

eFunctionalSafety®



SIS 2 day training

Safety Instrumented Systems

Specification, Design & Engineering
Installation, Commissioning & Validation
+ Operation & Maintenance overview



SIS 2 day

FSM

Functional Safety Management, including planning, life-cycle procedures, verification, assessment and audit

SRS

Safety Requirements Specification key contents

SIS DESIGN

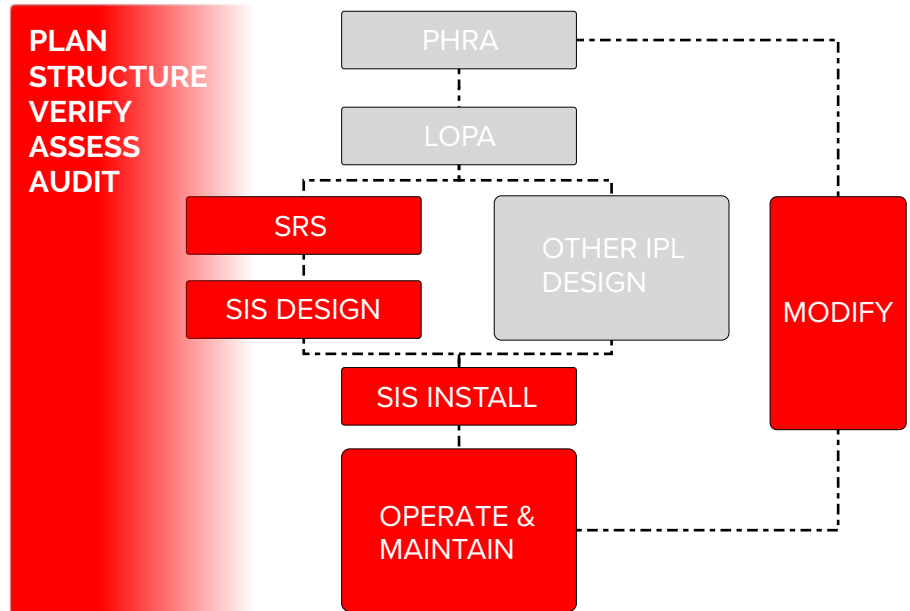
Equipment selection rules, SIS/SIF concept design including SIL verification calculations.

INSTALLATION

I&C checklists and Validation requirements

O&M

Operation and maintenance including proof test procedure requirements.



SIS 2 covers the lifecycle phases coloured in red

Outline

The Safety Instrumented System (SIS) life-cycle of IEC 61511 covers all the stages shown in the above outline. This 2 day course is designed to cover the lifecycle aspects of the SIS that occur after process hazard analysis and SIL assessment has been completed, i.e. from the SRS through to the operation & maintenance requirements of a new or modified SIS.

Revised for latest
IEC 61511 edition 2



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Aimed at End Users, OEM's, Integrators, EPC's and those in the Process Industry Supply Chain

SUITABILITY

Process Operators of Major Accident Hazard sites:

EHS / SHE Professionals
Process Engineers
Control & Instrument engineers
Project engineers and managers
Maintenance technicians

Original Equipment Manufacturers of:

Instruments, Interfaces, PLC's,
Solenoids, Actuators and Valves

Integration and Engineering companies:

Control & Instrument engineers
Project engineers and managers

Learning outcomes:

Differentiate between functional safety standards IEC61508, IEC61511 and their primary usage.

Describe the IEC 61511 SIS safety lifecycle and its key inputs, procedures and outputs.

Explain the importance of Functional Safety Planning, competence management, lifecycle phase verification activities, audit and assessment requirements for SIS.

Demonstrate the key contents of safety requirements specifications, and the critical important parameters the describe safety systems and functions.

Understand the main rules around equipment selection for SIS, including "certification" and prior use options.

Develop an understanding of failure rates and hardware fault tolerance and explain how these affect probability of failure in the context of safety instrumented functions.

Explain the key contents of well designed proof test procedures for safety instrumented functions (SIF), and the importance of authorized bypass procedures and ongoing management of change.

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Course Contents

1. Introduction
2. Key background & Terminology
3. Functional Safety Management
4. SIS Safety requirements specification
5. Design & Engineering
6. Installation, commissioning and Validation
7. Operation, maintenance and modification



Safety Lifecycle Overview

Safety in context

Why do we need SIS?

