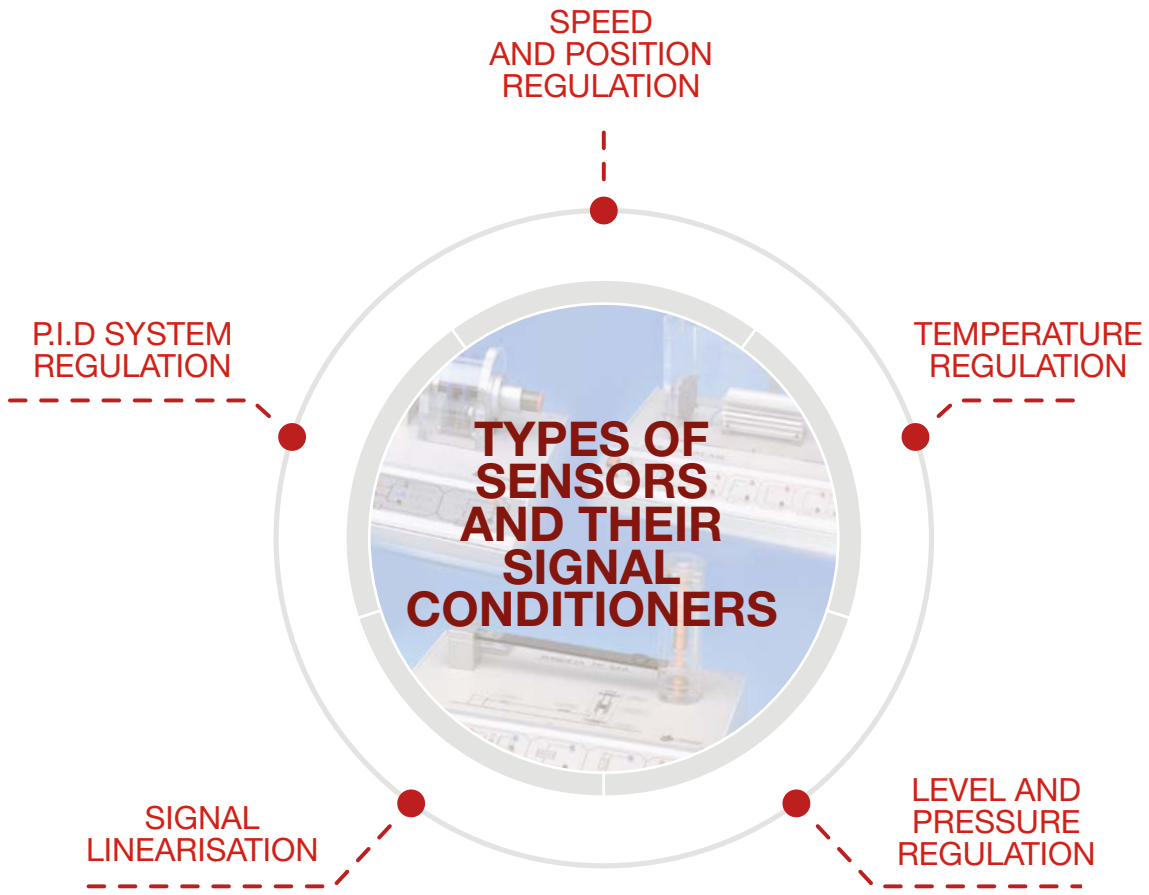
7 regulation and control systems

The training equipment designed for this area consists of a modular programme enabling study through the analysis and design of different measurement and regulation systems. Functional models with integrated industrial sensors are used to study both these sensors and closed loop regulation systems for different processes (speed, temperature and level).



Simplicity

Process models with ready-to-work integrated actuators and sensors. 2 mm sockets for quick connection and multi-point measurement.

Quality

Compliant with the European low voltage and electromagnetic compatibility directives. Elements printed in accordance with the IEC (Electrotechnical Commission) standard.

Back-up resources

This equipment includes a set of back-up elements to aid the trainer, e.g.:

- Practical Manuals.
- Theory Manuals.
- Data collection and display software.
- Technical instruments, etc.

