



the standard in safety

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# Achieving Functional Safety

with Global Resources and Market Reach





**Burner management systems**  
**Combustion controls**  
**Electric vehicle components (on-board, off board)**  
**Electrosensitive equipment**  
**Elevator components**  
**Gas detection equipment**  
**Motor drives**  
**Process control equipment**  
**Programmable automation controllers (PACs)**  
**Programmable components**  
**Programmable logic controllers (PLCs)**  
**Protective relays**  
**Robotics and accessories**  
**Safety relays**

# Focusing on Function as a Safety Priority

As part of the broad scope of product safety, functional safety zeroes in on the safety-related systems of a product. And the earlier the better — focusing on functional safety early in the design process allows flexibility and reduced need for redesign, leading to faster market acceptance and cost savings down the road.

Functional safety examines the efficacy of the safety-related system by considering the input variables to a device and confirming that the activating quantities of the output are within its designed parameters. This examination involves precise evaluations of:

- Software
- Hardware
- Environmental factors
- Safety lifecycle management processes.

A unique feature of the evaluation is a functional safety management audit. The audit is a mechanism used to help reduce systematic problems from appearing in the product design by looking at elements of the manufacturer's process that may impact its safety quality. Functional safety management concerns both the development of new products and the maintenance of safety processes for released products.

With rapid advancements in digital technology driving product design and development, the significance of functional safety to product success continues to become more evident. Today, achieving the safety requirements of the marketplace can mean the difference between capitalizing on new opportunities and missing the mark.

Introducing new metrics to the conventional UL Listing Mark — and providing the overarching value of preventing challenges and promoting safety — functional safety is a measure designed to support long-term success.

## Achieving the Demand

A host of factors drive the demand for functional safety evaluation among equipment and device manufacturers:

- Customer requirements
- Market acceptance
- Competitive advantage
- Legislation
- Regulations
- Trade unions
- Insurance companies



## UL's Unique Benefits

Working with the demands and specifications of its customers, UL is able to tailor its services to meet individualized needs.

With the resources to meet the complexities of any challenge and the agility to respond to custom requirements, UL is positioned to consistently deliver:

- **Credibility**  
Once a manufacturer has the UL Functional Safety Mark, its customers immediately have a higher level of confidence when purchasing the marked product, as the UL Mark is the most recognized symbol of safety in the world.
- **Highly responsive to unique technical needs**  
Our deep technical expertise gives us the flexibility to work with the demands and specifications you provide for each project to meet your request. We tailor the service offering to meet your individualized product evaluation needs.
- **Broad experience and expertise**  
UL brings the value of its traditional follow-up service and field surveillance along with the added benefit of a quality management system perspective.



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- **Consistent technical partner**

Working with the same engineer throughout certification processes, manufacturers gain service consistency with our technical professional who becomes expert in your products, tests, and objectives.

- **Single resource**

Consolidating product testing and certification at one global organization creates significant efficiencies that can deliver greater return on your compliance investment.

- **Maintenance review process**

If a change is made to an existing functional safety certified product, UL does not require undergoing the entire certification process again. If the change is determined not to be safety critical, the UL report is updated and the customer can continue using the functional safety mark. If the change is determined to be safety critical, UL evaluates the product. The entire certification audit is not conducted, just the necessary evaluation to assess the change.

UL has been one of the most recognized and trusted resources for product safety testing and certification — helping manufacturers gain access to domestic and global markets. As functional safety has come to the fore with the evolution and adoption of new technologies, this holds true more than ever.

Today, UL's growing list of functional safety deliverables is leading the way for device and equipment manufacturers looking to seize functional safety as a competitive advantage.



## Marks that Make a Difference

Backed by more than a century of technical experience and expertise, UL is distinguished by a depth of its services and capabilities. UL's listing marks are a symbol of safety unparalleled in the industry.

### Functional Safety Listing Mark

UL now offers a UL Functional Safety Listing Mark that can be added for those qualifying companies in the process of getting a traditional Listing from UL. The UL Listing Mark is one of the most commonly recognized safety certification marks in the world, and is the most common UL Mark. If a product carries this Mark, it means UL found that representative product samples met UL's safety requirements. The UL Functional Safety Listing Mark is available in U.S., Canadian and European designations.

The Functional Safety Listing Mark replaces the traditional UL listing mark on products. Manufacturers are not obliged to apply both marks — the combined Functional Safety Listing Mark is sufficient. However, those manufacturers who want to put both marks on their product are welcome to do so.

And only UL puts the safety rating — such as Safety Integrity Level (SIL) and/or Performance Level (PL) — directly on the Mark, making it easy for the user to understand exactly what has been certified.



