MECHATRONICS TECHNOLOGY

WORKFORCE-READY, HANDS-ON TRAINING
Mechatronics Technology: Workforce-Ready, Hands-On Training

Mechatronics is a facet of engineering science based on a combination of mechanical engineering, electrical engineering, and computer science, and is fundamental to all forms of systems, device, and product designs that incorporate a balance of mechanical structure with electronic and software control technologies. Simply put, today’s advanced manufacturing industry relies on mechatronics technology, and because of that, mechatronics is one of today’s fastest growing career fields.

Mechatronics applications can be found in most everyday tasks, from making coffee to washing laundry to accessing a computer hard drive, as well as many not-so-everyday tasks, like the operation of an MRI machine or a robotic assembly system. Mechatronics also encompasses pneumatics and hydraulics systems and just about anything else that involves or controls motion.

Careers in mechatronics are as diverse as the mechatronics field itself. Mechatronics engineers, by necessity, must be cross-trained in several disciplines and must also have the ability to communicate across these disciplines. The need for mechatronics engineers goes far beyond the consumer goods industries, and includes (but is certainly not limited to) technology, aerospace, and agriculture.

To answer this need, Lab-Volt is proud to lead the way in offering hands-on training programs in Mechatronics Technology. With over 70 years of dedicated industrial training systems development, Lab-Volt continues to be at the forefront of safe, highly-regarded learning environments and the first choice for businesses, teachers, and departments who want the best programs for their trainees and students.

REAL-WORLD COMPREHENSIVE TRAINING IN MECHATRONICS TECHNOLOGIES

Mechatronics engineers must be able to install machines, connect them to electronic circuits, and master their control software. Such diverse skills put mechatronics specialists in high demand in the workforce. In fact, well-known consumer products leader Procter & Gamble Co. trains all new hires in Mechatronics. The Mechatronics diagram on the next page illustrates the overlap and integration of the many fields that are encompassed by mechatronics.

Lab-Volt’s Mechatronics Technology program offers comprehensive coverage in all of these areas, as well as cross-technology troubleshooting and problem-solving, preparing trainees for jobs in mechatronics. Lab-Volt’s program also incorporates hands-on training using real-world equipment and comprehensive web-based training.
MECHATRONICS INDUSTRY SKILLS COVERAGE

- Electricity and Electronics
- Electrical and Mechanical Systems
- Electric Power and Controls
- Fluid Power Systems
- PLCs and Drives
- Automation and Robotics
- Instrumentation and Process Control
- Manufacturing Technologies
- Web-Based Industrial Training
Industrial Training Zone by Lab-Volt delivers a broad range of online industrial training courses designed to help you build a more competent, qualified, and efficient workforce. Imagine an industrial training program that delivers powerful training right to your computer – the right content in the right context, comprehensive assessments, and the latest tools to measure performance. Our interface gives you more ways than ever to meet your industrial training needs. ITZ courses are SCORM-Compliant and run in a standards-based Learning Management System (LMS).

Electrical Theory, Model 47905

This theory-based course is designed for electrical technicians, those seeking to renew their electrical master’s certification, and those seeking to become journeymen. This course begins with the basics – the atom, charge, voltage, current, etc. – followed by an in-depth, theoretical approach to circuit analysis, basic magnetism, magnetic induction, and single- and poly-phase AC circuits.

**Topic Coverage**
- Fundamentals
- Basic Physics
- Circuit Fundamentals
- Circuit Analysis
- Basic Magnetism
- Magnetic Circuits
- Single-Phase AC Circuits
- Magnetic Induction
- Poly-Phase AC Circuits

**Course Length:** 15 hours
Online Industrial Training

Mobile Electrical, Model 47907

Mobile Electrical is designed to help students understand the fundamental concepts of the electrical systems of mobile equipment, including the basic electrical system common to almost all combustion engine vehicles, and how the battery, charging, and starting systems function and interact with each other.

Topic Coverage

• Electrical Fundamentals
• Circuit Fundamentals
• Circuit Analysis
• Basic Magnetism
• Circuit Components
• Electrical Testers
• Charging and Starting Systems

Course Length: 15 hours

PLC Fundamentals, Model 47910

The Programmable Logic Controller (PLC) course explores the hardware, firmware, and software that make a PLC function. The course also examines appropriate PLCs to use for specific purposes, how to connect devices to a PLC, and how to read and write basic PLC ladder-logic software programs.

