Welcome to"Get SMART in your Production and save Time & Money"

The presentation will begin 4:00 – 4:45 PM CET | 10:00 – 10:45 AM ET

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- Product manager for industrial amplifiers and software

- Graduate engineer

- 20 years of experience in factory automation

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Michael Guckes

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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?

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

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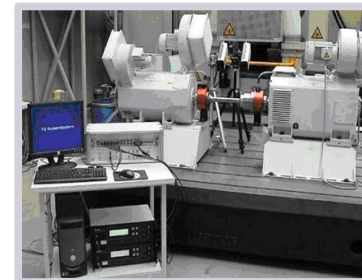

Assembly

Metal working

Machine control

Functionality testing
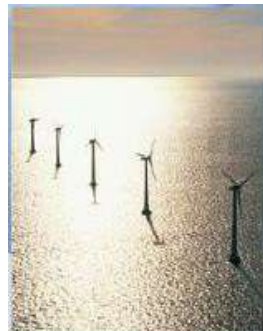
Energy production

Medical production

Functional test stands

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Digital revolution: Communication 4.0

2020

Industrial revolution: Industry 4.0

The 4th Industrial Revolution Is Upon Us.

FROM INDUSTRY 1.0 TO INDUSTRY 4.0

PRODUCTIVITY

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

1800   1900   2000

Principles of Scientific Management   TQM   • Lean • Six Sigma

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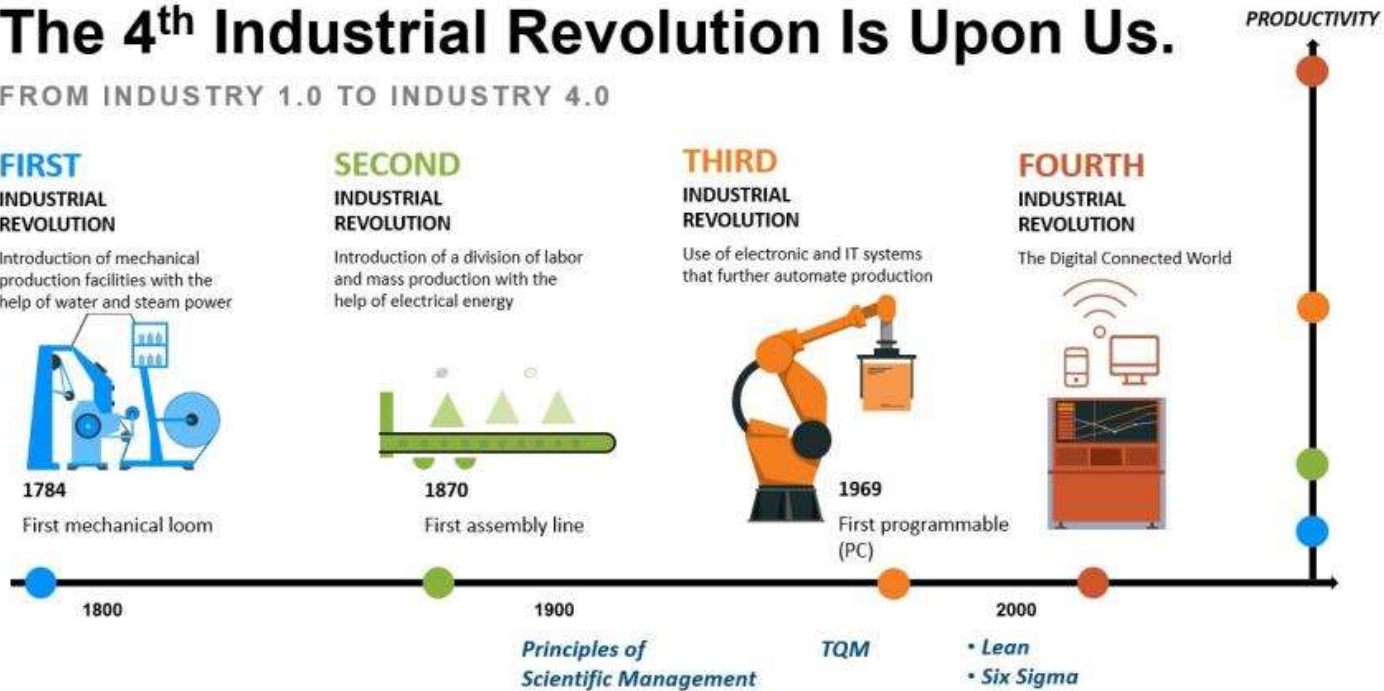
Tasks of modern control technology

Industrial environments include three factors: <u>quality, time and cost</u>

What users need:

- Precise and electrically robust operation

- Simple integration into the system components

- Easy handling

- Comprehensive, preventive diagnostics, easy maintenance

- High system availability

Megatrends:

- Shorter and shorter product life cycles

- Increasing IT networking

- Demographic change

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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.
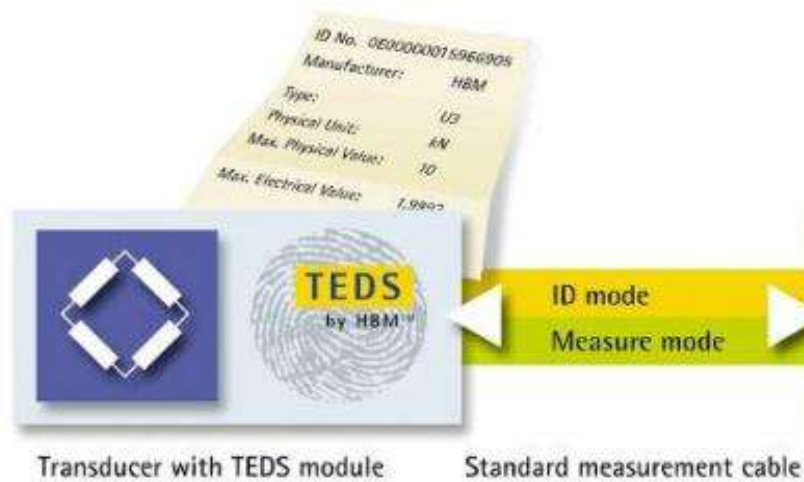
...without
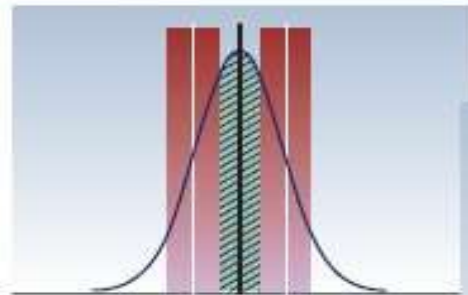
Process monitoring with conventional measuring amplifiers, high rejection rate due to measuring inaccuracies

... with

- Component variance
- Yield

100 %
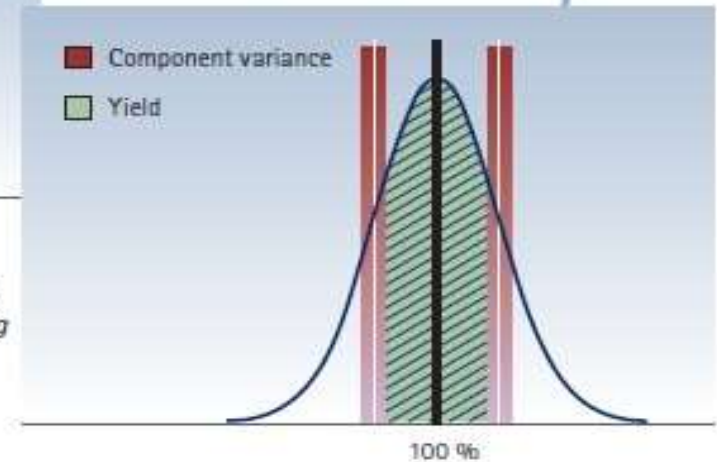
Increased efficiency with PMX, optimum yield with precise measurement results

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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

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Calibration Traceability – Quality you can trust

- 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 hbm.com or via the browser of the amplifier

- Quality assurance in production and test benches

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Industry 4.0 and the Internet of Things (IoT)

Industry 4.0 is only a part of the cloud and IoT

Brings benefits:
- Asset services
- Predictive maintenance
- Device management

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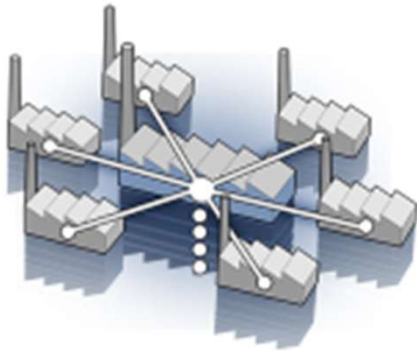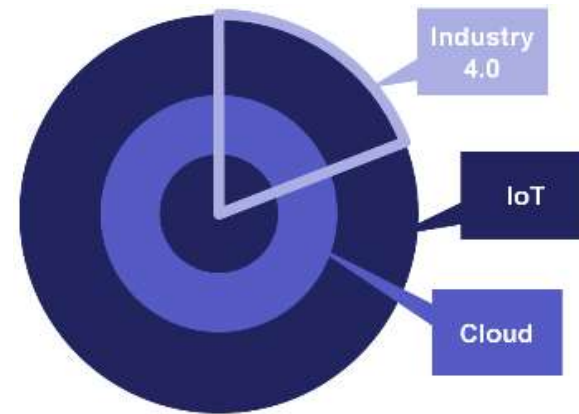
"Internet of Things": What does that mean?

- **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
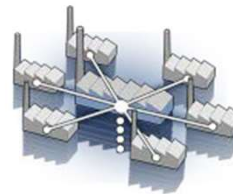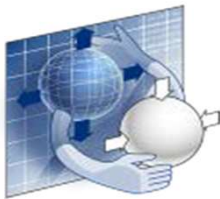
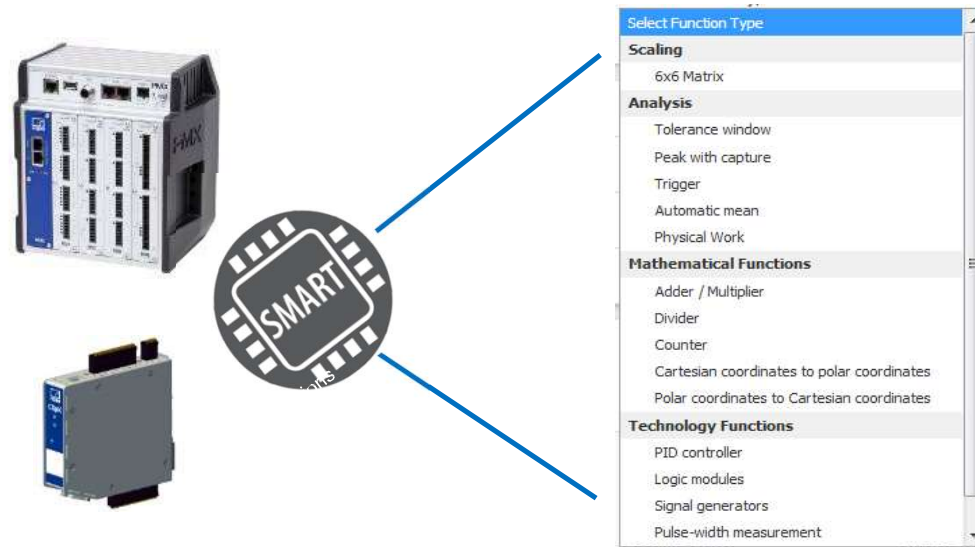# Digital revolution: Measurement & controls 4.0

