

Lab-Volt®

Wind Turbine Technology



Wind Turbine Technology: Workforce-Ready, Hands-On Training

Not long ago, wind power generation seemed an economically unattainable utopian goal. Today, much of the world is embracing this technology, with wind farms becoming more and more prevalent. As a result, there is a high demand for Wind Turbine Technicians, and while new programs about wind power technology are flourishing in colleges and universities worldwide, the need for hands-on training systems in this technology is acute.

To answer this need, Lab-Volt Systems, Inc. is proud to lead the way in offering hands-on training programs in Wind Power Technology. With over 50 years of dedicated Electrical and Mechanical training systems development, Lab-Volt continues to be at the forefront of safe, highly-regarded learning environments and the first choice for teachers and departments who want the best programs for their students.

REAL-WORLD COMPREHENSIVE TRAINING FOR WIND TURBINE TECHNICIANS

The growing demand for wind energy has resulted in the rapid growth of hiring in this industry and the need for Wind Turbine Technicians is acute. Wind Turbine Technicians handle the maintenance and repair of wind turbines. Wind turbine technicians must be agile and safety-conscious. The work is demanding and requires a thorough knowledge of hydraulics, mechanical devices, electric power generation, worksite safety, electricity, and electronics, with many of the job responsibilities taking place 300 feet (91.44 meters) above the ground.

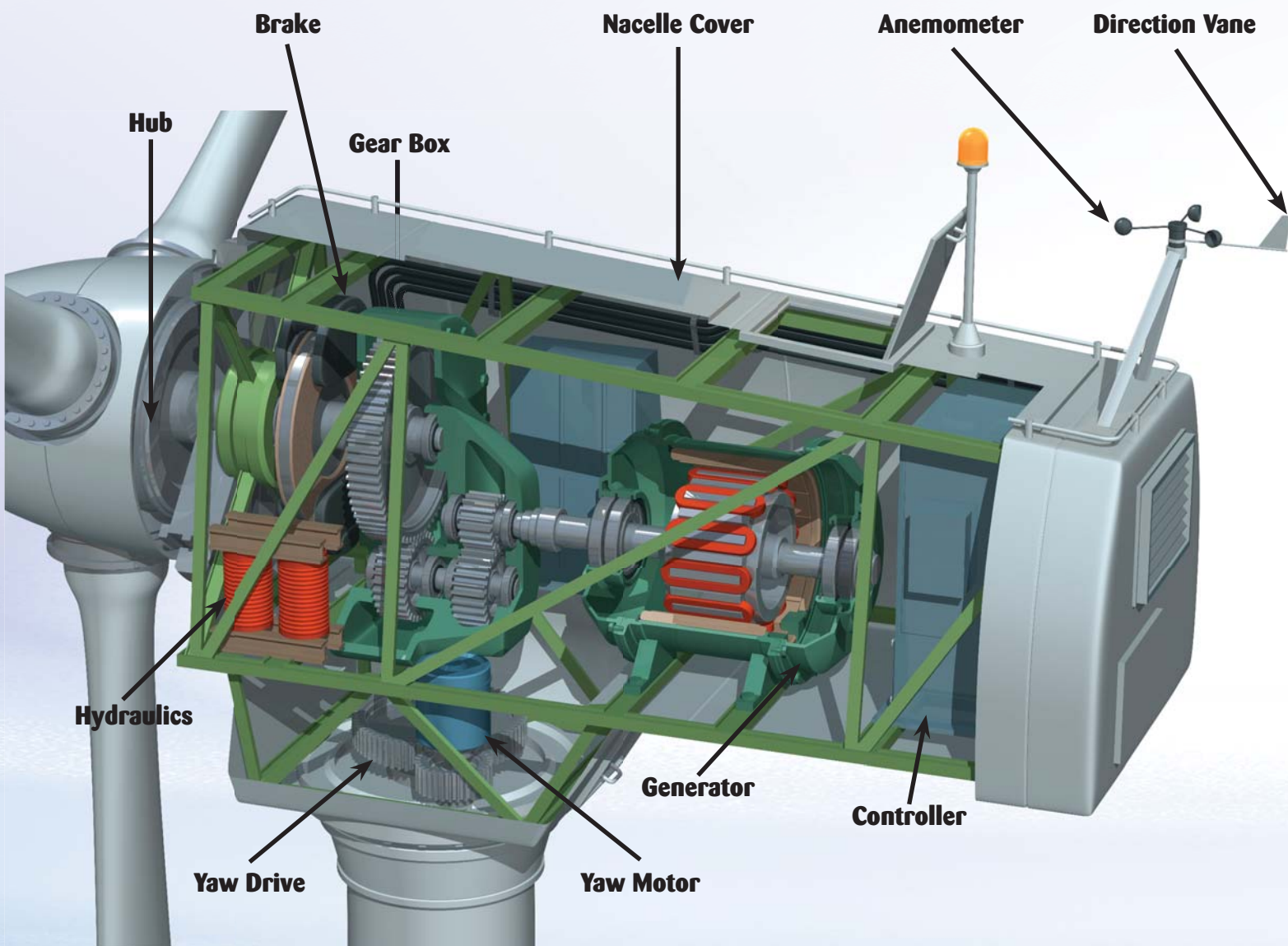
Lab-Volt's Wind Turbine Technology program offers comprehensive coverage in all of these areas, as well as cross-technology troubleshooting and problem-solving, preparing students for jobs in the wind power energy industry. Lab-Volt's program also incorporates hands-on training using real-world equipment and comprehensive simulation software covering wind farms and grid-tied systems.





