The Factory of The Future
Qualification for Industry 4.0

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Festo Didactic, Inc.
Festo is a productivity company

From Industry — For Industry
Partner of technical training and development.

Technical Education

Automation

Factory Automation

Process Automation

Training and Consulting

Didactic

Learning systems
Festo Industrial Customers in Indiana – Sampling of 100+

For Industry, By Industry

- PTS Precision Tools Service, Inc.
- SHUTTLEWORTH
- BOBST
- BENTELER makes it happen
- CATERPILLAR®
- faurecia
- Nestlé
- MOTION INDUSTRIES
- Manufacturing Technology, Inc.
- Nestle
- Murray Equipment, Inc.
- PREH IMA AUTOMATION
- Quaker
Festo Industrial Customers in Alabama – Sampling of 100+

For Industry, By Industry

- BASF
  The Chemical Company

- MOTION INDUSTRIES
  Keeping Industry in Motion

- HYUNDAI

- DESHAZO AUTOMATION

- FASTENAL

- FITZ-THORS ENGINEERING, INC

- Mercedes-Benz

- brose
  Excellence in Mechatronics
Industry 4.0 and Digitalization

The fundamental change
From Industry 1.0 to 4.0 | Emphasis of the particular industrial revolutions
Industrial revolutions | First industrial revolution - The steam machine

**Historical facts:**
- 1705: First steam machine developed by Thomas Newcomen
- 1769: Essential improvement and patent registration by James Watt
- Start of industrialization

**Ideas:**
- Providing of higher energy quantities
- Location-independent generation of energy
- Distribution and transmission of energy over long distances
Industrial revolutions | Second industrial revolution - The conveyor belt

“First organization, then automation!”

Historical facts:
- 1834: First electrical motor developed by Hermann Jacobi (twenty-five times higher cost than steam engine)
- 1866: Invention of dynamo by Ernst Werner von Siemens
- 1908: Installation of conveyor belt by Henry Ford

Ideas:
- Production of Ford Model T as mass product
- Understanding of scale effects and consistent usage
- Collaborative work organization
- Implementation of automation
Industrial revolutions | Third industrial revolution - Automation

**Historical facts:**
- 1949: First NC controlled tolling machines by John T. Parson
- 1950s: Toyota (Lean) Production
- 1961: First industrial robots
- 1969: First PLC
- 1970s: CAD (Computer-Aided Design)
- 1983: CIM (Computer Integrated Manufacturing)
- 1992: “The second revolution of automotive industry” by Womack, Jones and Roos

**Ideas:**
- Manage customer markets
- Manage high quality requirements
- Delivering a high amount of product variants
- Customer-orientated solutions
Fundamental paradigm shift in Industry 4.0

### Third industrial revolution
- Central control
- Established value chains
- Production system operation is planned in advance
- Products are passive objects in the processing operation

### Fourth industrial revolution
- Decentralized self-organization through ad-hoc networking
- Virtual ad-hoc organizations
- Autonomous, self-organizing production units
- Active production process supported by intelligent products

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3.0

The use of computers and robots leads to greater production automation.

4.0

Industry 4.0 describes the networking of people, machines, and products – in real time, via the Internet.
Cyber Physical Manufacturing

Industry 4.0

Industry 4.0: the fourth industrial revolution – guide to Industrie 4.0

Industry 4.0 represents the fourth industrial revolution in manufacturing and Industry 4.0 is the current industrial transformation with automation, data exchanges, cloud, cyber-physical systems, robots, Big Data, AI, IoT and semi-autonomous industrial techniques to realize smart industry and manufacturing goals in the intersection of people, new technologies and innovation.

The next revolution in manufacturing

Prevent problems and optimize uptime with the power of Industry 4.0 and IBM.

Industry 4.0 / IoT – Products and solutions

Industry 4.0 is more than just a flashy catchphrase. The convergence of trends and technologies promises to change the way things are made.

