FASTEC
Software for Production

INDUSTRY 4.0

WHITEPAPER

Step 7 | Focus on Planning:
Save Time and Resources With Effective Planning.

We digitalize factories

Preface
A Good Plan Is Also Needed in the Future

The vision of Industry 4.0: The networked factory of the future organizes itself, is tailor-made, but affordable. Products, machines, tools – everything communicates with each other. Because the intelligent factory is networked with its customers and suppliers, it knows at all times what is to be produced when, what time, which preliminary products and raw materials are needed for this and when they are available. In theory, this creates unprecedented flexibility, which in turn enables small series or even single-part production („batch size 1"). The visionary goal: Small quantities at the cost of mass production. At least that is the concept. Industry 4.0 – is it wishful thinking or will it soon become reality? What are the requirements that must be met so that the vision can become reality? More importantly, where or to what extent does it even make sense?

Realistic Assessment of Customer Needs
From my point of view, there is a classic dichotomy in products: The things of everyday use and the „non-daily" consumer goods. Does it make sense to personalize margarine, milk or toilet paper? Certainly one or the other in marketing has the idea of an individually adapted diet in mind, which includes individual diets and other health characteristics already in the basic food – but is that a concept for millions and millions of customers? From today's perspective, probably not.

The situation is different, however, for the objects that we carry with us or with which we surround ourselves – i.e. clothing, accessories, the furnishings of our home or our vehicles such as cars, two-wheelers, boats, etc. In production, we will therefore continue to distinguish between mass-produced goods and more individualized goods, but we will probably have to consider a further increase in individualization. What does this mean for production planning? Will it become a crucial point with regard to the advancing customization of products up to batch size 1? What are the consequences of gradually moving away from mass production on which classic production planning is based? How can an efficient process flow be ensured on such terms? Although software development is progressing rapidly, planning by people still dominates in many cases, who are more or less well supported by current technologies. It is becoming apparent that artificial intelligence will support us even better in the future. But we don't have to wait for tomorrow – even today it makes a lot of sense to support production planning with a planning system. You will find out which functions and advantages the planning module of an MES can offer you on the following pages.

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.

Optimal Planning – The Heart of Every Production

The professional planning of production processes is essential for every production company and forms the basis for cost-optimized production with high adherence to schedules. The module Detailed Scheduling of an MES supports you in this.

Plan Comfortably and Effectively ✔

Meet delivery deadlines, minimize stock, reduce lead times, lower production costs and at the same time be able to react flexibly to changes in plans: All these requirements can be mastered with the MES module Detailed Scheduling. Compared to planning methods with spreadsheets or planning boards, using the MES with an integrated planning module saves a lot of time. Various evaluations and dashboards provide information on the current status of production and make it easier to readjust in the event of deviations from the plan. Current production data and machine statuses flow into the Gantt chart display in real time. If, for example, a machine is malfunctioning, it is possible to react immediately. Upcoming maintenance dates can also be actively taken into account in the planning. If an order is to be brought forward spontaneously, it can be moved quickly and easily using drag & drop and the effects on the other orders are visualized immediately and automatically. Individual requirements can be answered with various module extensions. For example, automatic detailed planning or personnel and material requirements planning offer decisive added value.
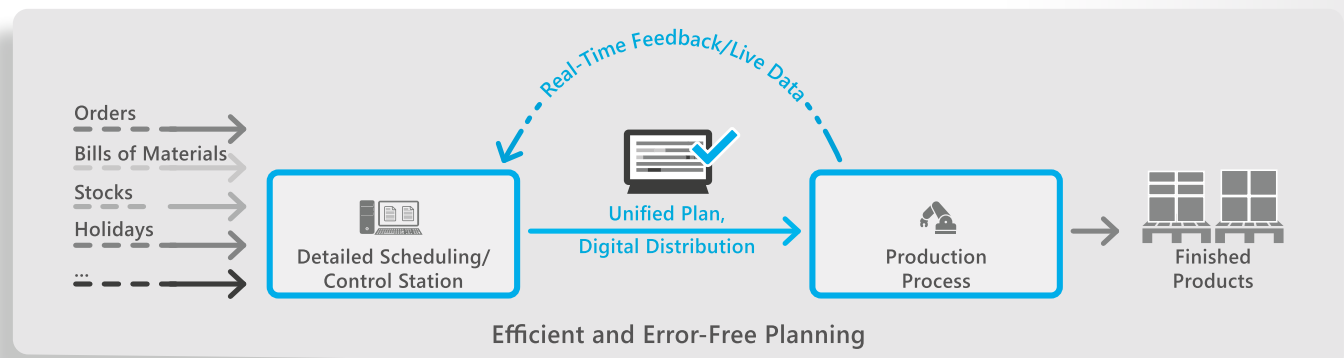
Reduce Time Required ✔