WIND TURBINE TECHNICIAN SKILLS COVERAGE

- Energy Fundamentals
- Mechanical Systems
- Hydraulics
- Electrical Fundamentals
- Programmable Logic Controllers (PLC)
- AC/DC Motors and Drives
- DC Power Electronics
- DC Power Circuits
- Electric Power Transmission, Generation, and Distribution
- Computer-Assisted Wind Power Technology
- Power Electronics
- Rigging Systems
- Safety



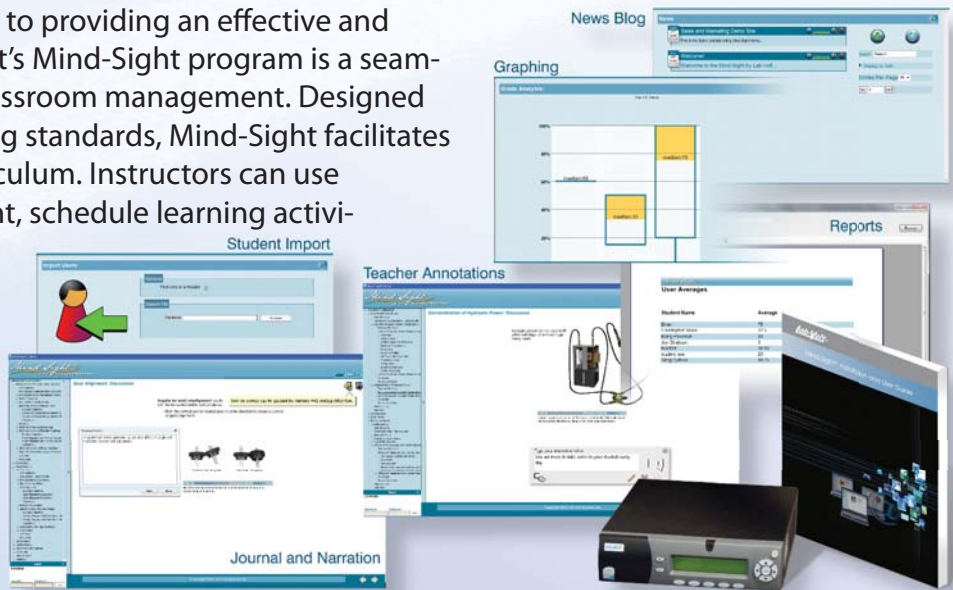
TARGETED TROUBLESHOOTING AND PROBLEM-SOLVING

For over 50 years, Lab-Volt has been the consistent leader in hands-on technical training and technical skill development. Relying on decades of satisfied users, as well as feedback from the power utility industry, wind power companies, and professional educators, Lab-Volt has developed hands-on training that fits the needs of the emerging wind power energy and turbine technology programs and is designed to meet a variety of training objectives.

