Industrie 4.0 in Practical Applications: Challenges and Experiences

Andreas Schreiber
Industrie 4.0 in Practical Applications: Challenges and Experiences

**Agenda**

- Introduction
- Smart Engineering and Production 4.0
- Practical applications
- Summary
Introduction

Challenges for producing industries

Increasing product variety
Short lead times
Flexible lot sizes
Transparent and controlled processes

Time-consuming processes in engineering, set-up, configuration and parametrization
Waiting times and inventories
Insufficient transparency in processes
What do we expect from Industrie 4.0?

Vertical integration of business processes for the manufacturing of individual products

- Customer's wish
  - Complete digital product description
  - Automated generation of production orders
  - Optimal shopfloor scheduling
  - Automated parametrization
  - Transparency about the order status

PLM system:
- Configurator
- Online shop
- ERP system
- MES system

Delivery

Machine control system
Introduction

What do we expect from Industrie 4.0?

Flexibility, efficiency and transparency along the value chain and the product life cycle

Components

- Fast prototypes
- One piece flow
- Efficient logistics
- Virtual development and optimization
- Transparency over the status
- Self-optimization
- Easy set-up and operation
- Availability of all relevant information

Production systems

- Easy adaptation to quantities and variants

Engineering  Production  Operation  Service
Introduction

The Digital Twin: The core of Industrie 4.0

customer benefit and user experience

Digital product

Physical product

Lean business and work processes

Digital value stream

Physical value stream

Global factory network

<AutomationML/>
Introduction

Digital agenda in a nutshell: Use case domains

- Turning thoughts and knowledge into data
- Data-driven point of sale & support
- Data-driven engineering and manufacturing @ customers
- Systems engineering and data-driven one piece flow manufacturing @ Phoenix Contact
- Enabling intelligent products and solutions (merge digital and physical twins)
But Industrie 4.0 needs preparation...

… because starting improvements in the virtual world requires a working real world

Simple control principles instead of complex optimization

Robust processes and minimum setup work

Optimal value chain and flow production

Maturity of staff

→ Lean first, then Industrie 4.0!
Industrie 4.0 in Practical Applications: Challenges and Experiences

Agenda

- Introduction
- Smart Engineering and Production 4.0
- Practical applications
- Summary
Smart Engineering and Production 4.0

**From circuit diagram to terminal strip**

- E-CAD Engineering
- Product Engineering
- E-Shop
- Manufacturing of terminal strip
- Line control system
- Digital Product Description
RFID tag for identification and additional information

Digital description for production, assistance and inspection
Industrie 4.0 in Practical Applications: Challenges and Experiences

Agenda

- Introduction
- Smart Engineering and Production 4.0
- Practical applications
- Summary
Practical applications

Production flow editor
Practical applications

Production of I/O modules

- Flexible production line for up to 120 product variants
- Integration of manual and automated process steps
- One piece flow
- Plug & work functionality for cells
- Adding new products and variants through production staff
Practical applications

**Industrial terminal strip assembly at Krones**

- DIN rail cutting (length up to 1 m)
- Fast terminal strip assembly out of 50 magazines
- Automated order processing from E-CAD system
- Production in “lot size 1” using line control system
Practical applications

Laser marking of terminal blocks

Terminal strip assembly on a Rittal machine (Pick & Place)

Laser marking of terminal blocks in a Phoenix Contact module

Parametrization using digital article data (eCl@ss)

Data exchange between modules using AutomationML
Intelligent building management

- Property management
- Building infrastructure
- Active energy management
- Room monitoring

- Secure global access to all facilities
- All information at a glance

Frank Schröder and Bernhard Tillmanns, PHOENIX CONTACT Electronics GmbH
Industrie 4.0 in Practical Applications: Challenges and Experiences

**Agenda**

- Introduction
- Smart Engineering and Production 4.0
- Practical applications
- Summary
Industrie 4.0 in Practical Applications: Challenges and Experiences

Summary

With Industrie 4.0, value chains and product life cycles will be completely digitized.

The integration and further development of standards like eCl@ss and AutomationML enables a fully digital representation of products in all levels of added value.

Using digital product descriptions, it will be possible to optimally support and to automate important processes in engineering and production.