5 electronics and communications

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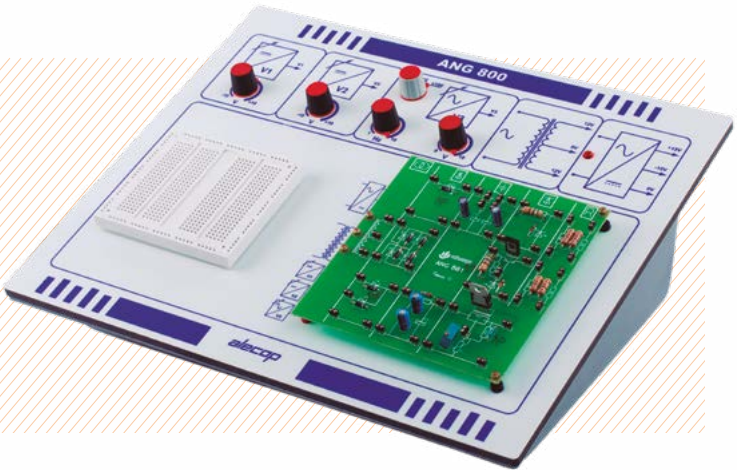
800 series

The ANG-800 and DIG-800 are complementary analog and digital training systems providing a reliable and cost-effective solution to teaching Electricity and Electronics.

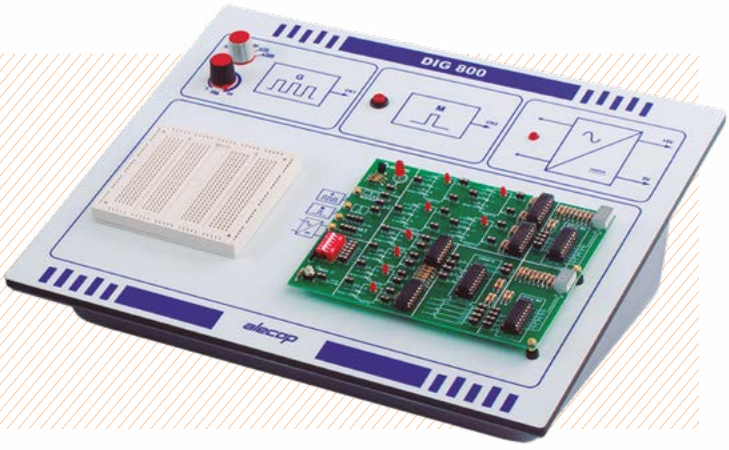
Both systems are based on consoles into which pre-constructed circuit boards and components can be inserted to cover various aspects of analog and digital components and circuits. A prototyping area is included on the console to allow for extra experiments and project work to be undertaken.

The consoles not only offer a convenient and robust platform for conducting experiments but also provide all necessary power supplies and signal sources. When the preconstructed circuits are inserted into the console the relevant power supply connections are automatically made keeping unnecessary and potentially confusing connections to a minimum. The only additional equipment required is an Oscilloscope and a Multimeter. These trainers are supplied with comprehensive user guides and experimental procedures together with storage cases, connecting leads and components.

ANG-800 console: Analog electricity and electronics



DIG-800 console: Digital electronics



ANG-800 console: Analog electricity and electronics



Training device for studying basic analog electronics circuits. It consists of a base module into which ready-mounted circuits can be fitted for analysis and on which activities can be carried out on a protoboard.

Ref.: PANANG806X (220V 50/60Hz)

Includes:

- Power source +/-15 volts dc 0.5A.
- Transformer with centre tapping 12-0-12 volts ac 0.3A.
- Two variable voltage sources +/-10 volts dc 0.1A.
- One AC voltage source with variable amplitude (0 - 10 volts) and frequency (1Hz to 1kHz).
- Protoboard.
- Storage drawer with connectors, accessories and electronic components.
- CD with: User Manual, Practical Manual and information about the main electronic components used on the device.

