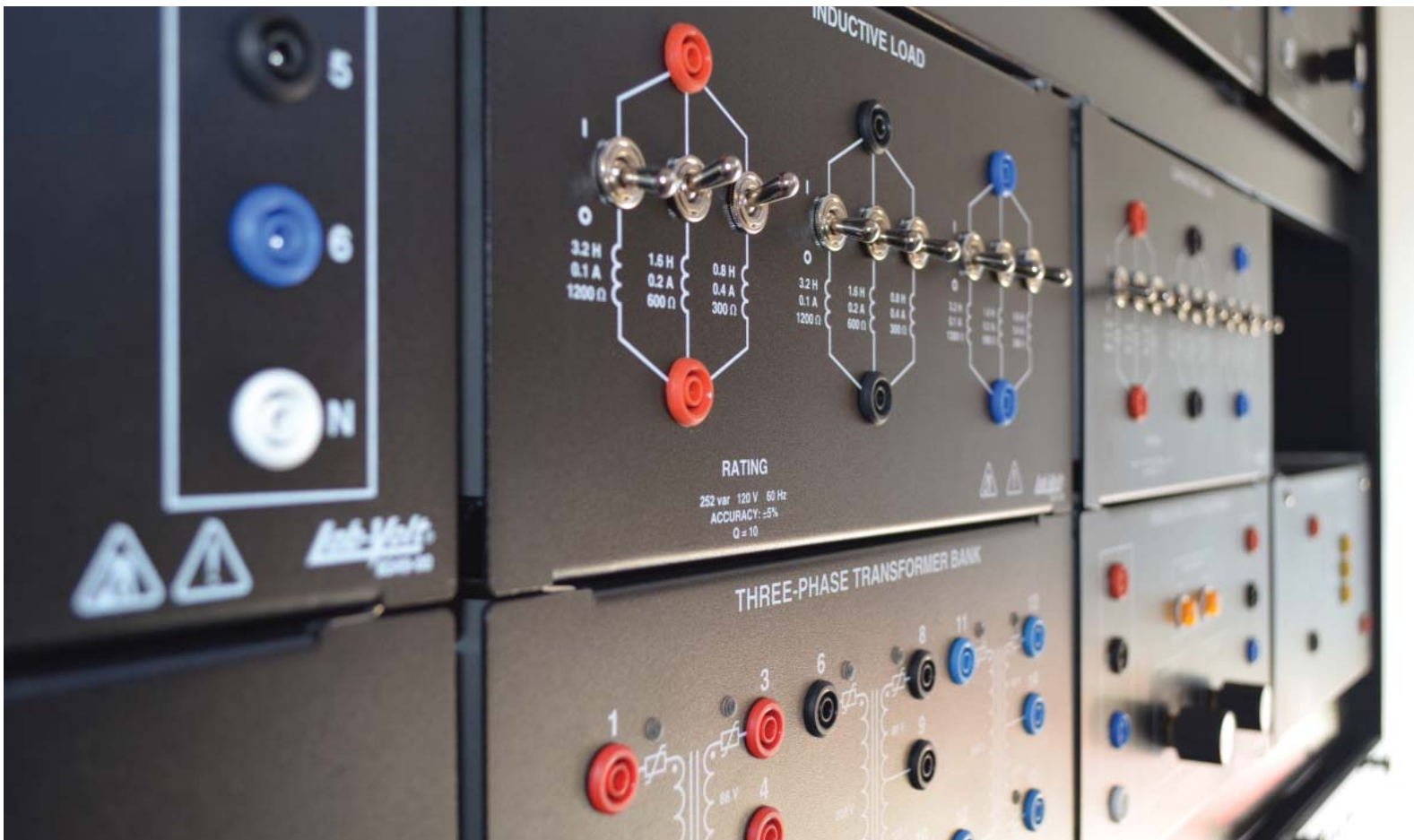


Festo Didactic: LabVolt Series Training Systems

A whole new range of possibilities



Sharing Your Commitment to Technical Education



Denkendorf (Germany)



Eatontown, New Jersey (USA)



Québec (Canada)

Festo Didactic Quick Facts

- Founded in 1965
- More than 900 employees
- Headquarters in Denkendorf (Germany) with two other core locations: Eatontown, New Jersey (USA) and Québec (Canada)
- Acquisition of Lab-Volt Systems in June 2014 and integration of the “LabVolt Series” products
- Part of the Festo Group, with over 60 companies and 250 branch offices worldwide
- Solutions provided in 40 languages to over 42,000 clients around the world

Origins of the LabVolt Series by Festo Didactic

For the last 50 years, Festo Didactic has been recognized worldwide for the development of high-quality, intuitive learning systems for technical education.

Festo Didactic further strengthened its leadership position as a world-wide supplier of technical education solutions through the acquisition of the US-Canadian manufacturer, Lab-Volt Systems, in June 2014. Lab-Volt’s portfolio of products is now part of the global offering of Festo Didactic and is referred to as the “LabVolt Series.”

Select among the largest product offering in the industry

This merger gives technical instructors from around the world access to the widest range of technical training products and services under one roof. Our expanded team of specialists can help you select the right combination of training equipment, curriculum, software, and E-Learning tools to improve the efficiency and success of your programs.

Our equipment integrates industrial and commercial components to provide for a realistic experience. Systems are modular, allowing for expansion and flexibility, making your investment future-proof with no dead-ends. Training options are also available.

Get expert support to improve technical training outcomes

Tens of thousands of organizations throughout the world trust Festo Didactic to support their technical training efforts in a wide variety of contexts: high schools, colleges, vocational schools, universities, military, unions, industrial companies, etc.

Our team will help you adapt your training programs to market needs, tailored to your requirements and objectives. Whether you need more information or simply advice, we are just a phone call or an email away!

Technical Topics Covered

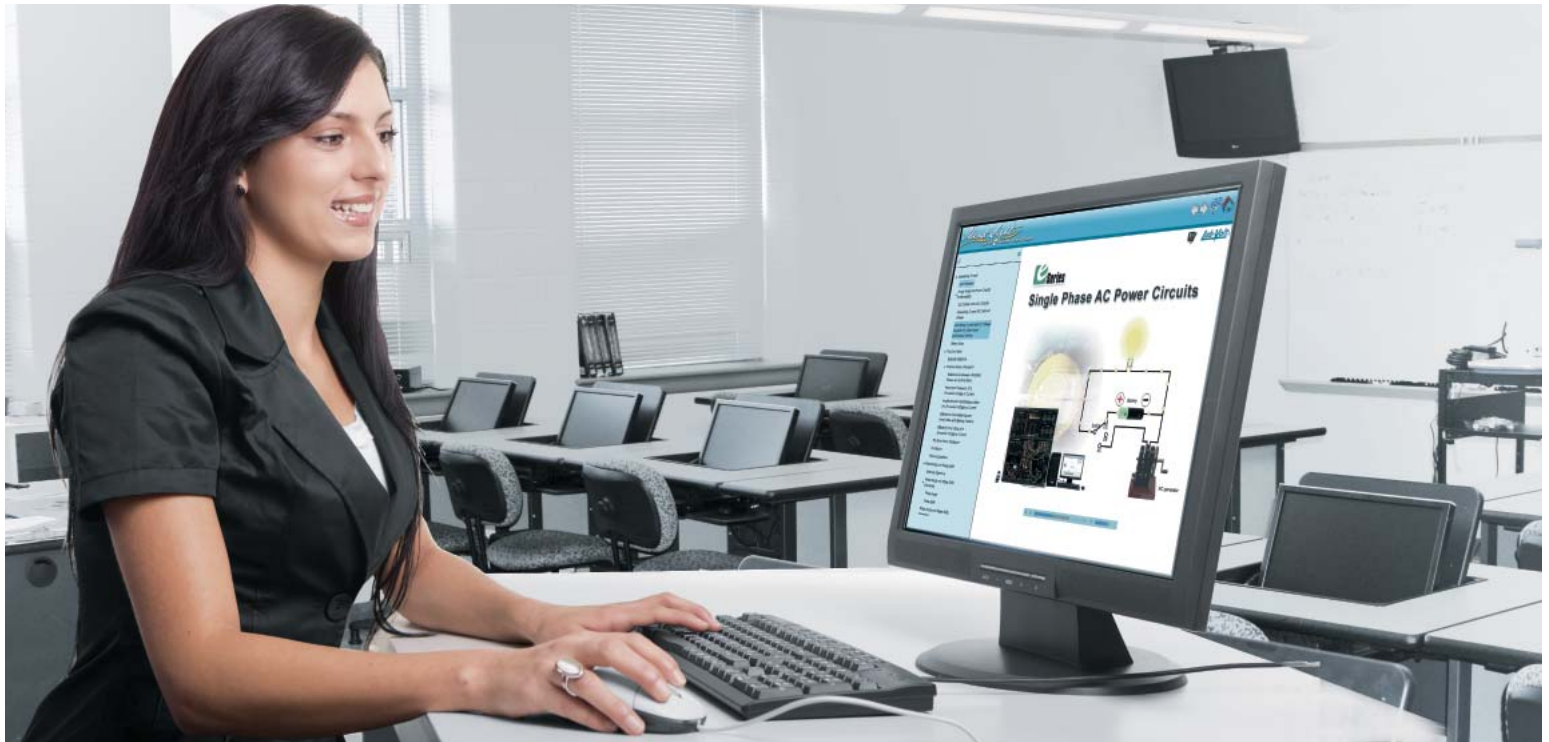


- You can find all details on the website dedicated to the LabVolt Series products: www.labvolt.com. Other products from Festo Didactic can be found at www.festo-didactic.com.
- As a result of continuous development and research work, technical specifications, textual information, pictures, and illustrations are subject to change. They are not binding. The specified data serves purely as a product description and is no guarantee in a legal sense. Please contact our sales department before placing an order.
- Part numbers shown are for reference only as they might be incomplete, depending on the country voltage. Before ordering, please refer to the complete product ordering information on our website.

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MindSight™ Learning Content Management System

Turn training into a stimulating E-Learning program



An E-Learning platform designed for technical education

MindSight – a SCORM-compliant learning content management system (LCMS) – integrates the necessary tools to focus on what's important: efficiently building and delivering engaging lessons, while monitoring student progress to ensure success.

A complete system

MindSight LCMS is a seamless integration of course delivery and classroom management.

MindSight allows instructors to manage enrollment, schedule learning activities, communicate with users, customize courseware, and track and report individual achievement as students work through the modules.

E-Learning for electronics

All components of MindSight's desktop client interact directly with the FACET Base Unit to enable and disable circuit modifications and circuit faults, enhancing the learning experience. No other LCMS or LMS can do this.

Main features

- Carefully selected tools that optimize the learning environment
- Extensive science and technology E-Learning course library (eSeries)
- SCORM 1.2 compliance
- Adapted to high school, vocational, college, or university students
- Customizable and scalable to suit evolving needs
- Complementary training lab equipment and programs for hands-on learning

MindSight LCMS Package – Single appliance
(LV Series 47513)

#583625

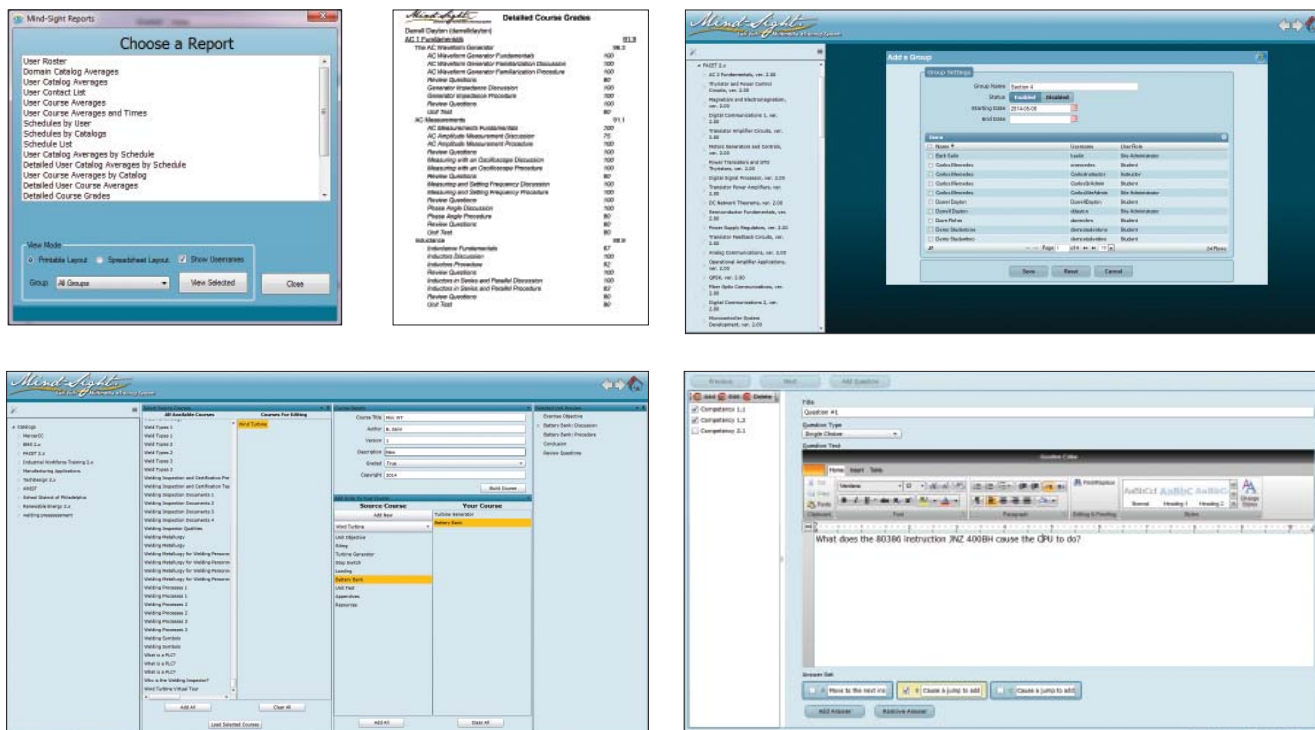
MindSight LCMS Package – Hosted
(LV Series 47513-1)

#583640

Contact your sales representative to get a quote tailored to your needs.

See also:

- eSeries E-Learning courses
- Industrial Training Zone
- FACET Electronics Training System



Multimedia courses

To quickly add content to MindSight, instructors can choose from a collection of E-Learning courses, called eSeries. eSeries courses are optimized when bundled and integrated directly into MindSight, because they benefit from its unique features. Each eSeries course is to be purchased separately.

High level of customization

MindSight does more than just run content; it allows for content annotation, reorganization, and manipulation as well. You can deliver pre-packaged eSeries lessons to your students, or customize curriculum by combining some or all of the content of two or more courses. The Test Editor also allows instructors to create custom exercises, quizzes, and tests.

Import of external content

MindSight will convert image files, video files, slideshows, PDFs, documents, spreadsheets, and Flash files into SCOs. This personalization of content allows specific information for industry and educational programs to be effortlessly included in the curriculum.

Purchasing options

Web-Based Hosted Version

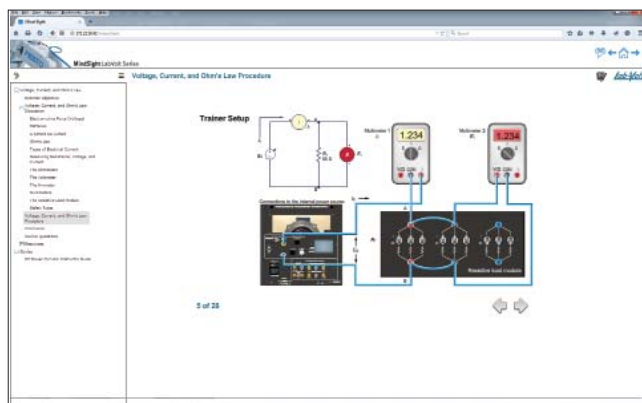
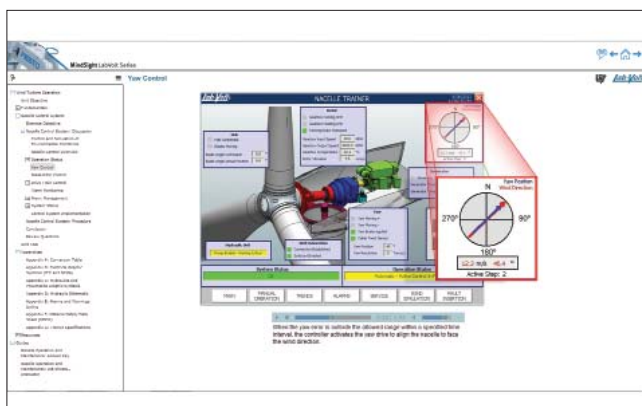
- Users can access MindSight 24/7 from any computer connected to the Internet.
- If necessary, more users can have access by purchasing additional seats.
- No need to worry about computer compatibility or IT maintenance issues.
- Annual subscription fees include automatic system and course updates, as well as unlimited data storage on our secure servers.

Network (LAN) appliance

- Traditional, server-based delivery allowing up to 30 concurrent users.
- The device is linked via IP address to the different computer workstations in the lab.
- No Internet connection is needed (except for initial setup and courses download).
- Optional extended warranty to protect the hardware and receive updates.

eSeries Courses

An extensive library of technical E-Learning courses



A computer-based approach

The book-based courseware for many LabVolt Series training systems is also available in E-Learning format. Each course is intended to be used with its corresponding training system. Student manuals and instructor guides are incorporated into menu trees and are accessible based on user rights. In most courses, the presentation of technical content is accompanied by voice-over narration to minimize the amount of on-screen reading.

