

EE 330L Energy Systems Lab (Fall 2026)

Laboratory 2 Introduction to LabVolt System Hardware

Introduction

The objective of this lab is to familiarize students with the LabVolt system, software and hardware, made by Festo (<https://www.festo.com>) under their Festo Didactic division. Students will begin to learn how to properly set up and operate the LabVolt equipment and take measurements.

The LabVolt system 8134-20 (see Figure 1) is largely customizable out of Electronics Module System (EMS) modules. Typically, each EE 330L lab will use a few of the EMS modules. Starting at the top, our LabVolt systems have:

- a) two (2) Three-Phase Transformer Bank 8348-40 EMS,
- b) one (1) Data Acquisition And Control Interface (DACI) 9063-00 EMS,
- c) one (1) Synchronizing Module / Three-Phase Contactor 8621-B0 EMS,
- d) one (1) Three-Phase Transmission Line 8329-00 EMS,
- e) one (1) Regulating Autotransformer 8349-40 EMS,
- f) one (1) Resistive Load 8311-00 EMS,
- g) one (1) Inductive Load 8321-00 EMS,
- h) one (1) Capacitive Load 8331-00 EMS,
- i) one (1) Power Supply 8525-20 EMS,
- j) one (1) Four-Quadrant Dynamometer / Power Supply 8960-30 EMS, and
- k) one (1) Four-Pole Squirrel-Cage Induction Motor 8221-20 EMS as well as
- l) JAMECO AC Adaptor and USB cable (USB-A to USB-B).

Experiment [Review the Lab Safety Document (lab_safety_spring2026.pdf)!]

Here, the user will connect their computer to the LabVolt system, wire a simple circuit, and take some measurements using the LVDAC-EMS software.

- 1) To begin, ensure that the LabVolt system is in 'start-up' state by:
 - Ensuring that large power cord from back of LabVolt system is plugged into 3-phase plug on wall. Alert instructor/TA if there is an issue, do **not** touch.
 - Ensuring both power switches located on the left side of the Power Supply EMS 8525-20 (lower left on Figure 1) are OFF.
 - Ensure all toggle switches on the Resistive Load 8311-00 EMS, Inductive Load 8321-00 EMS, and Capacitive Load 8331-00 EMS are in the down/0/OFF position.
 - Ensuring 'Power Input' jacks on the lower right of the DACI 9063-00 EMS are disconnected.
 - Ensuring 'Power Input' switch is OFF and no AC power cord is connected on lower left of the Four-Quadrant Dynamometer / Power Supply EMS 8960-30 (center bottom on Figure 1).
- 2) Plug JAMECO AC Adaptor (i.e., 'wall wart') into a 120 V wall outlet and plug cord into one of the 'Power Input' jacks located on the lower right of the DACI 9063-00 EMS. Connect USB cable (USB-A to USB-B) to your computer and the USB jack on the DACI 9063-00 EMS.

