Industrial Workforce Development

Course Catalog for Skills Development

FESTO

www.festo.com

Learning Center

Festo is a global engineering and manufacturing company that maintains its own training teams for customers around the world.

- We are training
- We are consulting
- We are industry
- We are the engineers of productivity

Our portfolio combines training courses with tailor-made knowledge checks, virtual education, courseware, and hands-on learning systems. This unique integration increases the effectiveness of learning, optimizes learning outcomes, and maximizes learning transfer.

We know that investments in training, coaching, and apprenticeship are smart investments in sustainability, knowledge, skills, loyalty, and retention of staff at your company.

The core benefit for all our participants is simple – more knowledge and an increased hands-on skill set lead to:

- **Energy savings**
- **Ideas and creativity**
- **Decrease in downtime**

Festo understands all of this because we are manufacturers as well as training providers. We practice what we teach in our own facilities – that is the reason why we are offering training 'From Industry, for Industry.' It cannot be more authentic than that.

Read more about our training approach and offerings inside this catalog.

Learning Center Midwest – Mason, Ohio

"We've really enjoyed working with Festo Didactic for their training classes. The topics covered, the training modules and the presentations are first class and very professional. The scheduling and logistics have always worked out well with no hassles or surprises. We continue to promote with our customer base looking for more opportunities to use the services Festo Didactic provides. Response and feedback from the participants have always been very positive. I highly recommend the classes and program."

Greg Coughlin
Product Manager
TSI Solutions

"This was a very good balance between theory and hands-on practice. I liked doing the hands on and then reviewing the theory side. This training has given me a deeper understanding of how the valves work and how to troubleshoot pneumatics more methodically. This class was very beneficial to my position and daily duties."

Participant in an Industrial Pneumatics, DC Electricity, PLC, and Sensor class from STIHL

Table of Contents

Why Festo?
From Industry, for Industry

Full operation of Learning Centers

Our independent Learning Centers serve local industries, applying Festo standards to help close the identified skills gaps. Our approach for establishing Learning Centers is driven by the vision to provide customized qualification solutions that meet individual and actual market demands.

From our site to yours

As the market leader for technical education, Festo Didactic is a professional partner in operating training departments and steering qualification measures according to our partner's vision. We hold training classes at our site in Mason, Ohio or will travel to your site to make things as seamless as possible for your employees' training needs.

Consulting services for curricula and training content development

Festo Didactic develops curricula and provides consulting services for training content development, academic skills standards, and programs. We deliver training solutions focused on measurable business outcomes with a wide range of standardized and customized trainings. Our training solutions are not only aimed at the delivery of individual qualification courses – we also develop programs and curricula, focusing on competencies for a particular position. The Learning Center portfolio also encompasses competence management and train-the-trainer programs.

Please contact our Festo Didactic Team at:
festolearningcenter.us@festo.com

Value Proposition

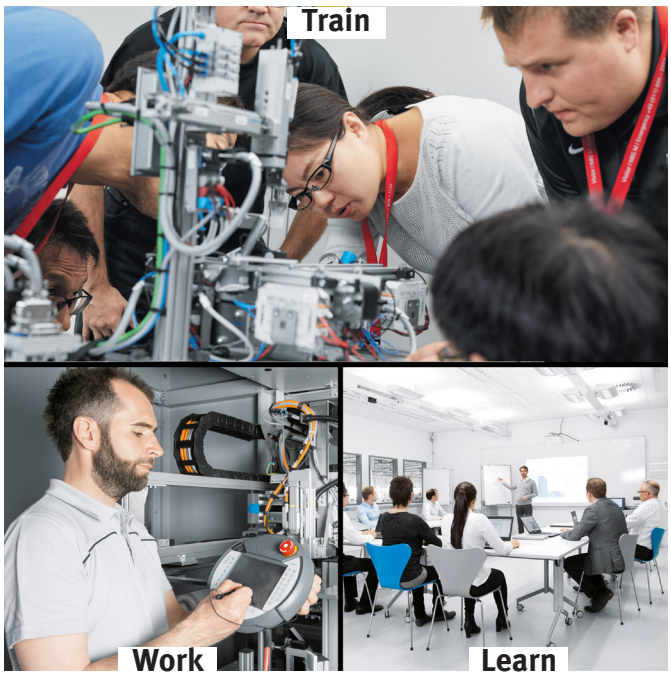
Festo trainings are hands-on. In our classes, theory is taught first – then it is applied to hands-on skills. Once equipped with the applicable skills and knowledge, trainees will flourish in their day-to-day tasks. Below is a sample two-day classroom training

Preparing
- Evaluation of company training needs
- Review of training content with facilitator
- Pre-assessment of participant skills and knowledge

Learning
- Theory 30%: Classroom knowledge transfer in specific industrial skills topics supported by cutting-edge digital curriculum
- Practice 70%: Hands-on skills transfer using Festo training equipment
- Troubleshooting exercises

Accomplishing
- Pre- and post-assessments
- Festo Certification

Apprenticeship Programs



Festo Didactic offers and supports successful apprenticeship programs.

Today's workforce challenge in manufacturing is the skills-gap experienced by our customers, partners, and suppliers. The lack of technical basics and STEM-related knowledge prevents applicants from starting promising careers in manufacturing.

At the same time, open positions stay vacant for a long time and ultimately even vanish. This equation means loss of productivity and profits – we believe this situation is not acceptable.

What is the dual-apprenticeship program?

Apprenticeship programs in Europe date back to the late 1800s. Today, apprenticeships are available in about 350 different professions with a duration of training between two and four years, depending on performance and trade.

Apprenticeship programs combine work experience, hands-on training, and theoretical education. Essentially, apprentices are hired by a company for the duration of the apprenticeship at a wage of 40-50% of the salary they will receive upon completion of the apprenticeship. Employers provide on-the-job-training, teaching the profession and all related knowledge and skills. The apprentice works for the company and attends classes at the Festo Didactic Learning Center. This program was designed to have the apprentice working with the company four days per week and one day at Festo's Training Center; however, for maximum flexibility, this model can be changed to meet the demands of the employers. Because of the program's integrated educational concept, it is called "dual-educational system" or "apprenticeship" (work and learn).

Benefits for the employer:

- Positive ROI
- Well-educated employees
- Increased level of loyalty
- Future specialists who know the entire production process
- Additional work opportunities for local community
- Gain highly competent employees who meet the needs of the company
- Improve productivity and quality of products and services
- Reduce turnover costs by increasing employee retention

Benefits for the apprentices:

- Education alternative to a college degree
- Paid apprenticeship – no debt at the end of the program
- DOL certification, and CEU credits
- Option to add college education still available after the program or later in life
- Career path instead of just a company-specific training
- Gain occupational proficiency necessary for employment opportunities and a living wage
- Unlock a professional career path with career advancement
- Have a job upon program completion

