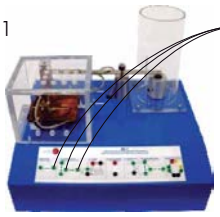
Modular System for the Study of Sensors

BS

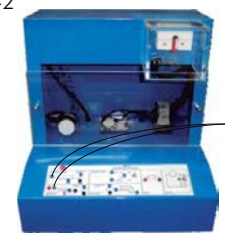
Technical Teaching Equipment

② Test Modules
(to be used with Base Unit)

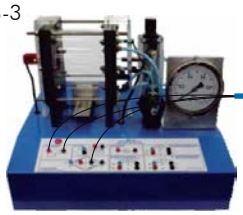
BS-1



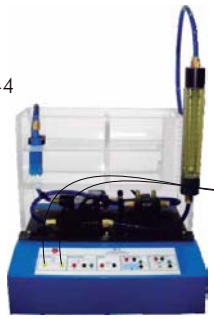
BS-2



BS-3



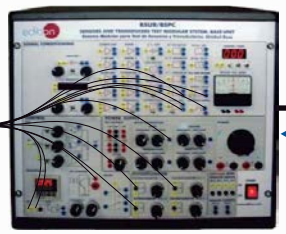
BS-4

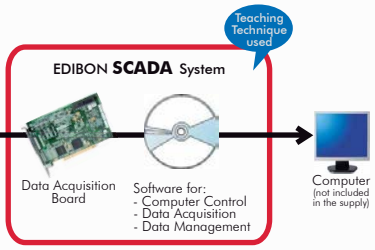


BS-5

① Base Unit:
(common for all test modules type "BS")

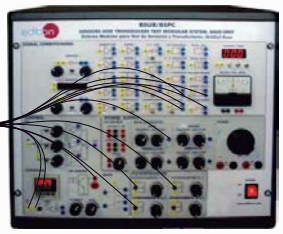
BSPC. Computer Controlled Base Unit





OR

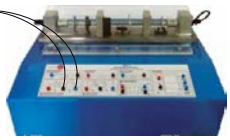
BSUB. Base Unit (non computer controlled)



② Test Modules
(to be used with Base Unit)

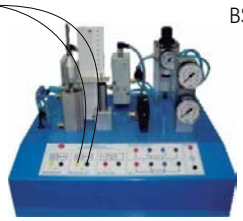
BS-6

BS-7



BS-8

BS-9



BS-10

Other modules

www.edibon.com
Products
Products range
Units
2.-Electronics

"BS" System includes a set of electronic components with a twofold purpose: to control the signal produced by the transducers, and to evaluate and quantify it. Sensors or transducers are common elements in the state of our technology. Therefore this SYSTEM has been developed to show the basic principles of different types of sensors and their way of processing signals.

This system consists of:

① Base Unit, to control the system:

Option 1: BSPC. Computer Controlled Base Unit, including EDIBON Computer Control System. OR

Option 2: BSUB.Base Unit (non computer controlled).

② Test Modules:

BS-1. Vibration and/or Deformation Test Module.
BS-2. Temperature Test Module.
BS-3. Pressure Test Module.
BS-4. Flow Test Module.
BS-5. Ovens Test Module.
BS-6. Liquid Level Test Module.
BS-7. Tachometers Test Module.
BS-8. Proximity Test Module.
BS-9. Pneumatic Test Module.
BS-10. Light Test Module.

ISO 9000: Quality Management
(for Design, Manufacturing, Commercialization and After-sales service)

European Union Certificate
(total safety)

Certificates ISO 14000 and
ECO-Management and Audit Scheme
(environmental management)

Worlddidac Quality Charter Certificate and
Worlddidac Member

BSPC. **Computer Controlled Base Unit:**

GENERAL DESCRIPTION

This unit is common for the different test modules type "BS", and can work with one or several modules.

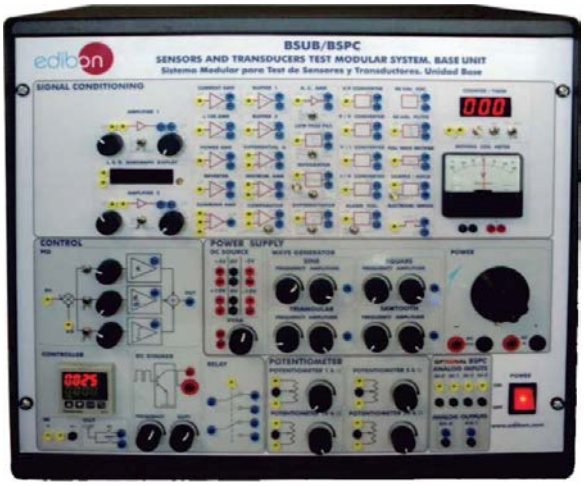
The BSPC is a complete unit designed to provide signal conditioning for many sensors and transducers output signals that must be conditioned before a data acquisition system can effectively and accurately acquire the signal. These circuits consist of differential and instrumentation amplifiers, filters, current to voltage and frequency to voltage converters, etc., developed for transducers such as potentiometers, RTD's, thermocouples, strain gauge bridges, etc.

The BSPC also includes a PID controller, industrial controller, DC Dimer and other interesting elements that can be used to introduce students the concepts about process control.

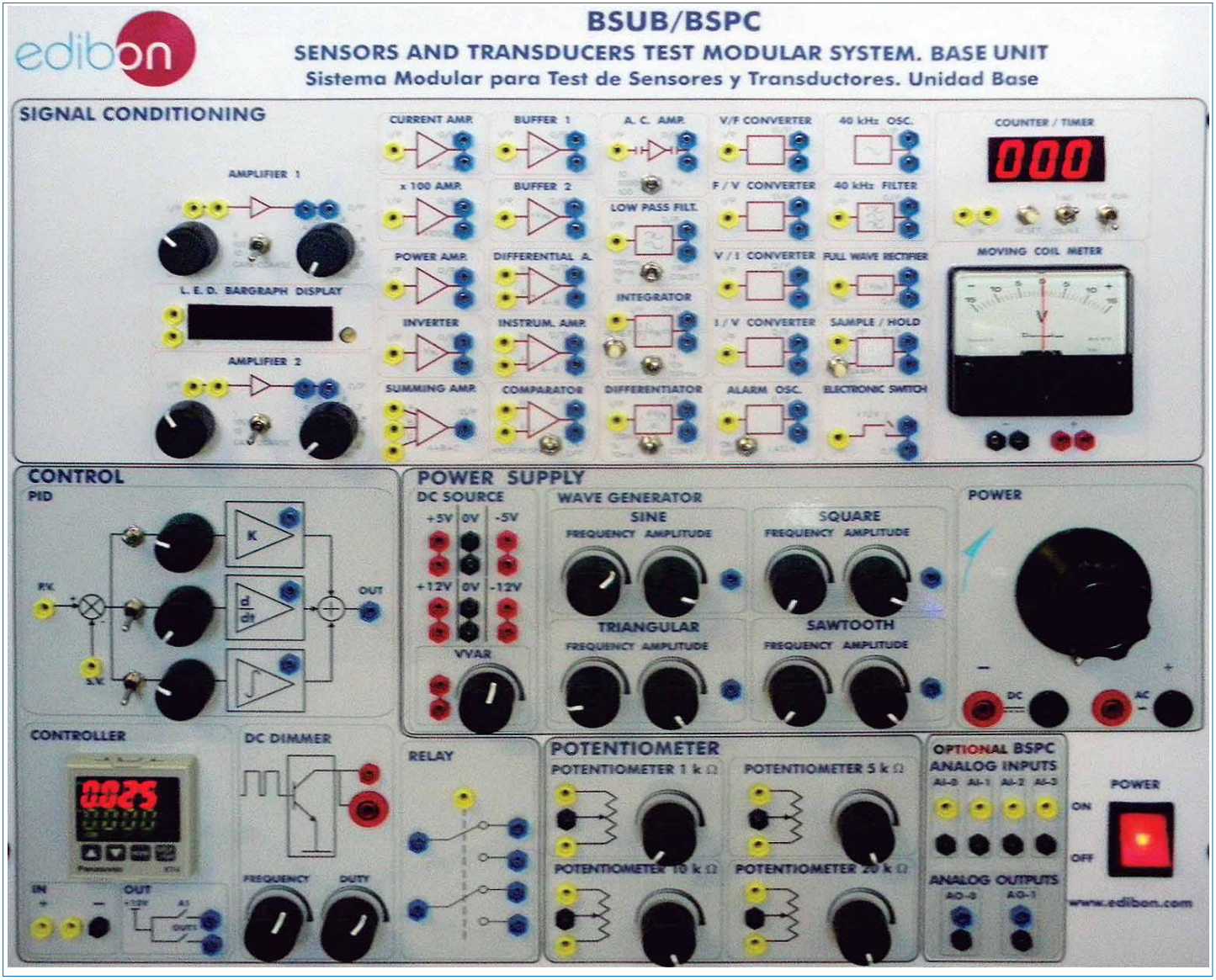
The sensors connect to the Base Unit and with power supplies through 2 mm terminals located in the front panel of each test module. The test modules may operate independently one of another.