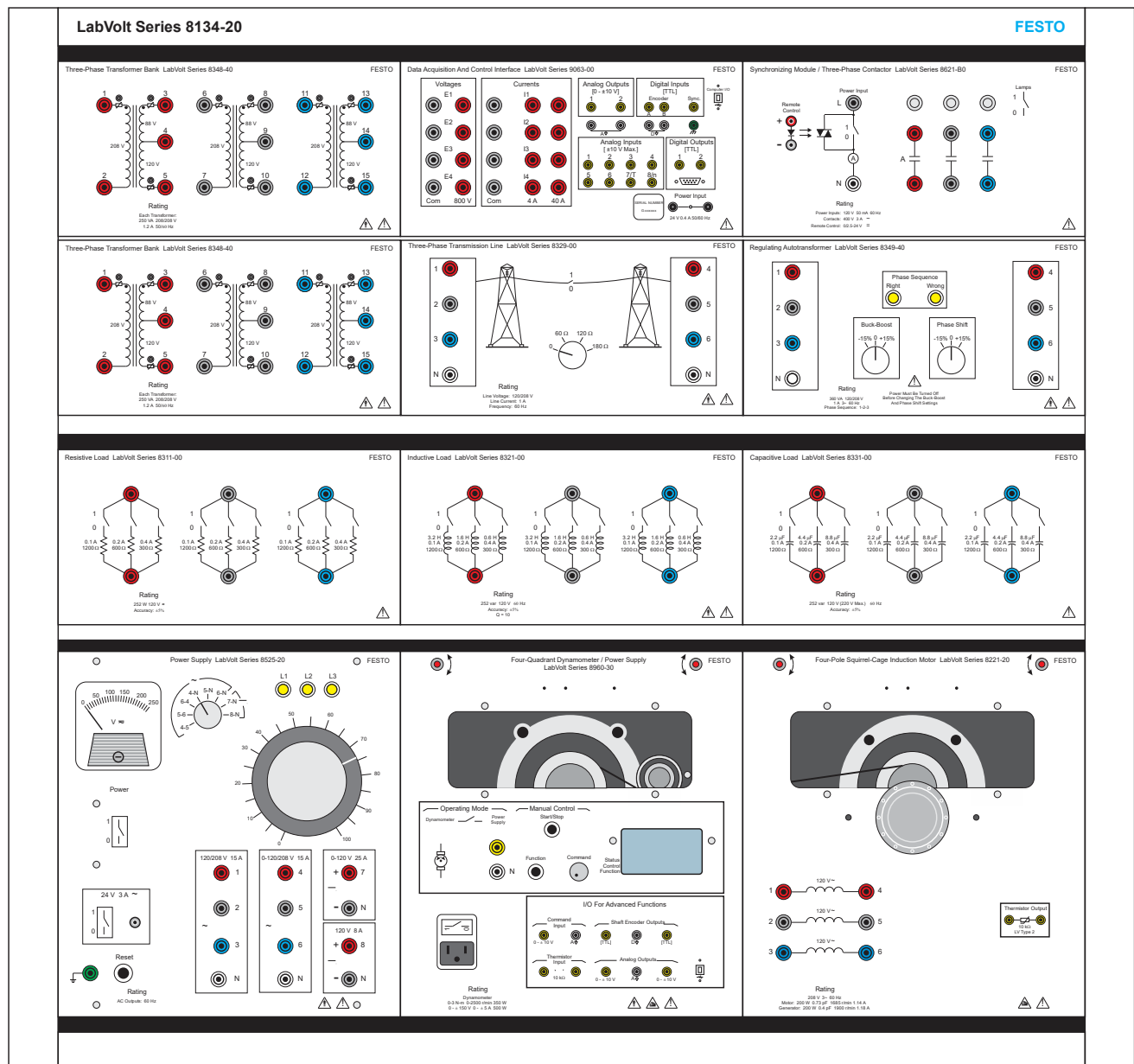
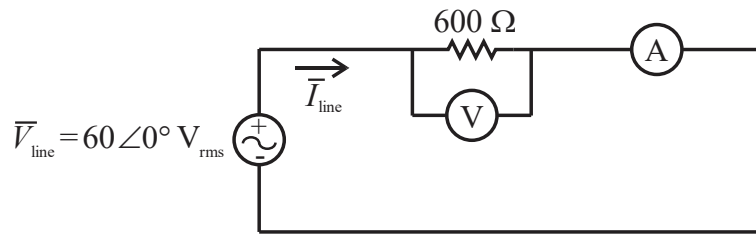
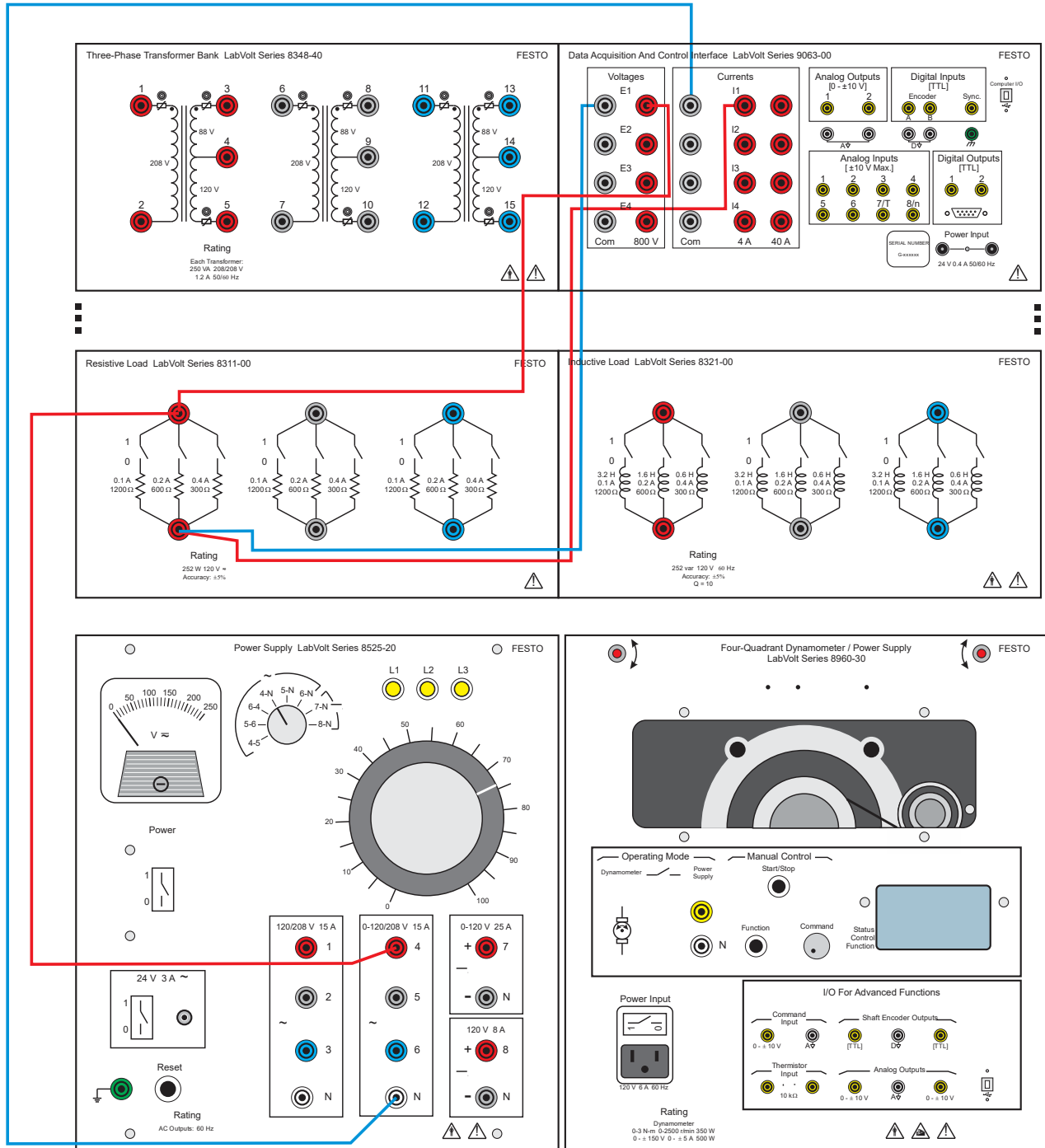


