FASTEC

Software for Production

WHITEPAPER

INDUSTRY 4.0

Step 6 | Focus on Traceability:
The Many Unknown Benefits
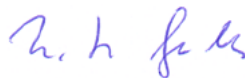
We digitalize factories

Preface

Complete Traceability as a Core Component of Industry 4.0.

The digitalization of production as a measure to increase efficiency on the shop floor has led to a massive increase in data from production processes. The use of this data is important for consistently high quality and productivity, but should not become an additional burden for employees. Custom-fit IT tools for the shop floor manage this balancing act; they can meet these divergent requirements in equal measure. In the previous whitepapers you got to know MES modules that record production data, determine key figures, bring transparency to your production and thus contribute to increasing your production efficiency. In addition, you were shown ways to systematically use this data in daily practice, in order to gradually improve your production performance. All Industry 4.0 approaches specifically aim to increase the flexibility of production companies through digitalization and automation and to give consumers more and more opportunities to influence product design (customer designed products). In this context, however, the safeguarding of consistently high product quality must also be considered as a benchmark of existential importance for manufacturing companies; precisely because the Internet, as a global and public platform, is also used intensively by dissatisfied customers to damage affected companies. Wherever consumers can be harmed by defective products – be it in the automotive or

pharmaceutical industries, but not least also in the food industry – complete process traceability is indispensable, primarily for the safety of customers, but also to limit corporate risks due to high claims for damages, to protect the company and product image and, where required, to comply with legal or insurance requirements.

The module Traceability, another component of an MES, provides the key to complete and consistent traceability. On the following pages, you will learn more about the requirements that are central to a traceability solution:

- Complete product-related documentation about the production process or even the entire value chain

- Limitation of defective products in the event of damage to minimize recall costs

- Comprehensive evaluation of the recorded and permanently logged data for process control and quality assurance

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.

One Module – Three Tasks
The MES Module Traceability Has to Fulfill the Following Tasks:

1 | Record or Track Relevant Data

This function is the basis for material and process trace-ability. It ensures that the production steps and the resulting process parameters are recorded and saved in real time (automated), mostly in the background. The data is recorded decentrally and compiled in a database.

2 | Create Transparency

In order to be able to decide whether a product meets the specified quality requirements, all process steps must be monitored online and compliance with the specifications must be checked.

To enable the production processes to be traced, the recorded data is linked to further information, e.g. which production processes the product went through in the process: Where and when was it processed, stored and tested by whom? What kind of material was involved? The use and evaluation of the data is also referred to as "tracing."

3 | Provide Control Functions

Control functions link quality-relevant data and make the decision on the basis of predefined rules whether, for example, a particular component may continue to be installed or whether it must be blocked for further processing due to possible defects. They are intended to filter out components or products for which there are quality risks due to unfavorable combinations of param-eters that are individually still within valid tolerances.
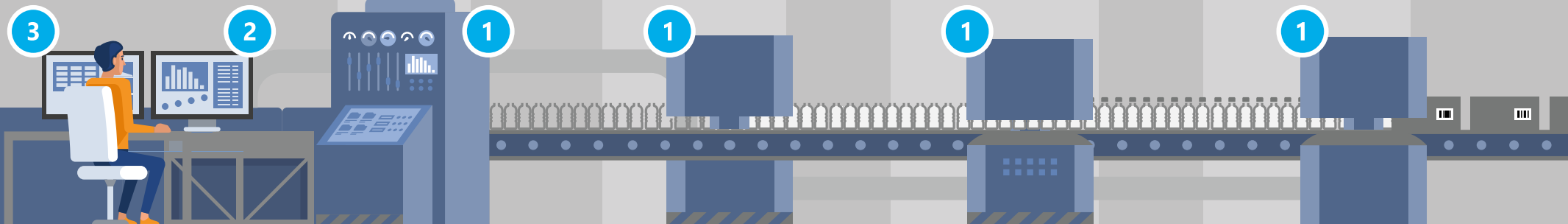
One Module – Three Tasks
1 | Track Relevant Data

First of all, it should be noted that a basic distinction is made between batch and serial number-related traceability. The first type is found primarily in batch-oriented production processes, such as those common in the pharmaceutical or food industries, but also in other industries.