Complete with 5 sets of circuit boards:

- Set A: DC and AC circuits: (4 boards).
- Set B: introduction to Analog Electronics: (3 boards).
- Set C: analog Communications (3 boards).
- Set D: digital Communications (4 boards).
- Set E: fiber Optics trainer (1 board).

Set A: DC and AC circuits (4 boards)

Ref.: ACCANG800A

1. DC fundamentals and networks theorems I
- Basic DC circuit.
- OHM Law.
- Series circuit.
- Parallel circuit.
- Kirchoff's voltage law.
- Kirchoff's current law.
- Kirchoff's law combined.
- Thevenin circuits.
- Kirchoff with 2 sources.
- Superposition theorem.

2. DC fundamentals and networks theorems II
- Thevenizing a bridge circuit.
- Delta to star conversion.
- Charge and discharge of capacitors.
- Capacitors connected in parallel and series.
- Resolution of a DC circuit with capacitors.

3. AC Circuits I
- Sinusoidal waveform, AC values.
- Purely resistive AC circuit.
- Purely capacitive AC circuit.
- Purely inductive AC circuit.
- RC series AC circuits.
- RL series AC circuits.

4. AC Circuits II
- RLC series circuit.
- RLC series resonance.
- RC parallel circuit.
- RL parallel circuit.
- RLC parallel circuit.
- RLC parallel resonance.
- Low pass filter.
- High pass filter.

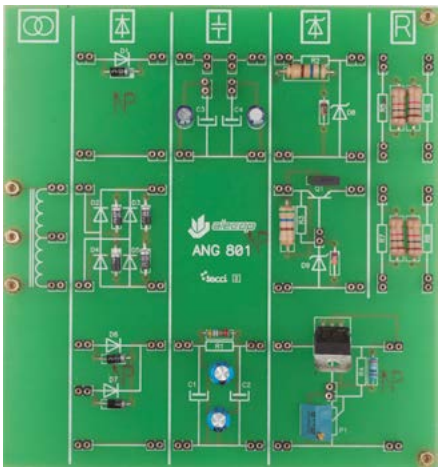
Set B: introduction to Analog Electronics (3 boards)

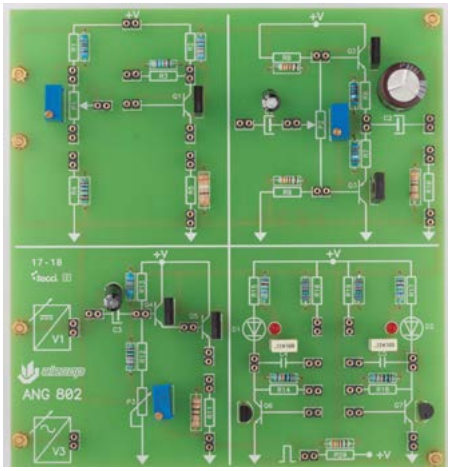
Ref.: ACCANG800B

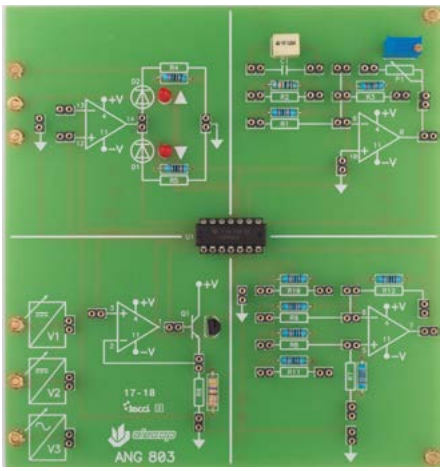
1. ANG-801 Rectification and filtering
- Single phase half wave rectifier.
- Single phase full wave rectifier with intermediate centre tap.
- Single phase full wave bridge rectifier.
- Filtering.
- Parallel stabilizer.
- Serial stabilizer.
- Stabilized adjustable power supply.

2. ANG-802 Transistor circuits
- Polarization of the bipolar transistor.
- A Class power amplifier.
- AB Class power amplifier.
- The switching transistor
- Astable multivibrator.
- Monostable multivibrator.
- Bistable multivibrator.

