User's Manual

ZR802S Explosion-proof Zirconia Oxygen Analyzer, Converter

IM 11M13G01-02EN

YOKOGAWA
Yokogawa Electric Corporation

IM 11M13G01-02EN
6th Edition

Introduction

Thank you for purchasing the ZR802S Explosion-proof Zirconia Oxygen Analyzer, Converter.

Please read the following respective documents before installing and using the ZR802S Explosion-proof Zirconia Oxygen Analyzer, Converter.

The related documents are as follows.

General Specifications

Contents	Document number	Note
ZR22S, ZR802S, and ZR202S Explosion-proof Zirconia Oxygen Analyzer, Converter	GS 11M13G01-01EN	Online manual

* the “EN” in the document number is the language code.

User’s Manual

Contents	Document number	Note
ZR802S Explosion-proof Zirconia Oxygen Analyzer, Converter Start-up and Safety Precautions	IM 11M13G01-01EN	Printed manual
ZR802S Explosion-proof Zirconia Oxygen Analyzer, Converter	IM 11M13G01-02EN	Online manual (This manual)

* the “EN” in the document number is the language code.

Technical Information

Contents	Document number	Note
ZR802G and ZR802S Zirconia Oxygen/Humidity Analyzer, Converter HART Communication	TI 11M12G01-61EN	Online manual
ZR802G and ZR802S Zirconia Oxygen/Humidity Analyzer, Converter MODBUS Communication	TI 11M12G01-62EN	Online manual

* the “EN” in the document number is the language code.

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http://www.yokogawa.com/an/zr802/download/

An exclusive User’s Manual might be attached to the products whose suffix codes or option codes contain the code “Z” (made to customers' specifications). Please read it along with this manual.

The Explosion-proof Zirconia Oxygen Analyzer, Converter has been developed for combustion control in various industrial processes. This analyzer basically consists of a detector and a converter. You can select between several versions, based upon your application.

Optional accessories are also available to improve measurement accuracy and automate calibration. An optimal control system can be realized by adding appropriate options.

This instruction manual refers to almost all of the equipment related to the ZR.
You may skip any section(s) on the equipment which is not included in your system.

This user's manual describes the way of installation, operation, maintenance, and others about Zirconia Oxygen Analyzer. Please note that some part of this manual may mention the products or system that you don't use.

Models and descriptions in this manual are listed below.

Models and descriptions in this manual

Model	Product Name	Description in this manual				
		Specification	Installation	Operation	Maintenance	CMPL
ZR22S	General-purpose detector			○		
ZR22S	High temperature detector (0.15 m)					
ZR802S	Zirconia Oxygen Analyzer	○	○		○	○
ZO21R	Probe protector for ZR22S		○			
ZO21P	High temperature probe adapter		○			
ZA8F	Flow setting unit (for manual calibration use)	○	○	○		
-	Auxiliary ejector assembly for high temperature use (Part No. E7046EC, 7046EN)					
-	Calibration gas unit case (Part No. E7044KF)					
-	Check valve (Part No.9292DN, K9292DS)	○	○			

CMPL : Customer Maintenance Parts List

This manual consists of twelve chapters. Please refer to the reference chapters for installation, operation and maintenance.

Table of Contents

Chapter	Outline	Relates to		
		Installation	Operation	Maintenance
1. Overview	Equipment models and system configuration examples	B	C	B
2. Specifications	Standard specification, model code (or part number), dimension drawing for each equipment	A	B	B
3. Installation	Installation method for each equipment	A		C
4. Wiring	Wiring procedures such as "Power supply wiring", "output signal wiring" or others	A		C
5. Components and Their Functions	Major parts and function are described in this manual	C	B	B
6. Startup	Basic procedure to start operation of Zirconia Oxygen Analyzer, Converter. Chapter 7 enables you to operate the equipment immediately.		A	C
7. Detailed Data Setting	Details of key operations and displays		B	C
8. Calibration	Describes the calibration procedure required in the course of operation.		B	C
9. Other Functions	Other functions described		B	A
10. Inspection and Maintenance	How to conduct maintenance of Zirconia Oxygen Analyzer, Converter and procedures for replacement of deteriorated parts		B	A
11. Troubleshooting	This chapter describes measures to be taken when an abnormal condition occurs.		C	B
CMPL (parts list)	User replaceable parts list		C	A

A: Read and completely understand before operating the equipment.
B: Read before operating the equipment, and refer to it whenever necessary.
C: Recommended to read it at least once.

Precautions in Handling Explosion-proof Zirconia Oxygen Analyzer, Converter

The Explosion-proof Zirconia Oxygen Analyzer, Converter (ZR802S) are designed as explosion-proof instruments.

When using either of these instruments in an explosion-susceptible hazardous area, note the following and observe the given precautions:

Use only the supplied, the Explosion-proof Zirconia Oxygen Analyzer, Converter (ZR802S) and accessories, or any explosion-proof certification may be invalidated.

For the details, refer to the system configurations in the manual.

CAUTION

Only trained persons use this instrument in industrial locations.

For the safe use of this equipment

WARNING

Handle it with care. Be sure not to accidentally drop it.

Handle safely to avoid injury.

Connect the power supply cord only after confirming that the supply voltage matches the rating of this equipment. In addition, confirm that the power is switched off when connecting power supply.

Some process gas is dangerous to people. When removing this equipment from the process line for maintenance or other reasons, protect yourself from potential poisoning by using a protective mask or ventilating the area well.

CAUTION

Oxygen concentration of sample/reference /calibration gas shall not exceed that found in normal air, typically 21 vol%.

CAUTION

The cell (sensor) at the tip of the detector is made of ceramic (zirconia element). Do not drop the detector or subject it to pressure stress.

- Do NOT allow the sensor (probe tip) to make contact with anything when installing the detector.
- Avoid any water dropping directly on the probe (sensor) of the detector when installing it.
- Check the calibration gas piping before introducing the calibration gas to ensure that there is no leakage of the gas. If there is any leakage of the gas, the moisture drawn from the sample gas may damage the sensor.
- The detector (especially at the tip) becomes very hot. Be sure to handle it with gloves.

CAUTION

This instrument is tested and certificated as explosion-proof type. Please note that the construction of the instrument, installation, external wiring, maintenance or repair is strictly restricted, and non-observation or negligence of this restriction would result in dangerous condition.

NOTICE

Specification check

When the instrument arrives, unpack the package with care and check that the instrument has not been damaged during transportation. In addition, please check that the specification matches the order, and required accessories are not missing. Specifications can be checked by the model codes on the nameplate. Refer to Chapter 2 Specifications for the list of model codes.

Details on operation parameters

When the Separate type Oxygen Analyzer arrives at the user site, it will operate based on the operation parameters (initial data) set before shipping from the factory.
Ensure that the initial data is suitable for the operation conditions before conducting analysis. Where necessary, set the instrument parameters for appropriate operation.
For details of setting data, refer to chapters 7 to 10.
When user changes the operation parameter, it is recommended to note down the changed setting data.

◆ Safety Precautions

■ Notes on Handling User's Manuals

- Please hand over the user's manuals to your end users so that they can keep the user's manuals on hand for convenient reference.
- Please read the information thoroughly before using the product.
- The purpose of these user's manuals is not to warrant that the product is well suited to any particular purpose but rather to describe the functional details of the product.
- No part of the user's manuals may be transferred or reproduced without prior written consent from YOKOGAWA.
- YOKOGAWA reserves the right to make improvements in the user's manuals and product at any time, without notice or obligation.
- If you have any questions, or you find mistakes or omissions in the user's manuals, please contact our sales representative or your local distributor.

■ Drawing Conventions

Some drawings may be partially emphasized, simplified, or omitted, for the convenience of description.

Some screen images depicted in the user's manual may have different display positions or character types (e.g., the upper / lower case). Also note that some of the images contained in this user's manual are display examples.

■ Trademark Notices

All other company and product names mentioned in this user's manual are trademarks or registered trademarks of their respective companies.

We do not use TM or ® mark to indicate those trademarks or registered trademarks in this user's manual.

■ Product Disposal

The instrument should be disposed of in accordance with local and national legislation/ regulations.

■ Safety, Protection, and Modification of the Product

- In order to protect the system controlled by the product and the product itself and ensure safe operation, observe the safety precautions described in this user's manual. We assume no liability for safety if users fail to observe these instructions when operating the product.
- If this instrument is used in a manner not specified in this user's manual, the protection provided by this instrument may be impaired.
- If any protection or safety circuit is required for the system controlled by the product or for the product itself, prepare it separately.
- Be sure to use the spare parts approved by Yokogawa Electric Corporation (hereafter simply referred to as YOKOGAWA) when replacing parts or consumables.
- Modification of the product is strictly prohibited.
- The following safety symbols are used on the product as well as in this manual.

WARNING

This symbol indicates that an operator must follow the instructions laid out in this manual in order to avoid the risks, for the human body, of injury, electric shock, or fatalities. The manual describes what special care the operator must take to avoid such risks.

CAUTION

This symbol indicates that the operator must refer to the instructions in this manual in order to prevent the instrument (hardware) or software from being damaged, or a system failure from occurring.

CAUTION

This symbol gives information essential for understanding the operations and functions.

NOTE

This symbol indicates information that complements the present topic.

This symbol indicates Protective Ground Terminal.

Warning and Disclaimer

The product is provided on an “as is” basis. YOKOGAWA shall have neither liability nor responsibility to any person or entity with respect to any direct or indirect loss or damage arising from using the product or any defect of the product that YOKOGAWA can not predict in advance.

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Precautions for the product

WARNING

Installation and wiring

The ZR802G should only be used with equipment that meets the relevant IEC, American or Canadian standards.

Yokogawa accepts no responsibility for the misuse of this unit.

Don't install instruments in the hazardous area.

Do not use an abrasive or organic solvent in cleaning the instrument.

Electrostatic discharge

The ZR802G contains devices that can be damaged by electrostatic discharge. When servicing this equipment, please observe proper procedures to prevent such damage. Replacement components should be shipped in conductive packaging. Repair work should be done at grounded workstations using grounded soldering irons and wrist straps to avoid electrostatic discharge.

CAUTION

The Instrument is packed carefully with shock absorbing materials, nevertheless, the instrument may be damaged or broken if subjected to strong shock, such as if the instrument is dropped. Handle with care.

This instrument is a Class A product, and it is designed for use in the industrial environment. Please use this instrument in the industrial environment only.

The HART communication may be influenced by strong electromagnetic field.

In this case another trial of the HART communication and/or operation with ZR802G touch screen can be carried out.

Other precautions

- Operations of this equipment are performed by touch screen.
  Press the appropriate part of the Display screen to expand the screen, and the calibration operation and setup change can be performed easily. Pay attention to erroneous operation.

Warning and Disclaimer

The product is provided on an “as is” basis. YOKOGAWA shall have neither liability nor responsibility to any person or entity with respect to any direct or indirect loss or damage arising from using the product or any defect of the product that YOKOGAWA can not predict in advance.

Notes on Handling User’s Manuals

- Please hand over the user’s manuals to your end users so that they can keep the user’s manuals on hand for convenient reference.
- Please read the information thoroughly before using the product.
- The purpose of these user’s manuals is not to warrant that the product is well suited to any particular purpose but rather to describe the functional details of the product.
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- If you have any questions, or you find mistakes or omissions in the user’s manuals, please contact our sales representative or your local distributor.

Drawing Conventions

Some drawings may be partially emphasized, simplified, or omitted, for the convenience of description.

Some screen images depicted in the user’s manual may have different display positions or character types (e.g., the upper / lower case). Also note that some of the images contained in this user’s manual are display examples.

Product Disposal:

The instrument should be disposed of in accordance with local and national legislation/regulations.

◆ CE marking products

■ Authorized Representative in the EEA and the Importer into the EU/ EEA Market

The Authorized Representative for this product in the EEA and the importer for this product into the EU/EEA market via Yokogawa sale channel is:

Yokogawa Europe B.V.
Euroweg 2, 3825 HD Amersfoort, The Netherlands

■ Identification Tag

This manual and the identification tag attached on packing box are essential parts of the product.

Keep them together in a safe place for future reference.

■ Users

This product is designed to be used by a person with specialized knowledge.

■ How to dispose Batteries and Waste batteries:

(Only valid in the EU for EU Battery Directive/Regulation and in the UK for UK Battery Regulation)

Batteries are included in this product. This marking indicates they shall be sorted out and collected as ordained in the EU battery Directive/Regulation and UK battery Regulation.

When you need to replace batteries, contact your local Yokogawa office in the EEA and/or UK respectively.

Do not dispose them as domestic household waste.

Battery type : Manganese dioxide lithium battery

Notice: The symbol (see above) means they shall be sorted out and collected as ordained in the EU Battery Directive.

■ Information of the WEEE Directive

This product is purposely designed to be used in a large scale fixed installations only and, therefore, is out of scope of the WEEE Directive. The WEEE Directive does not apply.
This product should be disposed in accordance with local and national legislation/regulations.
The WEEE Directive is only valid in the EU and UK.

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ZR802S
Explosion-proof
Zirconia Oxygen Analyzer, Converter

IM 11M13G01-02EN 6th Edition

CONTENTS

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1. Overview

The ZR802S converter uses a digital display, displays the cell temperature and cell emf in addition to the oxygen concentration and includes a Human Machine Interface (HMI), that offers easy touch panel operation.

This analyzer is most suitable for monitoring combustion and controlling the low-oxygen combustion of various industrial furnaces in explosive atmosphere at petroleum refinery, petrochemical plant, and natural gas plant.

Some examples of typical system configurations are illustrated below:

1.1 System Configuration

The system configuration should be determined by the conditions; e.g. whether calibration is to be automated, and whether flammable gas is present and requires safety precautions. The system configuration can be classified into two basic patterns as follows:

1.1.1 System 1

This system is for monitoring and controlling oxygen concentration in the combustion gases of a large-size boiler or heating furnace. Clean (dry) air (21%O_2) is used as the reference gas and the span gas for calibration. Zero gas is fed in from a cylinder during calibration. The gas flow is controlled by the ZA8F flow setting unit (for manual valve operation).

System configuration Example 1 of Separate type Analyzer

- Automatic calibration system uses instrument air for reference gas.
  For the calibration gas, a standard gas cylinder may be used for more accurate calibration.
- Applications: Oxygen concentration monitoring and control in boilers.
  (for private and public power generation) and in heating furnaces.

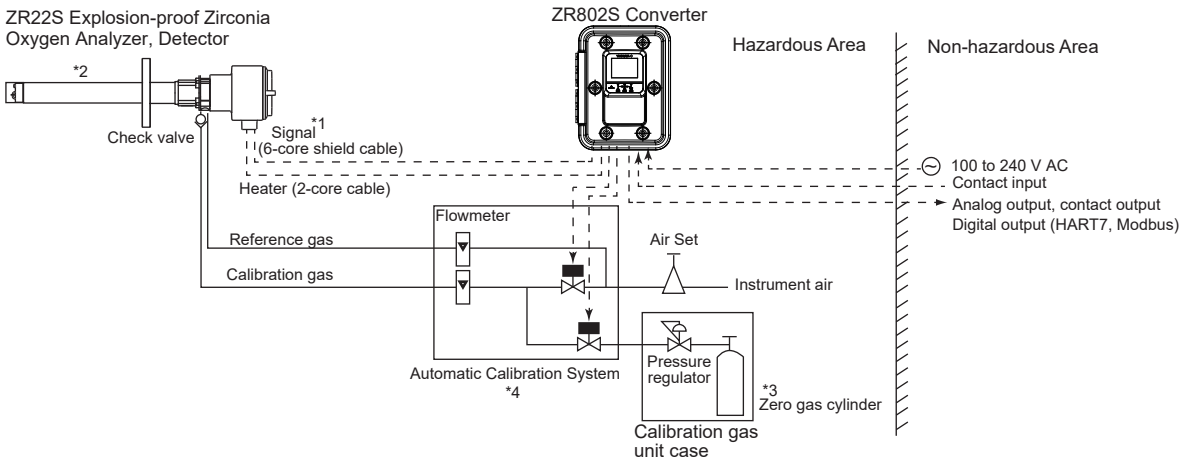
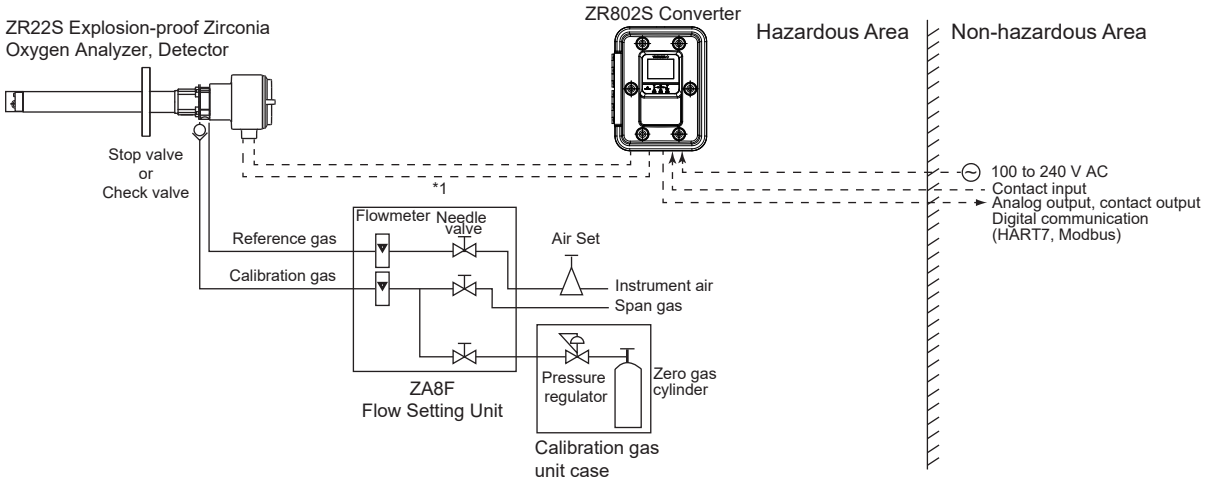


Figure 1.1 System configuration Ex. 1

1.1.2 System 2

This example, System 2, represents typical applications in large boilers and heating furnaces, where there is a need to monitor and control oxygen concentration. The reference gas and calibration-time span gas are (clean, dry) instrument air. Zero gas is supplied from a gas cylinder.

System 2 uses the automatic calibration system, with auto-switching of the calibration gas. A “combustible gas detected” contact input turns off power to the heater. There’s also contact output from the converter that can be used to operate a purge gas valve to supply air to the sensor.



*1 Shield cable: Use shielded signal cables, and connect the shields to the FG terminal of the converter.

Figure 1.2 System configuration Ex. 2

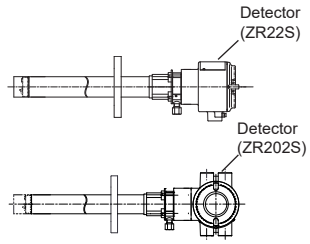
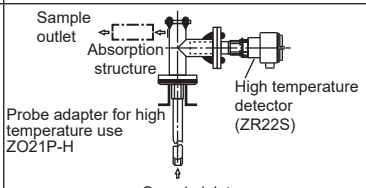
1.2 System Components

Table 1.1 System Components

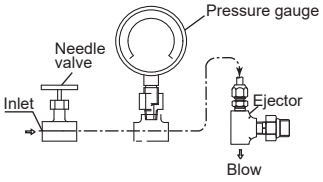
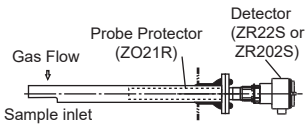
	Model or Partnumber	System Components	Separate type system config.	
			Ex.1	Ex.2
1	ZR22S	Explosion-proof Zirconia Oxygen Analyzer, Detector	●	●
2	ZR802S	Explosion-proof Zirconia Oxygen Analyzer, Converter	●	●
3	ZR202S	Integrated type Explosion-proof Zirconia Oxygen Analyzer		
4	ZO21P	Probe Adapter	○	○
5	E7046EC/E7046EN	Ejector Assembly for High Temperature Probe of Oxygen Analyzer	○	○
6	ZO21R-L	Probe Protector for Oxygen Analyzer	○	○
7	ZA8F	Flow Setting Unit for manual calibration		●
—	—	Automatic Calibration Unit for the Hazardous area(*1)	●	
8	L9852CB/G7016XH	Stop Valve for Calibration gas line (*2)		(●)
9	K9292DN/K9292DS	Check Valve for Calibration gas line (*2)	●	(●)
"10 "	"G7003XF/K9473XK, G7004XF/K9473XG"	Air Set	●	●
11	G7001ZC	Zero gas Cylinder	●	●
12	G7013XF/G7014XF	Pressure Regulator for Gas Cylinder	●	●
13	E7044KF	Case Assembly for Calibration-gas Cylinder	●	●
14	ZR22A	Heater Assembly for ZR22S	○	○

●: Items required for the above system example
○: To be selected depending on each application. For details, refer to Chapter of Options.
(●): Select either
(*1): You can use this when option code of “/AC” is specified. Customers should provide.
(*2): When ZR22S specifies Stop valve (/SV) or Check valve (/CV) as an option code, they are correspondingly installed in the equipment.

Detector Components

<table>
<tr><th colspan="3">Sample gas temperature 0 to 700ºC</th><th colspan="3">Sample gas temperature 700 to 1400ºC</th></tr>
<tr><th>Mounting</th><th>Insertion length</th><th>General use Probe</th><th>Application</th><th>High temperature detector</th><th>Application</th></tr>
<tr><td rowspan="2">Horizontal to vertical</td><td rowspan="2">2 m or less</td><td> 
</td><td>Boiler
Heating furnace</td><td rowspan="2"> 

Temperature:
Probe material; SUS310S 800ºC
Probe material; SiC 1400ºC
Mounting: Vertical downwards
Insertion length: 1.0m, 1.5m
When duct pressure is atmospheric or negative, attach air ejector.

High temperature ejector assembly (E7046EC, E7046EN)
 
</td><td rowspan="2">Heating furnace</td></tr>
<tr><td> 
</td><td>For pulverized coal boiler with gas flow velocity 10 m/sec or more</td></tr>
</table>

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2. Specifications

This chapter describes the specifications for the following:

ZR802S	Zirconia Oxygen Converter (See Section 2.2)
ZA8F	Flow Setting Unit (See Section 2.3)

CAUTION

Oxygen concentration of sample/reference /calibration gas shall not exceed that found in normal air, typically 21 vol%.

2.1 General Specifications

Standard Specifications

Measurement Object: Oxygen concentration in combustion exhaust gas and mixed gas (excluding inflammable gases)
Measurement System: Zirconia system
Oxygen Concentration: 0.01 to 21 vol%O2
Note: In the case of explosion-proof use, oxygen concentration shall not exceed that found in normal air, typically 21%
Measurement Range: 0.01 to 100 vol% O2
Output Signal: 4 to 20 mA DC (maximum load resistance 550 Ω)
Setting Range: Any setting in the range of 0 to 5 through 0 to 100 vol% O2 (in 1 vol% O2), or partial range
Display Range: 0 to 100 vol% O2
Warming-up Time: Approx. 20 min.
Repeatability:
(Excluding the case where the reference gas is by natural convection)
±0.5% F.S. ; range from 0 to 5 vol% O2 or more and less than 0 to 25 vol% O2 range
±1% F.S. ; range from 0 to 25 vol% O2 or more and up to 0 to 100 vol% O2 range
Linearity: (Excluding standard gas tolerance and the case where the reference gas is by natural convection) (Use oxygen of known concentration (with in the measuring range) as the zero and span calibration gases.)
± 1% F.S.; 0 to 5 or more and less than 0 to 25 vol% O2 range and sample gas pressure within ± 4.9 kPa
± 3% F.S.; 0 to 25 or more and less than 0 to 50 vol% O2 range and sample gas pressure within ± 0.49 kPa
± 5% F.S.; 0 to 50 or more and up to 0 to 100 vol% O2 range and sample gas pressure within ± 0.49 kPa
Drift: (Excluding the first two weeks in use and the case where the reference gas is by natural convection.)
Both zero and span ± 2% F.S. /month
Response Time:
Response of 90% within 5 seconds.
(Measured after gas is introduced from calibration gas inlet and analog output starts changing.)

Safety, EMC, and RoHS conformity standards

Installation altitude: 2000 m or less
Installation category: (IEC61010); II
Pollution degree: (IEC61010); 2
Measurement category: O (other)
Note · Installation category, called overvoltage category, specifies impulse withstanding voltage. Category II is for electrical equipment.
· Pollution degree indicates the degree of existence of solid, liquid, gas or other inclusions which reduce dielectric strength. Degree 2 is the normal indoor environment.

Safety :

CE	EN 61010-1 EN IEC 61010-2-030
UL	UL61010-1 UL61010-2-030
CSA	CAN/CSA-C22.2 No. 61010-1 CAN/CSA-C22.2 No. 61010-2-030
Morocco/LVD Arrêté:	
	NM EN 61010 1 NM EN 61010 2 030
GB	GB30439 Part 1
EAC	ГОСТ 12.2.007.0-75

EMC:

CE	EN 61326-1 Class A Table 2 EN 61326-2-3 EN 61000-3-2, EN IEC 61000-3-2
Morocco/EMC Arrêté:	
	NM EN 61326 1 Class A Table 2 NM EN 61326 2 3 NM EN 61000 3 2
RCM	EN61326-1 Class A Table 2
KC	Korea Electromagnetic Conformity Standard 한국 전자파적합성 기준
EAC	ГОСТ 30804.6.2 (IEC 61000-6-2) ГОСТ IEC 61000-6-4

Note · This instrument is a Class A product, and it is designed for use in the industrial environment. Please use this instrument in the industrial environment only.
· Influence of immunity environment (Criteria A) : Output shift is specified within ±20% of F.S.

RoHS: EN IEC 63000

Others:

REACH Regulation EC 1907/2006

Information of the WEEE Directive

This product is purposely designed to be used in a large scale fixed installations only and, therefore, is out of scope of the WEEE Directive. The WEEE Directive is only valid in the EU and UK.

2.2 ZR802S Explosion-proof Zirconia Oxygen Analyzer Converter

2.2.1 Standard specification

Display: LCD color display of size 320 by 240 dot with touchscreen

Operation: Touch screen operation when the door is open.

Analog Output:

Number of points; Two points (input-output isolation)

Output signal;

- 4 to 20 mA DC linear or log can be selected (maximum load resistance 550 Ω)
- HART7 Communication (maximum load resistance 550 Ω)
- Burn out signal according to NAMUR NE43.

Output range;

Oxygen concentration; Any setting between 0 to 5 through 0 to 100 vol% O2 in 1 vol% O2, or partial range is available. For the log output, the minimum range value is fixed at 0.1 vol% O2.

Output damping;

0 to 255 seconds. Hold/non-hold selection, preset value setting possible with hold.

Analog Input:

Number of points;

one point (for Pressure compensated)

Input signal; 4 to 20 mA DC (maximum 40 mA)

• Converter power supply (standard) voltage; 16.6 to 25.2 V
• With no power supply (option)

Digital Communication:
HART7; AO1, 250 to 550 Ω
Ethernet (Modbus TCP);
10/100 Mbps, Cable length Max.100 m, grounding the shield
RS-485 (Modbus RTU);
115200/38400/9600 bps, Cable length Max.600 m (115200 bps) Max.1200 m (38400/9600 bps) grounding the shield

Contact Output:
Number of points;
Four points (one is fail-safe, normally open)
• For DO-1/DO-2/DO-3, select either one, normally energized (normally closed) or normally de-energized (normally open) status. (Open when power is on.)
• DO-4 is fail-safe. (ON at Fault or Failure of NE107 setting), fixed normally energized (normally open, closed at power-off).
Contact capacity;
30VDC 3A or 250VAC 3 A (load resistance)
Contact output for automatic calibration (Contact output for explosion-proof solenoid valve supplied by customer):
Two points; zero +/-, span +/-
Contact capacity; 250 V AC 0.6A (driven by supply voltage to the converter)
Function; Fault, High-high alarm, High alarm, Low-low alarm, Low alarm, Maintenance, Calibration, Range switching answer-back, Warm-up, Calibration gas pressure decrease (answer-back of contact input), Temperature high alarm, Blowback start, Flameout gas detesaction (answer-back of contact input), Calibration coefficient alarm, Startup power stabilization timeout alarm, Simple cell resistance alarm, With simple cell resist. meas.

Contact Input:
Number of points;
Two points (No-voltage contact input or Transistor contact input)
On/Off detection;
• No-voltage contact input
Resistivity value 200 Ω or less; closed
Resistivity value 100 kΩ or above; open
• Transistor contact input
Voltage -1 to +1 VDC; closed,
Voltage value 4.5 to +25 VDC or above; open
Contact capacity;
Off-state leakage current 3 mA or less
Function; Calibration gas pressure decrease alarm, Range switching, External calibration start, Flameout gas detection, (ON: heater shut-off and span calibration gas inflow), Blowback start, Reboot

Environmental condition:
Ambient Temperature; -20 to +55°C
Storage Temperature; -30 to +70°C
Humidity; 10 to 90% RH at 40°C (Non-condensing)

Power Supply Voltage:
Ratings; 100 to 240 V AC
Acceptable range; 85 to 264 V AC

Power Supply Frequency:
Ratings; 50/60 Hz
Acceptable range; 47 to 63 Hz

Power Consumption: Max. 800 VA, approx. 330 VA for ordinary use.
Power supply 100V AC:
Max. 160 VA (160 W), approx. 120 VA (approx. 100 W) for ordinary use
Power supply 230 V AC:
Max 550 VA (370 W), approx. 260 VA (approx. 100 W)

Maximum Distance between Detector and Converter:
Conductor two-way resistance must be 10 Ω or less (when a 1.25 mm2 cable or equivalent is used, 300 m or less.)

Construction: Equivalent to NEMA/CSA TYPE 4X, IP66 (with conduit holes completely sealed with a cable gland)
Wiring Connection: eight holes
Type; M20 × 1.5mm, 1/2NPT
Installation: Wall or 2-inch pipe mounting
Material:
Case; Aluminum alloy
Window; glass
Paint Color: Mint green (equivalent to RAL 190 30 15)
Finish: Polyurethane corrosion-resistance coating
Weight: Approx. 16 kg

Explosion-proof Approval

Explosion-proof approval of major standards and directives	Detector (ZR22S)	Integrated type (ZR202S)	Converter (ZR802S)
ATEX:			
Applicable Standard:	EN IEC 60079-0 EN 60079-1 EN 60079-31		EN IEC 60079-0 EN 60079-1 EN 60079-31 EN 60529 +A1 +A2
Type of protection	II 2 G Ex db IIB+H_2 T2 Gb II 2 D Ex tb IIIC T300 ºC Db		II 2G Ex db IIC T6 Gb II 2D Ex tb IIIC T85ºC Db
Temperature class for Ex “db”	T2		T6
The maximum surface temperature for Ex “tb”	T300ºC		T85ºC
Ambient temperature	-20ºC and 60ºC	-20ºC and 55ºC	-20ºC and 55ºC
Enclosure Rating	IP66		IP66
IECEx:			
Applicable Standard:	IEC 60079-0 IEC 60079-1 IEC 60079-31		IEC 60079-0 IEC 60079-1 IEC 60079-31
Type of protection:	Ex db IIB+H_2 T2 Gb Ex tb IIIC T300ºC Db		Ex db IIC T6 Gb Ex tb IIIC T85ºC Db
Temperature class for Ex “db”	T2		T6
The maximum surface temperature for Ex “tb”:	T300ºC		T85ºC
Ambient temperature	-20ºC and 60ºC	-20ºC and 55ºC	-20ºC and 55ºC
Enclosure Rating	IP66		IP66
FM [Division system]:			
Applicable Standard	FM Class 3600 FM Class 3615 FM Class 3810 ANSI/NEMA 250		FM Class 3600 FM Class 3615 FM Class 3616 FM Class 3810 NEMA 250
Type of protection	Class I, Division 1,Groups B, C and D Class II/III, Division 1, Groups E, F and G		Class I Division 1, Groups B, C, D; T6 Class II, Division 1, Groups E, F, G, Class III, Division 1; T6
Temperature Class:	T2		T6
Ambient temperature	-20ºC and 60ºC	-20ºC and 55ºC	-20ºC and 55ºC
Enclosure Rating	Type 4X		Type4X, IP66
FM [Zone system]:			
Applicable Standard	Not applied		ANSI/UL 60079-0 ANSI/UL 60079-1 ANSI/UL 60079-31 ANSI/UL 61010-1 ANSI/UL 61010-2-30 ANSI/UL 50E NEMA 250 ANSI/IEC 60529

Explosion-proof approval of major standards and directives	Detector (ZR22S)	Integrated type (ZR202S)	Converter (ZR802S)
Type of protection:	Not applied		Class I, Zone 1, AEx db IIC T6 Gb Zone 21 AEx tb IIIC T85ºC Db
Temperature class for Ex “db”			T6
The maximum surface temperature for Ex “tb”:			T85ºC
Ambient temperature			-20ºC and 55ºC
Enclosure Rating			Type4X, IP66
CSA [Division system]:			
Applicable Standard:	C22.2 No.0 C22.2 No. 0.4-04 C22.2 No.0.5 C22.2 No.25 C22.2 No.30 C22.2 No.94 C22.2-No.61010-1-04		Not applied
Type of protection	Class I, Division 1,Groups B, C and D Class II/III, Division 1, Groups E, F and G		
Temperature Class:	T2		
Ambient temperature	-20ºC and 60ºC		
Enclosure Rating	Type 4X		
CSA [Zone system]:			
Applicable Standard:	Not applied		CSA-C22.2 No. 94.2 CSA-C22.2 No. 60079-0 CAN/CSA-C22.2 No. 60079-1 CAN/CSA C22.2 No.60079-31 CAN/CSA-C22.2 No. 60529 CAN/CSA-C22.2 No. 61010-1 CAN/CSA-C22.2 No. 61010-2-030
Type of protection			Ex db IIC T6 Gb Ex tb IIIC T85ºC Db
Temperature class for Ex “db”			T6
The maximum surface temperature for Ex “tb”:			T85ºC
Ambient temperature			-20ºC and 55ºC
Enclosure Rating			Type 4X, IP66
EAC:			
Applicable Standard:	ГОСТ 31610.0 ГОСТ IEC 60079-1 ГОСТ IEC 60079-31		ГОСТ 31610.0 ГОСТ IEC 60079-1 ГОСТ IEC 60079-31
Type of protection:	1Ex db IIB+H_2 T2 Gb Ex tb IIIC T300 ºC Db		1Ex db IIC T6 Gb X Ex tb IIIC T85°C Db X
Temperature class for Ex “db”	T2		T6
The maximum surface temperature for Ex “tb”:	T300ºC		T85ºC
Ambient temperature	-20ºC and 60ºC	-20ºC and 55ºC	-20ºC and 55ºC
Enclosure Rating	IP66		IP66

Explosion-proof approval and registration in specific countries	Detector (ZR22S)	Integrated type (ZR202S)	Converter (ZR802S)
KOREA:			
Applicable Standard:	Notice of Ministry of Labor No. 2016-54		Notice of Ministry of Labor No. 2021-22
Type of protection:	Ex d IIB+H_2 T2 Not applied for "tb"		Ex db IIC T6 Gb Ex tb IIIC 85ºC Db
Temperature class for Ex “db”	T2		T6
The maximum surface temperature for Ex “tb”:			T85ºC
Ambient temperature	-20ºC and 60ºC	-20ºC and 55ºC	-20ºC and 55ºC
Enclosure Rating	IP66		IP66
CHINA:			
Applicable Standard:	Not applied		GB/T 3836.1 GB/T 3836.2 GB/T 3836.31
Type of protection:			Ex db IIC T6 Gb Ex tb IIIC 85ºC Db
Temperature class for Ex “db”			T6
The maximum surface temperature for Ex “tb”:			T85ºC
Enclosure Rating			IP66
TAIWAN:			
Registration	IECEx registered and approved for use in Taiwan. For explosion-proof specifications, please refer to the IECEx section.		
INDIA:			
Registration	IECEx approved for use in INDIA. For explosion-proof specifications, please refer to the IECEx section.		

2.2.2 Functions

Display Functions:
Value Display;
Displays values of the measured oxygen concentration, etc.
Graph Display;
Displays trends of measured oxygen concentration and the test result from a cell resistance tester.
Data Display;
Displays various useful data for maintenance, such as cell temperature, reference junction temperature, maximum/minimum oxygen concentration, or the like
Status Message;
Indicates an alarm or error occurrence by flashing of the corresponding icon.
Indicates status such as warming-up, calibrating, or the like by the marks.
Alarm Display;
Alarm name, description, Countermeasures display at error occurrence, NAMUR NE107 compliant 4-symbol display

Calibration Functions:
Calibration method;
Zero/span calibration (Either zero or span can be skipped)
Calibration mode;
- Automatic Calibration; Explosion-proof solenoid valves must be provided by customer. It calibrates automatically at specified intervals.
- Semi-automatic Calibration; Explosion-proof solenoid valves must be provided by customer. Input calibration direction on the touchscreen or contact, then it calibrates automatically afterwards.
- Manual Calibration; Calibration with opening/closing the valve of calibration gas in operation interactively with an LCD touchscreen.

Calibration gas setting;
- Zero calibration gas concentration setting range; 0.3 to 21 vol% O2 (minimum setting; 0.01 vol% O2)
- Span calibration gas concentration setting range; 4.5 to 21 vol% O2 (minimum setting; 0.01 vol% O2)

Use N2-balanced mixed gas containing 0 to 10% scale of oxygen, and 80 to 100 % scale of oxygen for standard zero gas and standard span gas respectively.
Calibration interval;
date/time setting (Max. 255 days)

Purging Function:
Before warming up the detector, feed the span gas for the set period of time to drain condensed water out of the piping of calibration gas. Detector's warming-up starts after the set period of purging time elapses.

Blowback Function:
To allow a periodic purging etc., open/close contact output in the set period of interval or time defined full/semi-automatically.

Fault:
Alarm Function;
The occurrence of Fault alarm stops the power supply to the heater. Fault alarm keeps turning on until the power shuts down.
Type; Cell voltage failure, Heater temperature failure, A/D converter failure, Memory failure, Hardware error, data redundancy mismatch

Alarm:
Function; Alarm keeps turning on until potential causes of a problem are eliminated.
Type; Oxygen concentration alarm, Zero-point calibration coefficient alarm, Span-point calibration coefficient alarm, EMF stabilization time-up alarm, Cold junction temperature alarm, Thermocouple voltage alarm, Input current alarm, Battery low alarm, Input-pressure alarm, Cell resistance alarm

NAMUR NE 107 Alarm Display Function:
Displays 4 warnings of NAMUR NE 107 standard;
F: Failure (Fault equivalent, Power supply to the heater shuts down.)
C: Function Check
S: Out of Specification
M: Maintenance Required

Data Logging Function:
Stores following data to SD card or visualizes on the instrument display. SD cards which are recommended or equivalent must be supplied by customer,

Event display;
Log of Alarms, Calibration Trend, Power-on history are displayed on the main unit.

Graph Display;
Displays trends of test result of resistivity from a cell resistance tester

SD card output;
Measurement log (date/time, oxygen concentration, cell e.m.f, test result from a cell resistance tester, cell condition, NE107 status, etc.)
Maintenance report (setup value, calibration value etc.) can be saved to SD cards in CSV format. The stored data can be copied to other converter by outputting user-setting parameters to SD cards.

Sensor Self-diagnosis Function:
Calibration mode diagnose;
Span/Zero compensation rate, cell response time, cell condition
Cell resistance test ;
result from a cell resistance test without feeding calibration gas
- Measurement mode; auto cell resistance test, semi-auto cell resistance test,
- Cell resistance test setting; stabilization time (min. sec.) starting time (year/month/date/hour/minute) measurement interval (day/time)

Display and setting content:

Measuring Related Items:
Oxygen concentration (vol% O_2), output current value

Display Items:
Cell temperature (°C), thermocouple reference junction temperature (°C), maximum/minimum/average oxygen concentration (vol% O_2), cell e.m.f. (mV), cell internal resistance (Ω), cell condition (in four grades), heater on-time rate (%), calibration record (twenty times), time (year/month/day, hour/minute)

Calibration Setting Items:
Span gas concentration (vol% O_2), zero gas concentration (vol% O_2), calibration mode (automatic, semi-automatic, manual), calibration type and method (zero-span calibration, zero calibration only, span calibration only), stabilization time (min. sec), calibration time (min. sec), calibration interval (day/hour), starting time (year/month/day, hour/minute)

Output Related Items:
Analog output/output mode selection, output conditions when warming-up/maintenance/calibrating (during blowback)/abnormal, oxygen concentration at 4 mA/20 mA (vol%O_2), time constant.

Alarm Related Items:
Oxygen concentration high alarm/ high-high alarm limit values (vol%O_2), oxygen concentration low alarm/low-low alarm limit values (vol%O2), oxygen concentration alarm hysteresis (vol%O_2), oxygen concentration alarm detection, alarm delay (seconds)

Contact Related Items:
Selection of contact input 1 and 2, selection of contact output 1 to 3 (Fault, high-high alarm, high alarm, low alarm, low-low alarm, maintenance, calibrating, range switching, warming-up, calibration gas pressure decrease, temperature high alarm, temperature high alarm, pressure high alarm, pressure low alarm, test result from a cell resistance tester, alarm of a cell resistance tester, calibration coefficient alarm, cell e.m.f. stabilization time over blowback, flameout gas detection

Model and Codes

Model	Suffix code	Option code	Description
ZR802S	----------	----------	Explosion-proof Zirconia Oxygen Analyzer, Converter
Conformity in Hazardous location	-A	----------	EU-Type Examination certificate of conformity for “d” and “t” (ATEX) (*1)
	-B	----------	US certificate of conformity for “d” ,”t”, and Class I, II, III Division 1 (by FM) (*2)
	-C	----------	Canadian certificate of conformity for “d” and “t” (CSA) (*2)
	-D	----------	IECEx certificate of conformity for “d” and “t” (*1) (*3)
	-K	----------	Korea Ex certificate of conformity for “d” and “t” (by KTL) (*1)
	-M	----------	China Ex certificate of conformity for “d” and “t” (by NEPSI) (*1)
	-Q	----------	EAC certified explosion-proof for “d” and “t” with PA (*1) (*4) (*5)
	-R	----------	EAC certified explosion-proof for “d” and “t” without PA (*1) (*4) (*5)
Converter thread	-M	----------	M20 x 1.5 mm
	-T	----------	1/2 NPT
Digital communication	-H	----------	HART
	-M	----------	HART+Modbus RS485
	-E	----------	HART+Modbus Ethernet
—	-N	----------	Always -N
—	-N	----------	Always -N
Options		/SCT	TAGNO. Engraved on the metal nameplate (*6)
		/H	Awning hood
		/CJ	Cold junction temperature compensation (with Pt1000 resistance thermometer) (*7)
		/AI	Analog input with no power supply
		/AC	With solenoid valve drive output for automatic calibration (*8)
		/RC	Rugged Coating (epoxy + urethane coating)
		/JP	Made in Japan (*4)

*1: Only “-M” can be specified to the converter thread.
*2: Only “-T” can be specified to the converter thread.
*3: If you want to order Taiwan Ex specification, please select -D. (Taiwan Ex registration based on IECEx)
If you want to order Indian Ex specification, please select -D. (Indian Ex approval based on IECEx)
However, in India, only IECEx certificate of conformity for “d” is applicable.
*4: If /JP is not selected, it is made in China.
Cannot be specified for Korea Ex (-K), China Ex (-M), EAC Ex with PA (-Q) and EAC Ex without PA (-R).
*5 Please select -Q for final destination of Russian Federation.
Please select -R for final destination of Kazakhstan and Belarus.
For more information about certification availability, please contact Yokogawa office.
*6: When suffix code except for /SCT is specified, it will be supplied the tag label with TAGNO. printed.
*7: Connect the supplied Pt1000 resistance thermometer for cold junction temperature compensation to CJ terminal, when /CJ is specified.
*8: Explosion-proof solenoid valves must be provided by customer.

Standard Accessories

Item	Q'ty				Description
	Std.	/RC	/AC	/RC, /AC	
Fuse	1	1	1	1	3.15A Parts No. A1113EF
Fuse	–	–	2	2	2.5A Parts NO. A1112EF
Mounting bracket (standard)	1	–	1	–	Parts No. K8001PN
Mounting bracket (Rugged Coating)	–	1	–	1	Parts No. K8001PR
U-bolt for pipe mounting	2	2	2	2	2B
Tag label (standard)	1	1	1	1	(Note1)

(Note 1) Tag label is included when suffix code except for /SCT is specified.
A blank label is included when no TAGNO. is specified.

<Items specified at order>

1. TAGNO. (only if necessary)
You can create TAGNO. (tag number) with alphanumeric characters described in the next table. 16 characters at maximum can be used.
If you specify TAGNO., it is displayed on the instrument screen, and is printed on the stainless name plate/tag label affixed to the instrument.

Symbol (Note)	-	Hyphen	_	Underscore
	=	Equal	+	Plus
	/	Slash	:	Colon
	(	Left parenthesis	)	Right parenthesis
	#	Hash	!	Exclamation mark
	.	Period		
Number	0, 1, 2, 3, 4, 5, 6, 7, 8, 9			
Upper case alphabetics	A, B, C, D, E, F, G, H, I, J, K, L, M, N, O, P, Q, R, S, T, U, V, W, X, Y, Z			
lower case alphabetics	a, b, c, d, e, f, g, h, i, j, k, l, m, n, o, p, q, r, s, t, u, v, w, x, y, z			

(Note): For ZR802S, if a space is specified for TAGNO, the space will be deleted and the setting will be left justified.

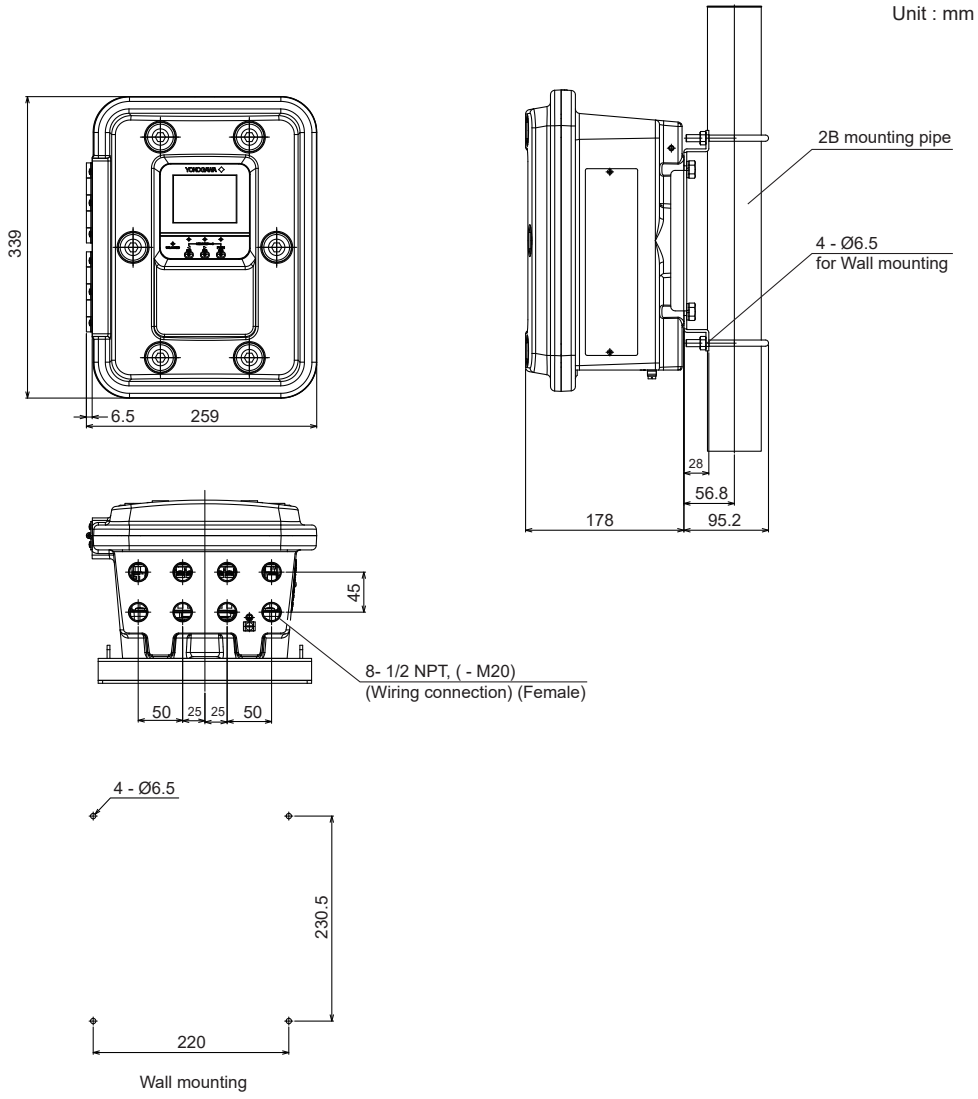
2. Language
English, Chinese, German, French, Portuguese, Russian, Japanese

SD card (supplied by customer)

Item	Q'ty	Parts No.	Description
SD card	1	773001	1 GB Customer may provide. 128 MB or above SD or SDHC

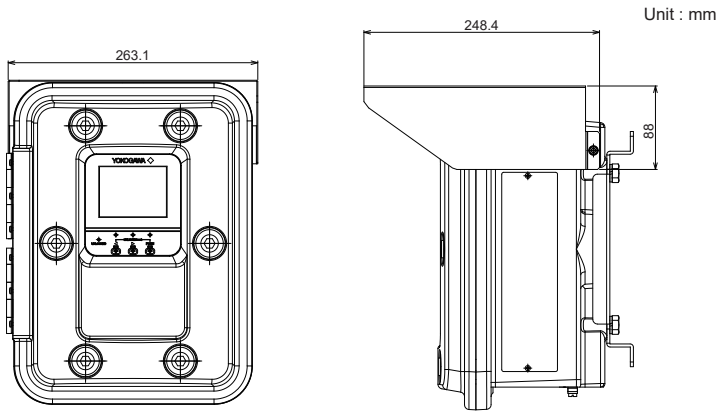
External Dimensions

Unit : mm



- **With sun shield hood (option code /H)**

Unit : mm



2.3 ZA8F Flow Setting Unit

This flow setting unit is applied to the reference gas and the calibration gas in a system configuration (System 1). Used when instrument air is provided.

This unit consists of a flowmeter and flow control valves to control the flow rates of calibration gas and reference gas.

Standard Specifications

Construction: Dust-proof and rainproof construction

Case Material: SPCC (Cold rolled steel sheet)

Flowmeter Scale: Calibration gas; 0.1 to 1.0 L/min.
Reference gas; 0.1 to 1.0 L/min.

