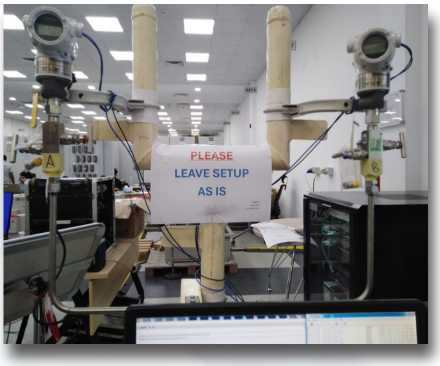
CASE STUDY

Preventing False Trips in Legacy Trusted & AADvance Systems via NAMUR-Compliant Analog Thresholds

Reduction in nuisance trips and production losses across the install base.



A major petroleum complex faced a costly, unexpected shutdown during a routine maintenance upgrade due to an outdated legacy safety system configuration. The system's overly sensitive fault settings, non-compliant with modern standards, misinterpreted a temporary sensor dip caused by maintenance as a critical hardware failure, triggering a false shutdown and production loss. Sensia's team identified the root cause and updated the configuration to the NAMUR NE43 industry standard. This introduced a critical "buffer zone," enabling the system to distinguish between true hardware faults (e.g., broken wires) and safe low-pressure readings. The solution was fully validated in a test environment replicating the site setup. This delivered significant business value by eliminating nuisance trips, preventing production losses, enhancing safety integrity, and standardizing configurations for easier support.

Key highlights

- Large global install base of Trusted systems commissioned >20 years ago; mixed philosophies persist.
- New signal additions often inherit legacy INI templates where AI thresholds are not NAMUR NE43 compliant.
- Customers frequently prefer " as-existing" philosophy, which can embed outdated limits into new channels.

Challenges

The primary challenge was an unexpected ESD trip at a Middle East petroleum complex during a critical upgrade project. The goal of this project was to enhance system reliability by replacing outdated pressure switches with a modern dual-redundant (1oo2D) pressure transmitter system.

The technical challenges that led to the incident were multi-layered:

- **A failed precaution:** The operations team forced the healthy process value (PV) of Transmitter B in the application logic. However, when the line was depressurized to remove the old switches, the transmitter's raw analog current dipped.
- **Legacy INI configuration:** The root cause was a non-NAMUR-compliant INI file for the AI module. This file had been in use since the system was commissioned over a decade prior.
  - Legacy fault threshold: The file was configured to declare a fault (State 2) when the current dropped below 4.00 mA
  - Legacy normal range: The normal operating range (State 3) was defined as 4.00 mA to 21.90 mA.
- **The Diagnostic Bypass:** This was the key finding. The AI module's diagnostics run at the I/O and driver layer, which is separate from the application layer.
  - When the current dropped below 4.00 mA, the I/O module itself generated a BAD channel status.
  - The force implemented by the operator only masked the process variable at the application layer; it did not and could not mask the BAD channel status coming from the I/O layer.
  - The 1oo2D voting logic received two inputs: "Transmitter A is Bypassed" and "Transmitter B is Faulty," which correctly resulted in a trip.

- **Shared Hardware:** The new pressure transmitters and old pressure switches shared the same impulse/tubing line, which aggravated the current dips during the venting process.
- **Configuration Error Solution:** An additional error was found where the 3.60 mA threshold was incorrectly mapped to the T3 location instead of T2 in the legacy file, further complicating the configuration.

Solution

Root Cause Analysis: This identified the critical disconnect between the application-layer force and the I/O-layer diagnostics.

INI File Remediation: The core solution was to modify the INI file settings to align with the NAMUR NE43 standard. This standardization re-defines the operating and fault-state boundaries for the analog inputs.

Validation (RE-FAT): The RE-FAT was conducted using a testbed with an engineering workstation, a Trusted TMR testbed, Pressure Transmitters and a HART Communicator to replicate the on-site setup. The goal was to validate the new INI file configuration for the GGII system based on the lessons learned from the B14 trip.

Test 1: Legacy (B14) Faulty Behaviour

First, the engineers tested the existing INI file from the B14 system to replicate and confirm the root cause of the trip.

- Case 1 (Healthy): A current above 4.0 mA was sensed, correctly showing a State 3 (Healthy).
- Case 2 (Fault - Under-range): When the current dropped below 4.0 mA, the system immediately changed to State 2 (Fault). This confirmed the narrow operating window that caused the B14 trip.
- Case 3 (Fault - Overrange): When the current exceeded 21.90 mA, the system changed to State 4 (Fault).

Test 2: Validating the New NAMUR-Compliant Configuration

After downloading the new, modified INI file, the team ran a new set of test cases to validate the NAMUR NE43 thresholds.

Case 1 (Healthy - Low):

- Action: A current was applied that was above 3.60 mA (e.g., 3.79 mA).
- Result: The system correctly registered a State 3 (Healthy). This proved the new configuration would not see a transient dip to 3.8 mA as a fault.

Case 2 (Fault - Under-range):

- Action: The current was dropped to below 3.60 mA.
- Result: The system correctly registered a State 2 (Fault). This confirmed the new, lower fault-detection threshold.

Case 3 (Healthy - High):

- Action: The current was raised to just under the new overrange limit (e.g., 20.5 mA).
- Result: The system correctly remained at State 3 (Healthy).

Case 4 (Fault - Overrange):

- Action: The current was raised to above 21.00 mA (e.g., 21.01 mA).
- Result: The system correctly registered a State 4 (Fault).

Results

- **Prevention of Nuisance Trips:** The primary result is the reduction of false ESD trips and associated production losses. The new 3.60 mA fault threshold provides a "buffer zone" (as per NAMUR NE43) that prevents transient, non-process-related current dips from being diagnosed as a hardware fault.
- **Enhanced Safety Integrity:** The solution creates a clear and correct separation between device faults and process-related trips. The system can now reliably distinguish between a transmitter that is truly faulty (e.g., broken wire, < 3.60 mA) and one that is reporting a valid low-pressure reading (e.g., 3.8 mA).
- **Standardization and Consistency:** By implementing the NAMUR NE43 standard, Sensia provided a consistent behaviour across all sites and platforms. This standardization applies to both Trusted and AADvance systems.
- **Improved Maintainability:** A standardized configuration eases long-term support and simplifies operational audits, as all systems will now behave in the same predictable, industry-standard manner.
- **Futureproofing:** A strong "Call to Action" to adopt these NAMUR-compliant templates across the entire install base and verification via RE FAT/site SAT with explicit BAD-status test cases.

Additional Validation and Outcomes

Customer-driven Change: During the RE-FAT, the client requested a modification to one of the new thresholds (the T6 value) from 20.70 mA to 21.00 mA. This change was made and validated live during the test.

Logic Confirmation: The test also "Confirmed correct operation of 1oo2D voting with transmitter fault filtering and alarms", ensuring the full logic chain, not just the I/O, was sound.

Configurarion before vs after remediation

Parameter	Legacy (at B14 / pre-fix)	NAMUR NE43 Target	Implemented (Post RE-FAT)
Under range threshold	< 4.00 mA → State 2 (FAULT)	< 3.60 mA → Fault	< 3.60 mA → State 2
Normal range	4.00 - 21.90 mA → State 3	3.60 - 21.00 mA → Normal	3.60 - 21.00 mA → State 3
Overrange threshold	> 21.90 mA → State 4 (FAULT)	> 21.00 mA → Fault	> 21.00 mA → State 4
Architecture	Pressure switches + single transmitter path	Dual-redundant transmitters (1oo2D) + NAMUR	1oo2D implemented; INI updated