



INDUSTRY 4.0  
**WHITEPAPER**

**Step 8** | Functional Networking as the Basis of  
the Self-Regulating Factory.

# Preface

## Evaluate and Use Data Intelligently

Industry 4.0 – wishful thinking becomes reality. A few years before the corona pandemic, the term “Industry 4.0” was a recurring buzzword in politics, business, the media and at various events. Germany in particular – the industrial location par excellence – was given a decisive role in this context. Our strengths: Automotive and mechanical engineering, electrical engineering, but also our vocational training concepts, e.g. dual studies or the close networking of industry with research institutions and universities. But not much had happened in this regard until corona suddenly turned the world upside down and digitalization gained momentum tremendously. This “digitalization storm” has also given the topic of Industry 4.0 a powerful boost.

But what has happened? Production has become “more intelligent.” And it is becoming clear that more and more “intelligence” will move into the shop floor. In this context, the IIoT, the “Industrial Internet of Things,” is often mentioned, generating more and more data as every sensor and actuator becomes intelligent and network-compatible. This growing mass of data can no longer be meaningfully processed using conventional methods. Sophisticated new IT technologies are therefore needed to extract relevant information and correlation from this data that is useful to users. Frequently used buzzwords that are mentioned in connection with these still young processes are “Big Data” and “Machine Learning.”

“Predictive Maintenance” is repeatedly cited as the prime example of these new technologies. Even though much of this is still in a development and testing phase, a great deal is being invested in these developments so that these technologies quickly find broad application. IT – especially the flow of information accompanying production – is only one component for the production process. On the same level is the material flow, which is just as essential for products to be created using information. There is still a great deal of potential here today that needs to be tapped in Industry 4.0 projects. Without automating the material flow, Industry 4.0 cannot achieve its goals on the shop floor.

There is still a long way to go for many companies. What we presented in the previous whitepapers is an important step, but no more than a partial step towards Industry 4.0. Even if we disregard the bold visions of individual products, integrated engineering, self-contained and crossplant supply and process chains from product creation to recycling, the next steps are also a challenge for production companies. Let’s take a closer look at that.



Dr. Karl-Heinz Gerdes, Founder of FASTEC GmbH



### About the Author

**Dr. Karl-Heinz Gerdes** is the founder and former Managing Director of FASTEC GmbH and has been active in the field of computer-integrated production for over 30 years. During his studies he was already working on microprocessor-controlled automation solutions. The development of decentralized control and networking solutions for interlinked plants with master computers was ultimately the guiding principle for the founding of FASTEC GmbH. The MES solution FASTEC 4 PRO, which is distributed by FASTEC today, was developed on this basis and has become even more sophisticated due to the experience gained from many complex customer projects.

# A Fully Automated Material Flow – The Next Step on the Way to Industry 4.0

Once the continuous flow of information is in place, the next step is to build a continuous flow of materials that complements the flow of information. Why?

The physical and information technology networking, the best possible interlinking of all processes and maximum transparency are the key to an efficiently functioning value chain and thus also to economical production. In a self-regulating factory, people, machines and processes can no longer be considered in isolation from one another – on the contrary: All information and goods flows must be viewed holistically and must be intelligently planned and controlled. We will come a lot closer to this step if we set up an integrated material flow and seamlessly link it with the continuous flow of information.