Painting: Baked epoxy resin, Dark-green (Munsell 2.0 GY 3.1/0.5 or equivalent)

Tube Connections: Rc1/4 or 1/4FNPT

Reference Gas Pressure: Clean air supply of sample gas pressure plus approx. 50 kPaG (or sample gas pressure plus approx. 150 kPaG when a check valve is used). Pressure at inlet of the Flow Setting Unit.(Maximum 300 kPaG)

Reference Gas Consumption:
Approx. 1.5 L/min

Calibration Gas (zero gas, span gas) Consumption:
Approx. 0.7 L/min (at calibration time only)

Weight: Approx. 2.3 kg

NOTE

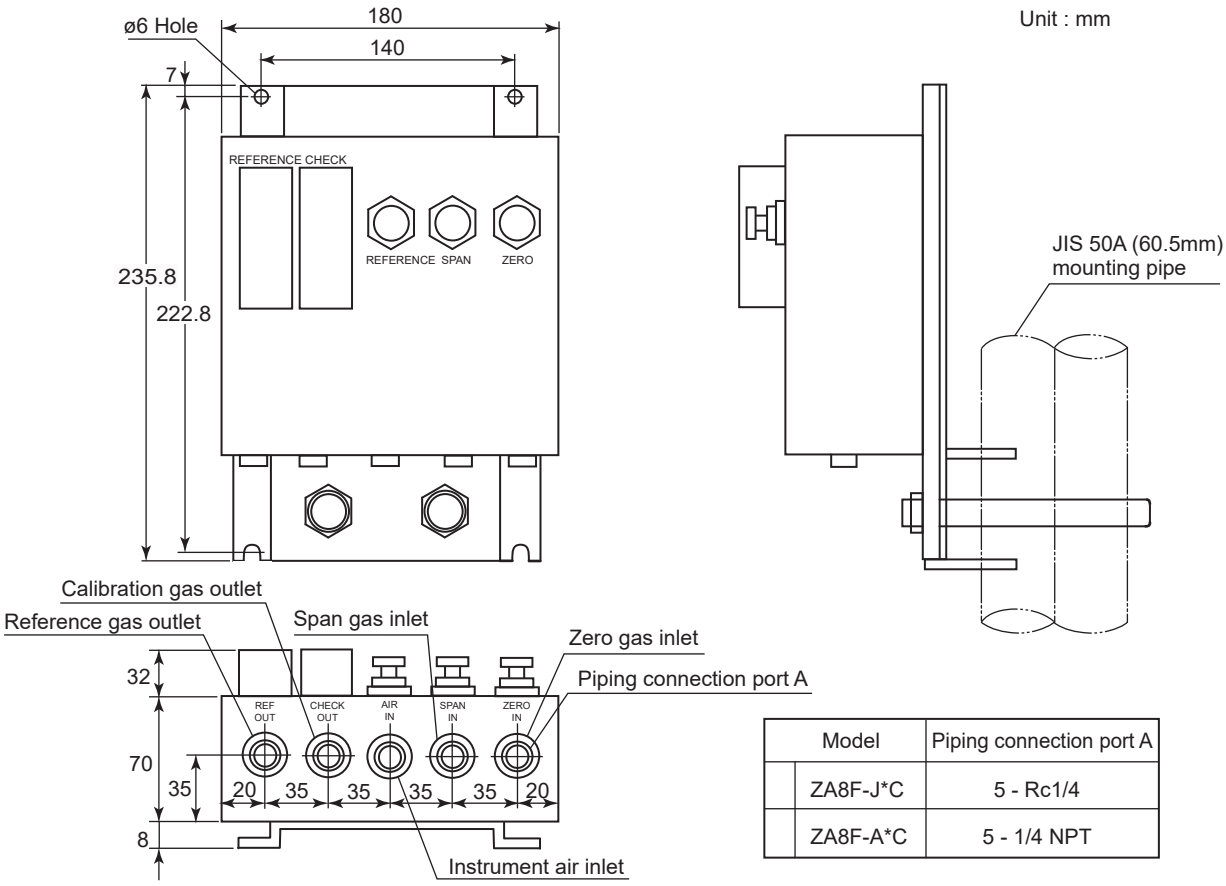
Use instrument air for span calibration gas, if no instrument air is available, contact YOKOGAWA.

- **Model and Codes**

Model	Suffix code	Option code	Description
ZA8F	--------	---------	Flow setting unit
Joint	**-J**	---------	Rc 1/4
	-A	---------	With 1/4 NPT adapter
Style code	***C**	---------	Style C

External Dimensions

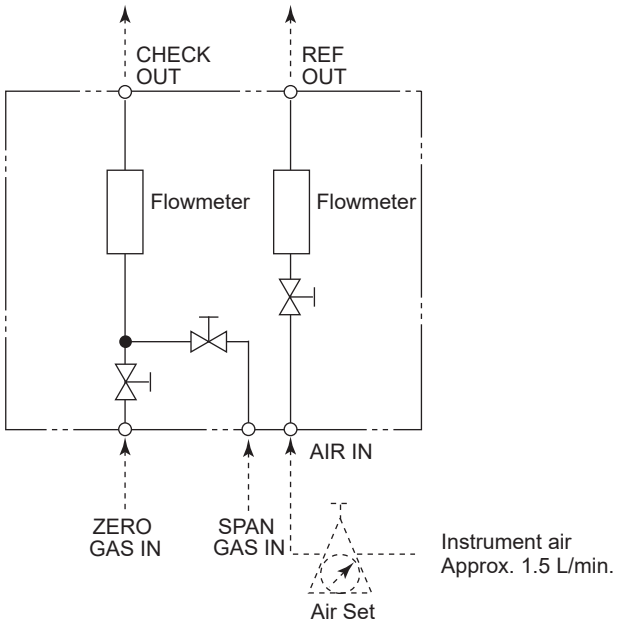
Unit : mm



Model	Piping connection port A
ZA8F-J*C	5 - Rc1/4
ZA8F-A*C	5 - 1/4 NPT

Weight : Approx. 2.3 kg

PIPING INSIDE THE FLOW SETTING UNIT



Air pressure ;
without check valve ; sample gas pressure + approx.50 kPaG
with check valve ; sample gas pressure + approx.150 kPaG

3. Installation

This chapter describes installation of the following equipment:

Section 3.1 Installation of the ZR802S Converter
Section 3.2 Installation of ZA8F Flow Setting Unit
Section 3.3 Insulation Resistance Test

CAUTION

Oxygen concentration of sample/reference /calibration gas shall not exceed that found in normal air, typically 21 vol%.

3.1 Installation of the ZR802S Converter

3.1.1 Installation Location

The following should be taken into consideration when installing the converter:

(1) Readability of the indicated values of oxygen concentration or messages on the converter display. Easy and safe access to the converter for operating keys on the panel and for checking and maintenance work.

(2) An ambient temperature of not more than 55 °C and little change in temperature (recommended within 15 °C in a day).

(3) The normal ambient humidity and without any corrosive gases.

(4) No vibration.

(5) Near to the detector.

(6) Not in direct rays of the sun. If the sun shines on the converter, prepare the hood (/ H) or other appropriate sunshade.

(7) Non-hazardous location.

3.1.2 Mounting of the Converter

The converter can be mounted on a pipe (nominal JIS 50A: O.D. 60.5 mm), a wall or a panel. The converter can be mounted at an angle to the vertical, however, it is recommended to mount it on a vertical plane.

Mount the converter as follows.

<Pipe Mounting>

(1) Prepare a vertical pipe of sufficient strength (nominal JIS 50A: O.D. 60.5 mm) for mounting the converter. (Converter weighs approximately 16 kg.)

(2) Mount the converter on the pipe. Fix it firmly on the pipe in the procedure described in Figure 3.1.

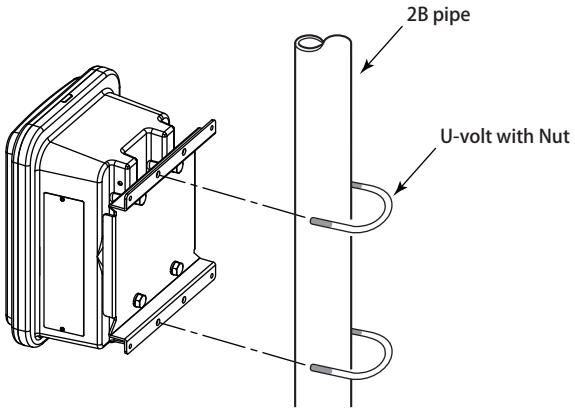


Figure 3.1 Pipe Mounting

<Wall Mounting>

(1) Drill mounting holes through the wall as shown in Figure 3.2.

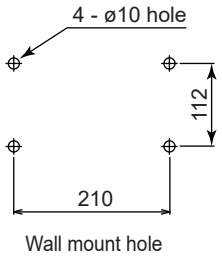


Figure 3.2 Mounting holes

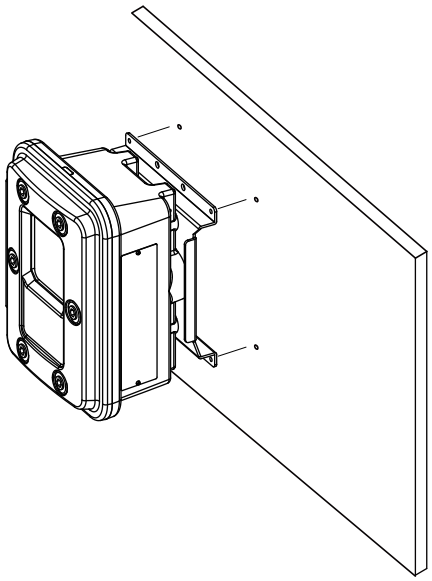


Figure 3.3 Wall Mounting

(2) Mount the converter. Secure the converter on the wall using four screws.

Note: For wall mounting, the bracket and bolts are not used.

3.2 Installation of ZA8F Flow Setting Unit

3.2.1 Installation Location

The following should be taken into consideration:

(1) Easy access to the unit for checking and maintenance work.
(2) Near to the detector or the converter
(3) No corrosive gas.
(4) An ambient temperature of not more than 55 °C and little changes of temperature.
(5) No vibration.
(6) Little exposure to rays of the sun or rain.

3.2.2 Mounting of ZA8F Flow Setting Unit

The flow setting unit can be mounted either on a pipe (nominal JIS 50A) or on a wall. It should be positioned vertically so that the flowmeter works correctly.

<Pipe Mounting>

(1) Prepare a vertical pipe of sufficient strength (nominal JIS 50A: O.D. 60.5 mm) for mounting the flow setting unit. (The unit weighs approximately 2 to 3.5 kg.)
(2) Mount the flow setting unit on the pipe by tightening the nuts with the U-bolt so that the metal fitting is firmly attached to the pipe.

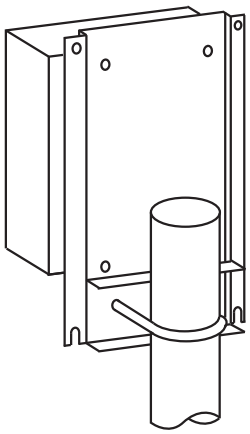


Figure 3.4 Pipe Mounting

<Wall Mounting>

(1) Make a hole in the wall as illustrated in Figure 3.5.

(2) Mount the flow setting unit. Remove the pipe mounting parts from the mount fittings of the flow setting unit and attach the unit securely on the wall with four screws.

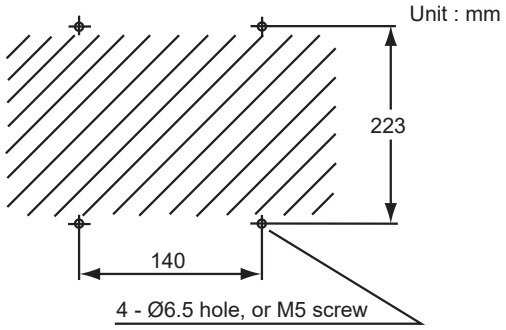


Figure 3.5 Mounting holes

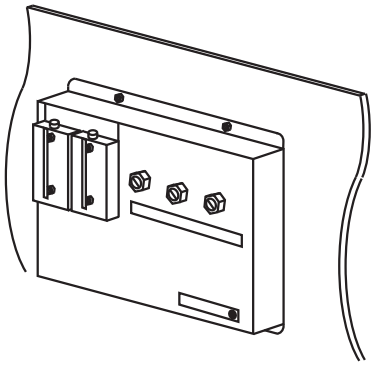


Figure 3.6 Wall mounting

3.3 Insulation Resistance Test

Even if the testing voltage is not so great that it causes dielectric breakdown, testing may cause deterioration in insulation and a possible safety hazard. Therefore, conduct this test only when it is necessary.

The applied voltage for this test shall be 500 V DC or less. The voltage shall be applied for as short a time as practicable to confirm that insulation resistance is 20 MΩ or more.

Remove wiring from the converter and the detector.

(1) Connect a Insulation Resistance meter (Power Supply OFF) between the crossover wiring and the grounding terminal. For polarity, set the crossover wiring to (+) and the ground terminal to (-).

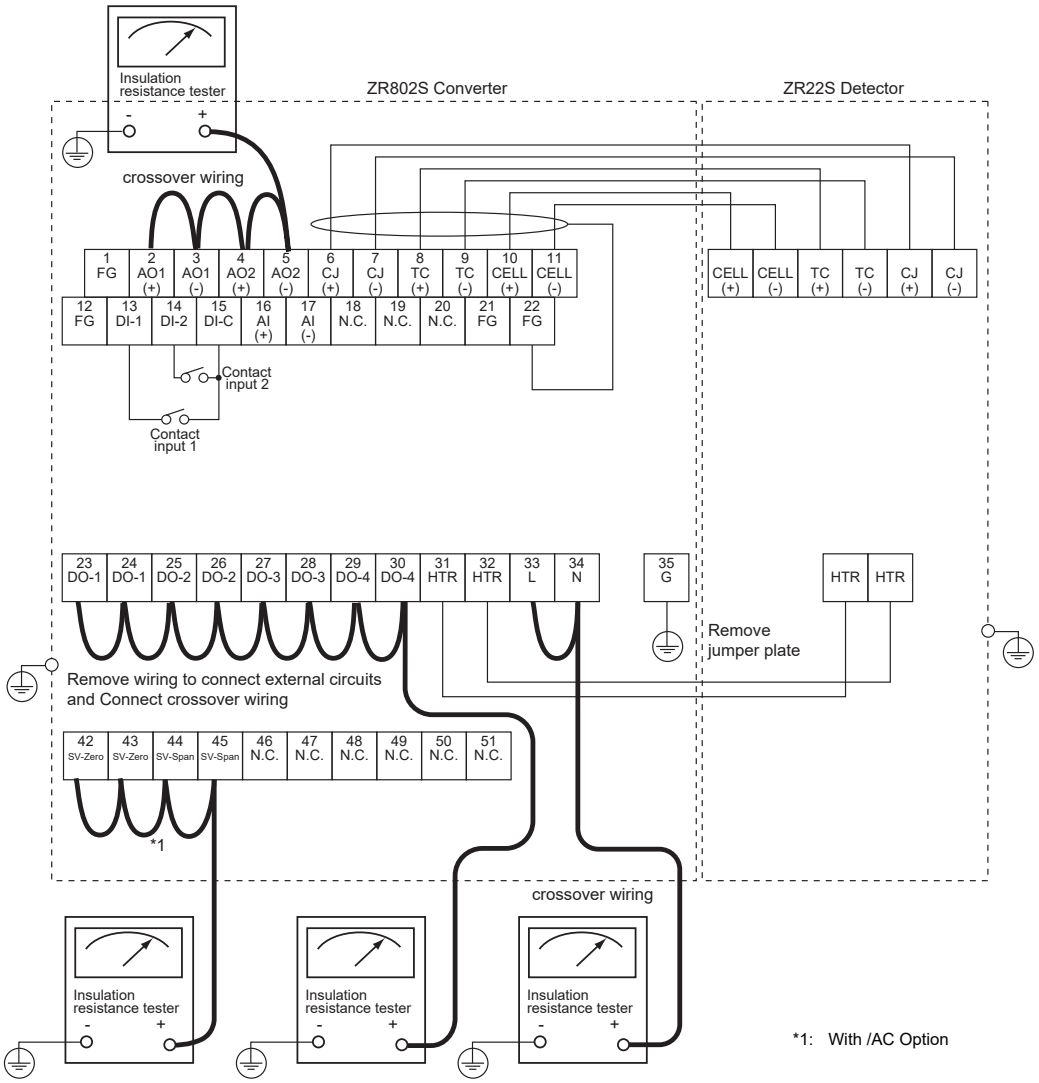
(2) Measure Insulation Resistance by setting Power Supply of Insulation Resistance meter to ON.

(3) After testing, remove Insulation Resistance gauge and connect a 100 k Ω resistor between the crossover wiring and grounding. Discharge the battery for more than a second. Do not touch the terminals with bare hands while discharging.

(4) You can perform similar tests between the heater terminal and ground, between contact output terminal and ground, and between the analogue output terminal and ground.

(5) Contact input terminal/sensor input terminal is isolated, but Insulation Resistance testing is abort because the voltage of the surge protection arrester between the terminal and ground is low.

(6) After completing all tests, put back the wiring in place.



4. Wiring

In this Chapter, the wiring necessary for connection to the ZR22S/ZR802S Explosionproof Zirconia Oxygen Analyzer is described.

4.1 General

WARNING

Do not turn on the power until you have confirmed that the power and heater are wired correctly. Turning on the power with incorrect wiring may cause the temperature control circuit of the detector to malfunction, resulting in a false operation.

CAUTION

This product complies with CE marking.
Where compliance with CE marking is necessary, the following wiring procedure is necessary.

- Install an external switch or circuit breaker to the power supply of the converter.
- Use an external switch or circuit breaker rated 5 A and conforming with IEC 947-1 or IEC 947-3.
- It is recommended that the external switch or circuit breaker be mounted in the same room as the equipment.
- The external switch or circuit breaker should be installed within the reach of the operator, and marked as the power supply switch of this equipment.

Wiring procedure

Wiring should be performed according to the following procedure:

(1) Be sure to connect the shield line to FG terminal of the converter.

(2) The outer sheath of the signal line should be stripped to a length of 50 mm or less.
The most outer sheath of the power cable should be stripped to a length of 20 mm or less.

(3) Signals may be affected by noise if signal lines, power cable and heater cable are located in the same conduit. When using conduit, signal lines should be installed in a separate conduit than power and heater cables.

(4) Install metal blind plug(s) in unused cable connection gland(s) of the converter.

(5) Metal conduit should be grounded.

(6) The following cables are used for wiring:

Table 4.1 Cable specifications

Terminal name of converter	Name	Need for shields	Number of cores
CELL+, CELL- HTR TC+, HTR TC- CJ+, CJ-	Detector signal	O	6
HEATER	Detector heater		2
L, N	Power supply		2 or 3 (*1)
AO-1+, AO-1-, AO-2+, AO-2-	Analog output	O	2 or 4
DO-1, DO-2, DO-3, DO-4	Contact output		2 to 8
SV-Zero+, SV-Zero- SV-Span+, SV-Span-	Solenoid valve output of explosion-proof automatic calibration		4 (*2)
DI-1, DI-2, DI-C	Contact input		3
AI+, AI-	Temperature input	O	2
RS485	RS485	O	3
Ether	Ether	O	(STP cable)

Note *1: When the case is used for protective grounding, use a 2-core cable.
*2: When /AC (option) is specified.

WARNING

Cables that withstand temperatures of at least 80°C should be used for wiring.

CAUTION

- Select suitable cable O.D. to match the cable gland size.
- Protective grounding should be connected in ways equivalent to JIS D style (Class 3) grounding (the grounding resistance is 100 Ω or less).
- For maximum use of options, nine cables are required for eight cable entries.
  In this case, create a cable using a mixture of two types: AO, DI, or AI. Shielded cables should be used for any mixed pattern. Never mix with other cables.

NOTE

Grounding of shielded cable

The shielded cables are very effective for noise-rejection, but the grounding of the shielded cables varies depending on the conditions of use.

One side grounding, which grounds only one end of the shield to ZR802S, requires longer cables and is effective for noise reduction when there is a potential difference of grounds between the ZR802S and the connected device on the other side.

If there is no potential difference between the ZR802S and the device on the other side, it may be more effective to connect to the ground on both sides.

It may also be effective to connect a capacitor in series to one ground while both sides being grounded.

4.1.1 Terminals for the External Wiring in the Converter

Open the front door and remove the terminal covering plate to gain access to the converter external wiring terminals

CAUTION

After wiring necessary cable to the converter terminals, be sure to fix the terminal covering plate with two screws again.

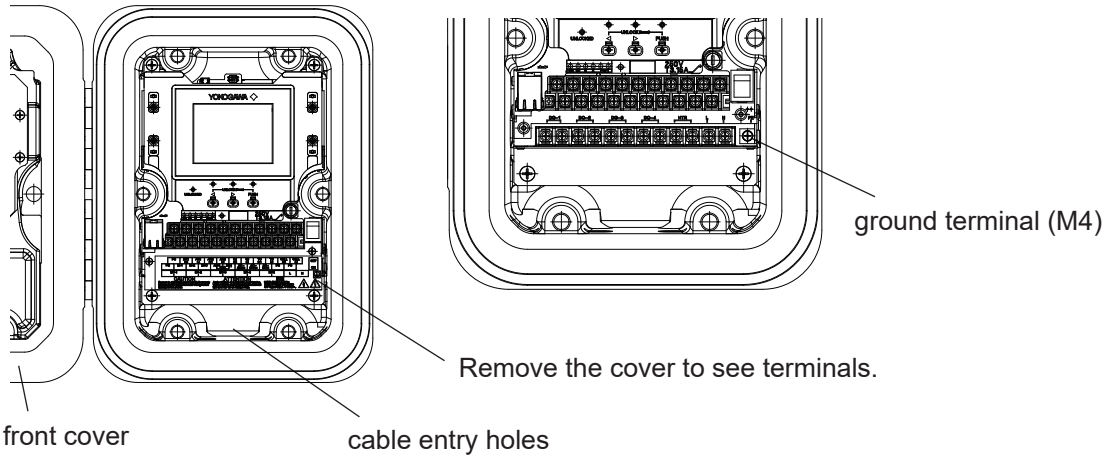


Figure 4.1 Terminals for external wiring in the converter (except /AC)

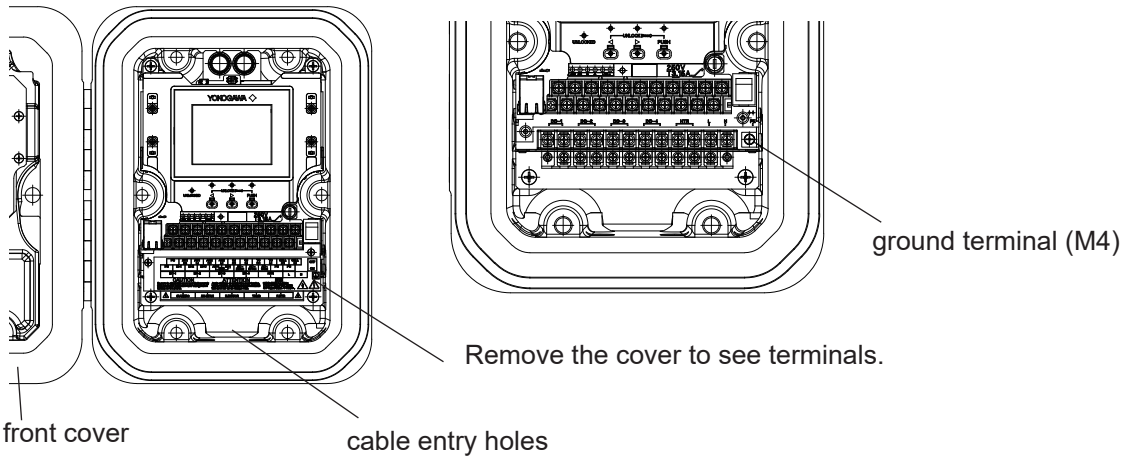
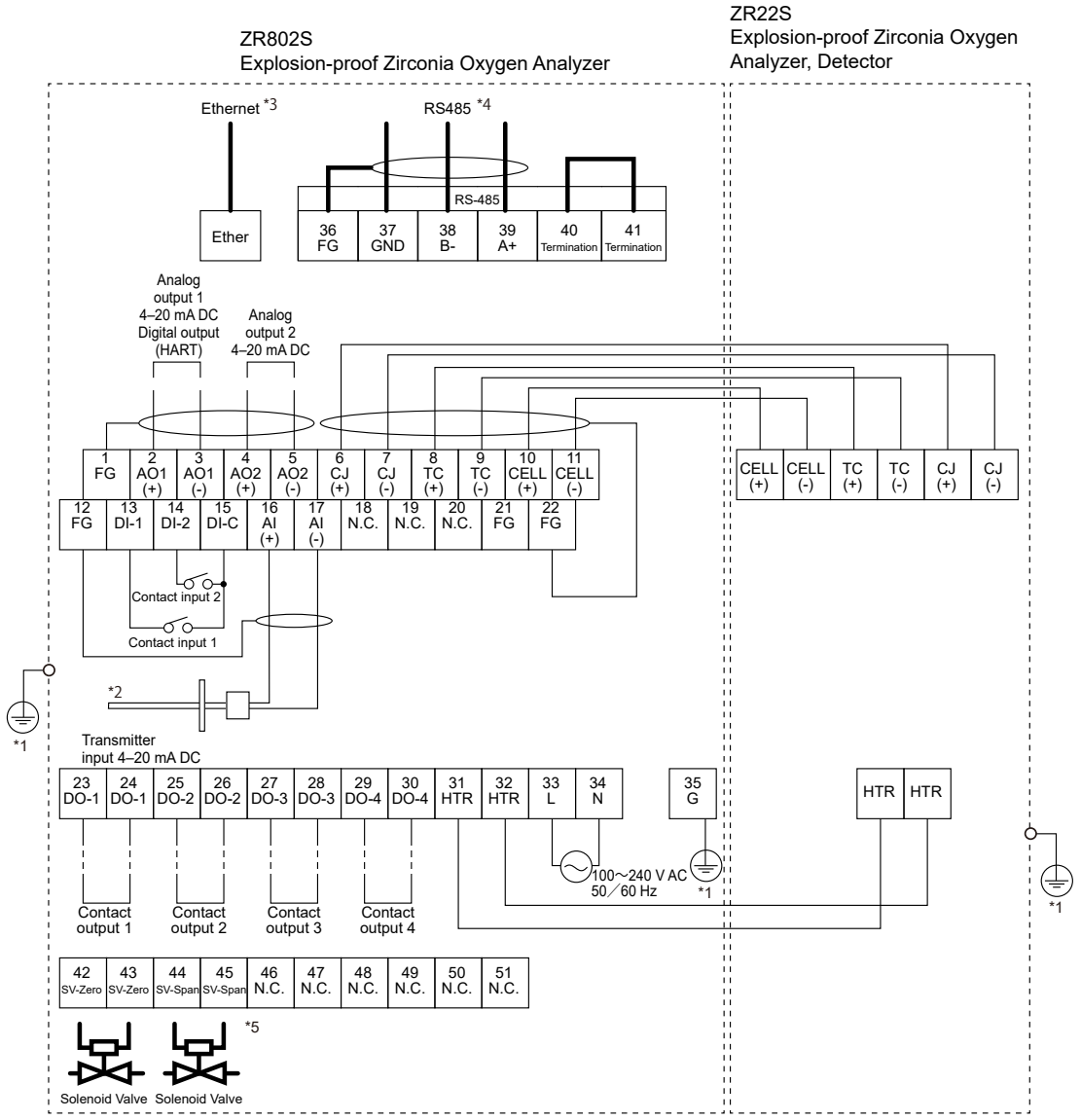


Figure 4.2 Terminals for external wiring in the converter (/AC)

4.1.2 Wirings

Connect the following wiring to the converter. It requires a maximum of nine wiring connections as shown below.

(1) Detector output (connects the converter with the detector.)
(2) Detector heater power (connects the converter with the detector.)
(3) Analog output signal
(4) Power and ground
(5) Contact output
(6) Operation of the solenoid valve of automatic calibration unit
(7) Contact input
(8) Pressure input
(9) RS485 or Ethernet



*1: The ground wiring of the converter should be connected to either the protective ground terminal in the equipment or the ground terminal of the converter case.
Ground to earth, ground resistance: 100 Ω or less.
*2: Option (Pressure transmitter provide by user.)
*3: Suffix Code "-E"
*4: Suffix Code "-M"
*5: With /AC Option

Figure 4.3 Wiring connection to the converter

4.1.3 Mounting of Cable Gland

Mount a conduit that matches the thread size, or a cable gland on each cable entry on the converter.

<Cable gland>

Symbols are inscribed near the cable entries for identifying the thread specifications. The cable glands shall be in type of protection Ex “db” or Ex “tb”, suitable for the conditions of use and correctly installed. They shall provide a degree of ingress protection of at least IP66.

Use the specified plug for the blind plug.

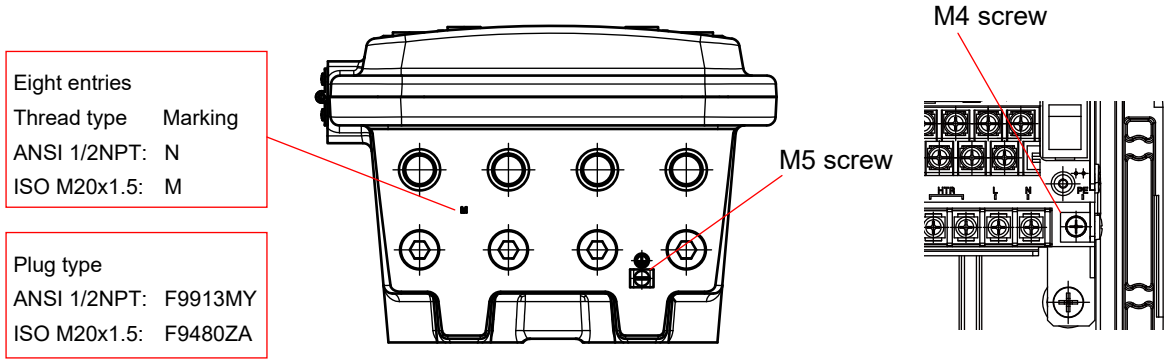


Figure 4.4 Cable gland mounting

<Conduit>

For ZR802S-B or ZR802S-C, seal all conduits within 18 inches of the enclosure.

Refer to user’s manual for detectors to install the conduit on the detectors.

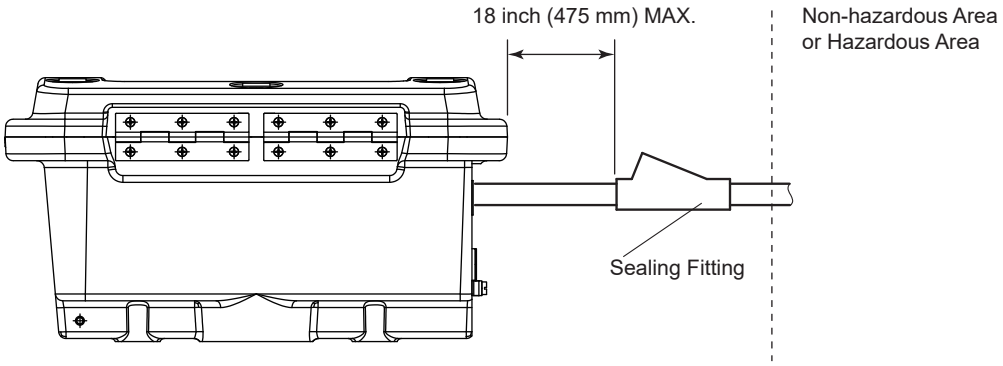


Figure 4.5 Conduit installation

WARNING

SEAL ALL CONDUITS WITHIN 18 INCHES

CAUTION

The conduit must be ANSI / ASME B1.20.1 compliant and tightly constructed with a wrench.

CAUTION

Unused entries shall be closed with suitable certified blanking elements.

4.2 Wiring

4.2.1 Connection to Converter

To connect the wiring to the converter, proceed as follows:

(1) M4 screws are used for the terminals of the converter. Each cable should be terminated in the corresponding size crimp-on terminals.

(2) When a rubber insulated glass braided wire is used for wiring to the detector, use a terminal box. For wiring between the terminal box and the converter, basically use a cable that withstand temperatures of at least 80°C.

NOTE

The above is to prevent moisture or corrosive gas from entering the converter.
Where the ambient environment of the detector and the converter is well-maintained, it is permissible to connect the wiring from the detector directly to the converter with protection by conduits.

WARNING

This wiring is to carry power for the heater. Be careful to wire the correct terminals, and be careful not to ground or short circuit terminals when wiring, as otherwise the instrument may be damaged.

4.2.2 Connection to Detector

When connecting the cable to the detector, proceed as follows:

(1) Mount cable glands or conduits of the specified thread size to the wiring connections of the detector.
The detector may need to be removed in future for maintenance, so be sure to allow sufficient cable length.

(2) If the ambient temperature at the location of wire installation is 75 to 150°C, be sure to use a flexible metallic conduit for the wire. If a non-shielded " 600 V silicon rubber insulated glass braided wire" is used, keep the wire away from noise sources to avoid noise interference.

The size of the terminal screw threads is M3.4. Each cable should be terminated in the corresponding size crimp-on terminals contact (*1) respectively. Use bare crimp terminals if the ambient temperature at the location of detector installation is over 60°C.

(3) Connect the cable shield to FG terminal on the converter except when 600 V silicon rubber insulated glass braided wire is used.

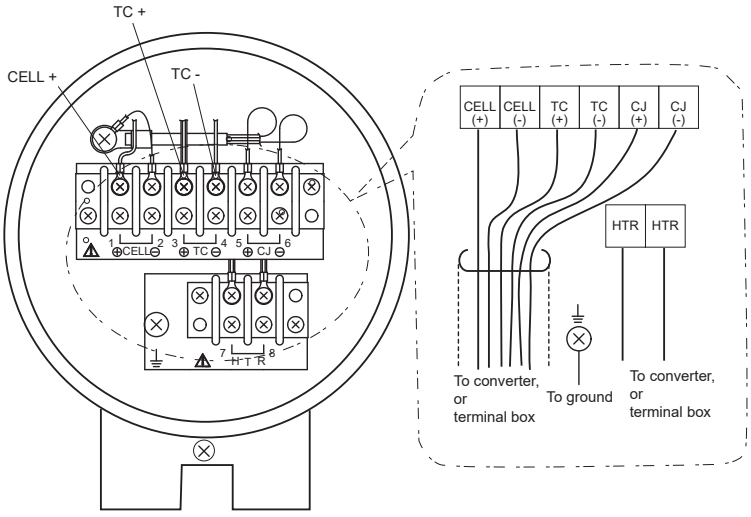


Figure 4.6 Terminal assignment of detector

- **Notice when closing the cover of the detector**

NOTE

- Before opening the detector cover, loosen the lock screw. If the screw is not loosened first, the screw will damage the cover, and the terminal box will require replacement.
  When opening and closing the cover, remove any sand particles or dust to avoid gouging the thread.
- After screwing the cover in the detector body, secure it with the lock screw.

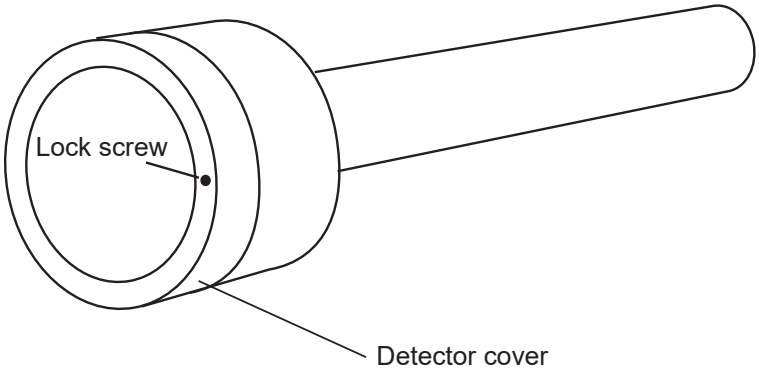


Figure 4.7

4.2.3 Power and Grounding Wiring

This wiring supplies power to the converter and grounds the converter/detector.

Power Wiring

Connect the power wiring to the L and N terminals of the converter. Proceed as follows:

(1) Use a 2-core or a 3-core cable.

(2) The size of converter terminal screw threads is M4. Each cable should be terminated corresponding to crimp-on terminals.

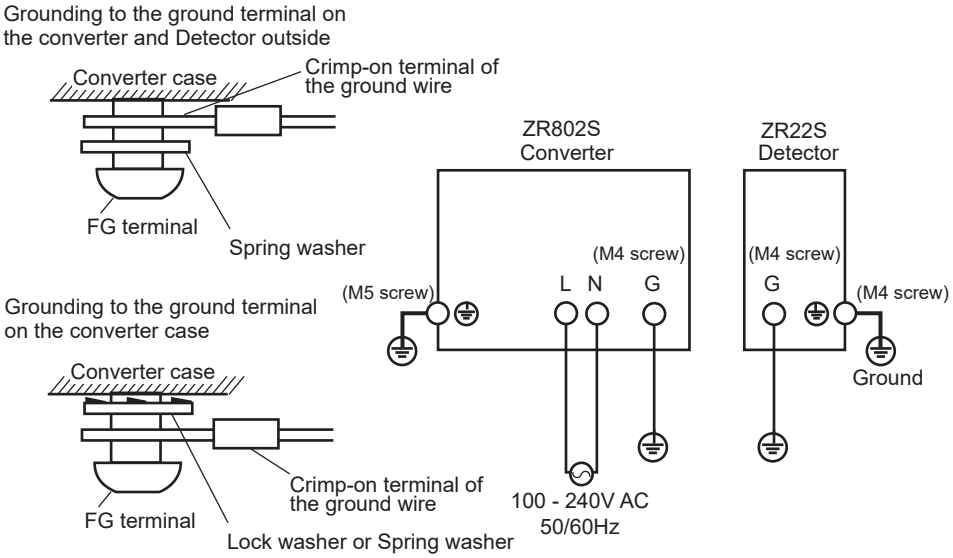


Figure 4.8

Grounding Wiring

The ground wiring of the detector should be connected to the ground terminal of the detector case. The ground wiring of the converter should be connected to either the ground terminal of the converter case or the protective ground terminal in the equipment.
The grounding terminals of the detector and the converter are of size M4. Proceed as follows:

(1) Keep ground resistance to 100 Ω or less (equivalent JIS D style (Class 3)).

(2) When the ambient temperature of the wiring installation is 75 to 150°C for the wiring of the detector, use wiring material with sufficient heat resistance.

(3) When connecting the ground wiring to the ground terminal of the converter case, be sure that the lock washer is in contact with the case surface (see Figure 4.8.).

(4) Ensure that the jumper plate is connected between the G terminal and the protective ground terminal of the converter.

(5) No intermediate parts are used for the internal ground terminal of the detector. Use crimping terminal for connection to the internal ground terminal in order to avoid corrosion by high contact potentials.

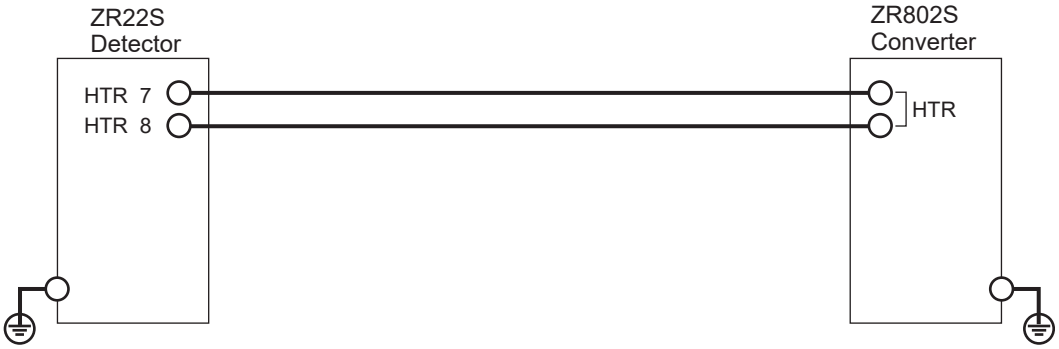
(6) In order to prevent the earthing conductor from loosening, the conductor must be secured to the terminal, tightening the screw with torque of approx. 1.2 N•m (for M4) or 2.0 N•m (for M5).

(7) Care must be taken not to twist the conductor.

4.2.4 Wiring for Power to Detector Heater

This wiring provides electric power from the converter to the heater for heating the sensor in the detector.

(1) Ambient temperature of the detector: 75°C or less



(2) Ambient temperature of the detector: exceeding 75°C

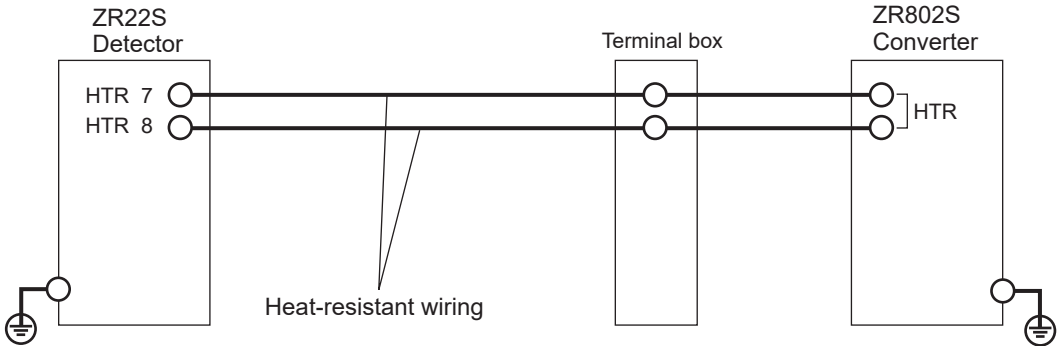


Figure 4.9 Wiring for power to detector heater

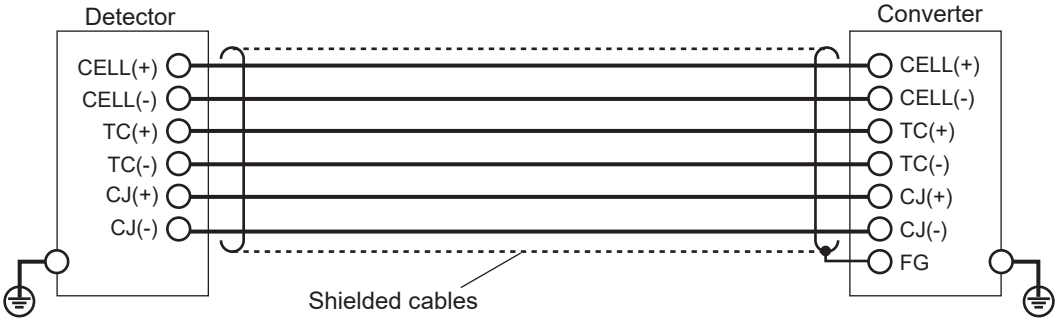
Cable Specifications

Basically, cables (2 cores) that withstand temperatures of at least 80°C are used for this wiring. When the ambient temperature of the detector exceeds 75°C, install a terminal box, and connect to the detector using six-piece 600 V silicon rubber insulated glass braided wires.

4.2.5 Wiring for Detector Output

This wiring enables the converter to receive cell output from the detector, output from a thermocouple and a reference junction compensation signal. Install wires that allow for 10 Ω of loop resistance or less. Keep detector wiring away from power wiring.

(1) Ambient temperature of the detector: 75°C or less



(2) Ambient temperature of the detector: exceeding 75°C

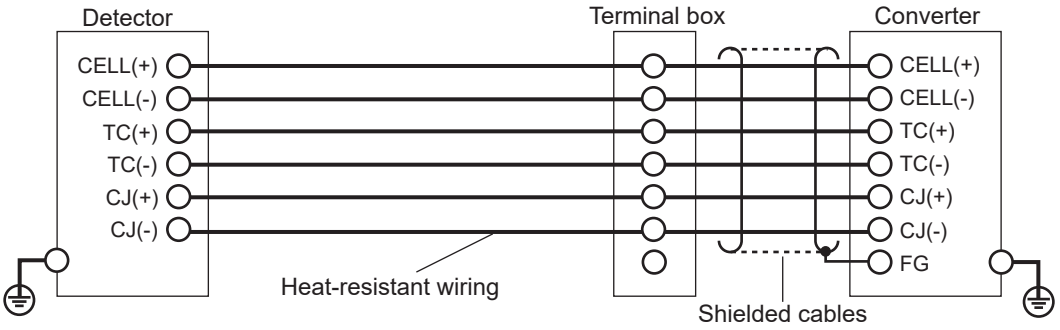


Figure 4.10 Wiring for detector output

CAUTION

If shielded cables cannot be used between the detector and the terminal box, for example, when heat-resistant wiring is used, locate the detector and the terminal box as close together as possible.

Cable Specifications

Basically, a cable (6-core) that withstand temperatures of at least 80°C is used for this wiring. When the ambient temperature of the detector exceeds 75°C, install a terminal box, and connect with the detector using six-piece 600 V silicon rubber insulated glass braided wires.

/CJ Option Specifications

When the /CJ option is specified, connecting the supplied cold junction compensation element to the CJ (+) and CJ (-) terminals of the converter, and connecting the tip to the FG terminal is not required, and cabling of the CJ terminal is not required.

In addition, the cabling of the TCs is connected using compensating leads for TYPE K.

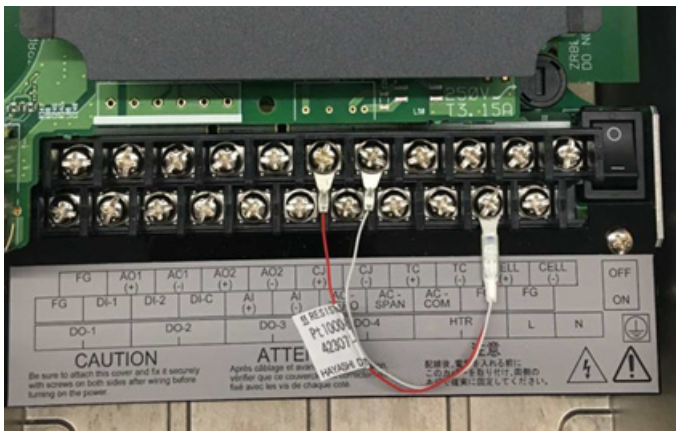


Figure 4.11 Connection of CJ compensation elements

4.2.6 Wiring for Analog Output

This wiring is for transmitting 4 to 20 mA DC output signals to a device, e.g. recorder. Maintain the load resistance including the wiring resistance at 550 Ω or less.

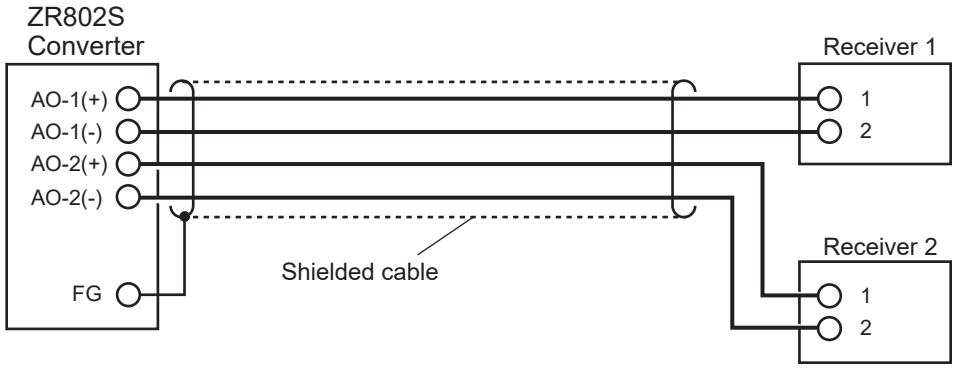


Figure 4.12 Wiring for analog output

Cable Specifications

For this wiring, use a 2-core or a 4-core shielded cable.

Wiring Procedure

(1) M4 screws are used for the terminals of the converter. The cables should be terminated with crimp-on terminals that fit M4 screw. Ensure that the cable shield is connected to the FG terminal of the converter.

(2) Be sure to connect “+” and “-” polarities correctly.

4.2.7 Contact Output Wiring

The converter has up to 4 contact outputs. The contact outputs 1 to 3 can be freely assigned to “low limit alarm”, “high limit alarm”, etc. user selectable, but the assignment of contact output 4 is fixed (“fault output”).

When using these contact outputs, install the wiring as follows:

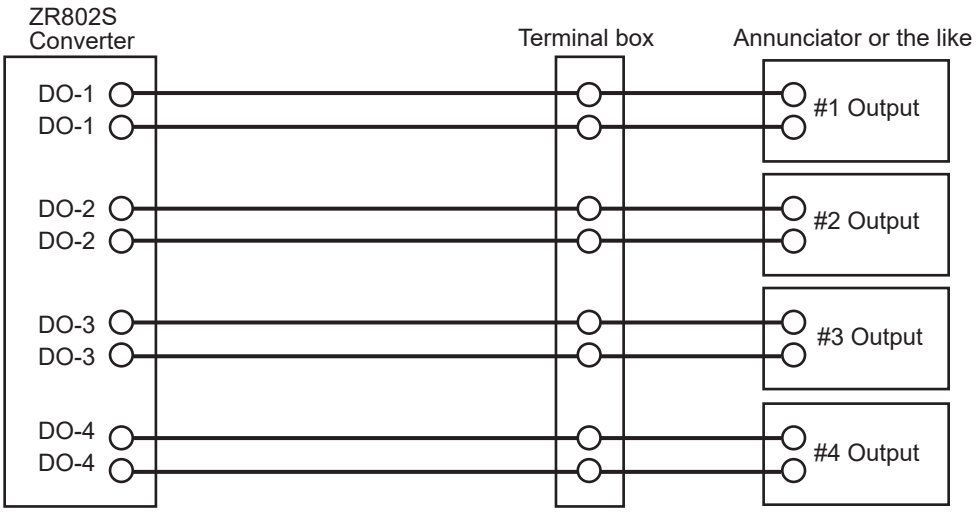


Figure 4.13 Contact output wiring

Cable Specifications

Number of wire in cable varies depending on the number of contact used.

Wiring Procedure

(1) M4 screws are used for the terminals of the converter. Each cable should be terminated with crimp-on terminals that fit M4 screw.

(2) The capacities of the contact output relay are 30 V DC 3 A, 250 V AC 3 A. Connect a load (e.g. pilot lamp and annunciator) within these limits. AC and DC voltage cannot be mixed.

4.2.8 Contact Input Wiring

The converter can execute specified function when receiving contact signals.
To use these contact signals, wire as follows:

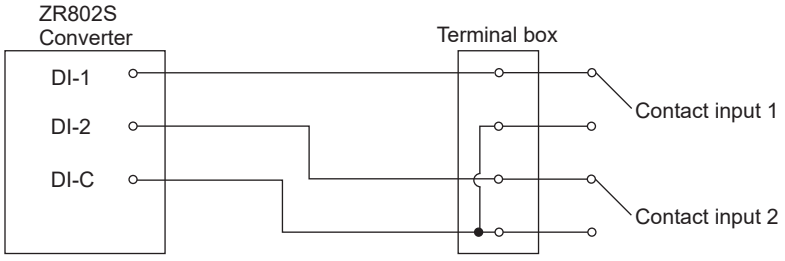


Figure 4.14 Contact Input Wiring

Cable Specifications

Use 2-core or 3-core cable for this wiring. Depending on the number of input(s), determine which cable to use.

Wiring Procedure

(1) M4 screws are used for the terminals of the converter. Each cable should be terminated with crimp-on terminals that fit M4 screw.

(2) The ON/OFF level of this contact input is identified by the resistance or voltage. Connect a contact input that satisfies the specifications in Table 4.2.