3. ANG-803 Operational amplifiers
- Comparator without feedback.
- Variable gain inverting amplifier.
- Non inverting amplifier.
- Inverting amplifier.
- Subtractor.
- Power amplifier.







Set B boards.

Set C: analog communications (3 boards)

Ref.: ACCANG800C

1. ANG800-AM Amplitude Modulation
- AM double sideband (DSB) with full carrier.
- Measuring modulation depth.
- Double sideband with no carrier.
- Generation of single sideband (SSB) with a filter.
- Recognising different modulation types from oscilloscope patterns.
- Demonstration of spectral components i.e. two sidebands and a carrier.
- AM demodulation with an envelope diode detector.
- AM and DSB using a product detector.
- Single sideband demodulation with a product detector.
- Post detection filters.

2. ANG800-FM Frequency Modulation
- Generation of FM with a voltage controlled oscillator.
- Modulation Index, narrow and wideband FM.
- Recognising FM from its oscilloscope pattern.
- Slope detection of FM.
- Demodulation with a phase locked loop (PLL).
- Operation of a quadrature detector (used in most commercial FM radios).
- Operation and advantages of a limiter.
- Post detection filters.
- Pre-emphasis and de-emphasis.

3. ANG800-PM Phase Modulation
- Generation of PM with phase index from 0 to +/- 360 degrees.
- Recognising PM from its oscilloscope pattern.
- Relationship between phase and frequency modulation.
- PM detection using an FM demodulator and an integrator.
- Detection using a balanced mixer and carrier reference.
- Effect of phase modulation index on residual carrier amplitude.
- Carrier reference recovery using a PLL.

Set D: digital communications (4 boards)

Ref.: ACCANG800D

1. ANG800-BDE Baseband digital encoding
- Using a Pseudorandom Binary Sequence (PRBS) as a test bit-stream.
- Non Return to Zero (NRZ) unipolar and bipolar.
- Return to Zero (RZ) unipolar and bipolar.
- Alternate Mark Inversion (AMI) coding.
- Manchester coding.
- Identify coding systems from their oscilloscope patterns.
- Magnitude of dc component in different coding systems.
- Bit-rate clock recovery strategies.
- Word framing in bit-streams.

2. ANG800-ADK Advanced digital keying
- Generation of Binary PhaseShift Keying (BPSK), QPSK, 8-PSK, 16-APSK, 16-QAM with an IQ modulator.
- Symbol mapping into I and Q streams.
- Recognising different keying systems from their constellation diagrams.
- Relationship between bit-rate and symbol rate.
- Identify the effect of noise in a constellation diagram.
- Symbol space and error rate for different signal to noise ratios.
- Demodulation with an IQ demodulator.
- Carrier reference recovery with a Costas loop.

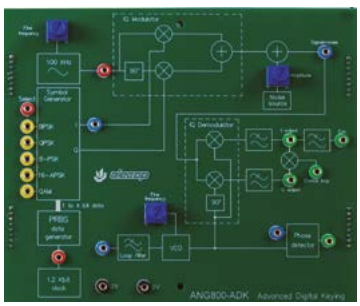
3. ANG800-DS Muestreo digital
- Pulse Code Modulation (PCM) using a 24 bit frame.
- 3 channel Time Division Multiplexing (TDM).
- Frame synchronisation and false syncing.
- Differential Phase Shift coding and decoding.
- Minimum shift keying, demodulation using phase demodulator.
- Gaussian minimum shift keying.

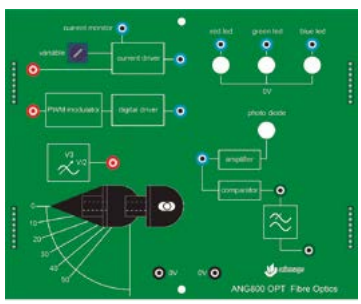
4. ANG800-PCM Pulse code modulation
- Signal sampling.
- A to D and D to A conversion.
- Resolution and number of bits.
- Signal reconstruction and aliasing.
- Pulse Width Modulation (PWM).
- Delta modulation and demodulation.
- Sigma Delta modulation and demodulation.
- Sigma delta modulator as an oversampling A/D converter.
- Conversion of a Sigma delta single bit-stream to N bit data.

