

40 75 43 – Process Liquid Analytical Measurement (Dissolved Oxygen Analyzers)

DISSOLVED OXYGEN (DO) ANALYSER

PART 1- GENERAL

SUMMARY

A programmable Dissolved Oxygen (DO) Controller/Analyser System shall be supplied for continuous monitoring and/or control of DO in water.

DISSOLVED OXYGEN (DO) ANALYSER

1. Controller/Analyser Requirements

The controller/analyser shall:

- a. Provide continuous, real-time monitoring and control of DO.
- b. Have optional parameters available, including (but not limited to); free chlorine, total chlorine, pH, conductivity, alkalinity and particle counts.
- c. Allow the setup of multiple password-enabled user logins, with access logs available. Logins will have configurable levels of access to system settings.
- d. Provide viewable and downloadable data logs, status logs and service reports.
- e. Have optional automatic cleaning available for the sensor.
- f. Have optional automatic verification of sensor function.
- g. Provide options for the communication of data, statuses and errors to local SCADA systems (or similar).

2. Standards and Certifications

- a. The manufacturer shall provide a controller enclosure rated to IP65/NEMA 4X. Any accompanying enclosures, e.g. for the purpose of expanding the capacity of the controller, shall also be rated to IP65/NEMA 4X.
- b. The sensor shall be rated to IP68/NEMA 6P.
- c. The controller system shall be manufactured in accordance with ISO 9001:2015, in an externally audited quality management system.

SYSTEM FEATURES

1. Control Feature Requirements

The controller will be capable of (either by default or optionally):

- a. Providing dosing outputs in the following operator selectable modes: off, manual, automatic
- b. Dosing via PID (Proportional/Integral/Derivative) algorithms. The controller will be able to provide a percentage output to chemical feed pumps for true PID control via 4-20mA signal and/or relay (digital output) in on/off, pulse width or pulse frequency modes
- c. PID control which will have the following options and/or safety features:
 - i. Dedicated failure mode, where dosing can be set to 'off' or a pre-defined percentage value in the event of an error state
 - ii. Be capable of accepting a site stop signal to cease dosing
 - iii. Be able to limit dosing % output to defined minimum and maximum values
 - iv. Configurable overfeed protection, in the event of a failure of dosing hardware (e.g. blocked injectors, empty chemical tanks and the like)
 - v. Viewable PID diagnostic screen, illustrating the extent to which the elements of the algorithm (proportional/integral/derivative) are contributing to the total percentage output
- d. Dosing via alternatives to PID (e.g. 'Feed Forward Control') when the process is unsuitable for the application of PID control
- e. Programmable events can be set via timer (e.g. every 24 hours) or scheduler (e.g. day/week/month)
- f. Providing viewable and downloadable data logs, status logs and service reports on controller operations
- g. When automatic cleaning options have been selected, both cleaning duration and interval can be modified

2. Hardware Requirements

The controller shall be supplied with a dissolved oxygen sensor.

Additionally, the following options/upgrades must be made available:

- a. Mounting/installation products, including:
 - i. Fittings for submersion via steel/plastic poles
 - ii. Mounting brackets for pole mounting/immersion suitable for wall, floor or rail mounting that, once installed, do not require the use of tools to retrieve/maintain the sensor.
 - iii. Automatic cleaning for sensor optics
 - iv. Automatic verification of sensor function
 - v. Discrete air compressor units, to allow for cleaning and/or verification of the sensor in the absence of site supply of pressurized water or air
- b. Additional and/or replacement sensors, to include:
 - i. Free chlorine
 - ii. Total chlorine
 - iii. pH
 - iv. Conductivity
 - v. Particle counts
 - vi. Alkalinity
 - vii. Turbidity
- c. Digital outputs (relays) up to a maximum of 8 per enclosure
- d. Digital inputs up to a maximum of 8 per enclosure
- e. Analogue outputs (4-20mA) up to a maximum of 4 per enclosure
- f. A backboard incorporating both controller/analyser and flow cell assembly

The system should also be expandable, by the addition of extra enclosures (or similar) to increase the capacity of an individual system beyond the limits stated above.