PROGRAMMABLE CONTROLLER  
(XXXXX)  
ALSO INVESTIGATED TO  
IEC 61508, Parts 1 – 3 (1998) UP TO SIL 3  
ISO 13849, Parts 1 – 2 (2006) UP TO PL e  
See installation manual for safety functions

### Functional Safety Recognized Component Mark

UL's service covers the evaluation of components or materials intended for use in an end product functional safety certification.

A recognized component is one whose complete safety in its application cannot be evaluated by looking at the component alone. Conditions of acceptability are placed around its use in order for it to satisfy the functional safety requirements. The UL Functional Safety Recognized Component Mark is available in U.S. and Canadian designations.





**Just some of the functional safety standards UL certifies to:**

**ASME A17.1:** Safety code for elevators and escalators

**CSA C22.2 NO 0.8:** Safety functions incorporating electronic technology

**EN 954:** Safety of machinery. Safety related parts of control systems. General principles for design.

**IEC 61496:** Safety of machinery – Electro-sensitive protective equipment

**IEC 61508:** Functional safety of electrical/electronic/programmable electronic safety-related systems

**IEC 61511:** Functional safety – Safety instrumented systems for the process industry sector

**IEC 61800-5-2:** Adjustable speed electrical power drive systems – Part 5-2: Safety requirements – Functional

**EN 50271:** Electrical apparatus for the detection and measurement of combustible gases, toxic gases or oxygen

**IEC/EN 62061:** Safety of machinery – Functional safety of safety-related electrical, electronic and programmable electronic control systems

**ISO 10218:** Robots for industrial environments – Safety requirements

**ISO 13849:** Safety of machinery – Safety-related parts of control systems

**ISO 26262:** Road vehicles – Functional safety (draft standard; publish date 2011)

**UL 991:** Safety-Related Controls Employing Solid-State Devices

**UL 1998:** Software in Programmable Components



## Beyond the Mark

Dedicated to providing manufacturers with knowledge, insight, and execution of safety requirement certification, UL also enables those not interested in securing a functional safety mark to benefit from UL's functional safety support.

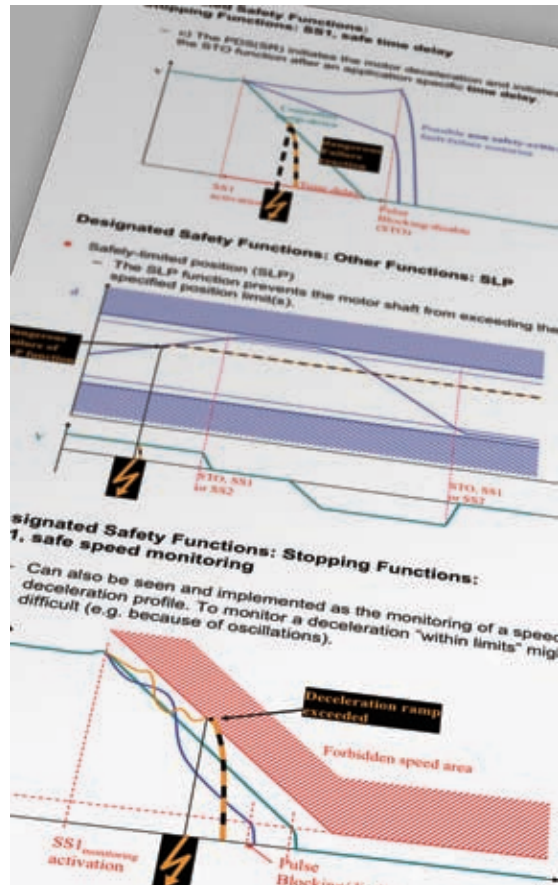
### Functional Safety Certificate

For those manufacturers not interested in securing or maintaining a mark, the functional safety certificate may be an attractive alternative. The certificate indicates that UL has evaluated a sample of the product and determined that on the date the certificate was issued, it complied with the safety requirements of a specific functional safety standard. The certificate automatically expires three years after its date of issue. The certificate can be renewed, possibly at reduced certification effort depending on the extent of product modifications or standard updates. There is no follow-up surveillance associated with the three-year functional safety certificate.

Products that receive a UL Functional Safety Certificate only are not eligible to use any UL mark. However, manufacturers may reference that the product has a UL Functional Safety Certificate in its advertising and promotion of the certified product.

This three-year functional safety certificate is often a good option for manufacturers that sell their products to systems integrators that use report or certificate quality management systems. The certificate indicates which functional safety standard and which safety ratings (e.g., SIL, PL) were used in the evaluation of the product.





