Introduction

Thank you for purchasing OX102 Current limit type Oxygen Analyzer.

To have the system deliver its full capabilities, read this instruction manual thoroughly before you use it. For safety reasons or to avoid possible damage to your equipment, strictly adhere to every cautionary note that appears in this manual.

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.

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 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.
Safety Precautions

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 and health including risk of injury, electric shock, or fatalities, or the damages to instruments. 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.

The following are signal words to be found only in our instruction manuals.

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

NOTE
This symbol indicates information that complements the present topic.
**WARNING**

**High temperature**
When the sensor is powered on, the sensor tip gets very hot. Be careful not to touch it.

---

**Power**
Be sure to check the power supply voltage before turning on the power.

**Grounding**
Be sure to connect a Class D (100 Ω or less) ground before turning on the power, to minimize the possibility of shock.

**Need for Grounding**
Do not cut the internal or external protective ground wire, or remove the ground wire from the terminal. This creates a shock hazard.

**Do not Operate without Protective Grounding and Fuse**
Do not operate the instrument without protective grounding and correct fuse.

**Fuse**
For safety, this product is fused internally. It is recommended that you ask the local service representative to change the fuse; do not either change it yourself, or open the case to check the fuse.

Turn off the power switch and disconnect the instrument from the power before changing the fuse. Do not use a fuse of different type or size, or shortcircuit the fuse holder.

**Environmental Restrictions**
Danger: Do not use this instrument in a flammable, explosive, or steamy environment.
Do not try to measure gases with traces of redox gas, corrosive gas, or organic silicone gas.

**Keep Hands Out**
While voltage is applied, keep hands out. Internal parts should be replaced by our service representative, or by an authorized person.

**External Connections**
Before wiring, to minimize the possibility of shock, disconnect power from the instrument. Also check ground connection to this instrument, to the system being measured, and to any associated external control equipment.
Notes on Use

• Do not drop or jolt the equipment, or its accuracy may be adversely affected.
• Do not attempt to disassemble the equipment, or it may malfunction.
• As far as possible, install the equipment horizontally. The sensor should be installed securely so that it does not vibrate. Avoid installing the equipment in places where the temperature exceeds 70°C.
• Avoid installing the equipment where it would be exposed to direct sunlight, radiant heat, or the weather, and where vibration exists.
• Avoid installing the equipment in atmospheres containing corrosive gases, gas atmospheres out of measuring scope, or atmospheres where the sensor is exposed to silicone gas.
• Keep the equipment away from noise-generating devices to minimize the possibility of malfunction, although it is designed to cope with noise.
• The sensor has a limited life, which varies depending on operating conditions. It is strongly recommended that you replace the sensor once a year from a preventive maintenance standpoint.
• Keep this instruction manual handy for your quick reference during operation and maintenance.

Notes on Use in Korea

The AC electric cable included with this product is not compliant with the safety standards in Korea.

Please do not use it to connect household appliances in Korea.

It is prohibited to use an adapter connector to change the plug shape for the AC electric cable of this product.

Restrictions on Use

• Do not use the equipment in atmospheres containing combustible, corrosive, or flue gases, or organic compounds.
• If it is used in silicon gas atmospheres, in flow furnaces or nitrogen reflow furnaces, the equipment must be used in the following system:
  • The sampling unit, K9424GA, must be used.
  • The sampling unit requires appropriate maintenance, which is determined by gas conditions.
    Filters and activated carbon packs should be replaced at intervals which depend on the operating conditions.
    For best measurement, use new activated carbon packs. Using expired packs may result in invalid measurement results, or even sensor deterioration.
• If you have any questions, please contact your Yokogawa representative.
After-sales Warranty

- Do not modify the product.

- During the warranty period, for repair under warranty, carry or send the product to the local sales representative or service office. Yokogawa will replace or repair any damaged parts and return the product to you. Before returning a product for repair under warranty, provide us with the model name and serial number and a description of the problem. Any diagrams or data explaining the problem would also be appreciated.
  - If we replace the product with a new one, we won’t provide you with a repair report.
  - Yokogawa warrants the product for the period stated in the pre-purchase quotation.

Yokogawa shall conduct defined warranty service based on its standard. When the customer site is located outside of the service area, a fee for dispatching the maintenance engineer will be charged to the customer.

- In the following cases, customer will be charged repair fee regardless of warranty period.
  - Failure of components which are out of scope of warranty stated in instruction manual.
  - Failure caused by usage of software, hardware or auxiliary equipment, which Yokogawa Electric did not supply.
  - Failure due to improper or insufficient maintenance by user.
  - Failure due to modification, misuse or outside-of-specifications operation which Yokogawa does not authorize.
  - Failure due to power supply (voltage, frequency) being outside specifications or abnormal.
  - Failure caused by any usage out of scope of recommended usage.
  - Any damage from fire, earthquake, storms and floods, lightning, disturbances, riots, warfare, radiation and other natural changes.

- Yokogawa does not warrant conformance with the specific application at the user site. Yokogawa will not bear direct/indirect responsibility for damage due to a specific application.

- Yokogawa Electric will not bear responsibility when the user configures the product into systems or resells the product.

- Maintenance service and supplying repair parts will be covered for five years after the production ends. For repair for this product, please contact the nearest sales office described in this instruction manual.
Model OX102
Current limit type
Oxygen Analyzer

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1. **Overview**

The OX102 Current limit Oxygen Analyzer is an advanced oxygen analyzer which is capable of measuring a wide range of oxygen concentrations, from ppm level to percentage level. The OX102 is best suited to ppm-level oxygen measurement - for example, monitoring the furnace gas of nitrogen reflow furnaces and the atmosphere of semiconductor plants. This analyzer uses a compact zirconia current limiting sensor. The sensor is designed for direct insertion type installation. Where the furnace gas of a nitrogen reflow furnace contains organic solvent at a few ppm to percentage level, the sensor should be used with the K9424GA sampling system, to avoid contact with the solvent.

Note that the OX102 cannot measure oxygen concentration if combustible or corrosive gases are present in the atmosphere to be measured.

This equipment needs to be returned to the factory for repair. Contact your Yokogawa representative.

1.1 **Standard Specifications**

1. Measurement principle: Zirconia current limiting method
2. Sampling system: Natural diffusion system
   If the sampled gas may include organic solvents, use a sampling unit.
3. Measured gas: O$_2$ in N$_2$ or mixed gases; cannot be used with silicone vapor, combustible gases and organic solvents
4. Measuring range: 0 to 25 %
5. Output range: 0-100 ppm/0-1000 ppm/0-10000 ppm/0-25 %, automatic/fixed switching mode
6. External output:
   a. 4-20 mA DC automatic/manual switching mode
   b. 1-5 V DC fixed (0-100 ppm/0-1000 ppm/0-10000 ppm/0-25 %)
   c. 4-20 mA DC identification signal for automatic switching

<table>
<thead>
<tr>
<th>Output Range</th>
<th>0-100 ppm</th>
<th>0-1000 ppm</th>
<th>0-10000 ppm</th>
<th>0-25%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identification Signal</td>
<td>4 V DC</td>
<td>3 V DC</td>
<td>2 V DC</td>
<td>1 V DC</td>
</tr>
</tbody>
</table>

