



# WHITEPAPER

## OEE-Manual

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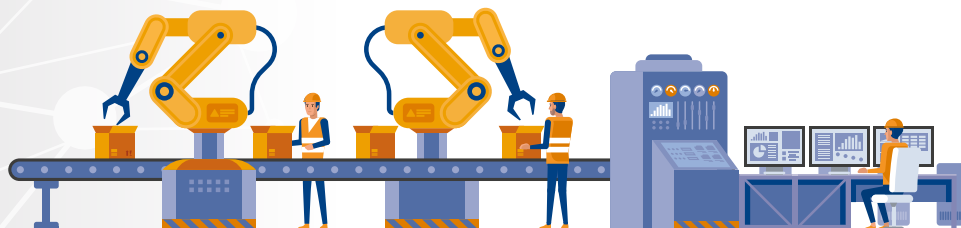
The OEE (Overall Equipment Effectiveness) ratio evaluates the productivity of equipment in production. The calculation can be automated with little effort and the data collected enables production to be monitored in real-time. The transparency created in this way makes it possible to react quickly to deviations.

## OUTLOOK:

With the help of OEE, a company's productivity can be increased without major costs. More output per unit of time at the same operating costs, less stress and unrest in production due to the reduction of disruptions – OEE can thus contribute significantly to increasing margins. Reason enough to take a closer look at the topic of OEE.

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# Measure Instead of Estimate

Because your Gut Feeling is Deceptive

Time and costs are the decisive factors for the success of a production company. However, many companies are hardly aware of the potential for optimization in production. If they were aware of the loss of profit margins – they would immediately address the issue of production optimization as a top priority.

The reason for this actually incomprehensible lack of action is the lack of transparency in production. The figures available there often do not allow for any conclusions about the existing potential. And „as long as things are running smoothly,“ many companies see no need for action. However, they are wasting a lot of money and potential as a result. In many production companies, productivity is still not measured consistently and systematically. Often, the number of units produced serves as an indirect indicator of productivity. If a certain number of units is achieved per shift, for example, production was satisfactory; if not, it appears to be less acceptable.

However, producing according to gut feeling is not a good method, because gut feeling is at best suitable for comparison: If it runs as usual, it runs well. If it goes differently, you rate it as less so.

- **Being Too Close**

This is a situation you also know from your everyday life. The question is: Do you see your child growing? The answer: You don't because you are constantly and very close to it. You only perceive it when a relative or friend says: „My, how you have grown!“ to your child after he or she has been absent for some time. The conclusion is this: Only a certain distance creates clear vision. This also applies to production.

- **Transparency with Figures, Data, Facts**

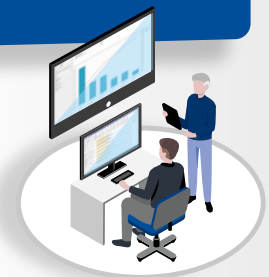
It is highly doubtful that the „gut feeling“ method can be used to produce with maximum productivity. Only what can be measured can be permanently improved. In production, this is where the OEE indicator comes into play: OEE (Overall Equipment Effectiveness) assesses productivity in production companies. The transparency achieved in this way enables a faster response to unforeseen events, such as malfunctions. With the help of OEE, a company's productivity can be increased without major costs; OEE can therefore make a significant contribution to increasing profit margins. More output in the same time at the same operating costs, as well as less turmoil and stress in production due to fewer disruptions, are rewarding and thus motivating incentives.

- **Example for the Financial Potential**

Let's take a machine that is used in 15 shifts per week for 50 weeks per year. With an operating hourly rate of only EUR 50 including the machine operator, a 1% increase in output corresponds to cost savings of EUR 3,000 p.a. Average rates of increase through an OEE implementation ranging from 5-10%.

### Higher Productivity Means:

- Lower costs in terms of staff and machine hours due to shorter order run times
- More output per shift
- Fewer disruptions – smoother processes reduce turmoil and chaos



# Examples from Production

## What are Malfunctions?

### Let's get started with some well-known statements about productivity:

- The more complex a machine or plant is, the more prone to faults it is in general. Due to its complexity, there are more potential sources of malfunctions; thus, the frequency of malfunctions inevitably increases.
- As the frequency of setup changes increases, so does the number of malfunctions.
- Machines run more reliably in steady state. This is why single-product lines (monolines) run better than lines with constant product changes.
- The susceptibility of a line to faults increases with age – this is where abrasion shows its effect.

