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Siemens Safety Integrated

Navigating Standards for Safety-Related Parts of Control Systems

AGENDA

- Why Safety?
- Machine Safety Standards
- Comparison of ISO 13849-1 and IEC 62061
- Safety-related parts of Control Systems
- Tool to calculate safety levels
- Machine Safety Life Cycle Support

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Machine Safety
History of Safety - USA/Europe

	History of Machine Safety in the USA
1877	Massachusetts, required guarding belts, shafts and gears
1890	Nine US states required machine guarding
1930	All US states had established job-related safety laws
1934	Bureau of Labor Standards (F.D. Roosevelt – Frances Perkins), Promote safety and health for working men and women
1971	Occupational Safety and Health Administration was established
1981	Lost Workday Incident Rates policy established by OSHA
1919	EN292 – Basic Concepts of Machine Safety
1996	EN 954 and EN 1050 – Machinery Safety

	History of Machine Safety in Europe
1989	1st pub. of the "Machinery Directive" as Directive 89/392/EC
1996	**EN 954-1** with „Categories" is published
1998	2nd pub. of the "Machinery Directive" as Directive 98/37/EC
1999	**IEC 61508** & SIL help to evaluate, "complex" state of the art
1997-2000	STSARCES project of EC: **EN 954-1 with SIL quantifiable? YES.**
2005	Pub. of **IEC 62061** (SIL, application standard of IEC 61508)
2006	Pub. of **ISO 13849-1** (PL, successor standard of EN 954-1)
2009	Commencement of the 3rd "Machinery Directive" 2006/42/EC
2012	New Work Item Proposal" to merge ISO 13849 & IEC 62061
2017	Planned completion of the merging into **ISO/IEC 17305**

Machine Safety
USA - Safety Guidance & applicable standards information (Control Design)

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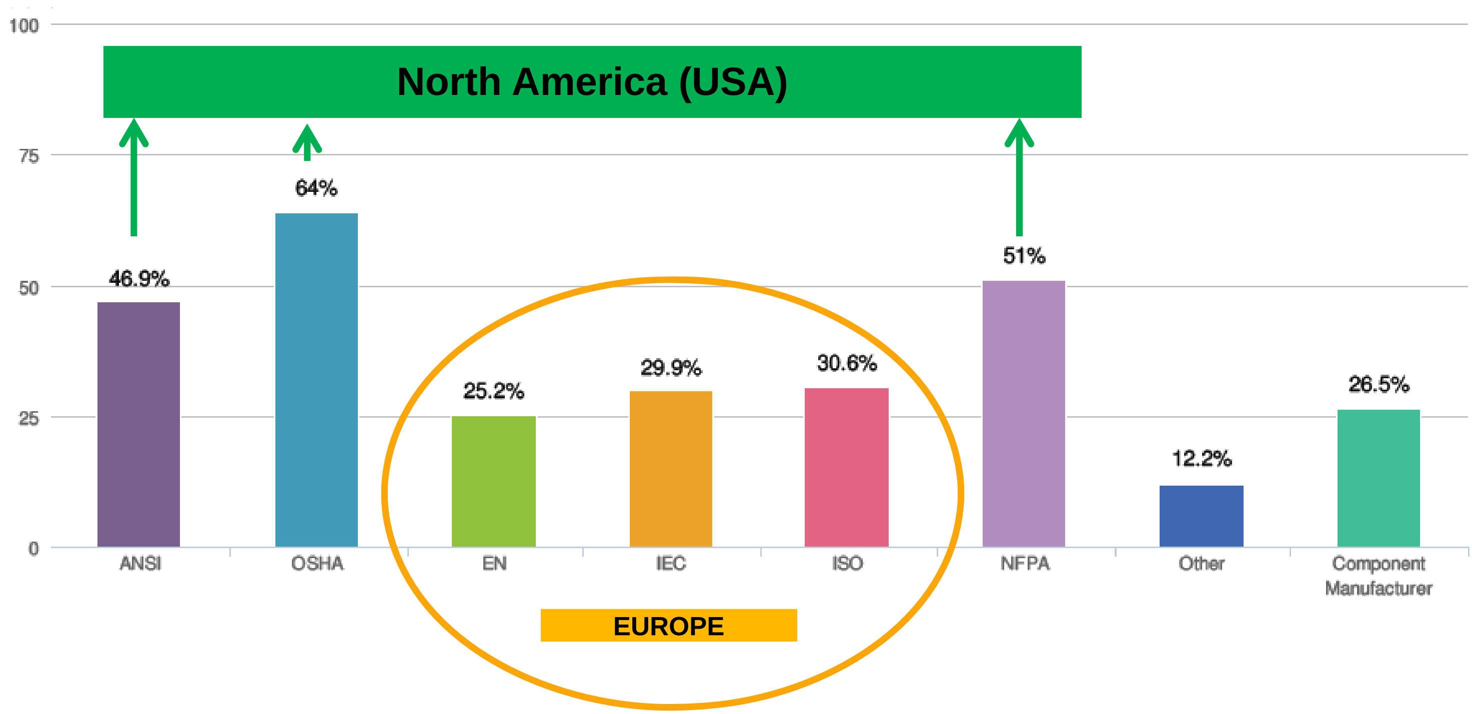

- Source Control Design – Machine Safety, Dec 2014 - Market Intelligence Report

Safety Life Cycle – Step 1 (Safety Education)
International Safety Standards

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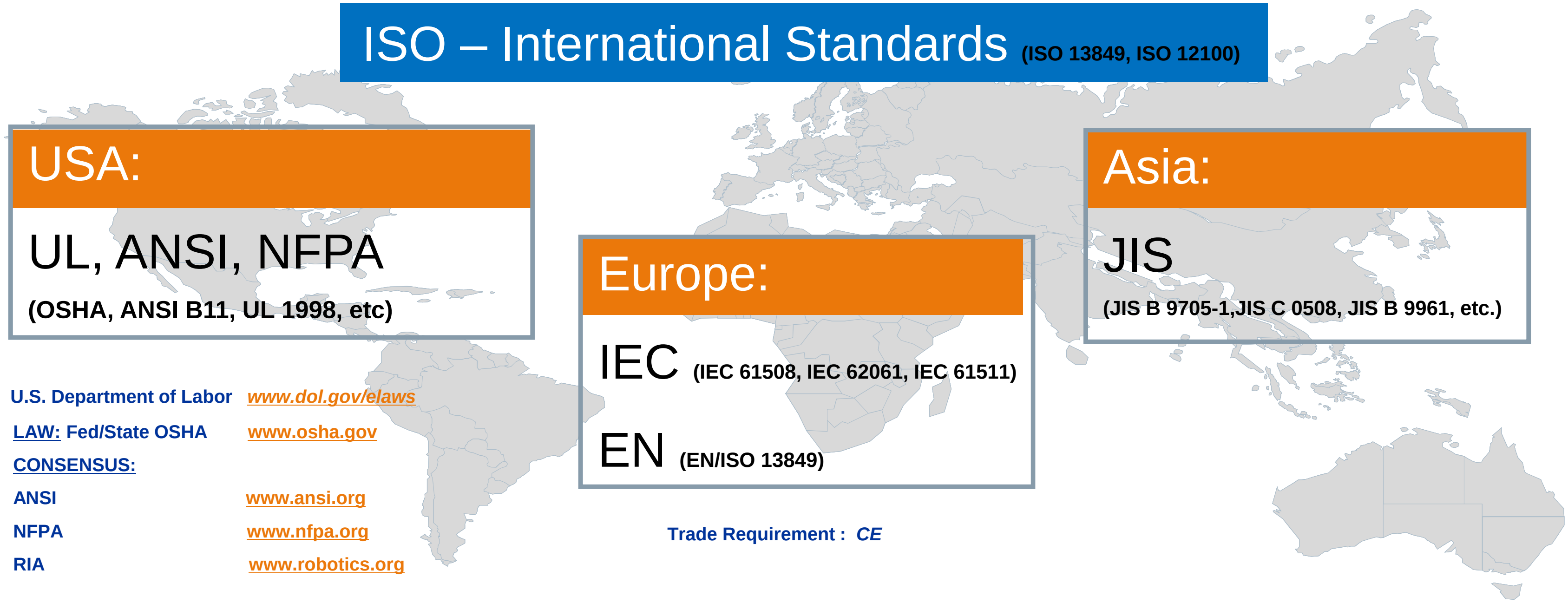

ISO – International Standards (ISO 13849, ISO 12100)

USA:

UL, ANSI, NFPA

(OSHA, ANSI B11, UL 1998, etc)

Europe:

IEC **(IEC 61508, IEC 62061, IEC 61511)**

EN **(EN/ISO 13849)**

Asia:

JIS

(JIS B 9705-1,JIS C 0508, JIS B 9961, etc.)

U.S. Department of Labor	***www.dol.gov/elaws***
LAW: Fed/State OSHA	**www.osha.gov**
CONSENSUS:	
ANSI	**www.ansi.org**
NFPA	**www.nfpa.org**
RIA	**www.robotics.org**

Trade Requirement : ***CE***

The regulations and standards applicable at the installation location of the system or machine are decisive. All countries follow the same basic principles for application. The European standards and regulations are recognized worldwide.

