iKnow SAFETY

Training Note

Safety Circuit Integrity Levels

Circuit Standards

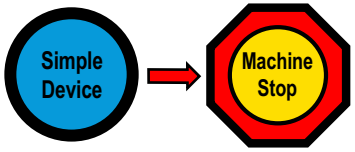
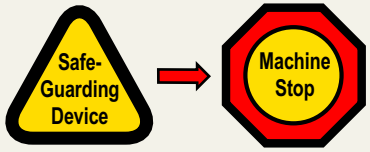
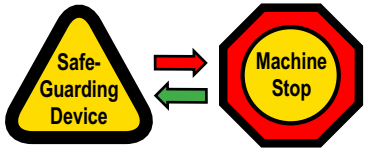
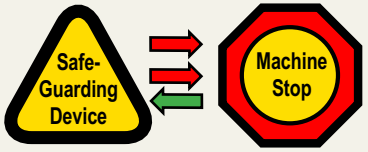
ISO 13849-1/EN954
OSHA 1910.217 b (13)
ANSI/RIA R15.06
ANSI B11. TR4
ANSI B11.19

Definitions

Integrity:
The degree to which a circuit, system or device can be expected to perform an anticipated function unimpaired in the event of a fault.

Reliability:
Ability of a machine, its circuits and components, to consistently perform its function within its specifications without failing.

The information contained is general in nature and is for educational purposes.

	Basic	Single	Single with Monitoring	Dual with Monitoring
Generic	Stop Command	Safety Stop Command	Safety Stop Command Monitoring Signal	Redundant Safety Stop Commands Monitoring Signal
				
	• Non safety-rated components • Integrated in accordance with relevant standards • Reliability depends on robust components • Redundancy not required	• Safety-rated components • Integrated in accordance with safety principles and design • Redundancy not required	• Safety-rated components • Conducts periodic test of system • Normal operation allowed if no faults are found • If unsafe fault is found, system will default to safe state or indicate that unsafe system exists	• Safety-rated components • Greatest degree of fault tolerance • Redundancy and self-checking • Single failure cannot cause loss of safety function • Faults detected immediately or at next demand on system
Fault	Possible loss of safety function	Greater reliability, but possible loss of safety function	Fault detected at each test	Safety function is ensured with a single fault. An accumulation of faults is not possible or detected.
Risk	**Very Low** Minor bump or bruise with no lost time	**Low** Minor first aid, infrequent exposure, or high likelihood of avoiding the hazard	**Mid Range** Injuries that are slight or normally reversible, requiring normal healing or only first aid.	**High or Very High** Normally reserved for hand-fed applications where injuries could be severe to irreversible
ANSI / B11	—	—	—	Control Reliable ANSI B11.19 (Clause 6.1 and Annex C) Not directly comparable to the requirements of ISO 13849-1 and exceeds a Category 2
ANSI / RIA	Simple	Single Channel	Single Channel with Monitoring	Control Reliable ANSI/RIA R15.06 (Clause 4.5) Control reliability for robots typically exceeds a Cat 3 but is not necessarily intended to be a Cat 4
ISO / EN	Category B ISO 13849-1/EN 954-1	Category 1 ISO 13849-1/EN 954-1	Category 2 ISO 13849-1/EN 954-1	Category 3 & 4 ISO 13849-1/EN 954-1