blowdown feature prevents the flow guide tube from clogging due to dust in the gas stream.
Refer to part 6.2 for operation procedures.

⇩

OPERATION

By turning the power on after completed piping and wiring, the transmitter turns on and the probe warm-up starts. The sensor usually takes approximately 30 minutes to reach the operation temperature which is 800°C for O2 probes.

These high temperatures allow the oxygen transfer through the zirconium bridge but also protect the probe by accelerating the oxidation of chemicals around the ceramic surface. In other words, organic compounds are burnt by the high temperature before reaching the zirconia surface. At low temperature, these organic chemicals get absorbed in the microscopic pores of the zirconium ceramic, which damages the sensor almost irreversibly. Moisture is accelerating this phenomenon below the dew point.

As a consequence, it is important the make sure that zirconium sensors are not exposed to organic components when they are cold or warming-up. They can then be mounted in two ways: either they are wired and heated up before being mounted on the deflecting tube while the combustion process is operating, or they can be installed and warmed up before the process start-up.

As the probes are ATEX certified, they cannot produce any source of ignition during that would lead to the explosion of the furnace inside atmosphere. There is no explosion risk in maintaining the probes on, even when the burners are off.

Once the analysers are installed and heated up, a calibration shall be performed to make the analyser give an accurate measured value.

5.2. SHUTDOWN

By turning the analyser power off, the transmitter shuts and the probe progressively cools down.

As explained in the previous paragraphs, the analyser shall not be shut off while exposed to flue gas samples or dewed conditions.

In case of short-term shutdown (about 1 week) of furnace, it is recommended to keep the power supply of the detector (converter) turned “ON” to prevent the probe pollution by residual organic components coming from the inside of the furnace. If the probes are cooled down, 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.

In case of long-term shutdown of furnace, turn off the power of the detector (converter) after the peripheral air of the detector inside the furnace (especially, temperature and humidity) has become an air environment. Or, turn off the power after taking the detector out of the furnace and leaving it as is 15 minutes or more.

When flow booster or blow off system is in use, stop the air supply.

Repeated start-ups and shutdowns of the combustion unit may expose the sensors to unusual amounts of unburnt compounds. In this case it is recommended to clean the sensors by injecting ambient air on the sensor at low flow rate for a couple of minutes. The filter will have to be changed more frequently.

If the power is turned on in a dewed condition, it leads to the failure of detector. Stop the operation following the procedures described below.

In case of short-term shutdown (about 1 week) of furnace

• Keep the power supply of the detector (converter) turned “ON”. This can prevent the detector from getting dewed.

Also, note that if “ON-OFF” is repeated in a condition where the detector has dewed (according to the furnace and ambient conditions), the detector might fail.

• When flow booster or blow off system is in use, stop the air supply to the ejector.

In case of long-term shutdown of furnace

• Turn off the power of the detector (converter) after the peripheral air of the detector inside the furnace (especially, temperature and humidity) has become an air environment. Or, turn off the power after taking the detector out of the furnace and leaving it as is 15 minutes or more.

• When flow booster or blow off system is in use, stop the air supply.

6. CALIBRATION & BLOWDOWN

6.1. CALIBRATION

In order to maintain good accuracy, proper calibration using calibration gas is necessary. The following 4 methods of calibration are possible. The converter language
Manual calibration: calibration fully manual.
Auto calibration: calibration operated by solenoid valves at defined frequency
Remote calibration: to operate a calibration from control desk.
All calibration: calibration operated by solenoid valves but launched by the operator.

6.1.1. PREPARATION

1. Perform wiring and piping 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 30NL/h.
2. Set the oxygen concentration in standard gas cylinder to be used.
3. Set the range for calibration

6.1.2. MANUAL CALIBRATION

Description

- Span/zero is calibrated once by key operation.
- Calibration must be made in the order of span then zero.
- Perform calibration after a calibration gas is supplied to the detector and the output signal of the detector becomes stable.
- If your calibration system is not automatic, the operator shall perform open and close operations, or adjust the flow rate of calibration gas.
- During calibration, if the analog output hold function (maintenance hold) is enabled, the analog output signal is held at the set value. Even after the calibration, the hold is maintained during the set time as a measurement recovery time.

Procedure	Operation (example)	Executes span calibration and zero calibration.	
	Key operation	Description	Displayed message (LCD)
(1)	ENTER	Display the screen on the right in accordance with the key operation summary and press the ENTER key, the manual span calibration screen appears.	CALIBRATION MENU MANUAL SPAN CAL.
(2)	ENTER	Press the ENTER key to perform manual span calibration. If supplying calibration gas manually (without the auto-calibration function) The operator shall open the span gas valve manually and adjust the flow rate to 30NL/h. If your detector has the auto-calibration function, you can activate the external solenoid valve using the contact output signal at the terminal block.	MANUAL SPAN CAL. START
(3)		Oxygen concentration value and cell electromotive force are displayed. Wait until the oxygen concentration is stabilized.	MANUAL SPAN CAL. 20.61 % 000.1 mV
(4)	ENTER	Press the ENTER key to determine the span calibration factor. During the process, the oxygen concentration value and cell electromotive force are highlighted.	MANUAL SPAN CAL. 20.61 % 000.1 mV
(5)		After the calibration is completed, the display returns to the screen on the right.	MANUAL SPAN CAL. START
(6)		If the operator opened the span gas valve manually, close the valve.	
(7)	ENTER	Display the screen on the right in accordance with the key operation summary and press the ENTER key, the manual zero calibration screen appears.	CALIBRATION MENU MANUAL ZERO CAL.

(8)	ENTER	Press the ENTER key to perform manual zero calibration. If supplying calibration gas manually (without the auto-calibration function) The operator shall open the span gas valve manually and adjust the flow rate to 30NL/h. If your detector has the auto-calibration function, you can activate the external solenoid valve using the contact output signal at the terminal block.	MANUAL ZERO CAL. START
(9)		Oxygen concentration value and cell electromotive force are displayed. Wait until the oxygen concentration is stabilized.	MANUAL ZERO CAL. 2.01 % 053.9 mV
(10)	ENTER	Press the ENTER key to determine the zero calibration factor. During the process, the oxygen concentration value and cell electromotive force are highlighted.	MANUAL ZERO CAL. 2.01 % 053.9 mV
(11)		After the calibration is completed, the display returns to the screen on the right.	CALIBRATION MENU MANUAL ZERO CAL.
(12)		The operator shall close the zero gas valve manually.	

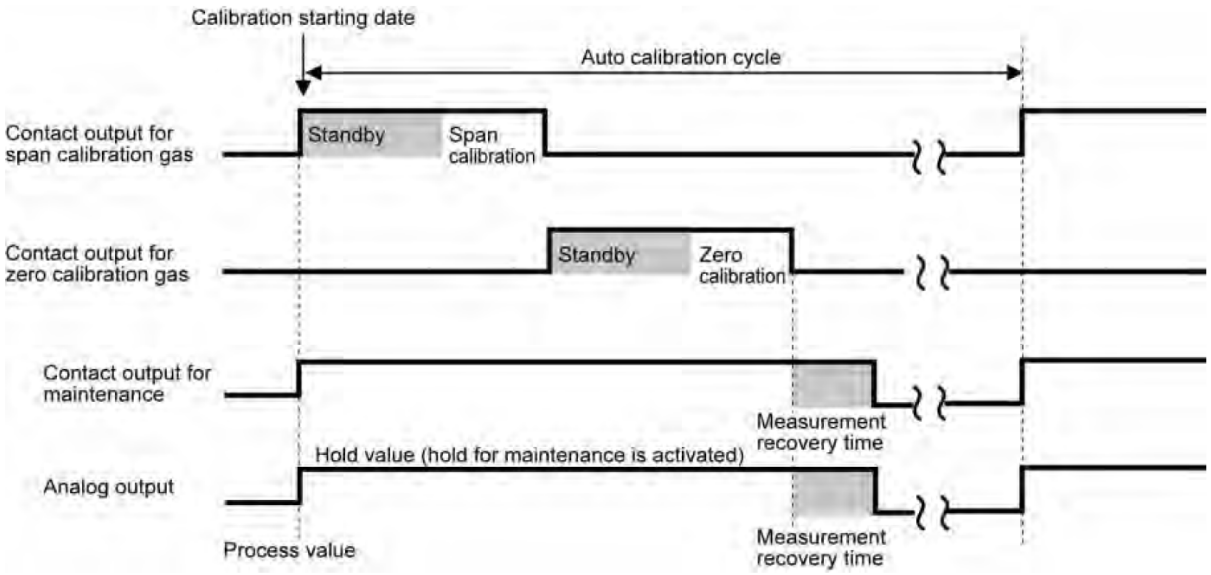
How to interrupt

- Press the ESC key to interrupt the operation.
- After the interruption, be sure to close the valves of span gas and zero gas.

6.1.3. AUTOMATIC CALIBRATION (OPTION)

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.
- The word “CAL” is displayed on the left of the measurement screen during automatic calibration.
- For automatic calibration, it is necessary to set the START DATE (**9.2.2**) of first calibration, the AUTO CAL CYCLE (**9.2.3**), the CAL. GAS (**9.2.7**), CAL WAIT TIME (**9.2.8**) and AO HOLD (MAINTE) (**9.5.9**)
- Refer to part **4.1** for the wiring of solenoid valves.



Procedure	Operation (example)	Setting the automatic calibration so that it is performed every four days from 13:00, 08/02/25	
	Key operation	Description	Displayed message (LCD)
(1)	ENTER	Display the screen on the right in accordance with the key operation summary and press the ENTER key.	CALIBRATION MENU SET AUTO CAL
(2)	ENTER	Press the ENTER key. The auto calibration valid/invalid setting screen appears.	SET AUTO CAL AUTO CALIBRATION
(3)	▶ ENTER	Use the ▶ key to select the auto calibration valid (YES). Press the ENTER key to set the value.	AUTO CALIBRATION YES NO
(4)	ENTER	Press the ENTER key to set the value.	AUTO CALIBRATION YES

(5)		The screen on the right appears.	SET AUTO CAL AUTO CALIBRATION
(6)	▲ ENTER	Press the ▲ key to display the screen on the right and press the ENTER key. The date and time for starting automatic calibration screen appears.	SET AUTO CAL START DATE
(7)	▲ ▶	Use the ▲ and ▶ key to set the auto calibration starting date and time screen. (Set the date and time of the future.)	START DATE 08/02/25 13:00
	ENTER	Press the ENTER key to set the value.	
(8)	ENTER	Press the ENTER key.	START DATE 08/02/25 13:00
(9)		The screen on the right appears.	SET AUTO CAL START DATE
(10)	▲ ENTER	Press the ▲ key to display the screen on the right and press the ENTER key. The cycle time setting of automatic calibration screen appears.	SET AUTO CAL AUTO CAL. CYCLE
(11)	▲ ▶	Use the ▲ and ▶ key to set the auto calibration cycle time.	AUTO CAL. CYCLE 04d 00h
	ENTER	Press the ENTER key to set the value.	
(12)	ENTER	Press the ENTER key.	AUTO CAL. CYCLE 04d 00h
(13)		The display returns to the screen on the right.	SET AUTO CAL AUTO CAL. CYCLE

How to interrupt

- Press the ESC key to interrupt the operation.

Caution

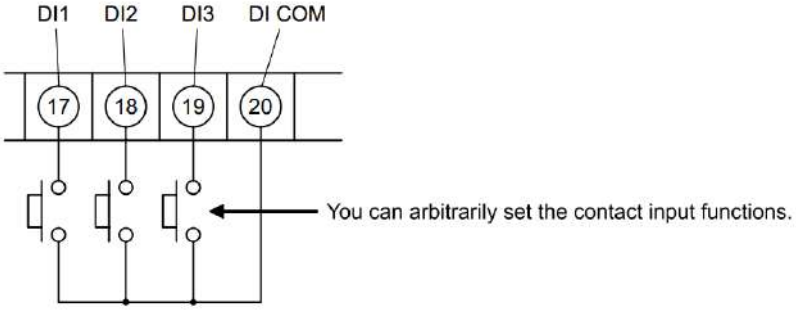
Automatic calibration is not performed under the following conditions.

- Warming-up is being performed.
- Contact of “Prohibition of calibration” is being input.
- Contact of “Heater off” is being input.

6.1.4. REMOTE CALIBRATION (OPTION)

You can perform all calibration by the contact input of the external terminal block.
To perform remote calibration, install piping and wiring for the standard gas cylinder and the solenoid valve according to part **4.1.**

1. Set one of the contact inputs DI 1 to 3 to “Remote calibration” in accordance with the following operation procedure.
2. Close the contact set to the “Remote contact” for one second or more (depending on the settings of (17) to (19) and (20) of the terminal block).
3. Remote calibration is started. The word “RCL” is displayed on the left of the display panel, which disappears when the calibration is completed.



You can arbitrarily set the contact inputs (17), (18), (19) and (20) of the external terminal block.
Piping and wiring for the standard gas cylinder and the solenoid valve shall be installed.

Description

- You can perform all calibration by the contact input using this function.
- 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.
- Refer to part 4.1 for the wiring of solenoid valves.

Procedure	Operation (example)	Executes remote calibration.	
	Key operation	Description	Liquid crystal display (LCD)
(1)	ENTER	Display the screen on the right in accordance with the key operation summary and press the ENTER key. The contact input setting screen appears.	PARAMETER MENU DIGITAL INPUT
(2)	▲ ENTER	Press the ▲ key several times and select one of DI 1 to DI 3. Press the ENTER key.	DIGITAL INPUT DI *
(3)	ENTER	Press the ENTER key. Contact is set.	DI 1 NONE
(4)	▲ ENTER	Press the ▲ key several times and select “REMOTE CAL.”. Press the ENTER key to set the value.	DI 1 REMOTE CAL.
(5)	ENTER	Press the ENTER key.	DI 1 REMOTE CAL.

(6) (7)	ESC	The screen on the right appears. Press the ESC key several times and return to the measurement screen. Close the contact set to the “REMOTE CAL.” Remote calibration is performed.	DIGITAL INPUT DI 1 12.34 Vol%

How to interrupt

- Press the ESC key to interrupt the operation.

Caution

Automatic calibration is not performed under the following conditions.

- Warming-up is being performed.
- Contact of “Remote blow” is being input.
- Contact of “Prohibition of calibration” is being input.
- Contact of “Heater off” is being input.

6.1.5. ALL CALIBRATION (OPTION)

Description

- Perform sensor maintenance [sensor check (setting), sensor recovery (setting)], span and zero calibration once for each sequentially by key operation.
- Actuate the solenoid valve attached to the exterior by the contact signal from the terminal block and supply standard gases sequentially. Span and zero gas calibration are automatically performed.
- If the output signal hold is set, the output signal is held to the set value during calibration. After the calibration, the hold is maintained until the time set in the measurement waiting time elapses.
- To perform sensor maintenance (sensor check, sensor recovery), the corresponding options are required.
- Note that the sensor recovery is performed if it is determined to be required at the sensor check.
- Refer to part **4.1** for the wiring of solenoid valves.

Procedure	Operation (example)	Executes all calibration.	
	Key operation	Description	Displayed message (LCD)
(1)	ENTER	Display the screen on the right in accordance with the key operation summary and press the ENTER key, the all calibration performing screen appears.	CALIBRATION MENU ALL CALIBRATION
(2)	ENTER	Press the ENTER key to perform all calibration.	ALL CALIBRATION START
(3)		The value of the concentration of oxygen and the cell electromotive force are displayed while executing the all calibration.	ALL CALIBRATION 20.61 % 000.1 mV
(4)		After the all calibration is completed, the display returns to the screen on the right.	CALIBRATION MENU ALL CALIBRATION

How to interrupt

- Press the ESC key to interrupt the operation.

6.2. BLOWDOWN (OPTION)

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. Use the blowdown function by one of the following three methods.

1. Manual Blowdown
2. Automatic Blowdown
3. Remote Blowdown

6.2.1. PREPARATION FOR BLOWDOWN

Perform wiring and piping correctly referring to Item **4.1**.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.
Set blowdown time.

6.2.2. MANUAL BLOWDOWN

Description

- You can perform blowdown operation once by key operation using this function.