Machine Safety Standards
Subdivided into Type A, B & C Standards

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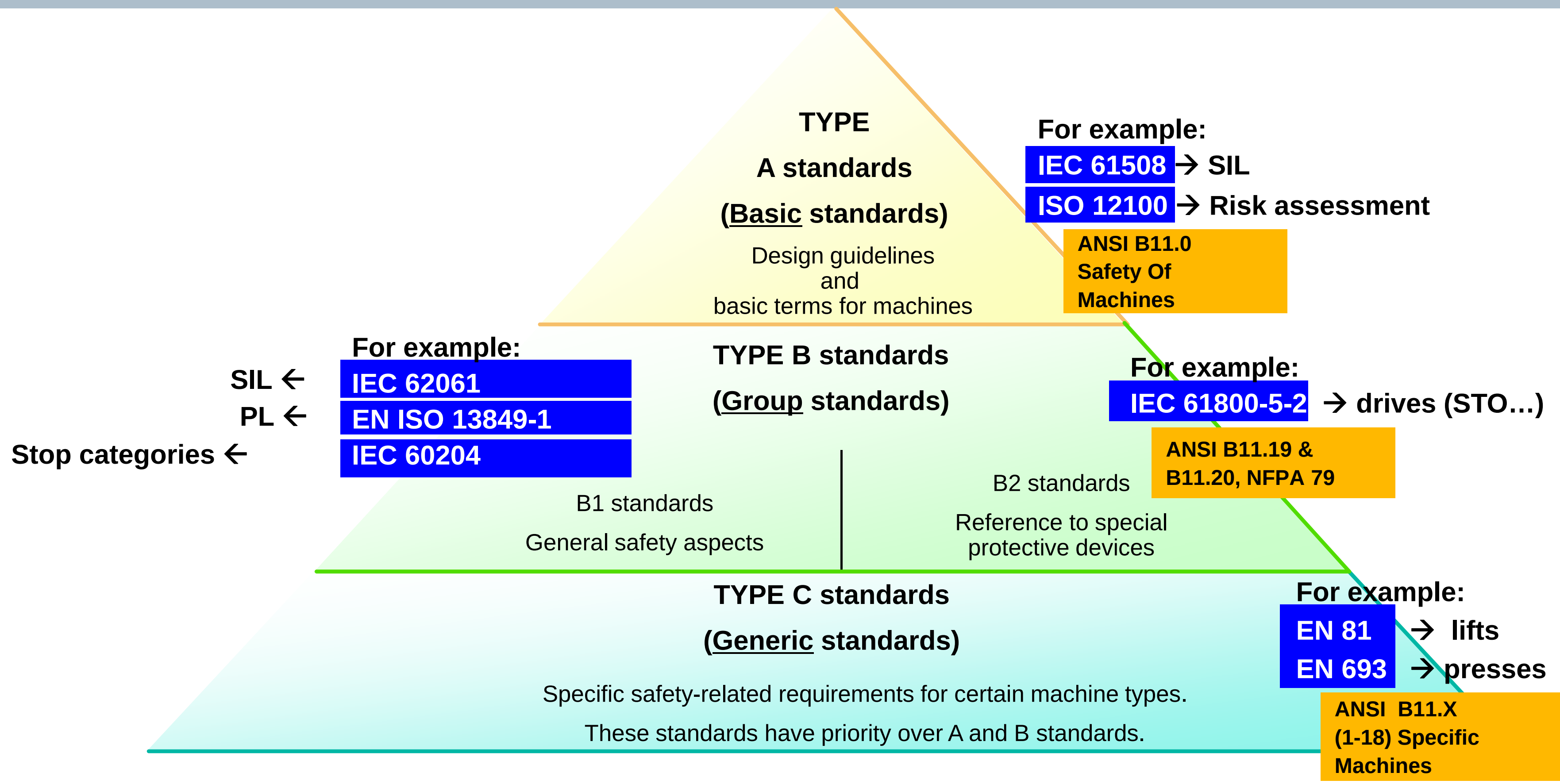

Machine Safety Standards
USA & OSHA

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USA – Machine Safety
Ensure Safe and Healthy Work Conditions
OSHA - The law " have to comply"
States must meet or exceed
OSHA Regulations defined in Code of Federal Regulations Title 29
Reference to Standards such as ANSI and NFPA • Considered consensus standards. • Standards are Voluntary • Unless - they become part of the law • "Incorporated by Reference"
ANSI – Coordinates Voluntary Standards
ANSI – Official representative to ISO/IEC
TUV – OSHA recognized NRTL

OSHA
Part 1910: Occupational Safety and Health Standards
Subpart O: Machinery and Machine Guarding 1910.211: Definitions 1910.212: General Requirements for all Machinery 1910.147(a)(2)(ii) ***The minor service exception provides that minor tool changes and adjustments and other minor servicing activities which take place during normal operation may be exempt from LOTO if the activity is routine, repetitive, and integral to the use of the equipment for production purposes, provided that the work is performed using alternative measures which provide effective employee protection.*** 1910.213-190.219: Machine Specific Regulations
Subpart J: General Environment Controls 1910.147: The Control of Hazardous Energy (Lockout/Tagout)

Machine Safety Standards
NFPA 79

Original NFPA 79 1997 - Restricted machine safety to electromechanical devices.

9.6.3 Where a Category 0 stop is used for the emergency stop function, it shall have only hardwired electromechanical components. In addition, its operation shall not depend on electronic logic (hardware or software).

NFPA 79 2002 – Allowed the use of safety PLC in safety-related.

11.3.4 Use in Safety-Related Functions. Software and firmware-based controllers to be used in safety-related functions shall be listed for such use. [Annex to NFPA 79 2002, A.11.3.4 IEC 61508]

NFPA 79 2007 – Allowed drives as a final switching device.

9.2.5.4.1.4 Drives or solid-state output devices designed for safety-related functions shall be allowed to be the final switching element, when designed according to relevant safety standards.

NFPA 79 2012 – Allowed the use of cableless control

9.2.7.1* General. Cableless control (e.g., radio, infrared) techniques for transmitting commands and signals between a machine control system and operator control station(s) shall meet the requirements of 9.2.7.1.1 through 9.2.7.1.4.

Machine Safety Standards Overview

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	Standards	Descriptions	USA	EU	Comments
ISO	International Organization for Standardization	ISO 13849-1, FS, Appl. specific std (PL), H-P ISO 13849-2, FS, Validation ISO 12100, FS, Risk Assessments	X - -	X X X	More guidance with safety calculations with the Safety Evaluation Tool
IEC	International ElectroTechnical Commission	IEC 61508 – Generic Safety Standard IEC 62061, FS, Application specific std. (SIL) IEC 61511 – Process Safety Standard	X X X	X X X	More guidance with safety calculations with the Safety Evaluation Tool
OSHA	Occupational Safety and Health Administration	OSHA 29 CFR 1910, Subpart O, Machinery and Machine Guarding Safety OSHA 29 CFR 1910.147 Control of Hazardous Energy (Lockout / Tagout)	X X	- -	Siemens Safety Solutions Tested and certified by NRTL's (as per OSHA's requirement)
ANSI	American National Standards Institute	ANSI B11 Series – 2007–2010	X	-	To be followed for application specific standards
NFPA	National Fire Protection association	NFPA 79 – 2015, Machine Safety NFPA 85 – 2011, Burner Mgmt. Systems NFPA 86 – 2011, Burner Mgmt. Systems	X X X	- - -	Compliance required, Wireless and Drives safety allowed
UL	Underwriters Laboratories	UL NRGF covers ANSI / UL 508 / 1998 / NFPA79 and IEC 61508 Also new UL Functional Safety mark like TUV	X	-	New UL Functional Safety Mark and recognition (similar to TUV-NRTL certification)
RIA	Robotics Industries Association	ANSI / RIA R15.06-2012, ANSI / RIA / ISO 10218-1-2007	X X	- X	Required for all robotic machine safety applications
CSA	Canadian Standards Association	CSA Z434: Safety requirements for robots and robot systems	-	-	Canadian requirement.

Machine Safety Standards
Overview - ISO 13849-1 and IEC 62061

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The EN 954-1 (CAT B, CAT 2, CAT3 & CAT4) was replaced by ISO13849-1:2006 because programmable electronic systems were considered insufficiently and the time response (e.g. testing intervals, life cycles) and the failure probability of components were not considered.

18 December 2009: EN 954-1 extension confirmed as two years , until 31 December 2011.

Two important standards:

ISO 13849-1:2006 and IEC62061:2005 – apply the time element to safety systems for the machinery sector.

ISO 13849-1:2006 builds on the "categories" of safety structure, uses the term "performance level" (PL), and then uses the alphabet, PLa through Ple.

IEC 62061 builds on the foundation of the structure or what is called "Hardware Fault Tolerance" and uses the term "safety integrity level" (SIL), Only three SILs apply to machine systems: SIL1, SIL2 and SIL3

A third element, diagnostics, not new at all, is added to the picture to give the safety system designer more flexibility to achieve the safety requirements. Putting these three elements together yields a time-sensitive level of integrity in a safety system.

