How to Adopt a Progressive Approach to Fieldbus Power in Chemical Processing

Getting more power to more devices in hazardous locations can be achieved by employing high power trunk technology with a modular power supply system

‘This protection prevents all other devices on a segment against short circuit or overload in the event of a failure.’ By Kristen Barbour and Bernd Schuessler

The chemical processing industry has conveyed its need for more power to more devices with longer cable distances. In order to meet these demands, a new power model was required. This demand has been met by the high power trunk (HPT) approach. HPT technology offers a unique power solution for general purpose as well as hazardous location chemical process applications. It takes the energy limitation away from the control room and embeds it deeper into the physical layer in the field. This gives the end user access to higher power, without losing the ability to run long trunk distances. Traditional fieldbus power supply architecture requires a separate power supply (and corresponding cabinet spacing) for each fieldbus H1 segment as well as connection of the field devices to the trunk by means of junction boxes. With the inherent power limitations of traditional power supply options and the current draw of field devices, most segments can only support up to six devices. Since most DSC H1 cards are limited to a maximum of four ports, splitting devices into different segments isn’t a cost-effective solution. As a result, traditional power supplies equal fewer devices on each segment, short cable distances and ultimately higher cost to incorporate all the field devices needed. Prior to the HPT approach, FISCO and FNICO (fieldbus intrinsic safe concept for Division 1 and fieldbus non-incendive concept for Division 2) were marketed as a way to achieve additional power on the fieldbus. However, their limitations on cable length, low power and lack of redundancy render these concepts ineffective in ultimately achieving end-user goals.

HPT technology can offer chemical processing engineers a way to get more power to more devices in hazardous locations.

HPT users enjoy the same benefits in terms of power, cable length and number of devices per segment in hazardous location applications as they do in general purpose applications. To meet the demands of the chemical processing industry, modular power supply systems have been designed to work in conjunction with field barriers and segment protectors. Depending on the application, the energy limitation when using HPT is done in the field using segment protectors and/or field barriers. Field barriers are distribution modules that allow spurs to branch into Zone 1/Division 1 areas. They can be installed in Zone 2/Division 2 areas. Field barriers combine three functions into a single unit: short circuit protection, distribution of the fieldbus trunk for easy device connection and connection of IS devices to standard power supplies. Segment protectors offer short circuit and overload protection. This protection prevents all other devices on a segment against short circuit or overload in the event of a failure. Additional benefits of the HPT concept are listed below. &#149 Live maintenance on the spur in the field can be done when non-incendive wiring practices are followed. &#149 Modular solutions allow for a range of power modules. &#149 Each segment can now handle 32 devices. &#149 Highly reliable fieldbus power is achieved. &#149 There is power redundancy. &#149 Physical layer diagnostics are available. Modular power supply systems allow choices in power supplies and power conditioners to meet the varied power requirements for field devices and fieldbus host systems. Modular fieldbus power supply systems have been designed specifically for the fieldbus H1 segments and in accordance to IEC 61158-2. These systems have been designed for installation in Zone 2 or Class 1/Division 2 hazardous areas. The modular “motherboard” systems differ in the number of modules and type of electronic modules. Some have the ability to “hot swap” without interrupting communication on the fieldbus segments. These systems offer many benefits over the basic power supply method including the following: &#149 Galvanic isolation and power supply redundancy &#149 Multiple segments &#149 Visual alarming and short circuit protection &#149 Detailed diagnostics for improved reliability and preventive maintenance &#149 Real-time physical layer diagnostics &#149 Host system specific connections One of the most significant benefits of employing a modular power supply system is the ability to diagnose physical layer problems. Detailed physical layer diagnostic modules offer an in-depth look into the overall physical layer with real-time diagnostics, trending, ground fault detection, alarming, time stamping and built-in oscilloscope that can be integrated easily back to the host controller. This allows for proactive and preventive maintenance before a segment goes down, which aids in the prevention of unexpected downtime and a reduction in maintenance costs. For the chemical processing engineer who desires to get more power to more devices in hazardous locations, the decision to employ an HPT approach, used in conjunction with a modular power supply system, promises to be advantageous. The high power trunk provides the power to handle the largest number of devices in the field, and the modularity of the power supply “motherboard” system offers maximum flexibility in getting exactly what one needs to meet the power requirements for each fieldbus segment. The use of segment protectors and field barriers allows for easy installation, short circuit protection, less wiring and live maintenance on the spur. Finally, the HPT approach provides end users with the high power and fieldbus trunk distance that equals that of general purpose applications. *Kristen Barbour has worked in the technology field for eight years, specializing in industrial automation. She is currently the product manager for point-to-bus and bus-to-bus products for Pepperl+Fuchs, 1600 Enterprise Pkwy., Twinsburg, OH 44087, which specializes in process and factory automation. Bernd Schuessler, a graduate of the FH Darmstadt in Germany with a bachelor’s degree in electrical engineering, joined Pepperl+Fuchs in 1998 as an applications engineer for remote I/O and HART systems. From 2001 to 2004, he served as fieldbus product manager. In 2005, he was promoted to fieldbus business development manager. He is an active member of the North American Foundation Fieldbus marketing council. Questions about this article can be addressed to either Barbour or Schuessler at 330-486-0002.*

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#1: Early Pollution Control

Contrary to popular opinion, the chemical processing industry has been concerned about toxic materials long before the advent of regulatory agencies.

