

Safety Instrumented Systems

Risk Assessment & Safety Function SIL Determination



Safety Instrumented Systems are found on the vast majority of process industry manufacturing facilities to protect against hazards to personnel, the environment and plant equipment.

One of the key process safety management requirements is to determine the criticality of all Safety Instrumented Systems (SIS) on the plant by identifying safety functions needed for each specific hazardous event, allocating safety functions to protection layers and determining the required Safety Integrity Level (SIL) of any Safety Instrumented Functions (SIF).

It is then important to assess the risk reduction provided by non-SIS protection and mitigation functions e.g. Basic Process Control System (BPCS) control and alarm functions, mechanical protection or Fire & Gas mitigation layers and, based on the target tolerable risk, determine the required reliability of each SIF identified.

From the IEC 61508/61511 standards, the properly determined Safety Integrity Level is fundamental for SIS design and operation/maintenance. It ensures a safety related system satisfactorily performs the required safety functions under all stated conditions within a defined time period.

SIL determination is the process of evaluating the required reliability for a SIF, taking account of the

severity of the hazardous event and other independent layers of protection that are contributing to the overall risk reduction.

Properly defined SIL levels allow for significant cost improvements to be achieved in both Greenfield and Brownfield operating environments. Asset operational safety integrity levels are maintained while the cost of ownership from ongoing testing and maintenance is optimized.

Inappropriate SIL determination can affect the safety integrity of the asset protection envelope and may in some cases place the asset integrity under threat. In addition to this, the potential lack of appropriate methods being used for SIL Determination can lead to an overly conservative approach which can result in both unnecessary capital outlay and long term operational spending.

Background to the ABB Approach

ABB's SIL determination package enables asset owners to become conversant with the relevance of SIL determination in the context of functional safety, and to then confidently determine the SIL level and configuration required to achieve these targets.

The Approach

Effective SIL determination requires input and operational experience contribution from many disciplines. Utilising a competent study leader and an appropriate number of relevant disciplines such as the responsible Instrumentation Engineer, Process Engineer, Operational and Project Management/Supervisory representation, including the Process Operators themselves, we can provide effective guidance to obtain maximum benefit for the study outcome.

Selection and calibration of an appropriate method e.g. Risk Graph, Layer of Protection Analysis (LOPA) or Fault Tree Analysis will be utilised to analyse the events identified from the earlier Hazard Study phase.

The risk assessment will detail each potential hazardous event taking into account the contribution from any other protective layers such as operator response to BPCS alarms, mechanical safety devices, etc. and assess the level of unmitigated risk in terms of target tolerable risk criteria. Where the identified outcomes are not tolerable, and the risk is to be further reduced by the use of a Safety Instrumented Function, then the Target SIL of the SIF will be identified.

Recording the outcome of the risk assessment process in an efficient and sustainable way can be achieved using appropriate ABB software support tools, thereby providing a traceable means for future modification, periodic reviews and assessments of key data and assumptions.

Benefits of ABB SIL Determination Methodology

- Supports the extensive application and compliance requirements for demonstrable knowledge of safety instrumented systems, the legislation concerned, the regulatory perspective and also the standards/criteria against which a company/system will be measured.
- Demonstration, that effective and robust risk assessment is being taken, shows the pro-active attitude which is expected by the authorities, public and workforce, and supports company risk management arguments.
- ABB SIL Determination Tools enhance the efficiency of the overall process and can be used to optimise the cost of safety for both CAPEX & OPEX regarding the initial derivation and periodic re-assessment for Target SIL requirements.

- Provides traceability of the allocation process for both Greenfield and Brownfield operations, thereby demonstrating the necessary systematic capability in the execution process.

ABB FSM Technical Authority

Where improvements are felt to be appropriate, ABB FSM TA services support the entire safety life cycle, providing safety requirement assessments, development of functional safety management systems, design and procurement of new SIS, provision of safety life cycle support tools, delivery of training and development for our customers.

Assured and certified products, services, delivery and execution

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