



**Press with IoT turbo? Connecting presses:**  
get off to a flying start.

With IoT technologies (Internet of Things) and digitized components, it is not only possible to satisfy central customer requirements more quickly, more intuitively and at lower cost. New business models such as pay per use are also opening up opportunities for extra revenue. At the EuroBLECH 2018, Bosch Rexroth will show how this works in practice.

Whether electro-mechanical or hydraulic, thanks to cross-technology digitalization, press manufacturers are able to choose which topology suits their application best. Thanks to digitized components, intelligent system solutions and modular IoT technology, stationary forming systems are now ready for the factory of the future and allow for new business models..

## Benefits: why connect presses?

Through the modular structure and the use of IoT technologies, press manufacturers are no longer faced with the automation pyramid requiring numerous interfaces in order to ensure connectivity, transparency and flexibility. Four typical use cases can be implemented not only more quickly but also more cost-effectively:

- streamlining design,
- speeding up installation
- maximizing productivity and
- minimizing downtimes.

An example: with the help of web technologies, suitable dashboards or ticket systems can be created quickly and without expert help in order to carry out

predictive maintenance and sell this to the customer as a service on a subscription basis.

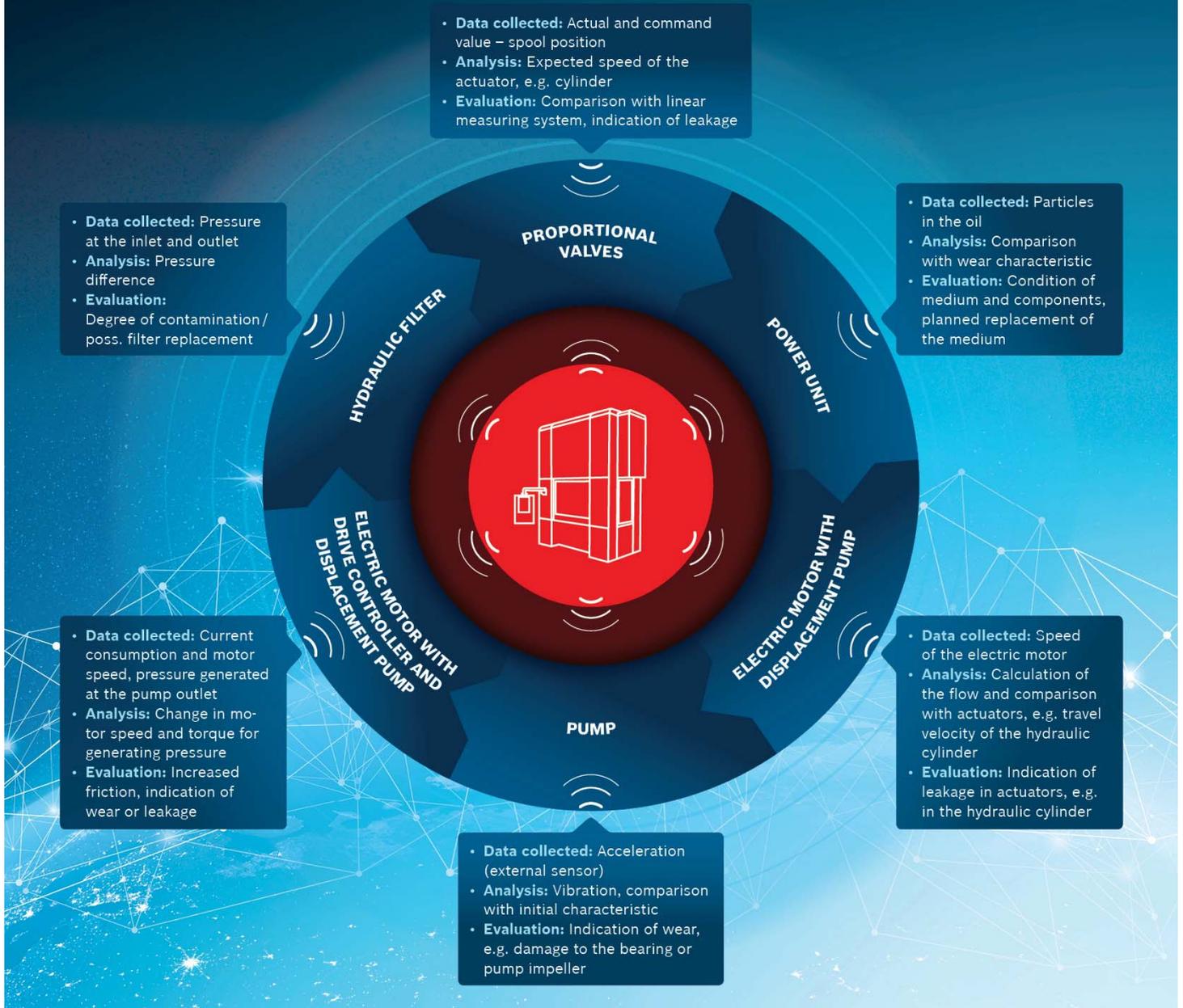
## Technology: connectable components

The extent to which a press is connected depends on the particular application. Either individual components, part-systems or the entire press can be connected. It is essential, however, that all components relevant to productivity should be connected. In order to better understand operating states and to generate productivity indicators, the press needs a certain sensor technology. These can be integrated into individual components – such as a flow meter on a valve – or external, such as a multifunctional sensor on a pump housing. For instance, the health of a press could be assessed on the basis of the housing temperature and vibration (acceleration). Virtual sensors could also be used to indicate when action needs to be taken. They provide collectible data from machine control systems or drives, e.g. the speed or the torque of electric motors. The following table shows a number of examples of how useful information can be obtained from a connected electro-hydraulic press:

Press component	Data collected	Analysis / information obtained	Evaluation / recommendation
<b>Hydraulic filter</b>	Pressure at the inlet and outlet	Pressure difference	Degree of contamination / poss. filter replacement