**The easyOEE productivity measuring device is a tool for recording machine data availability, performance and quality - simply and quickly, as the name suggests.**

#### • Example 1

A pharmaceutical production company wants to test whether OEE recording is useful and uses the device on a single-product line. After a good two weeks, the production manager reports that productivity on this line has doubled. The reason for this increase was the recording of short downtimes. These stoppages on the line describe downtime that is less than two minutes. The realization of the effect that the sum of the many short downtimes has on the total shift time was enormous. While it was known beforehand that the line was stopping more frequently,

the actual quantity was surprising. The service technicians of the equipment manufacturer were then informed and analyzed and eliminated the causes at short notice. This prevented expensive losses in the long term.

#### • Example 2

The extreme dependence of OEE on the Lot size became visible for the first time through the OEE recording at a food customer. It became clear how much the many very small orders massively reduced productivity due to setup and cleaning processes. As a result, the sales department took countermeasures. The newly gained transparency also helped to massively reduce reaction times to machine malfunctions as well as setup and cleaning times. Overall, it was even possible to reduce shift times despite increasing throughput, which led to lower personnel costs.

#### • Example 3:

At a meat processing company, it became clear from the OEE recording that the existing three slicers formed the bottleneck in production. They were then replaced by a new, more powerful slicer, which also led to a sustainable increase in productivity

### Summary:

The OEE takes a holistic view of equipment productivity. Based on the recorded data, optimization measures can be implemented that lead to an increase in productivity. After just a few weeks, the data is resilient and provides transparency.

### Customer Success:

- A pharmaceutical manufacturer increases OEE on a packaging line from 40% to 80%.
- A Swiss food producer invests EUR 400 and saves CHF 75,000
- A meat product manufacturer doubles output within 2.5 years

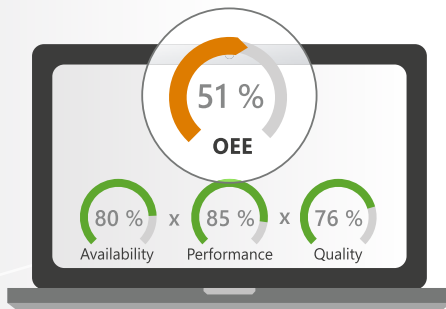


# What is Behind OEE?

Simple Key Figure with Great Significance

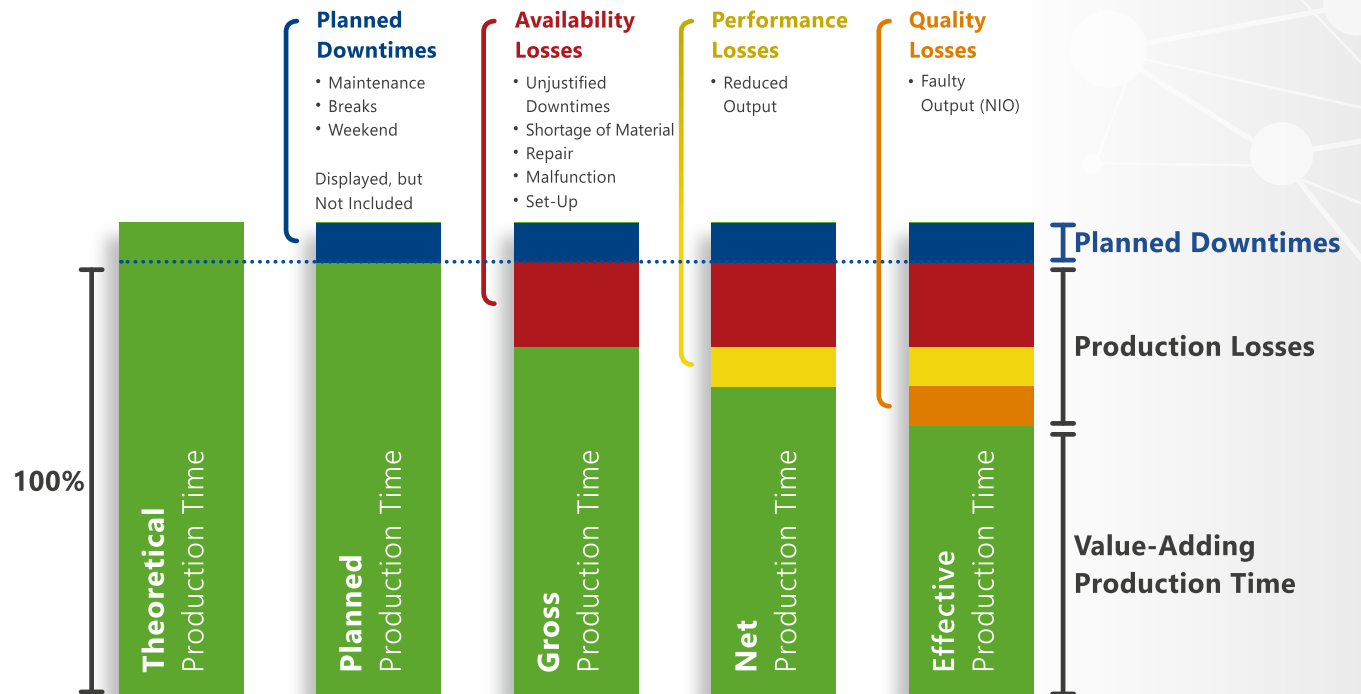
The OEE value is a central key figure for evaluating the productivity of a machine, plant or line. The abbreviation OEE stands for **“Overall Equipment Effectiveness.”**