MODULAR PROGRAMME

The system is based on a “module” support, which can be configured according to user needs. The 540 series enables all the content to be studied, with high function integration on each module.

Assembly and power supply system

The basis of the modular programme consists of the assembly frame and the ±15 V power supply module (ALI-700 module), which is required for all training module configuration requiring an electronic power supply.



Table-mounted training frame

- This is a physical support for the modules, blocks and panels used for the practical activities.
- It transmits the electrical supply from the power supply modules to all the modules requiring it.

The frame dimensions are selected in accordance with the equipment to be mounted on the frame. Its horizontal structure consists of an aluminium section and the rectangular side supports are oven-dried painted iron sections.

As regards locating the frame on the work tables, it may be fixed (the frame can be fixed to the tables) or mobile (in which case it is supplied with removable legs with non-slip feet). The module power supply and fixing systems consist of a series of connectors, into which the connection points located on the rear of the modules are inserted, exerting a slight pressure.

Ref.: 9EBxPxxCP

x: 1,2: frame height in tiers.
xx: 10, 14, 18, 20, 22, 28, 36, 44: nº of insertable single modules.

Training Module **ALI-700**

±15 V. POWER SUPPLY

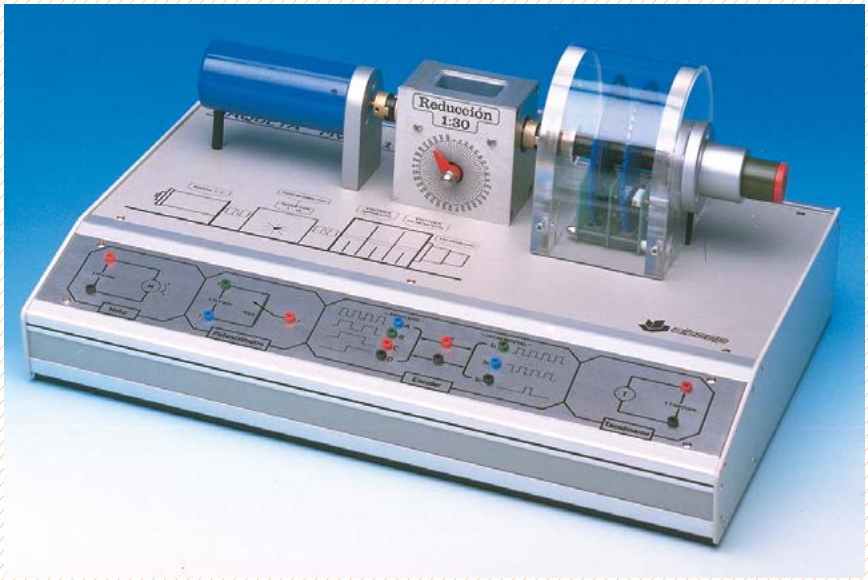
Power source: ± 15 V. It transmits the power supply via the table-mounted frame. These voltages are also available at 2 mm terminals.

It provides a nominal current of 2 A, and includes thermal and short circuit protection with automatic reset after a few seconds.

Ref.: MDULALI700

540 Series

Study of speed and position control processes



Ref.: 9EQCAMV541

Speed and position in a DC engine unit

MV-541

It consists of a model that incorporates a rotation axis powered by a DC motor, including the sensors, which are arranged in an accessible form to facilitate understanding by the student.