## With MES to Industry 4.0 – The Best Way to Achieve Your Goal.

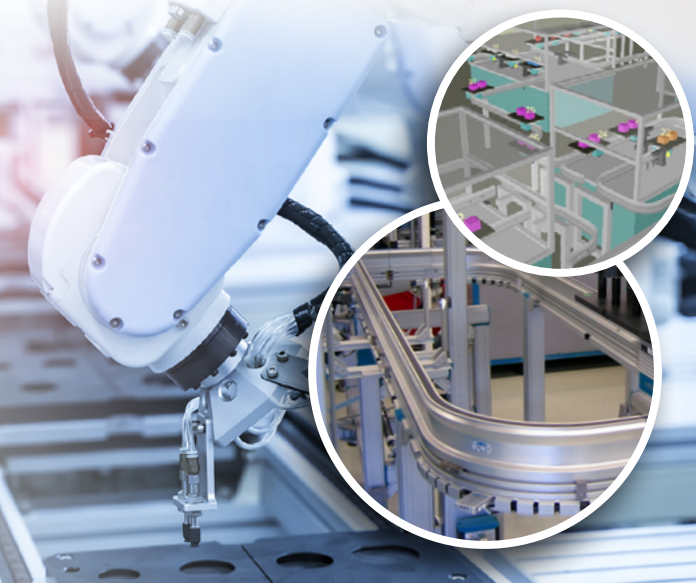
In the previous articles in this series of whitepapers, the importance of MES as the basis for Industry 4.0 was explained in its various functional facets. Our goal is to provide production companies with a helpful and practical guide, showing a realistic path that will step by step bring them closer to the big goal. However, we will continue to only consider the aspects of Industry 4.0 that affect the area of production.

## What Benefits Can Be Achieved Here?

- Through the interlinking of the entire processes, the throughputs are accelerated. This leads directly to a reduction in production and delivery times.
- In a continuous production process, only small buffers and intermediate storage facilities need to be implemented, as these are only required in the event of an incident.
- Costs can be noticeably reduced through more efficient use of resources and minimized overhead.
- Shift systems are irrelevant for machine production; in a self-regulating factory, they will lose much of their importance, since production can take place around the clock.

## What Do These Developments Mean for Manufacturing Companies?

- Intelligent automation is achieved. This consists of flexible machines with minimal set-up times, which are also universally linked to one another.
- The requirements for planning, coordination and adherence to plan specifications increase considerably, since clocking without buffers has no fault tolerance.



# What Can Be Implemented Today?



For the time being, let's say goodbye to the „real batch size 1“ – that is, to customer-specific products that are not created through selecting a configuration, but require a new or redesign and subsequently cannot be produced through a single-stage machining process without special tools (molds) on a machine.

Although 3D printing offers unprecedented opportunities in this area, it is still a long way from producing in quantities for a large and broad market. From our point of view, we're talking about Industry 5.0 or 6.0 in this context – but not 4.0.

Our "batch size 1" are product variants that are manufactured in large numbers, but are produced in smaller or very small batch sizes. These variants usually only arise through a differentiation in later process steps. Thus, we usually have complex products that consist of several to very many components assembled together, depending on the variant. We are looking at the manufacture of the individual components as well as the assembly of the manufactured components to the finished end product.

## This Approach Requires Three Things:

1. Reliable and accurate production planning so that all required individual parts are available for the final assembly. Production planning requires permanent synchronization of all assembly processes with component production.
2. A high level of flexibility in assembly, which makes it possible to manufacture many product variants.
3. A material flow that brings together all areas with their production stations or steps, assembly stations, etc. in an orderly fashion and supplies them with the necessary materials.

## What Are the Resulting Requirements for the Shop Floor?

1. The machines and automation systems have to produce and assemble more flexibly and with minimal to no set-up effort.
2. The intelligent material flow must be able to supply and remove all required raw materials and components (e.g. by intelligent transport robots).
3. The higher the quantities and the lower the variance of the product to be manufactured, the more efficient are interlinked, product-variable production and assembly lines.

## What Are the Consequences for an MES?

The mentioned seamless interlinking of information and material flow requires the integration into or connection of the material flow systems used in the shop floor to the MES. Up to now, independent software systems, so-called material flow or master computers, have been used to control the material flow. In the context of Industry 4.0, the MES and master computer must be seamlessly interlinked, ideally in one system. This further increases transparency on the shop floor. If real-time data from the material flow is now also incorporated into the real-time monitoring, an even more accurate picture of production is created.



## Further Goals of Industry 4.0

The vision of Industry 4.0 pursues more far-reaching goals, for example the “digital twin:” With a functional mapping of the complete shop floor system in the computer, e.g. implemented as a VR model, a “virtual production” would even be conceivable in which all processes can be simulated in advance in connection with Detailed Scheduling. Although this approach is extremely useful in the context of factory design planning for complex plant constellations, it offers little benefit for an existing production facility later on.

Only in the case of structure-related material flow bottlenecks, i.e. if material jams and overflowing buffers are possible in production, such a model would be able to provide useful predictions by simulating the stock development at the buffers.

