Electricity & electronics

EB-2000 Training System

By Marketing Dept. Degem Systems Ltd.

Degem Systems

Degem's solution

EB-2000 family of Electronics Computerized Training Laboratory comprises the following main blocks:

- *Basic electronics*
  - AC and DC circuits, electromagnetism, semiconductors, basic communication circuits, sensors and stepper motors, Op-amp's, logic circuits & sequential logic circuits
- *Advanced electronics*
  - DC-AC conversion, 3-phase motor speed control, optoelectronics, power supplies, complex digital circuits, feedback and power amp's, microprocessors & microcontrollers, RISC processors, etc.

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System features

- Modular and upgradeable architecture, the lab can be configured to your present needs, enabling future expansion without major investment
- Computerized design, integrating the computer

  with the training system
- “Hands-On” with emphasis on troubleshooting and repairs (fault simulation)
- Flexible: the equipment was developed for teaching various groups of trainees at different levels

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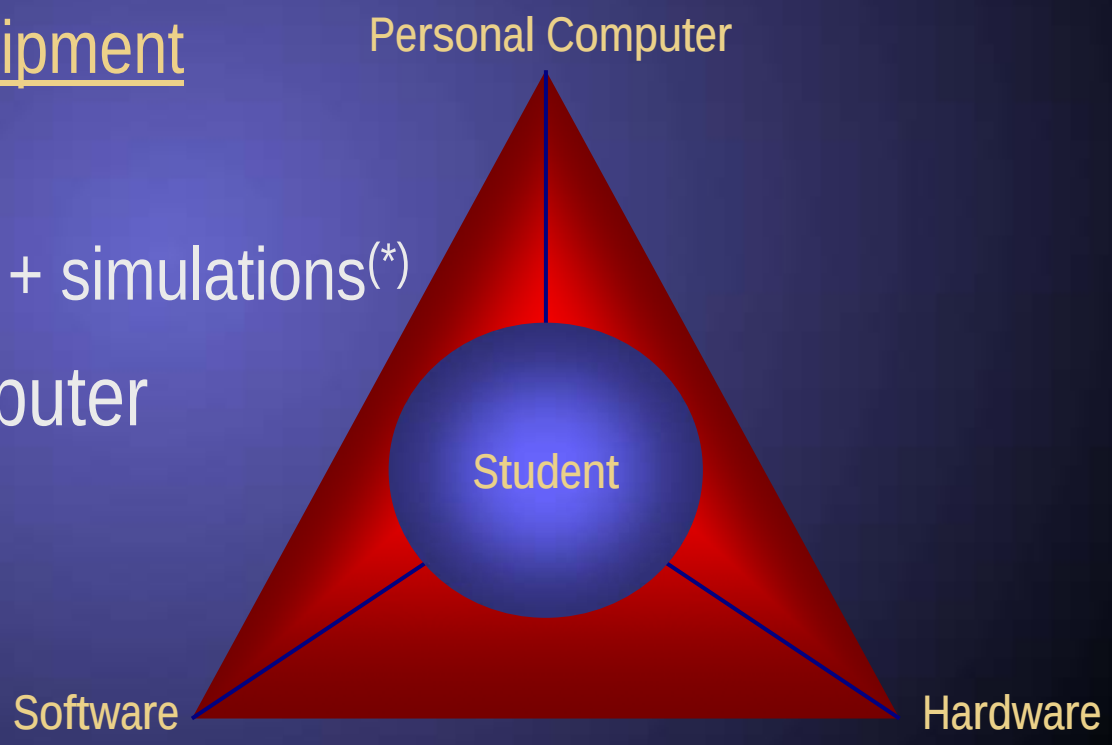
Computerized laboratory

- Hardware
  - Training equipment
- Software
  - Courseware + simulations(*)
- Personal computer

