Integrated Benefits

Profibus conquers industrial communication in the process industry
Profibus reduced wiring and commissioning costs while greatly improving diagnostic capabilities in the world’s largest production plant for vitamin E at DSM Nutritional Products

For almost 14 years, Bitburger is consistently using Profibus in their plants – the outcome: flexible, powerful and transparent production processes

Simatic technology is increasing process visibility in the biotech pilot plant of Novartis

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Dear Readers,

Fieldbus systems can guarantee long-term profits in automation technology. In the future, they will make a significant contribution to minimizing the downtime of plants through improved diagnostics and preventive, simplified maintenance – that is the general conclusion of the ARC white paper on the subject of fieldbuses.

However, in addition to this statement, the ARC Group also documents the unique benefits of Profibus. Profibus is the only fieldbus system worldwide that can cover all areas and functions in the production and process industry. Profibus DP is used worldwide in almost all plants using DCS and fieldbus technology. Profibus DP is absolutely essential for the connection of motors, remote I/Os, and other devices. If Profibus DP is available in every plant, Profibus PA can easily be used for the integration of process devices such as measuring transducers, actuators, and so on.

This approach leads to substantial benefits for the plant owner: full utilization of the functions of Profibus DP and Profibus PA, Profibus for HART devices as an important means for protecting investments in field devices, and Profisafe for integration of fail-safe technology.

This leads to a drastic reduction in the complexity and costs – through integrated engineering, reduced spare parts stocking, less training for personnel, efficient asset management in the life cycle of a plant, and so on – because all the fieldbus technology can be implemented on the basis of one technology.

In this issue of Process News, we have picked a Profibus application at DSM Nutritional Products as one example of the many successful projects in recent time that show how using Profibus really pays off. You will find out more in the focus on industrial communication starting on page 7.

I hope we will be able to give you a few valuable tips.

Yours,

Bernd Theilmann
Head of PCS 7 Product Management
Modernization project with Simatic PCS 7 at ThyssenKrupp Stahl AG

Owing to the company’s wealth of experience in the field of blow steelworks as well as an optimized automation solution based on the modern Simatic PCS 7 process control system, gefeba Elektro GmbH received an order from Thyssen-Krupp Stahl AG to modernize the Beeckerwerth steelworks in Duisburg. The order includes the complete replacement of the existing control system during ongoing operation.

The project includes, among other things, 45,000 I/Os, 40 automation systems, and 50 operator stations distributed over five control stands.

Other components of the solution are a sophisticated redundant concept to increase the availability of the control system and long-term archiving of process data.

Find out more:
www.siemens.com/pcs7
E-mail: marion.schemken@siemens.com

Siemens to equip cement works in southern Bavaria with new instrumentation and control system

Siemens has received an order from the company Südbayerische Portland Zementwerk Gebr. Wiesböck & Co. GmbH, Rohrdorf, to modernize the instrumentation and control system of its rotary kiln and cement mills. Cemat V6.0 will be used as the control system. The aim of the modernization is to ensure the maximum possible availability of the production equipment.

The rotary kiln is the heart of the cement works. Coal and heavy oil are used as the primary fuels; secondary fuels include processed plastic, paper degasifying materials, tires and liquid secondary fuels. In order to make efficient use of these fuels by ensuring fault-free operation of the installation and, at the same time, to reduce emission of waste gases to a minimum, Rohrdorfer Zement decided to install modern instrumentation and control technology.

For the rotary kiln, Siemens is supplying the Cemat V6.0 control system. Cemat V6.0 is based on Simatic PCS 7 and was specially developed for the cement industry. In addition, the four Cemat V5 cement mills are to be upgraded to Cemat V6.0. In the context of the current project, Siemens will also expand the operator control and visualization system at the central control station by adding a variety of redundancy features. This will increase protection against failure in the future.

Established in 1930, Südbayerische Portland Zementwerk Gebr. Wiesböck & Co. GmbH belongs to the Rohrdorfer Zement corporation, which owns 35 companies with 800 employees, manufacturing a variety of building materials in Bavaria and Austria.

Find out more:
www.siemens.com/cement
E-mail: cement@siemens.com
The 2nd International Industrial Ethernet Symposium 2005, held May 9 and 10, 2005, in Amsterdam, focuses on current trends and developments relating to Industrial Ethernet. Which network solution is suitable for which application? What criteria must be taken into consideration in the selection of the network configuration? What savings and productivity gains can be achieved with an optimum network solution? The symposium will provide the answers to these and other questions.

“This conference provides users with an excellent opportunity to network, share real world experiences, and meet with Siemens technical experts as well as management”, said Gary Dickinson, the chairman of the user community and superintendent, I&E, at CF Industries.

The conference offers a number of energizing and engaging sessions with several well-known keynote speakers from a broad range of industries, as well as keynote speeches from Siemens top management. Moreover, it also offers sessions on product roadmaps and technical workshops and discussions of best practice solutions for topics such as industrial security, DCS lifecycle management, and many more.

According to past attendees, one of the most valuable portions of past conferences has been the “Solution Showcase” – a technology exhibit where users can talk with the product experts about their particular applications, as well as get a chance to see the latest technology in action. This year’s Solution Showcase will demonstrate how Siemens systems and solutions help users manage the lifecycle of existing automation systems. “The Solutions Showcase is one of the main events at the conference. In addition to providing a sneak peek, the showcase offers attendees numerous opportunities for ‘hands-on’ time with the latest technology from Siemens and ‘face time’ with Siemens product experts”, according to Chris DaCosta, controls platform manager at Air Products and Chemicals, Inc., and user community vice chairman.

Due to the popularity of the US conference, an additional conference is being planned for the European Region in autumn 2005.

International Industrial Ethernet Symposium in Amsterdam

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Numerous participants from more than 50 countries will take the opportunity to discuss practical solutions and current trends, and share experiences. In addition, the event will present a number of successful Industrial Ethernet applications in many different sectors, ranging from the automotive to the paper industry. Other topics addressed will be both established Industrial Ethernet standards such as Profinet and new technologies such as network and access protection as well as solutions for mobile and wireless communication.

Find out more:
www.siemens.com/ies2005
E-mail: holger.sack@siemens.com
Vitamin E

Vitamin E (tocopherol – the illustration shows crystals under polarized light) is a fat-soluble vitamin and, like vitamins A and C, has a very important cell-protection function in the body. It protects red blood cells, muscles, nerves, and other tissue from damage by free radicals. The daily requirement is approximately 30 milligrams.

