

# Functional Safety

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13-15 November 2018  
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# Topics

- Ø Background
- Ø What is Functional Safety?
- Ø Safety Evolution
- Ø Achieving Functional Safety



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# Background

- ∅ Make the plant safe!!
- ∅ Exposure to safety applications
- ∅ You don't know what you don't know
- ∅ Lessons learnt



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# What is Functional Safety?

## ∅ Definition for machines (fail safe):

- § is the part of the overall safety of a system, or piece of equipment, that depends on **automatic protection operating correctly** in response to its inputs, or failure in a **predictable manner**
- § Remove energy sources to make the machine safe (typically power off is good)



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# What is Functional Safety?

- Ø Definition for Process applications (fault tolerant / high availability safe):
  - § In the event that the safety system is compromised (failure / fault etc), the safe state is to **continue to operate** and / or **execute an orderly shutdown** procedure
  - § Removing energy sources may introduce a greater hazard (typically power off is bad)



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# What is Functional Safety?

## Ø Head to Toe system – Functional Safety Management (5 Key Segments)

### § General Requirements

- § Strategies & policies agreed with customer to achieve Functional Safety

- § Means for evaluating achievement

### § Organisational Requirements

- § Personnel ID (who will do what)

- § Lifecycle phases (once implemented, care & maintain)

### § Assessment

- § Format & structure of information

- § Selected measures, techniques used to meet the requirements

### § Auditing and Revision

- § Requirements and procedures for periodic safety audits

- § Traceability and document /revision control

### § Configuration Management

- § Procedures for configuration management of safety related systems & safety related control systems

- § Component supplier lifecycle services



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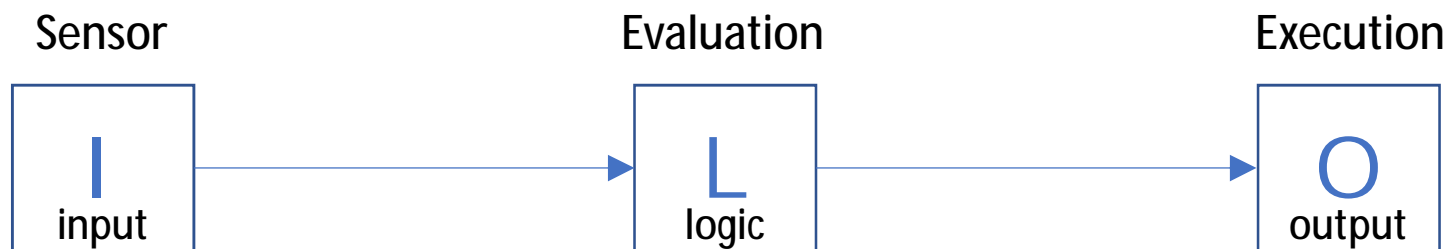
# What is Functional Safety?

∅ What is a Safety Function....

Function of a machine whose failure can result in immediate increase of the risks

∅ A safety function is assigned to the elimination or reduction of a risk

§ The safety function is executed by all components which are involved in the safety function



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# What is Functional Safety?

## ∅ How should I do safety

- § Use standards for guidance
- § Training courses
- § Employ an expert to assist

## ∅ Standards – what to use?

- § AS/NZS 4024.1201 (ISO 12100) General Principles for Design – risk assessment and risk reduction
- § AS/NZS 4024.1303 (ISO 14121) Risk Assessment – practical guidance and examples of methods

## ∅ What components do I use?

## ∅ SIL (Safety Integrity Level) or PL (Performance Level)?

- § IEC 62061:2006 or ISO 13849-1 (AS/NZS 4014.1503)
- § Both these two standards address functional safety in similar but different methods. The designer may choose to use either of the two standards



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# Safety Evolution

Ø Safety was seen as a pain in the neck.....a hinderance

§ Safety was seen as inversely proportional to productivity

§ Interfered with access to the machine



§ **Functionally Safe!**

§ Uncomfortable

§ Heavy

§ Hot



§ **Functionally Safe!**

§ Comfortable (Pads)

§ Light (Foam or Composite)

§ Cool (Ventilation)



§ **Functionally Safe!**

§ Comfortable

§ Light

§ Cool

§ **Performance Enhancing!**

*Bicycle Helmet Safety has evolved from a pure focus on safety to an integral tool for improving athletic performance*

# Safety Evolution

- Ø Lock Out Tag Out (LOTO) is good
  - § LOTO is still the preferred energy isolation method for locking out ALL energy sources to your machine
  - § LOTO can take time depending on how many sources and location of isolation points
- Ø What if I need regular interaction with the machine?
  - § Access control can assist with regular operational tasks
- Ø A well designed safety system can improve machine performance