<b>Electric motor with displacement pump</b>	Speed of the electric motor	Calculation of the flow and comparison with actuators, e.g. travel velocity of the hydraulic cylinder	Indication of leakage in actuators, e.g. in the hydraulic cylinder
<b>Electric motor with drive controller and displacement pump</b>	Current consumption and motor speed, pressure generated at the pump outlet	Change in motor speed and torque for generating pressure	Increased friction, indication of wear or leakage
<b>Proportional valves</b>	Actual and command value – spool position	Expected speed of the actuator, e.g. cylinder	Comparison with linear measuring system, indication of leakage
<b>Pump</b>	Acceleration (external sensor)	Vibration, comparison with initial characteristic	Indication of wear, e.g. damage to the bearing or pump impeller
<b>Power unit</b>	Particles in the oil	Comparison with wear characteristic	Condition of medium and components, planned replacement of the medium

Table: Evaluation of connected components in an electro-hydraulic press (examples)

# EVALUATION OF CONNECTED COMPONENTS IN AN ELECTRO-HYDRAULIC PRESS



Visualization of the networked components and subsystems

## Example: connectivity in an electro-hydraulic press

The example of an electro-hydraulic deep drawing press which Bosch Rexroth constructed for the EuroBLECH 2018 shows how easily forming systems can now be connected. The main components include a connected central power unit and a variable-speed motor pump drive with a frequency converter. This provides data regarding speed, pressure values and motor temperature, etc.

The high-performance IH04 press module includes a standardized safety concept in accordance with Category 4, the highest EN693 category. The modular control plate features pilot-operated control valves with

onboard electronics, such as the 4WRTE directional control valve, which provides not only the current position of the valve spool but also the actual and command temperature value. Further data sources include the pressure transducer and the integrated IMS-A length measurement system for detecting the plunger position. The Motion Logic Control MLC used can evaluate connected sensors and virtual sensors. The IoT Gateway from Rexroth serves as an edge device for data collection, pre-processing and forwarding. In this case, it forwards the data to two analysis systems:

1st analysis system:

Online Diagnostics Network (ODiN)

On the cloud level, the Online Diagnostics Network ODiN uses machine learning algorithms to determine the health index of individual systems. In conjunction with a service contract, the machine operator is given specific recommendations for predictive maintenance.

