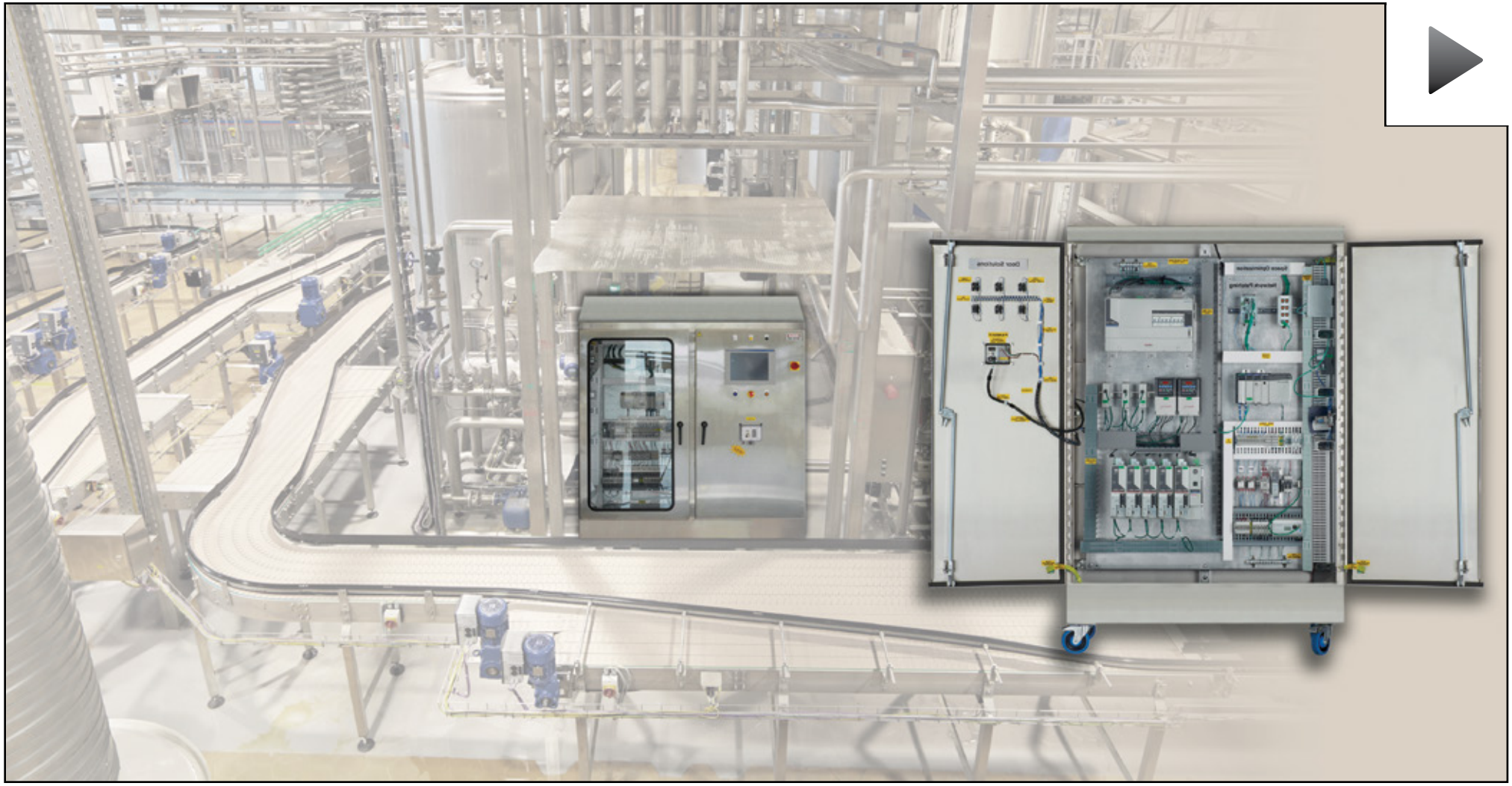

AutomationWorld® TACTICAL BRIEF

Control Panel Optimization

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Arc Flash Safety 1, 2, 3

By Renee Robbins Bassett
Deputy Editor

Industrial network equipment must frequently have its data be monitored and extracted, which requires frequent access to the equipment.

