COURSE OVERVIEW IE0350

Safety Integrity Level (SIL) Determination & Verification

Course Title
Safety Integrity Level (SIL) Determination & Verification

Course Reference
IE0350

Course Duration/Credits
Five days/3.0 CEUs/30 PDHs

Course Date/Venue

Session(s)	Date	Venue
1	April 06-10, 2025	Meeting Plus 9, City Centre Rotana Doha, Doha, Qatar
2	July 20-24, 2025	Boardroom 1, Elite Byblos Hotel Al Barsha, Sheikh Zayed Road, Dubai, UAE
3	October 04-08, 2025	Safir Meeting Room, Divan Istanbul, Turkey
4	December 15-19, 2025	Hampstead Meeting Room, Marriott London Regents Park, London, United Kingdom
5	January 11-15, 2026	Boardroom 1, Elite Byblos Hotel Al Barsha, Sheikh Zayed Road, Dubai, UAE
6	February 08-12, 2026	Olivine Meeting Room, Fairmont Nile City, Cairo, Egypt

Course Description

This practical and highly-interactive course includes various practical sessions and exercises. Theory learnt will be applied using our state-of-the-art simulators.

The ANSI SP 84 (formerly ISA 84.01) “Application of Safety Instrumented Systems for the Process Industries” standard requires that companies assign a target safety integrity level (SIL) for all safety instrumented systems (SIS) applications. The assignment of the target SIL is a decision requiring the extension of the process hazards analysis (PHA). The assignment is based on the amount of risk reduction that is necessary to mitigate the risk associated with the process to an acceptable level. All of the SIS design, operation, and maintenance choices must then be verified against the target SIL.

This course covers the systematic method for selecting safety integrity levels (SILs) for safety instrumented systems (SIS). Although numerous methods have been proposed and adopted by industry, layer of protection analysis (LOPA) is rapidly becoming the most frequently used method. Its popularity stems from its ease of use and the accuracy of the results it provides. LOPA accounts for most existing layers of protection, more than any other method. With this proper accounting, the SIS is neither overdesigned nor overpriced. The LOPA method ensures that users achieve the maximum return on their risk reduction investments.

The result of using poor methods to select SILs is typically either an overdesigned or an under designed safety instrumented system. The risk analysis that forms the basis for SIL selection, however, can be greatly improved. This will provide the user with more accurate results so formerly inflated requirements can be relaxed, which will in turn lower not only the initial installation costs, but the cost of ongoing maintenance.

Much of the material in this course is based on the application of the safety life cycle as it is described in the international standards ANSI SP 84 (formerly ISA 84.01) "Application of Safety Instrumented Systems for the Process Industries" and EN/IEC 61508/61511. This course expands upon the framework developed in these standards. In addition to describing the tasks that users should perform during the safety life cycle, this course also provides detailed procedures for accomplishing these tasks. These procedures are based on risk analysis and reliability engineering principles from a variety of disciplines.

Course Objectives

Upon the successful completion of this course, each participant will be able to:-

- Apply and gain a good working knowledge on the standards related to safety integrity level (SIL) which includes IEC 61508, IEC 61511 and ISA S84
- Discuss the safety life cycle including its phases and the safety requirement specification for safety integrity level (SIL)
- Integrate risk reduction and risk management and identify the proper hazard analysis for HAZOP study, fault tree analysis, event tree analysis and failure mode and effects analysis (FMEA)
- Select sensors and final elements, determine the probable causes of failure and list the general requirements for fail safe operations
- Illustrate a detailed explanation on safety instrumented systems including its safety architecture and major systems and explain how SIF fits with SIS and SIL
- Employ the SIL application for safety instrumented level, compare low demand mode and continuous mode and determine the probability of failure on demand
- Develop a proper SIL determination by using the ALARP, semi quantitative, safety layer matrix, risk graph and LOPA methods
- Carryout a detailed SIL verification and validation, provide a SIS documentation schedule and risk reduction diagrams and demonstrate proof testing
- Explain the certified software models for safety software, development life cycle and asset management software
- Illustrate the operation, planning and maintenance of SIS and recognize the need for smart Safety Instrumented Systems, intelligent field devices, digital communications and smart logic solvers
- Cite practical examples of risk graph, risk matrix and multiple layers of protection