Machine Safety
Comparison of ISO 13849-1 and IEC 62061

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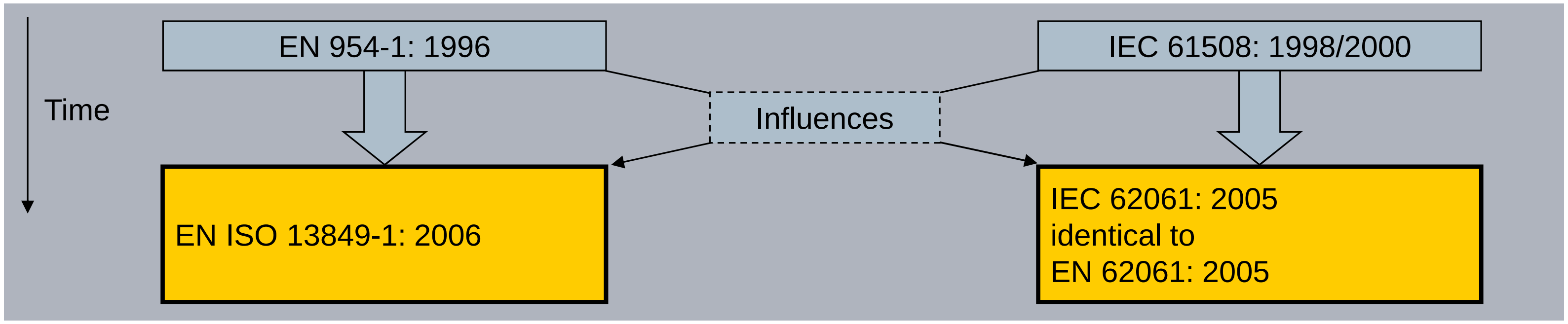

Feature	EN 954-1	EN ISO 13849-1	IEC 61508	EN 62061
For manufacturers of	Machinery	Machinery	Components	Machinery
Technology	Also non-electrical	Also non-electrical	Electrical	Electrical
Concept: Safety function Required safety level Probability of failure	 Parts Categories ---	 Total PL_r PFH_D	 Total SIL PFH_D	 Total SIL PFH_D
Use of programmable electronics (PLC, …)	No	Yes	Yes	Yes
Presumption of conformity, if applied	Yes	Yes	No	Yes

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Machine Safety
Comparison of ISO 13849-1 and IEC 62061

- The SIL and/or PL safety levels define just how reliable a safety system must be:

Performance Level (PL) EN ISO 13849-1	Mean probability of one dangerous failure per hour	SIL as per IEC61508 and EN IEC 62061	Maximum acceptable safety system failure
a	$\geq 10^{-5}$ to $<10^{-4}$	-	One risk failure every 10000 hours
b	$\geq 3X10^{-6}$ to $<10^{-5}$	1	One risk failure every 1250 days
c	$\geq 10^{-6}$ to $<3X10^{-6}$	2	One risk failure every 115.74 years
d	$\geq 10^{-7}$ to $<10^{-6}$	3	One risk failure every 115.74 years
e	$\geq 10^{-8}$ to $<10^{-7}$	4	One risk failure every 1,157.41 years

Technology	EN ISO 13849-1	EN 62061
Hydraulic	Applicable	Not applicable
Pneumatic	Applicable	Not applicable
Mechanical	Applicable	Not applicable
Electrical	Applicable	Applicable
Electronics	Applicable	Applicable
Programmable Electronics	Applicable	Applicable

- When a safety system is correctly used - its **probability of failure is the same as the probability of a hazard**.
- This means that IEC 62061 und ISO 13849 define a **quantitative** risk and therefore go further than EN 954-1.

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Machine Safety
Comparison of different safety standards per ANSI B11.0:2010

Risk Reduction	System Architecture				
Column 1	Column 2	Column 3	Column 4	Column 5	Column 6
ANSI B11.TR6 (ISO 13849-1:1999)	ANSI B11.0	Robotics Industry (RIA R15.06 / CSA Z434)	CATEGORY (ISO 13849-1:1999)	SIL (IEC 61508)	Performance Level (ISO 13849-1: 2006
Highest: Requirements of B and the use of well-tried safety principles shall apply. Safety-related parts shall be designed, so that a single fault in any of these parts does not lead to a loss of the safety function, and the single fault is detected at or before the next demand upon the safety function, but that if this detection is not possible, an accumulation of undetected faults shall not lead to loss of the safety function.	Highest: Redundancy w/ continuous self-checking (e.g., Dual channel w/ continuous monitoring)	R1 / R2A (Control reliable)	4	3	e
Intermediate / High: Requirements of B and the use of well-tried safety principles shall apply. Safety-related parts shall be designed, so that a single fault in any of these parts does not lead to the loss of the safety function, and whenever reasonably practicable, the single fault is detected.	Intermediate / High: Redundancy w/ self-checking upon start-up (e.g., Dual channel w/ monitoring at cycle/start-up)	R2A / R2B (Control reliable / Single channel with monitoring)	3	3 to 2	d or c
Low / Intermediate: Requirements of B and the use of well-tried safety principles shall apply. Safety function shall be checked at suitable intervals by the machine control system.	Low / Intermediate: Redundancy that may be manually checked (e.g., Dual channel w/ optional manual monitoring)	R2B / R2C (Single channel with monitoring / Single channel)	2	2 to 1	b
Lowest: Requirements of B shall apply. Well-tried components and well-tried safety principles shall be used.	Lowest: Single channel	R3A (Single channel)	1	0	a
B: SRP/CS and/or their protective equipment, as well as their components, shall be designed, constructed, selected, assembled and combined in accordance with relevant standards so that they can withstand the expected influence. Basic safety principles shall be used.		R3B / R4 (Simple)	B		a

**Taken from ANSI B11.0:2010*

Machine Safety Standards

Status of ISO/IEC 17305

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Status of ISO/IEC 17305
Today

- Two standards: ISO 13849 und IEC 62061 are overlapping and can be used alternatively.

- What do? Optimizing or to strike a new path?

- Optimizing:
- ISO 13849-1 – Amendment is still not practice-oriented

- New Concepts:
- Working Draft 17305
- The planned Merging of both standards ISO 13849 and IEC 62061

Status of ISO/IEC 17305
Why improving & merging? – the most relevant reasons for -

- Need for a **simple/practical standard**, with practical examples to be added:

  More explanation/guidance (to avoid deviating interpretation)

- The request to have **more flexibility** for the quantification of the risk

  estimation seems to be interlinked with the problems reported with regard to

  the determination of the required PL or SIL

- The ideas behind **"functional safety" and "safety related control system"**

  need to be clarified

- Particular problems with **DC, CCF and validation**:

  Those parts need more guidance/clarifications

Status of ISO/IEC 17305
Design of Safety Control System (SCS)

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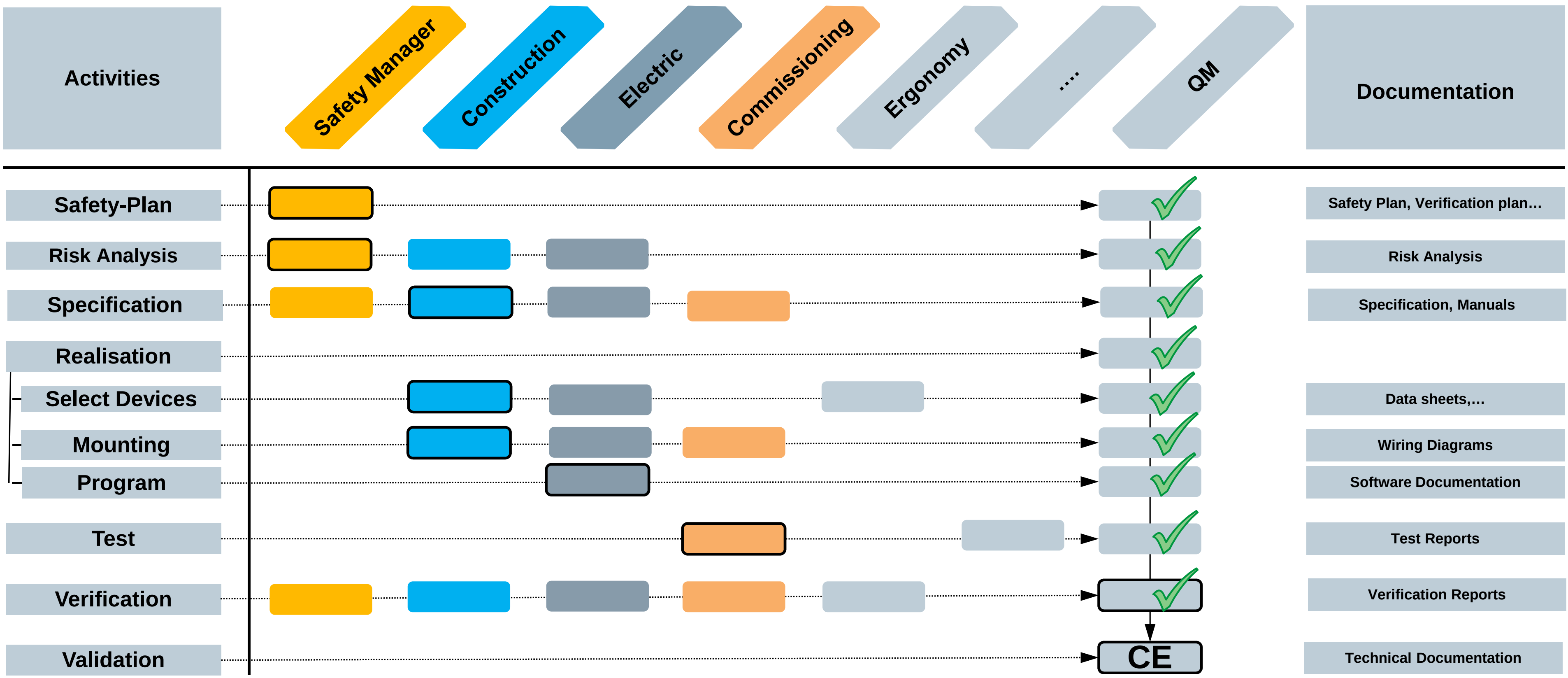

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Machine Safety Standards

Safety Related Parts of Control System

Safety Related Parts of Control System
Basic Implementation Procedure – Risk Reduction

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Steps to be performed by the machine manufacturer

- 1 Risk assessment
- 2 Risk reduction
  - Step 1: Safe design
  - Step 2: Technical protective measures
  - Step 3: User information on residual risks
- 3 Validation of the machine
- 4 Placing the machine on the market

Technical documentation

Each step must be comprehensibly documented:

Procedure and results

Test strategy and test results

Responsibilities, …

Safety Related Parts of Control System
Step 2: Technical Protective Measures

Technical protective measures

- A safety function must be defined for each hazard that cannot be eliminated by design
- Safety functions can be performed by safety systems

Example: Safety function, without safety system

Access to the hazardous location is permanently prevented (fixed mechanical cover, …)

Example: Safety function, with safety system

"When the protective cover is opened during normal operation, the motor must be switched off."

