

# WITTMANN 4.0

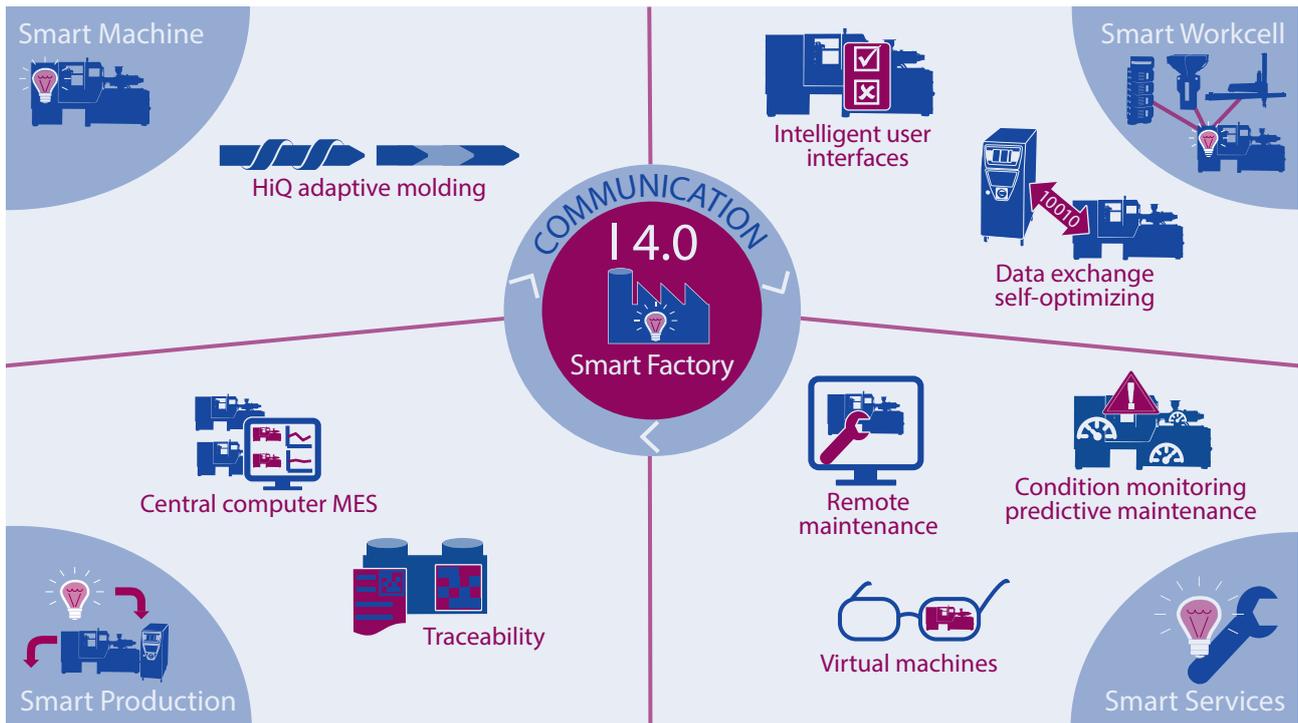
The fully integrated production cell

world of innovation



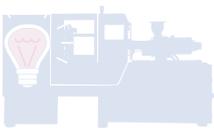
# INDUSTRY 4.0

The term Industry 4.0 designates interactive networking in production by using modern Internet technologies. The aim is to establish communication between manufacturing equipment, products and their components to achieve efficient and customized production.



With its modular "WITTMANN 4.0" library, the WITTMANN Group has numerous 4.0 technologies to offer. The focus lies on intelligent functions for self-optimization of the individual auxiliaries, a uniform platform for data transmission between the injection molding machine and the peripherals from WITTMANN, various modules for service and maintenance, and easy integration into an MES system.

4 categories provide a clearer overview of the available WITTMANN 4.0 technologies:



### Smart Machine

The basic prerequisites for a stable injection molding process with varying environmental conditions and equipment are precise, absolutely repeatable and adaptive injection molding machines and peripheral equipment.



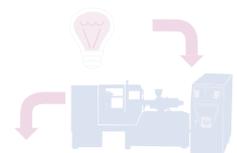
### Smart Workcell

Up to now, the "Industrial Internet of Things" (IIoT) stopped at the level of the machines. The WITTMANN Group is the first and currently the only company worldwide which can also collect data correctly from connected auxiliaries and cope with the complexity of changing workcells and automatic compilation of valid data sets.



### Smart Services

The aim is to have a machine and auxiliaries with maximum uptime. This includes fast and safe mold change, as well as continuous condition monitoring to detect anomalies. However, if support from the WITTMANN Group should still be required, it can be secured via remote servicing.



### Smart Production

The traditional domain of Industry 4.0 is the integration of the machines and workcells into superordinate software packages such as ERP and MES. This not only enables production planning and monitoring, but also data collection for the traceability of production parameters.