The OEE value is the product of **availability, performance and quality level**. When calculating the OEE value, losses due to unplanned downtime, deviations from the planned number of pieces, and defective parts and parts that need to be reworked are also taken into account.



This Results in the Following Calculation Formula

$$\text{Availability \%} \times \text{Performance \%} \times \text{Quality \%} = \text{OEE \%}$$



▶ The OEE value can thus be used to identify, analyze and subsequently eliminate all equipment losses.

# Calculation of the OEE Value

## The Formula in Detail

- **Availability**

The degree of availability of a plant, machine or line results from the ratio between actual and theoretically possible production time. The availability is reduced by malfunctions and the time spent on eliminating malfunctions.

Preparing and re-processing a plant, machine or line also reduce the degree of availability. This results in the following formula for calculating the degree of availability:

$$\text{Degree of Availability} = \frac{\text{Actual Production Time}}{\text{Planned Production Time}}$$

- **Performance**

The performance level of a plant, machine or line is determined by the ratio between the parts actually produced and the technically possible parts per unit of time. This is because a plant, machine or line cannot always be operated at the highest speed according to the manufacturer's specifications. According to the manufacturer's specifications. The cycle times depend, among other things, on the production processes, on the products to be processed and also on the operating personnel. Idle time and minor interruptions, as well as reduced operating speeds lead to a reduction in the performance level. This results in the following formula for calculating the performance level:

$$\text{Performance Level} = \frac{\text{Actual Performance}}{\text{Target Performance}}$$

- **Quality**

The quality level of a plant, machine or line is determined by the proportion of good parts produced in relation to the total number of parts produced. The higher the quantity of good parts produced, the better the quality of the production processes. Process errors that cause scrap and rework minimize the quality level, as does, for example, reduced output due to startup losses during production startup. This results in the following formula for calculating the quality level:

$$\text{Degree of Quality} = \frac{\text{Good Parts}}{\text{Total Parts Produced}}$$

**Multiplication of the values means that all factors are important. Example:**

Availability Level of 93,55 %, Performance Level of 71,12 % and Quality Level of 100 %

▶ **OEE calculation: (93.55 x 71.12 x 100) % = 66.53 %.**



# Approaches to OEE Recording

## Comparison of Manual and Automatic Recording



### Manual Recording

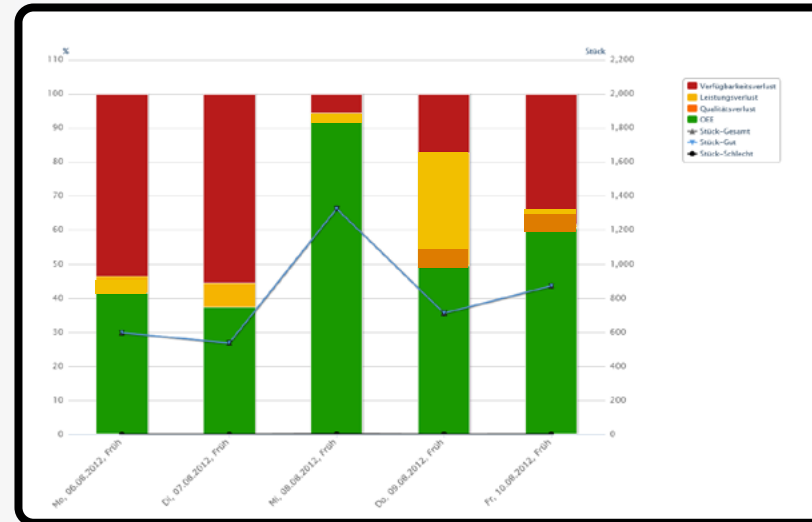
The manual approach is based on manual records in which production employees hand record each downtime with duration and cause. From this, the availability is determined.

