ELECTRICITY

EDUCATION

Electricity

Training Lab

About SES

Systems, goes above and beyond to supply educators and learners with the best educational systems, including **Neulog, Degem Systems, MultiCenter** and **MagiClass.**

Renowned for their ability to cater to numerous fields, sectors and segments, SES systems spread across a wide spectrum, offering unique solutions in the fields of **electronics, microcontrollers, telecommunication, autotronics, mechatronics, pneumatics, hydraulics, CNC machines, refrigeration and air-conditioning, green energy, computerized systems, science, robotics, logger sensors and STEM.**

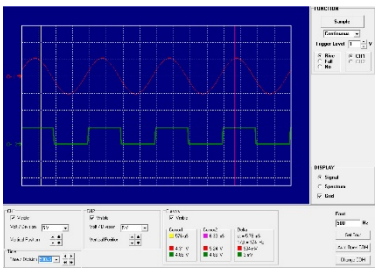
Each proprietary SES system and device is perfectly designed and manufactured from the highest quality materials in accordance with all safety requirements and regulations. SES is a quality assured firm with the certification of ISO-9001:2015.

SES solutions are used in over 50 countries worldwide by professional developers for high-level technological commercial products and both governmental and private institutions covering educational programs for universities, colleges, vocational training centers and schools, high schools, junior high schools and primary schools.

Basic Electronics Topics

- **Electricity**
  - Direct current, Ohm's Law and electrical power
  - Kirchhoff's laws and electric circuits
  - Resistors and potentiometers
  - Alternate current and RLC circuits
  - Magnetism and electricity
  - Transformers, motors and generators
  - Power control – SCR, TRIAC, DIAC, PUT
- **Semiconductors**
  - Diodes, Zener diodes, LEDs, Displays
  - LDR, phototransistor and photodiode
- **Analog electronics**
  - The bipolar transistor in DC circuits and as an amplifier
  - The FET transistor in DC circuits and as an amplifier
- **Digital electronics**
  - Logic gates
  - Boolean algebra, functions and equations
  - Codes, decoders and multiplexers
  - Binary adding, subtraction and comparison
  - Flip-flops and their applications
  - Registers and their applications
  - Counters and their applications
  - Converters (ADC, DAC)
- **Power supplies**
  - Transformers
  - Rectifiers
  - Filters
  - Regulators
  - Converters
- **Programmable components**
  - Logic function implementation with graphic editor
  - VHDL
- **Principles of microcontrollers**
  - The microcomputer and its operation principles
  - Microcontroller programming
- **Industrial electronics**
  - Actuators, control components and control circuits
  - DC motor and Step motor control
  - Sensors
  - DC-AC and AC-DC conversion
  - Three phase motor control

EB-3000 Universal Training System



- EB-3000 supports every stage of electronics study, which is a must for almost every profession such as: **electronics, electricity, mechatronics, automotive, instrumentation, process control**, etc.

- The system includes: **5-voltages power supply, 2 voltmeters, ammeter, frequency counter, logic probe, logic analyzer, 2-channel digital oscilloscope, function generator** (sine, triangle and square signals).

- The system contains also: 3.2" color graphic display with touch panel, keyboard, 10 relays for inserting faults.

- The system provides USB wire communication with the PC for:

  - Virtual instrument **D-Scope** software that controls the system function generator and graphic display of the scope signals.
  - Microprocessor and microcontroller editor, assembler, C compiler and debugger development software.

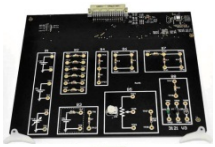
- The plug-in cards are connected to the trainer through a 48-contact, very low resistance industrial connector.

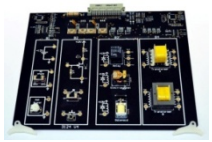
- Each plug-in card has its own controller for automatic identification by the main platform, for saving its required configuration and for automatic self-diagnostics while plugging it in.