# SMART MACHINE

## HiQ-Packages

Wittmann

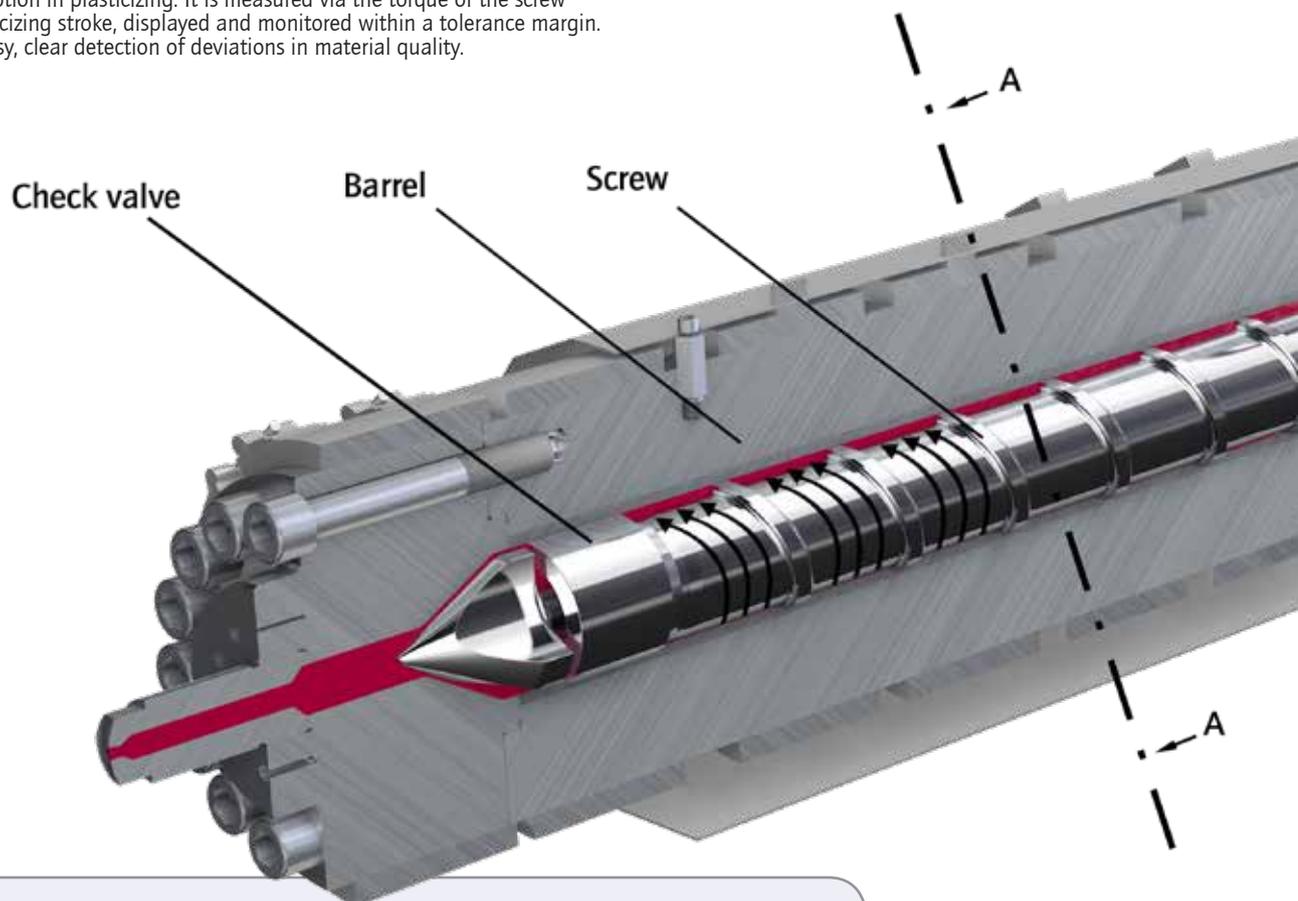
Battenfeld

The HiQ-packages offer add-ons for the existing UNILOG B8 machine control system software. They provide additional features to give the operator more information about the process, and to facilitate operation of the equipment.

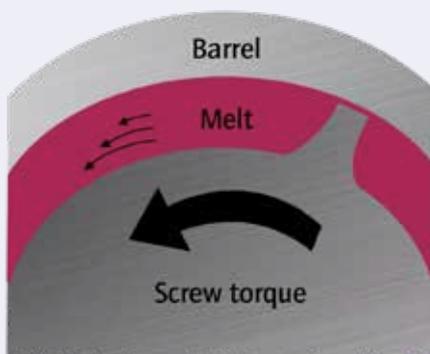
### HiQ-Melt

#### Melt quality monitoring

HiQ-Melt is a method to monitor the material quality. The process variable is the energy consumption in plasticizing. It is measured via the torque of the screw along the plasticizing stroke, displayed and monitored within a tolerance margin. This enables easy, clear detection of deviations in material quality.

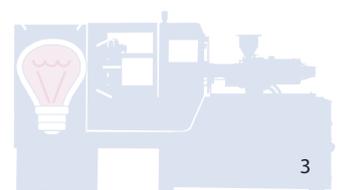


Detail A - A



Cross-sectional diagram of the barrel

The thick, viscous plastic melt resists the rotation of the screw. The drive torque required to overcome the resistance is measured.



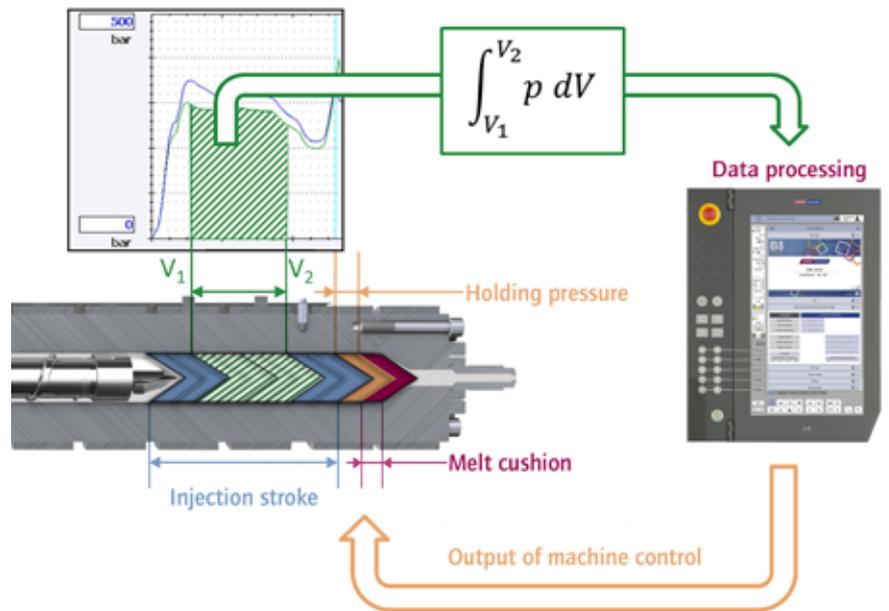
# SMART MACHINE

## HiQ-Packages

### HiQ-Flow

#### Viscosity-controlled compensation

The process control mechanism is based on readings from a large number of measurement points along the injection stroke. A tolerance margin is allocated to the integral value. As soon as that margin is exceeded, the injection process is adjusted accordingly within the same injection cycle by altering either the changeover time to holding pressure or the amount of holding pressure, or a combination of both. Deviations in temperature and material batch attributes can thus be compensated effectively, which makes for reliable parts quality.

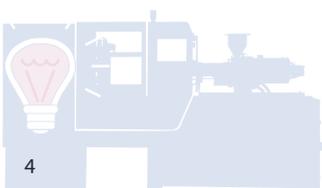
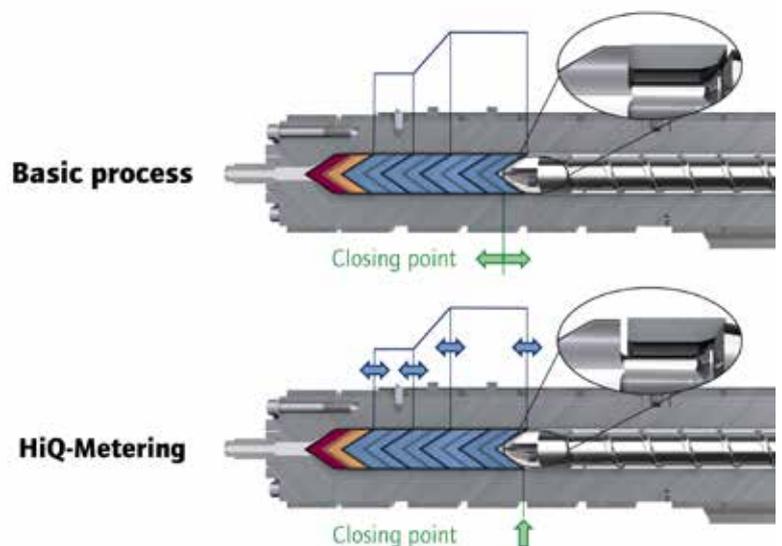


### HiQ-Metering

#### Active closing of the check valve

An additional step is programmed between the end of metering and the decompression stroke, during which the screw releases the shut-off ring and closes it by controlled movements. Consequently, the shut-off ring is already closed when injection starts. Even minute deviations in the screw's end position are compensated by shifting the entire injection profile.

- » Program step between the end of metering and the decompression stroke
- » Controlled movements of the screw release the shut-off ring and bring it into the "closed" position.
- » Shut-off ring closed prior to start of injection
- » Minute metering end point deviations are compensated by shifting the injection profile.