Table 4.2 Identification of Contact Input ON/OFF

	Closed	Open
Resistance	200 Ω or less	100 kΩ or more
Voltage	-1 to 1 VDC	4.5 to 25 VDC

4.2.9 Pressure Input Wiring

When inputting the measurement gas pressure by external input, connect a two-wire pressure transmitter (hereinafter referred to as transmitter). The oxygen value is compensated based on the pressure signal sent from the connected transmitter when the setting is “Pressure input selected” and “external input”. As for the wiring of the transmitter, refer to appropriate transmitter user’s manual.

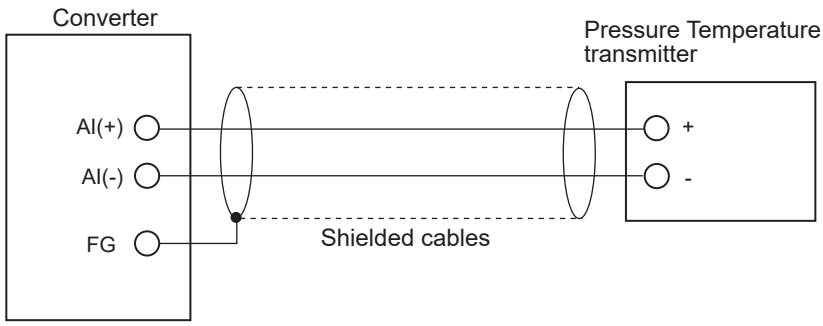


Figure 4.15 Pressure input wiring

● Applicable Temperature Transmitter

Apply a transmitter that is suit for the following interfaces:

Output signal: 4 to 20 mA DC, two-wire system (*1)

Maximum supply voltage from the analyzer: 24.2 V DC

Input resistance of the analyzer: Maximum 250 V (The load resistance of the transmitter is the total of wiring resistance and input resistance.)

(*1) When /AI is specified, the use of 4-wire transmitter eliminates the supply voltage of the transmitter. Prepare it separately.

Transmitter Burnout

When outputting a burnout signal of the transmitter with a contact output of the analyzer, use “high/low-limit pressure alarm”. (Refer to Section “7.1 Current Output Setting”) In this case, set the burnout signal of the transmitter to exceed the high limit (20 mA or more).

Cable Specifications

Use a two-core shielded cable for wiring.

Wiring Procedure

(1) M4 screws are used for the converter terminals. Cables should be equipped with appropriate crimp contacts. Ensure that the cable shield be connected to the FG terminal of the converter.

(2) Be sure to connect “+” and “-” polarities correctly.

4.2.10 Communication wiring

ZR802S wired digital communication can be Ethernet(Modbus TCP) or RS-485 (Modbus RTU) depending on your requirements.

Be sure to use shielded cables to prevent malfunction due to external noise ad to avoid the effects of radiated noise from ZR802S on other equipment.

● RS-485 cable

Use RS-485 cable when the digital communication code-M (Modbus RTU) is selected. All RS-485 terminal screws are clamping terminals.

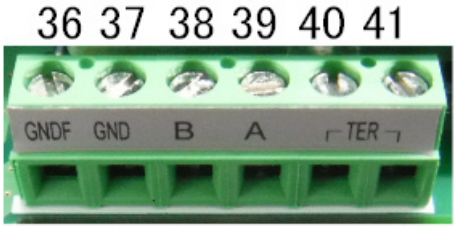


Figure 4.16 RS-485 terminal screw

Table 4.3 RS-485 Terminal Assignments

Terminal	Name	Application
36	GNDF	shield
37	GND	signal GND
38	B	data (negative electrode)
39	A	data (positive electrode)
40	TER	terminal resistor (110Ω)
41	TER	terminal resistor (110Ω)

Use a multi-core shielded cable with stranded core wires (twisted pair). The shield connects to terminal 36.

Termination resistor for signal (resistance value 110 Ω) is built-in. Perform termination according to the communication environment.

When terminating, connect terminals 40 and 41 using a jumper as shown in Figure 4.17.

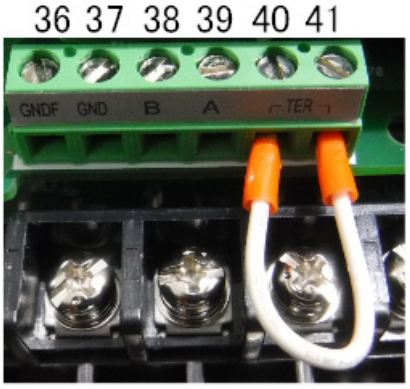


Figure 4.17 How to terminate RS-485

Ethernet cable

Use Ethernet cable when the digital communication code -E (Modbus TCP) is selected. RJ45 connectors are provided in the positions shown in Figure 4.18.

Insert a Category 5 or higher STP cable (shielded cable) into RJ45 connector. Both straight and cross connection is available for cable connection.

Figure 4.18 Ethernet connector position

5. Components and Their Functions

In this Chapter, the names and functions of components are described for the major equipment of the ZR Explosion-proof Zirconia Oxygen Analyzer.

5.1 ZR802S Converter

Operation panel

- LCD touch panel (Infrared touch display when the front cover is closed)
- It is an easy-to-understand Japanese Display.
- You can operate while interacting with screen
- Various Display modes are available
- LCD with backlight for visible darkness
- Alarm code is displayed in addition to the alarm number.
- You can manage security with a password.

Touch panel display Display examples

Figure 5.1 Home screen example

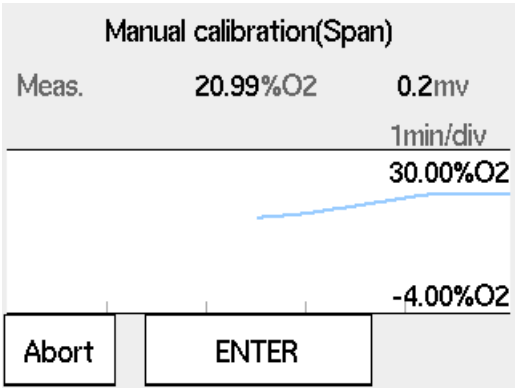


Figure 5.2 Trend screen

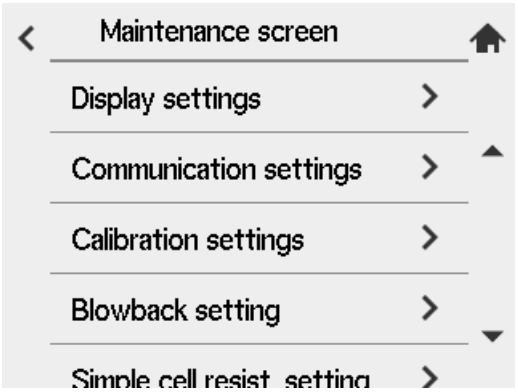


Figure 5.3 Data display setting example.

Self-diagnose leads to a remedy.
When a trouble occurs, an alarm is displayed on LCD.

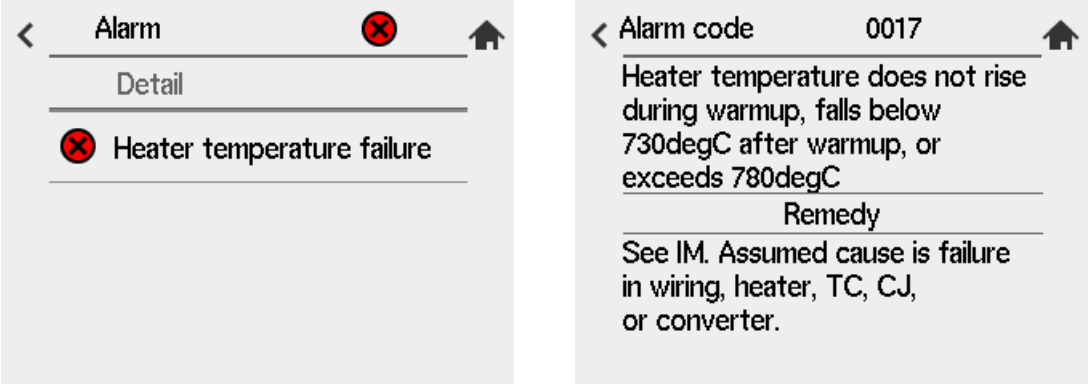


Figure 5.4 Alarm description example

5.2 Touchpanel Switch Operations

5.2.1 Home screen and icons

ZR802S adopts touch panel type which is operated by pressing the display. Figure 5.1 shows the home screen. Icons displayed on the screen depend on setup and device status.

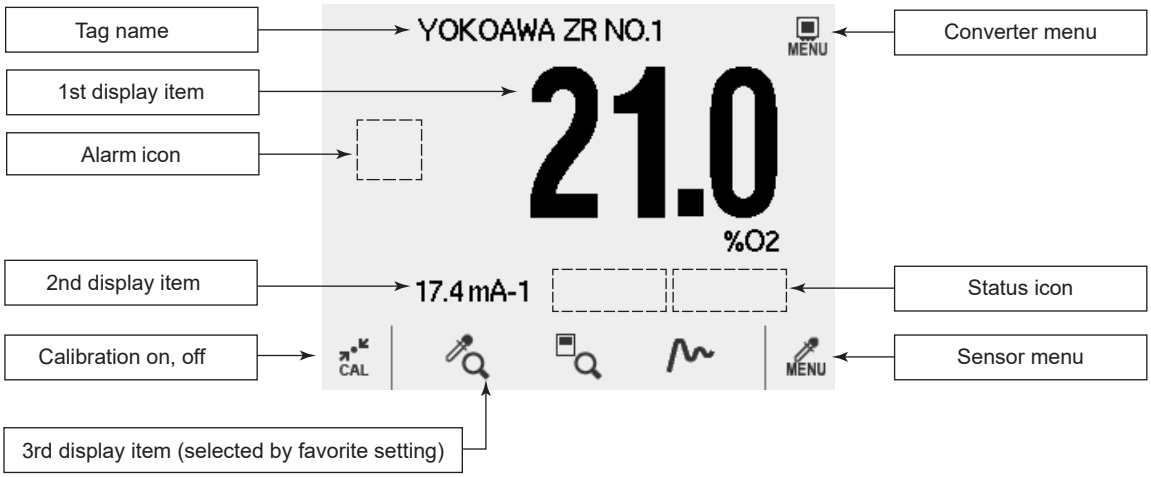


Figure 5.5 Home screen

Tag name: A setup tag name is displayed here. (See Section “9.4.5 Entering Tag Names”)

1st to 3rd display item: Selected item is displayed. You can place a shortcut you select in the favorite setting. (See Section “7.4.4 Alarm Setting Procedure”)

Shortcut icon

Sensor detail	Converter detail	Trend
Blowback	Set up	Save load
Maintenance	Restart	Simple cell resistance measurement

Alarm icon Display area:

Alarm icon is displayed here.

Press the area that the icon indicates to see the description of each alarm.

Fault icon 	Alarm icon 

See Section “9.4.2 NE107 mode”.

Status Display icon area: Icons are displayed depending on the device status. Some can be interrupted by pressing the corresponding icon.

Status	Left Display	Right Display	Priority	Interruption
Purging in progress (before warm-up	PURGE		High	×
Warm-up	WARM			×
Calibration in progress	CAL *1			O
During blowback	BLOW *1			O
Simple cell resistance measurement in progress	CELL *1			O *2
AO hold in progress		HOLD		×
AO switch range in progress		RANGE	Low	×

*1 While the icon is blinking, the status is being stabilized.
*2 The operation can be interrupted only while the icon is blinking.

5.2.2 Screen flow

Figure 5.6 shows the screen flow chart. You can move to each setting, execution or confirmation screen from “Converter menu”, “Sensor menu” on Home screen. [Home] returns to Home screen from any screen.

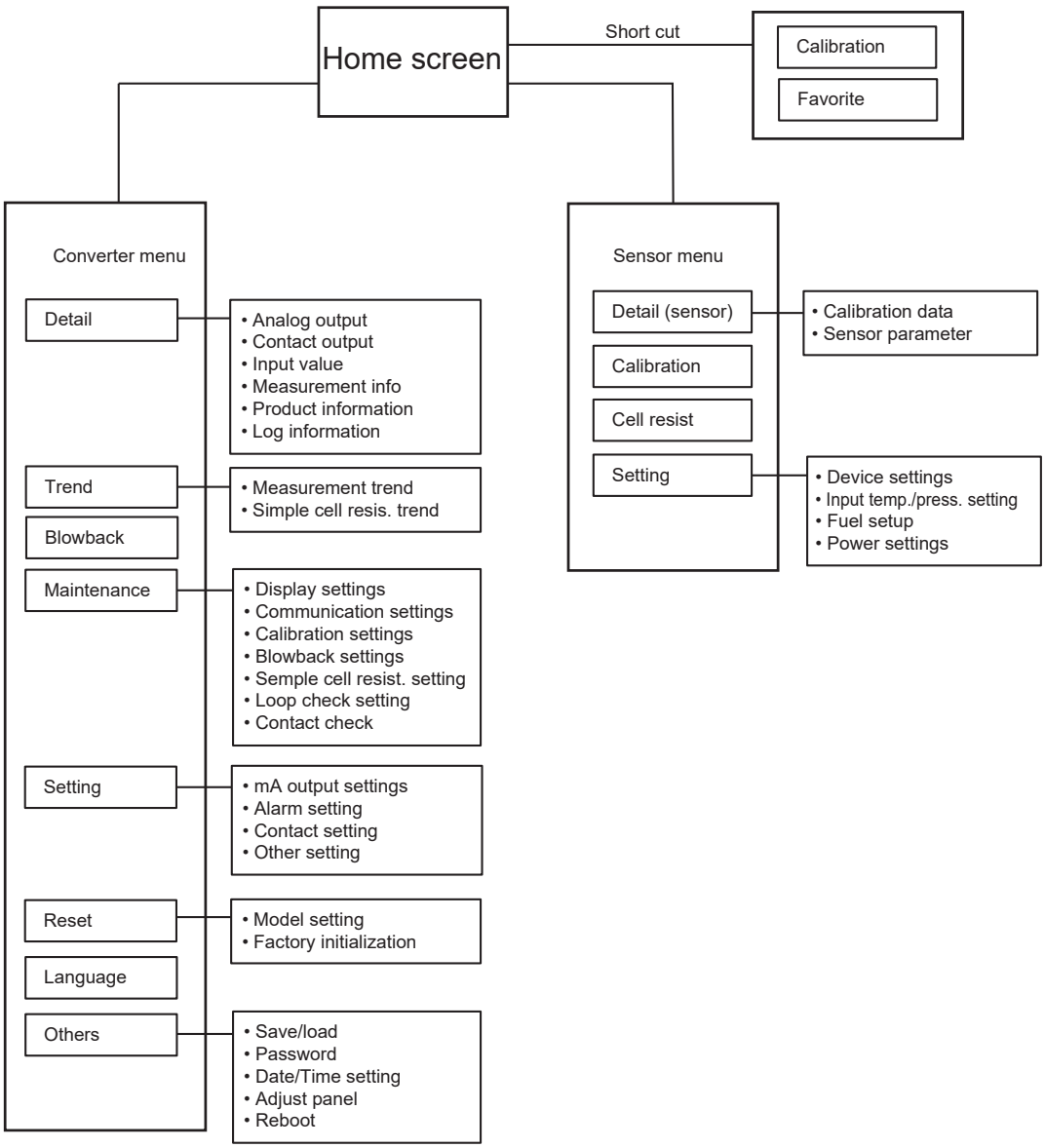


Figure 5.6 Screen flow chart

5.2.3 Functions on screens

(1) Home screen:
Displays three value of each selected item. See Section “6.9 Setting Display Item”. Icons are displayed to indicate alarm or status of the device.

(2) Converter menu:
Calibration, Maintenance, Setting and other items are displayed.

(3) Sensor menu:
This allows you to view such detailed data as the cell (sensor) electromotive force, cell (sensor) temperature etc. See Section “9.1 Detailed-data Display”.

5.2.4 Entering Numeric and Text Data

When you enter a password, for instance, which uses text, numeric data or symbols, first an alphabetic entry screen appears.

Pressing the [123] key changes the numeric value entry screen and allows you to enter a numeric value. You can also press [#@&] to switch to symbolic screen and enter symbols. The only screen that can enter numeric values is the numeric entry screen.

Two to three alphabets and symbols are assigned to each key. Press the key several times to select character. When the desired character is turned at the cursor position, you can enter it by pressing the [→] key or another character key. After entering the numeric value and text, press [↵] to exit the entry screen. To return without inputting, key screen upper left [<] button.

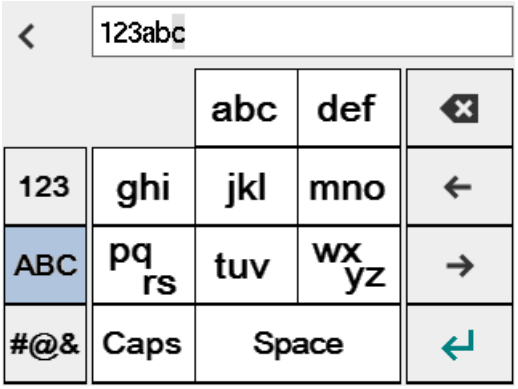


Figure 5.7 Text-data Entry

5.3 Infrared Switch Operations

5.3.1 Display and Infrared Switch

ZR802S adopts infrared switch enabling operations while the cover being closed. At the startup, the infrared switch is disabled. By enabling it, the infrared switch can be used. Refer to “5.3.2 How to enable/disable infrared switch” to enable the function.

Figure 5.8 shows the infrared switch and the display. Table 5.1 shows the functions of the switch.

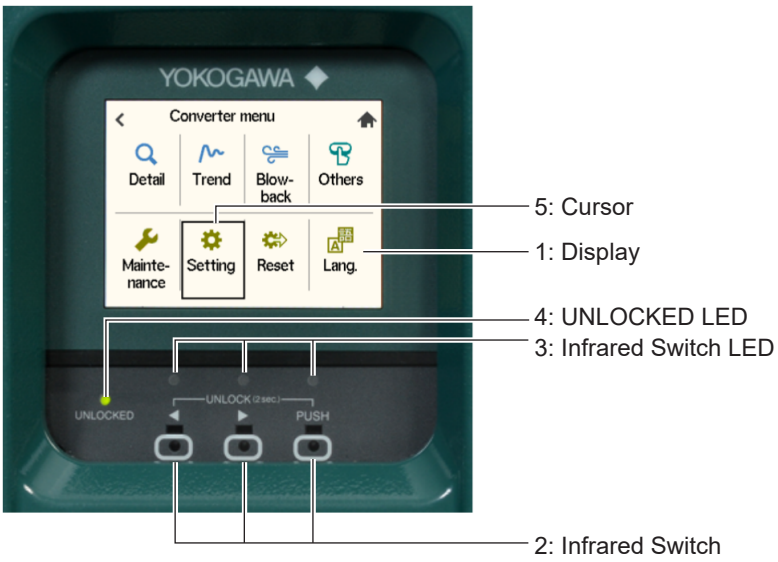
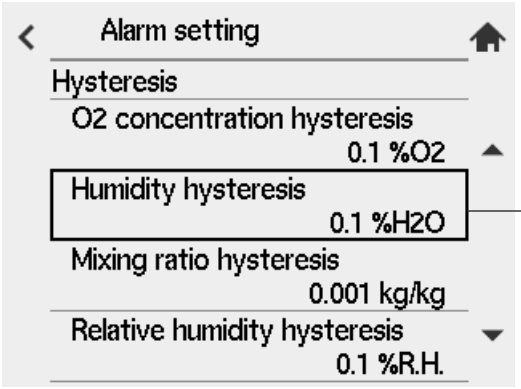


Figure 5.8



1 Displays data: Home screen shown in 6.3.1 and icons are displayed.

2 Infrared Switch: Three infrared switches enable operations including data setting.

3 Infrared Switch LED: Lit on when each infrared switch detects touch operation.

4 UNLOCKED LED: Lit on when infrared switch is enabled.

5 Cursor: Indicates the item being selected.

Table 5.1 Infrared Switch Icons, Functions

Icon	Function
◄	Move the cursor toward the left. Keep pressing to move the item continuously. Selected item moves in a loop.
►	Move the cursor toward the right. Keep pressing to move the item continuously. Selected item moves in a loop.
PUSH	Performs the same operation as when the item is touched on the touch panel (execute, move to the next screen, etc.).

Press finger firmly on the glass surface of the switch to operate the infrared switch.

To press the same switch two times in a row, press it once then lift your finger from the glass surface before repeating the press for the second time. Or press and hold your finger on the switch until the selected item goes to a desired place.

The movement pattern of the selected item differs depending on the displayed screen.

CAUTION

The infrared light emitted from the infrared light-emitting element is reflected by the finger and received by the light-receiving element. This amount of light received determines whether the switch is on or off.

1 Always close the case cover completely. Otherwise, the infrared switch may not respond properly.

2 Wet or dirt on the glass surface may degrade the response time. Wipe off any water droplets or dirt on the glass surface for operation. Keep your fingers clean as well.

3 Direct sunlight may affect the switch, causing response failure. In this case, attach a sunshade cover or change the angle of the display.

4 When opening/closing the case cover, if the glass surface has water droplets or dirt on it, LED may flick.

5.3.2 How to enable/disable infrared switch

Enable the infrared switch as follows. UNLOCKED LED is lit on when the switch becomes enabled.

- Press "◄" and "PUSH" simultaneously for over 2 seconds.

However, the following conditions need to be satisfied in advance.

- The touch panel has never been used even once after the startup.
- More than 180 seconds have passed since the last time the touch panel was used.

The enabled infrared switch becomes disabled under the following conditions. UNLOCKED LED turns off when the infrared switch becomes disabled.

- The touch panel is used.
- More than 180 seconds have passed since the last time the infrared switch was used.

5.4 ZA8F Flow Setting Unit

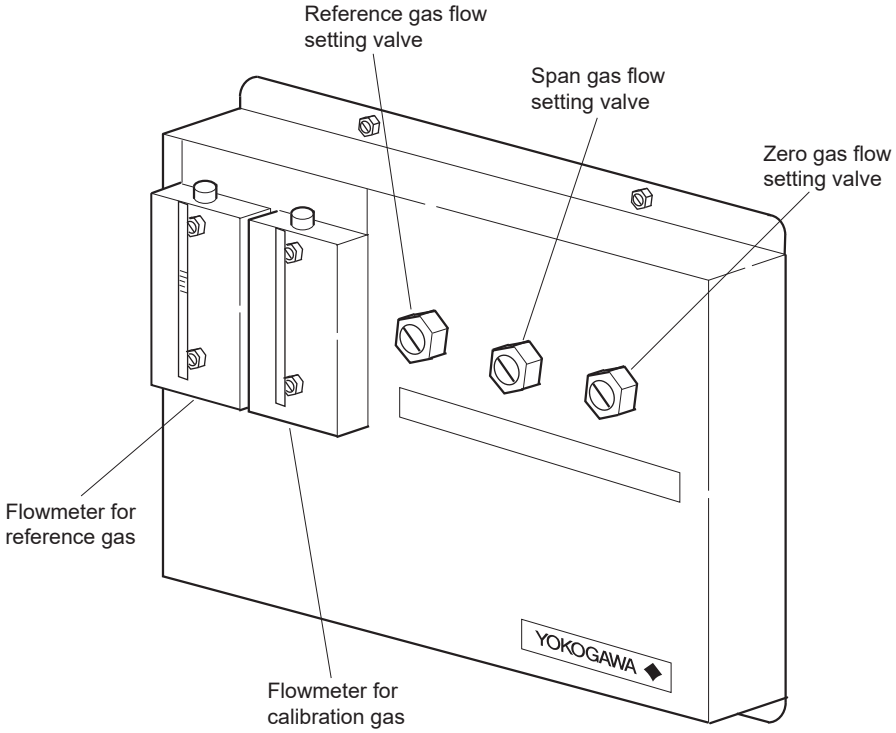


Figure 5.9 ZA8F Flow Setting Unit

6. Startup

The following describes the minimum operating requirements — from supplying power to the converter to analog output confirmation to manual calibration.

6.1 Startup Procedure

The startup procedure is as follows:

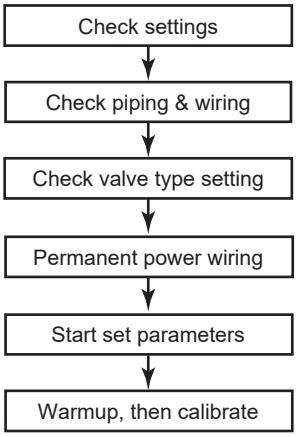


Figure 6.1 Startup Procedure

6.2 Checking Piping and Wiring Connections

Check that the piping and wiring connections have been properly completed in accordance with Chapter 4, “Piping,” and Chapter 5, “Wiring.”

6.3 Checking Valve Setup

Set up valves and associated components used in the analyzer system as follows:

(1) If a stop valve is used in the detector’s calibration gas inlet, fully close this valve.

(2) If instrument air is used as the reference gas, adjust the air-set secondary pressure so that an air pressure equals sample gas pressure plus approx. 50 kPa (or sample gas pressure plus approx. 150 kPa when a check valve is used, maximum pressure rating is 300 kPa) is obtained. Turn the reference gas flow setting valve in the flow setting unit to obtain a flow of 800 to 1000 mL/min. (Turning the valve shaft counterclockwise increases the rate of flow. Before turning the valve shaft, if the valve has a lock nut, first loosen the lock nut.) After completing the valve setup, be sure to tighten the lock nut.

NOTE

The calibration gas flow setting is described later. Fully close the needle valve in the flow setting unit.

6.4 Supplying Power to the Converter

CAUTION

To avoid temperature changes around the detector, it is recommended that (rather than turning it on and off) power be continuously supplied to the Oxygen Analyzer if it is used in an application where it is used periodically.

It is also recommended to flow a span gas (instrument air) beforehand.

Supply power to the converter. A display as in Figure 6.2, which indicates the detector's sensor temperature, then appears. As the heat in the sensor increases, the temperature gradually rises to 750°C. This takes about 20 minutes after the power is turned on, depending somewhat on the ambient temperature and the sample gas temperature.

After the sensor temperature has stabilized at 750°C, the converter is in measurement mode. The display panel then displays the oxygen concentration as in Figure 6.3. This is called Home screen.

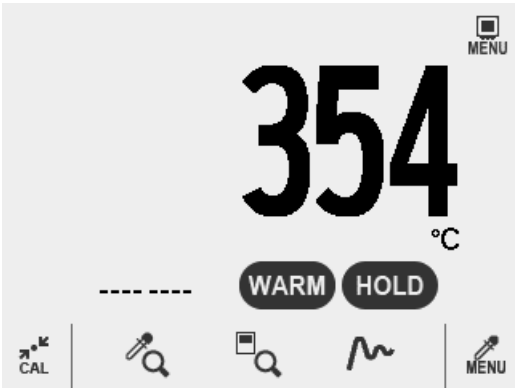


Figure 6.2 Display During Warm-up

Figure 6.3 Measurement Mode Display

6.5 Confirmation of Converter Type Setting

This converter can be used for an oxygen analyzer.
Before setting the operating data, be sure to check that the desired converter model has been set.

CAUTION

If the converter type setting is changed, the operating data that have been set are initialized and the default settings remain.

(1) Press the [Converter menu] key.
(2) Select [Reset] > [Model setting].
(3) Confirm the displayed product model is one presently being used. Oxygen Analyzer is preset at the factory shipment.
(4) If [Humidity model] is preset, press [Oxygen model] to change the model. After changing the model, press [Execute].
(5) If a converter model is changed after setting the operating data, the entered data are initialized. Enter again the operating data to meet the model to use.

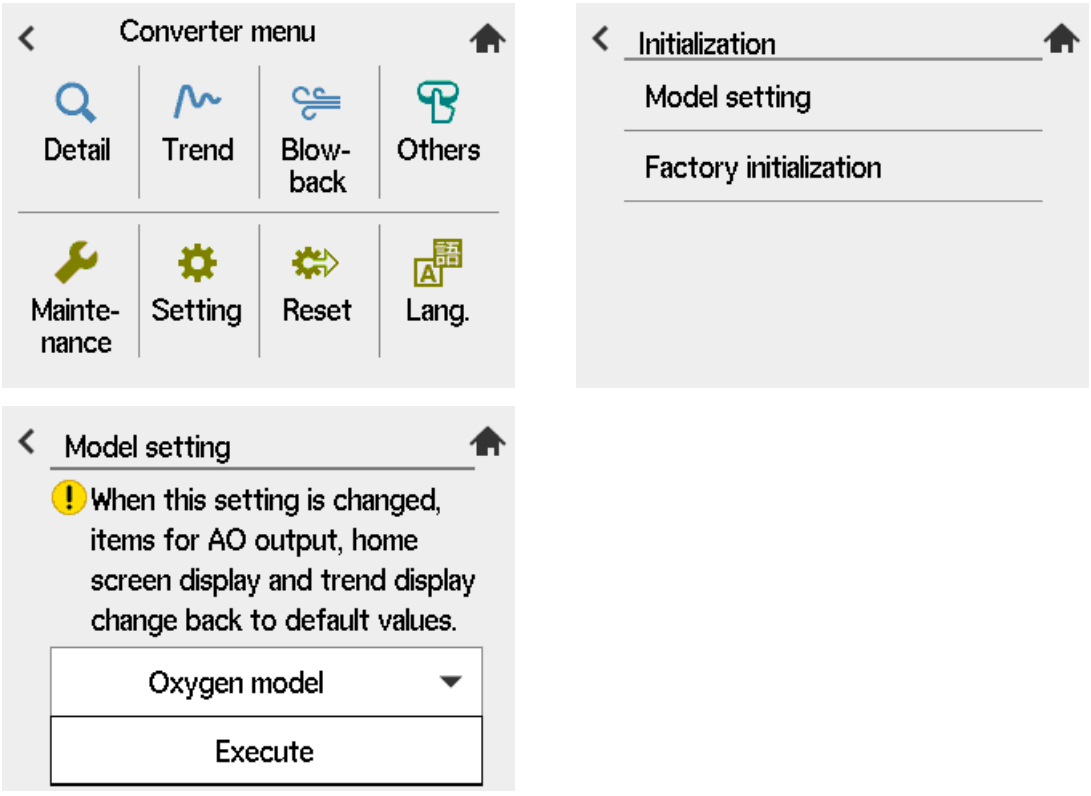


Figure 6.4 Equipment Setup

6.6 Confirmation of Detector Type Setting

(1) Press the [Sensor menu] key.
(2) Select [Setting] > [Setting].
(3) Confirm ZR22 (PT1000:Ohm) is selected as detector. Factory default is ZR22.
(4) If [ZS8D/ZO21DW] is preset, press [Selection of detector] to set [ZR22].

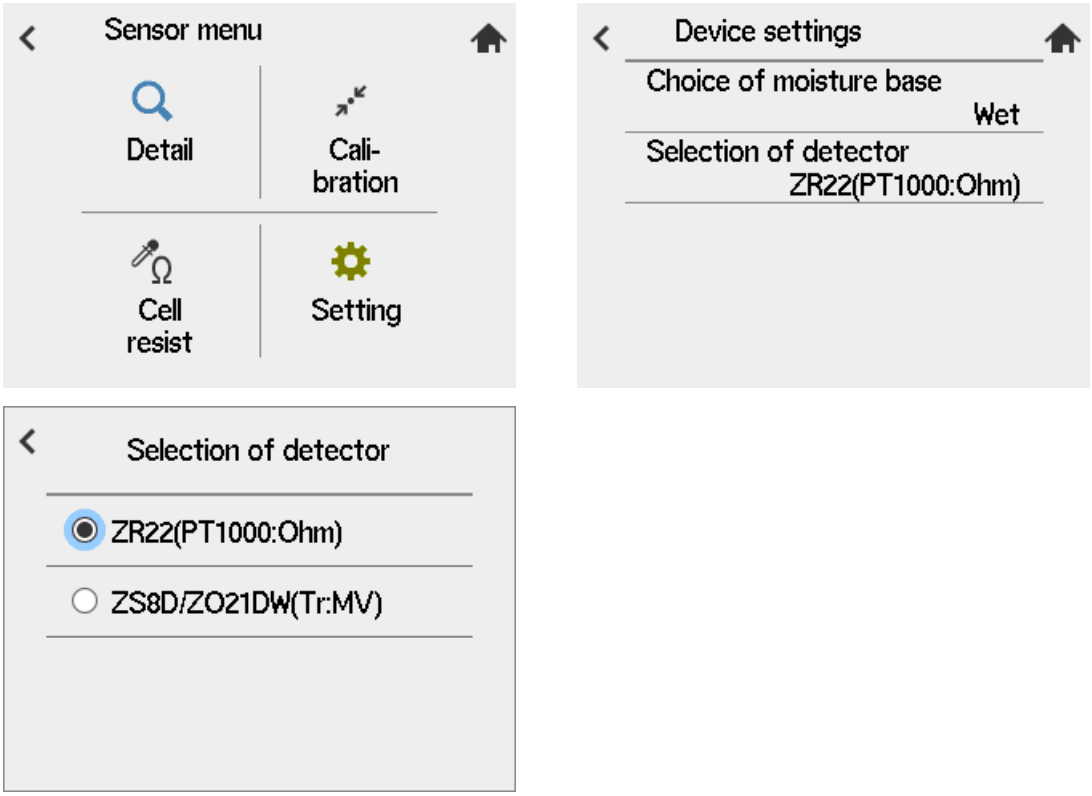


Figure 6.5 Selection of detector

CAUTION

If sensor/detector settings are to be changed, first disconnect the wiring connections between the sensor/detector and the converter. Then change detector settings appropriately.

6.7 Selecting moisture base

Combustion gas contains water vapor generated by hydrogen combustion in the fuel. Therefore, if this water vapor is removed, the oxygen concentration at this time shows a higher value than when water vapor is contained. Here, you can specify whether to use the value in wet gas as the measured oxygen concentration value, or arithmetic and use it as the value in dry gas.

If you select "Choice of moisture base" in screen of the 7.6, the window "Wet", "Dry" to select. The factory default is "Wet".

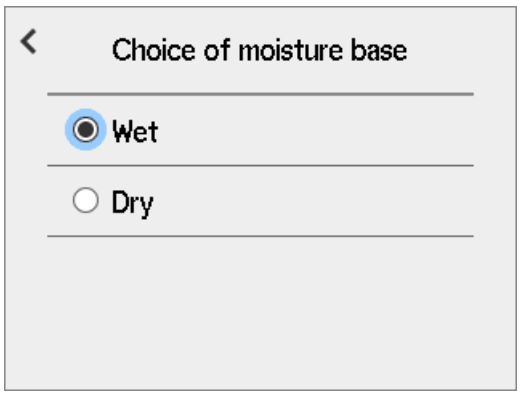


Figure 6.6 Choice of moisture base

6.8 Output Range Setting

This section sets forth analog output range settings. For details, consult Section “7.1 Current Output Setting”, later in this manual.

Minimum Current (4 mA) and Maximum Current (20 mA) Settings

To set the minimum and maximum current settings, follow these steps:

(1) Select the “Setting” from Converter menu.
(2) Select “mA-output settings”.
(3) Select “mA-output1”.
(4) On “Selection of AO1 Oxygen concentration” enter “4mA point” and “20 mA point”
(5) Set “mA-output2” in the same manner as steps above.

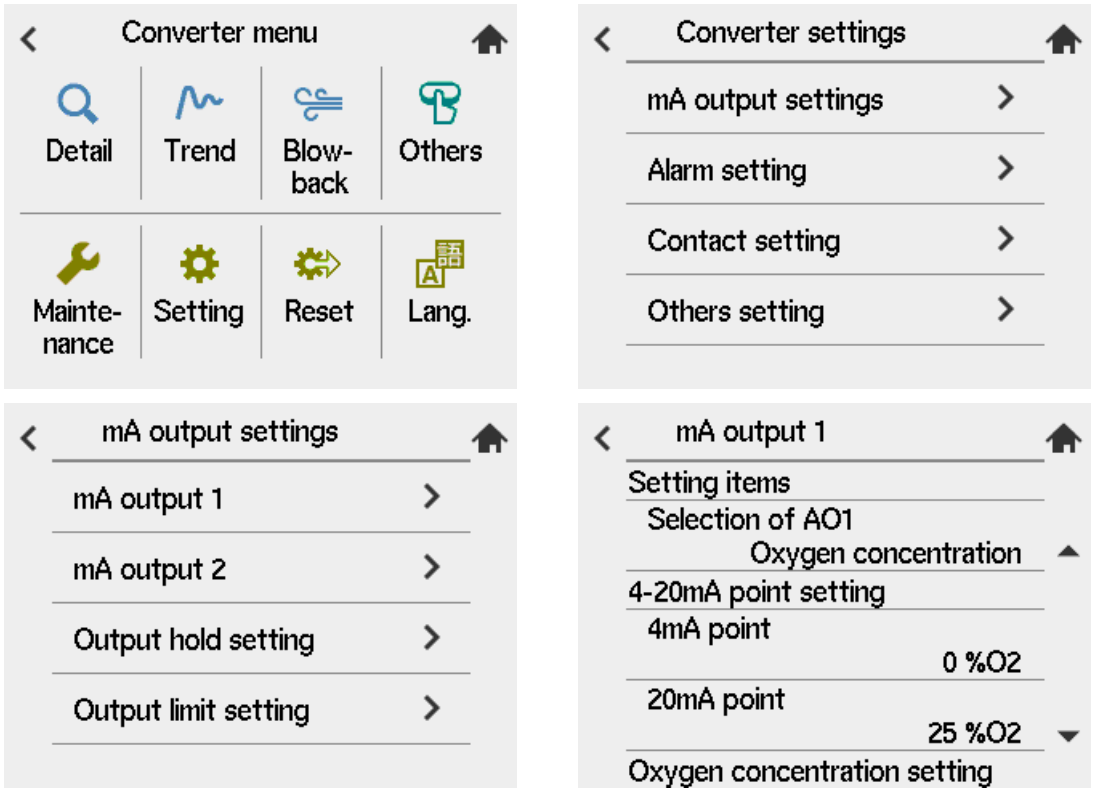


Figure 6.7 Setting “mA-output”

NOTE

Each setting is limited in value. See “8.1 Calibration Briefs” for details.

6.9 Setting Display Item

This section briefly describes the Home screen item shown in Figure 6.8

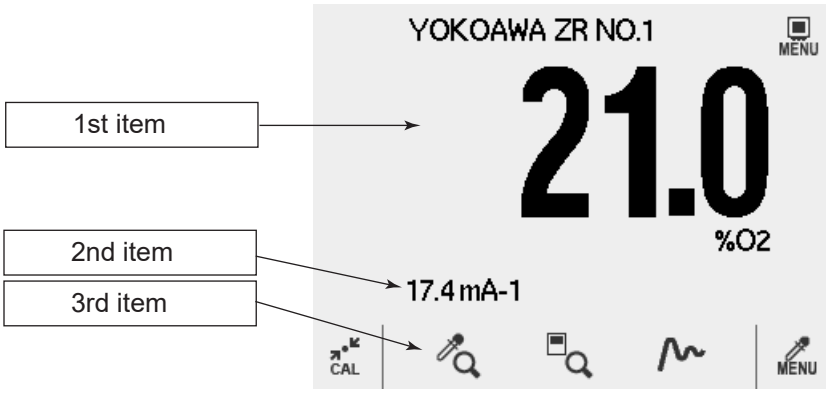


Figure 6.8 Home screen

(1) [Converter menu] > [Maintenance]

(2) Select the “Display settings”.

(3) Select “Display item”. Select “1st display item” selection. A window opens to select an item to display.

(4) Repeat the steps as shown above to setup 2nd or 3rd display item selection.

(5) Table 6.1 shows display Items that enable the selection of display items in individual display areas.

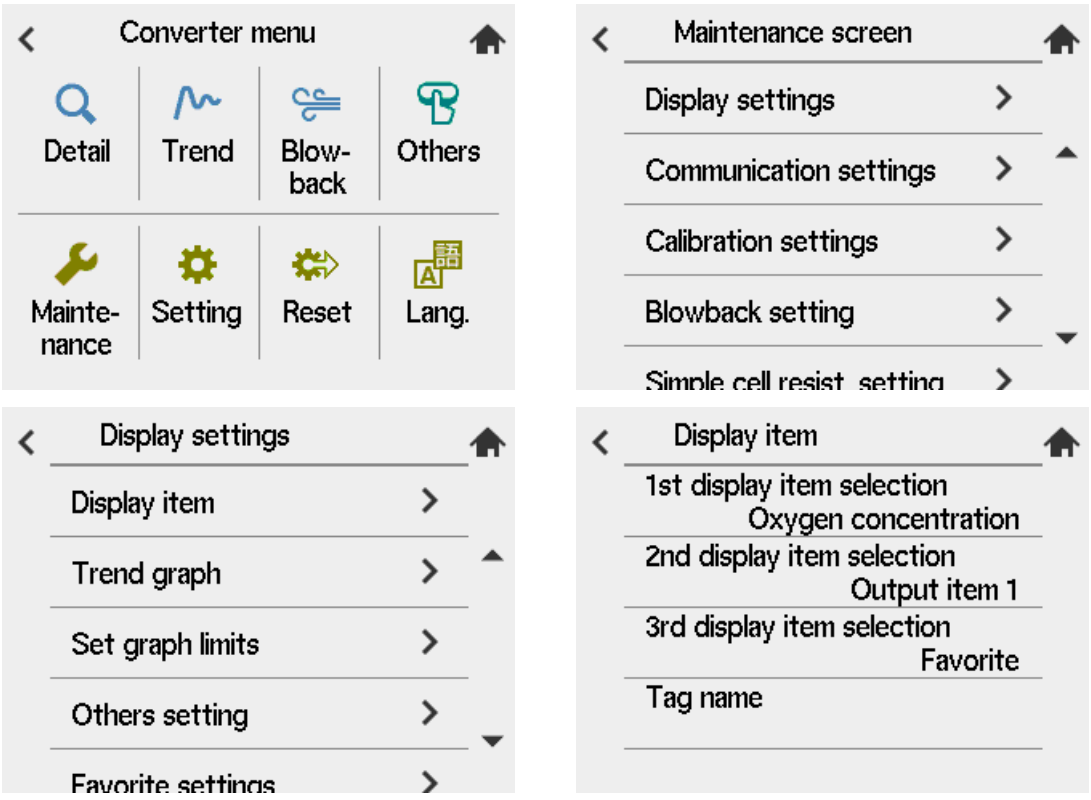


Figure 6.9 Setting Display Item

Table 6.1 Display Items

Item	1st display item	2nd, 3rd display item	Display
Oxygen concentration	○	○	Oxygen concentration during measurement
Air ratio		○	Current computed air ratio
Moisture content		○	Moisture content (%H_2O) in the exhaust gas
Output item 1	○	○	Oxygen concentration with the equipment set for oxygen analyzer (See *1 below.)
Output item 2	○	○	Oxygen concentration with the equipment set for oxygen analyzer (See *1 below.)
AO output 1		○	Current value output from analog output 1
AO output 2		○	Current value output from analog output 2
Favorite		○ 3rd display item only	

*1: If an analog output damping constant is set, the oxygen concentration display then includes these settings.

Favorite settings

(1) "Display settings" > "Favorite settings"

(2) "Favorite settings" can have up to four items.

Figure 6.10 Favorite settings

About the Air ratio:

“Air ratio” is defined as the ratio of (the amount of air theoretically required to completely burn all the fuel) to (the amount of air actually supplied).

For this equipment, the air ratio will be obtained in a simplified way by measuring the oxygen concentration in the exhaust gas. The air ratio may be expressed mathematically by:

$$m = \{ 1 / (21 - \text{Oxygen concentration}) \} \times 21$$

If you use the air ratio data for estimating the combustion efficiency, etc., check that no air is leaking in beforehand and that the measured value has not been affected by any interference gas (CH_4, CO, H_2, etc.).

About moisture content:

The moisture content in the exhaust gas is calculated based on the parameters of the fuel setting (refer to Section “7.7.3 Setting Fuels”). The moisture content may be expressed mathematically by:
Moisture content = {(water vapor content per fuel unit quantity) + (water content in air)}/ total amount of exhaust gas

$$= \{ Gw + (1.61 \times Z \times Ao \times m)\} / \{ X + (Ao \times m)\}$$

where,

Gw = water vapor content in exhaust gas, m^3/kg (m^3/m^3)
Z = Ambient absolute humidity, kg/kg
Ao = Ideal air amount, m^3/kg (m^3/m^3)
m = Air ratio
X = Fuel coefficient

For details on each parameter, refer to Section “7.7.3 Setting Fuels”.

6.10 Checking Current Loop

The set current can be output as an analog output.

(1) “Converter menu” > “Maintenance”
(2) Select “Loop check setting”.
(3) Set AO1 test output, AO2 test output on “Loop check setting”.
(4) Select “Test validity AO1/AO2”. Check an item to enable. Press the save icon to store the data.
(5) Press the save icon on the Loop check setting. Preset current starts to output.
(6) When you exit the maintenance screen, Test validity AO1/AO2 turns off.

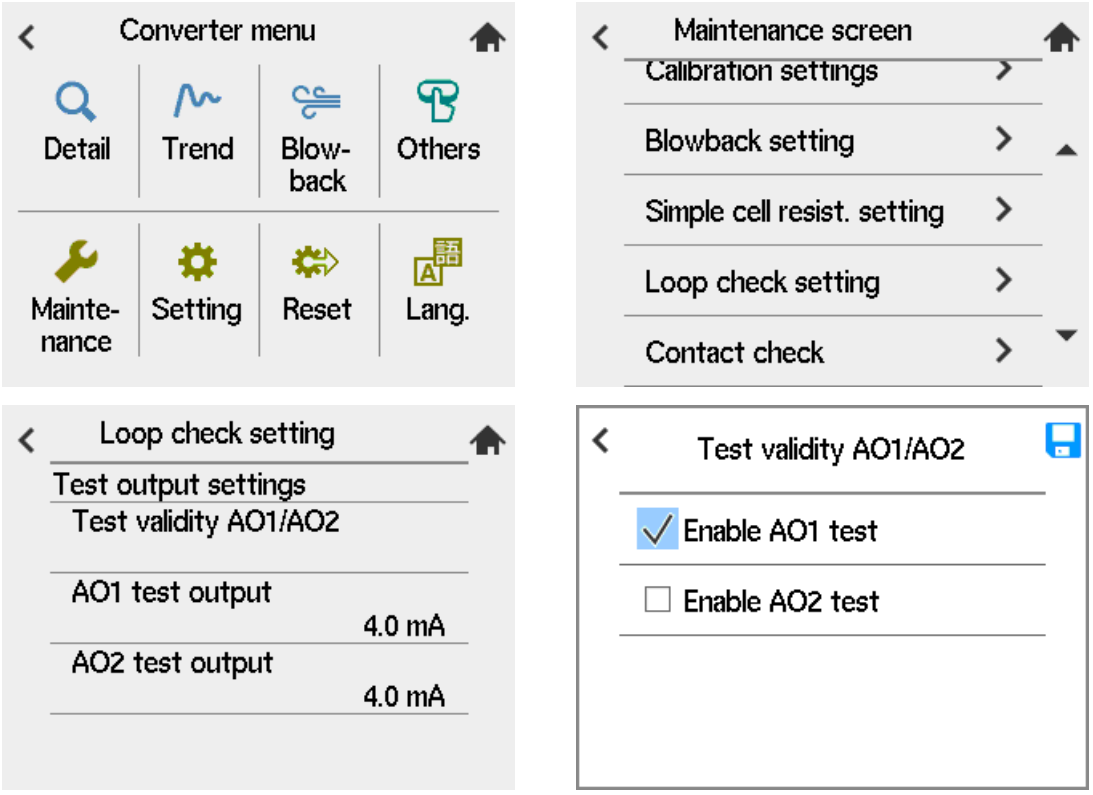


Figure 6.11 Current loop check

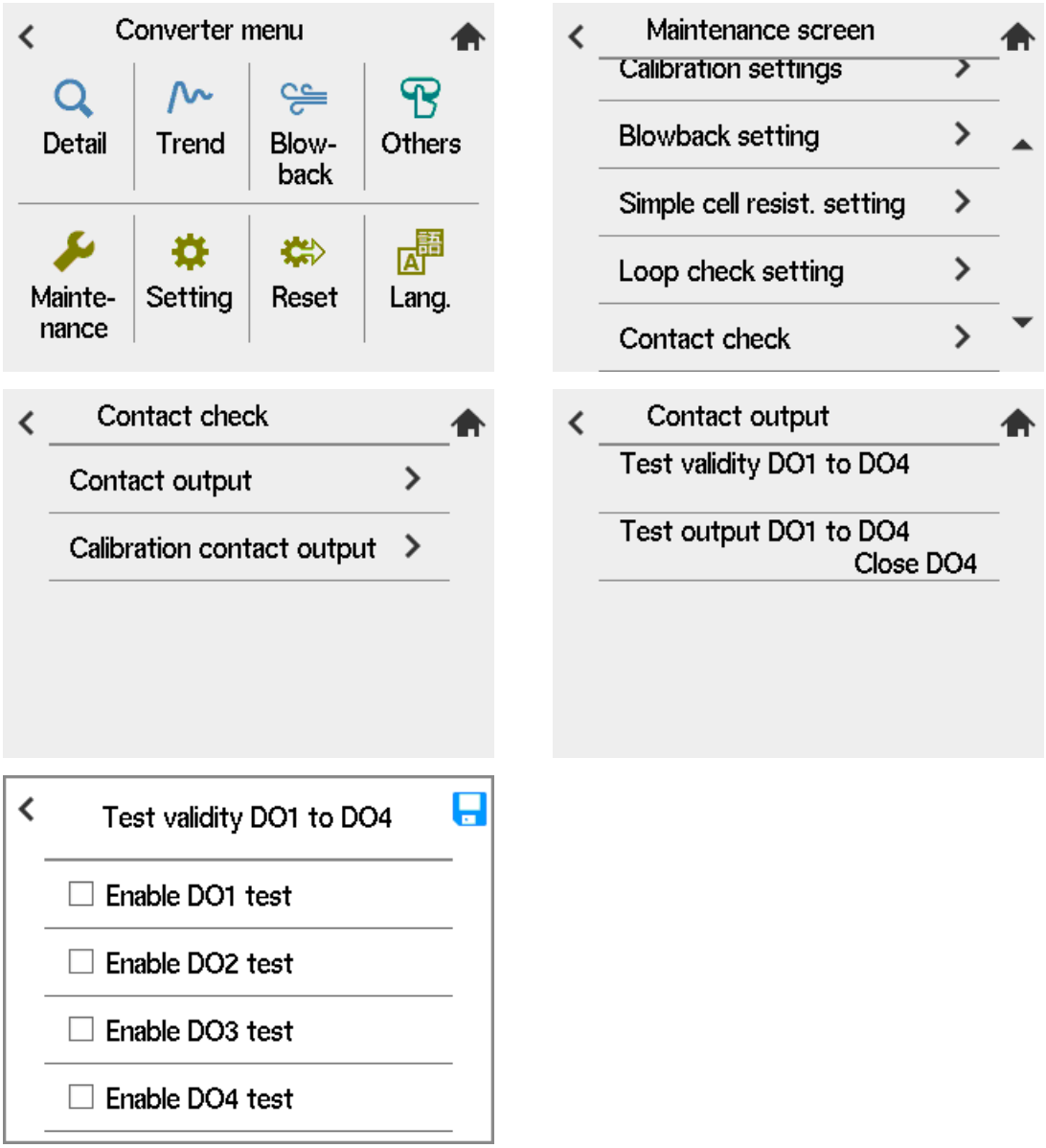
6.11 Checking Contact I/O

Conduct the contact input and output checking as well as operational checking of the solenoid valves for automatic calibration.