Extensive coverage

The eSeries library of multimedia courses takes advantage of technology to accommodate different types of learners and bring flexibility to the learning process. Courses mainly cover Electricity and Electronics, Manufacturing, Telecommunications, Industrial Technology, and Renewable Energy. Interactive content presents theory, exercises and/or procedural job sheets, videos, tests and quizzes, etc., with enhanced graphics and/or animations to improve comprehension.

Several delivery formats

eSeries courses are implemented through the MindSight Learning Content Management System (LCMS) which allows learners to work in an optimized learning environment. Instructors can also customize content and assess the progression of each student. Courses also come as SCORM-compliant files designed to be hosted by a third-party, SCORM 1.2 compliant management system.

eSeries courses are also available in stand-alone files on CD-ROM, running on a web browser without requiring any management system.

Courses currently available

- Grid-Tie Training System
- Nacelle Operation and Maintenance
- Solar Thermal Energy Training System
- Grid-Tied Systems for Simulator
- Solar/Wind Energy Training System
- Grid-Tied Systems with Simulator
- Mechanical Training System
- Pumps Training System
- Piping Fundamentals
- Industrial Wiring Training System
- Preparatory Electricity & Electronics Training System
- Industrial Controls Training System
- Industrial Controls Training System and Simulation Software
- Electromechanical Training System
- DC and AC Power Circuits Training System
- Radar Training System
- Programmable Logic Controller Basic Programming
- Refrigeration Training System
- Advanced Hydraulics
- Hydraulics Fundamentals
- Advanced Pneumatics
- Pneumatics Fundamentals
- Temperature Processes
- Pressure, Flow, and Level Processes

Complete eSeries Library (LV Series 47945-E)

#585644

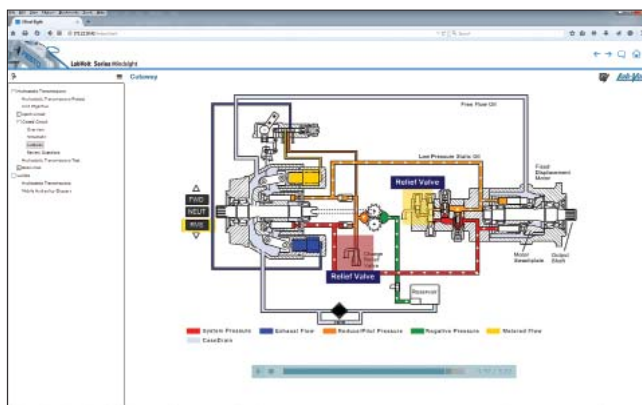
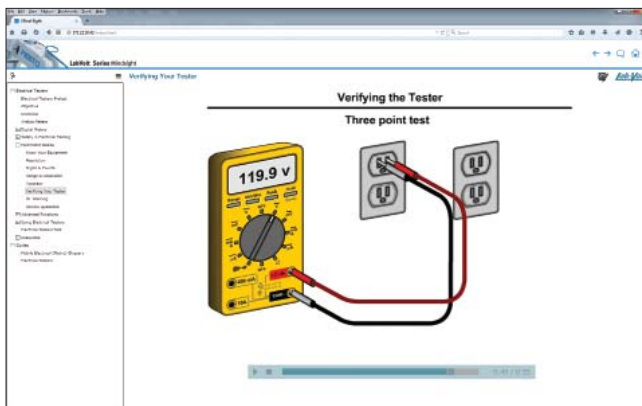
See www.labvolt.com for specific eSeries course part numbers.

See also:

- MindSight LCMS
- FACET Electronics Training System
- Industrial Training Zone

Industrial Training Zone eSeries Courses

Online, E-Learning content for workforce development



E-Learning for industry: self-paced, modular, web-based

The Industrial Training Zone (ITZ) eSeries Courses deliver a broad range of fundamental and specialty industrial training courses designed to help build a competent, qualified, and efficient workforce.

The ITZ eSeries Courses provide a powerful training tool that can be used directly where training is required, e.g., in the classroom, at the plant, or in the office. It offers all the important content in the appropriate context, comprehensive assessments, and the latest tools to evaluate performance.

With seamless integration into MindSight, the ITZ eSeries Courses provide a multitude of ways to fulfill industrial training needs.

Main features

- Broad range of fundamental and specialty industrial training courses
- Used by top-tier manufacturing, industrial, and technical associations
- Comprehensive assessments
- eSeries courses format for a seamless integration within the MindSight learning and content management system (LCMS)
- Multimedia content promotes learning retention and use on the job
- Courses are also available for third-party LCMS or in stand-alone mode (on a CD-ROM)

Topic coverage

- Electricity
- Mechanics
- Fluid Power
- Manufacturing
- Programmable Logic Controllers
- Welding
- Safety
- Engines

Courses currently available

- Industrial Hydraulics
- Industrial Pneumatics
- Industrial Electrical
- Industrial Mechanical
- Electrical Theory
- Mobile Hydraulics
- Mobile Electrical
- AC/DC Motors and Drives
- Pneumatic Specialist
- PLC Fundamentals
- Weld Academy
- Industrial Safety
- Diesel Engines
- Marine Diesel Engines
- Gas Turbine Engines
- Advanced Hydraulics
- Brushless DC Motors

Complete ITZ eSeries Library (LV Series 47940-E)

#585640

See www.labvolt.com for specific course ordering numbers.

See also:

- MindSight LCMS
- eSeries courses

FACET Electronics Training System

Fault-Assisted Circuit Electronics Training

CE



Complete, modular training

The FACET Electronics Training System is based on a program consisting of courses carefully designed to foster recognition, understanding, experimentation, troubleshooting, application, design, and evaluation of analog and digital electronics circuitry.

The complete learning solution encompasses four areas of study:

- Basic Principles of Electricity and Electronics
- Digital and Micro-processor Electronics
- Industrial Electronics
- Communications Systems

Hands-on learning

FACET incorporates built-in circuit modification and fault-insertion training capabilities. Students perform experiments on a wide range of analog and digital electronics and electricity training modules that combine theory and application with practical skills training techniques. Each module connects with a base unit that distributes power and controls the circuits on the board. A complete training station consists of training hardware (any one of the modules, plus a base unit and accessory kit), instruments, and student manual or MindSight Learning Content Management System with the eSeries courseware.

Several delivery modes

FACET is delivered in a standard, paper-based curriculum. It is also offered as an E-Learning courseware through the LCMS MindSight.

When combined with the LCMS MindSight® and eSeries courses, FACET becomes a totally connected learning system for electronics, with all the computer-based learning advantages.

FACET is suitable for a multitude of training purposes in educational, industrial, and military training laboratories.

Total program duration is approximately 400 hours.

Main features

- Durable construction where components are capable of thousands of cycles of operation
- All circuits and components capable of withstanding any combination of voltage or connections from the base unit
- Voltage regulation and protection against over-voltage and short circuit conditions
- Gold-plated zero insertion force (ZIF) connector technology
- Silk-screened circuit and component identification
- Minimal wiring required; saves lab time
- Variety of industrial-grade components provide broad, hands-on, real-world training experience

Manual Base Unit (LV Series 91000-3)

#580866

Computer Interface Base Unit (LV Series 91000-5)

#580867

See www.labvolt.com for all other ordering numbers (circuit boards, accessories, etc.)

FACET Boards



Modules currently available

- DC Fundamentals
- DC Network Theorems
- AC 1 Fundamentals
- AC 2 Fundamentals
- Semiconductor Devices
- Transistor Amplifier Circuits
- Transistor Power Amplifiers
- Transistor Feedback Circuits
- Power Supply Regulation Circuits
- FET Fundamentals
- Thyristors and Power Control Circuits
- Operational Amplifier Fundamentals
- Operational Amplifier Applications
- Digital Logic Fundamentals
- Digital Circuit Fundamentals 1
- Digital Circuit Fundamentals 2
- 32-Bit Microprocessor
- Analog Communications
- Transducer Fundamentals
- Magnetism and Electromagnetism
- Generator Buffer
- Digital Communications 1
- Digital Communications 2
- Motors, Generators, and Controls
- Fiber Optic Communications
- Power Transistors and GTO Thyristors
- Communications Transmission Lines
- QPSK/DQPSK/DPSK
- Microcontroller System Development
- Digital Signal Processor
- Breadboard
- Microprocessor Application Board

Digital Multimeter/ Function Generator



Compact, general-purpose instrumentation module that provides the necessary test equipment (except the oscilloscope) to perform the courses in the FACET program. The module consists of a sine/square/triangle waveform function generator and an auto-ranging digital multimeter. All instruments share a common power input and are housed in a portable enclosure.

Dual-Trace Digital Storage Oscilloscope



The Dual-Trace Digital Storage Oscilloscope is a cost-effective oscilloscope that is ideally suited for general purpose use in any classroom laboratory. Two low-capacitance probes are included with the unit.

Virtual Instrument Package (USB Version)



Replaces standard desktop test equipment (Digital Multimeter / Function Generator, LV Series 1247-1, and oscilloscope) with a powerful, space-saving, virtual instrumentation package that gives students state-of-the-art tools to measure, analyze, observe, and report the results of electronic circuit tests. It encompasses a multimeter, a spectrum analyzer, an arbitrary waveform generator (AWG), and an oscilloscope.

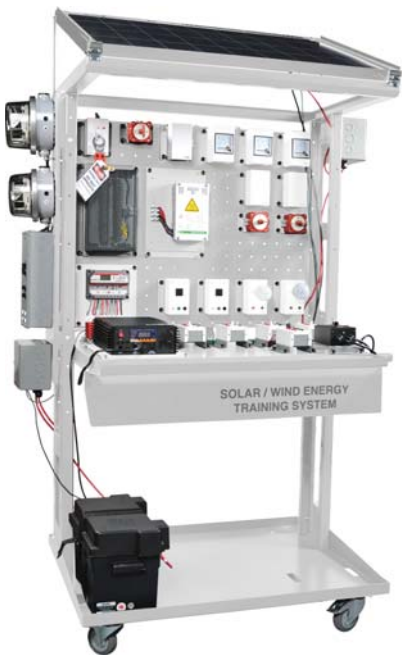
Digital Multimeter/Function Generator (LV Series 1247-1)	#580851
Virtual Instrument Package – USB version (LV Series 1250-1)	#580856
Dual-Trace Digital Storage Oscilloscope (LV Series 798-1)	#585695

Solar/Wind Energy Training System



The Solar/Wind Energy Training System forms a complete hybrid energy training system. This modular program covers the history, fundamentals, installation, operation, maintenance, and servicing of alternative energy systems. It fits the needs of high school and college students.

The Solar/Wind Energy Training System includes everything required to function as a stand-alone, hands-on learning workstation: Instructor Guide, Student Guide, training modules with fault insertion, and power-generating equipment. The trainer is made with real-world components that are used in industry; the same components that students will see in their own homes, schools, or workplaces.



Topic coverage

- Energy Fundamentals
- Trainer Familiarization and Safety
- Solar Module
- Wind Turbine
- Solar/Wind Systems
- Going Green

Main features

- Made with high-quality components currently used in residential, commercial, and industrial applications
- Easy and safe to use, durable, and manufactured to the highest quality standards
- CSA/UL certified version available

eSeries Solar/Wind Energy Training System (LV Series 46549-E0)	#583452
eSeries Grid-Tie Systems with Simulator (LV Series 46549-J)	#583455
eSeries Grid-Tie Systems for Simulator (LV Series 46549-1) (Requires Model 46120-A. Intended to be used with Model 46120)	#583456
Solar/Wind Energy Training System (LV Series 46120)	#580181
Solar/Wind Energy Training System – UL/CSA Certified (LV Series 46120-H)	#580195
Solar Energy Training System (LV Series 46120-F)	#580189
Wind Energy Training System (LV Series 46120-G)	#580192
Several add-ons are available at www.labvolt.com .	

Solar Thermal Energy Training System



The Solar Thermal Training System forms a complete hybrid energy training system that demonstrates how solar radiant energy can be harnessed from the sun and converted to solar thermal energy in order to elevate air, water, and surface temperatures within a residential home or commercial business. Students learn how to install the system components, operate the system, and measure different parameters, such as pressure, temperature, and flow rate. The training system enables students to set up various realistic heating systems, such as radiant floor heaters, passive and active solar water heaters, space heaters, and hot water heat exchangers. This realistic system provides a safe, small-scale hot water supply, radiator, and hydronic floor heating system. It can be configured to exchange and store thermal energy. The trainer permits experimenting with open- and

closed-loop heating systems. The main (primary) loop can collect thermal energy and a secondary loop can distribute and apply heat to a gas, liquid, or solid in order to dissipate the thermal energy

Topic coverage

- Introduction to Solar Thermal Energy
- Solar Thermal Energy Systems
- Multi-Loop Systems

Main features

- High-quality components currently used in residential, commercial, and industrial applications
- Includes power supply, differential controller, thermostat controller, and connection block
- Easy to use, durable, and manufactured to the highest quality standards

eSeries Solar Thermal Energy Training System (LV Series 46548)

#579818

Solar Thermal Energy Training System (LV Series 46121)

#8046646

Grid-Tie Training System*



The Grid-Tie Training System is a safe, complete hands-on training tool designed to train students for careers as photovoltaic (PV) solar installers.

The system, which uses high-quality UL-listed components, reproduces a residential environment where students can develop their skills in the installation and wiring of a grid tie system, in compliance with the National Electrical Code® (NEC).

The Grid-Tie Training System integrates industrial-grade components, such as an AC Distribution Panel, a Combiner Box, a Sunny Boy Grid-Tie Inverter, AC and DC Cut-Offs, and a String Inverter Simulator. The system provides topic coverage of a typical system configuration. The fully-illustrated curriculum is divided into two parts: components installation and wiring, and commissioning.

Topic coverage

- Trainer Familiarization and Wiring
- Safety Practices
- Lockout/Tagout Procedure
- Installing the Components
- Commissioning the Trainer

Main features

- Includes everything required to operate as a stand-alone, hands-on training workstation
- Wide range of industrial-grade components
- Easy to use, durable, and manufactured to the highest quality standards
- Grid connected equipment
- Utility-interactive software
- Compliant with the NEC

***Only available in North America**

eSeries Grid-Tie Training System (LV Series 46546-E)

#583450

Grid-Tie Training System (LV Series 46125)

#583754

Wind Turbine Nacelle Training System



The Wind Turbine Nacelle Training System is a complete scaled-down version of a commercial wind turbine nacelle, making it a highly cost-effective training solution. This comprehensive demonstrator is an excellent substitute for expensive, real equipment.

Many features make this system unique. Users can fully interact with the machine, thus enhancing the learning experience. The course covers fundamentals of wind energy, and the nacelle offers training for real-world operation and maintenance situations, preparing students with the skills and training for jobs as wind turbine technicians. The system can also be offered with Grid-Tied Connection. The trainer consists of a complete drive train including the main shaft, a gearbox with a transparent side cover, speed sensors, a hydraulic brake, and an asynchronous generator.

The yaw system is fully operational. A manual hydraulic pump and an accumulator, as found in real-world wind turbines, are also included. A Siemens PLC controls the different functions of the Nacelle and is located in a transparent electrical enclosure for easy observation, with all the other electrical components.

Topic coverage

- Nacelle Familiarization, Safety, and Control System
- User Interface and Wind Simulation
- Hub and Low-Speed Shaft
- Gearbox, Coupling, and Alignment
- Basic Hydraulic Circuit
- Hydraulic Brakes
- Electrical Circuit and Panel
- Troubleshooting



Main features

- Comprehensive demonstrator shows how a wind turbine nacelle, electrical hub, and hydraulic hub operate
- Teaches maintenance, performance, design, and troubleshooting, all in one unit
- All behaviors of a nacelle have been programmed into the unit
- Faultable through the HMI (Human Machine Interface) and the fault panel
- Industrial computer with touch-screen interface, using a software programmable logic controller and remote inputs and outputs, which control the whole system
- Electrical panel with frequency drives, breakers, and power supplies
- Weather sensors to monitor wind speed and direction
- Full industry-standard electrical and hydraulic schematics are provided

Pitch hubs expand learning

To expand study, an optional Electric Pitch Hub or Hydraulic Pitch Hub (shown above) can be connected to the Nacelle for conjoined operation. They both feature a representation of the blade and all the components typically found in the hub.

Each hub training system addresses blade pitch control and emergency back-up systems using the appropriate technologies typical to their respective electrical or hydraulic pitch control systems. A Siemens PLC controls the different functions of the hubs and is located in a transparent electrical enclosure, with all the other electrical components.

Wind Turbine Nacelle Training System (LV Series 46122-1)	#8046642
Electric Pitch Hub (LV Series 46123)	#588248
Hydraulic Pitch Hub (LV Series 46124)	#588252

eSeries Nacelle Operation and Maintenance (LV Series 46547-E)	#583451
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Geothermal Training System



The Geothermal Training System maximizes learning capabilities by regrouping every subsystem that is found in a real geothermal home energy installation. It efficiently teaches the fundamentals of heat transfer, refrigeration, and air conditioning applied to geothermal energy HVAC projects. It is suitable for varied educational requirements: future system designers and builders, maintenance technicians, or students learning energy efficiency. Transparent panels allow observation of the interior of the system.