- Experiment manual and courseware (including theory) for every card.

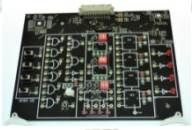
- Various electronics study programs for Mechatronics, for Autotronics, for Electrical Machines and Electricity using EB-3000 and its plug-in experiment cards are available.

EB-3000 Plug-In Experiment Cards





EB-3121 DC Circuits I – Ohm and Kirchhoff Laws
EB-3122 DC Circuits II – Norton, Thevenin and Superposition
EB-3123 AC circuits – Signals and Filters
EB-3124 Magnetism, Induction and Transformers
EB-3125 Diodes, Zener diodes and Transistors
EB-3126 Bipolar and FET Transistor amplifiers
EB-3127 Industrial semiconductors – SCR, Triac, Diac and PUT
EB-3128 Optoelectronic semiconductors – LED, phototransistor, LDR, 7-SEG
EB-3129 Electrical components and Control circuits
EB-3131 Operational amplifiers I – Inverter, Non-inverter, Summing and Differential.
EB-3141 DC motor, Step motor and Generator Control
EB-3142 Motor control with Optical and Hall Effect sensors
EB-3143 AC-DC and DC-AC conversion circuits
EB-3144 3 Phase Motor Control
EB-3151 Logic components – AND, OR, NOT, NAND, NOR, XOR
EB-3152 Decoders, Multiplexers and Adders
EB-3153 Sequential logic – Flip-flops, Registers and Counters
EB-3154 555, ADC and DAC circuits
EB-3191 Introduction to 8 bit Microcontrollers with the 8051
EB-3198 Programmable Logic Devices



The document '**Electronics Training Labs**' describes the specifications of the EB-3000 universal training system and the EB-3000 electronics cards.

EL-3800 Electricity Equipment

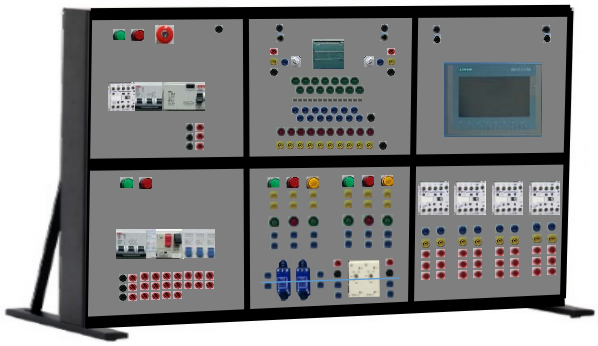
EL-388X – Electricity Workstations

EL-3881 – PLC workstation

Purpose: A complete workstation for prcatice PLC programming in ladder diagrams, grapgic function blocks, with HMI screens, PLC application in automation, PLC motor control, manual motor control and more.

Includes:

- EL-3806
- EL-3811
- EL-3813
- EL-3821
- EL-3822
- EL-3824
- EL-3825



Recommended:

- EL-3847
- EL-3848

Optional:

- EL-3826
- EL-3831
- EL-3832
- EL-3833

EL-3882 – Electrical machine workstation

Purpose: A complete workstation for practice electrical machines and transformers, including measurements in a modern way.

Includes:

- EL-3803
- EL-3811
- EL-3841
- EL-3842

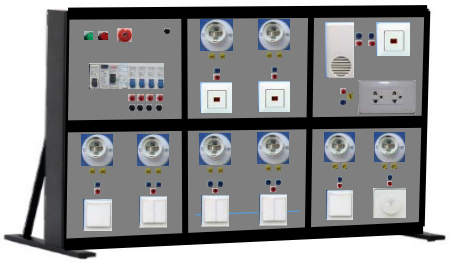
Recommended:

- EL-3843
- EL-3844
- EL-3845
- EL-3851
- EL-3852
- EL-3853
- EL-3854
- EL-3855
- EL-3856

EL-3883 – Electric domestic installation workstation

Purpose: A complete workstation for practice domestic installation of electrical systems.

