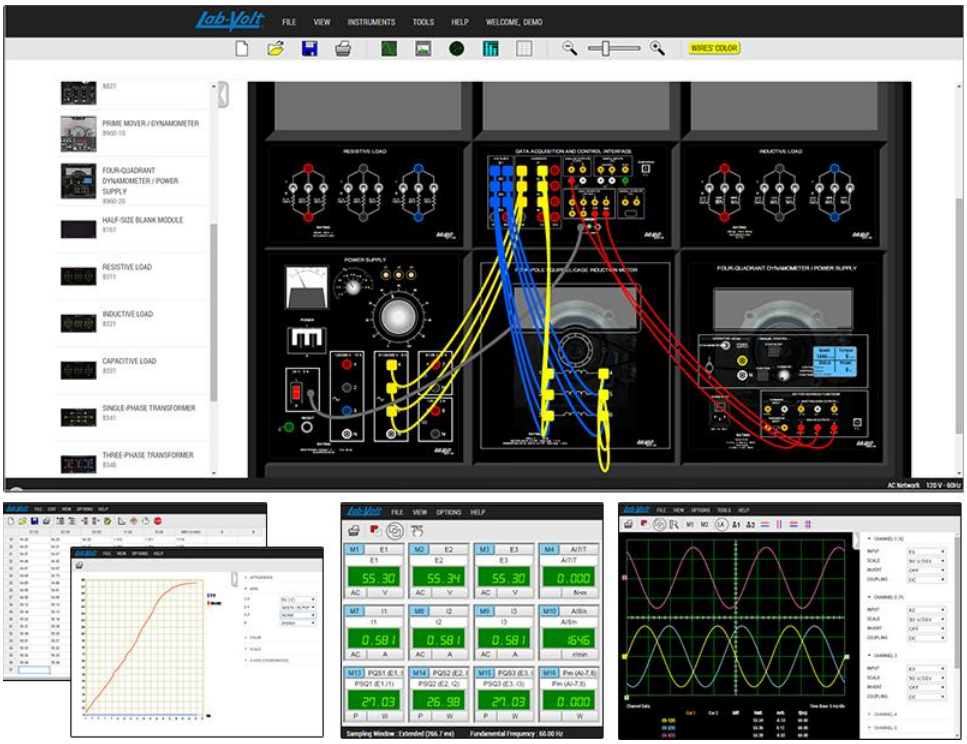
Electromechanical Systems Simulation Software (LVSIM®-EMS)

8970

LabVolt Series

Datasheet



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General Description

The Electromechanical Systems Simulation Software (LVSIM®-EMS) is a simulation software that covers the same courseware as the following systems:

- Computer-Assisted 0.2 kW Electromechanical Training System, Model 8006-1
- DC and AC Power Circuits Training System, Model 8010-1
- Electromechanical Training System, Model 8010-9
- AC Power Transmission Training System, Model 8010-B

All workbooks parts of the systems above are available in the navigation menu of LVSIM-EMS for online consultation. To obtain the printing rights, Campus Licenses for each are available and must be ordered separately.

With LVSIM-EMS, all the standard EMS laboratory equipment is replaced by images of the actual EMS modules that students can manipulate on the computer screen. Students can identify and set up equipment for a given exercise, make the necessary connections between the virtual EMS modules, and verify the connections made without the need for actual EMS equipment.

Sophisticated mathematical models fully simulate the electrical and mechanical characteristics of all the actual EMS modules: power supplies, motors, generators, transformers, electrical and mechanical loads, etc. All modules simulated in the LVSIM-EMS software feature the same front panel information as the actual EMS modules. Short-circuit connections in the virtual equipment setup cause the virtual circuit-breaker protection to trip. This trip condition is clearly indicated on the virtual EMS modules.

Used either as a complement to the actual EMS laboratory equipment, or as a stand-alone product, LVSIM-EMS is a cost-effective tool that enables students to perform the same exercises as in the courseware of the above-mentioned training systems. When used as a stand-alone package, the LVSIM-EMS software allows students to perform hands-on activities related to electrical power and machines, including active, reactive, and apparent power, phasors, ac/dc motors and generators, three-phase circuits, and transformers.

LVSIM-EMS is a web-browser based application **available in three different configurations.** The simulation software can either be installed locally on a Windows® personal computer (local version), on a Windows server (network version), or accessed directly online through the labvolt.com website at lvsim.labvolt.com (online version). Both network and local versions are delivered with perpetual license for the current version. The online version is delivered as a annual license with possibility to expand for more years.

