

Welcome to the “Using Smart Industrial Electronics to Lower Production Costs” Webinar

The presentation will begin at 1pm Central time

All attendees microphones are muted for the entire webinar session. Be sure your speaker is active and join the audio conference.

If you have a question, please send it to the host using the “Q&A” function. Questions will be answered at the end of the presentation.

PUBLIC

Organizational Information

- All participants' **microphones** are **muted** during the webinar.
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- Today's presentation will be E-mailed to all attendees. The webinar will also be posted on our website: <http://www.hbm.com/en/3157/webinars/>
- If you have additional technical questions, feel free to contact our Americas technical support team at support@usa.hbm.com or the European technical support team at support@hbm.com.

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Agenda

- Advantages of the digital measuring chain
- What benefits does high-quality measurement technology bring?
- How do "smart functions" support automation technology?
- Modern automation concepts and efficient diagnostics; applications
- The "Smart factory" What do we win?

Three key factors count in industry: quality, time and cost

- Manufacturing Monitoring, Test Rigs, Functional Test Stands, Condition Monitoring
- Absolute cost control through integrated systems and functionality according to Industry 4.0



Assembly



Metal working



Machine control



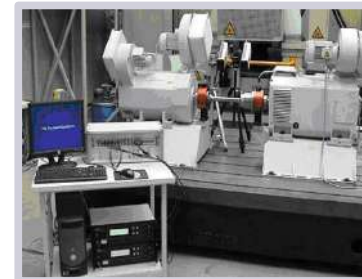
Functionality testing



Energy production



Medical production



Functional test stands

Digital revolution: Communication 4.0

1998



2021



Industrial revolution: Industry 4.0

The 4th Industrial Revolution Is Upon Us

FROM INDUSTRY 1.0 TO INDUSTRY 4.0

FIRST INDUSTRIAL REVOLUTION

Introduction of mechanical production facilities with the help of water and steam power



1784

First mechanical loom

SECOND INDUSTRIAL REVOLUTION

Introduction of a division of labor and mass production with the help of electrical energy



1870

First assembly line

THIRD INDUSTRIAL REVOLUTION

Use of electronic and IT systems that further automate production



1969

First programmable (PC)

FOURTH INDUSTRIAL REVOLUTION

The Digital Connected World



2000

- Lean
- Six Sigma

1800

1900

Principles of Scientific Management

TQM

PRODUCTIVITY

Tasks of modern control technology

Industrial environments include three factors: quality, time and cost

What users need:

- Precise and electrical robust operation
- Simple integration into the system components
- Easy handling
- Comprehensive, preventive diagnostics, easy maintenance

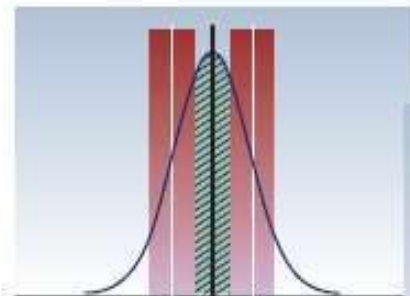
Megatrends:

- Shorter and shorter product life cycles
- Increasing IT networking
- Demographic change

Performance, Accuracy, Measurement Uncertainty – WHY??

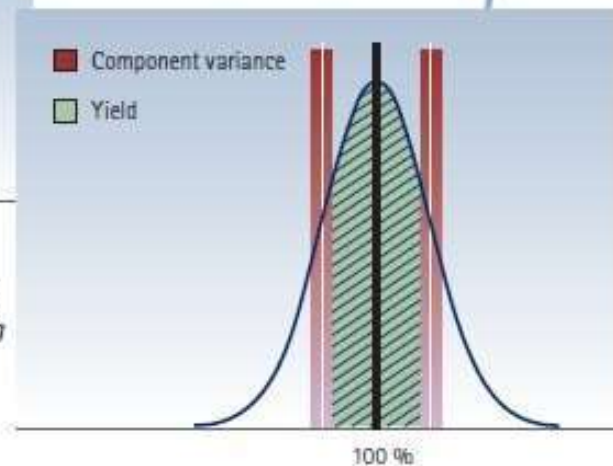
- Greater accuracy makes it possible to record manufacturing tolerances more precisely.
- Components are precisely tested and manufactured with the necessary tolerance.
- Reduces rejects and conserves resources while maximizing output.

...without



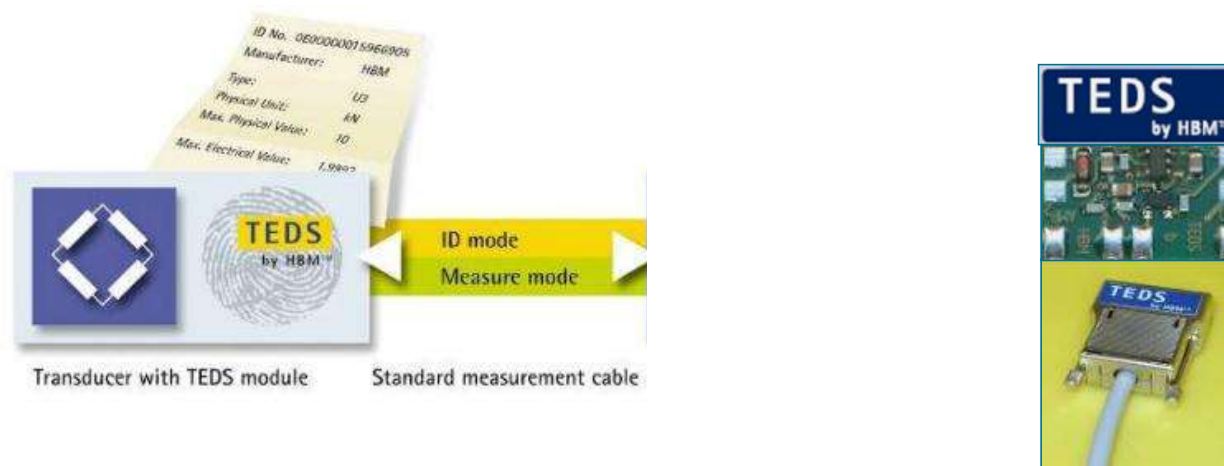
Process monitoring with conventional measuring amplifiers, high rejection rate due to measuring inaccuracies