Exclusive Smart Training Kit - H-STK®

*Participants of this course will receive the exclusive "Haward Smart Training Kit" (**H-STK®**). The **H-STK®** consists of a comprehensive set of technical content which includes **electronic version** of the course materials conveniently saved in a **Tablet PC**.*

Who Should Attend

This course provides an overview of all significant aspects and considerations of safety integrity level (SIL) determination and verification for senior process control engineers, senior control systems engineers, process control engineers, process engineers, control systems engineers, reliability and integrity engineers as well as safety engineers, professionals and regulators.

Training Methodology

All our Courses are including **Hands-on Practical Sessions** using equipment, State-of-the-Art Simulators, Drawings, Case Studies, Videos and Exercises. The courses include the following training methodologies as a percentage of the total tuition hours:-

30% Lectures
20% Practical Workshops & Work Presentations
30% Hands-on Practical Exercises & Case Studies
20% Simulators (Hardware & Software) & Videos

In an unlikely event, the course instructor may modify the above training methodology before or during the course for technical reasons.

Course Fee

Doha	**US$ 6,000** per Delegate. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.
Dubai	**US$ 5,500** per Delegate + **VAT**. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.
Istanbul	**US$ 6,000** per Delegate + **VAT**. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.
London	**US$ 8,800** per Delegate + **VAT**. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.
Dubai	**US$ 5,500** per Delegate + **VAT**. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.
Cairo	**US$ 5,500** per Delegate + **VAT**. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

Course Certificate(s)

Internationally recognized certificates will be issued to all participants of the course who completed a minimum of 80% of the total tuition hours.

Certificate Accreditations

Certificates are accredited by the following international accreditation organizations: -

- British Accreditation Council (BAC)

  Haward Technology is accredited by the **British Accreditation Council** for **Independent Further and Higher Education** as an **International Centre**. BAC is the British accrediting body responsible for setting standards within independent further and higher education sector in the UK and overseas. As a BAC-accredited international centre, Haward Technology meets all of the international higher education criteria and standards set by BAC.

- The International Accreditors for Continuing Education and Training (IACET - USA)

  Haward Technology is an Authorized Training Provider by the International Accreditors for Continuing Education and Training (IACET), 2201 Cooperative Way, Suite 600, Herndon, VA 20171, USA. In obtaining this authority, Haward Technology has demonstrated that it complies with the **ANSI/IACET 2018-1 Standard** which is widely recognized as the standard of good practice internationally. As a result of our Authorized Provider membership status, Haward Technology is authorized to offer IACET CEUs for its programs that qualify under the **ANSI/IACET 2018-1 Standard**.

  Haward Technology's courses meet the professional certification and continuing education requirements for participants seeking **Continuing Education Units** (CEUs) in accordance with the rules & regulations of the International Accreditors for Continuing Education & Training (IACET). IACET is an international authority that evaluates programs according to strict, research-based criteria and guidelines. The CEU is an internationally accepted uniform unit of measurement in qualified courses of continuing education.

  Haward Technology Middle East will award **3.0 CEUs** (Continuing Education Units) or **30 PDHs** (Professional Development Hours) for participants who completed the total tuition hours of this program. One CEU is equivalent to ten Professional Development Hours (PDHs) or ten contact hours of the participation in and completion of Haward Technology programs. A permanent record of a participant's involvement and awarding of CEU will be maintained by Haward Technology. Haward Technology will provide a copy of the participant's CEU and PDH Transcript of Records upon request.

Accommodation

Accommodation is not included in the course fees. However, any accommodation required can be arranged at the time of booking.