Lab-Volt's unparalleled computer-based fault insertion capabilities allow instructors to set faults, requiring students to locate, isolate, and troubleshoot malfunctions through a series of troubleshooting steps, enabling students to understand and safely operate industrial-type equipment, while developing troubleshooting and problem-solving skills that will help prepare them for on-the-job challenges.



Student tracking and management is key to providing an effective and successful learning environment. Lab-Volt's Mind-Sight program is a seamless integration of course delivery and classroom management. Designed around the most up-to-date programming standards, Mind-Sight facilitates Lab-Volt's Wind Turbine Technology curriculum. Instructors can use Mind-Sight to manage student enrollment, schedule learning activities, customize courseware and track student achievement as they work through the modules. Currently, Mind-Sight is a LAN-based solution to deliver curriculum locally, however, it will ultimately be a web-based solution so that students can log on and study from anywhere at any time!



- SCORM-Compliant Courseware
- Flexible Scheduling Options
- Easy Grade Viewing
- Real-Time Data Collection
- Simple Report Generation
- Competency Testing
- Manual Skill Assessment

WIND TURBINE SYSTEMS

Wind Turbine Nacelle Training System

The Wind Turbine Nacelle Trainer is a complete scaled-down version of commercial wind turbine nacelles. 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 and features a 24" slewing bearing, a gearmotor, a drive, a position sensor and fail-safe hydraulic brakes. 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, with all the other electrical components.



Topic Coverage

- Introduction to Energy Production with Wind Power
- Machine Safety
- Introduction to SCADA
- Transmission System
- Hydraulic Braking System
- Wind Turbine Operation
- Electrical System
- Heating/Cooling Systems
- Troubleshooting

Wind Turbine Hub Training Systems

Lab-Volt offers two Wind Turbine Hub Training Systems – an Electrical Pitch Control Trainer and a Hydraulic Pitch Control Trainer – featuring all the components typically found in the hub of a commercial wind turbine and a representation of the wind turbine blade. Each Hub Trainer 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.



Electrical Hub Trainer shown front and left side.

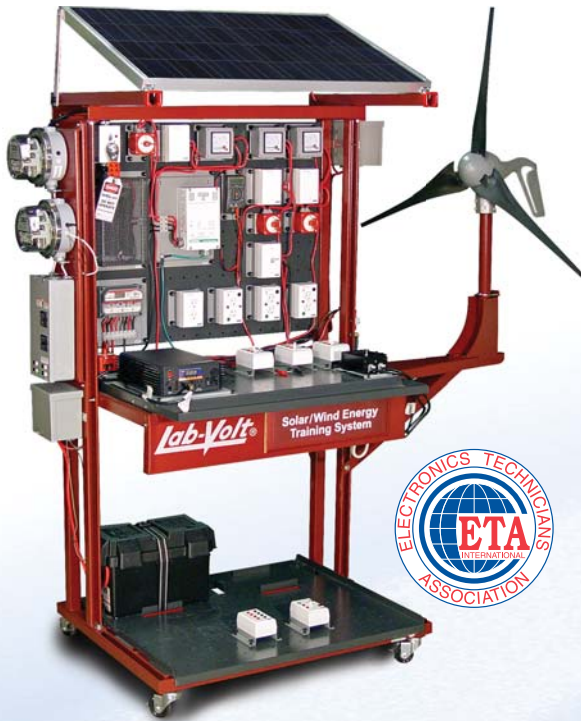
Topic Coverage

- Introduction to Energy Production with Wind Power
- Machine Safety
- Introduction to SCADA
- Rotor
- Electric Pitch Control Operation (Electrical Pitch Hub Trainer Only)
- Hydraulic System (Hydraulic Pitch Control System Only)
- Hydraulic Pitch Control Operation (Hydraulic Pitch Hub Trainer Only)
- Electrical System
- Back-Up Power
- Troubleshooting



