

Standard Specification

I-SPE-STD-016

Turbidity Analysers

Document Number: SPE-00503

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		Position	Signature	Position	Signature	Date
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This Engineering Standard was endorsed an RPEQ on behalf of Seqwater.

Version History

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1	29/11/2022	Original Release				

(Refer Controlled Document in REX for Author, SME, Owner and Approver details)

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1 Purpose

This document is part of a suite of Seqwater Engineering Standards which are in alignment with the Seqwater Quality Management System. Their purpose is to provide a consistent approach to the development, modification, and management of Seqwater infrastructure that is fit for purpose and safe.

This Standard Specification provides the minimum requirements and recommendations for the design, supply and installation of new or replacement plumbed turbidity analysers suitable for continuous online turbidity monitoring within a water treatment plant and Seqwater network systems. This document must be used in conjunction with the documents it references to assist in ensuring a fit for purpose asset.

This Engineering Standard provides guidance on standard operating and physical requirements of the turbidity analyser. For the purpose of this Engineering Standard, the battery limits are:

- The sample line connection into the analyser
- The sample line connection out of the analyser
- Incoming power supply terminals of the analyser indicating transmitter
- Control and communication cable terminals of the analyser indicating transmitter for connections to plant control system

Separate inlet and outlet sample lines is the normal configuration for turbidity analysers under this standard specification. Contact Seqwater Engineering for requirements for immersion/insertion applications.

This Standard Specification is not intended to be relied upon solely for design, supply and installation works; advice from specialist engineers and/or Manufacturers may be required on a case-by-case basis.

This Standard Specification forms the minimum requirements for the selection of preferred equipment for turbidity analysers for use within Seqwater infrastructure. This preferred equipment shall be developed through one or more open market procurement processes with the resultant selection(s) listed in X-LST-STD-001, Seqwater Preferred Equipment List. Seqwater's Commercial Manager shall approve the recommended preferred equipment that results from the open market procurement process.

2 Application of Standard Specification

This Standard Specification applies to all Seqwater employees, suppliers, contractors and consultants working for, or on behalf of, Seqwater unless otherwise stated. It applies to all new assets and to all existing assets undergoing refurbishment or modification. It must be used in conjunction with other relevant Seqwater Engineering Standards and project specific documents to define the technical requirements for infrastructure design and construction.

Seqwater Engineering Standards detail Seqwater's minimum requirements and recommendations to provide infrastructure that will be fit for purpose, and safe to operate and maintain. However, at all times the designer remains responsible for ensuring infrastructure designed is fit for purpose and safe to construct, operate, maintain, and demolish. In doing so the designer must exercise appropriate due diligence to identify and manage hazards so far as is reasonably practicable.

Designers must also ensure compliance with relevant Australian Legislation, Standards, Codes and Guidelines (including those produced by WSAA). Where no Australian Standard exists for a particular application, work must conform to the most current version of an industry accepted international standard.

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Deviation from meeting the minimum requirements in this standard requires written agreement from Seqwater as per the deviation process detailed in Procedure X-PRO-STD-008 *Asset Standards Management and Application*. This process includes completion of an Asset Standards Deviation Request Form and submission via the Seqwater Project Representative (for external parties) or via Seqwater's Engineering Mailbox (engineering@seqwater.com.au) (for internal parties).

Where noted in this Standard Specification that Seqwater approval or acceptance shall/must be sought, approval or acceptance must be gained through the Seqwater Asset Standard Deviation process, as identified above.

Responsibility for ensuring compliance with Seqwater Engineering Standards lies with those engaged in the management and execution of design, construction, and modification of Seqwater infrastructure. This includes modifications to the functional design of the infrastructure including technical changes made which would extend the infrastructure outside of its design operating envelope and/or approved operation and maintenance practices.

In the case that it is identified that a specific requirement within this Engineering Standard does not meet the requirements of project specific documents, another Seqwater Engineering Standard or Australian Legislation, Standards, Codes or Guidelines, the conflict must be brought to the attention of the Seqwater Principal Engineering Standards and Assurance (or their delegate) via the Engineering Mailbox, and written agreement must be gained prior to application of the requirement.

Advice must be sought from Seqwater to clarify any ambiguities regarding this Engineering Standard.

Seqwater undertakes regular updates of its Engineering Standards. Before utilising this Engineering Standard the complete list of Seqwater Engineering Standards should be reviewed, to ensure currency and applicability of standards to be applied to the works.

3 Definitions

The following definitions (Table 3-1) apply to this Standard Specification.