Electrical enclosures safeguard both the energized equipment within them and the people who work around them, but they also pose a risk for igniting an arc flash incident every time they are opened. An arc flash is an explosive blast of flame, debris, sound and force—the severity of which is determined by the distance from the arc and the amount of energy available. Knowing and understanding the arc flash risk and available safety solutions, along with their strength and limitations, enables facility managers to select and implement a safeguard that delivers the necessary level of protection while simultaneously meeting productivity and efficiency goals.

1. Flame-resistant apparel.

Made from fabrics that resist ignition, flame-resistant apparel is designed to protect workers in designated areas where intermittent exposure to flame or heat is possible. Normal fabrics, such as cotton and nylon, will burn away from the point of ignition with an increasing rate of flame spread and continue to burn after removal of the ignition source. This makes the wearer extremely vulnerable to injury. Flame-resistant fabrics are engineered to self-extinguish almost immediately upon removal of the ignition source—preventing it from destroying the protective barrier that acts as a shield between the wearer's body and the flame. Additionally, to accommodate a variety of risk levels, flame-resistant apparel is offered in everything from button-down shirts and jeans to arc flash suits, gloves and boots. Although flame-resistant apparel will minimize injuries while allowing employees to perform daily functions, it does not actually prevent the occurrence of arc flash or eliminate the possibility of a worker igniting or encountering a blast. When using flame-resistant apparel, it is crucial that users know and adhere to strict laundering and care procedures to prevent the fabrics from losing its flame resistant properties, rendering it an ineffective safety solution. Further, it can be cumbersome, time-consuming and laborious to put on, with the extra time and effort needed to suit-up can slow production, particularly when the risk is high enough that multiple layers of protection are necessary.

2. Data interface ports

Communication or control equipment housed in electrical enclosures typically require frequent access by operators in order to analyze data, modify settings or perform maintenance. If these activities require the enclosure to be opened, the worker can be at risk of igniting an arc flash incident. Data interface ports offer an alternative option to opening the enclosure. By providing an external plug-in, data inter-

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face ports enable users to access and interact with equipment inside the electrical enclosure. Through this external port, technicians can directly connect to and interact with control components without needing to open an enclosure. With data interface ports, operators have an external pass-through port that allows them to monitor performance, change settings and extract data while the enclosure door remains closed. While this solution does allow workers to access and modify control equipment without fire exposure, it does not offer the same level of availability as being able to monitor the equipment in the field. First, specialized panels must be installed that are wired to designated equipment, then users will be able to externally connect to the equipment. This solution does prevent operators from interfacing directly with equipment within, and requires excess equipment and set-up time in order to effectively connect to and manipulate controls. This process can eat away at productivity and increase the time it takes to extract relevant production data.

3. Distributed I/O

Since there is a potential for an arc flash occurrence every time the electrical enclosure is opened, being able to take distributed I/O equipment—which may contain live voltage with sufficient energy for an arc flash event—out of the electrical enclosure, and mount it in the field, minimizes risk exposure and ensues continued connectivity. Mounting equipment and controls outside the electrical enclosure provides engineers with easy and immediate access to it without opening the enclosure. This not only ensures the same level of connectivity and communication, but also enhances operator safety. Distributed I/O products featuring IP ratings, such as IP65, IP67, IP68 and IP69K, can reliably perform in dusty, wet and harsh environments without fear of element ingress without malfunctioning, causing network faults, service interruptions or arc flash ignition. While these network solutions are able to function reliably outside of protective enclosures, not all communications and control equipment offer the same flexibility and durability. Some energized controls may require housing within electrical enclosures.

Increase Your Network Security

Prevent unauthorized access or accidental breaches by establishing a robust physical network infrastructure that offers barriers to network-wide security risks through the use of an integrated physical and logical architecture that includes Panduit Micro Data Centers, industrial zone systems and physical port security.

Enclosures: Critical Specification Factors

By David Greenfield
Editor of Content

When it comes to automation technologies, most of the focus is on the devices inside the cabinet. However, selection and assembly of the box that contains your critical electronic devices is no less important.