(*) when required



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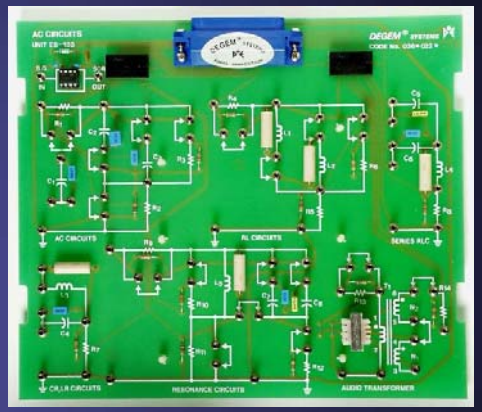
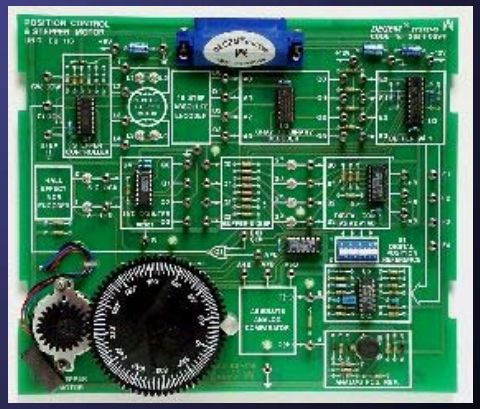
PC board courses (1)

The following subjects are covered by the available PC boards:

- Basic electronics
  - DC circuits I & II
  - AC circuits
  - Electromagnetism
  - Semiconductors fundamentals I & II
  - Motors and generators
  - Industrial semiconductors
  - Optoelectronics I
  - AM communication circuits
  - FM stereo transmitter & receiver
  - Position control and stepper motors
  - Operational amplifiers I & II
  - Logic circuits I & II
  - Sequential logic circuits





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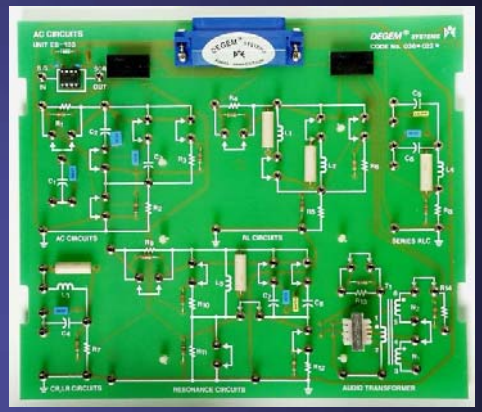
PC board courses (2)

- Advanced electronics
  - DC-DC & DC-AC conversion circuits
  - 3–phase motor speed control
  - Optoelectronics II
  - Power supplies
  - Complex digital circuits
  - Erasable programmable logic device
  - Feedback and power amplifiers
  - Oscillators, filters and tuned amplifiers
  - Logic families
  - Introduction to microprocessors & hexadecimal terminal for EB-151
  - Microcontroller 8051 – fundamentals
  - Microcontroller 8051 – peripherals
  - 32-bit 80960SA RISC processor



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Training workstation

The EB-2000 family comprises the following parts:

- PU-2000 with MB-U power supply or PUZ-2000 with internal supply
- EB-2000 printed circuit boards that plug into PU-2000 or PUZ-2000 main units
- EB-2000 experiment manuals
- EB-2000 Zrun courseware
- PU-2200 instrumentation unit with function generator, counter and digital multimeter
- DL-20 patch cord kit

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PUZ-2000 main unit

- Computerized, compact desktop unit serving as a mounting base for training modules (PC boards)
- Modules are easily and quickly inserted and removed by the trainee
- Power supply and rack units incorporated
- Linked up to a standard PC, it creates a compact, powerful and comfortable training workstation

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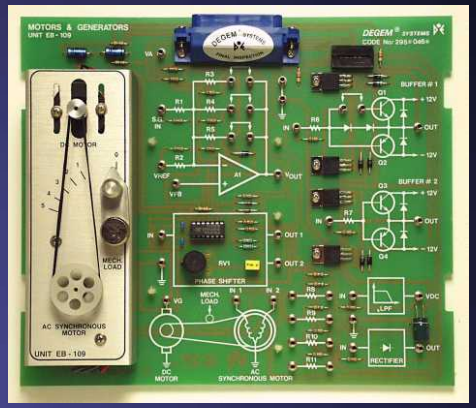
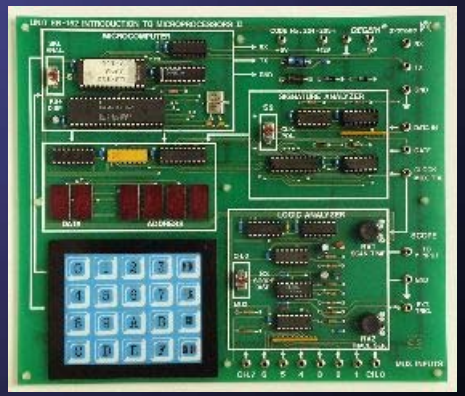
PC board features

