Stonel™ Axiom™ AN / ANX valve position indicator / controller for applications up to SIL 3

Safety Manual

01/2025

Stonel publication 105535revB

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1. General information

The Stonel™ Axiom™ series valve position indicator / controller is used to indicate the position of a valve assembly and control the position of the valve. The safety function is controlling the position of the valve by switching air to the pneumatic actuator by operation of the integral pneumatic valve. This device also provides signal outputs of valve position that can be used for diagnostics. The end user can use this information in different ways depending on the SIF or sensory input that is being instrumented.

Axiom™ series valve position indicator / controller can be used in a multitude of configurations and any sub classification depending on the model and SIF being implemented for the desired Safety Function and SIL level.

The valve position can be indicated using one of the defined outputs (SST solid state sensors or Namur sensors). It provides input feedback of the valve to the safety system. The Axiom unit also controls the position of the valve.

End user must follow all guidance identified in the Installation, Maintenance and Operating Instructions (later referred as IMO) with this safety manual to verify the products proper installation and operation.

2. Structure of valve position indicator

2.1. System components and description of use

See the IMO for the detailed technical description of the device and the system architecture.

2.2. Permitted device types

The information in this manual pertaining to functional safety applies to all device variants mentioned in the device type coding below. It is up to the end-user to verify that the correct model is selected for the intended function and the SIF.

2.3. Supplementary device documentation

Related AN / ANX Installation, Maintenance and Operating Instructions listing

IMO	Applicable models	Description
105410	AN35, AN45	Axiom AN with SST sensors or Namur sensors
105479	ANX35, ANX45	Axiom ANX with SST sensors or Namur sensors

Table 1

These are available from our Stonel product center or for download at:
www.valmet.com/flowcontrol/brands/stonel/approvals/functional-safety-sil-certifications/

3. Description of safety requirements

3.1. Safety function

Valve Position Control: The function of this device is to control the position of the attached actuator / valve. This can be performed by energizing / de-energizing the solenoid in the single coil model. In case of dual solenoid models the valve is actuated by energizing either solenoid valve. For complete safety and reliability, the Actuator / Valve that are being operated should also be considered.

3.2. Restrictions for use in safety-related applications

Please ensure that the valve monitor / controller is used correctly for the application in question and that the ambient conditions are considered. The instructions for installation conditions, as detailed in the IMO, shall be observed. Input air quality is a very important consideration with any pneumatic valve. Dirty air can contribute to numerous failure conditions. The specifications in the IMO shall not be exceeded.

3.3. Functional safety assessment

The audited development process, as tailored and implemented by the Stonel Axiom valve position indicator / controller development project, complies with the relevant safety management requirements of IEC 61508 SIL 3, SC3 (SIL 3 Capable).

The assessment of the FMEDA also shows the Axiom meets the requirements for architectural constraints of an element such that it can be used to implement a SIL 2 safety function (with HFT = 0) or a SIL 3 safety function (with HFT = 1).

This means that the Axiom is capable for use in SIL 3 applications in Low Demand Mode when properly designed into a Safety Instrumented Function per the requirements in this safety manual.

The examination is based on route 2h according to IEC61508.

The table below shows the specific values for functional safety for SIL 3 in low demand mode applications.

IEC 61508 Failure Rates in FIT*

Model Series	Function	SIL	λ	λsd	λsu	λdd	λdu
AN35x1xxx ANX35x1xxx AN45x1xxx ANX45x1xxx	Valve control DTT (single Solenoid)	SC3	5.68E-7	0	269	0	299
AN35x1xxx ANX35x1xxx AN45x1xxx ANX45x1xxx	Valve control ETT (single Solenoid)	SC3	5.81E-7	0	107	0	474
AN35x2xxx ANX35x2xxx AN45x2xxx ANX45x2xxx	Valve control (dual Solenoid)	SC3	8.21E-7	0	275	0	546

* FIT = 1 failure / 10^9 hours

λ = Total Failure Rate (λ = λs + λd)
λsd = Safe Detected Failure Rate
λsu = Safe Undetected Failure Rate
λdd = Dangerous Detected Failure Rate
λdu = Dangerous Undetected Failure Rate
DTT = De-Energize to trip
ETT = Energize to trip
SC3 = Systematic Capability: SIL 3 can be achieved (with HFT = 1)

Note:
If the system / application requires a higher degree of safety, it is recommended to compare the solenoid status with the valve position indicator. If there is a discrepancy, the appropriated steps to achieve a safe state must be performed.

