Industrial 4.0: The Era of Smart Factories

- By Marc Jarrault, MD, Lapp India Pvt. Ltd.

Industry 4.0is the legacy of its earlier three revolutions.The first industrial revolution took place when the method of new manufacturingprocess was introduced.This transformationinvolved going from hand production method to machines by using water and steam power.The second industrial revolution, also known as technology revolution was the phase of rapid industrialization. It denoted the extensive use of machinery in mass manufacturing of goods.The third industrial revolution,was considered to be the digital revolution. The era started when robots were added in the industrial automation sector to have machines help man in manufacturing goods. As of today, we are on the edge of the fourth industrial revolution, also known as Industry 4.0, which has enabled factories' production process to be intelligently networked. With Industry 4.0, the factories are shaping up to be agile to the ever-changing demands of manufacturing.

Industry 4.0 can be defined as the digital transformation of manufacturing. It leverages third platform technologies, such as Big Data/Analytics and the Industrial Internet of Things, that requires convergence of Information Technology,Operational Technology, robotics, data and manufacturing.This new revolution is principally based on comprehensive networking of company and business processes - from Enterprise Resource Planning (ERP) level to sensor level. It helps in ensuring 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 system. 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 of data network cables and connectors level will also play a critical role in its success. Although Ethernet cables and connectors have become the usual standardised technology, the requirements for Ethernet cables and connectors used in manufacturing environments are much higher than that of the ones with specifications used in offices. They need to meet various requirements depending on how they are utilised, especially in terms of data rates and mechanical robustness. The following factors influence the cable requirements for the Smart Factory.

Plants with 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.

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 IO 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 group, being one of the world’s leading suppliers of integrated solutions and branded products for cable and connection technology, is already helping in shaping smart factory initiative by meeting the challenges of the current era. We are actively re-thinking and re-defining the cable and connection technology to meet the challenges of the smart factory of the future.As a step towards this initiative, we have developedhighly flexibleETHERLINE® FD Cat. 6A.These cables can transmithighest data rates with consistent reliability in drag chains that are under constant movement with a data rate of 10 Gbit/s.In order to fulfil the Cat. 6A requirements, we recommend the use of M12 connectors where water-tightness and dirt resistance in accordance with IP67 are required.

We also offer space-saving yet robust solutions such as the 30 per cent thinner ETHERLINE® EC, suitable for use at sensor level which allows the tightest bending radii. Thanks to the robust PUR outer sheath, the cable can also be used with high mechanical stresses or in oily environments. Another extension to the ETHERLINE® products is the robust 4-wire Cat. 5e Ethernet® cables. These are also available as finished products with a pointed, space-saving M8 connector that is substantially smaller than the M12 connector, commonly used with Industrial Ethernet. Building on this innovation, we will be launching ETHERLINE® ACCESS, the managed and unmanaged switches at the Automation Expo’17.The switches along with data cables and connectors form Lapp’s offering for the industrial network solutions to ensure reliable connectivity for the smart factories era.