Please visit https://lvsim.labvolt.com and try the online version!

The LVSIM-EMS virtual equipment is so representative of the actual EMS laboratory equipment that it allows students to develop hands-on abilities as they would with actual equipment. It also allows students to prepare laboratories in advance by virtually making the connections required in the exercise, validating their connections, and finally saving and printing the setup. Such a preparation can significantly reduce laboratory time and the need for physical hardware. By combining stations using virtual equipment with stations using actual equipment, with students using each type alternately, it is possible to set up an electromechanical training station that maximizes cost-effectiveness.

LVSIM-EMS simulates the following modules from the 8006-1, 8010-1, 8010-9, and 8010-B training systems:

- Capacitive Load, Model 8331
- Capacitor-Start Motor, Model 8251
- Data Acquisition Interface, Model 9062
- Data Acquisition and Control Interface, Model 9063

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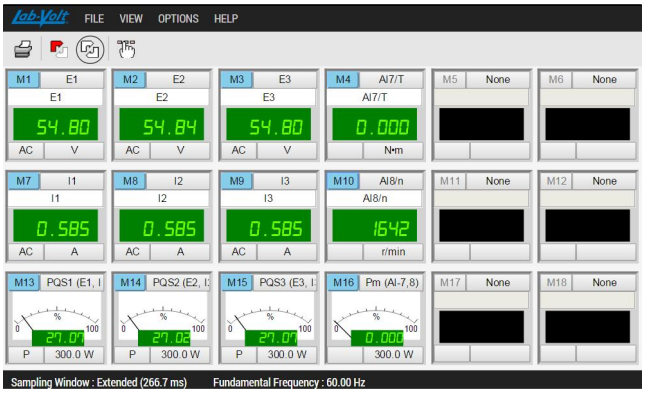
- DC Motor/Generator, Model 8211
- Four-Pole Squirrel-Cage Induction Motor, Model 8221
- Four-Quadrant Dynamometer / Power Supply, Model 8960-2
- Full-Size Blank Module, Model 8160
- Half-Size Blank Module, Model 8161
- Inductive Load, Model 8321
- Lead-Acid Battery Pack, Model 8802
- Permanent-Magnet DC Motor, Model 8213
- Power Supply, Model 8821
- Power Supply, Model 8823
- Prime Mover / Dynamometer, Model 8960-1
- Regulating Autotransformer, Model 8349
- Resistive Load, Model 8311
- Single-Phase Transformer, Model 8341
- Synchronizing Module, Model 8621
- Synchronizing Module / Three-Phase Contactor, Model 8621-A
- Synchronous Motor/Generator, Model 8241
- Synchronous Motor/Generator with Thermistor Output, Model 8241-2
- Three-Phase Transformer, Model 8348
- Three-Phase Transmission Line, Model 8329
- Universal Motor, Model 8254

Make sure to select the right license type (8970 Series for local or network installations, 8972 Series for online access).

Virtual Instrumentation

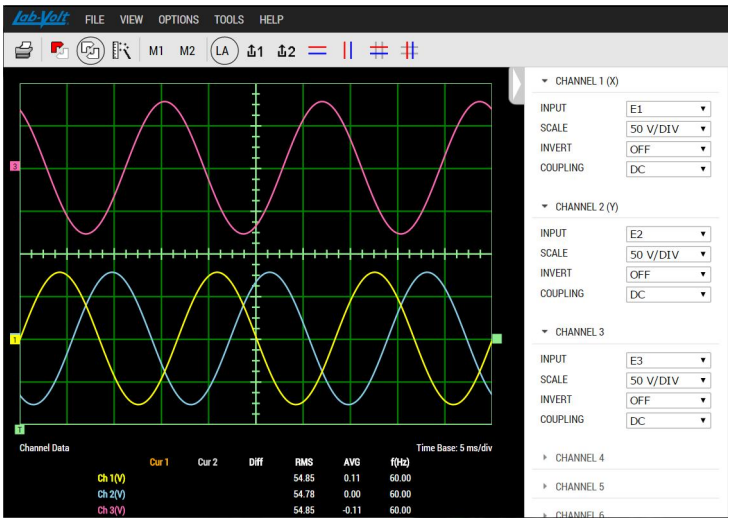
LVSIM-EMS comprises a set of conventional and specialized instruments that can be used for measuring, observing, and analyzing electrical and mechanical parameters in electric power systems and power electronic circuits. Each instrument appears as a window on the computer screen. The conventional instruments include ac/dc voltmeters and ammeters, power meters, and an eight-channel oscilloscope. The specialized instruments include a six-channel phasor analyzer, a harmonic analyzer, torque, speed, and mechanical power meters, and user-programmable meters. The software is also provided with data-recording and graph-plotting capabilities. The various instruments are briefly described in the next section of this datasheet.