Vitamin E is found naturally in vegetable oils, cereal grains, and eggs, but is also being produced synthetically, and is becoming more and more significant as a health-promoting and cell-protecting additive in foods and cosmetics.

DSM Nutritional Products in Switzerland is the world’s largest producer of vitamin E. The Vitex plant in Sisseln is one of the most important production sites for vitamin E, covering about 50 percent of world demand.
Profibus DP- and PA-based communication solution at DSM Nutritional Products

One Bus for Everything (Almost)

Profibus is conquering more and more areas of application, including the process industry, as an example in Switzerland demonstrates. The state-of-the-art vitamin E production plant of DSM Nutritional Products, designed for reliable, continuous operation with downtimes reduced to the absolute minimum, was automated with the Simatic PCS 7 process control system. All devices in the process were networked using Profibus DP and PA. The positive result: Profibus reduces wiring and commissioning costs and considerably simplifies process instrumentation diagnostics.

Profibus is now widely established in factory automation, and is considered a standard for integrating actuators, sensors, and drives in automation systems. In the process industry, however, with its generally large plants and heterogeneous system environments, the prevailing opinion had been that a uniform and totally integrated fieldbus solution was simply not conceivable.

DSM Nutritional Products in Switzerland, however, did not share this opinion. For its new Vitex plant for manufacturing vitamin E (tocopherol) in Sisseln in Switzerland, the company consciously ignored the reservations and decided to standardize the plant’s automation with Profibus. The reasons were convincing: simple wiring, central parameterization, and the possibility of transferring diagnostic data directly from the fieldbus devices to the process control system.

Since DSM had already had positive experience with the Simatic PCS 7 process...
control system in numerous production plants, PCS 7 was also used in the new plant in Sisseln—but with a new feature. Based on successful preliminary tests in other plants, DSM decided to implement all of the communication on the process level with Profibus DP and PA for the first time.

Emphasis on productivity

Today, vitamin E is increasingly used in nutrition, and is therefore manufactured on a large industrial scale. The production facility in Sisseln has a capacity of 25,000 tons a year, and is therefore one of the largest plants of its kind worldwide. DSM’s main concern, already during the conception phase, was productivity—which, of course, gave the automation technology a particularly important position. Above all, however, the plant was to be designed to allow continuous operation with minimal downtime.

The plant, which stretches over several floors of the building, is made up of 27 subplants, each of which is equipped with its own Simatic PCS 7 automation system. All automation systems are networked via Industrial Ethernet. From every automation system, a Profibus DP segment integrates the drives, and a Profibus PA segment the process instruments (including 70 Sitrans P pressure transmitters), with the control system.

Special tasks, dedicated solutions

Siemens solution provider Controlmatic GmbH, in close cooperation with DSM engineers, implemented all the automation technology for the plant. Controlmatic had also already made positive experience with Profibus in two smaller pilot projects. Consequently, all parties involved were confident of being able to complete the project successfully, despite the relatively tight time schedule. The software test, with simulation of the peripheral hardware, made a major contribution to rapid commissioning. The line test/loop check of the approximately 1,000 Profibus PA devices was completed two to three times faster than in the 4–20 milliampere devices. Due to its modular structure, which allows different

Intuitive system diagnostics with Profibus PA

To create a common diagnostic standard for all plants and to simplify the associated configuration, Siemens submitted a proposal for standardizing the quality code. The proposal has since been accepted by the PNO (Profibus user organization).

Considering the NAMUR recommendations NE 107, “Self-monitoring and diagnosis of field devices,” and NE 91, “Close to plant asset management,” four distinct values were selected from the states available for the quality code to represent the four status messages “function check,” “device failure,” “maintenance required,” and “out of specification,” as specified in NE 107. A fifth value (corresponding to “OK”) is transmitted if the device is not in any of the mentioned states.

The value range of the quality code can include another 12 status bits to transmit more finely graduated status information beyond the status messages required by NE 107. This detailed information can be reduced again to the status message in NE 107 in the maintenance station if desired. The detailed quality code contains the actual state of the measured parameter in three-status form (“good,” “uncertain,” or “poor”), the device status (for example, “local operation”), and the information for the maintenance personnel—also in three-status form (“maintenance required,” “maintenance request,” or “maintenance alarm”). The detailed failure analysis (e.g., “sensor soiled 33 percent”) is transmitted in the acyclic communication slot via diagnostic tools such as Simatic PDM. This procedure prevents a message flood and makes it easier for operators to respond specifically to diagnostic messages.

This principle is implemented consistently in the maintenance station of Simatic PCS 7 V6.1. Hierarchically structured diagnostic images are created automatically from the hardware configuration of the plant, and all components of the control system are represented in the form of uniform faceplates, without additional engineering effort. An intuitive “traffic light” look (green—yellow—red), together with plain text messages, enables rapid localization of faults. For automatic tracking of repairs, PCS 7 also offers the possibility of starting maintenance orders and logging their progress.
transmission techniques and numerous application profiles, Profibus is suitable for all sections of a plant and enables unrestricted, uniform communication. Profibus PA is ideal for the supply and simultaneous communication of sensors and actuators in the explosion-hazardous zone, for example, while with Profibus DP, distributed automation structures with a high data volume can be implemented.

In Sisseln, the PA field devices are linked by a DP/PA coupler and field barriers, the conventional HART field devices are linked by a Profibus DP remote I/O system, and the valves by a DP valve terminal. Motors with frequency converters are linked directly via Profibus DP, and the other nonvariable-speed motors via an I/O card in the process control system.

Since the power supply on the bus is limited in the explosive areas for safety reasons, the number of devices per Profibus segment is restricted, consequently Profibus PA fieldbus barriers are used. These barriers ensure that higher power can be applied on the input side, while on the field side, the intrinsically safe and reaction-free connection of up to four Profibus PA fieldbus devices is possible. That way, it was possible to combine up to 24 fieldbus devices with intrinsic safety in one segment. Despite the relatively large number of devices per PA segment, and the lower transmission capacity of Profibus PA compared to the Profibus DP backbone with 31.25 kilobits per second, the maximum access mission capacity of Profibus PA compared to the Profibus DP backbone with 31.25 kilobits per second, the maximum access cycle was less than 0.4 seconds. With this cycle time, all of the time requirements of the plant can be met.

Diagnostic capability as a system advantage

One considerable advantage of Profibus is the possibility of monitoring the function of the individual fieldbus devices through the network. To achieve this, different status data are transmitted – according to a largely uniform standard – that allow specific detection of malfunctions.

