tec.nicum academy

Functional safety of machinery

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functional.safety

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Schmersal is an approved course provider for the "Functional Safety of Machinery" training course of the TÜV Rheinland Functional Safety Training Program.

During the 8 half-day online training participants will experience theory, practical examples, discussions on General Machine Safety based on ISO 12100 and Functional Safety according to ISO 13849 and IEC 62061, added to by all the knowledge and experience of the trainers and the course provider.

Engineers with proven experience in Machine Safety and Functional Safety will go in-depth into the requirements, the demands of international standards and, by passing a final exam, will receive an official **Functional Safety Engineer (TÜV Rheinland) certificate**, confirming their knowledge. Non-engineers will receive an official **Functional Safety Qualified (TÜV Rheinland) certificate.**

International regulations, basic risk assessment concepts, examples of protective equipment for machinery, safety functions, circuit designs, Performance Level (PL) and Safety Integrity Level (SIL) calculations will be described, discussed, designed, and tested during the course.

Course objectives

This training course has been developed to create high-level knowledge in:

- Risk assessment and reduction
- Specifying machine guarding
- Developing safety functions
- Performance level calculation and validation
- Calculation and validation of the Safety Integrity Level

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Who should attend?

Professionals with proven experience in machine and functional safety (application engineers, system integrators, designers, safety specialists) who wish to test and certify their knowledge with an official international certification.

Participant eligibility requirements

Participants who wish to obtain the FS Engineer (TÜV Rheinland) certificate have to fulfil the following requirements listed below, and attend the complete training course and pass the exam:

1) A minimum of 3 years experience in the field of functional safety
2) University degree (Bachelors, Masters, Diploma etc.) in Engineering or other technical area

Additional information

The standards ISO 13849 part 1, part 2 and IEC 62061 are required working material for this training and need to be aquired and brought along by the participants.

Course fee (€)

Please contact us for information: academy@tecnicum.com

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Agenda
Day 1/2:

TÜV Rheinland
Functional safety training program

- Machine Directive, A, B and C standards
- Standards and status of standards regarding Functional Safety in Machine safeguarding
- Basic concepts of European Guidelines (Machinery Directive/Regulation and CE Marking)
- Importance (meaning) of harmonised and non-harmonised standards
- Machines and safety components listed in the appendix IV of the Machinery Directive

Risk analysis

- Methods for determination of necessary measures for the reduction of risks at machines (ISO 12100)
- Hazards & risks
- 3-Step risk reduction strategy: Direct, Indirect, and Indicative safety
- Proof and documentation
- Safety function definition
- Procedure acc. to ISO 13849 and EN 62061
- Risk matrix & risk graph
- Required PL & SIL calculations
- Examples
- Comparison of safety classifications

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Agenda
Day 3/4:

Introduction to ISO 13849

- Importance (meaning) of safety categories
- Control categories
- Basic safety principles, well-tried safety principles and well-tried components
- Principal information regarding deterministic fault consideration, faults, and fault exclusions acc. to ISO 13849-2

Safety devices

- Definition of safety devices, advantages and disadvantages, installation requirements, configuration of safety devices
- Types of protective equipment for machinery (separating and non-separating guards)
- Interlocking, guarding locking, position switches, proximity switches, ESPEs, AOPDs, AOPDDRs, mats, edges, bumpers, two-hand controls, enabling devices
- Guards, interlocking devices:
  - Types, examples regarding application, installation requirements acc. to different safety categories
  - Circuit examples
  - Faults, fault exclusions
  - Normative requirements
- Other safety devices:
  - Type, installation requirements, advantages, and disadvantages
  - Calculation of safety distances

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Agenda
Day 3/4:

Safety functions of machines

- Power-drive systems
- Start/re-start interlock, start functions, reset
- Hold-to-run controls
- Emergency off, emergency switching off, stop categories, muting etc
- Realisation acc. to the different safety categories
- Stop functions
- Other safety functionse

Circuits, schematics & examples

- Connection of safety devices to controls, interface circuits
- Realisation acc. to the different safety categories
- Examples for correct and incorrect typical circuits

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Agenda
Day 5/6:

New standards regarding safety of machinery

- Importance (meaning) of these standards regarding quality management, documentation and safety related availability