All too often, serious discussion about the cabinet that will house the control and communication devices that comprise an automated system rarely takes place. This is not to say that no consideration is given to control cabinet specification. It's just that, in many cases, all the factors that should be considered are not always brought to the table.

This article, compiled with information provided by Hoffman, an enclosure supplier based in Anoka, MN, looks at the primary issues that should be a part of any discussion about proper housing for control equipment.

Environmental Factors

Most people would agree that application environmental factor considerations are top of mind when it comes to control system cabinets. From forms and presence of liquid and airborne particulates to wide temperature variations to ultraviolet (UV) rays, environmental elements and conditions can have a significant impact on how an enclosure will perform over years of operation.

Specifiers and purchasers must also take into consideration whether the enclosure, in its application, will be located indoors or outdoors; exposed to wash down or direct sunlight; or be subject to the effects of harsh chemicals or corrosive agents.

Of the many environmental issues to consider, the effects of temperature on components will often find its way to the top of the list. Non-metallic enclosures, such as those made of polycarbonate or polyester, provide great insulation while metallic, such as stainless steel, absorb and conduct heat. If heat dissipation is a concern, a metallic enclosure will typically dissipate heat better than a non-metallic enclosure. Several thermal management solutions are available to address heat concerns, including passive options such as paint color changes or louvers and active options such as filter fans, heat exchangers and air conditioners.

Another application issue to consider is installation location, such as high on a pole or in a high-traffic accessible area. The installation location may also have electromagnetic, radio frequency interference or wireless transmission requirements. Accessibility and security also need to be considered, and can be solved through various latching or locking options.

Material and finish choice is also an important decision. Different materials affect weight impact resistance and strength, and corrosion performance.

Enclosures: Critical Specification Factors

Standards

Four of the most commonly recognized certification agencies that enclosures are certified with include, the International Electrotechnical Commission (IEC), which is based in Europe and accepted globally, Canadian Standards Association (CSA) for Canadian market, Underwriters Laboratories (UL) and National Electrical Manufacturer's Association (NEMA) for the North American market. The corresponding standards published by these agencies are IEC 60529, CSA C22.2 No. 94.1 and 94.2, UL 50, 50E, and 508A, and NEMA 250.

IEC 60529 includes a list of requirements with two number codes used to identify ingress protection levels. Commonly referred to as the IP rating, these codes reflect an electrical enclosure's ability to protect against access to electrified parts by people, tools, liquid, dust or dirt. IP ratings do not cross directly to NEMA, CSA and UL Type ratings. For example, some IP ratings allow a minimal amount of dust or water to enter an enclosure as long as the ingress does not interfere and compromise the performance of the electrical and electronic equipment inside the enclosure.

The NEMA 250 standard is the basis for UL 50, 50E and CSA 22.2 No. 94.1 and 94.2. While the enclosure construction requirements and performance Type Ratings are the same for NEMA, UL and CSA, NEMA compliance is self declared by the manufacturer, while UL and CSA require approval of testing and manufacturing inspection.

Gaskets

The often overlooked enclosure gasket performs the critical task of preventing the infiltration of dust, liquids and contaminants, as well as EMI and RFI penetration in

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EMC applications. Many different tests are conducted on gasket materials to verify suitability for intended application and compliance to the Type and IP performance ratings. The gasket is the most critical component for maintaining the enclosure seal, and it must be maintained to ensure proper protection.

To ensure that gaskets provide necessary levels of protection, the enclosure Type ratings include the following tests:

- Type 12: dripping water and circulation of concrete dust or atomized water spray
- Type 13: 2 gallons per minute of a water/wetting agent mix for 30 minutes
- Type 3: concrete dust is circulated around the enclosure and hose tested
- Type 3R: 3 spray nozzles each producing 5 psi of water spray for 1 hour
- Type 4, 4X: 65 gallons per minute hosedown for a minimum of 5 minutes from 10-12 feet
- Type 6: temporary submersion in 6 feet of water for 30 minutes
- Type 6P: temporary submersion in 6 feet of water for 24 hours

For indoor applications, a gasket with a UL Type rating of 12 or 13 is typically recommended. Type 3, 4, 4X, 6 and 6P rated gaskets are commonly used for outdoor applications. While Type 3, 4, 4X, 6 and 6P rated enclosures can also be used in indoor applications, these enclosures are typically more expensive than Type 12 or 13 enclosures.