This diagnostic capability was especially important for the vitamin E plant in Sisseln. Because the plant was to be operated continuously and with minimum interruptions, the automation system had to be able to detect malfunctions in individual components at an early stage to largely eliminate downtime – a requirement that was easily satisfied by Profibus. The operating state of individual fieldbus devices is displayed in plain text so that technical service personnel can proactively intervene before a single component or even the entire plant fails.

The cyclic communication of process or control parameters is tagged over Profibus PA by the actual value in connection with a status byte or quality code. In the Profibus profile V3.0 PA, 256 different values are defined, of which a certain number are occupied by device diagnostics (e.g., sensor short circuit), depending on the device type. This enables a wide range of individual status messages, yet is making effective asset management difficult.

In the meantime, a new standard that reduces this large number of diagnostic messages to a more manageable level (see box on the left) has become available. However, the standardized diagnostics were not available during the Sisseln project. Therefore, DSM developed its own special I/O driver components, including the appropriate software for visualization on the WinCC level. This system allows the vitamin E plant to evaluate the diagnostic messages of the individual fieldbus devices according to NAMUR recommendation 64, and to only record the information that is actually relevant to the operation of the plant.

Working perfectly

The first concept meetings with DSM were held in July 2002. In May 2004, the plant went into operation, and has since met all expectations. The relatively tight time schedule for a project of this size was ultimately only achievable because Profibus enabled integrated, uniform communication between the control and the fieldbus level. The time-saving programming of the Simatic PCS 7 system and the rapid configuration of the connected field devices with the aid of the Simatic process device manager (PDM) also contributed to the fast commissioning.
Profibus in the process industry

One for All

Fieldbus systems enable cost savings in the planning phase, in engineering, in the building of the plant, and in operation, according to the FuRIOS study conducted by Infraserv Hoechst, the control systems technology interest group IGR, and Aventis. In addition, Profibus offers its users a number of unique advantages, as Dr. Volker Oestreich, managing director of the Profibus user organization, confirms: “Profibus is the only fieldbus that allows uniform solutions in production and process automation.”

For a long time, the subject of fieldbuses in the process industry was considered with great reserve. However, in view of the considerable economic advantages of fieldbus technology, Profibus is being increasingly used as a communication solution in chemical plants. Profibus has proven itself in practice and has left an extremely positive impression. This was also documented by NAMUR at its annual general meeting in November 2004, says Volker Oestreich: “NAMUR has confirmed the maturity of Profibus PA for use in the process industry. The positive experiences in multivendor projects were singled out especially. This assessment tells us that the further developments of the Profibus systems in recent years fully meet the requirements of the process industry. Competitive systems, on the other hand, were considered to need additional improvements.”

Integrated solution especially for hybrid applications

Profibus can draw on a wide and solid base of experience in almost all industries. With more than 13 million nodes, Profibus has easily become the world’s number one fieldbus system. “The universal application possibilities for practically all jobs in the industrial environment are another of Profibus’s strengths,” Volker Oestreich adds. “The demand for totally networked production landscapes, especially in so-called hybrid applications in the pharmaceutical, chemical, and cosmetic industries, is getting louder and louder. Profibus is the only universal fieldbus that allows uniform solutions in production and process automation.” The same opinion is expressed in a white paper of the ARC Advisory Group.

Effective investment protection and process optimization

However, there are still regional differences in Profibus acceptance, Volker Oestreich acknowledges: “We still have a lot of catching up to do, especially in North America.” For this reason, the Profibus trade organization and the Profibus integration center have started a number of Profibus seminars in which the advantages of Profibus are presented (see box on the right). The pressure for cost-effective, efficient production is very high today in all industries – and obviously also in the process industry. Therefore, in the further development of Profibus for applications in the process industry, particular attention was paid to the demand for effective tools to optimize life-cycle costs.

“Profibus has proven itself in practice and has left an extremely positive impression.”

“We use Profibus DP and PA because we need fewer hardware components in comparison with a conventional solution. This reduces the costs, not only in the initial purchase, but also for the whole life cycle of the plant, from planning to maintenance. For Clariant, it is also important that the measured values arrive at the control system with a higher level of accuracy, because there is no longer any need for conversion from digital to analog and vice versa. Alternative fieldbus systems would be out of the question for us, because Profibus has the strongest support in our region, and the choice of field devices is the biggest.”

Improving process quality and asset management are important goals in the process industry. With the possibility of field device diagnostics, Profibus PA offers an important element for effective asset man-
With its remote I/O for process control and HART on Profibus profiles, Profibus also plays a dominant role in the upgrading of existing plants, and contributes to protecting investments: Existing instruments and new Profibus devices can be combined easily.

The FuRIOOS study, which was conducted by Infraserv Hoechst, IGR, and Aventis, also confirms that the use of fieldbus-based communication solutions enables considerable cost savings compared to remote I/O.

“We can see that our concept is making a major contribution to protecting investments and reducing the total cost of ownership. That is why the percentage of Profibus devices in process technology will grow considerably in the next few years,” Volker Oestreich predicts.

Find out more:
www.siemens.com/profibus
E-mail: volker.oestreich@profibus.com
E-mail: claude.hestroffer@siemens.com

"Profibus for the Process Industry” seminars score in the US

The Profibus Trade Organization (PTO) and the Profibus Integration Center (PIC) recently conducted Profibus roadshows in Philadelphia, Houston, and Atlanta.

The seminars drew over 200 participants and included detailed instructional presentations on how to engineer and install a Profibus based control system for process industry applications. End user presentations by engineers from Air Products and Chemicals Inc., Maverick Technologies, and Control Corporation of America shared their experience using Profibus. Using a single fieldbus technology for all applications in a process plant provides opportunities for significant cost savings in engineering, training, and maintenance costs. A live multivendor demonstration was on display that included instrumentation from Siemens, hosted on a Simatic PCS 7 process control system. This demonstration provided seminar participants with a first hand look at Profibus.

The feedback from participants has been overwhelmingly positive at each of the seminars. The PTO plans to host several more one-day “Profibus for Process Industry” seminars in various cities across the US during the remainder of 2005.

Upcoming Seminars: April 14, 2005 Charlotte, NC; May 10, 2005 St. Louis, MO; July 14, 2005 Boston, MA; September 14, 2005 Los Angeles, CA.

Find out more:
www.us.profibus.com/www/x
E-mail: tanmoy.basu@siemens.com
Industrial communication for the process industry

More Communication

The enormous economic advantages of networking processes with Profibus are convincing more and more companies to abandon conventional point-to-point technology. New products, a broad technology platform, and the possibility of automating the entire production process – from raw material delivery through actual production, packing and logistics – with one fieldbus system are important factors in the success of Profibus in the process industry.