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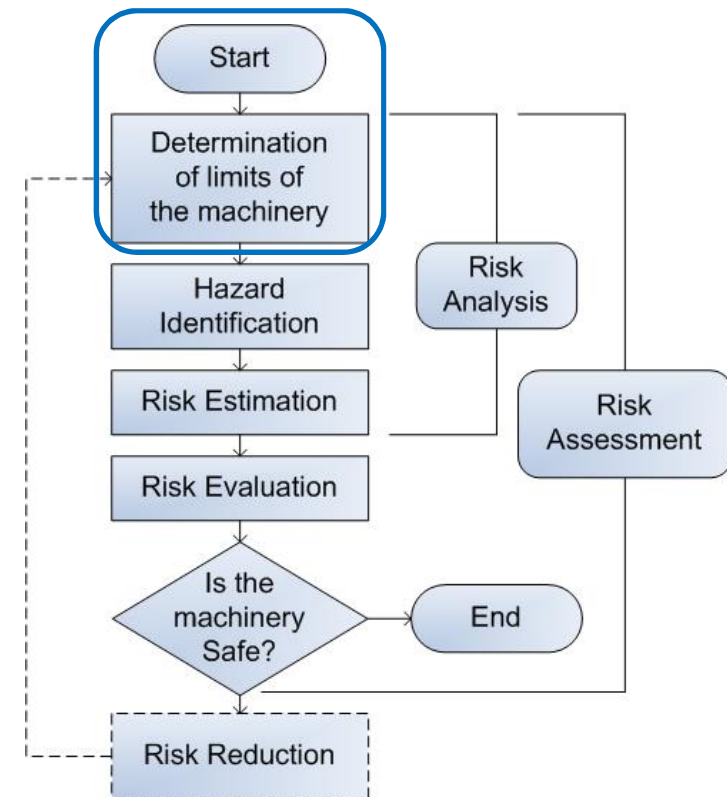
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# Achieving Functional Safety

## Ø Machine Limits

- § Usage throughout lifecycle,
- § Modes of operation (startup, setup, infeed etc)
- § Maintenance access
- § Transportation
- § Operator tasks (SOP's)
- § Cleaning & housekeeping
- § Fault recovery (jam/blockage etc)



# Achieving Functional Safety

## Ø Hazard Identification

- § Mechanical - Cutting parts – severing
- § Mechanical - moving elements – crush, drawing-in
- § Electrical - Live electrical parts – electric shock, burn
- § Thermal hazard – radiation – burn
- § Noise – moving parts – permanent hearing loss
- § Substance – biological agent – damage to eyes and skin



## Ø Link hazards to tasks (SOP's)?



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# Achieving Functional Safety

## Ø Risk Estimate

§ Choose a risk scoring system (HRN, Matrix, Graph, Hybrid etc)

“The choice of a specific risk estimation tool is less important than the process itself.

The benefit of risk assessment comes from the discipline of the process rather than in the absolute precision of the results, as long as all the elements of risk are fully considered and documented.

Resources are better directed at risk reduction efforts rather than attempting to achieve absolute precision in risk estimation.

Any risk estimation tool should deal with at least two parameters representing the elements of risk. One parameter is Severity Of Harm, the other is Probability Of Occurrence of that harm.” **AS/NZS 4024.1303:2014**



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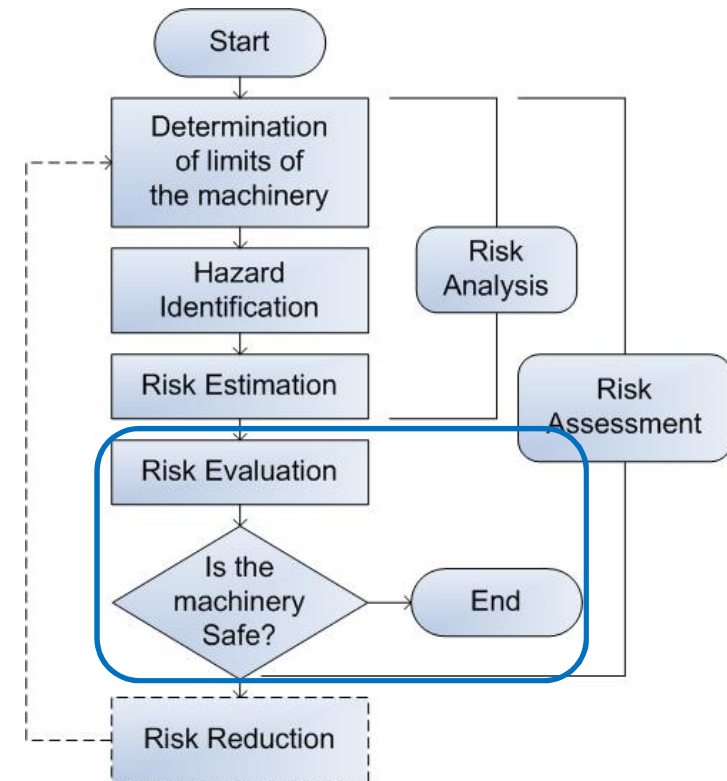




