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INSPIRING INNOVATIONS

Figure 1: High system availability: the Plus version of the QUINT Power power supply was primarily developed for use in the process industry

Safe power supplies in the process industry: Certification, redundancy, and functional safety

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Introduction

Permanent system availability and high operational safety are of paramount importance in the process industries. Stringent requirements are placed on the security of power supplies where power failure of the process system could result in incidents endangering people and the environment, increased costs, and more. The failure of even just one controller in a refinery can cause major damage, which is why the devices used must be especially safe.

Phoenix Contact's new Plus version of the QUINT Power series of power supplies offers new functionality for even greater system availability and operational safety (Figure 1).

INSIDE:

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With a 20 A nominal output current, the QUINT Power Plus version is ideal for use in the process industry, with integrated decoupling MOSFET that enables superior system availability. In addition, thanks to its double overvoltage protection (OVP) in the form of two protective circuits, the Plus version switches the output off in order to protect against overvoltages. Operational safety is further enhanced by a protective coating and SIL 3 approval.

Higher system availability with integrated redundancy

Redundant power supply concepts are used wherever the security of the supply is of utmost importance. For example, redundant power supply systems are often used in the oil and gas sectors, as well as in the chemical industry. Similarly, in pharmaceuticals, the failure of the supply voltage can quickly result in the loss of a batch, loss of data, or worse. Redundant power supply concepts are also used in power stations and industrial production plants, where every minute of downtime is extremely costly.

To implement redundancy for the 24 V supply, two power supplies are usually switched in parallel and decoupled from one another using external redundancy modules. If one of the power supplies fails, the other takes over. Different redundancy concepts are used, depending on the application requirements – from simple decoupling with passive diode modules to advanced intelligent solutions featuring active redundancy modules.

The use of external redundancy modules has become standard in the market, with power supplies in various applications being decoupled using this method. However, the new QUINT Power Plus version with 20 A nominal output current is the first power supply to offer an integrated decoupling function, eliminating the need for external modules (Figure 2).

Figure 2: Integrated redundancy: the QUINT Power Plus version offers great potential for space and cost savings in the system with integrated decoupling MOSFET.

The new Plus version with integrated decoupling MOSFET is suitable for 1+1 and n+1 redundancy in the process industry. This saves a lot of space in the control cabinet. In parallel operation, the power supplies are completely decoupled from one another. In the event of a device fault or failure, the other device automatically takes over the entire power supply and prevents unintentional system downtime.

Unlike other marketable standard power supplies with an integrated decoupling function, QUINT Power is the only one to provide preventive function monitoring. Individually-adjustable signaling thresholds for the output current detect and indicate asymmetrical load distributions or overloads in the event of a fault. This enables the user to swiftly restore redundancy. In the process industry, the control and signaling of faults plays an important role in achieving consistently high system availability.

Greater operational safety, thanks to double overvoltage protection (OVP)

Stable control of the 24 V supply is required in order to guarantee safe supply of the system. Control can be affected by interference from faults caused by internal or external influences. This could be the ingress of impurities, such as conductive debris or dust. Interference can then lead to voltage dips or voltage rises. A voltage dip at the load is prevented by a redundant system. In contrast, an unintentional voltage rise leads to an overvoltage at the load and endangers system safety. Systems may be damaged or fail completely as a result. To protect against overvoltages of this kind, external overvoltage modules are normally used, e.g., upstream of safety controllers in the process industry.

The QUINT Power Plus version protects the load against voltage rise as a stand-alone solution; external voltage limitation is not required downstream. In contrast to conventional solutions, in order to protect the consumer in the event that voltage control fails, the Plus version switches the output off by means of double OVP. Phoenix Contact

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is the first and so far only company to offer this innovation for DIN rail power supply units. In the event of failure, conventional DIN rail power supply units only limit the output voltage to 35 V DC, which can cause damage to the load and result in system downtime.

The TÜV-certified double OVP reduces the risk of system downtime considerably. It meets the demands for functional safety (SIL) on the basis of IEC 61508 and IEC 61511, the safety standards for the process industry. With a safety integrity level of SIL 3 and hardware fault tolerance (HFT) = 1, it greatly increases operational safety. In the event of a voltage control fault, the QUINT Power Plus version limits the output voltage of the power supply to less than or equal to 30 V DC before the power supply disconnects in order to protect users. In redundant operation, the loads will therefore still be supplied steadily, safely, and reliably (Figure 3).

