

40 75 53 – Process Liquid Analytical Measurement (Turbidity Analysers)

TURBIDITY ANALYSER

PART 1- GENERAL

SUMMARY

A programmable Turbidity Controller/Analyser System shall be supplied for continuous monitoring and/or control of turbidity in water.

TURBIDITY CONTROLLER/ANALYSER

1. Controller/Analyser Requirements

The controller/analyser shall:

- a. Provide continuous, real-time monitoring and control of turbidity.
- 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 both sensor optics and flow cell (if selected).
- f. 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.
- d. The measurement of turbidity shall be compliant with ISO 7027-1:2016

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. Programmable events can be set via timer (e.g. every 24 hours) or scheduler (e.g. day/week/month)
- e. Providing viewable and downloadable data logs, status logs and service reports on controller operations
- f. 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 turbidity sensor.

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

- a. Mounting/installation products, including:
 - i. Flow cells for installation on a suitable sample line
 - ii. Pipe insertion kits for steel and PVC pipework
 - iii. Fittings for submersion via steel/plastic poles
 - iv. Automatic cleaning for sensor optics and flow cell (if flow cell option has been selected)
- 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. 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.
- h. 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 turbidity shall utilize the following technologies:

- a. Infrared nephelometry, compliant with ISO 7027
- b. Alteration of emitter intensity, allowing calculation of the gradient of light output vs. detected signal, which forms the basis of measurement
- c. Calibration should be single point, via both Formazin standard solution (in accordance with ISO 7027) and solid secondary standard blocks
- d. Calibration should not require a zero measurement
- e. Solid secondary standard blocks will be available in multiple NTU values, so take account of expected turbidity levels
- f. Sensor will be capable of performing background light checks, and triggering an alarm if a threshold is exceeded

2. Sensor Specifications

Turbidity

Range 0.01..1000 NTU or better

Accuracy <1% of measured value or 0.01 NTU, or better

Reproducibility <0.3% of measured value or 0.005 NTU, or better

Operating pressure 10 bar (145 psi)

IP rating IP68

3. Cleaning Requirements

Automatic cleaning options will be made available for turbidity sensor optics and flow cells, 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 flow cell cleaning, the addition of an automated dump valve to allow for the removal of settled solids

FLOW CELLS

Flow Cell Requirements

The flow cell will:

- a. Have a maximum operating pressure of at least 6 bar (87 psi)
- b. Optionally be able to operate in backpressure mode, which uses sample pressurisation to prevent the formation of nucleating bubbles within the flow cell
- c. Have optional automatic cleaning, with the addition of an automated dump valve to allow for the removal of settled solids.
- d. Have access to an optional bubble removal unit, to be installed prior to the flow cell, for the removal of entrained bubbles

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. Suitable continual flow of sample water (approx. 500ml/min)
- c. 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