Table 3-1 – Definitions

Term	Definitions
Analyser Indicating Transmitter	Digital programmable controller which connects to the analysing element, provides local control, local monitoring and communications (fieldbus and/or relay) signals for interface with an external control system, and the turbidity value as a 4-20mA signal output for interface with an external control system.
Analysing Element	A device which measures the physical property of turbidity.
Analyser	A Turbidity Analyser. Equipment used for measuring fluid turbidity and providing local indication and control system interfaces, consisting of the combination of the Analyser Indicating Transmitter and the Analysing Element.
Contractor	An entity engaged by Seqwater to undertake work in accordance with an agreed contract and defined scope of work.
Maintained Command	A command that is held for as long as the effect is required i.e., if the equipment is sent a maintained run command, it will operate for as long as the run signal is held.

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Term	Definitions
Manufacturer / Supplier / Vendor / Original Equipment Manufacturer (OEM)	The entity that manufacturers or supplies equipment to meet the specifications of the Contractor.
Owner / Principal / Seqwater	The entity that engages the Contractor to undertake the work and takes custody of the outcome. The Owner may delegate responsibilities to other entities to act on its behalf (e.g. a consultant).
Pulsed Command	A momentary change in state i.e., equipment receives a pulsed run command, it will continue to run until it receives a subsequent stop command.
REX	Seqwater Electronic Document and Records Management System.
Sample Inlet	A location where the sample is introduced into the analyser
Seqwater Approval / Acceptance	Written sign-off gained via the deviation process, as detailed in X-PRO-STD-008 Asset Standards Management and Application.
Shall / must	Indicates a mandatory requirement
Should	Indicates a recommendation
Standard	Includes a Standard Specification, Standard Code of Practice or other Standard issued by a recognised association or body set up for the purpose

4 Abbreviations

The following abbreviations (Table 4-1) apply to this Standard Specification.

Table 4-1 – Abbreviations

Abbreviation	Description
AC	Alternating Current
AS	Australian Standards
DC	Direct Current
IP	Ingress Protection
LCD	Liquid Crystal Display
MTBF	Mean Time Between Failures
NTU	Nephelometric Turbidity Unit
PLC	Programmable Logic Controller
RCM	Regulatory Compliance Mark (Australia)
SEQ	South East Queensland
SCADA	Supervisory Control and Data Acquisition
TSI	Technical Support and Improvement
WSAA	Water Services Association of Australia

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5 Reference Documents

The documents listed in Table 5-1 and Table 5-2, and the requirements therein, are relevant to this Standard Specification. In their latest editions, these documents form a part of this Standard Specification. Note that this is not an exhaustive list of documents relevant to the works.

Table 5-1 – Reference Seqwater Documentation

Asset Standard Document Number	Document Title	Waternet Reference
B-SPE-STD-003	Commissioning Requirements	SPE-00346
E-SPE-STD-001	Electrical Design and Construction	SPE-00352
I-SPE-STD-015	Instrumentation	SPE-00353
M-SPE-STD-001	General Mechanical	SPE-00367
M-SPE-STD-004	Protective Coatings	SPE-00348
X-LST-STD-001	Seqwater Preferred Equipment List	REG-01074
X-PRO-STD-001	Asset Standards Document Classification and Naming Structure	PRO-01873
X-PRO-STD-002	Engineering Drawing Number Procedure	PRO-01872
X-PRO-STD-004	Development and Review of Asset Standards	PRO-01874
X-PRO-STD-006	Equipment Numbering and Naming Convention	PRO-02190
X-PRO-STD-007	Drawing & Spatial Data Standards	PRO-02187
X-PRO-STD-008	Asset Standards Management & Application	PRO-02205
X-PRO-STD-009	Engineering Design, Construction, Operation and Maintenance	PRO-01617
X-TMP-STD-022	Asset Standards Deviation Request Form	TEM-00224

Table 5-2 – Reference External Standards, Specifications and Codes

Standard/Specification	Document Title
AS/NZS 3000	Electrical Installations (Wiring Rules)
AS/NZS 4020	Testing of products for use in contact with drinking water
AS 4312	Atmospheric corrosivity zones in Australia
AS 61010.1	Safety requirements for electrical equipment for measurement, control and laboratory use – General Requirements
AS CISPR 11	Industrial, scientific and medical equipment – Radio-frequency disturbance characteristics – Limits and methods of measurement
IEC 61326-1	Electrical equipment for measurement, control and laboratory use – EMC requirements – Part 1: General requirements
ISO 7027-1	Water quality — Determination of turbidity — Part 1: Quantitative methods

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The controlled version of this document is registered. All other versions are uncontrolled.

6 Technical Requirements

6.1 General Analyser Requirements

The turbidity analyser may be a single or multi-channel analyser and shall be suitable for measuring turbidity in treated water, filtered water, raw water, settled water and/or supernatant return water as per the application specified, and shall be compliant with *ISO 7027-1 Water quality — Determination of turbidity — Part 1: Quantitative methods* or US EPA approved. The analyser shall be made up of components commonly used for the application and represent current water industry best practice.

