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Functional Safety and Safety Integrity Level Training Course

28 February – 4 March 2027
Muscat

Functional Safety and Safety Integrity Level Training Course

Ref: 690_25829 **Date:** 28 February – 4 March 2027 **Location:** Muscat **Fees:** 5500 GBP

Functional Safety and Safety Integrity Level Training Course is a 1-week training course for instrumentation engineers, process safety specialists, technical risk leads and operations superintendents, centred on a Safety Instrumented System Lifecycle Verification Dossier. Industrial plants operating hazardous processes face strict lifecycle demands to prevent major accident hazards while sustaining plant operational availability. Jupiter Prime Training delivers this course to give engineering teams technical mastery across lifecycle allocation, engineering design and operational proof testing.

Why Functional Safety and Safety Integrity Level Matters Now

Major industrial facilities manage hazardous inventories where unmitigated instrumented failures lead to catastrophic containment losses, regulatory intervention or prolonged production shutdowns. Engineering leaders must balance stringent risk reduction targets against the operational costs of spurious trips and complex maintenance testing. The discipline rests on the international standard IEC 61511 Functional safety – Safety instrumented systems for the process industry sector and its parent standard IEC 61508 Functional safety of electrical/electronic/programmable electronic safety-related systems. Operating facilities must also align technical designs with statutory governance such as HCIS Directive SAF-11, alongside corporate standards including SAES-J-601 and SAEP-250 for formal integrity level assignment and verification.

Who Gains Most from Functional Safety and Safety Integrity Level

- Instrumentation and control engineers responsible for designing logic solver architectures and selecting field instruments
- Process safety practitioners and risk facilitators leading hazard assessments and risk reduction allocation exercises
- Operations and maintenance supervisors managing bypass permits, diagnostic alarms and scheduled proof-test routines
- Asset integrity superintendents tracking device failure data and validating statutory compliance across plant shutdowns

Multidisciplinary teams gain most when instrument engineers, process safety specialists and maintenance superintendents attend together to establish a shared approach to safety lifecycle management.

Functional Safety and Safety Integrity Level Capabilities

Participants acquire practical technical expertise across each lifecycle stage to substantiate risk reduction and safeguard operational uptime.

- Allocate target integrity requirements using calibrated risk matrices and layer of protection analysis — process safety committees
- Specify architectural constraints and hardware fault tolerance requirements — instrumentation procurement teams
- Calculate average probability of failure on demand and spurious trip rates — engineering design reviewers
- Formulate safety requirement specifications for field sensing elements and final elements — systems integration contractors
- Validate proof-test coverage intervals and partial stroke testing strategies — maintenance planning teams
- Prepare statutory compliance deliverables across engineering milestone stages — regulatory approval authorities

Key Functional Safety and Safety Integrity Level Terms

- Safety Instrumented Function — an instrumented loop with dedicated sensors, logic solver and final elements designed to achieve a safe state.
- Safety Integrity Level — a discrete tier specifying the target safety performance and risk reduction factor required of an instrumented loop.
- Probability of Failure on Demand — the likelihood that a safety function fails to perform its protective action when a process demand occurs.
- Hardware Fault Tolerance — the ability of an instrumented hardware architecture to continue executing a safety action despite specified hardware faults.
- Spurious Trip Rate — the frequency at which an instrumented protective function executes an unneeded shutdown, disrupting ongoing plant production.
- Safety Requirement Specification — the definitive engineering document detailing functional logic, timing limits, response actions and integrity parameters for safety functions.

Functional Safety and Safety Integrity Level Day by Day

Day 1: Safety Lifecycle Frameworks and Hazard Analysis

- Safety Lifecycle Structure Under IEC 61511 — Aligning Project Phases With Operational Management
- Parent Principles From IEC 61508 — Determining Hardware Integrity and Systematic Capability Baseline
- Statutory Compliance Workflows Under HCIS Directive SAF-11 — Structuring Milestone Design Deliverable Packages
- Hazard Identification Linkages and Cause and Effect Matrices — Bridging HAZOP Findings to Instrumented Functions
- Defining Safety Instrumented Functions — Establishing Functional Boundaries for Sensing and Actuation