Counting the number of pieces produced, e.g. per hour, is the basis for determining the performance factor, and writing down bad parts allows the quality factor to be determined.



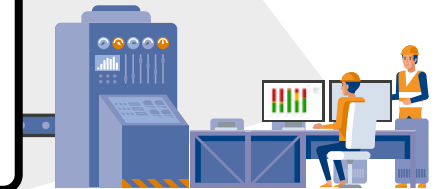
### Automatic Recording

The automated approach uses the production cycle as the source of information for clocked machines and plants. As long as a clock pulse is generated within a specified interval, the acquisition software „knows“ that the machine, plant, etc. is producing and therefore available. With a time measurement between two clock pulses, the software can determine the actual clock pulse and relate it to the target clock pulse. In this way, the performance factor is determined. By input of quantities of bad parts the Quality level is determined.



Example of an OEE report available at the push of a button in graphical form:

- Availability Loss
- Performance Loss
- Quality Loss
- OEE Value



### The Two Approaches Differ with Respect to Time Expenditure and the Accuracy of Recording

In the manual approach, the time required to record data by ticking predefined reasons for disturbance is still limited, whereas writing down user texts not only takes more time, but also makes subsequent statistical reports more difficult. This is a major disadvantage of the manual approach – the recorded data is then usually transferred by hand to an Excel file for the purpose of report, which takes time. By far **the biggest disadvantage, however, is that the reports always represent only a historical view.** You could also say that faults are viewed from the rear-view mirror. This method does not support fast reactions when incidents occur.

# Advantages of Automatic OEE Recording

Digital Data – in the Office or on the Go

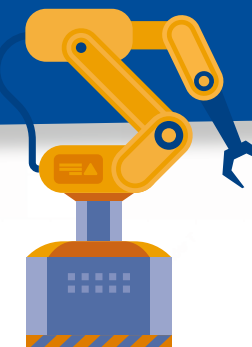
**In advantage: The automatic recording can provide data immediately in any form and trigger an alarm in case of malfunctions!**

- Sudden, undesirable situations can be quickly responded to, e.g., by automatically triggering alarms, and thus worse can be prevented by rapid countermeasures.
- Reports at the push of a button and in real-time
- Essentially, automated recording can be implemented on any clocked machine or plant, regardless of its age. The often encountered opinion that automated acquisition only works with new machines and plants is wrong. This is probably based on the idea that data acquisition requires direct access to the machine controller, i.e. PLC, which admittedly could be difficult with old machines. However, a PLC coupling is neither necessary for this nor is it tied to it.
- **It is not always necessary to access the machine control system: In fact, it often takes less effort to pick up a suitable, clock-synchronous signal at a suitable point or to generate this signal via a push-button or photoelectric sensor and to process it further with the aid of an acquisition module.**
- It is not always necessary to access the machine control system: In fact, it often takes less effort to pick up a suitable, clock-synchronous signal at a suitable point or to generate this signal via a push-button or photoelectric sensor and to process it further with the aid of an acquisition module.
- Visualization of data in real-time: OEE software, which is usually installed on standard office computers, prepares and visualizes the data. The person responsible for production can thus see at a glance how the productivity of his machines and systems is doing. He can decide how his OEE values are to be presented to him: by machine, shift, product, order or personnel etc.
- Clear presentation: The data can be presented in various views, either as a diagram or in the form of lists. With data prepared in this way, it is possible to quickly identify which machine is running optimally, where intervention is required, and where losses are occurring.



**Improvement potentials in production become apparent at a glance!**

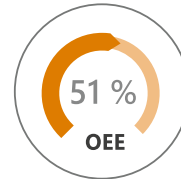
**Direct PLC coupling is not required for OEE recording. Nor is this tied to the existence of a PLC at all.**



*In PDF 2 gleiche Textblöcke im Kommentar*



# What is the Benefit of OEE?



## OEE Provides Results – but it Depends on What you make out of it

OEE provides exact figures. These figures are the yardstick for productivity; they show crystal clear at any time how high productivity is. In a sense, OEE is a rev counter for the production manager.

