Overview

The ZR22 is a direct insertion (in-situ) type oxygen detector. This detector when inserted through the wall of a flue or furnace allows continuous monitoring of the oxygen concentration of combustion gas via a zirconia cell. Yokogawa offers three (3) types of oxygen detectors: low temperature, high temperature, and pressure compensated. These detectors are subject to harsh environments because they are directly mounted in combustion applications. We recommend utilizing one of the many accessories Yokogawa has available to increase the life of the detector.

-Features

- The built-in heater assembly of the probe can be replaced on site, reducing maintenance costs.
- The probe uses a long-life, high reliability Zirconia sensor
- The probe uses three-reference air supply methods (natural air convection, instrument air, and pressure compensated) in its applications.
- The separate type converter incorporates an LCD touch-screen for ease of operation.
- This converter is used as an oxygen analyzer.
- The integrated type integrates both probe and converter, to reduce wiring, piping, and installation costs. This type of unit uses an optical switch for ease of operation at the site.
- Remote maintenance using digital communications (HART®) reduces maintenance costs.
Basic System Configuration

System configuration Example 1 of Separate type Analyzer

- Automatic calibration system uses clean, dry 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 large boilers and in heating furnaces, and the like.

System configuration Example 1 of Integrated type Analyzer

- For an integrated type as shown in the figure above.
- Applications: Oxygen concentration monitoring and control of packaged boilers, on-board ship boilers, and heating furnaces.

Note:
The installation ambient temperature limits range for integrated type analyzer is -20 to 55 °C.

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

*2 Select the desired probe from the Probe Configuration table on page 4.

*3 When a zirconia oxygen analyzer is used, 100% N₂ gas cannot be used as the zero gas. Use approx. 1 vol% O₂ gas (N₂-balanced).
## STANDARD SPECIFICATIONS

### Process gas temperature 0 to 700°C

<table>
<thead>
<tr>
<th>Mounting</th>
<th>Insertion length</th>
<th>General-use Probe</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horizontal to vertical</td>
<td>0.4 to 2 m</td>
<td>Detector (ZR22G or ZR202G)</td>
<td>Boiler heating furnace</td>
</tr>
<tr>
<td>Vertical</td>
<td>2.5 m or more</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Horizontal to vertical</td>
<td>3 m or less</td>
<td>Probe Protector (ZR22R)</td>
<td>For pulverized coal boiler with gas flow velocity 10 m/s or more</td>
</tr>
<tr>
<td>Horizontal to vertical</td>
<td>0.4 to 2 m</td>
<td>Dust filter for Oxygen Analyzer (E7042UQ)</td>
<td>Black liquid recovery boiler</td>
</tr>
<tr>
<td>Vertical</td>
<td>2.5 m or more</td>
<td></td>
<td>Cement Kiln</td>
</tr>
</tbody>
</table>

### Process gas temperature 0 to 1800°C

<table>
<thead>
<tr>
<th>Mounting</th>
<th>Insertion length</th>
<th>General-use Probe</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horizontal to vertical</td>
<td>0.4 to 2 m</td>
<td>Detector (ZR22G or ZR202G)</td>
<td>Heating furnace</td>
</tr>
<tr>
<td>Vertical</td>
<td>2.5 m or more</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Horizontal to vertical</td>
<td>3 m or less</td>
<td>Probe Protector (ZR22R)</td>
<td>Black liquid recovery boiler</td>
</tr>
<tr>
<td>Vertical</td>
<td>2.5 m or more</td>
<td></td>
<td>Cement Kiln</td>
</tr>
</tbody>
</table>

### Drift: Both zero and span ±2% Maximum value of set range/month

### Response Time: Response of 90% within 5 seconds.
(Measured after gas is introduced from calibration gas inlet and analog output starts changing.)

### Application Example

#### Separate and integrated type Zirconia Oxygen Analyzers

- Large, medium and small boilers (boilers for power generation: heavy oil, gas or coal)
- Various industrial furnaces (refinery process/iron manufacture heating furnace, coal kiln, and black liquid recovery boilers)

For other applications, contact Yokogawa Electric Corporation.

### General Specifications

#### Oxygen Analyzer System

- Measurement: Oxygen concentration in combustion exhaust gas and mixed gas (excluding flammable gases).
- Measurement System: Zirconia system
- Oxygen Concentration: 0.01 to 100 vol% O₂
- Output Signal: 4 to 20 mA DC (maximum load resistance 550Ω)
- Measurement Range: Any setting in the range of 0 to 5 through 0 to 100 vol% O₂
- Digital Communication (HART®): 250 to 550Ω, depending on number of field devices connected to the loop (multi-drop mode).
- Display Range: 0 to 100 vol% O₂
- Warm-up Time: Approx. 20 min.
- Repeatability: ±0.5% Maximum value of set range.
- Linearity: (Excluding standard gas tolerance) ±1% Maximum value of set range.

#### Oxygen Analyzer

- Sample Gas Temperature: 0 to 700°C (Probe only); 700 to 1800°C (with High Temperature Probe Adapter)
- Sample Gas Pressure: -0.725 to +36.3 psi (+0.725 to +36.3 requires pressure compensation.)
- Probe Length: 0.15, 0.4, 0.7, 1.0, 1.5, 2.0, 2.5, 3.0, 3.6, 4.2, 4.8, 5.4m
- Probe Material: SUS 316 (JIS)
- Ambient Temperature: -20 to +150°C (-4 to 302°F)
- Reference Air System: Natural Convection, Instrument Air, or pressure compensated
- Instrument Air System: Pressure; 29psi + the pressure inside the furnace (It is recommended to use clean, dry plant air.)
- Consumption; Approx. 1LPM
- Wetted Material: SUS 316 (JIS), Zirconia, SUS 304 (JIS) (flange), Hastelloy B, (Inconel 600, 601),...
The built-in heater assembly of the probe can be replaced.