# SMART WORKCELL

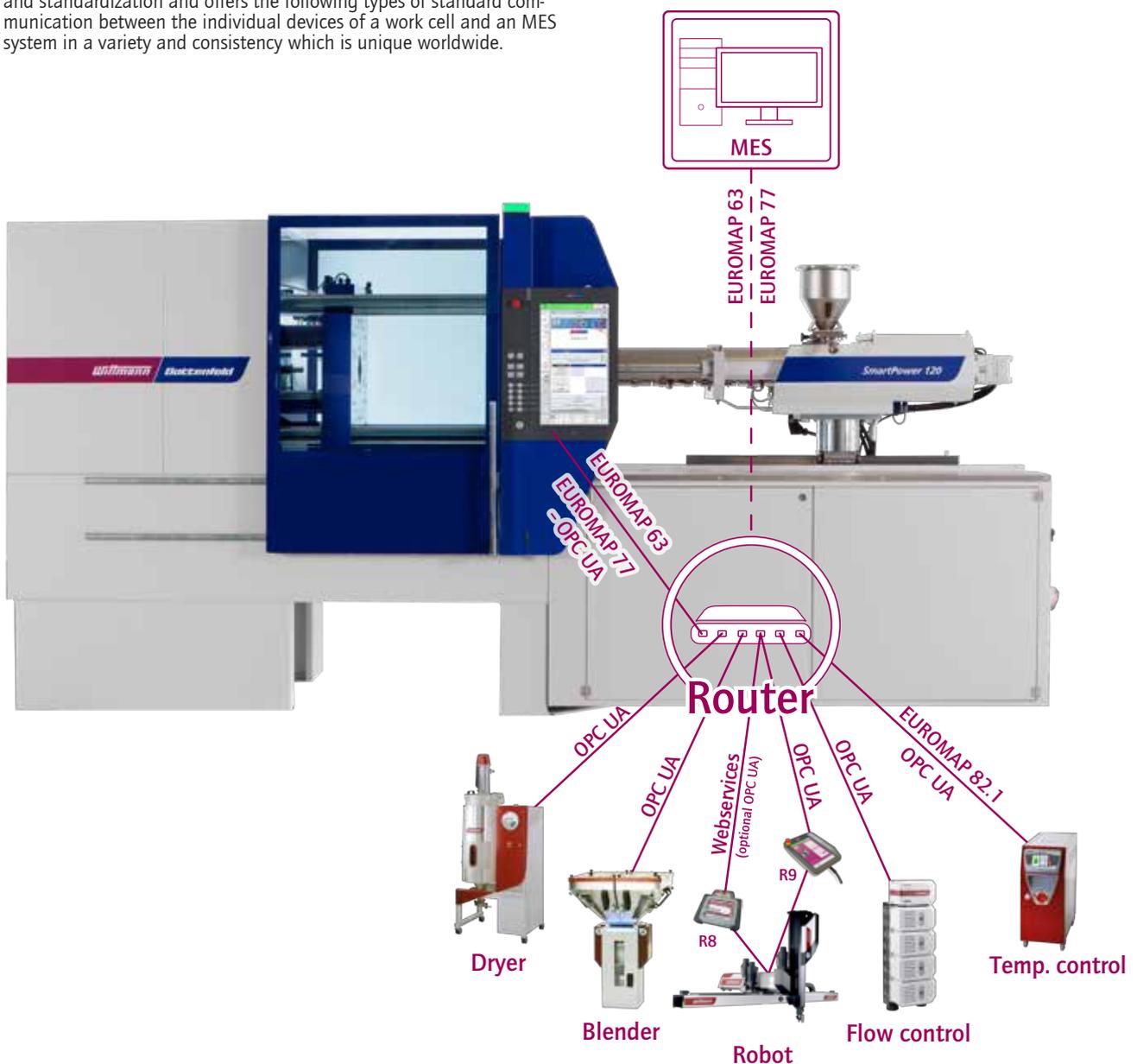
## Communication/MES

Wittmann

Battenfeld

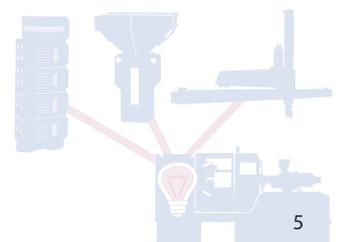
Standardized interfaces are a basic prerequisite for the successful and wide-spread introduction of Industry 4.0 technologies. Even the global expansion of the Internet itself could only proceed after the IEEE 802 standards had been introduced, observed and further developed. Industrial networks are currently undergoing a similar development process. Based on the OPC UA industrial M2M communication protocol and under the umbrella of EUROMAP, the plastics industry is developing standards for a great variety of communication tasks.

Here, the WITTMANN Group plays a leading role in the development and standardization and offers the following types of standard communication between the individual devices of a work cell and an MES system in a variety and consistency which is unique worldwide.



### Smart Workcell

Auxiliaries have a direct influence on the result of a process and consequently on product quality. In a Smart Workcell, the injection molding machine is able to access the parameters and condition of the peripherals and to respond intelligently to any changes. The Smart Workcell thus allows for even higher quality standards in the manufactured parts as well as complete data storage and traceability.



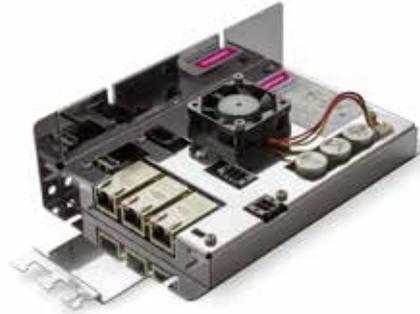
# SMART WORKCELL

## IT Security

### WITTMANN 4.0 router

This is an in-house development by the WITTMANN Group, which fulfills many different tasks:

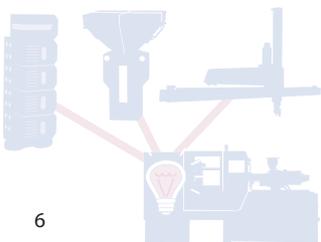
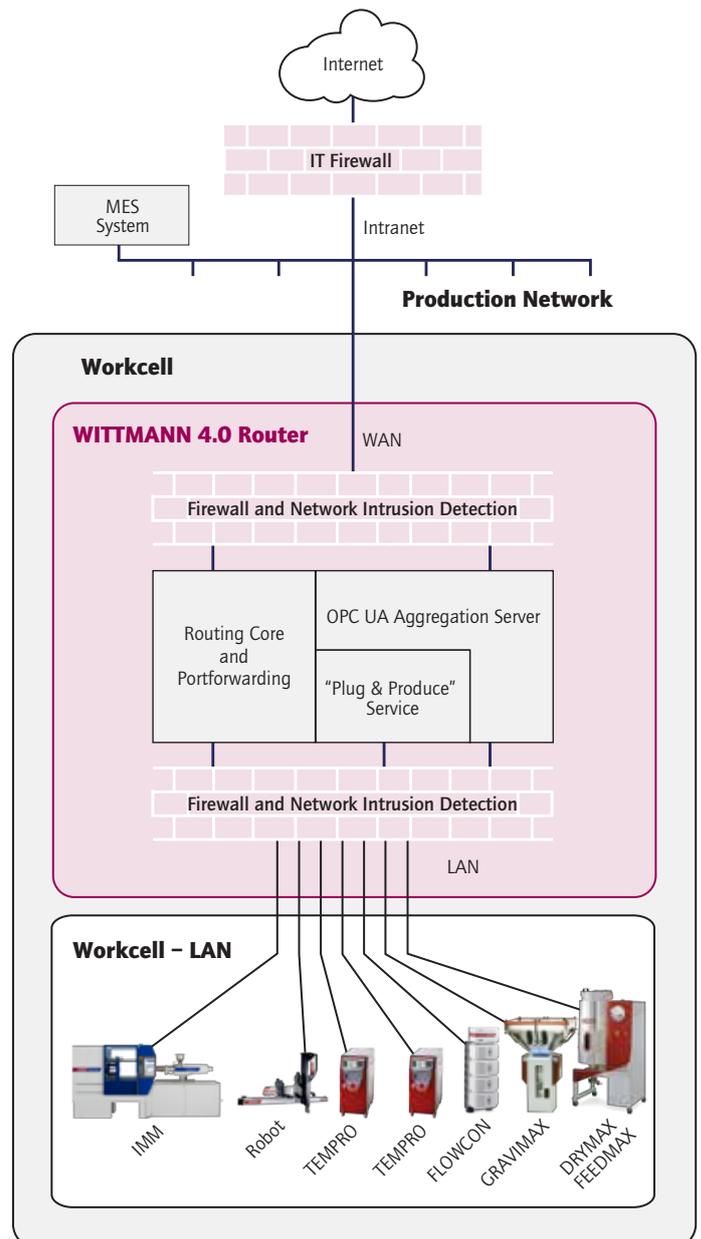
- » Network structuring  
the devices "behind" the router form their own sub-network
- » External communication gateway  
aggregation server for the individual participants in the sub-network
- » Proprietary firewall  
optimized for using WITTMANN 4.0 peripherals  
and OPC UA communication
- » Automatic recognition of connected participants