Procedure	Operation (example)	Performing manual blowdown	
	Key operation	Description	Displayed message (LCD)
(1)	ENTER	Display the screen on the right in accordance with the key operation summary and press the ENTER key, the manual blowdown performing screen enters.	BLOW DOWN MENU MANUAL BLOW DOWN
(2)	ENTER	Press the ENTER key to perform manual blowdown.	MANUAL BLOW DOWN ENTRY
(3)		While executing the screen on the right appears.	MANUAL BLOW DOWN 11.11 vol%
(4)		After the calibration is completed, the display returns to the screen on the right.	BLOW DOWN MENU MANUAL BLOW DOWN

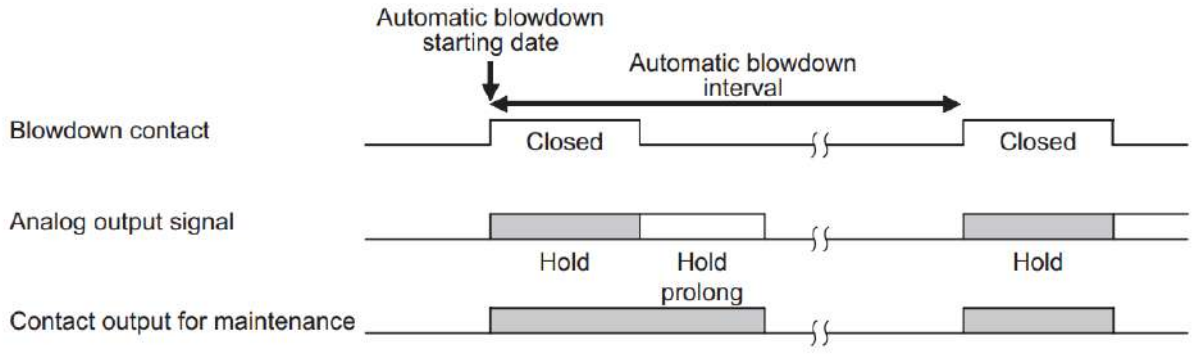
How to interrupt

- Press the ESC key to interrupt the operation.

6.2.3. AUTOMATIC BLOWDOWN (OPTION)

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.
- The word “BLW” is displayed on the left of the measurement screen during automatic blowdown.
- If 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.
- To perform automatic blowdown, the corresponding options are required.



Procedure	Operation (example)	Setting the blowdown so that it is performed for 30 seconds every 24 hours from 13:00, 08/02/25	
	Key operation	Description	Displayed message (LCD)
(1)	ENTER	Display the screen on the right in accordance with the key operation summary and press the ENTER key.	BLOW DOWN MENU SET AUTO BLOW
(2)	ENTER	Press the ENTER key. The auto blowdown valid/invalid setting screen appears.	SET AUTO BLOW AUTO BLOW
(3)	▶ ENTER	Use the ▶ key to select the auto blowdown valid (YES). Press the ENTER key to set the value.	BLOW DOWN YES NO
(4)	ENTER	Press the ENTER key.	BLOW DOWN YES
(5)		The screen on the right appears.	SET AUTO BLOW AUTO BLOW
(6)	▲ ENTER	Press the ▲ key to display the screen on the right and press the ENTER key. The date and time setting of automatic blowdown screen appears.	SET AUTO BLOW START DATE

(7)	▲ ▶	Use the ▲ and ▶ key to set the auto blowdown starting date and time. (Set the date and time of the future.)	START DATE 08/02/25 13:00
	ENTER	Press the ENTER key to set the value.	
(8)	ENTER	Press the ENTER key.	START DATE 08/02/25 13:00
(9)		The screen on the right appears.	SET AUTO BLOW START DATE
(10)	▲ ENTER	Press the ▲ key to display the screen on the right and press the ENTER key. The auto setting blowdown interval screen appears.	SET AUTO BLOW AUTO BLOW CYCLE
(11)	▲ ▶ ENTER	Use the ▲ and ▶ key to set the auto blowdown interval. Press the ENTER key to set the value.	AUTO BLOW CYCLE 24h 00m
(12)	ENTER	Press the ENTER key.	AUTO BLOW CYCLE 24h 00m
(13)		The screen on the right appears.	SET AUTO BLOW AUTO BLOW CYCLE
(14)	▲ ENTER	Press the ▲ key to display the screen on the right and press the ENTER key. The setting blowdown time screen appears.	SET AUTO BLOW BLOW DOWN TIME
(15)	▲ ▶	Use the ▲ and ▶ key to set the blowdown time. (Common with the manual blowdown.)	BLOW DOWN TIME 030 S
	ENTER	Press the ENTER key to set the value.	
(16)	ENTER	Press the ENTER key.	BLOW DOWN TIME 030 S
(17)		The display returns to the screen on the right.	SET AUTO BLOW BLOW DOWN TIME

How to interrupt

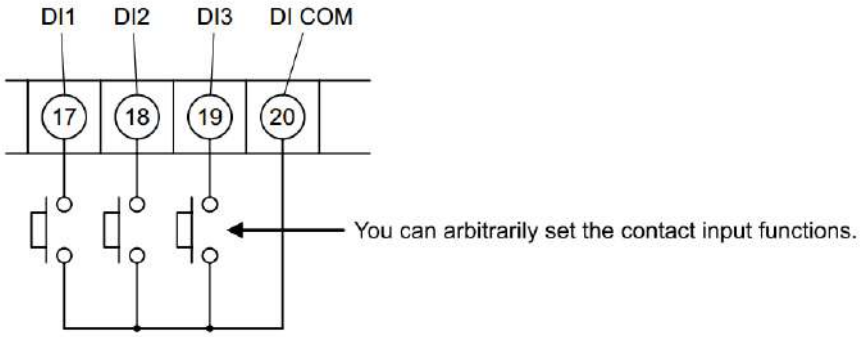
- Press the ESC key to interrupt the operation.

6.2.4. REMOTE BLOWDOWN (OPTION)

You can perform blowdown by the contact input of the external terminal block.

To perform remote blowdown, install piping and wiring for the supply air and the solenoid valve according to part 4.1

1. Set one of the contact inputs DI 1 to 3 to “Blowdown ON” in accordance with the following operation procedure.
2. Close the contact set to the “Blowdown ON” for one second or more (depending on the settings of (17) to (19) and (20) of the terminal block).
3. Blowdown is started. The word “RBL” is displayed on the left of the display panel, which disappears when the blowdown is completed.



You can arbitrarily set the contact inputs (17) to (19) and (20) of the terminal block.

Piping and wiring for the supply air and the solenoid valve shall be installed.

Description

- You can perform blowdown by the contact input using this function.
- Actuate the solenoid valve attached to the exterior by the contact signal from the terminal block and supply air. Blowdown is automatically performed.
- Refer to Sections **4.1** for the wiring of solenoid valves.

Procedure	Operation (example)	Performing remote blowdown	
	Key operation	Description	Liquid crystal display (LCD)
(1)	ENTER	Display the screen on the right in accordance with the key operation summary and press the ENTER key. The contact input setting screen appears.	PARAMETER MENU DIGITAL INPUT
(2)	▲ ENTER	Press the ▲ key several times and select one of DI 1 to DI 3. Press the ENTER key.	DIGITAL INPUT DI 1

(3)	ENTER	Press the ENTER key. Contact is set.	DI 1 NONE
(4)	▲ ENTER	Press the ▲ key several times and select “BLOW DOWN ON”. Press the ENTER key to set the value.	DI 1 BLOW DOWN ON
(5)	ENTER	Press the ENTER key.	DI 1 BLOW DOWN ON
(6)	ESC	The screen on the right appears. Press the ESC key several times and return to the measurement screen.	DIGITAL INPUT DI 1
(7)		Close the contact set to the “BLOW DOWN ON.” Blowdown is performed.	12.34 Vol%

How to interrupt

- Press the ESC key to interrupt the operation.

7. ANALYSERS CHECKS, MAINTENANCE & AFTER SALES SERVICE

CAUTION:

- Carefully read the Technical Instruction for ATEX Equipment delivered by Fuji Electric before performing any manipulation of Fuji Electric ex-proof products.
- Fuji Electric is not responsible for damages created by the application of maintenance procedures outside of Fuji Electric workshop.
- The handling of Fuji Electric ATEX equipment must be performed in compliance to Fuji Electric procedure by qualified operators.
- All operation and step of this procedure must be performed power-off and in safe area. If the work is done while current is flowing, there is a fear of getting an electric shock.
- All handling must be performed in a clean and adapted room.
- The probe shall be held by the aluminum head with a protected vice. Take care that the aluminum head is not damaged nor distorted.
- The operation temperature of the detector (tip of the ceramic heater) is about 800°C and the surface temperature is also very high. So, never touch it by bare hand. Otherwise, there is a fear of getting a burn.
- Before proceeding with the cleaning of the flow guide tube, turn off the main power and cool the tube down fully and then, do the work. Otherwise, there is a fear of getting a burn.
- Don't use other renewal parts than those designated by the maker. Otherwise, the original performance is not displayed fully and an accident or failure could come about.
- Dispose of the renewal parts including the maintenance parts as an incombustible article.

Fuji Electric can supervise some maintenance operation on your demand.

7.1. CHECKS

Analysers required periodical checks and maintenance, to ensure the accuracy of the measurement and the perfect safety of the installation.

Basic checks are listed below:

Mechanical Checks

For safety reasons, it is important to check that the ex-proof structure of the probe is correctly maintained over time.

Check that probe cable gland remains tightened. It is possible to retighten the cable gland directly. However, if you have any doubt or if you notice any deterioration, it must be replaced.

Over time, the gaskets between mounting flange can be deteriorated and leaks may appear on the installation. If you have any doubt or if you notice any deterioration, it must be replaced.

Calibration gas cylinders get empty over time. It is recommended to check that calibration gas is still available when calibrating the probe.

Check that the deflecting tube allow the flue gas to pass through without any obstacle. If it is clogged by solid materials, it is possible to sweep the tubes

Probe filter must be replaced before they are clogged.

If you notice that the frequency you must sweep the tube and replace the filter is

When the filter replacement frequency is too high, it is recommended to think about reconsidering the tube design to limit the maintenance operations. Please refer to your Fuji Electric representative to get further information on how to design the sampling system according to the flue gas specifications. Many solutions exist.

Analyser operation Check

If lags are observed between the expected oxygen concentration and the measured value, it can be useful to inject calibration gas to the probe and check its sensitivity and accuracy.

If the sensor reactivity is sufficient, the calibration should suppress the lag. If it is not, the gentle blowing of ambient air on the sensor for a couple of minutes leads to the probe regeneration.

Perform the check periodically for using the product always in good condition. Especially, perform the checks shown in table below. Moreover, perform the periodic check at a time of checking the furnace or every 6 months.

	Check	Details of
Daily check	Execution of span & zero calibration	When the converters are in use: By injecting reference gas to the probe, check sensor voltage once a month as a rough standard. (refer to the instruction manuals of the converters)
	Check for looseness of cable gland.	On junction box, retighten the cable gland or if the packing is found deteriorated, replace. On probe, cable gland must not be dismantled. Dismantling the cable gland may break the sensor.
	Check of residue in calibration gas cylinder	Check it by a primary pressure gauge.
	Check of blowdown (when blowdown nozzle is fitted)	Referring to each instruction manual of the converters check at 200 to 300kPa {2 to 3kgf/cm^2}
Periodic check	Check for leak from packing fitted between flow guide tube and mating flange and gasket of probe.	If either of the packing and gasket or both of them are found deteriorated, replace with new gasket and replace the packing (not included in scope of supply).
	Check by disconnecting for clogging or corrosion of flow guide tube.	Check following the procedure in Item **7.2.1.4**.
	Removing detector, check for loading of filter of detector.	When it is necessary to replace the filter, refer to Item **7.2.1.2**.

7.2. MAINTENANCE

7.2.1. DAILY MAINTENANCE

7.2.1.1. GENERAL RECOMMENDATIONS

To ensure a longer life of the detector, some maintenance operations may be required on the explosion-proof assembly.
In these cases, operators have 2 possibilities:
Managers can rely on Fuji Electric' maintenance services directly. A qualified RB operator will ensure ATEX compliant maintenance procedures and the traceability of Fuji Electric products.
Managers rely on other maintenance providers. To ensure ATEX compliant maintenance procedures and traceability of RB-T products, the maintenance providers must contact Fuji Electric to get the appropriate procedure depending on each site configuration and manage the maintenance registration.
Fuji Electric ensures the conformity and the maintenance of technical procedures provided to clients for safe maintenance operations on Fuji Electric ATEX materials.

According to the observations and checks, daily maintenance operations shall be adapted to each application. Usually these operations consist in replacing the probe filters and gaskets, clearing the deflecting tube, cleaning the probe flame-arrestor, replacing the gas cylinders and regenerating the sensor.

The replacement frequency of detector, probe filter and detector gaskets as well as maintenance periods of flow guide tube differ depending on the working conditions and on the components of measured gas and the amount of dust.

The average replacement frequencies are shown below. These values are to be considered as rough standards and shall be adapted to each application.

Component	Maintenance or Replacement Frequency
ZFKX probe type ZPF2	Average 5 years lifetime
Flame-arresting nose	1 year lifetime
Probe Filter	Average 6 months interval
Detector Gasket	Average 6 month interval
Flow Guide Tube	When Clogged or corroded

7.2.1.2. FILTER REPLACEMENT

- Turning the power to the detector “OFF”, lower the surface temperature of the tip (at the ceramic filter side) by cooling down fully with the air.
- After having been cooled down fully, remove the filter frame from the detector.
- Screw a new probe filter to the detector and then, tighten till the filter does not move any longer.

7.2.1.3. FLAME-ARRESTING NOSE REPLACEMENT

This operation implies opening of the ex-proof assembly. Please refer to corresponding EX equipment instructions sheet before operating.

- The probe must be removed from deflecting tube
- The analyser must be turned “OFF” and cooled down to ambient temperature
- After having been cooled down fully, remove the blocking M4 screw from the nose base.
- Unscrew the nose from the probe flange. Take care not to block the threads together.
- Screw the new nose on the probe flange, and tighten the blocking screw
- Analyser must be turned “ON” and the probe must be heated-up before being mounted on deflecting tube again.
- Replace the detector gasket before mounting the probe on deflecting tube

7.2.1.4. DEFLECTING TUBE MAINTENANCE

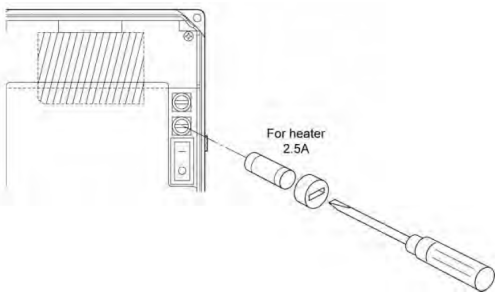
- After removing the flow guide tube from the furnace wall and then, from the detector, cool the tube down fully in the air.
- Remove dust sticking to the outside of the flow guide tube by water-washing with the use of a scrubbing brush.
- Remove dust sticking to the inside of the flow guide tube by using a metallic rod. (Clean so that tube is through at least about 3/4 part of the whole interior.)
- For the flow guide tube for high dust, remove together dust sticking around the gas outlet

7.2.1.5. FUSE REPLACEMENT

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

Open the front door and you can see a fuse. To replace the fuse, insert a flathead screwdriver or coin into the fuse cap and turn it to the left while pressing it in order to remove the cap and replace the fuse.

Put the cap on the fuse and turn it to the right to fix it.



Φ5×20 mm 2.5 A
(Example: 0213, 2.5 A, manufactured by Littelfuse)
Note: Use time-lag fuses.

