

14.0 Software Solutions

Balint Rehak
Bosch Rexroth



Bosch Group – Focus Manufacturing

Where do we come from?



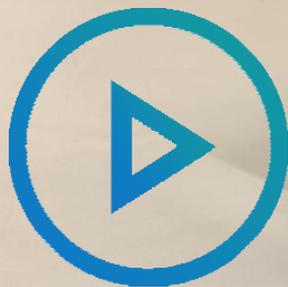
ROB. BOSCH

Werkstätte für Feinmechanik & Elektrotechnik

STUTTGART



Who we
are today?



Manufacture #LikeABosch
with the Nexeed Industrial
Application System



Bosch Group

Key figures 2019

Bosch Group

€ 77.9 billion euros sales revenue

 402,800 associates



Mobility Solutions

60%



Industry Technology

9%

rexroth
A Bosch Company



Consumer Goods

24%



Energy & Building Technology

7%



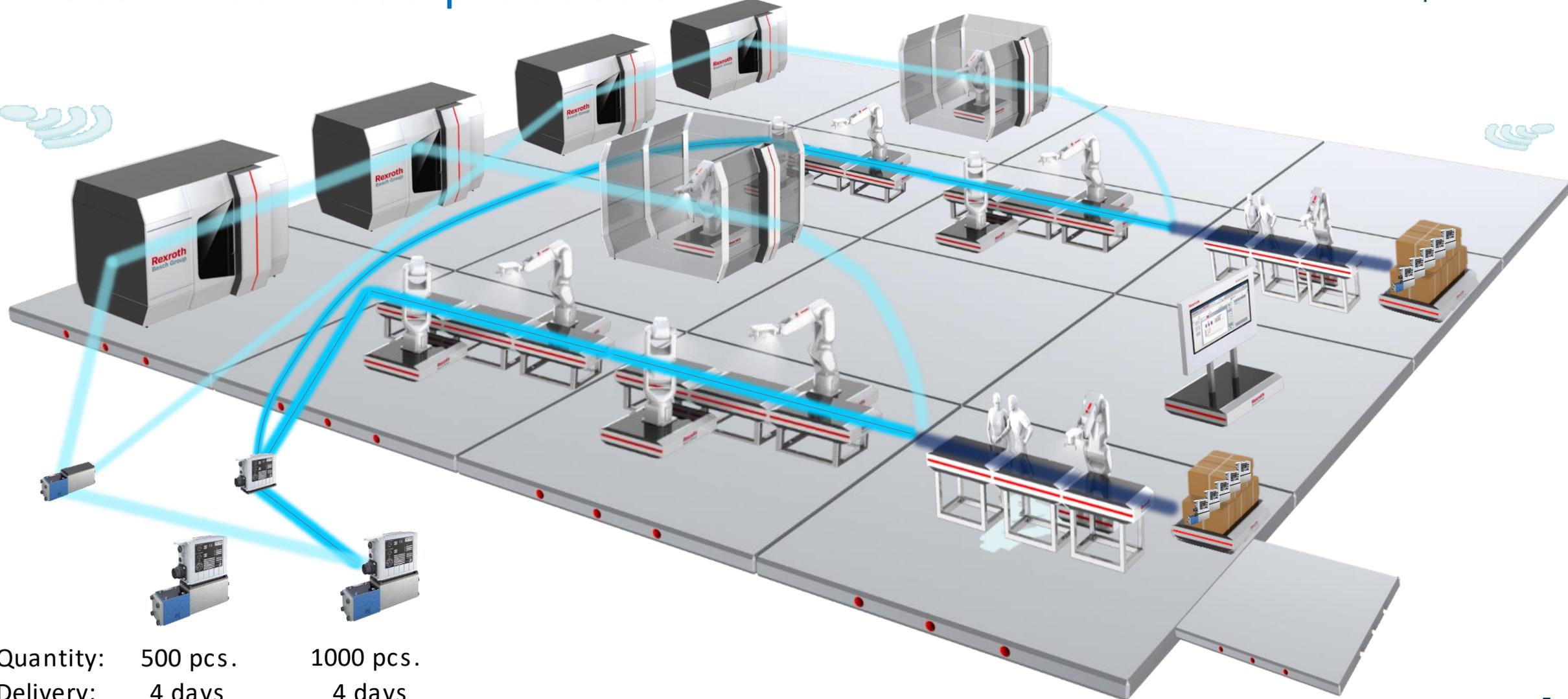


Our Mission – Factory of the Future

Factory of the Future

Customized mass production

- 1. Incoming order
- 2. Capacity expansion
- 3. Material flow & production



Quantity: 500 pcs. 1000 pcs.