7. Repeatability:

<table>
<thead>
<tr>
<th>Measuring Range</th>
<th>Repeatability</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 - 100 ppm</td>
<td>±15 ppm O$_2$</td>
</tr>
<tr>
<td>100 - 1000 ppm</td>
<td>±25 ppm O$_2$</td>
</tr>
<tr>
<td>1000 - 5000 ppm</td>
<td>±0.3 of reading</td>
</tr>
<tr>
<td>5000 - 10000 ppm</td>
<td>±7.5% of reading</td>
</tr>
<tr>
<td>1 - 25%</td>
<td>±0.25%O$_2$</td>
</tr>
</tbody>
</table>

8. Alarm contact output: 2 contact outputs. contact rating 110 V AC/24 V DC, 1 A
   a. Alarm output if oxygen concentration abnormal (Hi, Lo)
   b. Alarm output if sensor disconnected (FAIL)

9. Alarm setting for abnormal oxygen concentration:
   a. Setting range: 1 ppm to 24.9% O$_2$
   b. Setting conditions: High alarm (Hi) Low alarm (Lo)

10. Indication: LED Digital indication, ranges 0-9995 ppm to 1.0-25.0%, autoswitching

11. Display and resolution: 3 steps
(12) Unit indication lamp:
   a. ppm LED turns on for O₂ measurement range 0-9995 ppm
   b. % LED turns on for O₂ measurement range 1-25.0 %

(13) Operation lamp:
   a. Hi.ALM: turns on when the O₂ concentration exceeds the high alarm setting
   b. Lo.ALM: turns on when the O₂ concentration goes below the low alarm setting
   c. FAIL: turns on when self-diagnostics detect sensor disconnected
   d. PASS: turns on when key lock is enabled, turns off when disabled

(14) Calibration:
   a. Atmospheric air one-point calibration: Calibration point setting range: 15 to 25% O₂
   b. One-point calibration at 100 ppm: Calibration point setting range: 80 to 120 ppm O₂
   c. One-point calibration at 1000 ppm: Calibration point setting range: 900 to 1100 ppm O₂
   d. One-point calibration at 10000 ppm: Calibration point setting range: 8500 to 9500 ppm O₂
   e. Complete calibration (*) Calibration with air, 20, 100, 500, 1000, 10000 ppm in that order

<table>
<thead>
<tr>
<th>Calibration Setting Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calibration Order</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>5</td>
</tr>
<tr>
<td>6</td>
</tr>
</tbody>
</table>

(*) A calibration kit for calibrating all ranges is not available. Prepare calibration gas of specified concentration on site or contact us for factory calibration.

(15) Fine tune mode: The measuring value can be adjusted to true analyzer value.

(16) Operating temperature:
   Converter: 0 to 50°C
   Sensor: 0 to 150°C
   0 to 250°C within 50 mm of sensor tip

(17) Extension cable: 4 m, 9 m, 29 m, operating temperature: 0 to 70°C

(18) Gas flow rate: 1 m/sec max.

(19) Operating pressure: 1013 ± 40 hPa abs

(20) Power supply: 100 to 240 V AC, 50/60 Hz, approx. 15 W

(21) Storage temperature: 0 to 70°C for both sensor and converter

(22) Self-diagnostic function: Detects sensor disconnection

(23) Sensor replacement: Compatibility can be achieved by entering a sensorspecific constant
1.2 Model and Suffix Codes

(1) OX102 Current limiting Type Oxygen Analyzer

<table>
<thead>
<tr>
<th>Model</th>
<th>Suffix Code</th>
<th>Option Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>OX102</td>
<td>- - - - - - -</td>
<td>- - - - - - -</td>
<td>Current limit type oxygen analyzer</td>
</tr>
<tr>
<td>Measuring Range</td>
<td>-1</td>
<td>- - - - - - -</td>
<td>0-100/1000/10000 ppm/0-25%O₂</td>
</tr>
<tr>
<td>Sensor</td>
<td>1</td>
<td>- - - - - - -</td>
<td>5 m (1 m sensor assembly + 4 m cable)</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>- - - - - - -</td>
<td>10 m (1 m sensor assembly + 9 m cable)</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>- - - - - - -</td>
<td>30 m (1 m sensor assembly + 29 m cable)</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>- - - - - - -</td>
<td>Not required</td>
</tr>
<tr>
<td>Manual</td>
<td>J</td>
<td>- - - - - - -</td>
<td>Japanese</td>
</tr>
<tr>
<td></td>
<td>E</td>
<td>- - - - - - -</td>
<td>English</td>
</tr>
<tr>
<td>Optional Nipple (*)</td>
<td>/J</td>
<td>- - - - - - -</td>
<td>Plastic nipple, 17 mm O.D. or G3/8 hole,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(for measuring range 0-1000 ppm or greater)</td>
</tr>
<tr>
<td></td>
<td>/S</td>
<td>- - - - - - -</td>
<td>Metal nipple (ferrule; teflon), Rc1/4,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(for measuring range 0-100 ppm)</td>
</tr>
</tbody>
</table>

* Either plastic or metal nipple should be specified according to the measuring range of the application, if required. When the OX102 is used with a sampling unit, nipple is not required.

(2) Sample unit, calibration kit (optional)

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>K9424GA</td>
<td>Sampling unit</td>
</tr>
<tr>
<td>K9424JA</td>
<td>Calibration kit: 1000 ppm, 6 cylinders (1 L) + needle valve assembly, with flow adjustment</td>
</tr>
<tr>
<td>K9424JB</td>
<td>Calibration kit: 1000 ppm, 6 cylinders (1 L) + needle valve assembly, without flow adjustment</td>
</tr>
<tr>
<td>K9424JR</td>
<td>Calibration kit: 10000 ppm, 6 cylinders (1 L) + needle valve assembly, with flow adjustment</td>
</tr>
<tr>
<td>K9424JS</td>
<td>Calibration kit: 10000 ppm, 6 cylinders (1 L) + needle valve assembly, without flow adjustment</td>
</tr>
</tbody>
</table>

(3) Optional Accessories

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>K9424GY</td>
<td>Activated carbon element (5 pieces/pack), for sampling unit</td>
</tr>
<tr>
<td>K9424JP</td>
<td>1000 ppm O₂ calibration gas, 1 L x 6 cylinders/box</td>
</tr>
<tr>
<td>K9424JQ</td>
<td>10000 ppm O₂ calibration gas, 1 L x 6 cylinders/box</td>
</tr>
<tr>
<td>K9424JC</td>
<td>Needle valve assembly, with flow adjustment</td>
</tr>
<tr>
<td>K9424JD</td>
<td>Needle valve assembly, without flow adjustment</td>
</tr>
<tr>
<td>K9424LA</td>
<td>Sensor assembly, specially designed for OX102</td>
</tr>
<tr>
<td>K9424LB</td>
<td>Extension cable, 4 m, specially designed for OX102</td>
</tr>
<tr>
<td>K9424LC</td>
<td>Extension cable, 9 m, specially designed for OX102</td>
</tr>
<tr>
<td>K9424LD</td>
<td>Extension cable, 29 m, specially designed for OX102</td>
</tr>
<tr>
<td>K9424DB</td>
<td>Metal nipple, Rc1/4, for measuring range of 0-100 ppm</td>
</tr>
<tr>
<td>K9424DF</td>
<td>Metal nipple (ferrule; teflon), Rc1/4, For 100&lt;?&gt;C or less</td>
</tr>
<tr>
<td>L9811LA</td>
<td>Plastic nipple, 17 mm O.D. or G3/8 hole, for measuring range 0-1000 ppm or greater</td>
</tr>
<tr>
<td>K9424GQ</td>
<td>Disk filter for Sampling Unit</td>
</tr>
<tr>
<td>K9436WH</td>
<td>Felt filter for Sampling Unit</td>
</tr>
</tbody>
</table>

* The insertion length cannot be changed once a metal ferrule is tightened with a nipple. It is because the ferrule engages with the sheath of the sensor once tightened.
1.3 External Dimensions

**Instrument Body**

Panels Dimensions

Panel Cutout

Minimum Clearance Required for side-by-side installation of multiple analyzers

Terminal Configuration

Weight: Approx. 1.2 kg
General

Sensor parameter Table

<table>
<thead>
<tr>
<th>Sensor NO.</th>
<th>XXXX</th>
<th>41Ø8±0.5 (150)</th>
<th>Gain1</th>
<th>Gain2</th>
<th>Gain3</th>
<th>Gain4</th>
<th>Gain5</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>B</td>
<td>A</td>
<td>B</td>
<td>A</td>
<td>A</td>
<td>BA</td>
<td></td>
</tr>
<tr>
<td>1.015</td>
<td>1.043</td>
<td>1.002</td>
<td>0.990</td>
<td>1.429</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Max temp. 70°C when plastic nipple (option code "J" or P/N L9811LA) is used.

