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Quarterly Technical Newsletter of Australia's leading supplier of low-voltage motor control and switchgear.

IN THIS ISSUE

What's Different About Safety

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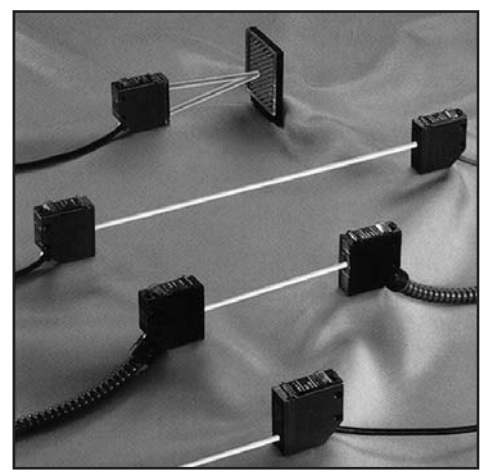
Most safety devices do not highlight any defects until they are called upon to operate. The seat belt in a car is used every day but it is hard to tell if the webbing or other parts will fail when called upon. The locking device in the take up reel could be defective and most users would not be aware there is a problem. On the other hand failure of non safety devices are usually noticed. If the motor wont start or the radio fails the driver is immediately aware.

This concept is true for just about every safety device. The lifeboat might not float, the fire extinguisher could be empty or the machine guard could be defective but the problem might not be noticed until the device is actually required.

Humans will accept alarming risks at times. When we become familiar with a risk we tend to ignore the consequences. The simple act of crossing the road is a definite hazard with a proven fatality rate yet most people will cross a busy road without any concern. The same thing happens with machines. The operator does not always appreciate that the



machine in front of him can suddenly kill or injure. The operator will sometimes try and defeat the systems that are there to protect them if they make the job harder or slower.

In cases where risk is high the tamper factor must be considered. If a guard operates a simple switch it is not hard to remove or modify the actuator. A product specifically designed for safety will use a key concept to prevent this. The switch will only operate with the correct matching part and any normal attempt to defeat this will fail.

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Safety is Non-Essential

Safety devices are normally non-essential to the basic process. They can always be removed and the vehicle or machine can still achieve its prime objective. This 'non essential' aspect has meant that most safety measures have had to be enforced by legislation. There is now a vast array of compulsory safety legislation which involves penalties for non compliance. In addition anybody who suffers an injury may be able to sue for damages and related to this there maybe a criminal penalty for anybody failing to ensure a safe environment. For machines there is a growing awareness of the need for safety which is supported by Standards and an increasing range of products designed specifically to meet safety requirements.

Safety by Concept

The safeguarding of machines is such a diverse area it is difficult to pin down any fixed safety design.

The Standards detail concepts which must be considered. The type of machine movement, the operator access required and what will happen if an attempt to defeat the safety systems is made, are all points that must be considered.

If the machine guarding involves an active system such as electrical controls the consequences of failure must be evaluated. Special design principles are required in the design to try and provide a system that is fail safe. In many safeguarding systems the ways in which an operator may inadvertently (or deliberately) defeat a safety system must be considered in the design.

Electrical Safety Devices

Safety devices can be mechanical, electrical, hydraulic or pneumatic. While only considering electrical methods the same principles can be applied to the other forms.

Safety devices can be categorised into different groups depending on the type of protection they offer.