Delivery: 4 days 4 days



I4.0 Software Solutions – From data to Information

Increase efficiency and create new business

The 3 steps to digitize machines (from sensors to cloud)



“Cloud” cockpits – Visualization & Analytics (SW)



IoT Gateway & Intelligent Edge



Sensors and devices (HW)

IoT Gateway

Data collection



Data



Data



Input:
Machine(s) & Sensors

**Bosch Rexroth IoT Gateway
Software**

Output:
**Cloud Systems, Data Bases &
Protocols**

get one standard data solution for all your machines – flexible and future-proofed

Increase efficiency and create new business Indeed, each and every life cycle phase..



from retrofitting of machines from
Robert Bosch built in the 19th century..



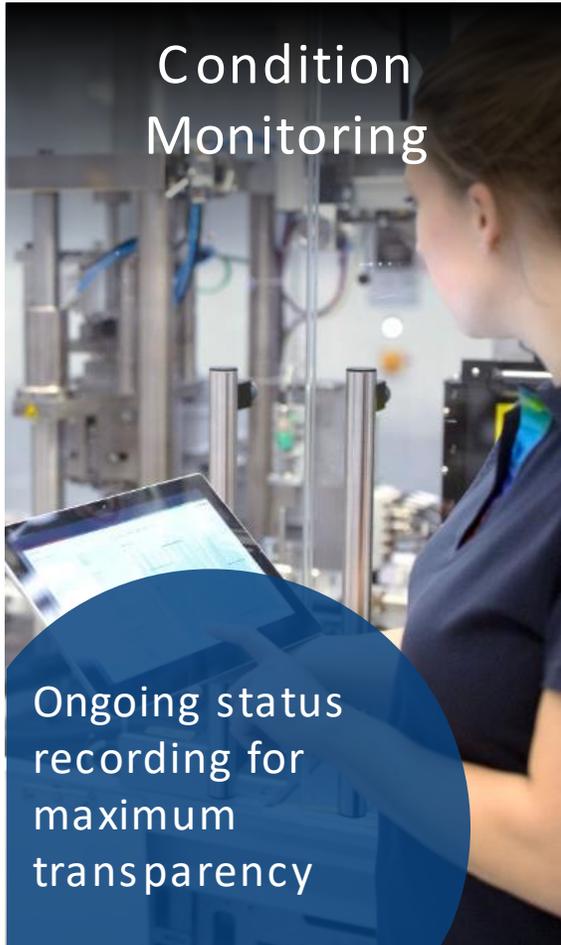
..to improving engineering of cutting
edge technology.