Figure 1 LabVolt system front panel

- 3) Start the LVDAC-EMS software on your computer. When the 'LVDAC-EMS Launcher' screen pops up, select 'Connected Mode'. When the 'LVDAC-EMS Start-up' screen pops up, verify 'Local Network Voltage and Frequency' has '120 V - 60 Hz' selected and click 'OK'. The 'LVDAC-EMS - Document 1' screen should now appear.
- 4) In this lab, you will set up the simple circuit shown conceptually in Figure 2a. This experiment will require the use of three (3) EMS modules, i.e., DACI 9063-00, Resistive Load 8311-00, and Power Supply 8525-20. The DACI 9063-00 EMS is used in conjunction with the LVDAC-EMS software. Together, they provide a set of computer-based test instruments. Of interest to this lab are the inputs for the voltmeters (E1 - E4 in the Voltages box) and ammeters (I1 - I4 in the Currents box) on the DACI 9063-00 EMS. These provide information allowing computer-based metering, oscilloscope, phasor analyzer, harmonic analyzer, ... instruments.



(a)



(b)

Figure 2 Circuit set up

- 5) The physical connections are shown in Figure 2b (components removed for clarity). For the most part, you will be using patch cords with stackable male banana connectors at each end to make wiring connections. The steps are listed as follows:

Note: As a reminder, voltmeters (large input impedance/open circuits) are connected in **parallel** with the component(s) that we wish to measure the voltage across. Ammeters (low input impedance/short circuits) are connected in **series** with the component(s) that we wish to measure the current through. **NEVER** connect an ammeter in parallel!