Topic Coverage

• What is a PLC?
• PLC Hardware
• How a PLC is Structured
• How to Program a PLC
• Devices Connected to a PLC
• How to Use Timers
• How to Use Counters

Course Length: 15 hours
Online Industrial Training

Industrial Mechanical, Model 47904

This course gives students an overview of the basic physics laws, schematics, and systems design associated with mechanical power transmissions. Students learn about the various components found in a typical mechanical system, and how these components function and interact with each other.

**Topic Coverage**

- Basic Physics
- Linear Actuators
- Clutches
- Brakes
- Clutch/Brake Combinations
- Bearings
- Gears
- Drives
- Couplings

**Course Length:** 15 hours

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Industrial Pneumatics, Model 47902

Industrial Pneumatics is designed to help students understand the various components found in a typical pneumatic system and how these components function and interact with each other. The course also explores the basic physics laws, schematics, and systems design associated with pneumatic systems and fluid power.

**Topic Coverage**

- Basic Physics
- Compressors
- Air Dryers
- Air Preparation
- Air Distribution
- Directional Control Valves
- Actuators
- Miscellaneous Valves
- Accessories
- Airline Conductors
- Vacuum
- Understanding Schematics

**Course Length:** 15 hours
eSeries Training

Electromechanical Training System, Model 8090-E0

This site-license course bundle is intended to be used in conjunction with either the 8006 EMS training equipment or the 8970 LVSIM-EMS software. It contains two courses with all technical content and exercise procedures built into the CBT. Each of the courses has a 20-question pretest and posttest.

Topic Coverage

- AC/DC Motors and Drives
- Power Controls and Transformers

Mechanical Training System, Model 46649-E0

This site-license course bundle is intended to be used in conjunction with either the 6081 Pneumatics Bench or with 6485 LVSIM-Pneumatics software. Pneumatics Fundamentals contains four courses, each of which has a pretest and posttest.

Topic Coverage

- Mechanical Systems Level 1
- Mechanical Systems Level 2
- Mechanical Systems Level 3
- Mechanical Systems Level 4

Pneumatics Fundamentals, Model 6486-E0

This site-license course bundle is intended to be used in conjunction with either the 6081 Pneumatics Bench or with 6485 LVSIM-Pneumatics software. Pneumatics Fundamentals contains four courses, each of which has a pretest and posttest.

Topic Coverage

- Introduction to Pneumatics
- Basic Physical Concepts
- Basic Control of Cylinders
- Basic Control of Pneumatic Motors
Advanced Pneumatics, Model 6486-E0

The Advanced Pneumatics site license course bundle is intended to be used in conjunction with the 6081-20, Electrical Control of Pneumatic Systems, and 6081-40, Servo Control of Pneumatic Systems hardware. Additionally, Electrical Control of Pneumatic Systems may be performed using the 6485 LVSIM-Pneumatics software.

Topic Coverage
- Electrical Control of Pneumatic Systems
- Servo Control of Pneumatic Systems

3531 Process Control: Pressure, Flow, and Level, Model 46977-E0

This site license course is intended to be used in conjunction with the 3531 Instrumentation and Process Control Training System: Pressure, Flow and Level. It is appropriate for use with the Hart (3531-A0) version of the trainer. Customers should also chose a controller (3539) to accompany the system. This course has four units, each of which has a pre-test and post-test.

Topic Coverage
- Familiarization with the Training System
- Measurement: Pressure, Flow, and Level
- Introduction to Process Control
- Advanced Process Control
eSeries Training

3531 Temperature Process Control, Model 46944-E0

This site license course is intended to be used in conjunction with the 3531-C0, Add-on to the Instrumentation and Process Control Training System, Model 3531-A0. The course is designed to train students on the basic use of the system and its devices.

Topic Coverage
- Familiarization with the Training System
- Temperature Process Measurement
- Temperature Process Control
- Heat Exchangers and Advanced Temperature Measurement

Applied Robotics, Model 4604-70

The Applied Robotics course provides complete and affordable training in the programming and operation of industrial robots. Through the curriculum and hands-on experience with the Servo Robot System and RoboCIM simulation software, students shall learn to create automated work cells ideal for Flexible Manufacturing Systems (FMS) and Computer Integrated Manufacturing (CIM).