### The "onion peel principle"

Several security layers protect the vital control system software against external cyber attacks. The aim is to maintain the production process with WITTMANN equipments even when the corporate network may be compromised.

- » **Layer 1 - IT firewall:**  
The outer layer is formed by the customer's network firewall. The security mechanisms and settings in place there are unknown to the network participants. Therefore this layer must be regarded as potentially "insecure".
- » **Layer 2 - WITTMANN 4.0 router:**  
The next security layer is formed by the restrictively designed WITTMANN 4.0 firewall. It is specially adapted to cover the peripheral units and functionalities which can be assumed to form part of the workcell.
- » **Layer 3 - machine/auxiliary level:**  
The innermost security layer is formed in various auxiliaries from WITTMANN by the distributed control system components working on different operating systems to complicate even further any possible attempts to infect the innermost core of the control system.



# SMART WORKCELL

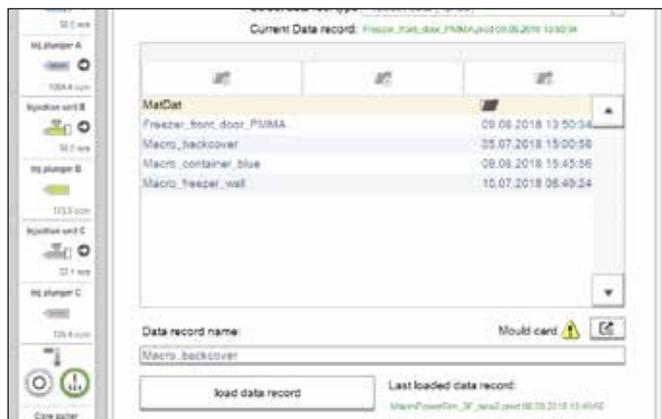
## "Plug & Produce"

Wittmann

Battenfeld

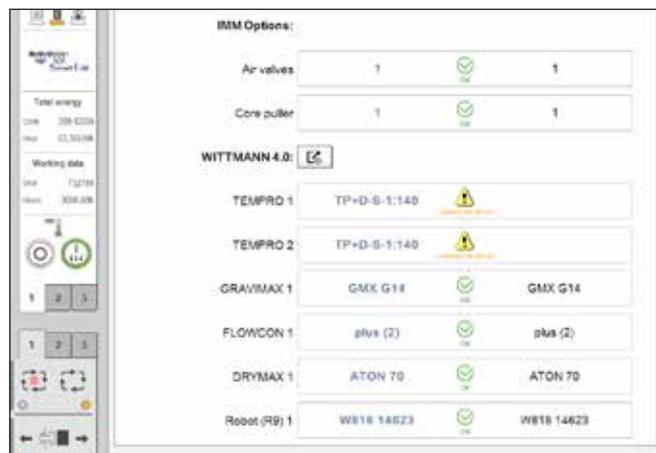
During mold change, a Smart Workcell offers the advantage of minimal user interaction. The versatile "Plug & Produce" function of WITTMANN 4.0 enables precisely this and guides the operator during a mold change to the correct composition and settings of the workcell in 3 simple steps.

### Step 1



Selection of the desired mold data set.

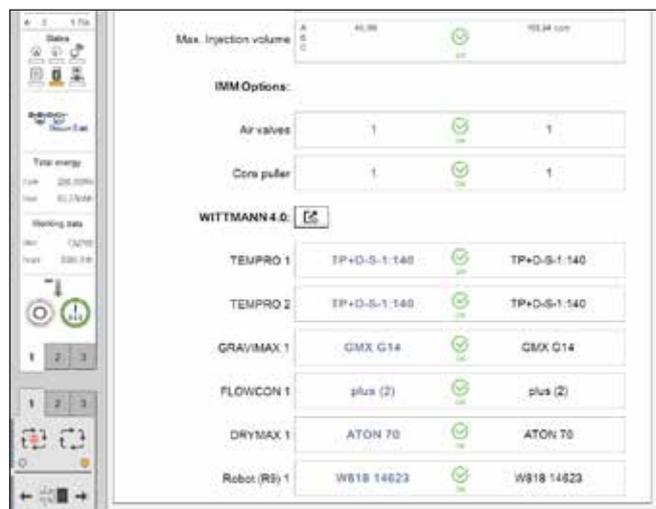
### Step 2



The necessary functions of the machine and peripheral units for this mold are displayed in the preview. These can now be prepared and brought to the machine or, in the case of a mold change, plugged in immediately.

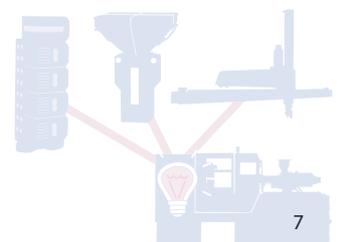
Following the process of connecting and disconnecting various devices, the new configuration of peripherals is recognized and displayed within seconds.

### Step 3



Now the mold data set can be loaded. The corresponding machine and equipment settings, which have been saved, are transmitted to the relevant units.

THAT'S ALL!  
Manual input errors have become a thing of the past.



# SMART WORKCELL

## One-Screen Solution

Modern auxiliaries for the injection molding process come with high-quality display screens for interaction with the operator. But as these displays are firmly attached to the equipment in most cases, these devices must be operated wherever they are placed for the production process, that is, also on the non-operator side or both end-faces of the machine or on top of the injection unit. Machine setters are therefore normally required to move between the operating terminal of the injection molding machine and those of the various peripheral units.

With its WITTMANN 4.0 technology, the WITTMANN Group now remedies this situation with a "One-Screen Solution": ONE central operating terminal for the injection molding machine and all WITTMANN 4.0 peripherals, no more running around the machine.