6.11.1 Checking Contact Output

To check the contact output, follow these steps:

(1) “Converter menu” > “Maintenance”
(2) Select “Contact check”.
(3) Select “Contact output” on the “Contact check”.
(4) On the “Contact output”, select “Test output DO1 to DO4” and check on the test output. Press the save icon and fix the item.
(5) On the “Contact output”, select “Test validity DO1 to DO4” and check on the test validity output .Press the save icon and fix the selection of test validity.
(6) Press the save icon on “Contact output” to output the setup data.
(7) When you exit the maintenance screen, test validity of DO1 to DO4 becomes OFF.



Contact output check

CAUTION

If you conduct an open-close check for contact output 4, Alarm 016 or Alarm 017 will occur. This is because the built-in heater power of the detector, which is connected to contact output 4, is turned off during the above check. So, if the above alarm occurs, reset the equipment or turn the power off and then back on to restart (refer to Section “9.10 Reboot”).

6.11.2 Checking Calibration Contact Output

The calibration contacts are used for solenoid valve drive signals for Automatic Calibration Unit. When using Automatic Calibration Unit, use the calibration contact output to check that the wiring connections have been properly completed and check equipment operation.

(1) “Converter menu” > “Maintenance menu”

(2) On Maintenance menu, select “Contact check”.

(3) Select “Calibration contact output”.

(4) On “Calibration contact output” select “Test output cal. contact”. Check on test to output and press the save icon to fix the item.

(5) On “Calibration contact output”, select “Test validity cal. contact”. Check on test to make valid and press the save icon to fix the item.

(6) Press save icon to output the setup data.

(7) When you exit the maintenance screen, test validity of cal. contact becomes OFF.

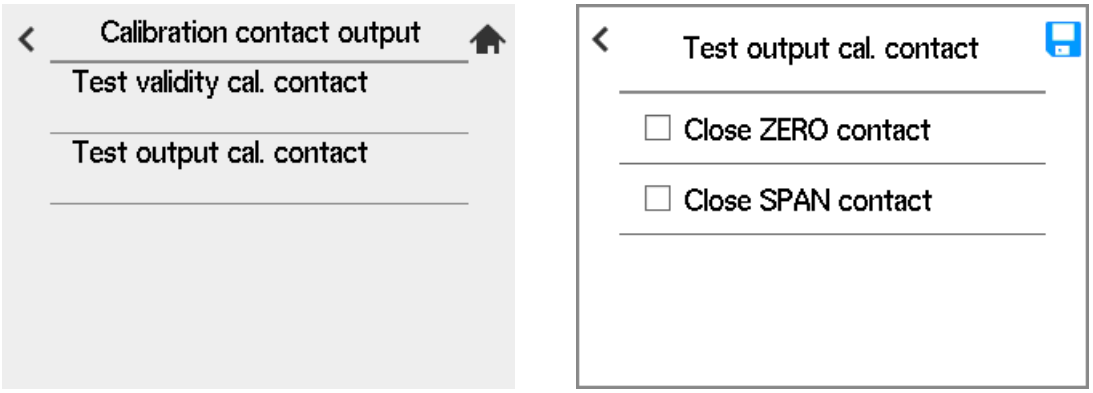


Figure 6.12 Contact Output Check Display

CAUTION

“Open” and “Closed” displayed on the Calibration contacts display indicate actions of drive contacts and are opposite to the valve open and close actions. If “Open” is displayed on the Calibration contacts display, no calibration gas flows. If “Closed” is displayed on that display, calibration gas flows.

6.11.3 Checking Input Contacts

(1) “Converter menu” > “Detail”

(2) Select “Input value”. “ON” or “OFF” on the display refers to the present status of the contact input terminal. The ON/OFF switches according to the contact open/close status so that you can check whether the wiring or the operation is performed properly.

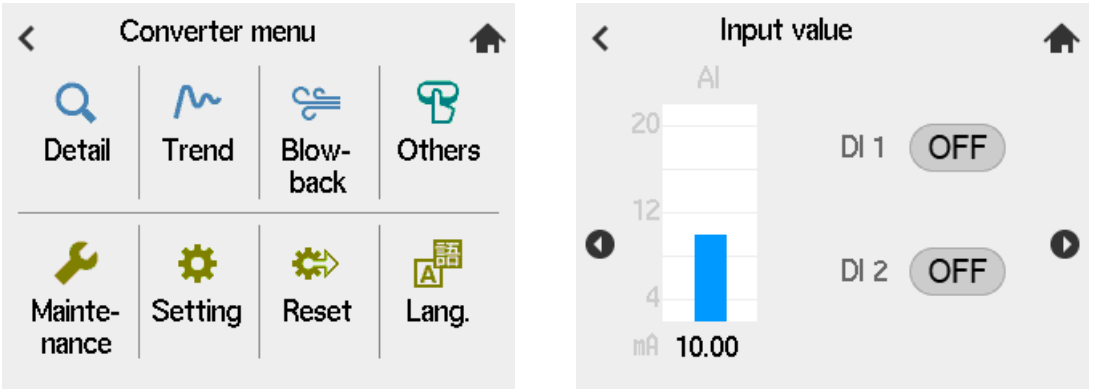


Figure 6.13 Input Contact Check Display

6.12 Calibration

To calibrate this instrument, the procedure is to measure zero gas and span gas and set the instrument to read the known concentrations. The procedure for both zero and span calibration, or for either zero or span calibration, can be performed manually from the touch display, or can be performed semi-automatically using contact signal inputs to start calibration, (allowing preset calibration and stabilization times), or it can be performed automatically at preset intervals.

Manual calibration needs the ZA8F Flow Setting Unit to allow manual supply of the calibration gases. Semi-automatic and automatic calibrations need Automatic Calibration Unit to allow automatic supply of the calibration gases. The following sections set forth the manual calibration procedures. For details on semi-automatic and automatic calibrations, consult Chapter “8. Calibration”, later in this manual.

6.12.1 Calibration Setup

“Converter menu” > “Maintenance” to go to Maintenance screen.

Select “Calibration settings”. Select “Calibration mode” then a window opens. Select “Manual”, “Semi-automatic”, “Automatic, semi-automatic.” Here select “Manual.”

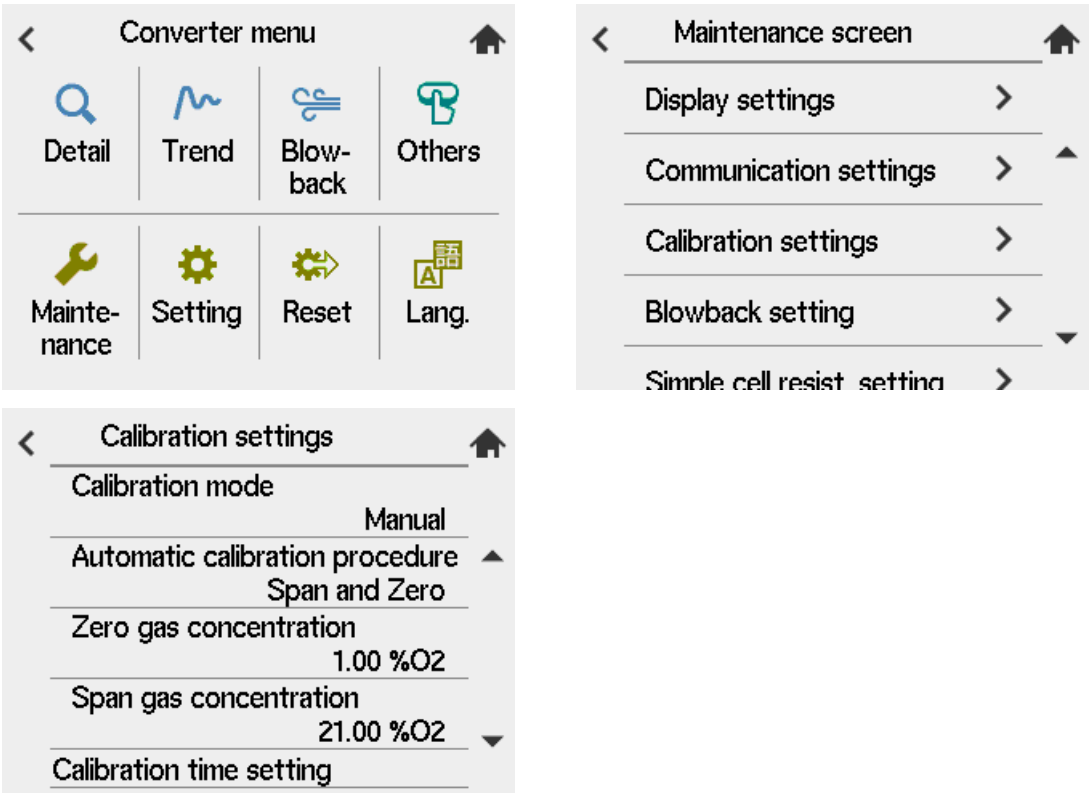


Figure 6.14 Calibration Setup Display

Calibration Gas Concentration Setting

(1) Zero gas concentration
“Calibration settings” > “Zero gas concentration” On the numeric-data entry page, enter an oxygen concentration value for the zero gas calibration.

(2) Span gas concentration

“Calibration settings” > “Span gas concentration”. On the numeric-data entry page, enter an oxygen concentration value for the span gas to use for the calibration.

If instrument air is used, enter 21 vol%O_2 value.

CAUTION

- If instrument air is used for the span gas, dehumidify to a dew point of -20°C or less to remove oil mist and dust before use.
- Insufficient dehumidification or use of dirty air may affect measurement accuracy.

6.12.2 Manual Calibration

Preparing for calibration Implementation

Before performing manual calibration, be sure that the ZA8F Flow Setting Unit zero gas flow setting valve is fully closed. Open the zero gas cylinder pressure reducing valve so that the secondary pressure equals sample gas plus approx. 50 kPa (or sample gas pressure plus approx. 150 kPa when a check valve is used, maximum pressure rating is 300 kPa).

Calibration operating instructions assume that the same instrumentation air as the reference gas is used as the span gas

(1) Home screen > “Calibration” > “Manual calibration” “Span”

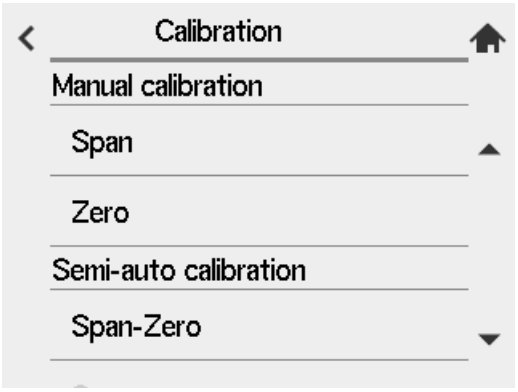


Figure 6.15 Manual calibration steps

(2) When “Span” is selected, screen of the span gas concentration is displayed. Check that the oxygen concentration value of the span gas on screen matches the oxygen concentration value of calibration gas to be actually used, and then select “Next”

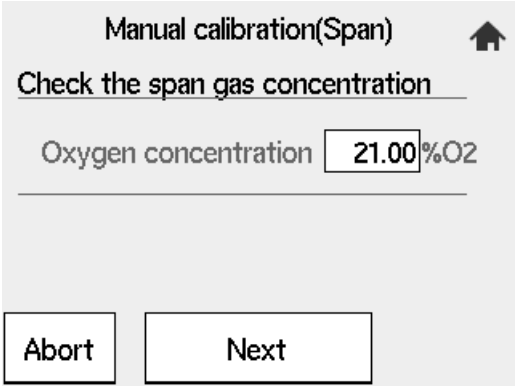


Figure 6.16 Span gas concentration check

(3) After the message of Figure 6.17 appears, feed the span gas to follow the message. Open the span gas flow setting valve on the flow setting unit and adjust the flow to 600 ± 60 ml / min. For the valve, loosen the locknut and slowly turn the valve shaft counterclockwise. To check the flow rate, monitor the calibration gas flowmeter.

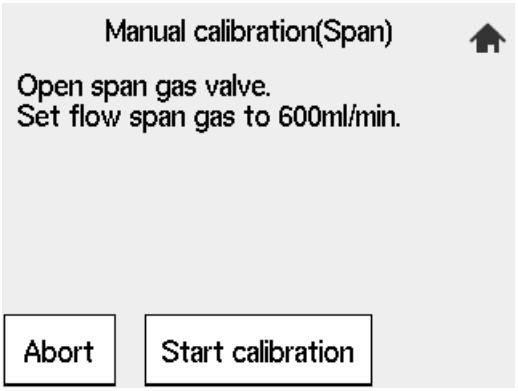


Figure 6.17 Span gas Flow Display

(4) Selecting “Start calibration” displays the trend graph of the oxygen concentration being measured (Figure 6.18) on screen. Wait for the reading to stabilize around 21% by monitoring the graph and the sensor electromotive force. At this point, calibration is not yet executed. It is acceptable for the reading to deviate from 21%.

(The vertical and horizontal scales of the graph are static.)

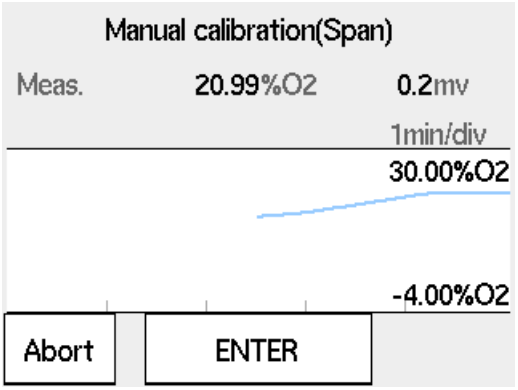


Figure 6.18 Trend during Span gas calib.

(5) After the measured value has stabilized, press the [Enter]. The screen of Figure 6.19 appears. At this point, the measured value is corrected to equal the span gas concentration setting. Close the span gas flow valve. The valve lock nut should be tightened completely so that the span gas does not leak.

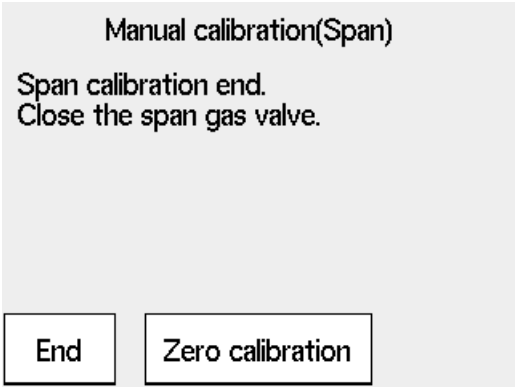


Figure 6.19 Span Calibration Complete

(6) Select “Zero calibration”. The screen of Figure 6.20 appears. Check that the oxygen concentration value on screen matches the oxygen concentration value of calibration gas that is actually used. Then select “Next”.

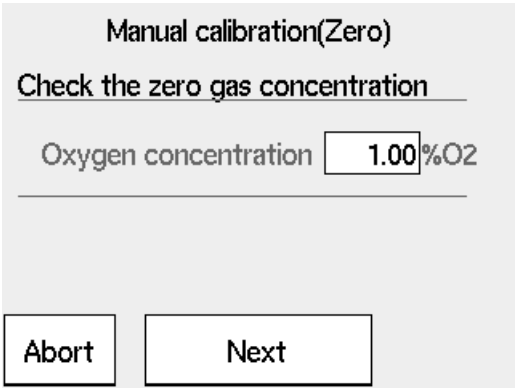


Figure 6.20 Zero gas concentration check

(7) Follow the instructions in the display as in Figure 6.21 to turn on the zero gas flow. Open the zero gas flow valve for the Flow Setting Unit and adjust that valve to obtain a flow of 600 ± 60 ml/min. The valve should be adjusted by loosening its lock nut and turning slowly the valve shaft counterclockwise. Use the calibration gas flowmeter to check the flow rate.

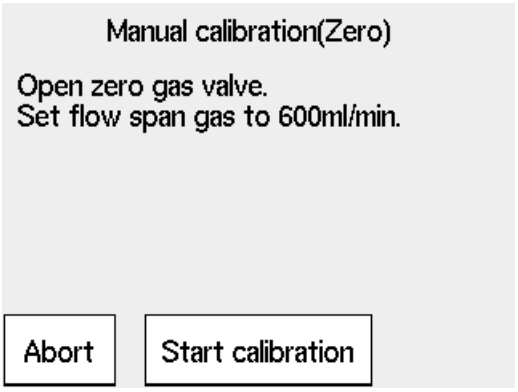


Figure 6.21 Zero gas flow rate check

(8) Similar to span calibration, selecting “Start calibration” displays the trend graph of the oxygen-concentration reading being measured (Figure 6.22) on screen. Wait for the reading to stabilize near the zero gas concentration by monitoring the graph and the sensor electromotive force. At this point, calibration is not yet executed, so it is acceptable for the reading to deviate from the zero air concentration.

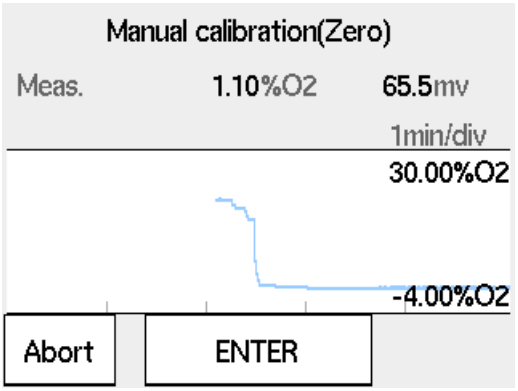


Figure 6.22 Trend in Zero gas calibration

(9) After the measured value has stabilized, press the [Enter] key to display the “Zero calibration complete” display shown in Figure 6.23. At this point, the measured value is corrected to equal the zero gas concentration setting. Close the zero gas flow valve. The valve lock nut should be tightened completely so that the zero gas does not leak.

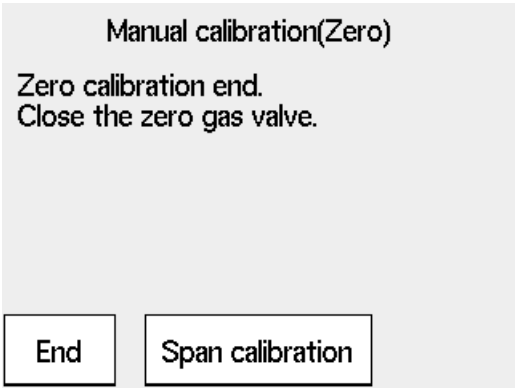


Figure 6.23 Zero Calibration complete

(10) Select “End”. An oxygen concentration trend graph (with the oxygen concentration being measured) appears and HOLD TIME flashes. This time is referred to as the output-stabilization time.

If the HOLD TIME has been set in “Output hold setting”, the analog output remains held. See Section “7.2 Output Hold Setting”

Manual calibration completes when the preset hold (output stabilization) time elapses. This hold (output stabilization) time is set to 10 minutes at the factory before shipment. If you press the [Enter] or [Abort] key within the hold (output stabilization) time, manual calibration completes.

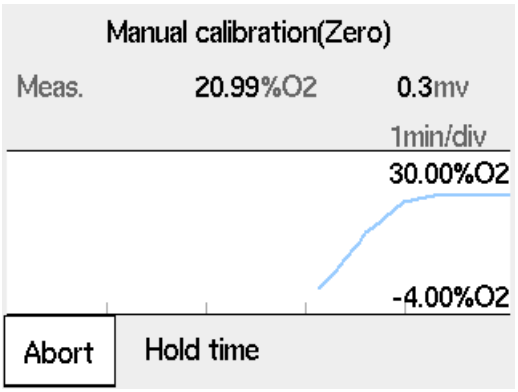


Figure 6.24 Hold Time

7. Detailed Data Setting

7.1 Current Output Setting

This section describes setting of the analog output range.

7.1.1 Setting Minimum Current (4 mA) and Maximum Current (20 mA)

(1) "Converter menu" > "Setting"

(2) Select the "mA output settings".

(3) Select "mA output1".

(4) Select "Selection of AO1" . Enter the value of "4mA point" and "20 mA point" for each.

(5) Set "mA output2" in the same way as the setting procedure for mA-output1 given above. See "6.8 Output Range Setting" for details.

NOTE

For the humidity measurement, 0% H_2O is a default setting for the minimum humidity and 25% H_2O is the default for the maximum humidity. If you first attempt to set 50% H_2O for the minimum humidity, you cannot set it because that value is outside the set range. In such a case, set the maximum humidity first.

7.1.2 Input Ranges

- **Oxygen Concentration setting range**

The range min. O_2 concentration value (corresponding to 4 mA output) can be set to either 0 vol%O_2 or in the range of 6 to 76 vol%O_2.

The range max. O_2 concentration value (corresponding to 20 mA output) can be set to any value in the range of 5 to 100 vol%O_2, however, the range max. setting must be at least 1.3 times the range min. setting.

If you do not observe this restriction, the measurement will be invalid, and any previous valid value will be used. The gray area in Figure 7.1 represents the valid setting range.

Setting example 1

If the range minimum (corresponding to 4 mA output) is set to 10 vol%O_2 then range maximum (corresponding to 20 mA output) must be at least 13 vol%O_2.

Setting example 2

If the range minimum (corresponding to 4 mA output) is set to 75 vol%O_2 then range maximum (corresponding to 20 mA output) must be at least 75x1.3=98 vol%O_2 (rounding decimal part up).

CAUTION

Requirements for explosion-proof use:

Oxygen concentration of sample/reference/calibration gas shall not exceed that found in normal air, typically 21 vol%.

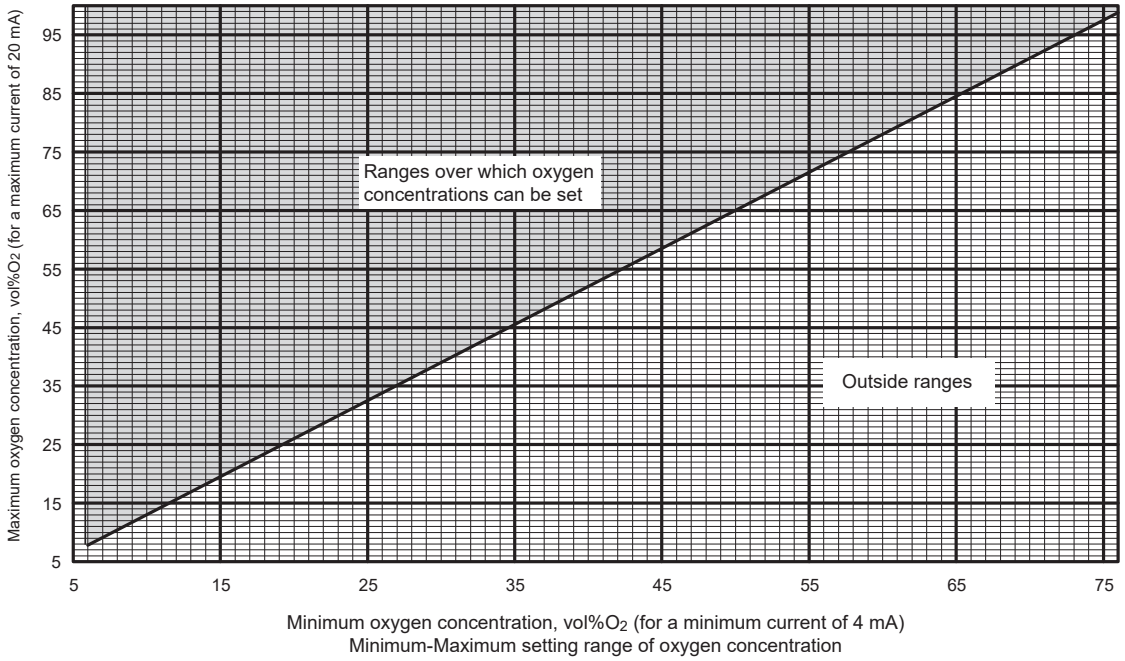


Figure 7.1

7.1.3 Setting Output Smoothing Factor

If the measured value changes suddenly, using this measured value as a control may cause harm such as frequent on-off operation.

In such a case, you can set a smoothing time constant of between 0 and 255 seconds to reduce the effect. Select “AO1 time constant”, “AO2 time constant” to enter an appropriate value.

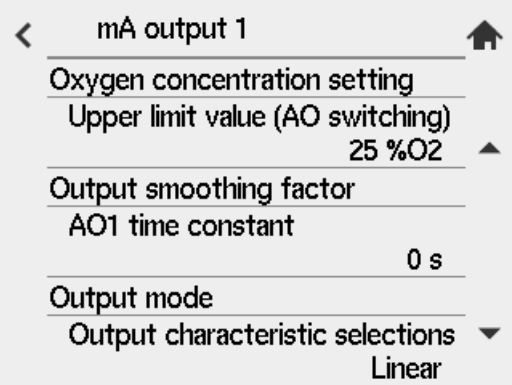


Figure 7.2 Output smoothing factor

7.1.4 Selection of Output Mode

You can select whether the relationship between the sample oxygen concentration and the analog output signal be linear or logarithmic. Press the [Output characteristic selections] in the output mode display. A linear/ logarithmic selection display then appears. Select the desired mode.

NOTE

If you select an output mode of “logarithmic”, regardless of range setting the minimum output value becomes fixed to 0.1 vol%O_2 , humidity; 0.1% H_2O.

Display of the minimum oxygen concentration value, the minimum humidity, the minimum mixing ratio remain unchanged.

7.1.5 Default Values

When the analyzer is delivered or reset to defaults, the output current default settings by as shown in Table 7.1.

Table 7.1 Output Current Default Values

Item	Default setting
4mA point oxygen concentration	0%O_2
20mA point oxygen concentration	25%O_2
Output smoothing factor	0 (seconds)
Output mode	Linear
Upper limit value (AO range switching)	25%O_2

7.2 Output Hold Setting

The “output hold” functions hold an analog output signal at a preset value during the equipment’s warm-up time or calibration or if an error arises. Outputs 1 and 2 can not be set individually. Table 7.2 shows the analog outputs that can be retained and the individual states.

Table 7.2

Equipment status / Output hold values available	Warm-up mode	Maintenance mode	Calibration mode, Blow back mode, Simple cell resistance measurement mode	On fault occurrence
4 mA	○			
20 mA	○			
No hold		○	○	
Last value hold		○	○	○
Preset value (2.4 to 21.6 mA)	○	○	○	○

○: The output hold functions are available.

7.2.1 Definition of Equipment Status

(1) During warm-up

“During warm-up” is the time required after applying power until sensor temperature stabilizes at 750ºC and the instrument is in the measurement mode.

(2) Under Maintenance

Maintenance mode starts when you go to the next item from Converter menu or Sensor menu.

Table 7.3 Target items under maintenance

Menu	Item	Maintenance (○: Enable)
Converter menu	Detail	
	Trend	
	Blowback	○
	Others	○
	Maintenance	○
	Setting	○
	Reset	○
	Lang.	○
Sensor menu	Detail	
	Calibration	○
	Cell resist	○
	Setting	○

(3) Under Calibration (see Chapter “8. Calibration”)

For manual Calibration:

Calibration period starts when you enter a calibration-start screen (Figure 7.14). The calibration period lasts until you end the calibration after the calibration operations. The mode ends after End key is entered and the preset HOLD TIME elapses.

For semi-automatic Calibration:

Calibration mode starts when you select Calibration on the touch panel or the command is issued by contact input. The calibration period lasts until the HOLD Time elapses after the calibration operations.

For automatic calibration;

Calibration period lasts after a calibration is conducted at the time of calibration-start until HOLD Time (output stabilization) elapses.

(4) During Blow back (see Section "9.5 Blow Back")

During semi-automatic blow back:

"During semi-automatic blow back" is the time required after pressing the [Blow back start] key, by using the touchpanel or entering a blow back start instruction by using a contact input, until the blow back time and Hold time (output stabilization) elapse.

During automatic blow back:

"During automatic blow back" is the time required after reaching the blow back start time until the blow back time and Hold time (output stabilization) elapse.

(5) During Simple Cell Resistance Measurement (see Section "9.6 Simple cell resistance measurement")

During semi-automatic simple cell resistance measurement

This starts when you press "Start" of the simple cell resistance measurement on the touch panel. The measurement period lasts until the simple cell resistance measurement time and HOLD time (output stabilization) elapse.

During automatic simple cell resistance measurement

This starts when you reach the simple cell resistance measurement start time. The period lasts until the simple cell resistance measurement time and HOLD time (output stabilization) elapse.

(6) Fault

"Fault " means that Fault (Power Supply to sensor heater is stopped) is occurring. For more information on Fault or errors, See Chapter "11. Troubleshooting".

7.2.2 Preference Order of Output Hold Value

The output hold value takes the following preference order:

High ↑ Preference order

Fault is occurring.
Under calibration/ during blow back.
/Simple cell resistance measuring
Under maintenance
During warm-up

For example, if the output current is set to 4 mA during maintenance, and no output-hold output for during calibration is preset, the output is held at 4 mA during the maintenance display. However, the output hold is released at the time of starting the calibration, and the output will be again held at 4 mA after completing the calibration and when the hold (output stabilization) time elapses.

7.2.3 mA output settings

(1) "Converter menu" > "Setting"

(2) Select "mA output settings".

(3) Select "Output hold setting".

(4) You can configure output status or preset value for each of Warm-up, maintenance, calibration/blow back/simple cell resistance measurement, or Fault.

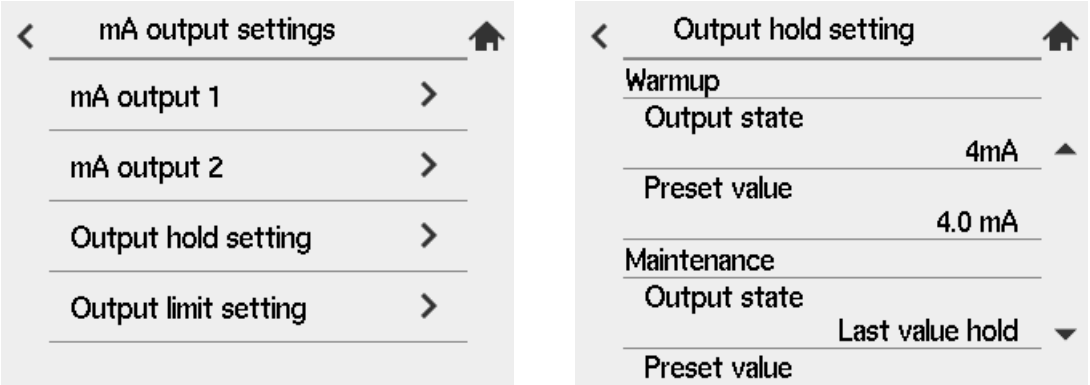


Figure 7.3 mA-outputs hold setting

7.2.4 Default Values

When the analyzer is delivered, or if data are initialized, output hold setting is the default as shown in Table 7.4.

Table 7.4 Output Hold Default Values

Status	Output hold setting	Preset value
Warm-up mode	4 mA	3.4 mA
Maintenance mode	Holds output at value just before maintenance started.	4 mA
Maintenance mode, Blow back mode, Simple cell resistance mode	Holds output at value just before starting calibration/blow back/simple cell resistance measurement	4 mA
On Fault occurrence	Holds output at a preset value.	3.4 mA

7.3 Output limit setting

Output limit is to set a limit in the range that set current value of the analog output signal beforehand.

You can set Upper limit value and Lower limit value.

You cannot set Output item 1 and Output item 2 individually.

7.3.1 Action of Output limit setting

Regardless of result of a measurement, it limits it current of the analog output signal is bigger than upper limit value or not to become smaller than lower limit value.

While current of the analog output signal is limited in upper limit value or lower limit value, Alarm 118 mA output 1 limit arrival, Alarm 119 mA output 2 limit arrival occurs.

7.3.2 Setting of Output limit

(1) “Converter menu” > “Setting”

(2) Select “mA output settings”.

(3) Select “Output limit setting”.

(4) Set upper limit value and lower limit value.

The set range of upper limit value and lower limit value is 2.4 mA to 21.6 mA both.

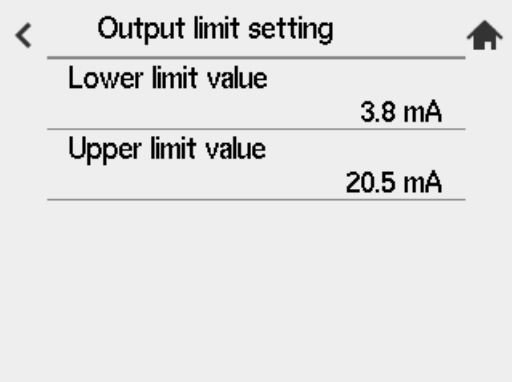


Figure 7.4 Setting of Output limit

7.3.3 Default Values

When the analyzer is delivered, or if data are initialized, output limit value is the default as shown in Table 7.5.

Table 7.5 Output Limit Default Values

Setting Item	Default value
Lower limit value	3.8 mA
Upper limit value	20.5 mA

7.4 Alarm Setting

The analyzer enables the setting of four alarms — high-high, high, low, and low-low alarms — depending upon the measurement conditions. In addition, You can set calibration coefficient alarm, temperature / pressure input alarm, simple cell resistance alarm, etc. The following section sets out the alarm operations and setting procedures.

7.4.1 Classification of Alarms

Based on NAMUR NE107, alarms can be classified into the following four types. When NE107 is set to ON in a display setup, alarms displayed on the converter are also labeled with 4 icons. Refer to “9.4.2 NE107 mode” for the setting.

- Failure: (equivalent to Fault, no power supply to heater)
- Function Check
- Out of Specification
- Maintenance Required

In the following sections, alarms are assumed to be enabled and categorized into the four types mentioned above.

7.4.2 Alarm values

(1) High-high and high alarm values

Outputs when “ON” is selected in setup items of the alarm “ON” and “OFF” and the measured value is larger than the setup limit

(2) Low and low-low alarm values

Outputs when “ON” is selected for setup items of the alarm “ON” and “OFF” and the measured value is smaller than the setup limit.

(3) Zero calibration coefficient alarm, Span calibration coefficient alarm

Outputs when calibration coefficient value (corrected value) is larger than the upper limit or smaller than the lower limit when calibration is performed.

(4) Temperature/pressure input alarm

Outputs when “ON” is selected in setup items of the alarm “ON” and “OFF” and the input value is larger than the setup limit.

(5) Simple cell resistance alarm

Outputs when the measured value of the simple cell resistance measurement is larger than the preset limit. For details on alarms, See Section “11.2.2 Remedies When Alarms are Generated”.

7.4.3 Alarm Output Actions

If the measured values of the oxygen concentration fluctuate between normal (steady state) values and the alarm setting, alarm outputs may be frequently issued and canceled.
To avoid this, set the alarm delay and hysteresis for alarm canceling under the alarm output conditions, as Figure 7.5 shows.
When a delay time is set, an alarm will not be issued so quickly even if the measured value differs from the steady state and enters the alarm setpoint range.
If the measured value remains within the alarm setpoint range for a certain period of time (for the preset delay time), an alarm will be issued. On the other hand, there will be a similar delay each time the measured value returns to the steady state from the alarm setpoint range (canceling the alarm status).
If hysteresis is set, alarms will be canceled when the measured value is less than or greater than the preset hysteresis values.
If both the delay time and hysteresis are set, an alarm will be issued if the measured value is in the alarm setpoint range and the delay time has elapsed.
For the alarm to be reset (canceled), the measured value must be beyond the preset hysteresis value and the preset delay time must have elapsed.
Refer to Figure 7.5 for any further alarm output actions. The delayed time and hysteresis settings are common to all alarm points.

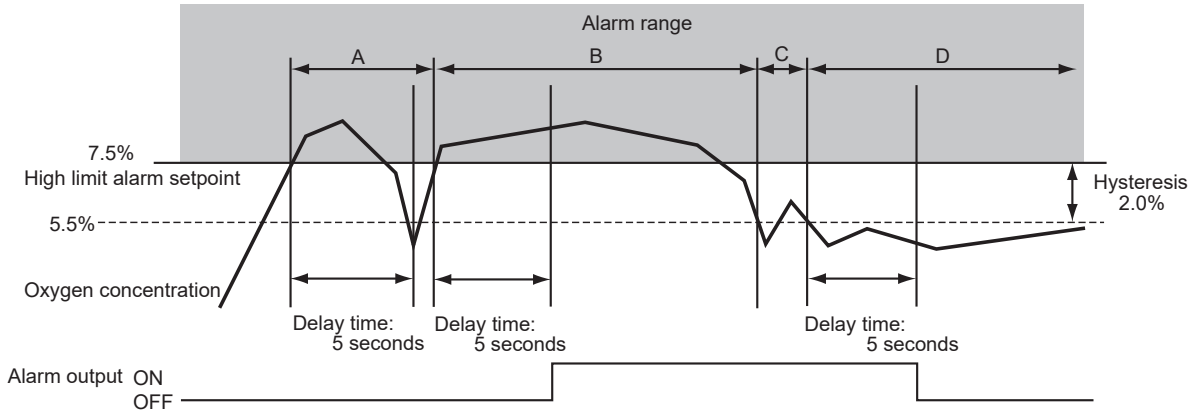


Figure 7.5 Alarm Output Action

In the example in Figure 7.5, the high limit alarm point is set to 7.5 vol%O_2, the delay time is set to five seconds, and hysteresis is set to 2 vol%O_2.

Alarm output actions in each section in this figure are as follows:

A. Although the oxygen concentration value exceeds the high limit alarm setpoint, it falls below the high limit alarm setpoint before the preset delay time of five seconds elapses. So, no alarm is issued.

B. The oxygen concentration value exceeds the high limit alarm setpoint and the delay time elapses during that measurement. So, an alarm is issued.

C. Although the oxygen concentration value falls below the hysteresis set value, the value rises again and exceeds the hysteresis set value before the preset delay time elapses. So, the alarm is not canceled.

D. The oxygen concentration value falls below the hysteresis set value and the preset delay time elapses, so the alarm is canceled.

7.4.4 Alarm Setting Procedure

(1) “Converter menu” > “Setting”

(2) Select “Alarm setting”.

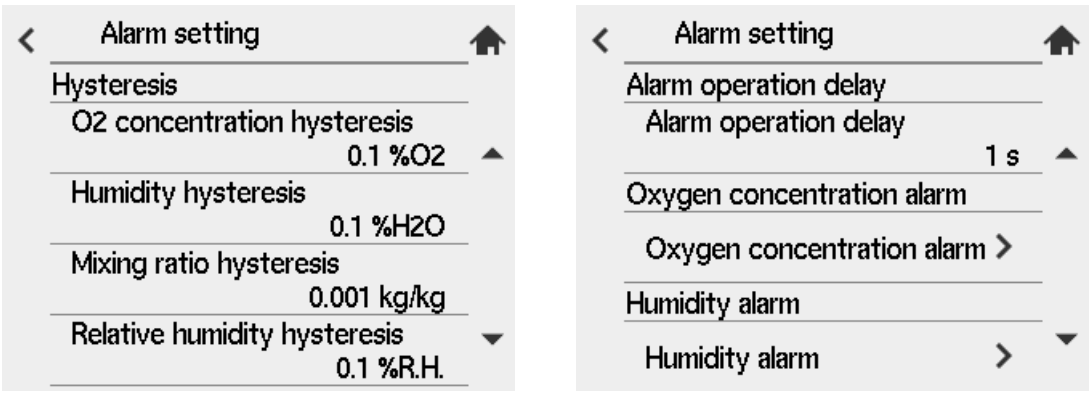


Figure 7.6 Alarm setting

• To set the hysteresis

(3) Select “Hysteresis” in the Alarm setting display. The numeric-data entry display then appears. Enter the desired hysteresis value.

• To set the delay time

(4) Select the “Alarm operation delay” in the Alarm setting display. The numeric-data entry display then appears. Enter the desired delay time, in seconds.

• To set the upper/lower alarm limit

(5) When you setup oxygen concentration alarm ON/OFF, or setup alarm value, select “Oxygen concentration alarm” to setup the alarm limit. To use High-high alarm, select “(HH) high-high alarm” and select one among “Failure”, “Function check”, “Out of specification”, “Maintenance Required”. Then High-high alarm becomes enabled.

(6) Set alarm value. To set the High-high alarm values select “(HH)high-high alarm value.” The numeric-data entry display then appears. Enter the alarm set value (percent of oxygen concentration).

(7) Set the other alarm settings in the same manner as in the steps above.

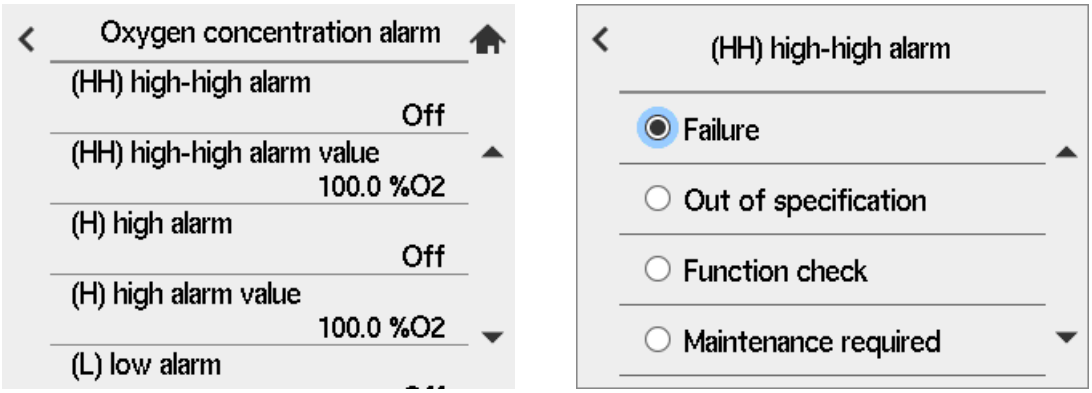


Figure 7.7 High/low alarm setting

NOTE

No alarm is issued when alarm is set to “OFF” (disabled) even after an alarm value is setup.

When using an alarm, setup one among Failure (stop power supply to the heater), Function check, Out of Specification, maintenance Required.

7.4.5 Default Values

When the analyzer is delivered, or if data are initialized, the default alarm set values are as shown in Table 7.6.

Table 7.6 Alarm Setting Default Values

Set item	Oxygen concentration	
	Setting range	Default setting
Hysteresis	0 to 9.9 vol%O_2	0.1 vol%O_2
Delay time	0 to 255 seconds	3 seconds
High-high limit alarm	–	OFF
High-high limit alarm setpoint	0 to 100 vol%O_2	100 vol%O_2
High limit alarm	–	OFF
High limit alarm setpoints	0 to 100 vol%O_2	100 vol%O_2
Low limit alarm	–	OFF
Low limit alarm setpoint	0 to 100 vol%O_2	0 vol%O_2
Low-low limit alarm	–	OFF
Low-low limit alarm setpoint	0 to 100 vol%O_2	0 vol%O_2

Table 7.7 Alarm classification and default value

Alarm name	ON/OFF default setup (Note 1)	Alarm classification change (Note 2)
High/High-high limit, Low/Low-low limit alarm	OFF	Feasible
Simple cell resistance alarm	M	Feasible
AO1 saturation	S	Disable
AO2 saturation	S	Disable
Calibration stability alarm	C	Feasible
Zero correction ratio high alarm	C	Feasible
Zero correction ratio low alarm	C	Feasible
Span correction ratio high alarm	C	Feasible
Span correction ratio low alarm	C	Feasible
Cold junction temperature high alarm	S	Disable
Cold contact temperature low alarm	S	Disable
Thermocouple voltage high alarm	S	Disable
Thermocouple voltage low alarm	S	Disable
AI current high alarm	S	Disable
AI current low alarm	S	Disable
Input temperature high alarm	OFF	Feasible
Input temperature low alarm	OFF	Feasible
Input pressure high alarm	OFF	Feasible
Input pressure low alarm	OFF	Feasible
Battery low alarm	M	Feasible
Fast warm-up function alarm	M	Feasible

(Note 1) Alarms with C: Function Check, S: Out of Specification, and M: Maintenance Required
(Note 2) "Disable" means Alarm classification is fixed.

7.5 Contact Output Setup

7.5.1 Contact Output

Mechanical relays provide contact outputs. Be sure to observe relay contact ratings. (For details, see Section “2.1 General Specifications”) The operation modes of each contact output are as follows. For contact output 1 to 3 you can select open or closed contact when the contact is “operated.” For contact output 4, contact is closed only.
When power fails, contact outputs 1 to 3 are open, and 4 is closed.

Table 7.8

	State when contact “operated”	When no power is applied to this equipment
Contact output 1	Open (deenergized) or closed (energized) selectable.	Open
Contact output 2	Open (deenergized) or closed (energized) selectable.	Open
Contact output 3	Open (deenergized) or closed (energized) selectable.	Open
Contact output 4	Closed (deenergized) only	Closed

7.5.2 Setting Contact Outputs

To set the contact outputs, follow these steps.

(1) “Converter menu” > “Setting”

(2) Select “Contact setting”.

(3) Select item to setup. See Table 7.9. An example setting is displayed below. In this example, Contact output1 is expected to setup to output “Open” during maintenance and warmup.

(4) Select “Contact state during operation” and “Open”.

(5) Select “ Selection of contact output” and check “Maintenance” and “Warmup.” Multiple items can be set.

(6) Setup other contact outputs in a similar way.

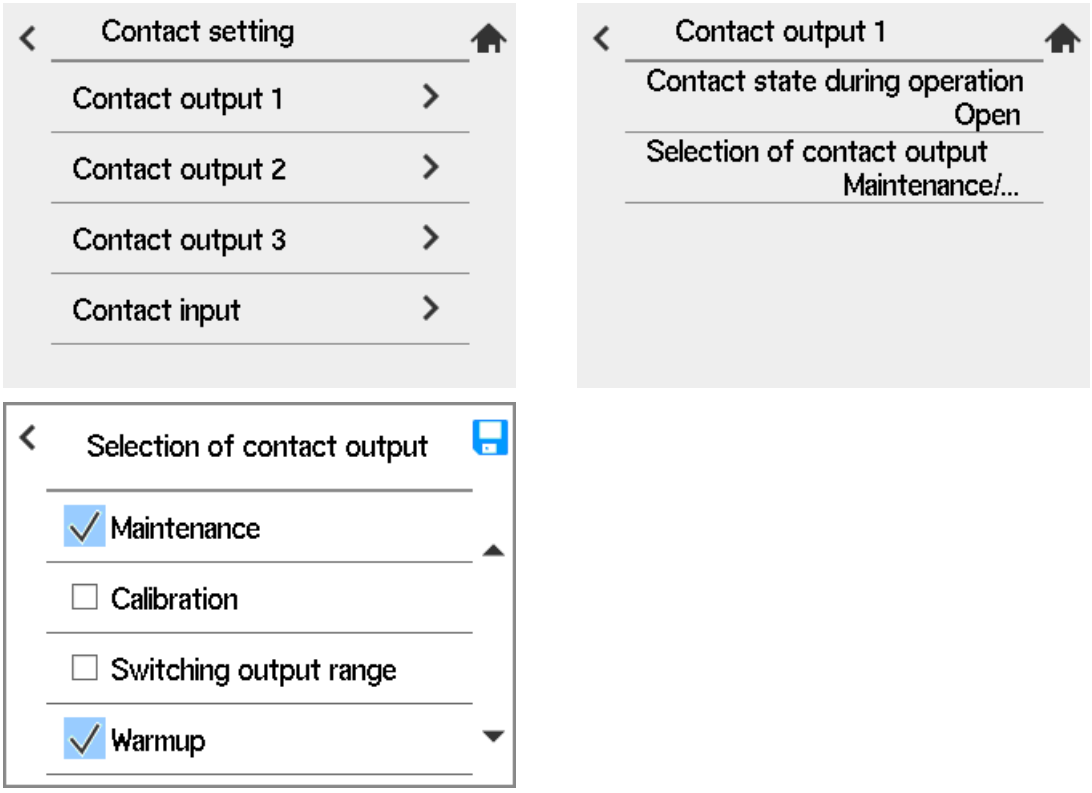


Figure 7.8 Contact output setting

CAUTION

The function of Contact output 4 is fixed as an fault only and fixed as “close during operation”. The setting cannot be changed.

Table 7.9 Contact Output Settings

	Item to be selected	Description
Alarm	(HH) high-high alarm	If “High-High alarm ON” is selected, contact output occurs when the high-high limit is issued. To do this, it is required, in Alarms setup, that the high-high alarm be set to be enabled beforehand (see Section “7.4 Alarm Setting”).
	(H) high alarm	If “High alarm ON” is selected, contact output occurs when the high limit alarm is provided. To do this, it is required, in Alarms setup, that the high limit alarm be set to be enabled beforehand (see Section “7.4 Alarm Setting”).
	(L) low alarm	If “Low alarm ON” is selected, contact output occurs when the low limit alarm is provided. To do this, it is required, in Alarms setup, that the low limit alarm be set to be enabled beforehand (see Section “7.4 Alarm Setting”).
	(LL) low-low alarm	If “Low-Low alarm ON” is selected, contact output occurs when the low-low limit alarm is issued. To do this, it is required, in Alarms setup, that the low-low alarm be set to be enabled beforehand (see Section “7.4 Alarm Setting”).
	Calibration correction alarm	If Calibration coefficient alarm is ON (enabled), then when a Zero correction ratio high/low alarm (Alarm 201, 202) or Span correction ratio high/low alarm (Alarm 203, 204) occurs, the calibration coefficient alarm contact output occurs. (see Section “11.2.1 Alarm Types”)
	Calibration stability alarm	If this alarm ON is selected, contact output occurs when the Calibration stability alarm (Alarm 120) occurs. (See Sec. “10.1 Replacing Fuses”)
	Upper and lower temp. alarm	This alarm is not used for an Oxygen Analyzer. When temperature measurement of a sample gas is performed with an external input, a contact output occurs if the temperature value exceeds the High limit which was setup in High limit alarm.
	Upper and lower press. alarm	When temperature measurement of a sample gas is performed with an external input, contact output occurs if the temperature value exceeds the high limit which was setup in High limit alarm.
	Simple cell resistance alarm	If this alarm is selected, a contact output occurs when a simple cell resistance alarm is output. But in Alarm setting, Simple cell resistance alarm needs to be set to be enabled beforehand.(See Section “7.4 Alarm Setting”.)
	Fault	If “Fault” is selected, contact output occurs when Fault is issued. (See Chapter “11. Troubleshooting”).
Other settings	Warmup mode	If “Warm-up” is selected, contact output occurs during warm-up. For the definition of Warm-up see Section “7.2.1 Definition of Equipment Status”.
	Switching output range	If “Switching output range” is selected, contact output occurs (“answer-back signal to a range change signal”) while a range change signal is applied to a contact input. To do this, it is required, in Input contacts setup, that the range change be selected beforehand. For more on this see Section “7.6 Input Contact Settings”.
	Calibration mode	If “Calibration” is selected, contact output occurs during calibration. For the definition of Under calibration see Section “7.2.1 Definition of Equipment Status”.
	Maintenance mode	If “Maintenance” is selected, contact output occurs during maintenance. For the definition of Under maintenance see Section “7.2.1 Definition of Equipment Status”.
	Blow back mode	If “Blow back” is selected, contact output occurs during blow back. For the definition of During blow back see Section “7.2.1 Definition of Equipment Status”.
	Cal. gas pressure drop	If “Cal. gas press. low” is selected, contact output occurs (“answer-back signal to a calibration gas low pressure signal”)when a calibration gas low pressure signal is applied to the contact input. To do this, it is required, in Input contacts setup, that “Cal. gas press. low” be selected beforehand. For more on this see Section “7.6 Input Contact Settings”.
	Process upset	If “Process upset” is selected, contact output occurs (“answer-back signal to a process upset signal) when the process upset signal is applied to the contact input. To do this, it is required, in Input contacts setup, that “Process upset” be selected beforehand (see Section “7.6 Input Contact Settings”)
	With simple cell resist. meas.	If “With simple cell resist. meas” is selected, contact output occurs during simple cell resistance measurement. See “7.2.1 Definition of Equipment Status” for the maintenance.