EDIBON Computer Control System (SCADA), formed by:

- Control interface is integrated into the box of the Base Unit (BSPC).
- Data acquisition board to be installed in a computer slot.
- Computer Control Software.



Front Panel in detail



Continue...

BSPC. **Computer Controlled Base Unit:** (continuation)

SPECIFICATIONS

Base Unit:

This unit is common for the different test modules type "BS", and can work with one or several modules.
All elements are included in a metallic box.

Signal Conditioning Circuits:

- Amplifiers:
  - DC amplifiers:
    - 3 Amplifiers.
    - Input range: +/-12 Vdc.
    - Input Impedance: 100 KΩ.
    - Adjustable gain: 1, 10,100 for the "Amplifier 1" and "Amplifier 2".
    - Fixed gain: 100 for "x100 Amp".
  - AC Amplifier:
    - Input range: 12 Vac.
    - Adjustable gain: 10, 100,1000.
    - Bandwidth: 10 - 16000Hz.
  - Power Amplifier:
    - Input range: 12 V max.
    - Output current: 1.5 A max.
    - Output power: 9W max.
  - Current Amplifier:
    - Gain: 10,000.
    - Output current: 1A max.
  - Buffers:
    - 2 Buffers.
    - Input voltage: 12V max.
    - Input impedance: 100 KΩ.
  - Inverting Amplifier:
    - Input voltage: 12V max.
    - Input impedance: 100 KΩ.
    - Gain: -1.
  - Differential Amplifier:
    - Input voltage: 12V max.
    - Inputs impedance: 100 KΩ (Input A) and 200 KΩ (Input B).
    - Ad (Differential gain): 1.0.
    - Ac (Common mode gain): 0.02 max.
  - Instrumentation Amplifier:
    - Input voltage: 12V max.
    - Inputs impedance: 100 KΩ.
    - Ad (Differential gain): 1.0.
    - Ac (Common mode gain): 0.006 max.
  - Summing Amplifier:
    - Input voltage: 12V max.
    - 3 Inputs.
    - Gain: 1.
- Comparators:
  - Schmitt trigger.
- Filters:
  - 40kHz filter: Pass-Band Filter at 40kHz.
  - Low-pass filter: selectable cut-off frequencies at 15Hz, 1.44Hz, 0.14Hz.
- Integrator:
  - Selectable Time constants: 100ms, 1s, 10s.
- Differentiator:
  - Selectable Time constants: 10ms,100ms, 1s.
- "Sample/Hold":
  - Time constant: 1ms.
- Converters Circuits:
  - Voltage to Current (V/I) converter:
    - Output current: ±20mA max.
    - Transfer ratio: 10mA/V.
  - Current to Voltage (I/V) converter:
    - Output voltage: ±2 V (6 V max.).
    - Transfer ratio: 0.1V/mA.
  - Frequency to Voltage (F/V) converter:
    - Transfer ratio: 1 V/kHz.
    - Maximum input frequency: 10 kHz.
    - No linearity: 0.024%.
  - Voltage to Frequency (V/F) converter:
    - Transfer ratio: 1 kHz/V.
    - Maximum input frequency: 10 kHz.
    - No linearity: 0.024%.

Continue...

- Other circuits:
  Full-Wave Rectifier.
  40kHz Oscillator:
  - Output frequency: 41093 Hz.
  - Output amplitude: 5 Vpp.

  Alarm Oscillator:
  - Oscillator frequency: 700Hz.
  - Switch turn off voltage: 2.3V.

  Electronic Switch:
  - Input voltage: 12 V max.
  - Switch voltage: 2.1V.
  - Output current: 500mA max.

Control Circuits:

- PID:
  Process control applications.
  Independent PID parameters adjustment (Proportional, Integrative and Derivative).
- Industrial Controller:
  Input: DC voltage, RTD sensor or Thermocouple.
  Output 1: Relay.
  Alarm output: Relay.
- Relay:
  Double relay.
  NO and NC terminal.
  12Vdc coil excitation.
- DC Dimmer:
  Light dimmer or DC motor speed controller applications.
  PWM generator.
  Frequency and duty cycle adjustable.

Power Elements:

- Power Supply:
  AC voltage range: 0 to 30 Vac.
  DC voltage range: 0 to +15 Vdc.
  Output current: 4A max.
- DC Source:
  2 Output for each voltage.
  DC voltages: +5 Vdc,-5 Vdc,+12 Vdc,-12 Vdc,0 to 12 Var.
  Output current: 500mA max.
- Wave Generator:
  Sine, square, triangular and sawtooth waveforms.
  Frequency range: 100 to 10000 Hz.
  Amplitude range: Adjustable +/- 10V.
- Potentiometers:
  4 Potentiometers.
  Impedance values: 0-1 KΩ, 0-5 KΩ, 0-10 KΩ and 0-20 KΩ.
  Power dissipation: 1 W max.

Measuring Elements:

- L.E.D. bargraph display:
  Input range: 0-5V.
- Counter/Timer:
  Temporization applications.
  Counting applications.
- Moving coil meter.

Analog Inputs and Outputs:

- 2 Analog Outputs:
  Output voltage range: -10V to +10V.
- 4 Analog Inputs:
  Input voltage range: -10V to +10V.

EDIBON Computer Control System (SCADA):

- Control Interface, integrated in the box of the Base Unit (BSPC).
- Data acquisition board to be installed in a computer slot.
- Computer Control Software.

Cables and Accessories, for normal operation.

Manuals: It is supplied with the following: Required Services, Assembly and Installation, Interface and Software, Starting-up, Safety, Maintenance & Practices Manuals.

REQUIRED SERVICES

- Electrical supply: single-phase, 220V./50Hz or 110 V./60Hz.
- Computer (PC)

DIMENSIONS AND WEIGHT

- Dimensions: 490 x 450 x 470 mm. approx.
  (19.29 x 17.72 x 18.50 inches approx.)
- Weight: 30 Kg. approx.
  (66 pounds approx.)

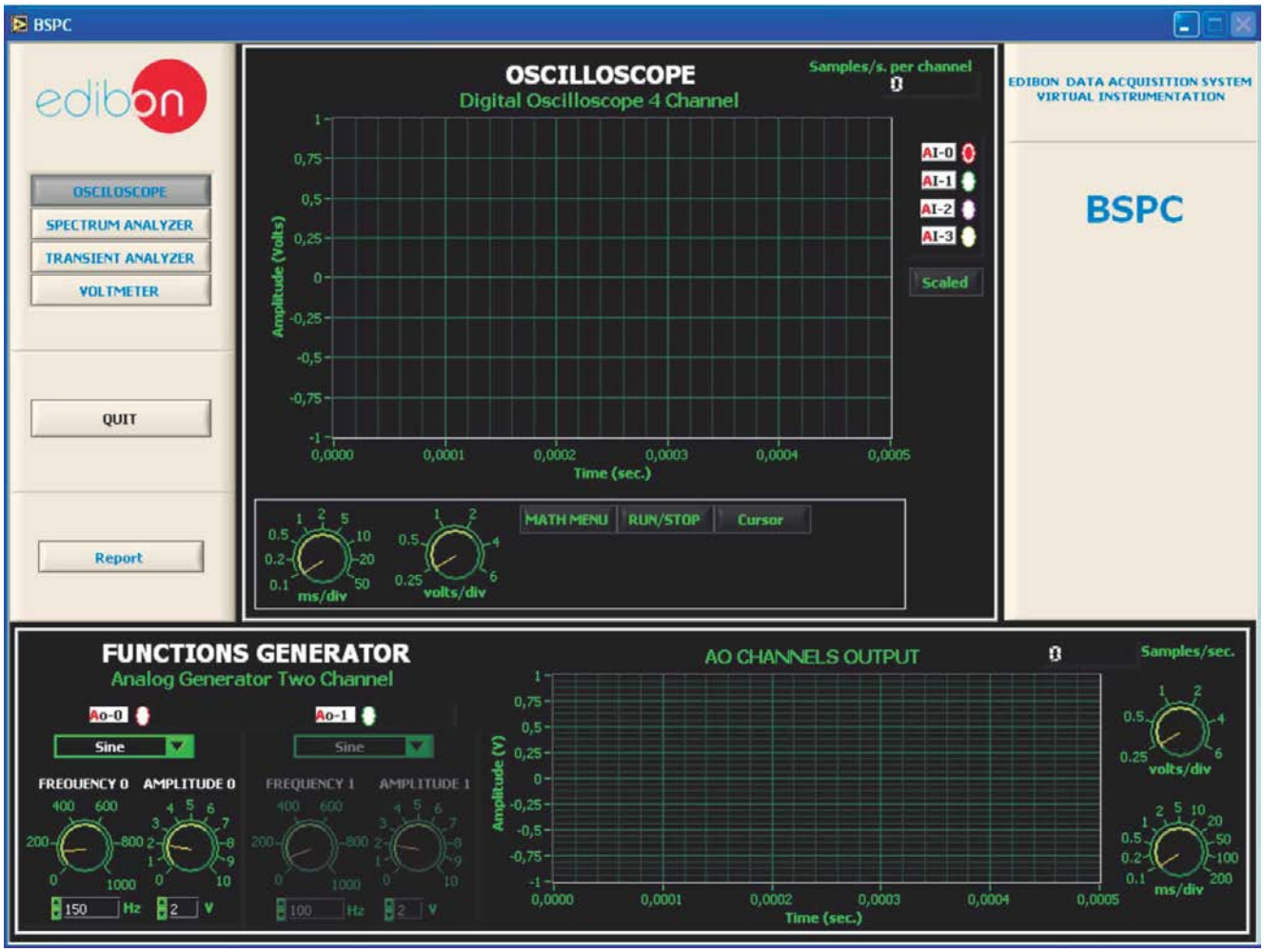
Continue...