The EB-2000 training system consist of different experimental PC boards made of resistant plastic They include:

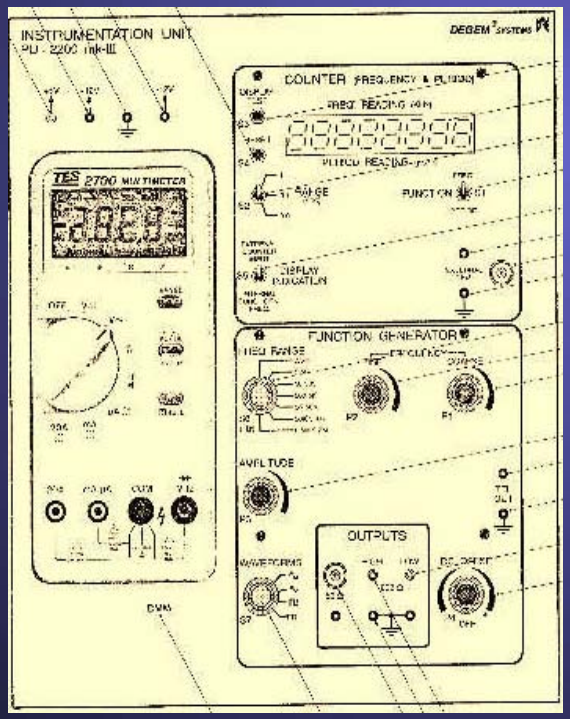
- Hardware (printed circuit board):
  - A male connector, which automatically energizes the plug-in board when it is inserted into the base unit
  - Circuit diagrams, clearly printed on the boards in accordance with ANSI Y32.14
  - Component with fixed values that are permanently connected and housed within the boards
  - 2-mm jacks for access to connections and measuring points
- Instructional materials:
  - Windows-based courseware
  - Trainee theory manuals
  - Trainee experiment manuals
  - Instructor manuals





PU-2200 measuring unit: specs

- Measuring instruments unit
  - A general purpose self-contained unit consisting of a *sine/square/triangular wave generator*, *counter* and a *digital multimeter*
  - The instruments are housed in a single enclosure



- *Sine/square/triangular wave generator:*
  Range: 1Hz – 100 KHz
  Output level: 0 – 16 Vpp (open circuit)
  Output impedance: 600 Ohm
  DC offset: 0 – 8 V (no load)
  TTL output: fan out to 10 loads
- *Counter:*
  Frequency Measurements:
  Range: 1 Hz – 10 MHz
  Gate time: 0.01 sec/0.1 sec/1 sec
  Resolution: 100Hz/10Hz/1Hz
  Period measurement:
  Range: 0.1 usec – 0.5 sec
  Resolution: 0.1 sec
  Input section:
  Sensitivity: 150 mV RMS up to 100 MHz
  Impedance: 100 Kohms
  Time base: frequency: 10 MHz +30 PPM
- *3½ digit digital multimeter:*
  DC voltage: 200mV/2V/20V/200V/1000V
  AC voltage: 200V/750V
  DC current: 200uA/2mA/200mA/2A
  Resistance: 200ohm/200Kohm/2Mohm
  Measurement rate: 2.5 measurement per sec

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Panel and PC interface technical specs

- Panel:
  - Two guides helps slide the plug-in boards into the main 36-pin male connector that has to provide power supply output voltages and change-over contacts of eight internal relays
- PC interface:
  - Special cable connects the base unit to the LPT1 parallel port (25-pin female D connector) of the personal computer

