INTRINSIC SAFETY POINTS TO THE FUTURE

TECHNICAL WHITE PAPER

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PROTECTING YOUR PROCESS

If you've ever seen a bomb squad on television or in the movies, you know that they typically take the explosives to a safe area in a large metal container designed to keep an explosion inside. But if you ask a real bomb technician, he'll tell you the best way to protect yourself from an explosion is to prevent it from happening in the first place. Think about which you would rather stand next to: A bomb exploding in a container, or a bomb that cannot explode at all?

This is exactly the difference between traditional hazardous area explosion protection and intrinsic safety. As its name implies, intrinsic safety, or I.S., refers to equipment and wiring that is inherently safe. In other words, an intrinsically safe system is one with energy levels so low that they cannot cause an explosion. This is typically achieved through the use of barriers-either zener diode barriers or isolated barriers-that limit the amount of energy entering hazardous areas. The term hazardous area refers to any location with combustible material such as gases, dusts or fibers that may produce an ignitable mixture. A hazardous area can be a sealed room filled with a volatile material, or an area open to normal foot traffic like the area around a gasoline pump. In North America, hazardous areas are usually designated by Classes, Divisions and Groups, although the international system of Zones and Groups is becoming increasingly popular.

What can I.S. do for you?
Intrinsic safety systems offer significant cost savings over traditional protection methods because there are no heavy conduits or bolted enclosures. Material costs are reduced because a standard enclosure is the only major expense for mounting the barriers. With I.S., low energy requirements eliminate shock hazards and safety "hot" permits so field instruments can be calibrated and maintained while power is on. And unlike most explosion protection methods, intrinsic safety systems operate seamlessly with retrofit applications and with modern technologies such as fieldbus. The affinity to newer technology is one reason intrinsic safety is becoming the dominant protection method.

Point-to-point I.S.
The traditional point-to-point intrinsic safety installation offers operational simplicity that is easy to expand and maintain. Intrinsic safety employs easy-to-use cable trays, intermediate conduit and cable glands. Zener diode barriers with or without removable fuses, or isolated intrinsic safety barriers incorporating features like removable wiring terminals, common backplane power connections, control-safe units for safety applications and wire saving technologies that reduce wiring without a fieldbus connection add up to superior solutions for a variety of applications.

Remote I/O and Intrinsically Safe Remote I/O
Systems are available that incorporate the advantages of remote I/O with the protection of intrinsic safety. The customer saves control room space, since the remote I/O and intrinsic safety hardware are external to the control room, plus the two functions, I/O and intrinsic safety, are combined into one space-efficient product. Since a system of this type is field-mountable, the terminal connections are in close proximity to the field instrument. Systems are built to withstand the corrosive effects of field environments, to survive high vibration applications or to provide redundant bus connections for reliable communication. In a system of this type, the I.S. I/O connections are transformed into a standard bus system protocol that can be easily integrated into PLC, DCS or PC control systems.

Another system used in hazardous location applications is intrinsically safe remote I/O. This product can be mounted directly within the hazardous location, extremely close to the process. The complete network and hardware are intrinsically safe. The ability to mount distributed groups of I/O modules throughout a facility is paramount. Like fieldbus applications, facilities using this type of system benefit from easy expansion and upgrades. Unlike fieldbus applications, remote I/O systems can use existing field instruments similar to their explosion-proof counterparts. Actually, many of the major suppliers of field instruments sell intrinsically safe transmitters in explosion-proof enclosures; therefore, much of the instrumentation is functionally similar.

Fieldbus
Intrinsic safety is also synonymous with the latest fieldbus (FOUNDATION, PROFIBUS) process automation technology. Application of a fieldbus network within a hazardous location is focused on reducing installation costs while providing increased functionality-features closely linked to intrinsic safety. By examining industry trends and I.S. equipment, it is clear that virtually any industry can take advantage of many of the new fieldbus developments. In fact, most suppliers already offer fieldbus products with intrinsic safety already built in.