Predictive Maintenance Bosch Nexeed Software

Nexeed Production Performance Manager (PPM) Use case overview

Condition Monitoring



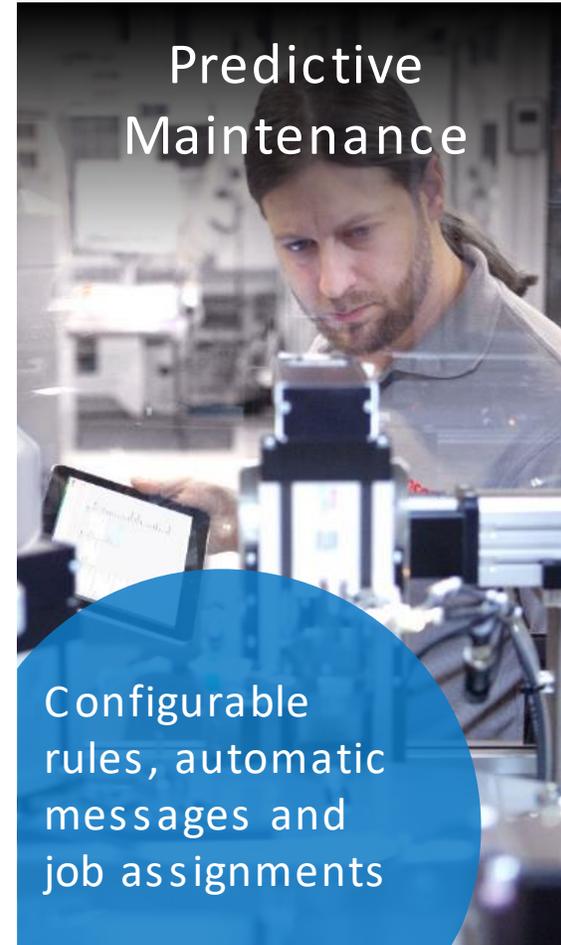
Ongoing status recording for maximum transparency

Process Monitoring



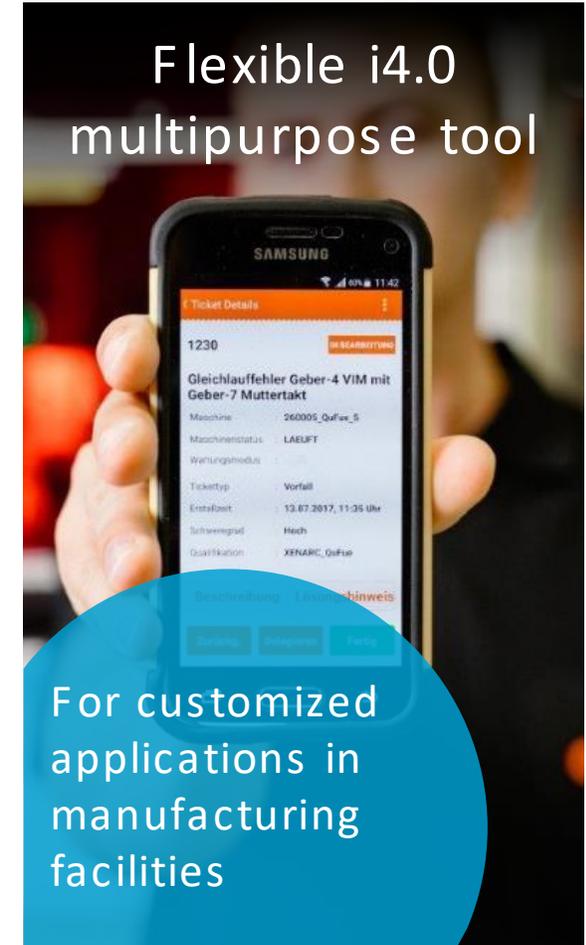
Reducing production errors and process deviations to a minimum

Predictive Maintenance



Configurable rules, automatic messages and job assignments

Flexible i4.0 multipurpose tool



For customized applications in manufacturing facilities

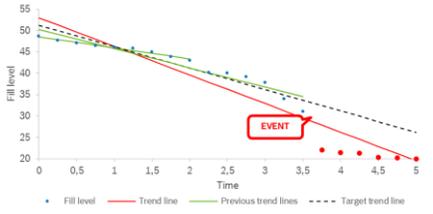
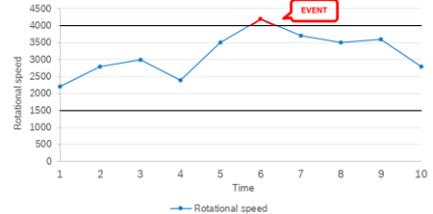
Ticket Details	
1230	IN BEARBEITUNG
Gleichlauffehler Geber-4 VIM mit Geber-7 Muttertakt	
Machine	260005_Qufire_5
Machinestatus	LAEUFT
Wartungsmodus	
Tickettyp	Vorfall
Erstellt	13.07.2017, 11:25 Uhr
Schweregrad	Hoch
Qualifikation	XENARC, GeFue