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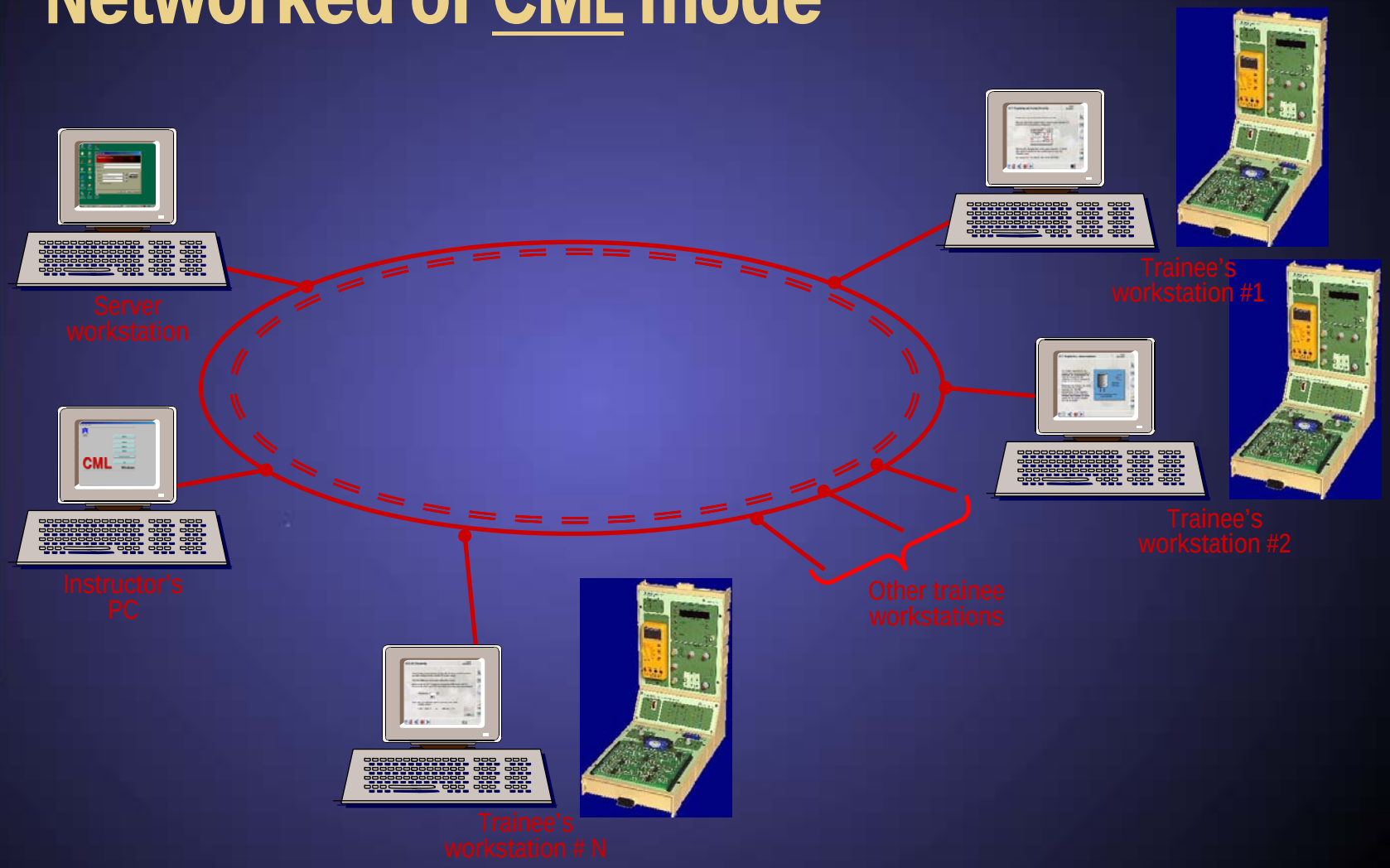
Networked or CML mode



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Computer Managed Laboratory

- By adding an instructor PC, which is linked to all the trainee workstations by a LAN, a CML is created
- The instructor can view each trainee's progress in real-time
- More time to spend with individual trainees
- Wide variety of reports
- Optimize the school's pedagogical administration