Topic coverage

- Geothermal Energy
- The Ground Loop
- Heat Pump Connections and Interior Piping

- Heat Pump Control and Safety
- The Refrigeration Cycle
- Psychrometrics
- Geothermal Heat Pumps
- Heat Exchangers
- Heat Pump Control and Safety Devices
- System Characterization
- Maintenance and Troubleshooting
- Geothermal Software Design Tools

Main features

- Ability to add a ground temperature control option
- Contains a set of measuring instruments
- All components are real-world commercial components
- Several test points
- Varying length ground loops
- Electrical faults for troubleshooting

Geothermal Training System (LV Series 46126)

#582383

Geothermal Training System with ground temperature control (LV Series 46126-A)

#582385

Electric Power Technology Training Systems

Based on an unrivaled training program



Flexible, complete training

The Electric Power Technology Training Program answers the increasingly diversified needs for training in the wide field of electrical energy. The program is a combination of hardware, software, and curriculum content aimed at maximizing learning and experimentation.

This highly customizable, modular program covers several different subjects in the field of electrical energy, such as rotating machines, electrical power transmission, power electronics, home energy production from renewable resources (wind and sunlight), large-scale electricity production from hydropower and wind power, smart-grid technologies (SVC, STATCOM, HVDC transmission, etc.), storage of electrical energy in batteries, and drive systems for small electric vehicles and cars.



Modular design approach

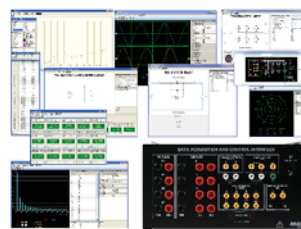
The program is highly flexible and allows a multitude of different customized training solutions. Modular hardware equipment and curriculum can be easily expanded to teach other subjects within the program. Instructors build their electrical-energy laboratory with a basic package of courses and equipment. New courses and equipment can then be added over time without needless duplication.



Sturdy and safe

All workstations, modules, and components are very sturdy, ensuring a prolonged service life in the demanding training laboratory environment.

The systems are designed to ensure user safety. Safety jacks are used for connections to electric power circuits. Inputs and outputs are protected against improper connections and overvoltage/overcurrent conditions.



Computer-based tools

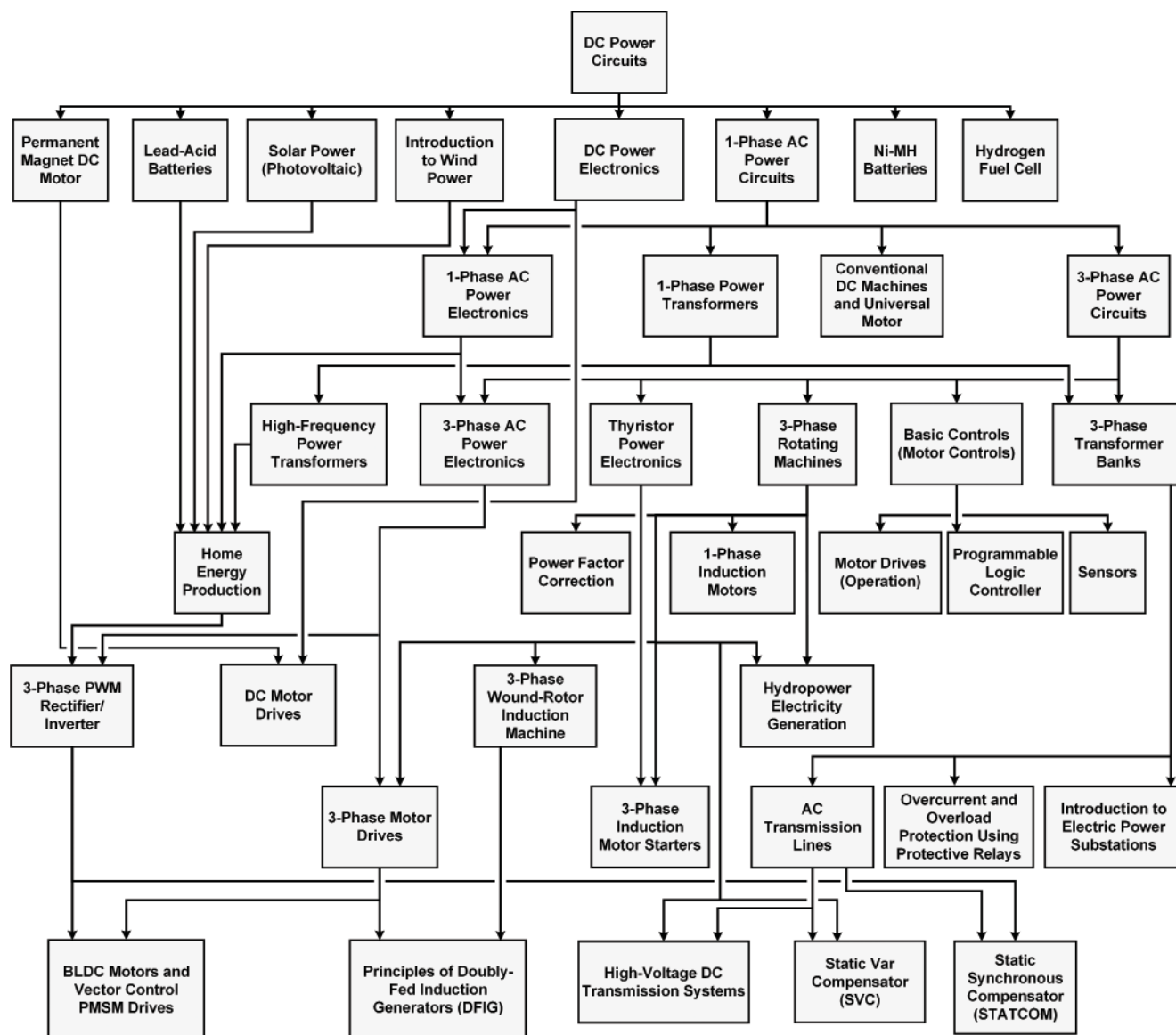
Computerized measuring instruments and control functions are available with selected hardware modules and software. Students can measure, observe, analyze, and control electrical and mechanical parameters more easily. These flexible, user-friendly tools allow for better understanding, monitoring, and control in comparison to conventional tools. They also lower the cost of acquisition and replacement of accessories.

Extensive program

The program allows instructors to select among the courses to build a training solution that matches specific needs. The courseware packaged with each course includes student manuals and instructor guides with all the theory required to perform the hands-on experiments.

The program starts with a variety of courses providing in-depth topic coverage of the fundamentals related to the field of electrical energy. It then builds on the knowledge gained by the student through these basic courses to provide training in more advanced subjects.

Electric Power Technology Programs



Pre-set training systems

The system and the program are totally customizable to specific needs. However, pre-set learning packages are readily available.

Each package includes necessary equipment, some of the courses shown above, and often the possibility to expand. These turnkey, pre-set packages are customizable and can be expanded to answer evolving needs.

- DC and AC Power Circuits
- Solar Power
- Small-Scale Wind Power
- Lead-Acid Battery
- Basic Renewable Energy
- DC Power Electronics
- Home Energy Production

- Hydrogen Fuel Cell
- Electromechanical Systems
- Power Electronics
- AC Power Transmission
- Smart Grid Technologies
- DFIG Principles
- Power Transmission

Electric Power Technology Pre-Set Training Programs

DC and AC Power Circuits Training System



The DC and AC Power Circuits Training System combines a modular design approach with computer-based data acquisition and control to introduce students to the fundamentals of electricity, such as direct current (DC), alternating current (AC), voltage, resistance, and Ohm's Law. The training system is designed to operate at a low voltage to ensure the safety of students beginning their training in electric power technology.

Topic coverage

- DC Power Circuits
- Single-Phase AC Power Circuits

Main equipment

- Workstation
- Resistive Load
- Inductive Load
- Capacitive Load
- Four-Quadrant Dynamometer/Power Supply
- Data Acquisition and Control Interface

eSeries DC and AC Power Circuits Training System (LV Series 21001-E) #579791

LabVolt Series 8010-1 #579281

Solar Power Training System



The Solar Power Training System introduces students to the production of electrical energy from solar power, with emphasis on the use and operation of photovoltaic panels, as well as storage of electrical energy in batteries. The system consists of a solar panel test bench and a monocrystalline silicon solar panel. Students can conduct indoor or outdoor experiments on solar panel operation and performance.

Topic coverage

- DC Power Circuits
- Solar Power (Photovoltaic)

Main equipment

- Workstation
- Resistive Load
- Lead-Acid Batteries
- Solar Panel Test Bench
- Monocrystalline Silicon Solar Panel
- Four-Quadrant Dynamometer/Power Supply

LabVolt Series 8010-2 #579284

Small-Scale Wind Power Electricity Generation Power System



The Small-Scale Wind Power Electricity Generation Training System enables students to study the complete process of wind power electricity generation directly in the classroom. Wind speed and air density are simulated using a user-friendly and configurable wind emulator. The learning system also covers the storage of electrical energy in batteries to ensure that it is available when there is no wind or during low wind periods.

Topic coverage

- DC Power Circuits
- Lead-Acid Batteries
- Introduction to Wind Power

Main equipment

- Workstation
- Resistive Load
- Lead-Acid Batteries
- Lead-Acid Battery Pack
- Wind Turbine Generator/Controller
- Four-Quadrant Dynamometer/Power Supply

LabVolt Series 8010-3 #579287

Lead-Acid Batteries Training System



The Lead-Acid Batteries Training System teaches the principles of lead-acid battery operation during both charge and discharge. It introduces students to the operation of lead-acid batteries and covers voltage regulation, internal resistance, capacity, depth of discharge, and cycle life of lead-acid batteries. Hands-on experiments cover the discharge characteristics and the most popular charging methods of lead-acid batteries.

Topic coverage

- DC Power Circuits
- Lead-Acid Batteries

Main equipment

- Workstation
- Resistive Load
- Lead-Acid Batteries
- Four-Quadrant Dynamometer/Power Supply

LabVolt Series 8010-4 #579290

Electric Power Technology Pre-Set Training Programs

Basic Renewable Energy Training System



The Basic Renewable Energy Training System provides in-depth coverage of foundational renewable energy systems. It provides an introduction to DC power circuits, and covers in detail the principles behind the production of electrical energy from both solar power and wind power. The students are then introduced to the storage of electrical energy produced from renewable resources into lead-acid batteries for future consumption.

Topic coverage

- DC Power Circuits
- Lead-Acid Batteries
- Solar Power (Photovoltaic)
- Introduction to Wind Power

Main equipment

- Workstation
- Wind Turbine Generator/Controller
- Resistive Load
- Lead-Acid Batteries
- Lead-Acid Battery Pack
- Solar Panel Test Bench
- Monocrystalline Silicon Solar Panel
- Four-Quadrant Dynamometer/Power Supply

LabVolt Series 8010-5 #579294

DC Power Electronics Training System



The DC Power Electronics Training System provides a comprehensive study of the diode and switching transistor, two semiconductor components that are widely used in power electronics circuits. The training system also provides in-depth coverage of various types of choppers, a power electronics device used in many DC power circuits. The operation of these modules is controlled via the LVDAC-EMS software, which also provides the instrumentation required to measure and record the experimental data.

Topic coverage

- DC Power Circuits
- DC Power Electronics

Main equipment

- Workstation
- Resistive Load
- Filtering Inductors/Capacitors
- Lead-Acid Battery Pack
- IGBT Chopper/Inverter
- Four-Quadrant Dynamometer/Power Supply
- Data Acquisition and Control Interface

LabVolt Series 8010-6 #579298

Hydrogen Fuel Cell Training System



The Hydrogen Fuel Cell Training System realistically demonstrates the basic functions of a 50 W hydrogen fuel cell system and is ideal for teaching the basic engineering principles of fuel cell systems. The modular design of the system enables flexibility in setup complexity – from simple experiments for teaching basic principles to complex experiments for experienced students. The course covers the structure and functioning principles of thermodynamics theory, and characteristics of a real fuel cell system.

Topic coverage

- Basic Functions of the Fuel Cell System
- Characteristic Curve of a Fuel Cell
- Parameters Influencing the Characteristic Curve
- Determination of the Hydrogen Current Curve
- Efficiency of the Fuel Cell Stack
- Set-up of a Fuel Cell Power Supply
- Efficiency of a Fuel Cell Power Supply
- Application I: Remote Traffic Light
- Application II: Fuel Cell Car

LabVolt Series 8010-8 #579307

Main equipment

- Workstation
- Traffic Lights
- Electronic Load
- Hydrogen Fuel Cell

Electric Power Technology Pre-Set Training Programs

Home Energy Production Training System



The Home Energy Production Training System is a comprehensive and flexible program related to home energy production systems including all the prerequisites in renewable energies and power electronics.

Topic coverage

- DC Power Circuits
- Lead-Acid Batteries
- Solar Power (Photovoltaic)
- Introduction to Wind Power
- Single-Phase AC Power Circuits
- Single-Phase Power Transformers
- DC Power Electronics
- Single-Phase AC Power Electronics
- High-Frequency Power Transformers

Main equipment

- Workstation
- Wind Turbine Generator/Controller
- Resistive, Inductive, and Capacitive Loads
- Filtering Inductors/Capacitors
- Transformer
- AC Power Network Interface
- Lead-Acid Batteries
- Solar Panel
- Rectifiers and Filtering Capacitors
- Insulated DC-to-DC Converter
- IGBT Chopper/Inverter
- Four-Quadrant Dynamometer/Power Supply
- Data Acquisition and Control Interface

Electromechanical Training System



The Electromechanical Training System combines a modular design approach with computer-based data acquisition to provide unrivaled training in basic electric power technology. Training is oriented toward today's competency requirements.

Topic coverage

- DC Power Circuits
- Permanent Magnet DC Motor
- Single-Phase and Three-Phase AC Power Circuits
- Single-Phase Transformers
- Three-Phase Transformer Banks
- Three-Phase Rotating Machines
- Power Factor Correction

Main equipment

- Workstation
- Permanent Magnet DC Motor
- Four-Pole Squirrel-Cage Induction Motor
- Synchronous Motor/Generator
- Resistive, Inductive, and Capacitive Loads
- Three-Phase Transformer Bank
- Transformer
- Synchronizing Module/Three-Phase Contactor
- Lead-Acid Battery Pack
- Four-Quadrant Dynamometer/Power Supply
- Data Acquisition and Control Interface

Electric Power Technology Pre-Set Training Programs

Power Electronics Training System



The Power Electronics Training System is a comprehensive introduction to the most common power electronic components and devices used in numerous industrial applications today. It provides unrivaled training in power electronics to students already having a sound knowledge of basic electric power technology.

Topic coverage

- DC Power Electronics
- Single-Phase and Three-Phase AC Power Electronics
- Thyristor Power Electronics
- DC Motor Drives
- Three-Phase Motor Drives
- Three-Phase Induction Motor Starters

Main equipment

- Workstation
- Permanent Magnet DC Motor
- Four-Pole Squirrel-Cage Induction Motor
- Resistive and Capacitive Loads
- Filtering Inductors/Capacitors
- Three-Phase Filter
- Three-Phase Transformer Bank
- Synchronizing Module/Three-Phase Contactor
- Lead-Acid Battery pack
- IGBT Chopper/Inverter
- Rectifier and Filtering Capacitors
- Power Thyristors
- Four-Quadrant Dynamometer/Power Supply
- Data Acquisition and Control Interface

AC Power Transmission Training System



The AC Power Transmission Training System is a comprehensive introduction to the basic principles of AC power transmission lines. Computerized controls provide better understanding, monitoring, and control compared to conventional measuring instruments. Optional courses may be added to provide students with the basic knowledge of electric power technology required to study AC power transmission systems.

Topic coverage

- DC Power Circuits
- Single-Phase AC Power Circuits
- Single-Phase Power Transformers
- Three-Phase Power Transformers

Main equipment

- Workstation
- Resistive, Inductive, and Capacitive Loads
- Three-Phase Transmission Line
- Three-Phase Transformer Bank
- Three-Phase Regulating Autotransformer
- Data Acquisition and Control Interface

Electric Power Technology Pre-Set Training Programs

Smart Grid Technologies Training System



The Smart Grid Technologies Training System provides a turn-key solution dealing with smart grid technologies. Real-world, complex applications, normally found in large power stations, can now be recreated within this training platform. Computerized controls provide better monitoring and control compared to conventional measuring instruments.

Topic coverage

- Home Energy Production
- Static Var Compensator (SVC)
- Static Synchronous Compensator (STATCOM)
- High-Voltage DC Transmission Systems

Main equipment

- Workstation
- Resistive, Inductive, and Capacitive Loads
- Filtering Inductors/Capacitors
- Three-Phase Filter
- Line Inductors
- Three-Phase Transmission Line
- SVC Reactors/Thyristor-Switched Capacitors
- Three-Phase Transformer Bank
- Three-Phase Regulating Auto-transformer
- Transformer
- AC Power Network Interface
- IGBT Chopper/Inverter
- Power Thyristors
- Insulated DC-to-DC Converter
- Four-Quadrant Dynamometer/Power Supply
- Data Acquisition and Control Interface

DFIG Principles Training System



The Doubly-Fed Induction Generators (DFIG) Training System combines a unique, modular design approach with computer-based data acquisition and control to provide unrivaled training in the basic principles of the doubly-fed induction generator (DFIG) to students that already have a sound knowledge of three-phase AC power circuits, rotating machines, and motor drives.