- Features

environments because they are directly mounted in

The ZR22 is a direct insertion (in-situ) type oxygen

Overview

Specifications

- The probe uses three-reference air supply methods

- The separate type converter incorporates an LCD touch-

(compensated) in its applications.

- Natural air convection, instrument air, and pressure

exhaust gas and mixed gas (excluding

Model ZR22G, ZR402G, and ZR202G

Yokogawa Corporation of America

General Specifications

- Large, medium and small boilers (boilers for power

- Separate and integrated type Zirconia Oxygen Analyzers

Application Example

STANDARD SPECIFICATIONS

Oxygen Analyzer System

• Large, medium and small boilers (boilers for power

• Separate and integrated type Zirconia Oxygen Analyzers

- The integrated type integrates both probe and converter, to

This converter is used as an oxygen analyzer.

- The separate type converter incorporates an LCD touch-

unit uses an optical switch for ease of operation at the site.

- Separate and integrated type Zirconia Oxygen

2. ZR402G Separate type Zirconia Oxygen Analyzer, Converter

Operated using an LCD touchscreen on the converter.

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

Output Signal: 4 to 20 mA DC, two points (maximum load resistance 550Ω)

Contact Output Signal: four points (one is fail-safe, normally open)

Contact Input: two points

Auto-calibration Output: Two points (for dedicated auto-calibration unit)

Ambient Temperature: -20 to +55°C

Storage Temperature: -30 to +70°C

Ambient Humidity: 0 to 95 %RH (non-condensing)

Installation Altitude: 2000 m or less

Category based on IEC 1010: II (Note)

Pollution degree based on IEC 1010: 2 (Note)

Note: Installation category, called over-voltage category, specifies impulse withstand voltage. Category II is for electrical equipment. Pollution degree indicates the degree of existence of solid, liquid, gas or other inclusions which may reduce dielectric strength. Degree 2 is the normal indoor environment.

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; 45 to 66 Hz

Power Consumption: Max. 300 W, approx. 100 W for ordinary use.

Safety and EMC conforming standards

Safety: Conforms to EN 61010-1: 1993

CSA C22.2 No.61010-1 certified

UL 3111-1 certified

EMC: Conforms to EN 61326: 1998

Maximum Distance between Probe and Converter:

Conductor two-way resistance must be 10Ω or less (when a 1.25 mm2 cable or equivalent is used, 300 m or less.)

Construction: Outdoor installation, NEMA4X/IP66 or equivalent (with conduit holes completely sealed with a plastic cable gland optional)

Wiring Connection: G1/2, Pg13.5, M20 by 1.5mm, 1/2 NPT, eight holes

Installation: Panel, wall or pipe mounting

Case: Aluminum alloy

Paint Color: Door; Silver gray (Munsell 3.2PB7.4/1.2)

- Case; Silver gray (Munsell 3.2PB7.4/1.2)

Finish: Polyurethane corrosion-resistance coating

Weight: Approx. 6 kg

Functions

Display Functions:

- Value Display; Displays values of the measured oxygen concentration

- Graph Display; Displays trends of measured oxygen concentration

- 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 with flashing of the corresponding icon. Indicates status such as warming-up, calibrating, or the like by icons.

- Alarm, Error Display; Displays alarms such as “Abnormal oxygen concentration” or errors such as “Abnormal cell e.m.f.” when any such status occurs.

Calibration Functions:

- Auto-Calibration; Requires the Auto-calibration Unit. It calibrates automatically at specified intervals.

- Semi-auto Calibration; Requires the Auto-calibration Unit. 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.

- Blowback Function; Output through the contact in the set period and time. Auto/semi-auto selectable.

- Maintenance Functions;

Can operate updated data settings in daily operation and checking. Display data settings,
calibration data settings, blowback data settings, current output loop check, input/output contact check.

Setup Functions:
- Equipment settings, current output data settings, alarm data settings, contact data settings, other settings.

Self-diagnosis:
- This function diagnoses conditions of the converter or the probe and indicates when any abnormal condition occurs.

Password Functions:
- Enter your password to operate the analyzer excepting data display. Individual passwords can be set for maintenance and setup.

Display and Setting Content:
- Measuring Related items: Oxygen concentration (vol% O2), output current value (mA), air ration, moisture quantity (in hot gases) (vol% H2O)
- Display Items: Cell temperature (°C), thermocouple reference junction temperature (°C), maximum/minimum/average oxygen concentration (vol% O2), cell e.m.f. (mV), cell resistance (Ω), cell condition (in four grades), heater on-time rate (%), calibration record (ten times), time (year/month/day/hour/minute)
- Calibration Setting Items: Span gas concentration (vol% O2), zero gas concentration (vol% O2), calibration mode (auto, semi-auto, manual), calibration type and method (zero-span calibration, zero calibration only, span calibration only), stabilization time (min.sec), calibration time (min.sec), calibration period (day/hour), starting time (year/month/day/hour/minute)
- Equipment Related Items: Measuring gas selection Output Related Items: Analog output/output mode selection, output conditions when warming-up/maintenance/calibrating (during blowback)/abnormal, 4 mA/20 mA point oxygen concentration (vol% O2), time constant, preset values when warming-up/maintenance/calibrating (during blowback)/abnormal, output preset values on abnormal
- Alarm Related Items: Oxygen concentration high-alarm/high-high alarm limit values (vol% O2), oxygen concentration low-alarm/low-low alarm limit values (vol% O2), oxygen concentration alarm hysteresis (vol% O2), oxygen concentration alarm detection, alarm delay (seconds)
- Contact Related Items: Selection of contact input 1 and 2, selection of contact output 1 to 4 (abnormal, high-high alarm, high-alarm, low-alarm, low-low alarm, maintenance, calibrating, range switching, warming-up, calibration-gas pressure decrease, temperature high-alarm, blowback, flameout gas detection)
- Converter Output: Two points mA analog output (4 to 20 mA DC) (maximum load resistance of 550Ω) and one mA digital output point (HART®) (minimum load resistance of 250Ω).