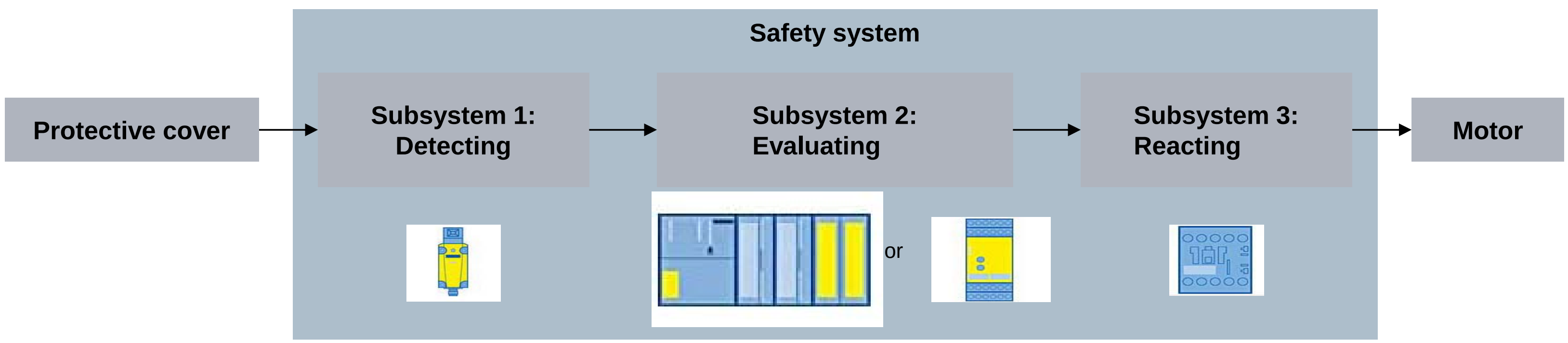
Safety Related Parts of Control System
Step 2: Technical Protective Measures

Safety system

- Performs safety functions
- Consists of subsystems

Subsystems of a safety system

- Detecting (position switch, light curtain, …)
- Evaluating (fail-safe controller, safety switching device, …)
- Reacting (contactor, frequency converter, …)



Safety Related Parts of Control System
Step 2: Technical Protective Measures

Relevant standards for designing and realizing safety systems for machinery

EN 954-1 (was valid until the end of 2011)

EN ISO 13849-1

EN 62061 (identical to IEC 62061)

Safety Related Parts of Control System
Step 2: Technical Protective Measures

Basic procedure for each safety function

a) Specifying the safety function

b) Determining the **required** safety level

c) Designing the safety function

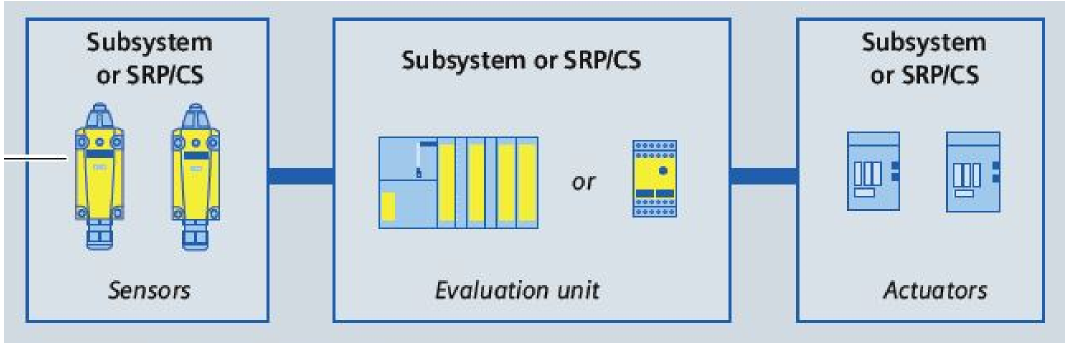
d) Determining the **achieved** safety level

e) Realizing and testing the safety function

Safety Related Parts of Control System
Step 2: Technical Protective Measures, a) Specifying the Safety Function

Boundary conditions of the safety function

- Hazard to be prevented on the machine
- Affected persons on the machine
- Concerned operating modes of the machine
- ...



Requirements for the functionality of the safety function

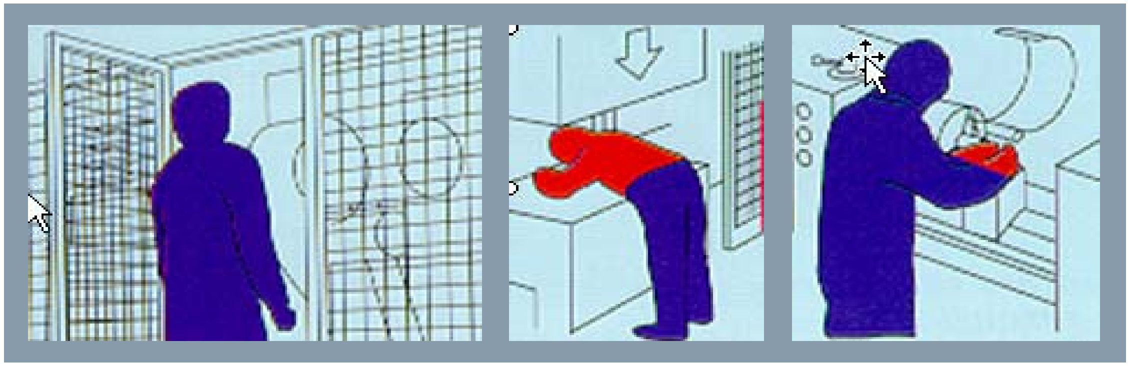
- Functional description of the safety function
- Required reaction time
- Reaction to faults
- Number of operations for electromechanical components
- …

Significance of the required safety level

The required safety level is a measure for the reliability of the safety function.

The required safety level depends on:

- Severity of the injury
- Frequency / exposure time
- Possibility of avoiding



The more severe the injury and the more probable its occurrence, the higher the required safety level.

EN 62061 and ISO 13849 show procedures for determining the required safety level.

Safety Related Parts of Control System
Step 2: Technical Protective Measures, b) Determining the reqd. Safety Level

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Specification according to EN 62061: SIL 1 to SIL 3

Frequency / exposure time	Fr
Less than 1 hour	5
1 h to 1 day	5
1 day to 2 weeks	4
2 weeks to 1 year	3
More than 1 year	2

+

Probability of occurrence	Pr
Frequently	5
Likely	4
Possible	3
Rarely	2
Negligible	1

+

Possibility of avoiding	P
Impossible	5
Possible	3
Likely	1

Severity of the injury	Se
Irreversible: E.g., losing limb(s)	4
Irreversible: E.g., broken limb(s)	3
Reversible: E.g., requiring attention from a medical practitioner	2
Reversible: E.g., requiring first aid	1

Severity of the injury Se	Class Cl = Fr + Pr + P				
	3 to 4	5 to 7	8 to 10	11 to 13	14 to 15
4	SIL 2	SIL 2	SIL 2	SIL 3	SIL 3
3			SIL 1	SIL 2	SIL 3
2				SIL 1	SIL 2
1					SIL 1

Safety Related Parts of Control System
Step 2: Technical Protective Measures, b) Determining the reqd. Safety Level

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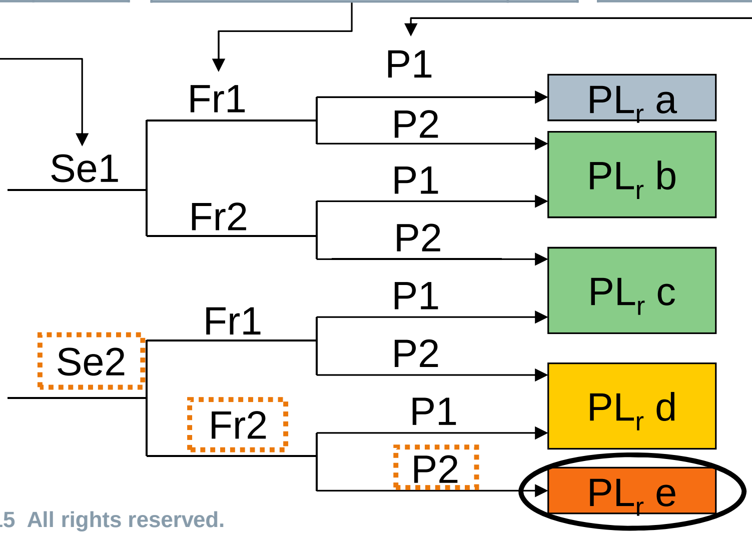
Specification according to EN ISO 13849: PLr a to PLr e

Severity of the injury	Se	Frequency / exposure time	Fr	Possibility of avoiding	P
Irreversible injury	Se2	Frequent up to continuous / long	Fr2	Scarcely possible	P2
Reversible injury	Se1	Seldom up to quite often / short	Fr1	Possible	P1



Safety Related Parts of Control System
Step 2: Technical Protective Measures, b) Determining the reqd. Safety Level

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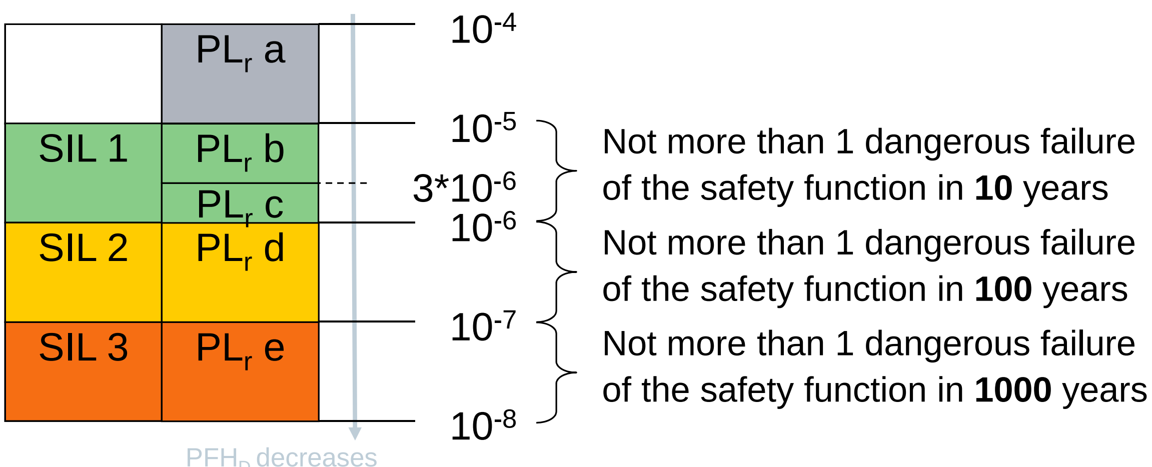
Requirements of the safety levels: Probability of failure