Note: To provide an alarm with a contact output, be sure to make an alarm setting.
When using contact output as an answer-back signal for an input contact, be sure to make an input contact setting.

7.5.3 Default Values

When the analyzer is delivered, or if data are initialized, alarm and other setting defaults are as shown in Table 7.10.

Table 7.10 Contact Output Default Settings

	Item to be selected	Contact output 1	Contact output 2	Contact output 3	Contact output 4
Alarm settings	(HH) high-high alarm				——
	(H) high alarm			ON	——
	(L) low alarm			ON	——
	(LL) low-low alarm				——
	Calibration correction alarm				——
	Calibration stability alarm				——
	Upper and lower temp. alarm				——
	Upper and lower press. alarm				——
	Simple cell resistance alarm				——
	Fault				ON
Other settings	Warmup	ON			——
	Switching output range				——
	Calibration		ON		——
	Maintenance	ON			——
	Blow back				——
	Cal. gas pressure drop				——
	Process upset				
	Cal. blowback simple cell resist.				——
	Contact state during operation	Open	Closed	Closed	Closed (fixed)

Note: Blank boxes in the above table indicate that the default is “disabled.”

7.6 Input Contact Settings

7.6.1 Input Contact Functions

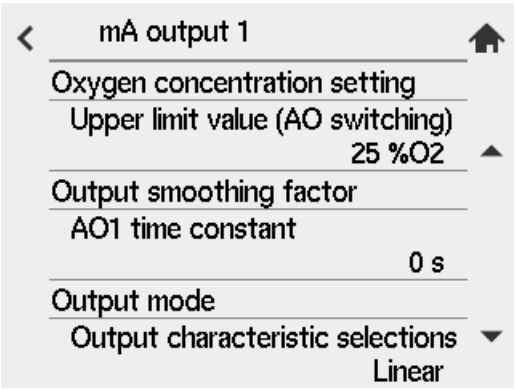
The converter input contacts execute set functions by accepting a remote dry-contact ("voltage-free contact") signal. Table 7.11 shows the functions executed by a remote contact signal.

Table 7.11 Input Contact Functions

Item	Function
Calibration gas pressure low	Contact input disables Semi-automatic or Automatic Calibration.
Measuring range change	While the contact signal is being input, mA output 1 switches as follows. When it is switching, "Range" is displayed on the screen (see "5.2.1 Home screen and icons"). When "Oxygen concentration" is selected for the setting item of mA output 1, the output range switches to 0–25%O_2 or 0–100%O_2.
Calibration start	Contact input starts Semi-Automatic Calibration. Calibration Mode setting must be [Semi-automatic] or [Automatic]. Contact signal must be applied for at least 1 sec. Even if input signal continues to be applied, calibration is not repeated unless contact input is released then reapplied.
Process upset (Combustible gas detection)	When the signal is sent to contact input, heater power will be switched off. Contact signal starts the operation with a single output signal of 1 second or longer. During the operation, span contact of calibration contact operates. When Auto calibration unit is used and span gas (instrumentation air) is connected, you can lead span gas to sensor unit as a safety purge. When the combustible gas (unburned-gas) is detected, temperature of the sensor unit falls and Fault is generated. Recovery is possible only if you shut down and reboot or restart the system.
Blow back start	When the signal is sent to contact input, the Blow back starts. The contact signal starts operation with a single output signal of 1 to 11 seconds. While the signal continues to be input, the second blow back does not occur. To have the second blow back, release the contact signal once and input again. Refer to section "9.5 Blow Back".
Restart	Restarts the device when an contact signal is input. After restarting, restart from warm-up mode.

CAUTION

- Measurement range switching function by an external contact input is available for analog output1 only. The range during switching is 0–25%O_2 or 0–100%O_2. See below.



- When making a semi-automatic calibration, be sure to set the semi-automatic or automatic mode using the Calibration setup display. When carrying out "Blow back," be sure to set "Blow back" in the contact output setup, and also set "Semi-automatic" or "Automatic, semi-automatic" to mode at Blow back setting.
- When the combustible gas detection signal is sent to contact input, the sensor heater will be switched off for safety. As a result, the heater's temperature falls and Fault is generated.

7.6.2 Setting contact

(1) “Converter menu” > “Setting”

(2) Select “Contact setting”.

(3) Select “Contact input” and select the contact open or closed, and the function.

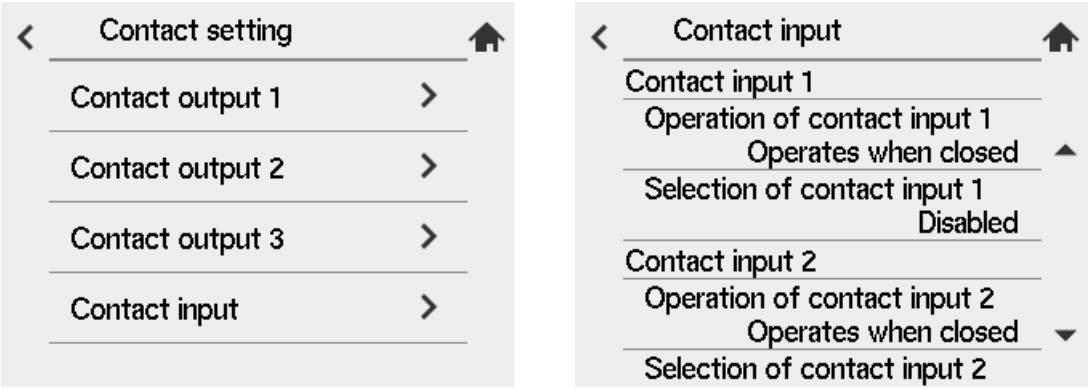


Figure 7.9 Contact input setting

7.6.3 Default Values

All contact inputs are set to “Disabled” and “Closed” prior factory shipment or after data initialization.

7.7 Other Settings

7.7.1 Setting the Date-and-Time

The following describe how to set the date-and-time. Automatic calibration or blow back works following this setting.

Proceed as follows:

(1) “Converter menu” > “Others”

(2) Select “Date/Time setting”.

(3) Input date and time. When you press “Adjust” the operation starts at the time you have set.

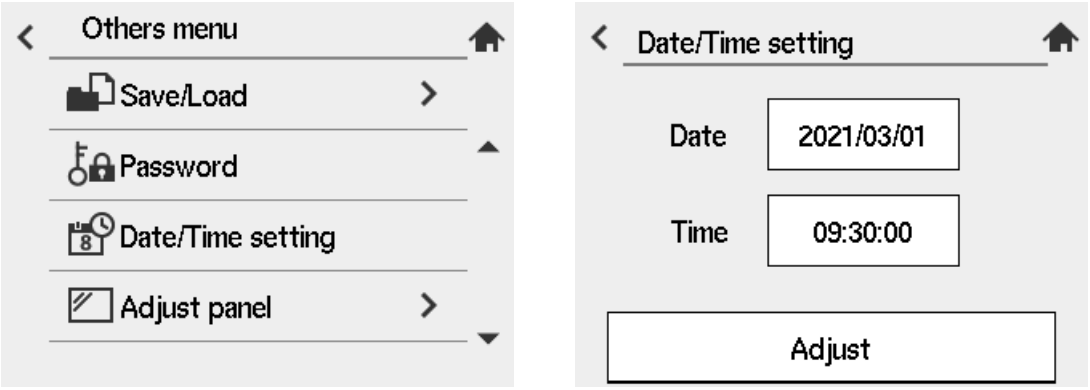


Figure 7.10 Date/Time setting

7.7.2 Setting the monitoring time for mean/max. min

The instrument can display the mean, minimum, maximum values of the oxygen concentration being measured. See 10.1.

This section explains how to setup the calculation time of the average value and the monitoring time of the maximum/minimum value.

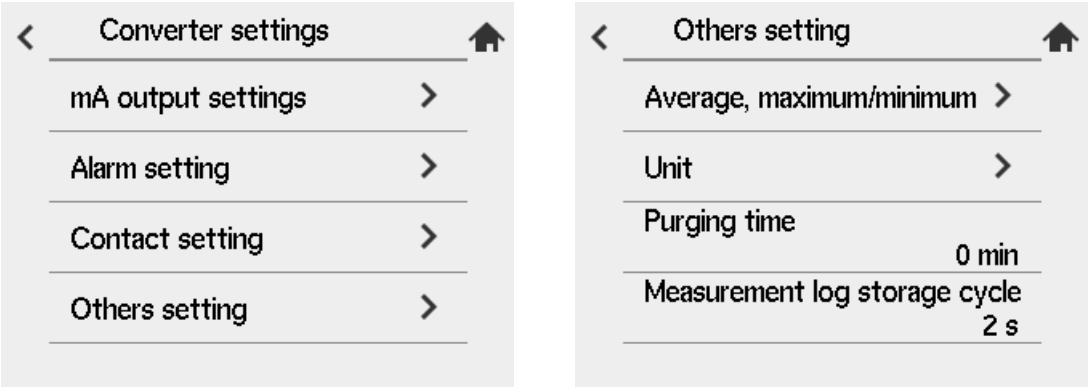
(1) “Converter menu” > “Setting”.

(2) Select “Others setting”. Select “Average, maximum/minimum”.

(3) Select “Average value calculation time” and enter a value from the numeric entry screen. The input range is 1 to 255 hours.

(4) Select “Max and min monitoring time”. Enter a numeric value from the screen. The input range is 1 to 255 hours.

As factory default or when data is initialized, “Average Value Calculation Time” is 1 hour, “Max and min monitoring time” is 24 hour.



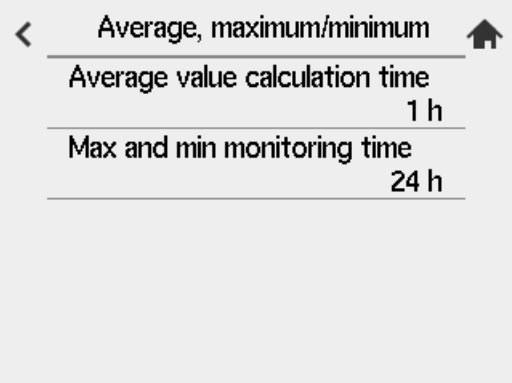


Figure 7.11 Setting the monitoring time of average/max.min. value

7.7.3 Setting Fuels

■ Input Parameters

The analyzer calculates the moisture content contained in exhaust gases. The following sets forth the fuel parameters necessary for calculation and their entries. The moisture content may be mathematically expressed by:

$$\text{Moisture content} = \frac{\overbrace{\text{(water vapor caused by combustion and water vapor contained in the exhaust gas)}}^{\text{+ (water vapor contained in air for combustion)}}}{\text{actual exhaust gas (including water vapor) per fuel}} \times 100 \quad \text{..... Equation 1}$$

$$= (Gw + Gw1)/G \times 100$$

$$= \frac{Gw + (1.61 \times Z \times m \times Ao)}{Go + Gw + [(m - 1)\,Ao + (1.61 \times Z \times m \times Ao)]} \times 100 \quad \text{..... Equation 2}$$

$$\fallingdotseq \frac{\boxed{Gw} + (1.61 \times \boxed{Z} \times m \times \boxed{Ao})}{\boxed{X} + \boxed{Ao} \times m} \times 100$$

where,

$\boxed{Ao}$: Theoretical amount of air per unit quantity of fuel, m^3/kg (or m^3/m^3) ... ② in Table 8.12

G: Actual amount of exhaust gas (including water vapor) per unit quantity of fuel, m^3/kg (or m^3/m^3)

$\boxed{Gw}$: Water vapor contained in exhaust gas per unit quantity of fuel (by hydrogen and moisture content in fuel), m^3 /kg (or m^3/m^3) ..... ① in Table 8.12

Gw1: Water vapor contained in exhaust gas per unit quantity of fuel (moisture content in air), m^3 /kg (or m^3/m^3)

Go: Theoretical amount of dry exhaust gas per unit quantity of fuel, m^3/kg (or m^3/m^3)

m: Air ratio

$\boxed{X}$: Fuel coefficient determined depending on low calorific power of fuel, m^3/kg (or m^3/m^3) ..... ③ in Table 8.12

$\boxed{Z}$: Absolute humidity of the atmosphere, kg/kg ..... Figure 8.15

Fill in the boxes with fuel parameters in Equation 2 above to calculate the moisture content. Use Ao, Gw and X shown in Table 7.12. If there are no appropriate fuel data in Table 7.12, use the Figure 7.12 equations for calculation. Find the value of “Z” in Equations 1 and 2 using Japanese Standard JIS B 8222. If a precise measurement is not required, obtain the value of “Z” from the graph in Figure 7.13.

- For liquid fuel

Amount of water vapor in exhaust gas (Gw) = (1/100) {1.24 (9h + w)} (m^3/kg)

Theoretical amount of air (Ao) = 2.96×(H1/10000)-1.36 (m^3/kg)

Low calorific power = Hl

X value = (0.805 / 10000) x Hx – 2.55 (m^3/kg)

where, Hl: low calorific power of fuel

h: Hydrogen in fuel (weight percentage)

w: Moisture content in fuel (weight percentage)

Hx: Same as numeric value of Hl

- For gas fuel

Amount of water vapor in exhaust gas (Gw) = (1/100) {(h2) + 1/2 ∑y (Cx Hy) + wv} (m^3/m^3)

Theoretical amount of air (Ao) = 2.68 x (Hl/10000) (m^3 /m^3)

Low calorific power = Hl

X value = (0.251 / 10000) x Hx (m^3/m^3)

where, Hl: low calorific power of fuel

CxHy: Each hydrocarbon in fuel (volume percentage)

h2: Hydrogen in fuel (volume percentage)

wv: Moisture content in fuel (volume percentage)

Hx: Same as numeric value of Hl

- For solid fuel

Amount of water vapor in exhaust gas (Gw) = (1/100) {1.24 (9h + w)} (m^3 /kg)

Theoretical amount of air (Ao) = 0.241 x (Hl / 1000) + 0.56 (m^3 /kg)

Low calorific power = Hl = Hh – 25 (9h + w) (kJ/kg)

X value = 1.11 - (0.0253 / 1000) x Hx (m^3/m^3)

where, w: Total moisture content in use (weight percentage)

h: Hydrogen content (weight percentage)

The average hydrogen content of coal mined in Japan, which is a dry ash-free type, is 5.7 percent. Accordingly, "h" may be expressed mathematically by:

h = 5.7 [{100 – (w1 + a)} / 100] x (100 – w) / (100 – w1)

where, a: Ash content (%)

w1: Moisture content (%), analyzed on a constant humidity basis

Hh: Higher calorific power of fuel (kJ/kg)

Hl: Low calorific power of fuel (kJ/kg)

Hx: Same numeric value of Hl

Figure 7.12 Calculation Formula

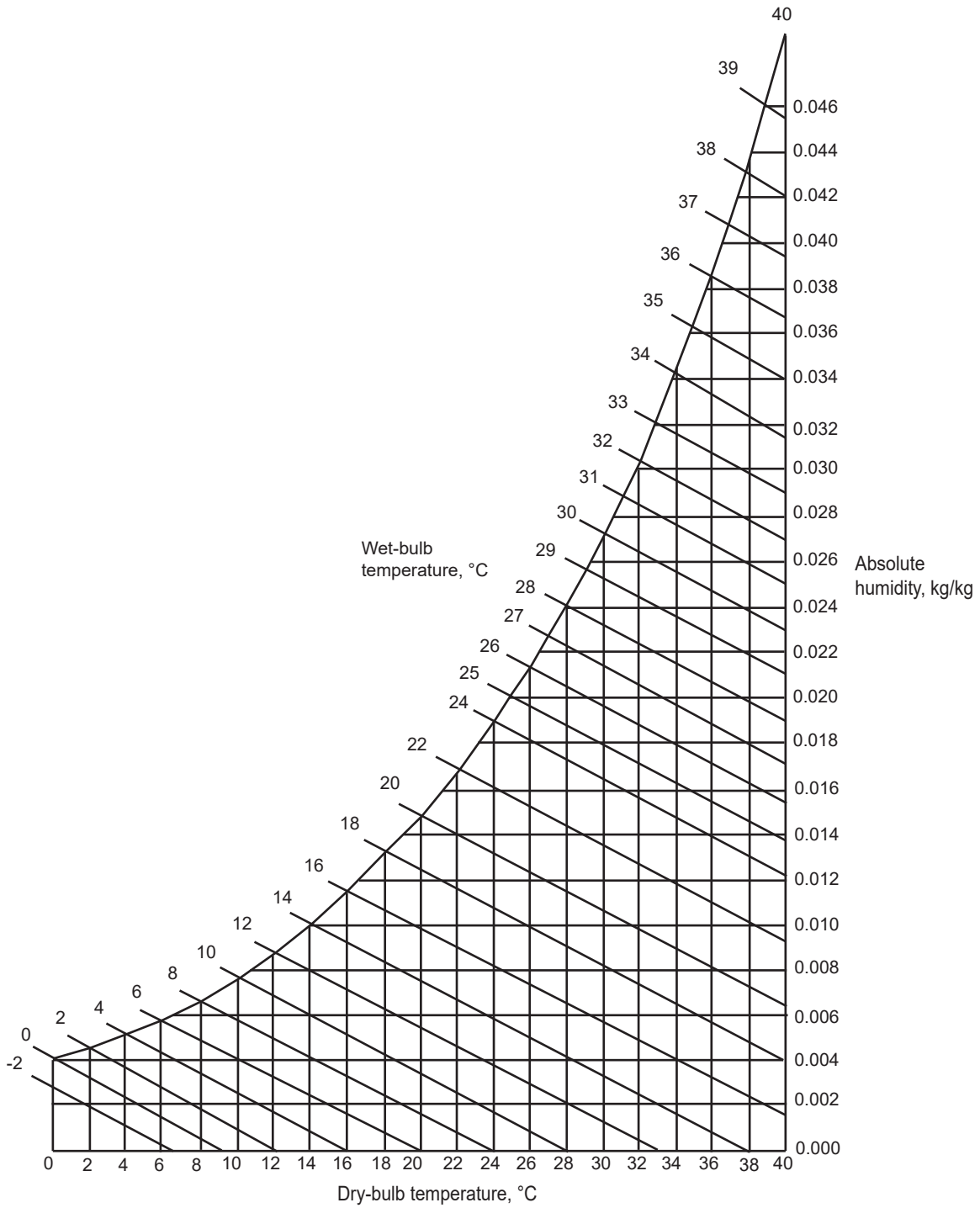


Figure 7.13 Absolute Humidity of Air

Table 7.12 Fuel Data

● **For liquid fuel**

Type \ Fuel properties			Specific weight kg/l	Chemical component (weight percentage)							Calorific power kJ/kg		Theoretical amount of air for combustion Nm^3/kg	Amount of combustion gas Nm^3/kg					X value
				C	H	O	N	S	w	Ash content	Higher order	Lower order		CO_2	H_2O	SO_2	N_2	Total	
Kerosene			0.78~0.83	85.7	14.0	—	—	0.5	0.0	0.0	46465	43535	11.4	1.59	1.56	0.00	9.02	12.17	0.96
Light oil			0.81~0.84	85.6	13.2	—	—	1.2	0.0	0.0	45879	43032	11.2	1.59	1.47	0.00	8.87	11.93	0.91
A	Heavy oil class 1	No.1	0.85~0.88	85.9	12.0	0.7	0.5	0.5	0.3	0.05	45544	42739	10.9	1.60	1.34	0.00	8.61	11.55	0.89
		No.2	0.83~0.89	84.6	11.8	0.7	0.5	2.0	0.4	0.05	45125	42320	10.8	1.58	1.32	0.01	8.53	11.44	0.86
B	Heavy oil class 2		0.90~0.93	84.5	11.3	0.4	0.4	3.0	0.5	0.05	43827	41274	10.7	1.58	1.27	0.02	8.44	11.31	0.77
C	Heavy oil class 3	No.1	0.93~0.95	86.1	10.9	0.5	0.4	1.5	0.5	0.1	43952	41441	10.7	1.61	1.22	0.01	8.43	11.27	0.79
		No.2	0.94~0.96	84.4	10.7	0.5	0.4	3.5	0.5	0.1	43116	40646	10.5	1.58	1.20	0.02	8.32	11.12	0.72
		No.3	0.92~1.00	86.1	10.9	0.5	0.4	1.5	0.6	0.1	43660	41190	10.7	1.61	1.22	0.01	8.43	11.27	0.77

② ① ③

● **For gas fuel**

Theoretical amount of air

Type \ Fuel properties	Specific weight kg/Nm^3	Chemical component (weight percentage)							Calorific power kJ/Nm^3		Theoretical amount of air for combustion Nm^3/m^3	Combustion product, Nm^3/m^3				X value
		CO	H_2	CO_2	CH_4	C_mH_n	O_2	N_2	Higher order	Lower order		CO_2	H_2O	N_2	Total	
Coke oven gas	0.544	9.0	50.5	2.6	25.9	3.9	0.1	8.0	20428	18209	4.455	0.45	1.10	3.60	5.15	0.46
Blast furnace gas	1.369	25.0	2.0	20.0	—	—	—	53.0	3391	3349	0.603	0.45	0.02	1.01	1.48	0.08
Natural gas	0.796	—	—	2.0	88.4	3.2	1.6	4.2	37883	34074	9.015	0.98	1.88	7.17	10.03	0.86
Propane	2.030	C_3H_8 90%, C_4H_{10} 10%							102055	93976	24.63	3.10	4.10	19.5	26.7	2.36
Butane	2.530	C_3H_8 10%, C_4H_{10} 90%							125496	115868	30.37	3.90	4.90	24.0	32.8	2.91
(Gases)		(Molecular Formula)														
Oxygen	1.43	O_2							—	—	—	—	—	—	—	—
Nitrogen	1.25	N_2							—	—	—	—	—	—	—	—
Hydrogen	0.09	H_2							12767	10758	2.390	—	1.0	1.89	2.89	0.27
Carbon monoxide	1.25	CO							12642	12642	2.390	1.0	—	1.89	2.89	0.32
Carbon dioxide	1.96	CO_2							—	—	—	—	—	—	—	—
Methane	0.72	CH_4							39750	35820	9.570	1.0	2.0	7.57	10.6	0.90
Ethane	1.34	C_2H_6							69638	63744	16.74	2.0	3.0	13.2	18.2	1.60
Ethylene	1.25	C_2H_4							62991	59060	14.35	2.0	2.0	11.4	15.4	1.48
Propane	1.97	C_3H_8							99070	91255	23.91	3.0	4.0	18.9	25.9	2.29
Butane	2.59	C_4H_{10}							128452	118623	31.09	4.0	5.0	24.6	33.6	2.98

② ① ③

Procedure

(1) “Sensor menu” > “Setting”.

(2) Select “Fuel setup”.

(3) Enter numerical value on “Exhaust water vapor content”, “Theoretical air volume” “X value”, “Absolute humidity of outside air”.

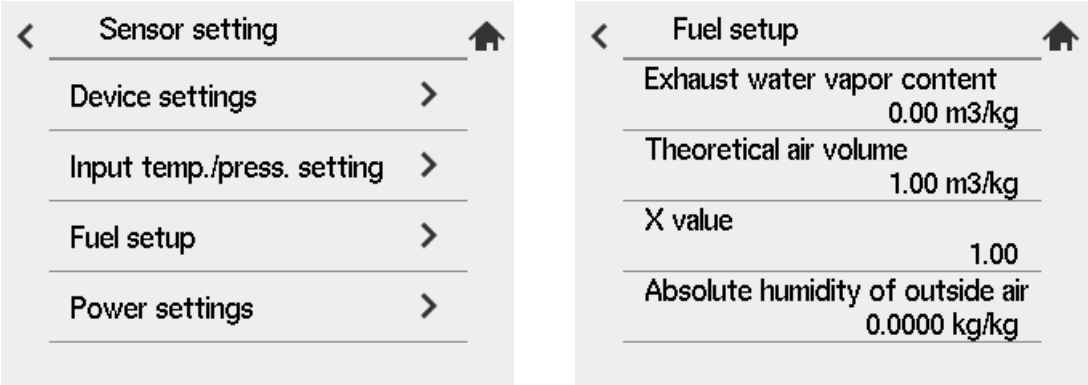


Figure 7.14 Fuel Setup

Default Values

When the analyzer is delivered, or if data are initialized, default, parameter settings are as shown in Table 7.13.

Table 7.13 Default Settings for Fuel Values

Item	Default setting
Exhaust water vapor content	0.00 m^3/kg (m^3)
Theoretical air volume	1.00 m^3/kg (m^3)
X value	1.00
Absolute humidity of outside air	0.0000 kg/kg

7.7.4 Setting Measurement Gas Pressure

This instrument can correct the oxygen concentration value by setting the pressure of the sample gas.

It is used when the influence of the pressure fluctuation of a sample gas, which occurs after calibration, cannot be ignored. (A pressure fluctuation of 1 kPa causes a deviation of about 1% in the reading value.)

If the sample gas pressure exceeds 5 kPa, do not use this function.

Use the sample gas pressure within ±5 kPa.

Setting method of the measurement gas pressure

There are two methods for inputting the sample gas pressure. One is measuring the actual gas pressure with a pressure transmitter. The other one is manually inputting a preset value in advance.

(1) “Sensor menu” > “Setting”.

(2) On “Sensor setting”, select “Input temp./press. setting”.

(3) On “Input temp./press.setting”, select “Oxygen model setting”.

(4) When you select “Pressure input selection”, a dialog box appears to select “Preset value”, “External input”. Select according to your system.

When Preset value is selected

(5) When “Preset value” is selected on “Pressure input selection”, enter a sample gas pressure on “Input pressure set value”.

When External input is selected

(6) When “External input” is selected on “Pressure input selection”, Enter the values of pressure of 4 mA point and 20 mA point respectively of a pressure transmitter you use.

(7) When alarm from sample gas pressure is used, select “Pressure upper limit alarm value”, “Pressure lower limit alarm value.” Enter the alarm pressure value with numeric input.

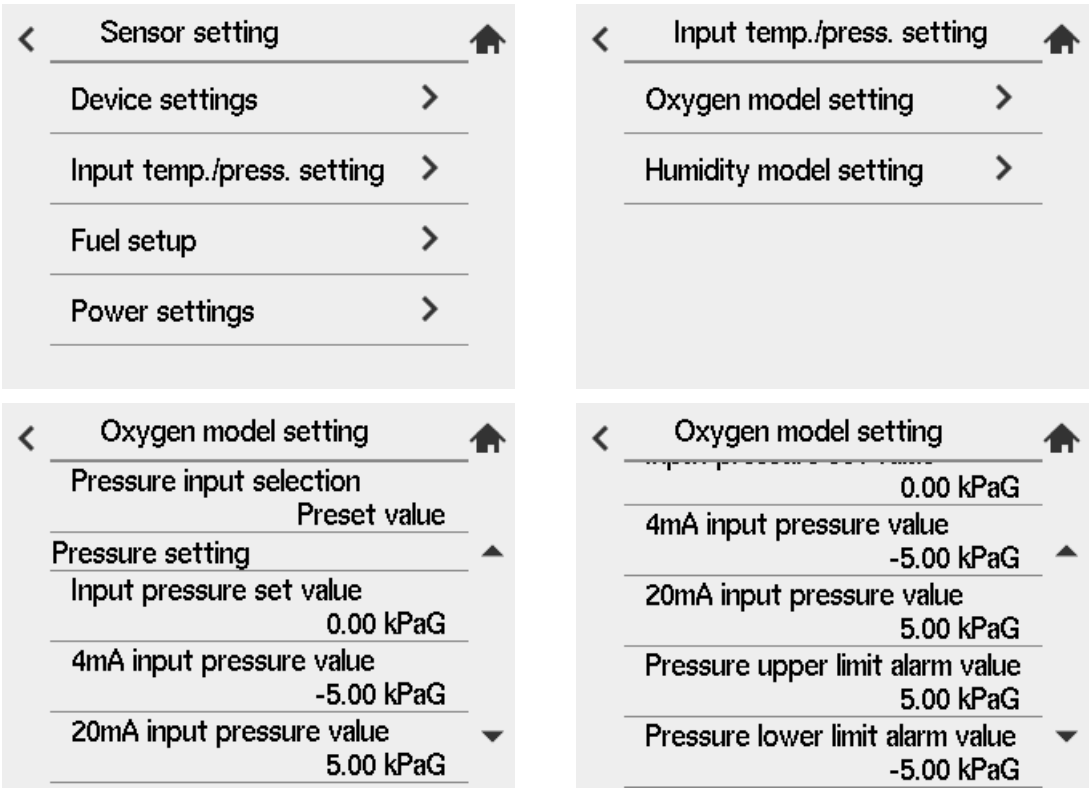


Figure 7.15 Setting Measurement Gas Pressure

Default Values

When the analyzer is delivered, or if data are initialized, measurement gas temperature and pressure set ranges and their default settings are as shown in Table 7.14.

Table 7.14 Measurement Gas Pressure Set Ranges and Default Settings

Set Item	Set range	Default setting
Pressure input selection	-	Preset value
Input pressure set value	-500 to 500 kPaG	0.00 kPaG
4 mA input pressure value	-500 to 500 kPaG	-5.00 kPaG
20 mA input pressure value	-500 to 500 kPaG	5.00 kPaG
Pressure upper limit alarm value	-500 to 500 kPaG	5.00 kPaG
Pressure lower limit alarm value	-500 to 500 kPaG	-5.00 kPaG

7.7.5 Setting Purging

Purging is to remove condensed water in the calibration gas pipe by supplying a span calibration gas for a given length of time before warm-up of the detector. This prevents cell breakage during calibration due to condensed water in the pipe.

Open the solenoid valve for the automatic calibration span gas during purging and after the purge time has elapsed, close the valve to start warm-up.

Purging is enabled when the cell temperature is 100°C or below upon power up and the purge time is set in the range of 1 to 60 minutes.

How to setup purging

(1) “Converter menu” > “Setting”

(2) Select “Others setting”. Enter “Purging time” value.

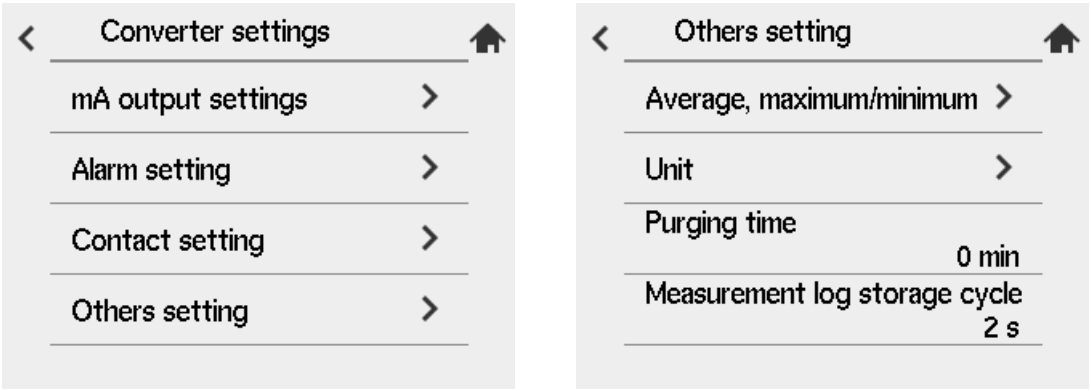


Figure 7.16 Purging time setting

7.7.6 Setting password

The instrument can protect various setup and executes by means of a password. You can setup the password of “Commissioning” and “Execute” respectively for each item as below. “Commissioning” password is for setting each revised setup data. “Execute” password is to execute maintenance or calibration.

Table 7.15 Password Setting Items

Menu	Item	Password (Commissioning / Execute)
Converter menu	Detail	-
	Trend	-
	Blowback	Execute
	Others	Commissioning
	Maintenance	Execute
	Setting	Commissioning
	Reset	Commissioning
	Lang.	Execute
Sensor menu	Detail	-
	Calibration	Execute
	Cell resist	Execute
	Setting	Commissioning

NOTE

You can establish password for the calibration or a shortcut of Favorite on Home screen as well.

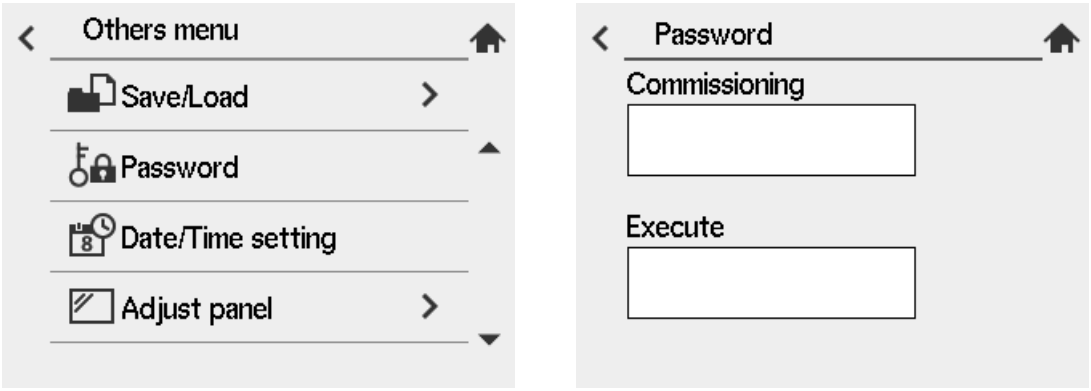


Figure 7.17 Passwords Display

<Default setting>

The passwords are not set as shipped from factory. If you reset data, the password settings are deleted.

CAUTION

If you setup a password, write down the password so you won't forget it.

You are asked for the password when entering a protected operation, such as "Setting" or calibration.

If your password is not verified, the message "Wrong password" (or similar message) appears.

When you enter a correct password, you can move to operator ID entry screen.

The operator ID is recorded in the log information to identify the person who operated on it. You can proceed without entering anything. Operator IDs can be up to 4 characters

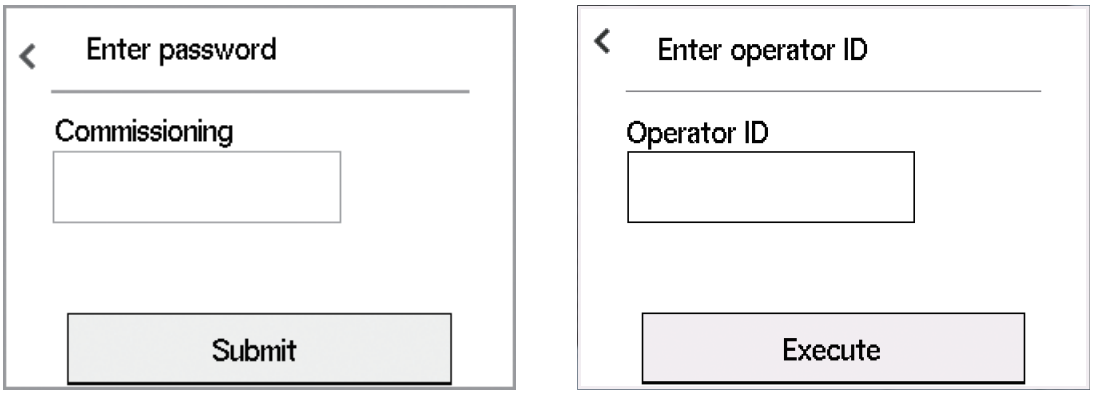


Figure 7.18 Password, Operator ID verification

7.7.7 Service mode

This function is used by our service personnel and is not available to the user. To view the service mode, proceed as follows.

(1) “Converter menu” > “Other setting”

(2) Scroll down to select “Service mode”

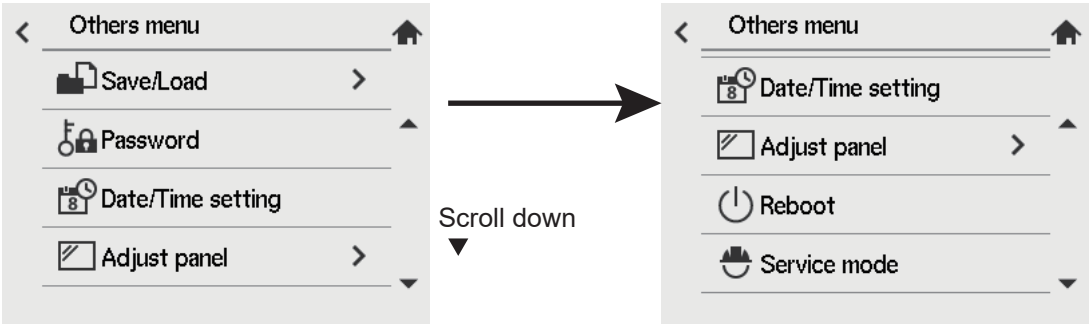


Figure 7.19 Service mode

NOTE

This function has been added since MAIN software Rev 1.04.01.

Update the firmware to the latest for devices with software Rev prior to Rev 1.04.01.

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8. Calibration

8.1 Calibration Briefs

8.1.1 Principle of Measurement with a zirconia oxygen analyzer

This section sets forth the principles of measurement with a zirconia oxygen analyzer before detailing calibration.

A solid electrolyte such as zirconia allows the conductivity of oxygen ions at high temperatures. Therefore, when a zirconia-plated element with platinum electrodes on both sides is heated up in contact with gases having different oxygen partial pressures on each side, the element shows the action of the concentration cell. In other words, the electrode in contact with a gas with a higher oxygen partial pressure acts as a negative electrode. As the gas comes in contact with the zirconia element in this negative electrode, oxygen molecules in the gas acquire electrons and become ions. Moving in the zirconia element, they eventually arrive at the positive electrode on the opposite side.
There, the electrons are released and the ions return to the oxygen molecules. This reaction is indicated as follows:

Negative electrode: $O_2 + 4e \rightarrow 2O^{2-}$

Positive electrode: $2O^{2-} \rightarrow O_2 + 4e$

The electromotive force E (mV) between the two electrodes, generated by the reaction, is governed by Nernst's equation as follows:

$$E = -RT/nF \ln Px/Pa \cdots\cdots \text{Equation (1)}$$

where,
- R: Gas constant
- T: Absolute temperature
- n: 4
- F: Faraday's constant
- Px: Oxygen concentration in a gas in contact with the positive zirconia electrode (%)
- Pa: Oxygen concentration in a gas in contact with the negative zirconia electrode (%)

Assuming the zirconia element is heated up to 750 °C, then we obtain equation (2) below.

$$E = -50.74 \log \frac{Px}{Pa} \quad \cdots\cdots \text{Equation (2)}$$

With this analyzer, the sensor (zirconia element) is heated up to 750°C, so Equation (2) is valid. At that point, the relationship as in Figure 8.1 is effected between the oxygen concentration of the sample gas in contact with the positive electrode and the electromotive force of the sensor (cell), where a comparison gas of air is used on the negative electrode side.

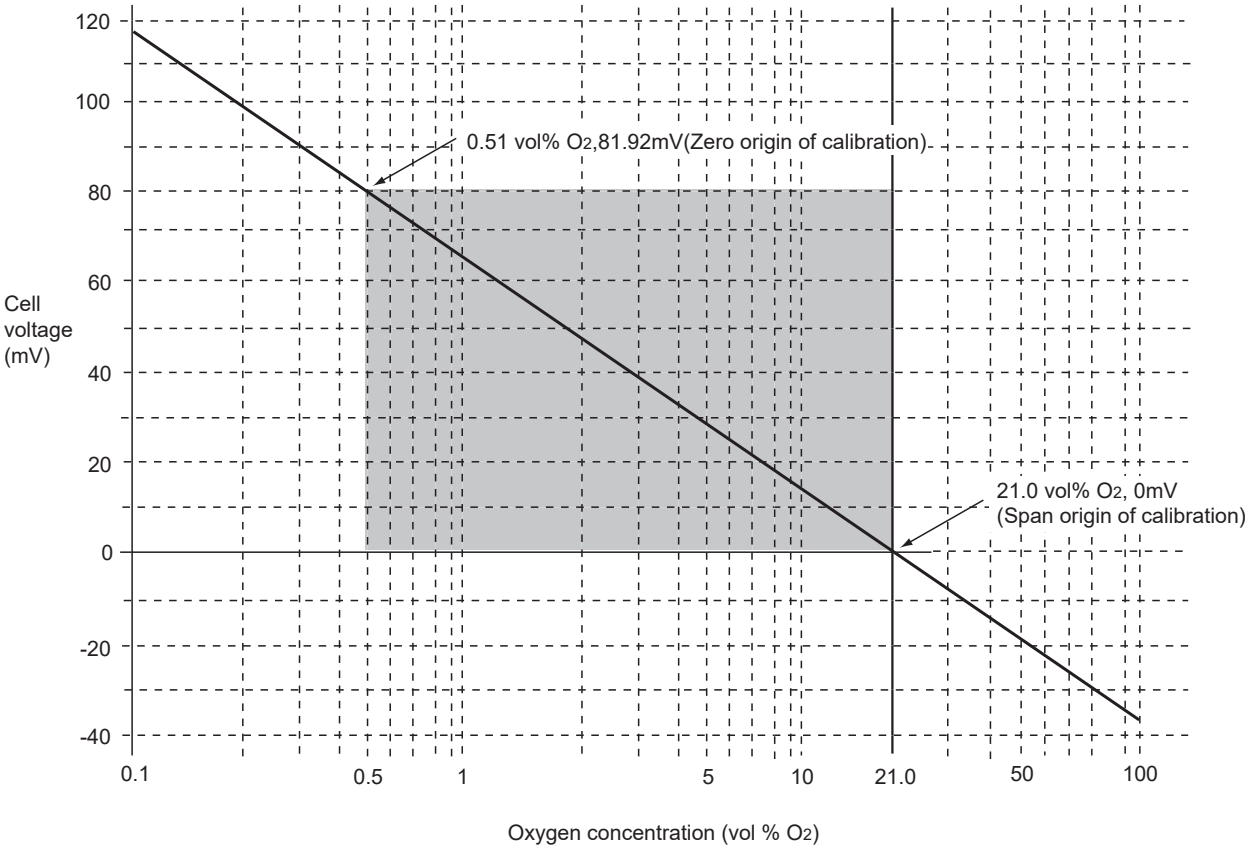


Figure 8.1 Oxygen concentration in a Sample Gas vs Cell Voltage (21 vol%O_2 Equivalent)

The measurement principles of a zirconia oxygen analyzer have been described above. However, the relationship between oxygen concentration and the electromotive force of a cell is only theoretical. Usually, in practice, a sensor shows a slight deviation from the theoretical value. This is the reason why calibration is necessary. To meet this requirement, an analyzer calibration is conducted so that a calibration curve is obtained, which corrects the deviation from the theoretical cell electromotive force.

8.1.2 Calibration Gas

A gas with a known oxygen concentration is used for calibration. Normal calibration is performed using two different gases: a zero gas of low oxygen concentration and a span gas of high oxygen concentration. In some cases, only one of the gases needs to be used for calibration. However, even if only one of the gases is normally used, calibration using both gases should be done at least once.

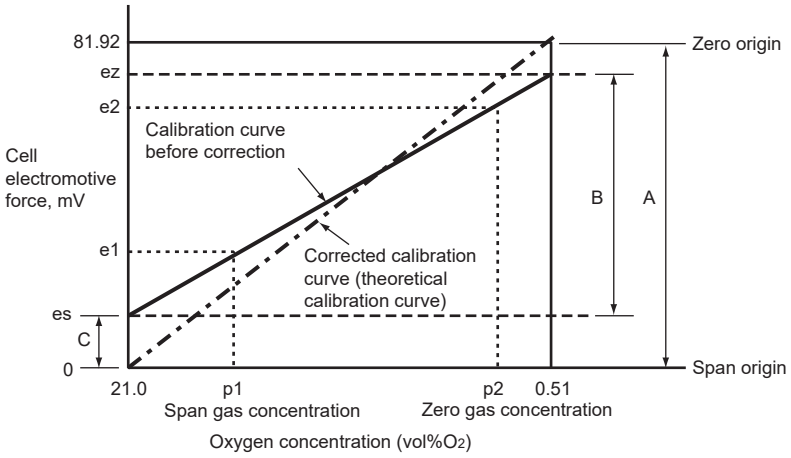
The zero gas normally used has an oxygen concentration of 0.95 to 1.0 vol%O_2 with a balance of nitrogen gas (N_2). The span gas widely used is clean air (at a dew-point temperature below -20°C and free of oily mist or dust, as in instrument air).

For best accuracy, as the span gas use oxygen whose concentration is near the top of the measurement range, in a nitrogen mixture.

8.1.3 Compensation

The deviation of a measured value from the theoretical cell electromotive force is checked by the method in Figure 8.2 or Figure 8.3.

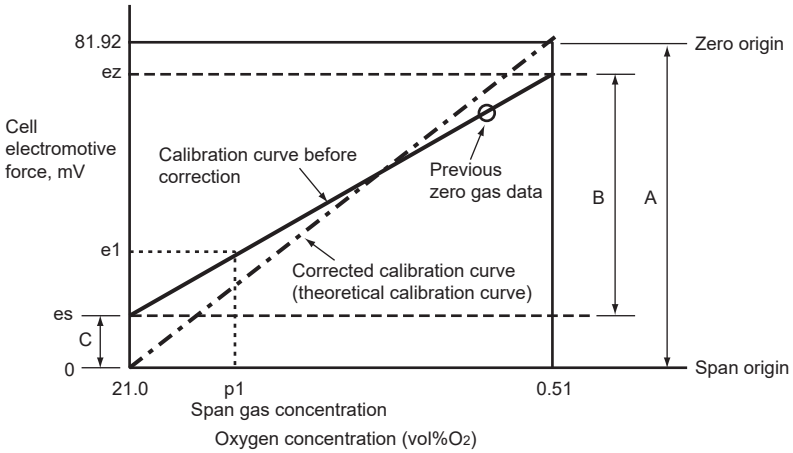
Figure 8.2 shows a two-point calibration using two gases: zero and span. Cell electromotive forces for a span gas with an oxygen concentration p1 and a zero gas with an oxygen concentration p2 are measured while determining the calibration curve passing between these two points. The oxygen concentration of the sample gas is determined from this calibration curve. In addition, the calibration curve corrected by calibration is compared with the theoretical calibration curve for determining the zero-point correction ratio represented by B/A x 100 (%) on the basis of A, B and C shown in Figure 8.2 and a span correction ratio of C/A x 100 (%). If the zero-point correction ratio exceeds the range of 100 ± 30% or the span correction ratio becomes larger than 0 ± 18%, calibration of the sensor becomes impossible.



Zero-point correction ratio = (B/A) x 100 (%) Correctable range: 100 ± 30%
Span correction ratio = (C/A) x 100 (%) Correctable range: 0 ± 18%

Figure 8.2 Calculation of a Two-point Calibration Curve and Correction Ratios using Zero and Span Gases

Figure 8.3 shows a one-point calibration using only a span gas. In this case, only the cell electromotive force for a span gas with oxygen concentration p1 is measured. The cell electromotive force for the zero gas is carried over from a previous measurement to obtain the calibration curve. The principle of calibration using only a span gas also applies to the one-point calibration method using a zero gas only.



Zero point correction ratio = (B/A) x 100 (%) Correctable range: 100 ± 30%
Span correction ratio = (C/A) x 100 (%) Correctable range: 0 ± 18%

Figure 8.3 Calculation of a One-point Calibration Curve and Correction Ratios using a Span Gas

8.1.4 Characteristic Data from a Sensor Measured During Calibration

In addition to calibration data, the following data is collected during calibration to determine the status of the sensors. However, if calibration is not performed correctly (e.g. semi-automatic calibration, an error occurs when it is automatic calibration), these data in this calibration will not be collected. These data can be viewed in the log information in converter menu and in the detailed display in sensor menu. For instructions and instructions on how to operate the data, refer to Section “9.1 Detailed-data Display” and “9.2 Converter Detail”.

(1) History of Span Point Correction Rate
The value up to the last 20 times is memorized.

(2) History of zero point correction rate

The value up to the last 20 times is memorized

(3) Response time

You can monitor the response time provided that a two-point calibration has been done in semi-automatic or automatic calibration.

(4) Cell’s internal resistance

The cell’s internal resistance gradually increases as the cell (sensor) deteriorates. You can monitor the values measured during the latest calibration. However, these values include the cell’s internal resistance and other wiring connection resistance. So, the cell’s degrading cannot be estimated from these values only.

When only a span calibration has been made, these values will not be measured, and previously measured values will remain.

(5) Robustness of a cell

The robustness of a cell is an index for predicting the remaining life of a sensor and is expressed in a number on four levels.

8.2 Calibration Procedures

NOTE

Calibration should be made under normal operating conditions (if the probe is connected to a furnace, the analyzer will undergo calibration under the operating conditions of the furnace). To make a precise calibration, conduct both zero and span calibrations.

The following sets forth the required calibration settings:

8.2.1 Mode

There are three calibration modes available:

(1) Manual calibration which allows zero and span calibrations or either one manually in turn;

(2) Semi-automatic calibration which lets calibration start with the touchpanel or a contact input, and undergoes a series of calibration operations following preset calibration interval and stabilization time.

(3) Automatic calibration which is carried out automatically following preset calibration interval.

Calibrations are limited by the following mode selection:

• When Manual calibration is selected:

Manual calibration only can be conducted. (This mode does not allow semi-automatic calibration with a contact input nor automatic calibration even when its start-up time has reached.)

• When Semi-automatic calibration is selected:

This mode enables manual and semi-automatic calibrations to be conducted. (The mode, however, does not allow automatic calibration even when its start-up time has reached.)

• When Automatic calibration is selected:

This calibration can be conducted in any mode.

To execute this calibration, follow these steps:

(1) “Converter menu” > “Maintenance”

(2) Select “Calibration settings” “Calibration mode” > “Manual”, “Semi-automatic, Auto”, “Semi-automatic.”

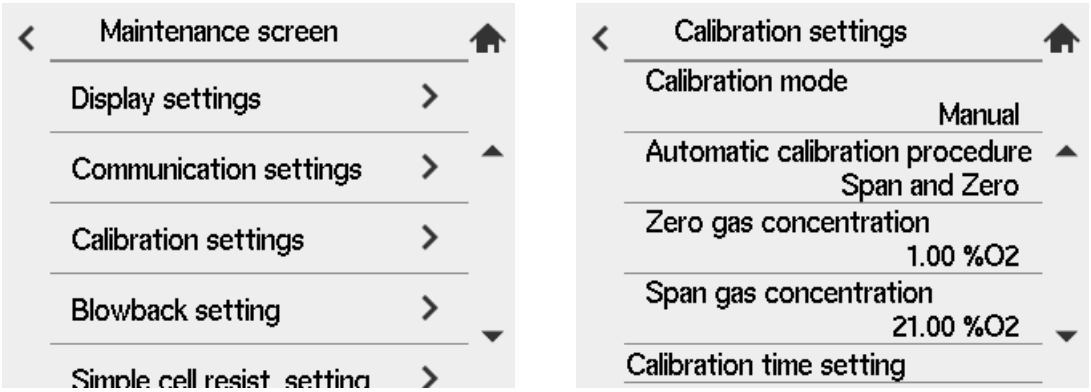


Figure 8.4 Calibration mode

8.2.2 Calibration procedure

Select one among Calibration of both span and zero, Calibration of only span, Calibration of only zero. Normally select “span-zero.”