Nexeed Production Performance Manager (PPM)

Predictive Maintenance – Rules overview

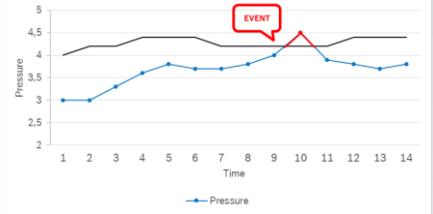
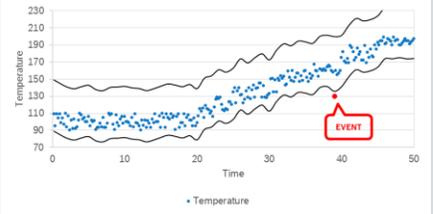
Static

- ▶ Upper/lower limits
- ▶ Trend recognition; Sum of two measurements
- ▶ Static target with tolerance; Range



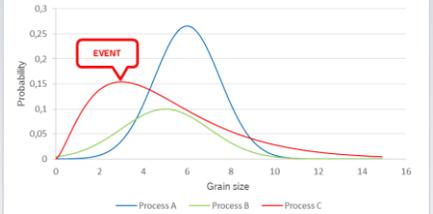
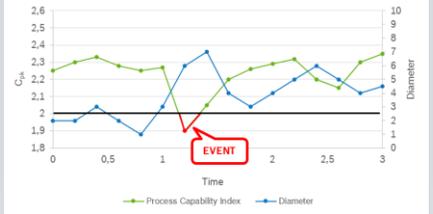
Dynamic

- ▶ Dynamic limits
- ▶ Reference series as limit
- ▶ Jump detection



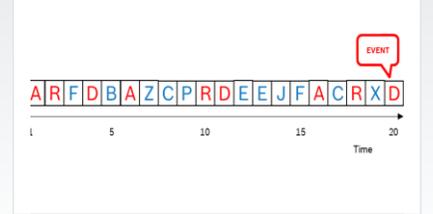
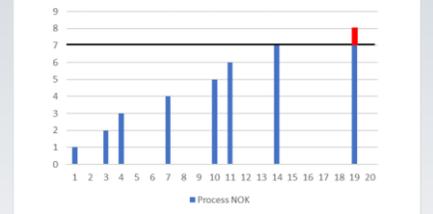
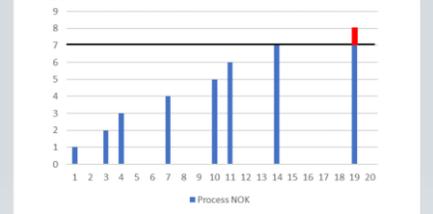
Statistic

