

# Overall Equipment Efficiency

White paper

Sensorik

40

Your automation, our passion.

 **PEPPERL+FUCHS**

# Abstract

## Overall Equipment Efficiency (OEE) by Pepperl+Fuchs GmbH, TE Connectivity, and Software AG

The increase in overall equipment effectiveness (OEE) is one of the most important applications of Industrie 4.0. However, retrofitting existing production systems poses major challenges for plant operators. For this reason, Pepperl+Fuchs, TE Connectivity, and Software AG – companies that are technological leaders in their respective market segments – have come together to develop a joint demonstrator for discrete production that replicates the following use cases:

- Process optimization
- Condition monitoring
- Value-added services “service on demand”

## Contact

Pepperl+Fuchs GmbH  
Lilienthalstrasse 200  
68307 Mannheim  
+49-621-7760  
info@de.pepperl-fuchs.com

# Classification

## Sensorik4.0® Solutions for Industrie 4.0 Applications

Industrie 4.0 is the pioneering concept of totally interconnected production systems that support the exchange of small or large amounts of data within a process – via the cloud – and can also communicate with higher-level information systems outside conventional corporate boundaries. In contrast to the classical strategy of hierarchically structured communication (horizontally, vertically), this modern interconnected methodology offers the advantage that communication can occur anytime, between any participant, on any hierarchical layer. Sensors having the ability to communicate is a significant characteristic of Sensorik4.0®. This term embodies Pepperl+Fuchs’ innovative sensor solutions for applications within the Industrie 4.0 framework.

## The Solutions Park Brings Industrial Sensors to the Internet of Things

The Solutions Park demonstrates real-world sensor solutions that highlight the customer benefits of Industrie 4.0. The customer benefits of Industrie 4.0 stem from the availability of process and diagnostic data from sensors and actuators within a company’s internal or external IT systems. For instance, using this data, these IT systems can perform visualization, realize model-based optimization processes, and schedule demand-based preventive maintenance processes. For such applications, Pepperl+Fuchs and our IT partners offer solutions that allow sensing technologies to be directly connected to a company’s IT infrastructure.

Pepperl+Fuchs offers a wide range of products designed to collect data from spatially dispersed sensors. Then, we make that data available to application-relevant databases on the Internet. This data is accessible on these Internet portals through mobile devices or can be used by downstream processes. In the context of Industrie 4.0, the idea of continuous engineering throughout the entire product life cycle plays a crucial role: All of the data must first be collected in a digital format, then made available for electronic processing. To this end, Pepperl+Fuchs has developed a system that directly compares quality data obtained during the manufacturing process to the design data – deviations are automatically identified.