Range: any setting between 0 to 5 through 0 to 100 vol% O2 in 1 vol% O2, or partial range is available (Maximum range value/minimum range value 1.3 or more)
- For the log output, the minimum range value is fixed at 0.1 vol% O2.
- 4 to 20 mA DC linear or log can be selected.

Input/output isolation
- Output damping: 0 to 255 seconds.
- Hold/non-hold selection, preset value setting possible with hold.

Contact Output: Four points, contact capacity 30 V DC 3 A, 250 V AC 3 A (resistive load).
- Three of the output points can be selected to either normally energized or normally de-energized status.
- Delayed functions (0 to 255 seconds) and hysteresis function (0 to 9.9 vol%O2 can be added to high/low-alarms.
- The following functions are programmable for contact outputs:

Contact Input: Two points, voltage-free contacts
- The following functions are programmable for contact inputs:
  1. Calibration-gas pressure decrease alarm, 2. Range switching - fixed range if use range switching (3) External calibration start, (4) Process alarm (if this signal is received, the heater power turns off), (5) Blowback start

Contact capacity: Off-state leakage current: 3 mA or less

Self-diagnosis: Abnormal cell, abnormal cell temperature (low/high), abnormal calibration, defective A/D converter, defective digital circuit

Calibration:
- Method: zero/span calibration
- Calibration mode: automatic, semi-automatic and manual (All are operated interactively with an LCD touchscreen). Either zero or span can be skipped.
- Zero calibration-gas concentration setting range: 0.3 to 100 vol% O2 (0.01 vol% O2 in smallest units).
- Span calibration-gas concentration setting range: 4.5 to 100 vol% O2 (0.01 vol% O2 in smallest units).
- Use nitrogen-balanced mixed gas containing 10 vol% O2 scale of oxygen and 80 to 100 vol% O2 scale of oxygen for standard zero-gas, and standard span-gas respectively.
- Calibration period: date/time setting: maximum 255 days
3. ZR202G Integrated type Zirconia Oxygen Analyzer

Oxygen Analyzer
Display: 6-digit LCD
Switch: Three optical switches
Output Signal: 4 to 20 mA DC, one point (maximum load resistance 550Ω)
Digital Communication (HART®): 250 to 550Ω, depending on quantity of field devices connected to the loop (multi-drop mode).
Contact Output Signal: Two points (one is fail-safe, normally open)
Contact Input Signal: Two points
Sample Gas Temperature: 0 to 700°C
High temperature service—greater than 700°C is not available.
Sample Gas Pressure: -0.725 to 36.3 psi
(+0.725 to +36.3 requires pressure compensation.)
Probe Length: 0.4, 0.7, 1.0, 1.5, 2.0, 2.5, 3.0m
Probe Material: SUS 316 (JIS)
Ambient Temperature: -20 to +55°C (-5 to +70°C on the case surface)
Storage Temperature: -30 to +70°C
Ambient Humidity: 0 to 95% RH (non-condensing)
Installation Altitude: 2000 m or less
Category based on IEC 1010: II (Note)
Polution degree based on IEC 1010: 2 (Note)
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; 45 to 66 Hz
Power Consumption: Max. 300 W, approx. 100 W for ordinary use.

Safety and EMC conforming standards
Safety: Conforms to EN 61010-1: 1993
CSA C22.2 No.1010-1 certified
UL 3111-1 certified
EMC: Conforms to EN 61326: 1998
Reference Air System: Instrument air, or pressure compensated

Instrument Air System (excluding Natural Convection):
Pressure; 29 psi + the pressure inside the furnace. (It is recommended to use clean, dry plant air.)
Consumption; Approx. 1NL/min
Material in Contact with Gas: SUS 316 (JIS), Zirconia, SUS 304 (JIS) (flange), Hastelloy B, (Inconel 600, 601)
Equivalent to NEMA 4X/IP66 (recirculation to furnace with pressure compensations only)
Gas Connection: 1/4 FNPT
Wiring Connection: 1/2 NPT select one type (4 pieces)
Installation: Flange mounting
Case: Aluminum alloy
Paint Color: Cover; mint green (Munsell 5.6BG3.3/2.9)
Case: mint green (Munsell 5.6BG3.3/2.9)
Finish: Polyurethane corrosion-resistance coating

Weight:
Insertion length of 0.4 m: approx. 8 kg (JIS 5K-65) / approx. 13 kg (ANSI 150-4)
Insertion length of 1.0 m: approx. 10 kg (JIS 5K-65) / approx. 15 kg (ANSI 150-4)
Insertion length of 1.5 m: approx. 12 kg (JIS 5K-65) / approx. 17 kg (ANSI 150-4)
Insertion length of 2.0 m: approx. 14 kg (JIS 5K-65) / approx. 19 kg (ANSI 150-4)
Insertion length of 3.0 m: approx. 17 kg (JIS 5K-65) / approx. 22 kg (ANSI 150-4)

Functions
Display Function: Displays values of the measured oxygen concentration, etc.
Alarm, Error Display: Displays alarms such as “AL-06” or errors such as “Err-01” when any such status occurs.

