

White Paper Industry 4.0

Industry 4.0, Smart Factory, the Internet of Things, Internet of Everything – there is no shortage of buzzwords when it comes to the concept for modern industry. IT-based automation with systems and assemblies networked together

should ensure technological progress and the competitiveness of the company. What is behind all this, and what needs to be considered for the infrastructure required?



The first industrial revolution is nearly 250 years behind us. Machines with steam and water power replaced the muscle power of workers, allowing the production of large, heavy goods that were simply impossible with manual labour. The start of the 20th century saw the Second Industrial Revolution, with division of labour supporting mass production. Conveyor belts permitted the efficient production of large quantities of goods, but still with the majority of the work carried out by humans. Only during the wave of automation in the Third Industrial Revolution about fifty years ago were heavy physical activities, dange-

rous and unhealthy work and systems that required high precision and repeatability increasingly handled by machines and robots. The worker doing the work became the system operator, the controller. Despite the high level of automation in factories, robots, machines and systems remained limited to predetermined specialised tasks. That only changed with the Fourth Industrial Revolution, which in the modern parlance of our times is known as Industry 4.0.

It arrived more gently and discreetly than the three before it, but has changed the production world more comprehensively than its predecessors. The simple idea of networked systems is based on a concept in which production systems independently exchange data not only among themselves but with the products they manufacture, allowing mutual control.

Comprehensive networking

The central component of the networked production facility is the so-called Smart Factory. Its primary feature is a greater use of information technology (IT), permitting flexible production as well as appropriately designed materials management and logistics. This approach, often also called Smart Industry, offers economic advantages – but it is only an intermediate step on the way to Industry 4.0. The goal is to make all processes, from design to materials management and from production to sales, thoroughly networked together – even including the processes of subsidiaries, service providers, suppliers and customers. Many a future-oriented company had already implemented this strategy before the term „Fourth Industrial Revolution“ was coined.

Autonomous Communication

In the production halls of Industry 4.0, production systems communicate with one another and with the product they are fabricating. Systems order raw materials from the warehouse, control production, test the finished product, prepare the documentation and request the transport of finished products and even the disposal of recyclables and waste. They initiate actions independently, both in their own company and in others, controlling one another. In principle, humans are no longer needed on the factory floor. Intelligent, highly automated systems ensure top reliability, outstanding fabrication quality and minimum tooling and downtime. Highly networked production offers a great deal of flexibility even for small lot sizes.

This is possible due to a modern, open concept that has been the norm in IT for years. Systems, assemblies and components are compatible with one another, significantly simplifying operation, service and retoo-

ling. Politicians are supporting networked production with extensive initiatives: Industrie 4.0 in Germany, l'Industrie du Futur in France and the Industrial Internet Consortium (IIC) in the United States.

Internet of Things and Big Data in industry

To be able to network systems, devices, sensors and actuators together, you need an IP connection. Between locations, they are connected to one another through the Internet, which is the origin of the term „Internet of Things (IoT)“. Since nowadays nearly everything is available with an Internet connection, the term has been expanded to „Internet of Everything“, or IoE.

To implement the concept of Industry 4.0 successfully, with all its numerous networked components, immense quantities of data (Big Data) must be transmitted on the network quickly, securely and reliably. Instead of staying in its protected office environment, IT has to work in harsh industrial environments where dust, moisture, chemicals, mechanical stress and special requirements for electromagnetic compatibility (EMC) are normal. Not only Ethernet, which dominates IT, but also Profinet, popular in production, must be used. At the same time, it is essential to take future developments into consideration to stay ready for the future, and to design the IT infrastructure to be ready for them now.

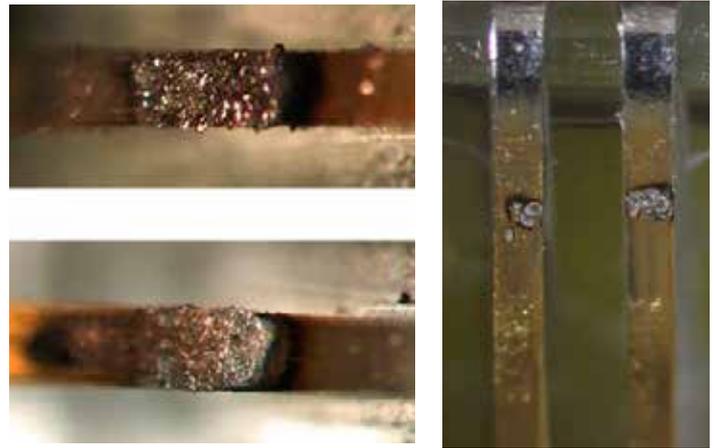
Special requirements for cabling

The basis of industrial IT infrastructure is cabling. Cables and especially connectors have to be particularly reliable and robust, and even non-technical people have to be able to handle them simply, safely and securely. This is particularly true when using Remote Powering, in which the device also receives its power through the data line. The best-known examples of this are the different variants of Power over Ethernet.