Zoom in

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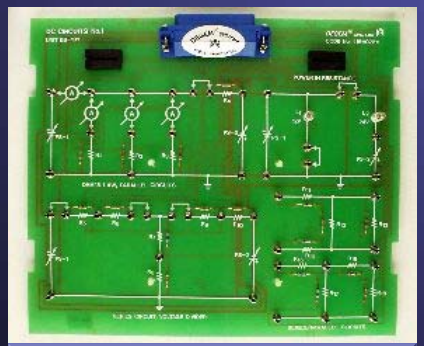
EB-101 & EB-102: DC circuits I & II

EB-101 EB DC circuits I – topics covered:

- Digital multimeter
- Resistance color code
- Ohm's law
- Power in a resistance
- Resistors in series
- Kirchoff's voltage law
- Voltage dividers
- Resistors in parallel
- Kirchoff's current law
- Current dividers
- Series-parallel circuits
- Troubleshooting DC circuits

EB-102 EB DC circuits II – topics covered:

- Thevenin's theorem
- Potentiometer
- Millman's theorem
- Superposition theorem
- Voltage source
- Maximum power transfer theorem
- Wye-delta and delta-wye conversions
- Troubleshooting DC circuits



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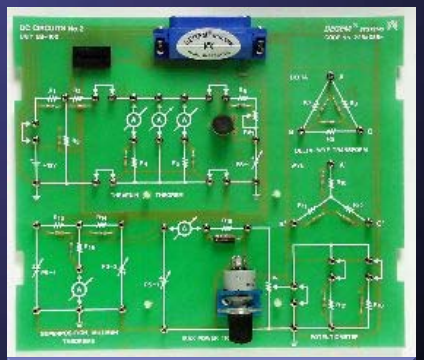
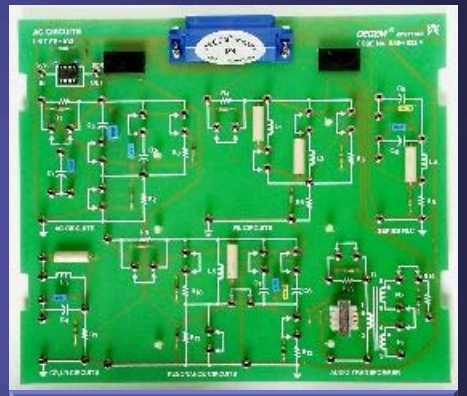


Zoom in

EB-103: AC circuits

EB-103 – topics covered:

- AC waveform
- AC current
- Capacitors
- R/C circuits
- Inductors
- R/L circuits
- Resonance
- R/C filters
- R/L filters
- Bandpass filters
- The transformer
- Troubleshooting AC circuits



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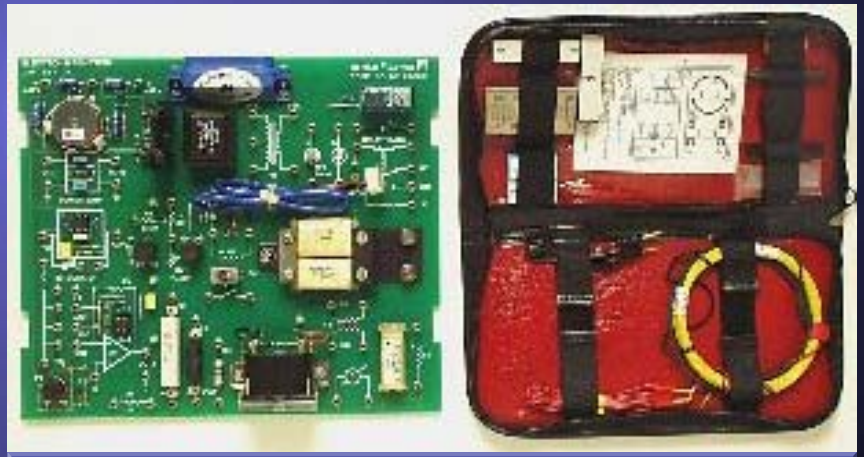
EB-105: Electromagnetism

EB-105 – topics covered:

- Magnetic field
- Magnetic field produced by an electric current
- Induced voltage
- Transformers
- Hysteresis