## Sensor Data within the Corporate IT System

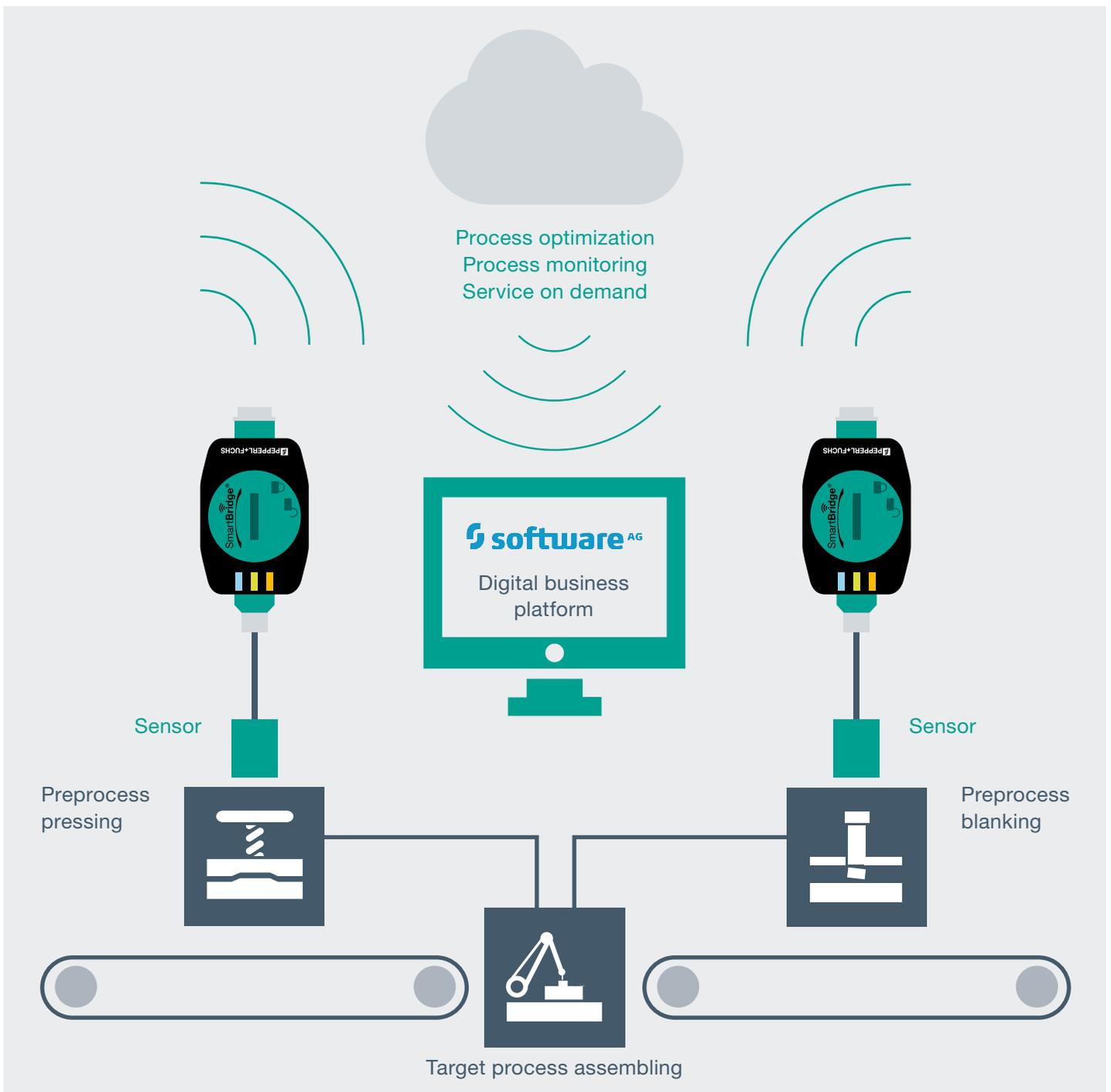
Replacing hierarchically organized machine communication with networked solutions offers several advantages: All of the data from field devices like sensors and actuators can be transmitted directly and without a loss of fidelity due to intermediate translation and processing transmitted to a corporate IT system. The information concerning availability and state of a machine or system allows early intervention, reducing the risk of product faults and costly downtime. With our IT partners, we developed solutions where a separate communication path brings sensor data directly from the field into the corporate IT systems.

# Description

## Overall Plant Efficiency (OPE)

Increasing the effectiveness of existing production lines and processes is a key point in favor of implementing Industrie 4.0. By adopting Industrie 4.0, networked industrial components can create significant added value with just a small amount of data from the production process, coupled with intelligent data analysis. A demonstrator jointly developed by Pepperl+Fuchs, connectivity specialist TE Connectivity, and Software AG serves to illustrate how this reactionless data retrieval and analysis process could be achieved. This demonstrator unit

shows how the process data is accessed, prepared, analyzed, and optimized through linked production processes. A condition-based cleaning service for process-contaminated components offered as a value-added service – possibly even provided externally – rounds off the objective of increasing machine and plant availability.