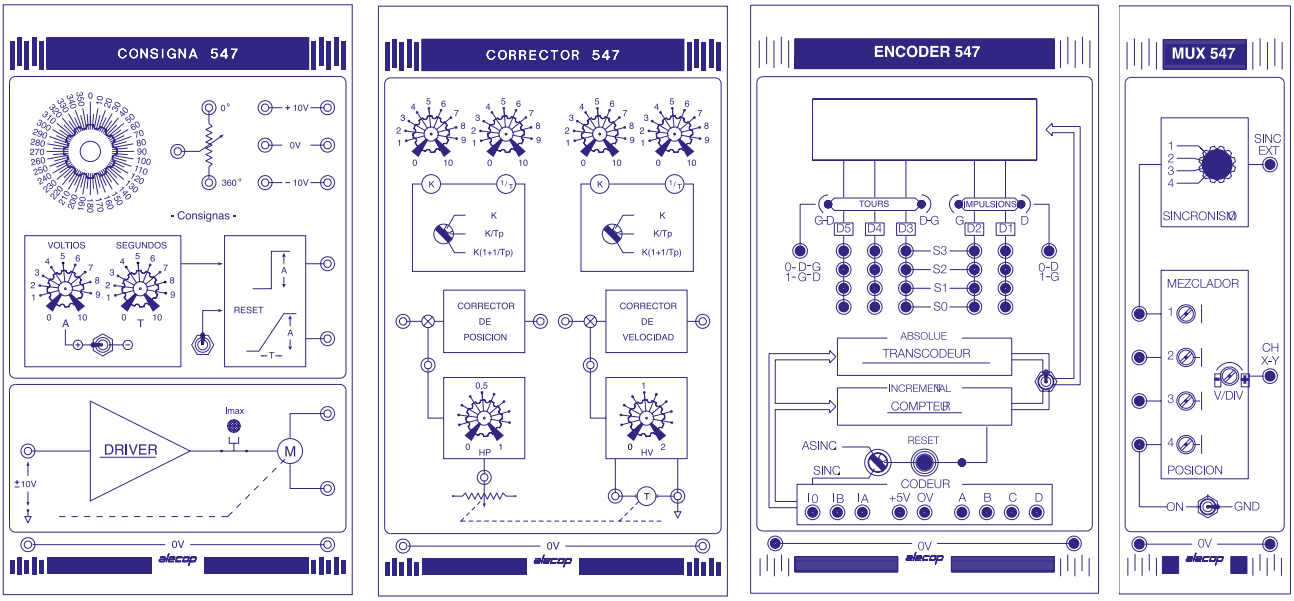
In associated with the motor axis, is available:
- A tacho speed for capturing.
- An absolute encoder and an incremental angular displacement uptake.
- A speed reducer indicating the angle of its axis reduced.
- A potentiometric angular position sensor.

The printed connection terminals are located on the front panel of the model, between the different sensors and the motor, with the conditioning and control models.

Standard components included:
- Table-mounted frame.
- ALI-700 power supply module.
- Series 540 model and specific control modules.

Standard accessories:
- Mains connection cable and 2 mm connectors.
- User Manual and Practical Manual.

Optional elements recommended:
- FPB training module: low pass filter.



Encoder conditioner

ENCODER-547

- Display panel containing 7-segment displays of the number of pulses and turns from the absolute or incremental encoders.
- Pilot lights for right-left pulses and right-left or left-right turns, with their corresponding terminals.
- Terminals with BCD output for the value of each digit on the display.
- Selection of counter for incremental encoder and decoder for absolute encoder.
- Reset is manual or synchronised with the incremental encoder signal.

Speed and position corrector

CORRECTOR-547

- These are speed and position correctors which may be either proportional, integral or proportional-integral, selectable via rotary switch.
- Corrector parameters adjustable via potentiometric controls.
- Includes conditioners for the tacho dynamo and the potentiometric sensor.
- Includes analogue comparator and adder.

Setting and driver modules

CONSIGNA-547

- This contains the signal generator for the speed setting (step or ramp) and the position setting.
- Power driver acting on the DC motor, with overvoltage protection calibrated to 1 A.

4-channel multiplexer

MUX-547

- Enables up to four analogue and/or digital signals to be viewed on an oscilloscope.
- The four input channels have offset adjustment control and actuator switch or reset to zero.
- It is equipped with a selector switch for sync with respect to any of the inputs and another selector for alternate or chopped display.
- Outputs for connection to the oscilloscope channel and for connection to its external sync.

540 Series

Study of temperature control processes



Ref.: 9EQCAMT542

A furnace temperature unit

MT-542

The model consists of a simulator of a furnace in which are located inside the heating (equipped with aluminium radiator) and the different temperature sensors.

