Clear concept for Industry 4.0

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There has been intensive public discussion about the realisation of Industry 4.0 for more than four years now. The overall aim is to use the so-called "Smart Factory" to achieve production advantages. The key elements are adaptability, resource efficiency, ergonomic design and integration of customers and business partners into business and value added processes. This change, which some people are calling the fourth industrial revolution, is meant to give companies a technical advantage in international competition.

After so much discussion, there is an ever-increasing desire to see something tangible. In other words, there are demands for clear, realisable concepts. Like many other manufacturers in the automation industry, the Stuttgart-based Lapp Group, a leading supplier of integrated solutions and branded products in the cable and connection technology sector, is rising to the challenge.

A number of research projects, including Smart Factory^{KL}, which the Lapp Group was involved in, have established that future production will be far more networked than is the case today. This means that in the future even very small components will be able to provide data in the company's network or even on the Internet. Industry 4.0 is primarily based on comprehensive networking of company and business processes - from ERP (Enterprise Resource Planning) level to sensor/actuator level. This is the only way to ensure that data from production facilities is supplied directly to the material, planning and production control systems. Communication between machines and plants will enable a self-controlling and self-optimising production system to be achieved.

To facilitate smooth and complete networking of systems in the production environment, there is a definite need for uniform standards. In addition to standardised communication protocols, standardisation at a physical level - data network cables and connectors - will also play a critical role in its success.

Reliable networking of production across all levels is only possible with a comprehensive cabling and connection concept that allows standardised installation. Although Ethernet has established itself as a standardised technology, different applications have very diverse requirements in terms of data rates, mechanical robustness and system-specific specifications. Generally speaking, Ethernet cables used in a production environment need to be more robust than LAN cables used in an office environment.

Plants must have a modular design

Where entire machines and plant components are communicating with one another and with the ERP level, an adequate data rate must be ensured in the backbone of the plant. This prevents bottlenecks and enables plant components to be upgraded or expanded at a later date. Therefore, plants designed for the Industry 4.0 vision need have a much more consistently modular design. Cabling complying with the Cat.6_A standard is definitely future-proof in the plant backbone, with data rates of up to 10 Gbit/s. This network cabling offers sufficient reserves, thus ensuring expandability. These backbone cables are normally installed in cable conduits or cable ducts. However, for larger, moving plant components the backbone often

has to be routed using drag chains. To meet these requirements Lapp has developed its ETHERLINE® Cat. 6_A FD cables, which are suitable for drag chain use, and guarantee reliable data transmission over several million bending cycles. However, Cat.6_A is not just about the backbone. Complex sensors, such as industrial cameras, also need these kinds of network connections as they have to transmit higher data rates. For the connection, you also need a connector that complies with the Cat. 6_A standard. If waterproofing and dirt resistance complying with IP67 are also required, M12 connectors are the ideal solution. To meet the Cat. 6_A requirements, the well-known D-coded M12 connector has recently been supplemented with an X-coded version.

Four cores instead of eight

Within a machine or production cell, 4-core Cat. 5 cables are the most frequently used products. They have a maximum data rate of 100 MBit/s. This is normally sufficient to network decentralised IO systems or machine-based visualisation systems. Industrial Ethernet systems such as PROFINET, ETHERNET/IP and ETHERCAT are then frequently used at this level. The major advantage of 100 MBit/s is that four cores are enough, rather than the eight necessary for Gigabit transmission. This significantly reduces the connection costs and the cables are more compact.

Space-saving solutions where things are tight

Most modern machines tend to have little space available for the sensor/actuator level. If you then want to integrate sensors and small decentralised I/O systems with these restricted spaces into the Ethernet network, in handling machines for example, this can cause problems. The Cat.5 Ethernet cables that are generally used today often need too much space because of their large outer diameter and bending radii. Either the machine has to be built larger, or the cable has to be installed without the necessary bending radius specified for installation. This can result in damage to the cables and to failure.

Lapp has developed the ETHERLINE® EC cables especially for these applications. The 4-core Cat5e Ethernet cables are only 5 mm thick and allow a small minimum bending radius of just 16 mm. This means that even drag chains can have very small dimensions, with a minimum bending radius of 40 mm. This is achieved with a compact star-quad structure and thin AWG26 braids. The star quad design means that the cores are not twisted in pairs, as is normally the case with data cables, but all four cores are twisted together. The robust PUR outer sheath enables the cable to be used with high mechanical stresses or in oily environments. The M8 connector provides another way of saving space. It is considerably smaller than the M12 connectors commonly used in Industrial Ethernet. The compact ETHERLINE® EC cables and M8 connectors are also available as an assembly, which combines robustness with impermeability complying with IP67.

The examples show that graduated Ethernet cabling solutions can be used to achieve tailored networking. Existing plants can already be optimised to provide the necessary data rate, mechanical stability and environmental conditions that make them ready to be part of the Smart Factory of the future.

Ethernet cabling solutions for the SmartFactory