Installing intrinsic safety equipment
Applying intrinsic safety is often simpler and less expensive than traditional wiring, and can frequently be accomplished without a shutdown of your process. I.S. wiring must not be intermingled with standard wiring, so it may be necessary to install separate cable runs and trays into the hazardous area. These wires cannot be in contact with unprotected wires (such as wires in an explosion-proof system) because a fault between wires could create an ignition point in the

hazardous area, thus invalidating the safety of the system. In most applications, these provisions are easy to meet because of intrinsic safety's reduced wiring requirements.

Steps must be taken to guarantee the correct intrinsic safety barrier device is connected to the correct field instrument. This can be a daunting process to anyone not yet comfortable with intrinsic safety, but the reality is the selection of barriers is no different than selecting the correct controller I/O card or interface port. Additionally, many of the remote I/O systems implementing intrinsic safety provide a large amount of intelligence to simplify the steps necessary to match the correct instruments. Moreover, many have simulation modes not found in standard control systems. A simulation mode can allow the system integrator to pre-test the system before going "live"-a huge advantage.

Instrumentation manufacturers have been building increased intelligence into their field devices for the past 10 years. HART, the digital network operating on a standard 4-20mA signal, was the first system that improved the functionality of process field instruments. From the beginning, intrinsic safety and HART have been partners. The benefits of being able to access intrinsically safe HART terminals on instruments in the field without the time consuming steps of procuring a "hot permit" or removing the bolts of a large, explosion-proof cover are obvious.

Intrinsic safety certifications

Intrinsically safe equipment is certified by one of two methods: systems or parameters. With a systems approval, every component is specified and the entire system is evaluated. A variance to any of those components voids the approval. By contrast, a parametric approval is one in which each device is evaluated separately and assigned a set of safety or "entity" parameters. With entity approval, a field device can be connected to any barrier with compatible safety parameters. For more information about regulations or approvals, contact the ISA or the National Fire Protection Agency (NFPA) or an approval agency such as Factory Mutual (FM), Underwriters Laboratories (UL) or the Canadian Standards Association (CSA).

Another level of certification that is becoming more popular both in Europe and in the U.S., and is particularly relevant to intrinsic safety, is SIL or Safety Integrity Level. SIL determines how safe your process is by evaluating it as a system instead of as individually rated components. By providing a common reference, SIL defines the effectiveness of the total system. There are three components to a SIL analysis: risk analysis, system architecture and analysis of the process components.