WIND TURBINE SYSTEMS

Solar/Wind Energy Training System, Model 46120



The Solar/Wind Energy Trainer forms a complete hybrid energy training system. This program demonstrates how wind turbines and solar cells are being used in the consumer and industrial markets to supplement the world's power needs.

The program explores solar and wind as energy sources that can be used to help reduce dependence on non-renewable fuel sources. Students gain a global perspective when they understand the economics, efficiency, and low environmental impact of producing energy from non-polluting, renewable sources.

Topic Coverage

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

Grid-Tie Training System

Lab-Volt's Grid-Tie Training System provides hands-on training in developing the skills required for installing a grid-tied system. The Grid-Tied Systems trainer includes an AC Distribution Panel, Combiner Box, Sunny Boy Grid-Tie Inverter, AC and DC Cut-offs, and a string inverter simulator. The Lab-Volt Grid-Tie Training System provides topic coverage of a typical system configuration.

- Grid Connected Equipment
- Utility-Interactive Software
- The NEC



Preliminary system shown. Subject to change.



WIND TURBINE TRAINING SYSTEMS

Mechanical Training System, Series 46101



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

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

Topic Coverage

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

Industrial Controls Training System, Series 8036



The Lab-Volt Industrial Controls Training System has unique controls training capabilities, which are enhanced by its modularity and its instructor-inserted faults.

The system allows students to select and mount control devices to form typical control circuits, and to troubleshoot them once a fault is inserted.

Topic Coverage

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



WIND TURBINE TRAINING SYSTEMS

Rigging Training System, Model 46109



The Lab-Volt Rigging System was created to cover the fundamentals of rigging practices, including techniques to help students move and install machines safely.

The mobile beam-style gantry is designed to conform to OSHA and CMAA standards. This 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
- Cranes and Hoists
- Machine Installation
- Machine Movement
- Lifting Objects and Unbalanced Loads

Industrial Wiring Training System, Model 46102

The Lab-Volt Industrial Wiring Training System, Model 46102 faithfully reproduces an industrial environment where students can develop their skills in the installation and wiring of industrial electrical equipment, in compliance with the National Electrical Code® (NEC®).

The system can also be used to teach trainees how to adjust and maintain industrial electrical equipment as well as enforce the safety rules to be followed when working at industrial sites.



Topic Coverage

- Enclosures and Conduits
- Electrical Power Distribution
- Electrical Wiring
- Three-Phase Motor Starters
- AC Motor Drive
- DC Motor Drive



WIND TURBINE TRAINING SYSTEMS

Hydraulics Training System, Series 6080



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

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

Topic Coverage

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

PROGRAMMABLE LOGIC CONTROLLERS

Lab-Volt's Programmable Logic Controller (PLC) trainers enable students to develop competence in operating, programming, and troubleshooting modern PLC-controlled circuits found in wind turbine and other industrial applications.

Model 3240-30



Model 3240-B0



Topic Coverage

- Familiarization with the PLC Trainer and with the RSLogix 500 PLC Programming Software
- Programming Basics
- Online Operations
- Latching Instructions
- Timer Instructions
- Counter Instructions
- Sequencer Instructions
- Comparison Instructions
- Shift Register Instructions/The Force Function

Other PLCs and PLC applications are also available. Please see our PLC Guide for more information.