	No.	Description
Consumables	1	Probe Filter
	2	Detector Gasket
	3	Flame-arresting Nose
Spare parts	3	Probe for replacement
	4	Flow guide tube

7.2.1.6. TROUBLE SHOOTING LIST

Symptoms	Probable causes	Checking methods (normal value)	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 10 min. after power switched ON	Break of wiring Wrong wiring Source voltage is too low.	Ohmic check of wiring Wiring check Check of supply voltage specification	Replacement Correct wiring 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
	Wrong parameters setting	Check automatic calibration intervals.	Set proper parameters
	The calibration is prohibited in the contact input of the external terminal block.	Check if the calibration is not prohibited in the contact input of the external terminal block.	Set proper parameters Correct wiring
	The heater is set to off at the contact input of the external terminal block.	Check if the heater is set to off at the contact input of the external terminal block.	Set proper parameters Correct wiring
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 proper value
		Check piping.	Correct wiring
Indication too high or too low	Loose flange and its surroundings Deteriorated O-rings	Check for gas leaks in detector and mounting part of flow guide tube flange.	Tighten mounting screws Replace detector element
		Check for leaks from the outside.	Seal
	Detector is faulty.	Check for gas leaks at calibration gas inlet. Check detector element voltage (mV) for higher or lower than other detector when flowing zero gas. (See “**Erreur ! Source du renvoi introuvable. Erreur ! Source du renvoi introuvable.**”)	• Tighten connectors • Replace detector element

Symptoms	Probable causes	Checking methods (normal value)	Remedy
	Abnormal detector element temperature	Refer to check items for detector temperature alarm described above.	• Replace detector element
	Indication difference between dry and wet base measurement	Oxygen concentration is higher in dry base.	• Normal
Disconnection detection error	Break of thermocouples Break of detector element Wrong wiring	Ohmic check of wiring Wiring check	• Replace the defective parts. • Correct wiring • Turn on/off the power supply.
Range cannot be switched.	“Range setting” is set in the contact input setting.	Check if “Range setting” is set in the contact input setting.	Cancel “Range setting” in the contact input setting.

Troubles	Probable causes	Check procedures (normal	Remedies
Indication is fixed. Indication response is slow.	Clogging of ceramic filter of detector and flow guide tube interior	Check visually for fouling of ceramic filter of detector and clogging of flow guide tube interior with dust.	Clean or exchange ceramic filter, if need be.
	Leak from detector gasket	Check for looseness of each joint and sealing of mounted part.	Retighten or Replace Detector gasket
	Deterioration of detector	Check by changing zero calibration gas over to span calibration gas and vice versa if it takes more than 5 minutes for 90% response.	Replace detector.
	Decrease of exhaust gas flowing velocity	Check exhaust gas responding time after stop of calibration gas supply.	Increase amount of exhaust gas inside flow guide tube to be taken in. Clean flow guide tube.
Temperature alarm continues coming on despite 20 minutes having elapsed after turning on power.	Disconnection of cable	Check continuity.	Replace cable.
	Error in wiring	Check wiring.	Wire correctly.
	Low supply voltage	Check if supply power is as specified.	Supply correct power.
	Disconnection of thermocouple	Check continuity. Check if resistance across terminals	Replace detector.
	Blown-off of fuse of converters	Check continuity of fuse.	Exchange fuse(s). (Refer to each instruction manual of converters.
	Disconnection of detector heater	Check heater resistance as follows (exclusive of wiring resistance): For 100V : 50 to 55Ω For 200V : 200 to 250Ω	Replace detector.
Indication is too high or too low.	Looseness of flange mounted part or deterioration of detector gasket or packing (not included in scope of supply).	Check sealing of detection unit, flow guide tube and flange mounted part.	Retighten mounting screw. Exchange O-ring. Exchange packing (not included in scope of supply
		Check for leak in from periphery.	Shield
	Deterioration of detector	Check sealing of calibration gas supply port. Check at a time of running zero and span calibration gases if detector output (mV) is higher or lower than others. (Refer to Table in Item “6.3”).	Retighten calibration gas joint. Replace detector.
	Abnormality of detector temperature	Check indicated temperature of converter.	
	Change of oxygen concentration peripheral air of terminal box or very high humidity	Check oxygen concentration of peripheral air of terminal box is 20.6Vol%.	Use reference gas inlet.

7.2.2. SHUTDOWN MAINTENANCE

To ensure the maintenance, the traceability and the operability of the analysers, Fuji Electric takes care of your equipment during the unit shutdown periods.

During the combustion unit shutdowns, the analysers shall be dismounted by the maintenance operators. The deflecting tube shall be inspected as well as the mating flanges. Calibration system sealing and operability shall also be inspected. According to these observations, the cleaning, replacement or redesign of the tube will be planned.

Each dismounted probe shall be tagged to ensure traceability then be sent back to Fuji Electric workshop in Villeurbanne, France.

Our operators systematically disassemble the probes. After the probe cleaning and replacement of used parts. The probes are heated up and tested.

A diagnostic report is issued to sum up the operability of each sensor. Then improvement proposal are made.

Fuji Electric agrees to make sure that all analysers are repaired and sent back on site before the process start-up.

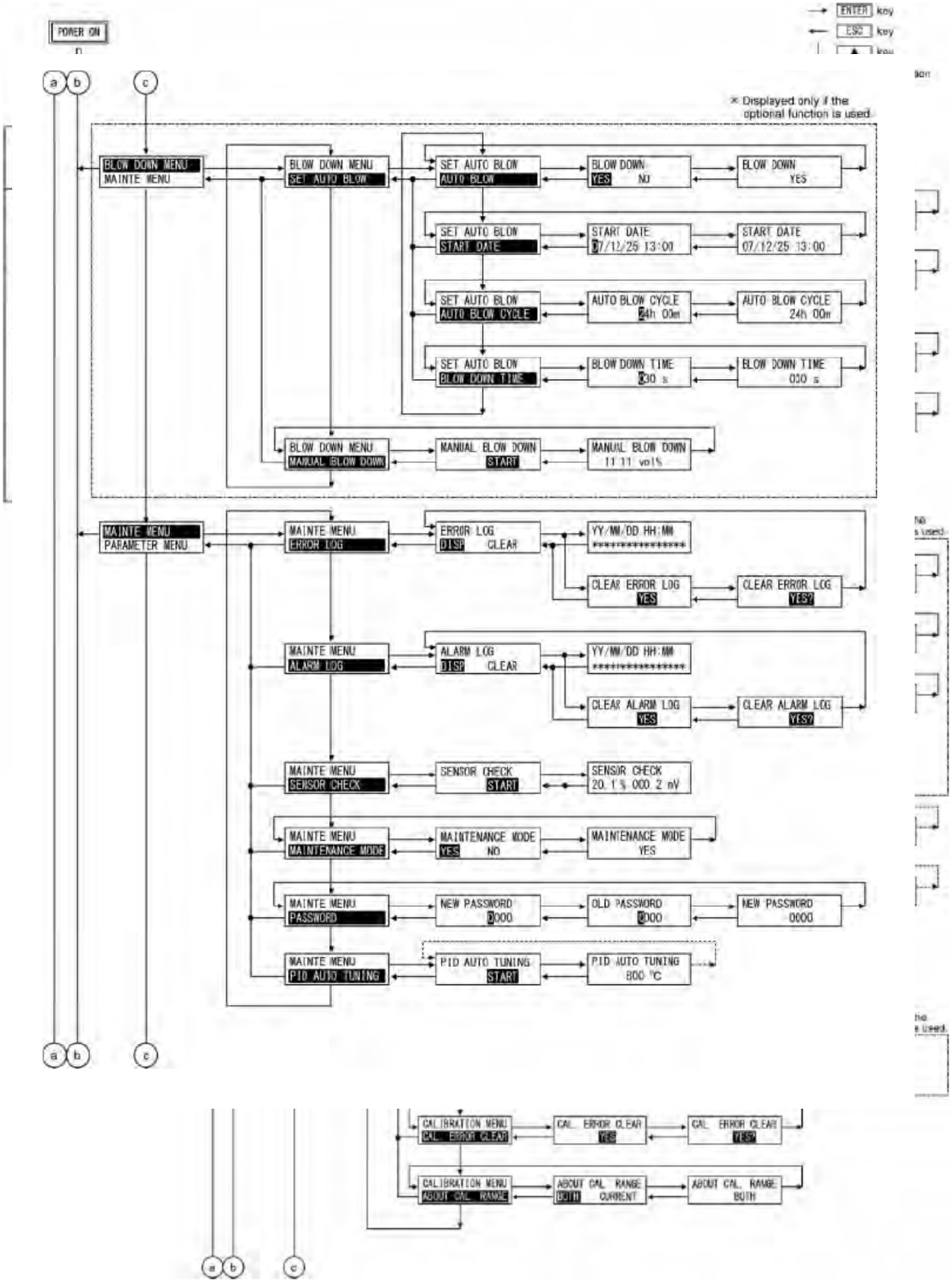
7.2.3. DETECTOR STANDARD OUTPUT VOLTAGE

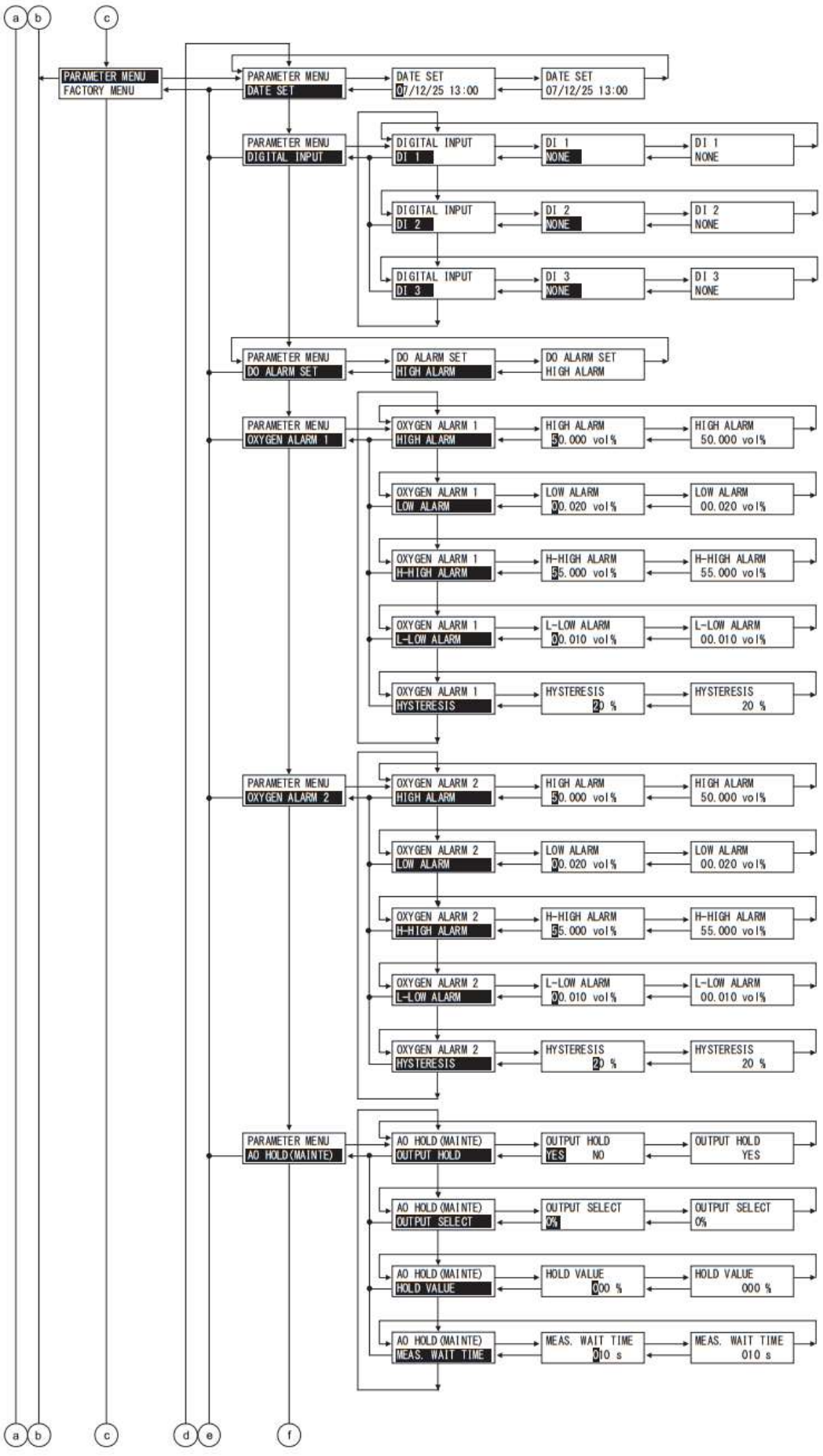
For the output voltage of the detector, refer to the standard output table below.

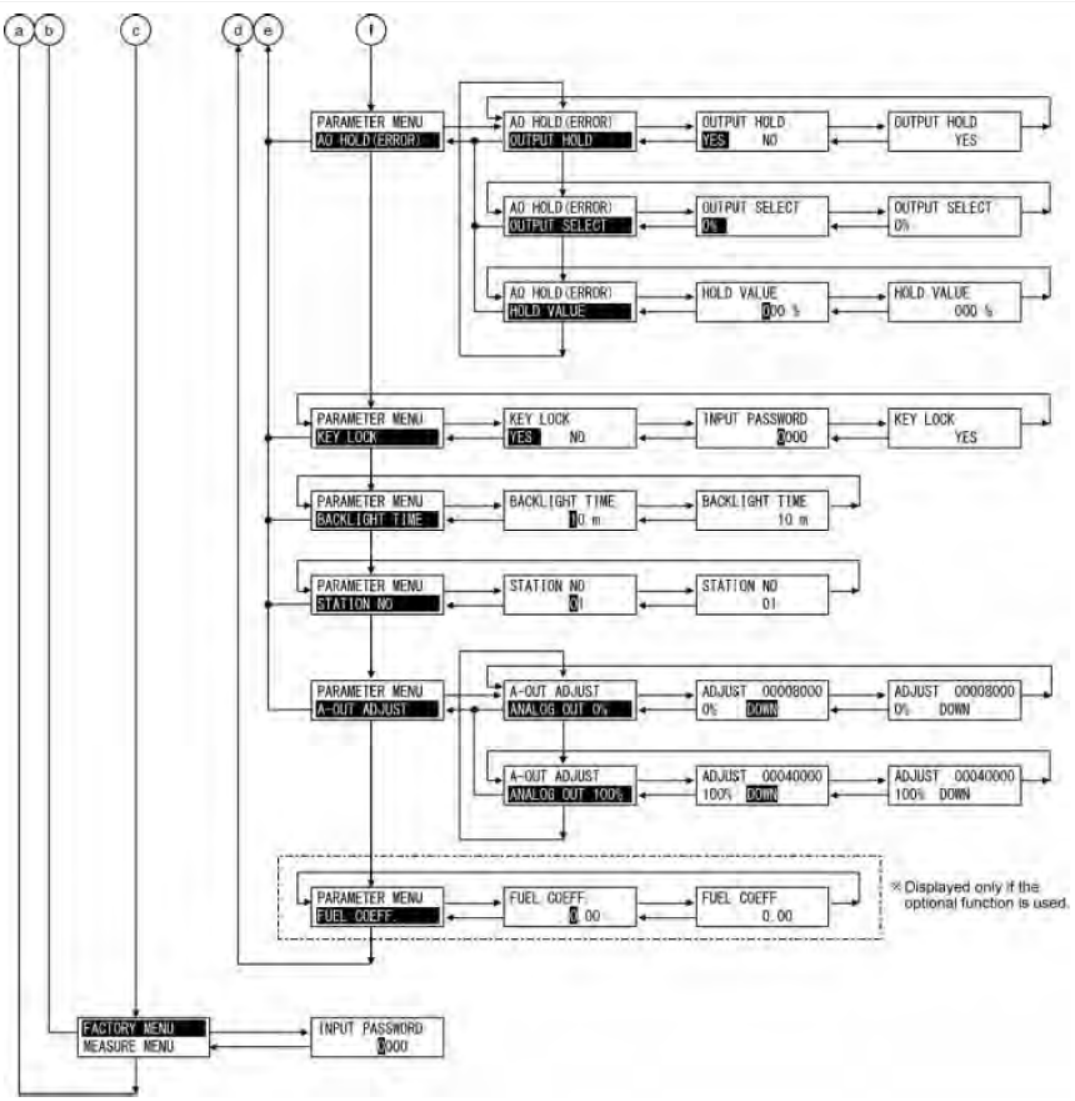
Oxygen concentration (Vol%)	Detector (ZFK2) output (Unit: mV)	Oxygen concentration (Vol%)	Detector (ZFK2) output (Unit: mV)
0.01	168.15	8.0	20.84
0.05	132.68	8.5	19.51
0.1	117.41	9.0	18.25
0.5	81.94	10.0	15.93
1.0	66.67	11.0	13.83
1.2	62.65	12.0	11.91
1.4	59.25	13.0	10.14
1.5	57.73	14.0	8.51
1.6	56.31	15.0	6.99
1.8	53.71	16.0	5.57
2.0	51.39	17.0	4.23
2.2	49.29	18.0	2.97
2.4	47.37	19.0	1.78
2.5	46.47	20.0	0.65
2.6	45.61	20.6	0.00
2.8	43.98	21.0	-0.42
3.0	42.46	22.0	-1.45
3.5	39.06	23.0	-2.43
4.0	36.12	24.0	-3.37
4.5	33.52	25.0	-4.27
5.0	31.20	30.0	-8.28
5.5	29.10	35.0	-11.68
6.0	27.18	40.0	-14.62
6.5	25.42	45.0	-17.22
7.0	23.79	50.0	-19.54
7.5	22.27		