EN 62061 and EN ISO 13849 describe requirements for the maximum permissible probability of failure of the safety function:

- Probability of dangerous failure per hour PFH_D
- The higher the safety level, the lower the required PFH_D



Safety Related Parts of Control System
Step 2: Technical Protective Measures, b) Determining the reqd. Safety Level

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Requirements of the safety levels: Safety system

EN 62061 and EN ISO 13849 describe requirements for the reliability of safety systems:

	PL_r a
SIL 1	PL_r b
	PL_r c
SIL 2	PL_r d
SIL 3	PL_r e

Increasing requirements for the reliability of safety systems

All phases of the lifetime of a machine are considered:

- From planning
- to shutdown

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Requirements of the safety levels: Safety system

The requirements concern:

- Engineering (depends strongly on the required safety level)
- Procedure

Requirements for **engineering**: (low → high safety level)

- Hardware structure (one-channel → two-channel)
- Fault detection capability (none → comprehensive diagnostics)
- Reliability of components (increasing)

Requirements for the **procedure**:

- Project management
- Test concept
- Technical documentation, …

Safety Related Parts of Control System
Step 2: Technical Protective Measures, c)Designing the Safety Function

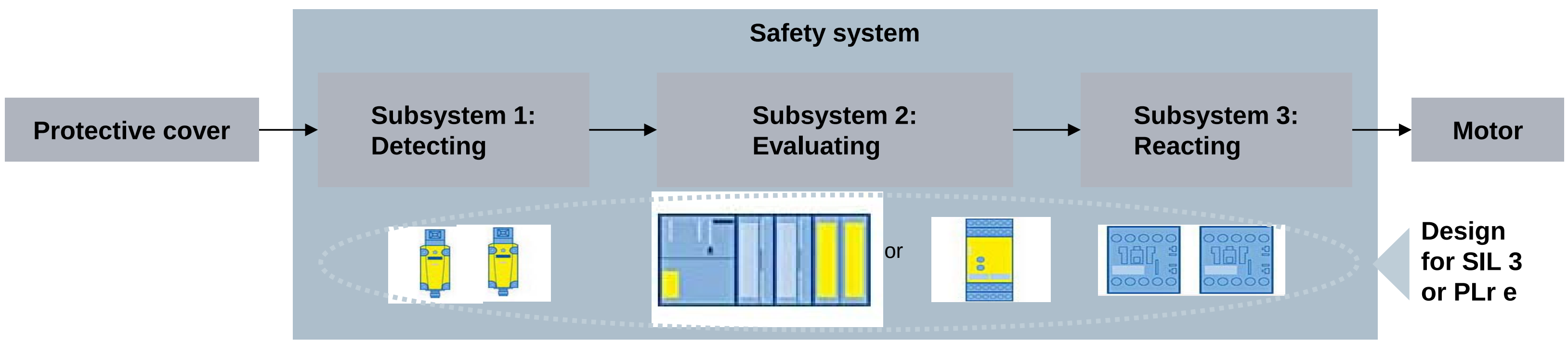
Objective of the design

The safety system performing the safety function must meet the requirements of the necessary safety level (SIL, PL_r).

Example

Safety function: “When the protective cover is opened during normal operation, the motor must be switched off.”

Required safety level: SIL 3 or PL_r e



Safety Related Parts of Control System
Step 2: Technical Protective Measures, d)Determining achieved Safety Level

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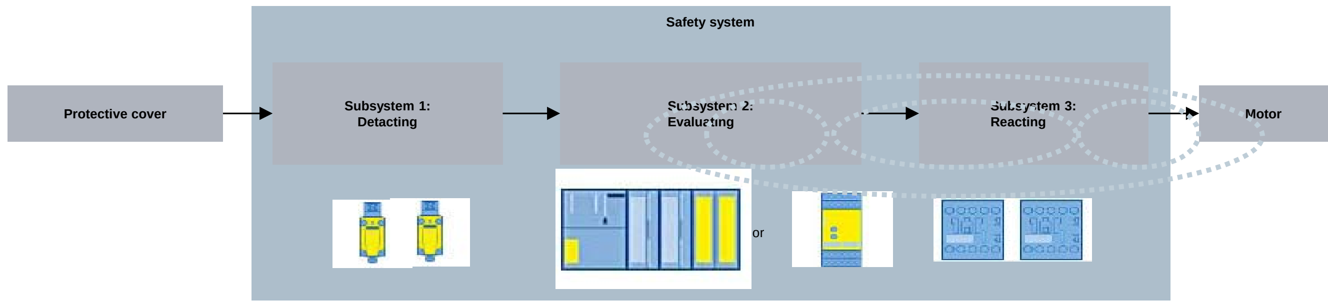
Design review

Can the required safety level (SIL, PL_r) be achieved?

Basic procedure

Assessment of the individual subsystems

- Achieved safety level (SILCL, PL)
- Probability of failure PFH_D



Assessment of the safety system

- Achieved safety level (SILCL, PL):
  Normally, the lowest achieved safety level of a subsystem determines the achieved safety level of the safety system.
- Probability of failure PFH_D: Total of PFH_D of the subsystems
- Achieved safety level of the safety system (SILCL, PL) = required safety level of the safety function (SIL, PL_r)?

Safety Related Parts of Control System
Step 2: Technical Protective Measures, d)Determining achieved Safety Level

Assessment of the subsystems

Safety-relevant characteristics of a subsystem:

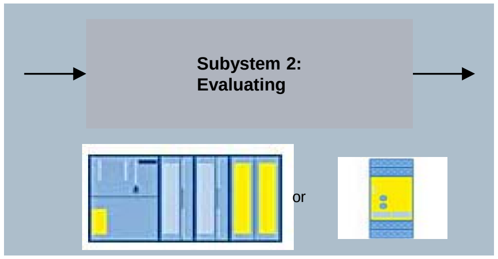
- Achieved safety level (SILCL, PL)
- Probability of failure PFH_D

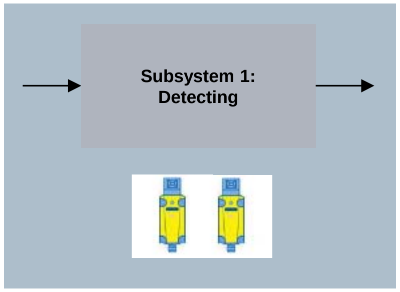
Finished subsystem

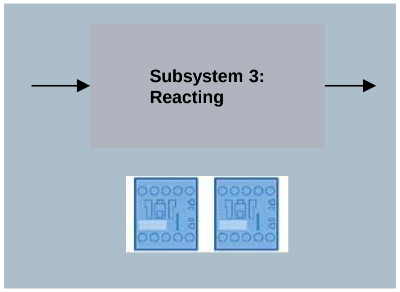
- Characteristics and certificates from the manufacturer

Designed subsystem

- Characteristics have to be calculated
- EN 62061 and EN ISO 13849 show how







Safety Related Parts of Control System
Step 3: User Information

User information warns of **residual risks**

User information does **not** replace

- safe design
- technical protective measures

Examples:

- Warnings in the operating instructions
- Special work instructions
- Icons
- Personal protective equipment

Document the measures
External and internal documentation

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Proof

External technical documentation	Internal technical documentation
For customer	Stays with manufacturer

External technical documentation

For customer

- Operating instructions with description for intended use
- Necessary circuit diagrams
- Safety guidelines
- Where appropriate, servicing manual
- EC certificate of conformity

Internal technical documentation

Stays with manufacturer

- Description of machine
- Overall drawing
- Full detailed drawing
- Documents on risk assessment
- Applicable standards and other technical specifications
- Technical reports with results on inspections/ tests carried out
- Operating instructions
- Copy of EC certificate of conformity
- Declaration of incorporation / assembly instructions for partly completed machinery

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Machine Safety Standards

SET – Tool to calculate safety levels

Safety Evaluation Tool SET

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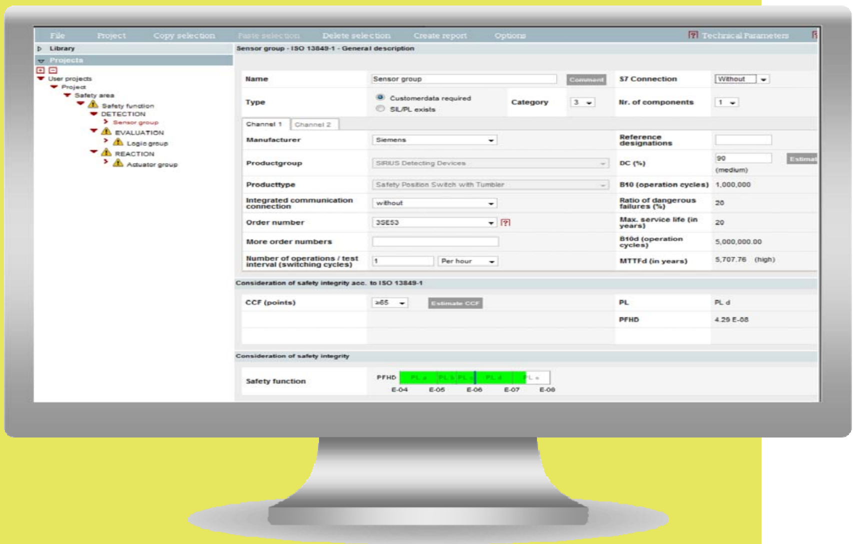
TÜV-tested Tool SET



› Overview

<u>Safety Evaluation Tool (SET):</u>

- **Online tool for determining safety levels** of safety functions according to:
  - EN ISO 13849-1 (Performance Level, PL)
  - EN 62061 (Safety Integrity Level, SIL).
- **Detailed configuration of the safety functions**
  - Emergency stop, fence, etc.
- **This tool is one of a kind**
  - Product information (PFHd-, SIL- and PL-values) of Siemens components are used directly in the safety-calculations.
  - Input of components from 'Third-Party-Manufacturers' is also possible.
- **Result**
  - Ready made TÜV-certified and compliant safety functions.
  - Time saving: Less manual calculations required.
  - Project documentation for the technical dossier of the machine.