Figure 1.2

Sensor

Model and Code | L (m) |
---------------|-------|
OX102-11       | 4     |
OX102-12       | 9     |
OX102-13       | 29    |

Figure 1.3

Extension cable

Figure 1.4

Sampling Unit (K9424GA, Optional)
<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>K9424JA</td>
<td>Calibration kit: 1000 ppm, 6 cylinders (1 L) + needle valve assembly, with flow adjustment</td>
</tr>
<tr>
<td>K9424JB</td>
<td>Calibration kit: 1000 ppm, 6 cylinders (1 L) + needle valve assembly, without flow adjustment</td>
</tr>
<tr>
<td>K9424JR</td>
<td>Calibration kit: 10000 ppm, 6 cylinders (1 L) + needle valve assembly, with flow adjustment</td>
</tr>
<tr>
<td>K9424JS</td>
<td>Calibration kit: 10000 ppm, 6 cylinders (1 L) + needle valve assembly, without flow adjustment</td>
</tr>
</tbody>
</table>

Figure 1.5 Calibration Kit (Optional)
2. **System Configuration**

A basic system of the OX102 oxygen analyzer comprises a sensor, extension cable and converter. The length of the extension cable is selectable - any of 4 m, 9 m and 29 m - to accommodate your application. An optional sampling unit (K9424GA) is available to filter out organic solvents, if a sample gas contains such solvents at a level between a few ppm and a few percent, such as in reflow applications. One-point calibration should be performed corresponding to the measuring range normally used. This can be conveniently achieved using the optional calibration kit (Refer to Section 1.3 figure 1.5).

When all ranges are used, they all need to be calibrated. Refer to Section 1.1 (14) “Calibration”.

### 2.1 System Configuration 1

This basic system configuration comprises sensor, extension cable and converter.

![Figure 2.1 System Configuration 1](image1)

### 2.2 System Configuration 2

This configuration, incorporating an optional sampling unit to remove organic solvents, should be used when a sample gas contains such solvents at a level of a few ppm to a few percent.

![Figure 2.2 System Configuration 2](image2)
3. **Installation**

This chapter explains installation procedures for components of the OX102 oxygen analyzer.

3.1 **Installing the Sensor**

(1) **Installation Site**

The OX102 should be installed in a place where there is adequate space for inspection and maintenance. For calibration, the sensor should be removed from the process and installed in the calibration kit.

(2) **Mounting**

The sensor should be mounted and fixed horizontally and securely using an optional nipple so that it cannot vibrate. Note the following when mounting the nipple.

**NOTE**

- When the measuring range used is 0-1000/10000 ppm O₂ or 0-25% O₂, or when the sensor is mounted in a location with severe vibration, a plastic nipple (L9811L8) should be used. Its connection is G3/8 screw or 17 mm O.D. hole. The maximum thickness of the mounting plate is 4 mm for a 17 mm O.D. hole.
- When the measuring range used is 0-100 ppm O₂, a metal nipple (K9424DB) should be used. Its connection is Rc1/4.
- The nipple should be securely tightened so that no leakage occurs. When mounting the sensor with a plastic nipple, use a finger-tight connection; when mounting the sensor with a metal nipple, finger tighten the connection then use a wrench to tighten it a further 1/2 turn.
- Within 50 mm of the sensor tip, it can get very hot. Do not mount the nipple in this hot area.

**WARNING**

- Sensor cable should be within 30 cm of sensor housing, and angle of bend (see figure below) should not be greater than 60°.
- When mounting sensor through a 17 mm hole, mounting plate should be no greater than 4 mm thick.

![Figure 3.1 Sensor Mounting](image-url)
3.2 Installing the Converter

(1) Installation Site

The converter should be installed in places where:

• Easy access to display and key operations can be achieved.
• Inspection and maintenance can be easily performed.
• Ambient temperature does not exceed 50°C and temperature fluctuations are minimal:
  Avoid exposure to direct sunlight or radiant heat.
• Humidity is moderate (40 to 75% RH recommended), and no corrosive gases or metal dust are present.
• Mechanical vibration should be negligible.
• No electromagnetic field should be present.
• No exposure to rain or water is allowed.

(2) Mounting

The converter is panel mounted (copperplate of 1 to 10 mm thickness) using the supplied brackets.

Procedure

• Insert the unit through the mounting hole from the front.
• Mount the converter on the panel using brackets. The brackets should be fixed to the designated position on the right and left sides of the housing by tightening the screws. See Figure 3.2.
• The converter should be upright and horizontal.
• Ensure that the converter bracket screws are tightly secured so there is no movement.

Figure 3.2 Converter Mounting

CAUTION

Over-tightening the screws may distort the case or damage the brackets.
3.3 Installing the Optional Sampling Unit (K9424GA)

The sampling unit is a desktop type and should be installed on a stand near the sampling point. Note the following when installing the unit.

The unit should be installed in places where:
• Ambient temperature is in the range of 0 to 40ºC and temperature fluctuations are minimal.
• Mechanical vibration is negligible.
• Adequate space for inspection and maintenance, such as replacing filter element, is secured.
• The unit should be securely mounted on a stand to prevent it falling.
• No exposure to rain or water is allowed.

The sampling unit incorporates a suction pump, which requires power supply of 100-240 V AC.

NOTE

The pumps and activated charcoal filter used in this equipment have limited life, and periodic maintenance or replacement will be required. Install this equipment in an accessible location to facilitate maintenance.

Maintenance conditions vary depending on the gas conditions. Replacement intervals for the filter and activated charcoal should be determined in accordance with the operating conditions.
• Used eight hours a day, pump life will be approximately one year.
• Filter life is about 50 hours. (if measured gas contains isopropyl alcohol of concentration 500 ppm, and flow is 500 ml/min.)
4. Wiring

This chapter explains the procedures for wiring the converter.

4.1 Precautions

NOTE

Do not apply power to the converter or any other devices, such as alarm devices, relating to the power circuit of the converter, until all wiring has been completed.

4.2 Wiring Types

The converter requires the following wiring.

(1) Sensor (special cable)
(2) Output signal (two analog output)
   - 4-20 mA DC (two-core shielded cable)
   - 1-5 V DC fixed range only (two-core shielded cable)
(3) Range identification signal: automatic range switching only (two-core shielded cable)
(4) High/Low alarm contact signal (600 V rated heavy-vinyl-insulated wire, or wire of equivalent or greater capacity)
(5) Fail contact signal (600 V rated heavy-vinyl-insulated wire, or wire of equivalent or greater capacity)
(6) Power supply (600 V rated heavy-vinyl-insulated wire, or wire of equivalent or greater capacity)
4.3 Terminals for External Connections

External connections should be made from the terminals on the rear side of the converter. Be careful not to make any mistakes.

