



INTEGRITY
CONTROLS & INSTRUMENTATION

SERVICES

Functional Safety Auditing

An FS Audit provides a systematic and independent examination of the safety lifecycle phase activities under review. It determines whether the “procedures” specific to the functional safety requirements comply with the planned arrangements, are implemented effectively, and are suitable to achieve the specified objectives. Industry best practice is encapsulated in the IEC 61511 standard [1]. Clause 5.2.6.2.1 notes: “The purpose of the audit is to review information documents and records to determine whether the functional safety management system (FSMS) is in place, up to date, and being followed. Where gaps are identified, recommendations for improvements are made.” ICI has developed special audit tools to help identify areas of concern and recommend improvements.

Safety Integrity Level (SIL) Determination

An analysis outlining hazard likelihood and consequences used to determine the risk reduction required for each SIF. The risk reduction factor (RRF) is then used to calculate the Safety Integrity Level requirement (SIL 1-4), with SIL 1 being the lowest RRF and SIL 4 being the highest RRF. ICI can use several methods of determining SIL however, the preferred method and the industry trend is in the direction of LOPA (Layers of Protection Analysis).

Safety Requirements Specifications (SRS) Design

The purpose of the SRS is to establish the Safety Instrumented System (SIS) design basis in accordance with the IEC 61511 standard. The SRS clearly defines what the SIS must do, how well it must perform, and how it will reduce risk—so the system can be properly designed, verified, and maintained. A well-defined SRS is key to preventing downstream design changes that could drive up costs, delay the schedule, or negatively impact the risk reduction achieved by the SIF.

Safety Integrity Level (SIL) Verification

Analysis that verifies each SIF achieves the required risk reduction as defined in the SRS (usually obtained from a LOPA). ICI can use a variety of software tools to verify SIL including ExSILentia, and our proprietary software Integrity SIS.

Preliminary Design Packages

Develop P&ID's, Instrument Index, and Scope of Work documents to create a preliminary engineering package that can be used as a bid-specification for detailed design. These documents can generate a +/- 30% Total Installed Cost estimate.

SIS Bridge Documents (C&E's, Control Narratives)

Develop Cause and Effect matrices and Control Narratives. These documents bridge information from the SRS to the control engineer and detail every function of the Logic Solver control program.

Functional Safety / SIS Oversight of Detail Design

The intent of detailed design is to specify all engineered equipment, bulk quantities, instrument and electrical wiring details, etc. to the extent that a contractor can accurately schedule and price the entire construction effort.

ICI will work with the selected Engineering service providers to ensure this phase of the engineering process meets the intent of the Functional Safety/SIS Design.

Boiler / Fired Heater / Compliance Studies and Detail Design

ICI specializes in reviewing new/existing installations for Prescriptive Boiler/Fired Heater Standards NFPA 85, 86, 87, API 556 and customer supplied engineering guidelines to ensure compliance. We have extensive experience in helping clients with these applications.

SIS Configuration

ICI can program any Triconex SIS to meet customer needs. To ensure the program functions as required use proprietary software and other commercially available software such as "Triconex Safety Validator" to virtually test all logic functions associated with the SIS to ensure full validation of logic before deployment.

Logic Solver (PLC) Wiring Diagrams / Enclosure Detail Design

The Enclosure Drawings details the entire bill of materials and interconnections necessary for any qualified vendor to order and build to specification.

Human-Machine Interface (HMI) Development

Configure HMI Screens to provide a window into the actions and health of the SIS. Typical items include First Outs and SIS diagnostics.

Factory Acceptance Testing / Site Acceptance Testing / Logic Revalidation

Develop and facilitate Factory Acceptance Test (FAT) and Site Acceptance Test (SAT) procedures and to ensure the SIS logic is working as intended. FATs can be done virtually or face to face. ICI performs full internal testing before the FAT to ensure the testing runs smoothly. The tests are automated to ensure efficiency and repeatability.

Automated SIS Logic Proof Testing

Automated testing provides an efficient, accurate, and cost-effective way to validate safety logic systems by simulating logic functions and operational sequences in a controlled offline environment.

Upon successful validation, test procedures can be exported to support live system testing, reducing commissioning time and risk across SIS platforms including Triconex, DeltaV SIS, Honeywell SIS, and Allen Bradley.

Proof Test Procedures and Facilitation

Proof testing is a necessary component in the Safety Lifecycle. Periodic tests are conducted on the SIS to ensure that it can react to a hazardous demand. Proof Tests must be written to test all elements of the SIS including the Sensors, Logic Solver and Final Elements. The testing is conducted on intervals that correlate with the SIL Verification and when changes are made to the system during mid-intervals. Proof tests are usually completed during a turnaround. ICI can automate proof testing to reduce commissioning time and minimize the risk manual testing introduces (see Automated SIS Proof Tests).

Custom Functional Safety Database Development

Many companies have their functional safety documents (SIS Instrument Index, LOPA Worksheets, Independent Layers of Protection, SIF Datasheets, Safety Requirement Specifications, Proof Test Procedures, etc.) in many different formats and locations. Integrity is working with several customers to ensure their existing system more functional and auditable. Integrity will work with you to find the best solution to:

- Rationalize/Streamline the applicable Functional Safety Documents
- Create a Database of relevant Functional Safety Documents with hyperlinks for fast retrieval of related documents.
- Create an automated method of moving data from excel, word and other documents to a relational database capable of maintaining data integrity throughout the database.
- Custom reporting for Intercompany Auditing, Periodic Proof Testing, Independent Layers of Protection, Safety Requirements Specifications, etc.
- While all companies have the same end in mind...safety, each company has a vision on how their Functional Safety Documentation should be stored, managed, retrieved, viewed, and reported.

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