The following peripheral units are supported by "app" technology on the B8 control system:

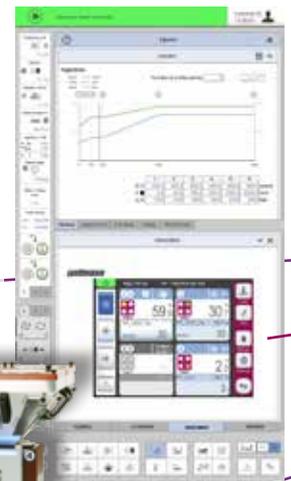
### FLOWCON plus:

The intelligent flow controller from WITTMANN, which keeps both the flow volume and the temperature constant on a reproducible level over the entire production period by means of fine adjustment valves and wear-free flow measurement. At the maximum level of complexity, 2 FLOWCON plus units, each with 4\*12 circuits can be controlled.



### GRAVIMAX G:

The gravimetric blender from WITTMANN with RTLS ("Real Time Live Scale") technology for highest possible batch accuracy. One blender can be supported for every injection unit.



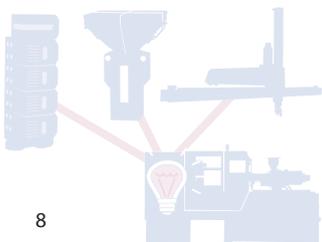
### TEMPRO plus D:

The classic among the peripherals from WITTMANN with direct cooling or indirect cooling as an open or pressurized units for temperatures of up to 180 °C. A special oil temperature controller permits a maximum temperature control range of up to 250 °C. At the highest expansion stage, 8 temperature controllers can be supported.



### ATON plus H:

The ATON plus segmented wheel dryer combines a constant dew point with energy efficiency. The VS option permits the integration of a blower in the frame below the dryer unit for the conveying of material. One dryer per injection unit can be supported.

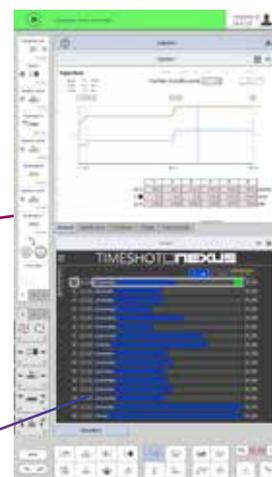
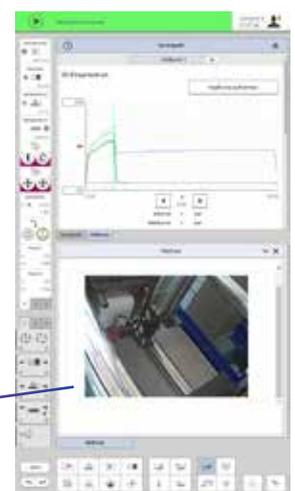
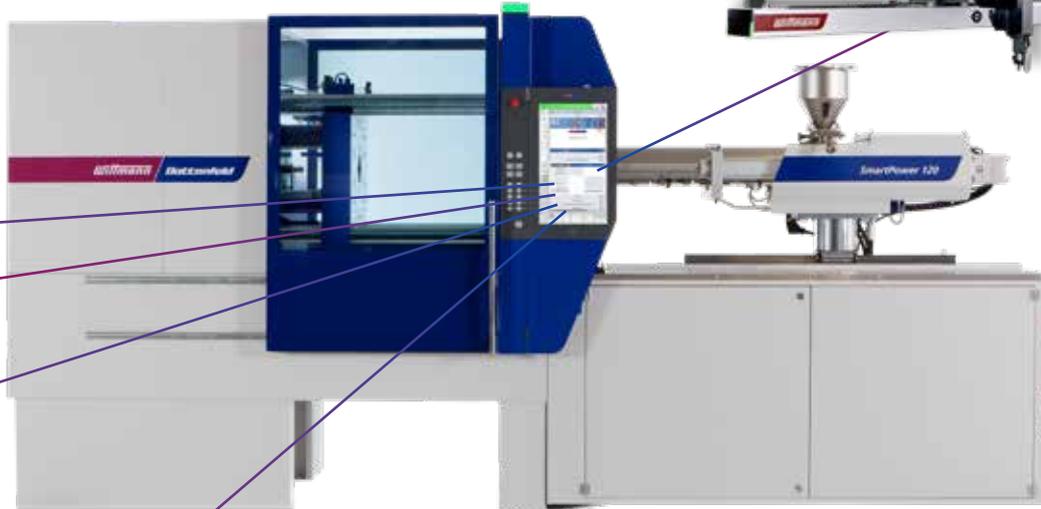


WITTMANN 4.0 uses other technologies for the integration of peripheral equipment: VNC and web browser.

#### VNC technology for mirroring:

**W8 robot:** All models of the extensive W8 robot series from WITTMANN are equipped with the innovative, high-performance R8 control system. This system not only supports the operation of up to 12 numerical servo axes, but also the connection of numerous I/O modules for integrated control of automation equipment.

**Quality inspection:** Many image recognition systems support integration via VNC. This enables the operator to view the results of the quality inspection.

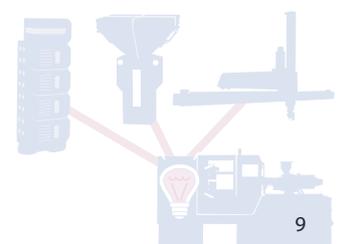


#### Web browser technology for the integration:

**WEBCAM:** The great variety of webcams on the market leaves virtually nothing to be desired. A frequently used application is viewing the non-operator side of the machine.

**Manufacturing execution systems:** An MES created with browser technology can be incorporated directly in the B8 control system. Here, it is a good idea to install functionalities which support actual production monitoring, such as TEMI+ by ICE-flex.

**External peripherals:** There are many other applications, such as cavity pressure sensors or hot runner controllers, which can be integrated into the B8 control system.



# SMART SERVICES

## Condition Monitoring System (CMS)

CMS, a system which combines technical components with human diagnostics expertise. The strategy of condition monitoring is to keep a continuous watch on the condition of injection molding machine components in order to optimize their availability and efficiency and to minimize their life cycle costs by keeping them in an optimal condition.

- » Detects machine defects before they cause a breakdown
- » Enables planning of preventive servicing
- » Reduces costs and increases productivity



Machine overview

### Maximum machine availability

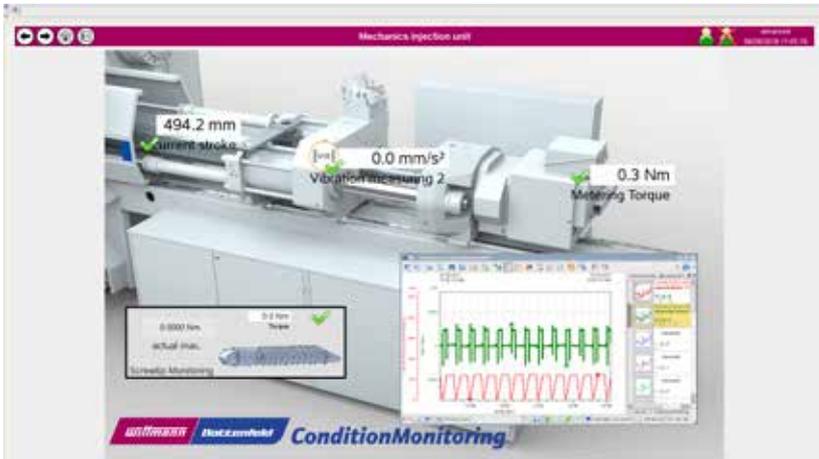
Machine breakdowns can be prevented most effectively by not waiting for them to occur in the first place. This is the objective of our preventive servicing concept.