Modifications

Since it is not uncommon for enclosures to be modified in the field, specifiers should consider the ease and modification flexibility of an enclosure material in their design criteria.

Thermoplastics or other non-glass filled polymeric materials are highly suitable for jobsite modifications. Fiberglass reinforced polyester is slightly more difficult to modify due to the glass strands contained being highly abrasive and not conducive to clean cutouts. In regards to metal enclosures, aluminum is fairly easy to cut and saw, mild steel is more difficult, but can be modified with standard hand tools. Stainless steel is difficult to cut and requires special tools and lubrication to provide clean holes and cutouts.

Condensation

Condensation results when moist air is cooled or comes into contact with a cool surface that is at or below its saturation point, also called its dew point. Needless to say, condensation can be a big problem for the electronics inside a control cabinet.

When water pools in the enclosure bottom as a result of condensation, users have been known to employ several methods to deal with this issue. Some of these methods include wiping with a towel; using

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Enclosures: Critical Specification Factors

light bulbs to raise the temperature, which also allows the air to hold more water; and even drilling a small hole in the bottom of the enclosure and mounting the enclosure at a slant to direct water towards the opening. While a drilled hole can be an effective way to drain the enclosure, it compromises the enclosure performance Type rating, and does not address the issue of moisture on the components themselves. The drilled hole allows humid air and water to re-enter through the very holes that were introduced to rid the enclosure of water, creating a continuous cycle of condensation.

Another common solution used for dealing with condensation is the use of drains and breathers that provide the functionalities of draining and pressure equalization, but most of these devices are only certified for hazardous location requirements, but are not UL and CSA certified to maintain the enclosure UL and CSA Type rating. These devices typically will not pass a UL, CSA or NEMA Type 4 water hose down test. Drains and breathers alone do not address the real problem of condensation on components and the related performance and corrosion issues. To deal with this issue, look for a condensate management solution that addresses the real issue of moisture that would include a UL 508A certified drain in combination with a device that can actually pull moisture out of the air inside a sealed enclosure.

For an example of an enclosure that was designed to accommodate a variety of environmental conditions, see the video below of the Hoffman WeatherFlo HD — an enclosure designed for protecting and cooling variable frequency drives in indoor or outdoor (UL Type 3R) applications.

IER: A Plan for Plantwide Ethernet

By Renee Robbins Bassett
Deputy Editor

"While Ethernet was initially derided as a weak technology that couldn't perform in harsh environments, its reach now includes the majority of many [industrial] peripherals, including robots."

Ethernet has become the enabler for rapid adoption of new technologies crossing over from the consumer realms—smart phones, tablets, cloud computing, and more. These new technologies bring a range of ease of use, ease of implementation and ease of plant floor management benefits that did not exist before. But without a solid industrial networking foundation on which to build, the benefits may never be realized.

With lots of industrialized variants of Ethernet being developed and refined, picking a protocol is only one part of a solid plan. But once you do, more and more detailed guidance is available. This summer Cisco Systems and Rockwell Automation announced an updated version of their "Converged Plantwide Ethernet (CPwE) Design and Implementation Guide." The now 564-page PDF aims to assist with developing an architecture for industrial Ethernet applications. It "focuses on the manufacturing industry to specifically help manufacturers seeking to integrate or upgrade their Industrial Automation and Control System (IACS) networks to standard Ethernet and IP networking technologies."