Behind these figures are facts – collected information about all processes and malfunctions, which are stored in a database. They form the basis for analyses and the foundation for improvement processes. OEE shows where optimization is necessary and makes sense. And the success – or failure – of measures implemented can be read off immediately. As a control instrument, OEE enables the monitoring of individual machines, complex plants or the entire factory in real-time. By highlighting all errors and malfunctions in the production process, it serves to permanently evaluate production efficiency. Weak points and causes of losses are immediately visible.

With OEE, the production manager has a tool in his hand with which he can eliminate one productivity killer after another and thus increase productivity noticeably and sustainably.

Unfortunately, it should be noted here that the desired positive results do not come about by themselves, but are the result of persistent engagement with the subject matter. The systematic approach also has a name: It is called CIP - Continuous Improvement Process. The name says it all, and the greatest difficulty is to maintain continuity. This is what makes the big difference between good and first-class production companies. Here, it is clear that perseverance wins. For your lean team or the Operational Excellence department, OEE recording provides the perfect basis for optimization projects.

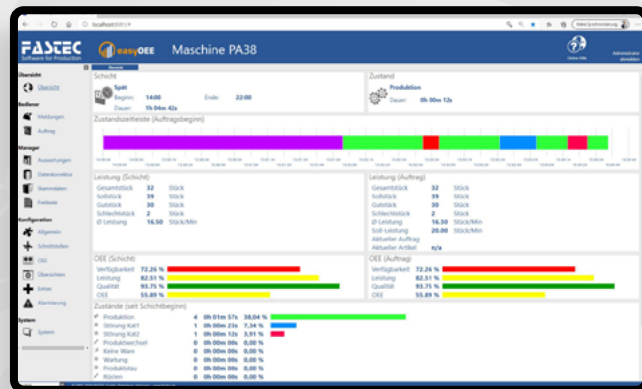
## Who can benefit from the use of OEE?

OEE is useful for manufacturing companies in many industries with discrete manufacturing processes. Especially in machine-intensive manufacturing industries with high machine hour rates, an OEE system quickly pays for itself. If faults are avoided here and sources of error are uncovered, this is reflected in higher productivity, mind you at the same operating costs, only by avoiding failures and waste. So the calculation is quickly made. As has been shown in practice, the use of OEE is quickly becoming an indispensable value and control instrument in production companies committed to the Continuous Improvement Process.

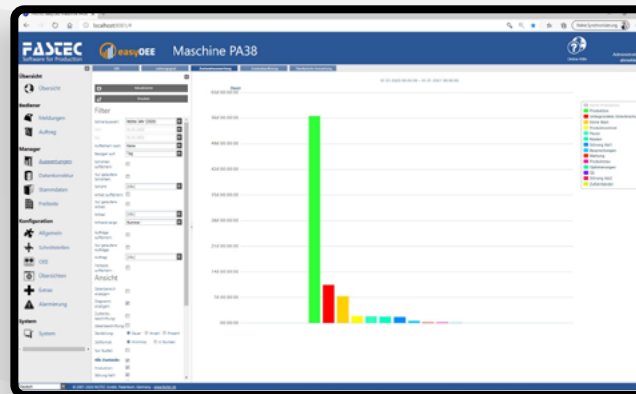


# OEE Indicates Where Optimization is Necessary and Reasonable

Identify Potentials and Initiate Improvements



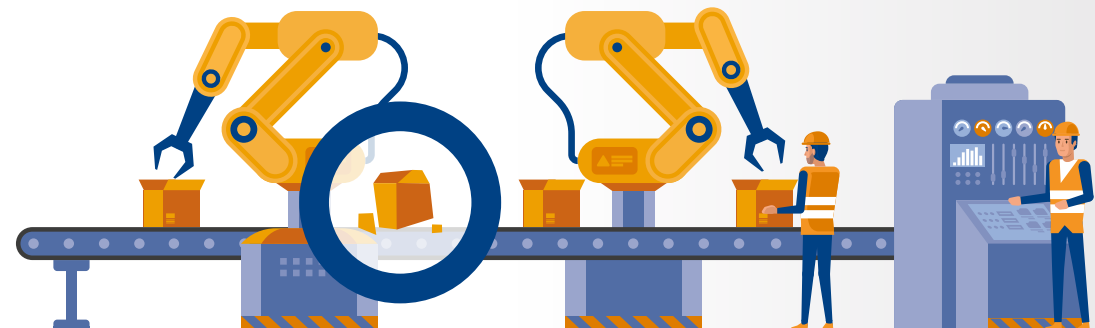
Live view: All recorded data is displayed in real time, creating transparency and can be acted upon quickly in the event of malfunctions.