## Design of the Demonstrator

The shop floor of the demonstrator shows two manufacturing processes that need to transfer pre products to the target manufacturing process with precision timing. In this case, the two preliminary processes (“pressing” and “punching”) feed into the assembly target process. The system as a whole is based on the link between preliminary process and target process and must be controlled in a manner that ensures it is both synchronized and operated for maximum productivity. Tasks such as these are usually handled by a manufacturing execution system (MES) implemented throughout a company. The demonstrator, by way of contrast, shows that only a small amount of specific data gleaned from processes is needed to handle control-related tasks. For instance, two retrofitable hardware components for retrieving data, including a corresponding component for transferring data to a business software program, are already delivering results comparable in value to those provided by conventional solutions.

The SmartBridge® interface from Pepperl+Fuchs is the retrofitable hardware used at sensor level. Spark from TE Connectivity retrieves process-related data at control level or fieldbus level. These two data ports transmit the extracted performance data via cable or radio interface to the business platform provided by Software AG. This form of data consolidation with downstream analysis enables three important value-added services to be provided within the context of Industrie 4.0:

### 1. Process optimization

The process data from drives and sensors retrieved by Spark is initially displayed on clear performance dashboards. In many cases, the transparency this setup provides with regard to key performance indicators is sufficient to uncover valuable potential for optimization. However, less obvious delays or micro downtimes can also be detected based on the principle of the historic data logger, and the preliminary processes and target processes optimized taking the order situation and current stock levels into consideration.

### 2. Condition monitoring

Logging information and warnings issued by individual components of the preliminary and target processes enables the actual condition of the machine and plant to be determined. Historic events are correlated with actual machine run times and maintenance recommendations provided by the manufacturer. This comparison provides a solid overview of the actual (maintenance) condition of the machine or plant. Compared with conventional, generally time-based maintenance intervals, condition-based maintenance enables an adaptive and ultimately more economic approach to service management for components, machines, and plants.

### 3. Service on demand

Ensuring potential failures are indicated at an early stage is probably the most generic method of reducing machine and plant downtime. Some industrial components already provide important information on contamination and wear. However, this information is currently only rarely used in practice. One of the main reasons for this is the “separation of power” between planning and project management on the one hand and the operation of machines and plants on the other. From a project manager’s perspective, handling status data that is not critical to the process represents an additional effort that is ultimately not productive. However, in terms of the TCO of machines and plants over their entire service life, there is significant economic potential to be found in making use of status data.

Photoelectric sensors from Pepperl+Fuchs provide information about diminishing detection capability due to soiling of the exit lens or the reflector. If this data could be tapped without incurring any significant integration costs, clear added value would be created with regard to operating the machine or plant.

A SmartBridge® interface is used for the demonstrator discussed here. This interface is easy to integrate into the sensor’s supply line and serves to separate the process and status data received from the sensor. The extracted status data is transmitted wirelessly to an Internet gateway and, from there, forwarded on to a service platform. The service platform can evaluate the status of the photoelectric sensors and trigger a service request where necessary. This kind of service can easily be implemented either by the in-house maintenance department or by an external provider, if necessary, and offered to the operator as a value-added service.

The joint demonstrator developed by Pepperl+Fuchs, TE Connectivity, and Software AG highlights in impressive fashion how process optimization can be achieved and an adaptive or “on demand” approach to service management implemented with just a few retrofitable, networked hardware components and a software platform with appropriate analysis tools. Achieving a noticeable increase in efficiency no longer necessarily means making new investments. In fact, increased efficiency can even be achieved with existing machines and equipment.

# Your automation, our passion.

## Explosion Protection

- Intrinsically Safe Barriers
- Signal Conditioners
- Fieldbus Infrastructure
- Remote I/O Systems
- HART Interface Solutions
- Wireless Solutions
- Level Measurement
- Purge and Pressurization Systems
- Industrial Monitors and HMI Solutions
- Electrical Explosion Protection Equipment
- Solutions for Explosion Protection

## Industrial Sensors

- Proximity Sensors
- Photoelectric Sensors
- Industrial Vision
- Ultrasonic Sensors
- Rotary Encoders
- Positioning Systems
- Inclination and Acceleration Sensors
- AS-Interface
- Identification Systems
- Logic Control Units
- Connectivity