Topic Coverage
- Introduction to Robotics
- Servo Robot System
- Manufacturing Applications
- RoboCIM Software

Quality Control, Model 4607-70

In Quality Control, students learn about tools, processes and systems that are used to determine and ensure high quality of manufactured products.

Topic Coverage
- Introduction to Quality Control
- Measurements and Drawings
- Making Precision Measurements
- Working with Electronic Circuits
- Sampling Plans and Variation
- Comparing Various Quality Standards
This site license course is intended to be used with the Piping Training System Equipment, Model 46105. The Piping Training System course is a hands-on training tool designed to train students for careers as pipe fitters and piping maintenance technicians. The main learning objectives are the reading of piping schematics, calculation of pipe lengths, fabrication, installation, and testing of piping circuits made of galvanized steel pipes, hoses, PVC pipes, and copper tubes.

### Topic Coverage
- Identification of Pipes, Fittings, Valves, and Hangers
- Piping Circuit Layout and Measurement
- Pipe Length Calculation
- Cutting, Reaming, and Threading Steel Pipes
- Identification, Insulation, and Assembly of a Steel Pipe Circuit Using Threaded Fittings
- Assembling a Hose Circuit Using Barb Fittings and Clamps
- Assembling a PVC Pipe Circuit Using Cemented Fittings
- Assembling a Copper Tube Circuit Using Flare Fittings

This site license course bundle is intended to be used in conjunction with the Pumps Training System, Model 46106. The Pumps Training System introduces students to maintenance tasks, such as pump installation, shaft alignment, wiring, operation, inspection, maintenance, troubleshooting, and component replacement. It also engages students in the measurement of the pumping circuit parameters, pump characteristic curves, and how to use a variable speed drive.

### Topic Coverage
- Single Pump Systems
- Multiple Pumps Systems
- Rotary Pumps
- Reciprocating Pumps
- Centrifugal Pumps
Simulation Training

Pneumatics Simulation Software (LVSIM®-PNEU), Model 6485

LVSIM-PNEU is a Windows™-based simulation software that covers the same courseware as the “Pneumatics Fundamentals” and “Electrical Control of Pneumatic Systems” subsystems of the Lab-Volt Pneumatics Training System, Model 6081. LVSIM-PNEU enables trainees to install virtual pneumatic equipment in the laboratory, interconnect the equipment, and perform lab exercises. Sophisticated mathematical models fully simulate the mechanical, electrical, and physical characteristics of the actual Lab-Volt pneumatic equipment. This allows trainees working with LVSIM-PNEU to obtain the same results as with the real Lab-Volt Pneumatics Training System.

Topic Coverage

• Pneumatics Fundamentals
• Electrical Control of Pneumatic Systems

Hydraulics Simulation Software (LVSIM®-HYD), Model 6385

LVSIM-HYD is a Windows™-based simulation program that covers the same courseware as the “Hydraulics Fundamentals” and “Electrical Control of Hydraulic Systems” subsystems of the Lab-Volt Hydraulics Training System, Model 6080. LVSIM-HYD enables trainees to install virtual hydraulic equipment in the laboratory, interconnect the equipment, and perform lab exercises. Sophisticated mathematical models fully simulate the mechanical, electrical, and physical characteristics of the actual Lab-Volt hydraulic equipment. This allows trainees working with LVSIM-HYD to obtain the same results as with the real Lab-Volt Hydraulics Training System.

Topic Coverage

• Hydraulics Fundamentals
• Electrical Control of Hydraulic Systems
Simulation Training

Electromechanical Systems Simulation Software (LVSIM®-EMS), Model 8970

The Lab-Volt Electromechanical Systems Simulation Software (LVSIM-EMS), Model 8970, is a Windows™-based software that covers the same course work as the Computer-Assisted 0.2-kW Electromechanical Training System, Model 8006.