Since the dawn of the Industrial Age, commercial enterprises have faced daunting challenges from economic and labor issues to ferocious competition and even government harassment. But, the processing industries, especially the chemical processing industry, have also been forced to deal with toxic and hazardous substances. Contrary to popular opinion, the chemical processing industry has been concerned about these materials long before the advent of regulatory agencies. Indeed, it\rquote s surprising how far back this concern can be traced. The Leblanc process for converting sodium chloride into sodium carbonate came about because of a need publicized by the French Academy of Sciences in 1775. A plant was set up to run the Leblanc process in 1791, but it did not go full-scale until it was introduced in England in 1823. During the process, salt is reacted with sulfuric acid, yielding sodium sulfate and hydrogen chloride. The sulfate is then reacted with limestone and coal, producing a black ash that contains the desired carbonate and certain other products that are easily removed. In fact, the name \ldblquote soda ash\rdblquote for sodium carbonate is derived from this process. One of the first things noted when this process was scaled up was that the escaping hydrogen chloride could do damage to the factory and local environment. Methods were quickly developed to capture the hydrogen chloride, convert it to chlorine and absorb it in lime for bleaching powder, which had its own market. Because calcium sulfide, which is contained in the ash, has an offensive odor, methods were developed to remove it and recover sulfur, which in turn was used to synthesize the sulfuric acid for the original process.

#2: Chlorine\rquote s Story

Chlorine\rquote s story serves as a model for today\rquote s chemical processing industry. One of the greatest contributions of science has been the chlorination of water. While the processes of sedimentation and filtration were used in many industrialized countries by the mid-1800s to purify water, it was the introduction of wide-scale chlorination in the early 20th century that virtually guaranteed safe drinking water. Thus, it\rquote s all the more tragic that the UN\rquote s World Health Organization estimates that 25,000 people per day die of diseases associated with contaminated drinking water. But if non-use of chlorine can have disastrous effects, so can its misuse. The world was introduced to the toxic properties of chlorine when it was deployed in World War I as a chemical weapon. No doubt due to chlorine\rquote s fierce reputation, industry was quick to initiate protective measures. As a result, the Chlorine Institute was founded in 1924 and has been instrumental in creating safety best practices and fostering the manufacture of emergency kits and recovery vessels. Another consequence of chlorine\rquote s use as a chemical weapon was the development of gas masks, which eventually morphed into the respirators used by industry today.

#3: Ubiquitous Benzene

Benzene, whose molecular structure is depicted in this model, is considered the first highly publicized chemical carcinogen in the age of OSHA.

It had been known for some time, at least since the late 1920s, that rubber workers had worse cancer morbidity and mortality than the general population. It was not until the 1970s, however, that a link was established with the ubiquitous solvent benzene. As a result, allowable occupational levels of the compounds were drastically reduced, and sampling methods and field-appropriate analytical instruments were promulgated. Lawsuits also were filed. Considering everything, this first highly publicized chemical carcinogen in the age of OSHA was reasonably well managed by government and industry. Although it may be cold comfort for those whose lives were damaged by overexposure, the result was more aggressive policies toward possible carcinogens.

#4: Dioxin Today

Although dioxin can refer to any member of the group of compounds that are byproducts of certain syntheses, most people think of dioxin as being 2-, 3-, 7- and 8-tetrachlorodibenzo-p-dioxin. Because this chemical occurs in the synthesis of Agent Orange, its reputation is not a good one. In addition, the discovery of improperly disposed chemical waste in the early 1980s near Times Beach, Missouri, created a panic concerning its potential toxic effects. Poorly designed studies in which extremely high doses of the substance were given to guinea pigs and other animals far more sensitive than humans caused researchers to conclude that dioxin was one of the most toxic of all synthetic substances. It was claimed that as little as one part per billion in soil would pose a health risk. However, the only proven effect of dioxin is the skin rash chloracne. This point came to light during the highly publicized case of Viktor Yushchenko, the president of the Ukraine who was disfigured but not killed after he was given massive doses of the chemical in an assassination attempt. *Michael D. Shaw is executive vice president for Interscan Corp., a Los Angeles-based manufacturer of toxic gas detection instrumentation and related software. His academic credentials include undergraduate biochemical research at UCLA under Roberts A. Smith and Nobel Laureate Willard Libby, pioneering endocrinology studies under Dr. Jessie Marmoston (County USC Medical Center) and a graduate stint at MIT under Gene Brown. Question and comments can be addressed to Shaw at mds1@gasdetection.com. Additional information is available at www.gasdetection.com.*