BSPC. **Computer Controlled Base Unit:** (continuation)

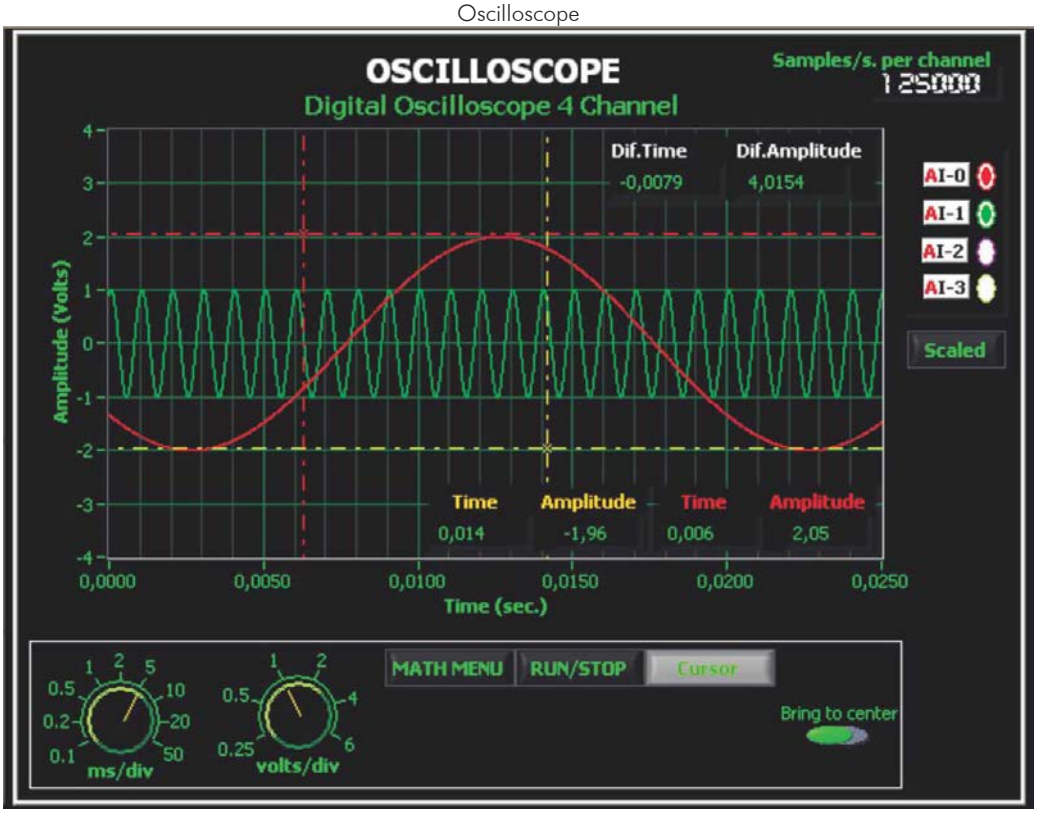
Software Main Screens

Main screen

You will find the following instruments: Oscilloscope, Spectrum Analyzer, Transient Analyzer, Voltmeter and Functions Generator.



Oscilloscope



This oscilloscope functionality is like any other digital oscilloscope. Data acquisition and measurement of the input signals.

Specifications:

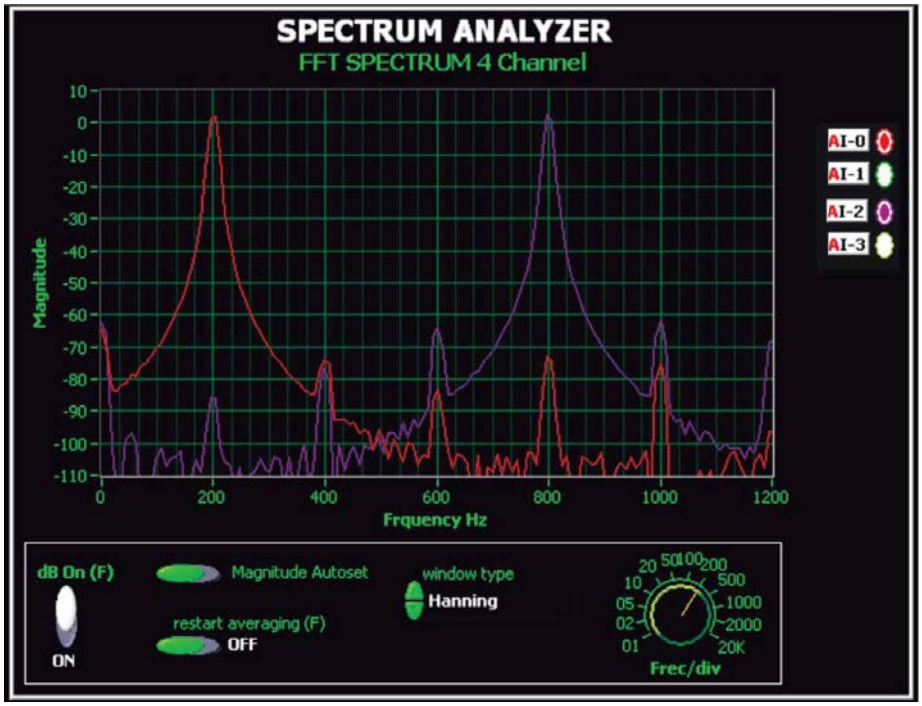
- -Channels: 4 simultaneous.
- -Maximum input voltage: ±10V.
- -Maximum sampling rate: 250.000 samples per second.

Continue...

BSPC. **Computer Controlled Base Unit:** (continuation)

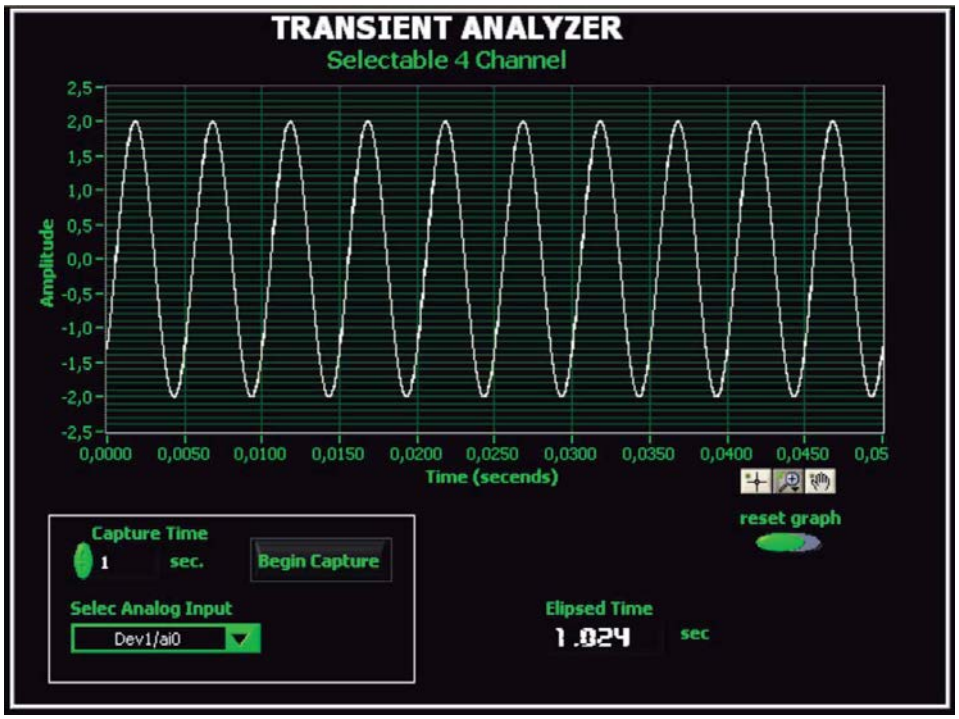
Software main screens

Spectrum Analyzer

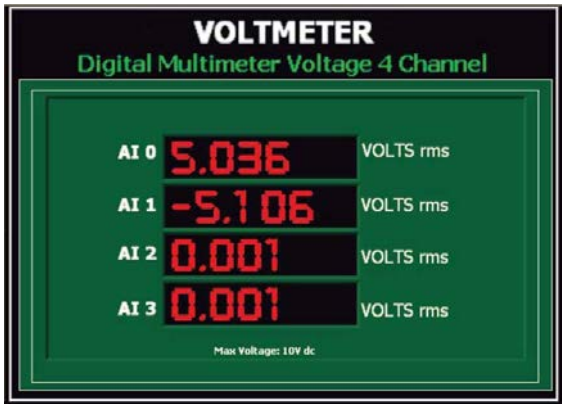


This virtual spectrum analyzer is similar to a laboratory conventional digital analyzer baser on the FFT.
Specifications:
-Channels: 4 (simultaneous).
-Maximum voltage: ±10V.
-Maximum sampling rate: 250.000 samples per second. (Max. Frequency approximate 25KHz).