Spare parts that may reasonably require replacement, light source, detector assembly and tubing / connection components shall be readily available in Australia and be supported as a minimum for the duration of the design life in accordance with Clause 6.2 of this specification. Lead time for the delivery of spare parts to a nominated Seqwater site shall be a maximum of three working days after receipt of order.

All components and ancillary equipment shall be designed to withstand washdown with a hand held, mains pressure water hose.

Refer to Standard Specification *I-SPE-STD-015 Instrumentation* for general requirements related to instrument assets.

6.2 Design Life

The minimum design life of the turbidity analyser shall be 10 years from the date of purchase unless otherwise specified and approved by Seqwater. It is understood that some components of the analyser, as specified in the manufacturers' preventative maintenance schedule, require regular replacement. These components do not discount the asset life.

6.3 Design Reliability Target

Each analyser should achieve a reliability and maintainability target, MTBF of 8750 hours minimum, resulting in an availability of 99.9%.

The design of the analyser shall be such that the replacement of any parts may be rapidly executed to minimise non-availability.

6.4 Operating Conditions

All components of the analyser must be suitable for the design, minimum and maximum flow, pressure, temperature, duty cycle and other operating conditions. They must have compatibility with the process medium with all wetted components designed using corrosion and wear resistant materials suitable to achieve the specified design life without the need for replacement. Components that are designed to be replaced do not fall under the design life requirements as documented in section 6.2 .

The analyser must be suitable for operating within the SEQ environment, including exposure to potential liquid or gaseous chemicals used within a water treatment plant. At a minimum, the analyser must be capable of operating in an open, fully exposed environment with ambient operating temperatures of 0 to +45°C and relative humidity of 10 to 95%. For further details, refer to Standard Specification *I-SPE-STD-015 Instrumentation*.

(Exception: Where specified and approved by Seqwater for nominated installation locations, the analyser must be capable of operating in ambient operating temperatures of 0 to +40°C and relative humidity of 10 to 95%.)

The analyser shall be required to operate continuously, 24 hours per day, 7 days a week under the defined operating conditions.

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Analyser must be designed to re-start automatically or to be remotely started after a power supply interruption.

6.5 Safety in Design

Seqwater's expectations relating to safety in design are outlined in the *Safety in Design* section of Standard Procedure *X-PRO-STD-009 Engineering Design, Construction, Operation and Maintenance*.

All equipment must be designed to perform its intended duty safely and without being attended. Wherever practicable, health and safety risks shall be fully mitigated ("designed out") during the design phase for both the construction and end use phases.

Where the analyser is being installed in a Classified Hazardous Area, it must comply with the requirements of the *Hazardous Area Application* section of Engineering Standard *E-SPE-STD-001 Electrical Design and Construction*, and the *Hazard Management* section of Engineering Standard *M-SPE-STD-001 General Mechanical*.

6.6 Electrical Compliance Requirements

The turbidity analyser shall be certified and marked with an Australian Regulatory Compliance Mark (RCM). The turbidity analyser shall be certified by the manufacturer as compliant with *AS 61010.1 Safety requirements for electrical equipment for measurement, control and laboratory use – General Requirements* or *IEC 61010-1* or *EN 61010-1*.

6.7 Drinking Water Compatibility

The Turbidity Analyser must conform to the Potable Water Compatibility section of Engineering Standard *M-SPE-STD-001 General Mechanical*. Where certification to AS/NZS 4020 cannot be provided, the supplier must demonstrate that the components which make up the Turbidity Analyser do not introduce substances which result in deterioration of water quality or cause physical harm to the public.

6.8 Physical and Operating Requirements

6.8.1 General Requirements

Turbidity analyser shall be continuous flow, continuous reading and must provide direct measurement turbidity reading in NTU.

A means for convenient mess free cleaning and flushing of instruments shall be provided.

An individual analyser indicating transmitter must be provided for each turbidity analysing element, except where the design demonstrates that multiple turbidity analysing elements sharing a transmitter will provide acceptable overall system reliability and this is accepted by Seqwater.

6.8.2 Calibration and Verification Requirements

The means shall be provided by the manufacturer for the primary calibration of the instrument using certified standard solutions preferably in sealed vials to avoid inhouse preparation and exposure.

The means shall be provided for verification of the instrument using a secondary standard that must consist of a solid matrix (non-liquid standard) to verify instrument accuracy is within $\pm 10\%$ of NTU.

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6.8.3 Ingress Protection Requirements

Enclosures for the turbidity analyser shall provide a minimum degree of protection of IP54. For further details, refer to Engineering Standard *I-SPE-STD-015 Instrumentation*.

All analyser vents and overflows shall be vermin proof.