8. CONVERTER NAVIGATION & INITIAL SETTINGS

8.1. KEY OPERATION FLOW DIAGRAM




a
b
c
PARAMETER MENU
FACTORY MENU
PARAMETER MENU
DATE SET
DATE SET
07/12/25 13:00
DATE SET
07/12/25 13:00
PARAMETER MENU
DIGITAL INPUT
DIGITAL INPUT
DI 1
DI 1
NONE
DI 1
NONE
DIGITAL INPUT
DI 2
DI 2
NONE
DI 2
NONE
DIGITAL INPUT
DI 3
DI 3
NONE
DI 3
NONE
PARAMETER MENU
DO ALARM SET
DO ALARM SET
HIGH ALARM
DO ALARM SET
HIGH ALARM
PARAMETER MENU
OXYGEN ALARM 1
OXYGEN ALARM 1
HIGH ALARM
HIGH ALARM
50.000 vol%
HIGH ALARM
50.000 vol%
OXYGEN ALARM 1
LOW ALARM
LOW ALARM
00.020 vol%
LOW ALARM
00.020 vol%
OXYGEN ALARM 1
H-HIGH ALARM
H-HIGH ALARM
55.000 vol%
H-HIGH ALARM
55.000 vol%
OXYGEN ALARM 1
L-LOW ALARM
L-LOW ALARM
00.010 vol%
L-LOW ALARM
00.010 vol%
OXYGEN ALARM 1
HYSTERESIS
HYSTERESIS
20 %
HYSTERESIS
20 %
PARAMETER MENU
OXYGEN ALARM 2
OXYGEN ALARM 2
HIGH ALARM
HIGH ALARM
50.000 vol%
HIGH ALARM
50.000 vol%
OXYGEN ALARM 2
LOW ALARM
LOW ALARM
00.020 vol%
LOW ALARM
00.020 vol%
OXYGEN ALARM 2
H-HIGH ALARM
H-HIGH ALARM
55.000 vol%
H-HIGH ALARM
55.000 vol%
OXYGEN ALARM 2
L-LOW ALARM
L-LOW ALARM
00.010 vol%
L-LOW ALARM
00.010 vol%
OXYGEN ALARM 2
HYSTERESIS
HYSTERESIS
20 %
HYSTERESIS
20 %
PARAMETER MENU
AO HOLD(MAINTE)
AO HOLD(MAINTE)
OUTPUT HOLD
OUTPUT HOLD
YES NO
OUTPUT HOLD
YES
AO HOLD(MAINTE)
OUTPUT SELECT
OUTPUT SELECT
0%
OUTPUT SELECT
0%
AO HOLD(MAINTE)
HOLD VALUE
HOLD VALUE
000 %
HOLD VALUE
000 %
AO HOLD(MAINTE)
MEAS. WAIT TIME
MEAS. WAIT TIME
010 s
MEAS. WAIT TIME
010 s
a
b
c
d
e
f


a
b
c
d
e
f
PARAMETER MENU
AO HOLD(ERROR)
AO HOLD(ERROR)
OUTPUT HOLD
OUTPUT HOLD
YES NO
OUTPUT HOLD
YES
AO HOLD(ERROR)
OUTPUT SELECT
OUTPUT SELECT
0%
OUTPUT SELECT
0%
AO HOLD(ERROR)
HOLD VALUE
HOLD VALUE
000 %
HOLD VALUE
000 %
PARAMETER MENU
KEY LOCK
KEY LOCK
YES NO
INPUT PASSWORD
0000
KEY LOCK
YES
PARAMETER MENU
BACKLIGHT TIME
BACKLIGHT TIME
10 m
BACKLIGHT TIME
10 m
PARAMETER MENU
STATION NO
STATION NO
01
STATION NO
01
PARAMETER MENU
A-OUT ADJUST
A-OUT ADJUST
ANALOG OUT 0%
ADJUST 00008000
0% DOWN
ADJUST 00008000
0% DOWN
A-OUT ADJUST
ANALOG OUT 100%
ADJUST 00040000
100% DOWN
ADJUST 00040000
100% DOWN
PARAMETER MENU
FUEL COEFF.
FUEL COEFF.
0.00
FUEL COEFF.
0.00
※Displayed only if the optional function is used.
FACTORY MENU
MEASURE MENU
INPUT PASSWORD
0000

8.2. INITIAL PARAMETER VALUE TABLES

8.2.1. PARAMETERS RELATED TO MEASUREMENT

Parameter setting	Displayed message	Range	Initial value	Reference page
Display range	OUTPUT RANGE RANGE1 RANGE2	Range1 or Range2	Range-1	
Decimal point position (Range1,Range2)	DECIMAL POINT 00.00	[00.00] [0.000]	[00.00]	
Full scale (Range1,Range2)	FULL SCALE 25.00	2 to 50 in 1 vol% steps	25.00 vol%	
Calculation time of maximum and minimum values	CALCULATE TIME 024 h	0 to 240 hours in 1-hour steps	24 hours	

8.2.2. PARAMETERS RELATED TO CALIBRATION

Parameter setting	Displayed message	Range	Initial value	Reference page
Auto calibration function (Displayed if the option is provided.)	AUTO CALIBRATION YES NO	YES or NO	Invalid (Auto calibration function: Invalid)	
Date and time for starting automatic calibration (Displayed if the option is provided.)	START DATE 99/01/01 00:00	Date and time in the future in the calendar	99/01/01 00:00	
Automatic calibration cycle time (Displayed if the option is provided.)	AUTO CAL. CYCLE 07d 00h	00d 00h to 99d23h (h: 00 to 23)	07d 00h	
Calibration gas concentration-1 calibration gas concentration-2	SPAN ZERO 20.600% 02.000%	Span: 00.010 to 50.000 vol% Zero: 00.010 to 25.000 vol% in 0.001 vol% steps	Span: 20.600 vol% Zero: 02.000 vol%	
Calibration wait time	CAL. WAIT TIME 020 s	10 to 300 sec. in 1 sec. steps	20 sec.	
Calibration range interlock	ABOUT CAL. RANGE BOTH CURRENT	Range interlock or display range	Range interlock	

8.2.3.

8.2.4. PARAMETERS RELATED TO BLOWDOWN

Parameter setting	Displayed message	Range	Initial value	Reference page
Automatic blowdown function	BLOW DOWN YES NO	YES or NO	NO (The automatic blowdown function is invalid.)	
Date and time for starting automatic blowdown	START DATE 99/01/01 00:00	Date and time in the future in the calendar	99/01/01 00:00	
Automatic blowdown cycle time	AUTO BLOW CYCLE 24h 00m	00h 00m to 99h 59m (m: 00 to 59)	24h 00m	
Blowdown time	BLOW DOWN TIME 030 s	0 to 999 sec. in 1 sec. steps	30 sec.	

8.2.5. PARAMETERS RELATED TO MAINTENANCE

Parameter setting	Displayed message	Range	Initial value	Reference page
Maintenance mode	MAINTENANCE MODE YES NO	YES or NO	NO (Sensor check function for calibration is invalid.)	
Password	NEW PASSWORD 0123	0000 to 9999	0000	

8.2.6. PARAMETERS RELATED TO PARAMETERS

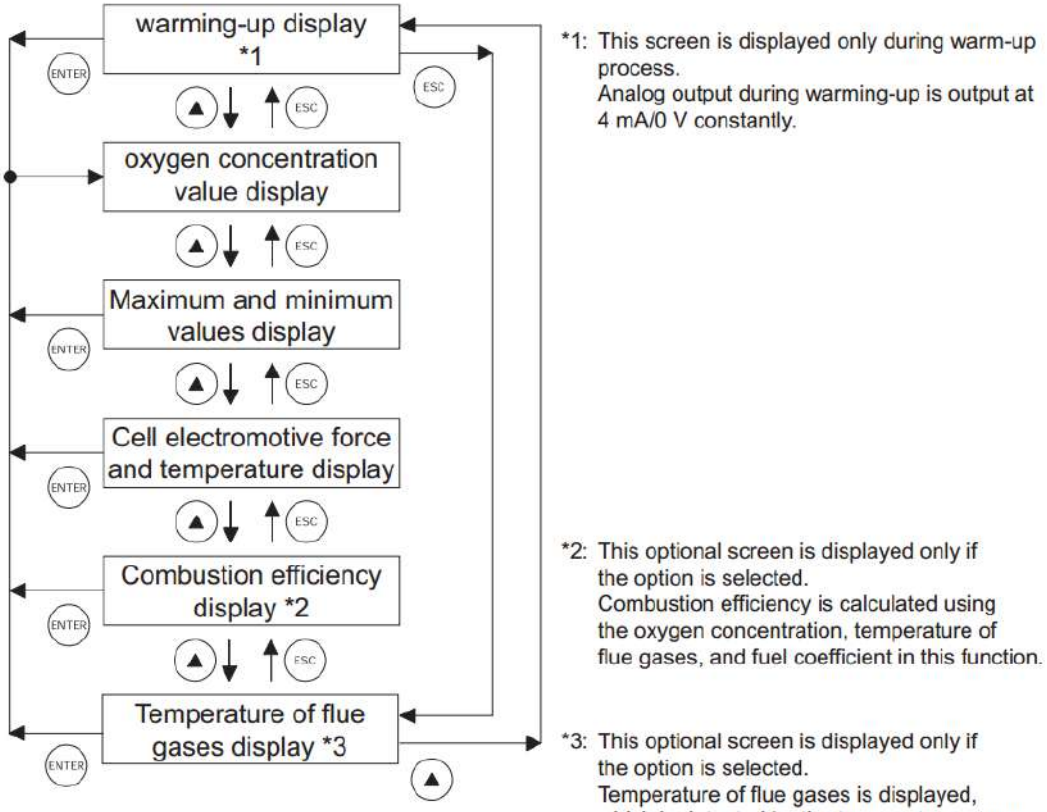
Parameter setting	Displayed message	Range	Initial value	Reference page
Current date and time	DATE SET 00/00/01 00:00	Date and time in the calendar	(00/01/01 00:00)	

Contact inputs 1 to 3	DI 1 NONE	DI1 to DI3 [NONE] [BLOW DOWN ON] [HEATER OFF] [PROHIBIT CAL.] [REMOTE CAL.] [REMOTE HOLD] [CALCULATE REST] [OUTPUT RANGE]	DI1 [NONE] DI2 [NONE] DI3 [NONE]	
Alarm contact output	DO ALARM SET ALARM NONE	[ALARM NONE] [HIGH ALARM] [LOW ALARM] [H-HIGH ALARM] [L-LOW ALARM] [H/L ALARM] [HH/LL ALARM]	[ALARM NONE]	
Upper limit of oxygen concentration (Range-1,Range-2)	HIGH ALARM 50.000 vol%	0.001 to 55.000 vol% in 0.001 vol% steps	50.000 vol%	
Lower limit of oxygen concentration (Range-1,Range-2)	LOW ALARM 00.020 vol%	0.001 to 55.000 vol% in 0.001 vol% steps	00.020 vol%	
Upper 2 limit of oxygen concentration (Range-1,Range-2)	H-HIGH ALARM 55.000 vol%	0.001 to 55.000 vol% in 0.001 vol% steps	55.000 vol%	
Lower 2 limit of oxygen concentration (Range-1,Range-2)	L-LOW ALARM 00.010 vol%	0.001 to 55.000 vol% in 0.001 vol% steps	00.010 vol%	
Hysteresis (Oxygen concentration alarm) (Range-1,Range-2)	HYSTERESIS 10 %	0 to 20 % in 1 % steps	10 %	
Analog output hold function	OUTPUT HOLD YES NO	YES or NO	NO (Analog output hold function is invalid.)	
Output value of analog output hold	OUTPUT SELECT 0%	[0 %] (4 mA/0V) [100 %] (20 mA/1V) [Last output value] [Setting value]	[0 %](4 mA/0V)	
Setting the value of analog output hold (Maintenance Hold Error Hold)	HOLD VALUE 000 %	0 to 100 % in 1 % steps	0 %	

Measurement recovery time	MEAS. WAIT TIME 010 s	0 to 300 sec. in 1 sec. steps	10 sec.	
Key lock function	KEY LOCK YES NO	YES or NO	No (Key lock function is invalid.)	
Automatic OFF time	BACKLIGHT TIME 10 m	0 to 99 min. in 1 min. steps	10 min.	
Station No.	STATION NO 01	0 to 99	01	
Fuel Coefficient	FUEL COEFF. 0.70	0.00 to 1.99	0.70	

8.3. ACTIONS DURING OPERATION

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



8.4. CHECK THE CONTENT OF DISPLAY

The condition of the unit is displayed on the left of the LCD with three letters. The maximum of three items are displayed on one display. If there are four or more items, "▼" is displayed at the bottom of the screen. Scroll the screen with the ▶ key to display the fourth and subsequent items.

The unit displays the following three pieces of information:

1. Condition information
2. Error information
3. Alarm information

8.4.1. CHECK OF CONDITION INFORMATION

Display message	State	Remarks
WUP	Warm-up	Appears during warm-up
CAL	Auto calibration	Appears during auto calibration
S	Span calibration	Displayed together with “CAL” or “RIC” during span calibration.
Z	Zero calibration	Displayed together with “CAL” or “RIC” during zero calibration.
SCK	Sensor check	Displayed during sensor check.
SRC	Sensor recovery	Displayed during sensor recovery.
BLW	Automatic blowdown	Displayed during automatic blowdown.
RIC	Rich mode	Option Displayed when oxygen concentration is 0.0023 vol% or less.
KYL	Key Lock	Displayed during key lock
RHO	Remote heater is off.	Displayed while remote heater is off.
RCP	Remote calibration is prohibited.	Displayed while remote calibration is prohibited.
RAH	Remote analog output hold	Displayed during remote analog output hold.
RCL	Remote calibration	Displayed during remote calibration.
RBL	Remote blowdown	Displayed during remote blowdown.
OVR	Over range	Displayed when an input is out of range

8.4.2. CHECK OF ERROR INFORMATION

Display message	Status	Remarks
Er1	Fault of heater temperature	Appears when control temperature of the heater exceeds the set range. The heater control is stopped.
Er2	Disconnection detection	Appears when disconnection is detected at the sensor, or thermocouples for temperature control or combustion control. The heater control is stopped.
Er3	Sensor error	Appears when the A/D value is saturated.
Er4	Span calibration error	Appears when the span calibration is abnormal. (The calibration gas is unstable. / The calibration factor setting is inappropriate.)
Er5	Zero calibration error	Appears when the zero calibration is abnormal. (The calibration gas is unstable. / The calibration factor setting is inappropriate.)

8.4.3. CHECK OF ALARM INFORMATION

Display message	Status	Remarks
ALM	Oxygen concentration error	Appears when the oxygen concentration exceeds any of specified upper 2 / upper / lower / lower 2 limit values. (Refer to **9.5.3**)
H	Upper limit error	Appears together with ALM.
L	Lower limit error	Appears together with ALM.
HH	Upper 2 limit error	Appears together with ALM.
LL	Lower 2 limit error	Appears together with ALM.