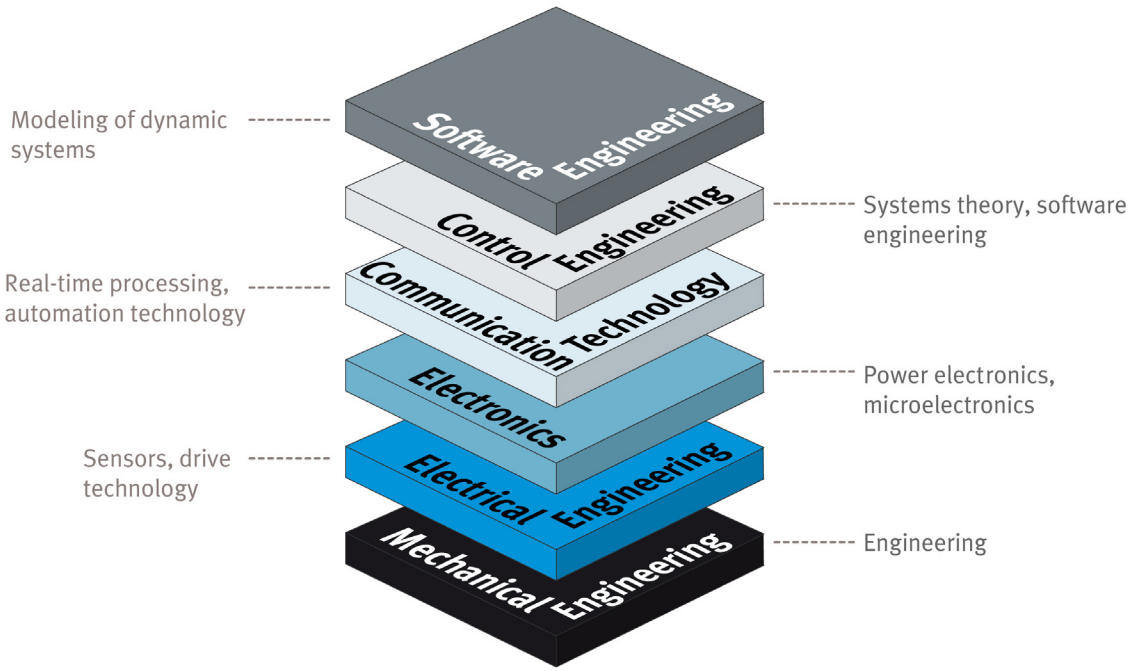
Festo Didactic and Apprenticeship in USA

There are several opportunities in the US, supported by local and national public entities, to start and foster apprenticeship and pre-apprenticeship programs. Festo Didactic supports these programs completely.

We support the planning and realization process with our specialized know-how. We also participate in technology hands-on training and train-the-trainer programs.

With our extensive network, we are able to bring manufacturers and the educational sector together for a successful outcome of apprenticeship programs, which help companies to fill their talent pipeline and increase productivity, as well as improve the quality of their workforce and individual lives and perspectives.

Mechatronics Apprenticeship Program



Employers today need multi-skilled workers to operate, maintain, and troubleshoot equipment on the shop floor. Mechatronics is the collection of multiple technical disciplines combined into a hybrid, approximately one-year apprenticeship program organized and supported by Festo Didactic.

Technical, hands-on training:

- Apprentices will attend hands-on training with Festo Didactic one day per week
- Training fees paid by company

On-the-job training in the company:

- Companies assign qualified trainers
- Companies develop related training plans
- On-the-job training consists of about 2,000 hours

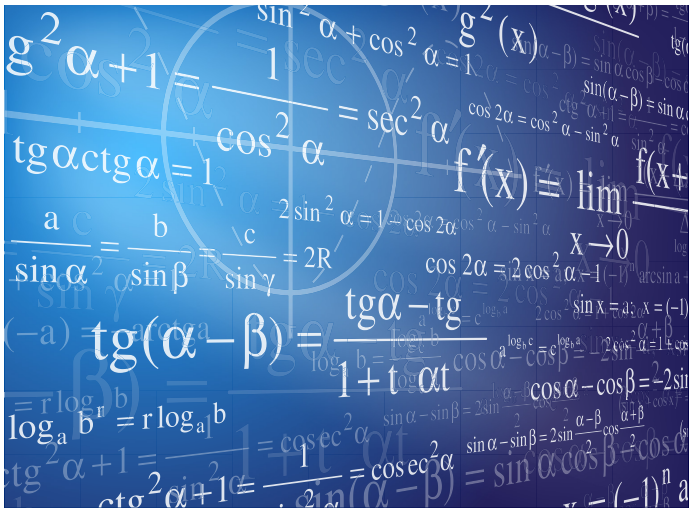
Train-the-trainer in participating companies for skill development in:

- Technical training and knowledge transfer
- Teaching methods and training standards
- Training for competencies
- Evaluation criteria and progress-checks
- Course preparation and implementation
- Monitoring and improving

“Recruiting qualified maintenance technicians is becoming increasingly challenging. As we prepare to launch a 1.9 million sq ft manufacturing facility, the demand for these technicians is high. By partnering with Festo, we can provide our technicians with essential hands-on technical skills in a focused environment that is both convenient and free from distractions. Festo is instrumental in ensuring the success of our technicians and the smooth startup of our plant.”

Jason Hendrickson
Senior Technical Training Specialist
Nestle Purina

Shop Math
SM111



SM111: 16-hour class covers:

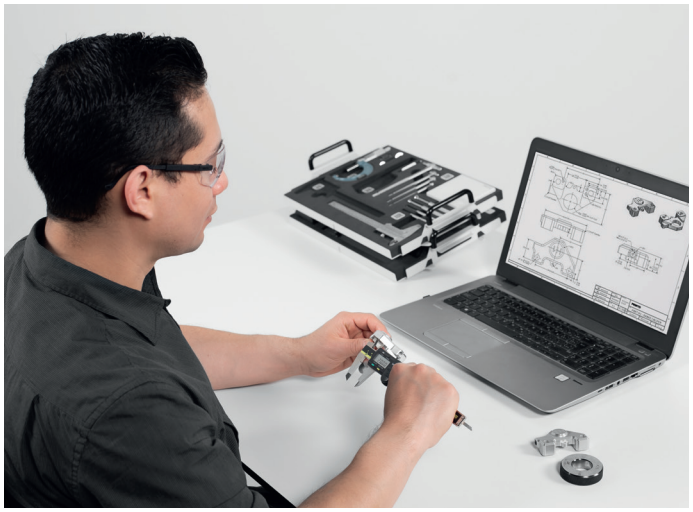
- Arithmetic of whole numbers
- Fractions
- Decimal numbers
- Ratio, proportion and percent
- Measurements
- Pre-algebra and basic algebra
- Practical plane geometry
- Solid figures
- Triangle trigonometry

Outcomes:

- Interpret practical mathematic skills needed in industrial areas
- Create calculations using whole numbers, fractions, decimals, and ratios
- Convert between US customary and metric systems
- Add, subtract, multiply, and divide signed numbers
- Work with exponents using the order of operation and find the square root
- Evaluate formulas and literal expressions
- Multiply and divide algebraic expressions, equations, and solve word problems
- Apply scientific notation
- Demonstrate numerical solutions for on-the-job applications using calculators

Prerequisite: General knowledge

Measurement Tools & Print Reading
MT111



MT111: 16-hour class covers:

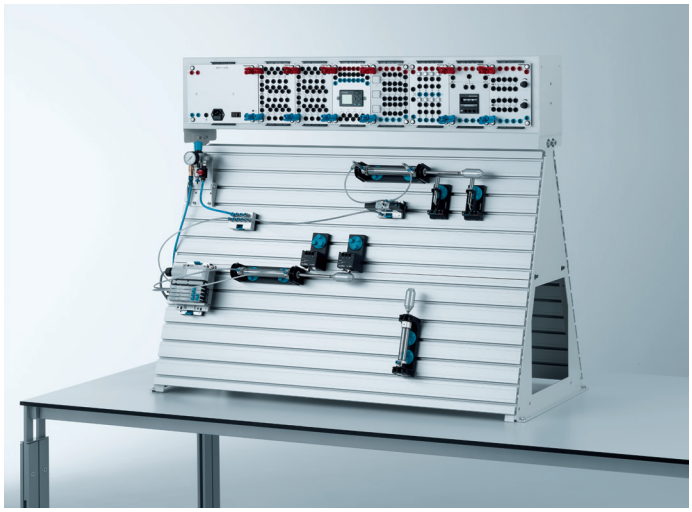
- Introduction to measuring units and standards
- Using tape measures and steel rulers
- Depth and feeler gauges
- Hardware, screw pitch, and thread types
- Technical drawings standards, layouts, views, and tolerances
- Interpreting exploded view diagrams
- Reading vernier calipers and micrometers
- Digital and dial calipers
- Inside and outside micrometers