Transient Analyzer



Voltmeter



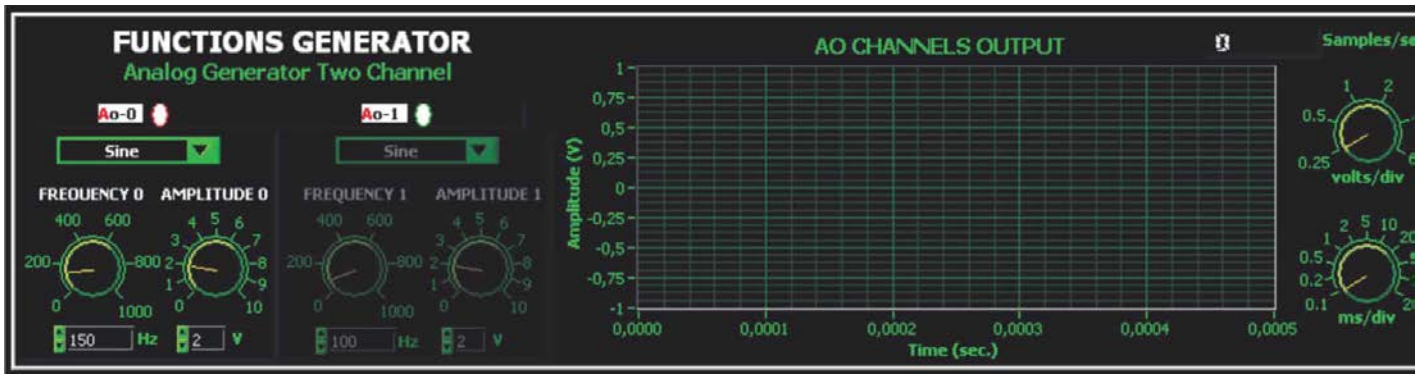
This multimeter measures 4 simultaneous channels, all of the channels are referred to a common point named AI_GND. This common point is located on the right of the 4 analog income channels of the equipment.
Specifications:
-Channels: 4 (Simultaneous) (AI0,..,AI3).
-Maximum voltage: 10V RMS.
-Measurement will be given in RMS voltage.

Continue...

BSPC. **Computer Controlled Base Unit:** (continuation)

Software main screens

Functions Generator



The functionality of this virtual function generator is similar to the functionality of a conventional laboratory generator. Basically the only notorious difference in that this one includes a graph where an output signal for each channel is shown.
Specifications:

-Channels: 2. (Allowing working simultaneously)
-Maximum output voltage: ±10V.
-Maximum generation rate: 800.000 samples/s (frequency. Max. 80KHz).

BSUB. **Base Unit:**

GENERAL DESCRIPTION

This unit is common for the different test modules type "BS", and can work with one or several modules.

The BSUB is a complete unit designed to provide signal conditioning for many sensors and transducers output signals that must be conditioned. These circuits consist of differential and instrumentation amplifiers, filters, current to voltage and frequency to voltage converters, etc., developed for transducers such as potentiometers, RTD's, thermocouples, strain gauge bridges, etc.

The BSUB also includes a PID controller, industrial controller, DC Dimer and other interesting elements that can be used to introduce students the concepts about process control.

The sensors connect to the Base Unit and with power supplies through 2 mm terminals located in the front panel of each test module. The test modules may operate independently one of another.

SPECIFICATIONS

This unit is common for the different test modules type "BS", and can work with one or several modules.
All elements are included in a metallic box.

Signal Conditioning Circuits:

- Amplifiers:
  - DC amplifiers:
    - 3 Amplifiers.
    - Input range: +/-12 Vdc.
    - Input Impedance: 100 KΩ.
    - Adjustable gain: 1, 10,100 for the "Amplifier 1" and "Amplifier 2".
    - Fixed gain: 100 for "x100 Amp".
  - AC Amplifier:
    - Input range: 12 Vac.
    - Adjustable gain: 10, 100,1000.
    - Bandwidth: 10 - 16000Hz.
  - Power Amplifier:
    - Input range: 12 V max.
    - Output current: 1.5 A max.
    - Output power: 9W max.
  - Current Amplifier:
    - Gain: 10,000.
    - Output current: 1A max.
  - Buffers:
    - 2 Buffers.
    - Input voltage: 12V max.
    - Input impedance: 100 KΩ.
  - Inverting Amplifier:
    - Input voltage: 12V max.
    - Input impedance: 100 KΩ.
    - Gain: -1.
  - Differential Amplifier:
    - Input voltage: 12V max.
    - Inputs impedance: 100 KΩ (Input A) and 200 KΩ (Input B).
    - Ad (Differential gain): 1.0.
    - Ac (Common mode gain): 0.02 max.
  - Instrumentation Amplifier:
    - Input voltage: 12V max.
    - Inputs impedance: 100 KΩ.
    - Ad (Differential gain): 1.0.
    - Ac (Common mode gain): 0.006 max.
  - Summing Amplifier:
    - Input voltage: 12V max.
    - 3 Inputs.
    - Gain: 1.
- Comparators:
  Schmitt trigger.
- Filters:
  40kHz filter: Pass-Band Filter at 40kHz.
  Low-pass filter: Selectable cut-off frequencies at 15Hz, 1.44Hz, 0.14Hz.
- Integrator:
  Selectable Time constants: 100ms, 1s, 10s.
- Differentiator:
  Selectable Time constants: 10ms,100ms, 1s.
- "Sample/Hold":
  Time constant: 1ms.

Continue...

- Converters Circuits:
  - Voltage to Current (V/I) converter:
    - Output current: ±20mA max.
    - Transfer ratio: 10mA/V.
  - Current to Voltage (I/V) converter:
    - Output voltage: ±2 V (6 V max.).
    - Transfer ratio: 0.1V/mA.
  - Frequency to Voltage (F/V) converter:
    - Transfer ratio: 1 V/kHz.
    - Maximum input frequency: 10 kHz.
    - No linearity: 0.024%.
  - Voltage to Frequency (V/F) converter:
    - Transfer ratio: 1 kHz/V.
    - Maximum input frequency: 10 kHz.
    - No linearity: 0.024%.
- Other circuits:
  - Full-Wave Rectifier.
  - 40kHz Oscillator:
    - Output frequency: 41093 Hz.
    - Output amplitude: 5 Vpp.
  - Alarm Oscillator:
    - Oscillator frequency: 700Hz.
    - Switch turn off voltage: 2.3V.
  - Electronic Switch:
    - Input voltage: 12 V max.
    - Switch voltage: 2.1V.
    - Output current: 500mA max.

Control Circuits:

- PID:
  - Process control applications.
  - Independent PID parameters adjustment (Proportional, Integrative and Derivative).
- Industrial Controller:
  - Input: DC voltage, RTD sensor or Thermocouple.
  - Output 1: Relay.
  - Alarm output: Relay.
- Relay:
  - Double relay.
  - NO and NC terminal.
  - 12Vdc coil excitation.
- DC Dimmer:
  - Light dimmer or DC motor speed controller applications.
  - PWM generator.
  - Frequency and duty cycle adjustable.

Power Elements:

- Power Supply:
  - AC voltage range: 0 to 30 Vac.
  - DC voltage range: 0 to +15 Vdc.
  - Output current: 4A max.
- DC Source:
  - 2 Output for each voltage.
  - DC voltages: +5 Vdc,-5 Vdc,+12 Vdc,-12 Vdc,0 to 12 Var.
  - Output current: 500mA max.
- Wave Generator:
  - Sine, square, triangular and sawtooth waveforms.
  - Frequency range: 100 to 10000 Hz.
  - Amplitude range: Adjustable +/- 10V.
- Potentiometers:
  - 4 Potentiometers.
  - Impedance values: 0-1 KΩ, 0-5 KΩ, 0-10 KΩ and 0-20 KΩ.
  - Power dissipation: 1 W max.

Measuring Elements:

- L.E.D. bargraph display:
  - Input range: 0-5V.
- Counter/Timer:
  - Temporization applications.
  - Counting applications.
- Moving coil meter.

Cables and Accessories, for normal operation.

Manuals: It is supplied with the following manuals: Required Services, Assembly and Installation, Starting-up, Safety, Maintenance & Practices Manuals.

REQUIRED SERVICES

- Electrical supply: single-phase, 220V./50Hz or 110 V./60Hz.
- Measurement instrumentation (oscilloscope, multimeter, etc.).