On the left side of the oven is located a fan whose window can be closed by a lid, available on the reverse side of a ventilation window also with a lid.

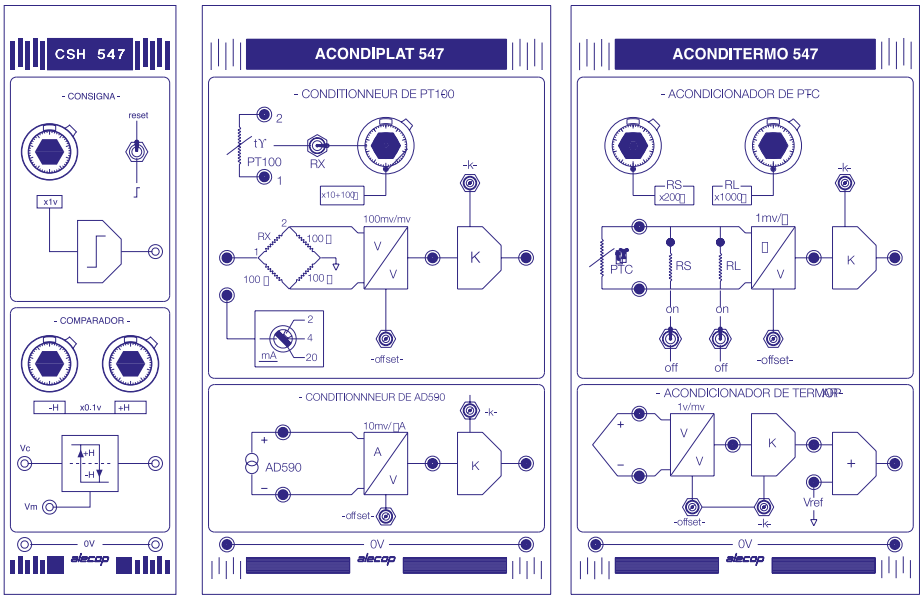
The sensors contained on the model are:
- 1 integrated temperature transducer AD-590.
- 1 type J thermo-couple.
- 1 positive temperature coefficient resistance transducer PTC.
- 1 platinum resistive transducer PT-100.

The last three sensors above are in heat contact with another three integrated transducers AD-590 installed, and which serve as reference thermometers for these. Readings are taken from these transducers on the digital thermometer placed on the front panel of the model.

Printed connection terminals between the heater and the different sensors are included with the conditioning and control modules.

Standard components included:
- Table-mounted frame.
- ALI-700 power supply module.
- Series 540 model and specific control modules.

Standard accessories:
- Mains connection cable and 2 mm connectors.
- User Manual and Practical Manual.



Set point and hysteresis control modules

CSH-547

- Set point signal generator, adjustable via potentiometric control.
- Comparator with hysteresis, with adjustable strip and pilot light indicating output level (0 or 1).

Thermocouple and PTC conditioner

ACONDITERMO-547

- PTC temperature sensor and thermocouple conditioners.
- Offset adjustment and gain controls.

AD-549 and PT100 conditioner

CONDIPLAT-547

- Platinum resistance conditioner (PT100).
- AD-590 conditioner.
- Offset adjustment and gain controls.

540 Series

Study of level processes and flow



Ref.: 9EQCAMD544

Level and flow of a deposit unit

MD-544

The model has a water-tight tank with two compartments, one to control the level and the other for drainage; there is a motorised pump which transfers the liquid from one place to another, and a set of sensors:

- For levels, using a float with linear potentiometer.
- For levels, by variable capacity.
- For levels, by ultrasound.
- For flow, by differences in hydrostatic pressure.
- For flow, by turbine.
- For hydrostatic pressure.

