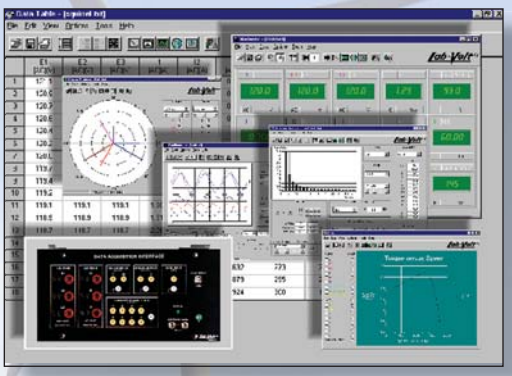
COMPUTER-ASSISTED WIND POWER TECHNOLOGY

Electromechanical Training System 0.2 kW

Models 8052-00 and 8052-10

Description



Lab-Volt Systems, Inc. is proud to lead the way in offering a new hands-on training program 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.

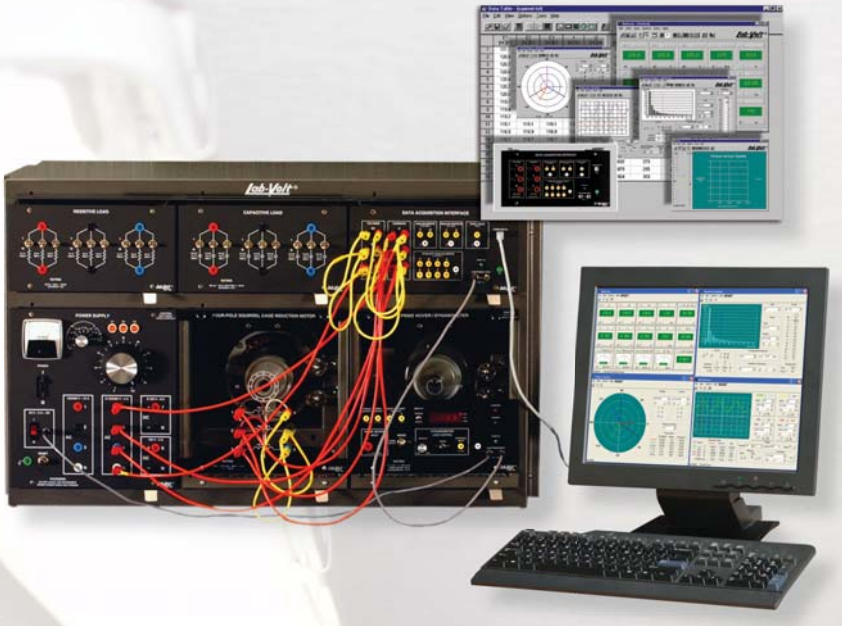
Relying on decades of satisfied users, as well as feedback from the power utility industry, wind power companies, and professional educators, Lab-Volt has developed a "hands-on" training system that fits the needs of the emerging wind power energy and turbine technology programs and is designed to meet a variety of training objectives.

The Lab-Volt Computer-Assisted 0.2-kW Wind Power Technology Training System, Model 8052-00 *Wind Power Technology: Power Systems*, covers electrical basics, from Ohm's law and complex impedance through single- and three-phase transformers and forms a modern modular program that, with the integration of data acquisition, provides new opportunities for laboratory observations in the study of electric power technology.

Model 8052-10 *Wind Power Technology: Asychronous and Doubly-Fed Generators*, is an add-on to Model 8052-00 and covers typical wind power asynchronous generator principles and synchronization, as well as doubly-fed induction generators and the associated power electronic converters. Lab-Volt also offers trainers that cover additional wind power topics such as mechanical, hydraulics, programmable logic controllers, wind turbine and other PLC applications, etc.

Developed specifically for low-power (0.2-kW) educational equipment, the 8052 system enables students to understand and safely operate industrial-type equipment. Careful attention to engineering detail ensures easy-to-understand laboratory results, easily-observed data values, and data which, when applied to governing formulas, provides results that verify electrical laws rather than deny them on the basis of large, operational-tolerance errors.

This highly-modular training system is based on time-proven technologies. Modular-program course materials provide instructors with complete versatility in selecting and adapting lessons and experiments to fit specific student needs and teaching objectives. Multi-use modules are applicable to other electrical topics, such as transmission lines, protective relaying, industrial motors, motor controls, power electronics, etc, offering a great opportunity for lower-cost future expansions.