Buncefield accident

SIS & BPCS

- SIS Safety Lifecycle Overview
- Functional Safety Management
- Hazard & Risk Assessment
- SIL Determination
- Safety Requirements Specification
- SIS Design
- Installation, commissioning and validation
- Operation and Maintenance
- Management of Change



Key Background and Terminology

Regulation Hierarchy - EU & UK

IEC Standards

Key terminology

- Hazard, harm, risk
- ALARP & Tolerable Risk
- Risk Reduction
- SIL - Low Demand / High Demand
- SIL and Risk Reduction
- BPCS and SIS Elements
- SIS & SIF
- SIF Examples

SIS Foundation Module - M01L02

Safety Integrity Level (SIL) – *Low Demand

	Required Risk Reduction Factor (RRF)	PFD _{average} Requirement of SIF (1/RRF)
SIL 1	10	0.1 or less
SIL 2	100	0.01 or less
SIL 3	1000	0.001 or less
SIL 4	10000	0.0001 or less

*Low Demand Mode – fewer demands on the safety function than one per year

Functional Safety Management

FSM Overview
 Functional Safety Planning
 Organisation and resources
 Procedures, Checklists & Tools
 Competence - Introduction
 Competence Management
 V+V Planning
 Verification plans
 Validation plans
 Functional Safety Assessment
 FS Audit

SIS Foundation Module - W01L03
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Competence Management

CMS Competence Management System

- Set a competence standard for lifecycle roles
- Ensure the context of each role is clear
- Set tasks, attributes and levels of required attainment
- Assign an Assessor
- Identify gaps
- Create an action plan to close gaps

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Safety Requirements Specification

Qualities of good requirements
 Process requirements
 SIS Requirements
 SIF Requirements
 SRS Detailed Contents
 Interfaces and other devices
 SIS Requirements overview summary
 SRS Challenges
 Avoiding SRS problems in development
 Avoiding SRS problems in operation

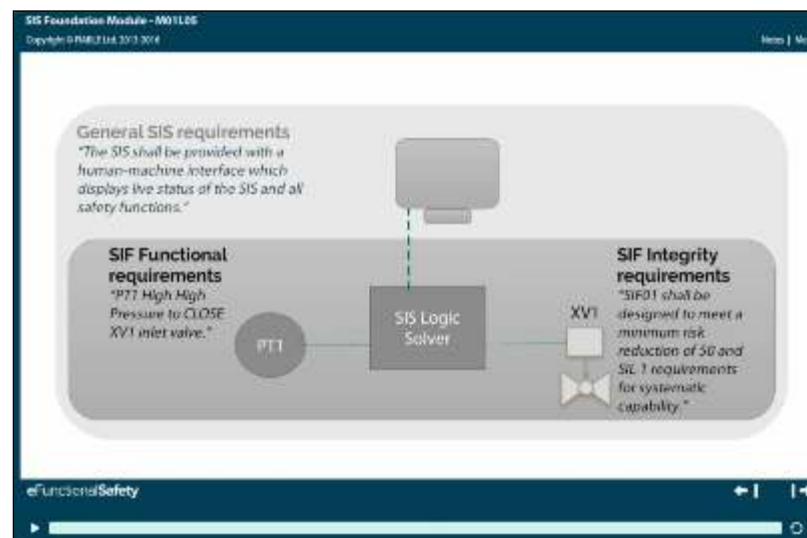


SIS Design & Engineering

Equipment selection
 Random & systematic failure
 Assessing systematic capability
 IEC61511 Prior use - FPL, LVL
 IEC61508 Assessment
 SIF Hardware Verification

- HFT and SIL - examples
- Failure Rates & Modes
- Probability of Failure—PFD/PFH

 Application Software Types
 Software design
 Software verification requirements



Installation, commissioning & validation

- Validation planning
- FAT requirements
- SAT and SIT requirements
 - Installation activities
 - Pre-commissioning
 - E&I Loop Check
 - Cold commissioning
 - Hot commissioning
- Functional Safety Assessment - stage 3



Operation & Maintenance

- Operations Planning & procedures
- Overrides and bypasses
- Overrides and bypasses
- Maintenance planning
- SIL - demand mode
 - Sensor failure modes
 - Logic solver failure modes
 - Valve assembly failure modes
- PFD and proof testing
- Example Inspection & Test Methods
- Management of change



Background Material

- Process industry accident summaries & videos
- Glossary of terms
- Abbreviations
- Course references

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