- ▶ Process capability index
- ▶ Normal distribution
- ▶ Nelson rules



Counts

- ▶ Hit of events
- ▶ Hit of process results
- ▶ Event sequence detection



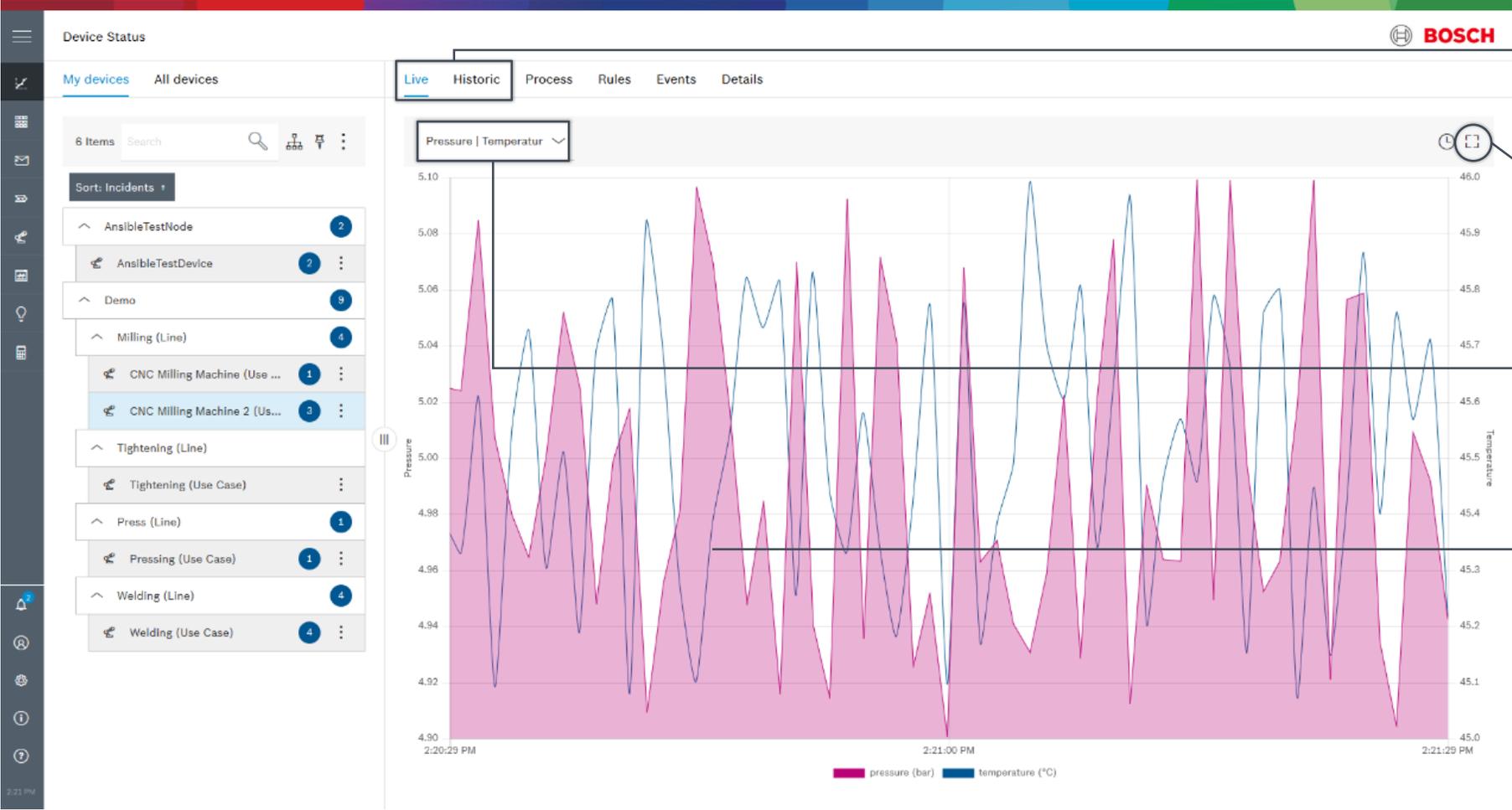
Individual

Rules that can be developed for your individual use case. We offer a guided approach to find the solution you need!

- Workshop & customized rule development (separate quotation)



Nexeed Production Performance Manager (PPM) Condition Monitoring



Chose between live measurements and historic data

Enables full-screen mode to monitor certain measurements directly at the production line

Customizable views

Displays all measurements from different sources in one live view

Nexeed Production Performance Manager (PPM) Process Monitoring

Device Status BOSCH

My devices | All devices

6 Items Search

Sort: Incidents

- AnsibleTestNode (2)
- Demo (9)
- Milling (Line) (4)
- Tightening (Line)
- Tightening (Use Case)
- Press (Line) (1)
- Pressing (Use Case) (1)
- Welding (Line) (4)

Live | Historic | **Process** | Rules | Events | Details

346 Items Torque | Angle

3/6/19 2:25 PM 3/6/19 3:07 PM

3/6/19 12:21 PM 3/6/19 3:07 PM

Phases Legend Limits Special Values Sort

Torque in Nm

Angle in °

Schraubstufe | torque Auf M2 | torque

Process details

process	
result	OK
ts	Mar 6, 2019 2:59:57 PM

Filter by: date, program, part type ID, part ID

Comparison mode

Process result (OK /NOK)

- View options:
- Different phases can be displayed
 - Show / hide legend
 - Show special values & limits
 - Sort data

Process curves

Show meta data

Waren-
eingang

Intralogistics

Optimize internal flow of goods

Nexeed Intralogistics Execution System (IES)

Optimize internal flow of goods

Transport Management UI Appl.