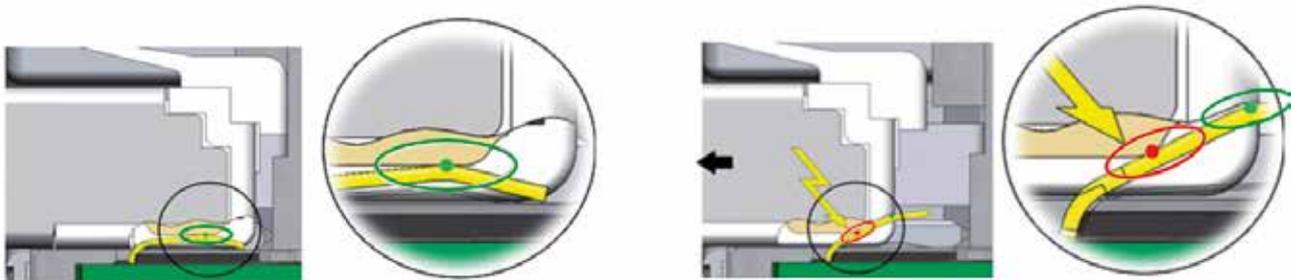
Remote Powering represents an additional stress on cables. For example, when a cable is unplugged during operation, this results in sparks that cause irreparable damage to the fine contacts of an RJ45 jack. Telegärtner jacks are designed so that the area whe-

re sparks occur are well separated from the contact area used for data transmission. Even after being unplugged under load numerous times, Telegärtner jacks still provide full transmission performance.

In addition to a design optimised for Remote Powering, Telegärtner RJ45 jacks have a patented built-in protector that prevents contacts from over-bending. It ensures that contacts are not bent too far when an RJ11 or RJ12 plug from a telephone or fax is plugged in.



If a device using PoE+ is unplugged during operation, this results in sparks that damage the fine contacts of the RJ45 jack.



If the plug is pulled during operation of Remote Powering, unavoidable damage occurs to the contacts due to the sparks generated. In a jack designed properly for use in the field, these sparks occur in an area (red) that is well separated from the contact area used for data transmission (green). As a result, even after being unmated multiple times under load, the jack still reliably provides high data rates.

Non-technical people often have difficulties distinguishing these from RJ45 plugs at first glance. However, they are narrower, and since the edges of the housing are somewhat higher than the contacts, they can over-bend the two outer contacts of the RJ45 jack. Jacks with contact over-bending protection are reliably protected from this damage. Even if an RJ11 or RJ12 plug is plugged in multiple times, these jacks still provide full transmission performance, offering the user the security of a fault-tolerant connection.

Minimum retooling and recovery times

Due to the high level of automation and the associated high investment, Industry 4.0 relies on high availability to work cost-effectively. Machines and systems only earn money when they are running and producing. Then there is the fact that faults rarely stay limited to the system in which they first occur. Processes and workflows are closely coordinated, both with one another and with those in other companies. Faults and interruptions usually have wide-range consequences. Recovery times in case of malfunction therefore have to be as short as possible. The same applies to retooling, for example when a machine or a device is modified or replaced. This work can be planned, but still needs to be kept as brief as possible. As an innovative solution provider, Telegärtner provi-

des a well-considered assortment of suitable product solutions. They are specifically designed to allow quick, simple on-site installation without special tools. Interruptions and downtime can be kept to the minimum necessary.



Gentle migration to Industry 4.0

Most companies won't network all their departments and processes at once. Investments already made in the past in existing systems and infrastructure will have to be amortised. Existing systems will therefore be modernised and integrated step by step. As a system supplier, Telegärtner offers a comprehensive product range for industry, office and wireless both indoors and out. Telegärtner is one of the few manufacturers worldwide building solutions for copper – both shielded and unshielded – fibre optic and coax systems. With our extensive, practical product range of innovative product solutions, Telegärtner can make an important contribution to Industry 4.0, which relies on reliable cabling.

Built to meet the concrete requirements of industrial users: The field-installable MFP8 IE RJ45 jack can be installed rapidly on either stranded or solid cable. The hinged parts of the shielding housing ensure particularly simple, quick assembly and are attached to the plug housing to prevent loss.



Summary

The concept of Industry 4.0 provides companies with the technical and economic advantage of innovative, highly flexible, efficient production. To that end, machines, equipment and products are networked together both throughout the company as well as with the systems of other companies, service providers, suppliers and customers. They exchange information independently and control one another with no need for human intervention. The basis of Industry 4.0 is a powerful data network of robust, reliable components that are structurally ready for the special needs of modern IT-based industry.

With the VM-Pro 8-8 connection module, damaged cables can quickly be repaired to keep downtime to the absolute minimum. It is also outstandingly well-suited for extending existing links, for example when equipment or systems are moved. There is no need for expensive rewiring.

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