Features and Benefits

- **Modularity** – System modularity maximizes flexibility and variety for experimentation, and allows multiple possibilities for expansion and customization.
- **Lab-Volt Motors** – Lab-Volt machines are designed and constructed at Lab-Volt and make learning the basic principles of motors and generators realistic and engaging. Lab-Volt's time-proven, fractional HP motor-generators offer the same characteristics as most large, off-the-shelf machines.
- **Safety** – Lab-Volt Electromechanical System (EMS) equipment is designed for student safety. All moving parts are completely enclosed. Our system utilizes safety leads wherever high voltage is present; all electrical connections are protected; and our motors are designed to be overloaded. It is nearly impossible to achieve Lab-Volt's level of safety and visibility with commercially available machines.
- **Expandable** – The Lab-Volt EMS is the nucleus of an entire line of Electric Power and Controls training equipment including control devices, motor drives, and power electronics. All EMS equipment is compatible with the entire line of Lab-Volt training systems.
- **Courseware** – Lab-Volt's industry-leading courseware is available as traditional lab manuals (with a wide variety of time-tested experiments), using a computer-interfaced data acquisition laboratory.
- **Data Acquisition** – Data acquisition saves student time in the lab. Instead of copying instrument readings in tables and hand-drafting graphs, the data acquisition unit allows fast, recallable data acquisition setup while supplying advanced instruments, such as an Eight-Trace Oscilloscope, Phasor Analyzer, Power Factor Meters, Frequency Meters, Phase Meters, Spectrum Analyzer, Harmonics Analyzer, etc. LabView® drivers are supplied with the data acquisition module, allowing for more advanced research projects. Additional (optional) conventional instruments are also available.

8052-00 Topic Coverage

Generator Fundamentals

Fundamentals for Electrical Power Technology
- Voltage, Current, Ohm's Law
- Equivalent Resistance
- Power in DC Circuits
- Series and Parallel Circuits

Alternating Current
- The Sine Wave
- Phase Angle
- Instantaneous Power

Capacitors in AC Circuits
- Capacitive Reactance
- Equivalent Capacitance
- Capacitive Phase Shift and Reactive Power

Inductors in AC Circuits
- Inductive Reactance
- Equivalent Inductance
- Inductive Phase Shift and Reactive Power

Power, Phasors, and Impedance in AC Circuits
- Power in AC Circuits
- Vectors and Phasors in Series AC Circuits
- Vectors and Phasors in Parallel AC Circuits
- Impedance

Three-Phase Circuits
- Balanced Three-Phase Circuits
- Three-Phase Power Measurement
- Phase Sequence

Single-Phase Transformers
- Voltage and Current Ratios
- Transformer Polarity
- Transformer Regulation

Special Transformer Connections
- The Autotransformer
- Transformers in Parallel
- Distribution Transformers

Three-Phase Transformers
- Three-Phase Transformer Connections
- Voltage and Current Relationships
- The Open-Delta Connection

8052-10 Topic Coverage
(Add-On to 8052-00)

Asynchronous and Doubly-Fed Generators

Fundamentals for Rotating Machines
- Prime Mover Operation

AC Induction Motors
- The Three-Phase Squirrel-Cage Induction Motor
- Eddy-Current Brake and Asynchronous Generator
- Effect of Voltage on the Characteristics of Induction Motors

Power Electronics Fundamentals
- Familiarization with the Reversible DC Power Supply
- Power Diode Single-Phase and Two-Phase Rectifiers
- Power Diode Three-Phase Rectifiers
- Familiarization with the Chopper/Inverter Control Unit (Chopper Modes)
- Familiarization with the Chopper/Inverter Control Unit (Inverter Modes)
- Familiarization with the IGBT Chopper/Inverter
- Introduction to High-Speed Power Switching
- The Buck Chopper
- The Boost Chopper
- The Buck/Boost Chopper
- The Four-Quadrant Chopper
- The Single-Phase Inverter
- Saturation and Effect of Frequency in Magnetic Circuits

Wound-Rotor Doubly Fed Induction Machines
- Wound-Rotor Induction Motor
- Wound-Rotor Induction Motor with Short-Circuited Rotor
- Wound-Rotor Induction Motor with Variable Rotor Resistors
- Wound Rotor Frequency Conversion Principles
- Speed Control of a Wound Rotor Generator Using Rotor Resistors
- Variable Speed Doubly-Fed Induction Generator using Rotor Frequency Injection

Supplemental Project

8075-50 – PLC and Mechanics of the Wind Turbine*

Project: Clutches, Brakes, Wind Sensors, Yaw and PItch Control, Gearboxes, Wind Turbine Electronic Supervision, Vibration Analysis

- System comprised of a Lab-Volt Nacelle Simulator – Model 3297 and a Wind Generator – Model 3213
- Small blower for generating air flow
- Nacelle equipped with DC motor and Mechanical clutch
- Two limit switches with NO and NC contacts
- Analog position sensor measures wind direction (0 - 10 V)
- Frequency variable pulse train signal measures wind speed (24 VDC)
- Requires external 24 V Power Supply
- Accepts two 24 VDC control signals from PLC for motor operation
- Includes job sheets

*PLC required. Not included with project.

