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Pilz GmbH & Co. KG
Felix-Wankel-Straße 2
73760 Ostfildern
Germany
http://www.pilz.com

Press Message

# Digitisation, internationalism and the role of humans are in the spotlight – the future of automation is safe

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It is always expected to be present, but only when it is absent is it actually noticed: safety has the task of protecting people, machinery and the environment. In the past, safety and automation were usually regarded as two separate systems with at least partly conflicting goals. Practice shows that considering the safety functions together with automation technology creates a distinctly better starting position. The challenges of automation can thus be tackled with much greater ease.

The hallmarks of modern industrial society include rising standards of living, a wider range of products and greater individuality in products, which leads to a larger range of variants with ever shorter product life cycles. These developments present fresh challenges to manufacturing industry: products need to be made more flexibly, faster, more efficiently and with more sparing use of resources.

The task of automation is to make everyday life easier for people, support them in their personal and industrial environment, and help them to control the complexity of the processes that surround us. It is increasingly dictating the pace of development of modern industrial society. Reliability as well as efficiency in industrial production are inseparably linked to automation. It establishes the technical basis for mass production. But efforts to optimise production are governed by the law of the “magic triangle” of costs, time and quality.

Success in optimising the magic triangle depends crucially on how the following trends in automation are reflected: first, digitisation to make production and technology more efficient and flexible; second, internationalisation to cover worldwide demand and establish manufacturing operations worldwide; and third, the (once again) increasingly important role of the human factor in the production plant. The aspect of safety occupies a significant role in shaping these trends. If safety aspects are overlooked or only taken into consideration with hindsight, their practical implementation becomes more difficult or nigh impossible.

**Safety cannot be taken for granted**

Mechanisation heralded in the first Industrial Revolution when Edmund Cartwright introduced the first weaving looms in 1787. Back then, the main motivation was to increase productivity and barely anyone spared a thought for the safety of the weaver. By contrast, today the spotlight is focused equally on the efficiency of the production process and the safety of the worker.

Our constitution is the starting point for all considerations of the aspect of safety in automation: it enshrines the individual’s right to physical integrity. Furthermore, at least within the scope of the EU Machinery Directive the requirement of safety throughout all life cycles of a machine has acquired a quasi-statutory character. Nevertheless, in many countries safe machinery and working conditions are still not a matter of course. Even in Germany and Europe, safe automation as we know it is still a relatively recent arrival on the scene.

Until the end of the 1980s safety was interpreted exclusively to mean the strict mechanical segregation of the working areas of humans and machinery. 1987, 200 years on from the invention of the weaving loom, was when Pilz went to market with the first safety relay that reliably halted machinery in the event of a hazard situation – the PNOZ. And not until 1995, when Pilz brought the first freely programmable safety system PSS 3000 onto the market, was it possible to use electronic control circuits in safety technology. That was because the European laws and standards that had existed up to that time expressly prohibited the use of a purely electronic control system in safety technology. A change in the legislation was only brought about after tough negotiations with the Federal German Ministries of Economics and Labour and Social Affairs as well as the relevant European committees in Brussels. Today, software-based functions for safety technology are routine and are acknowledged as the state of the art.

**Digitisation: connectivity as the benchmark of productivity**

The use of internet technologies has become commonplace in everyday life. We do our shopping and banking on the internet, visit government departments online and upload photos into the cloud. To do all that, we need the relevant data in digital form. The Fourth Industrial Revolution – or "The Internet of Things" – will be the next step. In Germany, we have come up with an engaging name for the seamless use of Internet technologies in production: Industrie 4.0. The goal is the smart factory, which can adapt readily to flexible processes, changing production conditions and individual batch sizes.

We can still only hazard a guess at what possibilities will take shape when in future every machine, every plant section, every product and every factory is integrated and all the data required is permanently available in real time at the point where it is needed. The fact is, according to a VDI study 40 % of Germany’s economic growth is attributable to digitisation. So digital data and its efficient exchange will in future define the production process and represent the actual value in the process chain. Not only will the level of integration rise; it will actually become the benchmark for progress in productivity.

In technical terms, digitisation and integration are not the problem in the industrial environment. But it is particularly challenging to master the complexity of integrated systems. Wherever things get more complex, the risk of making mistakes rises. So in future the key tasks of modern automation solutions will include addressing the growing complexity of distributed, integrated machinery and systems in as user-friendly a way as possible.

Pilz offers the necessary support in the form of software tools such as editors that are suitable for automation and safety in equal measure. These tools guide the user and constantly check their inputs. Malfunctions are thus ruled out at the outset. The result is that automation and safety merge to provide a single solution – physically blended but logically without feedback and clearly distinct.

If all communication is decentralised, the demand for secure communication will rise. This includes safety aspects (machinery safety) and security requirements (operational security) in equal measure. New protection targets alongside the existing requirements now include the protection of production data, product and plagiarism protection, know-how protection, access protection and integrity protection. Pilz knows the safety requirements of mechanical engineering and automation companies, but also those of end customers. The latter, and their safety requirements, must be recognised. The challenge is to standardise the requirements of the two worlds of automation and information technology (IT) into appropriate, workable solutions. In future, both areas of safety will be closely connected: safety without security is

as unthinkable as vice-versa.