### Customized Test Reports

UL can also generate customized, informative test reports specific to the needs of a manufacturer for any type of testing or evaluation pertinent to functional safety, as well as GB or IECEx Test Reports per scheme requirements.

### Advisory Services

UL Advisory Services personnel work with customers every step of the way to help make product development, launch, and lifecycle successful. An independent and discrete part of the UL organization — with no crossover to UL's Certification Services — UL Advisory Services helps manufacturers execute the front end preparatory work that minimizes rework when it comes to meeting functional safety certification standards. In greatly increasing a product's first pass yield, UL Advisory Services can deliver:

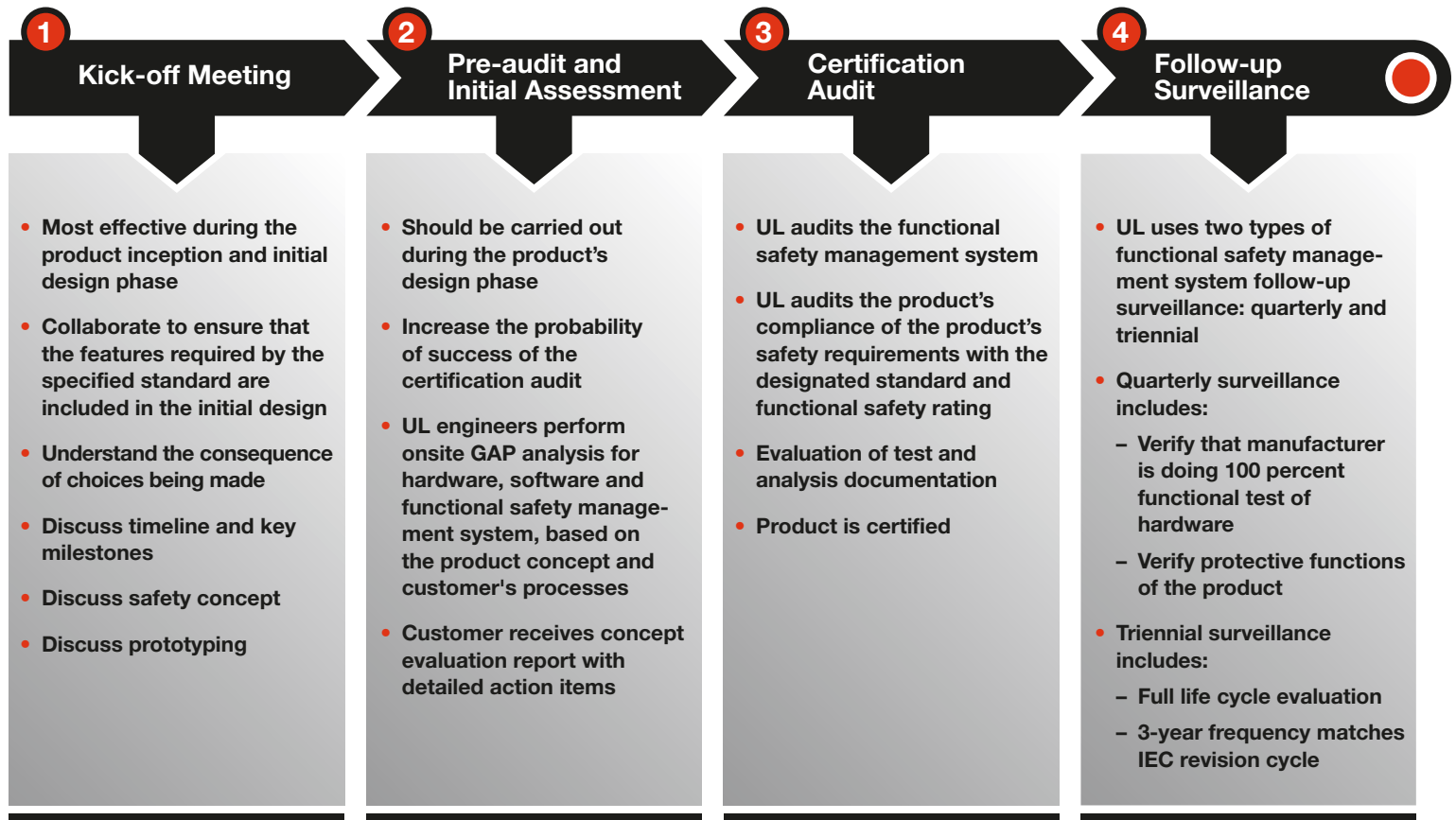
- Failure Modes and Effects Analysis (FMEA)
- Failure Modes, Effects, and Diagnostic Analysis (FMEDA)
- Functional Safety Management Plans