Metering Window



The Metering window displays up to eighteen meters, which can be configured individually for measuring ac/dc voltage and current, electrical power (active, reactive, and apparent), torque, speed, mechanical power, etc. The voltage and current meters have several modes of operation that allow measurement of the mean (dc) value, RMS value, crest factor, RMS value of a particular harmonic (up to the 15th value), RMS value of the harmonics, and total harmonic distortion (THD). Six of the eighteen meters are user-programmable and give access to a larger variety of functions for measurement of power factor, efficiency, impedance, frequency, energy, phase shift, etc. The layout of the meters in the Metering window is user-customizable.

Oscilloscope



The Oscilloscope displays up to eight waveforms simultaneously, each of a different color for easy identification. Each channel has independent vertical controls similar to those found on conventional oscilloscopes. An automatic scale-setting function allows the sensitivity of each channel to be set automatically according to the magnitude of the observed parameter. The time base and trigger controls are similar to those found on most oscilloscopes. The RMS value, average value, and frequency of each observed parameters can be displayed in the Oscilloscope window. Two vertical cursors can be activated to perform precise measurements at particular points on the displayed waveforms. The Oscilloscope toolbar includes two memory buttons for saving displayed waveforms.

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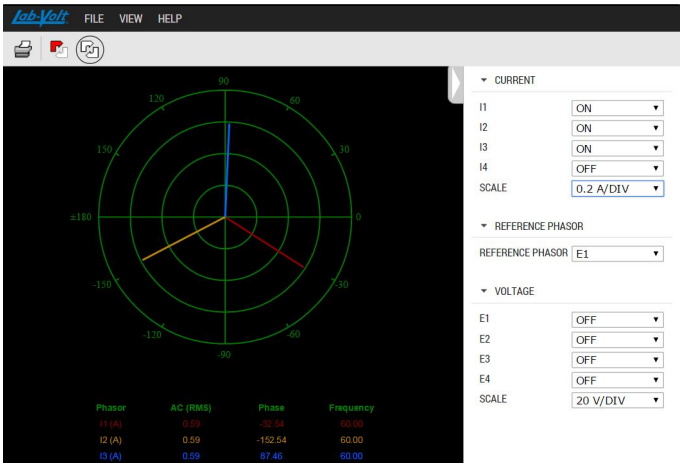
Phasor Analyzer



The Phasor Analyzer displays the phasors related to the measured voltages and currents. The amplitude and phase angle of each voltage and current is clearly represented by the orientation and length of their corresponding phasors, allowing easy comparison between the displayed parameters. This produces a unique and dynamic display of the voltages and currents in a circuit (especially in three-phase circuits) that cannot be obtained with conventional instruments. The RMS value, phase angle, and frequency of the voltage or current related to each phasor is displayed in the Phasor Analyzer window.

Harmonic Analyzer

The Harmonic Analyzer allows observation and analysis of the harmonic components in the measured voltages and currents. The fundamental frequency can be manually set to the ac power network frequency or automatically set to the frequency of the fundamental component of the selected voltage or current. The harmonic components of the selected voltage or current can be displayed using a vertical scale graduated in either absolute or relative values. A group of data displays in the Harmonic Analyzer indicates the values of the dc component of the selected voltage or current, as well as the total harmonic distortion (THD). Vertical and horizontal cursors can be displayed to perform precise measurements at particular points on the display. Since the equipment simulated by LVSIM-EMS produces only dc and sinusoidal ac signals (without harmonics), the Harmonic Analyzer, which is intended for use with devices that produce harmonics, is not often used with LVSIM-EMS.