Calibration Functions:
Auto-calibration: Requires the auto-calibration Unit. It calibrates automatically at specified intervals.
Semi-auto Calibration: Requires the auto-calibration unit. Input calibration start signal by optical switch or contact, then it calibrates automatically afterwards.
Manual Calibration: Calibration with opening/closing the valve of calibration gas in operation interactively with the optical switch.

Maintenance Functions:
Can operate updated data settings in daily operation and checking. Display data settings, calibration data settings, test settings (current output loop check, input/output contact check).

Setup Functions:
Initial settings suit for the plant conditions when installing the converter. Current output data settings, alarm data settings, contact data settings, other settings.

Display and setting content:
Display Related Items: Oxygen concentration (vol% O₂), Output current value (mA), air ratio, moisture quantity (in hot gases) (vol% H₂O), Cell temperature (°C), thermocouple reference junction temperature (°C), maximum/minimum/average oxygen concentration (vol% O₂), cell e.m.f. (mV), cell internal resistance (Ω), cell condition (in four grades), heater on-time rate (%), calibration record (ten times), time (year/month/day/hour/minute)

Calibration Setting Items: Span gas concentration (vol% O₂), zero-gas concentration (vol% O₂), calibration mode (auto, semi-auto, manual), calibration type and method (zero-span calibration, zero calibration only, span calibration only), stabilization time (min.sec), calibration time (min.sec), calibration period (day/hour), starting time (year/month/day/hour/minute)
Output Related Items: Analog output/output mode selection, output conditions when warming-up/maintenance/calibrating/abnormal, 4 mA/ 20 mA point oxygen concentration (vol% O₂), time constant, preset values when warming-up/maintenance/calibrating/abnormal, output preset values on abnormal

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

Contact Related Items: Selection of contact input 1 and 2, selection of contact output 1 and 2 (abnormal, high-high alarm, high-alarm, low-low alarm, low-alarm, maintenance, monitoring, range switching, warming-up, calibration-gas pressure decrease, flameout gas detection (answer back of contact input)

Converter Output: One mA analog output point (4 to 20 mA DC (maximum load resistance of 550 Ω) with mA digital output point (HART®) (minimum load resistance of 250 Ω). Range: any setting between 0 to 5 through 0 to 100 vol% O₂, and partial range is available (Maximum range value/minimum range value 1.3 or more)

For the log output, the minimum range values are fixed at 0.1 vol% O₂, 4 to 20 mA DC linear or log can be selected. Input/output isolation Output damping: 0 to 255 seconds. Hold/non-hold selection, preset value setting possible with hold.

Contact Output: Two points, contact capacity 30 V DC 3 A, 250 V AC 3 A (resistive load)

One of the output points can be selected to either normally energized or normally de-energized status.

Delayed functions (0 to 255 seconds) and hysteresis function (0 to 9.9 vol% O₂) can be added to high/low-alarms.

The following functions are programmable for contact outputs.


Contact Input: Two points, voltage-free contacts

The following functions are programmable for contact inputs:

(1) Calibration-gas pressure decrease alarm, (2) Range switching - fixed ranges if use range switching, (3) External calibration start, (4) Process alarm (if this signal is received, the heater power turns off)

Self-diagnosis: Abnormal cell, abnormal cell temperature (low/high), abnormal calibration, A/D converter abnormal, digital circuit abnormal

Calibration: Method; zero/span calibration

Calibration mode; automatic, semi-automatic and manual (All are operated using optical switches). Either zero or span can be skipped.

Zero-calibration gas concentration setting range: 0.3 to 100 vol% O₂ (in 0.01 vol% O₂).

Span-calibration gas concentration setting range: 4.5 to 100 vol% O₂ (in 0.01 vol% O₂).

Use nitrogen-balanced mixed gas containing 10 vol% O₂ scale of oxygen for standard zero-gas, and 80 to 100 vol% O₂ scale of oxygen for standard span-gas.

Calibration period; date/time setting: maximum 255 days

Input/output isolation

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

Model and Suffix Codes

1. Separate type Zirconia Oxygen Converter

<table>
<thead>
<tr>
<th>Model</th>
<th>ZR402Z-T-E-E-A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Options</td>
<td>Zirconia Oxygen Humidity Analyzer Converter</td>
</tr>
<tr>
<td>/HS</td>
<td>Preset for Humidity Measurement</td>
</tr>
<tr>
<td>/H</td>
<td>Hood</td>
</tr>
<tr>
<td>/SCT</td>
<td>Stainless Steel Tag Plate</td>
</tr>
<tr>
<td>IM 11M12A01-02E</td>
<td>Instruction Manual ZR402</td>
</tr>
</tbody>
</table>

Note: When the ZR22 is used with existing older model converters, ZA8C, AV8C and HA400, ROM replacement and addition of a cold junction temperature compensation board are required. These ROMs are included when the /ZA, /AV, or /HA options indicated in the ZR22G model code.