... with



Increased efficiency with PMX, optimum yield with precise measurement results

TEDS – Setup measuring chain in only seconds



- Read TEDS (0 and 1-wire) as per the IEEE1451.4 standard
- Easy setup of the measuring chain
- Scaling: 2-point, table, polynomial

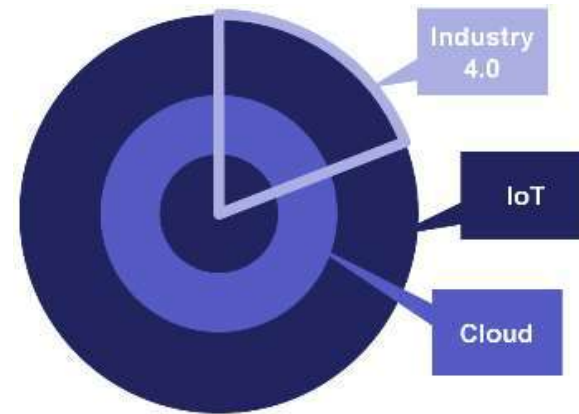
Calibration Accessibility

- The calibration data is stored as a calibration certificate in PDF format in the internal amplifier device memory.
- Users can download it at any time via www.hbm.com or via the browser of the amplifier
- Quality assurance in production and test benches



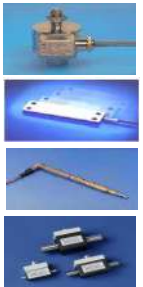
Industry 4.0 and the Internet of Things (IOT)

- Industry 4.0 is only a part of cloud and IoT
- Brings benefits:
 - Asset services
 - Predictive maintenance
 - Device management



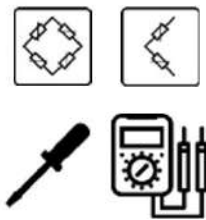
“Internet of Things”: What Does This Mean?

- **Sensors** that allow for easy and fast integration with complex production systems - for example through availability of “electronic data sheets”
- **Measuring amplifiers** that can communicate in real time with sensors and today’s Industrial Internet systems
- **Test and measurement software** that bridges the gap between easiest possible handling and increasingly complex functionality
- **Individual information** stored directly in the object
- **Network** of Internet-connected **objects**
- **Individual** decision making based on information evaluated locally Individual on-demand **services** for event-driven, real-time process control



Digital Revolution: Measurement & controls 4.0

1998

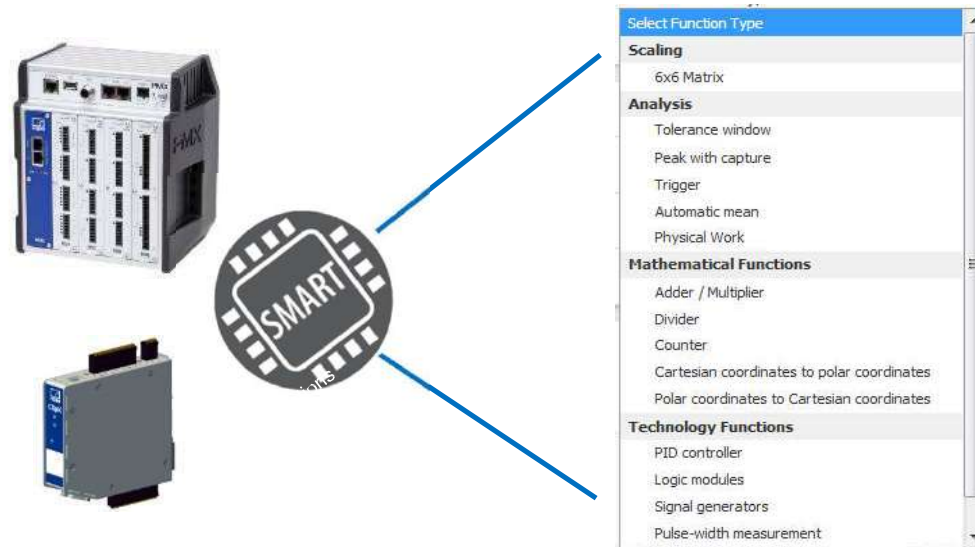


Today's Smart Electronics



How do Smart Functions help in testing and production technology?