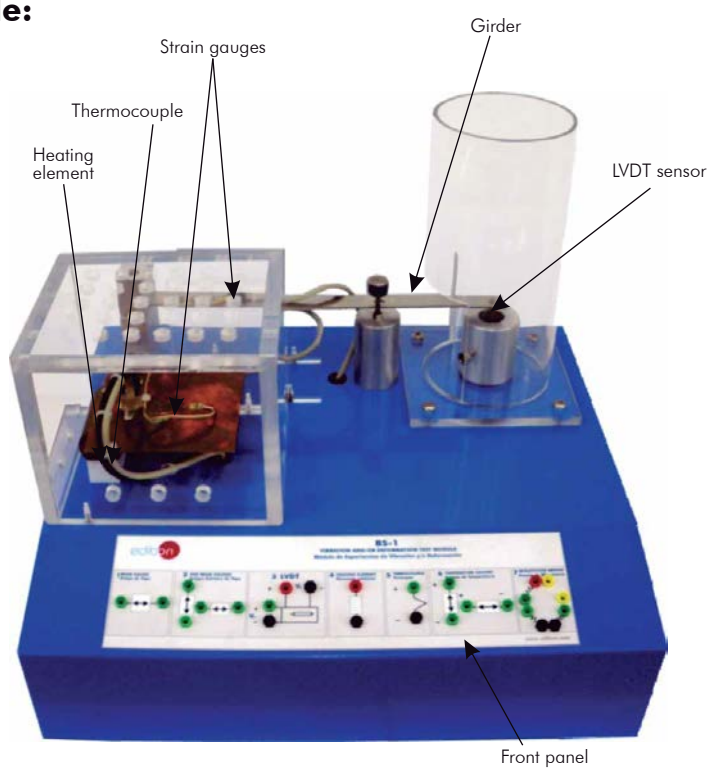
DIMENSIONS AND WEIGHT

- Dimensions: 490 x 450 x 470 mm. approx. (19.29 x 17.72 x 18.50 inches approx.)
- Weight: 30 Kg. approx. (66 pounds approx.)

BS-1. **Vibration and/or Deformation Test Module:**

GENERAL DESCRIPTION

This Test Module has been designed to teach mechanical vibration and displacement variable measurement techniques.
On the upper side of the test module there is a girder or elastic/vibrant sheet that is the one carrying the sensors, which can have many applications depending on the use we give to them during the performing the practices with the unit.
This girder is strongly fixed to the module chassis in one of its ends. This enables this free projection system to vibrate on a flat surface but also turns it resistant to the movement of other surfaces.
On the girder bottom there are different types of sensors that work in different ways.
When the girder is distorted, the surfaces are in traction or compression, as appropriate. Is at this moment when the sensor outlets are to be analyzed.
Near the girder fixed end there is also a mechanism to heat the system and a thermocouple to measure the temperature which is used to determine the dependence that studied material has on the temperature.
On the girder free end there are control instruments that can determine the movement variations, as for example lineal displacement and deformations.
The girder end vertical column has a coil that provides a signal that is proportional to the speed and a measurement system that can be used to give a signal that is proportional to the displacement.



SPECIFICATIONS

Painted steel box.
Connection diagrams for each transducer are represented graphically.
Strain gauges:
Gauges of a metallic material that vary their resistance depending on the distortion to which they are going to be subjected. They are stacked in different positions so that during the vibrant bar movement some of them suffer compression and others extensions.
There are three strain gauges modules each one in different positions.
Characteristics: Resistance at 24°C: 120Ω. Gauge factor at 24°C: 2.120.
Wheatstone bridge:
Wheatstone bridge adapted for connect the strain gauges modules.
Heating element and thermocouple:
Heating element used to produce temperature variations in the vibrant girder and to see how this situation affects the strain gauges.
A K thermocouple place near the resistance measures the girder temperature.
Characteristics: Temperature range: -50°C to 350°C.
LVDT Sensor:
Linear displacement sensor, that detects the relative displacement of a ferromagnetic core between the primary and the secondary.
Input Voltage range: 10 to 24VDC.
Sensor connections with the Base Unit and with power supplies are through 2 mm. terminals located in the front panel of the Test Module.
Manuals: It is supplied with the following manuals: Required Services, Assembly and Installation, Starting-up, Safety, Maintenance & Practices Manuals.
Each module may operate independently of another.

EXERCISES AND PRACTICAL POSSIBILITIES

1.- To measure the vibration of a vibrant girder using strain gauges.
2.- To use a heating element to rise the girder temperature in order to study the effect on the sensors. (Thermocouple and heating element).
3.- To detect the displacement of the BS-1 module vibrant girder using a LVDT sensor.
4.- Effect of temperature variation on the strain gauges.
5.- Effect of deformation on the resistance of a girder.
6.- Measurement of the three deformation dimensions or deformation of spherical or cylindrical coordinates systems.
7.- Linear variable differential transformer (LVDT) for measuring displacements.
8.- Analysis of how to compensate the variation of resistance of a strain gauge due to temperature variations, using compensating gauges.
9.- Linear variable differential transformers (LVDT) as a weighing system.
10.- Effect on the vibration of a girder with different masses.

REQUIRED SERVICES

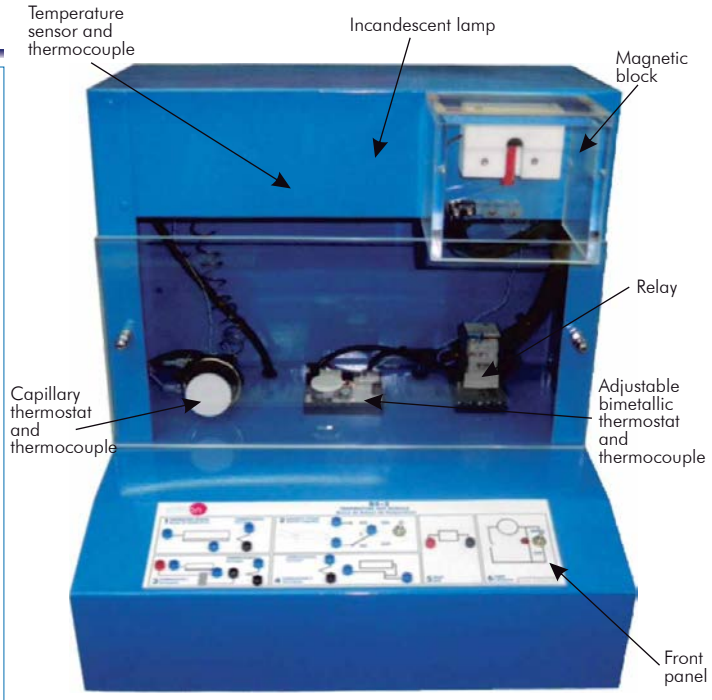
- Electrical supply: single-phase, 220V./50Hz or 110 V./60Hz.
- Computer Controlled Base Unit (BSPC) or Base Unit (BSUB).

DIMENSIONS AND WEIGHT

- Dimensions: 405 x 300 x 350 mm. approx. (15.94 x 11.81 x 13.78 inches approx.)
- Weight: 10 Kg. approx. (22 pounds approx.)

BS-2. **Temperature Test Module:**

GENERAL DESCRIPTION



The Temperature Test Module has been designed to teach the use and applications of sensors of temperature as a measure, and its control.
We have a half-open space in whose interior there are two lamps that are going to heat that space. Temperatures will be around 40°C in the lower part and around 80°C in the upper part.
To measure the temperatures there are different type of sensors placed in different positions that are at different distances from the warming source, in order to get higher or lower temperatures.
Among the sensors there are thermostat sensors. The thermostat sensors contain a contact, that is closed at a precise temperature, which can be directly chosen with a numbered dial placed on the thermostat. There is also a switch sensor and thermocouple.
On the other hand, in the external casing there is a "magnetic block" where we have a "Curie effect" temperature control.
Sensors:
Bimetallic switch sensor. It is placed at the central part of the module, very close to one of the heater sources, in order to allow the temperature to rise quickly even over the switching temperature.
Adjustable bimetallic thermostat.
It is placed in the central part of the module at the lowest position, because the temperatures at which it works must be not too high. It is based, just as the one before, on the combination of two different metals, but with the difference that in this one we can chose the cut-off temperature.
Relay that enables to turn on and off in the magnetic block, both the incandescent lamp and the heater resistor that rise the temperature in the magnetic block.
Magnetic block. It is in the external part of the module. It has a ferrite with an empty cylindrical form through which goes a resistor that is going to heat it at high temperatures. It also has a gravity switch that closes two sockets.
Capillary thermostat. The capillary is placed in the upper part on the left end of the module, near another lamp, since the temperatures reached will be high. The thermostat works with a fluid placed at 90 mm. in the capillary tube. The switch temperature is adjustable.
Thermocouples.