The Transport Management section features a 3D warehouse layout with red and blue paths indicating material flow. Below this are images of a white autonomous mobile robot (AMR), a blue and red forklift, and a yellow and blue RFID@BOSCH system. A small image of a white pallet truck is also visible.

Transport optimization

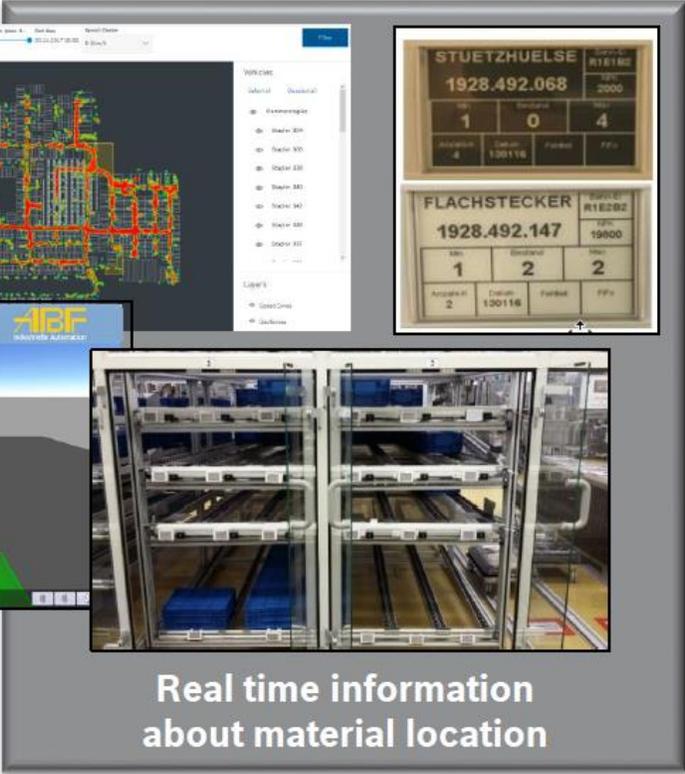
Fleet Analytics UI Appl.



The Fleet Analytics section displays several data visualizations: a 'Year-over-year' bar chart comparing 2017 and 2018, a 'Nov 2017' bar chart showing daily performance, and a 3D simulation of a forklift with a sensor icon. A legend at the bottom identifies 'Handling Time' (blue), 'Unloaded Trip' (yellow), and 'No Data' (grey).

Fleet analysis and safety features based on sensor data

Stock Management UI Appl.



The Stock Management section shows a 3D warehouse map with red and green paths, a screenshot of a software interface with a sidebar menu, and two physical inventory cards. The top card is for 'STUETZHUELSE' with quantity 104, and the bottom card is for 'FLACHSTECKER' with quantity 2.