Set E: fiber optics trainer (1 board)

Ref.: ACCANG800E

1. ANG800-OPT Fiber optics
- LED optical source and driver.
- Fiber characteristics relative to wavelength and physical length.
- Estimation of light entry characteristics.
- Bandwidth and linearity.
- Estimation of bending and joint losses.
- Detectors and interface electronics.
- Compare Analog and Digital coding.
- Low frequency channel characteristics.
- PWM link implementation.



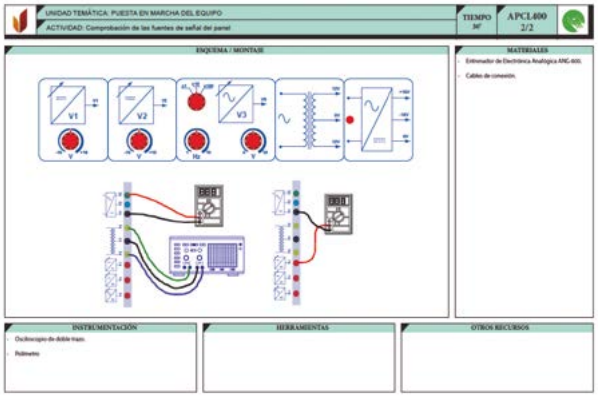


Set D (left) and Set E (right) boards.

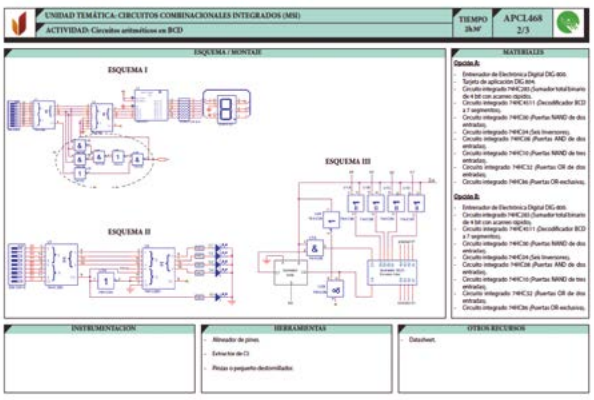
With the equipment, a set of practical activities is delivered on CD support. Given the open nature of the equipment, this set of activities can be complemented with other activities that the teacher considers appropriate. These can be carried out either on the Proto-Board or by designing new application circuits in the center's own laboratory.



ANG-800 activity example



DIG-800 activity example



DIG-800 console: Digital electronics



Training device for studying basic digital electronic circuits. It consists of a base module into which ready mounted circuits can be fitted for analysis and on which activities can be carried out on a protoboard. Ref.: 9EQDI8006I

Includes:

- Power source +5 volts DC 1A.
- Variable frequency oscillator, 1Hz - 100KHz (0-5V TTL).
- Digital pulse generator via push-button with debouncing circuit.
- Protoboard.
- Storage drawer with connectors, accessories and electronic components.
- CD with User Manual, Practical Manual and information on the main electronic components used on the device.

Complete with 4 applications boards:

- Gate and Logic functions.
- Combinational Circuit applications.
- Sequential Circuits.
- Digital Circuit construction board including 8 x 16 pin DIP sockets, 8 micro switches, 10 LED red diodes and four 7 segment displays.

Topic coverage includes:

- Knowledge of an IC.
- Light Emitting Diodes (LED).
- Study of the different logic gates (NOT, AND, OR, NAND, NOR, XOR, XNOR).
- Combinational circuits SSI.
- Priority encoders.
- Decoders and demultiplexers.
- Seven-segment Displays.
- Decoders BCD to Seven-segment Display.
- Multiplexors.
- Comparators.
- Arithmetic circuits in natural binary.
- Arithmetic circuits in BCD.
- Asynchronous flip-flops.
- Synchronous flip-flops.