1998

**Today's Smart Electronics**

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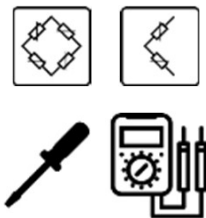
How do Smart Functions help in testing and production technology?

Automation with Calculated channels

- A lot of **applications require additional signals/ information and calculations** based on the measured 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

Example: Controlling Press Capacity

$$x = \frac{F1 * x1 + F2 * x2 + F3 * x3}{F}$$

$$y = \frac{F1 * y1 + F2 * y2 + F3 * y3}{F}$$
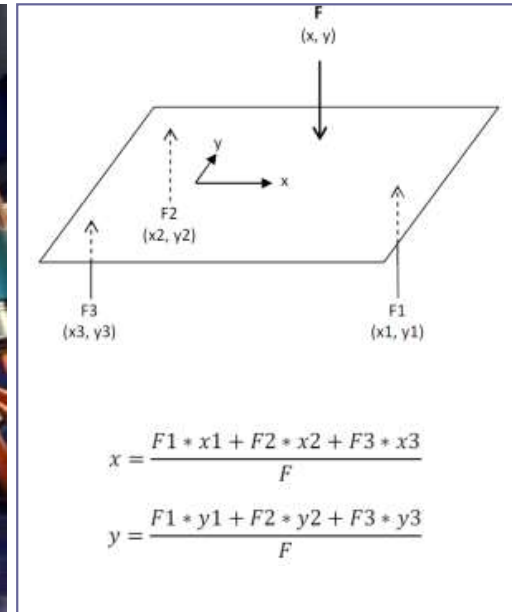
Calc.channel: Mathematical functions

Industry compliant measurement technology:

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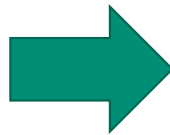   - Force measurement on 2 or 4 columns allow load-distribution

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Intelligent hardware – Edge computing

- Intelligence in the measurement components

- Change from programming to parameterization

  Pre-implemented logic:

Software program code

Pre-implemented calculated channel in the edge controller

Function test rig – Automated component testing

Ethernet (TCP/IP)

**Control/
Real-time:**
- Start/Stop
- Speed
- Test curve call

CoDeSys

PC / Catman:
- Process visualization
- Data storage (local)
- Report storage/printing

PMX:
- Real-time measurement channels
- Peak values
- Limit values
- Tolerance band evaluation
- OK / NOK counter

Sensors: Force, pressure, torque, etc.

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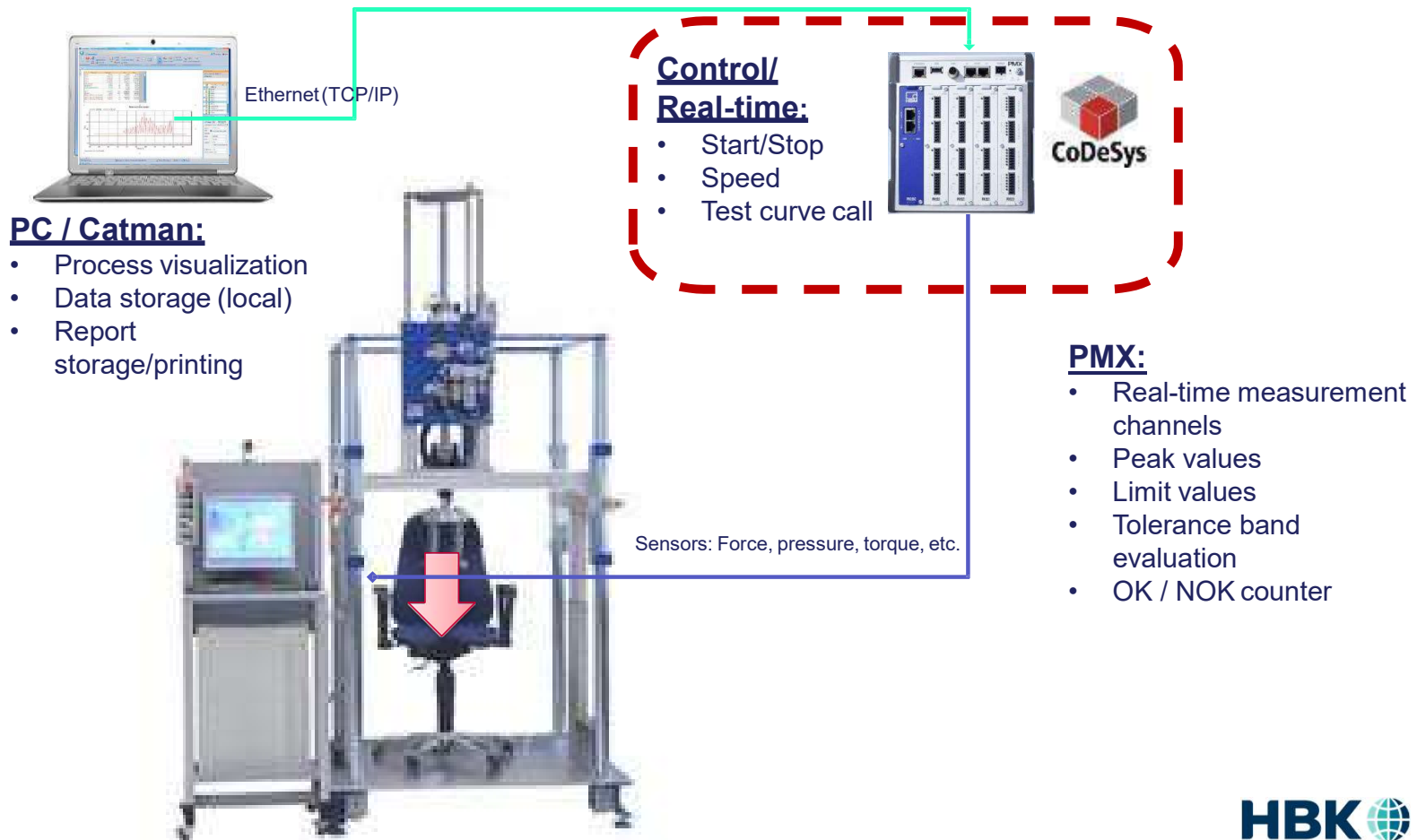
Operation and visualization – 100% Control

