40 75 86 – Process Liquid Analytical Measurement (Alkalinity Analysers)

ALKALINITY ANALYSER

PART 1 – General

SUMMARY

A programmable Alkalinity Analyser System shall be supplied for continuous monitoring and/or control of alkalinity in water.

ALKALINITY ANALYSER

1. Controller/Analyser Requirements

The controller/analyser shall:

a. Provide continuous monitoring and control of alkalinity

b. Have capability to control dosing to both increase and/or decrease alkalinity, including flow-adjusted dosing.

c. Have optional products to pre-condition the sample water, for example in the instance of suspended solids being present.

d. Allow the setup of multiple password-enabled user logins, with access logs available. Logins will have configurable levels of access to system settings.

e. Provide viewable and downloadable data logs, status logs and service reports.

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.

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

d. 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. Responding to the loss of sample flow (detected via an integrated flow switch) by entering an alarm state and switching active PID dosing to off/a set manual % value

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. Monitor chemical usage, by means of recording the volume of acid dispensed via the dosing pump but also via an integrated level sensor within the acid tank.

2. Hardware Requirements

The controller shall be supplied with:

a. An alkalinity sensor, with all associated components mounted on a suitable backboard.

b. An integrated sample flow switch.

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

a. Additional and/or replacement sensors (including, but not limited to):

i. Free chlorine
ii. Total chlorine
iii. pH
iv. ORP/Redox
v. Conductivity
vi. Turbidity

b. Digital outputs (relays) up to a maximum of 8 per enclosure
c. Digital inputs up to a maximum of 8 per enclosure
d. Analogue outputs (4-20mA) up to a maximum of 4 per enclosure
e. 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.

PART 2- PRODUCTS

SENSORS

1. Sensor Requirements

The sensor for the monitoring of alkalinity levels shall utilize the following technology:

a. Total alkalinity shall be measured by performing a titration with an acid, which shall be automatic.

b. The monitoring of the titration shall be carried out via a conductivity sensor; whilst neutralisation of the titrated acid is taking place, the conductivity of the sample water will change at a certain rate. Once all the ions in the sample that can neutralise the acid have been exhausted, the conductivity will begin to change at a different rate as more acid titrant is added.

c. The point of change in the rate of conductivity increase during the titration shall be used to determine the volume of acid dosed to neutralise the alkalinity in the sample and thus calculate the total alkalinity in mg/l $CaCO_3$. This shall form the basis of measurement.

d. The sensor shall not require calibration, either initially or as part of regular care and maintenance.

e. The internal conductivity probe shall be made available in differing K values, to account for different conductivity levels in the sample water. These probes shall be replacement and interchangeable.

f. The acid used in the titration shall be available from the manufacturer in multiple normalities (N), to account for differing ranges of alkalinity in the sample water. The normality of the acid should be changeable in situ if required by changes in site conditions.

1. Sensor Specifications

Alkalinity:
Range: 5-1500 mg/l
Limit of detection: 10 mg/l $CaCO_3$
Accuracy: ±0.5ppm
Reproducibility: <2% of measured value or 1 mg/l $CaCO_3$ (whichever is greater)
Typical titrant: PTSA (Paratoluenesulfonic Acid)
No calibration required

WARRANTY

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

PART 3 EXECUTION

Preparation

The alkalinity sensor 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 (minimum 500ml/min)