The planning module takes over the roughly planned production orders as well as the planned orders from the ERP system and can plan them capacitively based on the available resources. A manual, semi-automatic or optimization-based automatic planning function is usually available to the planner. The planning module compares the following questions with previously set framework conditions:

- Are there enough personnel, material and operating resources available to process the work steps?
- Are there alternative working operations or necessary transport and idle times?
- Do manufacturing order networks have to be included?
- Are individually defined rules adhered to, for example regarding sequences, dates, capacities, etc.?

This allows the planner to significantly reduce both the time required and planning errors.

Minimize Costs ✔

With a higher level of planning accuracy, the production planner can minimize buffer times or react early on to unexpected delays, for example due to material not being delivered on schedule. In addition, the creation of optimal set-up sequences reduces set-up times and the associated costs. At the same time, reduced set-up times create free capacities for further orders and thus increase throughput. In addition, the detailed planning provides specific information on how much of which material is required at what point in time, which means that stocks can be optimized and their costs reduced. In this way, the production planner finds the best possible balance between delivery reliability and capital commitment when using capital-intensive preliminary products. Good Detailed Scheduling therefore minimizes production costs and makes better use of machine utilization.

Real-Time Feedback/Live Data

Orders
Bills of Materials
Stocks
Holidays
...

Detailed Scheduling/
Control Station

Unified Plan,
Digital Distribution

Production
Process

Finished
Products

Efficient and Error-Free Planning

We digitalize factories

Detailed Scheduling:
Functions and Benefits at a Glance

✔ Manual, semi-automatic or automatic planning

✔ Consideration of resources, restrictions and planning specifications

✔ Simulation of different planning scenarios

✔ Quick overview of all important order information

✔ Ergonomic and user-friendly operation

✔ Provides better planning results efficiently, quickly and economically

For the production planner, this means significantly less time and planning effort compared to conventional planning methods. The planner can even integrate urgent or high-priority executive orders quickly and easily into the current order planning without losing track of things. In doing so, the planner can immediately make concrete statements about the target dates of the rush orders or about the effects on the delivery dates of other orders.

Always Stay on Top Of Things
The planning module gives the production planner an overview of the current planning situation at all times. This transparency and the comparison of the planned with the actual production process enable quick detection of deviations from the plan. Rush orders, changed order priorities, etc. can be taken into account in a planning scenario with just a few clicks, as can malfunctions on a machine or the absence of a machine operator. If this results in unavoidable postponements, customers can be informed immediately.

Schedule Production Orders Quickly and Easily
The foundation of production planning remains the ERP system with its master and transaction data. The data required for planning is usually taken from the ERP via an interface. Once the Detailed Scheduling has been completed, the results can be made available to the ERP system for further processing. This requires an interface that allows not only the import of data, but also the writing back of the planning results. The ERP system thus receives information relevant to production and sales from Detailed Scheduling, for example:
• about the demand for the material used
• about the planned utilization of resources or
• resources currently affected by required maintenance.