Pareto analysis: Reasons for disruptions are sorted by duration or number, thus represent the weighting.

Name	Startzeit	Endzeit	Dauer	Produkt
Neuer Auftrag	09.09.2012 13:04:47	09.09.2012 13:19:03	00:00:04	
Stopp	07.08.2012 11:39:54	07.08.2012 11:39:58	00:00:04	
Überbrückung	07.08.2012 11:39:58	07.08.2012 11:39:53	00:00:13	
Stopp	07.08.2012 12:00:46	07.08.2012 12:00:58	00:00:18	
Überbrückung	07.08.2012 17:14:01	07.08.2012 17:43:04	00:17:13	
Überbrückung	07.08.2012 18:19:38	07.08.2012 18:44:02	00:24:44	
Überbrückung	07.08.2012 21:19:38	07.08.2012 21:19:43	00:00:04	
Schulung	08.08.2012 08:18:07	08.08.2012 08:37:08	00:27:01	
Überbrückung	08.08.2012 08:34:01	08.08.2012 08:34:49	00:02:29	
Überbrückung	08.08.2012 13:34:05	08.08.2012 14:00:00	00:25:54	
Stopp	08.08.2012 14:00:00	08.08.2012 14:00:02	00:00:02	
Produktion	13.08.2012 14:00:00	13.08.2012 14:00:02	00:00:02	
Stopp	13.08.2012 15:13:05	13.08.2012 15:14:04	00:20:59	
Überbrückung	13.08.2012 15:14:04	13.08.2012 15:14:08	00:00:13	
Überbrückung	14.08.2012 07:47:02	14.08.2012 07:51:42	00:04:29	
Überbrückung	14.08.2012 09:39:49	14.08.2012 09:44:47	00:14:58	
Überbrückung	15.08.2012 11:10:08	15.08.2012 11:12:06	00:02:07	
Stopp	18.08.2012 01:44:41	18.08.2012 01:45:00	00:14:19	
Überbrückung	18.08.2012 05:18:07	18.08.2012 05:25:07	00:07:00	
Stopp	18.08.2012 10:13:06	18.08.2012 10:13:06	00:00:07	
Schulung	19.08.2012 02:07:45	19.08.2012 02:07:52	00:00:07	
Überbrückung	19.08.2012 08:19:42	19.08.2012 09:10:13	00:50:32	
Neuer Auftrag	20.08.2012 12:03:48	20.08.2012 12:02:46	00:00:58	
Überbrückung	20.08.2012 12:03:38	20.08.2012 12:19:01	00:09:23	
Stopp	22.08.2012 02:10:15	22.08.2012 02:10:12	00:01:04	

Tabular fault listing: The plant conditions are sorted chronologically according to the sorted chronologically by timestamp to track events.



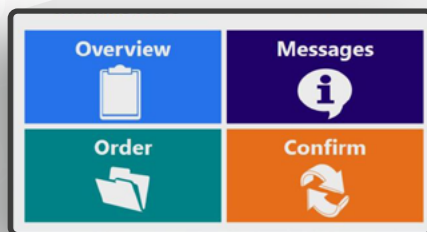
# Potential Analysis with easyOEE

## The Easy Way to Digital Production

The potential analysis with easyOEE is used to analyze productivity and optimization potential directly in your production. We support you with commissioning, data validation and the implementation of initial optimizations. The project is scheduled for a period of three months. The easyOEE productivity measurement device is connected to a machine. Your electrician can process existing digital signals or install a light barrier.

The configuration is based on your master data. The machine operator registers a Production order on the device to start production. easyOEE then automatically records quantities and production times. As soon as a malfunction occurs, the machine operator selects the reason for the malfunction from a preconfigured list and can refine it using user texts. It is also possible to process technical malfunctions of the machine automatically.

The quality of the products is differentiated by connecting an NIO counter or entering the scrap manually. The web browser provides access to the machine and transparency in production. If a network connection is not feasible, offline operation is also possible. The recorded data is displayed in live views and can be conveniently reported.