6.8.4 Air Bubble Trap

An internal/external air bubble trap or bubble rejection feature must be available with the analyser.

6.8.5 Analyser Performance Requirements

The analyser performance must be maintained without manual intervention for a minimum period of 30 days.

The following range, accuracy, repeatability and resolution requirements shall be met for the specified process application:

Table 6-1 – Analyser Range, Accuracy, Repeatability and Resolution Requirements

Process Application	Range	Accuracy (% of reading)	Repeatability (% of reading)	Resolution
Treated Water	0-10 NTU	±2%	±1%	0.01 NTU
Filtered Water	0-5 NTU	±2%	±1%	0.01 NTU
Settled Water	0-20 NTU	±2%	±1%	0.01 NTU
Raw Water	0-9999 NTU	±5% (0-1000 NTU) ±10% (>1000 NTU)	±1%	0.1 NTU (0-1000 NTU) 1 NTU (>1000 NTU)
Supernatant Return Water	0-50 NTU	±2% (0-40 NTU) ±5% (>40 NTU)	±1%	0.1 NTU

Note: The ranges listed here are the standard analyser capabilities required for the specified process application. The calibration range and 4-20mA output range may vary between sites.

A maximum response time of 60 seconds shall not be exceeded. Shorter response time using minimum flow is preferred.

6.8.6 Dual Range

For raw water applications, the analyser must be capable of having two separately configurable 4-20mA analogue outputs to allow measurement at the specified resolutions whether the value is low range or high range, without manual intervention to reprogram the range.

6.8.7 Analysing Element Requirements

The sensor shall use a light source with colour compensation suitable for use in highly coloured water with a temperature range of 0 to 45°C. An automatic self-cleaning facility for the optical surfaces shall be provided where frequent maintenance is required, or the optical windows are in direct contact with the sample. The frequency of self-cleaning shall be user set.

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6.8.8 Analyser Power Requirements

The analyser shall be powered with 24 VDC or 230 VAC 50 Hz single phase, as specified by the Principal or installation designer. Designers should note that 24 VDC is preferred where practical. Where 230 VAC power is specified, the analyser shall be suitable for 230 VAC supply without the need for external step-down transformers.

6.8.9 Analyser Local Control Interface

The analyser shall be based on microprocessor technology with all programming/parameterising undertaken locally via the front panel keypad. Parameterising shall have the capability of being password protected.

A minimum of four-digit backlit display shall be provided which must show the measurement value. Where a multi-channel analyser is used, the measurement parameter in addition to the measurement value must be shown.

The display shall include automatic decimal point positioning where required to indicate the turbidity reading to the specified resolution.

6.8.10 Analyser Outputs - Digital

The analyser shall have as a minimum the following signals via relay contacts, fully configurable for:

- Analyser fault
- Sample flow fault

The 'Analyser Fault' signal must be configurable as a fail-safe contact which remains closed under normal operating conditions and opens upon power loss or an analyser fault.

The 'Sample flow fault' output shall operate independently of the general "Analyser fault" output to provide the status of the sample flow rate (healthy / unhealthy), with user choice of normally open or normally closed contacts.

6.8.11 Analyser Outputs – Analogue

The analyser shall have a minimum of one 4-20mA output which must be fully scalable for turbidity indication. For raw water applications a minimum of two fully scalable 4-20mA outputs shall be provided to achieve dual range capability as specified in section 6.8.6.

An additional 4-20mA output for analogue sample flow rate is desirable.

6.8.12 Analyser Hold Function

Analysers which have the maintenance/hold function shall have the capability of being disabled and password protected. The maintenance/hold function will be managed by site SCADA.

6.9 Protective Coatings

The protective coating shall be suitable to achieve the design life (refer Section 6.2), without the need for re application. A minimum C3-Medium corrosivity category (as per AS 4312), will apply for all external surface protection requirements. A C4-high or C5-very high corrosivity category shall be assigned to equipment that will be installed in the specific environments, including those specified by Engineering Standard *M-SPE-STD-004 Protective Coatings*.

6.10 Markings

In addition to the manufacturers name plate, labelling must be in accordance with the Labelling and Nameplate section of *I-SPE-STD-015 Instrumentation* and *X-PRO-STD-006 Equipment Numbering and Naming Convention*. Equipment Field Labelling is to be added when the analyser is installed.

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7 Changes from previous version

This Standard Specification will be regularly reviewed and updated, including the consideration of requested alterations, in accordance with Seqwater Procedure *X-PRO-STD-004 Development and Review of Asset Standards*. Changes made from the previous version of this document are summarised in Table 7-1 below.

Table 7-1 Changes from previous version

Section Number	Change

8 Verification

Compliance with this document may be verified by internal audit.

9 Further Information

For further information please contact the owner of this document.

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