High availability of distributed systems through PNO redundancy

Automation of modern process-related installations is increasingly being structured on a distributed basis. This trend has been emerging since the mid-seventies when the first distributed process control system (DCS) appeared on the market. This system solved the use of conventional control panel technology with individual controls, as well as hardwired controls with comprehensive wiring and cabling effort and expense.

In the 80s, the breakthrough occurred with the distributed process control systems.

The control room was increasingly dominated by workstations equipped with monitors.

In the 90s, the first process automation bus systems were conceived and the control systems were equipped with new interfaces.

The initial developments and use of remote I/O systems can be traced back to this time. Thus, the distributed structure was extended into the field. Distributed I/O systems are the connecting elements between the sensor/actuator levels and the higher-level process control system.

Profibus DP has established itself as the interface between the process control system and remote I/O. The explosion-hazardous area has become apparent as the main area of application of remote I/O systems in the field of process automation.

Status Quo

The remote I/O system *excom*® from TURCK has proven itself in the process industry and its high level of demands with regard to safety and availability of systems.

excom® is a remote I/O system for use in explosion hazardous areas. It comprises bus-compatible remote input and output modules for connection of binary and analogue intrinsically safe field devices. The specific Ex-approval of the system permits use in zones 1 and 2. The field circuits are approved for zone 0.

Many users who equip their systems with remote I/O systems wish for the installation benefits of a fieldbus structure, but do not wish to accept disadvantages in terms of availability. This level of availability is demanded both from the hardware as well as from the data transmission. Thus *excom*® allows a completely redundant design. The power supply can be redundantly implemented with 24 VDC or also with the option of 230 VAC. With the AC power supply, smaller incoming cross-sections can be installed in contrast to the DC supply. Naturally, all modules including the power supply can be exchanged during operation (how-swapped) in zone 1.

The availability of a remote I/O is not just achieved by the hardware. The benefits of a fieldbus system to transfer a vast amount of data with a minimum installation effort provides a high signal density per Profibus cable. There is a redundancy concept for the bus structure to ensure that entire system sections are not totally dependent on the availability of a cable.

The focus on redundancy

TURCK therefore supports so-called line redundancy. This concept increases the availability with the least possible effort. In a design of this type the *excom*® system is connected via two bus interfaces (gateways) via a bus (line) with either one or two masters.

This redundancy concept does not allow for a redundant bus structure. The switch over of the master module is not coupled to the slave module. The slave must be applied separately to both masters, so that double the engineering effort may be required with a partial enhancement of the availability.

A twin bus structure on the other hand provides the system redundancy. In this concept two masters communicate via separate bus structures with a slave, which also features two gateways. For a long time no standard existed in the Profibus world regarding the implementation of system redundancy. This is why there are many manufacturer-specific redundancy solutions. The implementation of various manufacturer-specific redundancy concepts is partly not possible or requires an inordinate amount of engineering effort in the control system. Soon the question is posed if applications of this type can be maintained in the control system. The user usually prefers to do without a redundant Profibus than a control system software which cannot be maintained.

Comprehensive redundancy solution

The TURCK remote I/O also provides a system redundancy solution as standard.
The TURCK system redundancy allows the connection of the redundant *excom*® via redundant bus physics, to a process control system with a Profibus master which is also redundant. The redundancy switch over is openly designed to accommodate every master on the market. Further benefits of the TURCK system redundancy are that the configuration (generally expansion of the systems) or modification of parameters during operation is also possible without shutting down system sections. This feature is not provided in every manufacturer-specific solution.

The "Slave Redundancy" profile defined by the PNO is now supported by the first control systems. The profile not only describes the redundancy behaviour but also the online configuration. Turck has implemented the standardised redundancy concept of the PNO V1.2 in the *excom*® gateway. The following benefits result for the user:

The existing redundancy functionality which exists in the *excom*® system is fully retained. This means that *excom*® can be integrated into a system redundancy via this profile. The redundancy circuit must no longer be matched to the respective master, but rather is accepted via the profile. On the redundant bus, Profibus slaves from diverse manufacturers can be connected according to the PNO redundancy profile without additional engineering effort. A separate Profibus for every slave manufacturer must no longer be installed in the field. Interoperability is at last provided in the Profibus DP redundancy concept. This standard fully serves the interests of the system operator.

With PNO slave redundancy V1.2, the system operator can select the products based on their functionality without limiting the availability of the system.

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