Industry 4.0

From Wikipedia, the free encyclopedia

Industry 4.0 is a name for the current trend of automation and data exchange in manufacturing technologies. It includes cyber-physical systems, the Internet of Things, cloud computing and cognitive computing. Industry 4.0 is commonly referred to as the fourth industrial revolution. 21
Cyber Physical Manufacturing

Industry 4.0

Technology Evolution

Source: Accenture. Figure 3 – The Combinatorial Effect of Technology
Industry 4.0 Advanced Manufacturing Evolution

Source: Overview of Smart Manufacturing 2018 - Dr. Thorsten Wuest
Core elements of Industry 4.0

Augmented / Virtual Reality
- Extended reality / computer-assisted expansion of reality perception
- Currently mainly realized by smart glasses

Big Data
Unspecific search for correlations and patterns in available but unstructured data. The goal is to detect unexpected connections → Basis for optimization

Condition Monitoring
Permanent or periodical measurements of physical variables. CM is considered as a building block of Smart Maintenance.

Communication standard
Standard in the communication of machines (M2M) Securely exchanging structured data.

RFID
Radio Frequency Identification (RFID) is a technology for the identification of products as well as a medium to store data. It is possible to read and write data from/on the RFID tag.

ERP/MES
ERP takes over the task of planning, controlling and coordinating all resources in a company. MES performs the detailed planning of production processes and resources.

Cyber-physical-systems
Merging of physical and virtual systems. They have their own intelligence in the form of microcontrollers and software, which allows them to connect to the outside world via sensors and actuator.

Machine-to-Machine Communication
M2M communication denotes the automated data exchange between machines. Machines must be networked and ready for data exchange.
Virtual Reality
Augmented Reality
Cyber-physical-systems
Identification systems - RFID

Machine-to-Machine Communication
ERP/MES

Flexible setup of the application modules
Modular structure of the production line
RFID process control
MES
Cyber-physical systems

Energy management
Expansion options
Mobile robotics

CP Lab – The Cyber-Physical Lab
Artificial intelligence / Machine learning

The amount of data we produce every day is truly mind-boggling. There are 2.5 quintillion bytes of data created each day at our current pace, but that pace is only accelerating with the growth of the Internet of Things (IoT). [source]
Big Data
Communication standards
Seamless integration – from top floor to shop floor

Industry 4.0

» Manufacturing industries

» Things and devices on the shop floor

Business Logic Services

Visualization

Quality Engine

KPIs/Metrics/Alerts

Data Services

Composition Environment

Plant Connectivity

Plant Data Collection

Environmental Building Management

Plant DB

Wireless Integration

DCS/PLC via OPC

LIMS/Inspection/Equipment Testing

MES

SCADA/HMI

Plant Historian

INTEGRATION

ERP

SCM

PLM

PLAN

MAKE

DELIVER
### TOP FLOOR TO SHOP FLOOR INTEROPERABILITY

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**Manufacturing Execution System (MES4) INTEROPERABILITY**

**Other Solutions**
Making the future adaptable in the Technology Plant

Learning at the Festo Technology Plant — Scharnhausen, Germany

Production plant of the future for valves, valve terminals and electronics

- **Automated and flexible**
  Highly flexible, energy-efficient assembly lines

- **Flexible, flowing production**
  An optimised flow of information and materials

- **Optimised energy consumption**
  Energy network for buildings and production processes

- **Learning taken for granted**
  Training factory as practical, integral constituent
Networked production architecture of the future

Unified data formats and standards for efficient engineering processes

**Virtual emulation:**
this will enable automatic start-up and reconfiguration.

**Plug and produce components:**
facilitate the exchange of defective production units and the reuse of individual units for new products.

“**I am finished.**”

“**I continue on to station 2.**”

**Condition Monitoring:**
the filter reports a contamination level of 95%. 
Festo Industry 4.0 Certification Program

From fundamentals through Advanced Industry 4.0

Three Levels with horizontal and vertical stacking

Level 1: Fundamentals

Level 2: Advanced Mechatronics

Level 3: Industry 4.0
# Festo Industry 4.0 Certification Program

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Festo Industry 4.0 Certification Program

The Process – Institution/Instructor Perspective

The Institution’s path to qualification

- Partnership
  - FI4.0CP easily integrates with existing programs
- Train-the-Trainer
  - Ensures all instructors are delivering same level of qualification
- Equipment
  - The materials are delivered through NC3 portal.
- Activate
  - Install proper equipment needed to teach the course(s).
Festo Industry 4.0 Certification Program

The Process – Student Perspective

Choose a Training Center
Students locate a NC3 Partner Institution that fits their needs

Enrollment

Courses
Courses and labs are led by FI4.0CP certified instructors.

Exam
At completion, end of course exam.

Students can horizontally or vertically stack certification levels.
Thank you for your attention- Questions

“Uber yourself before you get Kodaked”
Thank You!