Course Instructor(s)

This course will be conducted by the following instructor(s). However, we have the right to change the course instructor(s) prior to the course date and inform participants accordingly:

Mr. Sydney Thoresson, PE, BSc, is a **Senior Electrical & Instrumentation Engineer** with over **40 years** of extensive experience within the **Petrochemical**, **Utilities**, **Oil**, **Gas** and **Power** industries. His specialization highly evolves in **Process Control Instrumentation**, **Process Instrumentation & Control**, **Process Control**, **Instrumentation**, Troubleshooting & Problem Solving, Instrumentation Engineering, Process Control (**PCI**) & Safeguarding, **Instrument Calibration & Maintenance**, **Instrumented Safety Systems**, High Integrity Protection Systems (**HIPS**), Process Controller, **Control Loop & Valve Tuning**, **Compressor Control & Protection**, **Control Systems**, Programmable Logic Controllers (**PLC**), **SCADA System**, **PLC & SCADA** - Automation & Process Control, **PLC & SCADA** Systems Application, Technical **DCS/SCADA**, **PLC-SIMATIC S7 300/400**: Configuration, Programming and Troubleshooting, **PLC, Telemetry and SCADA** Technologies, Cyber Security of Industrial Control System (**PLC, DCS, SCADA & IED**), Basics of **Instrumentation Control System, DCS**, **Distributed Control System** - Operations & Techniques, Distributed Control System (**DCS**) Principles, Applications, Selection & Troubleshooting, Distributed Control Systems (**DCS**) especially in **Honeywell DCS**, **H&B DCS**, **Modicon, Siemens**, **Telemecanique**, **Wonderware** and **Adrioit,** Safety Instrumented Systems (**SIS**), Safety Integrity Level (**SIL**), Emergency Shutdown (**ESD**), **Emergency Shutdown** System, Variable Frequency Drive (**VFD**), **Process Control & Safeguarding**, **Field Instrumentation**, **Instrumented Protective Devices** Maintenance & Testing, Instrumented Protective Function (**IPF**), **Refining & Rotating Equipment**, **Equipment Operations**, **Short Circuit Calculation**, **Voltage Drop Calculation**, **Lighting Calculation**, **Hazardous Area Classification**, **Intrinsic Safety**, **Liquid & Gas Flowmetering**, **Custody Measurement**, **Ultrasonic Flowmetering**, **Loss Control**, **Gas Measurement**, **Flowmetering & Custody Measurement**, **Multiphase Flowmetering**, **Measurement and Control**, **Mass Measuring System Batching** (**Philips**), Arc Furnace Automation-Ferro Alloys, Walking Beam Furnace, Blast Furnace, Billet Casting Station, Cement Kiln Automation, Factory Automation and Quality Assurance Accreditation (**ISO 9000** and **Standard BS 5750**). Further, he is also well-versed in **Electrical Safety**, **Electrical Hazards Assessment**, **Electrical Equipment**, **Personal Protective Equipment**, Log-Out & Tag-Out (**LOTO**), **ALARP & LOPA** Methods, Confined Workspaces, Power **Quality**, Power **Network**, Power **Distribution**, **Distribution Systems**, **Power Systems Control**, **Power Systems Security**, Power **Electronics**, Electrical **Substations**, **UPS** & **Battery System**, **Earthing & Grounding**, Power **Generation**, **Protective Systems**, **Electrical Generators**, **Power** & **Distribution Transformers**, **Electrical Motors**, **Switchgears**, **Transformers**, **AC** & **DC Drives**, **Variable Speed Drives** & **Generators** and **Generator Protection.** He is currently the **Projects Manager** wherein he manages projects in the field of electrical and automation engineering and in-charge of various process hazard analysis, fault task analysis, FMEA and HAZOP study.

During Mr. Thoresson's career life, he has gained his thorough and practical experience through various challenging positions and dedication as the **Contracts & Projects Manager**, **Managing Director**, **Technical Director**, **Divisional Manager**, **Plant Automation Engineer**, **Senior Consulting Engineer**, **Senior Systems Engineer**, **Consulting Engineer**, **Service Engineer** and **Section Leader** from several international companies such as **Philips**, **FEDMIS**, **AEG**, **DAVY International**, **BOSCH**, **Billiton** and **Endress/Hauser**.