Automation with Calculated channels



- A lot of **applications require additional signals/ information and calculations** coming from the measuring signal .e.g.: Peak, Mean, math. logic functions, timer, counter, PID regulator,..
- Combinations are possible, Calculation speed is **1ms** for each channel, easy setup via Web-GUI

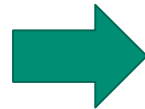
Intelligent Hardware – Edge computing

- Intelligence in the measurement components
- Change from programming to parameterization

Pre-implemented logic:

```
0001 IF switch = TRUE THEN
0002   devSpeed:=T#10ms;
0003 ELSE
0004   devSpeed:=T#25ms;
0005 END_IF
0006
0007 IF devTimer.Q THEN
0008   devTimer (IN := FALSE, PT := devSpeed);
0009   engine := NOT engine;
0010   IF engine = FALSE THEN
0011     steps := steps + 1;
0012   END_IF
0013 ELSE
0014   devTimer (IN := TRUE, PT := devSpeed);
0015 END_IF
```

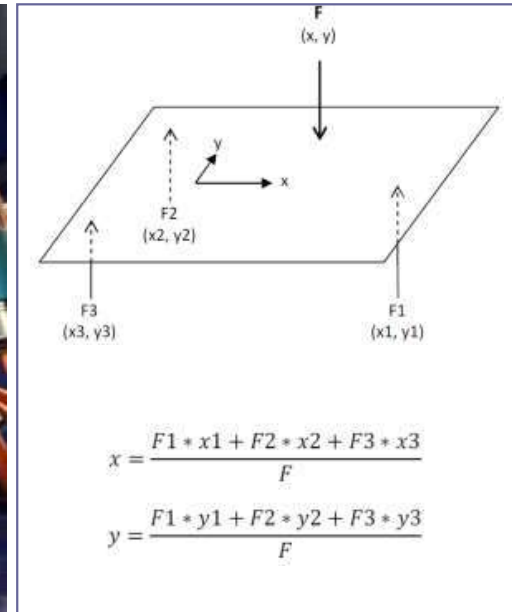
Software program code



Process	Selection Parameters	Help
Setpoint	0 (step)	Y: 20
Process Value	URC Fence (step)	Y: 0
K _p	0 (kg)	Y: Registering Vari...
T _i	0.1 (s)	Calculated Chan...
T _d	0.2 (s)	Min/Max Flag
Youtset	0	
Start/Stop with	1	
Enable/ly	1	