<table>
<thead>
<tr>
<th>Model</th>
<th>Language</th>
<th>English</th>
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<tbody>
<tr>
<td>ZA8C</td>
<td>M1234FH-A</td>
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</tr>
<tr>
<td>HA400 (kg)</td>
<td>M1234FM-A</td>
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<tr>
<td>HA400 (%)</td>
<td>M1234FK-A</td>
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<tr>
<td>AV8C</td>
<td>M1234FF-A</td>
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2. Separate type Zirconia Oxygen / High Temperature Humidity Analyzer, Detectors

**Model ZR22G ZIRCONIA OXYGEN DETECTOR**

<table>
<thead>
<tr>
<th>Code</th>
<th>Model Description</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZR22G</td>
<td>Zirconia Oxygen/Humidity Analyzer Detector</td>
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<tr>
<td>-015</td>
<td>0.15 meter for use w/ZR22P high temp adapter</td>
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<tr>
<td>-040</td>
<td>0.4 meter</td>
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</tr>
<tr>
<td>-070</td>
<td>0.7 meter</td>
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<td>-100</td>
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<td>-150</td>
<td>1.5 meter</td>
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<td>-200</td>
<td>2 meter</td>
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<tr>
<td>-250</td>
<td>2.5 meter</td>
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<td>-300</td>
<td>3 meter</td>
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<td>-360</td>
<td>3.6 meter</td>
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<td>-420</td>
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<td>-480</td>
<td>4.8 meter</td>
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<tr>
<td>-540</td>
<td>5.4 meter</td>
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<table>
<thead>
<tr>
<th>Wetted Material</th>
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<tbody>
<tr>
<td>-S</td>
<td>Stainless Steel</td>
</tr>
<tr>
<td>-C</td>
<td>Stainless Steel with Inconel cal gas tube</td>
</tr>
<tr>
<td>-A</td>
<td>ANSI CLASS 150-2-RF (equivalent) flange</td>
</tr>
<tr>
<td>-C</td>
<td>ANSI CLASS 150-4-RF (equivalent) flange</td>
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<tr>
<td>-O</td>
<td>JIS SK32A (for high temp probe adapter) ZR22P flange</td>
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<tr>
<td>-W</td>
<td>Westinghouse flange</td>
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<table>
<thead>
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<th>Reference Air</th>
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<tbody>
<tr>
<td>-E</td>
<td>External connection</td>
</tr>
<tr>
<td>-P</td>
<td>Pressure compensation (for applications above 20° H20)</td>
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</table>

<table>
<thead>
<tr>
<th>Gas Thread</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>-T</td>
<td>1/4 inch NPT</td>
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<table>
<thead>
<tr>
<th>Connection Box Thread</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>-T-E-A</td>
<td>NPT (1/2NPT)</td>
</tr>
<tr>
<td>-Q-E-A</td>
<td>Quick connect for cables (must select /Q on cables)</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Options</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>/IAC24</td>
<td>Integral auto-calibration unit mounted for indoor installations</td>
</tr>
<tr>
<td>/ZA</td>
<td>For detector use with ZA8C</td>
</tr>
<tr>
<td>/AV</td>
<td>For detector use with AV8C</td>
</tr>
<tr>
<td>/HA</td>
<td>For detector use with HA400</td>
</tr>
<tr>
<td>/D</td>
<td>Derezane coating for high sulfur applications</td>
</tr>
<tr>
<td>/C</td>
<td>Inconel bolt, Oiring</td>
</tr>
<tr>
<td>/CV</td>
<td>Check valve</td>
</tr>
<tr>
<td>/SCT</td>
<td>Stainless steel tag plate</td>
</tr>
<tr>
<td>/PT</td>
<td>Printed tag</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Spare Parts - ZR22</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>E7042UQ</td>
<td>Universal cell assembly kit (for ZO21D/ZR22/ZR202)</td>
</tr>
<tr>
<td>M123FF-A</td>
<td>AV8C single channel conversion kit (for one probe)</td>
</tr>
<tr>
<td>M123FF-A</td>
<td>AV8C single channel conversion kit</td>
</tr>
<tr>
<td>M1234FM-A</td>
<td>HA400-A conversion kit (kg)</td>
</tr>
<tr>
<td>M1234FK-A</td>
<td>HA400-V conversion kit (vol%)</td>
</tr>
<tr>
<td>K9470BG</td>
<td>Dust filter for oil/gas applications</td>
</tr>
</tbody>
</table>

**Note 1:** The 4" ANSI Flange (-C) is suggested for probe lengths of 3m or greater.

**Note 2:** Derezane coating is recommended for any application up to 250°F (120°C) when elements corrosive to the detector may be present, such as those found in chemical incinerators.

**Note 3:** The check valve is recommended for use on the calibration gas port for positive pressure applications to prevent contamination of the calibration line during operation.

**Note 4:** ZR22 probe requires a conversion kit if used with AV8C/HA400/ZA8C analyzers. The ZR22 detector uses a PT1000 temperature sensor instead of a transistor type cold junction.
3. Integrated type Zirconia Oxygen / High Temperature Humidity Analyzer, Converter