Day 2: Risk Reduction and SIL Determination

- Calibrated Risk Graph Methods — Classifying Consequence Severity and Occupancy Exposure Parameters
- Layer of Protection Analysis Frameworks — Evaluating Initiating Event Frequencies and Protection Layers
- Risk Matrix Calibration Under SAEP-250 Appendix H — Aligning Risk Criteria With Corporate Tolerability
- Target Risk Reduction Factor Derivation — Assigning Performance Tiers Across SIL 1 Through SIL 3
- Overcoming Independence and Enabling Condition Flaws — Validating Independent Protection Layer Integrity

Day 3: Architecture Constraints and Hardware Reliability

- Logic Solver and Field Device Architectural Configurations — Comparing 1oo1, 1oo2 and 2oo3 Architectures
- Hardware Fault Tolerance Rules — Applying Route 1H Safe Failure Fraction and Route 2H Prior Use
- Dangerous Undetected Failure Rate Modelling — Evaluating Component Reliability Data From Industry Databases
- Spurious Trip Rate Calculations — Mitigating Unscheduled Plant Outages in High-Availability Operating Plants
- Safety Requirement Specification Compilation — Documenting Process Safe State Criteria and Response Times

Day 4: SIL Verification and Probability Calculations

- Probability of Failure on Demand Calculation Models — Quantifying Low-Demand Mode Performance Equations
- Proof-Test Interval and Mission Time Impact — Determining Optimum Testing Windows for Field Equipment
- Proof-Test Coverage Factoring — Accounting for Incomplete Testing and Valve Stiction Degradation
- High Integrity Protection Systems Design Under SAEP-374 — Implementing Autonomous Partial Stroke Valve Testing
- Common Cause Failure Analysis — Factoring Beta Factors and Environmental Stressors Into Redundant Architectures

Day 5: Operational Governance, Testing and Lifecycle Audits

- Operational Bypass and Override Administration — Controlling Risk Exposure During Field Instrument Maintenance
- Field Proof-Test Procedure Execution — Auditing Testing Records Against Safety Requirement Specifications
- Failure Tracking and Mean Time to Restoration — Verifying In-Service Reliability Data Against Design Assumptions
- Management of Change Governance — Preventing Integrity Erosion During Process Hardware Modifications
- Safety Instrumented System Lifecycle Verification Dossier — Presenting Loop Verification Deliverables for Plant Authorisation

Applying Functional Safety and Safety Integrity Level After the Course

- Audit the facility safety requirement specification against current field configurations to verify that sensor response times and proof-test intervals match design assumptions
- Perform verification calculations on critical safety instrumented functions using collected maintenance failure logs to confirm that target risk reduction factors and spurious trip rates remain within tolerable thresholds

Functional Safety and Safety Integrity Level Questions FAQ

What is Functional Safety and Safety Integrity Level and why does it matter now?

Functional Safety and Safety Integrity Level defines the systematic management and quantitative reliability targets of instrumented safety systems. It matters now because industrial facilities must prevent major accident hazards while complying with stringent safety directives and maintaining operational plant availability.

Which roles gain most from Functional Safety and Safety Integrity Level training?

Instrumentation engineers, process safety specialists, control systems designers and maintenance superintendents gain most. These professionals are directly responsible for specifying, verifying and maintaining safety instrumented functions across operating assets.

How does Functional Safety and Safety Integrity Level differ from a general process hazard analysis course?

It focuses specifically on the quantitative reliability, architectural configuration and lifecycle verification of instrumented systems under IEC 61511. Process hazard courses focus on qualitative hazard identification across broad plant operations.

What do you bring back from Functional Safety and Safety Integrity Level training?

You bring back a completed Safety Instrumented System Lifecycle Verification Dossier, containing allocation worksheets, reliability calculations and proof-testing schedules ready to guide instrument design reviews and statutory compliance audits.

Functional Safety and Safety Integrity Level: The Way Forward

The Safety Instrumented System Lifecycle Verification Dossier first informs capital project design reviews and operational safety sign-offs. Engineering superintendents, safety specialists and technical authorities use its quantitative calculations to approve equipment architectures. After completing initial plant turnaround testing, asset teams should revisit field failure data and proof-test coverage factors, ensuring real operational conditions continue to validate the original integrity level assumptions.