Topic coverage

- Three-Phase Wound-Rotor Induction Machine
- Principles of Doubly-Fed Induction Generators (DFIG)

Main equipment

- Workstation
- Three-Phase Wound-Rotor Induction Machine
- Resistive Load
- Three-Phase Transformer Bank
- IGBT Chopper/Inverter
- Rectifier and Filtering Capacitors
- Four-Quadrant Dynamometer/Power Supply
- Data Acquisition and Control Interface

Electric Power Technology Pre-Set Training Programs

Power Transmission Smart Grid Technologies Training System



The Power Transmission Smart Grid Technologies Training System provides a turn-key solution related to power transmission of smart grids. Students learn that SVCs and STATCOMs can be used in conjunction with HVDC transmission systems to greatly enhance the controllability and power transfer capability of a power network, and are thus essential tools to the implementation of a smart grid.

Topic coverage

- AC Transmission Line
- Static Var Compensator (SVC)
- Static Synchronous Compensator (STATCOM)
- High-Voltage DC Transmission Systems

Main equipment

- Workstation
- Resistive, Inductive, Capacitive Loads
- Three-Phase Filter
- Line Inductors
- Three-Phase Transmission Line
- SVC Reactors/Thyristor-switched Capacitors
- Three-Phase Transformer Bank
- Three-Phase Regulating Auto transformer
- Three-Phase Transformer
- IGBT Chopper/Inverter
- Power Thyristors
- Four-Quadrant Dynamometer/Power Supply
- Data Acquisition and Control Interface

Four-Quadrant Dynamometer/Power Supply



The Four-Quadrant Dynamometer/Power Supply is a highly versatile USB peripheral designed to be used in the Electric Power Technology Training Systems.

Two operating modes are available: Dynamometer and Power Supply. A wide variety of user-selectable functions is available in each operating mode. In the Dynamometer mode, the unit becomes a four-quadrant dynamometer that can act as either a fully configurable brake or a fully configurable prime mover. In the Power Supply mode, the unit becomes a four-quadrant power supply.

In each operating mode, key parameters related to the selected function are displayed and can be monitored using the computer-based instruments in the software LVDAC-EMS.

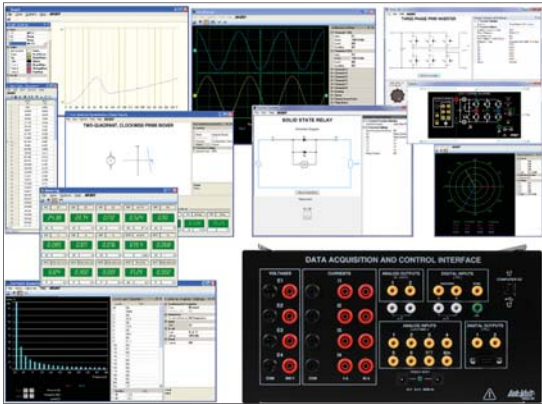
Main features

- Multipurpose device combining power supply, prime mover, dynamometer, metering, and emulator properties
- Manual or computer-based control mode
- Optional functions can be added to the standard functions to further enhance the training possibilities

Available control function sets

- Standard functions (manual control)
- Standard functions (computer-based control)
- Turbine emulator
- Lead-acid battery charger
- Ni-MH battery chargers
- Solar panel emulator
- Software development kit (SDK) for standard functions – computer-based control

Data Acquisition and Control Interface (DACI)



The Data Acquisition and Control Interface (DACI) is a highly versatile peripheral used for measuring, observing, analyzing, and controlling electrical and mechanical parameters in electric power systems and power electronics circuits. The DACI performs data acquisition to feed raw signal data to the LVDAC-EMS computer-based instruments, and it performs various types of control functions. To activate data acquisition for a specific function, a license for this function must be ordered. Together, the DACI and LVDAC-EMS are the cornerstone of the Electric Power Technology training program and allow training in a wide range of electric power topics.

Main features

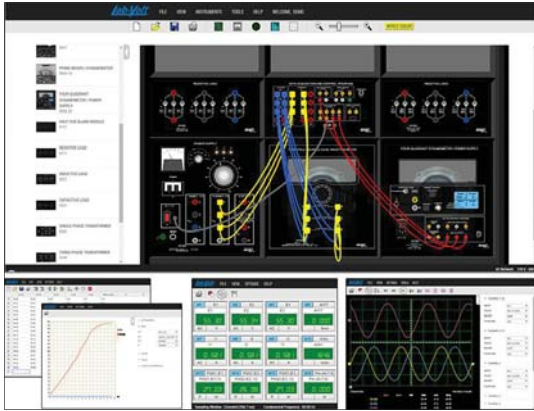
- Flexible computer-based measurement and instrumentation tools and control functions
- Virtual tools lower the cost of acquisition and replacement of accessories
- In-depth theory prior to performing the manipulations

- Pre-built SCADA interfaces facilitate an understanding of the process taking place
- Several control functions available to fit specific training needs

Available function sets

- All control function sets for the LV Series 9063
- Computer-based instrumentation
- Chopper/inverter control
- Thyristor control
- Home energy production
- Three-phase PWM rectifier/inverter control
- BLDC motor/PMSM control
- High-voltage DC (HVDC) transmission system control
- Static Var compensator (SVC) control
- Software development kit (SDK) for LV Series 9063
- Synchronous generator control
- Static synchronous compensator (STATCOM) control
- Synchroscope function

Electromechanical Systems (EMS) Simulation Software



LVSIM-EMS is a powerful electro-mechanical systems simulation software, covering the same courseware as the Computer-Assisted 0.2-kW EMS (LVSeries 8006), the Electromechanical Training System (LVSeries 8010-9), and the AC Power Transmission Training System (LVSeries 8010-B).

Sophisticated mathematical models fully simulate the electrical and mechanical characteristics of most of the actual EMS modules, enabling students to perform actual experiments using virtual equipment. A set of virtual conventional and specialized instruments can be used for measuring, observing, and analyzing electrical and mechanical parameters in electric power systems and power electronic circuits. Software is available in a local version, a network version, and a web-hosted version (lvsim.labvolt.com) and can be used as a complement to the actual EMS laboratory equipment or as a stand-alone product.

Topic coverage

- Fundamentals of Electric Power Technology
- Alternating Current (AC)
- Capacitors in AC Circuits
- Inductors in AC Circuits
- Power, Phasors, and Impedance in AC Circuits
- Three-Phase Circuits
- Special Transformer Connections
- Single and Three-Phase Transformers
- Rotating Machines Fundamentals
- DC Motors and Generators
- Special Characteristics of DC Motors
- AC Induction and Synchronous Motors
- Three-Phase Synchronous Generators
- AC Power Transmission

Main features

- Students can practice with EMS equipment operation and connection on a home PC
- Mix of real and simulated hardware lowers the cost of a full lab
- Network and online versions

eSeries Electromechanical Training System (LV Series 8980-E) #586998

DACI with Computer-Based Instrumentation Tools (LV Series 9063-B)	#579677
DACI with all Function Sets (LV Series 9063-A)	#581447
Function sets are detailed on www.labvolt.com .	

EMS Simulation Software for 1 user (LV Series 8970) – local version	#586920
EMS Simulation Software for 1 user (LV Series 8972) – online version	#586971
Other license options are detailed on www.labvolt.com	

2-kW Electromechanical Training System



The 2-kW Electromechanical Training System is a unique modular program in electric power technology consisting of several modules, which can be grouped to form four subsystems dealing with the different techniques associated with the generation and use of electrical energy. The system simulates large power machines, yet is very safe for student experimentation. It incorporates heavy-duty components and machines that can be combined to create different configurations tailored to technical or university courses. Also available is the 2-kW DFIG Generator Laboratory Kit (8013-A) designed for customers that are interested in further experimentation with the doubly-fed induction generators used in wind turbines.

Topic coverage

- 2-kW EMS – Modularized
- Power Circuits
- DC Machines
- Transformers and AC Machines

Main features

- Faceplates are silkscreened with the symbols and diagrams and provide easy access to all windings
- Shatter-proof shields for safe observation of machine interior
- Wide range of heavy-duty components
- Machines have a specifically high inertia to simulate large-power machines
- Machines may be joined with a hard rubber coupling device and patented locking fasteners designed to eliminate vibrations
- Metering modules cover the complete range of measurements required with a minimum number of meters
- System allows several combinations of machines that can be studied simultaneously

2-kW Electric Power Transmission Training System



The 2-kW Electric Power Transmission Training System uses hands-on exercises to teach the principles of transmission of electric power. This turn-key training equipment maximizes hands-on involvement with the subject matter. The instructor can select specific experiments that will satisfy the objectives of technical courses or university programs. The system provides laboratory results that are easy to understand, with data values that are easily observed. The data, when applied to formulas, provide results that verify electrical laws rather than deny them because of large operational tolerance errors.

Topic coverage

- Power Measurements
- Voltage Regulation and Power Transmission Capability of a Transmission Line
- Shunt Capacitors and Phase Angle Between Sender and Receiver

- Parameters Affecting Active and Reactive Power Flow
- Power-Handling Capability and Parallel Lines
- Effects of Series Compensation on the Voltage Regulation and Power Factor
- The Alternator
- The Synchronous Motor
- The Synchronous Compensator and Long High Voltage Lines
- Transmission Line Networks and the Three-Phase Regulating Autotransformer
- Hunting and System Oscillation
- Power System Transients

Main features

- Inductive, resistive, and capacitive load components are included
- Electrical component symbols and diagrams are clearly silk-screened on the front panel of each module.
- Safe: all electrical components can be interconnected without electric shock hazard

2-kW EMS – Modularized (LV Series 8013-1)	#587305
2-kW EMS – Power Circuits (LV Series 8013-2)	#587312
2-kW EMS – DC Machines (LV Series 8013-3)	#587319
2-kW EMS – Transformers and AC Machines (LV Series 8013-4)	#587326

2-kW Electric Power Transmission Training System – Analog Meters (LV Series 8059-2)	#587414
2-kW Electric Power Transmission Training System – with Data Acquisition Interface (LV Series 8059-4)	#587416
See website for more options	

Digital Servo Training System



The Digital Servo Training System is designed to familiarize students with the fundamentals of digital servo motion control. The system features a single-axis, belt-driven positioning system, a digital servo controller, and powerful software tools. Users can create their own control strategies by modifying the existing ones or by developing new ones through the open-source firmware and software controls. The 32-bit microcontroller is coupled to a power amplifier, specially designed for DC brush and DC brushless motor control. Motor control can be achieved in several ways: by using the included hardware controller, LABVIEW or MATLAB/SIMULINK, or an optional analog controller. The control algorithm can be performed either by the microcontroller to ensure fast response and smooth closed-loop control, or by a computer.

Topic coverage

- Equipment and Software Familiarization
- Open Loop Servo Motor Static Characteristics

- Open Loop Servo Motor Transient Characteristics
- Servo Closed Loop Speed Control
- Motor Shaft Angular Position Control
- Linear Position Sensing
- Linear Position Control
- Following Error in a Linear Position Control System

Main features

- Safe, robust, and compact system
- 32-bit microcontroller coupled to a power amplifier
- Many inputs and outputs for monitoring and control
- Position and speed control, friction brake, belt tensioning and backlash, dual encoders, transferable inertia load
- High-speed communication through a USB connection
- Easy connection to mechanical devices
- Observation and control can be performed simultaneously

0.2-kW Electromechanical Training Systems



The 0.2-kW Electromechanical Training System (EMS) is a modular instructional program representing a comprehensive approach to teaching electric power technology through laboratory observations.

Through careful attention to engineering detail, the EMS System meets this objective, and in so doing, provides laboratory results that are easy to understand, with data values that are easily observed. The data, when applied to formulas, provides results that verify electrical laws rather than deny them because of large operational tolerance errors.

The program deals with the different techniques associated with the generation and use of electrical energy. Four subsystems cover the common electrical machines, and are available as a package that consists of the equipment necessary to perform the laboratory exercises.

Topic coverage

- Electric Power Technology
- Power Circuits
- DC Machines
- Single-Phase Transformers and AC Machines
- Three-Phase Transformers and AC Machines

Main features

- Clear plastic faceplates can be lowered for access to the machine
- Cutaway bell housings permit visual inspection/observation of the internal construction during operation
- Shaft of each machine has a concave and slotted end to facilitate the use of tachometers, holding brakes, plugging switches, or inertia wheels
- Metering modules cover the complete range of required measurements
- System conception and load components simplify calculations

Complete 0.2 kW EMS – Modular (LV Series 8001-1)	#587243
Complete 0.2 kW EMS – Power Circuits (LV Series 8001-2)	#587250
Complete 0.2 kW EMS – DC Machines (LV Series 8001-3)	#587257
Complete 0.2 kW EMS – 1-phase transf./AC Machines (LV Series 8001-4)	#587264
Complete 0.2 kW EMS – 3-phase transf./AC Machines (LV Series 8001-5)	#587271

0.2-kW Protective Relaying Training System



The 0.2-kW Protective Relaying Training System is cost-effective equipment that allows the study of the protection of generators, transformers, and induction motors.

It is an innovative program that extends training in protective relaying beyond the operation and calibrations of individual relays into broader circuit applications. The program provides hands-on training at the system level in Generator Protection, Transformer Protection, and Induction Motor Protection.

A wide range of additional and optional equipment allows instructors to create elaborate systems, hands-on exercises, and simulations, making the system flexible enough to be tailored to specific training needs. For power utility users, it is possible to combine external protective relays.

Topic coverage

- Common Electrical Modules
- Power System Modules
- Protective Relaying Control Station
- Protective Relays

Main features

- Modular, industrial-grade system approach allowing selection of areas of interest for study and training customization
- Wide range of protective relays: undercurrent/overcurrent, under-voltage/overvoltage, synchronism check, underfrequency/over-frequency, phase balance, phase sequence, reverse power, and power factor
- Fault insertion capability for troubleshooting at the system level
- Ability of power utility customers to combine their own protective relays with the 0.2-kW Protective Relaying Training System to obtain equipment setups that correspond to existing one-line and three-line diagrams

Dissectible Machines Training System



The Dissectible Machines electro mechanical trainer provides hands-on instruction in the construction and operation of rotating machines. It can be integrated in any training program that includes industrial applications of electric power technology. Students construct two different machines at the same time, which once assembled, can be used to demonstrate their electrical and mechanical characteristics.

Topic coverage

Assembly of:

- Direct Current Machine
- Split-Phase Capacitor-Start Motor
- Capacitor-Run Motor
- Two-Value Capacitor Motor
- Universal Motor
- Three-Phase Wound-Rotor Induction Motor
- Three-Phase Squirrel Cage Induction Motor
- Synchronous Machine
- Synchronous Reluctance Motor
- Two-Speed Variable-Torque Motor
- Two-Speed Constant-Torque Motor
- Two-Speed Constant-HP Motor
- Two-Phase Wound-Rotor Induction Motor
- Triple-Rate Motor

Motor Winding Kit



The Motor Winding Kit offers a cost-efficient approach to teaching construction techniques for electrical machines. Starting with such basic components as laminations, motor ends, and magnet wire, the Motor Winding Kit permits the construction of four machines: a squirrel-cage induction motor, a wound-rotor induction motor, a three-phase synchronous machine, and a split-phase capacitor-start motor. Rotors can also be constructed.

Once the machine is mounted on the support module, it can be inserted into a standard LabVolt Series workstation and coupled to a prime mover or a dynamometer to check its electrical specifications, thus expanding learning. This complete assembly kit can be reused many times.

Topic coverage

- Equipment Familiarization
- Split-Phase Capacitor-Start Motor
- Three-Phase Squirrel Cage Induction Motor
- Three-Phase Wound-Rotor Induction Motor
- Synchronous Machine

MagTran® Training System



The MagTran® Training System is designed to teach magnetic circuit principles and the application of these principles to basic transformers. It is a versatile system suitable for a broad range of teaching programs – from vocational schools to universities.

The system consists of a set of laminated iron bars, a vise-type, nonmagnetic base that holds the bars in place, coils, and other related components that can be assembled in many ways. Correlated courseware contains an extensive set of laboratory experiments that illustrate basic principles of magnetism and electromagnetic induction.

The system is designed to operate at the 0.2-kW power level. It includes all the equipment required to perform the exercises contained in the courseware, except for an oscilloscope.

Topic coverage

- Magnetic Circuits and Transformers

Main features

- Enables students to build single- and three-phase transformers
- An incandescent lamp enables the observation and study of magnetic coupling
- Students can rearrange magnetic circuits to learn about inductance and transformer ratios
- Enables measurement of magnetic fluxes as low as $10 \mu\text{Wb}$ to demonstrate leakage flux, saturation, and magnetic shunts
- A low-cost flux meter with a special built-in circuit enables the observation of hysteresis loops on an oscilloscope (not included)
- Exploration of the shaded-pole principle, magnetic amplifiers, and permanent magnet properties.
- High-quality components designed for hands-on training purposes

Fluid Power Training Packages

Training solutions that meet your needs



Main features: Hydraulics*

- Quick-Fix® mounting system
- On-board equipment/component storage
- Tool-free connections with low-leakage couplings
- User-friendly training environments
- Modern measurement and diagnostic technology and cartridge valves
- Compact, integrated design
- Low weight, easy to handle
- Easy-to-read symbol system.

Main features: Pneumatics*

- Quick-Fix® mounting system
- Safety connections
- On-board equipment/component storage
- User-friendly training environments
- Advanced courses made easy
- Vacuum technology
- Low weight, easy to handle
- Easy-to-read symbol system.