With Predictive Monitoring, the WITTMANN BATTENFELD CMS software continuously monitors the users' injection molding machines. In this way, any irregularities are detected early, before they can lead to a breakdown.



Example: monitoring of the hydraulic system





Example: metering torque monitoring



Example: electrical equipment of the control cabinet

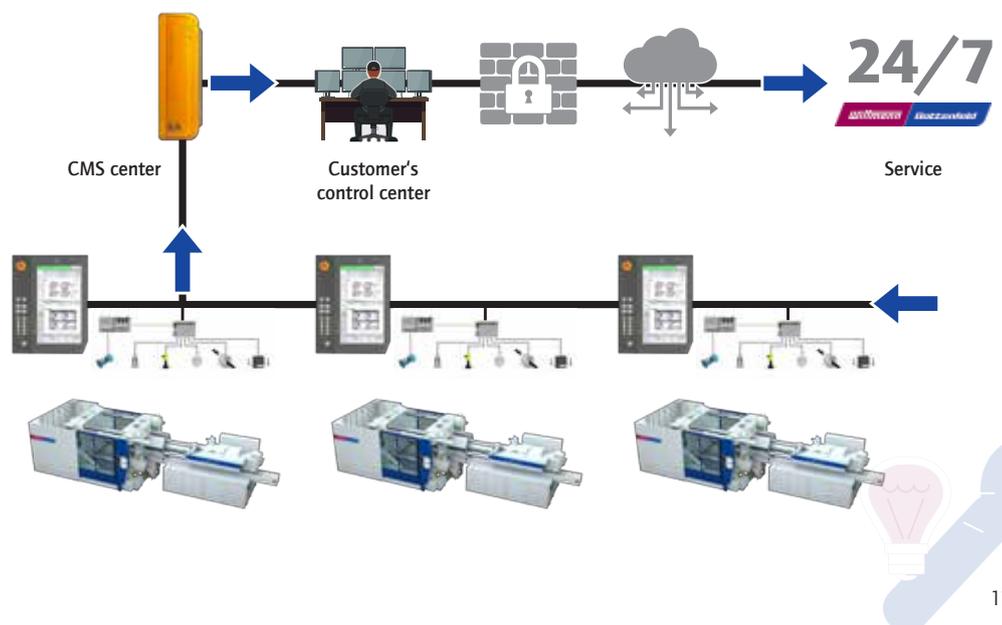
The sensors and analysis units of the condition monitoring system (CMS) check many different values:

- » Vibrations
- » Torques
- » Forces
- » Pressures
- » Flow quantities
- » Temperatures
- » Oil condition
- » Control cabinet climate
- » Smoke detectors

CMS overview

A CMS control center can monitor up to 50 machines simultaneously and pass on early warnings to the corporate maintenance staff by email. This enables intervention in time to prevent unplanned machine downtimes.

Additional external support from the WITT-MANN BATTENFELD remote service team is also possible at any time.



# SMART SERVICES

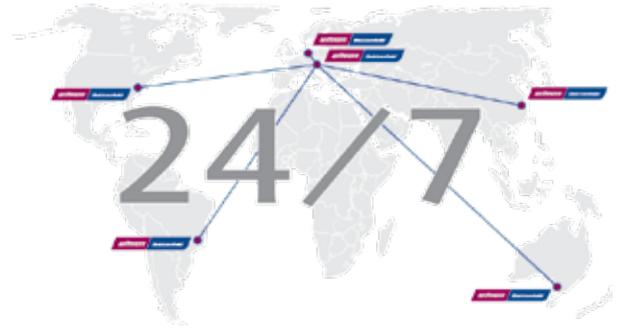
## Web Service – Remote Control

### Remote engineer - the online expert

WITTMANN BATTENFELD helps users to remedy defects as quickly as possible.

- » **Support via the Internet:**  
in addition to telephone support, WITTMANN BATTENFELD offers a number of web-based services which enable users to contact a WITTMANN BATTENFELD service engineer directly.

Thanks to the WITTMANN BATTENFELD web service, users are only seconds away from the WITTMANN Group's entire technical expertise.



CONNECT



- » **The basic principle of the remote service is simple:**  
The machine is equipped with a control system software which makes it possible to carry out numerous service functions simply via the Internet. If desired, the WITTMANN BATTENFELD service hotline can access the user's system to provide live support, analyze log files, execute diagnostics programs or remedy defects directly online.

- » **Wide range of services by remote access:**
  - Troubleshooting, user support, monitoring and remote inspection
  - Round-the-clock access to the expert knowledge of WITTMANN BATTENFELD worldwide
  - Increased machine availability and more productivity through short response times
  - 70 % of all notified technical problems with injection molding machines are solved via remote access.

# SMART PRODUCTION MES

*Wittmann*

*Battenfeld*

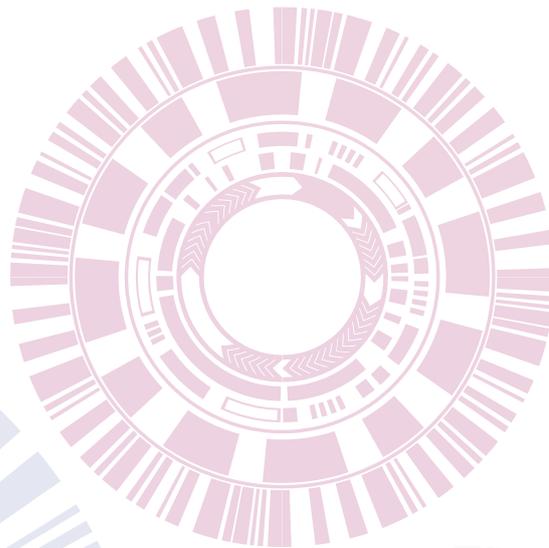
## TEMI+

Manufacturing execution systems (MES) are the basis and backbone of production process control in modern injection molding plants.

With TEMI+, WITTMANN BATTENFELD offers a modular, easy-to-handle and simultaneously innovative MES

- » Geared to the requirements of the plastics processing industry
- » Ready to meet the challenges of Industry 4.0 and digitization

TEMI+ is the first system worldwide to support the WITTMANN 4.0 auxiliaries as well.



