Power supplies enhance system availability

Redundant auxiliary voltage supplies with integrated overvoltage protection

Availability is of paramount importance – particularly for process engineering systems. An interrupted auxiliary voltage supply of individual components or in larger parts of the system can result in long and thus expensive production downtimes. Reliability can be ensured by means of Phoenix Contact's redundancy concepts – overvoltage protection (OVP) protects sensitive loads against overvoltages (figure 1)

Figure 1 Redundant power supply systems are traditionally used in the oil and gas sectors, as well as in the chemical industry

If one takes a closer look at the common loads in the process industry, DCS systems (distribution control system), remote I/O stations, and active marshalling distributors, which are often supplied by two power terminals decoupled from one another, are the most notable examples. In addition, one will find numerous other loads, such as signal conditioners, relays, and 4-wire transmitters, which only have one single voltage input.

As such, redundant systems are, in many cases, an effective method of avoiding the so-called single point of failure. This is also true for the generally required auxiliary voltage

supply, which in most fields supplies 24 V DC. To implement redundancy for the 24 V supply, two auxiliary voltage networks are switched in parallel and decoupled from one another using redundancy modules. The devices also ensure continued operation in case a short circuit occurs in one of the two current paths.

Different redundancy concepts

Using passive diode modules is the easiest way of decoupling. In doing so, it must be ensured throughout the entire system lifecycle that redundancy is only present when the total load current of all loads is not greater than the maximum current of an individual power supply unit. This is the only way to ensure that if one path fails, the other path can fully take over the supply.

Active redundancy modules – such as of the QUINT Oring type – take over the monitoring function of the total current and output an alarm if the current draw becomes too high. This feature simplifies expansion and identifies gradual errors during predictive maintenance. Furthermore, these intelligent modules also ensure an even load on both network paths, thanks to the ACB technology (Auto Current Balancing). The devices control and actively pass on the current distribution across the two supply paths, which maximises the service life of power supply units and DC/DC converters. Using powerful MOSFET transistors instead of diodes for decoupling minimises power dissipation.

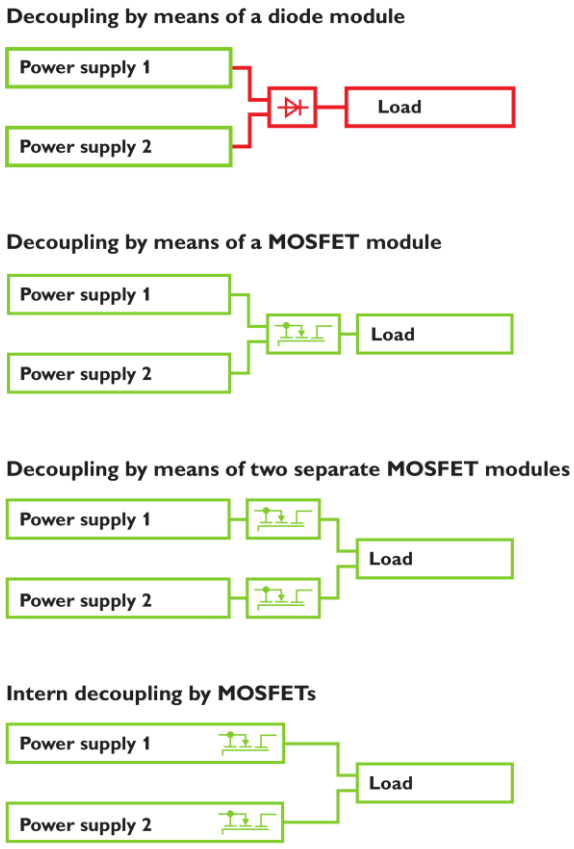

Figure 2 Overview of redundancy concepts: Decoupling by means of diode module (top), decoupling by means of MOSFET module (center), and decoupling by means of two separate MOSFET modules (bottom)

If a power supply drifts off on the output voltage side too much, this behavior is also reported in good time. The decoupling module is often followed by a fuse distributor. From here

onwards, the supply chain is no longer redundant, even if loads are supplied with redundant power terminals via two different fuses. Errors occurring on the network or on the fuse distributor may still result in the failure of the system in this case (figure 2).

Fully redundant auxiliary voltage supply

The optimum redundancy concept including complete monitoring options consistently comprises two physically separated current paths. Each of these consist of the supply network, a power supply unit or a DC/DC converter, and an intelligent Quint 4 S-Oring module decoupling the paths from each other. Any single point of failure is thus eliminated. MOSFET transistors again ensure low power dissipation, and redundant cabling through to the load results in maximum process reliability for the system.