Robustness, simplicity, and reliability – with these positive traits, Profibus is conquering the process industry. Profibus supports both rapid communication with intelligent distributed peripheral devices (Profibus DP) and communication and simultaneous power supply for measuring transmitters and actuators (Profibus PA). It can be extended during operation, and can be used in both standard environments and in explosive areas.

Due to its modular concept with mutually supportive transmission technologies, a uniform communication protocol, and a large number of application-specific profiles based on these protocols, Profibus is the only fieldbus that can be used in both the production and the process industries. Profibus also supports HART communication for linking preinstalled HART devices as well as safety-oriented communication for fail-safe applications up to safety class SIL3 or AK6.

Numerous manufacturers of control systems and process instruments offer a wide range of equipment that meets practically all of the requirements in the process industry. The Profibus portfolio of Siemens ranges from network components such as links and bus interfaces for controllers and automation systems or Profibus DP/PA couplers, through operator panels, process instruments, analyzers, and control devices for motors and drives.

With the Profisafe profile, Profibus can also be used for safe Profibus communication between safety-oriented devices in the field, and safety-relevant applications running in automation systems, without having to change the standard Profibus communication mechanisms. In addition to the controllers and distributed I/O modules that have been available since 2000, Siemens is currently working on process instruments that support the application of Profisafe in process automation, for example in pressure monitoring. The first instruments are expected for the end of this year.

Efficient, manufacturer-neutral engineering by Profibus

Intelligent field devices offer a large number of integrated evaluation and diagnostic functions and therefore make effective asset management easier. The interoperability of Profibus also allows single-controller operation of field devices made by different manufacturers.

The foundation for this interoperability is the device descriptions, device master file (GSD), and electronic device description (EDD). The GSD defines the value range for the cyclic data exchange between Profibus master and Profibus slaves. The EDD stores the standardized and manufacturer-specific properties for the acyclic parameterization, diagnosis, and monitoring of measured values for every device; engineering tools such as Simatic PDM define the specific device parameters for parameterization, diagnosis, or measured value monitoring.

Future topics: Vertical integration and Profinet

As the distribution of Profibus in process automation grows, the importance of vertical networking on the production and management level is also increasing. Here Industrial Ethernet has established itself as an efficient communication backbone. With the growing distribution of intelligent field devices, efforts are now being made in many industry sectors to connect advanced asset management systems and MES with IT functions directly via Industrial Ethernet.

For this purpose, the Profinet standard was developed. It is based on Industrial Ethernet and can penetrate right into the field level. Special emphasis was placed on protecting investments: existing fieldbus systems such as Profibus networks can be integrated easily, without modifying existing devices.

Two versions, one successful system: Profibus DP and PA
A broad introduction of Profinet is about to take place in the automotive industry, the food and beverage industry, and logistics. In some applications, Profinet has already proven its capabilities. However, for applications in the process industry, a few technological questions still remain to be clarified – for example, the transmission of auxiliary energy on the bus and the topic of explosion protection. Siemens is cooperating with the Profibus user organization to find solutions that will make Profinet fit for process automation.

Focus on safety
Having a single network standard for the entire system reduces training and spare parts costs, and simplifies the implementation of interfaces and software. With Profinet as an efficient Ethernet standard for the field level as well, greater data volumes necessary for functions such as asset management and diagnostics can be transmitted without any problems. To ensure a smooth, trouble-free data exchange within the uniform Ethernet network, Siemens has developed special security modules for automation technology that enable delineation of stand-alone network segments. The result are protected, but at the same time connected, islands. This approach avoids misaddressing and undesirable communication. Appropriate solutions for the process industry are currently being developed by Siemens and the Profibus user organization in cooperation with NAMUR, GMA, VDMA, and ZVEI.

New Profibus DP/PA coupler
The new Profibus DP/PA coupler offers doubled performance in comparison with its predecessor. The voltage has been increased from 19 to 31 volts, and the current from 400 to 1,000 milliamps, while the power loss has been kept constantly low at 12 watts.

This means that up to 31 devices can now be connected to a DP/PA coupler via Profibus PA and integrated into Profibus DP networks. In addition, enough power is available to supply other components of the connected devices such as the radar excitation of a level sensor. In the future, classic four-wire transmitters with external supply could require only two wires as a result.

The increase in the voltage now also allows much greater segment expansions of up to 1,900 meters, without any problems. In conjunction with active subdistributors with integrated barriers, so-called ex-hubs, or field barriers, the new DP/PA coupler can also be used for ex-zone applications.
Bitburger Brewery has relied on Profibus for 14 years

Successful Bit by Bit

Bitburger Brewery Th. Simon GmbH chose Profibus for the first time in 1991 to modernize its production facilities, and the company has since continued to extend the use of Profibus in several expansion and conversion projects. The economic benefit that results from higher plant efficiency and product quality, as well as reduced maintenance and service effort has become increasingly evident the longer the digital fieldbus network is in operation. Bit by bit, Profibus has been ensuring cost-effective and reliable production for 14 years.

Almost everyone in Germany knows the catchy slogan from the TV commercial: “Bitte ein Bit” (“A Bit, please”). Bitburger Brewery is one of the largest and most important private breweries in Germany. The best raw materials, qualified staff, and extremely precise high-tech processing procedures are important ingredients in the success of the brewery in this fiercely competitive industry. A reliable and efficient process and plant automation system is indispensable to guarantee both the high quality and economic efficiency of production.

Ready for the future

The Bitburger company philosophy is to use progressive technologies that guarantee high quality standards. In line with this maxim, the company decided to work with Siemens in 1982 to automate the production processes with the Braumat process control system. Since then, the Braumat solution has continuously been modernized and expanded, so that today Bitburger has a technologically advanced and extensive process management and information system that protects existing investments with its capacity for integration, while also leaving room for further modernization.

One of the most decisive steps in the history of process automation at Bitburger was the decision in 1991 to use a communication solution based on the digital Profibus fieldbus system for the first time. Profibus had been on the market for only about a year, and Bitburger was taking a certain risk with this brand-new bus system.

The frequency converters of filling plant 4 were the first to be networked with Profibus, primarily with the aim of considerably reducing the wiring costs. The solution proved to be so good in this initial application that Bitburger installed Profibus in all subsequent modernizations. The brewery benefited enormously from the openness and versatility of Profibus: all tasks, right up to synchronization of the drives in the process.