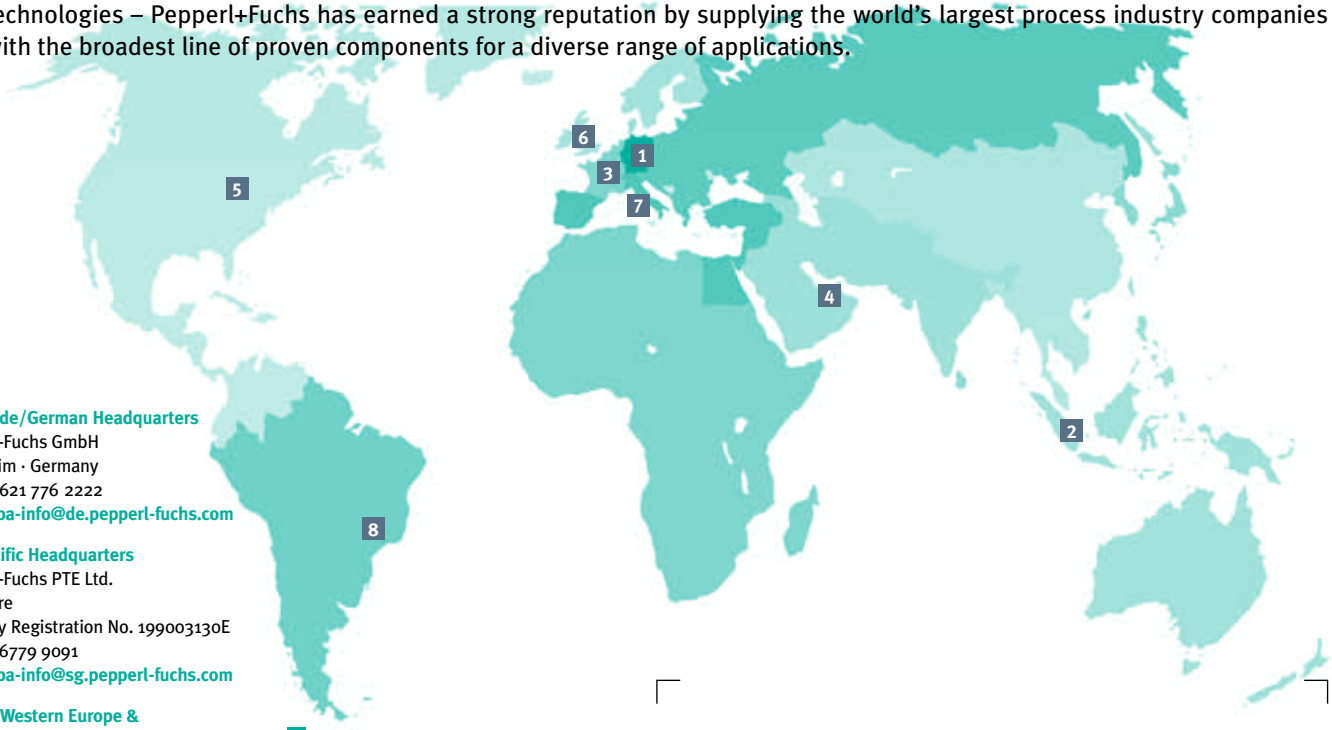
A SIL rating is not a hazardous area classification nor a product certification, but an analysis of complete systems and rating them by how effectively they can do their jobs. This procedure is known as LOPA or Layer Of Protection Analysis. LOPA is often used to determine the target design SIL for a safety critical system by considering the number of different mechanisms or layers used to increase the safety of the overall process.

For instance, a system using high-quality isolated barriers without a backup or fail-safe mode, might earn a SIL 2 rating. A similar system in an identical application having additional equipment layers for safety applications, might earn a higher SIL 3 rating. The calculations and measurements are complex, especially for multiple branches. But during the next few years, you will see SIL ratings becoming increasingly important for companies doing business throughout the world.

Intrinsic safety equipment suppliers such as Pepperl+Fuchs can provide information on the system safety that can be used to calculate the SIL rating for your entire process. It is critical to realize that individual I.S. components cannot be SIL rated, nor can one SIL 2 system be added to another SIL 2 system and automatically keep the SIL 2 rating; it must be reevaluated as a system. As long as you remember that FM, UL, and CSA certifications are for components and SIL ratings are for complete systems as-installed, you'll be able to make intelligent decisions about your intrinsic safety equipment.

While some explosion-proof equipment continues to be used primarily in North America, intrinsic safety is rapidly becoming the recognized norm for equipment used in hazardous areas. International requirements such as ATEX and CE as well as the European CENELEC approval are becoming more universal, and it is critical to become familiar with all these agencies and ratings if you do business internationally. Most manufacturers of intrinsic safety equipment are experts and can help you with international requirements and standards, as well as with designing a system that meets your exact safety needs.

For over a half century, Pepperl+Fuchs has provided new concepts for the world of process automation. Our company sets standards in quality and innovative technology. We develop, produce and distribute electronic interface modules, Human-Machine Interfaces and hazardous location protection equipment on a global scale, meeting the most demanding needs of industry. Resulting from our world-wide presence and our high flexibility in production and customer service, we are able to offer complete individual solutions – wherever and whenever you need us. We are the recognized experts in our technologies – Pepperl+Fuchs has earned a strong reputation by supplying the world's largest process industry companies with the broadest line of proven components for a diverse range of applications.



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