Quick-Fix® Mounting System

Our hydraulics and pneumatics training packages are modular in structure. For example, you could start with the basic level of electrohydraulics/electropneumatics and then move on to the advanced level. Or if you are more interested in higher level fluid power topics, you can start there. The choices are yours. All equipment set components can also be ordered separately, so you can create customized solutions.

The workbooks accompanying the training packages contain project-oriented exercises of increasing complexity. There are also positional sketches, illustrations, videos, animations, and cross-sectional draw-



Safety Connections

ings, which explain how things look in the real world. For a complete and expert treatment of fluid power topics the training also covers basic physics, technical calculations, safety, efficiency, analytical fault-finding, and professional documentation.

Practical basic and continuing training using industrial components provides the confidence to apply the acquired knowledge in the workplace. The components are specially selected for the exercises in the workbook.

Note: nearly all hydraulic/pneumatic and electrical connections are located on the easily-accessible upper side of the components.



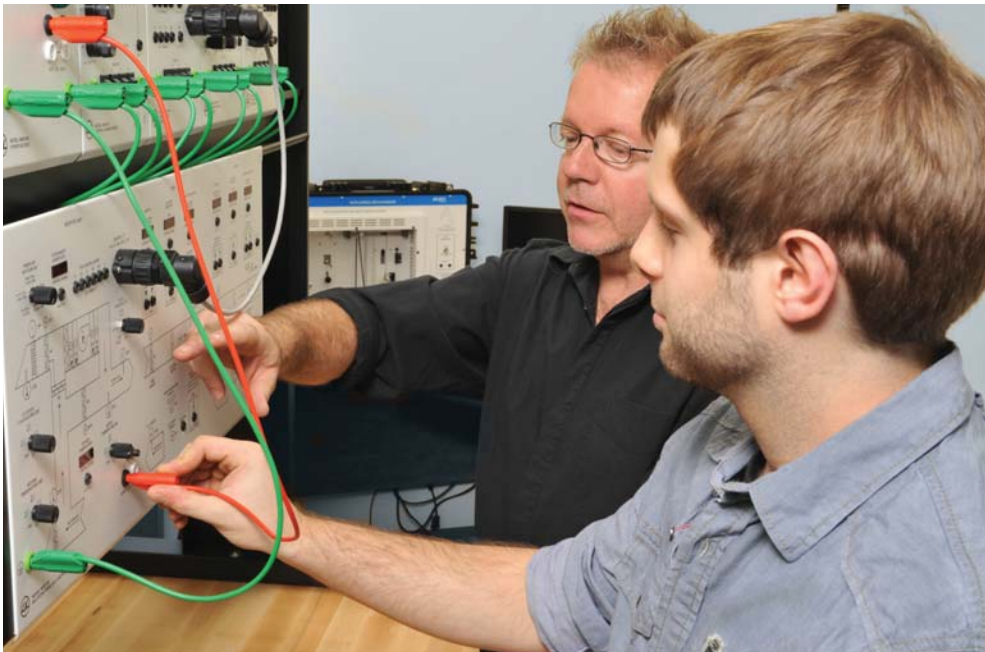
User-Friendly Training Environment

Most equipment sets are delivered in practical, Systainer-compatible equipment trays which fit in the drawers of the workstations. The large pictograms on the components, designed in accordance with the latest standards, provide clear instructions for connecting the components and ensures short preparation and follow-up times. When dismantling circuits, you can quickly and easily locate where the component goes in the equipment tray.

*For more detailed information on Fluid Power Training Packages go to:
<http://www.festo-didactic.com/int-en/learning-systems/equipment-sets/>

HVAC-R Controls Training Systems

Aligned to industry needs



1.The **Electricity Fundamentals Training System** is a complete introduction to electricity and to the electrical components used in HVAC-R systems. Through this program, students learn how to connect, perform measurements, calculate, and troubleshoot circuits.

2.The **Electric Heating Training System** uses a modular design approach to study the control of an electric residential forced-air system. The system features components such as a thermostat, a control transformer, sequencers, and thermal limit switches among others.

3.The **Building Energy Management Training System** is a complete introduction to direct digital control (DDC) of HVAC-R systems. It covers the main schemes of control used in building energy management. This includes single-zone control, constant air volume systems, and variable air volume systems. The course material covers important topics such as heating, cooling, free cooling, smoke detection, CO₂ level detection, humidity control, and human-machine interfaces (HMI).

4.The **Multi-Zone Wireless Control Training System** features a rooftop unit controller that interacts with zone controllers using a wireless communication protocol. The curriculum explains floating and analog control of a single-zone, as well as multi-zone control. This training system allows students to acquire hands-on experience with industrial HVAC-R control



1



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4

The HVAC-R modular training solutions are used by students to learn theory, hardware, and controls found in typical HVAC-R systems, as well as to develop practical troubleshooting knowledge. All systems use residential, industrial, and commercial parts.

Comprehensive curriculum with hands-on exercises accompanies each system. The experiments replicate various typical and realistic scenarios.

The learning material follows recognized certification organizations, such as HVAC Excellence, NATE, NOCTI, and NCCER, for a better alignment to industry needs.

Electricity Fundamentals Training System (LV Series 3460)	#588465
Electric Heating Training System (LV Series 3463)	#588467
Building Energy Management Training System (LV Series 3466)	#588470
Multi-Zone Wireless Control Training System (LV Series 3467)	#588473

Refrigeration System Demonstrator



The Refrigeration System Demonstrator is an integrated training system for instructor demonstration and hands-on student experimentation in the fundamental principles and components of typical refrigeration systems and heat pumps. It is designed to clearly show the different refrigerant stages within the cycles of the most common refrigeration system configurations.

The training system is supported by correlated courseware employing a competency-based, individualized approach to the study of refrigeration fundamentals.

Topic coverage

- Physics Applied to Refrigeration
- Introduction to Refrigeration
- The Compressor
- The Evaporator and Condenser
- Metering Devices
- System Control Devices
- Introduction to Heat Pump Systems
- Refrigeration Faults

Main features

- Clear tubing sections within the evaporator and condenser coils to allow students to view refrigerant flows and changes of state
- Clear evaporator and condenser coil enclosures
- Four manual valves enabling reversal of refrigerant flow for heat pump demonstrations
- Variable-speed fans and adjustable dampers to simulate changing environmental conditions
- Fault-insertion switches
- Instrumentation including temperature meter, compound gauges, pressure gauges, circuit breakers, indicator lamps, and gauge manifold
- Circuit breakers and a safety pressure switch

Refrigeration Training System



This integrated training system introduces students to the principles and components of a refrigeration system using industrial and commercial devices.

It clearly demonstrates the operation of the most common refrigeration system configurations, including dual evaporator systems. Lockable fault-insertion switches allow students to practice troubleshooting skills, which may be conducted at either the schematic control panel or at the suspect devices and components.

Fully integrated courseware guides students through alternative modes of system set-up and control. The training system includes all the equipment required to perform the exercises contained in the courseware.

Topic coverage

- Introduction to the System Trainer
- Setup
- Receiver, Accumulators, Oil Separators
- Compressor
- Operation of Metering Devices
- System Control Services
- Evaporator and Condenser Principles
- Refrigeration Systems
- Variations of System Loading
- System Troubleshooting

Main features

- Two forced-air evaporator coils operating individually, in series, or in parallel
- Variable-speed fans and adjustable damper to simulate changing environmental conditions
- Schematic panel with multicolored electrical and tubing schematics, as well as indicator lamps and functional duplication of test points
- Fault-insertion switches
- Instrumentation includes temperature, watt, volt, and ampere meters, as well as pressure gauges
- Circuit breakers and safety pressure switch to protect the system

Heat Pump Training System



The Heat Pump Training System provides the necessary hardware and manuals to develop a solid understanding of typical domestic heat pumps.

It has clearly identified separate circuits connected through a four-way reversing valve to demonstrate the cooling and heating modes of operation. Timed automatic defrost as well as backup electric heating are also covered. Students will use manual and programmable thermostats to implement different scenarios in a plenum chamber. The trainer also includes indicator lights, test points, pressure gauges, and troubleshooting instrumentation.

Topic coverage

- Trainer Familiarization
- Manual Thermostat Operation
- Electric Heating
- Defrosting
- Programmable Thermostat Operation
- Troubleshooting

Main features

- Blowers and ducting simulate distribution methods of heating and cooling
- Several test points for troubleshooting exercises
- Electric heat for secondary heating
- Four-way reversing valve
- Capillary-tube controls with check valves
- Controls that include manual and programmable thermostats, fan/limit temperature sensor, high-pressure controller, low-pressure controller, and defrost timer
- Control panel with multicolored electrical and tubing schematics and indicator lamps
- Control panel that includes thermostat selection switch, manual thermostat heating mode selection, defrost time termination, and power switches

Refrigeration Training System (Compact)



The compact Refrigeration Training System is designed to teach refrigeration fundamentals. It demonstrates the operation of typical refrigeration circuits using industrial and commercial devices. The compactness of the training system allows its placement on a table or a bench, reducing the floor space requirements. It integrates instrumentation and process control components, as well as an electrical control panel. Instructors can insert faults to teach troubleshooting. The training system features a powerful data acquisition system whose tools enable students to easily monitor operating conditions in real-time to provide key information, simplifying system troubleshooting and performance analysis.

Topic coverage

- Refrigeration Fundamentals and Components
- Enthalpy Diagram
- Electrical Control of Refrigeration Systems

- Pressure and Temperature Control in Refrigeration
- Thermostatic Expansion Valve Adjustment
- Troubleshooting

Main features

- Cooling chamber enclosing a forced-air evaporator
- Air-forced condenser with variable speed fan
- Thermostatic expansion valve and two capillary tubes of differing lengths to compare the coefficients of performance obtained with different metering devices
- Electronic pressure control with LCD display
- Thermostatic control; pressure control
- Heat load simulation
- Transducers used to acquire data at the critical points of the system
- Conditioning of the compressor voltage and current
- Integrates a powerful data acquisition system – LVHVAC software – for real-time monitoring

Refrigeration Skills Trainers



The Refrigeration Skills Trainers are designed to teach future refrigeration technicians the manual skills of the trade.

Electrical wiring, piping, evacuating and charging refrigerant, as well as troubleshooting are covered.

Topic coverage

- Reading electrical and mechanical assembly drawings
- Cutting, bending, and installing tubing
- Connecting typical electrical refrigeration components
- Charging and operation of assembled circuits

Available Skills Trainers

- Domestic Freezer: Provides a basic understanding of the applications of a standard condensing unit and a natural convection evaporator.
- Heat Pump: Includes the basic components of a typical heat pump unit and can be operated in two modes: the cooling mode or the heating mode.
- Beverage Cooler: Includes the basic components of a commercial refrigerating system.
- Dual Temperature Refrigerator: Provides a basic understanding of a two-stage cooling system, such as that found in a typical two-compartment refrigerator.
- Walk-In Cooler: Provides a basic understanding of the applications of forced-air evaporators and water cooled condensers.
- Air Conditioning: Includes the basic components of a typical air conditioning unit.
- Universal Refrigeration: Provides hands-on training in the principles and components of universal refrigeration units.

Domestic Freezer (LV Series 3410-2)	#587599
Heat Pump (LV Series 3411-2)	#587605
Beverage Cooler (LV Series 3412-2)	#587610
Dual Temperature Refrigerator (LV Series 3413-2)	#587614
Walk-In Cooler (LV Series 3414-2)	#587619
Air Conditioning (LV Series 3415-2)	#587625
Universal Refrigeration (LV Series 3420)	#587631

Industrial Controls Training Systems



The Industrial Controls Training Systems are designed to teach the theory and techniques of electric motor controllers. They allow students to select and mount control devices to form typical control circuits, and to troubleshoot them once a fault is inserted. The modular systems offer unique controls training possibilities and include insertable faults.

Four basic systems each cover a specific topic dealing with various aspects of industrial controls equipment operation:

- Basic Controls
- Programmable Logic Controller
- Motor Drives
- Sensors

Topic coverage

- Basic Controls
- Programmable Logic Controller
- Motor Drives
- Sensors
- Troubleshooting

Main features

- Sturdy, mobile, two-sided workstation
- Designed according to CSA standards
- Contains advanced devices (PLC, AC Drive, PWM, DC Drive, Softstarter) and common electrical panel components
- Electrical connections between the modules mirror real-life connections
- The motors in the training system are actual industrial machines

eSeries Industrial Controls Training System (LV Series 3161-E) #586013

Industrial Controls Training System – Basic Controls (LV Series 8036-1)	#581502
Industrial Controls Training System – PLC (LV Series 8036-2)	#581509
Industrial Controls Training System – Motor Drives (LV Series 8036-3)	#581511
Industrial Controls Training System – Sensors (LV Series 8036-4)	#581516

Industrial Controls Training System Simulation Software



The Industrial Controls Simulation Software features true simulations of the motor control circuits of the Industrial Controls Training System.

The precise simulations allow students to complete all the exercises in the training system courseware on a computer without the need for any actual equipment. This simulation software is specially designed to perform the exercises found in the courseware, and cannot be used to perform customized exercises.

The software can be used as a stand-alone product or in conjunction with the different available eLearning course formats (eSeries, SCORM, and stand-alone).

Topic coverage

- Basic Controls
- Programmable Logic Controller
- Motor Drives
- Sensors
- Troubleshooting

Main features

- Precise simulations allow completion of all exercises with or without equipment
- Can be used in conjunction with a Learning Content Management System such as MindSight
- Includes a Site License

eSeries Industrial Controls Training and Simulation Software (LV Series 3161-J) #586019

Industrial Controls Training System Simulation Software (LV Series 3161-H) #586017

Mechanical Training System



The Mechanical Training System covers the installation, use, maintenance, and troubleshooting of mechanical drive components. It is divided into five levels. Each level is further divided into specific topics which deal with the components encountered in industry. Engineered for ease of use, the system comes with a universal steel base unit on which the students prepare the setups using T-slotted extrusion bars, allowing the base to be configured as required by the task. The modularity of the system allows the development of training programs that meet specific needs. System can be integrated with other products in the Industrial Maintenance program, including rigging, pumps, piping, electrical wiring, power distribution, hydraulics, pneumatics, and electro-mechanical systems (EMS).

Topic coverage

- Introduction to Mechanical Drive Systems
- Belt, Chains, and Gear Drives
- Couplings and Shaft Alignment
- Bearings and Linear Bearings
- Gaskets, Seals, Ball Screws, Clutches, and Brakes
- Laser Alignment, Lubrication, and Vibration Analysis

Main features

- Heavy-duty equipment with industrial components
- Fully-illustrated job sheets
- Lockout/tagout and safety panels ensure student safety
- Several subsystems allow delving into specific topics
- Provides hands-on, highly-safe mechanical training
- Meets a variety of needs and budgets

eSeries Mechanical Training System (LV Series 46649-E)

#583461

Mechanical Training System – Level 1 (LV Series 46101-1)

#580121

Mechanical Training System – Level 2 (LV Series 46101-2)

#580128

Mechanical Training System – Level 3 (LV Series 46101-3)

#580131

Mechanical Training System – Level 4 (LV Series 46101-4)

#580134

Mechanical Training System – Level 5 (LV Series 46101-5)

#580140

See www.labvolt.com for details about each subsystem.

Industrial Wiring Training System



The Industrial Wiring Training Systems are hands-on systems designed to train students for careers as electricians and electrical maintenance technicians.

The systems, which use high-quality UL-listed components, faithfully reproduce an industrial environment where students can develop their skills in the installation and wiring of industrial electrical equipment, in compliance with US national standards.

Comprehensive curriculum consisting of fully-illustrated student manuals containing job sheets and/or work orders, an instructor guide, and a reference book from the National Center for Construction Education and Research (NCCER) are also included when required.

Topic coverage

Level 1:

- Enclosures and Conduits
- Electrical Power Distribution
- Electrical Wiring

Level 2:

- Three-Phase Motor Starters
- AC Motor Drive
- DC Motor Drive

Main features

- Four equipment setups allow multiple student groups to work at a single workstation
- Two or more setups can be grouped together to form complex industrial applications
- Power bus installed at the top of the workstation to supply power
- Provides hands-on industrial wiring training in compliance with the National Electrical Code® (NEC)
- Wide-range of industrial-grade, UL-listed components

eSeries Industrial Wiring System (LV Series 46849-E)

#583479

Basic Industrial Wiring Training System (LV Series 46102-1)

#580143

Industrial Wiring Training System – Level 1 (LV Series 46102-2)

#580145

Industrial Wiring Training System – Level 2 (LV Series 46102-3)

#580148

See www.labvolt.com for more information.

Fire Alarm Training Systems



The Fire Alarm Training Systems are hands-on training tools designed to form students for careers as fire alarm technicians. The systems reproduce typical workplace settings, allowing students to develop their skills in the installation and wiring of fire alarm systems. Student learning is based on practical, hands-on tasks using commercial-grade components. All necessary accessories and parts (control panels, alarm station, heat detector, smoke detector, etc.) are provided for a comprehensive, realistic training. Two systems are available: The Conventional Fire Alarm System, LV Series 46103-A, and the Addressable Fire Alarm System, LV Series 46103-B. Each system mainly consists of a fire alarm control panel, an auxiliary panel, initiating devices including fire alarm stations, heat and smoke detectors, notification appliances including horns, and accessories.