Free use of the online tool: www.siemens.com/safety-evaluation-tool

› Next

Safety Evaluation Tool
Risk graph for determining the required SIL/PL level

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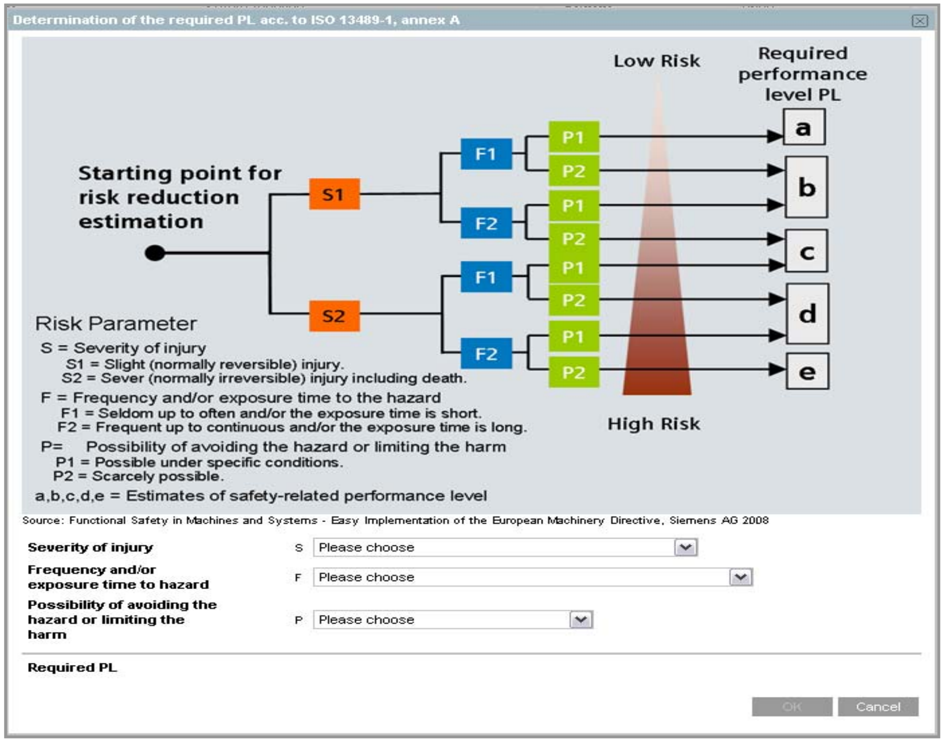
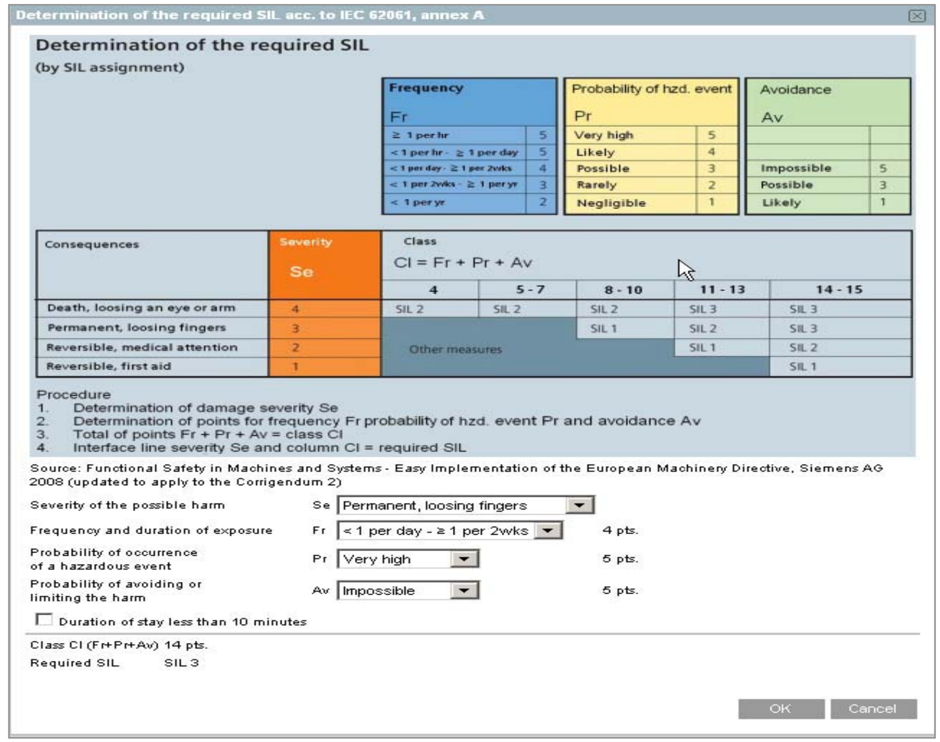
Integrated risk graph for determining the required SIL/PL level



Risk graph for PL (EN ISO 13849-1)



Risk graph for SIL (EN 62061)

Safety Evaluation Tool
Basic steps

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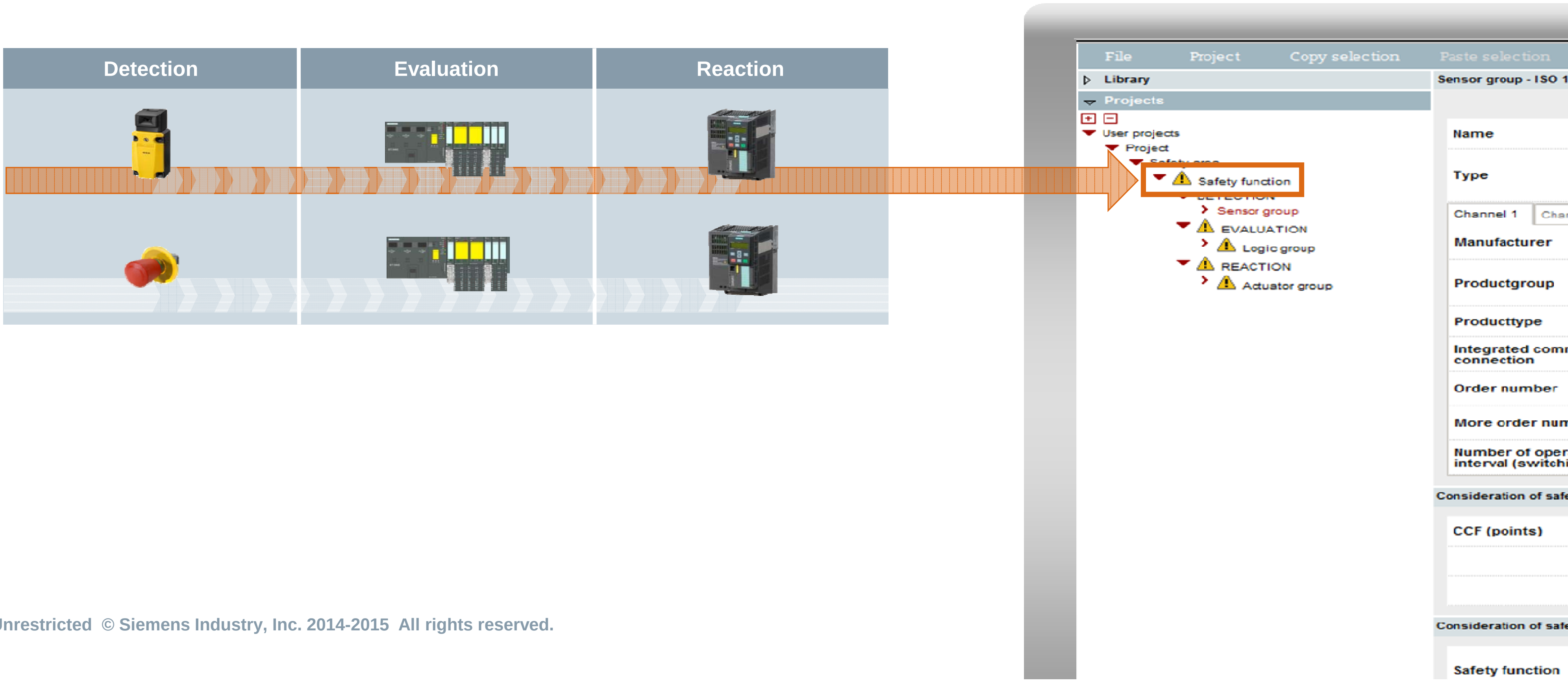
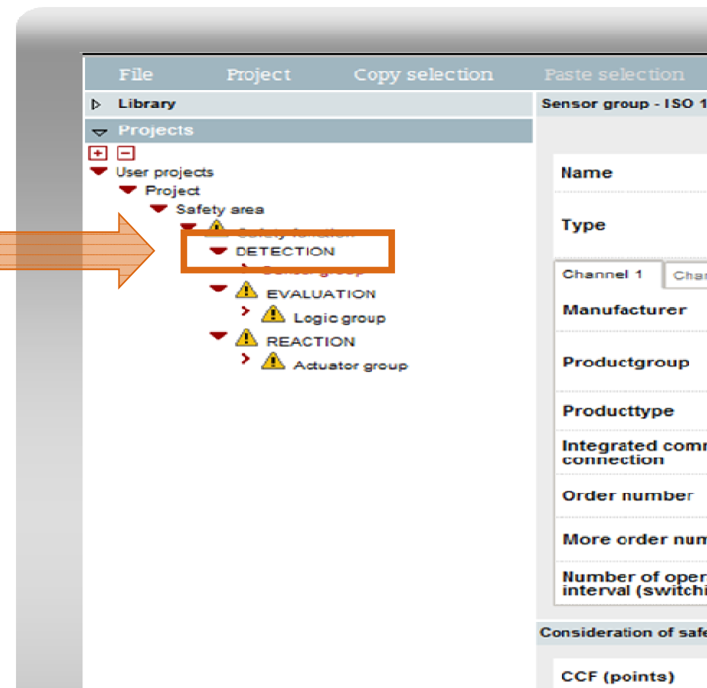
Create a safety function



