Dissolved Oxygen Analyzers – Power Plants

Yokogawa Singapore
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Monitoring of Trace level (ppb or $\mu$g/l) dissolved oxygen is very important in boiler feed water / power plant applications.

Yokogawa provides the latest state of art technology for DO analysis

- **Special OPTIFLOW membrane – highly stable**
  - Minimum Detection 1 ppb to saturation
  - Working specs: $0...130^\circ\text{C}$ and max 12 Bar
  - Response time: T98 < 60sec
  - Stabilization time: < 2hrs
  - ATEX certified

- **Smart Transmitter with Digital Communication (HART or FieldBus)**
  - Range: 0-25 to 1999 ppb ($\mu$g/l) or 0-1 to 50 ppm (mg/l) freely config
  - On-line sensor diagnostics
  - Easy to use EXA keypad with LCD display
  - IP65 housing suitable for field (pipe/wall) or panel mounting
  - Freely configurable for Polarographic or Galvanic sensors
  - Automatic Temperature compensation
Dissolved Oxygen (DO2) in Boiler Demin Water

Example 1: 2-wire loop powered installation

Transmitter: DO202G-A-E/U/Q
Sensor: OXYGOLD G 120 (p/n 237395)
Cable: WU10-V-05 (VP cable 5 mts)
Adapter: K1523JB (SS)
Flow fitting: K1598AC (SS)

4..20mA / 24VDC
Dissolved Oxygen (DO2) in Boiler Water

Example 2: 2-wire loop powered installation

4..20mA / 24VDC

Transmitter: DO202G-A-E/U/Q
Sensor: OXYGOLD G 120 (p/n 237395)
Cable: 355110 (VP connector, cable 5 mts)
OR WU10-V-05
Adapter: K1523JA (PP) OR K9148NA (SS)
Flow fitting: FF40-P22 (PP) or FF40-S22 (SS)

Process Water <130 degC / 12 Bar max
Dissolved Oxygen (DO2) in Boiler Water

Example 2: 4-wire (AC) powered installation

Power: 100~240VAC
Output: 1x 4..20mA + 2x contact alarm

Transmitter: DO202G-A-E/U/Q
Distributor: VJ A7-026-AAT0
Sensor: OXYGOLD G 120 (p/n 237395)
Cable: 355110 (VP connector, cable 5 mts)
OR WU10-V-05
Adapter: K1523JA (PP) OR K9148NA (SS)
Flow fitting: FF40-P22 (PP) or FF40-S22 (SS)

Process Water
130 degC / 12 Bar max

Return

Voltage: 4..20mA / 24VDC
Dissolved Oxygen (DO2) in Boiler Water

DO202 Wiring & Setting

**Wiring Polarographic sensor to DO202**
- Temperature sensor: (E&F) to the terminal 11 and 12
- Measuring electrode: cathode (A) connected to terminal 17
- Reference electrode: anode (B) connected to terminal 18
- Overall shield: (S) to terminal 14 if available.
- Place the jumper in the POLAROGRAPHIC position.

**DO202 Setting (before connecting sensor)**
- Service code **01**, set *S.TYPE = 1, *V.POL = 0.675 V, *SENS = 35 nA/ppm
- Service code **22**, *SENS = 35nA/ppm ....or depend on sensor certificate
- Service code **56**, *UNIT = 1 (ppb)
- Fill sensor with 1.5ml Oxylyte G electrolyte
- After (connect) Power ON: wait for approx 2 hrs for sensor to stabilize -before perform Calibration (Air or Zero) or use for measurement

**NOTE:** The readings will be 1999ppb (saturation) in air or if sensor is in normal tap water; switch display (code 56=0) to ppm to read actual ppm in air.

- How to confirm sensitivity of sensor: check certificate > example shows 324nA in Air>
- connect sensor to DO202 power-on & wait 2 hrs>
- leave sensor in air (dry) and check reading on DO202> example reading is 9.2ppm. Calculate sensitivity = 324/9.2= 35.217 nA/ppm

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<table>
<thead>
<tr>
<th>T-11</th>
<th>E</th>
<th>White</th>
</tr>
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<tbody>
<tr>
<td>T-12</td>
<td>F</td>
<td>Green</td>
</tr>
<tr>
<td>T-17</td>
<td>A</td>
<td>Black/ Trans</td>
</tr>
<tr>
<td>T-18</td>
<td>B</td>
<td>Red</td>
</tr>
<tr>
<td>T-14</td>
<td>S</td>
<td>Grn-Yellow</td>
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VP cable
**Dissolved Oxygen (DO2) calibration**

**Air calibration**
This is the most common and easiest way to calibrate the analyzing system. The calibration is done in **AIR.CAL** mode in maintenance level. Move the sensor to a maintenance site and wash off any dirt on the membrane. Lightly wipe off any remaining water from the membrane with a soft tissue. Expose the sensor to the air in an environment where there is no temperature change and no wind (a convenient way to accomplish this environment is to place the sensor in an empty bucket). In this Calibration basically the sensor “current-in-air” is adjusted. The Value of current for each ppb sensor is given in the Certificate supplied along with it.

**Zero check**
A zero value check can be performed in Pure Nitrogen gas. Use the N2 gas purge out air from sensor flow fitting and let the sensor be N2 atmosphere for ~60sec. The display reading should be nearly zero ppb (typically <10ppb or <2% of air value), this confirms that sensor is in good condition with good response time.

If not try to change the Electrolyte in the sensor or check membrane.

**Water calibration**
Move the sensor to a maintenance site and wash off any dirt on the membrane. Lightly wipe off any remaining water from the membrane with a soft tissue. Prepare the necessary equipment and reagents to be used for the span and (if required) zero calibration.

- Equipment for span calibration includes:
  - Beaker or bucket
  - Magnetic stirrer/ agitating the water
  - Demineralized water
  - Air supply pump
  - Glass diffuser to generate small air bubbles

**Note:** It takes 15 to 30 minutes of aeration before it can be assumed that the water is fully saturated with air. Refer IM 12J6C3-02E-E (DO202) for more details.

- Reagent for zero calibration:
  - Sodium sulfite
  - demineralized water

The zero oxygen solution contains 20-30 grams of sodium sulfite per liter.