You can select one of the following seven alarms to output to the alarm contact (Numbers of contacts of the external terminal block: (21), (22)) when an oxygen concentration error occurs.

[Not used] : No alarm is output to the contact output
[Upper limit alarm] : Alarm contact is output when an upper limit alarm occurs.
[Lower limit alarm] : Alarm contact is output when a lower limit alarm occurs.
[Upper 2 limit alarm] : Alarm contact is output when an upper 2 limit alarm occurs.
[Lower 2 limit alarm] : Alarm contact is output when a lower 2 limit alarm occurs.
[Upper/lower limit alarm] : Alarm contact is output when an upper or lower limit alarm occurs.
[Upper 2 / lower 2 limit alarm] : Alarm contact is output when an upper 2 or lower 2 limit alarm occurs.

9. SETTING AND OPERATION OF PARAMETERS

9.1. MEASURE MENU

9.1.1. DISPLAY RANGE SETTING SCREEN

Description

- You can set the display range of oxygen concentration value using this function.
- Settable range: Select one of the following
  (1) “Range 1”: Displayed in the range set in the range setting 1.
  (2) “Range 2”: Displayed in the range set in the range setting 2.

Procedure	Operation (example)	Setting the display range to “Range 1”	
	Key operation	Description	Displayed message (LCD)
(1)		Display the screen on the right in accordance with the key operation summary and press the ENTER MODE key. The display range setting screen appears.	MEASURE MENU OUTPUT RANGE
(2)	RIGHT ENTER MODE	Use the RIGHT key to select the range-1. Press the ENTER MODE key to set the value.	OUTPUT RANGE RANGE1 RANGE2
(3)	ENTER MODE	Press the ENTER MODE key.	OUTPUT RANGE RANGE1
(4)		When it is fixed, the display returns to the screen on the right.	MEASURE MENU OUTPUT RANGE

Note

- If “Range setting” is set in the contact input setting, you cannot change the display range on this screen.

9.1.2. DECIMAL POINT POSITION SETTING SCREEN

Description

- You can set the decimal point position of full scale for oxygen concentration display using this function.
- Settable range: Select one of the following.
  (1) “00.00”: Displayed with two-digit integer and two decimal places.
  (2) “0.000”: Displayed with one-digit integer and three decimal places.

Procedure	Operation (example)	Setting the display of two-digit integer and two decimal places (Range 1)	
	Key operation	Description	Displayed message (LCD)
(1)	ENTER MODE	Display the screen on the right in accordance with the key operation summary and press the ENTER MODE key.	MEASURE MENU OUTPUT RANGE
(2)	ENTER MODE	Press the ENTER MODE key. The decimal point position setting screen appears.	OUTPUT RANGE DECIMAL POINT
(3)	UP ENTER MODE	Use the RIGHT key to select the two-digit integer and two decimal places. Press the ENTER MODE key to set the value.	DECIMAL POINT 00.00
(4)	ENTER MODE	Press the ENTER MODE key.	DECIMAL POINT 00.00
(5)		When it is fixed, the display returns to the screen on the right.	OUTPUT RANGE DECIMAL POINT

Note

- If changing “0.000” to “00.00,” “25.00” is set as the full scale value.
- If changing “00.00” to “0.000,” “5.000” is set as the full scale value.

9.1.3. FULL SCALE SETTING SCREEN

Description

- You can set the full scale value for display of oxygen concentration value using this function.
- Settable range: If the decimal point position is set to “00.00”: 02.00 to 50.00 vol%
  If the decimal point position is set to “0.000”: 2.000 to 9.000 vol%

Procedure	Operation (example)	Setting the full scale value to 20.00% (Range-1)	
	Key operation	Description	Displayed message (LCD)
(1)		Display the screen on the right in accordance with the key operation summary and press the  key.	MEASURE MENU OUTPUT RANGE
(2)		Press the  key to display the screen on the right and press the  key. The full scale setting screen appears.	OUTPUT RANGE FULL SCALE
(3)		Use the  and  key to set the full scale value. Press the  key to set the value.	FULL SCALE 20.00
(4)		Press the  key.	FULL SCALE 20.00
(5)		The display returns to the screen on the right.	OUTPUT RANGE FULL SCALE

9.1.4. SETTING THE SCREEN FOR CALCULATION TIME OF MAXIMUM AND MINIMUM VALUES

Description

- You can set the calculation time of maximum and minimum values of oxygen concentration value using this function.
- Settable range: 0 to 240h

Procedure	Operation (example)	Setting the calculation time of maximum and minimum values to 24 hours	
	Key operation	Description	Displayed message (LCD)
(1)	ENTER MODE	Display the screen on the right in accordance with the key operation summary and press the ENTER MODE key. The screen for calculation time of maximum and minimum values setting screen appears.	MEASURE MENU CALCULATE TIME
(2)	UP RIGHT ENTER MODE	Use the UP and RIGHT key to set the calculation time of maximum and minimum values. Press the ENTER MODE key to set the value.	CALCULATE TIME 024 h
(3)	ENTER MODE	Press the ENTER MODE key.	CALCULATE TIME 024 h
(4)		When it is fixed, the display returns to the screen on the right.	MEASURE MENU CALCULATE TIME

9.2. CALIBRATION MENU

9.2.1. AUTOMATIC CALIBRATION SETTING

Description

- You can set the automatic calibration to valid or invalid using this function.
- If changing the automatic calibration setting from valid to invalid during automatic calibration or remote calibration, the calibration is forcibly canceled.

Procedure	Operation (example)	Setting the automatic calibration to valid	
	Key operation	Description	Displayed message (LCD)
(1)	ENTER MODE	Display the screen on the right in accordance with the key operation summary and press the ENTER MODE key.	CALIBRATION MENU SET AUTO CAL
(2)	ENTER MODE	Press the ENTER MODE key. The auto calibration valid/invalid setting screen appears.	SET AUTO CAL AUTO CALIBRATION
(3)	RIGHT ENTER MODE	Use the RIGHT key to select the auto calibration valid (YES). Press the ENTER MODE key to set the value.	AUTO CALIBRATION YES NO
(4)	ENTER MODE	Press the ENTER MODE key.	AUTO CALIBRATION YES
(5)		The display returns to the screen on the right.	SET AUTO CAL AUTO CALIBRATION

Note

- If the time for automatic calibration comes during manual treatments (calibration, blowdown, sensor check, or sensor recovery) or remote treatments (calibration, blowdown, or heater off), the treatment being performed is prioritized and the automatic calibration starts after the treatment is completed.
- If the time for automatic calibration comes at the same time with automatic blowdown, the automatic blowdown starts first and the automatic calibration starts after the automatic blowdown is completed.
- If “Prohibition of calibration” is set in the contact input setting and the contact input is on, automatic calibration is not performed.
- If disconnection is detected (O_2 sensor input, O_2 sensor thermocouple input, or thermocouple input (combustion control: option)), or a heater temperature error or A/D saturation error occurs, automatic calibration is not performed.
- Automatic calibration is not available during warm-up operation.

9.2.2. DATE & TIME FOR STARTING AUTOMATIC CALIBRATION

Description

- You can set the date and time for starting automatic calibration using this function. Automatic calibration is performed in a specified cycle from a specified date and time.
- If it is invalid, the automatic calibration does not start at a specified date and time.
- Settable range: date and time in the future in the calendar

Procedure	Operation (example)	Setting the automatic calibration so that it is performed from 13:00, 08/02/25	
	Key operation	Description	Displayed message (LCD)
(1)	ENTER MODE	Display the screen on the right in accordance with the key operation summary and press the ENTER MODE key.	CALIBRATION MENU SET AUTO CAL
(2)	UP ENTER MODE	Press the UP key to display the screen on the right and press the ENTER MODE key. The execution confirmation screen of manual span calibration appears.	SET AUTO CAL START DATE
(3)	UP RIGHT	Use the UP and RIGHT key to set the auto calibration starting date and time screen.	START DATE 08/01/01 00:00
	ENTER MODE	Press the ENTER MODE key to set the value.	
(4)	ENTER MODE	Press the ENTER MODE key.	START DATE 08/02/25 13:00
(5)		The display returns to the screen on the right.	SET AUTO CAL START DATE

Caution

- You cannot change the setting value during automatic calibration or remote calibration.
- Check that “Current date and time setting” in the parameter menu is properly set.

9.2.3. CYCLE TIME SETTING OF AUTOMATIC CALIBRATION

Description

- You can set the automatic calibration cycle using this function.
  The cycle starts from a specified date and time for automatic calibration.
- Settable range: 00d 00h to 99d 23h (h: 00 to 23)

Procedure	Operation (example)	Setting the automatic calibration so that it is performed every four days	
	Key operation	Description	Displayed message (LCD)
(1)	ENTER MODE	Display the screen on the right in accordance with the key operation summary and press the ENTER MODE key.	CALIBRATION MENU SET AUTO CAL
(2)	UP ENTER MODE	Press the UP key to display the screen on the right and press the ENTER MODE key. The cycle time setting of automatic calibration appears.	SET AUTO CAL AUTO CAL. CYCLE
(3)	▲ RIGHT	Use the ▲ and RIGHT key to set the auto calibration starting date and time screen. Press the ENTER MODE key to set the value.	AUTO CAL. CYCLE 04 d 00 h
(4)	ENTER MODE	Press the ENTER MODE key.	AUTO CAL. CYCLE 04 d 00 h
(5)		The display returns to the screen on the right.	SET AUTO CAL AUTO CAL. CYCLE

Caution

- You cannot change the setting value during automatic calibration or remote calibration.

9.2.4. PERFORMING ALL CALIBRATION

Description

- You can perform all calibration on the screen using this function.
  Zero calibration is automatically performed after the span calibration.
- You cannot perform “ALL CALIBRATION” during warm-up operation.

Procedure	Operation (example)	Performing all calibration on the screen	
	Key operation	Description	Displayed message (LCD)
(1)	ENTER	Display the screen on the right in accordance with the key operation summary and press the ENTER key, the all calibration performing screen appears.	CALIBRATION MENU ALL CALIBRATION
(2)	ENTER	Press the ENTER key to perform all calibration.	ALL CALIBRATION START
(3)		Oxygen concentration value and cell electromotive force are displayed during all calibration.	ALL CALIBRATION 20.61 % 000.1 mV
(4)		After the all calibration is completed, the display returns to the screen on the right.	CALIBRATION MENU ALL CALIBRATION

How to interrupt

- Press the ESC key to interrupt the operation.

9.2.5. PERFORMING A MANUAL SPAN CALIBRATION

Description

- Before starting span calibration, the operator shall supply span gas to the detector and check that the display is stabilized.
- You cannot perform manual span calibration during warm-up operation.

Procedure	Operation (example)	Performing span calibration on the screen	
	Key operation	Description	Displayed message (LCD)
(1)	ENTER	Display the screen on the right in accordance with the key operation summary and press the ENTER key, the manual span calibration screen appears.	CALIBRATION MENU MANUAL SPAN CAL.
(2)	ENTER	Press the ENTER key to perform manual span calibration. If supplying calibration gas manually (without the auto-calibration function) The operator shall open the span gas valve manually and adjust the flow rate to 30NL/h. If your detector has the auto-calibration function, you can activate the external solenoid valve using the contact output signal at the terminal block.	MANUAL SPAN CAL. START
(3)		Oxygen concentration value and cell electromotive force are displayed. Wait until the oxygen concentration is stabilized.	MANUAL SPAN CAL. 20.61 % 000.1 mV
(4)	ENTER	Press the ENTER key to determine the span calibration factor. During the process, the oxygen concentration value and cell electromotive force are highlighted.	MANUAL SPAN CAL. 20.61 % 000.1 mV
(5)		After the calibration is completed, the display returns to the screen on the right.	MANUAL SPAN CAL. START
(6)		If the operator opened the span gas valve manually, close the valve.	

How to interrupt

- Press the ESC key to interrupt the operation.
- After the interruption, be sure to close the valves of span gas.

9.2.6. PERFORMING A MANUAL ZERO CALIBRATION

Description

- Before starting zero calibration, the operator shall supply zero gas to the detector and check that the display is stabilized.
- You cannot perform zero calibration during warm-up operation.

Procedure	Operation (example)	Performing zero calibration on the screen	
	Key operation	Description	Displayed message (LCD)
(1)	ENTER	Display the screen on the right in accordance with the key operation summary and press the ENTER key, the manual zero calibration screen appears.	CALIBRATION MENU MANUAL ZERO CAL.
(2)	ENTER	Press the ENTER key to perform manual zero calibration. If supplying calibration gas manually (without the auto-calibration function) The operator shall open the span gas valve manually and adjust the flow rate to 30NL/h. If your detector has the auto-calibration function, you can activate the external solenoid valve using the contact output signal at the terminal block.	MANUAL ZERO CAL. START
(3)		Oxygen concentration value and cell electromotive force are displayed. Wait until the oxygen concentration is stabilized.	MANUAL ZERO CAL. 2.01 % 053.9 mV
(4)	ENTER	Press the ENTER key to determine the zero calibration factor. During the process, the oxygen concentration value and cell electromotive force are highlighted.	MANUAL ZERO CAL. 2.01 % 053.9 mV
(5)		After the calibration is completed, the display returns to the screen on the right.	CALIBRATION MENU MANUAL ZERO CAL.
(6)		The operator shall close the zero gas valve manually.	

How to interrupt

- Press the ESC key to interrupt the operation.
- After the interruption, be sure to close the valves of zero gas.

9.2.7. CALIBRATION GAS SETTING

Description

- Set calibration gas concentration (span/zero calibration gas concentrations).
  Use the calibration gas concentration 1 for the range 1, and the calibration gas concentration 2 for the range 2.
- Use normal air (atmosphere) as a span calibration gas and set its concentration to 20.600% O_2/N_2.
- Settable range: Span calibration gas 00.010 to 50.000 %O_2/N_2
  Zero calibration gas 00.010 to 25.000 %O_2/N_2

Procedure	Operation (example)	Setting the span/zero calibration gas concentrations (Range 1)	
	Key operation	Description	Displayed message (LCD)
(1)	ENTER	Display the screen on the right in accordance with the key operation summary and press the ENTER key.	CALIBRATION MENU CAL. GAS (RANGE 1)
(2)		The set content is displayed now.	SPAN ZERO 20.600% 02.000%
(3)	▲ ▶ ENTER	Use the ▲ and ▶ key to change the calibration gas concentrations. Press the ENTER key to set the value.	SPAN ZERO 20.600% 02.000%
(4)	ENTER	The set content is displayed. Press the ENTER key.	SPAN ZERO 20.600% 02.000%
(5)		The display returns to the screen on the right.	CALIBRATION MENU CAL. GAS (RANGE 1)

Note

- You cannot change the setting value during automatic calibration or remote calibration.
- Set with span calibration gas concentrations ≧ zero calibration gas concentrations.

9.2.8. CALIBRATION WAIT TIME SETTING

Description

- Set the waiting time from supply of calibration gas to start of calibration.
  (Set the time so that the calibration gas becomes stable before the calibration.)
- Settable range: 10 to 999sec.

Procedure	Operation (example)	Setting the waiting time to start of calibration to 20 seconds	
	Key operation	Description	Displayed message (LCD)
(1)	ENTER	Display the screen on the right in accordance with the key operation summary and press the ENTER key.	CALIBRATION MENU CAL. WAIT TIME
(2)	▲ ▶ ENTER	The set content is displayed now. Use the ▲ and ▶ key to change the wait time. Press the ENTER key to set the value.	CAL. WAIT TIME 020 S
(3)	ENTER	Press the ENTER key.	CAL. WAIT TIME 020 S
(4)		The display returns to the screen on the right.	CALIBRATION MENU CAL. WAIT TIME

Caution

- You cannot change the setting value during automatic calibration or remote calibration.

9.2.9. CALIBRATION ERROR CLEAR

Description

- You can clear the errors occurred during calibration using this function.
  If an error occurs during calibration, an error display (Er4, Er5) and abnormal contact output (close) continues until the next calibration is properly completed.
- Clear the error display on the measurement screen and open the abnormal contact output.
- Error log information is not cleared.