The second type has great importance in automotive production and the manufacture of other, mostly complex and high-quality products. In principle, however, the same methods are used for both types. Current data from the production processes is the basis for traceability software. This includes information based on serial or batch numbers (e.g. about raw materials, materials, components or assemblies used), recorded process data, set parameters or the start and end of a work operation, the process stations and workplaces run through and last but not least, other resources used, such as tools and equipment.

Some of this data is also of interest for operational production control, such as the duration of individual process steps or the overall lead time. It therefore makes sense that the traceability software is integrated as a component in an MES, because this means that production-relevant data is also available in other modules.

The necessary data comes from various sources; it should be recorded automatically as far as possible and stored in the MES. In this way, they are centrally available. It is used via evaluations in which the data is filtered according to the desired criteria and visualized clearly.

There Are Good Reasons to Introduce a Traceability Solution as a Building Block of an MES:

- If the traceability module is a component of an MES, further MES benefits open up for manufacturing companies in addition to seamless material and process traceability, which first and foremost lead to more transparency and more efficient production through appropriate measures. Once the decision has been made in favor of a traceability solution within the framework of a modular MES, the system can also be expanded retrospectively with additional functions and adapted to new requirements.

- The seamless material and process traceability in the MES module Traceability should not only be seen as a chore (stipulated by legislation and customers), but above all as an opportunity to benefit from the functions as a company. How this added value is represented is explained in the next section.

One Module – Three Tasks

2 | Create Transparency

In order to create maximum transparency and ensure high data quality, all process-relevant workstations and test stations must be integrated into the system.

There are various options for this, which are determined by the component to be integrated: Whether it is an automatic line, a semi-automatic or manual workstation, there are often different connectivity solutions for each type of line or workstation. You should find out which of these is best for you together with an experienced MES partner.

Options for Collecting Data Include the Following:

- Reading in serial and batch numbers in the form of optical codes (e.g. data matrix or barcode) using a 2D/3D scanner. This can be done manually using a hand scanner or automatically using special cameras.

- Radio-based systems such as RFID, whereby tools in use, for example, can be automatically identified and documented without human intervention if they are close to a reading device.

- Manual entry of individual measured values and assignment to serialized products or batches.

- Continuous acquisition of process values through the integration of machine controls or sensors using I/O modules.

- Fully automated transfer of detailed result data sets for all process steps from machine and line controls via system interfaces (Simatic S7, Beckhoff TwinCAT, OPC UA etc.).

- Transfer and consolidation of production-relevant data from external systems such as ERP, QMS or host computers using various interfaces (e.g. via SQL, file import, web services, etc.). As all data is available centrally in the MES and can be analyzed using individually configurable evaluations, an overview of the entire internal value chain is possible, thus creating a transparent production process. This transparency helps to improve processes and makes them more efficient in order to avoid any kind of waste.
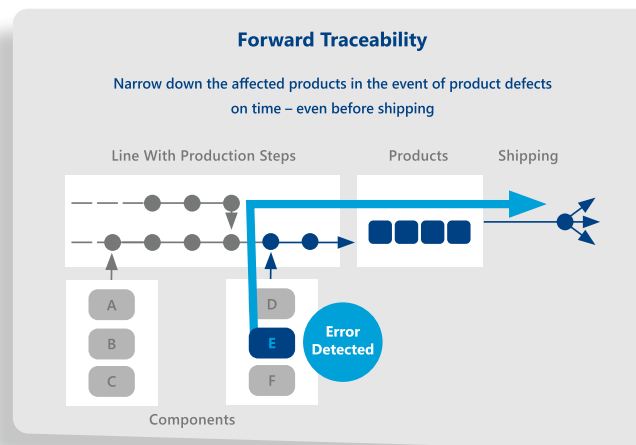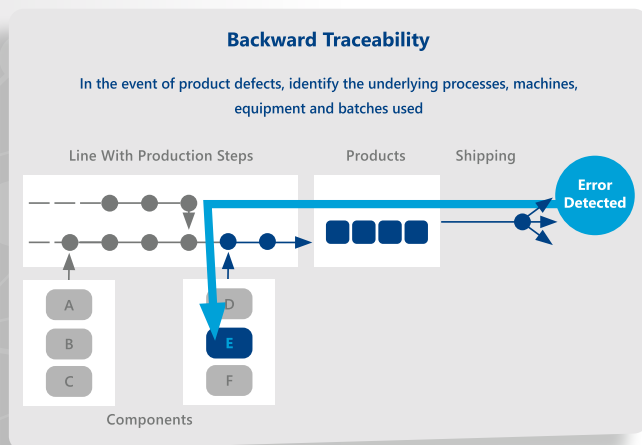
One Module – Three Tasks
3 | Control for Stability, Quality and Safety