![Terminal Configuration](Figure 4.1)

**WARNING**

- When wiring, ensure that the mains power supply is disconnected, to minimize the risk of electric shock.
- Use 600 V rated heavy-vinyl-insulated wire (JIS C3307), or wires or cables of equivalent or greater capacity for connections.
- Connect to a ground with a ground resistance of 100 Ω or less.
- Use (4-mm screw) crimp-on terminals with insulating sleeves for power supply and ground terminals.
- The converter is not equipped with a power switch. Use an external two-pole power switch.
- All wiring should be attached to the installation panel, so that the connection terminals and cables are protected if the cable is pulled or jerked. Fix the extension cable from the sensor and the AC power cable at separate points.

4.4 Wiring Procedures

Follow the instructions below for wiring the converter.

1. **Sensor wiring**
   Sensor is connected using a special extension cable with 15P connector. Plug in the connector and tighten the screws to secure it.

2. **Signal output**
   There are two types for signal output: 4-20 mA DC and 1-5 V DC. The 1-5 V DC output signal is only available for a fixed range. Use two-core shielded wires for signal output wiring. Perform the wiring as shown in Figure 4.2.
Figure 4.2  Output Signal

(3) Range Identification Signal
The range identification signals are output when automatic range switching mode is selected. See Section 1.1 (6). For these range identification signals, terminal 3 is positive and terminal 4 negative (see Figure 4.1). Use two-core shielded wires for the wiring.

(4) High/Low Alarm Contact Output
This contact output is a relay contact and closes when an alarm condition exists. Use 600 V-rated insulated wires (JIS C3307), or wires or cables of equivalent or greater capacity, for connections as shown in Figure 4.3.

(5) Fail Contact Signal
This contact output is a relay contact which closes when a failure occurs due to a disconnection of sensor heater or sensor cables. Use 600 V-rated vinyl insulated wires (JIS C3307), or wires or cables of equivalent or greater capacity, for connections as shown in Figure 4.4.

(6) Power Supply Wiring
Use 600 V-rated vinyl insulated wires (JIS C3307), or wires or cables of equivalent or greater capacity for power supply wiring as shown in Figure 4.5.
5. Component Functions

This chapter describes functions of main equipment of the OX102 oxygen analyzer.

5.1 Sensor

The sensor uses a zirconia current limiting system, enabling direct insertion of the sensor at elevated temperatures up to 150°C. 0 to 250°C within 50 mm of sensor tip. The sensor should be used at a measuring point pressure of 1013 ± 40 hPa abs. When replacing the sensor, enter the data in the Sensor Parameter Table (attached to the sensor control block) into the converter. This ensures sensor compatibility.

![Sensor Parameter Table](F501.ai)

* Sensor Parameter Table (Example)

<table>
<thead>
<tr>
<th>Sensor Parameter Table</th>
<th>Sensor No. YA-0007</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gain 1</td>
<td>1.015</td>
</tr>
</tbody>
</table>
| Gain 2 | A 1.043  
| B -65 |
| Gain 3 | A 1.002  
| B -25 |
| Gain 4 | A 0.990  
| B -19 |
| Gain 5 | A 1.429  
| B -17 |

When replacing the sensor, enter values in the Sensor Parameter Table into the converter. See Section 6.3 (1) “Setting Sensor Parameter” for procedure.

5.2 Converter

The converter provides oxygen concentration readings based on the signals from the sensor and outputs a 4-20 mA/1-5 V DC signal outside. Also the converter has various functions, including the high/low alarm contact output, easy, one-touch calibration, and self-diagnosis function.
Operating Keys:

- **[ALM]**: Used to enter the high/low alarm setting mode
- **[4-20mA]**: Used to configure 4-20 mA output, used together with **[▲]** key to enter the 1-5 V output setting mode, used together with **[▼]** key to enter the automatic/manual switching mode
- **[%]**: Used for percentage indication for reading
- **[ppm]**: Used for ppm indication for reading, used together with **[CAL]** key to enter the measurement mode from any other modes
- **[CAL]**: Used for entering the calibration mode
- **[▲]**: Used for increasing the value during data setting
- **[▼]**: Used for decreasing the value during data setting
- **[ENT]**: Used for confirming the data entry

Figure 5.2 Converter

5.3 Sampling Unit (Optional)

The calibration kit for the OX102 oxygen analyzer comprises a standard gas cylinder and pressure regulating valve to supply standard gas for calibration, when necessary.
**Part Number** | **Description**  
--- | ---  
K9424JA | Calibration kit: 1000 ppm, 6 cylinders (1L) + needle valve assembly, with flow adjustment  
K9424JB | Calibration kit: 1000 ppm, 6 cylinders (1L) + needle valve assembly, without flow adjustment  
K9424JR | Calibration kit: 10000 ppm, 6 cylinders (1L) + needle valve assembly, with flow adjustment  
K9424JS | Calibration kit: 10000 ppm, 6 cylinders (1L) + needle valve assembly, without flow adjustment

*For a system without flow adjustment, adjust the flow rate to 500 ml/min using the needle valve (K9424JD).*

**Figure 5.4 Calibration Kit**

**NOTE**

Shelf life of gas cylinder

The shelf life of a calibration gas shall be one year from the manufacturing date specified on the label of the cylinder. Yokogawa shall not guarantee accuracy of the equipment, if it is calibrated with an expired calibration gas.
6.  Operation

This chapter explains how to operate the OX102 oxygen analyzer.

6.1  Startup

The startup procedure is outlined in the following chart.

(1) Checking wiring and piping  See Section 6.1 (1)

(2) Checking gas flow rate, when using sampling unit  See Section 6.1 (2)

(3) Applying power to converter  See Section 6.1 (3)

(4) Warming up / Configuring parameter  See Section 6.3

(5) Calibration  See Section 6.3 (6)

Note: For operating procedure of the calibration kit, see Section 6.1 (4).

Figure 6.1  Setup

(1) Checking wiring and piping, when using the sampling unit
   Ensure that wiring is made correctly in accordance with the procedures described in Chapter 4.
   Piping is only required when using a sampling unit. Ensure that piping is installed properly so that it is free from gas leakage.

(2) Checking gas flow rate, when using the sampling unit
   Turn on the power switch of the sampling unit. Adjusting the gas flow rate should be performed with the sensor connected to the sampling unit. While opening the flowregulating valve of the flowmeter completely, adjust the front needle valve until the flowmeter reads approximately 500 ± 100 ml/min. See Figure 5.3.

