

TÜV Rheinland Functional Safety Engineer Certification

Time: Day 1 8:00 am to 4:30 pm Day 2 8:00 am to 4:30 pm Day 3 8:00 am to 4:30 pm
 Day 4 8:00 am to 4:30 pm Day 5 8:00 am to 12:30 pm
CEU: 2.6

Recommended Precursor Courses:

- Safe Automation in the Process Industry (or equivalent training/experience)
- SIL Verification – Fundamentals and Calculations (or equivalent training/experience)

Audience: Control system specialists, instrumentation and electrical personnel, and SIS design specialists, who have at least 3 years of experience in SIS application and who want to prepare for TÜV certification

Description: While SIS Engineers might have a particular aspect of SIS work that they are most experienced in, success in taking the TÜV Functional Safety Engineer exam requires the applicant to have a broad understanding of most aspects of the ISA/IEC 61511 standard. This 4-day course provides a holistic refresher on primary activities required for the identification, design, implementation, and management of Safety Instrumented Systems (SIS), per the current edition of ISA/IEC 61511-1.

The course begins with a review of the official definitions of key terminology and the functional safety planning required of the facility. The course then summarizes the common process-sector semi-quantitative hazards and risk assessment (H&RA) methods (e.g., LOPA and event tree), including updated limitations on safety function allocation. A recap of the SRS content requirements is provided, focusing on the pragmatic order in which this information should be developed. The two ISA/IEC 61511-1 approaches for SIS device approval and three primary design constraints on achieving a target SIL are reviewed, Mandatory SIS Assurance Activities throughout the complete lifecycle are then addressed. Finally, the course covers the obligations for Operations and Maintenance phase of the lifecycle, including the use of compensating measures during online bypasses of SIS equipment and the mandatory activities associated with managing change to either the SIS itself or the basis of the allocation of safety functions to the SIS. The course supplements ISA/IEC 61511-1 requirements with additional guidance from other industry RAGAGEP publications.

The course material is supplemented throughout with hands-on refresher exercises for key SIS safety life-cycle activities such as

- The allocation of safety functions to instrumented protection layers.
- Determining the SIS mode of operations
- The correct use of IEC 61508 safety failure fraction, adjusting for differences between the SIS design and SIS device certificate assumptions.
- The calculation of PFDavg using both Boolean and Markovian approaches, accounting for SIS design options such as voting architecture, diagnostic coverage, and partial testing.
- The identification of compensating measures for use during online SIS bypasses.
- Management of change to protection layers.

Outline

<u>DAY 1 – “Planning” SIS</u> <ul style="list-style-type: none">• SIS Standards Overview• Management of Functional Safety• Hazards & Risk Assessment• Allocation of Safety Functions	<u>DAY 2 – “Doing” SIS Part 1</u> <ul style="list-style-type: none">• Process Requirements Specification• Conceptual SIS Design• Completing the SRS	<u>DAY 3 – “Doing” SIS Part 2</u> <ul style="list-style-type: none">• Data Estimation• Quantitative Design Verification• Pre-construction SIS Assurance Activities (FSA1-2)
<u>DAY 4 – “Checking” and Sustaining SIS</u> <ul style="list-style-type: none">• Pre-startup SIS Assurance Activities<ul style="list-style-type: none">• Application Programming and Instrument Verification• Validation• FSA3• SIS O&M<ul style="list-style-type: none">• Performance Assessment & Auditing• Managing Change• TÜV Rheinland FSE Module and Final Q&A		<u>DAY 5 – Exam</u> <ul style="list-style-type: none">• Setup (8:00 – 8:30)• Exam (8:30 – 12:30)

Required pre-reading for this course: Either of the following

- ANSI/ISA-61511-1:2018, Functional Safety: Safety Instrumented Systems for the Process Industry Sector - Part 1: Framework, Definitions, System, Hardware and Application Programming Requirements, Research Triangle Park, NC (2018)
- IEC 61511-1 Edition 2.1, Functional Safety: Safety Instrumented Systems for the Process Industry Sector - Part 1: Framework, Definitions, System, Hardware and Application Programming Requirements, Geneva, Switzerland, (2017-08)

Recommended pre-reading for this course:

- ISA TR84.00.04 Part 1, Guidelines for the Implementation of ANSI/ISA 84.00.01-2004 (IEC 61511 Modified), Research Triangle Park, NC (2015).
 - Chapter 4
 - Annexes D-G
- ISA TR84.00.02, Safety Integrity Level (SIL) Verification of Safety Instrumented Functions, Research Triangle Park, NC (2022).
 - Chapters 5-8
 - Section 11.1
 - Table F.1
 - Table G.10