- Integrated Test Plans
- Safety Cases
- SIL, PL, and Class calculation, verification, etc.
- Safety Manuals
- Safety Plans
- Safety Requirements Specification (SRS)
- Software FMEA / software Hazard and Operability (HAZOP) analysis
- Validation Plans

An ideal resource for those companies needing front-end support in preparing the inputs necessary to secure Functional Safety Marks or Certifications, UL Advisory Services leverages UL's deep domain expertise to give it the flexibility to work with the demands and specifications manufacturers provide for each project.







### 1. Kick-off Meeting

A face-to-face meeting occurs once a product is submitted for functional safety evaluation and once the company designates the desired functional safety standard and safety rating.

**To ensure effectiveness and efficiency, this meeting should take place during the product's R&D phase.**

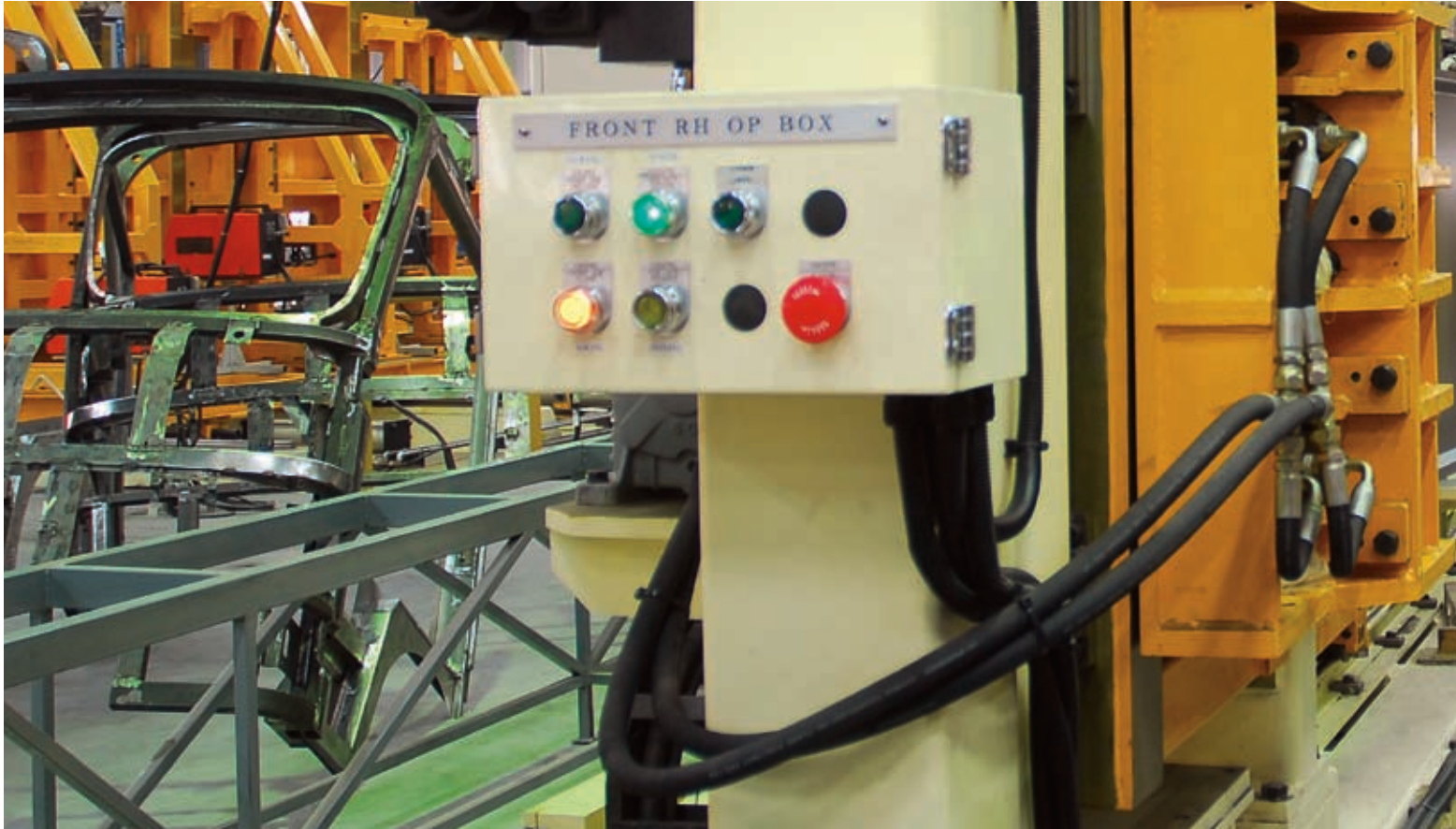
Very often it is not possible to fully understand how a product will be applied in a larger safety system. Aspects to be considered include the internal concepts to accommodate the safety requirements — redundancy, diversity, and self-diagnostics. The use of these concepts depends on other components in the system, the components that must be interfaced.