In combination with the appropriate power supplies from the Quint 4 series, the separate auxiliary voltage networks are, furthermore, loaded evenly, and thanks to intelligent function monitoring, decoupling can be fully monitored at all points of the supply networks. Moreover, the perfectly matched system solutions from the Quint 4 series – with their combination of power supply and redundancy module – offer a high degree of functionality and performance.

Double OVP for even more reliability

Process engineering systems are always designed for maximum availability. To protect the sensitive hardware against overvoltage, the power supply systems reliably limit the output voltage to a safe level. The OCP circuit prevents voltages above the OVP threshold resulting from an internal fault of the power supply from leaving the module. Consequently, many control system manufacturers demand double OVP for full protection. The combination of Quint 4 power supplies and S-

Phoenix Contact's redundancy concepts

Phoenix Contact offers various solution concepts which meet all the requirements for redundant power supply systems:

- Passive diode modules – robust and inexpensive
- Active redundancy modules – controlled and fully monitored
- Active single redundancy modules – strictly separated and fully monitored

Oring/Plus and S-Oring/VP versions from the same series doubly protects process control systems. Because the double OVP of the entire system meets SIL3 (Safety Integrated Level 3), it can also be used in safety-relevant applications. Different types of applications and process control systems require different OVP thresholds for a high degree of process reliability (figure 3).

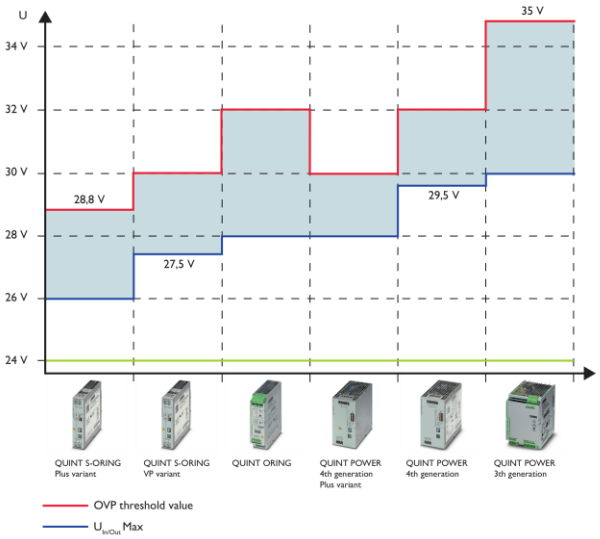

Figure 3 OVP threshold values are particularly significant for the process industry – control system manufacturers' requirements differ greatly throughout this sector

Due to part variations, the actual OVP limit of devices is based on the Gaussian distribution. The tolerance inspection yields a voltage range with an upper limit that equals the OVP value specified in the Phoenix Contact data sheet. This ensures that absolutely no voltage greater than this limit occurs at the output of the device. The restricted voltage range between the maximum input voltage and the OVP threshold was designed so as to ensure a high degree of flexibility and safe mode of operation. This mode of operation prevents any unintended tripping of the OVP – and thus, system downtimes – caused by overvoltages that occur during regular operation. These may result from dynamic loads and load shedding, for example. With their small restricted voltage ranges, Quint 4 and Quint S-Oring/VP power supplies offer a high degree of flexibility (figure 4).

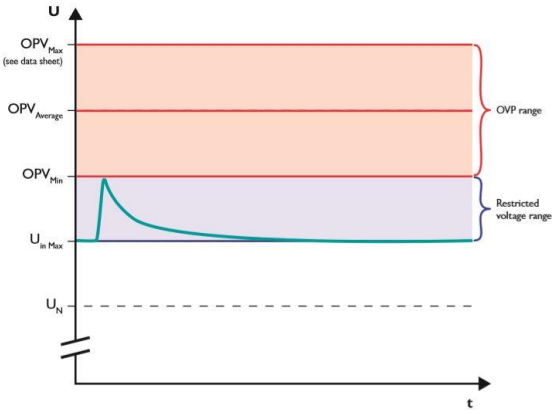

Figure 4 The restricted voltage range between Uin Max and OVPMin prevents any unintended triggering of the OVP, and thus, system downtimes
Figure 5

Summary

Phoenix Contact's wide range of products and solutions in the field of power supplies provides various options for different applications, not only for the process industry – for enhancing system availability and thus, process reliability as a whole. The devices of the

Quint series offer perfectly matched system solutions for demanding redundancy applications.

More information: www.phoenixcontact.net/webcode/#0153

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