Includes:

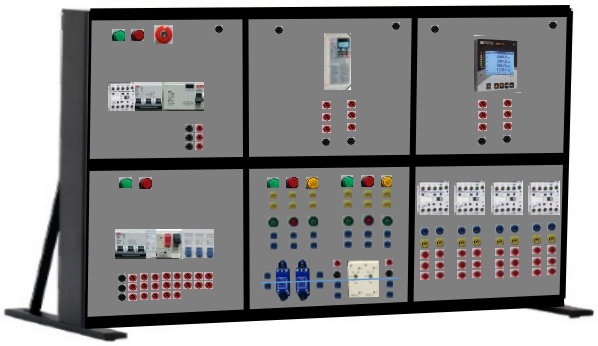


- EL-3806
- EL-3812
- EL-3861
- EL-3862
- EL-3863
- EL-3864
- EL-3865

EL-3884 – Electrical control and machine workstation

Purpose: A complete workstation for prcatice electrical machine measurements and contol.

Includes:



- EL-3806
- EL-3811
- EL-3813
- EL-3824
- EL-3825
- EL-3841
- EL-3842

Recommended:

- EL-3847
- EL-3848

Optional:

- EL-3843
- EL-3844
- EL-3845
- EL-3851
- EL-3852
- EL-3853
- EL-3854
- EL-3855
- EL-3856

EL-3885 – Solar photovoltaic energy workstation

Purpose: A complete workstation for practice installation and measurements of photovoltaic electrical systems.

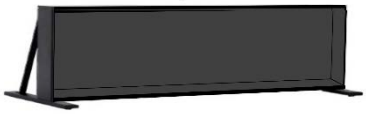
Includes:

- EL-3803
- EL-3812
- EL-3861
- Battery

Solar photovoltaic panel

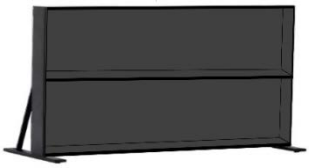
EL-380X – Electricity Rack Units

EL-3803 – Electricity 3 rack unit master system



- Metal base for 3 electricity panel modules
- Mounting bands hold the panel modules

EL-3806 – Electricity 6 rack unit master system



- Metal base for 6 electricity panel modules
- Mounting bands hold the panel modules

EL-381X – Electricity Power Units

EL-3811 – 3 Phase power switch board panel

- A panel module in a sturdy plastic box plugged into one of the EL-380X racks
- Includes:
  - Three phase power cable
  - Mushrum switch with key
  - Red lamp
  - Green lamp
  - Three phase circuit breaker
  - 24V DC power outlet
  - 3 phase power outlet terminals

EL-3812 – Single Phase power switch board panel

- A panel module in a sturdy plastic box plugged into one of the EL-380X racks
- Includes:
  - Single phase power cable
  - Mushrum switch with key
  - Red lamp
  - Green lamp
  - Ground fault distribution switch
  - Four power circuit breaker
  - 24V DC power outlet
  - Four single phase power outlet terminals

EL-3813 – 3 Phase industrial control switch board panel

- A panel module in a sturdy plastic box plugged into one of the EL-380X racks
- Includes:
  - Mushrum switch with key
  - Red lamp
  - Green lamp
  - Three phase ground fault distribution switch
  - Three phase circuit breaker
  - Ground outlet terminal
  - 3 phase power outlet terminals

EL-3814 – Solar photovoltaic controller and inverter panel

- A panel module in a sturdy plastic box plugged into one of the EL-380X racks
- Includes:
  - Solar photovoltaic panel inlet
  - Battery charging controller
  - Baterry outlets
  - Inverter 12V DC to 110V/230V AC
  - 110V/230V AC outlet socket

EL-382X – Electricity PLC Units

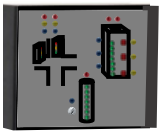
EL-3821 – Programmable Logic Controller (PLC) panel