Pre-implemented calculated channel in the edge controller

Example: Controlling Press Capacity

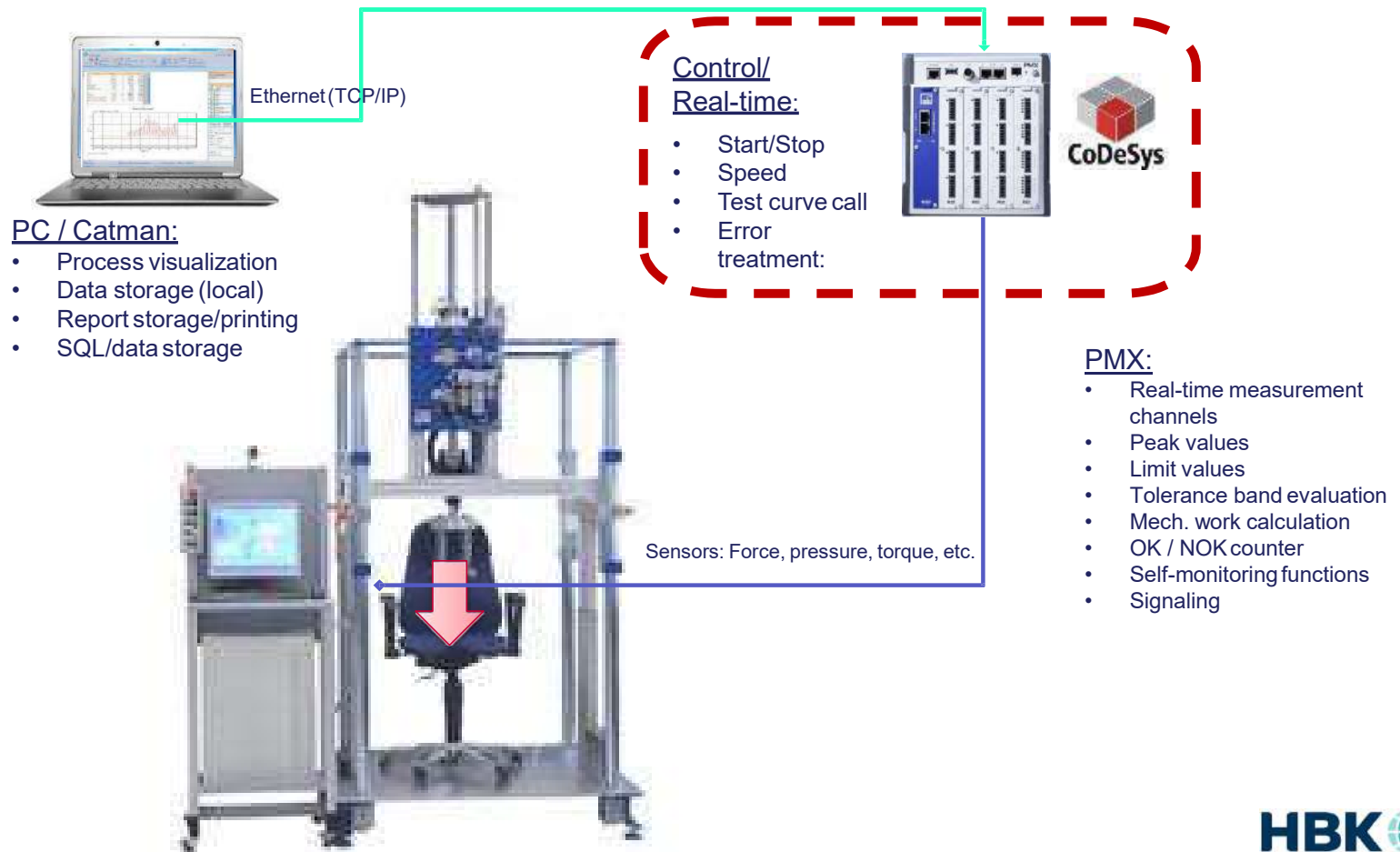


Calc.channel: Mathematical functions

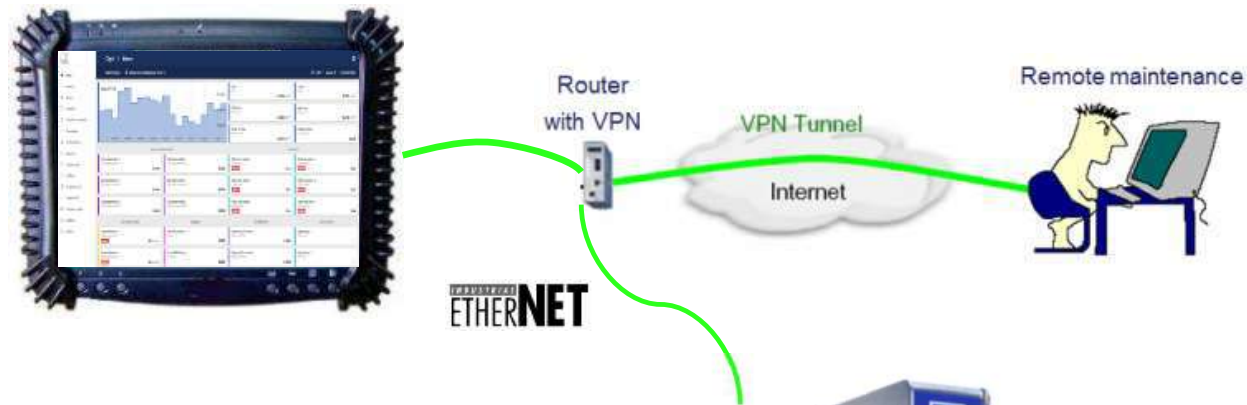
Industry compliant measurement technology:

- SLB700 Strain sensors measuring bending on each column
- 2 sensors per column:
 - mounted in opposite position, allow bending compensation of column
 - force measurement on 2 or 4 columns allow load-distribution

Function test rig – Automated component testing



Operation and visualization



Connection for remote maintenance via Internet

Every ClipX or PMX has its own web interface with responsive design:



Remote operation, maintenance and diagnostics

Live demos accessible world wide (max. 2 connections)



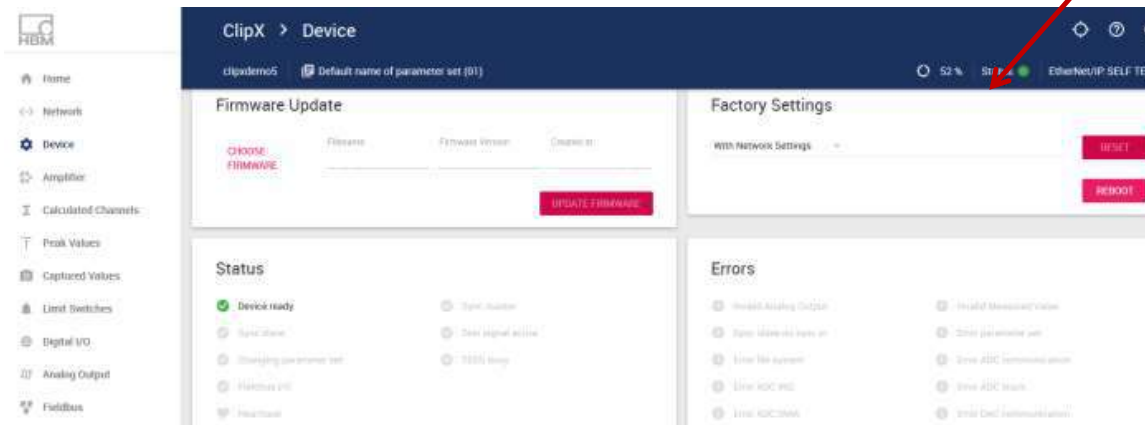
ClipX live demo via internet: <http://clipxdemo.hbm.com>
PMX live demo via internet: [PMX Online Demonstration | HBM](#)