Topic coverage

- Wiring and Schematics
- Component Location and Wiring
- EOLR
- Remote Zone Indicators
- Pull Stations/Connections
- Control Panels
- Horn Strobes
- Junction Boxes
- Layout Diagrams

Main features

- Commercial-grade equipment
- Circuit and component identification with dry board markers
- Configurable control panels
- Fire alarm shielded cables running in EMT conduits
- Sound levels of the alarms can be adjusted
- Wide variety of components for realistic training
- Systems can be fixed to a wall or to an optional mobile workstation
- Work orders or job sheets for task-based learning

Piping Training System



The Piping Training Systems form a hands-on program 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. The systems can also be used to teach students how to enforce the safety rules when working at industrial sites. Several configurations are available to match specific training needs. Also offered is the LabVolt Series 46105-F, Backflow Prevention Training System, which features the most common check valve backflow preventers used in typical residential and commercial installations.

Topic coverage

- Motor Operators
- Pipes and Pipe Fittings
- Valve Types and Operation

- Safety Valves
- Steam Traps
- Valve Maintenance
- Fabrication, Assembly, and Installation
- Measurement and Layout
- System Testing
- Safety Rules and Procedures

Main features

- Sturdy, yet flexible design integrates components that meet industrial safety standards
- Wide-range of industrial-grade components
- Versatile mobile workstation allowing up to two students groups to work simultaneously
- Modular approach allows the system to be configured to fit different training needs
- Two or more equipment setups can be grouped together to form complex industrial applications
- Three configurations are available for supplying water to the system

Conventional Fire Alarm System (LV Series 46103-A)	#583745
Addressable Fire Alarm System (LV Series 46103-B)	#583748

eSeries Piping Training System (LV Series 46759-E)	#583477
Piping Training System (LV Series 46105)	#580150
Backflow Prevention Training System (LV Series 46105-F)	#580160

Pumps Training System



The Pumps Training System familiarizes students with pump operation principles and associated maintenance tasks, such as pump installation, lubrication, shaft alignment, inspection, and component replacement. Through hands-on activities, students also learn how to start up, operate, and troubleshoot industrial pumps in different configurations. They discover the impact of valve restriction, air injection, and Net Positive Suction Head (NPSH) on pump efficiency by using a cavitation valve, a load valve, and two different water reservoirs. System modularity allows the selection of models required to meet customized training objectives. A wide variety of pumps is also offered as individual options and correspond to the most common types found in industry.

Topic coverage

- Pump installation
- Lubrication
- Shaft alignment
- Inspection
- Component replacement
- Valve restriction
- Air injection
- Pump wiring
- Fluid mechanics
- Pump maintenance
- Laser alignment
- Vibration analysis

Main features

- 13 different types of dismountable industrial pumps
- Transparent pump cover allows cavitation observation
- Configure variable speed drives using local panels or software
- Fault-insertion by the instructors
- Latest three-phase AC drive included to vary the speed of motor-driven pumps
- Easy electrical connections between the drive and motor can be made using banana jacks or terminal blocks

eSeries Pumps Training System (LV Series 46749-E)	#583474
Pumps Training System (LV Series 46106)	#580162
Multiple Pump Training System Add-On (LV Series 46106-1)	#580168
Second Drive Option Add-On (LV Series 46106-2)	#580171

Rigging Training System



Moving machines is a basic requirement for any industrial plant. Machines that need to be moved in industrial settings are all different, since they are usually built for specific applications. They have different shapes and are often asymmetrical. Their weight, which is not evenly balanced on the machine supports, can create difficulties for the rigger. Therefore, riggers need to be highly-skilled and qualified to move machines safely and efficiently.

The Rigging Training System covers the fundamentals of rigging practices, including techniques to help students move and install machines safely. The heavy-duty, steel crane has polyurethane swivel casters with roller bearings, and pivoting support legs for easy maneuvering in tight places.

Topic coverage

- Ropes and Slings
- Wedge Sockets
- Dollies and Roller Pipes
- Gantry Cranes and Hoists
- Machine Installation
- Machine Movement
- Lifting Objects and Unbalanced Loads

Main features

- Mobile, beam-style gantry is designed to conform to OSHA and CMAA standards
- Heavy-duty, steel crane has polyurethane swivel casters with roller bearings, and pivoting support legs for easy maneuvering in tight places
- Storage for all material on the crane
- Wide variety of components enhances realistic training

Rigging Training System (LV Series 46109)	#580174
Adjustable-Height Rigging Training System (LV Series 46109-A)	#580178

Programmable Logic Controllers (PLC)



Programmable Logic Controllers 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. The PLC trainers can be used independently or connected to other PLC applications. The program is highly flexible and allows a multitude of different customized training solutions.

Main features

- 24 VDC built-in power supply
- PID capability
- Fault switches to develop troubleshooting skills
- Easy expansion using rackless I/O modules (LV Series 3244)
- Most PLCs include full curriculum covering all the basics of PLC programming
- Some PLCs come in a rugged suitcase for easy transportation and storage

PLC Allen-Bradley MicroLogix 1100



- Used by DeVry University for their PLC course
- Built-in 10/100 Mbps Ethernet/IP port for peer-to-peer messaging
- Embedded Web server and LCD screen
- Five push-buttons and five toggle switches
- Online editing functionality
- Digital and Analog I/Os; Digital (24 VDC): 10 inputs (four 40kHz high-speed), six outputs (two 40 kHz high-speed); Analog (0 - 10 VDC): two inputs
- Onboard traffic light simulator
- Compatibility with MicroLogix and SLC instruction set
- RSLogix 500 programming software (LV Series 3245-A) required

PLC Siemens ET200S IM-151-8



- Digital I/Os: eight 24 VDC inputs and 12x 24 VDC outputs
- Based on SIEMENS® S7-300 technology (IM151-8 CPU)
- Four push-buttons and four toggle switches
- Requires Step 7 programming software (LV Series 5939)
- Includes Siemens Resource Curriculum CD-ROM (no other curriculum included)

PLC Siemens ET200S IM-151-8 with Case



- Digital I/Os: eight 24 VDC inputs and twelve 24 VDC outputs
- Based on Siemens S7-300 technology (IM151-8 CPU)
- Four push-buttons and four toggle switches
- Requires the Step 7 programming software (LV Series 5939)
- Includes Siemens Resource Curriculum CD-ROM (no other curriculum included)

PLC Allen-Bradley MicroLogix 1100 with Case



- Built-in 10/100 Mbps Ethernet/IP port for peer-to-peer messaging
- Embedded Web server and LCD screen
- Online editing functionality
- Five push-buttons and five toggle switches
- Digital and analog I/Os; Digital (24 VDC): 10 inputs (four 40kHz high-speed), six outputs (two 40 kHz high-speed); analog (0 - 10 VDC): two inputs
- Onboard traffic light simulator
- Compatibility with MicroLogix and SLC instruction set
- RSLogix 500 programming software (LV Series 3240-D) required

PLC Allen-Bradley MicroLogix 1200 with Case



- Digital I/Os: 14 inputs and 10 relay outputs, hard-wired to 24 VDC
- Three push-buttons and four toggle switches
- Compatibility with MicroLogix and SLC instruction set
- RSLogix 500 programming software (LV Series 3245-A) required

PLC Allen-Bradley MicroLogix 1500



- Digital I/Os: 12x 24 VDC inputs and 12 relay outputs, hard-wired to 24 VDC
- Six push-buttons and six toggle switches
- Compatibility with MicroLogix and SLC instruction set
- RSLogix 500 programming software (LV Series 3245-A) required

PLC Siemens ET200s
IM151-8 with Case
(LV Series 3240-C) #587535

PLC Allen-Bradley
MicroLogix 1100 with Case
(LV Series 3240-D) #588462

PLC Allen-Bradley MicroLogix
1200 with Case
(LV Series 3240-4) #587542

PLC Allen-Bradley MicroLogix
1500 (LV Series 3240-3) #587537

PLC Applications

Basic to advanced control systems that mimic real-world technological applications



Traffic Light Training System



Electro-Pneumatic Training System

The PLC Applications, Series 8075, aim to further develop student understanding of PLC programming. Basic principles are integrated with more advanced concepts in order to design small-scale systems typical of what can be found in the industry. The PLC Applications series is divided into several systems, each system covering a specific topic related to PLC controls. Through practical examples, students gain a strong knowledge of PLCs and of the studied applications.

Job sheets are provided with each application. The training capabilities of the systems are enhanced by their modularity and by the ability to use instructor-inserted faults.

Main features

- Tabletop systems
- Cost-effective applications
- Realistic components
- Can be interconnected with other training systems
- Highly modular systems; accessories available to make the applications more complex
- Fault-insertion capabilities
- Comprehensive curriculum included with each application
- PLC sold separately (customers can also use their own)

The **Traffic Light Training System** is a classic PLC training system allowing the implementation of vehicle and pedestrian traffic control at an intersection.

- N-S/E-W traffic control with pedestrian crossing
- Another unit can be added to create a full, four-direction traffic light
- Flow management with proximity detectors (optional)
- Traffic light synchronization

The **Electro-Pneumatic Training System** uses a modular design approach to study the control of an electric residential forced-air system.

- Two double-acting cylinders
- Two reed switches and one mechanical limit switch for PLC feedback
- Control valve station featuring single- and double-solenoid valves
- Applications: stamping, hold and punch, filling process, etc.

PLC Applications



Electro-Mechanical Training System

The **Electro-Mechanical Training System** enables diverse PLC-controlled positioning and motion processes. This system is available with a DC or a stepper motor.

- Industrial 1800 r/min, 90 VDC motor **or** high-torque stepper motor
- Two magnetic limit switches for PLC feedback
- Perforated base to accommodate optional sensors
- Optional 100 ppr optical encoder



Wind Turbine Training System

The **Wind Turbine Training System** uses a PLC to monitor the speed and direction of the wind and control the position of the wind turbine nacelle.

- System comprised of a nacelle simulator and a wind generator
- Nacelle equipped with DC motor and mechanical clutch
- Two limit switches with NO and NC contacts
- Analog position sensor for determining wind direction
- Variable-frequency pulse-train signal for measuring wind speed

Electro-Mechanical Training System with DC Motor (LV Series 8075-3)	#582534
Electro-Mechanical Training System with Stepper Motor (LV Series 8075-4)	#582538

Wind Turbine Training System (LV Series 8075-5)	#582542
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PLC Applications



Level Process Training System

The **Level-Process Training System** introduces level control using a PLC, control relays, a pump, and a set of sensors.

- Submersible variable speed pump
- Level process column
- Float switch
- Capacitive and magnetic level switches
- Solenoid and manual valves
- Optional analog level sensor
- Self-regulating process allows a variety of PLC control schemes



Bottling Process Training System

The **Bottling Process Training System**

is a small-scale reproduction of a widespread industrial process combining pneumatics, motion control, and PLC sequencing.

- Film canister capping process
- Two high-torque stepper motors
- Dual stepper motor drive
- Inductive proximity switch
- Mechanical switch
- Single solenoid directional valve
- Double-acting cylinder

AC/DC Training System



The AC/DC Training System is a cost-effective solution that introduces students to the basic principles of electrical circuits, both alternating current (AC) and direct current (DC).

This highly-safe training equipment allows for exploration and manipulation of the most common electrical components, such as power sources, resistors, inductors, capacitors, transformers, switches, relays, and motors.

The training system comes in a convenient, rugged carrying case with sturdy wheels and a telescopic handle for easy transportation.

The curriculum is divided into two courses designed to progressively introduce students to the important concepts of AC and DC circuits, and includes hands-on exercises, helping students to develop the skills necessary to work in the field of electricity.

Topic coverage

- Basic concepts of electrical circuits, both in DC and AC
- Ohm's law
- Kirchhoff's voltage and current laws
- Using measuring instruments
- Solving series and parallel circuits
- Electromagnetism
- Electrical distribution
- Troubleshooting electrical circuits
- Exploration of the most common electrical components: power sources, resistors, inductors, capacitors, transformers, switches, relays, motors

Main features

- Complete learning package with the most common electrical components and measuring instruments (voltmeters, ammeters, ohmmeters, etc.)
- Easy transportation
- Fault switches to improve troubleshooting skills

Advanced PLC Training System (Rockwell Automation)



The purpose of the Advanced PLC Training System is to familiarize students with the specifics of the programming environment and languages so that they can efficiently learn PLC programming.

The system contains industrial components of the latest technology: a CompactLogix 5370 controller, a PanelView Plus 7 graphic terminal, and a Stratix 2000 industrial Ethernet switch. Several inputs and outputs are accessible from the front panel using 2-mm test leads. Eight switches allow the addition of electrical faults during troubleshooting exercises. A SysLink interface allows connection to Modular Production System (MPS) stations from Festo.

Realistic examples are displayed on the graphic terminal and correspond to real PLC applications that can be interfaced with the trainer.

Topic coverage

- Familiarization with Studio 5000 and FactoryTalk View Studio
- Understanding PLC operation and addressing
- PLC programming in four different IEC 61131 languages: Ladder Logic, Sequential Function Chart, Function Block, and Structured Text
- Designing human-machine interfaces
- Troubleshooting

Main features

- Conveniently mounted in a suitcase for protection, storage, and transportation
- Uses high-end Rockwell software and hardware that are used in actual factories
- Can be used alone or in conjunction with existing LabVolt Series PLC applications or any other applications

CNC Training Systems

Computer Numerical Controlled (CNC) machines that contribute to superior CNC training systems



The skills required to perform simple to more sophisticated Computer Numerical Controlled (CNC) turning and milling tasks are the focus of the LabVolt Series lathes and mills. Each machine has an on-board micro-processor that stores downloaded part programs, thereby eliminating the need for a dedicated computer for operation. The easy-to-use membrane keypad enables students to operate and control the machine by simply pressing buttons on the control panel.

Each machine connects directly to an Ethernet or RS-232 port of a personal computer to provide simultaneous programming and parts processing. The CNC Lathes and Mills are designed to support low-voltage communications with robotic units and accessories to create automated work cells ideal for flexible manufacturing systems (FMS) and computer integrated manufacturing (CIM). In addition, they feature TTL connectors for communication.

Control Panel Features

- Ability to restart programs from stopping point after a safety interruption
- 20-character by four-line LCD display
- Stall light indicator/push-button abort key
- Manual mode controls

Safety Features

- Full cover over bed and work area
- Key-released emergency stop push-button
- Sensor switches monitored by the machine for safety cover open, and protection from over-travel on all axes

Each machine can be programmed using the LabVolt CNC Lathe/Mill software and CAD/CAM software.

CNC Lathe Training System (Light Duty)



The CNC Lathe (Light Duty) consists of a horizontal lathe, a head-stock, and a tailstock. It can machine pieces of soft materials, such as plastics and waxes, as well as harder materials, such as aluminum and brass. Pieces can be turned into a variety of cylindrical bumps, grooves, and hollows. Stock is mounted onto the lathe using a three-jaw chuck that centers the stock and holds it in place.

Main features

- Software allowing the programming of up to 20 tools
- Includes a three-jaw, self-centering chuck
- Each axis driven by its own DC stepper motor
- Programmable speeds of 0-36 cm/min (0-14 in/min)
- 60 W (0.08 hp) DC variable-speed spindle motor
- Programmable spindle motor with chuck speed of 0-2800 r/min
- Assortments of machining tools and stock materials of different sizes offered as options to enhance and expand training system capabilities

CNC Lathe Training System (Heavy Duty)



The CNC Lathe (Heavy Duty) uses two ball screws, each driven by a stepper motor, to move the cross slide that carries the cutting tool along the Z-axis (right and left) and X-axis (in and out) with maximal positional accuracy. The speed of each stepper motor can be programmed separately for feed rates up to 762 mm/min (30 in/min). A 746 W (1.0 hp) motor rotates the spindle and three-jaw chuck, and thus the stock, at speeds programmable up to 3400 r/min. To facilitate maintenance, the Z-axis ball screw is protected by a dust cover.

Main features

- An optional 10-tool automatic tool changer is available
- Capable of threading using an optical-encoder feedback loop
- Stand-alone manual mode operation
- Batch mode for independent operation or operation in CIM cells
- Software allowing the programming of up to 10 tools
- 745 W (1 hp) constant-torque DC spindle motor
- Quick-change tool post

CNC Mill Training System (Light Duty)



The CNC Mill (Light Duty) consists of a milling table, a headstock carrying the spindle motor, and a vertical column with dovetail slide. The stock can either be mounted directly on the mill table or secured in a vise that holds it to the table. It can machine pieces of soft materials, such as plastics and waxes, as well as harder materials, such as aluminum and brass. The CNC Mill System supports low-voltage communications with robotic units and provides connections for up to four auxiliary devices.

Main features

- Software included with full 3D tool path emulator and easy-to-use graphical interface, allowing the programming of up to twenty tools
- 12-key membrane keypad with 20-character by four-line LCD display
- Feed-rate and spindle-speed override capability
- Removable side panel for access to robot
- Connects to host computer through RS-232 or Ethernet port
- Assortments of machining tools and stock materials of different sizes offered as options to enhance and expand training system capabilities

CNC Mill Training System (Heavy Duty)



The CNC Mill (Heavy Duty) consists of a milling table, a headstock carrying the spindle motor, and a cast-iron vertical column with dovetail slide. Two ball screws, each driven by a stepper motor, are used to move the table along the X axis (left and right) and Y axis (backward and forward) to feed the stock through the periphery of the end mill. A third ball screw, also driven by a stepper motor, is used to move the headstock along the Z axis (up and down) for positioning the end mill. The speed of each stepper motor can be programmed separately for feed rates up to 508 mm/min (20 in/min).