Sophisticated mathematical models fully simulate the electrical and mechanical characteristics of all the actual EMS modules: power supply, motors, generators, transformers, and electrical and mechanical loads. Used either as a complement to the actual EMS laboratory equipment or as a stand-alone product, LVSIM-EMS is a cost-effective learning tool that enables trainees to perform the same exercises as in the Computer-Assisted 0.2-kW Electromechanical Training System, Model 8006, courseware.

Topic Coverage

• Power Circuits and Transformers
• AC/DC Motors and Generators

Industrial Controls Simulation Software, Model 3161-H0

Lab-Volt’s Industrial Controls Simulation Software features true simulations of the components of the Model 8036, Industrial Controls Training System. The precise simulations allow students to complete all exercises at their computers without equipment. The software can be used as a stand-alone product or in conjunction with Lab-Volt’s Mind-Sight platform.

Topic Coverage

• Basic Controls
• PLCs
• Sensors
• Motor Drives
The Advanced Mechatronics System (AMS) is a training solution that uses real-world hardware components found in today’s industrial mechatronic applications. It reproduces the main steps of an industrial packaging line. All components are pre-programmed and pre-assembled in a fully-functional industrial application. With pneumatic distribution, filling, quality control, product sorting, storage and retrieval, network communication, and motor control sub-systems, the AMS covers many of the most prominent features of modern production lines.

**Topic Coverage**

- Familiarization
- Electricity
- Mechanics
- Fluid Power
- Programmable Logic Controllers
- Advanced Subjects: servo motion and artificial vision
Industrial Technology

Preparatory Electricity & Electronics (PEET 2.0), Model 48800

The Preparatory Electricity and Electronics Trainer (PEET) 2.0 focuses on fundamental electricity and electronics skills development and includes topics and components relevant in industry today. This trainer also uses Locktronics to present and teach the curriculum. Locktronics is an easily-configurable system that mimics the layout of a circuit diagram, simplifying the transition from circuit diagrams to functional circuits.

Topic Coverage
• Fundamentals of AC/DC
• Basic Electronics
• Motors and Generators

Electric Power Technology Training Systems, Series 8010

The Electric Power Technology Training Systems are based on the Lab-Volt Electric Power Technology Training Program, each system providing a turn-key solution dealing with some aspects of the wide field of electrical energy. Each system in the 8010 Series is based on Lab-Volt’s proven modular design approach. Most systems also use computer-based data acquisition and control using Lab-Volt’s recently-developed Four-Quadrant Dynamometer/Power Supply, Model 8960, and the Data Acquisition and Control Interface, Model 9063, two state-of-the-art USB peripherals which greatly enhance the learning experience of students. These systems provide unrivaled training in electrical energy.

8010 Training Systems
• 8010-1: DC and AC Power Circuits
• 8010-2: Solar Power
• 8010-3: Small-Scale Wind Power Electricity Generation
• 8010-4: Lead-Acid Batteries
• 8010-5: Basic Renewable Energy
• 8010-6: DC Power Electronics
• 8010-7: Home Energy Production
• 8010-8: Hydrogen Fuel Cell
• 8010-9: Electromechanical
• 8010-A: Power Electronics
• 8010-B: AC Power Transmission
• 8010-C: Smart Grid Technologies
• 8010-D: DFIG Principles
• 8010-E: Power Transmission Smart Grid Technologies
The Lab-Volt Industrial Controls Training System has unique controls training capabilities, which are enhanced by its modularity and its instructor-inserted faults. The system allows students to select and mount control devices to form typical control circuits, and to troubleshoot them once a fault is inserted.

**Topic Coverage**
- Electric Motor Control
- Circuit Layout and Specifications
- Basic Control Circuit
- Jogging Control Circuits
- Reduced AC Voltage Starters
- Controls with Electronic Devices
- AC & DC Drive Controls
- PLCs
- Sensors
- Troubleshooting

**Robot Systems, Models 5150 & 5250**

Lab-Volt’s Robot Systems, Models 5150 and 5250, are complete and affordable training programs for the programming and operation of industrial robots. Through the curriculum and hands-on experience with the Robot Systems, students learn to create automated work cells ideal for Flexible Manufacturing Systems (FMS) and Computer Integrated Manufacturing (CIM).