Diagnostics for reliable operation and predictive maintenance



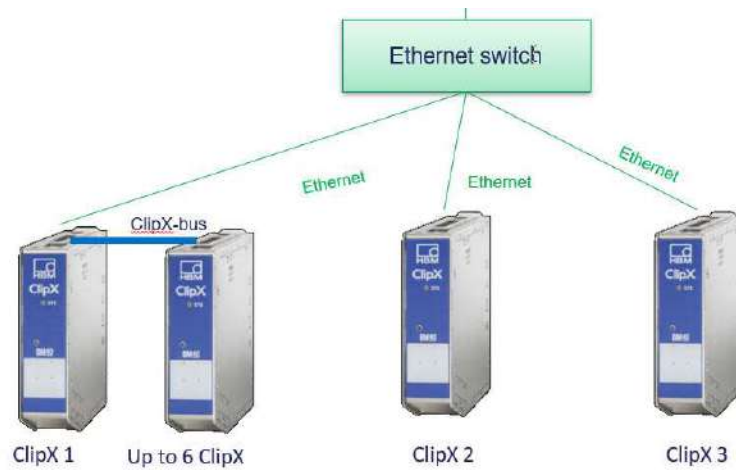
Signals and visualization:

- ClipX with 3 different operator levels; password protected
- Level 2 freely configurable
- Measuring-, TEDS- and System-status
- Test-signals freely configurable
- Log file for error and operator loggings, stored within ClipX
- Status information (short) in the headline

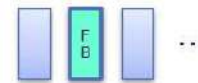


Building up your measurement and control system

Intermodule communication



System Variants



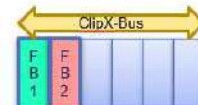
At each ClipX a sensor can be operated, with or without fieldbus



ClipX system with 2 to 6 modules internally synchronized without field bus module



ClipX system with 2 to 6 modules internally synchronized with a fieldbus module



ClipX system with 2 to 6 modules internally synchronized with 2 different fieldbus modules



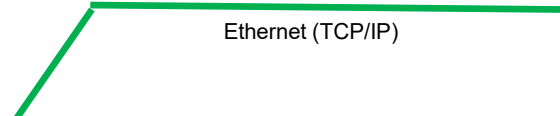
Each ClipX module has an OPC-UA interface and can send its data to the cloud in parallel

Open Flexibility & Connectivity Of Today's Smart Electronics

Simultaneous PC and PLC connection



HMI, Scada and PC connection



Ethernet (TCP/IP)



PC Control



Instrument connection



Analog 4-20mA/+/-10V
Digital I/O



PLC connection



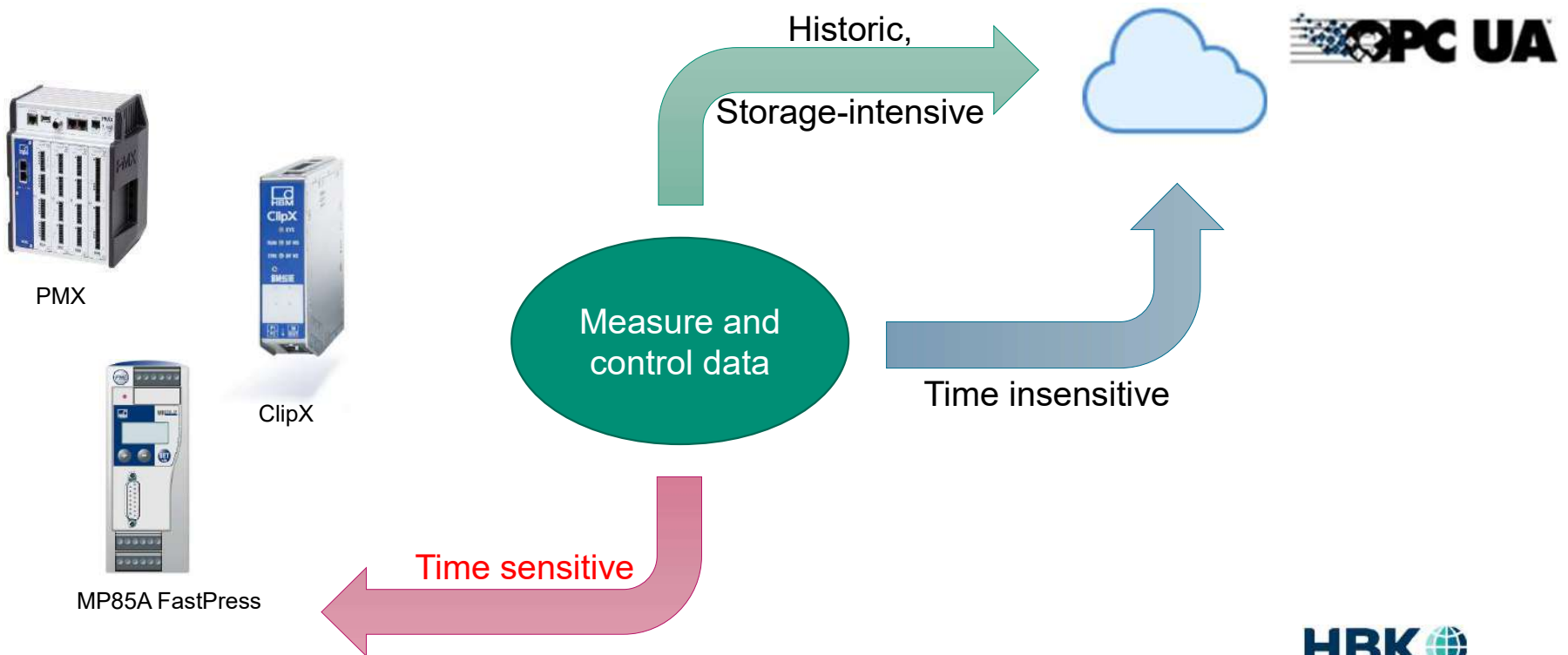
Fieldbus (Real-time)