Braumat and Profibus at Bitburger

1982: Installation of the first Braumat system
1992: First installation with Profibus
1996: New filtrate buffer unit equipped with Profibus DP devices
1997: First use of Profibus PA and PA process instruments in the fermentation and storage cellars
1999: Modernization of the filtration unit and the hazardous area in the dealcoholization unit with Profibus DP and PA devices
2002: Modernization of the hazardous area in the dealcoholization unit with Profibus DP and PA devices
2004: More than 1600 devices networked via Profibus DP and PA devices
filling plants, can be networked using by a single fieldbus system.

**Integration ensures greater efficiency**

The far-sightedness and desire for innovation that Bitburger demonstrated in its choice of Profibus has more than paid off. The automation solution based on Braumat and Profibus offers Bitburger numerous advantages above and beyond the original aim of reducing wiring costs.

With Braumat and Profibus, the principle of horizontal and vertical standardization is implemented throughout the plant at both the management and process levels. All process instruments communicate via the same communication protocol — from the drives of the filling plant and the frequency converters to the pressure and temperature sensors. This means that costs for installation, data storage, documentation, and training are also considerably reduced. The standardized communication ensures that data storage is consistent throughout the plant, allowing Bitburger to manage everything without isolated islands of automation. In addition, digital communication increases the accuracy of the process values, and opens up new ways to optimize production. For example, an important process parameter can be exactly determined based on a very slight difference in the density of the fermenting boiler, and used to save time in the process.

Bitburger can also fully exploit the potential of the increasing distribution of intelligent devices in the process, and optimize the maintenance and service of the automation infrastructure — for example, using the diagnostic capabilities of Profibus. This can both eliminate unnecessary action and costs, and effectively prevent failure of components and systems.

**Protecting investments, now and in the future**

A further important element in the assessment of the economic advantages of the automation solution is the protection of previous investments. Thanks to the openness and compatibility of Profibus and Braumat, the systems installed at Bitburger will largely survive the next round of modernization with few problems — as they have for the last 14 years.

**Find out more:**

www.siemens.com/breweries
E-mail: claude.hestroffer@siemens.com

**Brewing industry: A typical example of hybrid plants with Profibus**

In a brewery, slow and continuous technical process steps in areas such as the brewing house, fermentation and storage cellars, filtration, and power are closely linked with very rapid and discrete technical production processes in the filling area. Industries with such a mixture of production processes are referred to as hybrid industries.

A communication solution using Profibus simplifies the integration of all of the production steps in a standardized network — especially in such applications. All production and process industries and individual tasks from incoming goods to quality control and dispatch have been taken into account in the development of Profibus. Profibus, with its Profibus DP communication protocol and the Profibus PA version for linking devices in the process environment, can therefore be used for all automation tasks in all areas — which eliminates heterogeneous systems and the need for additional interfaces.
Air Products turns to Simatic PCS 7 for reduced product development time and optimized control

Next Generation

Worldwide equipment, gas and chemicals provider Air Products brought a new air separation unit (ASU) online at its plant in Gent, Belgium, to satisfy a neighboring steel producer’s demand for pure oxygen. Capable of producing some 960 tons of oxygen per day, the new ASU is the third generation of separation unit at the site, but represents the first to use the Simatic PCS 7 process control system.

Air Products won the contract to build and operate the new ASU in May 2004. The company was already supplying the steel works with oxygen from an existing ASU at its own Gent facility, but a new ASU was needed to satisfy the work’s increasing demand, as the company looked to improve its operations.

Uniform control solution helps reduce development time-scale

An ASU capable of producing 960 tons of oxygen per day requires a highly sophisticated control system to monitor and control various product flows and pressures, and to guarantee product quality. Simatic PCS 7 offers a uniform, common platform for control and automation extending from field level to controller level to ERP and MES level, thus simplifying system integration and commissioning, and so helping to reduce the ASU’s development time-scale whilst improving overall control.

Air Products control systems manager Dave Weir comments: “The tight integration was a real benefit for us in the development of the new ASU. If you take the SCADA and HMI aspects, for example, we’ve had to use separate, bolt-on software packages in previous projects, and integrating the hardware and software to make them work together is a real engineering challenge. But with PCS 7, they’ve been specifically designed to work together, so development time and commissioning time are reduced to a minimum. That’s a real strength.”

Protecting investments while offering ample upgrade opportunities

Using the PCS 7 system also made it easy for Air Products to leverage its investment in the legacy DCS system, configured for its complex regulatory and advanced control strategies, says Dave Weir. “In the past, if we had looked to add a new HMI layer, for example, that would have meant significant engineering work to integrate with the DCS, or might even have meant scrapping the DCS system altogether and starting from scratch,” says David Weir. “With PCS 7, we have protected that investment so that we can build on our strengths and not have to reinvent any wheels. At the same time,” he concludes, “the scalability of the PCS 7 architecture will provide an easy upgrade path for the future when we look to migrate from the legacy product to an all-Siemens solution.”

Find out more:

www.siemens.com/chemicals
E-mail: sean.cahill@siemens.com
Guidelines for implementing automation projects in a GMP environment

Engineering ABC

The Simatic PCS 7 process control system has been in use successfully for years all over the world in production plants that have to comply with GMP regulations. Especially relevant for applications in the pharmaceutical industry, the new version 6.0, that was released last year, features numerous additional validation and 21 CFR Part 11 support functions. The Simatic PCS 7 GMP engineering manual is a practical guideline which describes how both the performance and flexibility of Simatic PCS 7 can be optimally exploited in automating plants that must be validated.

To make things even easier for users who have to configure and implement a GMP-compliant automation solution, Siemens has compiled a special GMP engineering manual that illustrates how to implement solutions based on Simatic PCS 7 in plants requiring validation in a GMP context. The manual uses the extensive validation and GMP know-how of Siemens, summarizing this expertise in the form of a best-practice guideline.

Configuration in the GMP environment

In the new PCS 7 GMP engineering manual, the implementation procedure is explained step by step following the system’s life-cycle, starting from the software installation and operating system setups to data archiving and backup, the configuring of individual applications such as engineering, batch controller, operator interface and archive with respect to topics such as access protection, change management, electronic signature, audit trail, etc.

Moreover, a detailed description is given regarding good engineering practices (GEP). Simatic PCS 7 offers a number of helpful engineering tools that support GEP (for example, libraries, Import/Export Assistant, Process Object View, etc.) and concepts (for example type/instance, modules) that reduce the engineering and validation effort. The engineering manual presents the various software modules of Simatic PCS 7, and explains how to handle these tools correctly in a validated environment.