Let's move on to the most important function of the module Traceability: Quality Assurance. The quality requirements of the customers for the product as well as the manufacturer itself make quality assurance indispensable. In addition, there are legal requirements to be met: The Equipment and Product Safety Act, for example, forces companies to introduce measures that rule out any risk from the product placed on the market.

Stable processes are required to ensure quality. Process control charts as well as histograms are available for continuous control of the manufacturing processes. Deviations must be identified and corrected as quickly as possible, preferably during the process.

Automatic process data monitoring is a suitable method for this. Once the products have been manufactured, **backward traceability** enables a targeted analysis of the causes of defects that have occurred. Using **forward traceability**, further products affected by possible errors can be narrowed down and their further processing can be stopped or delivery to the customer prevented. This type of safeguarding based on quality-relevant data reduces the number of possible defective products and significantly saves costs in the case of product recalls or preventive quality assurance measures compared to conventional measures. Traceability as an MES component goes beyond this functionality and enables intervention in the processes, e.g. by means of process interlocking.

Here, during the production process, e.g. in the event of an accidentally nonexecuted work step, exceeded parameters or measured values that fall outside the norm, operative intervention is made in the production process and further processing is stopped. Quality information about the raw materials or preliminary products used – both in internal and external production – can also be used during production for automatic locking of subsequent processing steps thanks to seamless material traceability. For example, if a supplier recalls a batch, the Traceability module can immediately prevent further processing of all products manufactured with it. The rules underlying the interlocking can be defined depending on the product or the production processes.

Backward Traceability

In the event of product defects, identify the underlying processes, machines, equipment and batches used

Line With Production Steps   Products   Shipping

Error Detected

A
B
C
D
E
F

Components

Forward Traceability

Narrow down the affected products in the event of product defects on time – even before shipping

Line With Production Steps   Products   Shipping

A
B
C
D
E
F

Error Detected

Components

With Traceability Towards Sustainable Production

The three core functions of traceability software are the basis for fully automated and partly self-organizing production.

The data networking of interrelated production steps in order to optimize the entire value chain is also the goal of Industry 4.0. The decision in favor of traceability software is therefore not only a quality assurance measure, but also a step towards Industry 4.0.

Data is the basis for process optimization using statistical methods. Big Data and machine learning have taken these methods to a new, higher level. The price for this is huge amounts of data. With traceability data, you create the necessary data basis.

In Conclusion – Note for Successful Project Implementation:

The software provider should meet three important requirements. The provider should

- firstly, offer a highly developed, flexibly configurable standard solution,

- secondly, the willingness to make cost-effective and also release-capable, customer-specific adaptations,

- and thirdly, have extensive experience in the integration of the various, in some cases highly customer-specific, process plants.

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 sophisticted 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.

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

www.youtube.com/FASTECGmbH

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