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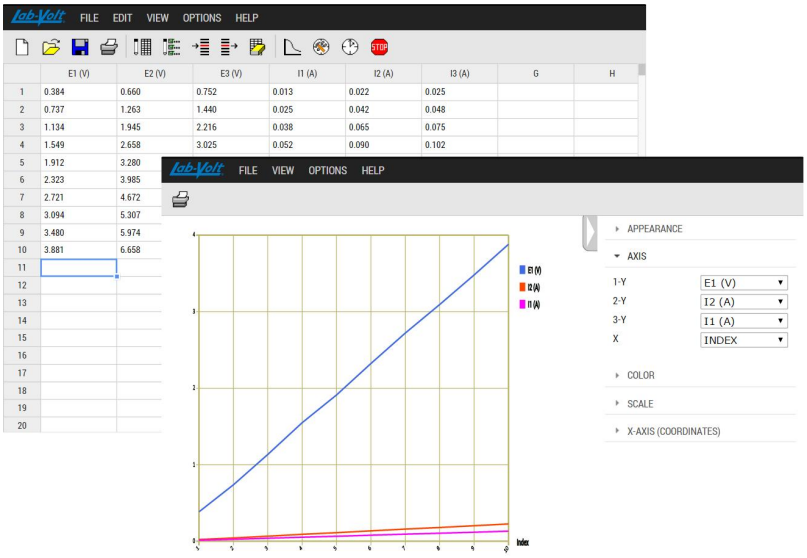
Data Table and Graph Windows



The values indicated by the various meters in the Metering window, as well as values measured by the other instruments, can be recorded in the Data Table window with a click of the mouse. The values recorded in the Data Table can be saved to a file (ASCII-formatted file). The recorded data can also be used to plot graphs by selecting which parameter(s) to plot in the Graph window. This allows lab results to be plotted quickly and easily. More sophisticated graphs can be created by exporting the contents of the Data Table window to any spreadsheet program, such as Microsoft Excel®, directly through the Windows Clipboard.

Software Protection and Licensing

The local and network version provides a perpetual licence and the online access version provides a annual licence (additional years can be purchased when ordering).

The local and network version of LVSIM-EMS are copy-protected by means of a hardlock security device. When LVSIM-EMS detects the security device, students have complete access to all measuring functions of the virtual instruments and other protected features of LVSIM-EMS, as well as to the student manuals included with the simulation software. Note that students are allowed to copy the software onto their personal computer to allow them to prepare laboratories in advance.

Two different security devices are available for LVSIM-EMS: a single-user hardlock key, which can be inserted in the USB port of the user's computer, and a multiple-user hardlock key, which can be inserted in the USB port of the network server or any computer in the same network. Once the hardlock key is active on the network, the other computer will see the available licences. Alternately, the multiple-user hardlock key can be inserted in a USB port inside the server using a circuit board with edge-type connector (provided with the key) that can be installed in a PCI expansion slot of the server.

The multiple-user hardlock key can be installed in servers running under one of the following Microsoft® operating systems: Windows 7, Windows 8, Windows 10, Windows 2008 Server, and Windows 2013 Server. As its name indicates, the multiple-user hardlock key allows several users of a network to run LVSIM-EMS simultaneously. Different versions of LVSIM-EMS are available, each allowing a particular number of users.

Online Edition

The online version of LVSIM-EMS is accessible directly via the internet, and requires no software installation nor any update since the latest version of the software is always available. The online version of LVSIM-EMS also includes a demo mode that allows students to prepare laboratories in advance by familiarizing with the equipment and connections. The demo mode does not require any login.

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Computer Requirements

Local and Network Versions:

- One (1) USB 2.0 port for the security dongle, Microsoft Windows 10 operating system recommended (compatible with Windows 7 and 8), basic dual core CPU, Google Chrome web browser installed (for better experience)

Online Version:

- Microsoft Windows 10 operating system recommended (compatible with Windows 7 and 8 but not fully compatible with mobile devices), basic dual core CPU, internet access (bandwidth usage of 50 KB/s maximum), Google Chrome web browser installed (for better experience)

Topic Coverage

- Fundamentals for Electric Power Technology
- Alternating Current
- 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
- Fundamentals for Rotating Machines
- DC Motors and Generators
- Special Characteristics of DC Motors
- AC Induction and Synchronous Motors
- Three-Phase Synchronous Generators

Features & Benefits

- Replicates the Electromechanical Training System, enabling students to perform actual experiments using virtual equipment
  - Install, move, and remove EMS modules in and from the workstation
  - Modify module connections at any time and change the color of wires
  - Install a timing belt between two EMS machines
  - Verify module connections using a tool that highlights all wires connected to a same circuit point
  - Perform measurements of voltage, current, power, speed, torque, impedance, resistance, reactance, and frequency and display the values on digital or analog meters
  - Record measurements in a data table and plot graphs using the recorded data
  - Display waveforms on a multi-channel oscilloscope and ac voltages and currents as phasors
- Students prepare for laboratories in advance using virtual equipment, thereby decreasing the time they require to perform the exercises using actual equipment
- Decreases the quantity of actual equipment required per student
- Allows students to practice with EMS equipment operation and connection at home on a personal computer