Router with VPN

VPN Tunnel

Internet

Remote maintenance

INDUSTRIAL ETHERNET
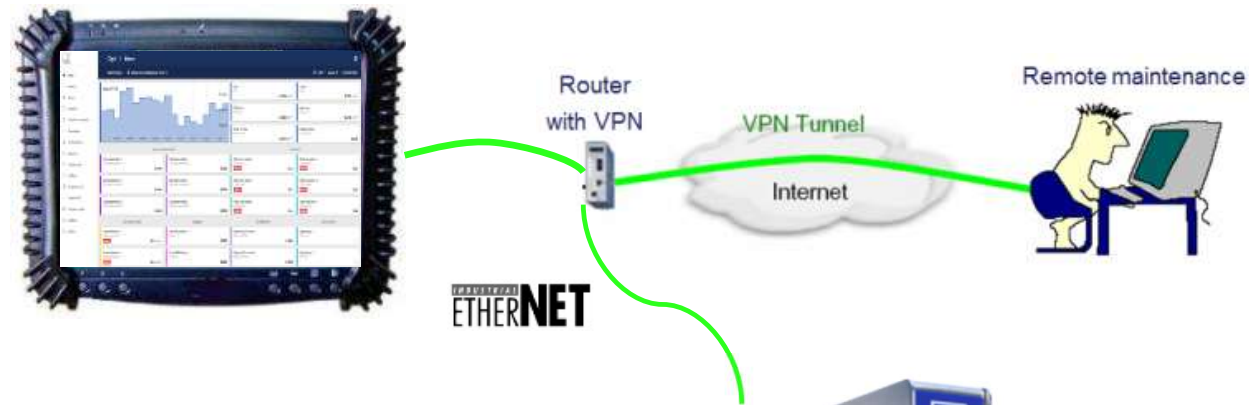
Connection for remote maintenance via Internet

Every ClipX has its own web interface with responsive design:

Remote operation, maintenance and diagnostics

Live demo accessible world wide (max. 2 connections)