8.2.3 Zero gas Concentration

Set the oxygen concentration for zero-point calibration. Enter the oxygen concentration for the zero gas in the cylinder used in the following procedures:

Select “Zero gas concentration” on the “Calibration settings”. The numeric-data entry display then appears. Enter the desired oxygen concentration for the zero-point calibration. The setting range is 0.3 to 100 vol%O_2.

8.2.4 Span gas Concentration

Set the oxygen concentration for span calibration. If instrument air is used as the span gas, enter 21% O_2.

Select “Span gas concentration” on the “Calibration settings”. Enter the desired span gas oxygen concentration from the numeric-data entry display.

(The span gas set ranges from 4.5 to 100 vol%O_2.)

Enter 02100 for an oxygen concentration of 21 vol%O_2.

NOTE

- When the instrument air supply is to be used as span gas, cool it to -20°C below dew point to remove moisture, oil mist and dust from the air.
- If you do not do this to purify the air, then the accuracy of the calibration may be affected.

8.2.5 Setting Calibration Time

• When the calibration mode is in manual:

First set the “Hold time” (output stabilization time).

“Hold time” refers to the time from when calibration is finished to when the test is resumed. This time setup the time after calibration until the sensor replaces calibration gas with the measured gas and the output returns to a steady state. After a series of calibration operations, the analog outputs are turned setup at “output hold” until the stabilization time has elapsed (if hold is turned setup). The “Stabilization Time” can be setup from 00 minutes 00 seconds to 60 minutes 59 seconds (see Section “7.2 Output Hold Setting”).

When the mode is turned setup to “Semi-automatic”:

In addition to the “Hold time” “stabilization time” described above, “calibration time” is turned setup. Calibration time is the time from when calibration begins to flow until calibration is executed. Setup times work commonly for both zero calibration and span calibration. The settling time and calibration time can be setup from 00 minutes 00 seconds to 60 minutes 59 seconds. Figure 8.5 shows the relationship between calibration time and the stabilization time.

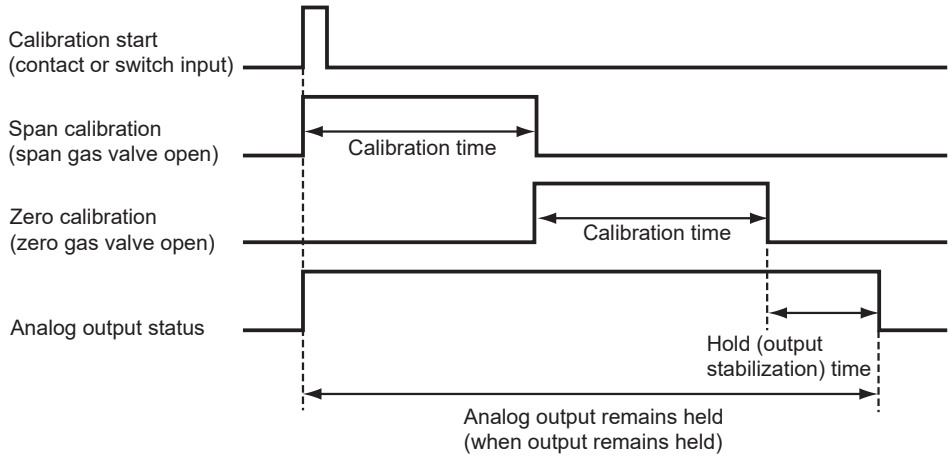


Figure 8.5 Calibration and Hold Time Settings

• When the calibration mode is in automatic:

In addition to the above Hold (output stabilization) time and Calibration time, set the Interval, First Start date, and First Start time.

Interval means the calibration intervals ranging from 000 days, 00 hours to 255 days, 23 hours.

Set the first calibration day and the First start-calibration time to the “Start date” and “Start time” respectively.

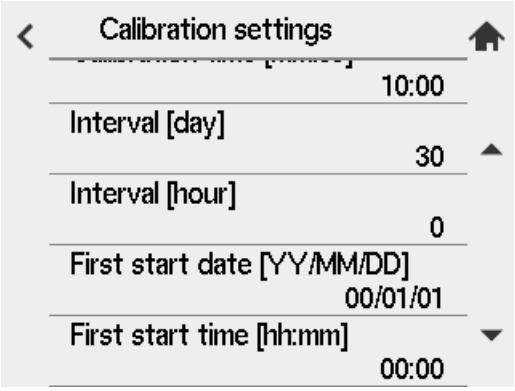


Figure 8.6 Calibration settings

NOTE

When setting calibration timing requirements, bear the following precautions in mind:

(1) If the calibration interval is shorter than the sum of Hold (output stabilization) time plus calibration time, the second calibration start time will conflict with the first calibration. In such a case, the second calibration will not be conducted. (When both zero and span calibrations are to be performed, the calibration time is double that required for a single (zero or span) calibration.)

(2) For the same reason, if the calibration start time conflicts with manual calibration or semi-automatic calibration, the current calibration will not be conducted.

(3) If the calibration time conflicts with maintenance service or blow back operation or simple cell resistance measurement operation, calibration will start after completing these tasks (see Section “7.2.1 Definition of Equipment Status”, earlier in this manual).

(4) If 000 days, 00 hours are set for the calibration intervals, only the first calibration will be conducted; a second or later calibration will not be conducted.

(5) If a past date is set to the calibration start day, no calibration will be conducted.

8.2.6 Default Values

When the analyzer is delivered, or if data are initialized, the calibration settings are by default, as shown in Table 8.1.

Table 8.1 Default Settings for Calibration

Item	Default Setting
Calibration mode	Manual
Automatic calibration procedure	Span and Zero
Zero gas concentration	1.00%O_2
Span gas concentration	21.00%O_2
Hold time [mm:ss]	10:00
Calibration time [mm:ss]	10:00
Interval [day]	30
Interval [hour]	0
First start date [YY/MM/DD]	00/01/01
First start time [hh:mm]	00:00

8.3 Calibration

8.3.1 Manual Calibration

For manual calibration, consult Section “6.12 Calibration”, earlier in this manual.

8.3.2 Semi-automatic Calibration

By the touch panel

(1) Press[set up] on Home screen to enter a calibration screen. Select “Span” of “Semi-auto calibration”. Only the procedure setting established at “8.2.2 Calibration procedure” is enabled.

(2) Press “Start calibration” . A trend screen appears and the calibration starts.

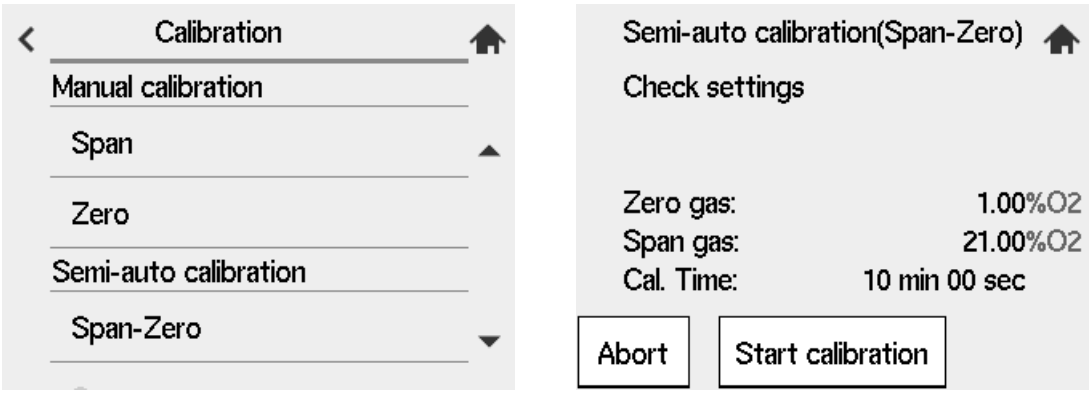


Figure 8.7 Semi-auto Calibration

By contact input

(1) Make sure that Calibration start has been selected in the Input contacts display (see Section “7.6.1 Input Contact Functions”, earlier in this manual).

(2) When the signal is sent to contact input, the calibration starts.

To stop calibration midway, follow these steps:

(1) Press the [Abort] key. If this key is pressed midway during calibration, the calibration will stop and the hold (output stabilization) time will be set up.

(2) Press the [Abort] key once again to return to the screen as shown in Figure 8.7.

8.3.3 Automatic Calibration

No execution operations are required for automatic calibration. Automatic calibration starts in accordance with a preset start day and time. Calibration is then executed at preset intervals.

NOTE

Before starting Semi-automatic calibration or Automatic calibration, operate the calibration gas solenoid valves and adjust calibration gas flow to 600 ± 60 ml/min.

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9. Other Functions

9.1 Detailed-data Display

"Sensor menu" > "Detail"

This section describes each data of sensors.

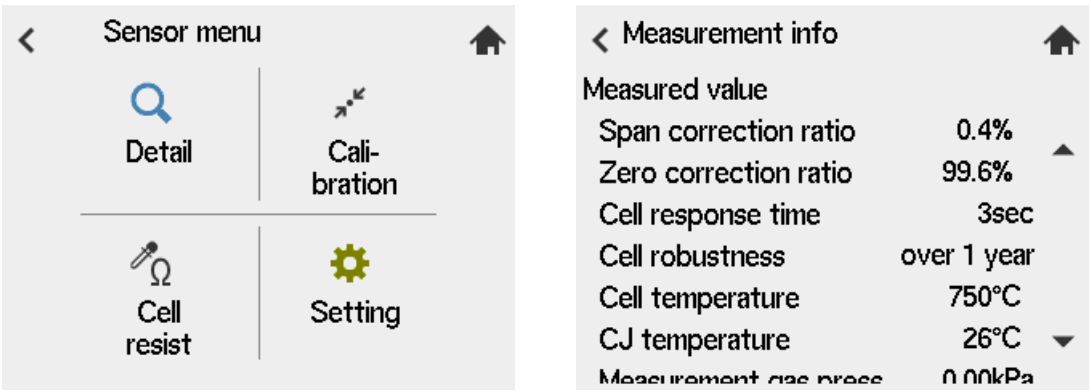
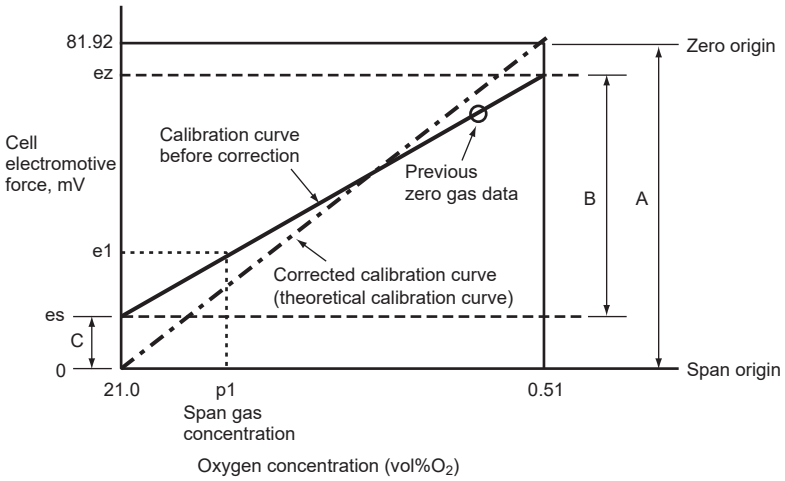


Figure 9.1 Detailed-data Display

9.1.1 Span correction ratio, Zero correction ratio

These are used to check for degradation of the sensor (cell). If the correction ratio is beyond the limits as shown in Figure 9.2, the sensor should no longer be used.

These ratios can be found by calculating the data as shown below.

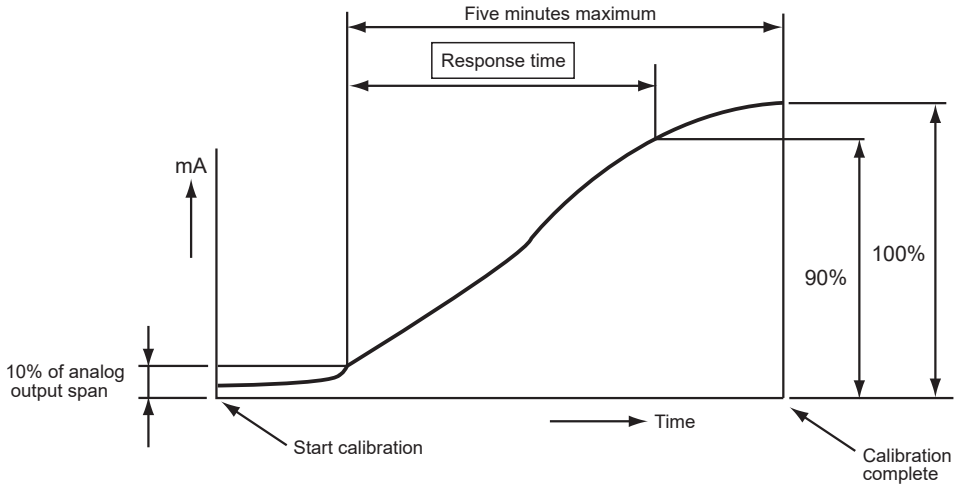


Zero gas correction ratio = (B/A) x 100 (%) Correctable range: 100 ± 30%
Span gas correction ratio = (C/A) x 100 (%) Correctable range: 0 ± 18%

Figure 9.2

9.1.2 Cell response time

The cell's response time is obtained in the procedure shown in Figure 9.3. If only either a zero-point or span calibration has been carried out, the response time will not be measured just as it will not be measured in manual calibration.



The response time is obtained after the corrected calibration curve has been found. The response time is calculated, starting at the point corresponding to 10% of the analog output up to the point at 90% of the analog output span. That is, this response time is a 10 to 90% response.

Figure 9.3 Typical Response Time characteristic

9.1.3 Cell robustness

The robustness of a cell is an index for predicting the remaining life of a sensor and is expressed as one of four time periods during which the cell may still be used:

(1) more than a year

(2) more than six months

(3) more than three months

(4) less than one month

The above four time periods are tentative and only used for preventive maintenance, not for warranty of the performance.

This cell's robustness can be found by a total evaluation of data involving the response time, the cell's internal resistance, and calibration factor. However, if a zero or span calibration was not made, the response time cannot be measured. In such a case, the response time is not used as a factor in evaluating the cell's robustness.

9.1.4 Cell Temperature

This displays the cell (sensor) temperature, which is determined from the thermocouple emf and cold junction temperature. Normally it is 750°C.

9.1.5 C. J. Temperature

This indicates the detector terminal box temperature (except for ZR802S-/CJ selected), which compensates for the cold junction temperature for a thermocouple measuring the cell temperature. When the ZR22 Detector is used, the maximum C. J. temperature will be 150°C. If the terminal box temperature exceeds this, take measures to shield the terminal box from heat radiation.

The maximum C. J. temperature varies depending on the type of detector.

When ZR802S /CJ is selected, this shows a temperature near terminal box inside a converter case.

9.1.6 Measurement gas press.

Displays the preset value or the value entered by the transmitter. Turn Display the measured gas pressure for the oximeter.

9.1.7 Cell voltage

The cell (sensor) voltage will be an index to determine the amount of degradation of the sensor. The cell voltage corresponds to the oxygen concentration currently being measured. If the indicated voltage approximates the ideal value (corresponding to the measured oxygen concentration), the sensor will be assumed to be normal.

The ideal value of the cell voltage (E), when the oxygen concentration measurement temperature is controlled at 750°C, may be expressed mathematically by:

E = -50.74 log (Px/Pa) [mV]

where, Px: Oxygen concentration in the sample gas
Pa: Oxygen concentration in the reference gas, (21 vol%O_2)

Table 9.1 shows oxygen concentration versus cell voltage.

Table 9.1 Oxygen Concentration Vs. Cell Voltage, (cell temperature: 750 °C)

%O_2	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
mv	117.83	102.56	93.62	87.28	82.36	78.35	74.95	72.01	69.41

%O_2	1	2	3	4	5	6	7	8	9
mv	67.09	51.82	42.88	36.54	31.62	27.61	24.21	21.27	18.67

%O_2	10	21.0	30	40	50	60	70	80	90
mv	16.35	0	-7.86	-14.2	-19.2	-23.1	-26.5	-29.5	-32.1

%O_2	100
mv	-34.4

9.1.8 Thermocouple voltage

The cell temperature is measured with a Type K (chromel-alumel) thermocouple. The thermocouple cold junction is located in the detector terminal box. The cell temperature and the thermocouple voltage (including the voltage corresponding to the cold junction temperature) are displayed.

9.1.9 Cold Junction Resistance (CJ resistance)

The ZR22 Detector measures the cold junction temperature using an RTD (Pt 1000).
If detector is “ZR22” is selected in the “Setting”, the RTD resistance values will be displayed.

9.1.10 Cell resistance

A new cell (sensor) indicates its internal resistance of 200 Ω maximum. As the cell degrades, so will the cell’s internal resistance increase. Those changes in the cell’s internal resistance are just a guide to the extent the cell is degrading. The updated values obtained during the calibration are displayed.

9.1.11 IF software revision

The revision (number) of the interface software installed is displayed.

9.1.12 Cell heater duty

The probe sensor is heated to and maintained at 750°C. When the sample gas temperature is high, the amount of heater ON-time decreases.

9.1.13 Pwr. supply voltage mode

For the best control of the detector's heater, the control parameters are automatically configured by power supply voltage and frequency. When the power voltage supplied to this instrument is lower than 165 V, "100V", is indicated. When it is over 165V, "200V" is indicated.

9.1.14 Power frequency mode

When the power frequency supplied to the instrument is lower than 55 Hz, "50 Hz" is indicated. When it is over 55 Hz, "60Hz" is indicated.

9.1.15 Simple cell resistance

Displays the numeric value gained from the cell resistance value by using a simple cell without using calibration gas. This value is effective to evaluate the sensor wellness between calibrations times. This shows a value gained from a latest calibration.

9.1.16 Simple cell robustness

Simple cell resistance measurement evaluates the cell's life expectancy with 4 levels: longer than 1 year, 6 months, 3 months or less than 1 month. (All values are estimated for the purpose of safety and prevention, and not calculated for the quality guarantee.)

9.2 Converter Detail

"Converter menu" > "Detail" to see the converter output or log data. Switch the screen with ◀ ▶.

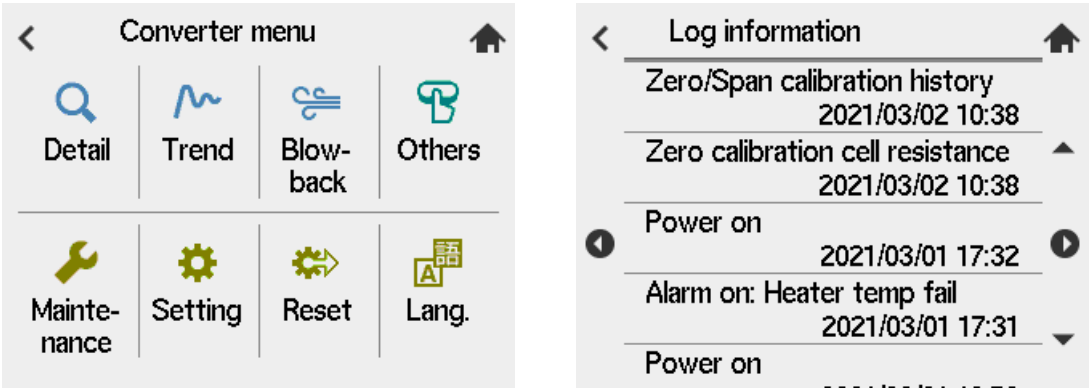


Figure 9.4 Converter Detail

9.2.1 Analog output

Displays Analog output1, Analog output2 on graphs with the unit (mA).

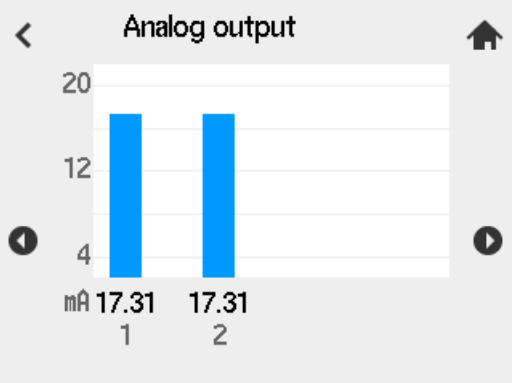


Figure 9.5 Analog output

9.2.2 Contact output

Displays the status of contact output from DO1 to DO4. When the contact is active, ON, not active, OFF is lit on. See 8.4 for details on contact ON/OFF.

Figure 9.6 Contact output

9.2.3 Input value

Displays analog input mA and contact input status of contact DI 1 and DI 2. Analog input is displayed on a graph with the unit (mA). When there is no analog input setting, the value is displayed "---" (bar). When the contact is active, the contact input is ON, when not the contact input is OFF.

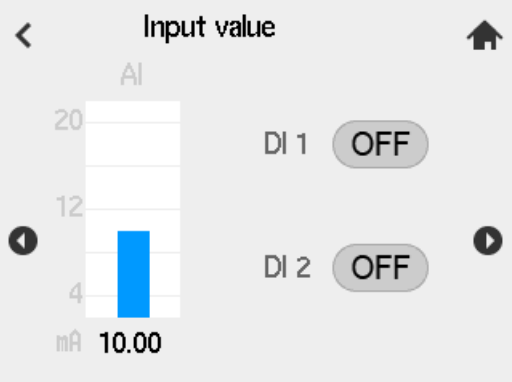


Figure 9.7 Input value

9.2.4 Measurement info

Displays average, maximum, minimum value of measurement. Maximum and minimum value show the date when the measurement is conducted. Setup the monitoring hour value of average/ max. min according to the setting described in 8.6.2.

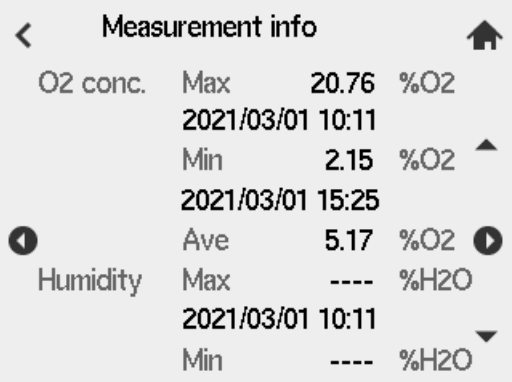


Figure 9.8 Measurement info

9.2.5 Product information

Displays the set time (see "7.7.1 Setting the Date-and-Time"), Serial No., version number of Main software, HART address, HART device revision number.

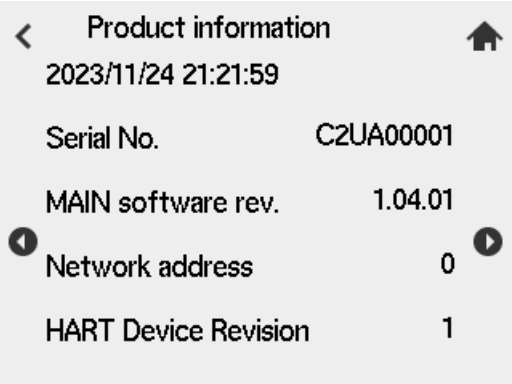


Figure 9.9 Product information

NOTE

"Serial No." has been displayed on the Product information since MAIN software Rev 1.04.01.

Update the firmware to the latest for devices with software Rev prior to Rev 1.04.01.

9.2.6 Log information

Displays Alarm occurrence, Alarm cancel, Calibration history, Cell resistance during calibration, date of power-on. Up to 20 logs are displayed. When you tap some specific log, you can see the detail data.

Table 9.2 Log information

Log item	Details (except Time)
Alarm: cell voltage error	Cell electromotive force (mV)
Alarm: Heater temperature error	Thermocouple electromotive force (mV)
Alarm occurrence: (Other)	-
ALARM RESET	-
Zero/span calibration history	Span Correction Ratio (%), Zero Compensation Ratio (%)
Cell internal storage resistor at zero calibration	Cell resistance (Ω)
Power Supply ON	-
Farm update	-
Operator ID	Operator ID input value

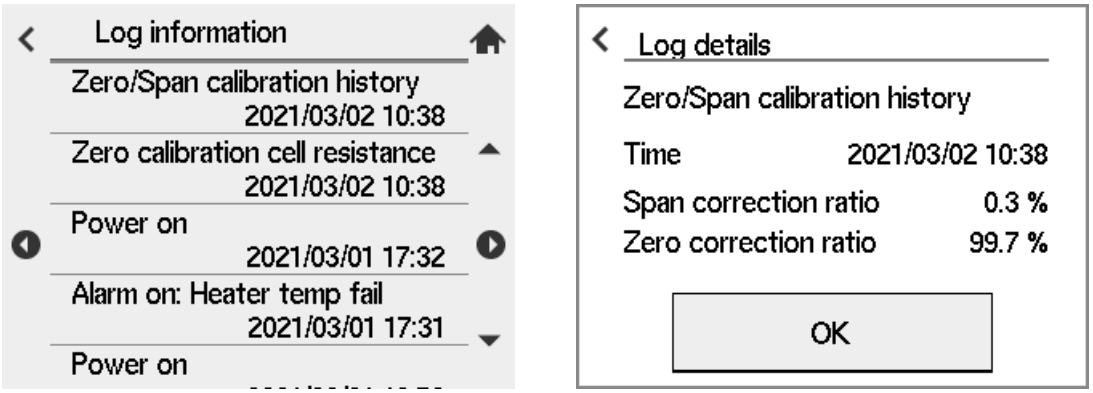


Figure 9.10 Log information

Changing HMI setting of Logbook configuration

You can change what to display on the Log information.

(1) “Converter menu” > “Maintenance” > “Display setting” > “other settings”

(2) Select “Logbook settings”. Check items to change.

You can see Cell resistance of zero calibration in “Calibration history”, power ON/Firm update/Operator ID in “Other”.

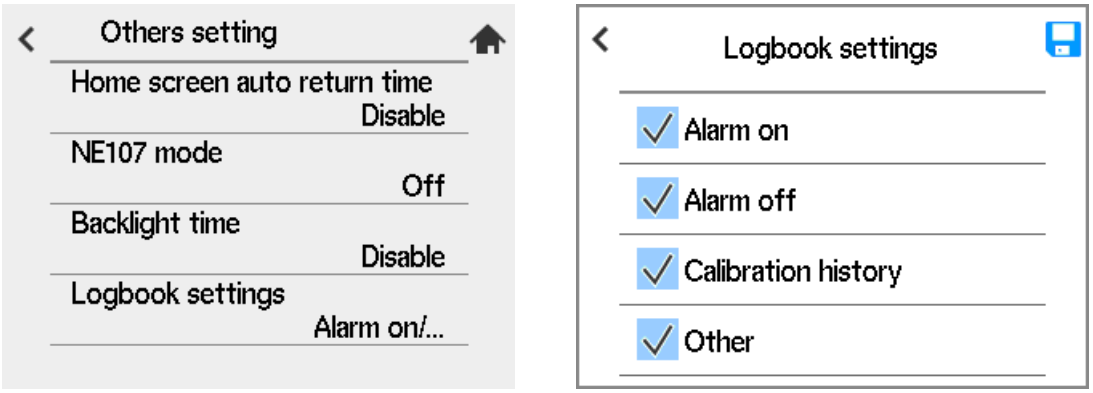


Figure 9.11 Changing log information setting

9.3 Trend Graph

"Converter menu" > "Trend". You can check the measurement trend and simple cell resistance trend. .You can check the transition of the measured value and sensor resistance value.

9.3.1 Measurement Trend setting

(1) "Converter menu" > "Maintenance" > "Display settings" > "Trend graph"

(2) Select "Graph selection items" from the Maintenance. A window opens to select an item to display. Selectable items are as shown in the Table 9.3.

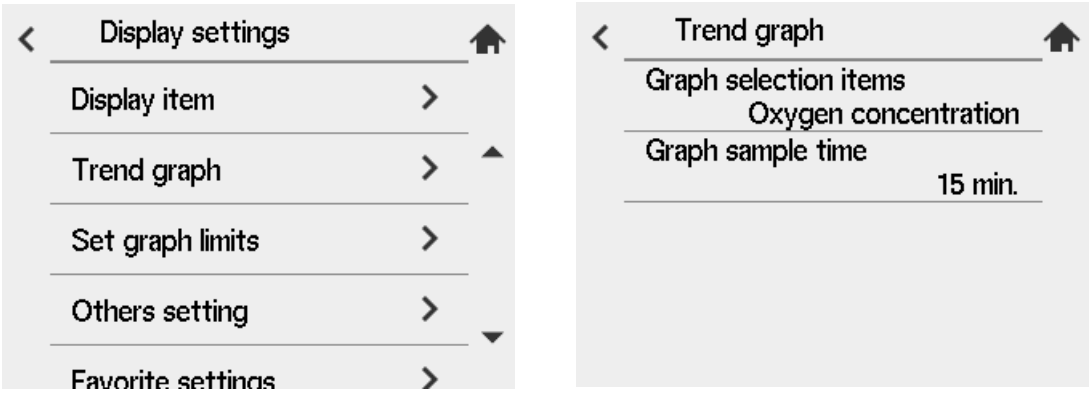


Figure 9.12 Trend graph setting

Table 9.3 Trend graph setting

selectable item	Description
Oxygen concentration	The graph shows the oxygen concentration during measurement.
Output item 1	The graph shows the item select as Output item 1. If this equipment is for the oxygen analyzer, the trend graph will be an oxygen concentration graph.
Output item 2	The graph shows the item select as Output item 2. If this equipment is for the oxygen analyzer, the trend graph will be an oxygen concentration graph.

(3) Select "Graph Sample Time" to Display the selectable sample time. Select the desired Display item from this menu.
Selectable sample time: 15 minutes, 30 minutes, 1 hour, 2 hours, 4 hours, 8 hours, 24 hours, 7 days, 14 days.

(4) "Converter Menu" > "Maintenance" > "Display settings" > "Set graph limits".
Setup the Hi and Low limits respectively. Tapping the graph area displays the scale of the vertical axis.

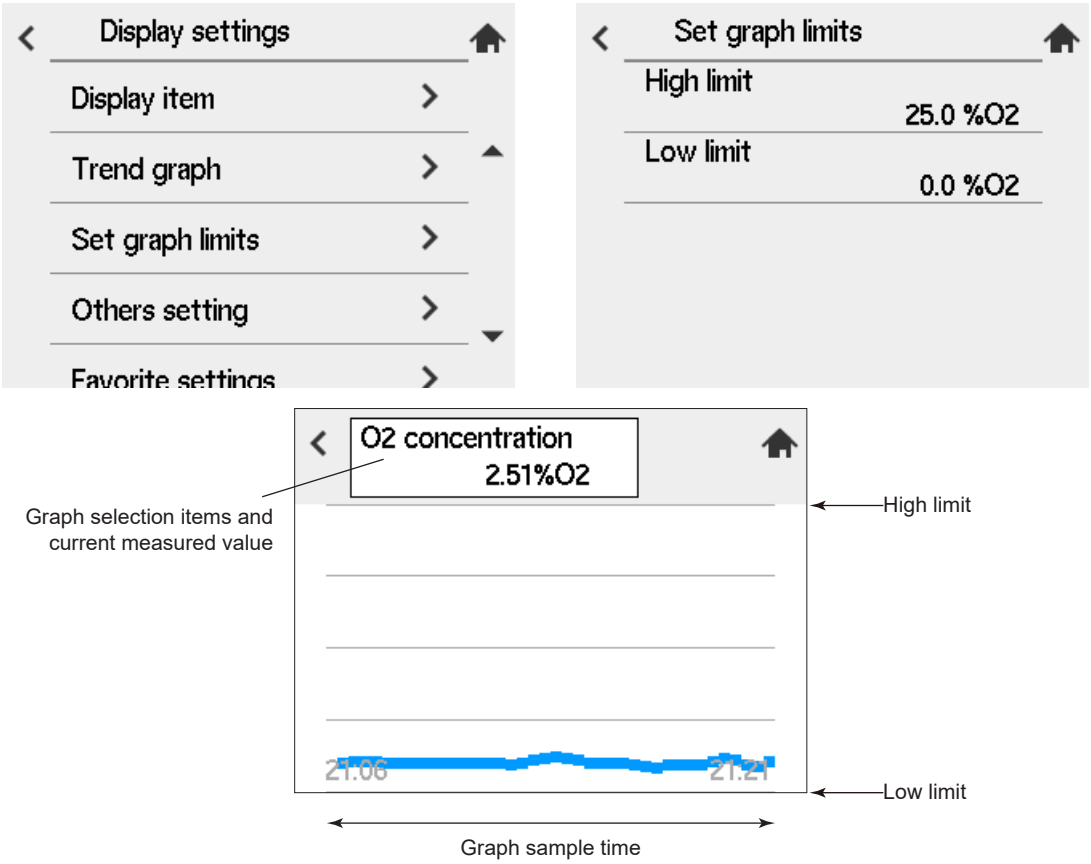


Figure 9.13 Trend graph

NOTE

If a rapid change in the measured value occurs during sampling, no sampled data are plotted on the graph. Use the graph indication tentatively. Check the output current for accurate data

9.3.2 Simple cell resistance trend

Displays the result of the simple cell resistance measurement (see "9.6 Simple cell resistance measurement"). On the measurement date the result is displayed in dots. (An example shown below shows a measurement taken once a day).

Trend displays only one data per day and the value measured at the earliest time of the day. The horizontal axis is static in six months. You can check the trend for another half year by pressing display switch. The vertical axis is determined by the value of the simple cell resistor alarm that is turned setup.

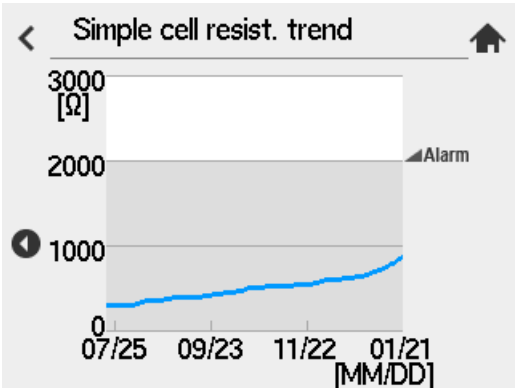


Figure 9.14 Simple cell resistance trend

9.4 Other functions of displays

9.4.1 Home screen auto return time

What is Auto return:

When there is no keypad entry for a certain period of time while the screen other than Home (screen) is displayed, the screen returns Home (screen). This shift is called Auto return. After the key touch operation stops, the Auto return time starts and lasts until the screen returns Home automatically. You can setup the Auto return time. However, Auto return is disabled during the following period.

- During manual calibration
- During semi auto calibration
- During semi auto blow back
- During semi auto simple cell resistance measurement
- During keypad calibration (While you are on the touch panel adjustment screen, touch panel confirmation screen)
- Trend screen (including Simple cell resistance trend) on display
- Details on display (Converter menu, sensor menu)
- Alarms on display
- When the change is not saved after changing the setting

(1) “Converter menu” > “Maintenance” > “Display setting”> “Other setting”.

(2) Select “Home screen auto return time”. Select “Disable”, “10 min.”, “60 min.”.

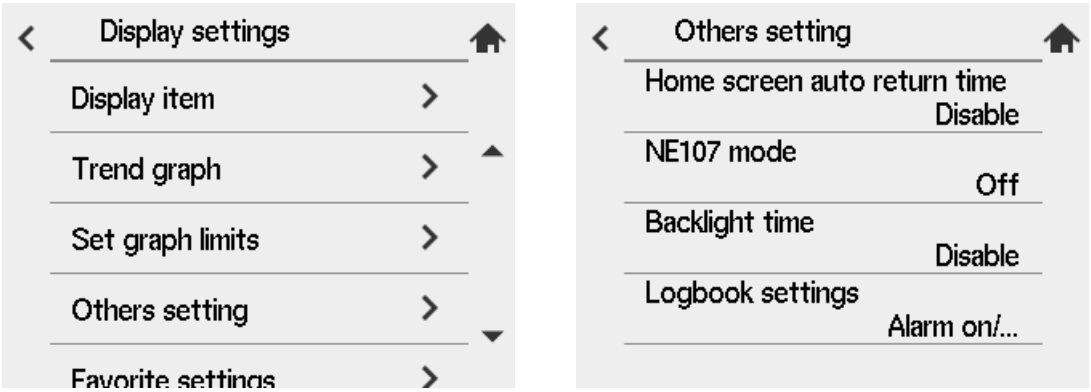


Figure 9.15 Other settings Display

9.4.2 NE107 mode

You can change the alarm display according to the NAMUR NE 107.

(1) "Converter" > "Maintenance" > "Display setting" > "Others setting"

(2) Select NE107 Mode. Select ON/Off.

Table 9.4 NE107 - Off

Icon	Alarm setting
	Failure (no power supply to heater)
	Function Check, Out of Specification, Maintenance Required

Table 9.5 NE107 - ON

Icon	Alarm setting
	Failure (no power supply to heater)
	Function Check
	Out of Specification
	Maintenance Required

9.4.3 Backlight time

You can set the back light to turn off automatically to keep LED life long. The backlight will turn off if no screen action is taken during a setup time.

(1) Select “Maintenance” → “Display setup” → “Other setup” from “converter Menu” screen.

(2) Select “Backlight time”. You can setup “disable”, “10 minutes”, “30 minutes” or “60 minutes”

9.4.4 Alarm notification screen flash

You can set whether to flash the screen when an error occurs while the home screen is displayed. The initial value is "Off." When "Off" is selected, the home screen will not blink even if an error occurs.

9.4.5 Entering Tag Names

You can assign any tag name to the instrument;

If there is an instruction in the specification at the time of order, it is entered at the time of shipment.

(1) Select "Maintenance" → "Display settings" → "Display Items" from "converter Menu" screen.

(2) Select "Tag Name" to enter screen and use alphabets, numbers, and symbols. You can enter up to 32 character of characters.

Figure 9.16 Entering Tag Names

9.4.6 Language Selection

You can select a display language from among Japanese, English, Chinese, French, German, Portuguese, and Russian.

The display language is set to the one specified in the purchase order when the analyzer is shipped from the factory.

(1) “Converter menu” > “ Language”. Set the language to display.

Figure 9.17 Language selection

Note

- When the language is changed, the trend data of the trend screen is cleared.
- Russian has been available since MAIN software Rev. 1.04.01.
  Update the firmware to the latest for devices with software Rev prior to Rev 1.04.01.

9.4.7 Unit

You cannot change the unit displayed on the screen. If you need to change the temperature to °F, the pressure to psi, please contact Yokogawa.

9.5 Blow Back

This section explains the parameter settings for performing blow back.

9.5.1 Mode

There are three modes of blow back operation: no function, semi-automatic, and automatic. Blow back is not performed when the mode is set to “No function”. In “Semi_Auto” mode, blow back can be started by key operation on the display or by a contact input signal, and then sequentially performed at a preset blow back time and hold time. In “Auto” mode, blow back is automatically performed at preset intervals. For “Semi_Auto” or “Auto” modes, blow back is performed. The following restrictions apply:

- **When “None” is selected:**

  Blow back is not performed

- **When “Semi-automatic” is selected:**

  Semi-auto blow back can be performed. (Blow back does not start at Auto blow back start time.)

- **When “Automatic, semi-automatic” is selected:**

  Blow back can be performed in either “Auto” or “Semi_Auto” mode.

  (1) “Converter menu” > “maintenance” > Blowback setting”

  (2) Select “mode” then you can select “None”, “Semi-automatic”, “Automatic, semi-automatic”.

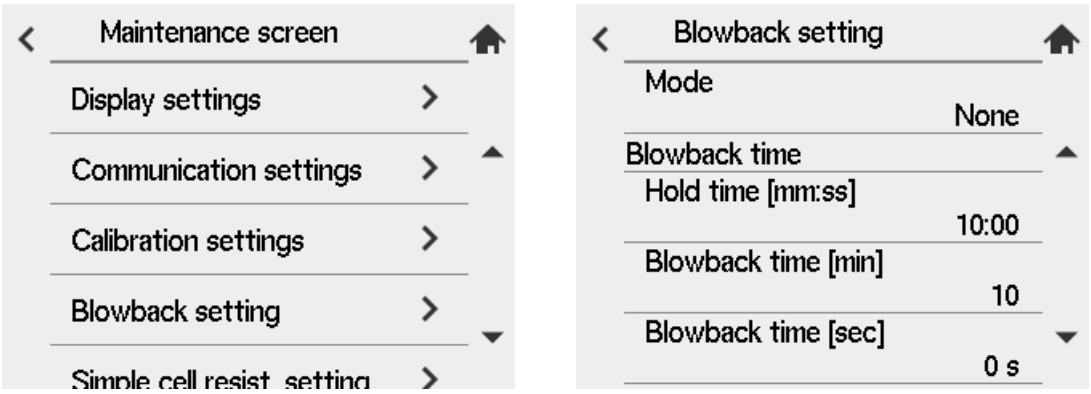


Figure 9.18 Blowback setting

9.5.2 Operation of Blow back

The timing chart of blowback operation is shown next. To perform blowback on contact input signal, input a contact signal for at least 1 second and not more than 11 seconds. When blowback is initiated, contact output repeats opening and closing approximately every 10 seconds during setup blowback time. After the blowback period has elapsed, the analogue output is held in a state configured at the “setup of the output hold” until the Hold time has elapsed (see Section "7.2 Output Hold Setting"). For the Hold time, set a time period from when the blow back ends until the sample gases are replaced in the detector and the output returns to the steady state.

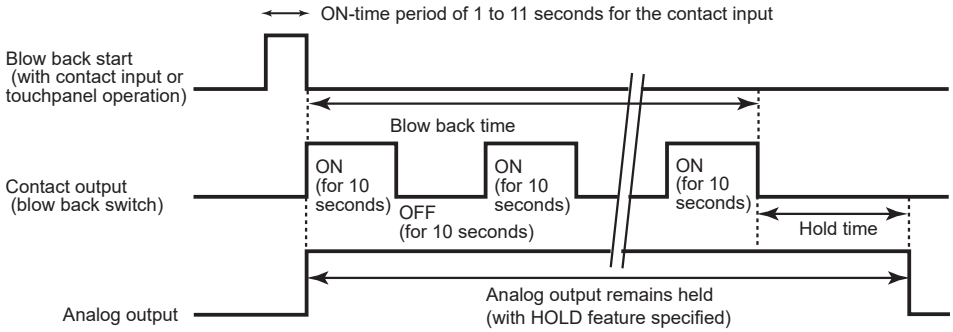


Figure 9.19 Operation of Blow back

9.5.3 Setting Output Hold Time and Blow back Time

If the blow back mode is in “No function”, the output “Hold time” and “Blow back time” are not displayed. If you select “Hold time”, the numeric-data entry display appears. Enter the desired “Hold time” (output stabilization time) from 00 minutes, 00 seconds to 60 minutes, 59 seconds.

When you select “Blow back time”, the numeric-data entry display appears. Enter the desired “Blow back time” from 00 minutes, 00 seconds to 60 minutes, 59 seconds.

9.5.4 Setting Interval, Start Date, and Start Time

The “Interval” is the time to execute blow back automatically. Display the numeric-data entry panel display to set the desired interval from 000 days, 00 hours to 255 days, 23 hours.

For the “Start date” and “Start time”, set the date when the blow back is first executed and the time when to start the blow back, respectively. If you want to execute the first blow back, for example, at 4:00 p.m. on March 25, 2001, enter 25/ 03/ 01 for the Start date and 16:00 for the Start time.

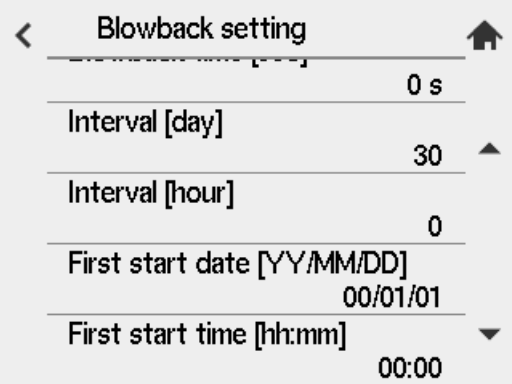


Figure 9.20 Setting Interval, Start Date, and Start Time

NOTE

- If the blow back is executed with an input contact, it must be preset in the Input contact settings (for more details, see Section "7.6 Input Contact Settings").
- Set the Contact output used as the blowback switch (for more details, see Section "7.5 Contact Output Setup").
- Do not set any other function for the contact used as the blow back switch. Otherwise, blow back may be activated when the contact is closed by any other function.
- If the start time of the automatic blow back comes during a maintenance service or calibration or semi-auto blow back or simple cell resistance measurement, the auto blow back of this time will not be executed.
- If you set the blow back interval at 000 days, 00 hours, only the first blow back is then executed. No subsequent blow backs will be executed.
- If a past date is set for the Start time, no automatic blow back will be executed.

9.5.5 Default Setting

When the analyzer is delivered, or if data are initialized, the blow back settings are by default, as shown in Table 9.6.

Table 9.6 Blow back Default Setting

Item	Default setting
Mode	None
Hold time [mm:ss]	10:00
Blowback time [min]	10
Blowback time [sec]	0s
Interval [day]	30
Interval [hour]	0
First start date [YY/MM/DD]	00/01/01
First start time [hh:mm]	00:00

9.6 Simple cell resistance measurement

When the cell of the zirconia oximeter deteriorates, the cell resistance increases. This function simply measures the cell resistance without using calibration gases.

9.6.1 MODE

There are three operation modes of simple cell resistance measurement of this instrument: “None” without simple cell resistance measurement, “Semi-automatic simple cell resistance measurement” in which simple cell resistance measurement is started by manipulation from the touch panel, and “Simple cell resistance measurement” in which simple cell resistance measurement is automatically performed at setup cycle. Here you can select these modes. The following restrictions apply to each mode:

- **When “None” is selected**

  Simple cell resistance measurement is not performed.

- **When “Semi-automatic” simple cell resistance measurement is selected**

  Semi-automatic simple cell resistance measurement is enabled (measurement is not executed when the start time of automatic simple cell resistance measurement is reached).

- **When “Automatic, semi-automatic” simple cell resistance measurement is selected**

  Both automatic and semi-automatic simple cell resistance measurement mode are enabled.

  (1) “Converter menu” > “Maintenance” >”Simple cell resist. setting”

  (2) When “Measurement mode” is selected in the “Simple cell resist. setting”, you can select “None”, “Semi-automatic”, “Auto, Semi-automatic.”

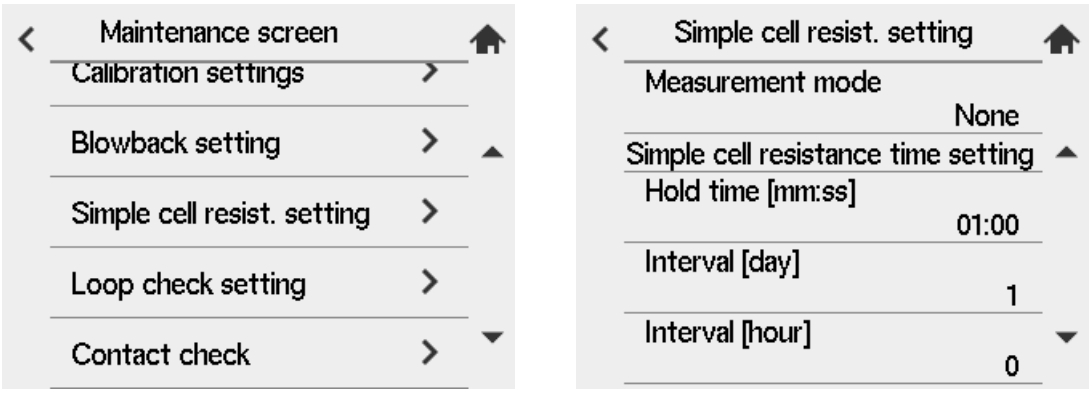


Figure 9.21 Simple cell resistance setting

9.6.2 Setup of Hold time, interval, start date, and start time

The stabilization time is turned setup because the measured value changes temporarily immediately after the simple cell resistance measurement. When “Hold time” is selected, the numeric entry screen is turned Display, so enter the hold time. Setup can range from 00 minutes 00 seconds to 60 minutes 59 seconds. Default has been setup in one minute. If no significant cell degradation occurs, the meter returns to the normal measurement in 1 minute.

When using Auto Simple Cell Resistance Measure, “Interval”, “First Start Date” and “First Start time” must be turned setup. The term “Interval” refers to the period at which automatic simple cell resistance measurement is performed. Select “Interval” and enter it from the numeric entry screen. Setup is possible for 000 days 00 hours to 255 days 23 hours. For Start Date and Start Time, setup the date on which you want to perform the first simple cell resistance measurement and the start time.

Note

- The degradation tendency of the cell can be checked with the simple cell resistance trend by performing automatic simple cell resistance measurement. Setup of the automatic simple cell resistance measurement is recommended when the measurement downtime by executing the simple cell resistance measurement is not an issue.
- A measurement time of approximately 15 seconds is usually required for simple cell resistance measurement. If the hold time is included, the measurement stops for more than 1 minute.
- When the start time of auto-simple cell resistance measurement comes during maintenance service or calibration or blow back or semi-auto simple cell resistance measurement, the auto simple cell resistance measurement of this time will not be executed.
- When “000 days 00 hours” is set to setup for the interval, simple cell resistance measurement is executed only for the first time and is not performed after the second time.
- If the previous date is turned setup on the starting date, the auto simple cell resistance measurement is not executed.

9.6.3 Default

When the analyzer is delivered, or if data are initialized, the default set values are as shown in Table 9.7.

Table 9.7 Default value of the simple cell resistance setting

Item	Default
Mode	Semi-automatic
Hold time [mm:ss]	01:00
Interval [day]	1
Interval [hour]	0
First start date [YY/MM/DD]	00/01/01
First start time [hh:mm]	00:00
Simple cell resistance alarm value	2000 Ω

9.6.4 Procedure for Simple Cell Resistance Measurement

Semi-automatic simple cell resistance measurement

(1) Select “Cell resist” from the “sensor Menu” screen.

(2) The message screen is displayed prior to starting the measurement. When “Start” is selected, measurement starts.

(3) The message “Simple cell resistance measurement in progress...” blinks. When the measurement is finished, the unit shifts to screen of the hold time.