Outcomes:

- Apply measurements with tape measures and steel rulers
- Proper measurement of dimensions with depth and feeler gauges
- Recognize hardware sizing including validation with the use of pitch gauges
- Understand and demonstrate how to read vernier scales
- Accurately measure precision components with digital micrometers and calipers
- Interpret technical drawings and exploded view diagrams

Prerequisite: General knowledge

Industrial Pneumatics
PN111



PN111: 24-hour class covers:

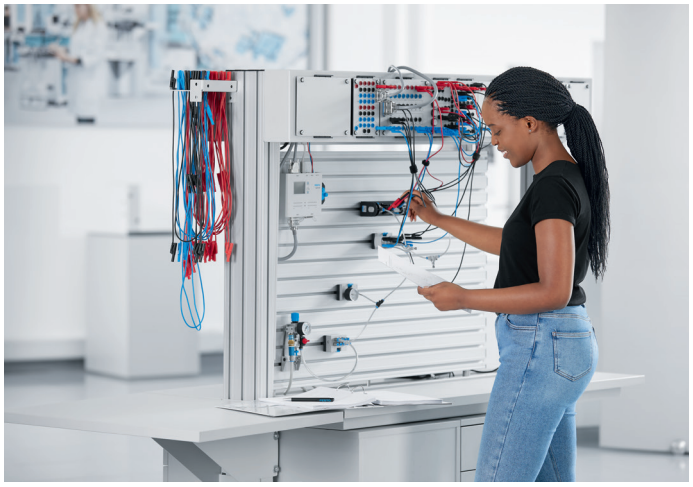
- Basic concepts of pneumatics
- Fundamentals of compressed air supply: production, preparation, and distribution
- Pneumatic drives: cylinders for different drive purposes
- Directional control valves: various valve types (pneumatically/electrically controlled, designs, different mid-positions, etc.)
- Shut-off valves, flow control valves, pressure valves, valve combinations
- Fundamentals of industrial electric controls: buttons, contacts, relays
- Pneumatic and electric control of valves; position, speed, logic, pressure, and time dependent control
- Cutting installation costs from single valve to valve terminal

Outcomes:

- Understands the fundamentals of compressed air generation
- Identify and explain symbols of pneumatic components
- Describe the design, features, and operation of pneumatic components
- Interpret technical specifications and data relating to pneumatic components
- Design, assemble, simulate, and test basic pneumatic and electro-pneumatic circuits

Prerequisite: General knowledge

Industrial Pneumatic Fundamentals & Troubleshooting
PN112



PN112: 32-hour class covers:

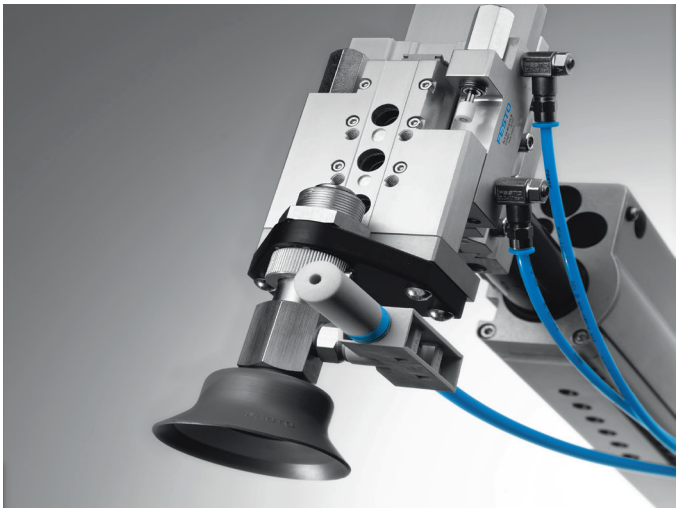
- Basic concepts of pneumatics
- Safety regulations and considerations
- Fundamentals of compressed air supply: productions, preparation, and distribution
- Directional control valves: pneumatically/electric control, designs, and failure modes
- Fundamentals of electrical controls of pneumatic systems: pushbutton, relays, etc.
- Pneumatic and electric logic: position, speed, pressure, tie
- Identifying and eliminating faults in pneumatic systems
- Disassembly, inspection, and repair of failed components

Outcomes:

- Understand the fundamentals of compressed air generation
- Identify and explain symbols of pneumatic components
- Interpret pneumatic and electro-pneumatic schematics
- Describe the design, features, and operation of pneumatic components
- Design, assemble, and test basic to advanced pneumatic and electro-pneumatic circuits
- Troubleshoot and repair basic to advanced pneumatic and electro-pneumatic circuits
- Apply systematic methodology to analyze faulted pneumatic system
- Create and evaluate a fault list

Prerequisite: General knowledge

Vacuum for Handling Technology
PN381



PN381: 8-hour class covers:

- Introduction to vacuum technology
- Vacuum generation in handling technology
- Vacuum components in handling technology
- Component selection criteria

Outcomes:

- Understand the generation and provision of vacuum
- Describe the fundamentals of vacuum
- Select and dimension suction cups
- Interpret the material properties of handling with vacuum
- Analyze the characteristics of the vacuum generator
- Design simple vacuum circuits

Prerequisite: Knowledge of Pneumatics or assess out

Systematic Safety Improvement in Pneumatic Systems
PN351

PN351: 16-hour class covers:

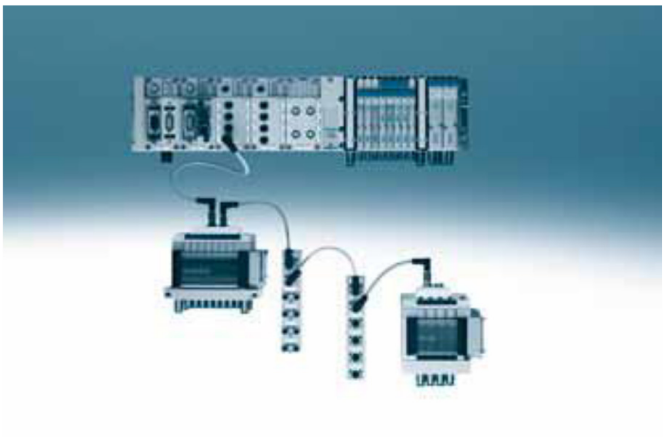
- Correct dimensioning
- Operation mode of a machine
- Technical safety functions
- Emergency stop, safety relay and safeguards
- Protective devices
- Pneumatic safety tips

Outcomes:

- Identify the risks associated with pneumatic processes
- Evaluate the risk factors associated with basic pneumatic designs
- Incorporate safety measures and circuits to enhance safety
- Gain knowledge of emergency and safety solution principles
- Enhance the safety of basic pneumatic designs

Prerequisite: Basic knowledge of Pneumatics & DC Technology

Valve Terminal CPX - Functions, Commissioning and Fault Elimination
PN163



PN163: 8-hour class covers:

- Design and functionality of various CPX valve terminal series
- Overview valve functions
- Interpretation and creation of pneumatic circuit diagrams
- Understanding the interconnections between pneumatics and electrical engineering
- Configuration of terminals and ordering spare parts
- Introduction to Quick Search Plus software for part modification and replacement
- Adaptable electrical connection technology
- Identification and resolution of faults in pneumatic and electric controls
- Diagnosis using fault LEDs on the communication node/ control module
- Applications of Festo software for commissioning and troubleshooting of CPX valve terminals

