Instrument Health and Calibration Training Course: AI Fault Detection for Process Plants

22 – 26 August 2027
Doha

Instrument Health and Calibration Training Course: AI Fault Detection for Process Plants

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Programme Summary

Instrument health monitoring and calibration is the subject of this one-week training course for instrumentation managers, maintenance and reliability leads and operations managers, ending in an instrument health plan for one plant unit. Many plants calibrate on fixed calendars while drifting sensors and sticking valves go unnoticed between visits. The programme moves from instrument criticality to drift and fault patterns, calibration interval review, AI fault detection and human sign-off. Mars Training Centre UK delivers this programme on instrument health and calibration to mixed-organisation cohorts.

The Business Case

Refineries, gas plants, chemical sites and power facilities rely on measurements that operators and control systems trust. A drifting transmitter or a sluggish valve can distort quality or hide a developing hazard. Leaders who match calibration effort to instrument risk, and who use analytics to find faults early, direct scarce technician time to where it protects the plant most.

- Measurement Reliability: Improves when drift and faults are found before they affect control.
- Maintenance Effort: Is redirected from low-risk routine checks to instruments that matter.
- Process Loss: Falls when valve and sensor faults are corrected before output is affected.

Principles and Evidence Base

- IEC 61511: Sets functional safety requirements for the process industry, applied in Sessions 1 and 3 to separate safety-related instruments from general ones.
- ISO 55001: Specifies an asset management system, applied in Session 1 to criticality and in Session 3 to interval decisions.
- IEC 60812: Describes failure mode and effects analysis, applied in Session 2 to rank instrument failure modes.
- Statistical Process Control: Separates normal variation from true drift, applied in Session 2 to signal checks.

Intended Participants

- Instrumentation and control managers who set calibration policy and technician priorities.
- Maintenance and reliability leaders who own failure records and inspection intervals.
- Operations managers who depend on trusted measurements for plant control.
- Process safety and quality leaders who review the effect of instrument faults on incidents and product.

Typical settings include refining, gas processing, petrochemicals and power generation.

Learning Outcomes

1. Participants will be able to evaluate an instrument population by criticality and failure history.
2. Participants will be able to diagnose sensor drift, stuck valves and signal faults from plant data.
3. Participants will be able to prioritise instruments for calibration and repair by risk.
4. Participants will be able to construct a calibration interval review that supports longer, shorter or unchanged intervals.
5. Participants will be able to design AI fault detection rules with human sign-off for safety-related devices.
6. Participants will be able to justify an instrument health plan to a plant leadership team.

Programme Structure

Day 1: Instrument Health Foundations and Criticality

Which instruments matter most, and what is known about their condition?

- Instrument Register Audit
- Criticality Ranking Matrix
- Safety-Related Device Screen
- Failure and Repair History Extract
- Instrument Ownership Table

Day 2: Sensor Drift, Valve Performance and Fault Patterns

How do drift and faults show up in plant data?

- Drift Trend Chart
- Control Chart for Signal Variation
- Valve Sticking and Hysteresis Check
- Failure Mode and Effects Worksheet
- Redundant Sensor Comparison Sheet

Day 3: Calibration Intervals and Risk-Based Review

When should an instrument be calibrated, and when can the interval change?

- As-Found and As-Left Record Analysis
- Interval Extension Test
- Risk-Based Calibration Schedule
- Out-of-Tolerance Impact Review
- Calibration Standards Traceability Check

Day 4: AI Fault Detection and Human Sign-Off

How can analytics flag instrument faults without replacing technician judgement?

- Signal Anomaly Detection Rules
- Fault Classification Review Table
- Alert Threshold Setting Sheet
- Technician Work Order Trigger Rules
- Sign-Off and Override Protocol

Day 5: Instrument Health Plan for One Plant Unit

Do the earlier tools join into a plan that plant leaders can approve?

- Applying the Session 1 Criticality Ranking Matrix
- Testing the Session 2 Drift Trend Chart
- Checking the Session 3 Risk-Based Calibration Schedule
- Reviewing the Session 4 Sign-Off and Override Protocol
- Completing the Instrument Health Plan

Methodology

The programme uses a data workshop built on a prepared record set for one process unit, with instrument lists, calibration results, trend data and repair history. Participants rank instruments, test drift signals and defend their plan to peers acting as the plant leadership team.

- Suggested activity: Reading calibration records to find instruments that repeatedly drift out of tolerance.
- Suggested activity: Comparing two redundant transmitters to decide which has drifted.
- Suggested activity: Reviewing an AI fault alert and recording whether a work order is justified.

Capstone Output

Each participant completes an instrument health plan for one plant unit. It holds a ranked instrument register, drift and fault findings, a calibration interval decision for each class of device, fault detection and alert rules with sign-off points, and a technician priority list. At work it guides maintenance planning and briefs plant leaders.

Frequently Asked Questions

Is an instrument health and calibration course suitable for managers who do not calibrate devices themselves?

Yes. Instrument health and calibration is taught through prepared records and templates. The programme assumes responsibility for instruments, maintenance or plant operation, but no earlier experience of data analysis or analytics tools.

Which standards and methods does instrument health and calibration rest on in this programme?

Instrument health and calibration rests on IEC 61511 for safety-related devices, ISO 55001 for asset management, IEC 60812 for failure mode analysis and statistical process control for drift.

How is the plan from instrument health and calibration used at work?

You use the instrument health plan to set calibration priorities, justify interval changes, agree fault alert rules with operations and direct technician time to critical devices.

How does instrument health and calibration differ from a programme on process control tuning?

Instrument health and calibration concentrates on sensor and valve condition, drift, intervals and fault detection, while a process control tuning programme concentrates on controller settings, loop response and control strategy.