3. Communication Requirements

In addition to the outputs stated above, the controller shall have the followings features available either by default or optionally:

- a. Digital industrial protocols, including; Modbus RS485, Modbus TCP/IP, Profibus DPV.
- b. LAN Ethernet or GPRS connectivity, providing access to an MQTT server system that allows two-way remote communication with the controller/analyser. This communication should include the ability to remotely alter systems settings and download service/access logs, although this feature should be limited by the security/access requirements below.
- c. The controller shall be accessible with a standard Internet browser using a fully interactive graphical interface that can include multiple accounts of varying security and access levels. The controller shall be capable of providing real-time monitoring and control via a personal computer, smartphone, or tablet device. Controllers that require software or apps for communications shall not be considered equal.
- d. The controller shall be capable of e-mail and SMS text alerts upon alarm activation. Controllers without the option of email and text notifications shall not be considered equal.
- e. Online data logging/storage for 30 days or more, with this data being made available for download (in an easily accessible, non-proprietary file format) via Internet browser.
- f. The controller shall include at least two programmable threshold levels and at least two programmable alarm levels for each sensor parameter. Both audible and visible alarms should be provided with the controller/analyser.
- g. The controller shall include at least two programmable threshold levels and at least two programmable alarm levels for each sensor parameter. Both audible and visible alarms should be provided with the controller/analyser.

PART 2- PRODUCTS

SENSORS

1. Sensor Requirements

The sensor for the monitoring of DO shall utilize the following technologies:

- a. Lumiphore technology, which relies upon dynamic luminescence quenching:
 - (a) Emission of blue light, causing corresponding emission of red light from the sensing foil (lumiphore)
 - (b) Detection of red light via an internal photodiode
 - (c) 'Quenching' of the lumiphore, where dissolved oxygen present in the water reduces the emission of red light
 - (d) The intensity of the red light detected by the photodiode is the principle of measurement
- b. Calibration should be possible without the use of specialized reagents, for example with deionized water.
- c. Optional zero-point calibration with an 'oxygen scavenger' chemical such as sodium sulphite
- d. Sensor will be capable of verifying sensor function automatically

2. Sensor Specifications

Dissolved Oxygen

Range 0 to 50 mg/l concentration; 0 to 500% saturation.

Accuracy $\pm 0.1\text{mg/l}$ (0 to 15 mg/l). $\pm 3\%$ of reading (15 to 30 mg/l). $\pm 15\%$ of reading (30 to 50mg/l)

Resolution, DO 0.01 mg/l

Response time $T_{90} < 65\text{ sec}$ at 25°C

Storage conditions $-5..60^{\circ}\text{C}$

Temperature Range $0..50^{\circ}\text{C}$.

pH Range pH2 - pH10

Salinity Range 0-55ppt

Accuracy, Temp $\pm 0.2^{\circ}\text{C}$ typical

Resolution, Temp 0.01°C

IP rating IP-68 with sensor cap installed

Maximum pressure 7 bar (101 psi) (Maximum)

3. Cleaning Requirements

Automatic cleaning options will be made available for DO sensor with the following features:

- a. The ability to alter both cleaning duration and interval
- b. No additional hardware added to the sensor body, to minimise fouling/ragging
- c. In the case of pressurized air cleaning, the ability to auto-verify sensor function

SENSOR INSTALLATION PRODUCTS

Pole Mounting Kit

The pole mounting kit will:

- a. Have the ability to be installed on:
 - i. Handrail
 - ii. Ground
 - iii. Wall
- b. Allow for the pole to be installed at multiple angles away from the vertical
- c. Once installed, not require the use of any tools (e.g. wrenches, spanners, screwdrivers or hex key) to retrieve the sensor for cleaning and/or maintenance
- d. Come supplied with a suitable bracket/pole rest, to allow for hands-free stowing of a retrieved sensor

WARRANTY

The controller electronics and sensors shall be covered by a standard manufacturer warranty of one (1) year.

PART 3 EXECUTION

Preparation

The system shall be provided pre-mounted onto a backboard, to allow for easy installation onto a suitable wall

Storage temperature should be 0 to 60 degrees Celsius

Contractor will install the transmitter and sensors in strict accordance with the manufacturer's instructions and recommendation, including:

- a. Suitable continual electrical supply (100-240VAC, or 9-36VDC in the case of DC-specified systems)
- b. In the case of pipe insertion, cleaning water supply (for sensor optics cleaning) should be at least 2 bar in excess of the pressure within the pipe

END OF SECTION