MachineDesign

Altech Corp.®

NEW PLUGGABLE SAFETY SYSTEM SIMPLIFIES INSTALLATION, IMPROVES DIAGNOSTICS AND SAFETY

Instead of direct signaling voltage, this new system features pluggable connections using OSSD outputs to improve diagnostic communication, predictive maintenance, and safety.

Traditional Safety Circuits

Basic safety systems are typically hardwired as normally closed safety switches and sensors using two redundant circuits, which are monitored by a safety relay. Although this method has been used for many years, there are inherent conditions which could possibly allow a fault in a safety component to be masked, creating an unsafe condition in which a door or gate could be opened while the machine is in a dangerous state.

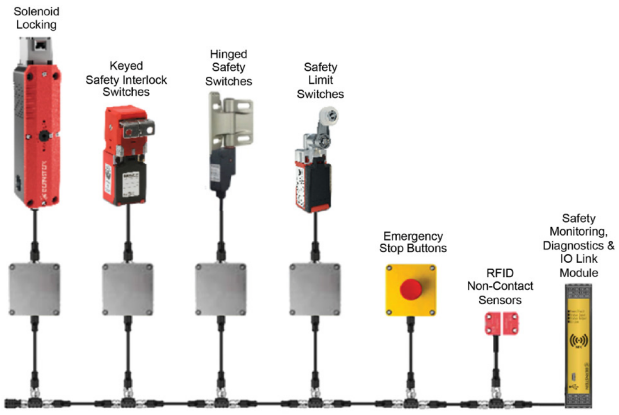

Figure 1: *Be sure to incorporate a variety of key safety features into your application.*

Eliminating Fault Masking

Fault masking is a condition that can occur when several safety switches are wired in series. What happens is a single contact or wire short occurs in one component and produces a fault mode in the safety relay. If a different door or gate is opened and closed afterward, the combination of events creates an unintended resetting of the safety relay that overrides the detection of the original fault. The control system interprets that sequence as an indication that the fault has been corrected, which means the machine can be restarted even though the original fault condition still exists. Therefore, the faulty door or panel can be opened while the machine is still running, putting the machine and personnel in critical danger. ISO has addressed this situation with ISO/TR 24119: Safety of Machinery—Evaluation of fault masking serial connection of interlocking devices associated with guards with potential free contacts.

Altech's Smart Safety Solution

Altech has introduced their SMART Safety System to eliminate fault masking. The system features safety switches and sensors with redundant OSSD (Output Signal Switching Device) safety outputs. By operating with two pulsed 24VDC signals, the non-tripped state can carry a 24V signal while the tripped state drops to 0VDC. The OSSD outputs self-check in this way: In the non-tripped state, the outputs periodically pulse low. The protective device checks the output to be sure it does go low when commanded to do so. If not, the output has either failed or shorted to 24V somewhere. So, during an idle signal, the 24V signal is periodically pulsed to 0V. An active signal is issued when both lines present 0V—a single line presenting 0V for a duration longer than the test pulse indicates an event. Sensors are run in a cascading order, so that the first sensor checks its state and, if closed, sends a signal to the second sensor, which repeats this action and moves to the third sensor, and so on, all the way down the line for up to 32 daisy chained sensors.

Switch and Sensor Types Offered

Switches and sensors available with this include non-contact RFID safety switches, self-contained emergency stop buttons, and a transition box that allows dry contact devices to be integrated into the OSSD system (See Figure 1).

Non-Contact RFID Sensors

Advanced non-contact safety switches, such as the SRF sensor from Altech, incorporate RFID technology to help solve several of the problems associated with other options. Compact in size, these solid-state sensors based on RFID technology generate a signal that determines if the sender and receiver are within range of each other—up to 13mm. RFID is a radio frequency device

Figure 2: *Non-contact sensors provide superior operation under a wide variety of environmental conditions.*

that incorporates a scanning antenna for transmit and receive functions, a signal decoder to interpret collected data, and a transponder (or RFID tag) to relay specific information about the sensor itself.

The scanning antenna delivers the RF signal that communicates with the transponder and provides the RFID tag with enough energy to communicate—for passive operation where the tags do not have batteries. Using the antenna as a power source allows the device to operate for long periods of time for relatively maintenance-free operation. When an RFID tag passes through the field of the antenna, it detects the activation signal from the antenna, which then wakes up the RFID chip, so that it can transmit any information gathered on its microchip to be picked up by the scanning antenna.

In general, RFID tags can be read in a wide variety of situations where barcodes or other optically read technologies are not feasible. Read times are fast, typically less than 100ms, and are ideal for use with large control systems. A large number of tags can be read simultaneously, making them efficient for plant wide operations. Active RFID tags have their own power source, so that the reader can be farther away and still acquire the signal.

These are typically used to replace keyed switches which require precise alignment to operate properly. Misalignment by only a few millimeters can happen when a door sags or a panel shifts on its hinges. Plus, small shifts such as these can cause damage to the switch or the key. As mentioned above, as long as the RFID elements are within 13mm, the device operates effectively. The SRF sensors also provide a warning whenever the actuator is beginning to travel out of range. Precision adjustment is not an issue (10mm assured sensing ON; 25mm OFF), which is ideal for robots, packaging equipment, and pick-and-place machines that are subject to excessive vibration—a major problem

for keyed or reed switches. In fact, since RFID sensors are solid-state components, they can be used in a wide variety of harsh environments where shock and vibration are a common factor that would damage other mechanical switches (see Figure 2). Another benefit of the non-contact nature of this technology is that with its mechanical-free operation, there is no wear and tear on the components. Non-contact RFID sensors can provide service life up to 20 years.