Mr. Thoresson is a **Registered Professional Engineering Technologist** and has a **Bachelor**'s degree in **Electrical & Electronics Engineering** and a **National Diploma** in **Radio Engineering**. Further, he is a **Certified Instructor/Trainer**, a **Certified Internal Verifier/Assessor/Trainer** by the **Institute of Leadership & Management** (**ILM**) and an active member of the International Society of Automation (**ISA**) and the Society for Automation, Instrumentation, Measurement and Control (**SAIMC**). He has further delivered numerous trainings, courses, seminars, conferences and workshops worldwide.

Course Program

The following program is planned for this course. However, the course instructor(s) may modify this program before or during the course for technical reasons with no prior notice to participants. Nevertheless, the course objectives will always be met:

Day 1

0730 – 0800	Registration & Coffee
0800 – 0815	Welcome & Introduction
0815 – 0830	**PRE-TEST**
0830 – 0845	**Review of Course** Objectives of Course ● Timetables
0845 – 0930	**Preface** Case Studies ● Bhopal Gas Tragedy ● Piper Alpha Disaster ● Chernobyl Catastrophe ● Flixborough Gas Explosion
0930 – 0945	Break
0945 – 1100	**Introduction to Safety Systems** Introduction ● Overview ● Ensuring Safety ● Layers of Safety ● Factors Affecting Safety ● Anatomy of a Disaster ● Disaster Prevention
1100 – 1245	**Standards** Introduction ● IEC 61508 ● IEC 61511 ● ISA S84 ● Summary
1245 – 1300	Break
1300 – 1420	**Safety Life Cycle** Introduction ● Overview ● Phases of the Safety Life Cycle ● Safety Requirement Specification
1420 – 1430	**Recap**
1430	Lunch & End of Day One

Day 2

0730 – 0930	**Risk Reduction** Introduction ● Risk Management ● Assessing Risk ● Tolerable Risk
0930 – 0945	Break
0945 – 1100	**Process Hazard Analysis** Introduction ● HAZOP Study ● Fault Tree Analysis ● Event Tree Analysis Failure Mode and Effects Analysis (FMEA)
1100 – 1230	**Video Presentation** HAZOP
1230 – 1245	Break
1245 – 1330	**Selecting Sensors & Final Elements** Introduction ● Non-Essential Components ● Certified or Proven ● Probable Causes of Failure ● Smart Field Instruments ● Digital Valve Controller ● General Requirements for Fail Safe Operations
1330 – 1420	**Case Study** **TOSCO AVON REFINERY INCIDENT** Official Slide Presentation ● U.S. Chemical Safety Board Investigation
1420 – 1430	**Recap**
1430	Lunch & End of Day Two

Day 3

0730 – 0930	***Safety Instrumented Systems*** *Introduction • Safety PLC • System Architecture • Major Systems*
0930 – 0945	*Break*
0945 – 1100	***Safety Instrumented Functions*** *Definition • Example of a Safety Function • What a SIF is • What a SIF is Not • How SIF Fits with SIS and SIL • Summary*
1100 – 1230	***Safety Instrumented Level*** *Introduction • General • SIL Application • Low Demand Mode vs Continuous Mode • Probability of Failure on Demand*
1230 – 1245	*Break*
1245 – 1420	***SIL Determination*** *Summary • Introduction • Safety Integrity Level Concepts • ALARP Method • Semi Quantitative Methods • Safety Layer Matrix Method • Risk Graph Method • LOPA Method*
1420 – 1430	***Recap***
1430	*Lunch & End of Day Three*