PLC Control



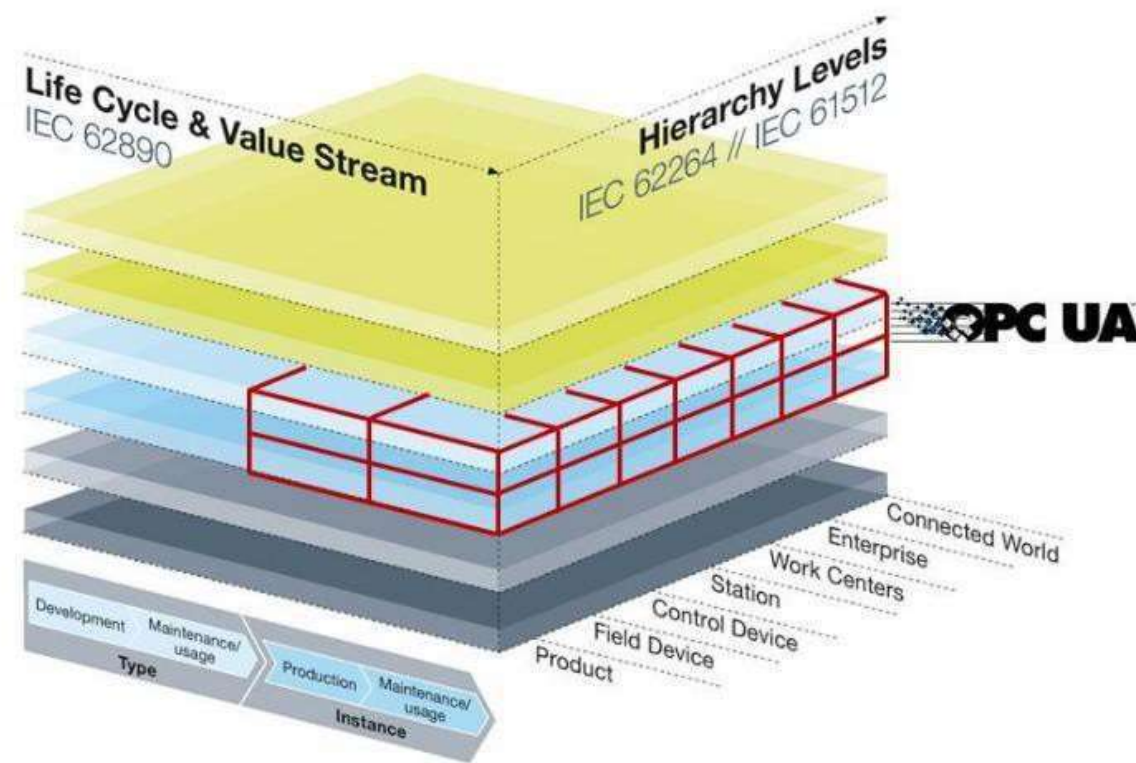
Intelligent Hardware – Data Processing

- Despite cloud uptake – edge computing is essential
- ‘Process data where it is most useful’

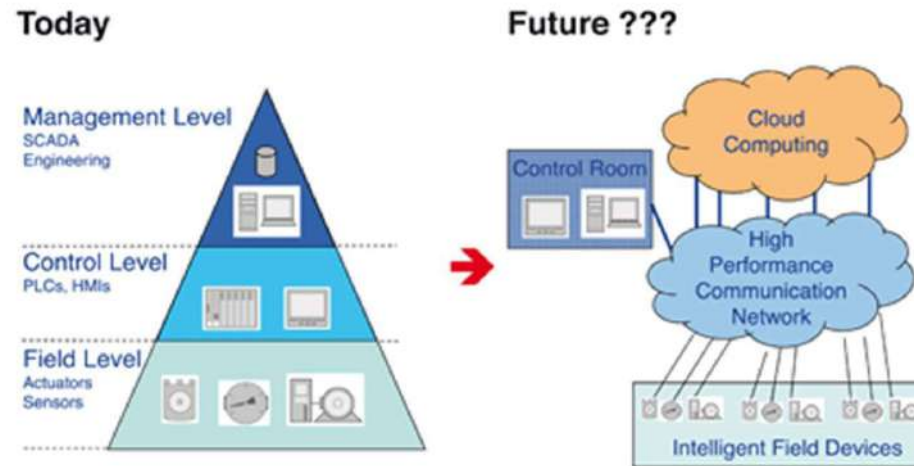


Properties of OPC UA

- OPC UA covers a large area of the Industry 4.0 Reference Architecture Model (RAMI 4.0)



Communication Technology for Industry 4.0

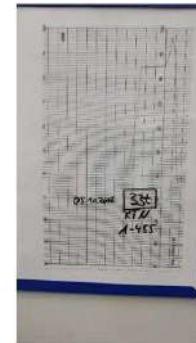


- Ethernet technology will replace the Fieldbus in the long term
- TSN standard for real-time capable networks
- Communication protocols and the LAN and WLAN interfaces integrated on one system on chip
- High integration on one component lowers the costs for an efficient communication connection
- Google Cloud joins the OPC Foundation