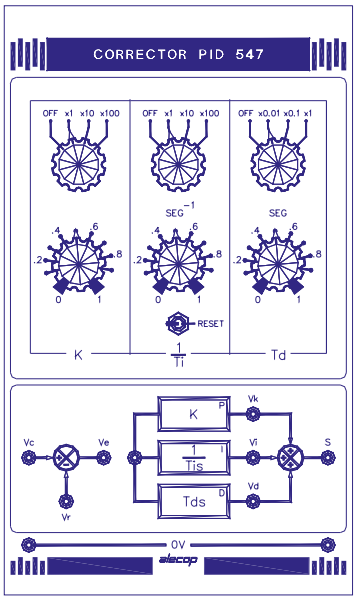
Printed connection terminals between the pump motor and the different sensors are included with the conditioning and control modules.

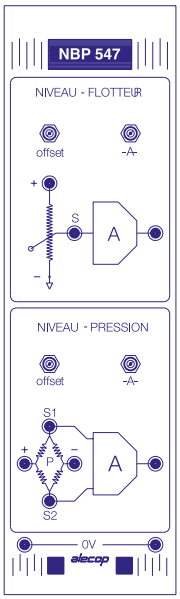
Standard components included:

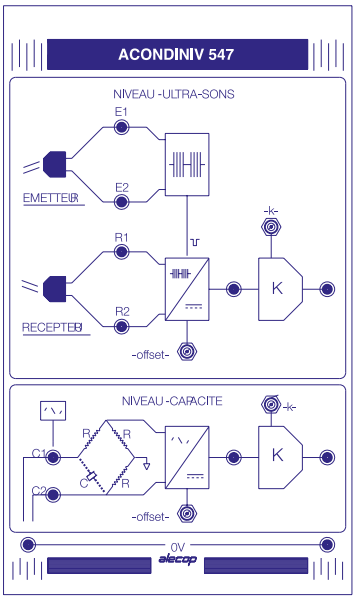
- Table-mounted frame.
- ALI-700 power supply module.
- Series 540 model and specific modules.

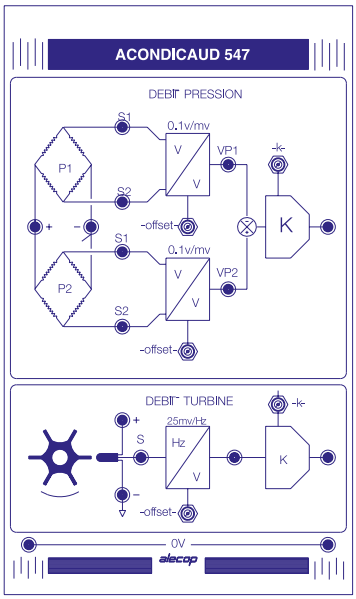
Standard accessories:

- Mains connection cable and 2 mm connectors.
- Manual and Practical Manual.









Setting and driver for pump motor modules

CSS-547

- Set point generator (adjustable ramp and step).
- Power amplifier for the motor pump.
- Overcurrent protection circuit calibrated to 1 A with automatic disconnection.

PID corrector

PID-547

- Adjustment of corrector parameter values via potentiometric controls.
- Selection of P, I, D correctors or any combination of the same.
- Reset switch.

Float and hydrostatic pressure conditioner

NBP-547

- Hydrostatic pressure sensor conditioner.
- Float type sensor conditioner.
- Offset and gain adjustment.

Flow conditioner

ACONDICAUD-547

- Pressure-difference flow sensor conditioner with offset and gain adjustment.
- Turbine flow sensor conditioner with frequency/ voltage converter and gain adjustment.

