



Integrated and Efficient Plug and Play From the Signal Processing Level Up to the Process Control System

Executive Summary

Automation systems in chemical and petrochemical plants must meet high and constantly increasing demands. As part of the automation level, the interface level can contribute significantly to improving plant efficiency and availability. Innovative interface product programs provide optimized solutions for the various application-specific requirements, which additionally save valuable space, install quickly and error-free, and facilitate planning and documentation.

A White Paper presented by:

Heinrich Kauper

Analog Ex Product Manager, Phoenix
Contact Electronics GmbH, Bad Pyrmont,
Germany

Phoenix Contact USA

P.O. Box 4100
Harrisburg, PA 17111-0100
Phone: 717-944-1300
www.phoenixcontact.com



Integrated and Efficient Plug and Play from the Signal Processing Level up to the Process Control System

Key concepts:

- Automation systems in chemical and petrochemical plants must meet high demands
- The interface level can significantly help improve plant efficiency and availability
- Innovative interface products can meet the needs of specific requirements, while saving space, allowing quick installation and facilitating planning and documentation

Introduction:

Automation systems in chemical and petrochemical plants must meet high and constantly increasing demands. As part of the automation level, the interface level can contribute significantly to improving plant efficiency and availability. Innovative interface product programs provide optimized solutions for the various application-specific requirements. They also provide other valuable benefits, such as saving space, allowing quick and error-free installation, and better planning and documentation.

As the interface between the field devices and the process control system, the interface level handles conventional functions such as electrical isolation, adapting and amplifying process signals, and filtering superimposed noise.

Galvanic isolation of the individual field signal circuits is vital for noise-free, precise signal transmission to ensure effective plant operation. Noise arising through ground potential differences and inductive or capacitive coupling can thus be reliably eliminated. This is especially true for geographically dispersed plants with varying electric potentials.



Phoenix Contact's MINI Analog product family offers integrated galvanic isolation for all functions required for analog signal processing. These active or passive one- or two-channel isolation amplifiers and signal converters have an innovative circuit design with low power loss and a resulting width of only 6.2 mm. When compared to the usual dimensions of 12.5 or 22.5 mm, the MINI Analog modules reduce the space required on the mounting rail by 50 to 70 percent.

Innovative Devices for Explosive Environments, ...

Many processing plants contain areas in which explosive atmospheres can occur. The measuring and control circuits in these plants are designed to some type of Ex technology standard. With intrinsic safety isolators (Ex i), in addition to their conventional functions, the interface level also isolates the intrinsically safe (Ex i) field devices from the non-intrinsically safe input and output cards in the process control system. As "associated equipment" for intrinsically safe circuits, Ex i isolation devices safely limit the energy that is fed into the Ex area so that no explosive sparks or any other thermal effects can occur. Because of the design requirements under ANSI/ISA 60079-11, or EN 60079-11 standard regarding intrinsically safe equipment, Ex i isolation amplifiers will be physically larger than comparable devices developed for non-Ex i applications.

With a width of only 12.5 mm per device for all functions, from the supply isolator up to the temperature transducer, and whether for one or two channels, the MACX Analog Ex modules from Phoenix Contact are one of the most compact series of Ex i isolation amplifiers available on the market. Compared to the typical dimensions ranging between 16 and 22.5 mm, this means space savings of up to 45 percent on the mounting rail. The narrow housing design is made possible by state-of-the-art transformer and circuit technologies characterized by reduced power loss. These devices, which also have precise response characteristics, provide consistently safe galvanic isolation for a 2.5 kV test voltage applied between inputs and outputs, as well as to the power supply. All MACX Analog Ex isolation amplifiers are certified in conformity with the current national and international standards for installation in Div 2, Ex Zone 2 and for Ex i circuits up to Div 1, and Ex Zone 0 (gas) and 20 (dust).

... Safety-related Applications (SIL), ...

If a measurement and control signal within the (Ex) plant structure is a component of the safety functionality, the plant operator must perform qualification of the signal transfer with regard to availability and quality in accordance IEC/EN 61508 or IEC/EN 61511, and recommended by ANSI/ISA 84.00.01. MACX Analog (Ex) devices have been developed in accordance with IEC/EN 61508. This allows their use in safety-related applications up to SIL 2 and, in some instances, even up to SIL 3.