(3) Applying power to the converter
   Ensure that the power supply voltage conforms to the specification of the converter before applying power to the converter (see Section 1.1 (19)). Turn on power to the converter. Measurement is not available for the initial 10 minutes since it takes that time for the sensor to reach the required operating temperature. The initial converter parameters are the default settings. If necessary, change the parameters to meet your application requirements, referring to Sections 6.2 and 6.3.
   Briefly after the converter is energized, it shows values at random on the display for about 5 seconds and then switches to measurement mode to indicate approximate values of the oxygen concentration at sampling point. At this stage, the readings are invalid since the sensor temperature has not reached the required operating temperature.
(4) Operating procedure for the calibration gas kit

1. Pull the needle tip up inside the gasket to the position shown in Figure 1.
2. Screw the valve onto the mouth of a container with the fingers until it meets resistance and then screw the locknut down. (Figure 2)
3. Turn the needle valve clockwise until it can no longer turn. (Figure 3)
4. Make a piping connection to the piping port of the valve. (Figure 4)
5. Turn the needle valve gradually in a counterclockwise direction to start the gas flowing.
6. Adjust the needle valve for the required flow rate.
7. To shut off the gas flow, turn the needle valve clockwise.
8. For storage, the needle valve should be firmly tightened as in Step 3.
6.2 Operational Flow Chart

The following definitions apply in general to the notation used in the text to express and explain the operation keys and the display descriptions. Refer to Figure 5.2 for the functions of the operation keys and the indications on the converter front panel.

- **Notation descriptions for the operational flow chart**

  (1) Display

<table>
<thead>
<tr>
<th>Notation</th>
<th>Status</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="206.png" alt="206" /> ppm</td>
<td>Indicates high alarm status occurs</td>
<td>1. Concentration indication ON 2. % lamp ON 3. ppm lamp OFF 4. High alarm lamp ON</td>
</tr>
<tr>
<td><img src="225.png" alt="225" /> ppm</td>
<td>Normally, displays oxygen concentration reading</td>
<td>1. Concentration indication ON 2. % lamp OFF 3. ppm lamp ON</td>
</tr>
</tbody>
</table>

Note:
- ![206](206.png) : Indicates flashing display, prompting you to configure
- ![225](225.png) : Indicates continuous (non-flashing) display
- % : A black circle indicates that the lamp is on
- ppm : A white circle indicates that the lamp is off
- H.ALM : A black square indicates that the high alarm lamp is on

(2) Key operations

[ppm + CAL]: Indicates that keys specified should be pressed simultaneously in left-to-right order. In this case, press the [ppm] key while simultaneously pressing the [CAL] key.
6.3 Configuring Data

(1) Configuring the sensor parameters

Upon replacing sensors, parameters must be configured following the chart below. Parameters to be configured are specified in the Sensor Parameter Table (Figure 5.1) attached on a new sensor.
Changing value
Gain 1 Value

Measured Value

(Note)

Indication

To be continued (to GIN.2)

Note) After one-point calibration, if [▲▼± ppm] and [ENT] key are pressed, GIN6 value is reset to 1.00. In this case, the calibration is required again. To check the sensor parameter, press [▲▼±%]. Press [ENT] to confirm the parameter.

Figure 6.4 Flow Chart of Sensor Parameter Setting
Gain 2 A Value

Gain 2 B Value

To be continued (to GIN.3)
To be continued (to GIN.5)
(2) Automatic/Manual Switching

In this mode, either automatic or manual range switching can be selected. Set either mode following the procedure shown in the flow chart below.

When the autoswitching is selected, the mode of “Configuring the 4-20 mA output signal” described in Section (3) is automatically determined.

Figure 6.5 Flow Chart of Automatic/Manual Switching Setting
(3) Configuring the 4-20 mA output signal

This mode is to configure the 4-20 mA output signal for the fixed range. Configure the signals following the procedure shown in the flow chart below. This mode is automatically determined if the automatic/manual range switching mode is set to autorange mode.

(*1) When AUTO is selected, the measurement mode remains unchanged.

(*2) Use [▲] and [▼] keys to configure Out.1 to 4.

Out.1 : Full scale 25% O₂
Out.2 : Full scale 10000 ppm O₂
Out.3 : Full scale 1000 ppm O₂
Out.4 : Full scale 100 ppm O₂

Figure 6.6 Flow Chart of 4-20 mA Output Signal Setting

(4) Configuring the 1-5 V output signal

This mode is to configure the 1-5 V output signal to correspond to a fixed range. Configure the signals following the procedure shown in the flow chart below. This output signal is always set to correspond to a fixed range. Therefore, even if automatic range switching is selected, this output signal should be configured for each range.
(5) Configuring high/low alarm contact output settings

This mode is to configure the oxygen concentration high/low alarm contact output settings. Configure settings following the procedure shown in the flow chart below. The high alarm setting should be equal or greater than the low alarm setting.

Figure 6.7 Flow Chart of 1-5 V Output Signal Setting
(*) If the entered high alarm setting is less than the low alarm setting, the display will show \( E \ldots \) for about 3 seconds and the entered setting will flash to prompt reentry. An appropriate value should be reentered.

Figure 6.8 Flow Chart of High/Low Alarm Setting
(.*) If the entered high alarm setting is less than the low alarm setting, the display will show [E- - -] for about 3 seconds and the entered setting will flash to prompt reentry. An appropriate value should be reentered.

(6) Resetting the sensor parameters to the default values
This is to reset the sensor parameters (A and B values for each gain, see Section 5) to the factory default values.

Note In the case of the sensor is replaced and the parameters are changed (refer to 6.3 (1) Configuring the sensor parameters), the parameter are reset to those changed value.

(7) Key lock
This is to lock each key operation.
6.4 Calibration

(1) Calibration

This mode is to calibrate the OX102 oxygen analyzer using the calibration gases, including atmospheric air. Enter the known concentration value of a calibration gas and then analyzer apply the calibration gas to the sensor and calibrate the sensor. The calibration requires calibration gases with known concentrations (1000 ppm O₂ or 10000 ppm O₂ calibration gases) and the calibration kit.

- Before shipment, a complete calibration of the OX102 oxygen analyzer from 0-100 ppm to 0-25% was performed with standard calibration gases at the factory.
- When using the equipment right after the delivery, first check the reading of the converter with the sensor in atmospheric air. If the reading is within a deviation of ±0.25% O₂ from 20.9%, the equipment does not need calibration and is ready for use. If the reading is out by a deviation of ±0.25% O₂ or greater, the equipment needs one-point calibration for each range.
- Calibration is basically performed at one point for each measuring range. Perform calibration following the procedure shown in the flow chart in the following pages.
- Flow charts illustrate how to perform calibration for each range. To perform calibration only for required ranges, skip unwanted ranges by pressing the [CAL] key repeatedly until the desired range appears. For complete calibration, contact us for factory calibration.
- Quick adjustment is available that enables the analyzer to harmonize output values with actual ones. For details, see Section 6.4 (2) “Moving zero point.” This function is useful when temporary adjustment is required or when calibration gas is not available at hand.
- The sensor deteriorates progressively in service. Its life varies depending on operating conditions. If the sensor cannot be calibrated or the response becomes quite slow, the sensor should be replaced.

<table>
<thead>
<tr>
<th>No.</th>
<th>Calibration Point</th>
<th>Calibration Setting Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Air</td>
<td>Atmospheric air or 15-25% O₂</td>
</tr>
<tr>
<td>2</td>
<td>20 ppm</td>
<td>15-25 ppm O₂ gas cylinder</td>
</tr>
<tr>
<td>3</td>
<td>100 ppm</td>
<td>80-120 ppm O₂ gas cylinder</td>
</tr>
<tr>
<td>4</td>
<td>500 ppm</td>
<td>400-600 ppm O₂ gas cylinder</td>
</tr>
<tr>
<td>5</td>
<td>1000 ppm</td>
<td>900-1100 ppm O₂ gas cylinder (*1)</td>
</tr>
<tr>
<td>6</td>
<td>10000 ppm</td>
<td>8500-9500 ppm O₂ gas cylinder (*2)</td>
</tr>
</tbody>
</table>

*(1) Or 1000 ppm O₂ calibration gas (1L, P/N K9424JP)
*(2) Or 10000 ppm O₂ calibration gas (1L, P/N K9424JQ)

For complete calibration, contact YOKOGAWA for factory calibration.
[Air Calibration] Indication

CAL1 is for 0-25% O2 range calibration. When using dry air as calibration gas, enter 20.9 using ▲ and ▼ keys.