3.4. Proof Test

The suggested Proof Test consists of a full stroke of the associated device as indicated below:

Step	Action
1.	Bypass the safety function and take appropriate action to avoid a false trip
2.	Send a signal to the solenoid valve to perform full stroke and ensure that the final control element is fully in the expected state.
3.	Inspect the Solenoid for any leaks, visible damage or contamination
4.	Restore the original air supply / input to the actuator and confirm that the normal operating state was achieved
5.	Remove the bypass and otherwise restore normal operation

For the test to be effective the movement of the Valve must be confirmed. To confirm the effectiveness of the test both the travel of the Valve and the slew rate must be monitored and compared to expected results to validate the testing.

Proof test coverage: Static application

Application	λdu PT* (FIT)	Proof Test coverage	
		No PVST	**With PVST**
Single Solenoid, DTT	22	93%	12%
Single Solenoid, ETT	37	92%	21%
Dual Solenoid	42	92%	22%

Proof test coverage: Dynamic application

Application	λdu PT* (FIT)	Proof Test coverage	
		No PVST	**With PVST**
Single Solenoid, DTT	10	94%	21%
Single Solenoid, ETT	24	93%	31%
Dual Solenoid	26	93%	30%

λdu PT* = Dangerous undetected failure rate after performing the recommended proof test.

4. Installation

4.4.1. Hardware fault tolerance

Valve Control function: The hardware fault tolerance of the standalone installation is HFT=0. If hardware fault tolerance of >= 1 is required, then a redundant configuration of the valve controller shall be used.

4.4.2. Installation and commissioning

The installation and commissioning/calibration of the device must be done by a qualified technician, according to the IMO. It is important that the mechanical connection to the valve/actuator is installed correctly and securely by a qualified technician. Every parameter related to the device type in question and mentioned in the IMO needs to be checked and compared against the device settings. If any deviations exist, the safety of the installation cannot be guaranteed.

4.4.3. Orientation

Orientation of the device is described in the IMO.

4.5. Operation

See IMO for the operation of the device.

Valve control function:
Single coil models: The solenoid pilot valve receives a signal from the controller. The pilot valve directs air to drive the spool valve into the other position. This in turn switches the air to the other side of the piston in the attached pneumatic actuator.

Dual coil models: The solenoid pilot valves receive signals from the controller. Each pilot valve directs air to drive the spool valve into the other position. This in turn switches the air to the other side of the piston in the attached pneumatic actuator.

4.6. Maintenance

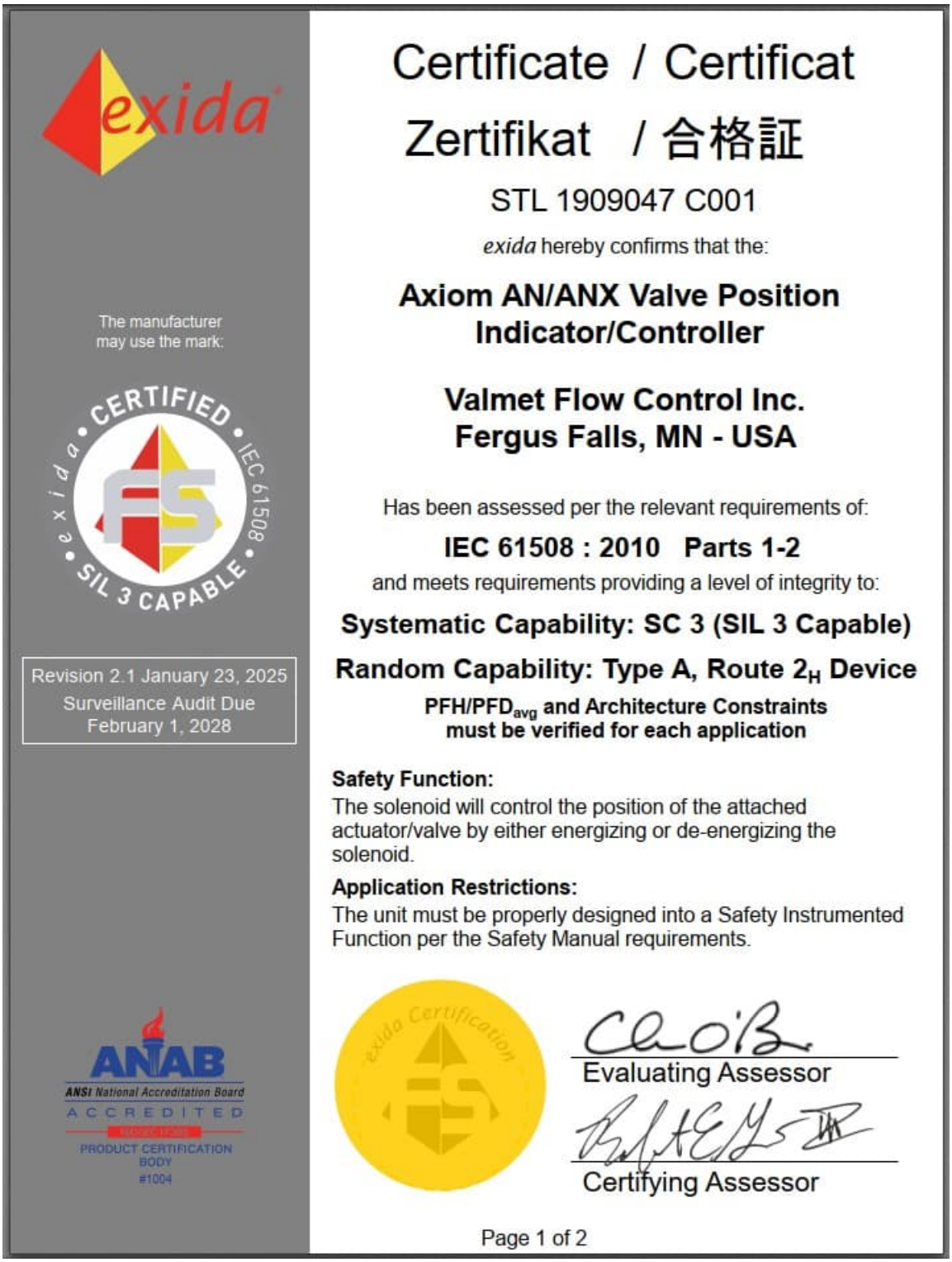
See the IMO for maintenance instructions.