ISO 13849

- Contents of ISO 13849-1, application area, restrictions regarding applicability
- Designated architectures (categories)
- Failure probability (MTTFd, B10d, T10d)
- Failure probability (DC)
- Failure probability (CCF)
- Failure probability (PL calculations)
- Documentation requirements and quality management
- Requirements regarding software
- Random and systematic failures
- Use of standard components in safety functions
- Proof of safety, verification, and validation of safety functions
- Examples

Validation

- Validation acc. to ISO 13849-2

Examples

- Examples for proof of functional safety acc. to ISO 13849-1

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Agenda
Day 7/8:

IEC 62061

- Content of IEC 62061, application area
- Design process
- SRS – Safety Requirements Specification
- Documentation requirements and quality management, life cycle model
- Meaning of terms SIL, SIL CL, HFT, SFF and their context
- Subsystems architectures
- Requirements regarding safety relevant application software
- Proof of safety, verification, and validation of safety functionse

Exampless

- Examples for proof of functional safety acc. to IEC 62061s

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Agenda
Day 9:

Exam

- Day 9 of online training
- Exam duration: 3 hours
- The exam consists of 70 multiple choice questions and 12 open questions
- The standards EN ISO 13849 part 1/part 2 and EN 62061 are essential working material for the exam. Additionally, a calculator should be brought along for the quantitative assessment

Ready to start our Functional Safety Training Program?

Have we sparked your interest? Then get in touch to claim your seat:

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excellence in safety

tec.nicum is the Schmersal Group‘s business unit for solutions and services related to machine, plant and occupational safety.

Schmersal restructured its service business in 2024. The range of safety services offered by tec.nicum has been significantly expanded – particularly with regard to digitalisation and complete solutions for machine safety – and the global activities and expertise have been more closely integrated.

In April 2024, Schmersal founded tec.nicum – Solutions & Services GmbH as a new subsidiary, which also incorporated omnicon engineering GmbH, which Schmersal had already acquired in 2019. The headquarters of the new subsidiary is located in Kirkel-Limbach, Germany.

The four pillars on which tec.nicum‘s offering has been built to date – academy, consulting, engineering and integration – have been supplemented by two more: digitalisation and outsourcing.

digitalisation: tec.nicum is increasingly offering newly developed software solutions, such as a new tool for carrying out risk assessments, as well as new digital technologies such as cloud solutions, IIoT applications, digitalised lockout-tagout procedures and energy management tools.

outsourcing: tec.nicum offers companies the opportunity to completely outsource all tasks related to machine safety, from the planning and installation of control cabinets to the design of holistic safety solutions. tec.nicum provides the user with ready-to-connect plug & play solutions.

Thanks to its worldwide consultancy network, tec.nicum services are available around the globe. tec.nicum provides customers with competent, product- and manufacturer-neutral advice and supports them in the safety-related design of their machines and production lines.

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Education center

- Training courses
- Customer-specific trainings
- In-house seminars
- Certified courses (mce.expert and FSE)

consulting

Analysis and documentation

- Technical support
- Risk assessment
- CE conformity assessment
- Evaluation of machines and production lines
- Reports

engineering

Planning and design

- Technical project planning
- Conceptual project development
- Electrical and mechanical design
- Executive project management

integration

Practical application

- Turnkey approach
- Installation
- Retrofit

digitalisation

Software integration

- tec**.ps** (Product Service System)
- tec**.ssm** (Schmersal Smart Machine)
- tec**.cvs** (AI and Computational Vision Solutions)
- tec**.dloto** (Digital Lockout Tagout)
- tec**.ems** (Energy Monitoring System)

outsourcing

Serial solutions

- Plug & Play products
- Engineer to Order projects
- Systems and cabinets

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The range of services offered by tec.nicum comprises six segments: academy (knowledge transfer), consulting (advisory services), engineering (technical planning), integration (execution and implementation), digitalisation (software solutions and new digital technologies) as well as outsourcing (complete solutions).

tec.nicum:
global service and engineering hubs

tec.nicum – Solutions & Services GmbH is a subsidiary of Schmersal Group. It offers a wide range of services relating to machine and occupational safety.

tec.nicum comprises a global consultancy network of TÜV Rheinland-certified Functional Safety Engineers and Machinery CE Experts. Services can be called upon around the world.

The range of services at tec.nicum is based on six modules: training and workshops in the academy section, consultancy services in the consulting section, the designing of safety solutions in the engineering section, practical implementation in the integration section, the development of software solutions and new digital technologies in the digitalisation section and the provision of complete solutions in the outsourcing section.

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