System design made easy

The guidelines provide detailed documentation on what criteria are important for the configuration and implementation of the control system, and can help ensure that the system builder understands the compliance requirements prior to design. The user receives a basic introduction to the current regulations and requirements for process systems, and how to meet these requirements through the correct configuration of the individual hardware and software components.

The engineering manual offers strong and consistent specification and configuration guidelines that minimize engineering, design, and change costs in GMP-compliant PCS 7 projects.

Find out more:
www.siemens.com/pharma
E-mail: fatime.ly@siemens.com
At its headquarters in Basel, Switzerland, the Novartis pharmaceutical company operates a biotechnical pilot plant that is used for the manufacture of natural substances for research. At the heart of the system are 24 fermenters with a capacity of between 10 and 3,000 liters in which natural substances can be produced on a scale ranging from a few grams to a few kilograms.

Controlled conditions for precise results

The specific fermentation process requires not only an exactly dosed feeding of nutrient solutions. Numerous parameters, such as pH value, temperature, and the content of dissolved oxygen, must also be maintained. This demanding task requires absolutely reliable process automation technology. Since the existing system could no longer meet these requirements, Novartis decided to renew the out-dated and inflexible technology.

Siemens implemented the project with Penta-Electric AG, a solution provider from the Basel region. The solution was based on Totally Integrated Automation using Simatic components: S7-300 controllers, ET 200, MP 370 touch panels, and Simatic Net. This choice guarantees trouble-free in-
teraction of all of the software and hardware components. Penta-Electric was responsible for all services relating to automation, electrical engineering, and plant construction.

**Conversion during operation**

A total of nine fermenters were equipped with a new automation solution. The special challenge for the project team was that the conversion of all of the hardware and software had to be done during operation. The individual systems were dismantled and assembled one at a time, in predetermined building phases, while production in the other fermenters continued.

This step-by-step conversion required sophisticated planning and corresponding logistics. The new automation technology was implemented in several phases. After the planning and configuration phase, which began in April 2002, the automation and electrical installation as well as control technology for two fermenters were exchanged until November 2002. The resulting standards and the experience gained in these projects was the foundation for the further conversion phases, which were completed by July 2003.

**Increased functional scope**

The new automation concept is characterized not only by absolute reliability, but also by significant improvements in the practical handling of the production process. Every fermenter has its own control unit with a display on which, for example, the entire fermentation process can be visualized with curve diagrams. “The fermenters have become more user friendly with the touch panels,” says Eric Weber, fermentation engineer in the pilot plant. “The touch panel also enables us to respond directly to alarm situations on site, and to specify whether or not the alarm is to be relayed to the control center, for example. Tasks like these used to be more complicated to handle in the past.” Another advantage of the new system is the much improved maintenance friendliness of the plant. Maintenance and operation of the plant can be performed by the appropriately trained service staff of Novartis.

**Availability and continuous data archiving**

To secure the availability of the plant even in the event of a component failure, the user interfaces, curve diagrams, and user programs can be saved centrally in the main engineering and service station. If a control panel or central unit fails, the required user software can be uploaded from the central engineering service station to the replaced component. It is immediately ready for operation afterwards.

Another important component of the automation solution is the MIS-Light Server, which guarantees the continuous process documentation and data archiving that is essential in the pharmaceutical industry. It receives all of the process data directly from the fermenter controllers via Industrial Ethernet OPC. In this way, the data can be called up at any time for documentation and evaluation. In addition, all touch panels on the individual fermenters are equipped with memory cards so that process data can be stored and displayed locally for the duration of a batch. These data are transferred to the MIS-Light server at regular intervals for long-term archiving and later evaluation.

Weber is extremely pleased with the project, which was completed at the end of 2003. The operation of the plant is basically the same, but with significant improvements. “In principle the new plant is a copy of the old one,” he says, “but it is an optimized copy.”

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**Find out more:**

www.siemens.com/pharma

E-mail: hansjoerg.munz@siemens.com
Case Study

Pharmaceutical Industry

ZLB Behring, employing 1,500 people at its Marburg site, is one of the world’s leading providers of drugs made from human plasma. These include products for treating clotting disorders, as well as immunoglobulins for immune defect therapy. ZLB Behring is a subsidiary of the Australian biopharmaceutical manufacturer CSL Limited, and operates production sites in Germany, Switzerland, and the United States.

A pharmaceutical buffer preparation tank and the appropriate heating and cooling system were recently added at the Faktor IX production division in Görzhausen, near Marburg, Germany. The aim of this project was to avoid delays and bottlenecks in the production of buffers, and to increase production capacity.

The additional components had to be installed and commissioned within an extremely tight time schedule. Only six weeks were available for the entire implementation phase, from assembly through pipe building and electrical installation, up to automation, commissioning, optimization, and qualification. This ambitious goal required sophisticated planning, and was ultimately achievable only because the individual building units were largely prefabricated and delivered as fully functional units.

The Siemens Competence Center for Life Science in Marburg was contracted to handle the project. In addition to the overall project management, its tasks included the process-technical design, planning, installation, and qualification of the plant technology, supplemented by the implementation of the entire automation, control and process technology.

Expert interaction

Jürgen Gliemann, project manager at ZLB Behring, explained the decision of his company: “The combination of automation expertise and validation competence led us to decide in favor of Siemens.” This view was underlined by project engineer Peter Scherer: “Another advantage was the local presence of Siemens and its existing know-how in pharmaceutical engineering.”

Close communication with the staff involved was typical of the cooperation between ZLB Behring and Siemens; this contributed to a very efficient project development. The entire project management was handled by one project manager, whose job...
it was to form the Siemens staff involved into a unified team and, at the same time, act as a central contact for the customer.

**Integration without change**

In addition to the tight schedule, another challenge was to integrate the additional pharmaceutical buffer tank into the existing and perfectly coordinated production area, without changing any structures or influencing mutual locks. For this reason, the source code of the existing Simatic controller was first modified, and the user interface for the buffer preparation tank implemented in the Simatic PCS7 process control system.

Siemens also had the job of developing a suitable control solution for the heating and cooling of the tank. The buffer preparation tank is fully encased by a jacket that is cooled by brine. This cooling method provides excellent heat transport capabilities, and therefore accelerates the tempering process. To achieve a steady cooling of the brine, a control program with a cascade-connected control circuit was implemented which controls several command and follower controllers. Its job is to achieve a precisely controlled cooling phase in which the brine is cooled over a defined period from 80 degrees Celsius to 25 degrees Celsius. Then the tank temperature must be kept at a constant 25 degrees Celsius. As the working system shows, the temperature control exhibits exactly the defined cooling behavior and is well within the requirements specified by the customer.