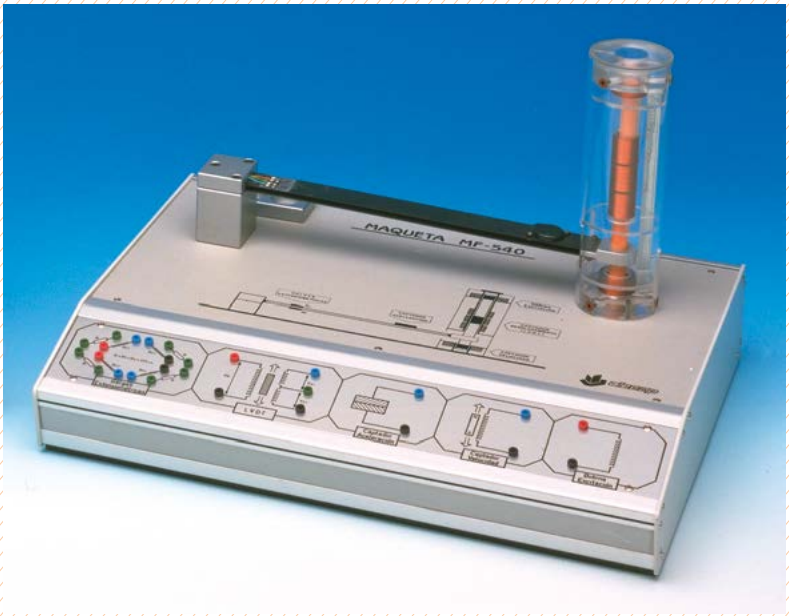
Ultrasonic and capacitive level conditioner

ACONDINIV-547

- Ultrasonic level sensor conditioner with oscillator and offset and gain adjustment.
- Capacitive level sensor conditioner with oscillator and offset and gain adjustment.

540 Series

Study of physical magnitude sensors



Ref.: 9EQCAMF540

Physical measures unit

MF-540

The MF-540 unit is designed to make a real, practical study of physical magnitude sensors, such as movement, linear speed and acceleration and buckling forces on a plate.

The model is made up of a vibrating cantilever consisting of two plates firmly fixed at either end to a fixed mount on the model, and to a vertical rod. As collectors items containing:

- An LVDT (linear variation differential transformer) as the sensor for movement.
- An inductive speed sensor.
- A piezoelectric acceleration sensor.
- Four strain gauges, 2 working by traction and 2 by compression, to collect the buckling forces.

The drive device for the vibrating cantilever is a coil, which when excited by an oscillating signal, will make the cantilever vibrate.

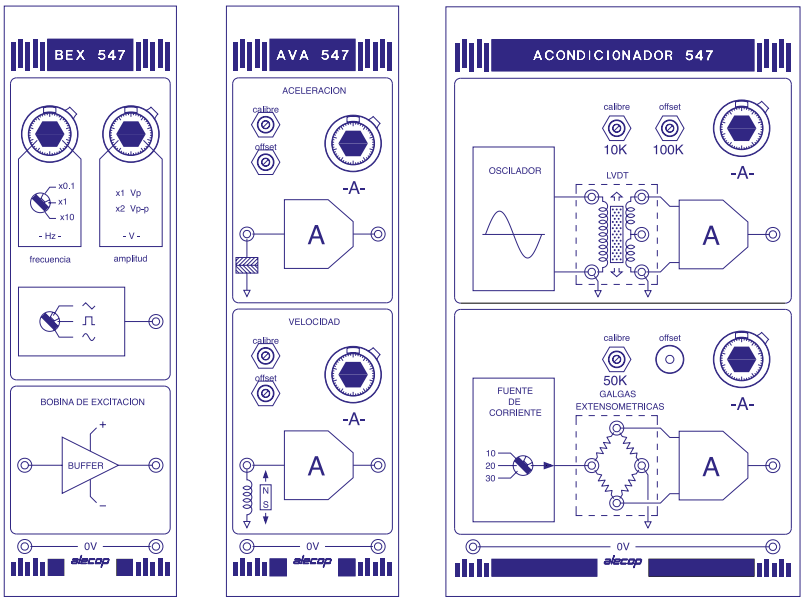
The connecting terminals from the various sensors and the drive coil to the modular control cabinet is on the front panel.

Standard components included:

- Table-mounted frame.
- ALI-700 power supply module.
- Series 540 model and specific modules.

Standard accessories:

- Mains connection cable and 2 mm connectors.
- User Manual and Practical Manual.
- Micrometer.
- Weights.
- Allen key and adjustment screwdriver.