(4) The resistor reading is Display at the top right of screen. The hold time can be ended by pressing the [Abort] key

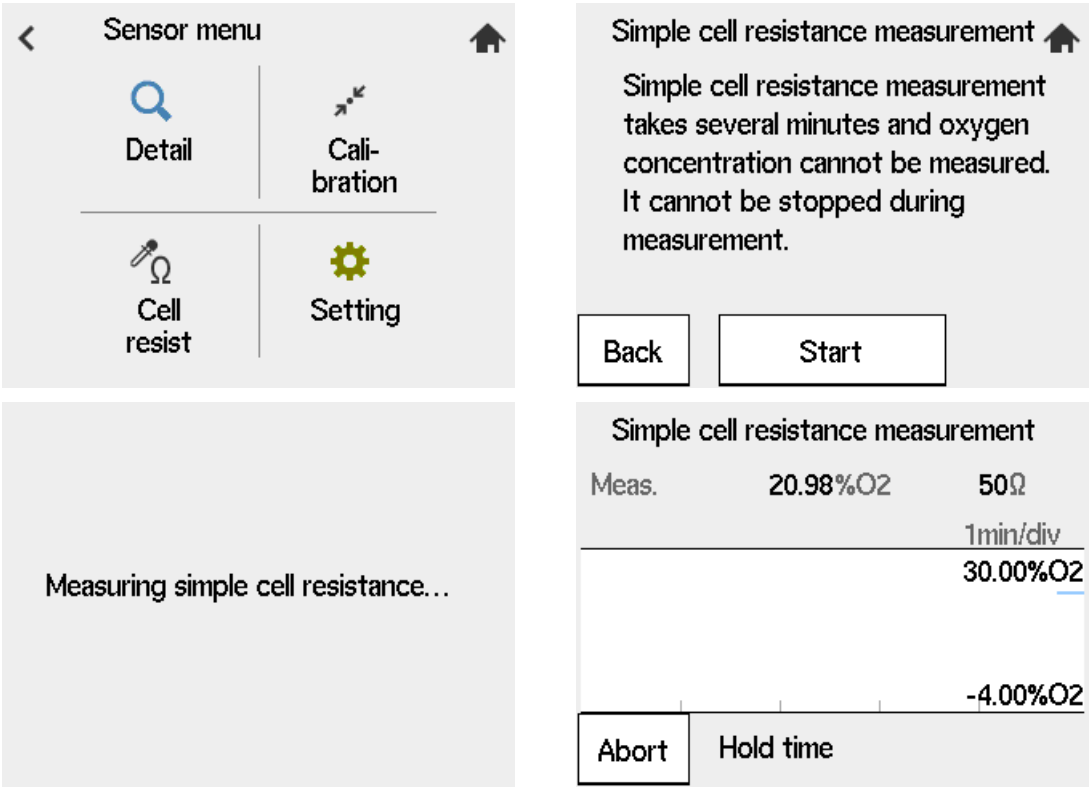


Figure 9.22 Procedure for Simple Cell Resistance Measurement

Auto simple cell resistance measurement

No operation is required to perform automatic simple cell resistance measurement. Measurement starts at the starting time of setup starting date. The cell resistor measurement is performed at the setup interval.

During measurement and hold time, the Oxygen concentration, Air ratio, Moisture content are displayed as "---"(bar).

NOTE

- The measurement results vary depending on the concentration of sample gases and the process conditions.
- If you want to measure an accurate value, perform zero calibration and check the cell resistance.
- If the measured value exceeds the 2000 Ω, a default of a simple cell resistance alarm, consider replacing the sensor. If it exceeds 3000 Ω, it is likely that normal measurement cannot be performed, and sensor replacement is recommended.

9.7 Communication Function

MODBUS Communication setup

ZR802S has a MODBUS function. RS485 communication and Ethernet (MODBUS TCP) are available by specification of the model of ZR802S.

Here, setup it according to your hardware configuration. For MODBUS communication, refer to TI 11M12G01-62EN.

RS485 Setup (RS)

MODBUS communication using RS485 is available.

Preset “MODBUS address”, “Baud Rate” and “Parity” from HMI according to the connected MODBUS master.

Setup according to your MODBUS communication requirements

Converter addressing	1 to 247(default 1)
Transmission speed	9600 [bps], 38400 [bps]115200 [bps] (default 9600 [bps])
Parity	Even, odd, none (default even)

The stop bit is 1 bit when the parity is “even”/“odd”, and 2 bit when the parity is “none”. It is recommended to setup the parity to “even” or “odd”.

(1) “Converter menu” > “Maintenance” > “Communication settings.”

(2) Select “MODBUS setting” to setup

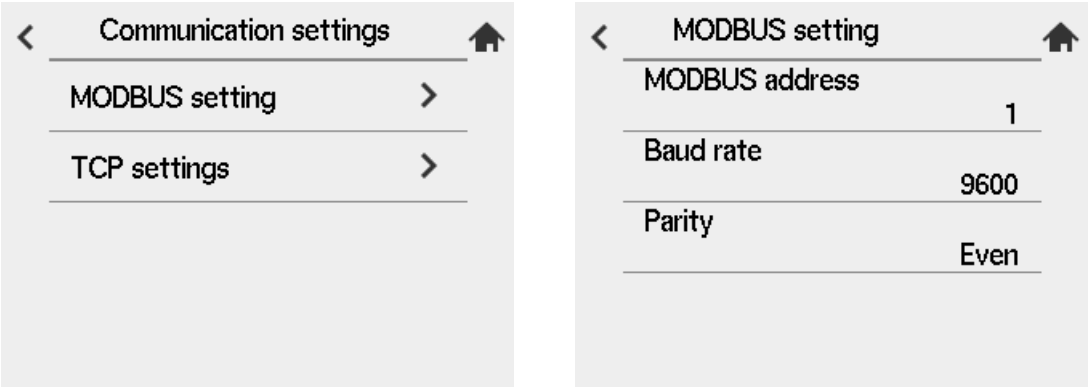


Figure 9.23 MODBUS Communication setup

Ethernet setup (E)

Modbus TCP communication is possible by connecting master devices with an Ethernet cable.

Communication standards	Ethernet
Session times (Up to.)	2
Protocol	Modbus TCP
Port number	502

The communication rate corresponds to Ethernet 10/100 and Protocol corresponds to Ipv4.

To assign an IP address automatically by DHCP, set “DHCP” to “On”. To use a fixed IP address, set “DHCP” to “Off” (default).

If you are using static IP addresses, setup IP addresses, subnet masks, and default gateways appropriately for your Ethernet environments. Ethernet setup parameter has the following default:

Parameter name	Default
DHCP enable	Off
IP Address	192.168.1.10
Subnet Mask	255.255.255.0
Default gateway	192.168.1.1

(1) “Converter menu” > “Maintenance” > “Communication settings.”

(2) Select “TCP settings” to setup.

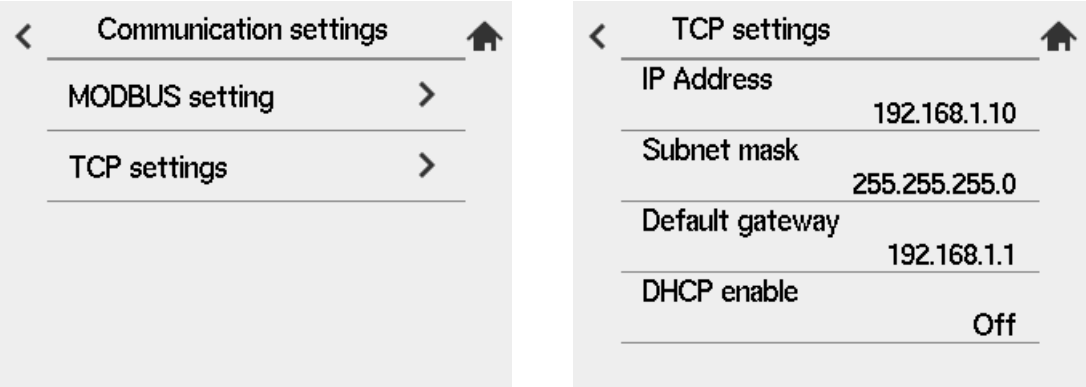


Figure 9.24 TCP settings

Note

Setup of Ethernet is reflected after ZR802S is restarted.

■ HART settings

This setting is used for the setup of HART communication.

Go to the [HART setting] to specify the HART address and set the SV, TV, and QV settings.

PV is not displayed on the transducer HMI screen

NOTE

The PV is linked to the [Selection of AO1] (Section 7.8) set for mA output 1.

To change PV, change the setting of mA output 1.

● Loop current mode

When only one device is connected on HART, keep the default “Enabled.

For Multi-drop connection: multiple number of field devices connect on a single HART cable, while requiring 4 mA fixed, set the parameter “Disabled”.

Enable: mA output 1 is normally Loop current.

Disable: mA output 1 is 4 mA fixed. For the Multi-drop connection.

● Network address

When only one device is connected on HART, keep the default “0".

For Multi-drop connection: multiple number of field devices connect on a single HART cable, assign different address from 1 to 63 to each device on the single HART cable so that none of them have same address as others.

● SV, TV, QV

Use Device Variable Code for ZR802G to set device variables to set the parameters of SV, TV, QV.

NOTE

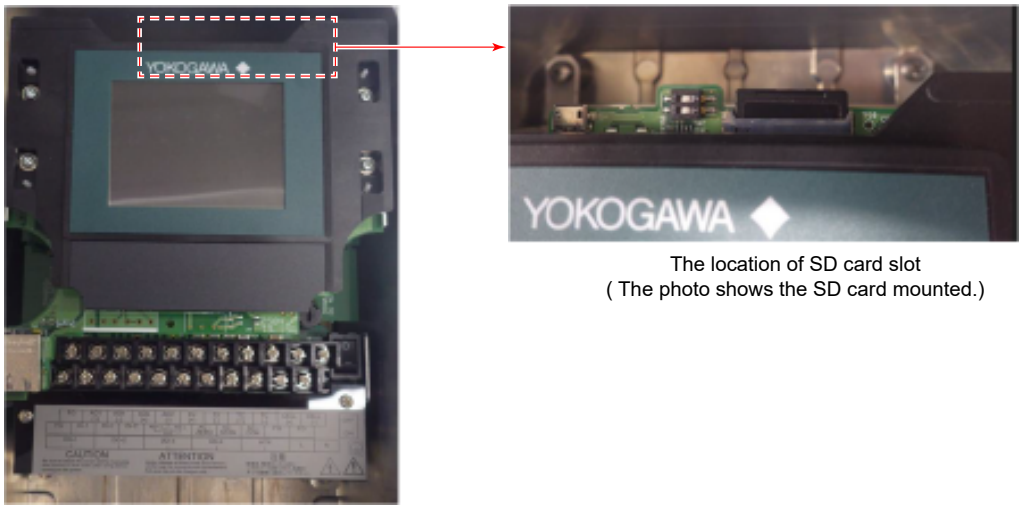
The ZR802G does not allow simultaneous device configuration between HMI and HART communication.

When setting devices via HART communication, if the setting screen is open in the converter, the setting command via HART communication returns a BUSY status (0x20) in the response.

For more information on HART communication, please refer to the technical document (TI 11M12G01-61EN).

9.8 Save load

Converter has functions for outputting log files, setup load, and updating software using SD-Card.



The location of SD card slot
(The photo shows the SD card mounted.)

Precautions When Using SD Card

- Be sure to format the SD card with SD Association software. If you use an SD card without being formatted by the tool, operation is not guaranteed.

  To download the formatter, select [Download] from the link below and proceed to SD Memory Card Formatter.

  https://www.sdcard.org
- Do not disconnect Power Supply or remove the SD card while accessing (reading/writing, software updating) the SD card.

9.8.1 Log file output

You can output the following files as log files:

- Maintenance report

  Outputs the last three calibration and various set values.
- Measured value log

  The following log data is output. Log cycle and measurement days can be selected from "1 second cycle × 8 days", "2 second cycle × 16 days", and "5 second cycle × 40 day
  - Date and time
  - Oxygen concentration
  - Cell voltage
  - CJ temperature
  - Thermocouple temperature
  - Simple cell resistance value
  - NE107 Status
  - Equipment status

Selecting Measurement log storage cycle

(1) “Converter menu” > “Setting” > “Other setting”

(2) Select “Measurement log storage cycle” to setup. Default is 2 seconds (16 days).

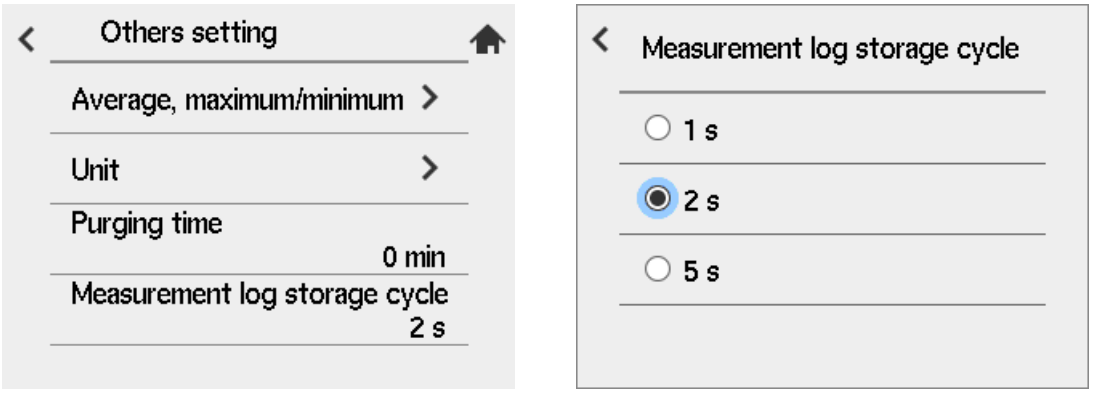


Figure 9.25 Measurement log storage cycle

- Setup File

  You can save a variety of set value. Tag names, passwords, language setup, and communication addresses are not saved. You can export the data files or copy to other converter to backup the configuration.
- Event Log

  Outputs the data that can be checked in the log data of converter detailed information. This data is used for checking by our service when a device malfunctions

Table 9.8 File name and output format of log file output

Output file	Folder name	File name	Output format
Maintenance report	Report/	ZC_report_YYYYMMDDhhmm.csv	.csv format
Measured value log	MeasLog/	ZC_measure_YYYYMMDDhhmm.csv	.csv format
Setup file (setup save)	SaveLoad/	ZC_setting.*	Binary file format
Event Log	EventLog/	ZC_event_YYYYMMDDhhmm.L00	Binary file format

Procedure for outputting log files

(1) “Converter menu” > “Other menu” > “Save/Load.”

(2) Select the file that you want to output.

(3) Check that the file name and press “Execute” to export the data into SD card. The SD card can be connected or disconnected except for when writing or reading files.

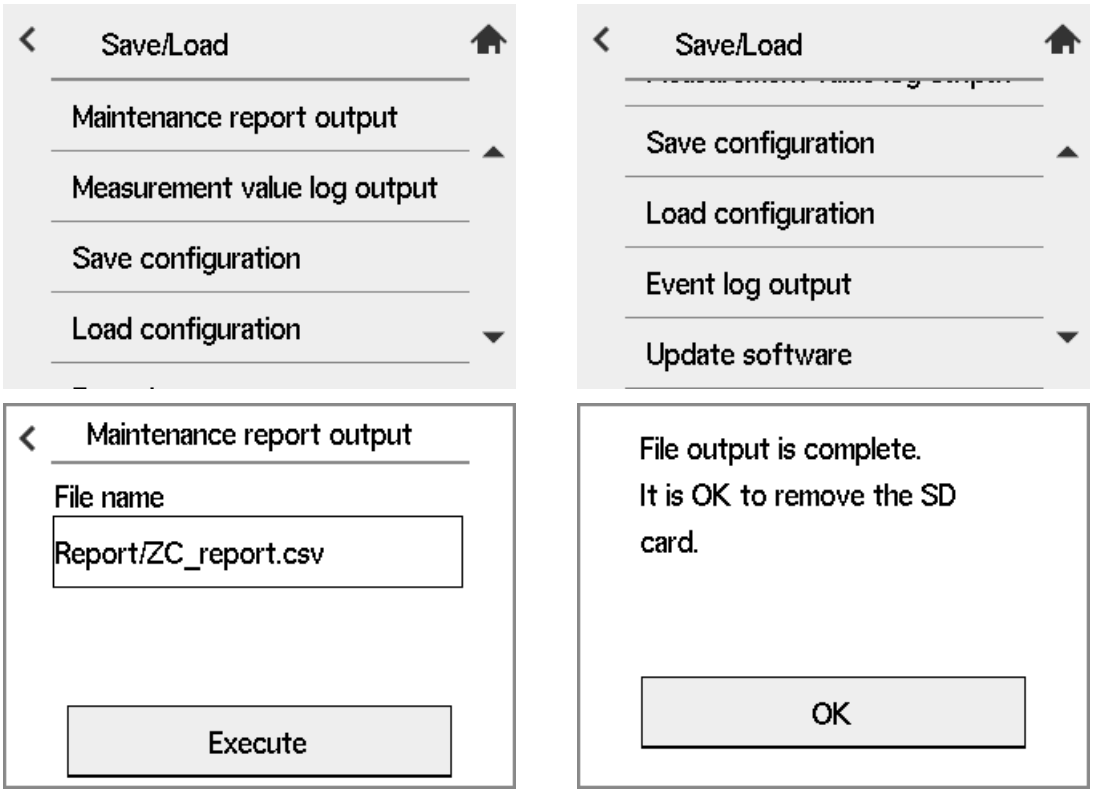


Figure 9.26 Outputting log files

9.8.2 Load configuration

(1) "Converter menu" > "Other" > " Save/Load"

(2) Select "Load configuration"

(3) Save the file output by "Save configuration" into a SD card. Press "Execute" to load the data.

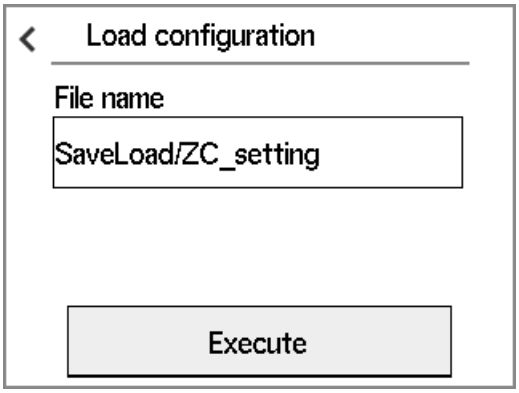


Figure 9.27 Load configuration

9.8.3 Update software

(1) “Converter menu” > “Other” > “Save/Load”

(2) Select “Update software”

(3) Save a designated file into a SD card to update the software. Normally you don't need to update the software. If you need the update file, contact Yokogawa.

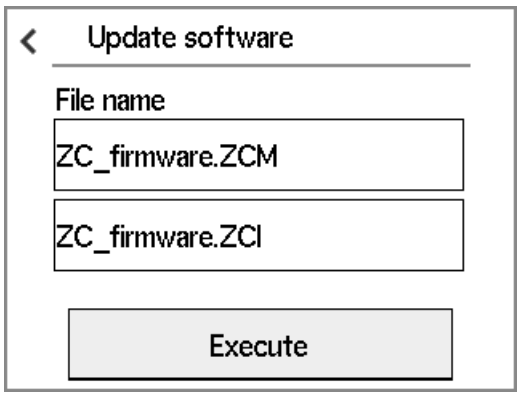


Figure 9.28 Update software

9.9 Data Initialization

Parameter settings can be initialized to the factory default settings. Initialization can be done for all parameters or for individual parameters. The parameters that can be initialized and their defaults are listed in Table 9.9.

(1) “Converter menu” > “Initialization”

(2) Select “Factory initialization”

(3) Press “Execute” to initialize to factory default.

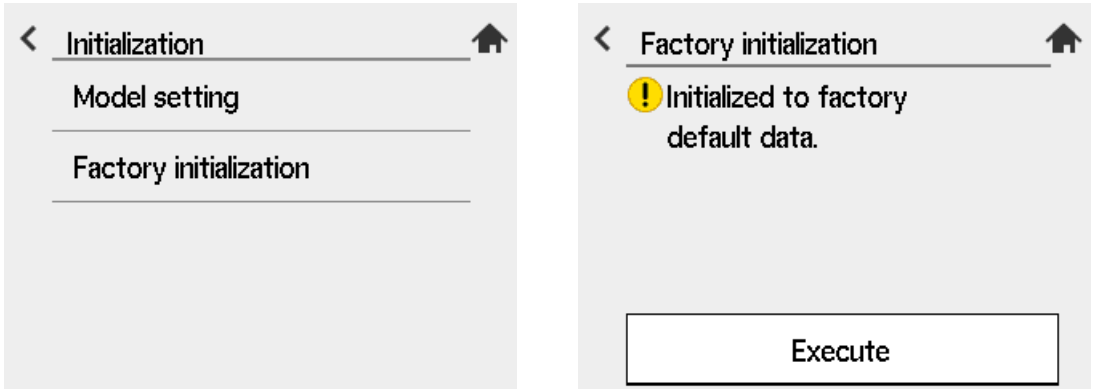


Figure 9.29 Initialization

WARNING

Do not turn off the power during initialization. Otherwise, initialization will not be performed properly.

Table 9.9 Initialization Items and Default Values (Oxygen Analyzer)

Item	Initialization Parameter		Default setting
Model Setting	-		Oxygen Analyzer
Language	-		Not initialized
Display settings	Display item	1st display item selection	Oxygen concentration
		2nd display item selection	Output item 1
		3rd display item selection	Favorite
		Tag name	Specified at order: Specified string NOT specified at order: Deleted
	Trend graph	Graph selection items	Oxygen concentration
		Graph sample time	15 min.
	Set graph limits	High limit	25.0%O2
		Low limit	0.0%O2
	Others setting	Home screen auto return time	Disable
		NE107 mode	Off
		Backlight time	Disable
		Alarm notification screen flash	Off
		Logbook settings	All ON
	Favorite settings	Favorite display item 1	Sensor details screen
		Favorite display item 2	Converter details screen
		Favorite display item 3	Trend screen
		Favorite display item 4	No setting
Communication settings	MODBUS setting	MODBUS address	Not initialized
		Baud rate	Not initialized
		Parity	Not initialized
	TCP settings	IP Address	Not initialized
		Subnet mask	Not initialized
		Default gateway	Not initialized
		DHCP enable	Not initialized
	HART setting	Loop current mode	Enable
		Network address	0
		SV	Oxygen
		TV	Oxygen
		QV	Oxygen
Calibration settings	Calibration mode		Manual
	Automatic calibration procedure		Span and Zero
	Zero gas concentration		1.00%O2
	Span gas concentration		21.00%O2
	Calibration time setting	Hold time [mm:ss]	10:00
		Calibration time [mm:ss]	10:00
		Interval [day]	30
		Interval [hour]	0
		First start date [YY/MM/DD]	00/01/01
		First start time [hh:mm]	00:00

Item	Initialization Parameter			Default setting
Blowback setting	Mode	Mode		None
	Blowback time	Hold time [mm:ss]		10:00
		Blowback time [min]		10
		Blowback time [sec]		0s
		Interval [day]		30
		Interval [hour]		0
		First start date [YY/MM/DD]		00/01/01
		First start time [hh:mm]		00:00
Simple cell resist. setting	Measurement mode			Semi-automatic
	Simple cell resistance time setting	Hold time [mm:ss]		01:00
		Interval [day]		1
		Interval [hour]		0
		First start date [YY/MM/DD]		00/01/01
		First start time [hh:mm]		00:00
mA output settings	mA output 1	Setting items	Selection of AO1	Oxygen concentration
		4-20mA point setting	4mA point	0%O2
			20mA point	25%O2
		Oxygen concentration setting	Upper limit value (AO switching)	25%O2
		Output smoothing factor	AO1 time constant	0s
		Output mode	Output characteristic selections	Linear
	mA output 2	Setting items	Selection of AO2	Oxygen concentration
		4-20mA point setting	4mA point	0%O2
			20mA point	25%O2
		Output smoothing factor	AO2 time constant	0s
		Output mode	Output characteristic selections	Linear
	Output hold setting	Warmup	Output state	4 mA
			Preset value	3.4 mA
		Maintenance	Output state	Last value hold
			Preset value	4 mA
		Cal. blowback simple cell resist.	Output state	Last value hold
			Preset value	4 mA
		Fault	Output state	Preset Value
			Preset value	3.4 mA
	Output limit setting	Lower limit value		3.8 mA
		Upper limit value		20.5 mA

Item	Initialization Parameter			Default setting
Alarm setting	Hysteresis	O2 concentration hysteresis		0.1%O2
	Alarm operation delay	Alarm operation delay		3s
	Oxygen concentration alarm	Oxygen concentration alarm	(HH) high-high alarm	Off
			(HH) high-high alarm value	100.0%O2
			(H) high alarm	Off
			(H) high alarm value	100.0%O2
			(L) low alarm	Off
			(L) low alarm value	0.0%O2
			(LL) low-low alarm	Off
			(LL) low-low alarm value	0.0%O2
	Zero correction ratio alarm	(H) high alarm		Function check
		(L) low alarm		Function check
	Span correction ratio alarm	(H) high alarm		Function check
		(L) low alarm		Function check
	Input temperature alarm	(H) high alarm		Off
		(L) low alarm		Off
	Input pressure alarm	(H) high alarm		Off
		(L) low alarm		Off
	Simple cell resistance alarm	Alarm setting		Maintenance required
		Alarm value		2000 Ω
	Other alarm settings	Calibration stability alarm setting		Function check
		Battery low alarm setting		Maintenance required
		Fast warmup alarm setting		Maintenance required

Item	Initialization Parameter			Default setting
Contact setting (continued on next page)	Contact output 1	Contact state during operation		Open
		Selection of contact output	Fault	OFF
			(HH) high-high alarm event	OFF
			(H) high alarm event	OFF
			(L) low alarm event	OFF
			(LL) low-low alarm event	OFF
			Maintenance	ON
			Calibration	OFF
			Switching output range	OFF
			Warmup	ON
			Cal. gas pressure drop	OFF
			Upper and lower temp. alarm	OFF
			Upper and lower press. alarm	OFF
			Blowback	OFF
			Process upset	OFF
			Calibration correction alarm	OFF
			Calibration stability alarm	OFF
			With simple cell resist. meas.	OFF
			Simple cell resistance alarm	OFF
	Contact output 2	Contact state during operation		Closed
		Selection of contact output	Fault	OFF
			(HH) high-high alarm event	OFF
			(H) high alarm event	OFF
			(L) low alarm event	OFF
			(LL) low-low alarm event	OFF
			Maintenance	OFF
			Calibration	ON
			Switching output range	OFF
			Warmup	OFF
			Cal. gas pressure drop	OFF
			Upper and lower temp. alarm	OFF
			Upper and lower press. alarm	OFF
			Blowback	OFF
			Process upset	OFF
			Calibration correction alarm	OFF
			Calibration stability alarm	OFF
			With simple cell resist. meas.	OFF
			Simple cell resistance alarm	OFF

Item	Initialization Parameter			Default setting
Contact setting (continuation of the previous page)	Contact output 3	Contact state during operation		Closed
		Selection of contact output	Fault	OFF
			(HH) high-high alarm event	OFF
			(H) high alarm event	ON
			(L) low alarm event	ON
			(LL) low-low alarm event	OFF
			Maintenance	OFF
			Calibration	OFF
			Switching output range	OFF
			Warmup	OFF
			Cal. gas pressure drop	OFF
			Upper and lower temp. alarm	OFF
			Upper and lower press. alarm	OFF
			Blowback	OFF
			Process upset	OFF
			Calibration correction alarm	OFF
			Calibration stability alarm	OFF
			With simple cell resist. meas.	OFF
			Simple cell resistance alarm	OFF
	Contact output 4	Contact state during operation		Closed (fixed)
		Selection of contact output	Fault	ON (fixed)
			Other settings	All OFF
	Contact input	Contact input 1	Operation of contact input 1	Operates when closed
			Selection of contact input 1	Disabled
		Contact input 2	Operation of contact input 2	Operates when closed
			Selection of contact input 2	Disabled
Others setting	Average, maximum/ minimum	Average value calculation time		1h
		Max and min monitoring time		24h
	Unit	Temperature setting	Temperature unit selection	°C
		Pressure setting	Selection of pressure unit	kPa
	Purging time			0min
	Measurement log storage cycle			2s
	Password	Commissioning		Deleted
		Execute		Deleted
	Adjust panel	Touch panel		Not initialized
		Brightness		50%

Item	Initialization Parameter			Default setting
Sensor setting	Device settings	Choice of moisture base		Wet
		Selection of detector		ZR22 (PT1000:Ohm)
	Input temp./press. setting	Oxygen model setting	Pressure input selection	Preset value
			Input pressure set value	0.00 kPaG
			4mA input pressure value	-5.00 kPaG
			20mA input pressure value	5.00 kPaG
			Pressure upper limit alarm value	5.00 kPaG
			Pressure lower limit alarm value	-5.00 kPaG
	Power settings	Power supply voltage		Auto
		Power frequency		Auto

9.10 Reboot

Reboot enables the equipment to restart. If the equipment is rebooted, the power is turned off and then back on. In practical use, the power remains on, and the equipment is restarted under program control.

When Fault happens, for safety, the power supply to the sensor heater is turned off. To cancel the error (Fault), reboot by following the procedure below or turn off the power once to restart the system.

CAUTION

Make sure that before a reboot or restarting the power that there is no problem with the detector or converter.

After the instrument reboots, if Fault occurs again, turn off the power. Find the problem by trouble shooting.

How to reboot the system

(1) “Converter menu” > “Others”

(2) “Reboot” A confirmation screen appears. Tap “Execute”.

(3) A confirmation screen appears again .Tap “Yes” to reboot.

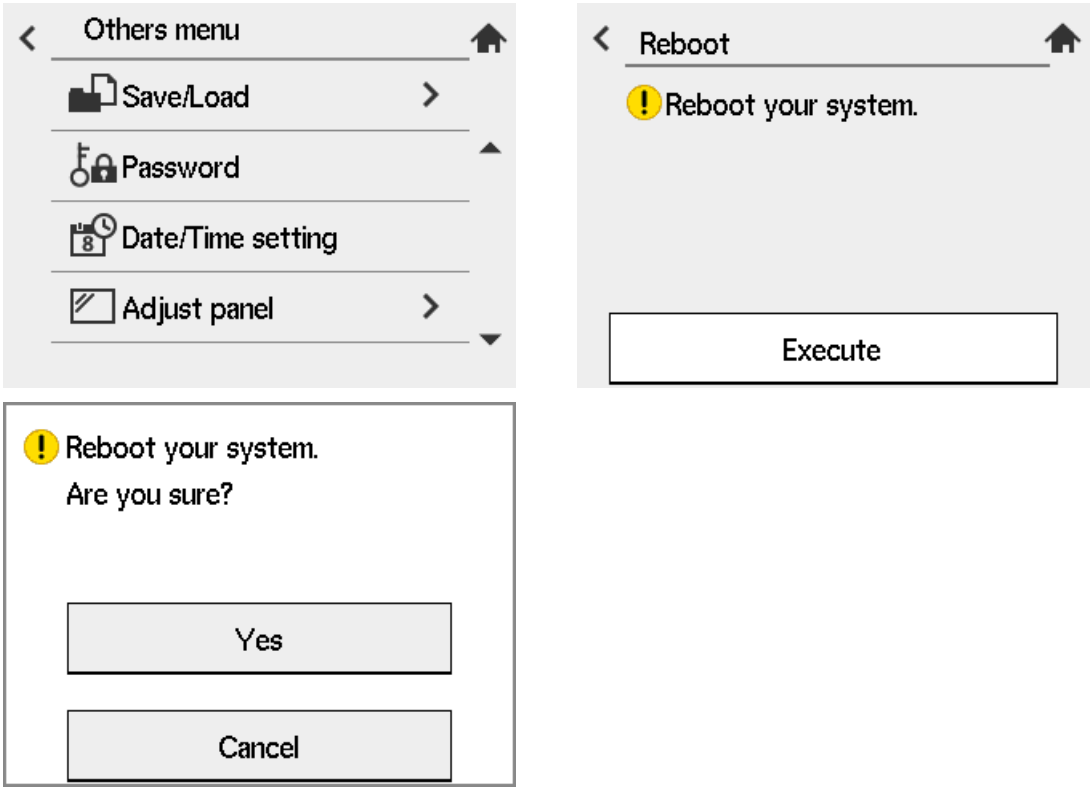


Figure 9.30 Reboot the system

9.11 Methods of Operating Valves in the ZA8F Flow Setting Unit

The ZA8F Flow Setting Unit is used as a calibration device for a system conforming to System 2. Calibration in such a system is to be manually operated. So, you have to operate the valve of the Flow Setting each time calibration is made (starting and stopping the calibration gas flow and adjusting the flow rate). For operation of the converter, see Section "6.12Calibration", earlier in this manual.

9.11.1 Preparation Before Calibration

To operate the ZA8F Flow Setting Unit, prepare for calibration as follows:

(1) Check for a complete closing of the zero gas flow setting valve in the unit and open the regulator valve for the zero gas cylinder until the secondary pressure equals sample gas pressure plus approx. 50 kPa (or sample gas pressure plus approx. 150 kPa when a check valve is used, maximum pressure rating is 300 kPa).

(2) Check that the oxygen concentration of the zero gas and span gas (instrument air 21 vol%O_2) in the cylinder is set in the converter.

9.11.2 Operating the Span Gas Flow Setting Valve

The following description is given assuming that instrument air, the same as the reference gas, is used as the span gas.

(1) When the display shown in Figure 9.31 (1) appears during calibration, open the span gas flow setting valve of the flow setting unit and adjust the flow rate to 600 ± 60 ml/min. Turn the valve slowly counterclockwise after loosening the lock nut if the valve has a lock nut. To check the flow rate, use the calibration flowmeter. If the sample gas pressure is extremely high, adjust the sample gas pressure to obtain pressures (listed in Table 9.10) ± 10%.

Table 9.10

Sample gas pressure (kPa)	50	100	150	200	250
Flow rate (ml/min)	500	430	380	350	320

(2) Adjust the flow rate and select “Valve opened” from the Manual calibration display. Check the Trend graph display to see that the measured value is stabilized. Then press the [Enter] key. The Manual calibration display shown in Figure 9.31 (2) appears.

Close the span gas flow setting valve to stop the span gas (air) flow. If the valve has a lock nut, be sure to tighten the lock nut to prevent any leakage of span gas into the sensor during measurement.

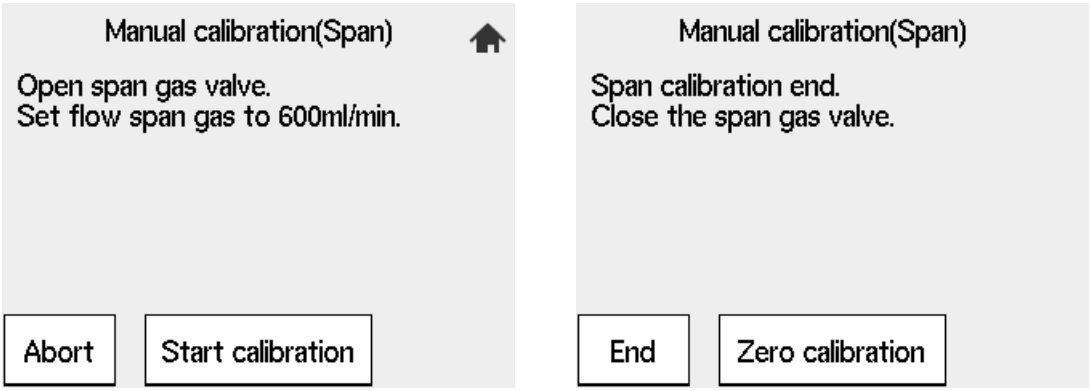


Figure 9.31 Span Gas Manual calibration

9.11.3 Operating the Zero Gas Flow Setting Valve

Operate the zero gas flow setting valve during zero-point calibration in the following procedures:

(1) When the display shown in Figure 9.32 (1) appears during calibration, open the zero gas flow setting valve of the flow setting unit and adjust the flow rate to 600 ± 60 ml/ min. To rotate the valve shaft, if the valve has a lock nut loosen the lock nut and slowly turn it counterclockwise. To check the flow rate, monitor the calibration gas flowmeter.
If the sample gas pressure is extremely high, adjust the sample gas pressure to obtain pressures (listed in Table 9.10) ± 10%.

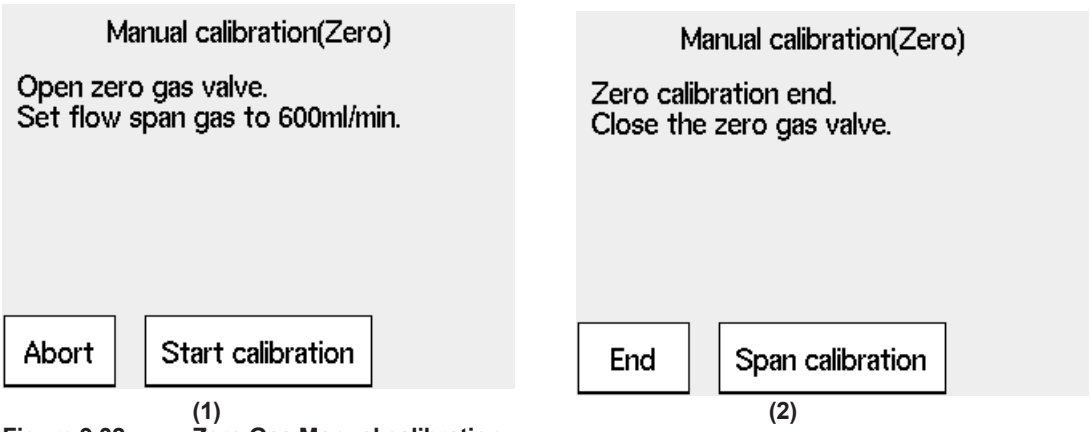


Figure 9.32 Zero Gas Manual calibration

(2) Adjust the flow rate and select “Valve opened” from the Manual calibration display. Check the Trend graph display to see that the measured value is stabilized. Then press the [Enter] key. The Manual calibration display shown in Figure 9.32 (2) appears.

Close the zero gas flow setting valve to stop the zero gas flow. If the valve has a lock nut, be sure to tighten the lock nut to prevent the any leakage of the zero gas into the detector because the valve may become loose during measurement.

9.11.4 Operation After Calibration

No special operation of the instrument is needed after calibration. However, it is recommended that the pressure reducing valve for the zero gas cylinders be closed because calibration is not required so often.

10. Inspection and Maintenance

This chapter describes the inspection and maintenance procedures for the Explosion-proof Zirconia Oxygen Analyzer to maintain its measuring performance and normal operating conditions.

WARNING

When checking the detector, carefully observe the following:

- The instrument modification or parts replacement by other than authorized representation of Yokogawa Electric Corporation is prohibited and will void ATEX flameproof Certification, Factory Mutual Explosion-proof approval and Canadian Standards Explosion-proof Certification.
- Do NOT touch the probe if it has been in operation immediately just before being checked. (The sensor at the tip of the probe heats up to 750°C during operation. If you touch it, you will get burned.)

CAUTION

- Do not subject the probe to shock or cool it rapidly.
  The sensor is made of ceramic (zirconia). If the detector is dropped or bumped into something, the sensor may be damaged and no longer work.
- Do not reuse a metal O-ring to seal the cell assembly. If you replace the cell or remove it from the probe for checking, be sure to replace the metal O-ring. Otherwise, the furnace gas may leak, and then the leaking corrosive gas will cause the built-in heater or thermocouple to go open circuit, or the detector may corrode.
- Before opening or closing the terminal box, first remove dust, sand, or the like from the terminal box cover.

The converter does not require routine inspection and maintenance. If the converter does not work properly, in most cases it probably comes from problems or other causes.

A dirty touchpanel should be wiped off with a soft dry cloth.

10.1 Replacing Fuses

The converter incorporates one fuse (3 for /AC option). If the fuse blows out, replace it with the following procedure.

CAUTION

- If a replaced fuse blows out immediately, there may be a problem in the circuit.
  Go over the circuit completely to find out why the fuse has blown.
- This fuse is for protecting the main power supply circuit and does not provide overcurrent protection for the heater temperature control circuit. For overcurrent protection circuitry, refer to Section 12.1.2, Remedies When Fault Occurs.

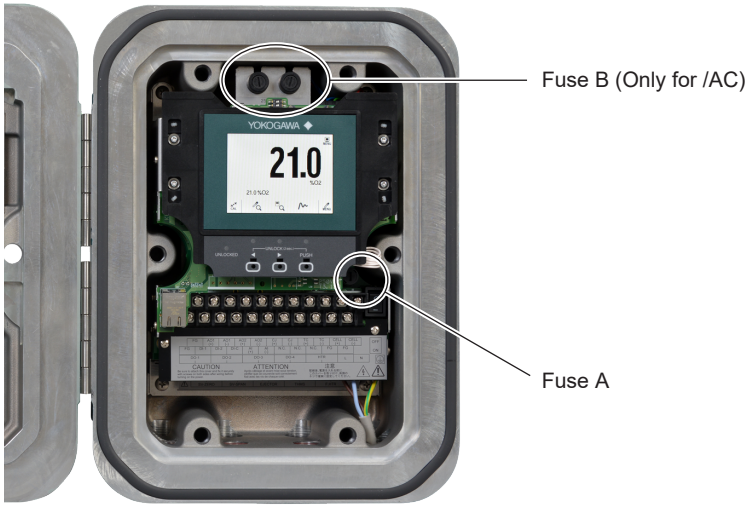


Figure 10.1 Location of Fuse in the Converter

To replace the fuse, follow these steps:

(1) Turn off the power to the converter for safe replacement.

(2) Remove the fuse from its holder. With the appropriate flat-blade screwdriver that just fits the holder cap slot (Figure 10.1), turn the fuse holder cap 90° counterclockwise.
By doing so, you can remove the fuse together with the cap.

(3) Use properly rated fuse (Fuse A: 3.15 A, Fuse B: 2.5 A). Place the fuse in the holder together with the cap, and push and turn the cap clockwise 90° with the screwdriver to complete installation of the fuse.

<Fuse A>

Maximum rated voltage: 250 V

Maximum rated current: 3.15 A

Type: Time-lag fuse

Standards: UL-, CSA- or VDE-approved

Part number: A1113EF

<Fuse B>

Fuse B is included only when /AC is specified.

Fuse B is included only when /AC is specified.

Maximum rated current: 2.5 A

Type: Time-lag fuse

Standards: UL-, CSA- or VDE-approved

Part number: A1112EF

Place a new, properly rated fuse in the holder together with the cap, and push and turn the cap clockwise 90° with the screwdriver to complete installation of the fuse.

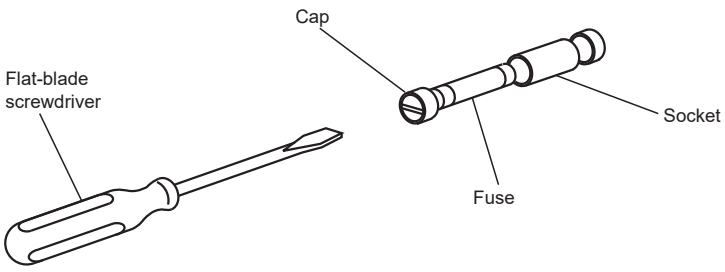


Figure 10.2 Removing the Fuse

10.2 Cleaning

Use a soft dry cloth to clean any part of the converter during inspection and maintenance.

10.3 Adjust LCD panel

Adjust he position of touch button or brightness of LCD panel.

“Sensor menu” > “Other menu” > “Adjust panel”

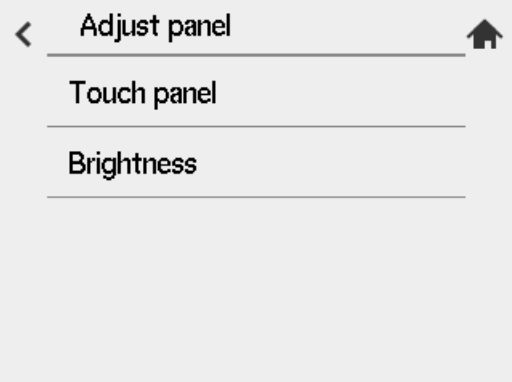


Figure 10.3 Adjust panel

■ Touch panel

● How to adjust the touch panel

(1) Touch “+” and you will see “Please touch the point”.

(2) Touch “+” and hold until you see “Please release from the point”.

(3) Once you release the point, “+” moves to 2nd place.

Touch and hold “+” until you see “Please release from the point.” Release the point.

Repeat touching on/off as (1),(2), until “+” moves to 4th place.

(4) After completing the touch and hold the 4th place, you will see “Please check the calibration result.”

If you touch the screen, the point you touched shows “Displayed point” by coordinate points.

(5) Touch “+” again, which shows “Touched point” by coordinate points. Check if the difference in coordinates of both points are acceptable.

To leave the screen, touch and hold it for three seconds.

(6) You will return to the first page of Adjust panel.

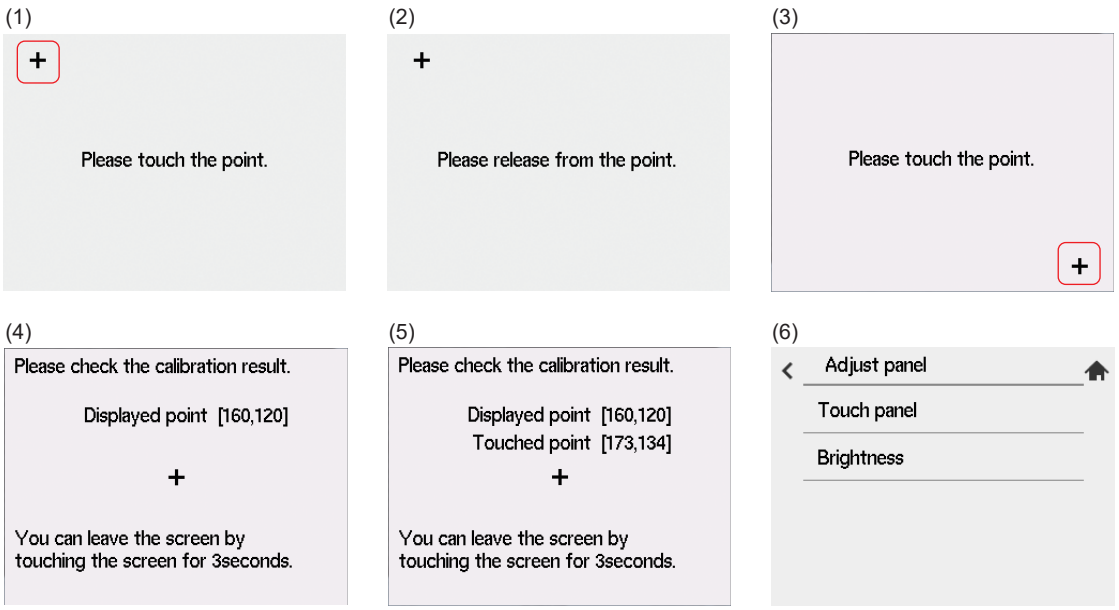


Figure 10.4 Touch panel position adjustment

Brightness

Adjust “Brightness” of back light. Select the level from below. The default is 50%. The larger % the brightness indicates, the brighter the light glows.

Brightness: 0%, 20%, 30%, 40%, 50%, 60%, 70%, 80%, 90%, 100%

11. Troubleshooting

This chapter describes Fault (errors) and alarms detected by the self-diagnostic function of the converter. It also explains inspections and remedies when other problems occur.

11.1 Displays and Remedies When Fault Occur

11.1.1 Fault

A Fault occurs when an abnormality is detected in the detector or the converter, e.g., in the cell (sensor), detector heater, or internal circuits of the converter.
If a Fault occurs, the converter performs the following:

(1) Stops the supply of power to the heater in the detector to insure system safety.

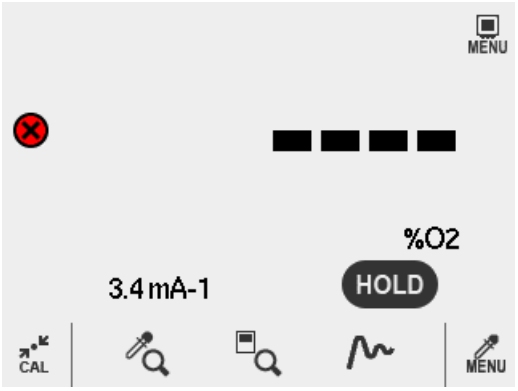
(2) Fault indication is displayed by blinking the icon to notify of a Fault generation (Figure 11.1).

(3) When Fault is set to output in “Selection of contact output”, Fault is output to contact. (refer to Section “7.5 Contact Output Setup”.)

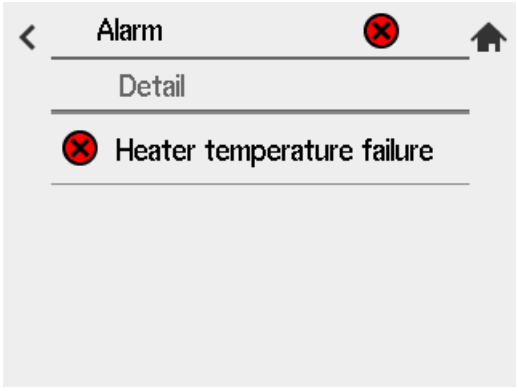
(4) The analog output becomes the status which is set in “Output hold setting”.

(refer to Section “7.2 Output Hold Setting”.)

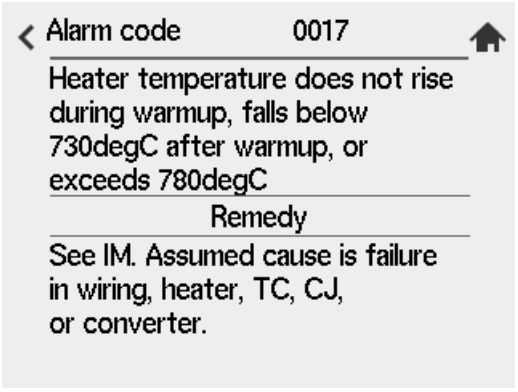
When the display shown in Figure 11.1 (1) appears, pressing the Fault indication brings up a description of the Fault (Figure 11.1 (2))



(1)



(2)



(3)

Figure 11.1 Fault description

Table 11.1 Types of Fault , Reasons for Occurrence

Alarm Number	Type	Occurrence Conditions
001	Hardware failure	Occurs when internal storage hardware fails.
002	Internal com. failure	This error occurs when there is an error in internal storage communication.
003	MAC address read failure	This error occurs when there is an error in MAC address being read.
004	Converter user param. failure	This error occurs when there is an error in reading converter setup data.
016	Cell voltage failure	Occurs when the cell (sensor) electromotive force input to converter becomes less than -50 mV.
017	Heater temperature failure	Occurs when temperature of the heater does not rise during warm-up, or when the temperature drops below 730°C or rises above 780°C after the warm-up. Also, when the polarity of the thermocouple output (TC+, TC-) from sensor is reversed.
018	A/D converter failure	Occurs when an error occurs in A/D converters in the electric circuitry of converter internal storage.
019	Sensor EEPROM failure	This error occurs when writing to memories is not performed normally in the electric circuitry of converter internal storage.
020	Sensor user param. failure	This error occurs when reading sensor setup data is abnormal.

