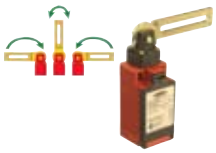
iKnow SAFETY

Training Note

Types of Safety Interlocks

	Interlock Type	Safety Function	Parts of System	Uses
CONTACT (mechanically actuated)	**Compact Mechanical** (plastic or metal)	Electromechanical switch with positive opening contacts	• 2-piece construction • Separate coded actuator	• Pivoting or sliding guards • Hazards that stop quickly or are far from the guard
		Per Guard*: Cat 1 or 2 = 1 switch Cat 2 = 1 switch + safety module Cat 2 or 3 = 2 switches Cat 3 or 4 = 2 switches + safety module		
	Rotary and Hinged	Hinge-mounted electromechanical switch with positive opening contacts	• 1-piece construction	• Rotating or pivoting guards • Hazards that stop quickly or are far from the guard
		Per Guard*: Cat 1 or 2 = 1 switch Cat 2 = 1 switch + safety module Cat 2 or 3 = 2 switches Cat 3 or 4 = 2 switches + safety module		
	Guard Locking	Key-operated interlock with solenoid locking and positive opening contacts	• 2-piece construction • Solenoid holds actuator in place	• Pivoting or sliding guards • Hazards that stop slowly or are close to the guard
		Per Guard*: Cat 1 or 2 = 1 switch Cat 2 = 1 switch + safety module Cat 2 or 3 = 2 switches Cat 3 or 4 = 2 switches + safety module		
NON-CONTACT (non-mechanically actuated)	**Magnetic**	• Multiple Reed Contacts • Coded Magnet	• Reed sensor • Magnetically-coded actuator • Safety module	• Pivoting or sliding guards • Washdown applications • Close tolerances • Size limitations
		Per Guard*: Cat 1 = 1 sensor/mag Cat 3 or 4 = 1 sensor/mag + safety module Cat 4 = 2 sensor/mag + safety module		
	Fiber Optic	• Optics • Controller	• Fiber optic cable • Optical elements • Controller	• Use with pivoting or sliding guards • Hazardous or explosive environments • Washdown applications • High levels of EMI/RFI noise present
		Per Guard*: Cat 1 = 1 optical element + photoelectric Cat 4 = 1 optical element + controller		

* The level of safety circuit integrity (e.g. categories per ISO13849-1/EN954-1) is dependent on each application. Extreme care should be used in designing and installing any safety system to ensure that all instructions and relevant regulations are complied with.

Definition

An interlock switch is a means of safeguarding that monitors the position of a guard or gate. The interlocking of a guard is used to shut off power, control access, and prevent the machine from starting when the guard is open.

Advantages

- The guard contains ejected materials
- Provides access for maintenance and repair
- Initial installation can be low-cost

Limitations

- Maintenance issues may be expensive
- Provides limited access
- Poor ergonomics
- Expensive to achieve higher levels of safety

Interlocking Standards

ANSI NFPA 79 *Electrical Standard for Industrial Machinery*

ANSI B11.19 *Performance Criteria for Safeguarding*

ANSI/RIA R15.06 *Safety Requirements for Industrial Robots and Robot Systems*

IEC 60204-1 *Electrical Equipment of Machines*

ISO 14119 (EN 1088) *Safety of Machinery – Interlocking Devices Associated with Guards*

IEC 60947-5 *Electromechanical Switches*