Zoom in

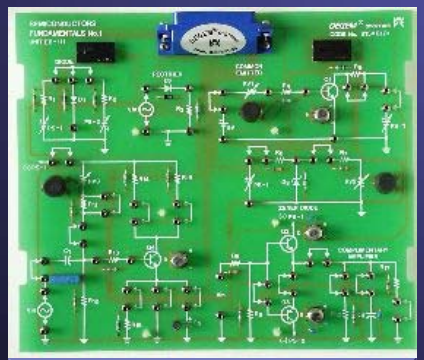
EB-111 & EB-112: Semiconductors fundamentals I & II

EB-111 – topics covered:

- Junction diode characteristics
- Diode rectifier
- Zener diode regulator
- Bipolar transistor characteristics
- Basic transistor amplifier I
- Basic transistor amplifier II
- Emitter follower and push-pull amplifier
- Troubleshooting semiconductor circuits

EB-112 – topics covered:

- Field-effect transistor (FET) characteristics
- FET amplifiers
- VMOS FET
- Thyristor (SCR)
- Triac
- Troubleshooting semiconductor circuits



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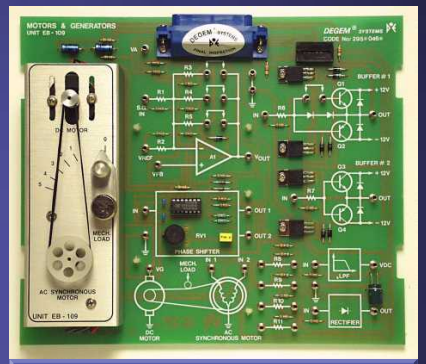
EB-109: Motors and generators

EB-109 – topics covered:

- Measure the speed of a motor
- Back-emf(*) of a DC motor
- Loading the DC motor
- Speed regulation, efficiency, torque and power
- AC motor and DC generator
- Load the AC motor with a DC generator
- Closed loop DC motor speed control
- Closed loop control of AC generator voltage
- PWM speed control of DC motor
- Troubleshooting motors and generators

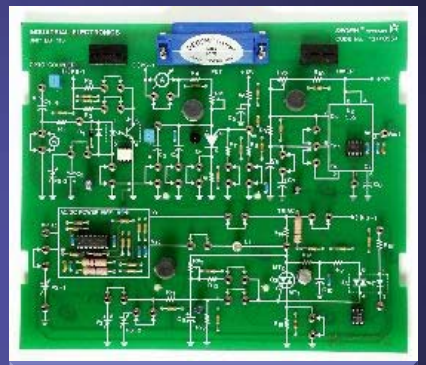


Zoom in

EB-113: Industrial semiconductors

EB-113 – topics covered:

- Optocoupler
- Programmable unijunction transistor (PUT)
- 555 timer
- Triac
- Troubleshooting an industrial electronics control circuit



Zoom in

EB-114: Optoelectronics I

EB-114 – topics covered:

- Light dependent resistor (LDR)
- Photodiode
- Phototransistor
- Light-emitting diode (LED)
- Incandescent lamp
- LED alphanumeric display
- Liquid crystal display (LCD)
- Troubleshooting optoelectronics circuits

Zoom in

EB-170: AM communication circuits

EB-170 – topics covered:

- Signal sources
- Amplitude modulation using a multiplier
- RF tuned amplifier
- IF mixer
- IF amplifier with automatic gain (AGC) control
- Envelope detection and AGC amplification
- Superheterodyne receiver performance
- Troubleshooting a superheterodyne receiver

Zoom in

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EB-171: FM stereo transmitter & receiver

EB-171 – topics covered:

- Principles of linear circuits
- DSSC (double sideband suppressed carrier) modulation
- Subcarrier recovery in the receiver
- DSSC demodulation
- Stereo separation in the receiver
- FM stereo transmission and reception
- Troubleshooting FM stereo circuits

Zoom in

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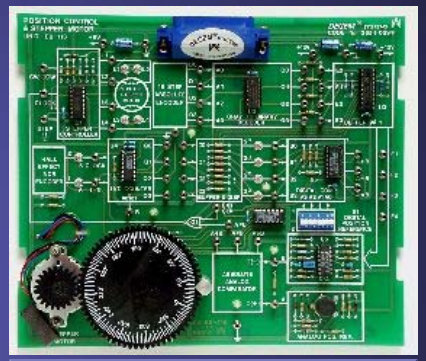
EB-116: Position control & stepper motors

EB-116 – topics covered:

- Stepper motor and driver
- Absolute encoder
- Digital comparator
- Closed-loop digital position control
- Closed-loop analog position control
- Hall effect incremental encoder
- Closed-loop position control with an incremental encoder
- Troubleshooting a closed-loop digital position control system



Zoom in

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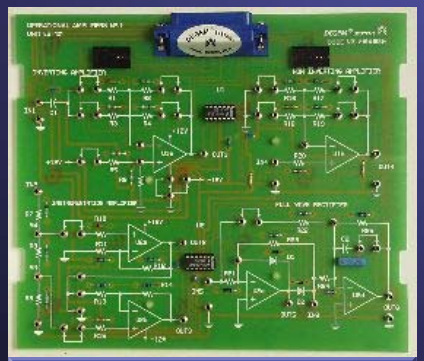
EB-121 & EB-122: Operational amplifiers I & II

EB-121 – topics covered:

- Inverting DC amplifier
- Inverting AC amplifier
- Single-supply amplifier
- Non-inverting amplifier
- Instrumentation difference amplifier
- Instrumentation rectifier
- Troubleshooting a system that consists of several operational amplifier circuits

EB-122 – topics covered:

- Comparators
- Integrators
- Differentiators
- Low-pass and bandpass filters
- Schmitt trigger
- Square wave generator
- Troubleshooting an analog signal processing circuit



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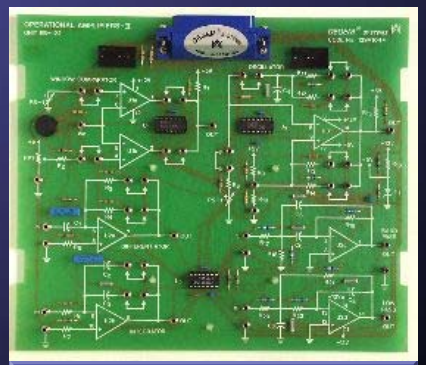


Zoom in

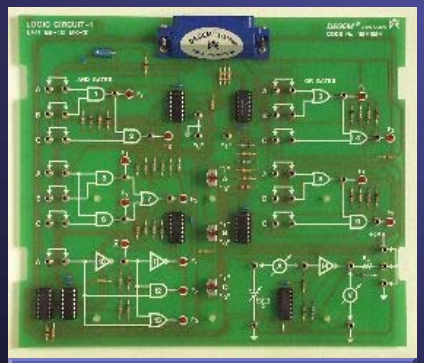
EB-131 & EB-132: Logic circuits I & II

EB-131 – topics covered:

- AND gates
- OR gates
- Combining logic gates
- NOT gates Boolean algebra
- Logic levels
- Troubleshooting a digital logic system

EB-132 – topics covered:

- NAND gates
- NAND equivalent circuit
- NOR gates
- NOR equivalent circuit
- Digital comparator
- Troubleshooting a digital logic system



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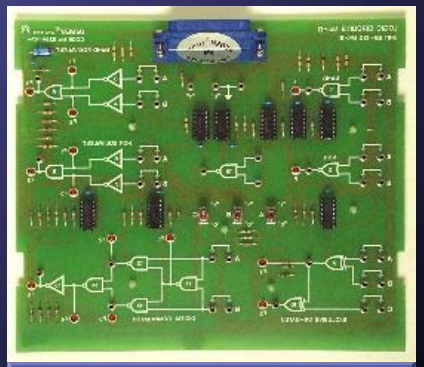
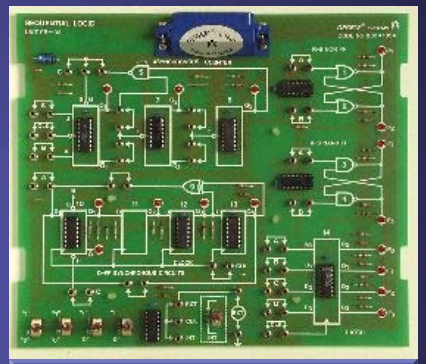


Zoom in

EB-133: Sequential logic circuits

EB-133 – topics covered:

- RS flip-flops
- Latches
- JK flip-flop
- JK asynchronous counters
- D flip-flop
- D flip-flop synchronous circuits
- Troubleshooting a sequential logic system



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