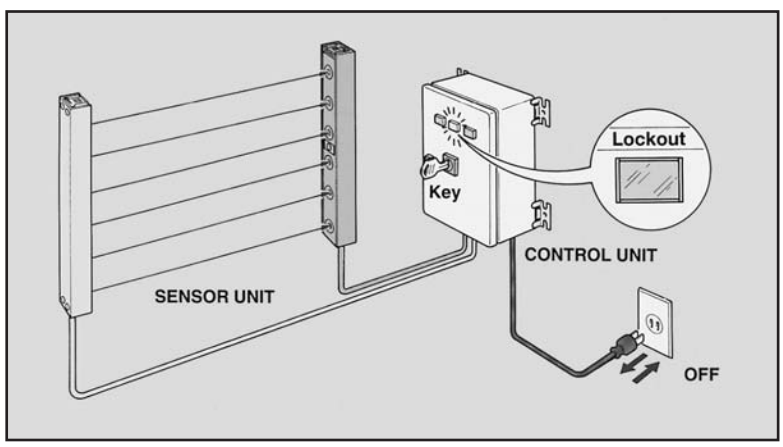
The degree of risk will vary in each situation and if it is low the safety can be of the lowest category. A low category device has a single control system without any indication of failure of the system. For a high risk situation a dual control system with cross monitoring self checking may be required. Between these extremes there is a range of categories that can be applied.

As a back-up to the automatic guarding devices there is also the Emergency Stop and the Isolator to be considered.

Emergency Stop

The emergency stop should only be considered as a back up to proper safety systems when protection against injury is considered. It is not intended for normal control and should not be relied upon for isolation.

The features of an emergency stop are it must be clearly visible and remain active at all times. They are normally of a latching design so the machine cannot be inadvertently restarted.



Light curtain. Pressure sensing by electro-sensitive means.

Emergency stop pushbutton station.

Isolator

An isolator must positively remove all power from the machine and either be next to the isolated item, or if remote provided with a padlocking facility. It is intended to allow maintenance processes to be preformed in safety as distinct for operational access.

An isolator must positively remove all power from the machine.

Interlock device with special actuation.

Presence Sensing

These devices detect the presence of person or body part and either stop the process or prevent it from starting. The device can be mechanical or an electro-sensitive system. The electro-sensitive systems typically employ a light beam or beams which detect an obstruction in their path.

Pressure sensitive devices provide safety, but must be reliable.

Pressure sensitive systems which detect when a person or object applies pressure to the device are also effective in some situations for providing safe operation.

Interlocking

The interlocking device provides the connection between a guard and the machine control. The device should prevent the machinery from operating until the guard is closed or if running prevent access before the hazard is removed. This may require the device to prevent the guard from opening until the safe state is reached.

What Makes a Safety Device?

Safety devices may at first seem to only offer the same function as normal machine control products. The need to consider the 'what if' situation sets a different standard of performance and not only the design of the individual component, but also the machine function and method of operation needs to be considered. At the device level the safety product must first of all not introduce a hazard itself. It must be tamper resistant and not expose the operator to mechanical or electrical hazard.

As an example pressure sensitive systems are required to operate at extra low voltage as they are exposed to potential damage which can result in failure.

The device must be able to withstand the working environment. This may include high temperatures, oils or other contaminants, vibration, magnetic fields or a high degree of mechanical use.

Safety circuits are usually energised in the safe or healthy state. The contacts in detection devices are therefore normally closed for the safe condition. When the detection device is actuated to the unsafe or machine stop condition it is essential that the internal contacts do break their circuit. This requires a positive break design to overcome any slight contact welding and to remove any reliance on a spring to move the contacts.

Fail safe design in the case of electronic circuits becomes much harder than the considerations required for a simple contact system. The consequences of failure of each component must be considered. Self checking and in the case of the highest category dual redundant systems, cross checking is required to improve the fail safe performance.

The possibility of an operator tampering with an interlock should be minimised. The 'keyed' type of interlock can only be operated with its mating part. The use of bits of wire or the like will not operate the device.

Conclusion

In the operation of any machine or process the risk to the operator or persons in the vicinity of the machine must be considered. In addition the deliberate or inadvertent actions that may defeat the safety measures provided must also be evaluated.

The consequences of the failure of the safety device itself and how this will be detected requires careful selection of the devices used. A safety device cannot achieve its objective if it not installed in a manner which correctly integrates with the machine operation to produce a safe state for the machine. The emergency stop and the isolator are also important components in the overall safety concept.

As a starting point in the design of safety systems, only products specifically designed for safety should be used.

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