Entering calibration value

Calibration completed

Calibration Flow

Figure 6.11
[100 ppm O₂ Calibration]

(*) CAL2 is for 0-100 ppm range calibration. Assuming the O₂ concentration of calibration gas is 110 ppm, enter this value using ▲ and ▼ keys.

Continued from CAL.1

Measurement Mode

Stop supplying calibration gas No.1

Supplying calibration gas No.3
(O₂ concentration in the range: 80-120 ppm)

Entering calibrated value

Calibrated value

Calculating

Changing value

Calibration accepted

Calibration completed

*1 Entered to skip calibration
*2 Entered to enter calibration value
*3 Entered to return to measurement mode
[1000 ppm O2 Calibration]

(∗) CAL3 is for 0-1000 ppm range calibration. Assuming the O2 concentration of calibration gas is 995 ppm, enter this value using ▲ and ▼ keys.

Continued from CAL.2

Measurement Mode

Stop supplying calibration gas No.3

Supplying calibration gas No.5 (O2 concentration allowance: 900-1100 ppm)

Entering calibration value

CAL4 (to the following page)

*1 Entered to skip calibration
*2 Entered to enter calibration value
*3 Entered to return to measurement mode
[10000 ppm O2 Calibration] ( ) CAL4 is for 0-10000 ppm range calibration. Assuming the O2 concentration of calibration gas is 9310 ppm, enter this value using ▲ and ▼ keys.

Continued from CAL.3

Measurement Mode

CAL4

% ○ ppm ●

Entering calibration value

9310

CAL4

0-10000 ppm O2 Calibration

CAL

ENT

ppm+CAL

Calibration value

9010

CAL

ENT

ppm+CAL

Calculating

Changing value

ERROR

YES

NO

Calibration accepted

9310

*1 Entered to skip calibration
*2 Entered to enter calibration value
*3 Entered to return to measurement mode

*1 Entered to skip calibration
*2 Entered to enter calibration value
*3 Entered to return to measurement mode

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The procedure for complete calibration, requiring six types of calibration gas, is illustrated in the following flow chart.

([Air Calibration])

(•) Calibration using air. When using dry air as calibration gas, enter 20.9 using ▲ and ▼ keys.

**Display shows "20" automatically in about 3 seconds and wait for a 20 ppm calibration.**

---

[Diagram showing calibration process]
Enter ppm + CAL

[20 ppm O2 Calibration]

Indication

20

ppm

Continued

% ppm + CAL

Stop supplying calibration gas No.1 and supply No.2 (O2 concentration allowance: 15-25 ppm)

Entering calibration value

19

ppm

Calibration value

Measurement mode

Calibration completed

19

ppm

ERROR

YES

NO

Wait for the calibration

[100 ppm O2 Calibration]

Indication

100

ppm

Calibration value

Waiting for 100 ppm calibration

Entering calibration value

95

ppm

Measured value

Changing value

Calibration completed

95

ppm

ERROR

YES

NO

Waiting for 500 ppm calibration

Note: To return to measurement mode, press [ppm + CAL]
[500 ppm calibration] Indication

500 ppm ▲ ▼

Entering calibration value

510 ppm

Calibration value

500 ppm + CAL

Measurement mode

Stop supplying calibration gas No.3 and supply No.4

(O2 concentration allowance: 400-600 ppm)

Calibration completed

510 ppm ▲ ▼

[1000 ppm calibration]

1000 ppm ▲ ▼

Entering calibration value

Stop supplying calibration gas No.4 and supply No.5

(O2 concentration allowance: 900-1100 ppm)

Calibration completed

1050 ppm ▲ ▼

Note: To return to measurement mode, press [ppm + CAL]
[10000 ppm O₂ Calibration] Indication

Enter calibration value

Calibration completed

Stop supplying calibration gas No.5 and supply No.6 (O₂ concentration allowance: 8500-9500 ppm)

Measurement mode

Note: To return to measurement mode, press [ppm + CAL]

(2) Moving zero point

This is to translate the output function: to change value b of the characteristic function, \( y = ax + b \). The range for moving the zero point is from -999 to +999 ppm.

Figure 6.13 Flow Chart of Moving Zero Point
7. **Inspection and Maintenance**

This chapter explains inspections to ensure best performance and operations of the OX102 oxygen analyzer.

If repair is required, this equipment will need to be returned to the factory. Contact your Yokogawa representative.

### 7.1 Sensor

This basic system configuration comprises sensor, extension cable and converter.

**NOTE**

- Do not touch the sensor head accidentally while the sensor is hot right after removing it from the process. The sensor can be as hot as 700ºC. This can cause severe burns.
- The sensor contains components made from ceramics (zirconia). Physical damage by dropping or jolting can result in sensor failure.

1. The sensor is of limited life, and its service life varies depending on operating conditions. When the sensor cannot be calibrated, it should be replaced.
2. After replacement, the sensor parameters specified in the Sensor Parameter Table (Figure 5.1) of a new sensor must be entered following the procedure described in Section 6.3 (1) “Configuring the sensor parameters.”
3. If the slots of the sensor head get clogged, it may cause false measurement. When clogging becomes severe enough to block the gas flow, clean the slots with a brush and subsequently by applying pressurized air (300 kPa max.) to the sensor while keeping the sensor head facing downward to prevent dust from getting into the inside of the sensor.

### 7.2 Converter

The fuse is mounted on a printed board inside the converter. If no display appears after applying power, the fuse needs to be replaced. Contact our service station for fuse replacement.

### 7.3 Sampling Unit (Optional)

The sampling unit is used to eliminate organic solvents using a built-in activated carbon filter, when the sample gas contains a small amount of organic solvents.

When this sampling unit is used with OX100 series Oxygen Analyzer, if the sampling unit is not properly maintained the life of the Oxygen Analyzer sensor will be adversely affected, drift will occur or the instrument will not calibrate.

Frequent filter maintenance is particularly important. If zero or span need frequent adjustment, check the filter first.

1. When the sample gas contains 500 ppm of isopropyl alcohol and flows at 500 ml/ min, the expected life of the activated carbon filter element is approximately 50 hours. After 50 hours service, the activated carbon filter element must be replaced. Using expired carbon filter may result in false measurement, or even sensor deterioration.
2. Replacement interval for the disk filter (P/N K9424GQ) varies depending on dust content in the sample gas. Check the cleanness of element to determine the filter replacement cycle. The felt filter (P/N K9346WH) is for preventing the activated carbon from leaking so it requires no replacement unless abnormal conditions occur.
(3) Increasing contamination of the filter may deteriorate the flow rate of sucked sample gas. The flow rate should be checked regularly by the flowmeter of the sampling unit. If the flow rate is outside of the specified range 500 ± 100 ml/min, readjust the flow rate.
8. Troubleshooting

The table below summarizes troubles that may develop in the OX102, problem source and corrective action.