Both models include Student and Instructor Manuals, User Guides, and all leads and cables required to operate the system.
Industrial Technology

Mechanical Training System, Model 46101

The Lab-Volt Mechanical Training System, Model 46101, covers the installation, use, maintenance, and troubleshooting of mechanical drive components.

The list of industrial components includes pulleys, sprockets, gears, various types of belts, single- and multi-strand chains, several types of couplings, shafts, bearings, ball screws, clutches and brakes, and all the components required to assemble the proposed set-ups.

Topic Coverage

• Belt Drives
• Chain Drives
• Gear Drives
• Lubrication
• Couplings
• Shaft Alignment
• Bearings
• Linear Bearings
• Ball Screws
• Gaskets and Seals
• Clutches and Brakes
• Laser Alignment
• Vibration Analysis

Pumps Training System, Model 46106

With Lab-Volt’s Pumps Training System, students learn how to start up, operate, and troubleshoot industrial pumps in different configurations. Maintenance is an essential part of the manufacturing process and requires specific skills. The Lab-Volt Pumps Training System familiarizes students with maintenance tasks, such as pump installation, lubrication, shaft alignment, inspection, and component replacement.

Topic Coverage

• Industrial Pumps
• Installation
• Performance
• Inspection
• Troubleshooting
• Maintenance
Lab-Volt offers the most comprehensive and flexible Hydraulics course available. Using the Hydraulics Training Systems, students gain a solid foundation in, and hands-on experience with, hydraulic components and circuits, the principles and concepts underlying hydraulic systems and applications, and methods of troubleshooting and testing hydraulic systems.

Each lesson builds upon previous lessons, making this an ideal job-training program.

**Topic Coverage**

- Pressure and Force
- Flow Rate and Velocity
- Work and Power
- Cylinders
- Circuits and Valves
- Troubleshooting

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The Lab-Volt Pneumatics Training System is an innovative, modular system that uses state-of-the-art hardware and courseware to deliver comprehensive training in the principles of pneumatic energy and its control applications. The Pneumatics Training System uses the same workbench and many electrical components of the Hydraulics Training System, Model 6080, providing a convenient interconnection between both systems.

**Topic Coverage**

- Basic Physical Concepts
- Basic Controls
- Electrical Concepts
- Functional Systems
- Industrial Applications
- Troubleshooting
PLC Applications

Lab-Volt’s Programmable Logic Controllers (PLCs) represent state-of-the-art microprocessor-based electronics that make up technologically advanced control systems with applications in virtually every segment of industry where automation is required.

**Traffic Light System, Model 8075-1**

- A well-known classic training system
- N-S/E-W traffic control with pedestrian crossing
- Another unit can be added to create a full, four-directions traffic light
- Flow management with proximity detectors (optional)
- Traffic light synchronization
- Fault insertion
- LEDs (long life)
- Ten 24 VDC control inputs
- Includes job sheets

**Electro-Pneumatic System, Model 8075-2**

- Two double-acting cylinders
- Two reed switches and one mechanical limit switch for PLC feedback
- Perforated work surface
- Control valve station featuring single- and double-solenoid valves (Accepts three 24 VDC control signals from PLC)
- Applications: Stamping, hold and punch, filling process, etc.
- Fault insertion
- Includes job sheets
PLC Applications

Electro-Mechanical System (DC Motor), Model 8075-3

- Explores drives and lead screw positioning systems used in motion processes
- Industrial 1800 RPM, 90 VDC motor
- Two magnetic limit switches for PLC feedback
- Bi-directional, regenerative DC drive
- Perforated base to accommodate optional sensors
- Fault insertion
- Optional 100 ppr Optical Encoder
- Accepts three 24 VDC control signals from PLC
- Includes job sheets

Electro-Mechanical System (Stepper Motor), Model 8075-4

- High-torque Stepper motor
- Stepper motor drive programmed by computer using manufacturer software
- Programmable Stepper motor drive
- Motion sequences triggered by the PLC I/Os
- Lead screw mechanism
- Two magnetic limit switches for PLC feedback
- DC power supply
- Perforated base to accommodate optional sensors
- Fault insertion
- Optional 100 PPR Optical Encoder
- Accepts eight 24 VDC control signals from PLC
- Includes job sheets
PLC Applications