**Pharmaceutical expertise from a single source**

In the opinion of all of the parties involved, this solution could ultimately only be implemented because Siemens was able to coordinate all experts and provide all the components from a single source, consequently reducing the number of interfaces and avoiding the usual adaptation losses so common of such complicated systems.

Siemens also performed the factory acceptance test at their own facility before installing the plant as well as the final site acceptance test. Both tests were documented compliant with GMP regulations and accepted by the customer. Moreover, Siemens conducted the final qualification of the new pharmaceutical buffer preparation tank – naturally, according to the internationally applicable FDA regulations for the pharmaceutical industry. The new pharmaceutical buffer solution tank then went into operation – right on schedule and with no problems, as all those involved confirmed with satisfaction.

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**Facts and figures**

- Buffer solution tank with external brine cooling
- Tank volume: 800 liters
- Cooling system: external cooling jacket with brine for fast tempering
- Control solution: cascade-connected control circuit with several lead and follower controllers
- Controller technology: Simatic
- Process control system: Simatic PCS7

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**Find out more:**

[www.siemens.com/pharma](http://www.siemens.com/pharma)

Dipl.-Ing. Stefan Schmidt

E-mail: s.schmidt@siemens.com
New international standards introduced in 2002 to improve shipping safety require water ingress detection and alarm systems in the cargo holds of all new single-skin bulk carriers. Ships built before 2003 must comply by the time they are 10 years old or, if they are already more than 10 years old, by their third annual inspection. C&A Stavros Kassidiaris Ltd. is a marine engineering and retrofitting firm in Piraeus, Greece, with 25 years of experience in supplying automation systems. To help the marine industry meet the new standard, the company designed a system that is fully compliant with the new regulation. This required a reliable, easy-to-install, low cost instrument to detect water in the many different materials that a ship may carry as cargo. Lloyd’s Register and American Bureau of Shipping (ABS) approvals are required for insurance purposes. Floats are not suitable because they cannot handle material build-up and require regular maintenance and frequent replacement.

Solution: Sitrans LC 300

C&A Stavros Kassidiaris found a reliable, low cost solution with the Sitrans LC 300 interface measurement instrument from Siemens. This two-wire capacitance instrument uses a unique inverse-frequency approach to capacitance technology that offers superior resolution and repeatability. Its patented Active-Shield technology protects the measurement from the effects of material build-up, vapor, dust or condensation. It works accurately in materials with low or high dielectric properties.

In a typical application, a Sitrans LC 300 sensor probe is attached to a cable in a metal stilling pipe located in the cargo hold. The 4-20 mA output is connected to a water ingress monitoring panel on the navigation bridge. The panel includes an LCD and buttons for calibration and diagnostics. It monitors the status of each cargo hold, indicating normal operation, material at alarm heights, and sensor or cable failure.

Reliable and cost-effective

Sitrans LC 300 reduces installation time, construction of pipes, and electrical wiring, making it a low cost solution. “C&A’s Water Ingress Detection Monitoring & Alarm System with Sitrans LC 300 requires less time for procurement and installation, and no maintenance,” said Stavros Kassidiaris. “The result is a significant decrease of the total cost.” The system enables the marine industry to meet the new regulations, and enhances shipping safety.
Wietersdorfer & Peggauer Zementwerke GmbH is a successful private enterprise in the Austrian buildings material industry, and the market leader in southern Austria. All systems – including level monitoring – must work perfectly in the production of the company’s wide range of products, so Wietersdorfer & Peggauer recently replaced fault-prone mechanical measuring instruments with a new, robust, and reliable solution: ultrasonic and radar measuring instruments from Siemens.

Non-contacting measurement
Unfortunately, before the conversion, the mechanical measurement of the raw meal in the homogenization silo did not always work reliably, which frequently had serious effects on production. Wietersdorfer & Peggauer therefore chose a non-contacting measuring principle based on ultrasonic and radar measuring instruments from Siemens.

The monitoring solution
- Crane track: Sitrans LU2 transmitter with two XPS30 ultrasonic sensors, 30 meters maximum measuring range
- Bunker: two 10-channel ultrasonic Sitrans LU10 transmitter with a total of 17 XPS30 sensors and one XCT12 high-temperature sensor; one CLS300 level switch per bunker for overflow protection
- Crusher control: one XPS15 ultrasonic sensor with Multiranger 100 transmitter
- Raw meal silo: Sitrans LR400 radar instrument with a range of 32 meters

The new measuring technology has since been installed and has proven itself in the hard daily routine. After several months in operation, not a single sensor has failed to date.

Wietersdorfer & Peggauer also recently equipped the chalk furnaces with new pressure transmitters in cooperation with Siemens. This project was completed with the usual success and within the allotted time as well.

Find out more:
www.siemens.com/cement
www.wup.at
E-mail: rene.breuer@siemens.com
Konya Seker benefits from integrated process automation

Konya Seker’s new sugar factory in Turkey is currently the only greenfield plant project in the European sugar industry. Thanks to its industry expertise and a convincing overall concept, Siemens was able to secure a large share of the orders for the factory installations – from energy generation to instrumentation. The well-designed concept was one of the main reasons why this large and important project was completed so quickly and smoothly.

Konya Seker is the largest private sugar producer in Turkey. At the end of 2004, the company put a new sugar factory into operation. The factory is located in Cumra, in the highlands of Middle Anatolia, about 185 miles south of Ankara, and about 19 miles southeast of Konya, a town with a population of 40,000. The factory can process up to 12,000 tons of sugar beet per day, yielding about 1,500 tons of sugar.

The new factory was the largest single project in the European sugar industry at the time. In the automation of the plant, the task was to achieve two goals that had always been considered incompatible. On the one hand, a highly modern plant was to be installed which would impress every engineer and set a new standard for the entire sugar industry. On the other hand, demanding economical aspects had to be taken into consideration: The production was to operate more cost-effectively than any other in the industry.

Experience as a basis for the optimum solution

With more than 50 years of experience in the sugar industry, Siemens came with the best recommendations for meeting these seemingly contradictory requirements. On the basis of numerous successfully completed new building projects in the sugar industry, Siemens designed the overall concept in close cooperation with the customer. The concept combines the advantages of Totally Integrated Automation with a uniform automation concept using Profibus as a fieldbus system. The result is an open, efficient, and at the same time cost-effective automation solution for the long-term. Siemens supplied all of the drive and control technology for the new factory as well as the networking of the field instrumentation, from the pH analytics to the frequency converters. Simatic PCS 7 was used as the process control system. Siemens also supplied a complete turbo set for power generation.
Full networking with Profibus

An essential step toward cost optimization in the automation of the plant was the consistent use of Profibus components for plantwide networking.