11.1.2 Remedies When Fault Occurs

(1) Alarm 016: Cell electromotive force error

This Fault occurs when the cell (sensor) voltage input to the converter falls below -50 mV (corresponding to about 200 vol%O_2). The following are considered to be the causes for the cell voltage falling below -50 mV:

(1) Poor contact in terminal connections between the converter and detector

(2) Breakage in wiring cable between the converter and the detector

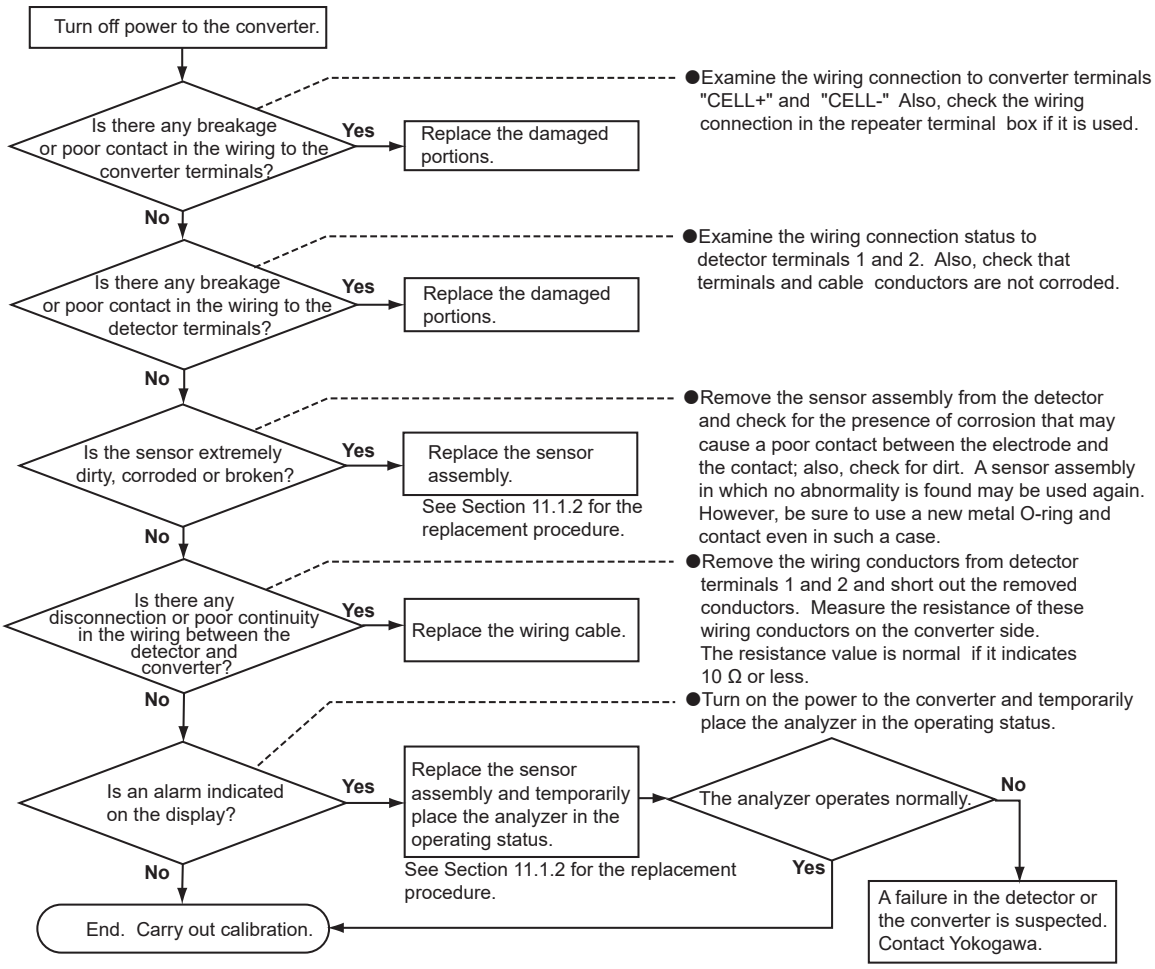
(3) Damage or deterioration of the sensor assembly

(4) Continuity failure between the sensor assembly electrode and the contact

(5) Wiring failure inside the detector

(6) Abnormality in electrical circuits in the converter

<Locating the failure and countermeasures>



(2) Alarm 017: Heater Temperature Failure

This alarm occurs if the temperature of the detector heater does not rise during warm-up, or it drops below 730°C or exceeds 780°C after the warm-up ends.

When alarm 017 occurs, alarm 205 (Cold junction temperature high alarm) and alarm 206 (Cold junction temperature low alarm) may have been issued at the same time. Be sure to press the alarm icon on the screen to identify each alarm and check if these alarms are occurring at the same time. If alarm 205 and alarm 206 are occurring at the same time, the problem might have been caused by the abnormality in the cold junction system at the detector terminal. In this case, perform a trouble shooting according to **(7) Alarms 205 and 206: Cold junction temperature alarm** in “11.2.2 Remedies When Alarms are Generated”.

When alarm 207 and alarm 208 occur at the same time, the problem might have been caused by the abnormality in the heater unit of the detector. In this case, perform the trouble shooting according to **(8) Alarms 207 and 208: Thermocouple voltage alarm** in “11.2.2 Remedies When Alarms are Generated”.

Or if the same problem happens immediately after the power supply starts, the polarity of the thermocouple output (TC +, TC-) from the detector may be reversed. Check the connection to detectors.

Causes considered for cases where Alarm 017 occurs independently are shown below.

(1) Faulty heater in the detector (heater wire breakage)

(2) Faulty thermocouple in the detector

(3) Faulty cold junction sensor located at the detector terminal block.

(4) Failure in electrical circuits inside the converter

(5) Heater temperature control overcurrent limiting triggered.

(6) TC+, TC- thermocouple terminals wired to detector with reverse (wrong) polarity.

Overcurrent protection is triggered if there are problems in the heater wiring. When the protective circuit is triggered, the internal fuse blows and the heater is disconnected, resulting in Alarm 017 (temperature failure).

<Locating cause of failure, and countermeasures>

(1) Turn off power to the converter.

(2) Remove the cable from terminals 7 and 8 of the detector and measure the resistance value between these terminals. The heater unit is normal if the resistance is lower than about 90 Ω. If the resistance value is higher, failure of the heater unit is suspected. In this case, replace the heater Assembly (IM 11M12A01-21E). In addition, check that the wiring resistance between the converter and detector is 10 Ω or less.

(3) Ensure that TC+ terminal (terminal 3 in detector) is connected to converter TC+ terminal, and TC- terminal (terminal 4) is connected to converter TC- terminal.

(4) Remove the wiring from terminals 3 and 4 of the detector and measure the resistance value between these terminals. The thermocouple is considered normal if the resistance value is 5 Ω or less. If the value is higher than 5 Ω, it may indicate that the thermocouple wire has broken or is about to break. In this case, replace the heater Assembly (IM 11M12A01-21E). Also, check that the wiring resistance between the converter and detector is 10 Ω or less.

(5) Even if items (2) to (4) are normal, the heater overcurrent protection fuse may have blown. Check for wiring problems such as the following:

(a) Heater terminals shorted.

(b) Heater terminal(s) shorted to ground.

(c) Heater terminals shorted to power supply.

If the internal fuse blows, this cannot be replaced by the user. Contact your Yokogawa service representative.

NOTE

Measure the thermocouple resistance value after the temperature difference between the detector tip and the ambient atmosphere has decreased to 50°C or less. If the thermocouple voltage is large, accurate measurement cannot be achieved.

(3) Alarm 018: A/D Converter Failure/Alarm 019: Sensor EEPROM Failure

- A/D Converter Failure

  It is suspected that a failure has occurred in the A/D converter mounted in the electrical circuits inside the converter.

- Sensor EEPROM Failure

  It is suspected that a failure has occurred in an operation writing to the memory (EEPROM) mounted in the electrical circuits inside the converter.

<Locating the failure, and countermeasures>

Turn off the power to the converter once and then restart the converter. If the converter operates normally after restarting, an alarm might have occurred due to a temporary drop in the voltage (falling below 85 V, the least amount of voltage required to operate the converter) or a malfunction of the electrical circuits affected by noise. Check whether or not there is a failure in the power supply system or whether the converter and detector are securely grounded.

If the alarm occurs again after restarting, a failure in the electrical circuits is suspected. Consult the service personnel at Yokogawa.

(4) Miscellaneous Failure (Alarm 001 to 004, 020)

An internal failure has occurred. Contact your Yokogawa service representative.

11.2 Displays and Remedies When Alarms are Generated

11.2.1 Alarm Types

When an alarm is generated, the alarm indication blinks in the display to notify of the alarm. Pressing the alarm indication displays a description of the alarm.
Alarms include those shown in Table 11.2.

Table 11.2 Types of Alarms and Reasons for Occurrence

Alarm number	Alarm Type	Reasons for Occurrence
101	Oxygen concentration high high alarm	Oxygen density exceeds setup limit.
102	Oxygen concentration high alarm	Oxygen density exceeds setup limit.
103	Oxygen concentration low alarm	Oxygen level is lower than setup.
104	Oxygen concentration low low alarm	Oxygen level is lower than setup.
105	Humidity high high alarm	The water content is above setup limit.
106	Humidity high alarm	The water content is above setup limit.
107	Humidity low alarm	The water content is below setup.
108	Humidity low low alarm	The water content is below setup.
117	Simple cell resistance alarm	The simple cell resistor has exceeded setup limit.
118	AO1 saturation	mA output has reached the upper or lower limit
119	AO2 saturation	mA output has reached the upper or lower limit
120	Calibration stability alarm	Electromotive force of the cell does not stabilize after calibration period has elapsed.
201	Zero correction ratio high alarm	Zero point correction ratio exceeds 130%
202	Zero correction ratio low alarm	Zero point correction rate is lower than 70%.
203	Span correction ratio high alarm	Span point correction ratio exceeds 18%
204	Span correction ratio low alarm	Span point correction rate is lower than-18%.
205	Cold junction temperature high alarm	Temperature of the cold contact has exceeded 155°C.
206	Cold junction temperature low alarm	Temperature of the cold contact is below-25°C.
207	Thermocouple voltage high alarm	Thermocouple electromotive force is over 42.1 mV (approx. 1020°C)
208	Thermocouple voltage low alarm	Thermocouple electromotive force is below-5 mV (approx.-170°C)
209	AI current high alarm	AI-input mA is above 20.5 mA
210	AI current low alarm	AI-input mA is below 3.8 mA
213	Input pressure high alarm	The input pressure exceeds setup value.
214	Input pressure low alarm	The input pressure is lower than setup value.
301	Battery low alarm	The internal battery is low. Turning OFF Power Supply when the battery is exhausted will reset the clock.
319	Fast warm-up function alarm	The function to shorten the warm-up time when an instantaneous power failure occurs does not work.

If an alarm is generated, actions such as turning off the heater power are not carried out. The alarm is cancelled when the cause of the alarm is removed. However, Alarm 205 to 208 may be generated concurrently with Alarm 017 (Fault: heater temperature error). In this case, the remedy when the error occurs has priority.

If the power to the converter is turned off after an alarm is generated and the converter is restarted before the cause of the alarm has been removed, the alarm will be generated again. However, Alarms 120, 201 to 204 (alarms related to calibration) are not generated unless calibration is executed.

11.2.2 Remedies When Alarms are Generated

(1) Alarm 101 to Alarm 108: Oxygen concentration alarm, Humidity alarm

This alarm is generated when the set alarm value is exceeded or falls below. For details on these alarms, see Section “7.4 Alarm Setting”, in the chapter on operation.

(2) Alarm 117: Simple cell resistance alarm

The result of the simple cell resistance measurement has exceeded setup alarm value. For a resistance value of 2000 Ω or more, consider replacing the sensor. For a resistance value of 3000 Ω or more, sensor replacement is recommended. If the alarm must be cleared, change setup alarm setting.

(3) Alarms 118 and 119: AO1 saturation, AO2 saturation

The analog output has reached the upper or lower limit. Check set value, and process-measurements.

(4) Alarms 120: Calibration stability alarm

This alarm occurs when electromotive force of the sensor (cell) does not stabilize after calibration period has elapsed because the sensor section of sensor is not filled with calibration gas (zero gas, span gas).

<Cause of occurrence>

- Low flow rate of calibration gases (specified flow rate :600 ± 60 ml/min).
- The length or thickness of the calibration gas tubing has been changed (lengthened or thickened).
- The measured gases flow toward the probe-tip of sensor.
- The response of the sensor (cell) deteriorated.

<Searching for the cause of the error and remedy>

(1) Calibration should be performed with calibration gases flowing at the specified flow rate (600 ± 60 ml/min) after confirming that there are no leaks in the pipes.

(2) When calibration is performed normally, perform steady operation as it is.

If the alarm recurs, check the following before replacing the sensor assembly.

- The tip of sensor probe is markedly contaminated with dust, etc. If it is, clean it (see section “11.2.2 Remedies When Alarms are Generated”). If an alarm also occurs in calibration after the sensor assembly is replaced, it may be caused by the flow of the measured gases. Make sure that the measured gases do not flow towards the probe tip of sensor, for example by repositioning sensor.

(5) Alarms 201 and 202: Zero correction ratio high and low alarm

Occurs when the zero-point compensation ratio exceeds 100 ± 30% in the auto calibration or semi-auto calibration (see section: “8.1.4 Characteristic Data from a Sensor Measured During Calibration”). Possible causes of this are as follows.

- Zero gas oxygen concentration does not match the zero gas concentration value setup in “setup of calibration”, or the span gas was used as the zero gas.
- The zero-air flow rate is outside the specified flow rate (600 ± 60 ml/min).
- The sensor assembly is damaged and the cell electromotive force is faulty.

<Searching for the cause of the error and remedy>

(1) Check the following and perform calibration again. If the status is not correct, correct it.

1. When “Zero gas concentration” is turned Display in setup of calibration, is set value matched with the actually used zero gas concentration?
2. Are calibration gas pipes installed to prevent zero air leakage?

(2) If calibration is performed again and there is no alarm, it is probable that calibration condition was incorrect as the reason for the alarm in the results calibration. In this case, no special remediation is required.

(3) If the alarm is triggered again after calibration, the sensor assembly may be degraded or damaged. It must be replaced with a new cell (sensor), but do the following before replacing.

Check the cell electromotive force when zero and span gases are flowed.

1. Running calibration turns Display the cell electromotive force in Trend screen.
2. Check that Display cell electromotive force is not significantly different from the theoretical oxygen-concentration. The theoretical value of cell electromotive force can be found in Table 11.3. The difference from the theoretical value is not generally acceptable, but consider it to be approximately ± 10 mV .

Table 11.3 Oxygen Concentration and Cell Electromotive Force

Oxygen concentration	Cell electromotive force
1% O_2	67.1 mV
21% O_2	0 mV

(4) Check the following steps to see if any degradation or damage to the sensor assembly caused by the alarm occurred suddenly during this calibration.

1. Select the detailed screen from the “Converter Menu” to display the log information.
2. By selecting “Zero/Span Calibration History”, you can check the values of the span point correction rate and zero point correction rate, so you can see the change in degradation of the cell (sensor).

(5) If the sensor assembly deteriorates abruptly, the check valve that prevents moisture from entering the calibration gas piping from inside the furnace may be defective. When gas from the furnace enters the calibration gas line, it cools and becomes condensed water and accumulates in the piping. This may have been blown into the sensor assembly by the calibration gas during calibration and the sensor assembly has been damaged by the rapid cooling of the cell.

(6) If the sensor assembly is gradually deteriorated, check the status of the sensor assembly by following the procedure below.

1. Select the detailed screen from the “Sensor Menu” and check “Cell Resistance”. New cell (Sensor) indicates a value of 200 Ω or less. On the other hand, cells (sensors) approaching the end of their life, Values range from 3 to 10 kΩ.
2. Check the “Cell health level”. Good cells (sensors) indicate “lifetime > 1 year”

(6) Alarms 203 and 204: Span correction ratio high and low alarm

This error occurs when the span point correction rate exceeds the range of 0 ± 18% in automatic calibration or semi-automatic calibration (see Section: “8.1.4 Characteristic Data from a Sensor Measured During Calibration”). This may be caused by the following:

- The span gas oxygen concentration does not match the span gas concentration value set in “Setting calibration”.
- The span gas flow rate is outside the specified flow rate (600 ± 60 ml/min).
- The sensor assembly is damaged and the cell electromotive force is abnormal.

<Searching for the cause of the error and remedy>

(3) Check the following and perform calibration again. If the condition is not correct, correct it.

1. When “Span Gas Concentration” is displayed in “Calibration Settings”, is the set value and the span gas concentration actually used matched?
2. Are calibration gas pipes constructed so that span gas does not leak?

(4) If no alarm was detected as a result of recalibration, it is probable that the calibration condition was inappropriate as the cause of the alarm in the previous calibration. In this case, no special remediation is required.

(5) If an alarm occurs again as a result of recalibration, the sensor assembly may be degraded or damaged as the cause of the alarm. It must be replaced with a new cell (sensor), but do the following before replacing.

It must be replaced with a new cell (sensor), but before replacement, follow the procedure of **(5) Alarm 201, 202: Zero correction ratio high and low alarm <Search for the cause of the error and remedy>** (3) to (6).

(7) Alarms 205 and 206: Cold junction temperature alarm

This error occurs when the cold junction temperature at the detector's terminal (terminal block in the converter when /CJ option was chosen) drops below-25°C or exceeds 155°C. If "C.J. Temperature" is indicated as 200°C or-50°C, the following may be considered.

- Breakage of the cold junction signal wire between the converter and the detector. Or, the cable is not securely connected to the connection terminal.
- The cold junction signal is in the middle of wiring, or the + and-poles are short-circuited at the connection terminal.
- Defective detector terminal cold junction temperature sensor
- Converter internal electrical circuit error

If the "C.J. Temperature" is higher than 150°C or lower than -20°C, the following may be considered:

- The temperature of the detector terminal block is out of the operating temperature range (-20°C to 150°C).
- Defective detector terminal cold junction temperature sensor
- Converter internal electrical circuit error

<Searching for the cause of the error and remedy>

Before proceeding with the operation below, investigate whether the terminal part of the detector exceeds the operating temperature range. The operating temperature range depends on the detector model. If it is exceeded, take measures to reduce the temperature, such as taking measures to avoid receiving radiant heat.

(1) Disconnect the power supply to the converter.

(2) Remove the wires from terminals 5 and 6 of the detector and measure the resistance between the terminals. If the resistance value deviates from the range of 1 to 1.6 kΩ, the cold junction temperature sensor may be defective.

Replace the cold junction temperature sensor.

(3) If the resistance value is within the range, the cold junction temperature sensor is considered normal. Check that the wiring cable is not broken or short-circuited and that it is securely connected to the terminal. Also check that the wiring resistance between the transmitter and sensor is 10 Ω or less.

(4) If the wiring is correct, the electrical circuit inside the transmitter may be faulty.

Contact our service.

(8) Alarms 207 and 208: Thermocouple voltage alarm

Generated when the electromotive force of the thermocouple drops below-5 mV (approx.-170°C) or exceeds 42.1 mV (approx. 1020°C). When alarm 207, 208 occurs, alarm 017 (heater temperature error) is always generated.

- The heater TC signal wire between the converter and the detector is broken, or the cable is not securely connected to the connection terminal.
- The positive and negative poles of the heater thermocouple signal wiring are shorted out in the wiring extension or at the connection terminals.
- Defective thermocouple of sensor heater
- Converter internal electrical circuit error

<Searching for the cause of the error and remedy>

(1) Disconnect the power supply to the converter.

(2) Remove the wires from terminals 3 and 4 of the detector and measure the resistance between terminals 3 and 4. If the resistance is 5 Ω or less, the thermocouple is considered normal. If the resistance is greater than 5 Ω, the wire may be broken or disconnected. In this case, replace the heater Assembly (IM 11M12A01-21E).

CAUTION

Measure the resistance of the thermocouple after the difference between the tip of the detector and the ambient temperature is 50°C or less. If the electromotive force of the thermocouple is large, it cannot be measured accurately.

(9) Alarms 209 and 210: AI current high and low alarm

If “External input” is selected in “Setting the measured gas pressure”, this occurs when the input current from the pressure transmitter (hereinafter referred to as transmitter) deviates from the range of 3.8 to 20.5 mA. If this alarm comes out at the same time as alarms 213 to 214 (pressure input alarm), take actions for alarms **(10) Alarms 213 and 214**. If alarms 209 and 210 are occurring independently, the cable between the converter and the transmitter may be broken.

<Searching for the cause of the error and remedy>

(1) Check the cable status, including the connection terminals.

(2) If there is no problem with the cable connection, display the measured gas pressure in the “Detailed Data Display”.

Check that this pressure matches the signal from the transmitter. If the pressure is incorrect, check that the output range of the transmitter matches the “input pressure setting” of the tester.

(3) If there is no problem with the range setting, it is probable that the device’s electrical circuit is faulty. Please consult our service.

(10) Alarm 213 and 214: Input pressure high and low alarm

If “External input” is selected in “Set measured gas pressure”, this alarm occurs when the input current exceeds the set alarm value. Possible causes are as follows

- The output range of the transmitter does not correspond to the “Input pressure setting” of the tester (in case of occurrence at start-up).
- Burnout is caused by an error in the thermocouple connected to the temperature transmitter.
- Abnormal transmitter.
- The pressure of the measured gas actually exceeds the alarm value.

<Searching for the cause of the error and remedy>

- Check that the temperature at 4 mA point and 20 mA point of the temperature transmitter matches the “Input pressure setting” of the tester.
- Check that there is no error in the actual measurement gas.

(11) Alarm 301: Battery low alarm

The internal circuit of the tester has a built-in battery, which is used to back up the internal clock, etc. When this alarm occurs, the internal clock may stop while the power is not supplied to the unit (this does not affect the set values of other operating parameters). The internal clock is used for automatic calibration and automatic blowback schedule management. Therefore, when using these functions, if the power supply to the tester stops, such as when a power failure occurs after the low battery alarm occurs, be sure to check the date and time set in the tester the next time the power is turned on. If it is different from the current time, set it again.

<Action>

The internal battery cannot be replaced by the customer. Contact our service.

Note

Approximate Battery Life (The battery life varies greatly depending on the operating environment. The following is only a guideline and is not a guarantee.)

- The internal battery is not consumed when power is supplied to the instrument. Consider it as a guideline for 10 years. However, after shipment, it will be consumed from the battery until start-up.
- When power is not supplied to the unit, the life of the internal battery changes greatly depending on the storage temperature. Storing the unit at room temperature (20 to 25°C) results in five years or more, but in the case of-30 to 70°C, the life of the internal battery is shortened to one year.

(12) Alarm 319: Fast warm-up function alarm

The internal circuit of the tester is equipped with a function to shorten the warm-up time when an instantaneous power failure occurs, but this alarm occurs when the tester does not operate. Contact our service to restore the warm-up reduction function.

11.3 Measures to be taken when measured values indicate abnormalities

The cause that the measured value indicates an abnormal value is not necessarily a failure of the equipment. Rather, there are many cases in which the measured gas itself is in an abnormal state or due to external factors that disturb the operation of the equipment. This section explains the causes and remedies for when the measured value indicates the following phenomena.

(1) The measured value shows a higher value than the actual value.

(2) Measured value shows lower value than actual value

(3) Measured values occasionally show abnormal values

11.3.1 The measured value is higher than the actual value

<Cause and remedy>

(1) The pressure of the measured gas increases.

Oxygen concentration measurement value X when the pressure of the measured gas becomes higher by Δ p (kPa) than at the time of calibration (vol%O_2) is as follows.

$X=Y[1+(\Delta p/101.30)]$

Y: Measured oxygen concentration at the same pressure as at calibration (vol%O_2)

If the change in the measured value due to pressure fluctuation cannot be ignored, measures must be taken. Consider the following points and make possible improvements in each process.

- Consider the following points and make possible improvements in each process.
- Is it possible to perform calibration under the average measured gas pressure (furnace pressure)?

(2) The amount of moisture contained in the comparison gas changes greatly (increases)

If the air at the detector installation site is used as a comparator gas, a large change in the amount of water contained in the air may cause an error in the measured oxygen concentration value (vol%O_2). If this error cannot be ignored, use a gas with a constant moisture content, such as instrumented air that is almost dry, as the comparison gas. Changes in the amount of water in the combustion exhaust gas can also be considered as an error factor. Normally, this amount of error is negligible.

(3) Calibration gas (span gas) is leaking into the detector.

If span gas leaks into the detector due to a defective valve installed in the calibration gas piping system, the measured value will show a higher value. Check valves in the calibration gas piping system (needle valves, check valves, solenoid valves for automatic calibration, etc.) for leaks. In the case of a manual valve, check that the valve is fully closed before checking for leaks. Also, check that there is no leakage at the joint part of the piping.

(4) The comparison gas enters the measurement gas side, or the measurement gas enters the comparison gas side.

The difference in oxygen partial pressure between the anode and cathode sides of the sensor is reduced, so the measured value indicates a higher value. Check your detector's manual to ensure there are no sensor installation problems.

An error that does not appear as alarm 016 may have occurred in the sensor. In addition, if the metal O-ring is not tightened sufficiently or if the seal surface is damaged or dirty, the measured gas or comparison gas may be leaking. Visually inspect the sensor. If any cracks are found, replace the sensor assembly with a new one.

(NOTE) The data such as cell health displayed on the detailed display screen should also be used as a reference for judging the quality of the sensor.

11.3.2 The measured value is lower than the actual value

<Cause and remedy>

(1) The pressure of the measured gas decreases.

If the change in the measured value due to pressure fluctuation cannot be ignored, take measures according to (1) in section 12.3.1.

(2) The amount of water contained in the comparison gas changes greatly (decreases).

If the air at the detector installation site is used as a comparator gas, a large change in the amount of water contained in the air may result in errors in the measured oxygen concentration (vol%O_2).

If this error cannot be ignored, use a gas with a constant moisture content, such as instrumented air that is almost dry, as the comparison gas. Changes in the amount of water in the combustion exhaust gas can also be considered as an error factor. Normally, this amount of error is negligible.

(3) Calibration gas (zero gas) is leaking into the detector

If zero air leaks into the detector, e.g. due to a defective valve installed in the calibration gas piping system, the measured value will be lower.

Check the valves in the calibration gas piping system for leaks. For manual valves, check that the valve is fully closed before checking for leaks.

(4) Combustible components exist in the measured gas.

If there is a combustible component in the measurement gas, it will burn in the sensor and the O2 concentration will decrease. Check for flammable components.

(5) The detector cell temperature is 750°C or higher.

If the measured gas leaks into the comparison gas side for some reason, the thermocouple may be corroded and the temperature of the sensor may become 750°C or higher. If the measured gas leaks into the comparison gas side for some reason, the thermocouple may be corroded and the temperature of the sensor may become 750°C or higher.

11.3.3 Measured values occasionally show abnormal values

<Cause and remedy>

(1) Noise comes in from the detector output wiring.

Ensure that the transmitter and sensor are properly grounded.

Check that the signal lines are not routed along other power lines.

(2) Affected by power supply noise.

Check that the power is not supplied from the same location as the other power equipment.

(3) Poor contact of wiring.

Poor contact in the wiring may cause the electromotive force of the sensor or thermocouple to change due to vibration, etc. Check that the wiring connections are not loose and that the crimped part of the crimp terminal is not loose.

(4) Combustible components in the measured gas enter the sensor.

If the combustible component is dust-like, attach the dust filter K9471UA to improve the flammability.

(5) There is a crack in the sensor or a leak in the sensor mounting part.

If the indication changes in synchronization with the fluctuation of the furnace pressure, check that there is no crack in the sensor, that the metal O-ring is firmly crushed, and that the flange of the sensor is in close contact with the contact surface of the probe.

(6) There is a leak in the calibration gas piping

In the case of negative pressure in the furnace, if the indication fluctuates with fluctuation in the furnace internal pressure, check the calibration gas piping for leaks.

Appendix Explosion protected Type Instrument

In this section, further requirements and differences for explosion proof type instrument are described. For explosion protected type, the description in this section is prior to other description in this User's Manual.

CAUTION

ZR802S has been tested and certified as being explosion proof. Please note that severe restrictions apply to these instrument's construction, installation, external wiring, maintenance, and repair. A failure to abide by these restrictions could make the instrument a hazard to operate.

■ ZR802S (General Instruction)

● Installation

Refer to chapter 3 of the IM 11M13G01-02EN for other than that described below.

- In order to prevent the earthing conductor from loosening, the conductor must be secured to the terminal, tightening the screw with torque of approx. 2.0N·m (M5) or 1.2N·m (M4). Care must be taken not to twist the conductor.
- Unused entries shall be closed with suitable certified blanking elements.
- Cable entry devices suitable for the thread form and the size of the cable entries must be used, according to the following marking on the equipment

Marking	Screw form / size
M	ISO M20x1.5
N	ANSI 1/2NPT

- When installing the equipment, the selected Type of Protection should be ticked as follows.
  ☑ Ex db IIC T6 Gb
  ☐ Ex tb IIIC T85 °C Db

● Operation

WARNING

POTENTIAL ELECTROSTATIC CHARGING HAZARD

- In hazardous areas, risk from electrostatic discharge and propagating brush discharges caused by rapid flow of dust shall be avoided. Avoid any actions which generate electrostatic charges, such as rubbing the equipment with a dry cloth.

WARNING

DO NOT OPEN WHEN AN EXPLOSIVE ATMOSPHERE MAY BE PRESENT

- Take care not to generate mechanical spark when access to the equipment and the peripheral devices in hazardous locations.
- Do not damage the mating surface of the case and cover.

CAUTION

All the blind plugs which accompany the ZR802S upon shipment from the factory are certified by the applicable agency in combination with those analyzers. The plugs for cable entries which are marked with the symbols "☐ Ex" on their surfaces are certified only in combination with the ZR802S.

Specific condition of use

1. Precaution shall be taken to minimize the risk from electrostatic discharges on the non-metallic parts (excluding glass parts) or coated parts of the equipment.
2. Flameproof joints are not intended to be repaired. Contact Yokogawa representative or Yokogawa office.
3. The fasteners used to fasten the cover and case shall only be replaced with Yokogawa fastener, Part number: K8001MD.

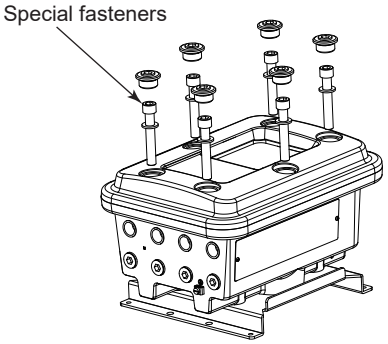


Figure App1.1 Special fasteners

Maintenance and repair

WARNING

- A modification of the equipment would no longer comply with the construction described in the certificate documentation.
- Only personnel authorized by Yokogawa Electric Corporation can repair the equipment.

ZR802S-A (EU-Type Examination certificate of conformity (ATEX))

Technical data

- Applicable standards
  EN IEC 60079-0
  EN 60079-1
  EN 60079-31
  EN 60529 + A1 + A2
- Certificate No.
  ATEX: FM21ATEX0052X
  Note: The symbol "X" placed after the certificate number indicates that the equipment is subjected to specific conditions of use. Refer to specific condition of use.
- Specifications
  Refer to Section, "2. Specifications" for other specifications than that described below.
- Equipment ratings (Ex marking)
  II 2 G ☐ Ex db IIC T6 Gb
  II 2 D ☐ Ex tb IIIC T85 °C Db
  Note: "☐" is the checkbox for selecting type of protection. Select the type of protection and check one of "□" on the nameplate. Once the type of protection is selected, it shall not be changed.
- Enclosure
  IP66
- Ambient temperature
  -20 to +55°C

Installation

Refer to Section, “3. Installation” for other than that described below.

- The equipment shall be installed in accordance with EN 60079-14 and relevant local codes and requirements.
- Cable glands, adapters and/ or blanking elements shall be installed so as to maintain the specified type of protection(s) and the rating of the equipment.

Nameplate

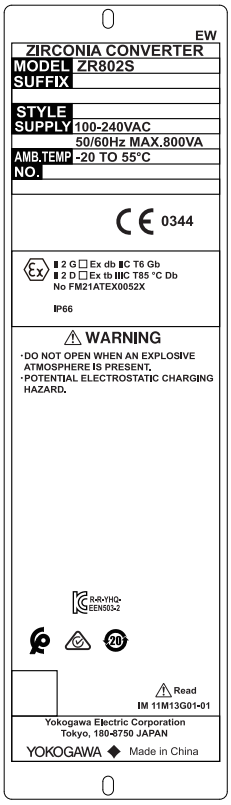


Figure App1.2 Example of nameplate (Design and texts may be changed)

- MODEL: Specified model code
- SUFFIX: Specified suffix code
- STYLE: Specified style code
- SUPPLY: Specified supply voltage and wattage
- Tamb: Specified ambient temperature range
- No.: Serial number
- MANUFACTURED: Month and year of production

  Ex marking:

  II 2 G ☐ Ex db IIC T6 Gb

  II 2 D ☐ Ex tb IIIC T85 °C Db

  Note: “☐” is the checkbox for selecting type of protection. Select the type of protection and check one of “□” on the nameplate. Once the type of protection is selected, it shall not be changed.
- Enclosure: IP66
- Certificate No.

  ATEX: FM21ATEX0052X
- ZIP CODE 180-8750 : 2-9-32 Nakacho, Musashino-shi, Tokyo

WARNING

DO NOT OPEN WHEN AN EXPLOSIVE ATMOSPHERE MAY BE PRESENT.
POTENTIAL ELECTROSTATIC CHARGING HAZARD.

ZR802S-B (US certificate of conformity)

Technical data

- Applicable standards

  [Division system]

  FM 3600
  FM 3615
  FM 3616
  FM 3810
  NEMA 250

  [Zone system]

  ANSI/UL 61010-1
  ANSI/UL 61010-2-30
  ANSI/UL 60079-0
  ANSI/UL 60079-1
  ANSI/UL 60079-31
  ANSI/UL 50E
  ANSI/IEC 60529

- Certificate No.

  FM21US0088X

  Note: The symbol "X" placed after the certificate number indicates that the equipment is subjected to specific conditions of use. Refer to specific condition of use.

- Specifications

  Refer to Section, "2. Specifications" for other specifications than that described below.

- Equipment ratings (Ex marking)

  ☐ CL I/II/III DIV 1 GP BCDEFG T6
  ☐ CL I ZN 1 AEx db IIC T6 Gb
  ☐ ZN 21 AEx tb IIIC T85 °C Db

  Note: "□" is the checkbox for selecting type of protection. Select the type of protection and check one of "□" on the nameplate. Once the type of protection is selected, it shall not be changed.

- Enclosure

  TYPE4X, IP66

- Ambient temperature

  -20 to +55°C

Installation

Refer to Section, "3. Installation" for other than that described below.

- The equipment shall be installed in accordance with NFPA 70 and relevant local codes and requirements.
- SEAL ALL CONDUITS WITHIN 18 INCHES.
- In a hazardous area, use appropriate certified cable glands for connecting cables, adaptors and/ or blanking element to maintain the specific degree of protection of the equipment.

WARNING

WHEN Ta ≥ 50°C, USE CABLE AND/OR DEVICE WITH A RATING ≥ 65°C

Nameplate

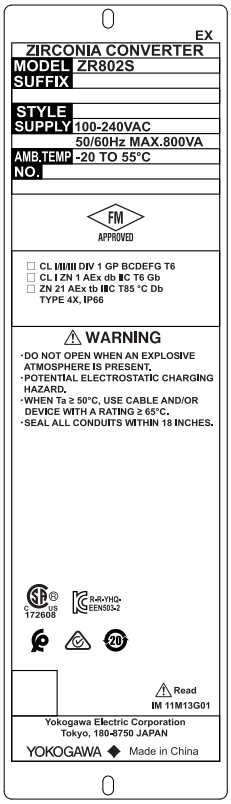


Figure App1.3 Example of nameplate (Design and texts may be changed)

- MODEL: Specified model code
- SUFFIX: Specified suffix code
- STYLE: Specified style code
- SUPPLY: Specified supply voltage and wattage
- AMB.TEMP: Specified ambient temperature range
- No.: Serial number
- MANUFACTURED: Month and year of production

  Ex marking:

  ☐ CL I/II/III DIV 1 GP BCDEFG T6

  ☐ CL I ZN 1 AEx db IIC T6 Gb

  ☐ ZN 21 AEx tb IIIC T85 °C Db

  Note: "☐" is the checkbox for selecting type of protection. Select the type of protection and check one of "□" on the nameplate. Once the type of protection is selected, it shall not be changed.
- Enclosure: TYPE4X, IP66

⚠ WARNING

WHEN Ta ≥ 50°C, USE CABLE AND/OR DEVICE WITH A RATING ≥ 65°C.

DO NOT OPEN WHEN AN EXPLOSIVE ATMOSPHERE MAY BE PRESENT.

POTENTIAL ELECTROSTATIC CHARGING HAZARD.

SEAL ALL CONDUITS WITHIN 18 INCHES

ZR802S-C (Canadian certificate of conformity)

Technical data

- Applicable standards
  CSA-C22.2 No. 60079-0
  CAN/CSA-C22.2 No. 60079-1
  CAN/CSA-C22.2 No. 60079-31
  CAN/CSA-C22.2 No. 61010-1
  CAN/CSA-C22.2 No. 61010-2-030
  CAN/CSA-C22.2 No. 60529
  CSA-C22.2 No. 94.2
- Certificate No.
  FM21CA0057X
  Note: The symbol "X" placed after the certificate number indicates that the equipment is subjected to specific conditions of use. Refer to specific condition of use.
- Specifications
  Refer to Section, "2. Specifications" for other specifications than that described below.
- Equipment ratings (Ex marking)
  ☐ Ex db IIC T6 Gb
  ☐ Ex tb IIIC T85 °C Db
  Note: "☐" is the checkbox for selecting type of protection. Select the type of protection and check one of "□" on the nameplate. Once the type of protection is selected, it shall not be changed.
- Enclosure
  TYPE4X, IP66
- Ambient temperature
  -20 to +55°C

Installation

Refer to Section, "3. Installation" for other than that described below.

- The equipment shall be installed in accordance with C22.1 and relevant local codes and requirements.
- In a hazardous area, use appropriate certified cable glands for connecting cables, adaptors and/ or blanking element to maintain the specific degree of protection of the equipment.

WARNING

WHEN Ta ≥ 50°C, USE CABLE AND/OR DEVICE WITH A RATING ≥ 65°C.

AVERTISSEMENT

QUAND Ta ≥ 50°C, UTILISER UN CÂBLE ET/OU UN APPAREIL AVEC UNE VALEUR ≥ 65°C.

Operation

WARNING

POTENTIAL ELECTROSTATIC CHARGING HAZARD.

AVERTISSEMENT

DANGER POTENTIEL DE CHARGES ÉLECTROSTATIQUES.

Nameplate

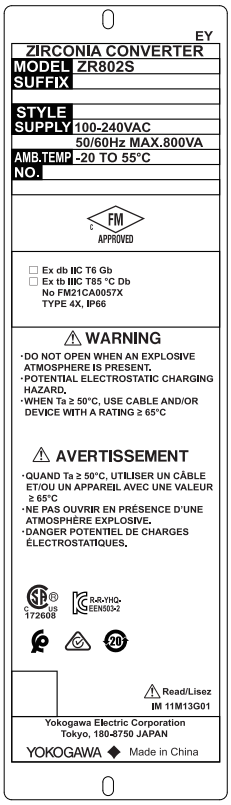


Figure App1.4 Example of nameplate (Design and texts may be changed)

- MODEL: Specified model code
- SUFFIX: Specified suffix code
- STYLE: Specified style code
- SUPPLY: Specified supply voltage and wattage
- Tamb: Specified ambient temperature range
- No.: Serial number
- MANUFACTURED: Month and year of production

  Ex marking:

  ☐ Ex db IIC T6 Gb

  ☐ Ex tb IIIC T85 °C Db

  Note: "☐" is the checkbox for selecting type of protection. Select the type of protection and check one of "□" on the nameplate. Once the type of protection is selected, it shall not be changed.
- Enclosure: TYPE4X, IP66
- Certificate No. FM21CA0057X

⚠ WARNING

WHEN Ta ≥ 50°C, USE CABLE AND/OR DEVICE WITH A RATING ≥ 65°C.

DO NOT OPEN WHEN AN EXPLOSIVE ATMOSPHERE MAY BE PRESENT.

POTENTIAL ELECTROSTATIC CHARGING HAZARD.

⚠ AVERTISSEMENT

QUAND Ta ≥ 50°C, UTILISER UN CÂBLE ET/OU UN APPAREIL AVEC UNE VALEUR ≥ 65°C.

NE PAS OUVRIR EN PRÉSENCE D'UNE ATMOSPHÈRE EXPLOSIVE.

DANGER POTENTIEL DE CHARGES ÉLECTROSTATIQUES.

ZR802S-D (IECEx certificate of conformity)

Technical data

- Applicable standards
  IEC 60079-0 Ed. 7.0
  IEC 60079-1 Ed. 7.0
  IEC 60079-31 Ed. 2.0
- Certificate No.
  IECEx FMG 21.0026X
  Note: The symbol "X" placed after the certificate number indicates that the equipment is subjected to specific conditions of use. Refer to specific condition of use.
- Specifications
  Refer to Section, "2. Specifications" for other specifications than that described below.
- Equipment ratings (Ex marking)
  ☐ Ex db IIC T6 Gb
  ☐ Ex tb IIIC T85 °C Db
  Note: "☐" is the checkbox for selecting type of protection. Select the type of protection and check one of "□" on the nameplate. Once the type of protection is selected, it shall not be changed.
- Enclosure
  IP66
- Ambient temperature
  -20 to +55°C

Installation

Refer to Section, "3. Installation" for other than that described below.

- The equipment shall be installed in accordance with IEC 60079-14 and relevant local codes and requirements.
- Cable glands, adapters and/ or blanking elements shall be installed so as to maintain the specified type of protection(s) and the rating of the equipment.

Nameplate

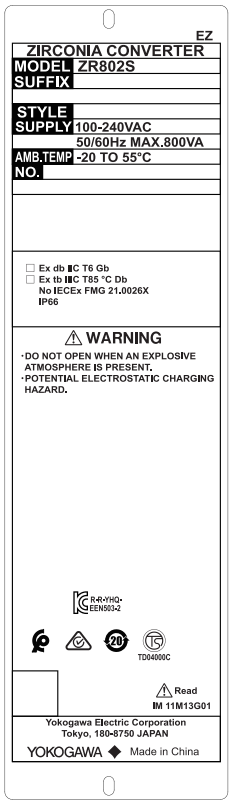


Figure App1.5 Example of nameplate (Design and texts may be changed)

- MODEL: Specified model code
- SUFFIX: Specified suffix code
- STYLE: Specified style code
- SUPPLY: Specified supply voltage and wattage
- Tamb: Specified ambient temperature range
- No.: Serial number
- MANUFACTURED: Month and year of production

  Ex marking:

  ☐ Ex db IIC T6 Gb

  ☐ Ex tb IIIC T85 °C Db

  Note: "☐" is the checkbox for selecting type of protection. Select the type of protection and check one of "□" on the nameplate. Once the type of protection is selected, it shall not be changed.
- Enclosure: IP66
- Certificate No. IECEx FMG 21.0026X

WARNING

DO NOT OPEN WHEN AN EXPLOSIVE ATMOSPHERE MAY BE PRESENT.
POTENTIAL ELECTROSTATIC CHARGING HAZARD.

ZR802S-M (CHINA EX certificate of conformity)

Technical data

- Applicable standards

  GB/T 3836.1

  GB/T 3836.2

  GB/T 3836.31
- Certificate No. GYJ22.1821X

  Note: The symbol "X" placed after the certificate number indicates that the equipment is subjected to specific conditions of use.

Refer to specific condition of use.

- Specifications

  Refer to Section, "2. Specifications" for other specifications than that described below.
- Equipment ratings (Ex marking)
- Ex db IIC T6 Gb
- Ex tb IIIC T85°C Db

  Note: "☐" is the checkbox for selecting type of protection. Select the type of protection and check one of "☐" on the nameplate. Once the type of protection is selected, it shall not be changed.
- Enclosure IP66
- Ambient temperature

  -20 to +55°C

Installation

Refer to Section, "3. Installation" for other than that described below.

- Installation and maintenance of the equipment shall be done in accordance with GB/T 3836.13, GB/T 3836.15, GB/T 3836.16, GB 50257 and GB 15577.
- Cable glands, adapters and/ or blanking elements shall be installed so as to maintain the specified type of protection(s) and the rating of the equipment.

Nameplate

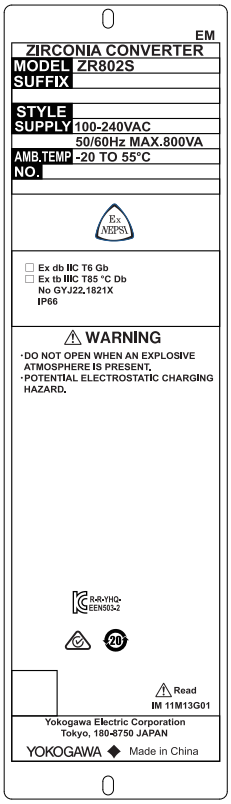


Figure App1.6 Example of nameplate (Design and texts may be changed)

- MODEL: Specified model code
- SUFFIX: Specified suffix code
- STYLE: Specified style code
- SUPPLY: Specified supply voltage and wattage
- Tamb: Specified ambient temperature range
- No.: Serial number
- MANUFACTURED: Month and year of production
- Ex marking:
- Ex db IIC T6 Gb
- Ex tb IIIC T85 °C Db

  Note: "☐" is the checkbox for selecting type of protection. Select the type of protection and check one of "☐" on the nameplate. Once the type of protection is selected, it shall not be changed.
- Enclosure: IP66

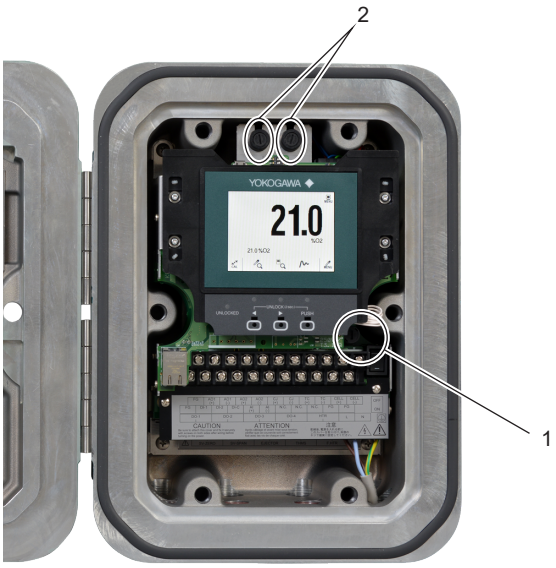
  Certificate No. GYJ22.1821X

WARNING

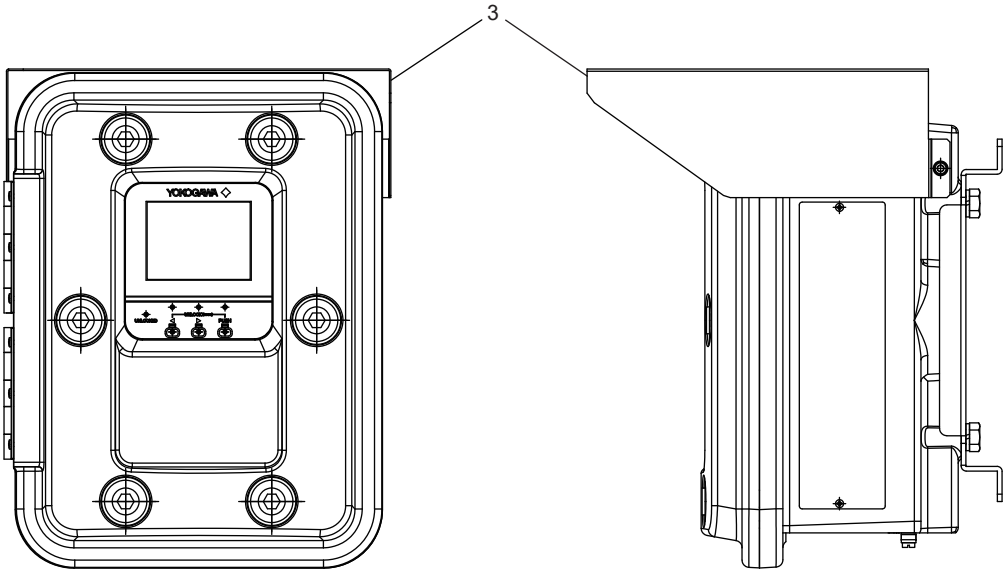
DO NOT OPEN WHEN AN EXPLOSIVE ATMOSPHERE MAY BE PRESENT. POTENTIAL ELECTROSTATIC CHARGING HAZARD.

Customer Maintenance Parts List

ZR802S
Explosion-proof Zirconia Oxygen Analyzer, Converter



Hood for ZR802S



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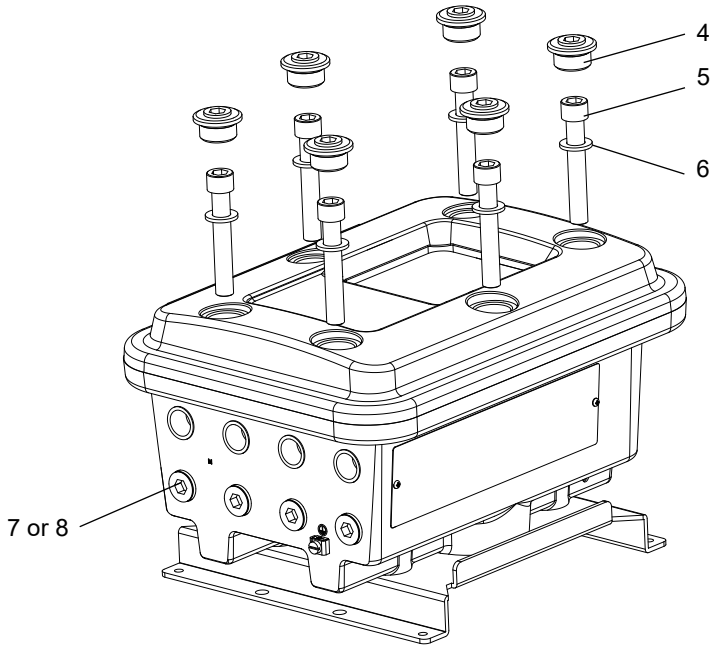

Item	Part No.	Qty	Description
1	A1113EF	1	Fuse (3.15 A)
2	A1112EF	2	Fuse (2.5 A) (Only for /AC)
3	K8000PA	1	Hood Assy (include Bolt and washer)
4	K8001MG	1	PLUG ASSY
5	K8001MD	1	BOLT
6	K8001ME	1	WASHER
7	F9480ZA	1	PLUG ASSY (M20) (for ZR802S-□-M)
8	F9913MY	1	PLUG (NPT1/2) (for ZR802S-□-T)

Revision Information

- Title : ZR802S Explosion-proof Zirconia Oxygen Analyzer, Converter
- Manual No. : IM 11M13G01-02EN

Nov. 2024/6th Edition
Added EAC conformity to the safety standards. (pages 2-2, 2-9)
Corrected errors. (pages 4-2, 7-18)
Revised a warning statement. (page 4-1)

June 2024/5th Edition
Added option code /JP. (page 2-9)

Dec. 2023/4th Edition
Added a compliant font. (page vii)
Added a section 7.7.7 Service mode.
Revised description with software version support and language selection. (pages 2-10, 9-6, 9-12)

Sep. 2023/3rd Edition
Conforms to safety standards (page 2-2)
Changed explanation (pages 2-7, 2,9)
Revised EUDECLARATION OF CONFORMITY.

June 2023/2nd Edition
Deleted UKCA (P. ix, 2-2, 2-9) and UK-DECLARATION OF CONFORMITY (five pages).
Added PESO standard (P. 2-6, App-2, App-3). Changed nameplate (P. App-3)

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