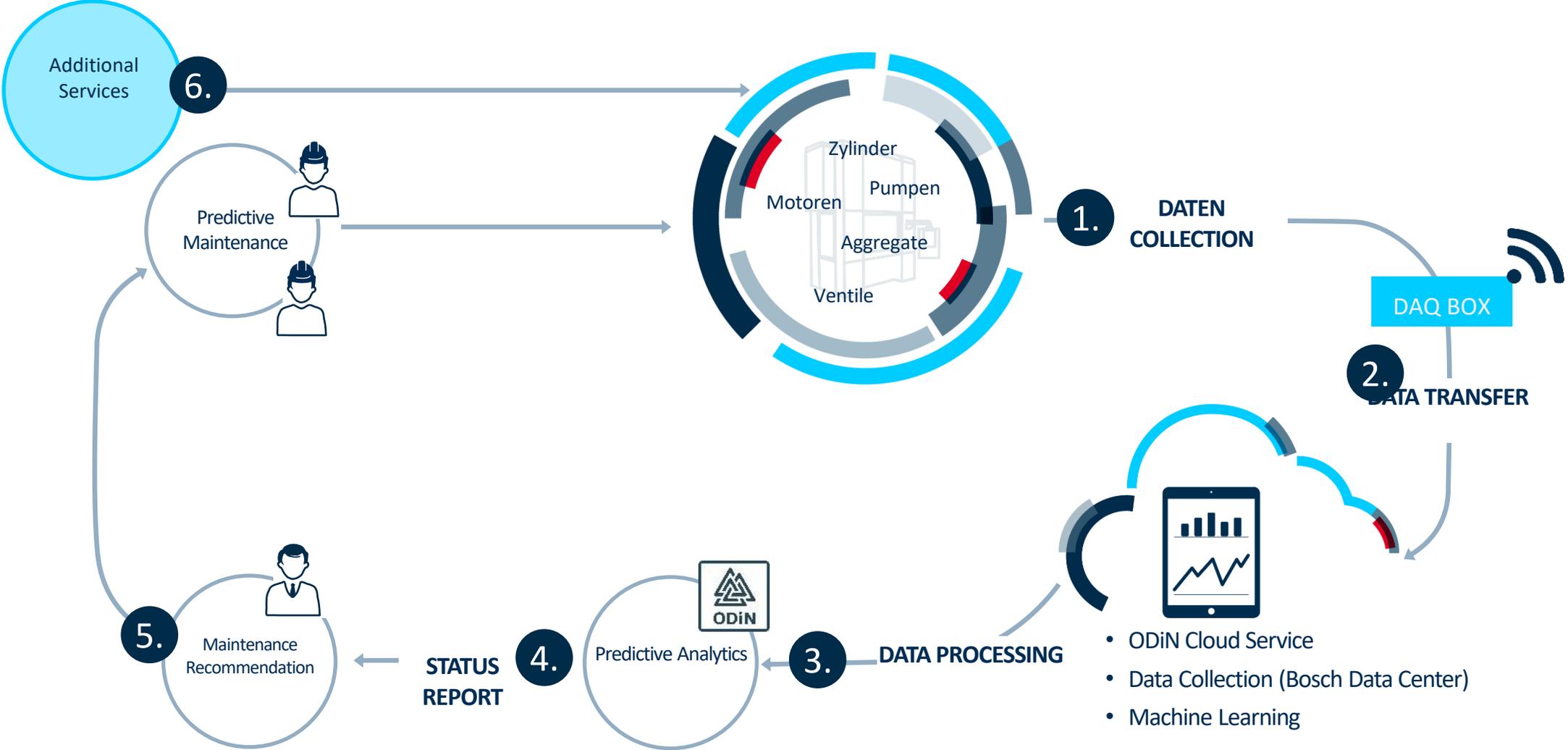
Real time information about material location