OPC-UA Application with ClipX (HBK Smart Factory)



Manual control



Manufacturing of ring torsion load cells

Monitoring of temperature in the ovens

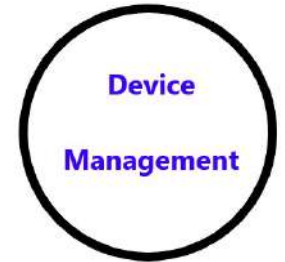
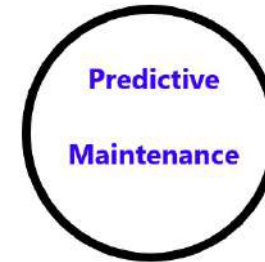
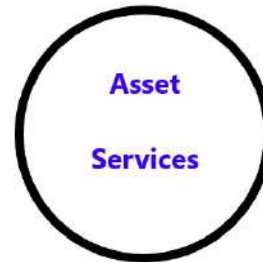


Automatic acquisition and check by ClipX smart device

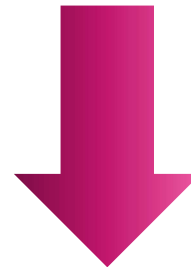


What do we win with using Modern Industrial Process Instrumentation

- Intelligent components
- Ensure quality
- Avoid rejects
- Avoid machine downtimes
- Increase transparency in the production



Optimize processes

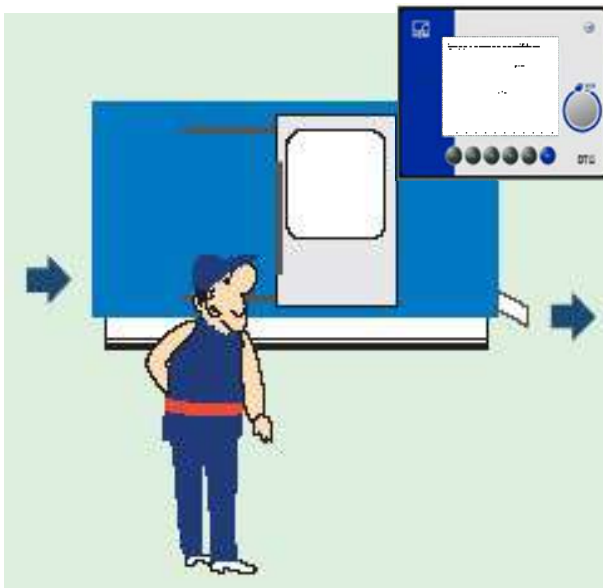


Decrease costs

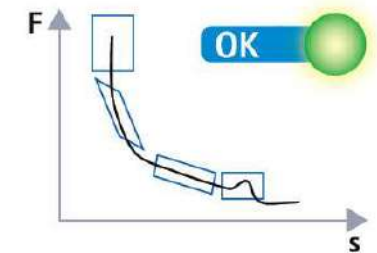
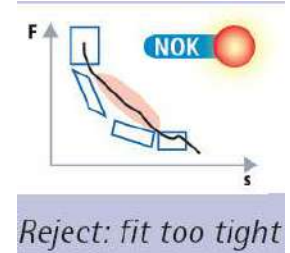


Increase turnover

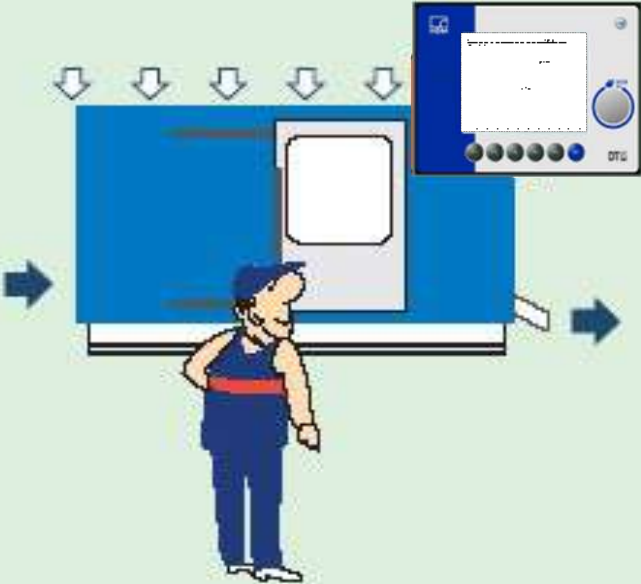
Benefits for Machine/Equipment Operators



- Adjustment help
- Scope into the process
- Immediate realization of disturbances
- Fast reactions in case of change
- Trend recognition
- Process optimizations



Benefits for the Plant



The illustration shows a worker in a blue uniform standing next to a large blue industrial machine. The machine has a control panel on the right side with a screen and several buttons. Above the machine, five white arrows point downwards, indicating input or monitoring points. On the left and right sides of the machine, blue arrows point outwards, indicating the flow of material or production. The worker is looking at the control panel.