Procedure	Operation (example)	Clearing a calibration error	
	Key operation	Description	Displayed message (LCD)
(1)	ENTER	Display the screen on the right in accordance with the key operation summary and press the ENTER key. The calibration error clear appears.	CALIBRATION MENU CAL. ERROR CLEAR
(2)	ENTER	Press the ENTER key. (The calibration error is not cleared yet.)	CAL. ERROR CLEAR YES
(3)	ENTER	Press the ENTER key. (Calibration error cleared.)	CAL. ERROR CLEAR YES?
(4)		The display returns to the screen on the right.	CALIBRATION MENU CAL. ERROR CLEAR

9.2.10. OPERATION SETTING SCREEN OF CALIBRATION RANGE

Description

- During calibration, you can select single or common range for the calibration factor using this function.
- Settable range: Select one of the following.
  - (1) "Range interlock": Performs calibration of the range that is currently displayed and sets the calibration factors of the other ranges to the same value as above.
  - (2) "Display range": Performs calibration of the range that is currently displayed.

Procedure	Operation (example)	Setting the calibration range to range interlock	
	Key operation	Description	Displayed message (LCD)
(1)	ENTER	Display the screen on the right in accordance with the key operation summary and press the ENTER key. The operation setting screen of calibration range appears.	CALIBRATION MENU CURRENT
(2)	▶ ENTER	Use the ▶ key to select the range interlock. Press the ENTER key to set the value.	ABOUT CAL. RANGE BOTH CURRENT
(3)	ENTER	Press the ENTER key.	ABOUT CAL. RANGE BOTH
(4)		When it is fixed, the display returns to the screen on the right.	CALIBRATION MENU BOTH

9.3. BLOWDOWN MENU

9.3.1. AUTOMATIC BLOWDOWN SETTING

Description

- You can set the automatic blowdown to valid or invalid using this function.
- If changing the automatic blowdown setting from valid to invalid during automatic blowdown, the blowdown is forcibly canceled.

Procedure	Operation (example)	Setting the automatic blowdown to valid	
	Key operation	Description	Displayed message (LCD)
(1)	ENTER	Display the screen on the right in accordance with the key operation summary and press the ENTER key.	BLOW DOWN MENU SET AUTO BLOW
(2)	ENTER	Press the ENTER key. The auto blowdown valid/invalid setting screen appears.	SET AUTO BLOW BLOW DOWN
(3)	▶ ENTER	Use the ▶ key to select the auto blowdown valid (YES). Press the ENTER key to set the value.	BLOW DOWN YES NO
(4)	ENTER	Press the ENTER key.	BLOW DOWN YES
(5)		The display returns to the screen on the right.	SET AUTO BLOW BLOW DOWN

Caution

- If the time for automatic calibration comes during manual treatments (calibration, blowdown, sensor check, or sensor recovery) or remote treatments (calibration, blowdown, or heater off), the treatment being performed is prioritized and the automatic calibration starts after the treatment is completed.
- If the time for automatic blowdown comes at the same time with automatic calibration, the automatic blowdown starts first.
- If disconnection is detected (O_2 sensor input, O_2 sensor thermocouple input, or thermocouple input (combustion control: option)), or heater temperature error or A/D saturation error occurs, automatic calibration is not performed.

9.3.2. DATE & TIME SETTING OF AUTOMATIC BLOWDOWN

Description

- You can set the date and time for starting automatic blowdown using this function. Automatic blowdown is performed in a specified cycle from a specified date and time.
- If it is invalid, automatic blowdown does not start at a specified date and time.
- Settable range: date and time in the future in the calendar

Procedure	Operation (example)	Setting the date and time for starting automatic blowdown to 13:00, 08/02/25	
	Key operation	Description	Displayed message (LCD)
(1)	(ENTER)	Display the screen on the right in accordance with the key operation summary and press the (ENTER) key.	BLOW DOWN MENU SET AUTO BLOW
(2)	(ENTER)	Press the (ENTER) key. The date and time setting of automatic blowdown screen appears.	SET AUTO BLOW START DATE
(3)	(▲) (▶)	Use the (▲) and (▶) key to set the auto blowdown starting date and time screen.	START DATE 05/02/25 13:00
	(ENTER)	Press the (ENTER) key to set the value.	
(4)	(ENTER)	Press the (ENTER) key.	START DATE 05/02/25 13:00
(5)		The display returns to the screen on the right.	SET AUTO BLOW START DATE

Caution

- You cannot change the setting value during automatic blowdown or remote blowdown.
- Check that “Current date and time setting” in the parameter menu is properly set.

9.3.3. AUTOMATIC BLOWDOWN CYCLE SETTING

Description

- You can set the automatic blowdown cycle using this function.
  The cycle starts from a specified date and time for automatic blowdown.
- Settable range: 00h 00m to 99h 59m (m: 00 to 59)

Procedure	Operation (example)	Setting automatic blowdown interval to 24 hours.	
	Key operation	Description	Displayed message (LCD)
(1)	ENTER	Display the screen on the right in accordance with the key operation summary and press the ENTER key.	BLOW DOWN MENU SET AUTO BLOW
(2)	▲ ENTER	Press the ▲ key to display the screen on the right and press the ENTER key. The procedure for auto setting blowdown interval screen appears.	SET AUTO BLOW AUTO BLOW CYCLE
(3)	▲ ▶ ENTER	Use the ▲ and ▶ key to select the auto blowdown interval. Press the ENTER key to set the value.	AUTO BLOW CYCLE 24 h 00 m
(4)	ENTER	Press the ENTER key.	AUTO BLOW CYCLE 24 h 00 m
(5)		The display returns to the screen on the right.	SET AUTO BLOW AUTO BLOW CYCLE

Note

- You cannot change the setting value during automatic blowdown or remote blowdown.
- Set the blowdown cycle value larger than the blowdown time.

9.3.4. PROCEDURE FOR SETTING AUTO BLOWDOWN TIME

Description

- You can set the blowdown time using this function (common with manual blow down).
- Settable range: 0 to 999 sec.

Procedure	Operation (example)	Setting blowdown time to 30 seconds.	
	Key operation	Description	Displayed message (LCD)
(1)	ENTER	Display the screen on the right in accordance with the key operation summary and press the ENTER key.	BLOW DOWN MENU SET AUTO BLOW
(2)	▲ ENTER	Press the ▲ key to display the screen on the right and press the ENTER key. The procedure for setting blowdown time screen appears.	SET AUTO BLOW BLOW DOWN TIME
(3)	▲ ▶ ENTER	Use the ▲ and ▶ key to set the blowdown time. Press the ENTER key to set the value.	BLOW DOWN TIME 030 s
(4)	ENTER	Press the ENTER key.	BLOW DOWN TIME 030 s
(5)		The display returns to the screen on the right.	SET AUTO BLOW BLOW DOWN TIME

Caution

- You cannot change the setting value during automatic blowdown or remote blowdown.
- Set the blowdown cycle value smaller than the blowdown time.

9.3.5. PERFORMING MANUAL BLOWDOWN

Description

- You can perform blowdown on the screen using this function.
- If you perform remote control (calibration, blowdown, turning off the heater) during manual blowdown, remote control is prioritized and manual blowdown is stopped.

Procedure	Operation (example)	Performing blowdown on the screen	
	Key operation	Description	Displayed message (LCD)
(1)	ENTER	Display the screen on the right in accordance with the key operation summary and press the ENTER key, the manual blowdown performing screen appears.	BLOW DOWN MENU MANUAL BLOW DOWN
(2)	ENTER	Press the ENTER key to perform manual blowdown.	MANUAL BLOW DOWN START
(3)		Oxygen concentration value is displayed during manual blowdown.	MANUAL BLOW DOWN 11.11 vol%
(4)		After the calibration is completed, the display returns to the screen on the right.	BLOW DOWN MENU MANUAL BLOW DOWN

How to interrupt

- Press the ESC key to interrupt the operation.

9.4. MAINTENANCE MENU

9.4.1. ERROR LOG DISPLAY

Description

- You can display an error log on the screen using this function.
- A latest piece of error information is displayed first.
  The maximum of 12 pieces of error information are saved.
  Press the ▲ key to display the older pieces of error information.
  The latest piece of error information is displayed next to the oldest piece of error information.
- The oldest piece of error information is overwritten by a new one.

Procedure	Operation (example)	Displaying an error log on the screen	
	Key operation	Description	Displayed message (LCD)
(1)	ENTER	Display the screen on the right in accordance with the key operation summary and press the ENTER key.	MAINTE MENU ERROR LOG
(2)	▶	Use the ▶ key to select the error log screen.	ERROR LOG DISP CLEAR
(3)	ENTER	Press the ENTER key, the latest error log appears.	YY/MM/DD HH:MM **********
(4)	▲	Press the ▲ key to display the previous piece of error log information.	YY/MM/DD HH:MM **********
(5)	ESC	Press the ESC key, the display returns to the screen on the right.	ERROR LOG DISP CLEAR
(6)	ESC	Press the ESC key again to return to the screen on the right.	MAINTE MENU ERROR LOG

Error log

Display message	Status
Sensorline Error	Sensor line disconnection of the zirconia oxygen analyser was detected.
TC-line Error	Temperature control line disconnection of the zirconia oxygen analyser was detected.
Sub temp. Error	Line disconnection of the thermocouple for combustion control was detected.
Warm-up Error	Warming-up was not completed within the warming-up monitoring time (45 minutes). • Warming-up is properly completed if the heater temperature of the zirconia oxygen analyser becomes the control temperature (800°C) ± 1°C and stable for one minute.
Cell temp. Error	Heater temperature exceeds the specified range (800°C ± 70°C)
Span gas Error	• The concentration of the calibration span gas being supplied is not stable. (In a discrimination treatment of stability, the error of ± 0.2% or more compared to the value in the previous treatment continues.)
Zero gas Error	• The concentration of the calibration zero gas being supplied is not stable. (In a discrimination treatment of stability, the error of ± 0.2% or more compared to the value in the previous treatment continues.)
Span cal. Error	Span calibration failed. (Calibration factor could not be determined.)
Zero cal. Error	Zero calibration failed. (Calibration factor could not be determined.)
Sensor Error, A/D data error	An error was detected in the A/D conversion of oxygen concentration value of the zirconia oxygen analyser. (260 mV or more, –50 mV or less)

9.4.2. CLEARING ERROR LOGS

Description

- You can clear all error logs saved using this function.

Procedure	Operation (example)	Clearing all error logs saved	
	Key operation	Description	Displayed message (LCD)
(1)	ENTER	Display the screen on the right in accordance with the key operation summary and press the ENTER key.	MAINTE MENU ERROR LOG
(2)	▶	Use the ▶ key to select the error log clear screen.	ERROR LOG DISP CLEAR
(3)	ENTER	Press the ENTER key to clearing error logs. (However, it has not been deleted yet.)	CLEAR ERROR LOG YES
(4)	ENTER	The screen is displayed again to check. Press the ENTER key to clear all the error logs.	CLEAR ERROR LOG YES?
(5)		After the processing is completed, the display changes to the menu screen.	ERROR LOG DISP CLEAR
(6)	ESC	Press the ESC key again to return to the screen on the right.	MAINTE MENU ERROR LOG

9.4.3. ALARM LOG DISPLAY

Description

- You can display alarm logs on the screen using this function.
- A latest piece of alarm information is displayed first.
  The maximum of 12 pieces of alarm information are saved.
  Press the ▲ key to display the older pieces of alarm information.
  The latest piece of alarm information is displayed next to the oldest piece of alarm information.
- The oldest piece of alarm information is overwritten by a new one.

Procedure	Operation (example)	Displaying alarm logs on the screen	
	Key operation	Description	Displayed message (LCD)
(1)	ENTER	Display the screen on the right in accordance with the key operation summary and press the ENTER key.	MAINTE MENU ALARM LOG
(2)	▶	Use the ▶ key to select the alarm log display screen.	ALARM LOG DISP CLEAR
(3)	ENTER	Press the ENTER key, the latest alarm log appears.	YY/MM/DD HH:MM **********
(4)	▲	Press the ▲ key to display the previous piece of alarm log information.	YY/MM/DD HH:MM **********
(5)	ESC	Press the ESC key, the display returns to the screen on the right.	ALARM LOG DISP CLEAR
(6)	ESC	Press the ESC key again to return to the screen on the right.	MAINTE MENU ALARM LOG

Alarms logs

Display message	Status
High alarm	Oxygen concentration value exceeded a specified upper limit.
Low alarm	Oxygen concentration value exceeded a specified lower limit.
Hi-High alarm	Oxygen concentration value exceeded a specified upper 2 limit.
Low-Low alarm	Oxygen concentration value exceeded a specified lower 2 limit.

9.4.4. CLEARING ALARM LOGS

Description

- You can clear all alarm logs using this function.

Procedure	Operation (example)	Clearing all alarm logs saved	
	Key operation	Description	Displayed message (LCD)
(1)	ENTER	Display the screen on the right in accordance with the key operation summary and press the ENTER key.	MAINTE MENU ALARM LOG
(2)	▶	Use the ▶ key to select the alarm log clear screen.	ALARM LOG DISP CLEAR
(3)	ENTER	Press the ENTER key to perform clearing alarm logs. (However, it has not been deleted yet.)	CLEAR ALARM LOG YES
(4)	ENTER	The screen is displayed again to check. Press the ENTER key to clear all the alarm logs.	CLEAR ALARM LOG YES?
(5)		After the processing is completed, the display changes to the menu screen.	ALARM LOG DISP CLEAR
(6)	ESC	Press the ESC key again to return to the screen on the right.	MAINTE MENU ALARM LOG

9.4.5. PERFORMING A MANUAL SENSOR CHECK

Description

- Manually supply atmospheric air or air from cylinder to the detector in order to measure the electromotive force of the sensor.

Procedure	Operation (example)	Performing a sensor check on the screen.	
	Key operation	Description	Displayed message (LCD)
(1)	ENTER	Display the screen on the right in accordance with the key operation summary and press the ENTER key, the manual sensor check performing screen appears.	MAINTE MENU SENSOR CHECK
(2)		Supplying atmospheric air or air from a cylinder manually (flow rate : 30NL/h)	SENSOR CHECK START
(3)	ENTER	Press the ENTER key to perform sensor check. During the process, electromotive force of the sensor is displayed.	SENSOR CHECK 000.2 mV
(4)	ESC	Press the ESC key to return to the screen on the right.	SENSOR CHECK START
(5)		When the check is completed, manually stop supplying air to the detector.	

Caution

- If the electromotive force of the sensor is out of the range from -5.0 mV through +5.0 mV, it is recommended to replace the sensor.

9.4.6. MAINTENANCE MODE SETTING

Description

- You can set the maintenance mode to valid or invalid with this function.
- If the maintenance mode is set to valid, the analog output signal is held at the set value (see **9.5.9**) and the contact output for maintenance of the external contact is on. The data portion of the measurement screen flickers.

Procedure	Operation (example)	Setting the maintenance mode to valid	
	Key operation	Description	Displayed message (LCD)
(1)	ENTER	Display the screen on the right in accordance with the key operation summary and press the ENTER key, the maintenance mode setting screen appears.	MAINTE MENU MAINTENANCE MODE
(2)	▶ ENTER	Use the ▶ key to select the maintenance mode valid (YES). Press the ENTER key to set the value.	MAINTENANCE MODE YES NO
(3)	ENTER	Press the ENTER key.	MAINTENANCE MODE YES
(4)		The display returns to the screen on the right.	MAINTE MENU MAINTENANCE MODE

Note

- If an error occurs while the maintenance mode is enabled, error handling is prioritized.
- If the analog output hold function (error hold) is enabled, the analog output signal is held at the value set at the hold value setting (error hold).
- The data portion of the measurement screen flickers and is highlighted.