Safety Evaluation Tool
Basic steps

Create components

Detection	Evaluation	Reaction
		



Safety Evaluation Tool
Basic steps

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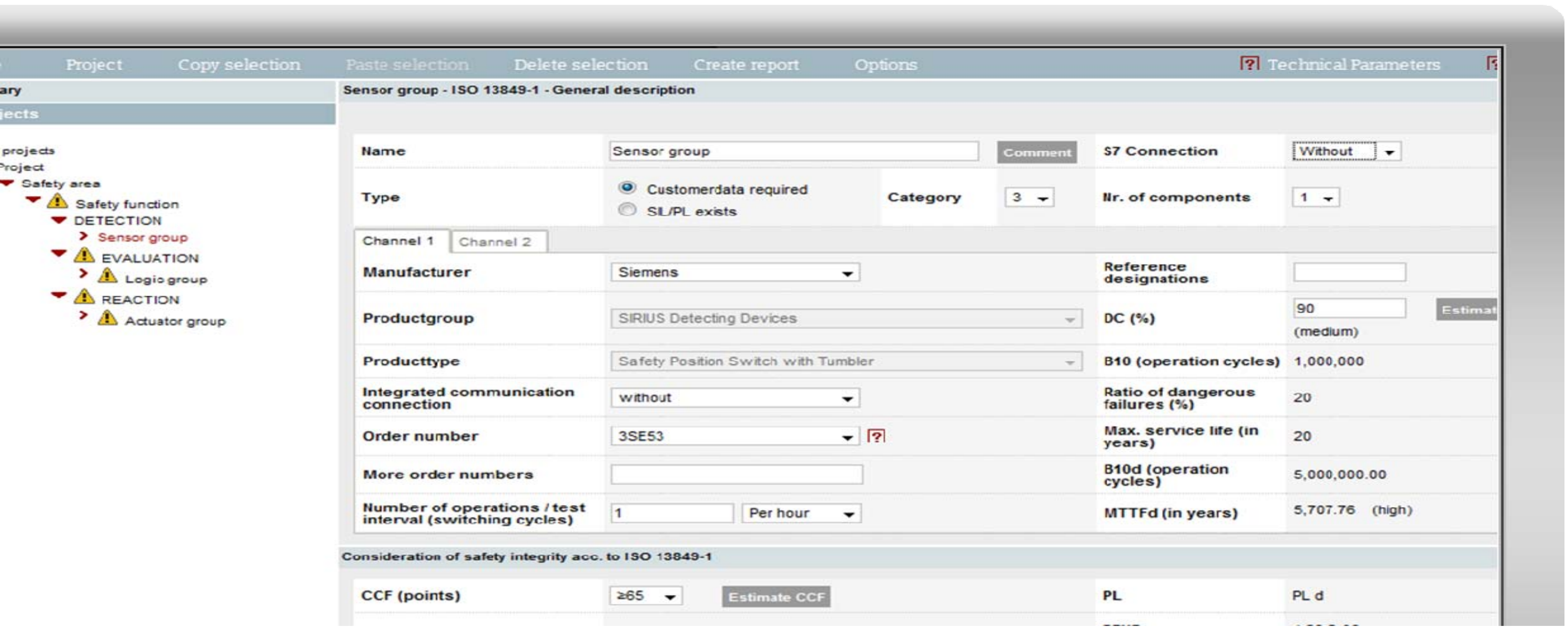
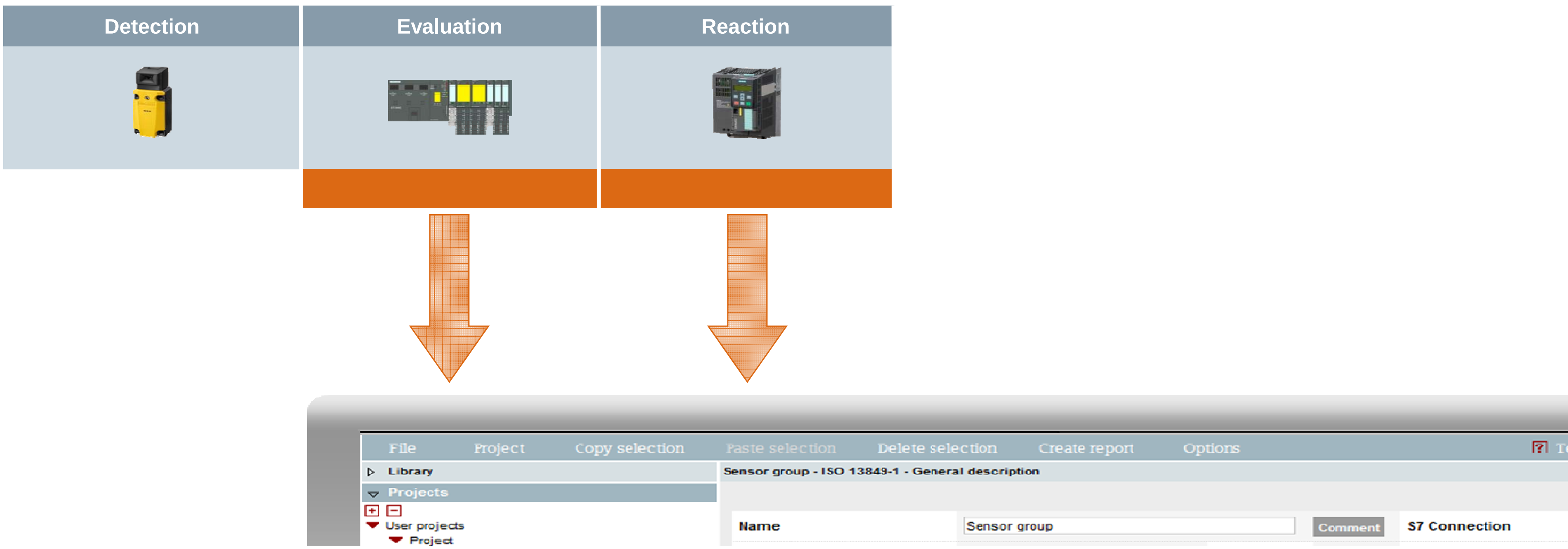
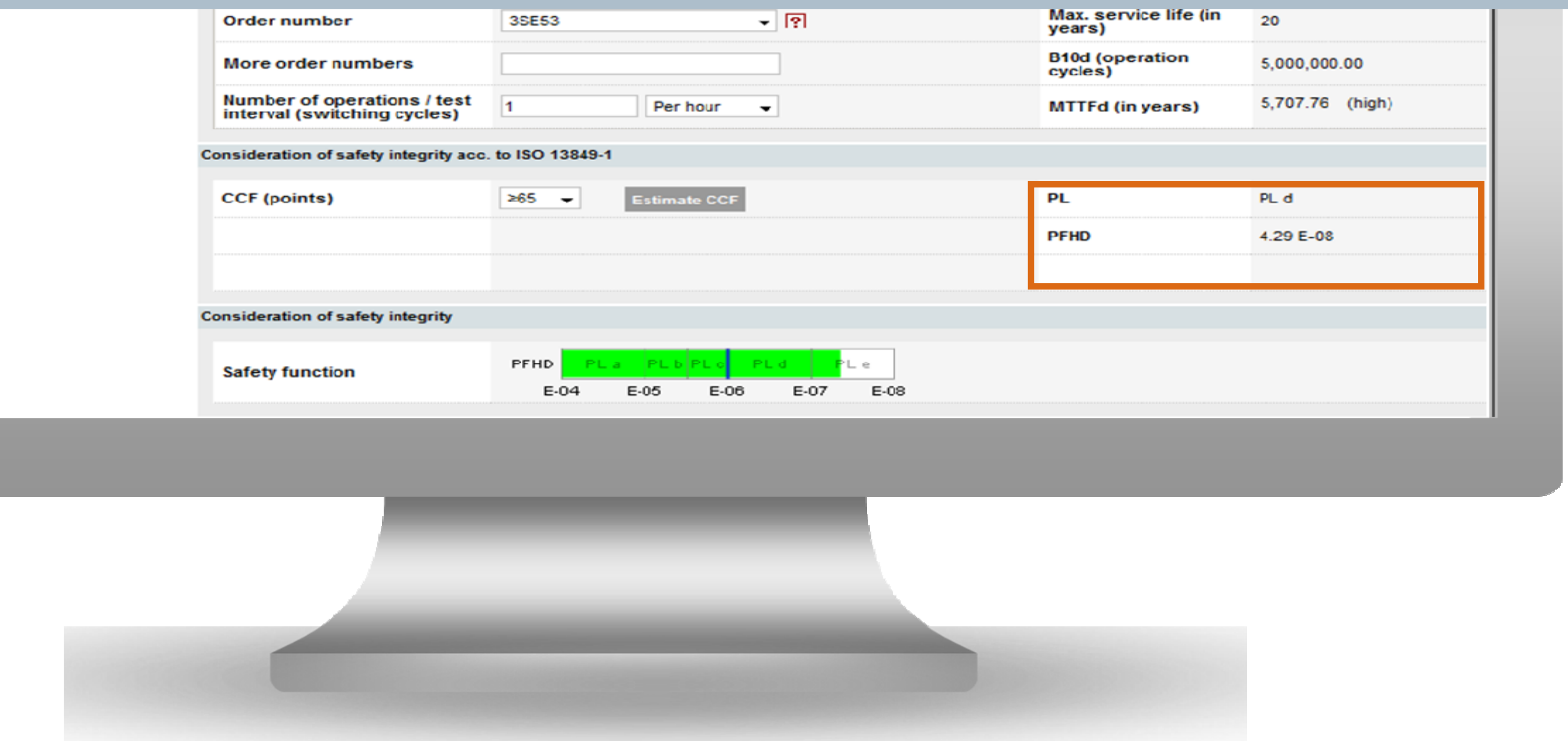
Enter data for components