- Connect a red cord from the red banana jack labeled '4' on the Power Supply 8525-20 EMS to the upper red banana jack on the Resistive Load 8311-00 EMS.
 - Connect a red cord from the lower red banana jack on the Resistive Load 8311-00 EMS to the red banana jack labeled 'I1' (4 A column) in the 'Currents' block on the DACI 9063-00 EMS.
 - Connect a blue cord from the black banana jack labeled 'Com' to the left of the red banana jack labeled 'I1' in the 'Currents' block on the DACI 9063-00 EMS to the white banana jack labeled 'N' below the red banana jack labeled '4' on the Power Supply 8525-20 EMS.
 - Connect a red cord from the red banana jack labeled 'E1' in the 'Voltages' block on the DACI 9063-00 EMS to the upper red banana jack on the Resistive Load 8311-00 EMS by stacking banana connectors.
 - Connect a blue cord from the black banana jack labeled 'E1' in the 'Voltages' block on the DACI 9063-00 EMS to the lower red banana jack on the Resistive Load 8311-00 EMS by stacking banana connectors.
 - On the Power Supply 8525-20 EMS, turn the small knob (upper center) to '4-N' position and the large knob (upper right) all the way counterclockwise (CCW) to '0'.
- 6) When the wiring connections are completed, ask instructor/TA to inspect and approve. After approval, toggle the 'Power' switch (center left) to the upper/1/ON position on the Power Supply 8525-20 EMS. Three lamps labeled 'L1', 'L2', and 'L3' should light up and the voltage gauge (upper left) needle should be at 0 V. **Take picture of the setup.**
- 7) On the 'LVDAC-EMS - Document 1' software screen on your computer, activate/select the 'Metering' instrument by clicking the icon on using the 'Instruments' drop-down menus. Except for 'M1' and 'M7', shut off all active meters. For meter 'M1', change the label to 'Vline'. For meter 'M7', change the label to 'Iline'. They should both show small values.
- 8) On the Power Supply 8525-20 EMS, slowly turn the large knob (upper right) clockwise (CW) until meter 'M1' ~60 V. Meter 'M7' block should still show a small value.
- 9) Next, toggle the switch for the 600 Ω resistor (red jacks) on the Resistive Load 8311-00 EMS to the upper/1/ON position. Meter 'M7' should now read ~0.1 A.
- 10) Change the label 'PQS1 (E1,I1)' for meter 'M13' to 'PQSIn' and activate the meter 'M13' to display the power being absorbed by the 600 Ω resistor (~6 W). Click the 'Single Refresh' icon to freeze the measured values.
- 11) Use the 'Metering' instrument to get the **measured circuit values and record in Table 1**. Also, **save screenshots** (see below) of the 'Metering' instrument screen with meter 'M13' on the 'P', 'Q', and 'S' settings.
- Option 1- Use 'Snipping Tool' to copy screen and save as a *.jpg file in folder of your choice.

- Option 2- Take a picture using your cellphone.
- Option 3- Click 'File' on 'Metering' instrument menu, select 'Print', choose 'Adobe PDF', and select filename and folder of your choice.

Table 1 Measured Circuit Parameter Values

$E1 = V_{line} (V_{rms})$	$I1 = I_{line} (A_{rms})$	$P (W)$	$Q (var)$	$S (VA)$

- 12) Close the 'Metering' instrument and select the 'Oscilloscope' instrument. On 'Oscilloscope Settings', ensure 'Input E1' has 'Scale' set to '50 V/div', 'Invert' is 'off', and 'Coupling' is 'DC' while 'Input I1' has 'Scale' set to '0.1 A/div', 'Invert' is 'off', and 'Coupling' is 'DC'. **Save a screenshot of the 'Oscilloscope' instrument screen.**
- 13) Close the 'Oscilloscope' instrument and select the 'Phasor Analyzer' instrument. **Save a screenshot of the 'Phasor Analyzer' instrument screen.**
- 14) Close the 'Phasor Analyzer' instrument and select the 'Harmonic Analyzer' instrument. On 'Harmonic Analyzer Settings', click the drop-down arrow for 'Number of Harmonics' and select '10 Harmonics'. **Save a screenshot of the 'Harmonic Analyzer' instrument screen.**
- 15) Close the 'Harmonic Analyzer' instrument. Then, close the LVDAC-EMS software.
- 16) Make an 'Equipment List' table (include descriptions, model #s, & brands; only list EMS used).
- 17) Lastly, shut down the LabVolt system by:
 - On the Power Supply 8525-20 EMS, toggle the 'Power' switch (center left) to the lower/0/OFF position, and turn the large knob CCW to 0.
 - On the Resistive Load 8311-00 EMS, toggle the switch for the 600 Ω resistor (red jacks) to the lower/0/OFF position.
 - Disconnect all patch cords and return to rack on side of the LabVolt system.
 - Disconnecting the DACI 9063-00 EMS as a USB device from your computer. Then, disconnect the USB cable from the computer and DACI 9063-00 EMS.
 - Unplug JAMECO AC Adaptor from wall outlet and 'Power Input' jack on DACI 9063-00 EMS.

Post Lab

Each group should write and submit one hard copy of a lab report on Lab 2 to the instructor following the guidelines given in the syllabus. Hints/prompts:

- 1) Include all pictures/screenshots along with relevant observations in text. E.g., are the waveforms on the 'Oscilloscope' screenshot in RMS or magnitude? Justify answer.
- 2) Include data from Table 1. Per Ohm's Law, what is the measured value of the 600 Ω resistor? From the data, does the resistor have a parasitic inductance/capacitance?

Due Monday September 14, 2026 by 4 pm to instructor's office or EECS mailbox.