Eingaben am Touch-Panel in der Produktion



Live-Übersicht im Büro oder auf Großbildschirmen



Auswertungen zur Analyse der erfassten Daten



# Profound Results in Three Months

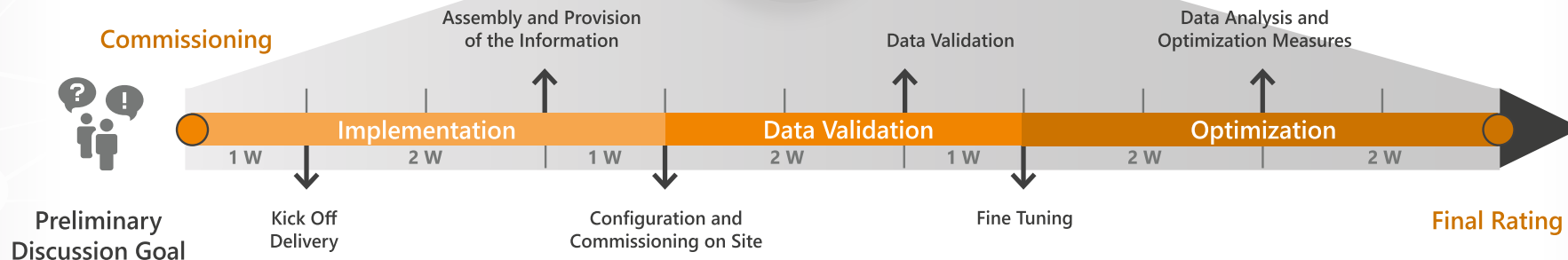
## Small Investment – Big Insights

easyOEE is a self-sufficient complete system that can be installed quickly and easily to record the productivity of individual machines, lines, plants and assembly work centers and to report online from the PC workstation: In the first step, project planning and objectives are coordinated. The device is delivered and a configuration file is sent. You close the device to the machine while FASTEC prepares the configuration. We support you with

a kickoff and at any time with our support and online help. Commissioning and training take place at your site. After about two weeks, the collected data is validated together and adjustments are made if necessary. After another two to four weeks, the verified machine data is analyzed together and optimizations are derived. In order to measure the success of the optimizations, a final evaluation takes place at the end of the project.

### Benefits at a Glance::

- ✓ Cost-effective, fast entry into the world of OEE
- ✓ For rent for fast ROI, incl. potential analysis
- ✓ Intuitive operation, incl. multilingualism
- ✓ Pre-installed software on touch panel PC
- ✓ Ready for operation within minimal time
- ✓ No intervention in the machine control necessary
- ✓ Anytime and anywhere access via web browser
- ✓ Production figures and machine status in real-time
- ✓ Detailed reports by order, item or shift
- ✓ With alert function



# A Look at the Practice

## Reports at the Push of a Button

What are the most frequent reasons for malfunctions? Could the degree of utilization of the machine be increased? How have quality and cycle time developed in the last month?

These questions can be answered with the dynamic, web-based, graphical and tabular reports of easyOEE. All reports can be filtered and grouped so that, for example, reasons for downtime can be displayed according to

frequency or duration, target and actual cycle times can be compared, quantities produced can be evaluated with the proportion of good/rejected parts, and OEE values can be analyzed with the partial key figures of availability, performance, and quality. This makes it possible to identify reasons for downtimes and potential improvements at a glance. Due to the permanent storage of the data in an SQL database, you can perform not only current reports but also evaluations of the past year

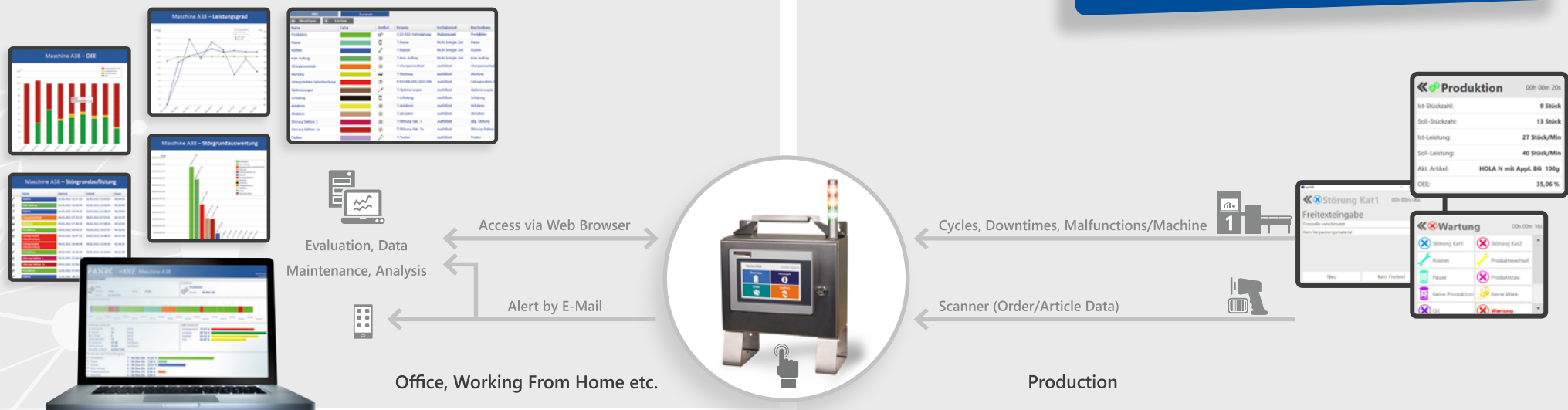
### Easy Configuration::