Use in any weather and conditions

Extreme conditions are not uncommon in the process industry, and systems and devices must be able to withstand a variety of factors that might cause potential disruption. Explosion protection is not just an issue in the chemical and petrochemical industry, either. Combustible and explosive substances in the form of gas or dust can also be encountered in many other areas. With its protective coating and hazardous location approvals (Class I Division 2, ATEX/IECEx approval in accordance with standards ANSI/ ISA 12.12.01, IEC 60079-0, IEC 60079-7, IEC 60079-11, and IEC 60079-15), the new Plus version safely supplies the system in potentially explosive areas (zone 2). Therefore, unlike conventional power supplies, the new QUINT Power solution is optimally equipped for use in the process industries. A compliant PCB coating protects against dust, gas, and 100 percent relative humidity. Use under extreme conditions is also supported by the permitted wide temperature range spanning from -40°C to +75°C – another unique feature of this solution. This level of system safety is hard to beat (Figure 4).

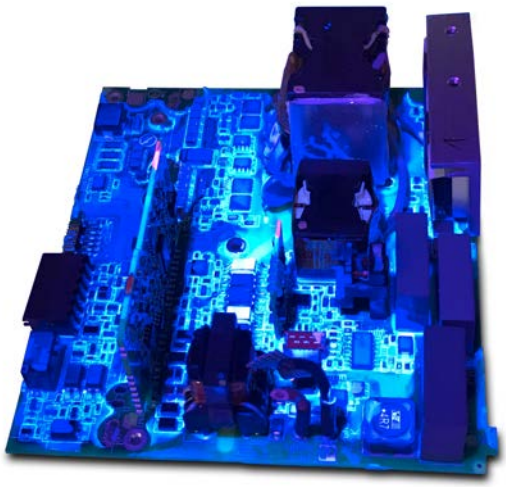

Figure 4: Optimized surface: the protective coating on the Plus version provides reliable protection against dust, gas, and humidity – enabling use in potentially explosive areas.

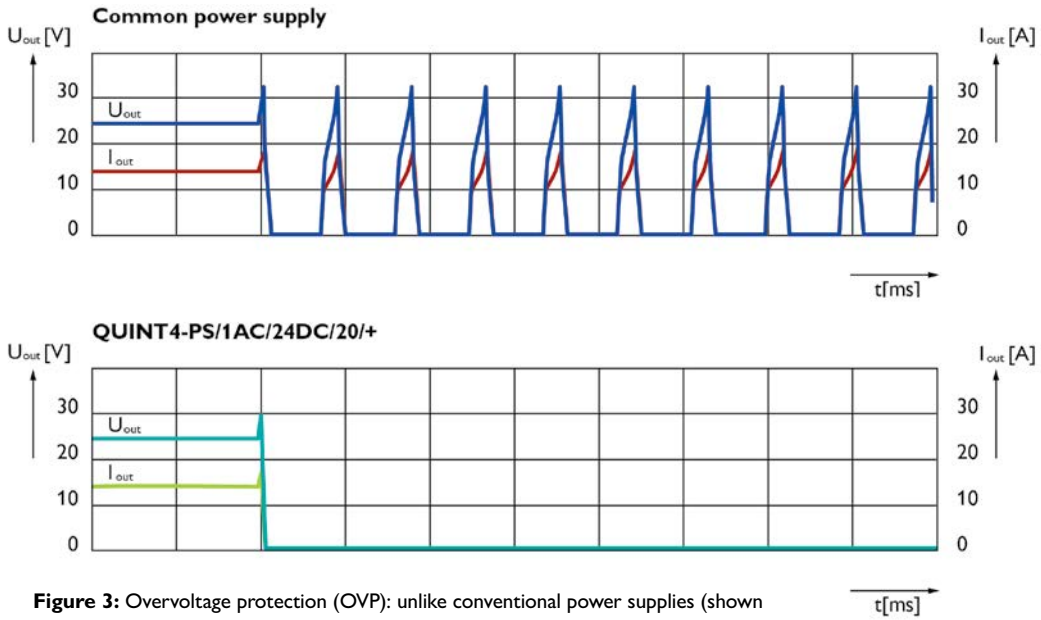

Figure 3: Overvoltage protection (OVP): unlike conventional power supplies (shown above), the QUINT Power Plus version (QUINT4-PS/1AC/24/DC/20/+, shown below) switches the output off in the event of a voltage control fault, thereby reliably protecting consumers against damage resulting from failures.

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Summary

The QUINT Power Plus version is ideal for applications that place extreme demands on availability and safety. All types of faults regarding system availability are monitored by the functions included with the Plus version. Thanks to the combination of integrated redundancy, double OVP, and SIL 3 approval, as well as the protective coating and Class I Division 2 / ATEX/IECEx approval, QUINT Power sets new standards for safe power supply in the process industry.

In addition to high system availability, users of the Plus version also benefit from space and cost savings, thanks to the simplified layout in the control cabinet. Now there is no need for additional external modules, with reduced wiring effort providing further cost savings.

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, Pennsylvania.

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