During maintenance work on the device, alternative safety function methods shall be taken to ensure process safety. This device should be considered in all SIF proof tests.

5. Repair

Any repair to the device shall be carried out under guidance by the manufacturer. Device failures must be reported to the manufacturer. The user shall provide a detailed report to the manufacturer describing the failure and any possible effects.

6. Certificate



exida

The manufacturer may use the mark:

CERTIFIED • IEC 61508 • exida • SIL 3 CAPABLE

Revision 2.1 January 23, 2025
Surveillance Audit Due
February 1, 2028

ANAB
ANSI National Accreditation Board
ACCREDITED
PRODUCT CERTIFICATION BODY
#1004

Certificate / Certificat
Zertifikat / 合格証

STL 1909047 C001

exida hereby confirms that the:

Axiom AN/ANX Valve Position Indicator/Controller

Valmet Flow Control Inc.
Fergus Falls, MN - USA

Has been assessed per the relevant requirements of:

IEC 61508 : 2010 Parts 1-2

and meets requirements providing a level of integrity to:

Systematic Capability: SC 3 (SIL 3 Capable)

Random Capability: Type A, Route 2_H Device

PFH/PFD_{avg} and Architecture Constraints must be verified for each application

Safety Function:
The solenoid will control the position of the attached actuator/valve by either energizing or de-energizing the solenoid.

Application Restrictions:
The unit must be properly designed into a Safety Instrumented Function per the Safety Manual requirements.

exida Certification

Evaluating Assessor

Certifying Assessor

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7. Certificate page 2

Axiom AN/ANX Valve Position Indicator/Controller

Certificate / Certificat / Zertifikat / 合格証

STL 1909047 C001

Systematic Capability: SC 3 (SIL 3 Capable)

Random Capability: Type A, Route 2_H Device

PFH/PFD_{avg} and Architecture Constraints must be verified for each application

Systematic Capability :

The product has met manufacturer design process requirements of Safety Integrity Level (SIL) 3. These are intended to achieve sufficient integrity against systematic errors of design by the manufacturer.

A Safety Instrumented Function (SIF) designed with this product must not be used at a SIL level higher than stated.

Random Capability:

The SIL limit imposed by the Architectural Constraints must be met for each element. This device meets *exida* criteria for Route 2_H.

IEC 61508 Failure Rates in FIT*

Application	λ_{SD}	λ_{SU}	λ_{DD}	λ_{DU}
Single Solenoid, DTT	0	269	0	299
Single Solenoid, ETT	0	107	0	474
Dual Solenoid	0	275	0	546

* FIT = 1 failure / 10^9 hours

SIL Verification:

The Safety Integrity Level (SIL) of an entire Safety Instrumented Function (SIF) must be verified via a calculation of PFH/PFD_{avg} considering redundant architectures, proof test interval, proof test effectiveness, any automatic diagnostics, average repair time and the specific failure rates of all products included in the SIF. Each element must be checked to assure compliance with minimum hardware fault tolerance (HFT) requirements.

The following documents are a mandatory part of certification:

Assessment Report: STL 19-09-047 R002 V2 R2 (or later)

Safety Manual: 105535, Rev B (or later)

80 N Main St
Sellersville, PA 18960

T-061, V5R3