» Competitiveness

» Transparency

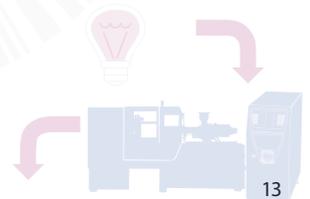
» Reliability

» Quality

» Traceability of production

» Productivity

» Cost reduction



# SMART PRODUCTION MES

» Easy to understand right away



» Intuitive and user-friendly

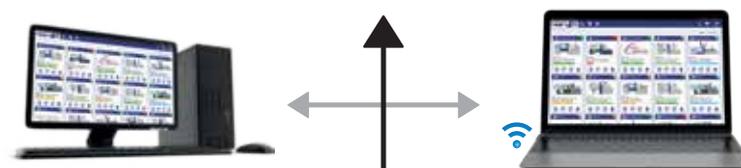
» Automatic data collection from all peripheral units connected to the WITTMANN 4.0 production cell

» Can be operated from any location thanks to web browser architecture

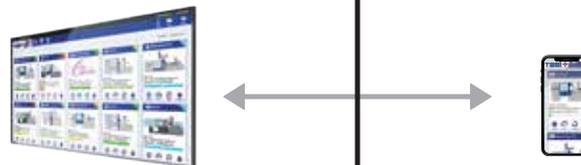


## TEMI+

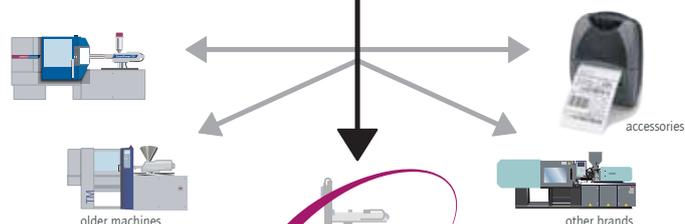
TEMI+ Company server



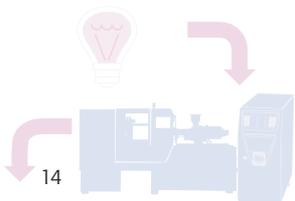
Production Planning

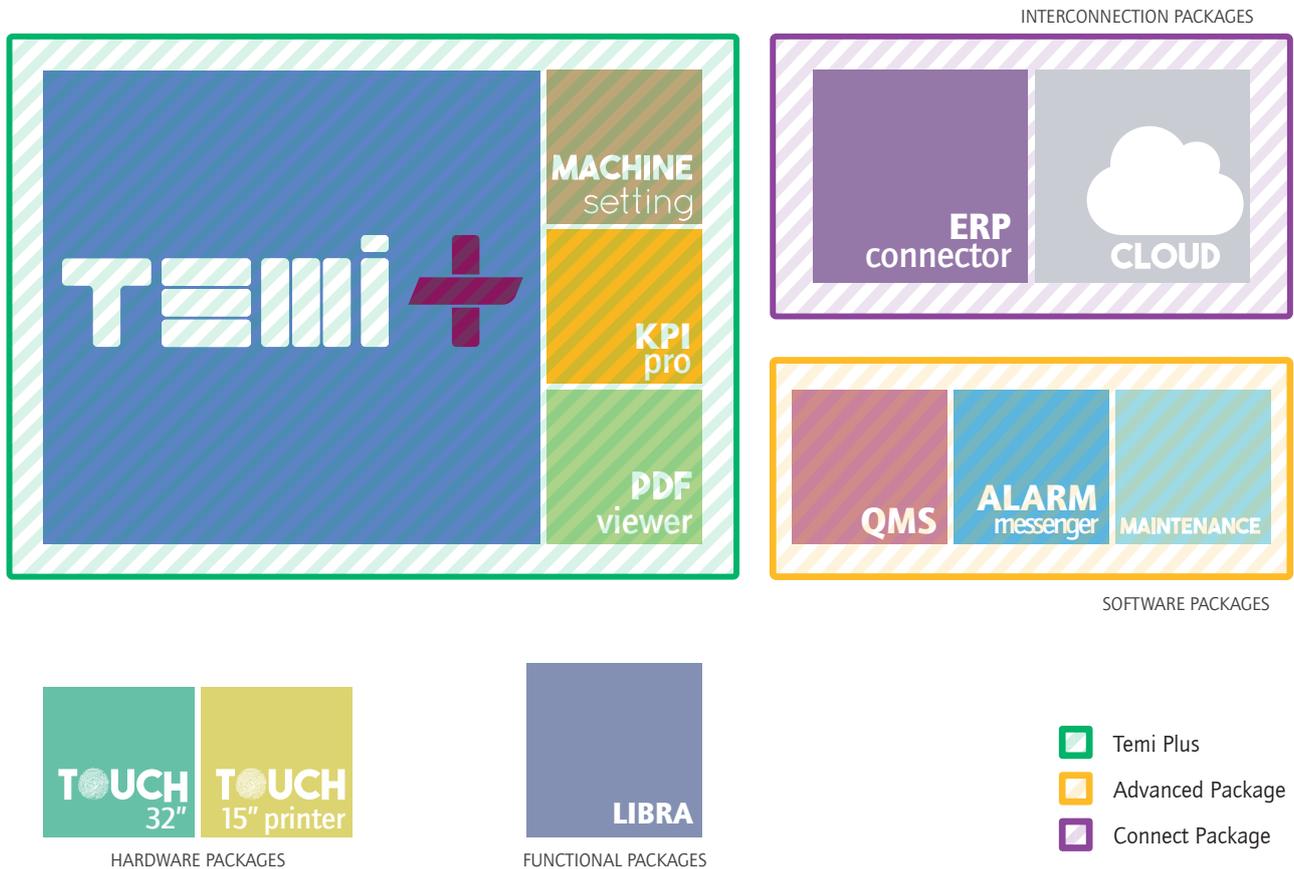


Monitoring



Production



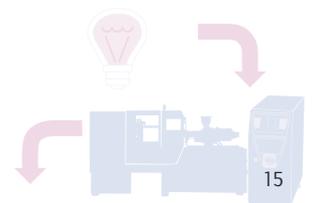


## TEMI+ and its modules

**TEMI Plus** is the standard package which includes all production planner, production monitor, data manager and OEE KPI pro functions. The data manager handles the administration of the production cell settings for the injection molding machine and the WITTMANN 4.0 peripheral equipment, as well as the PDF viewer for documents, working instructions and product drawings.

The **Advanced Package** is an extension which includes all functions and modules such as the alarm manager, the QMS module and the maintenance manager. These serve to improve both productivity and product quality by reducing downtimes in conjunction with digital quality inspection.

The **Connect Package** is an extension which adds the interface to connect the TEMI Plus with ERP systems and cloud services.



# SMART PRODUCTION MES

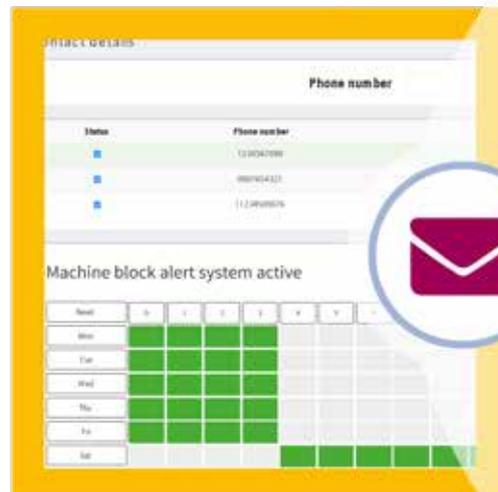
## ERP connection module

Work orders from an existing ERP (Enterprise Resource Planning) system can be transmitted automatically to TEMI+ and completion feedback sent to the ERP system from there.



## Alarm messenger

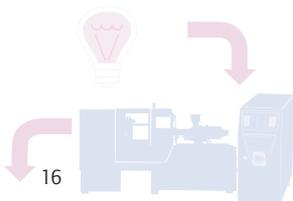
Even a production process with perfect parameter settings can be interrupted once in a while. In such cases, TEMI+ issues a mobile report specifying the time and the cause of the standstill.