Model ZR202G INTEGRAL TYPE OXYGEN ANALYZER/DETECTOR

<table>
<thead>
<tr>
<th>Code</th>
<th>Model Description</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZR202G</td>
<td>Integral type Zirconia Oxygen Humidity Analyzer</td>
<td></td>
</tr>
<tr>
<td>-040</td>
<td>0.4 meter</td>
<td></td>
</tr>
<tr>
<td>-070</td>
<td>0.7 meter</td>
<td></td>
</tr>
<tr>
<td>-100</td>
<td>1 meter</td>
<td></td>
</tr>
<tr>
<td>-150</td>
<td>1.5 meter</td>
<td></td>
</tr>
<tr>
<td>-200</td>
<td>2 meter</td>
<td></td>
</tr>
<tr>
<td>-250</td>
<td>2.5 meter</td>
<td></td>
</tr>
<tr>
<td>-300</td>
<td>3 meter</td>
<td></td>
</tr>
<tr>
<td>-S</td>
<td>Stainless Steel</td>
<td></td>
</tr>
<tr>
<td>-C</td>
<td>Stainless Steel with inconel cal gas tube</td>
<td></td>
</tr>
<tr>
<td>-A</td>
<td>ANSI CLASS 150-2-RF (equivalent) flange</td>
<td></td>
</tr>
<tr>
<td>-B</td>
<td>ANSI CLASS 150-3-RF (equivalent) flange</td>
<td></td>
</tr>
<tr>
<td>-C</td>
<td>ANSI CLASS 150-4-RF (equivalent) flange</td>
<td></td>
</tr>
<tr>
<td>-W</td>
<td>Westinghouse flange</td>
<td></td>
</tr>
<tr>
<td>-N</td>
<td>No auto-calibration unit mounted (see /IAC24 option below)</td>
<td></td>
</tr>
<tr>
<td>-E</td>
<td>External connection</td>
<td></td>
</tr>
<tr>
<td>-P</td>
<td>Pressure connection (for applications above 20&quot; H2O)</td>
<td></td>
</tr>
<tr>
<td>-T</td>
<td>1/4 inch NPT</td>
<td></td>
</tr>
<tr>
<td>-T</td>
<td>NPT (1/2NPT)</td>
<td></td>
</tr>
<tr>
<td>-E</td>
<td>English</td>
<td></td>
</tr>
<tr>
<td>-A</td>
<td>Always -A</td>
<td></td>
</tr>
<tr>
<td>/IAC24</td>
<td>Integral auto-calibration unit mounted for indoor installations</td>
<td>2</td>
</tr>
<tr>
<td>/D</td>
<td>Derakane coating for high sulfur applications</td>
<td>3</td>
</tr>
<tr>
<td>/C</td>
<td>Inconel bolt, Oring</td>
<td></td>
</tr>
<tr>
<td>/CV</td>
<td>Check valve</td>
<td></td>
</tr>
<tr>
<td>/H</td>
<td>Hood</td>
<td></td>
</tr>
<tr>
<td>/SCT</td>
<td>Stainless steel tag plate</td>
<td></td>
</tr>
<tr>
<td>/PT</td>
<td>Printed tag</td>
<td></td>
</tr>
</tbody>
</table>

**Spare Parts - ZR202**

E7042UD Universal cell assembly kit (for ZO21D, ZR22, ZR202)
M1200DB-06 High temperature fly ash filter for ZR202
M1234SE-A Self-cleaning high temp fly-ash filter

**Note 1:** The 4" ANSI Flange (-C"U) is suggested for probe lengths of 3m or greater.
**Note 2:** Derakane coating is recommended for any application up to 250°F (120°C) when elements corrosive to the detector may be present, such as those found in chemical incinerators.
**Note 3:** The check valve is recommended for use on the calibration gas port for positive pressure applications to prevent contamination of the calibration line during operation. The /CV option is not needed when the auto-calibration unit is mounted.
**Note 4:** M1234-SE-A and M1200DB-06 are not compatible to ZO21D probe. M1200DA-02 cannot be used with ZR22 or ZR202 probes.
4. Probe Protector for Zirconia Detectors

MODEL ZR22R LOW TEMPERATURE PROBE PROTECTOR

HOW TO ORDER:
Specify the model number, add the insertion length, and the flange connections code selection(s) to the model number and total the prices to arrive at list price.

PRODUCT NOTES

PROBE PROTECTOR - This accessory is used when the sample gas flow velocity is approximately 10 m/sec (33 ft/sec) or more and dust particles may attack the probe, such as in the case of coal fired boilers. The probe protector MUST be the same length and flange type as the probe.

The model ZR22R Probe Protectors are required for coal-fired applications, or other applications with particulate laden flue gas, where the gas flow is 10 meters/second or more.

Insertion Length: 1.5 m, 1.55 m, 2.05 m.
Flange: ANSI CLASS 150-4-FF (without serration) equivalent
Material: SUS316 (JIS), SUS304 (JIS) (Flange)
Weight: 1.05 m; Approx. 10 kg
1.55 m; Approx. 13 kg
2.05 m; Approx. 16 kg

5. Probe Support for Zirconia Detectors

MODEL ZR22V LOW TEMPERATURE PROBE SUPPORT

HOW TO ORDER:
Specify the model number, add the insertion length, and the flange connections code selection(s) to the model number and total the prices to arrive at list price.

ZR22V Probe Supports are needed if the detector is 2.5 meter or greater, horizontal installation is required, and no probe protector (ZR22R) is used.
6. Adapter for High Temperature Probe of Separate Type Oxygen Analyzer (for applications above 700°C)

**MODEL ZR22P HIGH TEMPERATURE PROBE ADAPTER**

<table>
<thead>
<tr>
<th>Code</th>
<th>Model Description</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZR22P</td>
<td>High temperature probe adapter</td>
<td></td>
</tr>
</tbody>
</table>

**HOW TO ORDER:**
Specify the model number, add the Tee configuration, transport tube material, insertion length, flange connection and options code selection(s) to the model number and total the prices to arrive at list price.

**ZR22P-H High Temperature Probe Adapter for Separate type Oxygen Analyzer**

Measuring O₂ in the high temperature gases (exceeds 700°C) requires a general-use probe ZR22G of 0.15 m length and a high-temperature probe adapter (model ZR22P).

Sample gas temperature: 0 to 1800°C
Sample gas pressure: -0.725 to 36.3 psi
(+0.725 to +36.3 requires pressure compensation.)