Rockwell Automation (www.rockwellautomation.com) and Cisco (www.cisco.com) have been working for years on "reference architectures" and other guidelines to help manufacturers build a solid industrial network foundation based on EtherNet/ IP. This guide is built on, and adds to, design guidelines from the Cisco Ethernet-to-the-Factory (EttF) solution and the Rockwell Automation Integrated Architecture. The guide introduction says it addresses "what manufacturers are interested in," which reads as a list of potential benefits of industrial Ethernet overall. Specifically:

- Globalizing operations through IT integration with control systems.
- Reducing mean-time-to-repair (MTTR) and increasing overall equipment effectiveness (OEE).
- Lowering the total cost of ownership (TCO) of the current IACS network approach.

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- Integrating the IACS with the wider enterprise.
- Mitigating risks by improving network uptime and equipment availability with superior security.
- Reducing costs and improved asset utilization. Guide authors include Paul Didier, Cisco industry solutions architect for manufacturing, and Gregory Wilcox, Rockwell Automation business development manager for networks. They and others have been busy producing a range of tutorials based on the material. For example, interested information technology (IT) and controls professionals can watch videos online anytime (www.ab.com/networks/architectures.html).

PANDUIT collaborated with Rockwell Automation, Cisco and other industry leaders to develop the Physical Infrastructure Reference Architecture Guide for designing, deploying and managing the physical infrastructure for an Industrial Ethernet network.

Optimized Control Panels Increase Productivity and Drive Out Costs

Sponsored Content

Industrial automation systems are undergoing dramatic changes that require businesses to adopt new strategies to fully utilize industrial Ethernet, advanced motor controls and controller architectures. With these new design requirements, control panel designers and design engineers must overcome many hurdles to ensure that automation systems improve efficiencies, productivity and drive out costs. The challenges are primarily associated with harsh environment deployments, network security liabilities, costly safety concerns, and electromagnetic interference (EMI) noise considerations in crowded, space optimized control panel systems.

For example, the increase of Ethernet nodes on the plant floor is a frequent challenge for control system designers. Greater use of Ethernet connected advanced controllers, computers and high speed motion control and power electronics can require new strategies beyond traditional panel selection and layout to avoid hazards such as electromagnetic noise or thermal risks.

Robust Design Essentials

The project cycle is another common challenge for designers who have limited time to complete plans and often encounter difficulty finding solutions that adequately meet numerous design requirements. Robust design is essential because the performance of a control system is only proven in the field where conditions are unpredictable and beyond what is possible to create in a laboratory environment. Problems in the field can also happen with control panel designs that are not well protected against the environmental risks, which can cause downtime or safety gaps, resulting in costly injuries. Lack of due diligence in any of these areas can cause mistakes that result in rework during panel building or problems with inspectors.

Increasing Design Flexibility

Control Panel Systems increase design flexibility and organization, provide robust, environment rated solutions and ensure safe and secure personnel access for optimum performance, availability and uptime at a lower total installed cost. By utilizing best practices and guidelines, manufacturers can achieve greater performance,

less susceptibility to EMI noise, up to 40% space savings, and implement best in class equipment protection and infrastructure management.

Control panel designers and design engineers have a tremendous amount of complexity to manage when applying control panels in today's industrial environments. Whether the application is in oil and gas, food and beverage, automotive, water treatment, or pharmaceutical, the competing design criteria make decisions about optimizing the control panel critical to the success of the project. Panduit and Pentair Equipment Protection have joined forces to holistically address the challenges of control panel design and leverage the power of two best-in-class organizations to provide control panel solutions engineered for next generation requirements.

5 Key Elements to Consider

A new white paper "Control Panel Optimization – Five Key Elements to Consider: Space Optimization, Noise Mitigation, Environmental Protection, Security and Safety" is being introduced by Panduit and Pentair Equipment Protection and explores best practices and solution tools that will enable system integrators, panel designers and builders to enhance the five elements common in the control panel development process and end use lifecycle.

Choose Your Method to Terminate Conductors

The StructuredGround™ Universal Ground Bar System (UGB) offers multiple termination methods and mounting options making it ideal for any control panel or enclosure application. The UGB enables the end user to choose the method in which to terminate conductors with connectors of their choice or simply cut and strip the wires. UL 467 Listed and CSA 22.2 Certified for grounding and bonding an equipment grounding conductor up to 2/0 AWG the UGB meets UL 508A requirements.
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