Industrie 4.0 The Evolutionary Leap in Manufacturing Engineering







Agenda

- PHOENIX CONTACT Overview
- Challenging Operation Requirements
- Versatile production lines
- Autonomous sub-systems
- Semantic and Syntax of Digital Article
- Non-hierarchical Automation Structures

PHOENIX CONTACT Overview

PHOENIX CONTACT Group 2014

- 13,000 Employees
- 1.75 bn. € Turnover

Industry Solutions





Automotive Industry



Energy



Power

T&D



Oil and

Gas

Urban Infrastructure



Components and Systems







Terminals

PCB Connector

Industrial Connectors



Over voltage Protection Power Supplies



Converter



IO Components Control Systems



Process know how in Manufacturing



- Manufacturer of Products
- Operating of own
 Manufacturing plants
 - 9 Countries of operation
- In-house knowledge of;
 - Metal parts, screws
 - Housings
 - Electronic components
 - Assembling



Industrie 4.0 –

Challenging Operation Requirements

Mass customisation

Use the advantages of mass production also in production of customized products even in 1 piece production

Modularisation

"Plug and Produce" solutions for modular machines and production facilities in discrete and continuous processes Collaboration

Product design, planning of production concepts are possible in parallel, enhance each other and complete a common Data Model





Industrie 4.0 –

Challenging Operation Requirements

Adaptive

Machines and production concepts react in a flexible way to new requirements

- Point-to-point communication Human and plants use Internettechnologies and communicate directly without hierarchy.
- Efficient

The production needs to be economic, resource efficient and sustainable.





Industrie 4.0 – Challenging Operation Requirements



Quelle: WZL, RWTH Aachen, aus einem Vortrag von Dr. Possel-Dölken, Phoenix Contact Maschinenbau



The limits of todays Automation

- Rigid and hierarchical integration of predefined systems and processes
- Flexibility only within the framework of foreseeable use
- Realization of all possible scenarios always leads to increasing complexity
- Cross-company integration is lacking
- Growing engineering effort during creating and operation
- Lack of simulation leads to high start-up costs (building-site programming)

Fulfilment of future requirements will become more complex!



Configurators and Selectors

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INSPIRING INNOVATIONS

Perspective Manufacturing Challenges



Requirements for future production

Non-hierarchical, agile integration of the horizontal valueadded and the vertical business processes as well as the lifecycle processes

Adaptability to volatile parameters (quantities, versions, production goods....)

Reduction of complexity and engineering – "intelligent" production

From rigid pre-planned systems to a network of selfconfiguring intelligent partial systems and processes



The Evolutionary Leap Increase Productivity

200 different types means200 different article numbers



INLINE I/O-Devices





Increase Productivity Machine design

- Conventional manufacturing
 - Assembly in Line order
 - Dependence of the operating steps
- Inflexibility
 - Parallelisation of Operating steps
 - Change of lot size
 - Change of product versions



INLINE E/A Geräte





Increase Productivity Machine design



INSPIRING INNOVATIONS

Increase Productivity

Digital article information

- Solution according "Internet of Things"
 - RFID is included in the device carrier and stores the digital article information



Processing stations report free capacities

INLINE I/O-Device

- Device carrier transports the device to the processing stations by a rotating conveyer – buffer function
- Processing instructions are initiated by the stored RFID information
- Process and measured data are digitally archived on the server initiated by the RFID



Digital Article Description Enabling





Industrie 4.0 Product controls production



What process parameters are required? Where does it get them?

Which print has been requested?

Does the real product fit to its digital representation?

Where does it fail?

Where is the next order? Where are the spare parts?



Increase Productivity

Exchange of processing stations



New products are added on site by the operators

Processing sequences are defined and changed by the operators

INSPIRING INNOVATIONS

Expandable manufacturing platform

Manual operating station are supported by a visualisation

Future perspective use case

Challenges

Reaction and adaption for unplanned and product variants, configurations and boundry conditions

Smart and cost effective ("Mass Customization")

Versatile Manufacturing

Modular design of mechatronic modules: Mechanic, Control and Commnication

New combination and self configuration of mechatronic modules with minimal engineering efforts





Designing Industrie 4.0 – **Network of R&D and Technique**

The development of solutions for Industrie 4.0 requires R&D and exchange of thoughts and ideas in networks

PHOENIX CONTACT is a leading driver and active participant







Bundesministerium für Bildung und Forschung

BETREUT VOM





Platform Industrie 4.0

it's OWL – Intelligent

Technical Systems

OstWestfalen Lippe

(Bitkom, VDMA und ZVEI)

(Automation for Versatile

Manufacturing - AWaPro)

The Third Dimension of Integration –



The product will have a digital memory through it's Livecycle – The digital product



Innovation drivers

Two convergent developments in technology





Industrie 4.0 Cyber-Physical Systems

- ... are the base of the "Smart Production" of tomorrow
- ... are Systems with embedded Software
- ... are connected via digital communication interfaces
- and connected with digital networks, e.g. Internet of Things, Services, Data and Human





Real-Time Communication in PROFINET



TCP/IP communication as well as real-time and isochronous real-time communication simultaneously on one line

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IP based Communication –

Seamless Integration from the Device to the WEB



INSPIRING INNOVATIONS

Technology-Know-how for intelligent Automation



- Experience and Competency
- Investment and R&D
 - Communication technology
 - Information technology
 - Web-technology
 - Security
 - Safety
 - Installation
 - Engineering



Industrie 4.0 – Intelligent Production Field of R&D activity





The Fourth Industrial Revolution has already started...



Intelligent networking of business processes, machines, workplaces, components and people



Conclusion

Solutions for the future The Challenges of Industrie 4.0 are not really new

Today: Various Aspects could be found in Industrial production

Tomorrow: Achievement of the total concept of Industrie 4.0 needs consequent development and integration

Inter communication of all technical systems is the key success factor



"Roads grow out of going them!"

Franz Kafka (1883 -1924) German-speaking author.

Thank you for your attention