Conducted with personnel involved in product development, these meetings ensure that all parties:

- Collaborate on safety specifications to ensure that the features required by the specified standard are included in the initial design
- Jointly walk through the safety requirements
- Discuss necessary test planning
- Define the project timeline and key milestones
- Conduct an overview of design documents, if they are available at this time
- Discuss concept proposals or concept alternatives
- Discuss any prototyping, if available at this time.

It is important to consider the long-term consequences of the choices being made and how a product will be applied in a larger safety system.





## 2. Pre-audit and Initial Assessment

The pre-audit and initial assessment is a collaborative phase designed to increase the probability of certification audit success. In this phase, UL engineers conduct a gap analysis for the customer's proposed functional safety management system, with a focus on traceability, testability, and ease of understanding.

UL then reviews the product concept — including safety requirements specifications and the safety concept. Finally, a gap analysis is conducted for hardware and software based on the design concept. The output of this phase is a concept evaluation report containing detailed action items for the customer to address before the certification audit.

## 3. Certification Audit

The product is certified during a certification audit. UL audits the functional safety management system's compliance with the designated standard or standards and safety rating. An evaluation is made of the completeness and correctness of the safety requirements and the safety requirements implementation. The compliance of the product's safety requirement with the standard or standards is then audited.



Evaluation of development documentation and test and analysis documentation is conducted, as is the execution or witnessing of testing on the product. At this time, UL fire/electric shock witness testing may also take place; or, if the customer prefers, the fire/electric shock testing can be done in a UL laboratory.

After the certification audit, there may be a few action items that the customer needs to address. UL will review the responses, and if determined to be acceptable, award the certification. Once UL verifies that everything is in order, the manufacturer can put the Functional Safety Listing Mark or Functional Safety Recognized Component Mark on the product, or the Functional Safety Certificate is issued.

**Maintenance Process:** If a customer makes a change to an existing functional safety certified product, the customer does an impact analysis or impact assessment of the change. If the change is determined not to be safety critical, the UL report is updated and the customer can continue to use the functional safety mark. If the change is safety critical, UL opens a “maintenance review project” to evaluate the product. The entire certification audit is not conducted, just the necessary evaluation to assess the change. Once the modified product passes these additional evaluations, the UL report is updated and the customer can continue to use the mark.

#### 4. Follow-up Surveillance

For products having passed certification and carrying a UL Functional Safety Mark, UL ensures the integrity of the mark using a two-layered surveillance program.

**Quarterly Surveillance:** A UL field representative will verify that the manufacturer has the processes and tools in place to assure that the protective functions of every unit of a product that leaves the factory match what is in the UL report, and that the software version matches what is in the report. For critical components identified in the functional safety investigation, UL will verify that they match what is in the report.

**Functional Safety Audit:** Complementing its Quarterly Surveillance, UL conducts an audit of the functional safety management system once every three years. The primary aim of this triennial audit is to make sure that the company’s processes are as originally assessed, and that their risk management and change management processes are still the same.

A further objective is to evaluate whether the current functional safety management system is still adequate or needs improvement and adjustment. In this way it provides value to the manufacturer by identifying opportunities and guidance for improvement of processes and organization.



## Relying on the Best

With responsiveness and flexibility that meets unique needs and a thorough process that examines both products and the management systems that support them, UL's experience and expertise ensures accuracy and assurance, insight and integrity.



As one of the most trusted resources for consolidated product safety testing and certification, UL delivers functional safety testing and certification services that provide manufacturers with:

- Unmatched credibility
- Highly responsive to unique technical needs
- Customizable, flexible service
- Broad experience and expertise
- Consistent technical expert as your testing partner
- Single resource for testing and certification
- Targeted maintenance review process

It's what you would expect from the worldwide leader.

For more information on UL's Functional Safety programs, please visit [www.ul.com/functionalsafety](http://www.ul.com/functionalsafety), or see contact information on the back cover of this brochure.

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US LISTED

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FUNCTIONAL  
SAFETY





With global resources and market reach, UL helps you achieve functional safety and open new doors to product success.

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