A process plant is not exactly the most pleasant workplace. This applies equally to man and machine. Harsh ambient conditions and large distances are typical of process control systems found in the pharmaceutical, chemicals and food industry, as well as in the oil and gas sector. However, even in the field, continuous production plants can’t manage without sensitive information technology. Optimum operations under economically efficient conditions and the management of the potential danger that lurks in almost every process control system demand the use of high-performance IT. This challenge is met by placing only the most essential components in the field and using data lines to establish connections with the remaining equipment off-site. However, until now, data transmission has proven to be the bottleneck: depending on the technology on which they are based, these transmission routes are technically challenging, susceptible to faults and technically limited in terms of their length. Help is at hand in the form of a concept that enables data to be transferred via Ethernet on the basis of TCP/IP protocol - requiring little installation effort, covering large transmission distances and offering better manageability and flexibility.

**Fig. 1:** An Ethernet link means that data can be transferred for up to 90 meters. If optical link modules are used, the maximum transfer distance is actually two kilometers.

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**VISUNET REMOTE MONITORS AND PANEL PC VISUALIZATION AND CONTROL BASED ON ETHERNET**

*As flexible as any other network component – data transfer via Ethernet means that monitors and PCs can even be used in hazardous areas.*
There is an unmistakable trend towards the decentralization of control and monitoring tasks in the process industry. For this reason, processes are increasingly being visualized not just on centralized control consoles, but also on decentralized mobile control panels in the field. This is the only way that plant operators can take on additional control tasks. This includes controlling supplementary parameters to enable conclusions to be drawn as quickly as possible about quality. In addition, faster response times are possible when there are deviations from normal operation. In the process industry, systems used in the field are often started manually; the machines can only be operated manually when they are stationary. For this startup phase it must be possible to access process displays and all relevant process data.

Visualization in the process industry

Ambient conditions in continuous production are extremely problematic. Systems for process visualization can be subject to major variations in temperature and humidity. On one hand, contact with process chemicals and solvents has a direct impact on components, while on the other, the systems must also withstand the cleaning of the plant with pressure cleaners. The components are often found not only in a harsh environment, but actually in hazardous areas, which is why the relevant licenses are required. Typical of such systems are also major mechanical stresses due to vibrations, caused by pumps. In addition, production systems in the process industry are mostly spread out over a wide area, so that large distances between the various system components need to be bridged.

For this reason, the key requirements for the components of a visualization system and for data transfer are:

- High density
- Chemically resistant surfaces
- Smooth surfaces
- Mechanically robust design
- Explosion-protection certification as appropriate
- Data transfer over long distances

This results in a network topology that can bridge major distances and that can operate with as few components as possible, so as to minimize technical and commercial expenditure, as well as susceptibility to faults.

The limitations of classic data transfer

Using as few components as possible and long data transfer links - these apparently contradictory requirements cannot be met with the usual PC video interfaces. They can be used to bridge only a few meters without additional components. On the other hand, KVM amplifiers enable data to be transferred for a few hundred meters. However, analog signal transfer is susceptible to interference. This problem can be solved by digitizing data transfer. Until now, project managers had no choice other than to try to find a compromise between a small number of components and long transfer links.

The alternative - Ethernet and TCP/IP

Both objectives can be met through the use of widely available network technologies based on the IEEE 802.3 Ethernet standard. This means that suitable image analysis and compression algorithms can be used to transfer video data in the network using the TCP/IP protocol. Depending on the complexity of the video images, the data rate ranges from just a few kilobit/s for largely static process images to several megabit/s for moving, full-screen camera images. The data can be fed to and picked up from any point on the LAN. Transmission requires only a suitable network cable (type Cat-6e or Cat-7 S/STP, screened/shielded twisted pair). The visualization platform becomes a “perfectly normal” network component, so that proprietary structures are avoided.

Minimum topology - maximum benefits

The direct connection of the visualization platform to an Ethernet-based network offers the user three benefits.

The topology is much simpler because there is no need for a KVM amplifier. This saves space, the power supply is not required and there is no additional heat dissipated because of supplementary elements. Fewer elements also mean simpler connection technology, which also implies greater reliability. In the past, ensu-
ring reliability meant installing an A/D and D/A converter at the beginning and end of a transfer link. Data transfer via the Ethernet is less susceptible to faults because purely digital data transfer is possible without these additional components. The visualization platform is clearly identified and managed with its IP address, making it a "perfectly normal" network component. This is compatible with other standard network components, so that there are no interface problems. Flexibility in relation to changes in the topology increases considerably. Because the RDP protocol is used, there is no need to install any additional software.

The maximum possible transfer links are much greater with Ethernet transfer under the same conditions. Suitable copper cables enable distances of 90 meters to be bridged easily, based on the distance between the monitor and the nearest component (switch, router, PC). This length is usually sufficient to get beyond the hazardous area, so that a switch can be installed in a safe area; alternatively an explosion-protected switch must be installed in the hazardous area. It is possible to extend the transfer link to a maximum of 2,000 meters using optical link modules.

Advantages are also found in day-to-day operations. Now, it is possible to access several PCs with one monitor. The network allows a monitor to be connected to several PCs by providing it with the relevant IP addresses. If the list of IP addresses has priorities attached, it is possible to automatically switch to another PC if a PC should fail. Likewise, several monitors can be operated on a PC. All monitors display the same contents in parallel mode. Individual operations are also possible as an alternative; several configured users can work on a single Server PC in multiplex mode using their own monitors. This means that hardware savings can be achieved.

**Summary**

Visualizing procedures in the process industry can be improved immensely through the use of Ethernet and TCP/IP together with RDP protocol. Because the visualization platform for this architecture is a normal network component, the installation effort required for the topology is reduced. Uncomplicated administration increases flexibility when changes are required. Greater resilience in comparison with analog transfer procedures and longer maximum transfer links mean that this technology is an real alternative to the classic concepts for data transfer in the process industry.