The process instruments are linked to the control system via Profibus. Profibus not only allows the transmission of the pure process signals, but also the transmission of all calibration data from the central engineering system after installation of the device on site. This approach considerably simplifies the engineering requirements: All of the instrumentation was configured by just one project engineer.

In addition, Profibus PA transmits the power to the individual devices. Up to 32 measuring instruments can be connected to one line that is supplied by a coupling module, without marshalling distributors or signal conditioning. The field wiring work was therefore limited to an absolute minimum.

For measurements such as level, pressure, temperature, and flow, Siemens sensors and transmitters are used, while Sipan analyzers evaluate process parameters such as pH value and conductivity online. All actuators, such as vents, valves, motors, and frequency converters, also communicate with the control system via Profibus.

Transparent and reliable

The factory’s control technology is based on the Simatic PCS 7 process control system throughout. This allows redundant automation systems to be dispensed with completely. Experience with other sugar factories had shown that PCS 7 automation systems are sufficiently robust even in their simplest forms. The PCS 7 servers, the operator systems, and all operating stations are networked by Industrial Ethernet.

The main factory of Konya Seker in Konya is connected to the Cumra factory by an intranet link. A management information system (MIS) was installed in Konya and Cumra. It stores all the relevant process and laboratory data and generates all the reporting for the two factories, with extensive real-time reporting online. With the MIS, the company is able to continuously keep an eye on the processes, detect critical developments early, and respond to them proactively before there is a total production outage.

From zero to full steam in just a few weeks

The automation technology implemented at the sugar factory in Cumra provides the technical basis for optimized processes and cost-effective continuous operation of the factory. That became clear already during commissioning, as production was successfully brought up to maximum capacity within just a few weeks. In close cooperation with the committed teams of the machine manufacturers involved and Konya Seker, Siemens proved that it is possible to reconcile the often conflicting demands of technicians and commercial managers – provided the technology is integrated just as well as the persons involved. That was certainly the case in Cumra.

Find out more:

www.siemens.com/sugar
E-mail: bernd.langhans@siemens.com
Silicon wafer production with Simatic technology

Systematic Growth

Solar energy is growing worldwide – and with it the demand for silicon wafers, which form the nucleus of every photovoltaic system. Deutsche Solar AG is one of the winners in this development – and because the company chose Simatic technology for the automation of its plants and processes from the very start, Deutsche Solar can allow its production capacity to grow flexibly and easily with the market.

Deutsche Solar AG, headquartered in Freiberg, Germany, belongs to SolarWorld AG. The company is one of the largest producers of monocrystalline and polycrystalline silicon wafers in Europe and has benefited from the rapidly growing solar power market. Consequently, it has greatly expanded its production capacity in recent years.

Solid basis for continued growth

The Freiberg company has been producing silicon wafers since 1997. The multistage production process, in which the melting of the silicon and its subsequent crystallization into polycrystalline blocks takes center stage – followed by sizing and capping of the blocks, sawing of the single wafers, cleaning and final inspection – has been consistently automated with one technology platform: Simatic controllers. Standardizing on a uniform system technology has enabled Deutsche Solar AG to allow the control and visualization system to grow with the production expansions over the years – expansions that have included new plants for ultra-filtration, pure water generation, compressed air and technical gases, ventilation, intermediate storage, tank and hazardous substances stores, slurry supply, and much more. The new plants and machines were all integrated quickly and easily into the existing automation solution.

Further expansion

This openness and flexibility, together with the fact that the complex requirements of solar-wafer production could always be implemented quickly and effectively with the Simatic-based solution, convinced Deutsche Solar to rely once more on Simatic when building a new crystallization plant and its associated subplants. By July 2005, the production capacity of silicon blocks will be increased by another 40 megawatts to a total solar capacity of 160 megawatts. The existing wafer production is also being expanded.

Ready for the future

Siemens has integrated the new plants into the current automation system, some during ongoing production, and at the same time migrated the existing Simatic S5 controllers to the more powerful S7 systems. The visualization has also been standardized with Simatic WinCC and converted to the new WinCC version. Now, all operator panels have a uniform visualization system. These automation projects have been completed – one is tempted to say “as usual” – to the customer’s total satisfaction, and Deutsche Solar AG can now expand its leading market position. Thanks to the openness and flexibility of the Simatic technology platform, future expansions will always be possible.

Find out more:
www.siemens.com/semiconductor
E-mail: uwe.brossmann@deutschesolar.de
E-mail: joerg.sawatzky@siemens.com
The ARC Advisory Group has recently published several documents that speak highly of Siemens systems and products. As stated in ARC’s white paper on Siemens’ process industry strategies, two of Siemens’ key differentiators are its ability to bring together process and discrete automation under a single control environment, and its philosophy of ownership of core system technologies. ARC rates Siemens as a leading supplier of process automation systems and process instrumentation in Europe, but the company is also rapidly emerging as one of the top process automation players in the worldwide market (particularly in the North American market). The focal point of growth for Siemens’ process business is the Simatic PCS7 system, which has reached the level of a “bulletproof” and fully scalable system on par with any other leading system available on the market today.

Another hot topic relating to Siemens industry strategy was recently discussed at the Simatic IT Partner Conference held in Italy last year. A field report from Greg Gorbach of the ARC Advisory Group states that Siemens presented a very thorough approach to its competitive strategy and organization. Because Simatic IT has embraced ISA 95, Siemens is very well positioned to benefit from the interoperability initiatives ARC is spearheading in the market.
The safe choice.

Process safety – reliable, flexible, easy

When it comes to your processes, depend on total safety – with a Safety Instrumented System (SIS) that does not allow for weak spots. SIMATIC® Safety Integrated is our comprehensive portfolio of safe, fault-tolerant and high-availability products for the process industries that leaves nothing to be desired. It's reliable: it reduces risks without stopping production. It's flexible: just look at the architecture and the bus systems – with integrated or separate safety technology. And it's easy: it connects up to any control system and is simple to configure, for instance with the Safety Matrix cause & effects tool. Because it is part of Totally Integrated Automation, our certified SIS is already a harmoniously integrated component of the SIMATIC PCS 7 process control system.

Get more information by faxing 00 800/74 62 84 27, Infoservice AD/Z 1109E www.siemens.com/process-safety