ClipX live via internet: http://clipxdemo.hbm.com

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# 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
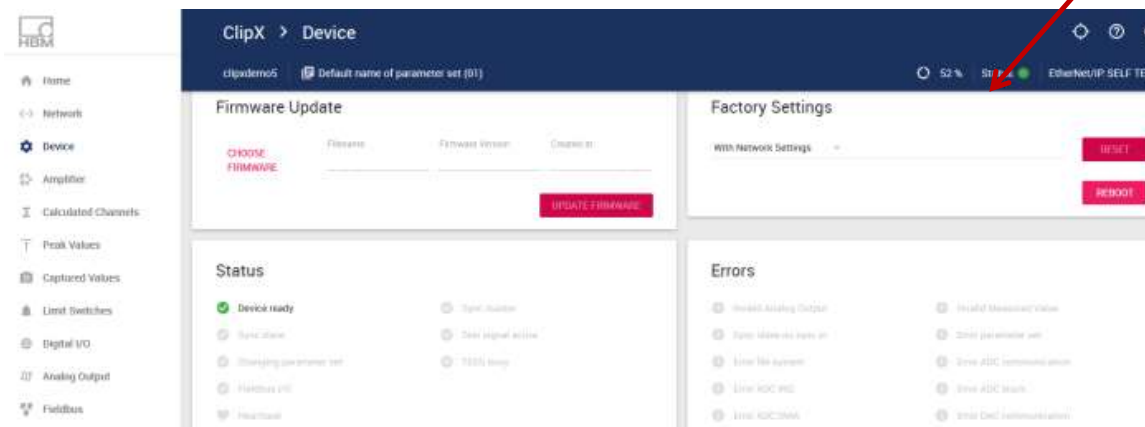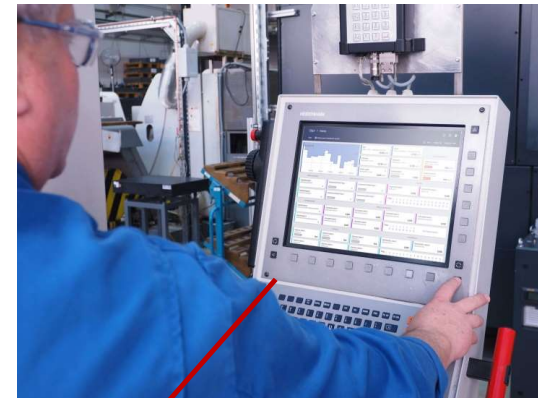
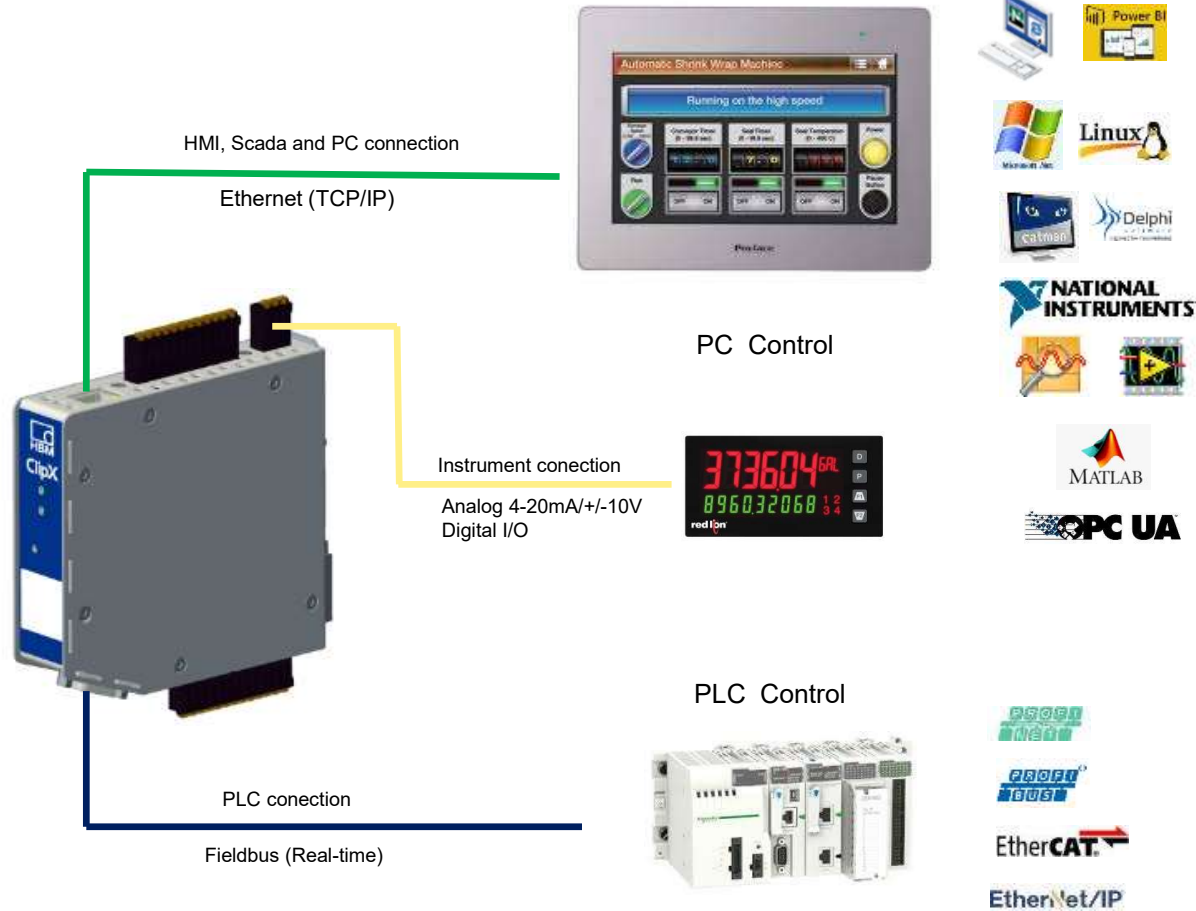# Building up your measurement and control system

Intermodule communication
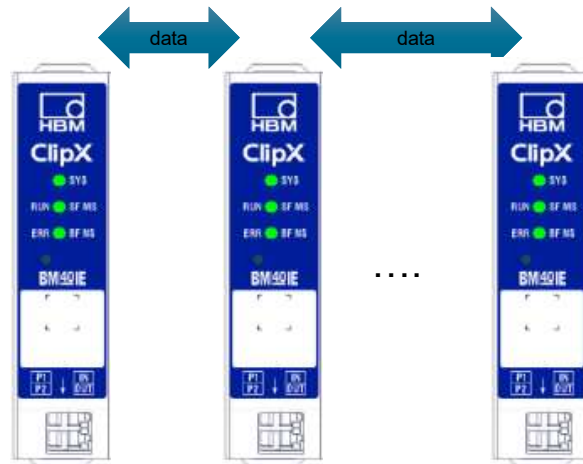
max. 6 ClipX modules

- Every ClipX module can send and receive Data via the "ClipX-bus"

- Measuring values or Calculated channel values with status

- Send: 1 signal; Receive: max. 5 signals

- Every module has 6 internal calculated channels (SMART-functions) and calculates with its own and/or measured channels from neighbor modules

- Data transmission rate: 1 kHz

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Open flexibility in the PC and PLC world

Simultaneous PC and PLC connection

HMI, Scada and PC connection

Ethernet (TCP/IP)