WIND TURBINE ELECTROMECHANICAL SYSTEMS

Renewable Energy Basic Training System

This foundational training system introduces students to both wind power and solar power, two popular sources of renewable energy with zero greenhouse gas (GHG) emissions, and requires only a basic knowledge of electricity principles. This course also introduces lead-acid batteries which are used to store electrical energy produced from wind power or solar power. The Wind Turbine Generator/Controller (Model 8216-0), allows students to study Wind Turbine operation and small scale production of electrical energy.



Program Coverage

- DC Power Circuits
- Lead-Acid Batteries
- Solar Power
- Wind Power
- Ni-MH Batteries
- DC Power Electronics: Diodes, IGBTs, and Choppers
- Battery Chargers and Small Electric Vehicles



0.2-kW Electromechanical Training System, Model 8001/8006/LVSIM/DACI/LVDAC-EMS

The Lab-Volt 0.2-kW Electromechanical Training System, deals with the different techniques associated with the generation and use of electrical energy. All machines have cutaway bell housings to permit visual inspection of the internal construction and observation of the machine during operation. LVSIM®-EMS is a virtual classroom laboratory in which students can install an EMS training system, set up equipment, and perform exercises, just as if actual EMS equipment were being used. Data Acquisition and Control interface (DACI) is a versatile USB peripheral used for measuring, observing, analyzing, and controlling

electrical and mechanical parameters in electric power systems and power electronics circuits.

These instruments and control functions are accessed through the Lab-Volt Data Acquisition and Control for Electromechanical Systems (LVDAC-EMS) software.

Topic Coverage

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



WIND TURBINE ELECTROMECHANICAL SYSTEMS

Computer-Assisted 0.2-kW Wind Power Technology Training System, Model 8052

The Lab-Volt Computer-Assisted 0.2-kW Wind Power Technology Training System covers electrical basics, from Ohm's law and complex impedance through single- and three-phase transformers, typical wind power asynchronous generator principles, and synchronization, as well as doubly-fed induction generators and the associated power electronic converters.



Topic Coverage: 8052-00

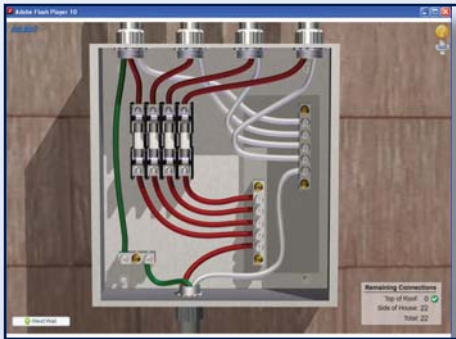
- Fundamentals for Electrical Power Technology
- Alternating Current
- Capacitors in AC Circuits
- Inductors in AC Circuits
- Power, Phasors, and Impedance in AC Circuits
- Three-Phase Circuits
- Single-Phase Transformers
- Special Transformer Connections
- Three-Phase Transformer

SIMULATION SOFTWARE AND ONLINE PROGRAMS

Grid-Tie Systems Simulation Software, Model 46120-A0

Topic Coverage

- Grid Connected Equipment
- Utility-Interactive Software
- The NEC



ITZ Renewable Energy Online Training Program, Model 47919

Topic Coverage

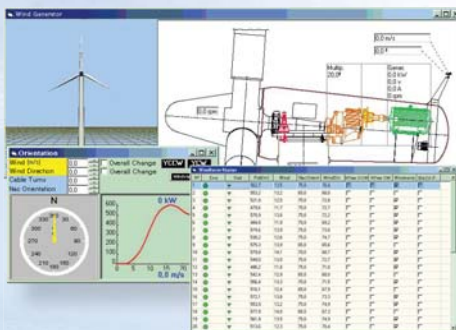
- Safety
- Mobile Hydraulics
- Mobile Electrical
- PLC Fundamentals
- AC/DC Motors and Drives
- Mechanical



Wind Farm Simulation Software

Topic Coverage

- Wind Turbine Block Diagram
- Structure of the Simulator
- Initial Start-Up
- Simulators used in the Program





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