- Reduction of stand still, repair and set-up times; faster throughput or cycle time
- Reduction of repair and tooling costs
- Decreasing part costs
- Decreasing production disturbances
- Longer production times; less downtime
- Parallel machine operations

Potential Application Areas

Metal Forming

Press systems

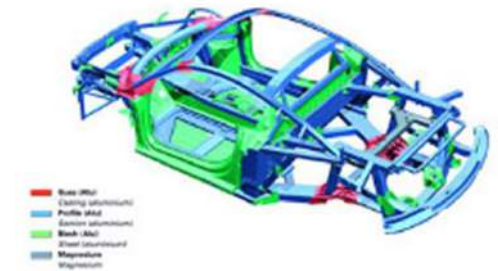
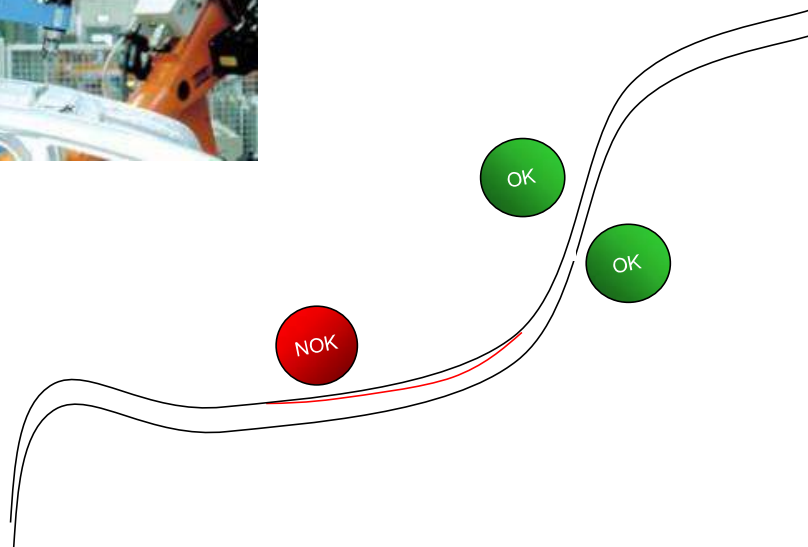
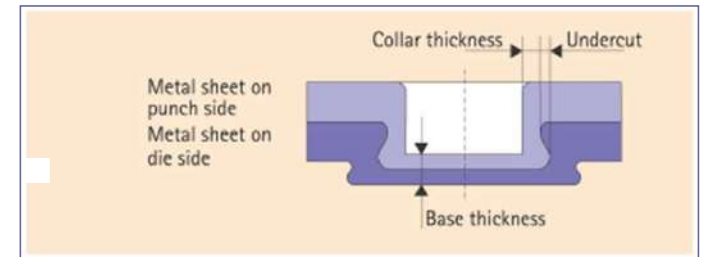


Assembly lines

Press-Fit
Functional / Final Testing

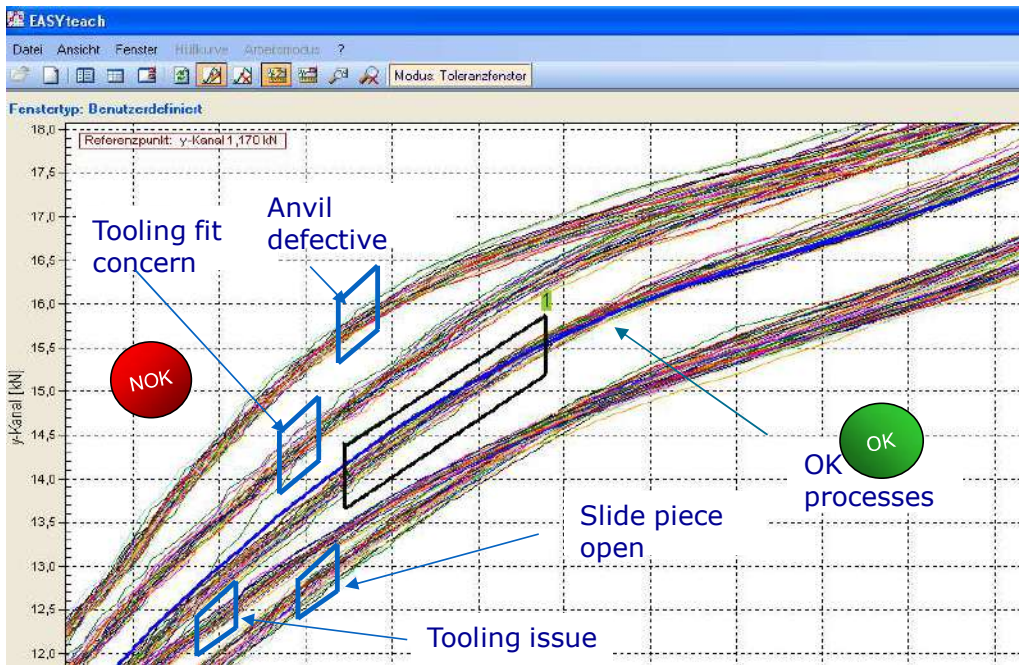


Application Example - Car Body Joining



Force and Displacement Measurements + Smart Electronics

Application Example - Car Body Joining



Immediate identification of minimal errors :

Every tolerance window detects a process state or tool error



Three key factors count in industry: quality, time and cost

- Absolute cost control through integrated systems and functionality driven by today's Industry 4.0

HBK Sensors + HBK Industrial Electronics ➡ Precise & Fast Measurements ➡ Time & Cost Savings



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