Outcomes:

- Possesses familiarity with the CPX valve terminals and their operating principles
- Understand the structure of a CPX valve terminal
- Recognizes the various modules of a CPX valve terminal
- Able to use the CPX maintenance tool software effectively
- Capable of diagnosing malfunctions in CPX valve terminals

Prerequisite: DC & AC Technology, Pneumatics & Sensor Technology

Industrial Hydraulics
HY511

HY511: 16-hour class covers:

- Properties of fluid, flow, pressure and force
- Hydraulic components and their functions
- Equipment and circuit diagram symbols
- Cylinders, motors, and valve types
- Control of flow and pressure
- Create, read, and interpret basic hydraulic circuit diagrams
- Valve activation types
- Solenoid valve operation

Outcomes:

- Design, assemble, and test basic hydraulic circuits
- Identify and describe the features and operation of hydraulic components
- Interpret graphical symbols for hydraulic components
- Perform simple calculations of pressure, flow, and force
- Adjust the pressure and flow of hydraulic components and systems
- Construct circuits with valves of all varieties and activation types

Prerequisite: General knowledge

Industrial Hydraulic Fundamentals and Troubleshooting

HY512

HY512: 24-hour class covers:

- Hydraulic operation and safety measures
- Properties of fluids, flow, pressure, and force
- Components and their function
- Equipment and circuit diagram symbols
- Cylinders, motors, and valve types
- Manual, mechanical, and solenoid valve operations
- Overview of maintenance requirements and common fail points in hydraulic systems
- Cavitation causes, symptoms, and preventative measures
- Fluid requirements and troubleshooting insufficient fluid quality problems

Outcomes:

- Demonstrate hydraulic and mechanical safety practices
- Create, read, and interpret basic hydraulic circuit diagrams
- Describe the features and operations of hydraulic components
- Calculate pressure, flow, and force in a hydraulic system
- Interpret hydraulic diagrams and use them to troubleshoot systems
- Identify common hydraulic component fail points
- Apply principles and documentation for systematic troubleshooting in a hydraulic system

Prerequisite: General knowledge

Industrial DC Technology

EL111

EL111: 16-hour class covers:

- Basic concepts of electricity
- Introduction to the AC/DC training system
- Switches
- Series and parallel circuits
- Voltage, current, and measuring instruments
- Resistance and Ohm's Law
- Solving series circuits
- Solving parallel and mixed circuits
- DC capacitors
- Electromagnetism
- DC relays

Outcomes:

- Identify various electrical components by sight and by symbol
- Sketch various symbols that represent electrical components
- State, list, and recognize the units for various electrical quantities
- Explain and apply Ohm's Law
- Clarify and implement Power laws
- Use a DMM to obtain continuity, resistance, voltage and current measurements
- Construct, analyze and troubleshoot simple electrical circuits (both series and parallel)
- Build and analyze series and parallel circuits

Prerequisite: General knowledge

Industrial AC Technology
EL121

EL121: 16-hour class covers:

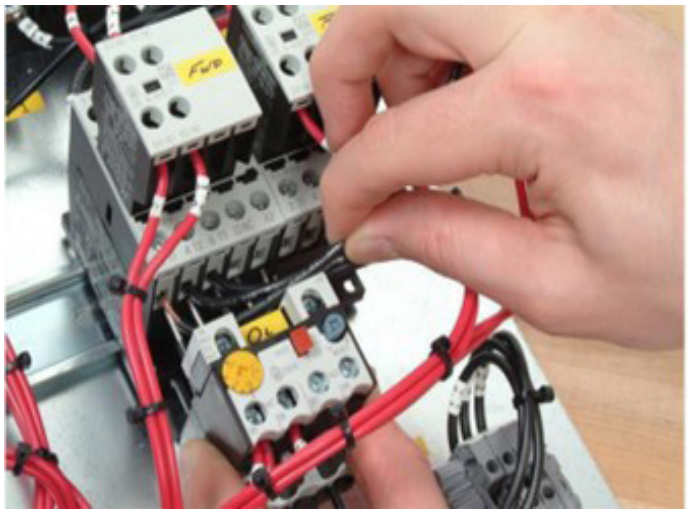
- AC circuits and AC capacitors
- DC and AC inductors
- Transformers
- AC relays and contactors
- Electrical distribution
- Circuit protection
- Troubleshooting methods

Outcomes:

- Identify components used in AC circuits by sight and symbol
- Analyze AC waveforms to determine period, frequency, and amplitude
- Apply Ohm's Law as it relates to AC circuits
- Calculate simple inductive and capacitive reactance
- Construct and troubleshoot AC circuits
- Recognize and compute variables in a transformer circuit
- Describe the operation of an AC relay
- Use a DMM to make measurements related to AC circuits
- Detect the components of an electrical distribution system
- Explain the usage of various circuit protection (fuses and circuit breakers)
- Troubleshoot simple faults inserted into working circuits

Prerequisite: DC Technology or assess out

Industrial Wiring - Level 1
EL171



EL171: 16-hour class covers:

- Dangers of electricity
- Basics of electrical control devises in DC and AC circuit
- Electrical installation standards and protection measures
- Reading electrical drawings
- Conductor installation
- Assemble an electro-pneumatic distribution systems
- Installation of a safety switch handle on a control enclosure
- Configuring an AC electrical motor
- Wiring an overhead door control system
- Troubleshooting the overhead door electrical control system

Outcomes:

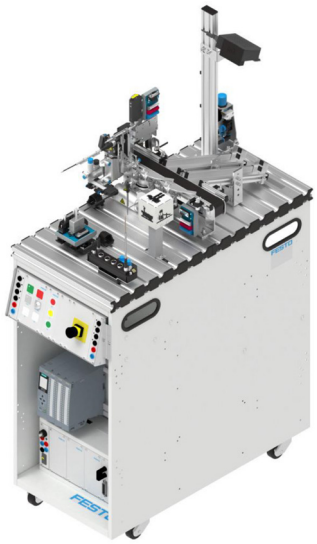
- Plan, install, and commission basic electrical circuits
- Differentiate American and European electrical symbols
- Explain fundamental electrical installation standards
- Guarantee the protection measures for the electrical circuit
- Identify and use proper electrical tools for installations
- Troubleshoot a basic electrical circuit

Prerequisite: Knowledge of DC and AC Technology

Industrial Wiring - Level 2

Modular Productions System Control Wiring

EL172



EL172: 16-hour class covers:

- Fundamental safety procedures
- Overview of IEC symbols
- Understanding and interpreting schematic diagrams
- Utilizing wiring hand tools
- Introduction to best practices in electrical controls wiring
- Wiring an electropneumatic control system with a safety relay
- Networking and installing a Programmable Logic Controller (PLC) within a modular production system
- Commissioning and assessing the modular production systems

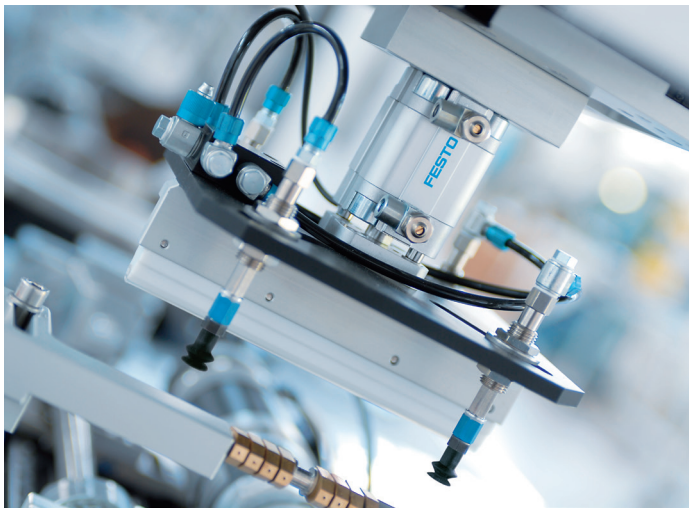
Outcomes:

- Able to read the wiring layouts, and schematic diagrams for the installation
- Capable of installing and wire the system
- Proficient in wiring and commissioning an electropneumatic system with a safety relay
- Competent in wiring and commissioning a Programmable Logic Controller (PLC) for a modular production system
- Applies best practices in wiring
- Collaborates with a team to commission the installation

Prerequisite: Fundamentals of Industrial Wiring and DC Technology

Principles of Sensor Technology

AUT121



AUT121: 16-hour class covers:

- Basic physical principles and characteristic features in use
- Sensor selection based on materials and ambient conditions
- Terms and definitions in sensor technology
- Design, function and applications of different sensors for detecting presence, distance, travel, force and pressure, and material quality
- Industrial applications and realization
- Technical data and limits on use of sensors
- Connection technology and signal processing
- Practical exercise and fault analysis

Outcomes:

- Understand and explain various sensor terms and fundamental functions
- Select the proper sensor for an application including, Position Switches, Limit Switches, Magnetic Switches, Inductive Sensors, Capacitive Sensors, Through Beam Sensors, Retro-Reflective Sensors, Diffuse Sensors and Fiber-Optic Sensors
- Obtain electrical connection and test the sensor for proper operation
- Troubleshoot faulty sensors, replace and adjust for optimal process efficiency

Prerequisite: General Pneumatic knowledge

Fundamental Principles of Smart Sensors

AUT122

AUT122: 16-hour class covers:

- Attributes and capabilities of smart sensors
- IO-Link communication protocol
- Smart inductive proximity sensors
- Smart photoelectric sensors
- Smart ultrasonic sensors
- Integration of smart sensors with PLCs

Outcomes:

- Understand what Industry 4.0 is and recognize the crucial role smart sensors play in its implementation
- Be aware of the key differences between smart sensors and traditional sensors, along with the advantages smart sensors provide
- Grasp the operational principles of the most common sensor types: inductive proximity sensors, photoelectric sensors, and ultrasonic sensors
- Become familiar with the communication protocols such as IO-Link and/or Profinet

Prerequisite: DC & AC Technology, Sensor Technology and PLC

FluidSIM®: Pneumatics, Hydraulics, and Electro-Pneumatics Simulations

AUT912

AUT912: 8-hour class covers:

- Symbol libraries
- Design of circuits
- Simulating and testing circuits
- Creating faults
- Forming libraries
- State diagrams
- Component animation
- Working principles
- Exercises
- Presentations
- Extended presentations
- Lesson plans
- Student and lecturer notes
- Educational films
- External interfacing

Outcomes:

- Comprehend and effortlessly maneuver through the software
- Design fluid power and programmable logic controller circuit diagrams
- Simulate and test circuits
- Change circuit parameters, such as flow, pressure, and component characteristics
- Create lecturer and student training notes
- Develop customized presentations and libraries
- Link the software to external equipment and machinery
- Incorporate videos into lesson plans
- Install and uninstall the software

Prerequisite: Knowledge of Pneumatics, Hydraulics, DC Technology & AC Technology

Manufacturing 101
MFG101

MFG101: 8-hour class covers:

- Introduction to safety devises
- Basic electricity fundamentals
- Overview of sensor terminology
- Fluid power and properties of compressed air
- Advantages and disadvantages of pneumatics
- Introduction of other manufacturing components such as controllers and motors

Outcomes:

- Distinguish common safety devises used in manufacturing
- Explain the difference between voltage, current and resistance
- Identify common sensor types and functions
- Interpret properties of air and pneumatics
- Recognize and explain basic pneumatic components and their functions
- Summarize the use of common components used in manufacturing environments

Prerequisite: General knowledge

Basic Motor Control Technology
MC111

MC111: 16-hour class covers:

- Introduction to manual and automatic starters
- Motor protection circuits
- Application of two and three-wire control and jogging
- Electromechanical contactors
- Timers and timed circuits
- Induction motors
- Reversible motor starters
- Motor braking methods

Outcomes:

- Identify various motor control components and their function
- Connect manual starters
- Build reduced voltage and soft start circuits
- Configure various motor braking circuits
- Construct two and three-wire control circuits
- Program motor timers
- Recognize common motor types and the applications
- Troubleshoot motor protection components and circuits

Prerequisite: Knowledge of AC Technology

Mechanical - Power Transmission Fundamentals
MCH101

MCH101: 24-hour class covers:

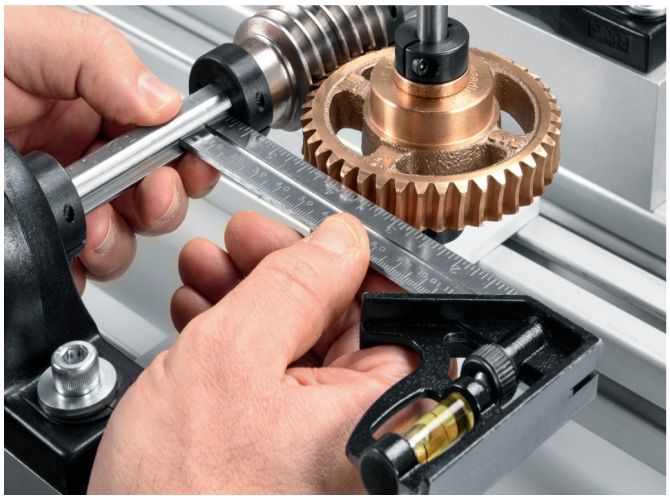
- Safety when working with mechanical systems
- Belt drive types
- V-drive belt pully installation, alignment and tension adjustment
- Chain roller types
- Roller chain sprocket installation, alignment and tension adjustment
- Spur gear installation and alignment
- Pitch diameter, speed and torque of drive systems
- Roller, plane and thrust bearings
- Seal types and gaskets
- Chain and bearing lubrication principles

Outcomes:

- Demonstrate safe practices when working with mechanical systems
- Install and align belt, chain, and gear driven systems
- Apply correct tensioning techniques of belt and chain-driven systems
- Identify various bearing types such as rollers, thrust and needle bearings
- Remove and replace various bearings, gaskets and seals
- Diagnose common causes of bearing failure
- Perform proper lubrication and preventive maintenance techniques for power transmission systems
- Troubleshoot mechanical systems

Prerequisite: General Knowledge

Mechanical - Power Transmission Intermediate
MCH102



MCH102: 16-hour class covers:

- Safety when working with mechanical power transmission systems Torque limiters
- Wedge, Synchronous and multi-belts applications
- Variable speed belt drives
- Silent and multiple strand chain drives
- Taper bore bushings
- Idler pulleys and sprockets
- Helical, Bevel, Worm, and Miter gears
- Gear alignment and backlash adjustment
- Ball screws and linear bearings