Insertion length: 1 m, 1.5 m
Material in Contact with Gas: SUS 316, Zirconia, SUS 304 (flange)
Probe Material: varies 4 inch ANSI
Installation: Flange mounting
Weight: Insertion length of 1.0 m: approx. 6.5 kg (JIS) / approx. 8.5 kg (ANSI)
Insertion length of 1.5m: approx. 7.5 kg (JIS) / approx. 9.5 kg (ANSI)
7. Integral Auto-calibration unit for ZR22G/ZR202G

MODEL IAC24 INTEGRAL AUTOCAL UNIT

<table>
<thead>
<tr>
<th>Code</th>
<th>Model Description</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>IAC24</td>
<td>Base model for indoor installations</td>
<td></td>
</tr>
<tr>
<td>-22</td>
<td>Autocal for ZR22G</td>
<td>123</td>
</tr>
<tr>
<td>-202</td>
<td>Autocal for ZR202G</td>
<td>1.3</td>
</tr>
<tr>
<td>-E-A</td>
<td>Always -E-A</td>
<td></td>
</tr>
</tbody>
</table>

**HOW TO ORDER:**

**PRODUCT NOTES:**

Note 1: IAC-24-[ ] ambient temperature cannot exceed 70°C.

Note 2: Use cable WZ-H-6H- [] with ZR22G

Note 3: All connections are Swageloc 1/4

Note 4: For indoor installations

Note: Also available pre-mounted when IAC24 option is selected in ZR22G/ZR202G model code. For remote mounted auto-calibration & manual calibration units, please refer to general specifications for model MCI-ACI calibration units (GS11M6AA-01E-A)

![IAC24-22-E-A Diagram](image-url)
• The built-in heater assembly of the probe can be replaced.

- Features
  - The life of the detector.

- General Specifications
  - Compensated. These detectors are subject to harsh environments because they are directly mounted in a flue or furnace allows continuous monitoring of the detector. This detector when inserted through the wall of a flue or furnace allows continuous monitoring of the detector.

  - Level of application: various combustion applications. We recommend utilizing one of these detectors with a ZR22/M or ZR402G, which accept any gas and are designed for in situ installation.

  - Mounting Insertion: The ZR22/2 (ZR402G) is designed for vertical insertion, whereas the ZR22/P (ZR402G) is designed for horizontal insertion. The ZR22 is a direct insertion (in-situ) type oxygen analyzer.

  - The SE-200GZ is a separate type converter, which incorporates an LCD touch-screen for ease of operation at the site. This converter is used as an oxygen analyzer.

  - The integrated type integrates both probe and converter, to reduce wiring, piping, and installation costs. This type of unit uses an optical switch for ease of operation at the site.

  - Remote maintenance using digital communications (HART®) reduces maintenance costs.

- Application Example
  - Yokogawa offers three (3) types of oxygen detectors: Separate and integrated type Zirconia Oxygen Analyzers (ZR22/M, ZR402G, and ZR202G).

  - Use of three-reference air supply methods compensated (ZR22/M and ZR402G) in its applications.

- General
  - Overview: The probe uses a long-life, high reliability Zirconia sensor.

  - Use of three-reference air supply methods compensated (ZR22/M and ZR402G) in its applications.
2. Model ZR22....-P (with pressure compensated) Separate type Zirconia Oxygen Detector

<table>
<thead>
<tr>
<th>Flange</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>t</th>
<th>PIPING</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANSI CLASS150-2-RF equivalent</td>
<td>152.4</td>
<td>120.6</td>
<td>4 - Ø19</td>
<td>19</td>
<td>A</td>
</tr>
<tr>
<td>ANSI CLASS150-3-RF equivalent</td>
<td>190.5</td>
<td>152.4</td>
<td>4 - Ø19</td>
<td>24</td>
<td>B</td>
</tr>
<tr>
<td>ANSI CLASS150-4-RF equivalent</td>
<td>228.6</td>
<td>190.5</td>
<td>8 - Ø19</td>
<td>24</td>
<td>B</td>
</tr>
<tr>
<td>Westinghouse</td>
<td>155</td>
<td>127</td>
<td>4 - Ø11.5</td>
<td>14</td>
<td>A</td>
</tr>
</tbody>
</table>

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GS 11M12A01-01E-A

3. Model ZR402G Separate type Zirconia Oxygen Converter

- With sun shield hood (option code /H)
4. Model ZR202G Separate type Zirconia Oxygen Analyzer

- With sun shield hood (option code /H)

Material of HOOD : Aluminum
5. Model ZR202G...-P (with pressure compensated) Integrated type Zirconia Oxygen Analyzer
6. Model ZR22P Adapter for High Temperature Probe of Separate type Oxygen Analyzer

7. ZR22R Probe Protector for Zirconia Oxygen Analyzer

8. ZR22V Probe Support
1. Filter for Oxygen Analyzer E7042UQ
This filter is used to protect the cell from corrosive dust components in natural gas or oil applications. Measured gas flow rate is needed to be 1m/sec or more to replace gas inside zirconia sensor.
- Mesh: 30 microns
- Material: Carborundum (Filter), SUS316 (JIS)
- Weight: Approx. 0.2kg

2. M1234SE-A Self Cleaning Fly-Ash Filter
This uniquely designed filter protects the Zirconia sensor in harsh coal-fired applications. The design prevents accumulation of fly-ash that would clog other fly-ash filters.
- Filter material: Hastaloy X
- Base Material: STTL 316
- Max OD: 6.35cm (2.5 in)
- Filter surface area: 296 sq-cm (46 sq-in)
- Max opera. temp.: 700°C (1292°F)
- Pore size: 10 micron