SPECIFICATIONS

Painted steel box. Connection diagrams for each transducer are represented graphically.
Bimetallic switch sensor:
Bimetallic contact thermal switch. Opening temperature: 50°C. Closing temperatures: 30°C. Configuration: N.C. contact.
Adjustable bimetallic thermostat:
With heater resistor that allows minimizing the differential cycles and preventing overpeaks. Temperature range: 0°C to 30°C. N. C. contact.
Magnetic Block:
Inside of an external case. Composed of a ferrite pipe, with a heater element inside of them.
Incandescent lamp.
Relay AC:
It allows to turn on and off the incandescent lamp placed over the temperature sensors. Voltage and current (nominal) :250V-10A. N.O. contact. Switching voltage: 12 V.
Capillary thermostat:
Temperature range: 0°C-90°C. Max. bulb temperature: 150°C. Socket current: 15A, 250V AC. N.C. contact.
Thermocouples:
3 Cromel-Alumel thermocouples type K. One of them is placed near the capillary thermostat and the bimetallic sensor, another on the adjustable bimetallic thermostat and the third one inside the magnetic collection. Each one of them is used to measure the temperature that each one of the sensor are controlling. Temperature range: -50 °C to 250 °C.
Sensor connections with the Base Unit and with power supplies are through 2 mm. terminals located in the front panel of the Test Module.
Manuals: It is supplied with the following manuals: Required Services, Assembly and Installation, Starting-up, Safety, Maintenance & Practices Manuals.
Each module may operate independently of another.

EXERCISES AND PRACTICAL POSSIBILITIES

1.- How to use the Curie effect as application of a high temperature thermostatic controller.
2.- Adjustable bimetallic thermostat. To use the bimetallic thermostat as a temperature controller, calculating its hysteresis.
3.- Adjustable bimetallic thermostat. How we can reduce the hysteresis by adding a resistor to the heating circuit.
4.- To use the thermostat based on a bimetallic sensor to control the temperature.
5.- To use the capillary thermostat.

REQUIRED SERVICES

- Electrical supply: single-phase, 220V./50Hz or 110 V./60Hz.
- Computer Controlled Base Unit (BSPC) or Base Unit (BSUB).

DIMENSIONS AND WEIGHT

- Dimensions: 405 x 300 x 400 mm. approx. (15.94 x 11.81 x 15.74 inches approx.)
- Weight: 5 Kg. approx. (11 pounds approx.)

BS-3. **Pressure Test Module:**

GENERAL DESCRIPTION

The Pressure Test Module has been designed to teach the use and applications of this kind of sensors measurement systems. It shows the different pressure measurement techniques.

On the left upper side of the module there is a pressure chamber with several sensors adjusted to measure the pressure changes inside the chamber. Next to the pressure chamber on the left side there is a relay activates a compressor that gives the system pressure.There are a compressor and a manometer connected next to the regulating valve with which the pressure chamber maximum pressure can be adjusted.

On both sides of the pressure chamber there are two diaphragms where displacement sensors are connected and some strain gauges that detect the diaphragm distortion as the pressure rises.

Sensors:

Linear positioning sensor (potentiometer).

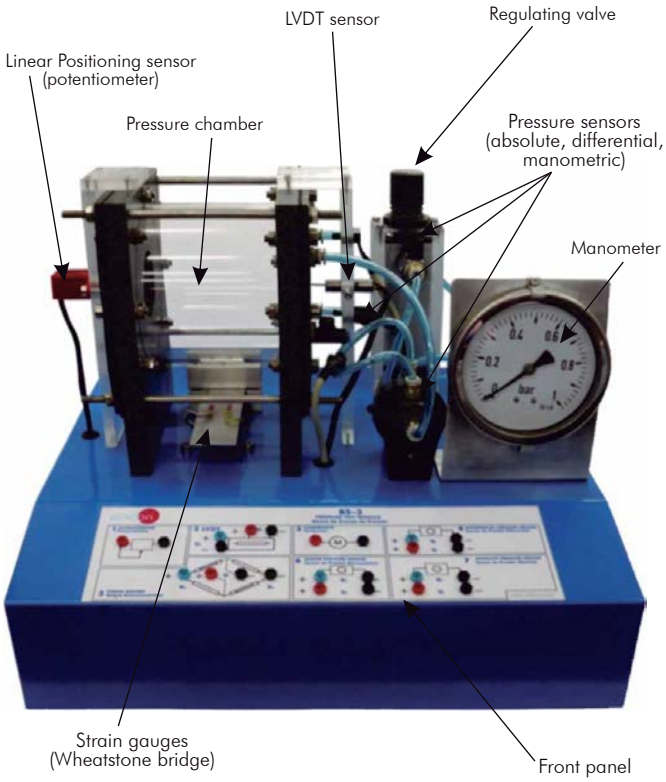
LVDT sensor.

Differential pressure sensor with hole board system.

Strain gauges.

Manometric pressure sensor.

Absolute pressure sensor.



SPECIFICATIONS

Painted steel box.
Connection diagrams for each transducer are represented graphically.
Linear positioning sensor (Potentiometer):
Resistor range: 500 Ω to 5KΩ. Operation force: 200-750g.
LVDT sensor:
Sensibility: 780mV/mm. Power voltage: 5 to 12Vdc. Total path: 2.5mm.
Differential pressure sensor:
Measurement range: 0 to 30 psi. Sensibility: 3.33mV/psi. Overpressure: 60 psi. Power supply range: 10 to 16 Vdc.
2 Strain gauges mounted in a Wheatstone bridge:
Nominal resistor: 25°C: 120Ω. Gauge factor: 2.00 to 2.1 typical. Nominal resistor tolerance: +-0.5%.
Manometric pressure sensor:
Measurement range: 0 to 30 psi. Sensibility: 3.33mV/psi. Overpressure: 60 psi. Power supply range: 10 to 16 Vdc.
Absolute pressure sensor:
Measurement range: 2 to 30 psi. Sensibility: -11mV/psi. Overpressure: 60 psi. Power supply range: 10 to 12 Vdc.
Air Compressor (located inside the steel box): Air flow: 10 l./min. Pressure: 1.83Kg/cm^2. Power supply: 220V, 50/60Hz.
Sensor connections with the Base Unit and with power supplies are through 2 mm. terminals located in the front panel of the Test Module.
Manuals: It is supplied with the following manuals: Required Services, Assembly and Installation, Starting-up, Safety, Maintenance & Practices Manuals.
Each module may operate independently of another.

EXERCISES AND PRACTICAL POSSIBILITIES

1.- Use of linear positioning sensor (potentiometer) to detect the displacement produced by a diaphragm expansion caused by the air pressure.

2.- Use of a LVDT as an element to measure the diaphragm distortion that is consequence of the pressure inside the pressure chamber.

3.- Differential pressure sensor with hole-board system. Use of a differential pressure sensor of the semiconductor type to measure the pressure fall in a hole-board system.

4.- Strain gauges. To detect objects using an infrared sensor by light beam interruption.

5.- Measure the pressure in the chamber, using two different types of sensors (manometric and absolute pressure sensor).

6.- Strain gauges for measuring deformations: their resistance changes as the diaphragm expands due to the pressure coming from the pressure chamber.

REQUIRED SERVICES

- Electrical supply: single-phase, 220V./50Hz or 110 V./60Hz.
- Computer Controlled Base Unit (BSPC) or Base Unit (BSUB).

DIMENSIONS AND WEIGHT

- Dimensions: 405 x 300 x 350 mm. approx. (15.94 x 11.81 x 13.78 inches approx.)
- Weight: 7.5 Kg. approx. (16.5 pounds approx.)

BS-4. **Flow Test Module:**

GENERAL DESCRIPTION

The objective this module is to show techniques to measure changeable fluids.

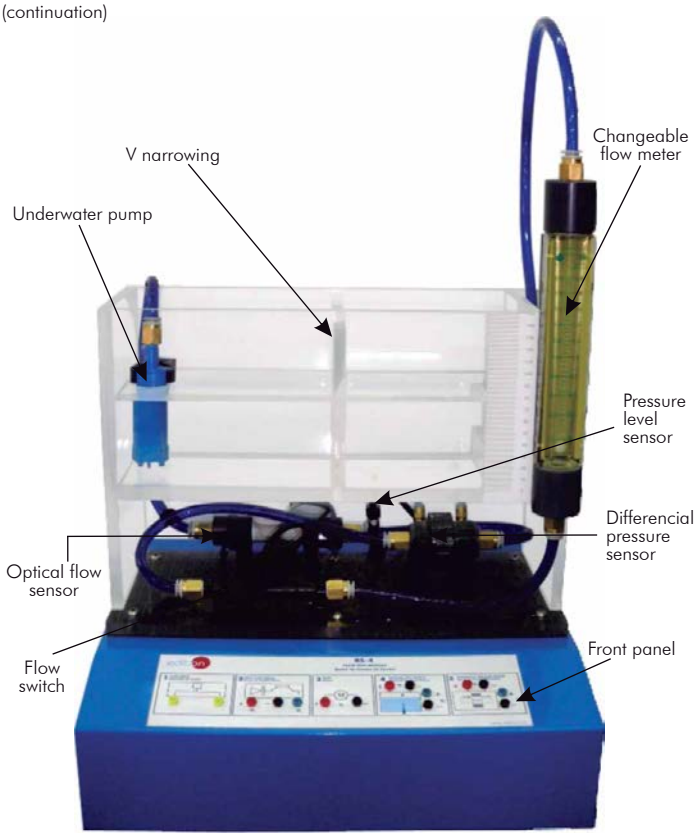
The module is made up of two tanks assembled on a structure. In one of them there is a pumping system that allows to pump the water from the reserve tank, using a measurement transducer system, and to return it to the main tank.

The pump enables that a big amount of water from the tank flows between the reserve tank and the main one. It is possible to change the flow volume by changing the pump power supply voltage using the terminals placed on the "BS-4" front panel.