**Internationality: automation transcends borders**

The high maturity of information and communication technology is also promoting the use of industrial automation technology worldwide.

On the one hand local companies are automating their production in order to operate more economically. The more automated the production processes, the more challenging the set of requirements facing the people who work in the factory.

On the other hand companies with international operations have local production operations that follow the same identical, standardised processes worldwide. The aim is to minimise the number of different machine designs to be managed and implemented in order to reduce the organisational input and costs. The advantage here for the global player: they can deploy staff or machinery at several locations and manufacture products worldwide according to the same quality and process specifications. This exports safety architectures to the regions in question – even where only reduced or possibly no safety requirements apply locally. The existence of active end users, system integrators and suppliers worldwide is gradually aligning local standards – this is a hitherto widely overlooked advantage of global integration.

An important requirement for safety standards is a uniform international understanding of what safety is and when it is legitimate to talk of a safe machine or safe process. Pilz has set an international safety standard for training and advancement in creating the CMSE® - Certified Machinery Safety Expert qualification. In 2013, Pilz defined the international qualification in partnership with TÜV NORD. This qualification programme now teaches extensive knowledge of the machine lifecycle in 22 countries worldwide.

**The new role of humans**

DIN V 19233 [1972] defines automation as “equipping a device so that it operates as intended, either entirely or in part, without human intervention”.

The ideal of automation was therefore about replacing humans and ousting them from factory halls. Any plans

that strive for a factory from which humans have been banished are now outdated. Along with growing complexity it is becoming clear that humans are superior to machines in a variety of areas. Humans are indispensable in intelligent production because, unlike machines, they can independently assess situations and make autonomous judgements, for example – and make decisions.
If humans are to remain in production, workplaces must be adapted to the age and qualifications of the individual workers. Robots, for instance, can take on more tasks that are physically strenuous or especially monotonous in close coordination with the worker, while humans carry out higher-grade activities. Automation will then be able to provide answers to the issues that demographic change is throwing up.

Instead of mere cooperation, it will result in a form of work where humans and machines do not just work together but increasingly collaborate. In many areas that means the human will move closer to the machine, or humans and machines will perform a task together and therefore share a working space, enabling both parties to play to their strengths. The closer together humans and machines are, the more important safety becomes. Only if safety is guaranteed at all times will humans be prepared to work in harness with a robot as a “colleague”.

These new forms of cooperation and the human’s newly defined role call for new, dynamic safety mechanisms. These for example allow robots to continue working at a reduced (and therefore safer) speed when a person moves into the working area instead of having to be halted abruptly – and in future they may even be able to incorporate safe evasive strategies. Intelligent sensors and actuators in distributed systems will take over more and more functions from control units, leading to better interaction between individual machine modules and between man and machine. Safe motion controllers that are linked synchronously by real-time Ethernet already incorporate local control and evaluation functions. Intelligent systems such as the first safe camera system SafetyEYE for three-dimensional zone monitoring and the camera-based PSENvip protection and measuring system point the direction towards intelligent sensor technology.

The range of solutions for safety is as diverse as the forms of human-machine collaboration. It is not possible to make a sweeping assessment of whether a robot system or the safety technology used is safe. Every application requires a separate assessment of its technical safety. Safe human-machine collaboration is ultimately the result of interaction between normative framework conditions, a complex risk analysis based on this, the choice of a robot with the appropriate safety functions, the choice of the right additional safety components and, finally, validation

**Valuable safety**

The image of safety is changing: safety is no longer regarded as merely a normative obligation that is at odds with the objectives of the magic triangle. Rather, mature safety is today a prerequisite for production to be available and efficient.

Take digitisation, for example: it is a key to the future of automation. But if protection for humans, machinery or data is put at risk by sources of error, market acceptance will not be achieved. Safety has rightly been identified and defined as a factor that is critical to success in the Research Alliance’s recommendations for implementation to the German government. Pilz had been strongly advocating as much. Without safety (and that includes security), Industrie 4.0 will not work.

As an ambassador of safety, Pilz is pushing for the protective goal of the “safe workplace” to be recognised on a worldwide scale. Globalisation is promoting the creation of uniform standards. Wherever automation happens, the safety standards also rise. This elevates safety to a corporate value: companies can secure competitive advantages through the quality of their safety standards, and thus set themselves apart.

The role of humans in the smart factory is ultimately being redefined in order to improve production and make it more efficient as part of achieving the desired quality standards. Instead of machines replacing humans, the focus is now on how the two can collaborate, provided humans are adequately protected.
Future-proof automation solutions need to take account of the safety aspect from the outset. Because there is more to safety than just hardware; it is a function that extends far beyond purely technical considerations.

***Contact***

Martin Kurth
Corporate and Technical Press
**Germany**
Telephone: +49 711 3409-158
E-Mail: m.kurth@pilz.de

Sabine Karrer
Technical Press
**Germany**
Telephone: +49 711 3409-7009
e-mail: s.skaletz-karrer@pilz.de

Stephan Marban
Press Relations
**Austria**
Telephone: +43 1 7986263-13
E-Mail: s.marban@pilz.at

Manuela Bernasconi
Press Relations
**Switzerland**
Telephone: +41 62 88979-33
E-Mail: m.bernasconi@pilz.ch

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