PC Control

Instrument conection

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

PLC Control

PLC conection

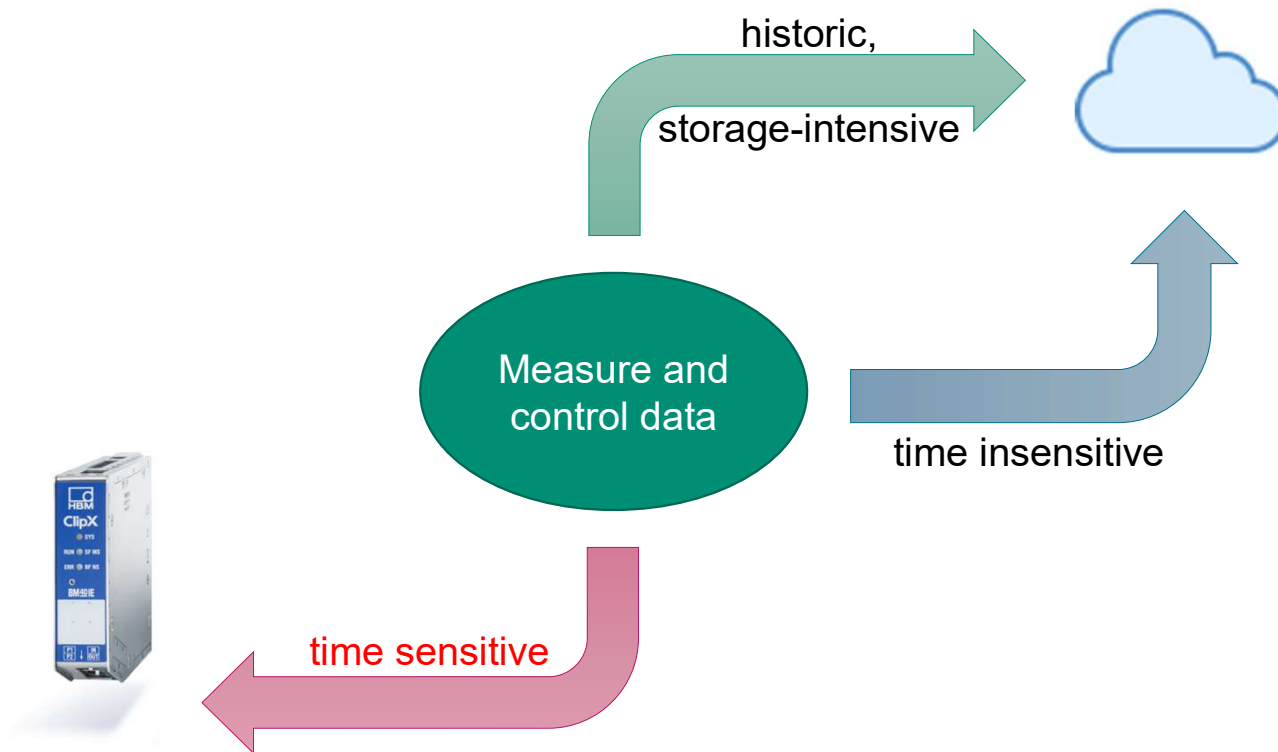Fieldbus (Real-time)

Where does software take place?

- Replacement of PLC tasks by software applications

- Condition: Less requirements for determinism
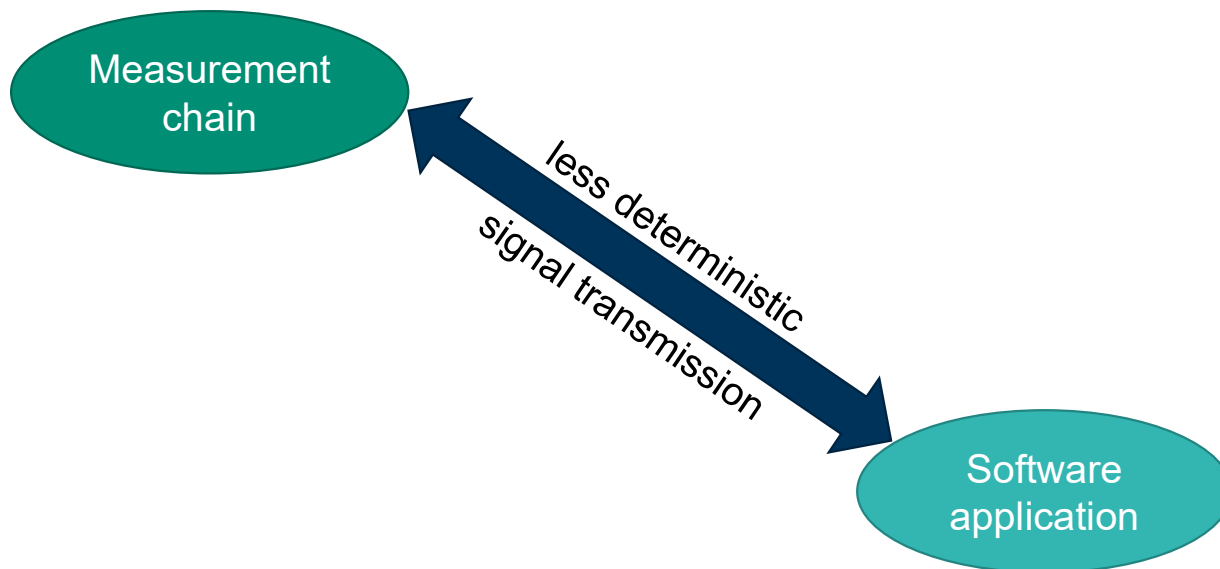
- Determinism increasingly available in software applications by using TSN protocols (Time-Sensitive-Network in Layer 2)

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Intelligent hardware – data processing

- Despite cloud uptake – edge computing is essential

- 'Process data where it is most useful'

historic,
storage-intensive

Measure and control data

time insensitive

time sensitive

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Open Web-interfaces capture production – Why?

