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Open To New Ways

PROFINET in Process Automation

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New prospects with PROFINET for the process industry

With over three million installed nodes, PROFINET has long since become a familiar feature of production automation and drive engineering applications. But what about the process automation sector? Although this sector traditionally reacts cautiously to new technologies, users have expressed heightened interest in PROFINET.

Introduction

In particular, the food and beverage industry sector is interested in PROFINET because of its large number of upstream and downstream processes. The chemical, oil and gas, and pharmaceutical industries have recently expressed considerable interest in the technology, as well. PROFIBUS PA is already widely used by facilities in these industry sectors. However, an integrated communication system such as PROFINET is essential to enable complete integration of centralized process-related operations of a plant with downstream applications involving mostly discrete processes, such as filling and packaging.

For this reason, PI (PROFIBUS & PROFINET International) established a working group of manufacturing companies (ABB, Emerson, Endress+Hauser, Pepperl+Fuchs, Siemens, Softing, Stahl, and Yokogawa) whose initial task was to define the particular characteristics of process industries. Additional consideration was given to the requirements of NAMUR (an international user association of automation technology in process industries). Besides the extended cycle times, continuous plant operation, and complex actuators and sensors, another major challenge is the sheer quantity of devices (up to 100,000 I/O signals). Moreover, life cycles in the process industry are often very long. It is not unusual to find 20-year old control systems, and many plants are even older than that.

These specific characteristics have always been an impediment to the introduction of new technologies in the past. In spite of this, PROFINET holds interesting prospects for process-related applications and the process industry sector, based in large part on its flexibility. In order to establish PROFINET on a widespread basis however, the specific requirements of this sector had to be implemented. This effort focused on four main areas:

<u>Investment protection</u>

In order to protect investments, seamless integration into existing fieldbuses must be possible. Many process industry plants have been in operation for several decades and have a large installed base of field devices, controllers, and communication systems. Continued use of this installed base is the aim. How can this be ensured? By means of a proxy concept, the three communication systems encountered in process industries – PROFIBUS PA, Hart, and

Foundation Fieldbus – can be integrated into the higher-level PROFINET network. The proxy assumes responsibility for implementing the physics and protocol and ensures the exchange of all I/O, diagnostic, and parameter assignment data as well as alarms with the field devices.

"Configuration in Run"

The chemical industry, whose plants operate continuously in most cases, places top priority on plant availability. It is inconceivable that a process would have to be shut down before making a parameter change or replacing a device. It must be possible to reconfigure devices and networks and to add, remove, or replace devices or individual modules during operation. Thanks to auto-sense and topology detection features, devices are identified automatically and their locations pinpointed. This enables convenient, reliable solutions to be developed for device / spare-part replacement scenarios, in which the replacement device parameters are assigned automatically by the control system. All of these "Configuration in Run" measures (CiR) are carried out in PROFINET without any interruption and without adversely affecting network communication. This ensures that plant repairs, modifications, or expansions can be performed without a plant shutdown in continuous production processes, as well.

Time synchronization and time stamping

In power plant automation, an especially high value is placed on time-correct tracking of individual process signals. This is especially critical when it comes to malfunctions in individual automation areas. Afterwards, the plant operator wants accurate information on the order in which signals were sent and at what time. He is then able to perform a detailed "root cause" analysis. An accuracy of 1 ms is critical for this purpose.

This requires a time stamp for digital and analog measured values and alarms that is accurate to the millisecond. A precondition for this is an exact time synchronization of the components involved: By means of a central system master clock (e.g., based on GPS or DCF77), a master selected specifically for this purpose transmits a cyclic equidistant clock signal to all bus nodes, thereby synchronizing them. This ensures that I/O devices can provide real-time information about alarms and other important events with a time stamp that is based on a network-wide standardized time of day. By acquiring events at a comparable time, an exact description and analysis of a possible fault can occur. Because not every field device has the ability for such a time stamp, a hybrid operation must also be possible. This is guaranteed with PROFINET too.

Scalable redundancy

To avoid automation failures caused by conditions such as wire breaks or short circuits, redundancy concepts were developed for PROFINET. These can be structured differently depending on the application ("scalable redundancy"). The basis for these concepts is the automatic switchover of communication paths to intact paths in the event of a fault, along with communication of status information regarding the cause of the communication interruption. The user can decide whether he wants to use controller redundancy, network redundancy, device redundancy, or device interface redundancy. Moreover, the recovery time of a communication system must be fast enough to prevent process disturbances. All redundant elements must have a diagnostic capability so that faults can be detected and faulty elements replaced.

Uniform concept

Many users express the desire for an integrated communication system down to the field level. PROFINET enables a direct path to MES and ERP systems, while at the same time facilitating the use of Internet services for things like remote maintenance, integration of wireless communication, or intelligent network management. New architectures can be realized with PROFINET. The flexible signal allocation allows signals to be assigned to controllers in the PROFINET network without any rewiring. This aids in future plant expansions, even when continuous processes are involved. Over the long-term, this can also make planning of automation systems easier since individual lines can still be expanded even during the commissioning phase. Entirely new paths are also possible: if, up to now, architectures have been based on the layer model of the conventional automation pyramid, flatter and thus more cost-effective architectures are now conceivable, especially for smaller applications.

Outlook

With completion of the “PROFINET for Process Automation” application profile, PI (PROFIBUS & PROFINET International) has taken an important step towards a uniform communication concept for process and production industries. The preconditions for this have been put in place with the implementation of process-specific requirements. What remains now are a few housekeeping tasks, such as the review of security concepts, coordination with FDI, development of test specifications for devices, and certification of devices that meet the PROFINET requirements. Starting in 2011 work can commence on implementing PROFINET products for process automation, thereby opening up whole new prospects for this industry sector.

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