Repeat steps for the other components



Safety Evaluation Tool
Basic steps



Show overall result

Safety Evaluation Tool
Basic steps

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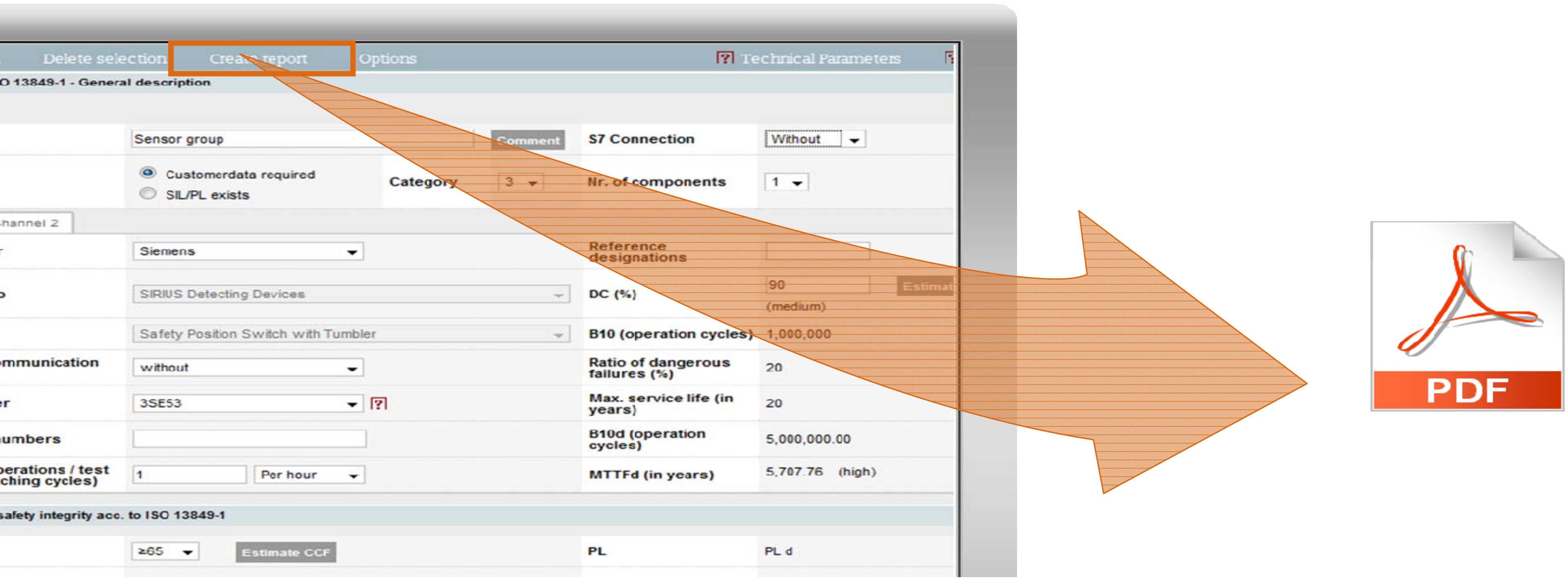
Generate documentation and save as PDF



Tools for Safety Calculations Comparison

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Major Software-tools available to simplify and speed up the calculations:

SISTEMA	Safety Evaluation Tool (SET)
Safety Integrity software tool for evaluation of machine applications available at no charge	The SET for the IEC 62061 & ISO 13849-1 standards takes you to your goal faster.
Tool for easy application of control standard EN ISO 13849-1	This TÜV-tested free-to-use, online tool supports the fast & reliable assessment of your machine's safety functions
Modeling tool for designated architectures & automated calculation of reliability values as per 13849-1	Automatic calculation in accordance with IEC 62061 & ISO 13849-1, certainty regarding compliance.
SISTEMA Cookbooks available	Faster online access to current product data
Printable summary document	Standard-compliant report, which can be integrated in the documentation as a proof of safety
http://www.dguv.de/ifa/en/pra/softwa/sistema/index.jsp	http://www.industry.siemens.com/topics/global/en/safety-integrated/machine-safety/safety-evaluation-tool/Pages/Default.aspx

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Machine Safety Standards

Evolution & Benefits of Machine Safety

Siemens Safety Integrated

Evolution of Machine Safety

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FUTURE

Focus on Machine Productivity & Safety

- Integrated Safety
- Intelligent safety devices
- Productivity Enhancing

PRESENT

Focus on Machine Productivity & Safety

- Use of safety rated devices
- Increased focus on safety standards
- Safety Standards implemented & enforced
- Better diagnostics

PAST

Focus on Machine Productivity

- Safety cumbersome
- Safety Often bypassed
- Increased injury & risks
- Standards often not implemented
- LOTO only

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Siemens Safety Integrated
Evolution of Safety Solutions

FUTURE

- Focus on Machine Productivity & Safety
- Integrated Safety
- Intelligent safety devices
- Productivity Enhancing

PAST

- Separate Automation controls
- Stand alone safety
- Hardwired safety
- Standards behind technology

PRESENT

- Acceptance of Safety PLC
  - for safety & non-safety functions
- Wide range of safety devices available
- Programmable Safety

Evolution of Safety Standards

SIEMENS

FUTURE

- Global Standards
- ISO 17305 – Merging of
  - ISO 13849 & IEC 62061
- Partnerships between
  - IEC / ISO / ANSI

PRESENT

- Mix of National & Global Standards,
  - Implemented & enforced
- ANSI B11, NFPA 79
- ISO 13849, IEC62061

PAST

- Used only Nationally Recognized Standards
- ANSI B11
- NFPA 79

Machine Safety
Key Trends in Safety

- Globalization of Safety Control Standards – ISO/IEC
- Increased focus on Safety Design to Improve Productivity
- Merging of Standards. Ex. ISO 13849/IEC 62061
- Transition from Electro-Mechanical to Electronic Safety Controls
- Safety Technology Integrated into Standard Automation Hardware
- Integration of Standard Controls and Safety Controls
- Addition of Configurable and Programmable Safety Devices
- Addition of Safe Motion Technology
- Safety Networks
- Safety being transparent

Machine Safety
Use of Safety – Increased Overall Equipment Efficiency (OEE)

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- Work productively while minimizing their risk of injury
- Enable design flexibility and increased diagnostics
- Increased likelihood that Standard Operating Procedures will be followed.
- Make machinery safer and easier to operate and maintain
- Reduce the motivation to bypass

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Machine Safety Standards

Machine Safety Life-Cycle Support

Siemens Safety Integrated

Machine Safety Life-Cycle Support — USA

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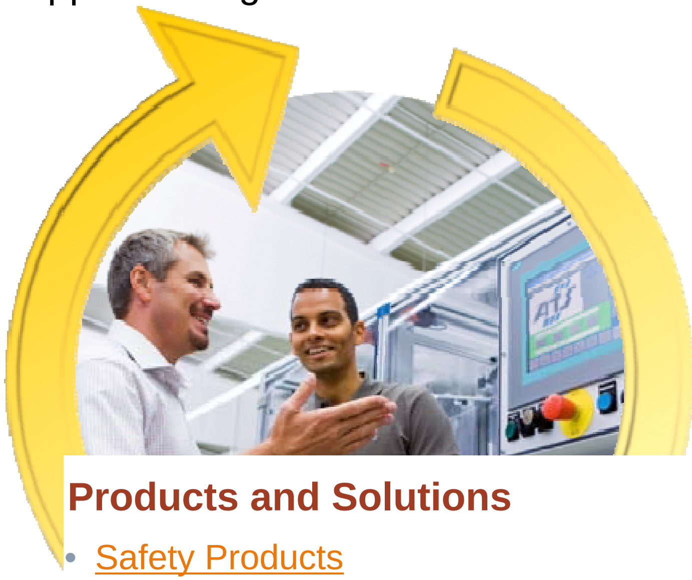
Siemens provides competent support throughout the entire machine safety lifecycle



Support

- Safety Consultants
- Safety Core Team
- Safety Validation

Implementation

- Siemens Solution Partners – Safety
- Safety Functional Examples
- Safety Training
- Risk Assessment Training

Products and Solutions

- Safety Products
- Safety Software
- Wireless Safety
- PC-Based Safety
- BMS

Safety Education

- Machine Safety Standards
- Safety Webinars
- Newsletter
- Safety White Papers
- Siemens Safety Website

Compliance

- OSHA Website
- Consensus Standards
- Risk Assessment Standard
- Safety Evaluation Tool - SET

Machine Safety Standards

Thank you for you time

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