Integration via industry standard protocols

- REST protocol
- OPC-UA

- Server ←→ Client principle
- More primitive structure
- Data is sent to an HTTP server in predefined intervals
- Client must know the server
- No communication from server to client

- OPC UA is a standardized, platform-independent software interface
- Minimal software development and maintenance effort
- Powerful, user-friendly and flexible
- Multi access possible
- Secure → User rights
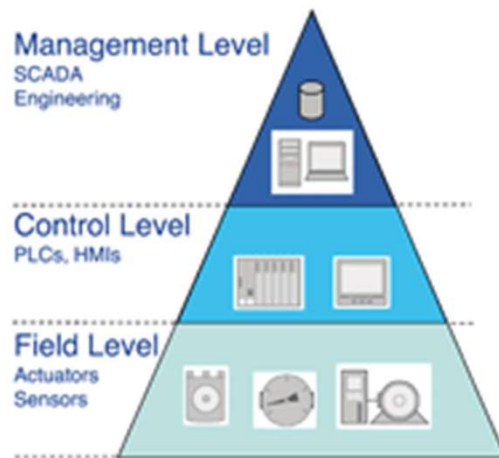- Works with client/server principle

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Properties of OPC UA

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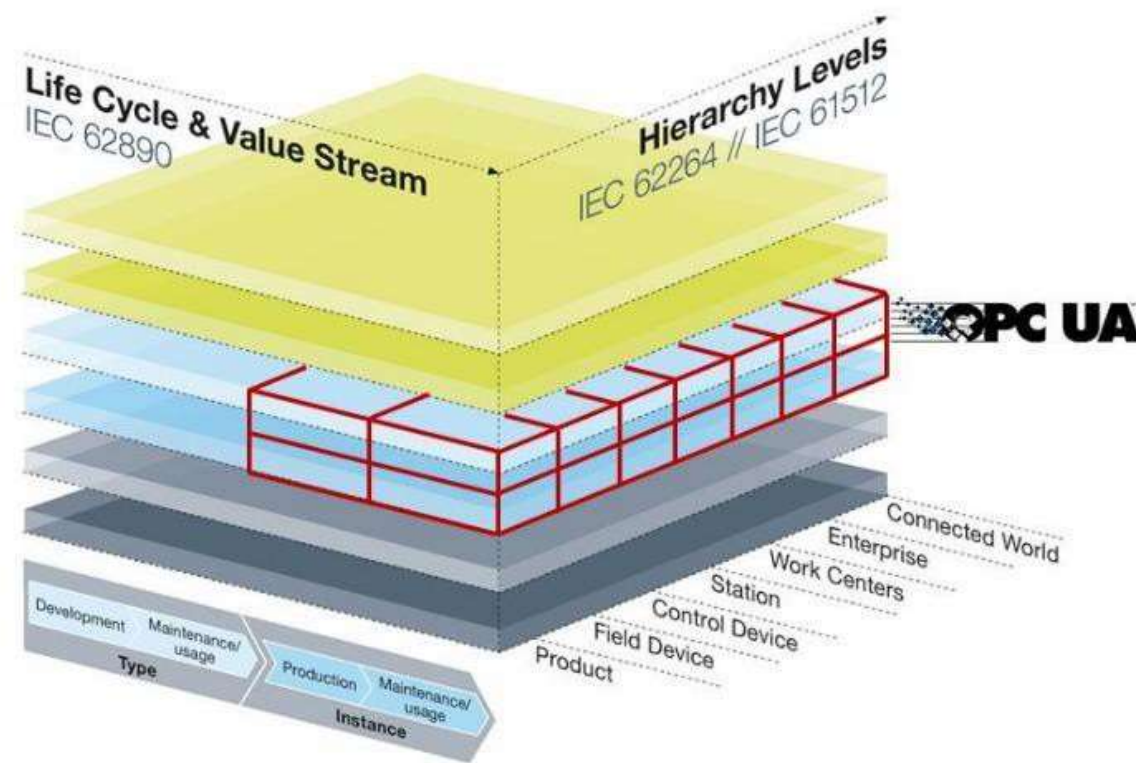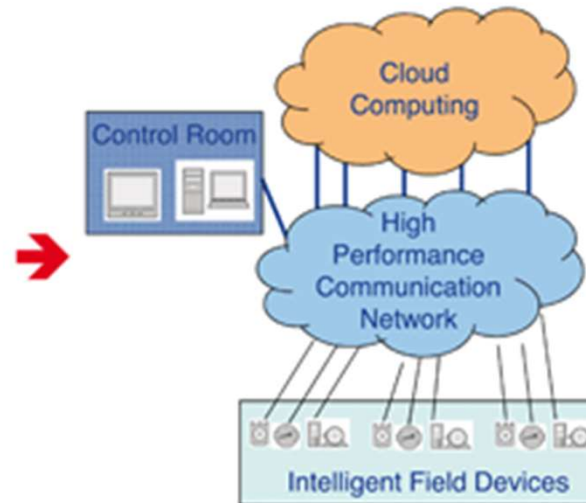
# Communication technology for Industry 4.0