# Achieving Functional Safety

## Ø Risk Evaluation

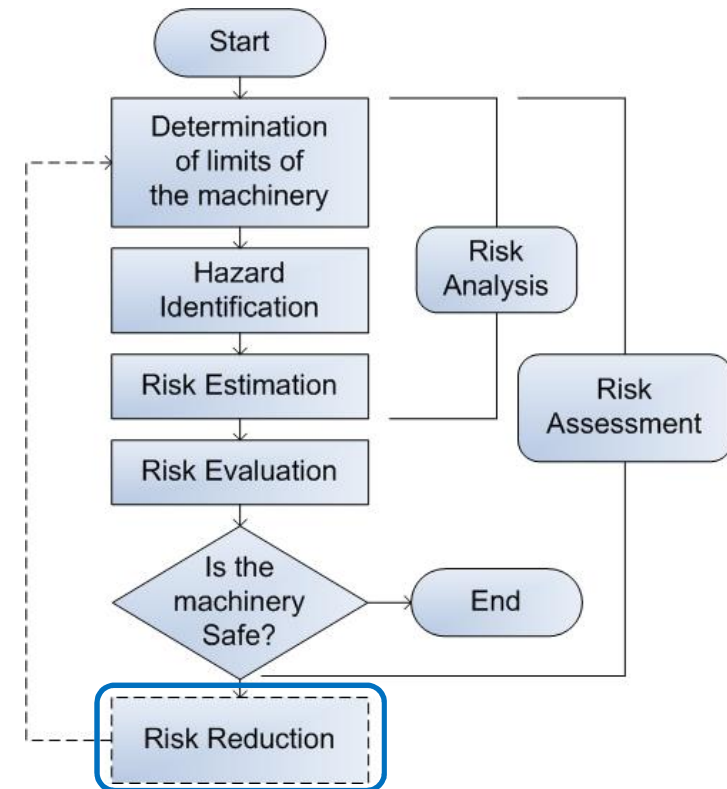
- § Decide which (if any) hazardous situations require further risk reduction
  - § Any additional PPE to reduce risk?
  - § Change of entry / access to the machine?
- § Determine if the risk reduction has been achieved without introducing new hazards



# Achieving Functional Safety

## Ø Risk Reduction Techniques

- § Inherently safe design measures - eliminate the hazard out by design
  - § These can include hazardous substance substitution, sharp edges, body ergonomics, better component selection
- § Safeguarding and Complimentary Protective Measures (guarding and other methods)
  - § Isolate / prevent access with fixed guards / fencing (weld it on?) and Interlocked guards (with or without locks)
  - § Sensitive Protective Equipment (light curtains, laser scanners, safety mats, safety edge)
  - § Other safety devices like hold-to-run, safe speed detection, pressure limiting devices, etc
  - § Emergency Stop, Internal escape systems
- § Information for use
  - § PPE, Safe Working Procedures, Training, Signage etc





# Achieving Functional Safety

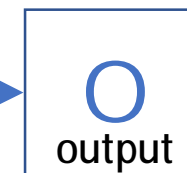
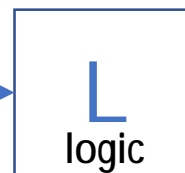
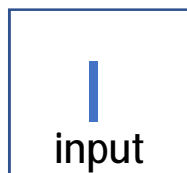
## Ø More Risk Reduction Techniques (Complimentary Measures)

- § Safe Torque Off (STO)
- § Stop Category 0, Stop Category 1
- § Safe Limited Speed
- § Zero Speed Detection
- § Presence Sensing (Laser Scanners / Light Curtains)



## Ø Safety Relay, Software Configurable Relay or Safety Controller (safety PLC)?

- § Standalone
- § Zone Control
- § Complexity & flexibility
- § Networked safety systems
- § Wireless systems



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