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List of Available Training Systems

Qty	Description	Model number
1	Electromechanical Systems Simulation Software (LVSIM®-EMS) - 1 User with USB Dongle	586920 (8970-00)
1	Electromechanical Systems Simulation Software (LVSIM®-EMS) - 5 Users with USB Dongles	586923 (8970-A0)
1	Electromechanical Systems Simulation Software (LVSIM®-EMS) - 10 Users with USB Dongles	586926 (8970-B0)
1	Electromechanical Systems Simulation Software (LVSIM®-EMS) - 15 Users with USB Dongles	586929 (8970-C0)
1	Electromechanical Systems Simulation Software (LVSIM®-EMS) - 20 Users with USB Dongles	586932 (8970-D0)
1	Electromechanical Systems Simulation Software (LVSIM®-EMS) - 25 Users with USB Dongles	586935 (8970-E0)
1	Electromechanical Systems Simulation Software (LVSIM®-EMS) - 30 Users with USB Dongles	586938 (8970-F0)
1	Electromechanical Systems Simulation Software (LVSIM®-EMS) - 35 Users with USB Dongles	586941 (8970-G0)
1	Electromechanical Systems Simulation Software (LVSIM®-EMS) - 40 Users with USB Dongles	586944 (8970-H0)
1	Electromechanical Systems Simulation Software (LVSIM®-EMS) - 5 Users Network	586947 (8970-P0)
1	Electromechanical Systems Simulation Software (LVSIM®-EMS) - 10 Users Network	586950 (8970-Q0)
1	Electromechanical Systems Simulation Software (LVSIM®-EMS) - 15 Users Network	586953 (8970-R0)
1	Electromechanical Systems Simulation Software (LVSIM®-EMS) - 20 Users Network	586956 (8970-S0)
1	Electromechanical Systems Simulation Software (LVSIM®-EMS) - 25 Users Network	586959 (8970-T0)
1	Electromechanical Systems Simulation Software (LVSIM®-EMS) - 30 Users Network	586962 (8970-U0)
1	Electromechanical Systems Simulation Software (LVSIM®-EMS) - 35 Users Network	586965 (8970-V0)
1	Electromechanical Systems Simulation Software (LVSIM®-EMS) - 40 Users Network	586968 (8970-W0)
1	Electromechanical Systems Simulation Software (LVSIM®-EMS) - 1 User Online, 1 year	586971 (8972-00)
1	Electromechanical Systems Simulation Software (LVSIM®-EMS) - 5 Users Online, 1 year	586974 (8972-A0)
1	Electromechanical Systems Simulation Software (LVSIM®-EMS) - 10 Users Online, 1 year	586977 (8972-B0)
1	Electromechanical Systems Simulation Software (LVSIM®-EMS) - 15 Users Online, 1 year	586980 (8972-C0)
1	Electromechanical Systems Simulation Software (LVSIM®-EMS) - 20 Users Online, 1 year	586983 (8972-D0)
1	Electromechanical Systems Simulation Software (LVSIM®-EMS) - 25 Users Online, 1 year	586986 (8972-E0)
1	Electromechanical Systems Simulation Software (LVSIM®-EMS) - 30 Users Online, 1 year	586989 (8972-F0)
1	Electromechanical Systems Simulation Software (LVSIM®-EMS) - 25 Users Online, 1 year	586992 (8972-G0)
1	Electromechanical Systems Simulation Software (LVSIM®-EMS) - 40 Users Online, 1 year	586995 (8972-H0)

List of Manuals

Description	Manual number
Electromechanical Systems Simulation Software (User Guide)	583879 (20858-E0)
Computer-Based Instruments for EMS (User Guide)	584396 (36221-E0)

Table of Contents of the Manual(s)

Electromechanical Systems Simulation Software (User Guide) (583879 (20858-E0))

- 1 Overview of LVSIM-EMS
- 2 Installing the Security Device
- 3 Installing and Running LVSIM-EMS

Computer-Based Instruments for EMS (User Guide) (584396 (36221-E0))

- 1 Familiarization with the Metering Window and the Data Table

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- 2 Familiarization with the Oscilloscope
- 3 Familiarization with the Phasor Analyzer
- 4 Familiarization with the Harmonic Analyzer
- 5 Measuring Three-Phase Power Using the Metering Window

Reflecting the commitment of Festo Didactic to high quality standards in product, design, development, production, installation, and service, our manufacturing and distribution facility has received the ISO 9001 certification.

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