This module has:

- Flow switch.
- Optical flow sensor.
- Underwater pump.
- Pressure level sensor.
- Differential pressure sensor.
- Changeable flow meter.
- V narrowing.

All the connections from the different transducers and from the pumping system are made using a group of 2 mm. terminals placed on the front panel of the test module with drawings describing their functions.



SPECIFICATIONS

Painted steel box. Connection diagrams for each transducer are represented graphically.

Flow switch:
Monitors the flow and closes an electric circuit. Contact form: N/O. Switching voltage AC: 240Vac. Switching voltage DC: 120Vdc.

Optical flow sensor:
It gives an output in pulses proportional to the liquid flow. At the output of this sensor we get a pulse signal with a frequency proportional to the flow volume that crosses the sensor.
Power supply: 5Vdc. Measurement range: 0.25 to 6.5 l./min. K factor: 4600 pulses/liter.

Underwater pump: The variation in the pump power supply voltage enables to change the water volume in the test module. Power supply: 12 Vdc.

Pressure level sensor:
It is a sensor that measures the pressure caused by the water in relation to the atmospheric pressure, so the liquid level in the tank can be calculated. Pressure range: 0 to 1psi. Sensitivity: 16.7mV/psi. Power supply: 10-16 Vdc.

Differential pressure sensor (Hole board system):
This sensor is connected to a hole-board system to measure the pressure difference caused by the volume narrowing of the conduct through which the water flows. On this way, with the measurement of the pressure difference between the hole board water output and input, it is possible to calculate the water volume that crosses the board.
Measurement range: 0 to 16 psi. Sensitivity: 1.5 mV/psi. Power supply: 10-16 Vdc.

Changeable flow meter:
Using a small floating buoy that is inside the tube calibrated in liter/minute, it can be read the volume measure flowing through the pipe. Range: 0-2 l./min.

V narrowing:
The connection between the main and the secondary tank, a dam, includes a "V" narrowing. The altitude of the water level above the dam bottom is a very precise measure of the flow relation. The ruler fixed on the right end of the tank will show this height.

Main and secondary tanks.

Sensor connections with the Base Unit and with power supplies are through 2 mm. terminals located in the front panel of the Test Module.

Manuals: It is supplied with the following manuals: Required Services, Assembly and Installation, Starting-up, Safety, Maintenance & Practices Manuals.

Each module may operate independently of another.

EXERCISES AND PRACTICAL POSSIBILITIES

1.- To measure the water volume produced by an underwater pump in the module using an optical flow sensor.

2.- To use a high-resolution optical flow sensor to measure low flow volumes.

3.- Pressure level sensor. To use a differential pressure sensor to measure the liquid level in one of the tanks.

4.- Differential pressure sensor. To measure the pressure-fall in the module hole board system, as a necessary parameter to determine volume.

5.- To measure the flow volume generated by the underwater pump using a flow meter of changeable area.

6.- To obtain the flow-volume value in the secondary tank using the V narrowing weir.

REQUIRED SERVICES

- Computer Controlled Base Unit (BSPC) or Base Unit (BSUB).
- Water supply.

DIMENSIONS AND WEIGHT

- Dimensions: 405 x 300 x 400 mm. approx. (15.94 x 11.81 x 15.74 inches approx.)
- Weight: 10 Kg. approx. (22 pounds approx.)

BS-5. **Ovens Test Module:**

GENERAL DESCRIPTION

With "BS-5" Test Module is possible to study temperature measurement techniques using several kinds of sensors placed inside the sealed place that is used as oven.

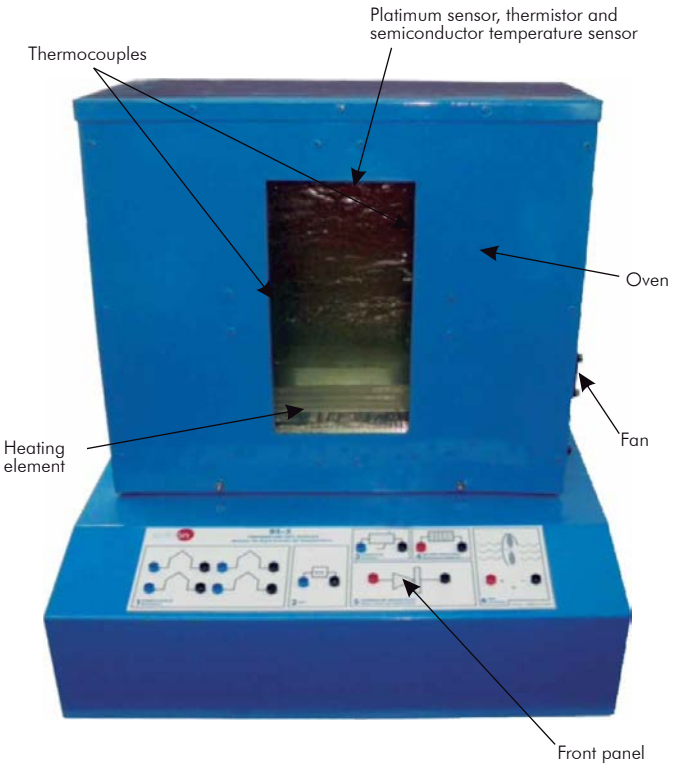
This module is basically made up of an oven that contains a changeable speed circular fan that enables to modify the oven time constant.

The heating element that the oven has can be manually controlled or work through a triac which can be regulated with a PID.

The measurement mechanisms the oven has are 4 identical thermocouples placed at different heights. The oven also has a platinum resistance thermometer, a thermistor and a semiconducting mechanism sensitive to temperature. Using any temperature gauge or thermometer it is possible to calibrate the different sensors by introducing the thermometer through the opening the oven has at its upper part.

This module has:

- Oven chamber.
- Heating element.
- Fan.
- Thermocouples.
- Platinum resistance thermometer.
- Thermistor.
- Semiconducting temperature sensor.



SPECIFICATIONS

Painted steel box.
Connection diagrams for each transducer are represented graphically.
Oven chamber.
Heating element:
Oven heating element made up of two parallel resistances with a maximum dissipation power of 500W. The heating element power supply is of 0-30V AC. Inside the heating element there is a temperature sensor element.
Fan:
Fan with changeable speed that can be operated varying the fan energy supply voltage.
Energy supply voltage: +12 Vdc (max). Maximum power: 0.96 W. Maximum air flow: 2.5 l./s.
Thermocouples:
4 thermocouples placed inside the oven, each one of them at a different height. Temperature range: -184°C to 400°C.
Platinum resistance thermometer:
Platinum resistance temperature detector, suitable for measuring air and gas temperatures. Temperature range: -70°C to 600°C. Resistance (0°C): 100+/-0.1Ω.
Thermistor:
NTC thermistor for temperature measurement and control, with great sensitivity and stability. Resistance at 25°C: 5.8 KΩ. Temperature range: -40°C to 125°C.
Semiconductor temperature sensor:
Reverse polarized diode. The current through the diode depends on the temperature at which balance with the surrounding environment is achieved. Therefore it needs a conditioning circuit able to transform this current variation in voltage proportional to temperature.
Sensor connections with the Base Unit and with power supplies are through 2 mm. terminals located in the front panel of the Test Module.
Manuals: It is supplied with the following manuals: Required Services, Assembly and Installation, Starting-up, Safety, Maintenance & Practices Manuals.
Each module may operate independently of one another.

EXERCISES AND PRACTICAL POSSIBILITIES

1.- Heating element. Raise the oven internal temperature, over the environmental temperature, using a heating element to do tests and practices related with temperature measurement.
2.- To use a fan as refrigerating element of the oven.
3.- To use thermocouples as temperature sensors elements inside the oven. Temperature measurement using a thermocouple.
4.- To measure temperature inside the oven using a platinum resistance thermometer.
5.- To measure temperature inside the oven using a thermistor temperature sensor.
6.- Temperature measurement using a thermistor, based on its negative temperature coefficient.
7.- To obtain the temperature value inside the oven using a semiconductor sensor (diode).
8.- PID control.

REQUIRED SERVICES

- Electrical supply: single-phase, 220V./50Hz or 110 V./60Hz.
- Computer Controlled Base Unit (BSPC) or Base Unit (BSUB).

DIMENSIONS AND WEIGHT

- Dimensions: 405 x 300 x 470 mm. approx. (15.94 x 11.81 x 18.50 inches approx.)
- Weight: 7.5 Kg. approx. (16.53 pounds approx.)

BS-6. **Liquid Level Test Module:**

GENERAL DESCRIPTION

The Liquid Level Test Module "BS-6" has been designed to teach the use and applications of level sensors and their measurement systems. This module teaches techniques to measure and control the liquid level in a tank.