2nd analysis system:

Production Performance Manager (PPM)

The Production Performance Manager (PPM) enterprise solution collects, harmonizes, visualizes and evaluates production and machine data from a wide range of sources in real time, allowing specialist personnel to carry out condition-based maintenance. In conjunction with a simple control configuration, predictive maintenance is also possible. The ongoing optimization of product quality based on the strict monitoring and documenting of process data is another possible use. As part of a global production network, production lines and processes can be depicted transparently and assessed across plants in order to make further improvements.

## Use cases: four major challenges

With the electro-hydraulic deep drawing press, Bosch Rexroth demonstrates how four classic use cases in the area of forming can be implemented cost-effectively and new business models can be created.

### 1. Streamlining design

With the aim of combining connectivity and power density, Bosch Rexroth has developed a new generation of press components with the help of the latest IoT technologies. For example, the new central power unit was optimized in terms of its performance, dimensions and noise emissions using computational fluid dynamics (CFD). With these properties, it can be integrated directly into the layout. The newly developed WRC-4X directional cartridge valves also set new standards in terms of performance, compactness and connectivity. Thanks to optimization using CFD simulations, these valves are more dynamic and consistently achieve flows that could previously only be achieved with the next highest available size. This reduces both the space required and investment costs. The standardized digital onboard electronics allows users to parameterize and adjust the valves via software. Via open interfaces, they can be connected efficiently to higher-level control systems and Industry 4.0 environments – even with analogue control.

### 2. Speeding up installation

The electro-hydraulic demo press also requires very little engineering and commissioning work, resulting in a short time to market. The new IH04 press module plays an important role here. Because it combines hydraulics and personal safety in a modular block, the user can skip various levels in the automation pyramid during the engineering process. The entire control plate, including the valve technology, firmware and safety functions in the control system, is fully checked and approved by the professional association.

### 3. Maximizing productivity

With the help of automation functions and the IoT Gateway, OEMs can improve productivity of individual components, part-systems or the entire press. On this basis, they can then put in place pay per use scenarios. On a part-system level, for example, a defined amount of energy rather than a power unit could be sold. Thanks to the efficient pressure-holding operation of intelligent hydraulic supply units, energy consumption can be reduced by around 60 percent. The customer can use this difference to finance hardware leasing. This ultimately means that in the future, it could be possible for end users to obtain a certain amount of press power as a complete package. Simulation tools such as Matlab/Simulink from MathWorks or Simster from Bosch Rexroth provide the necessary flexibility in the event of production changes, helping users in conjunction with the digital twin.

### 4. Minimizing downtimes

In order to avoid downtimes, the IoT already offers effective analysis and evaluation tools for condition-based and predictive maintenance. For predictive maintenance for example, Rexroth offers the ODiN service package. The Online Diagnostics Network provides the user with a Machine Health Index as an indicator for predictive maintenance. To complement this, intelligent hydraulic supply units extend the service life through targeted monitoring of the medium.

### Business cases: pay per use

The benefits of digitalization and IoT from a business perspective can be described in specific business cases. These include new ways of working together, leaner business processes and digital value creation networks, as well as new business models which create new sources of revenue. The OEE Improve! Filter Monitoring pay per use offering is an example of how this can work.

## Get started with an experienced partner

In the factory of the future, IoT technologies and modular automation building blocks with a high power density and integrated safety functions will be standard tools. Automation is increasingly becoming a means to an end – to solve the classic challenges of forming systems efficiently and cost-effectively. Digital systems, IoT technologies and disruptive solution approaches with CFD-based design are the current forerunners of this development. With its connected deep drawing press, Bosch Rexroth demonstrates how simply, intuitively and cost-effectively OEMs can already take advantage of new applications and business models. The technical proof of concept has already been carried out. Prior to marketing, Bosch Rexroth tests each solution in its modular portfolio in the company's own plants, assuming the role of key user. As a result, end users benefit from systems such as ODIN or intelligent hydraulic supply units early on. The OEMs now need to take advantage of the opportunities offered by digitalization and IoT technology with proven tools and the know-how of an experienced partner. The process: defining the use case, selecting IoT building blocks and getting started.

**To find out more about the specific opportunities and how the technologies are implemented, visit Bosch Rexroth at the EuroBLECH (Stand D08, Hall 11).**

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