Day 4

0730 – 0930	***SIL Verification & Validation*** *Introduction • Verification • Validation • A Structured Approach • System Decomposition*
0930 – 0945	*Break*
0945 – 1100	***SIS Documentation*** *Introduction • Documentation Schedule • Documentation Format Examples • Risk Reduction Diagrams • Safety Requirements Specification • Software Safety Requirements • Verification, Validation & Functional Safety Assessment*
1100 – 1230	***Proof Testing*** *Introduction • Proof Testing • Diagnostics • Partial Valve Stroking*
1230 – 1245	*Break*
1245 – 1315	***Safety Software*** *Introduction • Development Life Cycle • Certified Software Models • Asset Management Software • Summary*
1315 – 1420	***Operation & Maintenance*** *Overview • Planning • Procedures • Operations • Maintenance • Predictive Maintenance • Summary*
1420 – 1430	***Recap***
1430	*Lunch & End of Day Four*

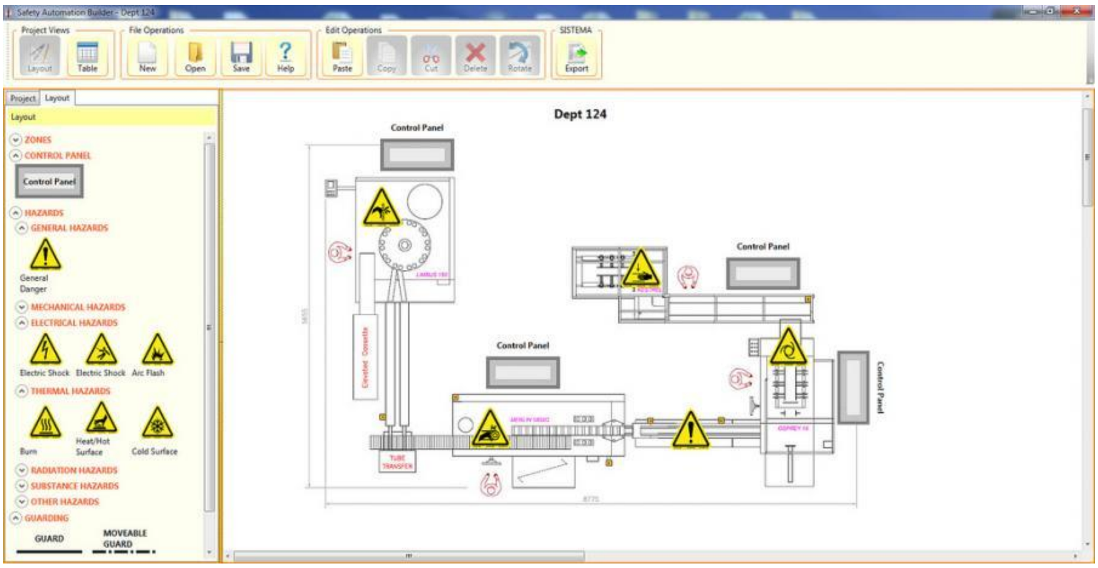
Day 5

0730 – 0900	***Smart Safety Instrumented Systems*** *Overview • Why it Matters • What is a Smart SIS? • Intelligent Field Devices • Digital Communications • Smart Logic Solvers • Complete Loop Solution • Smart SIS Implementation*
0900 - 0930	***Video Presentation*** *HART Digital Communications*

0930 – 0945	*Break*
0945 – 1145	***Practical Examples*** *Determination of SIL by Risk Graph Method ● Determination of SIL by Risk Matrix Method ● Multiple Layers of Protection*
1130 – 1230	***Addendums*** *Frequently Asked Questions ● Other Subjects*
1230 – 1245	*Break*
1245 – 1345	***Video Presentation*** *Explosion at BP Texas City Refinery*
1345 – 1400	***Course Conclusion*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Course Topics that were Covered During the Course*
1400 – 1415	***POST-TEST***
1415 - 1430	*Presentation of Course Certificates*
1430	*Lunch & End of Course*

<u>Simulator (Hands-on Practical Sessions)</u>

Practical sessions will be organized during the course for delegates to practice the theory learnt. Delegates will be provided with an opportunity to carryout various exercises using the "Safety Automation Builder Software (Rockwell Automation)" software.



<u>Safety Automation Builder (Rockwell Automation) Software</u>

<u>Course Coordinator</u>

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