Oscillator coil driver modules

BEX-547

- Oscillator with variable amplitude and frequency, from 0 - 10 V and 0.1 Hz - 100 Hz.
- The signal is amplified by a current buffer providing up to 0.3 A.

Speed and acceleration conditioner

AVA-547

- Conditioners for the speed and acceleration sensor signals.
- Preamplifier and internal bandpass filter to eliminate mains noise.
- Adjustable amplifier and offset.

LVDT conditioner and gauges

ACONDICIONADOR-547

- Conditioners for displacement sensor signals (LVDT) and bending stresses (strain gauges).
- Adjustment controls for zero displacement and for calibre and gain for the LVDT.
- Gauge conditioner with rotary selector switch for setting Wheatstone bridge current.
- Controls for correction of offset and calibre and gain adjustment.

DAQ-601

Control module by Matlab/Labview

Control and data acquisition system. Module support for data acquisition, signals generation and digital control of processes. Programmable from MATLAB-SIMULINK, through the Data Acquisition Toolbox, and LABVIEW environment.



Technical characteristics

- Bus interface:
  - PC connection: USB serial port. No need to install cards in the computer. Allow to use laptops.
  - USB specification: USB Full Speed.
  - USB bus speed: 12Mb/s.
- Analog Inputs:
  - Channels: 8 single-ended / 4 differentials.
  - Input range: +/-10Vcc.
  - ADC resolution: 14 bits.
  - Bandwidth: 300 KHz.
  - Converter type: Successive approximation.
  - AI FIFO: 2,047 samples.
  - Trigger sources: Software, PFI 0, PFI 1.
  - Overvoltage protection.
- Analog Outputs:
  - Channels: 2.
  - DAC resolution: 14 bits.
  - Output range: +/-10V.
  - Maximum update rate: 5Ks/seg simultaneous per channel.
  - AI FIFO: 2,047 samples.
  - Trigger sources: Software, PFI 0, PFI 1.
- Digital I/O:
  - 13 digital lines.
  - 2 counter sources.
  - 2 digital triggers.
  - Direction control: each channel individually programmable as input or output.
  - Output driver type: each channel individually programmable as open collector or active drive.
  - 5V power source.

CD with documentation and software included:

- User manual and examples of control practical activities by Matlab and Simulink. These examples can be extended by the Matlab user, developing their own control algorithms.
- Graphical GUI user interfaces developed in Matlab to control 540 series models. These applications can be run from Matlab or through the included Runtime, without the need for Matlab.
- Use of the data acquisition toolbox for data acquisition and process control through Matlab and Simulink.



GUI user interfaces

Applications to be used by Matlab users or through facilitated Runtime, without the need for Matlab:

GUI_MV541: For dc motor speed and position control (using MV-541 model).

- Open Loop experiment.
- Closed loop speed control, PI controller.
- Closed loop position control, PID controller.

GUI_Level: For tank level control (using MD-544 model).

- On Off Control.
- Open loop experiment.
- Closed loop control, PID controller.

GUI_Flow: For tank flow control (using MD-544 model).

- Open Loop experiment.
- Closed loop control, PI controller.

GUI_MT-542: For temperature control (using MT-542 model).

- On Off Control.
- Open loop experiment.
- Closed loop control, PID controller.