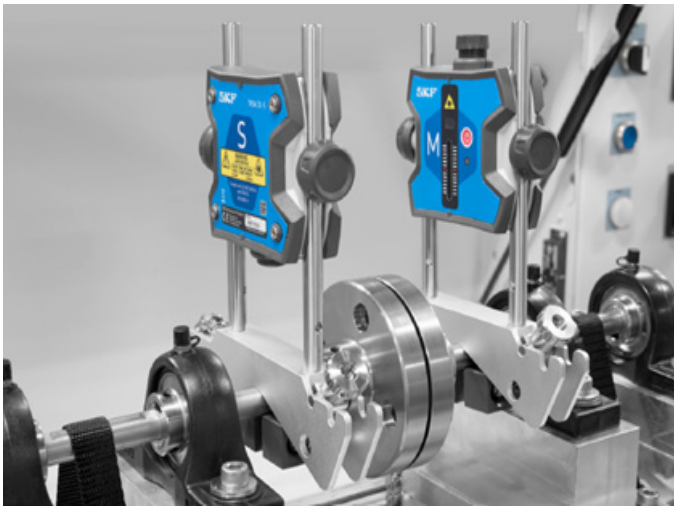
Outcomes:

- Demonstrate safe practices when working with mechanical systems
- Install and align wedge, synchronous, multi-belt systems, silent and multi strand chain drives
- Apply correct tensioning techniques for wedge, synchronous, multi-belt systems, silent and multi-strand chain drives
- Remove and replace taper bore bushings
- Install and align helical, bevel, worm, and miter gear driven systems
- Identify and determine proper backlash adjustment for various gear driven systems
- Remove and replace ball screw and linear bearings
- Troubleshoot synchronous belt, silent chain, and gear driven systems

Prerequisite: Mechanical Power Transmission Fundamentals

Mechanical - Clutches Brakes and Shaft Alignment

MCH103



MCH103: 16-hour class covers:

- Clutch and brake types
- Torque limiters
- Coupling types
- Motor/coupling alignment

Outcomes:

- Assemble and secure various hubs to shafts
- Install and adjust clutches, torque limiters and brakes
- Troubleshoot common clutch, brakes, and torque limiter problems
- Install and align motor couplings using a laser alignment system

Prerequisite: Mechanical Power Transmission Fundamentals and Mechanical Power Transmission Intermediate

CoDeSys: A Hardware-Independent Introduction to PLC Programming

PLC371

PLC371: 16-hour class covers:

- Overview of the CoDeSys software
- Introduction to the IEC 61131-3 PLC programming languages
- Apply a systematic method for independent PLC programming
- Describe the sequence of automated systems using Sequential Function Chart (SFC)
- Utilize the Visualization tools with CoDeSys
- Troubleshooting automated systems with CoDeSys
- Professional documentation for PLC programming project

Outcomes:

- Operate and combine IEC 61131-3 languages (CoDeSys V3) to program a professional solution for an industrial application
- Program IEC 61131-3-compatible industrial controllers
- Illustrate the sequence of MPS Distribution Station or MecLab Handling module using Sequential Function Chart (SFC) or Motion Step digram
- Program the sequence of the used module
- Use debugging tools to simulate, test, and trace
- Troubleshoot using CoDeSys
- Master the fundamentals of visualization
- Design and apply a range of variables (local, global, and system)
- Create an Empty project for I/O testing
- Initiate a Boot project to start the controller automatically
- Identify process relationships

Prerequisite: General knowledge of PLC

PLC Fundamentals – Allen-Bradley

PLC411

PLC411: 16-hour class covers:

- Basic design and operation
- PLC Sections
- Input types
- Memory types
- Logic processing
- Output types
- Numbering systems
- Boolean functions
- Programing a PLC according to IEC 61131 standard
- Basic troubleshooting

Outcomes:

- Explain the operation and design of various relays
- Outline the PLC sections, types of input and output devices, and categories of memory in a PLC
- Expound on different types of PLC addressing
- Convert different numbering systems used in a PLC
- Illustrate various Boolean gates/truth tables
- Demonstrate how to use a PLC for troubleshooting to resolve problems

Prerequisite: Knowledge of DC Technology & Sensors Technology

PLC Fundamentals – Siemens

PLC391

PLC391: 16-hour class covers:

- Basic design and operation
- PLC sections
- Input types
- Memory types
- Logic processing
- Output types
- Numbering systems
- Boolean functions
- Programing a PLC according to IEC 61131 standard
- Basic troubleshooting

Outcomes:

- Explain the operation and design of various relays
- Outline the PLC sections, types of input and output devices, and categories of memory in a PLC
- Expound on different types of PLC addressing
- Convert different numbering systems used in a PLC
- Illustrate various Boolean gates/truth tables
- Demonstrate how to use a PLC for troubleshooting to resolve problems

Prerequisite: Knowledge of DC Technology & Sensors Technology

Intermediate PLC – Allen-Bradley
PLC401

PLC401: 16-hour class covers:

- Ladder logic programming
- Basic functions: operation and programming
- Program modifications
- Uploading and downloading programs to a PLC
- Programming of sequential systems

Outcomes:

- Program a PLC
- Upload and download programs to and from a PLC
- Comprehend and program basic PLC functions - including; Identity, Not, AND, OR, Combination, Seal-In, Set/Reset, On Delay Timer, Off Delay Timer, Up Counter, Down, Counter, Up/Down Counter and Move Function
- Modify a current PLC program
- Program sequential systems

Prerequisite: PLC Fundamentals or assess out

Intermediate PLC – Siemens
PLC421

PLC421: 16-hour class covers:

- Ladder logic programming
- Basic functions: operation and programming
- Program modifications
- Uploading and downloading programs to a PLC
- Programming of sequential systems

Outcomes:

- Program a PLC
- Upload and download programs to and from a PLC
- Comprehend and program basic PLC functions - including; Identity, Not, AND, OR, Combination, Seal-In, Set/Reset, On Delay Timer, Off Delay Timer, Up Counter, Down, Counter, Up/Down Counter and Move Function
- Modify a current PLC program
- Program sequential systems

Prerequisite: PLC Fundamentals or assess out

Troubleshooting of Automated Systems Controlled by PLCs

PLC441

PLC441: 24-hour class covers:

- Communication-focused approach to addressing system malfunctions.
- Functional correlations between mechanics, pneumatics, electrics, and PLC
- Structure and function of a PLC
- Workflow descriptions for processing machines and production systems: Introduction to Sequential Function Charts (SFC) and GRAFCET
- Utilizing technical documentation to troubleshoot automated systems
- Hands-on troubleshooting exercises

Outcomes:

- Capable of understanding process and functional relationships within an automated systems
- Able to interpret technical documentation
- Knowledgeable about the operation of PLCs
- Competent to understand the construction, design characteristics, and functionality of components, as well as their interrelationships
- Systematically identify and eliminate the root causes of failures
- Qualified to create fault lists for future reference to identify the root causes of recurring failures

Prerequisite: Knowledge of DC Technology, Basic Pneumatic, Basic PLC, and Sensors

Variable Frequency Drives

VF111

VF111: 16-hour class covers:

- Introduction to AC 3-phase induction motors
- Review of motor torque, speed, and power
- System circuitry overview
- VFD parameter settings
- Motor acceleration, deceleration, and braking
- Open and closed loop control and encoder operation
- VFD maintenance and troubleshooting

Outcomes:

- Comprehend the circuitry and operation of a VFD
- Program various system parameters
- Control motor acceleration and deceleration
- Interpret motor braking methods
- Recognize cause and effect of parameter changes
- Clarify how closed loop and open loop systems operate
- Troubleshoot a basic VFD system

Prerequisite: General knowledge

Basic Principles of Digital Technology
DT111

DT111: 16-hour class covers:

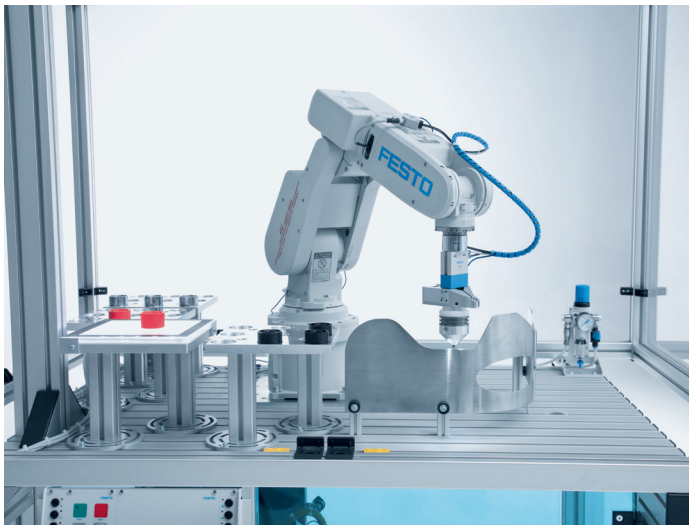
- Employing fundamental logic module
- Designing and enhancing logic circuits
- Implementing a Schmitt trigger
- Utilizing trigger circuits
- Storing signals with flip-flops
- Developing counting circuits
- Converting and transmitting data
- Configuring arithmetic circuits

Outcomes:

- Understand the most commonly used logic operators
- Learn to implement simple logic statements as circuits
- Use switching matrix diagrams to simplify circuits
- Familiarize yourself with the Schmitt trigger component and understand hysteresis
- Explore different types of trigger circuits and learn how to integrate delay elements into digital circuits
- Get acquainted with various types of flip-flops and will learn to set up digital circuits with memory
- Recognize synchronous and asynchronous counting circuits and develop forward and backward counting circuits
- Acquire familiarity with various types of adding circuits

Prerequisite: Knowledge of DC & AC Technology, and Sensor Technology

Robotics Fundamentals
ROB111



ROB111: 16-hour class covers:

- Handling device fundamentals, types, applications, advantages and disadvantages, and end effectors
- Linear motion, circular motion of mechanics
- Coordinate systems; world, reference
- Drives, servo, and induction motors
- Movement vs. speed feedback
- Motion control; basic blocks, and typical date
- Hands-on examples and exercises

Outcomes:

- Identify the different types of handling systems
- Describe the mechanics behind robotics systems
- Illustrate the working principles behind the control of movement and speed
- Clarify the concept of a coordinate system
- Enunciate the principle of a motion control system
- Cognizant of the safety issues when working with robot arms
- Capable of operating the robot arm with the teach pendant
- Create basic motion programs for a robot arm

Prerequisite: Knowledge of Pneumatic & PLC Fundamentals

Servo and Stepper Motor Control
SRM111

SRM111: 24-hour class covers:

- Introduction to stepper and servo motors
- Rotary and linear mechanical drives
- Displacement encoders (incremental, absolute, resolver)
- Safety when working with stepper and servo controllers
- Drive commissioning and manual control
- Position control of a rotative axis
- Velocity control of a rotative axis
- Torque control of a linear axis
- Single axis motion control with a PLC

Outcomes:

- Describe the operational principles of synchronous machines
- Clarify the operational principles of stepper and servo controllers
- Differentiate between the various types of encoders and identify their function and specific application
- Distinguish among the various types of mechanical drives (axes) and clarify their construction
- Translate and modify the relevant parameters of the configuration software and the effects on the drive system
- Discern the roles of the PLC and the drive within the motion control system
- Summarize the steps required to administer the motion control job in a program

Prerequisite: Basic knowledge of Pneumatics, DC & AC Technology, Sensor Technology & PLC Fundamentals

SMED - Reducing Setup Time with Single Minute Exchange of Die
LP131

LP131: 16-hour class covers:

- Relationship between batch size and setup time
- Reducing setup times as the only way to reduce batch sizes and inventories in production
- SMED (Single Minute Exchange of Die) method and phases
- OTED (One Touch Exchange of Die) method
- Constructive solutions for fast setup processes
- Influence on production control
- Practical implementation of methods in a model plant

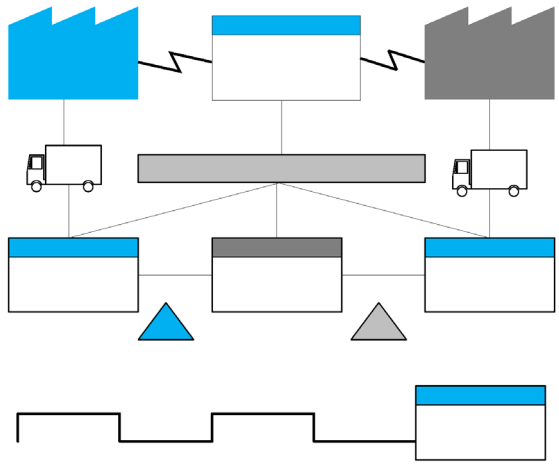
Outcomes:

- Recognizing waste
- Comprehend the significance of short setup times of efficient and cost effective order processing, adaptable production, and minimized inventory levels
- Improve maintenance activities applying the SMED method
- Apply and teach the SMED method

Prerequisite: Basic technical knowledge & lean manufacturing topics

Analyzing and Designing Value Streams

LP161



LP161: 16-hour class covers:

- Lean thinking as the basis of recording value streams
- Preparatory steps for value stream analysis
- Stages of current value stream analysis
- Practical implementation of current and future state value stream mapping using a concrete example
- Customer takt as a key performance indicator for designing new processes
- Deriving a project plan
- Fundamental aspects of introducing value stream mapping

Outcomes:

- Knowledge about the value stream mapping method and capable of applying the technique
- Record and present the value added process and be able to use the current state value stream map to identify waste, weak points, and deficits
- Comprehend the design of stable processes that are both lean and robust, and capable of applying value stream mapping in the development of future processes
- Identify the factors that need to be considered for implementing value stream mapping within their company

Prerequisite: Basic knowledge of lean manufacturing topics

Lean Production – Interactive Workshop Experience

LP191

LP191: 16-hour class covers:

- Inventory minimization as an important basis for increased productivity
- Principle of pull production control
- Advantages compared to conventional production control methods
- Types and functions of different pull production control methods
- Application of methods
- Kanban: the classic pull principle
- SMED: Optimization of setup processes with Single Minute Exchange of Die
- Continuous Improvement Process (CIP) as part of the business game
- Introduction of Value Stream Mapping (VSM)

Outcomes:

- Comprehend the principles of lean thinking
- Recognizes fundamental methods for improvement
- Analyze the causes of delivery problems and low productivity
- Develop and implement ideas for meeting customer requirements and process improvements

Prerequisite: General knowledge

Effective Industrial Problem-Solving Techniques for Maintenance Staff
PN142

P142: 16-hour class covers:

- Defining, understanding and communicating problems
- Causes of downtimes and how to prepare a fault list
- Methods for analyzing weak spots (Pareto, cause-effect diagram, brain-writing, FMEA, measure plan)
- Critical thinking and how to use it on the shop floor
- Find the root cause of the problem using the problem-solving techniques

Outcomes:

- Skillfully grasp and convey problems
- Assemble a team to initiate the analysis of a significant problem that cannot be addressed alone
- Apply various techniques to identify and eliminate the root cause of the problem
- Design and analyze a machine fault list for various production systems
- Implement effective measures and manage action plans to achieve a lasting resolution of the problem
- Utilize fundamental Failure Mode and Effect Analysis (FEMA) on industrial systems

Prerequisite: Basic general knowledge

Basics of Effective Maintenance
IM181

IM181: 16-hour class covers:

- Role of maintenance and technical service
- Six common sources of loss in machines and systems
- Maintenance, inspection, and repair
- Key indicators for maintenance:
  - OEE (Overall Equipment Effectiveness)
  - TEEP (Total Equipment Effectiveness Productivity)
  - MTBF (Mean Time Between Failures)
  - MTTR (Mean Time to Repair)
- Create maintenance and inspection plans
- Evaluation of maintenance work