<table>
<thead>
<tr>
<th>Abnormal symptom</th>
<th>Problem source</th>
<th>Corrective action</th>
</tr>
</thead>
<tbody>
<tr>
<td>No indications</td>
<td>No power applied.</td>
<td>Apply power.</td>
</tr>
<tr>
<td></td>
<td>Fuse has blown.</td>
<td>Replace the fuse.</td>
</tr>
<tr>
<td>FAIL lamp lit</td>
<td>Sensor connector or sensor heater is disconnected.</td>
<td>Replace the sensor.</td>
</tr>
<tr>
<td>Low value displayed</td>
<td>Operating pressure is out of specified range.</td>
<td>Use within the specified pressure range.</td>
</tr>
<tr>
<td>High value displayed</td>
<td>Improper calibration</td>
<td>Recalibration</td>
</tr>
<tr>
<td></td>
<td>Sensor failure.</td>
<td>Replace the sensor.</td>
</tr>
<tr>
<td></td>
<td>Expired activated carbon has been used.</td>
<td>Replace the activated carbon filter.</td>
</tr>
<tr>
<td>Slow response</td>
<td>Ambient pressure around sensor is negative.</td>
<td>Use within the specified pressure range.</td>
</tr>
<tr>
<td></td>
<td>Sensor has been clogged.</td>
<td>Clean the sensor head.</td>
</tr>
<tr>
<td>Large error in measurement</td>
<td>Operating temperature is out of specified range.</td>
<td>Use within the specified temperature range.</td>
</tr>
<tr>
<td></td>
<td>Operating pressure is out of specified range.</td>
<td>Use within the specified pressure range.</td>
</tr>
<tr>
<td></td>
<td>Sample gas contains oxidation-reduction gas or corrosive gas.</td>
<td>Specified accuracy cannot be expected in measurement.</td>
</tr>
<tr>
<td></td>
<td>Sensor head touches wall.</td>
<td>Reinstall the sensor following procedure as in Section 3.1.</td>
</tr>
<tr>
<td></td>
<td>Expired activated carbon has been used.</td>
<td>Replace the activated carbon filter.</td>
</tr>
<tr>
<td>Occasional, large fluctuations in readings</td>
<td>Sensor failure</td>
<td>Replace the sensor.</td>
</tr>
<tr>
<td></td>
<td>Operating pressure is out of specified range.</td>
<td>Use within the specified pressure range.</td>
</tr>
<tr>
<td>Calibration fails</td>
<td>Improper calibration gas concentration</td>
<td>Use proper calibration gas.</td>
</tr>
<tr>
<td></td>
<td>Sensor failure.</td>
<td>Replace the sensor.</td>
</tr>
<tr>
<td></td>
<td>Operating pressure is out of specified range.</td>
<td>Recalibrate within the specified pressure range.</td>
</tr>
<tr>
<td></td>
<td>Useful life of activated charcoal filter is over.</td>
<td>Replace activated charcoal filter.</td>
</tr>
<tr>
<td>No alarm contact signal is activated 1.</td>
<td>Alarm contact signal is not set.</td>
<td>Set the alarm contact signal properly.</td>
</tr>
<tr>
<td></td>
<td>Alarm contact relay failure.</td>
<td>Contact Yokogawa.</td>
</tr>
</tbody>
</table>
Appendix 1. Sampling Unit

K9424GA Sampling Unit for OX100/OX102

This sampling unit is designed for the OX100 Series Oxygen Analyzers and is used where a sample gas contains a small amount of organic solvent (e.g. isopropyl alcohol), such as in reflow furnaces.

The sampling unit comprises two membrane filters to eliminate dust and mist, a suction pump to draw a sample gas, an activated carbon filter to eliminate organic solvents, and a flowmeter to monitor sample gas flow rates.

NOTE

If repair is required, the equipment will need to be retuned to the factory.

For repair or maintenance, contact your Yokogawa representative.

1. Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Detail</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pressure at sampling point :</td>
<td>Atmospheric pressure</td>
</tr>
<tr>
<td>Pressure at sample outlet :</td>
<td>Atmospheric pressure</td>
</tr>
<tr>
<td>Gas temperature :</td>
<td>50 ºC max.</td>
</tr>
<tr>
<td>Organic solvent content :</td>
<td>ppm to a few percentage level of isopropyl alcohol (IPA) equivalent</td>
</tr>
<tr>
<td>Dust content :</td>
<td>5 mg/Nm3 max.</td>
</tr>
<tr>
<td>Life expectancy of activated carbon:</td>
<td>The expected life of the activated carbon filter is approx. 50 hours when a sample gas contains 500 ppm of isopropyl alcohol and flows at 500 ml/min.</td>
</tr>
<tr>
<td>Power supply :</td>
<td>100 to 240 V, 50/60 Hz</td>
</tr>
<tr>
<td>Piping connection :</td>
<td>Rc1/4</td>
</tr>
<tr>
<td>Operating environment temperature range:</td>
<td>0 to 40 ºC</td>
</tr>
<tr>
<td>Life of membrane filter :</td>
<td>When specified flow is no longer possible. Replace as early as possible.</td>
</tr>
<tr>
<td>Pump life :</td>
<td>Approximately one year when used eight hours a day.</td>
</tr>
</tbody>
</table>

Included Accessories

1. Power cord (1)             | A1007WD (AC 100 V standard)                                           |
                            | A1009WD (AC 200 V by Tokuchu special order)                            |
2. Fuse (2)                  | A1109EF (rating 1 A)                                                  |
3. Instruction Manual (1)    | K9424JY                                                               |
2. Installation

The sampling unit is a desktop type and should be installed on a stand near the sampling point. Note the following when installing the unit.

The unit should be installed in places where:
- Ambient temperature is in the range of 0 to 40 °C and temperature fluctuations are minimal.
- Mechanical vibration is negligible.
- Adequate space for inspection and maintenance, such as replacing filter element, is secured.
- The unit should be securely mounted on a stand to prevent its dropping.
- No exposure to rain or water is allowed.

Procedure:

1. Feed sampling tubing from the sampling point through a stop valve to the sample gas inlet, GAS IN, with care not to produce gas leakage. The piping connection of the sample gas inlet is Rc1/4. Use an appropriate joint for this connection.

2. Feed gas vent tubing from the sampling outlet, GAS OUT, with care not to produce gas leakage. The piping connection of the sampling gas outlet is Rc1/4. Use an appropriate joint for his connection.

3. Insert a power cable to the power connector of the sampling unit.

![Figure 1 Piping Diagram](image1)

![Figure 2 Sampling Unit](image2)
3. Operating Procedure

3.1 Starting Operation

Before starting the operation of the sampling unit, make sure to power down the OX100 Series oxygen analyzer. Take the following steps to start operating the unit.

1. Mount an OX100 Series sensor to the sensor connector of the sampling unit until it stops against the end. Then pull out the sensor to 1-2 mm front and tighten the locknut firmly with fingers. The locknut should be finger tight only, do not use a wrench for tightening.

2. Completely open both stop valves, sampling gas intake and gas vent.

3. Turn off the power switch of the unit and connect to a voltage conforming to the specification.

4. Open the flow regulating valve of the flowmeter and the needle valve on the front completely by turning the valves counterclockwise completely.

5. Turn on the power switch of the unit. The suction pump starts working.

6. If the flowmeter reads below 0.5 l/min, close the needle valve on the front gradually by turning it clockwise until the flowmeter reads 0.5 l/min. If the flowmeter reads over 0.5 l/ min, close the flow regulating valve of the flowmeter gradually by turning it clockwise until the flowmeter reads 0.5 l/ min.

7. Turn on the power of the OX100 Series oxygen analyzers.

3.2 Stopping Operation

Take the following steps to stop operating the unit.