The production planner can schedule the individual operations to the machines on the basis of the orders and work schedules transferred from the ERP system. Here, the system checks individually defined planning rules (e.g. sequences of operations or production orders, deadlines, etc.) and the availability of resources and their capacities. If conflicts arise during the scheduling of production orders or operations – for example, if confirmed delivery dates are postponed due to a resource bottleneck or if there is insufficient personnel capacity to process an order – the production planner is immediately alerted visually. In this way, the planner can take countermeasures, e.g. by postponing and splitting operations, or possibly also increasing capacity by adding extra personnel.

**Planning Must Take OEE Into Account**
In order for planning to deliver realistic results, it must take the OEE into account. Otherwise, even small disturbances or performance losses can quickly destroy the entire plan.

Planning Scenarios – What If?

If the boundary conditions for planning change, the production planner needs detailed answers to complex questions immediately. For example:

- A machine has broken down. How can the orders still be completed on time?

- A rush order has to be scheduled retrospectively. How do the delivery dates of other orders shift?

- One machine is always a bottleneck. Is it worth buying another machine? What will this change?

With the help of the planning scenarios, the production planner can simulate various what-if scenarios, which can be analyzed immediately thanks to the clear evaluations in terms of delivery reliability, throughput times, set-up times, capacity utilization, etc. The best possible scenario can then be transferred directly to production.
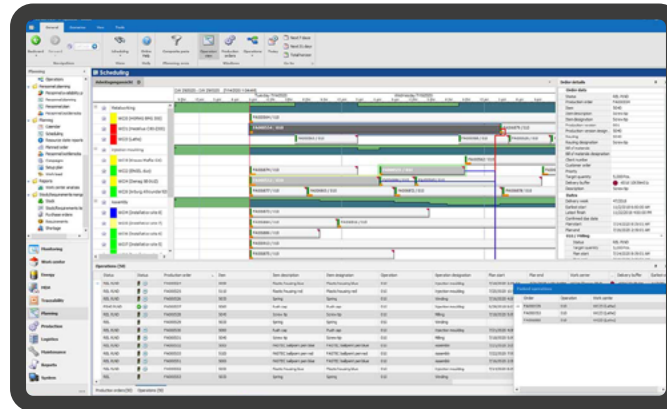
At a Glance:
Additional Module Extensions

+ Automatic Detailed Scheduling Support
Above all, production and planned orders with complex or-
der networks, a large number of operations and alternatives,
complicated set-up processes or many bottlenecks can be
effectively planned for the resources thanks to automatic
Detailed Scheduling support. Using mathematical algo-
rithms, directly executable production plans are generated.
The production planner initiates this time-saving support
function with a click of the mouse. A feasible production
plan is calculated and displayed in the Gantt plan based on
the ERP master data, the logical and scheduling dependen-
cies of all work operations, stored optimization criteria,
capacities and availability of resources, etc. The goal is ef-
ficient planning support, especially when planning a large
number of orders, whereby the production planner always
has the upper hand and always has the opportunity to
make independent decisions and intervene in the planning.

+ Planned Orders
By entering desired dates and priorities, you can control
how the planned orders are scheduled. The result shows
whether the planned order can be implemented as re-
quired and what influence this has on the rest of the
production plan. The planned orders are scheduled
taking into account the batch sizes stored and the
limited production capacities.

+ Operating Resources Availability
When scheduling orders or operations, the availability of
operating resources is checked. It can be defined whether
scheduling is prevented or whether warnings are displayed
if the resources are not available on time.

+ Material Availability Planning
On the basis of the planned independent requirements
and production orders, the material requirements plan-
ning in ERP generates the order proposals, taking ware-
house stocks and open purchase orders into account. In
Detailed Scheduling, the material availability of the re-
quired components is checked when planning orders
or work operations. You can define whether scheduling
is then prevented or whether warnings are displayed if
the material is not available on time. The resulting inven-
tory history for a material item is calculated by Detailed
Scheduling and can be retrieved.