Emergency Stop Buttons

Altech also offers an emergency stop button in a connection box enclosure used for direct plug-in integration into the OSSD safety chain (see Figure 3). These feature a twist to release button and an optical status display via LED as well as the transmission of the device status using the DCD diagnostic to the machine control system. Emergency stops provide simple integration into the sensor chain using M12 connections, which allows diagnostic information to be available for every emergency stop device available. The devices also monitor machine compliance via regular test cycles.

Figure 3: *Emergency stop button with OSSD outputs.*

Transition Box

SEU connection boxes provide for the connection of existing dry contact electromechanical safety switches and sensors, such as interlocks or other emergency stop devices, all of which can be integrated into the OSSD safety chain (see Figure 4). Status data can also be transmitted to the connection box via DCD diagnostics.

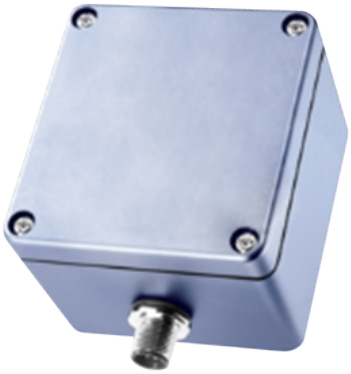

Figure 4: *SEU transition box.*

Easy Plug-in Installation and Maintenance

We're talking about simple and quick installation where both the sensor and the actuator are mounted with two screws each and require a minimum amount of alignment. Since they don't have to be perfectly aligned, users have a much wider tolerance for mounting positioning.

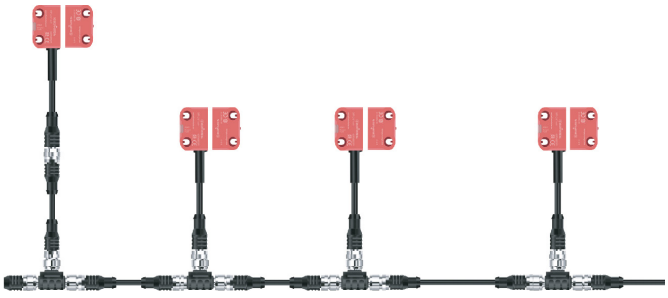

Figure 5: *The SRF safety RFID sensors are daisy chained using the M12 pluggable system.*

Figure 6: *Safety diagnostics operate independently of the safety outputs.*

The SRF safety RFID sensors are connected using an M12 pluggable system that includes "T" connectors for plug-and-play series installation (see Figure 5). Ease of connection also eliminates wiring errors that can crop up in manually wired systems. Individual sensors are connected to the sensor chain "main line" using the "T" connector, while the sensor chain "main line" incorporates a four-conductor unshielded cable for additional cost savings. The series line is ended using a standard terminal cap.

Since the sensors are installed in series, there is no need for large wiring bundles when multiple hoods, doors, gates, and panels need to be monitored. Up to 32 switches can be serially connected. The sensors provide safety levels of PLe, Cat. 4 (according to EN ISO 13849-1) and SIL CL3 (according to DIN EN 62061). The transmitter, receiver, connectors, and wiring are also IP69 rated for adherence to wash-down requirements.

Industry 4.0 Diagnostic Capability

The concept and drive toward Industry 4.0 includes the idea to include as much data collection capability as possible and making this data available centrally and flexibly to aid in an intelligent production situation. As automation and IT merge, equipment can integrate on a broader level—through warnings prior to a safety problem. This is why Altech's DCD and I/O Link are so important as companies move into the future.

The systems must provide diagnostics to pinpoint where the problem or potential problem may occur, then communicate that information to the proper sources. Altech's DCD, as mentioned above, provides

that diagnostics by offering over 20 different types of information that can be monitored through the internal bus system.

Once available, this data can be accessed by the machine's control system via IO Link technology and then be delivered through a standard USB port, PLC, or Android smartphone or tablet (using NFC—Near Field Communication—technology). The diagnostics system operates independently of the safety outputs (see Figure 6). Available data can include actuator detection, operating voltage warnings, status of internal or external feedback loop, actuator code received, and device temperature. The SMART Safety System is able to permanently assign a name and descriptive text to each device, safety chain, and machine, making it easier for the user to identify the corresponding device.

Error messages stored in the diagnostics module, using a time stamp, can be retrieved via all interfaces if needed. Thanks to the NFC function, this important diagnostic information can be read even when there is no voltage on the diagnostic module. This feature allows efficient troubleshooting and accelerates restart of defective machines. Moreover, a fault memory stores system-relevant data to simplify troubleshooting. All this detailed diagnostic data provides a complete status image of each sensor, even when designed into a multiple-sensor series arrangement to support smart production.

Conclusion

Keeping employees and equipment safe is critical to maintaining continual throughput. Downtime is expensive. This is why installing the proper safety components in your machine will assure that downtime is minimal, and people are safe. Altech solutions provide a wide range of components and systems to allow manufacturers—whether Industrial 4.0 enabled or not—to save time and costs on installation, maintenance, and repair operations. Each component is designed to comply with an appropriate standard while simultaneously providing the necessary safety features needed for your applications.