Outcomes:

- Recognize the different areas and roles of maintenance
- Identify the six typical kinds of losses of machines and systems and improve these in a systematical way
- Familiarize yourself with standard maintenance documents and be able to utilize them in daily tasks
- Incorporate and enhance their work within the maintenance processes

Prerequisite: Basic knowledge of Pneumatics, DC Technology, Sensors Technology & PLC Fundamentals

Introduction to Industry 4.0: Core Elements and Business Opportunities
TCM261

TCM261: 16-hour class covers:

- Introduction to Industry 4.0
- Difference between Industry 3.0 and 4.0
- Overview of the core elements and technologies of Industry 4.0
- Social-technological developments and their consequences
- Industry 4.0 business models and creating new business ideas
- Bottom-up and top-down strategies to implement Industry 4.0
- Industry 4.0 competency development
- Industry 4.0 change management

Outcomes:

- Recognize the core elements and basic technologies of Industry 4.0
- Comprehend how the core elements are interconnected and how they can contribute to a comprehensive approach for enhancing processes and products
- Identify the opportunities for creating new business models and consider the factors to take into account when implementing new strategies for Industry 4.0

Prerequisite: General knowledge

Basic Programmable Logic Controllers for Industry 4.0
AUT301

AUT301: 16-hour class covers:

- Programmable Logic Controllers (PLCs)
- Project management in TIA Portal
- Programming Languages in IEC 61131
- Device configuration in TIA Portal
- I/O Link module configuration
- Programming of basic logic functions, internal bits (marks), timer, and counters
- Downloading and uploading projects
- Commissioning and troubleshooting a PLC system using TIA Portal software
- Determine when I/O link configuration is advantageous based upon data collection

Outcomes:

- Describe the sections of a PLC, the various types of input and output devices, and the different types of memory used in a PLC
- Create tags to address inputs, outputs, internal bits, timers, and counters
- Generate a basic project using TIA Portal
- Establish communication between the computer and the PLC
- Differentiate between a combinatorial (logic) and a sequential system
- Program in Ladder, Instruction List and/or in Function Block: Inputs, outputs, internal bits, timers, and counters
- Commission and troubleshoot a basic electro-pneumatic system controlled by a PLC

Prerequisite: Industrial Pneumatics, DC Technology & Sensors Technology

Human Machine Interface – Operation and Visualization for Industry 4.0

AUT302

AUT302: 16-hour class covers:

- Frequently used terms when working with an HMI
- Fields of application and products of user interfaces
- Structure and function of user interfaces
- Fundamentals of developing an HMI user interface
- Project engineering of fundamental objects and elements in TIA Portal
- Integration of sensors and actuators in project engineering
- Commissioning of the HMI module on the Modular Production System (MPS) 400 distributor
- Writing site code to RFID tag from HMI

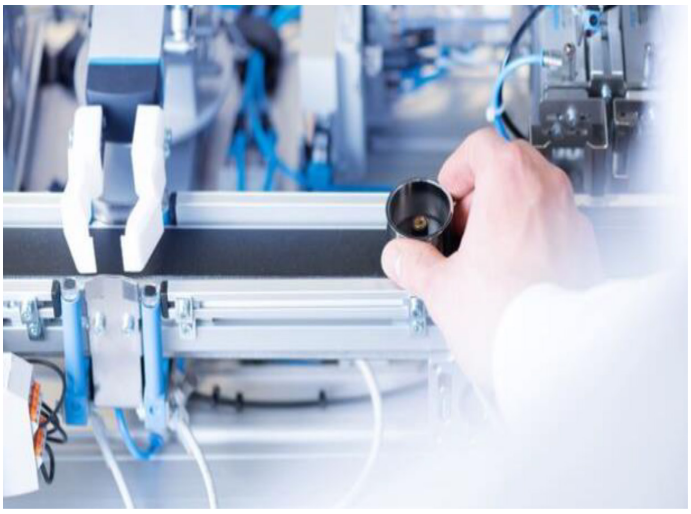
Outcomes:

- Create a device configuration for the PLC and HMI with the Siemens TIA Portal
- Carry out the runtime settings for the HMI
- Load the configuration and simulate the HMI
- Configure basic objects in the TIA Portal: text field, graphic view, date/time field, graphic I/O field, bars, slider, & button
- Animate graphic views
- Design an I/O field for the output of a digitalized analog value
- Depict an I/O field for the input and output of a truth value
- Construct an I/O field for the input of an integer
- Prepare an I/O field for the input and output of a floating-point number
- Product traceability from raw material to finish material

Prerequisite: Basic PLC programming with TIA Portal

Object Identification with RFID for Industry 4.0

AUT303



AUT303: 16-hour class covers:

- Introduction to object identification
- Binary identification
- Overview of barcodes
- QR code/2D code
- Number systems
- RFID – Radio Frequency Identification: How RFID works
- RFID Technology
- Selection of an RFID system by way of example
- Writing, reading, and analyzing the data on an RFID tag

Outcomes:

- Differentiate between binary, optical, and RFID object identification systems
- Describe the features of RFID
- Identify the components of an RFID system
- Comprehend the operation of an RFID transponder
- Grasp how an RFID reading and writing device interacts with the transponder
- Write to and read out an RFID transponder manually
- Explain the display formats for dates and times in computer systems
- Elucidate the importance of product traceability

Prerequisite: Programmable Logic Controllers

Certifications

DOL Certification

Employers will benefit from having apprentices receive skill-based education that prepares them for good paying jobs. Apprentices will learn on-the-job training under the guidance of an experienced worker. The credentials validate the skills and competencies a prospective employee, or an upskilling current employee, need to be productive and successful in a manufacturing environment. This certificate removes guesswork from hiring and promoting by matching the right candidate with the right job and growing the skillset of their existing workforce. It will increase the speed at which the employee achieves value-added production. The DOL certificate will also bring new people into manufacturing with essential skills as demonstrated by the credential they hold. Upon completion of the program, the apprentice will have a National DOL certificate as a Mechatronics Technician, which they can use in any state of the USA.

National Coalition of Certification Centers (NC3) Certification

The National Coalition of Certification Centers (NC3) provides a learning path for STEM to Job Ready Skills. The stackable Industry Based Certifications focus on core technical competencies that stack into a comprehensive applied knowledge base. The broad base of certifications prepares participants for a career and enhances existing employees' experience with relevant credentials. Festo, one of the 17 industry partners of NC3, continually grows the certification base to meet current industry needs.

NIMS Certificate

The benefit of a NIMS credential demonstrates the credential holder met the industry benchmark for that occupational competency. This provides the individual with a competitive edge while the demonstration of skills can equate to a promotion or raise for incumbent workers. Individuals can amass national, industry-recognized skills validations while completing apprenticeships or other formalized training programs.

What's Next?

1. Choose your courses.
2. Contact the Festo Didactic US Learning Center for additional information and the course content overview.

Together you can:
- Package several training courses to create a program that fits your needs.
- Select the best time and location for your courses(s): your site, a Festo location, or a third-party location
- Talk to a Festo trainer to discuss the training content for your participants

Please contact a Didactic team member at:
festolearningcenter.us@festo.com

Proudly in partnership with:

The Association for Packaging and Processing Technologies

National Coalition of Advanced Technology Centers

National Center for Supply Chain Technology Education
RESOURCES FOR EDUCATION & INDUSTRY

FESTO
Global Industry Partner of WorldSkills International

worldskills

Festo Didactic Inc.
Learning Center Midwest
7777 Columbia Road
Mason, OH 45039
festolearningcenter.us@festo.com

www.festo.com

240142 EN 04/2025 Festo Didactic Inc.