Level Process Control System, Model 8075-6
- Submersible variable speed pump
- Level process column
- Electronic level process Interface
- Float switch
- Capacitive level switch
- Magnetic level switch
- Solenoid valve
- Manual valve
- Optional analog level sensor
- Self-regulating process allows a variety of PLC control schemes
- Explore batch and PID control (dependent on PLC specifications)
- Includes job sheets

Shown with optional equipment

Bottling Process System, Model 8075-7
- Film canister capping process
- Compact application combines pneumatics, motion control, and PLC sequencing
- Two high-torque Stepper motors
- Dual Stepper motor drive
- Inductive proximity switch
- Mechanical switch
- Single solenoid directional valve
- Double-acting cylinder
- DC power supply
- Perforated work surface
- Dual Stepper motor drive can be used as a Step/Dir or Jog/Dir drive
- Optional accessories allow containers to be filled with liquid during process
- Includes job sheets

Shown with optional equipment
PLC Applications

Flexible Manufacturing System, Model 5901-3/-4

The Lab-Volt Flexible Manufacturing System (FMS) consists of two subsystems: Models 5901-3 and 5901-4. The Flexible Manufacturing System, Model 5901-3, allows students to familiarize themselves with manufacturing applications commonly encountered in modern facilities. The modular construction of the FMS permits a wide variety of set-ups allowing students to reproduce the operation of an industrial production line. The Flexible Manufacturing System (Advanced Applications), Model 5901-4, is an add-on to the Model 5901-3 and provides the latest manufacturing technology equipment to create more sophisticated applications.

PLCs, Series 3240

The Lab-Volt Programmable Logic Controllers in the Series 3240 enable trainees to develop competence in operating, programming, and troubleshooting modern PLC-controlled systems. Once the training program is completed, trainees should be able to use their freshly acquired knowledge of PLC programming to achieve PLC control of various industrial applications.
Instrumentation & Process Controls

Process Control, Model 6090

The Lab-Volt Process Control Training System familiarizes students with the fundamentals of instrumentation and process control. It demonstrates the control of pressure, flow, level, temperature, and pH processes. This training system can also demonstrate advanced process control techniques, such as feed-forward control, second-order control, and cascade control when used with a controller featuring these functions.

Topic Coverage
- Introduction to Process Control
- Process Dynamics
- Proportional Plus Integral Control Mode
- Proportional Plus Derivative Control Mode
- The PID Controller
- Pressure Processes
- Flow Processes
- Level Processes
- PID Process Control

Instrumentation and Process Control, Model 3531

The Lab-Volt Instrumentation and Process Control Training System introduces students to a wide range of industrial processes (temperature, pressure, flow, and level) as well as their instruments and control. This training system features two workstations: the Process Workstation and the Instrumentation Workstation.

The use of modern equipment coupled with a complete training program helps students to get the theoretical and practical knowledge that is mandatory to work in the process control industry.

Topic Coverage
- Temperature
- Pressure, Flow, and Level
- Air – Pressure and Flow
- Optional manuals on a wide range of additional topics are also available
Custom Solutions

Turnkey Solutions and Support

No matter where you are located worldwide, Lab-Volt will collaborate with you to determine the best equipment and training programs suitable for your needs, your budget, and your available space. Lab-Volt will then design the lab, install and test the equipment, and train your local instructors.

Training, Testing, Tracking, and Troubleshooting

Ultimately, the Return on Investment for any training in the Mechatronics industry comes when technicians are able to apply the skills they have learned to reduce downtime and keep operations running smoothly.

Lab-Volt’s blended learning model helps trainees progress from a basic understanding of fundamental principles all the way through advanced troubleshooting. Drawing on Lab-Volt’s extensive library of printed and digital curriculum and wide variety of hands-on, faultable training simulators, technicians will be well-prepared for the next, most crucial step – machine-specific troubleshooting!

Customization and Content

Ask us about our customized industry and machine-specific learning solutions that help your technicians put this valuable content into real-world context.

Lab-Volt’s capabilities include virtual video tours, actual component and system photographs, animated schematics, training and troubleshooting videos, 3-D modeling, industry-specific safety tips, and turn-key mobile training labs.

Visit our website at www.labvolt.com to find your local Lab-Volt Dealer.