Together we prepare the easyOEE for commissioning. To do so, we import the shift model, the article master data with default values and the state tree.

We design the configuration of the views on the device and in the office individually. A wide range of displays, information and key figures are available as standard.

Operation is so intuitive that you can make modifications independently. In addition, support is available to help you with questions and suggestions.

*Dynamic, web-based, graphical and tabular reports for fast and efficient analysis of data*



# Customer Experiences



*"We didn't know what availability and performance our lines were delivering. We therefore started with the easyOEE potential analysis tool to measure productivity and to perform a status quo analysis on three machines in the converting department. In the very first month, thanks to easyOEE, we were able to increase our OEE value on these three machines by up to 11%.*

*Building on this, the FASTEC 4 PRO MES system was then introduced, which revealed further capacity reserves and brought another 10% increase in OEE in the first year of use"*

**Belal Al-Shaibani**  
Process Manager

MEDICE Arzneimittel Pütter GmbH & Co. KG



*"The setup of the easyOEE terminal in advance and the installation on site was successfully carried out in a very short time and was almost self-explanatory. The import of the article master data from the ERP system was also possible without any problems and was carried out quickly in order to bypass parallel master data maintenance.*

*Through the additional binding of a simple hand scanner, the process data such as article number and process order number are read in by the employee, thus preventing input errors"*

**Marc Bruns**  
Group IT Manager

Gustav Berning GmbH & Co. KG



*"About a year ago, our OEE values were still at 35% and are currently at 60%. Thanks to the transparency we have achieved, we can now respond to disruptions in production in time and also plan much more optimally – without any hectic rush.*

*We are able to react immediately and specifically if something unusual happens in production. In addition, everything is logged in detail and documented in a way that can be evaluated, so that with regular reports we have the opportunity to achieve constant process optimization"*

**Dirk Kirchner**  
Production Manager

VION Convenience GmbH



# We would be happy to advise you personally!

We see ourselves as your partner on your way to digital production

- **We Have Process Experience:**

We have been digitalizing factories since 1995, meaning that we not only know many industries, but have also successfully implemented over 400 digitalization projects. Worldwide.

- **We Like It Simple:**

Not every planning process is the same. Not every data source is the same. That's why we have developed two solutions for you, which you can use individually or in combination. Completely according to your needs.

- **We Make It Fit:**

Our solution must fit your processes and challenges today, as well as your business goals. Now. That's why you can purchase a solution from us that can be flexibly adapted and expanded as needed. To grow with you.

- **We Take Your Project to Heart:**

Our customers are important to us and we are interested in long-term cooperation. That's why we accompany our customers throughout the entire process – and afterwards, of course.

- **We Offer Software Solutions from a Single Source:**

In addition to easyOEE, FASTEC also offers the modular and cross-industry configurable MES (Manufacturing Execution System) FASTEC 4 PRO.

Our software solutions can be used autonomously and combined with existing systems. The interaction of our solutions results in additional synergy effects as well as the advantage of receiving everything from a single source.



Lars Knitter

Prokurist / Head of Sales & Marketing

*Consulting for interested parties and customers as well as support for national and international digitalization projects with experience since 2013.*



Edwin Schott

Project Manager for potential analysis with easyOEE

*Specialist for the introduction of system solutions with a focus on change management*

**We would be happy to consult you individually!**

Our sales department will provide you with further user reports and information material!  
Or simply make an appointment for a presentation at your site, at our premises in Paderborn or via web:  
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Digitalization



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