Kaptoris



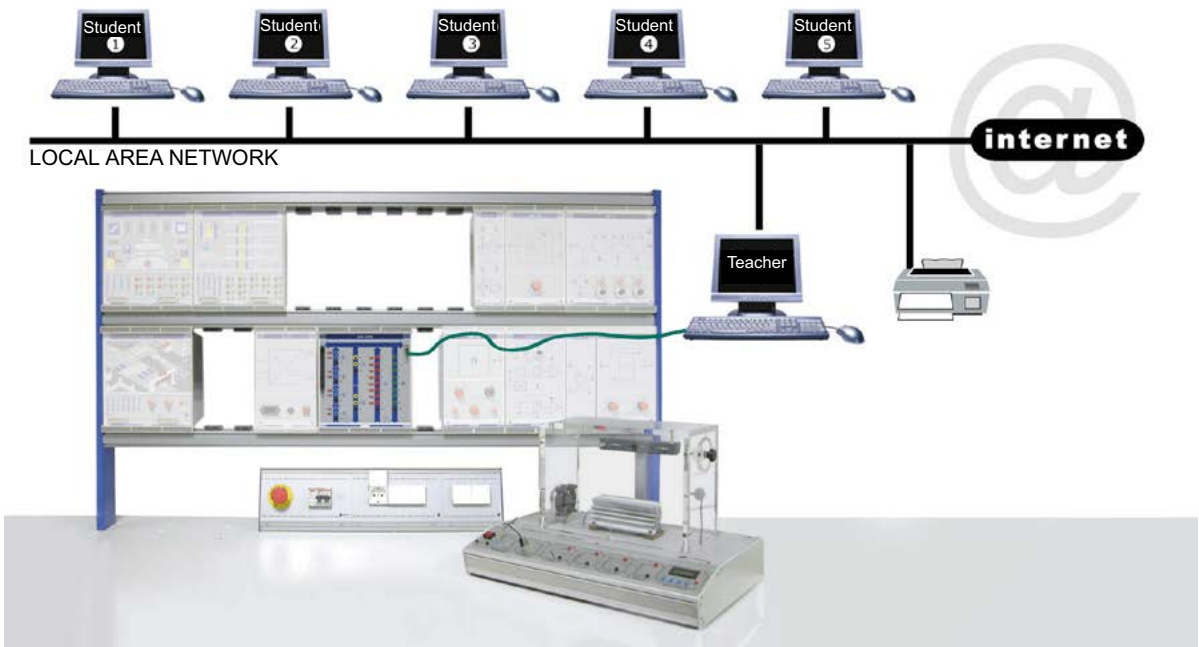
Versatile and powerful

Two features which make the KAPTORIS data acquisition system a general purpose tool indispensable for the analysis of teaching applications in laboratories of electricity, electronics, etc.

Team work

Using the KAPTORIS data acquisition system in a network facilitates group learning through tools, which allow:

- Teaching resources to be shared among several stations within the classroom: while one student captures the data, the others can analyse the obtained results.
- Carry out e-learning, on real units available in the classroom.



SAD450M (module)

The SAD450M has the same technical features as the SAD450 but is in module format, and facilitates data acquisition with Alecop units in module format.

A frame and an ALI700 mains supply source are needed to operate. These are not included with the unit.

Kaptoris software included.

MDULSAD450M



KAPTORIS **SOFTWARE**

General purpose tool for acquiring, displaying and processing signals, both analogue and digital

Features of the software

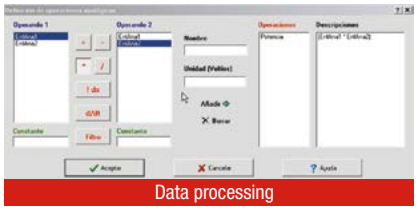
- Simple data analysis, very easy to use.
- Graphic display of signals.
- Real time monitoring of the data as it is acquired.
- Programming by level or by time the start of the acquisition.
- Comparative analysis of signals.
- Operations between signals: Integration, derivation, arithmetical operations, filters.
- Generation of reports and data tables.
- Exporting data to TXT format.
- Exporting graphics to BMP, WMF format.
- Data acquisition from a unit with a remote connection through a local network. (Internet).
- Monitoring the screen of any PC connected to the network.

MINIMUM REQUIREMENT OF THE SYSTEM

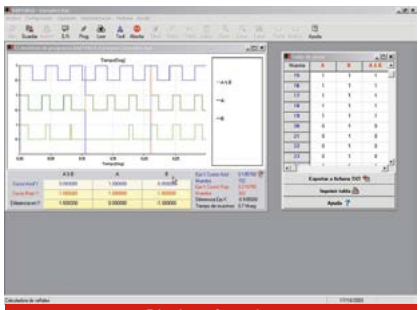
- PC with Windows operating system.
- USB communication line.
- Local network, only if wishing to make remote acquisitions.



System configuration



Data processing



Display of results