8052-00 System Components

Model	Name (Quantity)
8134	EMS Workstation (1)
8311	Resistive Load (1)
8321	Inductive Load (1)
8331	Capacitive Load (1)
8341	Single-Phase Transformer (1)
8348	Three-Phase Transformer (1)
8621	Synchronizing Module (1)
8821-20	Power Supply (1)
8951	Connection Leads and Accessories (1)
9062-10	Data Acquisition Interface (1)
30328-00	Student Manual
30328-10	Instructor Manual

Optional with Model 8052-00

Model	Name
8110	Mobile Workstation (Replaces 8134)
8160	Full-Size Blank Module
8161	Half-Size Blank Module

*Models 8160 and 8161 are recommended as a safety precaution to populate empty module slots, preventing possible injury.)

8052-10 System Components

(Add-On to 8052-00)

Model	Name (Quantity)
8211	DC Motor/Generator (1)
8221	Four-Pole Squirrel-Cage Induction Motor (1)
8231	Three-Phase Wound-Rotor Induction Motor (1)
8311	Resistive Load (1)
8325	Smoothing Inductors (1)
8331	Capacitive Load (1)
8731	Three-Phase Rheostat (1)
8737	Tandem Rheostats (1)
8837-A0	IGBT Chopper/Inverter (1)
8840	Enclosure/Power Supply (1)
8842	Power Diodes (1)
8942	Timing Belt (1)
8951-C0	Connection Leads and Accessories (1)
8960-10	Prime Mover/Dynamometer (1)
9017	Thyristor Speed Controller (1)
9029	Chopper/Inverter Control Unit (1)
9033	Function Generator (1)
9034	PID Controller (1)
9056	Current/Voltage Isolator (1)
85822-00	Student Manual
85822-10	Instructor Manual

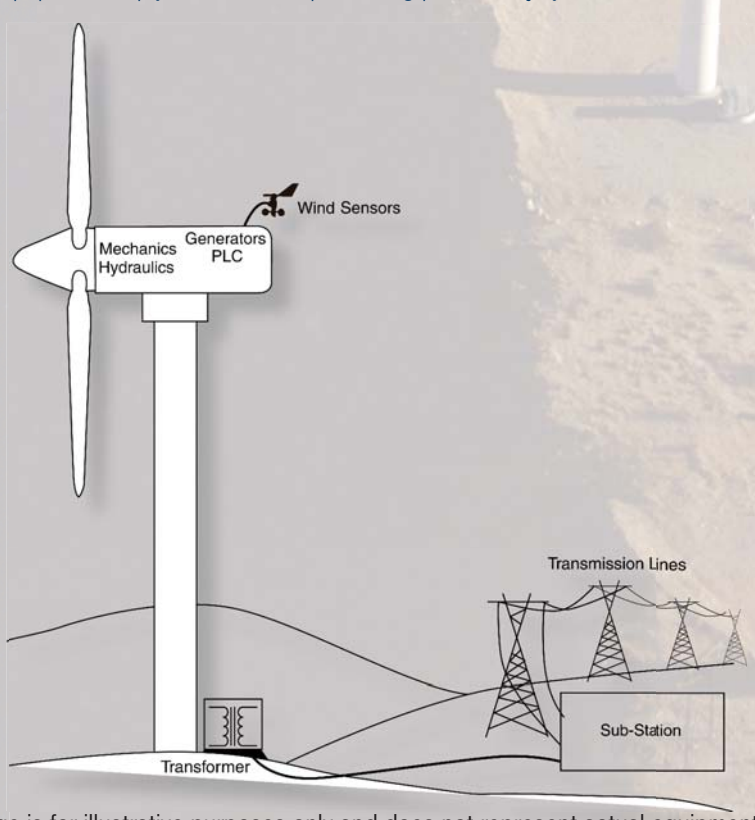


Image is for illustrative purposes only and does not represent actual equipment.

* If Model 8052-10 is purchased, the optional blank modules from 8052-00 are not required.

- For additional Alternative and Renewable Energy Technology training systems, such as Mechanics, Hydraulics, etc., please request our Alternative and Renewable Energy Technology Product Guide.