This brings us from Manufacturing Execution Systems to the next logical step: The fully networked material flow and the resulting requirements for manufacturing companies. In recent years, increasingly flexible material flow systems have been developed for this purpose that can effectively support this step.

However, this is far from the „end of the line.“ We have now created the basis for a self-regulating factory at the shop floor level with the continuous networking of the information and material flow. In a further step, a supply chain must be implemented into which the shop floor is to be integrated. The ERP system is the leading system in this process and roughly plans the orders to be executed for production. This goes hand in hand with the fact that the ERP also schedules and orders the corresponding material requirements. Detailed Scheduling can then be carried out in the MES on this basis.

Für die selbstregelnde FaFor the self-regulating factory, this coupling has to be expanded into a control loop. It must enable production to compensate for external and internal disturbances. External disturbances are mainly problems with the supply of resources, e.g. delayed delivery of ordered materials. Internal disturbances are production disruptions, e.g. due to spontaneous machine breakdowns, above-average rejects or short-term staff absences. However, one should be aware that the decisions of an autonomously operating production control system only lead to meaningful results if there is an AI developed for it. This AI, in turn, should be mature enough to deliver results that are at least as good as, or better than a competent production manager with a lot of experience. Due to the large number of influencing factors, this step is certainly a major challenge for developers of production IT systems, but it is only a matter of time before AI is fully grown.



# INDUSTRY 4.0

# The Complete Industry 4.0 Whitepaper Series From FASTEC

FASTEC provides manufacturing companies with MES solutions for discrete manufacturing. As a leading MES provider, FASTEC has implemented a wide range of customized solutions in many projects since it was founded in 1995 – each unique in terms of the production processes and manufacturing methods involved. Our systems are used nationally and internationally in various industries.

We work in a practice-oriented, efficient manner and ensure that our projects lead to lasting benefits for our customers. Together with you, we develop suitable solutions for your requirements, which we then implement precisely, quickly and cost-effectively on the basis of our MES standard software, which can be configured in many ways. Our customers benefit from our wide range of experience. In the end, there is a result that convinces our customers: A flexible and easily expandable system with sophisticated functions. FASTEC users are enthusiastic about the numerous features of the software and its usability in everyday use.

Decide on FASTEC 4 PRO – for a custom-fit MES solution with maximum customer benefit.

We take you on a journey into digital manufacturing; our whitepaper series serves as a guide.

- Step 1:** What Is Industry 4.0? Where Is the Journey Heading?
- Step 2:** How Do I Find the Right Partner on the Way to Industry 4.0?
- Step 3:** 10 Tips for MES Implementation – What You Should Keep in Mind.
- Step 4:** Focus on Transparency:  
The Modules MDA, PDA, Monitoring Etc.
- Step 5:** Focus on Optimization:  
Key Figures and How to Work With Them.
- Step 6:** Focus on Traceability:  
The Many Unknown Benefits.
- Step 7:** Focus on Planning:  
Save Time and Resources With Effective Planning.
- Step 8:** **Functional Networking as the Basis of the Self-Regulating Factory.**



# Stay Competitive in the Long Term – With Us.

FASTEC GmbH is based in Paderborn, Germany and specializes in the digitalization of production processes based on the in-house developed Manufacturing Execution System (MES) FASTEC 4 PRO. The modular standard software can be configured across industries, is compatible with future releases and operated intuitively.

FASTEC has been accompanying its customers on their way to digital transformation since 1995. Around 400 companies in over 20 countries use FASTEC 4 PRO in over 10,000 production facilities. Work processes are optimized and costs are reduced in the long term thanks to the holistic digitalization of production.

## We would also like to give you a good advice personally!

Our sales department will be happy to provide you with further user reports and information material! Or else, make an appointment with our sales department for a presentation at your location, in our company or via web. Of course, you can also experience FASTEC 4 PRO live and on site with our customers.

[vertrieb@fastec.de](mailto:vertrieb@fastec.de) or by phone at **+49 5251 1647-0**

Additionally, we offer videos of our software and customer solutions in our YouTube channel:

[www.youtube.com/FASTECGmbH](http://www.youtube.com/FASTECGmbH)

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