Today

Future

- 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

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OPC-UA / REST application with ClipX (HBK Smart Factory)
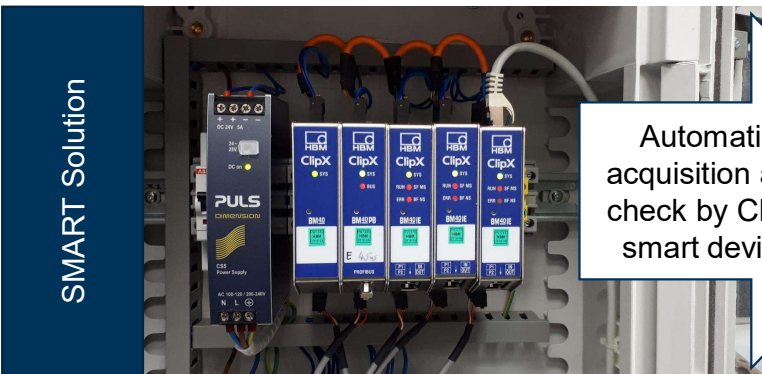

Where we all come from

Manual control
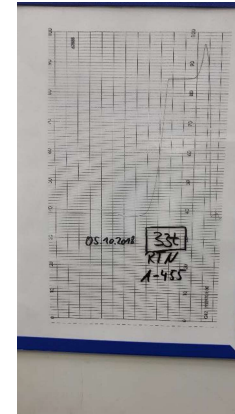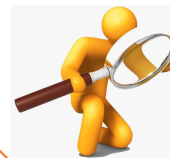
Manufacturing of ring torsion load cells

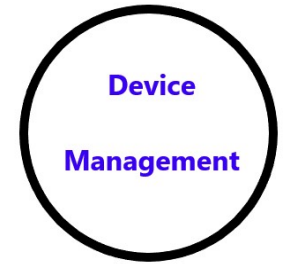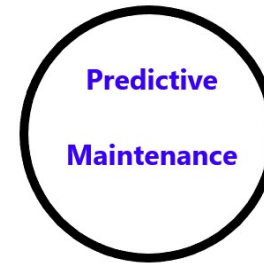Monitoring of temperature in the ovens
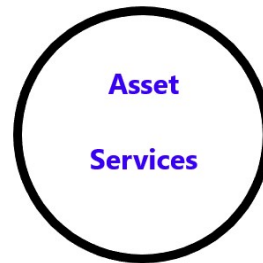
SMART Solution

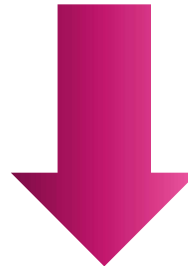Automatic acquisition and check by ClipX smart device

What do we win with Industry 4.0 & IoT

- Intelligent components

- Ensure quality

- Avoid rejects

- Avoid machine downtimes

- Increase transparency in the production

Asset Services

Predictive Maintenance

Device Management

Optimize processes

Decrease costs

Increase turnover

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Measurement and Control Smartness in Core Applications

Reliable measurements in diverse sectors of industry including aerospace, automotive or **test stand construction**.

For **production monitoring (WT & IMS)** ensures enabling high quality, fast cycle times and reliable processes.

Experiments and tests

Production monitoring

Test benches and material testing

Service and Calibration
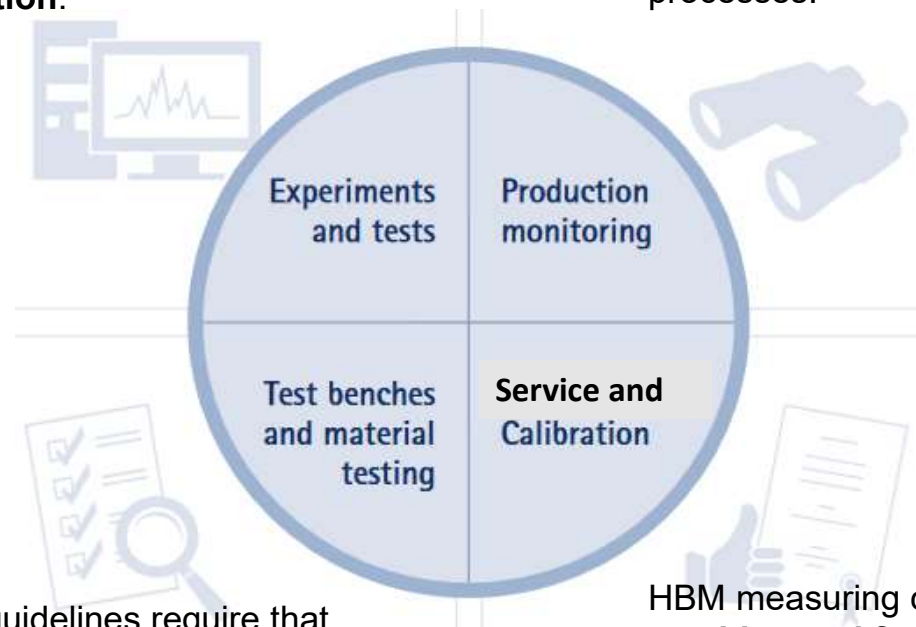
International quality guidelines require that **material and product properties** are checked for safety.

HBM measuring chains with industrial precision for **machine and factory calibration** in industrial process control, test & measurement tasks.

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SMART digital measurement chains in modern automation

Act as…

- Solution provider for precise industrial measurements
- Innovative integration via bus-systems into machine control systems
- Flexible for monitoring and automation tasks in various applications

Users benefit…

- Save time and money
- Use modern and future-proof technologies
- Get a "full service" with HBM (field-service, calibration, custom-sensors, application-support, software-development)

Questions?

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Notes

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