+ Personnel Requirement Planning With Qualifications
In many production companies, personnel is also a (further)
limiting factor in Detailed Scheduling. Often, it is not the
number of staff available that is decisive, but primarily the
required qualification of the personnel. It is helpful if the
qualification(s) for each employee can be stored individ-
ually in the MES and the Detailed Scheduling takes them
into account when scheduling an order. This prevents or-
ders or work operations from not being carried out due
to a lack of suitable personnel.

+ Management of Static and Dynamic Set-up Matrices
In many production facilities, set-up processes are part of
everyday life. Set-up changes are usually not always con-
stant processes, but depend on so-called predecessor-suc-
cessor relationships. As a result, set-up changeovers cause
different efforts and result in different set-up times.
Dynamic set-up matrices or, alternatively, set-up rules can
map this behavior. Set-up matrices are still easy to main-
tain with a manageable number of set-up transitions; set-
up rules, on the other hand, are mainly used if the large
number of set-up times means that they can no longer be
managed using a set-up matrix.

+ Preliminary Planning
The task of the preliminary planning is to bundle the same
individual orders. As a result, many (mostly small) individ-
ual orders become larger production complexes with cor-
responding order networks, which are then produced in a
coherent manner. This also creates a better overview and
avoids possible set-up time losses.

Conclusion: An MES Planning Tool Provides Valuable Support in Order Planning

Benefits of Using an MES Planning Tool:

- Better results, lower costs
- Reduced set-up times lead to time savings in terms of personnel and machines
- Improved scheduling reduces material supply costs
- Faster throughput times shorten delivery times
- Fewer delays improve adherence to schedules
- Optimized use of resources reduces costs and improves the result
- Planning taking into account the available capacities: All limiting factors and their capacities are included in the planning
- Multi-resource planning: All the resources required for a production or planned order are taken into account, i.e. machines, personnel, material and additional resources; these can be planned in parallel in terms of capacity
- Consistent transparency: From the individual production order to the entire production plan
- Time savings when creating plans, especially through the use of automatic forward and backward scheduling
- Automatic sequence planning, e.g. taking into account dynamic set-up times
- Fast response to changes, e.g. in the event of unexpected machine disruptions, rush orders or executive orders as well as less disruptions in the control of plan changes
- Higher customer satisfaction through improved adherence to delivery dates

- Creation of alternative planning scenarios enables comparisons
- Safeguarding investment decisions through comparative planning scenarios
- Quick detection of bottlenecks and detection of optimization potential
- Adaptable through module extensions, e.g. personnel requirements planning, material requirements planning, etc.
- Optimization of benefits through combination with other MES modules (e.g. PDA, MDA, Maintenance, Production Logistics)

The entire company benefits from these diverse advantages and far-reaching benefits. However, Detailed Scheduling can only provide these benefits in combination with other MES modules. After all, the basis of good planning is data that reflects the current status of production. This combination with other MES modules is also the best basis for an Industry 4.0 solution. To summarize again and to build the bridge to Industry 4.0: A comprehensive MES solution creates transparency and helps users to keep a close eye on their production, to find weak points and to analyze processes in more detail in order to make targeted improvements. Building on this transparency, Detailed Scheduling then helps to plan better. In the next step, the production can be expanded to an Industry 4.0 solution, because the basis for this is a continuous flow of information and seamlessly interlocking processes. If this foundation is not yet in place, further steps are premature and ultimately not recommended from an economic point of view. The necessity of a radical reconstruction of the existing production is only given in very few cases. This should not mean „business as usual." Above all, it is important to work continuously and sustainably on improving processes and procedures. Taking care of the important tasks without neglecting the urgent ones is crucial for the long-term success of the company.

The following questions remain: How should the company develop further? Where is the journey heading? But also: Where do problems occur again and again? Which correlations always lead to problems? For the latter, an MES is an ideal tool that provides answers to many of these questions. It helps us a great deal to first understand our own production better and then to improve it. Let us be aware: Networked production in terms of Industry 4.0 has a much better chance of becoming a reality if it is based on clear figures, facts and an understanding of interrelationships.

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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