9.4.7. PASSWORD SETTING

Description

- You can set a password for switching the “Key lock function” valid/invalid, which is to prevent unauthorized people from making various setting or operating the unit manually (modification, etc.)
  Note: Refer to **9.5.16**.
- When you set the “new password” you desire, the screen transits to the password authentication screen automatically.
  After you input the “old password” in the password authentication screen, the new password will be registered.
- The factory-set password is “0000”.
  An authorized person should manage the set password for remembrance’ sake.
- Settable value: 4 digits from 0 to 9

Procedure	Operation (example)	Setting to change from old password “9999” to new password “0123”	
	Key operation	Description	Displayed message (LCD)
(5)	ENTER	Display the screen on the right in accordance with the key operation summary and press the ENTER key.	MAINTE MENU PASSWORD
(6)	▶ ▲	Use the ▶ key and the ▲ key to input the new password.	NEW PASSWORD 0123
(7)	ENTER	Press the ENTER key.	OLD PASSWORD 0000
(8)	▶ ▲	Use the ▶ key and the ▲ key to input the old password.	OLD PASSWORD 9999
(5)	ENTER	The new password is displayed by pressing the ENTER key.	NEW PASSWORD 0123
(6)	ENTER	Press the ENTER key.to go back to the screen on the right.	MAINTE MENU PASSWORD

9.4.8. PID AUTO TUNING

Description

- Heater temperature of the detector is PID controlled. This “PID auto tuning” function optimizes each value of P (proportion), I (integration), and D (derivation) for the environment where the unit is installed.
  Note : Each value of P, I and D has been set at factory. If temperature is not properly controlled, perform PID auto tuning.
- Measured value and analog output become unstable during PID auto tuning because the controlled temperature goes up and down.
- You can hold the analog output value during PID auto tuning, because it is a part of maintenance (Refer to **9.5.9**).
- You cannot use PID auto tuning with auto calibration or automatic blowdown at the same time.

Procedure	Operation (example)	Execute PID auto tuning from the screen	
	Key operation	Description	Displayed message (LCD)
(9)	ENTER	Display the screen on the right in accordance with the key operation summary and press the ENTER key to display the PID AUTO TUNING START screen.	MAINTE MENU PID AUTO TUNING
(2)	ENTER	Press the ENTER key to start PID auto tuning.	PID AUTO TUNING START
(3)		Temperature to be displayed changes during PID auto tuning..	PID AUTO TUNING ***°C
(4)		When PID auto tuning is completed automatically, the display returns to the screen on the right.	MAINTE MENU PID AUTO TUNING

How to interrupt

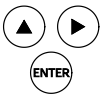
- Press the ESC key to interrupt the operation.
  If you interrupt PID auto tuning, each value of P, I and D is to be set to the value before tuning.

9.5. PARAMETER MENU

9.5.1. CURRENT DATE AND TIME SETTING

Description

- You can set a current date and time for the unit using this function.
- Settable range: date and time in the future in the calendar

Procedure	Operation (example)	Setting the current date and time to 13:00, 2015/02/25	
	Key operation	Description	Displayed message (LCD)
(1)		Display the screen on the right in accordance with the key operation summary and press the ENTER key.	PARAMETER MENU DATE SET
(2		Use the ▲ and ▶ key to set the date and time. Press the ENTER key to set the value.	DATE SET 15/02/25 13:00
(3)		The display returns to the screen on the right.	PARAMETER MENU DATE SET

9.5.2. CONTACT INPUT SETTING

Description

- You can set the functions for the contact inputs 1 to 3 using this function.
- Settable range: Select one of the following
  1. [NONE] : Performs no treatment by contact input.
  2. [BLOW DOWN ON] : Performs blowdown by contact input.
     (Switch OFF to ON to perform blowdown.)
  3. [HEATER OFF] : Turn off the heater by contact input.
     (OFF／ON:Heater ON／Heater OFF)
  4. [PROHIBIT CAL.] : Sets if calibration is prohibited or valid by contact input.
     (OFF/ON: Calibration is valid/prohibited.)
  5. [REMOTE CAL.] : Performs all calibration by contact input.
     (Switch OFF to ON to perform blowdown.)
  6. [REMOTE HOLD] : Holds the AO by contact input.
     (OFF/ON: not held/held)
  7. [CALCULATE REST] : Resets maximum and minimum calculations of O_2 by contact input.
     (Switch OFF to ON to perform reset.)
  8. [OUTPUT RANGE] : Switches the range by contact input.
     (OFF／ON: Range-1/Range-2)

Note) The functions other than “NONE” cannot be set for multiple contacts.

Procedure	Operation (example)	Setting the blowdown function for the contact input 1	
	Key operation	Description	Displayed message (LCD)
(1)	ENTER	Display the screen on the right in accordance with the key operation summary and press the ENTER key.	PARAMETER MENU DIGITAL INPUT
(2)	▲ ENTER	Use the ▲ key to select the contact input 1 setting screen. Press the ENTER key to set the value. (Also follow this procedure for the contact inputs 2 and 3.)	DIGITAL INPUT DI 1
(3)	▲	Use the ▲ key to select the function for contact input 1.	DI 1 NONE
(4)	ENTER	The item selected is highlighted. Press the ENTER key to set the value.	DI 1 BLOW DOWN ON
(5)	ENTER	Press the ENTER key.	DI 1 BLOW DOWN ON
(6)		The display returns to the screen on the right.	DIGITAL INPUT DI 1

9.5.3. SELECTION OF ALARM CONTACT OUTPUT

Description

- You can set the alarm conditions for alarm contact output using this function.
- Settable range: Select one of the following.
  1. [ALARM NONE] : Alarm contact output is not performed.
  2. [HIGH ALARM] : Alarm contact output is performed when an upper limit alarm occurs.
  3. [LOW ALARM] : Alarm contact output is performed when an lower limit alarm occurs.
  4. [H-HIGH ALARM] : Alarm contact output is performed when an upper 2 limit alarm occurs.
  5. [L-LOW ALARM] : Alarm contact output is performed when an lower 2 limit alarm occurs.
  6. [H/L ALARM] : Alarm contact output is performed when an upper or lower limit alarm occurs.
  7. [HH/LL ALARM] : Alarm contact output is performed when an upper 2 or lower 2 limit alarm occurs.

Procedure	Operation (example)	Setting the lower limit alarm function for alarm contact output	
	Key operation	Description	Displayed message (LCD)
(1)	ENTER	Display the screen on the right in accordance with the key operation summary and press the ENTER key.	PARAMETER MENU DO ALARM SET
(2)		The selection of alarm contact output setting screen appears.	DO ALARM SET ALARM NONE
(3)	▲ ENTER	Use the ▲ key to select the low alarm. Press the ENTER key to set the value.	DO ALARM SET LOW ALARM
(4)		The display returns to the screen on the right.	PARAMETER MENU DO ALARM SET

9.5.4. UPPER LIMIT SETTING OF OXYGEN CONCENTRATION

Description

- You can set the upper limit of oxygen concentration using this function.
  Use the oxygen concentration 1 for the range 1, and the oxygen concentration alarm 2 for the range 2.
- Settable range: 0.001 to 55.000 vol%

Procedure	Operation (example)	Setting the upper limit of oxygen concentration to “50.000 vol%” (Range 1)	
	Key operation	Description	Displayed message (LCD)
(1)	ENTER	Display the screen on the right in accordance with the key operation summary and press the ENTER key.	PARAMETER MENU OXYGEN ALARM 1
(2)	▲ ENTER	Use the ▲ key to select the oxygen concentration upper limit value setting screen. Press the ENTER key to set the value.	OXYGEN ALARM 1 HIGH ALARM
(3)	▲ ▶ ENTER	Use the ▲ and ▶ key to set the oxygen concentration upper limit value. Press the ENTER key to set the value.	HIGH ALARM 50.000 vol%
(4)	ENTER	Press the ENTER key.	HIGH ALARM 50.000 vol%
(5)	ESC	Press the ESC key.	OXYGEN ALARM 1 HIGH ALARM
(6)		The display returns to the screen on the right.	PARAMETER MENU OXYGEN ALARM 1

Note

- A setting error occurs if the following condition is not satisfied:
  “Upper 2 limit of oxygen concentration” ≥ “Upper limit of oxygen concentration” ≥ “Lower limit of oxygen concentration” ≥ “Lower 2 limit of oxygen concentration”

9.5.5. LOWER LIMIT SETTING OF OXYGEN CONCENTRATION

Description

- You can set the lower limit of oxygen concentration using this function.
  Use the oxygen concentration 1 for the range 1, and the oxygen concentration alarm 2 for the range 2.
- Settable range: 0.001 to 55.000 vol%

Procedure	Operation (example)	Setting the lower limit of oxygen concentration to “00.020 vol%” (Range 1)	
	Key operation	Description	Displayed message (LCD)
(1)	ENTER	Display the screen on the right in accordance with the key operation summary and press the ENTER key.	PARAMETER MENU OXYGEN ALARM 1
(2)	▲ ENTER	Use the ▲ key to select the oxygen concentration lower limit value setting screen. Press the ENTER key to set the value.	OXYGEN ALARM 1 LOW ALARM
(3)	▲ ▶ ENTER	Use the ▲ and ▶ key to set the oxygen concentration lower limit value. Press the ENTER key to set the value.	LOW ALARM 00.020 vol%
(4)	ENTER	Press the ENTER key.	LOW ALARM 00.020 vol%
(5)	ESC	Press the ESC key.	OXYGEN ALARM 1 LOW ALARM
(6)		The display returns to the screen on the right.	PARAMETER MENU OXYGEN ALARM 1

Note

- A setting error occurs if the following condition is not satisfied:
  “Upper 2 limit of oxygen concentration” ≥ “Upper limit of oxygen concentration” ≥ “Lower limit of oxygen concentration” ≥ “Lower 2 limit of oxygen concentration”

9.5.6. UPPER 2 LIMIT SETTING OF OXYGEN CONCENTRATION

Description

- You can set the upper 2 limit of oxygen concentration using this function.
  Use the oxygen concentration 1 for the range 1, and the oxygen concentration alarm 2 for the range 2.
- Settable range: 0.001 to 55.000 vol%

Procedure	Operation (example)	Setting the upper 2 limit of oxygen concentration to “55.000 vol%” (Range 1)	
	Key operation	Description	Displayed message (LCD)
(1)	ENTER	Display the screen on the right in accordance with the key operation summary and press the ENTER key.	PARAMETER MENU OXYGEN ALARM 1
(2)	▲ ENTER	Use the ▲ key to select the oxygen concentration upper 2 limit value setting screen. Press the ENTER key to set the value.	OXYGEN ALARM 1 H-HIGH ALARM
(3)	▲ ▶ ENTER	Use the ▲ and ▶ key to set the oxygen concentration upper 2 limit value. Press the ENTER key to set the value.	H-HIGH ALARM 55.000 vol%
(4)	ENTER	Press the ENTER key.	H-HIGH ALARM 55.000 vol%
(5)	ESC	Press the ESC key.	OXYGEN ALARM 1 H-HIGH ALARM
(6)		The display returns to the screen on the right.	PARAMETER MENU OXYGEN ALARM 1

Note

- A setting error occurs if the following condition is not satisfied:
  “Upper 2 limit of oxygen concentration” ≥ “Upper limit of oxygen concentration” ≥ “Lower limit of oxygen concentration” ≥ “Lower 2 limit of oxygen concentration”

9.5.7. LOWER 2 LIMIT SETTING OF OXYGEN CONCENTRATION

Description

- You can set the lower 2 limit of oxygen concentration using this function.
  Use the oxygen concentration 1 for the range 1, and the oxygen concentration alarm 2 for the range 2.
- Settable range: 0.001 to 55.000 vol%

Procedure	Operation (example)	Setting the lower 2 limit of oxygen concentration to “00.010 vol%” (Range 1)	
	Key operation	Description	Displayed message (LCD)
(1)	ENTER	Display the screen on the right in accordance with the key operation summary and press the ENTER key.	PARAMETER MENU OXYGEN ALARM 1
(2)	▲ ENTER	Use the ▲ key to select the oxygen concentration lower 2 limit value setting screen. Press the ENTER key to set the value.	OXYGEN ALARM 1 L-LOW ALARM
(3)	▲ ▶ ENTER	Use the ▲ and ▶ key to set the oxygen concentration lower 2 limit value. Press the ENTER key to set the value.	L-LOW ALARM 00.010 vol%
(4)	ENTER	Press the ENTER key.	L-LOW ALARM 00.010 vol%
(5)	ESC	Press the ESC key.	OXYGEN ALARM 1 L-LOW ALARM
(6)		The display returns to the screen on the right.	PARAMETER MENU OXYGEN ALARM 1

Note

- A setting error occurs if the following condition is not satisfied:
  “Upper 2 limit of oxygen concentration” ≥ “Upper limit of oxygen concentration” ≥ “Lower limit of oxygen concentration” ≥ “Lower 2 limit of oxygen concentration”

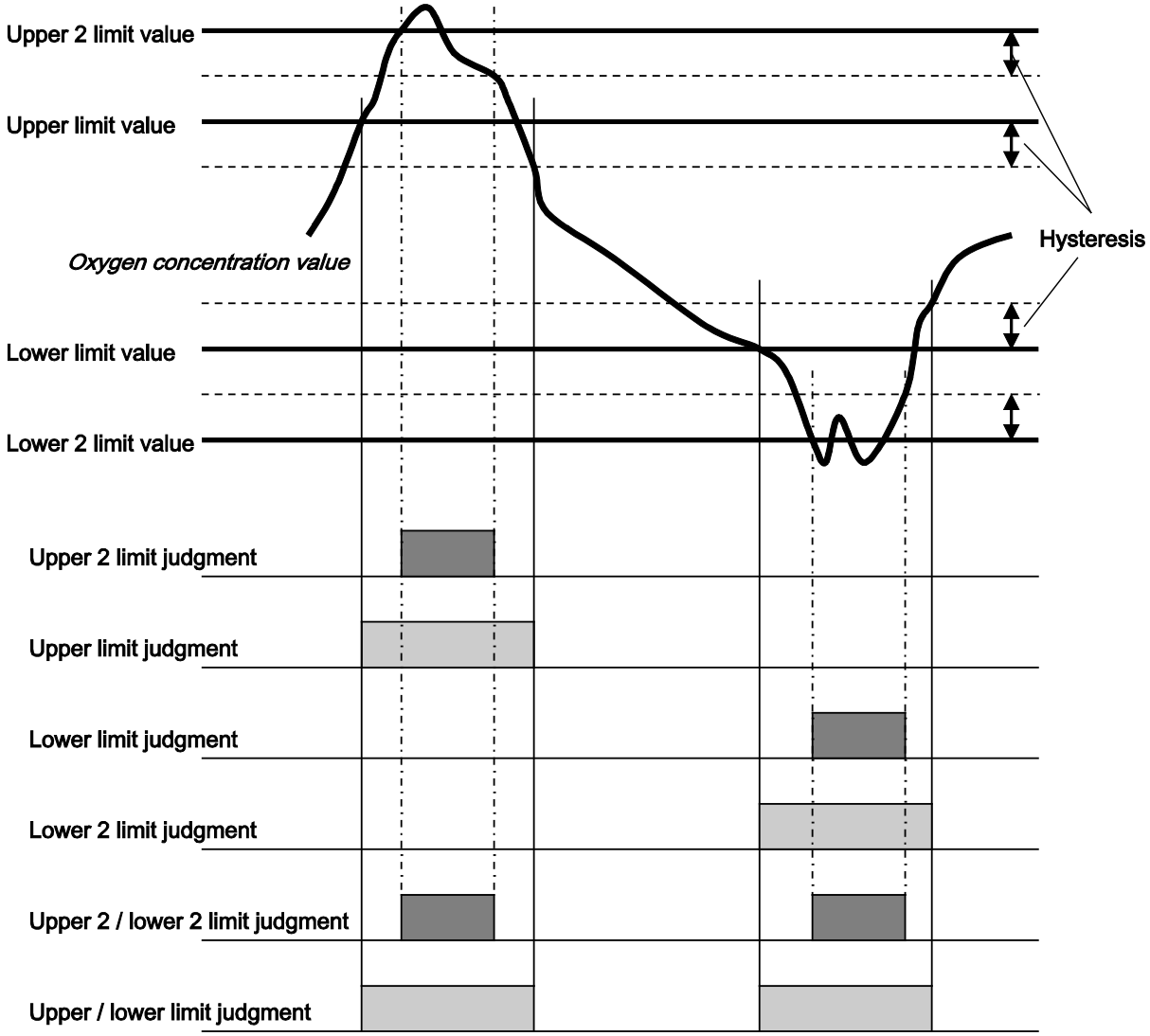
9.5.8. HYSTERESIS SETTING

Description

- You can set the hysteresis for alarm condition of oxygen concentration.
  Use the oxygen concentration 1 for the range 1, and the oxygen concentration alarm 2 for the range 2.
  Perform the setting using the percentage (%) of the range compared to the full scale.
- Settable range: 0 to 20 %

Procedure	Operation (example)	Setting the hysteresis for alarm condition of oxygen concentration to “20%” (Range 1)	
	Key operation	Description	Displayed message (LCD)
(1)	ENTER	Display the screen on the right in accordance with the key operation summary and press the ENTER key.	PARAMETER MENU OXYGEN ALARM 1
(2)	▲ ENTER	Use the ▲ key to select the hysteresis setting screen. Press the ENTER key to set the value.	OXYGEN ALARM 1 HYSTERESIS
(3)	▲ ▶ ENTER	Use the ▲ and ▶ key to set the hysteresis. Press the ENTER key to set the value.	HYSTERESIS 20 %
(4)	ENTER	Press the ENTER key.	HYSTERESIS 20 %
(5)	ESC	Press the ESC key.	OXYGEN ALARM 1 HYSTERESIS
(6)		The display returns to the screen on the right.	PARAMETER MENU OXYGEN ALARM 1

Hysteresis : If the value fluctuates around the condition value, there is a possibility that alarms occur frequently. When determining alarms, set a hysteresis width for the condition in order to prevent chattering. For alarm check, set the percentage (%) of the range compared to the full scale as hysteresis width (see the figure below).This is common among “Upper 2 limit value,” “Upper limit value,” “Lower limit value,” and “Lower 2 value.”