If it is necessary to switch higher power or current levels safely as implemented via explosion-proof technology, or in Ex applications in explosion protection type Ex d/e, the PSR safety relay series provides an extensive product line designed and certified especially for applications in accordance with IEC/EN 61508/61511, and ANSI/ISA 84.00.01, up to SIL 3. The safety relays are adapted to the relevant safety-related process control systems and controllers to allow the implementation of a wide variety of solutions, from emergency shutdown (ESD) to fire and gas (F&G) applications. Features and functions such as positively driven contacts and line and load detection ensure comprehensive diagnostics and high availability.

... For Connecting a Large Number of Signals, ...

Various device designs are used at the interface level. Ex i isolation amplifiers in rail-mounted housings are widely used in different applications. These devices, usually with one or two channels, are available for a wide range of functions and allow implementation of flexible, modular systems. Modern rail-mounted devices are not only slim but offer features such as pluggable connection technology for quicker troubleshooting and replacement if necessary. Modular designs are typically wired individually to the respective I/O cards.

Controlling and monitoring complex chemical and petrochemical plants requires a transparent, space-saving design for reliably processing a large number of signals. Using technologies that must be wired separately can lead to increased installation and startup costs, especially if many signals are involved. Interface solutions employing motherboard or backplane technology can minimize these costs. Normally, 8 or 16 interface modules are mounted, screwed on, or plugged onto the motherboard. On the system side, the signals are routed through plug connectors with high pin counts. This allows a plug-and-play connection to the control level via preassembled system cables.

On the other hand, the new termination carrier design from Phoenix Contact is based on a patented aluminum profile specifically developed for this purpose. It has an integrated mounting rail contour to accept various standard interfaces (Figure 1). Unlike motherboard solutions, the termination PC board is mechanically decoupled from the interface modules and integrated into the profile so that it is protected. Mechanical decoupling prevents PC board conductor breaks. This is why the termination carrier design is vibration-proof up to 2g in compliance with IEC 60068-2-6 and shockproof up to 15g in compliance with IEC 60068-2-27. Integrated screw clamps allow for quick and stable installation of the termination carrier on all commonly used DIN mounting rails.



Figure 1: Termination carrier solutions for various interfaces.

...For High Plant Availability ...

The profile housing can be adapted to any length. This permits optimum adaptation to the required number of I/Os and to the width of the interface device type employed. All system connections are located on the control side to make optimum use of the existing space. The length on the control cabinet mounting rail is therefore defined only by the housing width of the DIN rail-mounted devices used. The component density in the control cabinet is defined not only by the length but also by the width. Just 170 mm wide, the termination carriers allow a transparent and maintenance-friendly design in standard control cabinets, which have a width of 800 mm and distances of less than 200 mm between the cable ducts. When using the termination carrier and dual-channel MACX-MCR-Ex devices, this means that up to 384 Ex i signals can be integrated into a surface area ranging from 700 to 1200 mm (Figure 2).

The maintenance-friendly design of the installed devices also contributes to high plant availability. The termination carrier design provides easy access to all termination points, including the integrated test sockets. In addition, the standard interface modules are hot-swappable because the power bridging connectors feed the module from underneath.

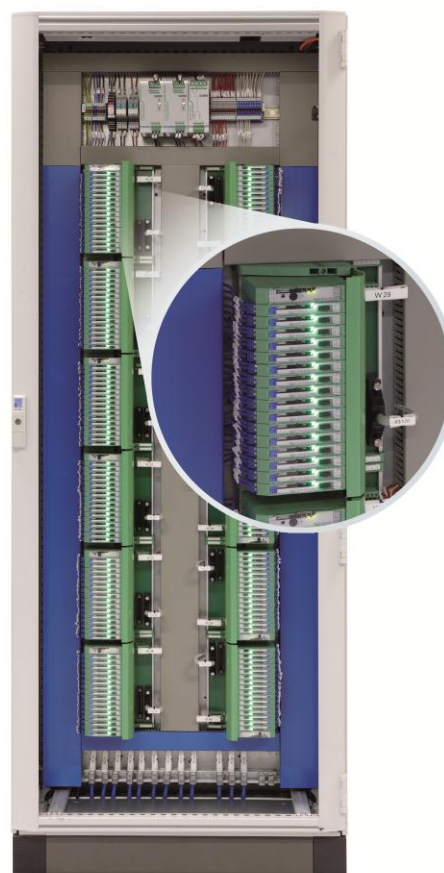


Figure 2 (at right): The termination carrier design makes possible a transparent control cabinet design with high packing density.