3. M1200DB-06 Hastelloy X Sintered Filter Assembly
This filter addresses blockage and coating problems experienced by tough applications.
- Mesh: 10 microns (filter)
- Material: Hastelloy X
- Maximum Temperature Rating: 1292°F (700°C)
- Connection: Stainless Steel c-clamp with bolts
- Weight: Approximately 18 lb (.8kg)

4. M1234VV-A Check Valve (/ CV option)
The check valve prevents the water vapor in the process from diffusing down the calibration line where it may condense and cause the cell to crack. A check valve should be used on all natural gas and positive pressure applications and any time a cal line is installed with long periods (>3 months) of time time between calibrations.
- Connection: 1/4 FNPT inlet; 1/4" MNPT outlet
- Material: 304SS
- Cracking Pressure: 1 psi
- Weight: Approximately 0.1lb (50g)
Note: The check valve is not a substitution for an inline filter for removing moisture from instrument air source.

5. Auxiliary Eductor Assembly, Model No. M1132KE
High temperature installations require the use of the auxiliary eductor assembly in all negative pressure installations. using instrument air, the auxiliary eductor draws a sample through the adapter tee for quick measurement without mechanical assistance. The assembly includes an eductor, regulator and pressure gauge and is included in the eductor option for the ZR22P high temperature adapter tee.
Note: Positive pressure requires the use of a needle valve to restrict the flow of sample gas.
6. Eductor, Model No. M1132KA (spare)
The ejector induces flow of the sample from the process through the transport tube. The draft causes the sample flow from the process to pulled through a high temperature adapter tee (i.e. transport tube).

Material: 316SS
Air Supply: 1/8" NPT female
Exhaust: 1/8" NPT male straight
Vacuum Force: 7.6" Hg
Vacuum Flow: 2.4 SCFM
Air Consumption: 1.7 SCFM
Weight: 6oz (170g)
Vacuum: 1/8" NPT male

7. Pressure Regulator, Model no. M1132KD (spare)
This general purpose regulator is used to adjust the flow of instrument air entering the eductor. Made of durable materials and corrosion resistant construction, it provides reliable operation in harsh industrial environments.
Flow Capacity: 20SCFM (33.6 m³/hr) at 100psig (700 kPa) supply - 20 psig (140 kPa) outlet.
Exhaust Capacity: 0.1 SCFM (0.17 m³/hr) - downstream pressure 5 psig (35 kPa) above setpoint.
Sensitivity: 1” (2.5 cm) of water
Effect of Supply Pressure Variation: Less than 0.2 psig (1.4 kPa) for 25 ps (170 kPa) change.
Maximum Supply Pressure: 250 psig (1700 kPa)
Air Consumption: Less than 6 SCFH (0.17 m³/hr)
Output Range: 0 to 60 psi (0 to 400 kPa)
Port Size: 1/4" NPT
Materials: Body - Die cast aluminum alloy; Diaphragm - Nitrile elastomer and nylon fabric; Trim - Brass, zinc plated steel, acetal.
Weight: 4.0lb (1.8kg)

8. Pressure Gauge, Model no. M1132ME
Indicates the pressure of instrument air flowing into the eductor.
Gauge size: 2”
Measure range: 0 to 60 psi (0 to 400 kPa)
Connection: 1/4” FNPT
Weight: 0.5 lb (0.2 kg)
The built-in heater assembly of the probe can be replaced.

Features
- Increases the life of the detector.

The many accessories Yokogawa has available to increase low temperature, high temperature, and pressure cell. Yokogawa offers three (3) types of oxygen detectors:

1. Zirconia oxygen concentration of combustion gas via a zirconia for combustion applications. We recommend utilizing one of.

Overview

General

- The probe uses a long-life, high reliability Zirconia sensor.
- The probe uses three-reference air supply methods.

Remote maintenance using digital communications reduces wiring, piping, and installation costs. This type of remote maintenance is useful in applications that require sufficient heating and cooling, such as natural air convection, instrument air, and pressure recovery boilers.

Oxygen Analyzer System

For other applications, contact Yokogawa Electric Corporation.

General Specifications

- Various industrial furnaces (refinery process/iron manufacture heating furnace, coal kiln, and black liquid recovery boilers)
- Large, medium and small boilers (boilers for power generation: heavy oil, gas or coal)

Application Example

Oxygen Analyzer

- Dust filter for (E7042UQ)) □

Separate and integrated type Zirconia Oxygen Analyzers

- Model ZR402G Separate type Zirconia Oxygen Analyzer Converter
- Model ZR22G Separate type Zirconia Oxygen Detector
- Model ZR202G Integrated type Zirconia Oxygen Analyzer

- Wetted Material: SUS 316 (JIS), Zirconia, SUS 304
- Instrument Air System: Pressure; 29psi + the pressure
- Reference Air System: Natural Convection, Instrument
- Sample Gas Temperature: 0 to 700°C (Probe only); 700 to 1800°C (with High Temperature Probe)
- Sample Gas Pressure: -0.725 to +36.3 psi
- Process gas temperature 0 to 700

- Analog output 1 4-20 mA DC
- Digital output
- Contact input 1
- Contact output 1
- Contact output 2
- Contact input 2
- Analog output 4-20 mA DC
- Digital output
- Total resistance is 100 ohm or less.
- 
- Contact input 1
- Contact output 1
- Contact output 2
- Contact input 2
- Analog output 4-20 mA DC
- Digital output
- 100 to 240 V AC, 50 or 60 Hz
- *1 Ground resistance is 100 ohm or less.