Artificial Intelligence ODiN by Bosch Rexroth

Predictive Analytics – ODIN

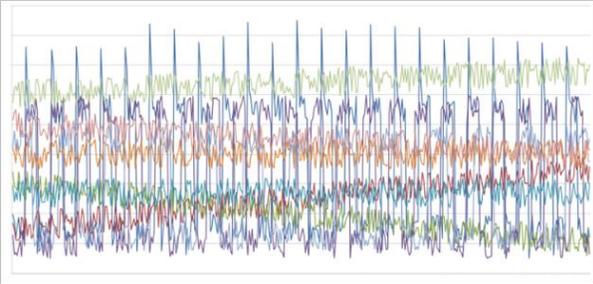
Six-Step Solution



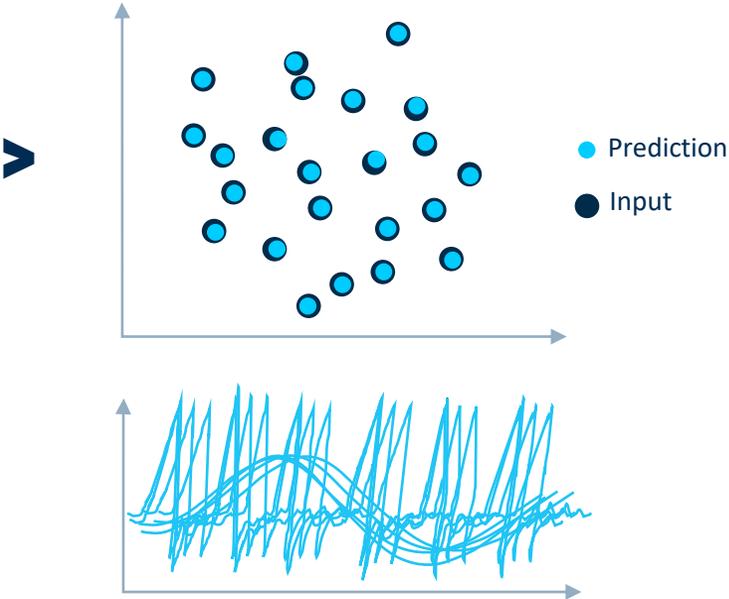
Predictive Analytics – ODIN

Machine Learning – Learning Phase

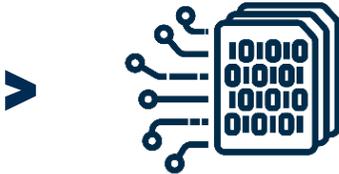
Learning Phase
e.g. Training Data
Component



Training Model applied
through machine
learning algorithm



Machine Learning Model



Machine Learning Model 1



Summary of Digital Factory

Data driven decisions

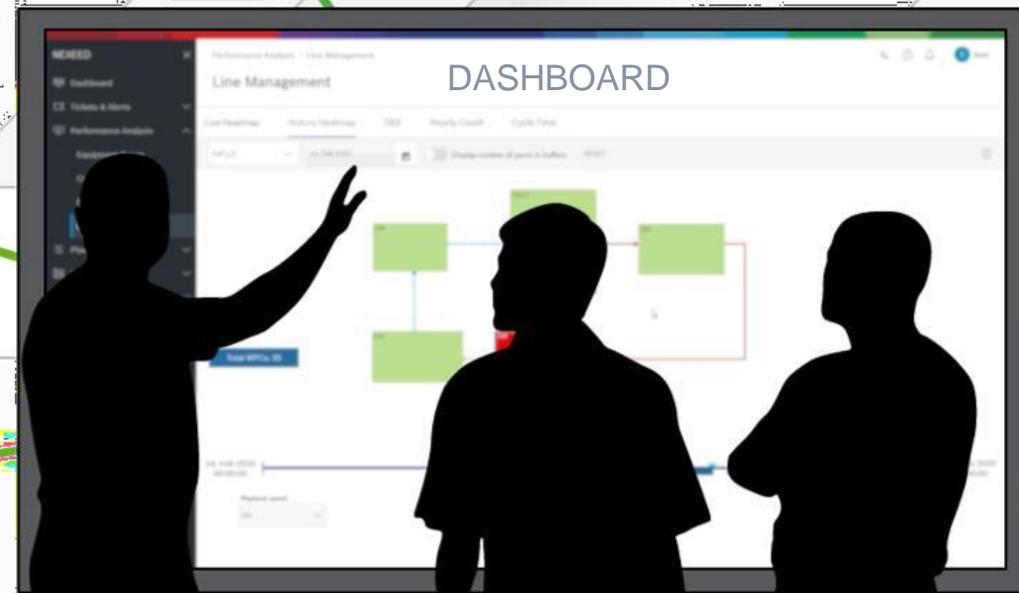


Digital factory:

- Real-time insights
- Fast reaction

Result:

- ✓ Reduces downtime costs
- ✓ Optimizes maintenance activities
- ✓ Increased production efficiency



BENEFITS



Transparency

in manufacturing



Productivity

Up to **5-10 %** higher



Maintenance cost

Up to **25 %** lower



Machine availability

Up to **15 %** higher

Thank you for your attention!