Pluggable and coded cable sets make it possible to match the interface modules to the termination circuit board quickly, safely and unambiguously. The electronics for feeding in the redundant diode-decoupled supply voltage and providing fault signaling are located in the power supply module, which is connected to the isolators via mounting rail connectors. The termination PC board has no active components whose failure would require the replacement of the entire module carrier (Figure 3).

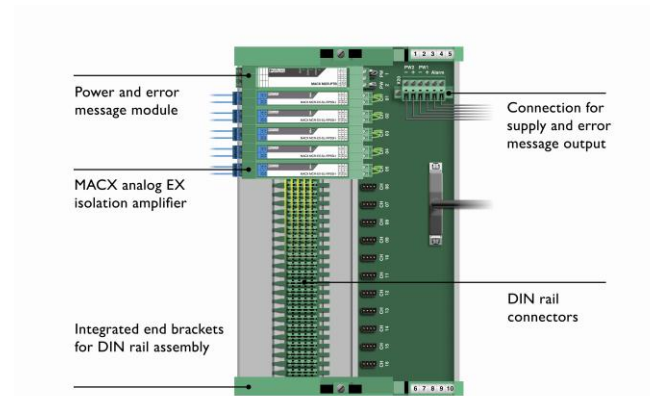


Figure 3: The isolation amplifiers are connected via the integrated mounting rail connectors with a separate supply and fault signaling module.

... And Reduced Engineering and Startup Costs

Since standard rail-mounted devices are adapted to the termination carrier, only one device type for each function is required to address both system applications and single applications used in almost all systems. This results in significantly lower engineering and documentation costs, especially when SIL applications are involved. In addition, storage costs also decrease, since it essentially cuts in half the number of device models that must be stocked.

Used together with preassembled and tested system cables, the termination carrier design substantially reduces the assembly time and often tedious troubleshooting during startup. This facilitates tasks such as the factory acceptance test (FAT) of entire control cabinets. The extensive range of system cabling products from Phoenix Contact provides solutions for I/O boards used in various process control systems. The connectors on the control side have been optimally adapted to the specific I/O board design. Additional system cabling designs are being developed or can be quickly implemented. In conjunction with the new termination carrier, users can receive an integrated and efficient plug-and-play solution, extending from the signal processing level up to the process control system itself (Figure 4).

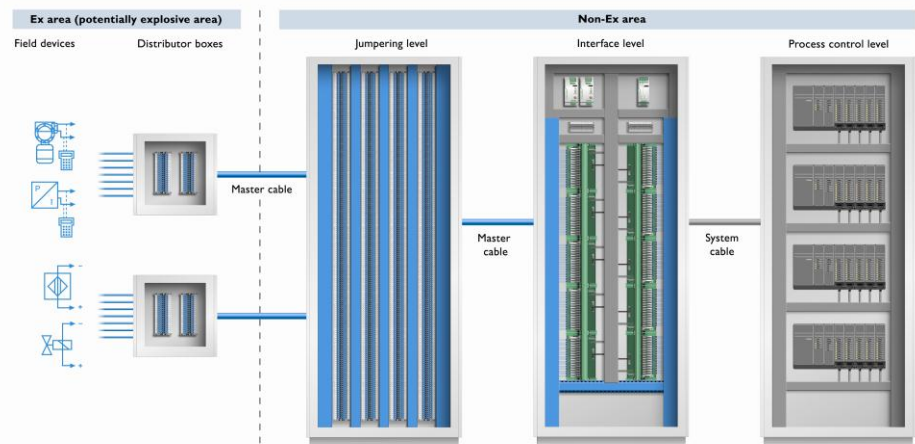


Figure 4: Typical plant configuration with 4-20 mA technology and point-to-point wiring.

About Phoenix Contact

Phoenix Contact develops and manufactures industrial electrical and electronic technology products that power, protect, connect and automate systems and equipment for a wide range of industries. Phoenix Contact GmbH & Co. KG, Blomberg, Germany, operates 50 international subsidiaries, including Phoenix Contact USA in Middletown, Pa.

To learn more about Phoenix Contact, visit www.phoenixcontact.com, or call technical service at 800-322-3225, e-mail info@phoenixcon.com