- Purpose: Practicing PLC programming and applications.
- Includes:
  - A panel module in a sturdy plastic box plugged into one of the EL-380X racks
  - PLC
  - 14 digital 24V DC inputs with 8 switches and lamps in parallel
  - 10 digital relay (24 – 230V DC or AC) outputs with lamps
  - 2 (0 – 10V DC) analog inputs
  - 10V DC outlet
  - Two ethernet communication outlets

EL-3822 – PLC HMI Touch screen display

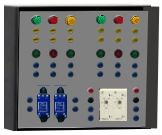
- Purpose: Practicing PLC HMI programming with the EL-3821.
- Includes:
  - A panel module in a sturdy plastic box plugged into one of the EL-380X racks
  - Widescreen TFT display
  - Touch screen + push buttons
  - Ethernet communication outlet

EL-3823 – PLC simulation modules



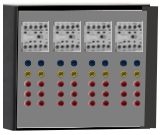
- Purpose: Practicing simulation systems application with PLC.
- Includes:
  - A panel module in a sturdy plastic box plugged into one of the EL-380X racks
  - Traffic lights simulation unit
  - Elevator simulation unit
  - Silo system simulation unit
  - PLC input and output terminals

EL-3824 – Switches, lamps and timers control system



- Purpose: Practicing automation and control PLC and manual applications.
- Includes:
  - A panel module in a sturdy plastic box plugged into one of the EL-380X racks
  - Two green lamps
  - Two yellow lamps
  - Two red lamps
  - Two red pushbuttons with terminals
  - Four green pushbuttons with terminals
  - Two limit switches with terminals
  - Two timers/counters with terminals

EL-3825 – Contactor control system

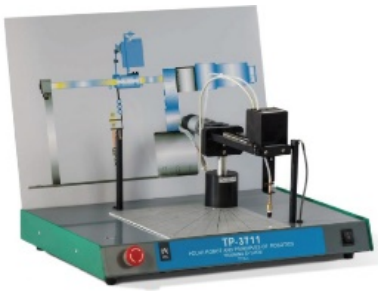


- Purpose: Practicing automation and control PLC and manual applications including Star-Delta motor control.
- Includes:
  - A panel module in a sturdy plastic box plugged into one of the EL-380X racks
  - Four three phase contactors with accessory contactor and terminals

EL-383X – Electricity PLC Simulation Systems

EL-3831 – PLC Polar robot (Three station system simulation)

- Purpose: Practicing polar robot control with PLC as a standalone system and in communication with master system.
- Includes:



- Simulation system in metal case
- Siemens PLC S7-1200
- 24V power supply
- Emergency stop button
- Main power switch
- Mechanical structure (3 degrees of freedom)
- Movement range on roll (0-90°)
- Movement range on elbow (180 mm)
- Movement range on z-axis (50 mm)
- Electric vacuum pump gripper
- Roll motor type (DC motor)
- Elbow motor type (DC motor)

EL-3832 – PLC sorting machine (Two station system simulation)

- Purpose: Practicing conveyor and sorting machine control with PLC as a standalone system and in communication with master system.
- Includes:

- Simulation system in metal case
- Siemens PLC S7-1200
- 24V power supply
- Emergency stop button
- Main power switch
- Four sorting barrier positions driven by a DC motor
- Resolution of barrier position (± 1 mm)
- Number of storage cells (4)
- Optical sensors (2)
- Inductive sensor
- Nominal movement range of the conveyor (180 mm)
- DC conveyor motor

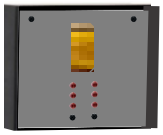
EL-3833 – Advance process control platform with PLC

- Purpose: Use of Industrial Process Control elements, Process control loops, Real-time PLC interface with ADC & Digital input/output, Process Control by PID.
- Includes:

- Heavy duty bench Workstation
- Electrical Control Panel
- Capacitive Level Sensor
- Temperature Transmitter
- Din rail mounting for PLC
- Process Control concept
- RTD Sensor
- Thermocouple Sensor
- Start , Stop , Emergency Stop button , Indicators for Pump , Heater , Stirrer, Solenoid Valve, Audio Indicator, Visual Indicator
- 2 Types of Controller : PID Control & PLC Control

EL-384X – Electrical Machines

EL-3841 – 3 phase motor frequency converter



- Purpose: Motor speed control by changing frequency
  - A panel in a sturdy plastic box plugged into one of the EL-3801 racks
  - Three phase motor frequency converter

EL-3842 – Multifunctional power meter

- Purpose: Electricity measurements over 100 parameters from basic frequency, voltages and currents, to all power parameters, four quadrant active, reactive and apparent energies, harmonics and time of use (TOU).
  - A panel in a sturdy plastic box plugged into one of the EL-3801 racks
  - 3x2” / 76x49mm backlit LCD display
  - An integral RS-485 and ethernet communication ports for a wide range of protocols.

EL-3843 – Three Phase induction motor with mechanical load

- Purpose: Practice 3 phase motor running and reversing, no load test, block rotor test, slip measurement, load test.
  - A three phase motor machine with mechanical loading arrangement
  - Provided with digital tachometer
  - Machine with class "B" insulation
  - Brake-Drum/Pully

EL-3844 – DC motor with mechanical load

- Purpose: Practice DC motor starting, running and reversing, speed control, no load test, block rotor test, slip measurement, load test.
  - A DC motor machine with mechanical loading arrangement
  - Provided with digital tachometer
  - Machine with class "B" insulation
  - Brake-Drum/Pully

EL-3845 – Single Phase induction motor with mechanical load

- Purpose: Practice single phase motor running and reversing, no load test, block rotor test, slip measurement, load test.
  - A single phase motor machine with mechanical loading arrangement
  - Provided with digital tachometer
  - Machine with class "B" insulation
  - Brake-Drum/Pully

EL-3846 – Three Phase induction motor with DC generator

- Purpose: Practice 3 phase motor with DC generator demonstrating fundamenta concepts of C compound generator on different loading condtions.
  - Electrical loading arrangement
  - Provided with digital tachometer
  - Machine with class "B" insulation
  - Heavy duty base

EL-3847 – Three Phase induction motor

- Purpose: Practice 3 phase motor running and reversing
  - A three phase motor machine
  - Machine with class "B" insulation. Heavy duty base

EL-3848 – Single Phase induction motor

- Purpose: Practice single phase motor running and reversing
  - A single phase motor machine
  - Machine with class "B" insulation. Heavy duty base

EL-385X – Electricity Transformer Units

EL-3851 – Three Phase Variable transformer

- A three phase variac

EL-3852 – Single Phase Variable transformer

- A single phase variac

EL-3853 – High current DC power supply

- A variable DC voltage high current power supply

EL-3854 Single and three phase resistive load

- Single and three phase resistive load

EL-3855 – Single and three phase inductive load

- Single and three phase inductive load

EL-3856 – Single and three phase capacitive load

- Single and three phase capacitive load

EL-396X – Electrical Installation Units

EL-3861 – Lamps and light switches

- A panel module in a sturdy plastic box plugged into one of the EL-380X racks
- Two lamps with terminals
- Single switch with terminals
- Dual switch with terminals

EL-3862 – Lamps and changeover light switches

- A panel module in a sturdy plastic box plugged into one of the EL-380X racks
- Two lamps with terminals
- Two changeover switches with terminals

EL-3863 – Lamps, cross changeover light switch and dimmer

- A panel module in a sturdy plastic box plugged into one of the EL-380X racks
- Two lamps with terminals
- Cross changeover switch with terminals
- Dimmer with terminals

EL-3864 – Stairway lighting system

- A panel module in a sturdy plastic box plugged into one of the EL-380X racks
- Two lamps with terminals
- Two pushbutton switches with terminals
- Stairway timer to be installed in the switch board unit

EL-3865 – Doorbell switch and power socket

- A panel module in a sturdy plastic box plugged into one of the EL-380X racks
- A doorbell with terminals
- A pushbutton switch with terminals
- Two power sockets with terminals

Basic Electricity Program

This course is designed to certify professional technicians, installers and manufacturing employees for electric domestic installations.