9.5.9. HOLD TREATMENT SETTING (MAINTENANCE HOLD)

Description

- You can set if the analog output hold function is valid or invalid using this function.
- If the analog output hold function is valid, the value set for the analog output is held at the value set for analog output when the following treatment is performed.
  - ・Calibration (Auto, All, Manual, Remote)
  - ・Blowdown (Auto, Manual, Remote)
  - ・Sensor diagnosis, Sensor recoverable
  - ・While the maintenance mode is set to “Valid.”

Procedure	Operation (example)	Setting the analog output hold function to valid	
	Key operation	Description	Displayed message (LCD)
(1)	ENTER	Display the screen on the right in accordance with the key operation summary and press the ENTER key.	PARAMETER MENU AO HOLD (MAINTE)
(2)	ENTER	Press the ENTER key. The analog output hold setting screen appears.	AO HOLD (MAINTE) OUTPUT HOLD
(3)	▶ ENTER	Use the ▶ key to select the output hold valid (YES). Press the ENTER key to set the value.	OUTPUT HOLD YES NO
(4)	ENTER	Press the ENTER key.	OUTPUT HOLD YES
(5)		The display returns to the screen on the right.	AO HOLD (MAINTE) OUTPUT HOLD

Note

- If an error occurs while the analog output hold function (error hold) is set to “Valid,” error hold processing is prioritized.
- Analog output signal during warming up is held at 0% (4 mA/0 V).

9.5.10. HOLD VALUE SETTING (MAINTENANCE HOLD)

Description

- Using this function, you can set the output value of analog output signal when the analog output hold function (maintenance hold) is enabled.
- If the maintenance mode is set to “Valid,” analog output signal is held at the value set in this procedure.
- Settable range: Select one of the following.
  - (1) [0%] : Held at 0% (4 mA/0 A).
  - (2) [100%] : Held at 100% (20 mA/1 A).
  - (3) [Last value] : Held at the value immediately before the value for analog hold.
  - (4) [Setting value] : Held at the value set (Refer to **9.5.11**)

Procedure	Operation (example)	Setting the output value of analog output hold to “0%”	
	Key operation	Description	Displayed message (LCD)
(1)	ENTER	Display the screen on the right in accordance with the key operation summary and press the ENTER key.	PARAMETER MENU AO HOLD (MAINTE)
(2)	▲ ENTER	Press the ▲ key to display the screen on the right and press the ENTER key. The analog output hold value setting screen appears.	AO HOLD (MAINTE) OUTPUT SELECT
(3)	▲ ENTER	Use the ▲ key to select the hold value. Press the ENTER key to set the value.	OUTPUT SELECT 0%
(4)	ENTER	Press the ENTER key.	OUTPUT SELECT 0%
(5)		The display returns to the screen on the right.	AO HOLD (MAINTE) OUTPUT SELECT

9.5.11. SETTING OF HOLD SETTING VALUE (MAINTENANCE HOLD)

Description

- Using this function, you can set the output value of analog output signal to an arbitrary value when the analog output hold function (maintenance hold) is enabled.
  This function is to set the output value of an analog output at a percentage (%) of the full-scale value, when “setting value” is selected and specified on **9.5.10**.
- Settable range: 0 to 100 %

Procedure	Operation (example)	Setting the output value of analog output hold to “000%”	
	Key operation	Description	Displayed message (LCD)
(1)	ENTER	Display the screen on the right in accordance with the key operation summary and press the ENTER key.	PARAMETER MENU AO HOLD (MAINTE)
(2)	▲ ENTER	Press the ▲ key to display the screen on the right and press the ENTER key. The hold setting value setting screen appears.	AO HOLD (MAINTE) HOLD VALUE
(3)	▲ ▶ ENTER	Use the ▲ and ▶ key to set the hold value. Press the ENTER key to set the value.	HOLD VALUE 000 %
(4)	ENTER	Press the ENTER key.	HOLD VALUE 000 %
(5)		The display returns to the screen on the right.	AO HOLD (MAINTE) HOLD VALUE

9.5.12. SETTING OF MEASUREMENT RECOVERY TIME (MAINTENANCE HOLD)

Description

- Using this function, you can set the time between hold condition (such as a calibration processing) and returning to the measurement condition (extension of hold) when the analog output hold function (maintenance hold) is enabled.
- Settable range: 0 to 300 sec.

Procedure	Operation (example)	Setting the time for extension of hold to “10 seconds”	
	Key operation	Description	Displayed message (LCD)
(1)	(ENTER)	Display the screen on the right in accordance with the key operation summary and press the (ENTER) key.	PARAMETER MENU AO HOLD (MAINTE)
(2)	(▲) (ENTER)	Press the (▲) key to display the screen on the right and press the (ENTER) key. The measurement recovery time setting screen appears.	AO HOLD (MAINTE) MEAS. WAIT TIME
(3)	(▲) (▶) (ENTER)	Use the (▲) and (▶) key to set the measurement recovery time. Press the (ENTER) key to set the value.	MEAS. WAIT TIME 010 S
(4)	(ENTER)	Press the (ENTER) key.	MEAS. WAIT TIME 010 S
(5)		The display returns to the screen on the right.	AO HOLD (MAINTE) MEAS. WAIT TIME

9.5.13. HOLD TREATMENT SETTING (ERROR HOLD)

Description

- Using this function, you can set whether the analog output hold function is valid or invalid when an error occurs.
- If the analog output hold function (error hold) is set to valid, analog output signal is held at the set value (see **9.5.14**) if an error occurs.

Procedure	Operation (example)	Setting the analog output hold function to valid	
	Key operation	Description	Displayed message (LCD)
(1)	ENTER	Display the screen on the right in accordance with the key operation summary and press the ENTER key.	PARAMETER MENU AO HOLD (ERROR)
(2)	ENTER	Press the ENTER key. The analog output hold setting screen appears.	AO HOLD (ERROR) OUTPUT HOLD
(3)	▶ ENTER	Use the ▶ key to select the output hold valid (YES). Press the ENTER key to set the value.	OUTPUT HOLD YES NO
(4)	ENTER	Press the ENTER key.	OUTPUT HOLD YES
(5)		The display returns to the screen on the right.	AO HOLD (ERROR) OUTPUT HOLD

Note

- If an error occurs while the analog output hold function (error hold) is set to “Valid,” error hold processing is prioritized.
- Analog output signal during warming up is held at 0% (4 mA/0 V).

9.5.14. HOLD VALUE SETTING (ERROR HOLD)

Description

- Using this function, you can set (select) the output value of analog output signal when the analog output hold function (error hold) is enabled.
- If the maintenance mode is set to "Valid," analog output signal is held at the value set in this procedure.
- Settable range: Select one of the following.
  - (1) [0%] : Held at 0% (4 mA/0 A).
  - (2) [100%] : Held at 100% (20 mA/1 A).
  - (3) [Last value] : Held at the value immediately before the value for analog hold.
  - (4) [Setting value] : Held at the value set (Refer to **9.5.15**)

Procedure	Operation (example)	Setting the output value of analog output hold to "0%"	
	Key operation	Description	Displayed message (LCD)
(1)	ENTER	Display the screen on the right in accordance with the key operation summary and press the ENTER key.	PARAMETER MENU AO HOLD (ERROR)
(2)	▲ ENTER	Press the ▲ key to display the screen on the right and press the ENTER key. The analog output hold value setting screen appears.	AO HOLD (ERROR) OUTPUT SELECT
(3)	▲ ENTER	Use the ▲ key to select the hold value. Press the ENTER key to set the value.	OUTPUT SELECT 0%
(4)	ENTER	Press the ENTER key.	OUTPUT SELECT 0%
(5)		The display returns to the screen on the right.	AO HOLD (ERROR) OUTPUT SELECT

9.5.15. SETTING OF HOLD SETTING VALUE (ERROR HOLD)

Description

- Using this function, you can set the output value of analog output signal to an arbitrary value when the analog output hold function (error hold) is enabled.
- This function is enabled if “Setting value” is set (Refer to **9.5.14**).
- Set the output value of analog output signal as a percentage (%) of the full-scale value of the display range. 0% is equivalent to 0 vol% (4 mA/0 V) and 100 % is to the full-scale value (20 mA/1 V).
- Settable range: 0 to 100 %

Procedure	Operation (example)	Setting the output value of analog output hold to “000%”	
	Key operation	Description	Displayed message (LCD)
(1)	ENTER	Display the screen on the right in accordance with the key operation summary and press the ENTER key.	PARAMETER MENU AO HOLD (ERROR)
(2)	▲ ENTER	Press the ▲ key to display the screen on the right and press the ENTER key. The hold setting value setting screen appears.	AO HOLD (ERROR) HOLD VALUE
(3)	▲ ▶ ENTER	Use the ▲ and ▶ key to set the hold value. Press the ENTER key to set the value.	HOLD VALUE 000 %
(4)	ENTER	Press the ENTER key.	HOLD VALUE 000 %
(6)	ENTER	Press the ENTER key to return to the screen on the right.	AO HOLD (ERROR) HOLD VALUE

9.5.16. SETTING OF KEY LOCK

Description

- Authorized person can set if the key lock is valid or invalid using this function.
  You need a “password” to make setting if the key lock is valid or invalid.
  Note: Refer to **9.4.7**.
- If the key lock is valid, you cannot make settings and manually operate the unit (manual blow down, manual calibration, etc.). However, you can see the screen transition and setting values.

Procedure	Operation (example)	Setting the key lock to valid	
	Key operation	Description	Displayed message (LCD)
(1)	ENTER	Display the screen on the right in accordance with the key operation summary and press the ENTER key.	PARAMETER MENU KEY LOCK
(2)	▶	Use the ▶ key to select the key lock valid (YES) or invalid (NO).	KEY LOCK YES NO
(3)	ENTER	Press the ENTER key.	INPUT PASSWORD 0000
(4)	▲ ▶	Use the ▲ and ▶ key to input the password.	INPUT PASSWORD 0123
(5)	ENTER	Press the ENTER key.	KEY LOCK YES
(6)	ENTER	Press the ENTER key to return to the screen on the right.	PARAMETER MENU KEY LOCK

9.5.17. SETTING OF AUTOMATIC OFF TIME

Description

- You can set the time for automatically turning off the backlight of the LCD (screen) using this function. When the time set for turning off the backlight elapses after the last operation, the backlight is turned off.
  (Press any key to turn on the backlight.)
  If 00 seconds is set, the backlight is not turned off.
- Settable range: 0 to 99 min.

Procedure	Operation (example)	Setting the time for automatically turning off the backlight to 10 minutes	
	Key operation	Description	Displayed message (LCD)
(1)	ENTER	Display the screen on the right in accordance with the key operation summary and press the ENTER key.	PARAMETER MENU BACKLIGHT TIME
(2)	▲ ▶ ENTER	Use the ▲ and ▶ key to set the automatic OFF time. Press the ENTER key to set the value.	BACKLIGHT TIME 10 m
(3)	ENTER	Press the ENTER key.	BACKLIGHT TIME 10 m
(4)		The display returns to the screen on the right.	PARAMETER MENU BACKLIGHT TIME

9.5.18. STATION NUMBER SETTING

Description

- You can set the station number of the unit for MODBUS communication using this function.
- Settable range: 0 to 99

Procedure	Operation (example)	Setting the station number to 01	
	Key operation	Description	Displayed message (LCD)
(1)	ENTER	Display the screen on the right in accordance with the key operation summary and press the ENTER key.	PARAMETER MENU STATION NO
(2)	▲ ▶ ENTER	Use the ▲ and ▶ key to set the station number. Press the ENTER key to set the value.	STATION NO 01
(3)	ENTER	Press the ENTER key.	STATION NO 01
(4)		The display returns to the screen on the right.	PARAMETER MENU STATION NO

9.5.19. ADJUSTEMT SCREEN FOR ANALOG OUTPUT 0%

Description

- You can adjust the analog output 0% using this function.

Procedure	Operation (example)	Adjusting the analog output 0% (4 mA)	
	Key operation	Description	Displayed message (LCD)
(1)		Connect the ammeter to the analog output terminals.	
(2)	ENTER	Display the screen on the right in accordance with the key operation summary and press the ENTER key.	PARAMETER MENU A-OUT ADJUST
(3)	ENTER	Press the ENTER key. The analog output 0% adjustment screen appears.	A-OUT ADJUST ANALOG OUT 0%
(4)	▶ ▲	Adjust the analog output with the ▶ and ▲ keys. Switch between “DOWN” and “UP” with the ▶ key. Adjust the value to 4 mA with the ▲ key, checking the analog output with the ammeter.	ADUST ****** 0% DOWN
	ENTER	Press the ENTER key to set the value.	
(5)		The display returns to the screen on the right.	A-OUT ADJUST ANALOG OUT 0%
(6)		Remove the ammeter connected to the analog output terminals.	

9.5.20. ADJUSTMENT SCREEN FOR ANALOG OUPUT 100%

Description

- You can adjust the analog output 100% using this function.

Procedure	Operation (example)	Adjusting the analog output 100% (20 mA)	
	Key operation	Description	Displayed message (LCD)
(1)		Connect the ammeter to the analog output terminals.	
(2)	ENTER	Display the screen on the right in accordance with the key operation summary and press the ENTER key.	PARAMETER MENU A-OUT ADJUST
(3)	ENTER	Press the ENTER key. The analog output adjustment screen appears.	A-OUT ADJUST ANALOG OUT 100%
(4)	▲ ENTER	Press the ▲ key. Press the ENTER key. The analog output 100% adjustment screen appears.	A-OUT ADJUST ANALOG OUT 100%
(5)	▶ ▲ ENTER	Adjust the analog output with the ▶ and ▲ keys. Switch between “DOWN” and “UP” with the ▶ key. Adjust the value to 20 mA with the ▲ key, checking the analog output with the ammeter. Press the ENTER key to set the value.	ADUST ****** 100% DOWN
(6)		The display returns to the screen on the right.	A-OUT ADJUST ANALOG OUT 100%
(7)		Remove the ammeter connected to the analog output terminals.	

9.6. FACTORY MENU

9.6.1. PASSWORD INPUT SCREEN

Description

- You can input the password for authorization authentication in this screen in order to execute the factory setting menu.
  Customers cannot execute the factory setting menu.

Caution

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

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