# TEMI+

## QMS module

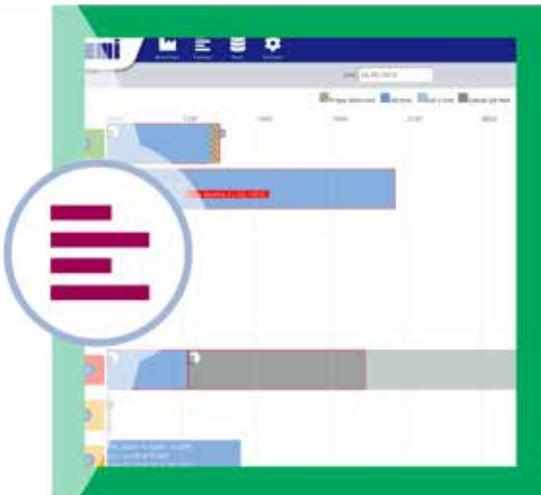
The instructions for quality inspection saved in TEMI+ can be retrieved during production, and the recorded process data or measurement readings for any parts produced can be traced completely and correctly allocated to the relevant lot.





**Production monitor**

Here, the condition of all machines and their current order processing can be checked live "at a glance". More detailed information about the individual production cells can be accessed easily from there.



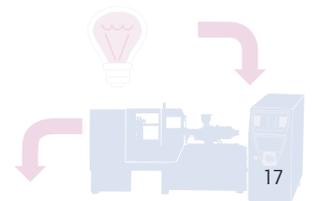
**Production planner**

Knowing what needs to be done, and when, is the key to successful production planning. This module provides an easy way to make the right decisions and optimize the production process.



**KPI pro**

TEMI+ presents in the form of a simple, clear graphic chart the key production figures which are essential for the commercial success of an injection molding plant.



# SMART PRODUCTION

## MES



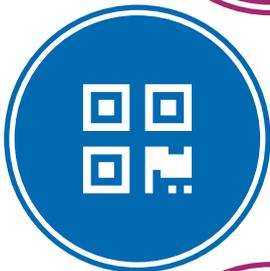
### INTERNET ARCHITECTURE

TEMI+ was developed on the basis of a web browser architecture, so that all users are able to retrieve and process the data saved in TEMI+ using their personal access data from anywhere on the corporate premises.



### PRODUCTION CELLS

TEMI+ is the first software product with a concept based on the logic of the Internet of Things. In this way it is now possible to network not only the machines of a production plant with each other and to save their data, but also to include the additional peripherals and their data, thanks to the advantages offered by WITTMANN 4.0 manufacturing cells.



### TRACEABILITY

With TEMI+, company staff no longer needs to bother about saving the production data. The system takes care of this simply and clearly by its automatic access to the relational databases connected with the production equipment.



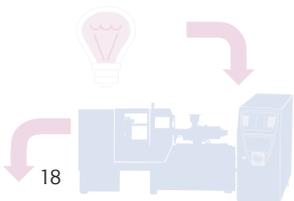
### TURNKEY SOLUTION

Not only the integration of TEMI+ in a company is easy; its intuitive, user-friendly HMI requires no lengthy and costly staff training courses. This means that users can benefit from the system immediately, which also contributes to shortening the payback period.



### UNBEATABLE PRICE/PERFORMANCE RATIO

In spite of the enormous versatility of the TEMI+ packages and modules, the required investment remains moderate, even for small and medium-sized companies wishing to benefit from the advantages of digitizing their production.



# SMART FACTORY

Wittmann

Battenfeld

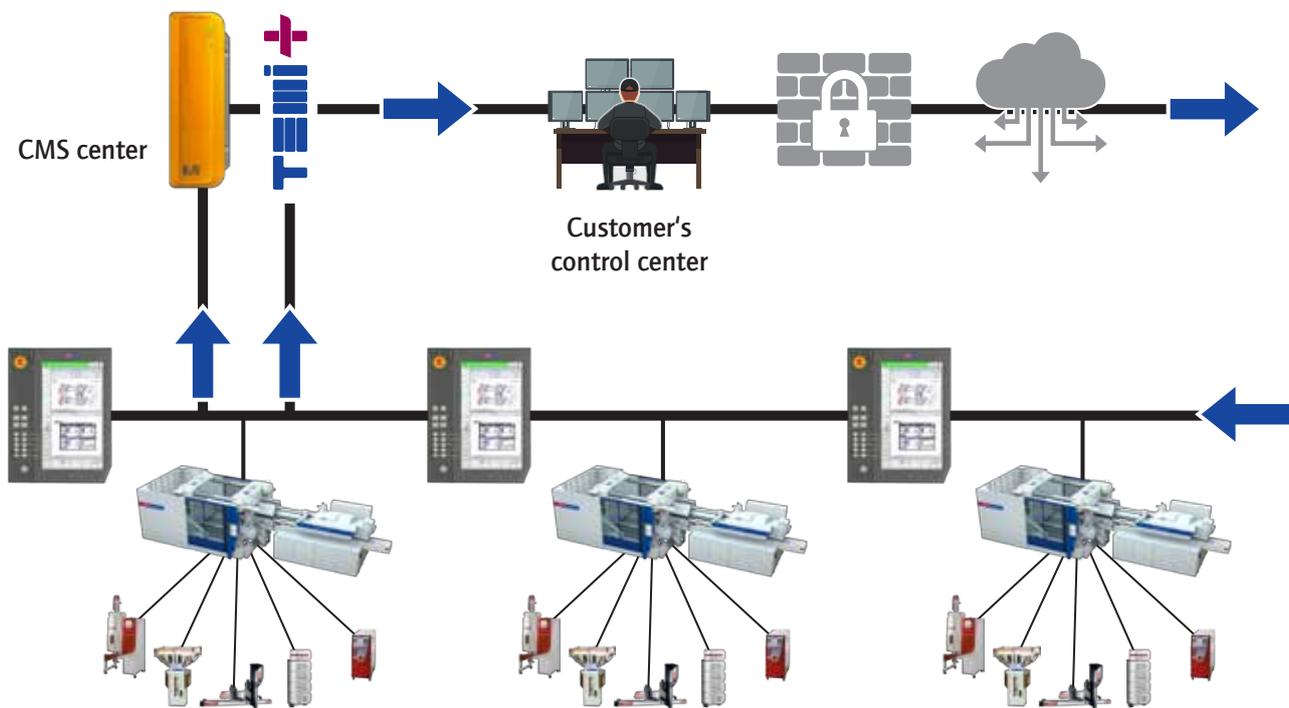
With the technologies presented here, the WITTMANN Group is the first company worldwide to lay the foundation for its customers' success in the era of digitization.

Services such as CMS and web service make it possible to minimize machine downtimes and maximize efficiency in production.

WITTMANN 4.0 provides the basis for barrier-free data exchange within the production cell with simultaneous network security.

The TEMI+ software module is a low-cost manufacturing execution system which supplies information from the production cells without time lag.

These solutions, which are already available today, open part of the way towards autonomous injection molding production. Thanks to networking, production cells will communicate with each other in future and be able to inform each other concerning disturbance variables. Autonomous machines will compensate process disturbance variables automatically by targeted corrective actions.



In this way, customers of the WITTMANN Group are optimally prepared for future development towards the Smart Factory.





**WITTMANN BATTENFELD GmbH**

Wiener Neustädter Strasse 81

2542 Kottlingbrunn | Austria

Tel.: +43 2252 404-0

[info@wittmann-group.com](mailto:info@wittmann-group.com)

[www.wittmann-group.com](http://www.wittmann-group.com)