Main features

- 12-key membrane keypad with 20-character by four-line LCD display
- Stall indicator
- 746 W (1 hp) motor
- Rear panel input for 5250 TTL control
- Pneumatic vise output
- Connects to host computer through RS-232 or Ethernet port
- Sturdy construction, with larger, more powerful components than the light-duty CNC Mill

CIM Cell System



The CIM Cell System offers safe and affordable hands-on training and courseware for Computer Integrated Manufacturing (CIM). The work cell incorporates student skills learned throughout the Exploring Mechatronics program. Students gain an understanding of the various skills that are required to form a mechatronics system.

Many devices can be integrated into the work cell to perform various processes: a gravity or pneumatic feeder, a linear slide, a rotary carousel, a conveyor, and various devices for the transfer or storage of parts.

Topic coverage

- Milling a Part with the CNC Mill
- Control of the Servo Robot and Linear Slide Using the RoboCIM 5250 Software
- Control of a Manufacturing System that uses the CNC Mill and Servo Robot
- Control of the Servo Robot and Rotary Carousel using the RoboCIM 5250 Software
- Control of a manufacturing system that uses the Servo Robot, CNC Mill, and Rotary Carousel

Robot System



The Robot System is a complete training program for the programming and operation of industrial robots, through which students learn to create automated work cells.

A stepper motor, located in the base of the unit, provides horizontal rotation, while five additional stepper motors, located in the shoulder, provide precision movements of the articulations and end effector. The Robot has five axes of rotation plus a gripper and is able to use all joints simultaneously to perform a programmed move sequence. Each articulation can be controlled and moved independently. The base of the unit includes one connector for an external stepper motor which can be used for further experimentation.

The control/simulation software program – RoboCIM 5150 – provides students with a virtual 3D environment, allowing them to learn the fundamentals of robotics.

Topic coverage

- Introduction and Familiarization
- Programming
- Program Editing and Control Instructions
- Industrial Activity Simulation using a Belt Conveyor, a Rotary Carousel, and a Gravity Feeder

Main features

- Training program that allows easy learning of robotics basics
- Six stepper motor drives, two-finger gripper, power transferred from the stepper motor to the joints through mini HTP timing belts with anti-backlash design
- Durable steel and aluminum construction requiring minimal maintenance
- Available Robotics System Software Development Kit intended for developers who are interested in developing their own applications for the Robot System

Servo Robot Training System



The Servo Robot System is a complete training program for the programming and operation of industrial robots, through which students learn to create automated work cells ideal for Flexible Manufacturing Systems and Computer Integrated Manufacturing.

The Servo Robot is driven by servo motors equipped with optical encoders to provide feedback to the controller and has five axes of rotation plus a gripper. The Servo Robot can be operated in the Articular mode, which allows each articulation to be controlled and moved independently, or it can be operated in the Cartesian mode where the gripper moves linearly, parallel to a specified axis.

The control/simulation software program – RoboCIM 5250 – provides students with a virtual 3D environment allowing them to simulate and control the operation of the Servo Robot System.

Topic coverage

- Familiarization with the Servo Robot System
- Point-to-Point and Task Programs
- Program Editing
- Control Overview
- Industrial Application
- Simulation using a Gravity Feeder, Belt Conveyor, Pneumatic Feeder, Rotary Carousel, or Linear Slide

Main features

- Simulate and control the operation of a servo robot
- Ability to control the movements using Articular and/or Cartesian coordinates
- Robot can be controlled using either a teach-pendant or the software, RoboCIM 5250
- Robotics System Software Development Kit also available to develop custom applications for the Servo Robot System

Robot System (LV Series 5150-1)

#582490

Robot System with Teach Pendant (LV Series 5150-2)

#582497

Servo Robot System (LV Series 5250-1)

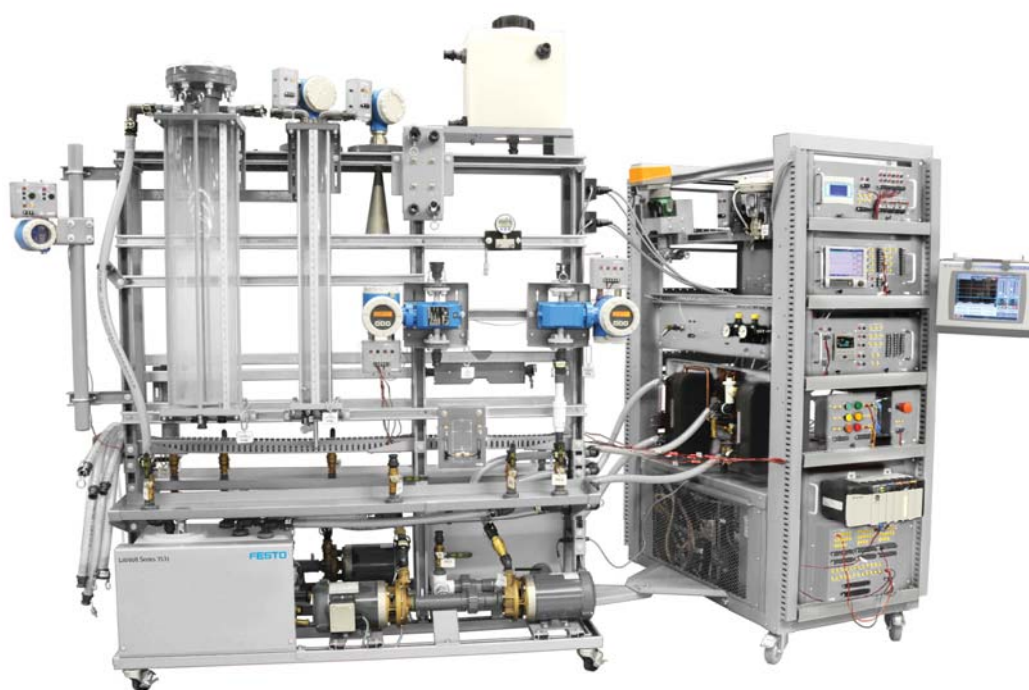
#582504

Servo Robot System with Work Surface (LV Series 5250-2)

#582508

Industrial Pressure, Flow, Level, and Temperature Process Training Systems

Theoretical and practical knowledge mandatory to work in the process control industry



* Process and Instrumentation workstations shown with optional equipment



Touch-Screen Graphic Terminal (10.4-in.)



FOUNDATION Fieldbus Add-on



AB CompactLogix PLC

The **Pressure, Flow, Level, and Temperature Process Training Systems** are modular systems that introduce students to a wide range of industrial processes, as well as their instruments and control devices. The training systems are part of the Instrumentation and Process Control program, which uses modern equipment and a complete curriculum to help students assimilate the theoretical and practical knowledge that is mandatory to work in the process control industry. Real processes can be replicated on this modular system in order to train employees without interfering with production. To maximize educational benefits, the teaching material covers industry standards for maintenance concurrently with the main training objectives.

The training systems allow students to:

- Measure and control process variables, such as pressure, flow, level, temperature, pH, and conductivity
- Create complex processes by adding optional components or by modifying the control strategies
- Create first and second order processes (interacting and non-interacting)
- Calibrate and set up the different smart transmitters and control valves

The systems feature two workstations:

The **Process Workstation** is the hub of the different processes to be investigated by the students. This double-sided, mobile workstation is equipped with two tanks, up to four centrifugal pumps, a rotameter, a drip tray, an instrumentation mounting pipe, ball valves, and process supports.

The **Instrumentation workstation** is designed to house the Electrical Unit and the Pneumatic Unit, as well as other electrical equipment, such as the variable speed drives. It aims to recreate the widespread industrial practice of separating the process environment from the instruments and controllers.

Pressure, Flow and Level Process Control -HART (LV Series 3531-A)	#582464
Temperature / Heat Exchanger Process Control -HART (LV Series 3531)	#582455
CompactLogix PLC (LV Series 3539-8)	#588522
PLC: AB CompactLogix (LV Series 46966)	#588383
FOUNDATION Fieldbus PLC Add-on (LV Series 3539-9)	#588524
Touch-Screen Graphic Terminal 10.4" (LV Series 46973-0)	#588409

Instrumentation Workstation – Siemens Solution



G120 PROFINET Drive



S7-1516 PLC



IPC 477 (19-in.)



ET200M HART

Main features

- Modular system that allows a wide variety of configurations
- Two-sided workstation that enables two student groups to work simultaneously
- Faults can be inserted by the instructor to develop the troubleshooting skills of the students
- Comprehensive curriculum
- Cost-effective solution
- Industrial-grade components, clear PVC piping
- Real-world, large-scale process loops implemented in a space-efficient work environment
- Different controller options depending on the objectives and budget
- Smart transmitters and control valves implemented using HART or FOUNDATION Fieldbus communication protocols
- Ethernet, Modbus, and PROFINET communication protocols also used with variable frequency drives/controllers
- Fast response temperature control system

- Advanced process control strategies such as ratio, feed-forward, and split-range
- Boiler simulation with three-element process control
- Real-time heat exchanger energy balance
- Environmentally-friendly temperature training system (no cooling water required)

Ability to use Allen-Bradley models on one side and Siemens models on the other

Siemens Solution

- Cost-effective solution for teaching industrial process control using Siemens devices
- Features the latest Siemens technology
- S7-1500 PLC series
- SIMATIC STEP 7 Programming software (TIA portal)
- PDM software
- SIMATIC ET 200M I/O module HART
- SINAMICS G120 drive
- WinCC Advanced V13

Pressure, Flow and Level Process Control Siemens – HART (LV Series 3531-E0)	#589668
G120 PROFINET Drive (LV Series 46975-E)	#589673
S7-1516 PLC (LV Series 3539-S)	#589670
ET200M HART (LV Series 46976)	#589674
HMI Industrial PC 19" (LV Series 46973-A)	#589672

Industrial DCS Process Control Demonstrator – Pressure, Flow, and Level



The Distributed Control System (DCS) is a modular demonstration unit capable of showing real-life process applications across a wide range of industries, including water and wastewater, oil refining, petrochemical, and food processing.

Each unit has two sections. The cart features the hardware, including valves, pumps, instruments and tanks, as well as the control panel with a controller, drive, variable frequency drives, managed switch, communication linking devices, input/output, switch and operator interface.

The control station desk consists of a touch-screen, all-in-one computer side-mounted on a mobile arm. Sections can function together or individually.

The unit uses the PlantPAx™ system from Rockwell Automation. It demonstrates all capabilities of the DCS process automation system, including how it works with temperature, pressure, flow, and level components, basic and advanced regulatory control capabilities, and complex process loops.

How the system integrates with Endress+Hauser instrumentation technology and the Plant PAx™ system for managing real-time data can also be observed.

Main features

- Smart transmitters using Hart, FOUNDATION Fieldbus, PROFIBUS PA, and Ethernet/IP
- Differential-pressure, radar, magnetic flow, and temperature transmitters
- Ethernet/IP communication for variable frequency drives
- ControlLogix PLC
- High-speed, touch-screen computer
- Industrial control cabinet
- Advanced network
- PID control and possibility to create cascade control loop strategies.
- Sequencer performing an automatic start-up sequence

Industrial pH and Conductivity Process Training System



The pH and Conductivity Process Training Systems are designed to introduce students to pH industrial processes and their associated instruments and controls. The modularity of the systems allows the instructor to select only the specific equipment necessary to attain the training objectives, without unnecessary equipment.

The pH and Conductivity Training Systems are available either as stand-alone systems or as add-ons to a 3531 system.

An optional conductivity process add-on is available to complement the basic 3532 system. The addition of optional equipment allows the system to be customized according to specific needs.

Topic coverage

- pH and conductivity measurements and instrumentation
- pH process control
- Chemistry
- Titration
- Water deionization
- Conductivity process control
- Troubleshooting

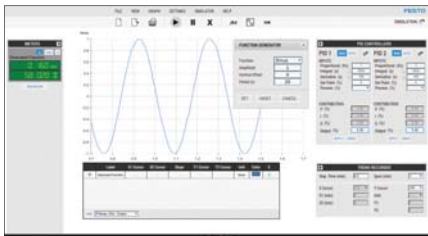
Main features

- Two workstations: the batch and continuous process workstation and the instrumentation workstation
- Can support either the HART or the FOUNDATION Fieldbus communication protocols
- Comprehensive curriculum
- Faults can be inserted by the instructor to develop the troubleshooting skills of the students
- Cost-effective solution
- Industrial-grade components, clear PVC piping
- Different controller options depending on the objectives and budget

pH Process Training System Allen-Bradley – HART (LV Series 3532)	#588494
pH Process Training System Allen-Bradley – FOUNDATION Fieldbus (LV Series 3532-1)	#588503
Conductivity Process Add-On – HART (LV Series 3532-C)	#588501
Conductivity Process Add-On – FOUNDATION Fieldbus (LV Series 3532-D)	#588502
Several other add-ons and options are available.	

Industrial Air Pressure/Flow Process Training System

I/O Interface with LVProSim



The Air Pressure/Flow Process Training Systems introduce students to process instruments and control performed on air processes. The training systems are part of the Instrumentation and Process Control program, which uses modern equipment and a complete curriculum to help students assimilate the theoretical and practical knowledge that is mandatory to work in the process control industry.

The modularity of the systems allows instructors to select only the specific equipment necessary to attain the training objectives, without unnecessary equipment. Several configurations are available for a single workstation. Adding optional equipment can increase the number of these configurations.

Topic coverage

- Air pressure and flow basics
- Air pressure and flow measurements
- Air pressure and flow process control

Main features

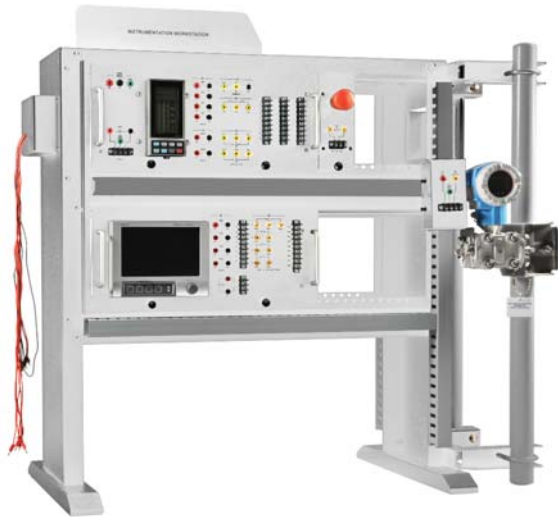
- Complete training program helps students to assimilate theoretical and practical knowledge
- Comprehensive curriculum
- Can support either the HART or the FOUNDATION Fieldbus
- Cost-effective solution
- Industrial-grade components, clear PVC piping
- Different controller options depending on the objectives and budget

Compatible with the 3531 systems, the **I/O Interface with LVProSim** module interfaces with a computer for data acquisition and PID control of a real process and provides interconnection between the process devices and the computer. It performs analog signal and digital signal conversions and sends the information to LVProSim, a process control software included with the interface.

LVProSim has two main features: it can operate as a process controller as well as a generic process simulator. LVProSim's modern web interface makes it easy to use, helping students focus on learning process control. LVProSim is free to use and can be downloaded without charge.

Air Pressure/Flow Process Training System – HART (LV Series 3533)	#588505
Air Pressure/Flow Process Training System Allen-Bradley – FOUNDATION Fieldbus (LV Series 3533-1)	#588506
I/O Interface with LVProSim (LV Series 9065-B)	#763509

Dual-Sided Instrumentation Workstation



Shown with optional models (PID Controller, Recorder, Transmitter, e-Stop)



Shown with optional models (CompactLogix PLC, HMI, Transmitter)

The Instrumentation Workstation is designed to house devices such as controllers, PLCs, Color Paperless Recorders, and Touch-Screen Graphic Terminals and was developed to expand the Small-Scale Process Control Training System with industrial devices.

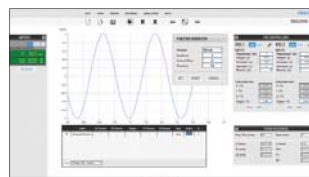
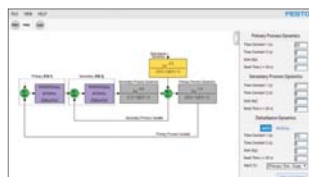
The workstation allows two student groups to work simultaneously. It features two Instrumentation Mounting Pipes to install instruments, usually differential-pressure transmitters, at the appropriate height and close to the point of measurement. The mounting pipe replicates the common indus-

trial practice of installing a measuring instrument directly on the process pipe or on an adjacent one.

The structure is pre-assembled, made of steel, and intended for use on a table (not supplied; offered as option).

Four pairs of mounting rails firmly hold the modules of the Process Automation line of products in place. One holder on each side permits users to neatly arrange the test leads. A touch-screen computer mount (not supplied; offered as option) can be attached to either side.

Small-Scale Process Control Training Systems



The Process Control Training Systems form a complete program designed to familiarize students with the fundamentals of instrumentation and process control. They are a cost-effective alternative to systems using industrial grade components, and fit the training needs of instructors wishing to teach process control fundamentals in any vocational school or college.

The systems demonstrate the control of pressure, flow, level, temperature, and pH processes and can also demonstrate advanced process control techniques, such as feedforward control, second-order control, and cascade control when used with a controller featuring these functions.