Electricity study program composed of the following units:

- Electricity laws and circuits
- Electrical working diagrams
- Domestic surface and conduit wiring
- Protecting electrical devices
- Sequence for inspecting and testing domestic installations
- Lamps and illuminations, types and installation
- Solar photovoltaic system structure and design
- Measurements in Solar photovoltaic system

This course is based on the following products:

- **EB-3000 and basic electronics experiment cards**
- **EL-3883 – Electric domestic installation workstation**
- **EL-3884 – Electrical control and machine workstation**
- **EL-3885 – Solar photovoltaic energy workstation**

The studies enable the graduate to maintain, to diagnose faults and to repair electric domestic installations

EL-389X – Electricity Special Training Systems

EL-3891 – Electrical Safety Demonstrator

Purpose: The trainer is helpful to learn, how to avoid accidents, that generally occuring while handling any electric or electronic device. The trainer has been designed for the people who are working in an electrical environment.

SES Training LABs

The training labs are based on learning-by-doing, which makes the students learn more quickly and remember what they have studied by performing practical experiments. They provide the students high profession skills and the knowledge on how to improve their chance of employment and earning capacity.

The manuals and courseware that accompany each course provide the theory background and experiments.

Electronics Training Lab
This modular laboratory is aimed for the **Electronics** profession, but also for technology disciplines that are also based in electronics, such as: **Electricity, Mechanics, Automotive, Robotics, Automation, Process control**.

Autotronics Training Lab
This modular laboratory is aimed for the five stages that comprise the automotive program: **Basic and automotive electronics, Car sub-systems simulators, Car sub-systems demonstrators, Car diagnostic and troubleshooting methods, Troubleshooting faults in a real car**.

Mechatronics Training Lab
This modular laboratory is aimed for the mechatronics program which includes the following disciplines: **Basic electronics, Pneumatics systems, Hydraulics systems, CNC machines**.

Refrigeration and Air-Conditioning Training Lab
The Refrigeration and Air-Conditioning training lab covers actual components and their interconnection, related functions, operation, diagnosis and repair methods through safe, hands-on practical activities.

Technology Preparation Training Lab
The Technology Preparation (Tech Prep) laboratory is a classroom-integrated laboratory consisting of educational modules covering a wide range of subjects such as: **Green energy, Computerized systems, Basic electronics, Basic communication, Mechanical systems.**

Science Training Labs
These laboratories (for primary, secondary and high schools) introduce the students to the computerized sensors world, **nature and industry processes** and **nature laws**. It will help them understand modern technologies such as: **home and medical appliances, wearing sensors, precise agriculture** and more.

Robotics Training Labs
The robotics programs (for primary, secondary and high schools) help students to build innovation and creativity skills. The idea is to make the students understand how systems work, to believe that they can improve them and be able to realize their ideas.

MultiCenter Training Lab
The MultiCenter offers a variety of selected interactive learning environments, with a large range of topics and activities such as: **Science, Technology, Graphic Design, Digital Music, Robotics, Computer Technologies** and much more for all sectors of society, cultures, different socio-economic groups and different age groups – from very young children to senior citizens.

EDUCATION

ELECTRICITY

Our Training Labs:

SCIENCE

ROBOTICS

ELECTRONICS

ELECTRICITY

TELECOMMUINCATION

AUTOTRONICS

MECHATRONICS

MULTICENTER

SCIENCE & ROBOTICS

TECHNOLOGY PREPARATION

REFRIGIRATION & AIR-CONDITIONING