1. Remove power from the OX100 Series oxygen analyzers.

2. Turn off the power switch of the sampling unit.

3. Close both stop valves for sampling gas intake and for gas vent completely by turning the valves clockwise completely.
4. Maintenance

When this sampling unit is used with OX100 series Oxygen Analyzer, if the sampling unit is not properly maintained the life of the Oxygen Analyzer sensor will be adversely affected, drift will occur or the instrument will not calibrate.

Frequent filter maintenance is particularly important. If zero or span need frequent adjustment, check the filter first.

4.1 Replacing the Activated Carbon Pack

(1) Remove the tubing from the case’s lid.
(2) Turn the lid counterclockwise to open it.
(3) Remove an old filter pack.
(4) Open a new filter pack and follow the steps below, referring to the figures, to put it into the case.
   • Shape the pack into cylinders (Figure 1).
   • Put it into the case by pushing it while pulling the seam(1) to puff out the pack and fold the both top corners (2) and (3) of the pack outside (Figure 2).
   • Push the pack into the case until the top of the pack sinks under the brim. Thrust the pipe protruding from the back of the lid onto the top center, not on the seam, and tighten the lid securely (Figure 3).
(5) Connect the tubing to the lid.

![Figure 1.](AP103E.ai) ![Figure 2.](AP103E.ai) ![Figure 3.](AP103E.ai)

4.2 Maintenance of the Disk Filter Attached on the Gas Inlet

(1) Disconnect the fitting from the sampling gas inlet.
(2) Remove the filter with tweezers.
(3) Clean the captured foreign substances out of the filter by air purges.
(4) Replace the restored filter with its smooth surface facing to the gas inlet.
   * When the filter becomes clogged shortly after the restoration, the filter needs to be replaced.
Appendix 2. Calibration Gas Kits

K9424JA, K9424JB, K9424JR, K9424JS Calibration Gas Kits for OX100/OX102

The calibration gas kits are designed for calibration of the OX100 Series Oxygen Analyzers. The kit comprises a calibration gas (filled pressure of 0.7 MPa, 6 one-litter cylinders) and a needle valve assembly. The calibration gas is available in two types: 900 to 1100 ppm O₂ and 8500 to 9500 ppm O₂ (N2 based). Prepare either one according to your application.

1. Connecting the Needle Valve Assembly to the Gas Cylinder

Take the following steps to connect the gas cylinder to the needle valve assembly.

(1) Turn the handle of the needle valve counterclockwise to pull the needle tip inside the gasket to the position shown in Figure 1.

(2) Loosen the locknut of the needle valve. Screw the valve into the mouth of the gas cylinder in a clockwise direction with fingers until it meets resistance by finger and then screw the locknut down (See Figure 2).
2. Supplying the Calibration Gas

Take the following steps to supply the calibration gas.

(1) Mount an OX100 Series sensor to the needle valve assembly by inserting 70 to 80 mm of the sensor and screwing down the locknut firmly with fingers. The locknut should be finger tight only and do not use a wrench for tightening.

(2) Turn the pressure regulating handle of the needle valve assembly’s regulator counterclockwise completely.

(3) Turn the handle of the needle valve clockwise until it can no longer turn so that the needle tip pokes into the gas cylinder (See Figure 3).

(4) Turn the handle of the needle valve counterclockwise to the position shown in Figure 1.

(5) Turn the pressure regulating handle of the regulator gradually in a clockwise direction to set the pressure at approximately 0.05 MPa. This allows the calibration gas to be supplied to the sensor for calibration.

![Figure 3](AP201E-3.ai)

3. Stopping Supplying the Calibration Gas

Take the following steps to stop supplying the calibration gas.

(1) Turn the handle of the needle valve clockwise until it meets resistance.

(2) Turn the pressure regulating handle of the regulator counterclockwise completely.
### Customer Maintenance Parts List

**Model OX102**  
Current Limit Type Oxygen Analyzer

<table>
<thead>
<tr>
<th>Item</th>
<th>Part No. (Ms code)</th>
<th>Qty</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>OX102-1N</td>
<td>1</td>
<td>Converter</td>
</tr>
<tr>
<td>2</td>
<td>K9424LA</td>
<td>1</td>
<td>Sensor</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>1</td>
<td>Sensor Cable</td>
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<tr>
<td></td>
<td>K9424LB</td>
<td></td>
<td>Cable (4m)</td>
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<tr>
<td></td>
<td>K9424LC</td>
<td></td>
<td>Cable (9m)</td>
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<tr>
<td></td>
<td>K9424LD</td>
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<td>Cable (29m)</td>
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K9424GA SAMPLING UNIT

<table>
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<tr>
<th>Item</th>
<th>Part No.</th>
<th>Qty</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>L9866CX</td>
<td>1</td>
<td>Flow Meter</td>
</tr>
<tr>
<td>2</td>
<td>K9424GN</td>
<td>1</td>
<td>Pump Assy</td>
</tr>
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<td>3</td>
<td>K9424HE</td>
<td>1</td>
<td>Power Unit</td>
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<tr>
<td>4</td>
<td>K9346WB</td>
<td>1</td>
<td>Filter Assy</td>
</tr>
<tr>
<td>5</td>
<td>K9346WM</td>
<td>1</td>
<td>Filter Element (active carbon filter: 5 packs)</td>
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<td>6</td>
<td>E7050AC</td>
<td>1</td>
<td>Valve</td>
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<tr>
<td>7</td>
<td>A1109EF</td>
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<td>Fuse</td>
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K9424JC NEEDLE VALVE ASSY

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<tr>
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<tbody>
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<td>1</td>
<td>Needle Valve Assy</td>
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<tr>
<td>2</td>
<td>K9424HQ</td>
<td>1</td>
<td>Regulator</td>
</tr>
</tbody>
</table>
Revision Information

- **Title**: Model OX102 Current Limit type Oxygen Analyzer
- **Manual No.**: IM 11M10A01-03E
- **Edition**: 4th Edition
- **Date**: Aug. 2017
- **Remark(s)**: Revised

**4th Edition**
- p. iv, "After-Sales Warranty,": Deleted a part of description.
- p. v, "Notes on Use,": Added the "Notes on Use in Korea."
- p. 4-3 Corrected error statement in (5)
- p. 6-5, Section 6.3, "Configuring Data," Figure 6.4: Added the description of note.
- p. 6-14, Section 6.3, "Configuring Data," Added the note of “6”.
- Ch-8 the table of Trouble Shooting was modified.
- p. A-3, Section 3.1, "Starting Operation,": Changed the description of “1”.

**3rd Edition**
- **Date**: Dec. 2007
- **Remark(s)**: Revised and Corrected over all

**2nd Edition**
- **Date**: Nov. 2005
- **Remark(s)**: Revised Section

- Added caution about requirement for return of equipment to factory for repair.
  - 1.1 Added conditions requiring sampling unit to specification.
  - 3.3 Added sampling unit installation environment conditions.
  - 5.3 Added caution regarding life of sampling unit suction pump.
  - 7 Added caution about requirement for return of equipment to factory for repair.
  - 7.3 Added sampling unit maintenance cautions.
  - 8 Added activated charcoal filter to items to check when troubleshooting.

**Appendix 1**
- Added cautions regarding activated charcoal filter life, operating environment temperature range, membrane filter life, and pump life, and requirement for return of equipment to factory for repair.

**Appendix 4**
- Added cautions regarding maintenance.

**1st Edition**
- **Date**: Dec. 2000
- **Remark(s)**: Newly published