Pressure, Flow, and Level Process Control Training System (LV Series 6090-1)	#588661
Temperature Process Control Add-On (LV Series 6090-2)	#588667
pH Process Control Add-On (LV Series 6090-3)	#588674
Pressure/Flow/Level Process Control Training System Entry-Level (LV Series 6090-8)	#589633
Pressure/Flow/Level/Temperature Process Control Training System Entry-Level (LV Series 6090-9)	#589638

Options and add-ons are available at www.labvolt.com.

A large selection of PID controllers and programmable logic controllers is available to control the processes. Industrial transmitters can also be used with this system.

The basic trainer demonstrates PID (proportional, integral, derivative) control of flow, pressure, and level processes. It comes with a variable-speed pump, a tank, a column, two-way valves, pressure gauges, flexible hoses, a venturi tube, an orifice plate, a rotameter, a paddle wheel flow transmitter, and a differential pressure transmitter. Add-on equipment includes Temperature Process Control, pH Process Control, Industrial Heat Exchanger, and Industrial Pressure, Flow, and Level.

The trainer processes can be controlled by a computer-based PID Controller through the use of a personal computer, the included Process Control and Simulation Software (LVProSim), and the optional

I/O Interface. The trainer processes can also be controlled using any conventional PID controller compatible with standard 4-20 mA signals or 0-5 V signals.

Topic coverage

- Pressure, Flow, and Level Processes
- PID Controller and Process Control
- Temperature Processes and Measurement
- pH Control and Measurement
- Process Dynamics
- Proportional Plus Integral/Derivative Control Mode

Main features

- Many work surface, bench, and panel options, stainless-steel drip tray, and lockable storage
- Cost-effective solution
- Wide range of add-ons and optional components to expand learning
- Movable components build a foundation of knowledge one device at a time, making it easier to teach circuit assembly
- Create circuits to mimic industry-specific process control applications
- Fault switches on most of the industrial components enable real-world troubleshooting
- HART, Ethernet/IP, PROFINET, or FOUNDATION Fieldbus communication protocols
- Environmentally-friendly temperature training system (no cooling water required)
- Process control simulation software available
- Curriculum available as job-sheets in standard student activity manuals or in PDF format on CD-ROM as a site license
- Innovative approach that also allows interconnection with other products, such as pneumatics applications, PLCs, etc.

Radar Training System



The radar system combines real-world radar with the power of modern surveillance technology, using patented technology to detect and track passive targets at very short range in the presence of noise and clutter. The computer-based control of the radar's processing and display functions ensures its longevity as a leading-edge pedagogical tool. The system provides students with real — not simulated — hands-on experience. It consists of seven subsystems, allowing instructors to configure a system tailored to their training needs and budget.

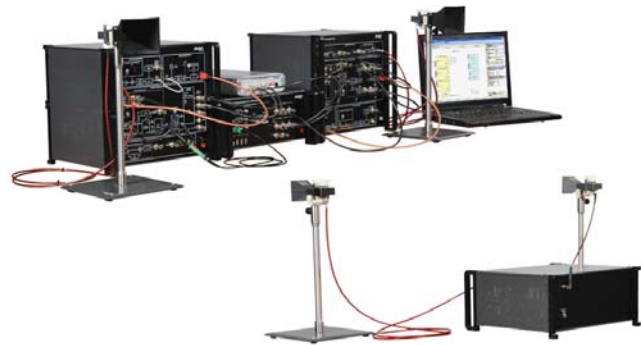
Topic coverage

- Principles of Radar Systems
- Analog MTI Processing
- Digital MTD Processing
- Tracking Radar
- Radar in an Active Target Environment
- Phased Array Antenna Radar
- Radar Cross-Section (RCS) and ISAR measurement
- Synthetic Aperture Radar (SAR) measurement

Main features

- Powerful, computer-based DSP, FPGA, and Data Acquisition System for Digital Analysis
- Realistic, high-gain parabolic antenna for high azimuth (angular) resolution
- Very high range resolution that allows classroom operation
- Fault-insertion capability
- Turnkey, cost-effective solution includes courseware and instrumentation
- Operates safely inside a lab

Satellite Communications Training System



Designed for hands-on, system-level training, this platform teaches modern telecommunications technologies using a fully-operational satellite link. Students can observe and study a wide range of concepts, such as analog and digital modulation, bandwidth and spectral efficiency, TDM, scrambling, encoding, frequency conversion, etc. It was awarded the 2012 Worlddidac Award for Best New Training System.

Main features

- Realistic system reflecting modern standards
- Uses license-free transmission and low power levels for complete safety
- Can be interfaced with external analog or digital equipment
- Fault-insertion capability

Optional telemetry and instrumentation add-on expands learning and lowers cost of measuring equipment

Topic coverage

- Satellite Communication Fundamentals
- Analog and Digital Transmission
- Link Characteristics and Performance
- Satellite Payloads and Telemetry
- Orbital Mechanics
- Satellite Orbits and Coverage
- Antenna Alignment for Geostationary Satellites
- Troubleshooting



Orbit Simulator Software

The software provides interactive visualization of satellite orbital mechanics and satellite coverage and illustrates the theory behind antenna alignment with geostationary satellites. Students can see unfamiliar concepts in action, such as inertial and rotating frames of reference and coordinate systems, etc.

eSeries Radar Training System SW Package (LV Series 9670-E)	#587463
Basic Radar Training System (LV Series 8096-1)	#582087
See website for add-ons	

Satellite Communications Training System (LV Series 8093)	#582081
Telemetry and Instrumentation Add-On (LV Series 8093-1)	#582084
Orbit Simulator Software (LV Series 9581)	#581877

Telephony Training Systems



The Telephony Training Systems are powerful learning tools that allow students to become familiar with the operation of modern telephone networks and digital private automatic branch exchanges (PABX). The training systems are also essential tools to introduce students to the Integrated Services Digital Network (ISDN).

The systems are built upon state-of-the-art, programmable equipment that operates real-world devices, including telephone sets and phone lines. The cornerstone is the Reconfigurable Training Module. This module, which uses digital signal processor (DSP) technology, can be programmed to act as different parts of a telephone network, such as a digital central office (CO) of the public switched telephone network (PSTN) or a digital PABX. Analog and digital interface cards, which the students install in the training module, allow connection of real analog and digital telephone sets and trunk lines.

Topic coverage

- Analog Access to the Telephone Network
- Multiplexing and Circuit Switching
- Central Office Operation
- Digital PABX
- PABX Analog Trunk
- Digital Trunk

Main features

- Powerful system for studying widespread telephone networks
- Provides the flexibility of a simulation, with the realism of real-life equipment
- Can be configured for different international standards
- DSP-based reconfigurable training system easily upgradable to emerging new standards and systems
- When configured as a digital PABX or when a digital trunk is set up, system allows study of the physical and network layers
- Can be configured as a digital CO of the public switched telephone network (PSTN) or as a digital PABX
- Fault-insertion capability

Telephony Training System – Analog Telephone (LV Series 8086-1)	#587496
Telephony Training System – Digital Telephone Add-On (LV Series 8086-2)	#587502
Telephony Training System – Analog Trunk Add-On (LV Series 8086-3)	#587505
Telephony Training System – Digital Trunk Add-On (LV Series 8086-4)	#587508

Communications Technologies Training Systems



Specifically designed for hands-on training in a wide range of communication technologies, beginning with basic pulse modulation techniques and various digital modulation schemes and extending to modern, spectrally efficient, digital communication techniques. Each training system covers specific topics and uses real frequencies – not simulations.

Main features

- Modular system reflecting modern standards
- Fault-insertion capability
- MATLAB® Import/Export in ADSL applications
- Flexible, open system using a high performance DSP-based Reconfigurable Training Module (RTM)
- Short-circuit-proof, low-power for safety and compatibility

Companion Software and RTM

The systems use the LabVolt Communications Technologies (LVCT) software along with a Reconfigurable

Training Module (RTM) to implement hardware; together these components provide tremendous flexibility at a reduced cost.

Topic coverage

- Pulse Modulation and Sampling
- Digital Modulation
- Basic Modems and Data Transmission
- Quadrature Phase Shift Keying
- Quadrature Amplitude Modulation
- Asymmetric Digital Subscriber Line
- Spread Spectrum
- Troubleshooting

Available systems and coverage

- System 1: PAM, PWM, PPM, Spectrum Analysis
- System 2: System 1 plus PCM, DPCM, Delta Modulation
- System 3: System 1 and 2, plus ASK, FSK, BPSK,
- System 4: Systems 1 through 3, plus QPSK, DQPSK, DQAM, QAM, ADSL
- System 5: Systems 1 through 4, plus DSSS, FHSS, CDMA

Communications Technologies Training System – System 1 (LV Series 8087-1)	#582025
Communications Technologies Training System – System 2 (LV Series 8087-2)	#582028
Communications Technologies Training System – System 3 (LV Series 8087-3)	#582030
Communications Technologies Training System – System 4 (LV Series 8087-4)	#582032
Communications Technologies Training System – System 5 (LV Series 8087-5)	#582036

Microwave Technology Training System with LVDAM-MW



This computer-assisted training system is a complete, state-of-the-art microwave training program that includes data acquisition and instrumentation. Specifically designed for hands-on, system-level training, this integrated package of software, hardware, and courseware contains all power supplies, high-quality microwave components, and accessories required to perform the experiments.*

Experiments are performed using the Data Acquisition and Management for Microwave Systems software (LVDAM-MW), built around a Data Acquisition Interface (DAI) that performs 12-bit A/D acquisition on four channels. It uses the acquired data to calculate and display the values of power and SWR measurements on a computer screen. This approach eliminates the need for a separate power meter and standing-wave ratio (SWR) meter, thereby providing high flexibility at a reduced cost.

*The training system is also available with stand-alone instruments which do not require a computer.

Topic coverage

- Basic principles of microwave signals
- Propagation, Detection and Measurement of Microwaves
- Study of Components, such as Gunn Oscillator, Directional Coupler, Tees, PIN diodes, etc.

Main features

- Microwave devices and components fabricated from electroless-plated brass to standard X-band waveguide dimensions
- Waveguide flanges joined by precision quick fasteners, allowing rapid assembly and disassembly of system configurations
- Virtual instrumentation for the LVDAM®-MW software: Power Meter, SWR Meter, Oscilloscope, PIN diode bias meter, frequency meter, data table, and smith chart
- Safe, low-power operation levels

Antenna Training and Measuring System



The Antenna Training and Measuring System is a complete, cost-efficient, working system for hands-on experimentation on antennas in the 1 GHz and 10-GHz bands. It can be used by students in a classroom, as well as by design and research teams.

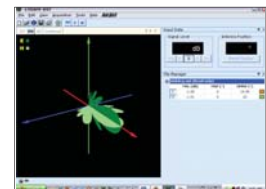
The system includes sets of antennas, an RF generator, and a receiving system with a rotating antenna positioner, linked to a data acquisition interface. It is designed for low-power, safe operation allowing measurements of antenna characteristics (radiation pattern).

Main features

- Stand-alone system that does not require an anechoic chamber
- Microwave devices and components are fabricated from electroless-plated brass to standard X-band waveguide dimensions
- Waveguide flanges are joined by precision quick fasteners, allowing rapid assembly and disassembly of microwave circuits

Topic coverage

- Basic Antenna Measurements
- Measurement and Display of Antenna Radiation Pattern
- Experimentation with Different Antenna Types
- Microstrip and Array Antennas
- Optional Multi-Beam Array Antenna
- Optional Two Elements Antenna Phasing



LVDAM-ANT Software

This software provides a toolbox for adjusting attenuation to prevent saturation, controlling antenna rotation and data acquisition, as well as for displaying measured antenna characteristics in the E and H planes (Radiation Pattern). It also includes algorithms for estimating beam width and antenna gain from measured characteristics.

Microwave Technology Training System with LVDAM-MW (LV Series 8091)	#582068
Microwave Technology Training System (LV Series 8090)	#582043

Antenna Training and Measuring System (LV Series 8092)	#582074
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Analog Communications Training System



A comprehensive program enables instructors to teach the principles of analog communications, both in theory and in practice, using a variety of training environments. The system consists of six instructional modules supported by six instrumentation modules. A door on the top of each instructional module provides access to circuit boards, test points, and fault-insertion switches.

Main features

- Unequaled, comprehensive system
- Hands-on experience in the generation, transmission, and reception of analog communications signals
- System design allows voltage and signal measurements, alignment, calibration, and signal tracing
- Noise can be introduced to simulate atmospheric disturbances, and to provide realistic signal-to-noise evaluation
- Fault-insertion capability

This system is also offered with the Data Acquisition and Management for Telecommunications (LVDAM-COM), a computer-based system for measuring, observing, and analyzing signals in telecommunications systems.

Topic coverage

- Basic Concepts and Equipment
- Spectral Analysis
- Amplitude Modulation (AM) and Frequency Modulation (FM)
- Double- and Single-Sideband Modulation (DSB and SSB)
- Narrowband Angle Modulation
- Troubleshooting AM and FM Communication Systems
- Frequency Division Multiplexing

Simulation software

The Analog Communications Simulation software LVSIM-ACOM covers the same courseware as the physical training system and recreates a 3D classroom laboratory on a computer screen. Students can install and connect equipment in the laboratory, perform a lab exercise, and obtain the same results as with the actual training equipment. Several license options are available.

Digital Communications Training System



The Digital Communications Training Systems form a complete and operational communications program. They use IC technology to implement signal modulators and demodulators that operate at standards employed in digital communications technology. The systems are equipped with various features that enhance hands-on learning: easy access to test points, fault-insertion switches, safety shielding and full short-circuit protection, silk-screened block diagrams and component labels, and fully-integrated courseware. Instructors can achieve a wide range of objectives at various levels.

Main features

- Uses IC technology to implement signal modulators and demodulators
- Courseware guides students through lab exercises in voltage and signal measurements, alignment, calibration, and signal tracing
- Equipment protected from short-circuit and over-voltage
- Fault-insertion capability

The Digital Communications Training system is also offered with the Data Acquisition and Management for Telecommunications (LVDAM-COM), a computer-based system for measuring, observing, and analyzing signals in telecommunications systems.

Topic coverage

- Pulse Modulation and Sampling (PAM, PWM, PPM)
- Digital Modulation (PCM, DPCM, Delta)
- Modems and Data Transmission (ASK, FSK, BPSK)
- Troubleshooting

Simulation software

The Digital Communications Simulation software, LVSIM-DCOM, covers the same courseware as the physical training system and recreates a 3D classroom laboratory on a computer screen. Students can install and connect equipment in the laboratory, perform a lab exercise, and obtain the same results as with the actual training equipment. Several license options are available.

Analog Communications Training System (LV Series 8080)	#581994
Analog Communications Training System with LVDAM-COM (LV Series 8080-A)	#582011
Analog Communications Simulation Software LVSIM-ACOM for 1 user (LV Series 9480)	#581695

Digital Communications Training System (LV Series 8085-1)	#582001
Digital Communications Training System with LVDAM-COM (LV Series 8085-B)	#582018
Digital Communications Simulation Software LVSIM-DCOM for 1 user (LV Series 9481)	#581746

We are here to help

Support services provide added value to your equipment



People-oriented services

- Installation
- Commissioning
- Learning-system trainings
- After-sales support

Easily set up your teaching environment

For a quick and easy installation of your new equipment, our team is available. We will set up your equipment and install any related software.

Our team will also be able to verify that everything works as it should so that you can have peace of mind. We certify that your equipment will be up and running when our team is done.

Leverage the knowledge of expert trainers

Instructors who have to integrate a new learning system may be overwhelmed by the complexity of getting acquainted with it – or may simply lack the time – in order to use it to its full potential.

You have access to our experts to supply instructor trainings adapted to your needs. These trainings lead to a quicker integration of the new equipment into your programs and ensures your instructors are well-prepared to maximize student learning.



For more information about installation, commissioning, and trainings, or if you need assistance, please contact us at services.didactic@festo.com

Your Ideal Partner for Technical Education



We support and assist you

Festo Didactic offers a wide range of systems and solutions for technical education.

We help you design and implement learning laboratories, educational equipment, and programs that train people to perform in highly dynamic and complex environments.

Our experienced Solution Centers teams can also customize solutions that perfectly match specific, unique training requirements of educational institutions or industrial companies.



Maximize learning success

Train-the-trainer sessions can be organized so that instructors better know how to use LabVolt Series training systems and successfully integrate their use in the curriculum.

You can also take advantage of a variety of training and consulting options that represent a cost-effective way to increase the return on your investment. Training sessions, workshops, and seminars are organized to support customers.

Festo Didactic also owns and/or operates Learning Centers on behalf of companies and governments in many countries. Contact us to learn more.



Service with value added

Festo Didactic takes pride in offering you high quality products and world-class support.

Festo Didactic provides its customers with training systems that can withstand rigors of repeated hands-on training. Products (except consumables) come with a two-year warranty.

Customer services will also support you in the event of trouble with the equipment or if you need spare parts.

Whether you need information, are looking for advice before making an investment, or have questions about the use of our products, we are always only a phone call or an email away.

Important

Unless otherwise specified, LabVolt Series training systems displayed in the current document do not have the CE marking (CE), and therefore cannot be sold in Europe.

As a result of continuous development and research work, technical specifications, textual information, pictures, and illustrations are subject to change. They are not binding. The specified data serves purely as a product description and is no guarantee in a legal sense. Please contact our sales department before placing an order.

For further information

All LabVolt Series training solutions are detailed on www.labvolt.com.

Information about other Festo Didactic solutions can be found at www.festo-didactic.com.

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