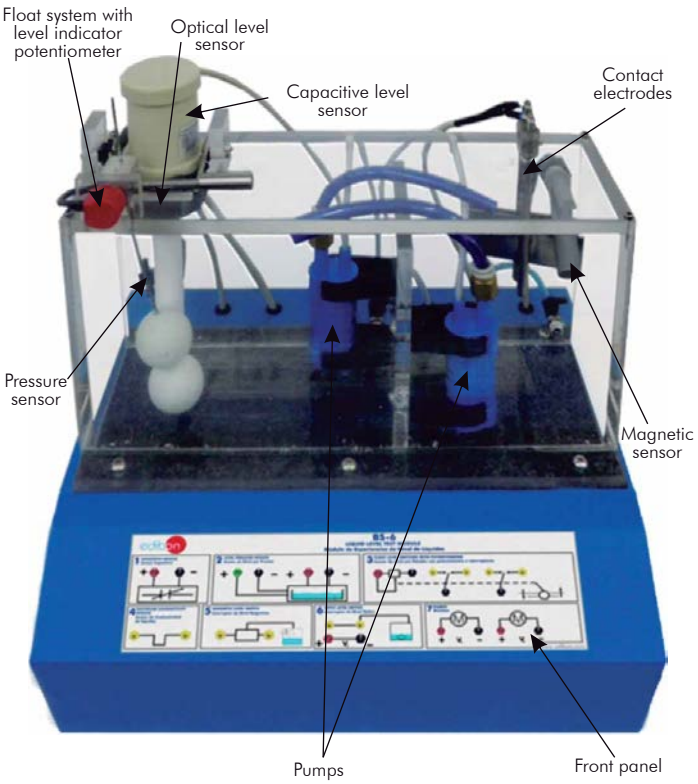
On this there is a two tanks system whose aim is to pump the liquid (usually water) between both tanks. Both tanks have sensors of different technology so they can be used as liquid storage tanks or to study the level measurement sensors. Each tank has an individual pump.

Sensors:

- Capacitive level sensor.
- Level sensor by pressure.
- Float level switches with potentiometer.
- Conductivity level sensor (Electrodes).
- Magnetic float level sensor.
- Optical level sensor.

Two pumps fed through direct current that can be used to pump the liquid from one tank to the other.

All the connections of the different sensors and pump systems are done using the 2 mm. terminals available on the test module front panel, with diagrams describing their functions.



SPECIFICATIONS

Painted steel box. Connection diagrams for each transducer are represented graphically.
Water tanks.
Capacitive level sensor:
Level sensor immersed in the tank. Power supply: 12-35 Vdc. Output: 4-20 mAdc.
Level sensor by pressure:
It is a differential pressure sensor that measures the pressure practiced by the water compared to the atmospheric pressure to measure the water level. Pressure range: 0-1psi. Sensibility: 16.7mV/psi. Excitation Voltage: 10-16 Vdc.
Float level switches with potentiometer:
It is a potentiometer fixed to a float arm that will vary its position depending to the water level. This system complements itself with two end and beginning path switches respectively. Switching voltage contacts: 250 Vac/125 Vdc.
Conductivity level sensor:
This sensor works with two electrodes immersed in one of the tanks. As the water level rises and covers the electrodes its resistance will decrease until it arrives to KΩ unit values; as long as the water does not touch the electrodes, the resistance between them will be very big and will behave like an open circuit.
Magnetic float level sensor:
Sensor formed by a small float that has inside a magnetic element, the float base has a Hall effect element that detects when the float has gone up due to the effect of the water. Switching voltage: 240Vac, 120Vdc.
Optical level sensor:
It is a photodiode and phototransistor, which in presence of water changes its refraction properties and make the output state approximately change from 3Vdc to 0Vdc. Power supply: 5Vdc. Load current: 20mA max. at 125°C.
2 Pumps:
The volume supplied by these pumps can be regulated varying the dc voltage value with which they are supplied. Power supply: 12Vdc (max. voltage). Nominal volume: 1 l./min. Nominal current: 1 A DC.
Sensor connections with the Base Unit and with power supplies are through 2 mm. terminals located in the front panel of the Test Module.
Manuals: It is supplied with the following manuals: Required Services, Assembly and Installation, Starting-up, Safety, Maintenance & Practices Manuals.
Each module may operate independently of one another.

EXERCISES AND PRACTICAL POSSIBILITIES

1.- To use a capacitive sensor to measure the liquid level in the tank.
2.- To use the differential pressure sensor as an element to determine the water level in a tank.
3.- To use a changeable resistance fixed to a float system as a liquid level measurement element.
4.- Conduction Sensor. Use of a sensor made up of to steel electrodes to measure the water level of a tank.
5.- Magnetic float level sensor. It detects a precise liquid level in the tank with a magnetic contact.
6.- Control of the module left tank liquid level using an optical level sensor.

REQUIRED SERVICES

- Computer Controlled Base Unit (BSPC) or Base Unit (BSUB).
- Water supply.

DIMENSIONS AND WEIGHT

- Dimensions: 405 x 300 x 380 mm. approx. (15.94 x 11.81 x 14.96 inches approx.)
- Weight: 10 Kg. approx. (22 pounds approx.)

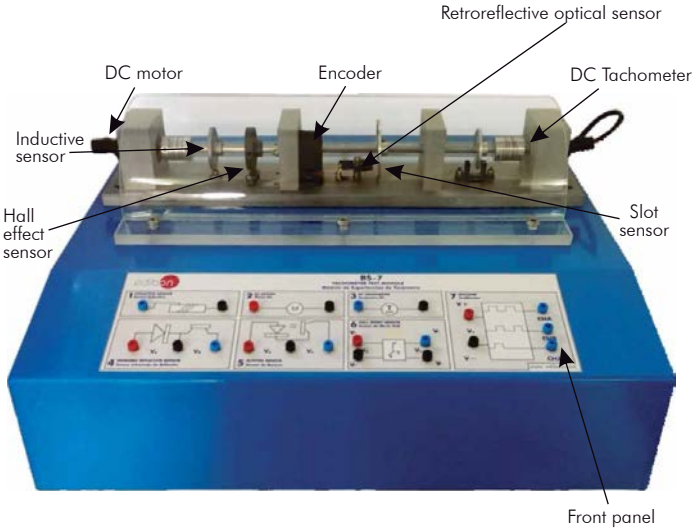
BS-7. **Tachometers Test Module:**

GENERAL DESCRIPTION

The Tachometer Test Module "BS-7" has been designed to teach linear and angular speed measurement techniques. In this module placed on the upper part we have a miniature motor used to move the axle. The motor speed can be changed adjusting the voltage delivered to the actuator motor. The rotation speed can be measured using the different measure transducers placed on the axle.

Elements included:

- DC Tachometer.
- Encoder.
- Inductive Sensor.
- Retroreflective optical sensor.
- Slot Optical Sensor.
- Hall Effect sensor.



SPECIFICATIONS

Painted steel box.

Connection diagrams for each transducer are represented graphically.

DC Motor:

Nominal voltage: 12V. Resistance: 9,7 Oh. Max. vacuum speed: 8500 r.p.m. Max. load speed: approx. 3500 r.p.m. Start voltage: 210mV.

Inductive Sensor:

Output voltage: up to 10 Vpp. Body-housing material: Steel. Operating temp. range: -40°C to +60°C.

DC Tachometer: Voltage rating: 1.5V(dc). Power rating: 1.21W.

Retroreflective optical sensor:

Sensor where an infrared emitting diode and a NPN phototransistor encased side-by-side on coverging optical axes in a black thermoplastic housing. Vo in output connectors of the module: 0.0-400mV for Vs=12VDC.

Slot Optical Sensor:

Slot optical sensor where an input LED and an output phototransistor are capsulated. Vo in output connectors of the module: 0.0-5V for Vs=5VDC.

Hall Effect sensor:

Hall-effect position sensor where exist a relationship between supply voltage and the combined effects of a change in sensitivity (gain) and null voltage output at room temperature.

Supply Voltage: 4 to 10V. Supply Current: 3.5mA. Output type: Differential. Output voltage: 0.25V to 2V. Sensitivity: -130 to +130 gauss; 0.75 to 1.06 mV/gauss. Vo in output connectors of the module: 0.0-1V for Vs=5VDC.

Encoder:

This optical encoder contains a LED source, an integrated circuit with detectors and output circuitry, and a codewheel which rotates between the emitter and the detector IC. Supply voltage: -0.5 to 7 V. Output voltage: -0.5 to Vdc. Output current per channel: -1 to 5 mA. Velocity: 30000 r.p.m.

Sensor connections with the Base Unit and with power supplies are through 2 mm. terminals located in the front panel of the Test Module.

Manuals: It is supplied with the following manuals: Required Services, Assembly and Installation, Starting-up, Safety, Maintenance & Practices Manuals.

Each module may operate independently of one another.

EXERCISES AND PRACTICAL POSSIBILITIES

1.- DC Motor. Provide the group of sensors of the BS-7 module fixed to the central axle of the equipment with movement power.

2.- DC Tachometer. To use a DC motor as a tachometer to measure the revolutions of the BS-7 module central axle.

3.- Inductive Sensor.

4.- Retroreflective optical sensor. To measure the central axle revolutions of the module using a light reflection optical sensor.

5.- To obtain the central axle speed value using a slot optical sensor through light interruption.

6.- To obtain the central axle speed value using a Hall-effect position sensor.

7.- To measure the central axle revolutions of the module using the encoder.

REQUIRED SERVICES

- Computer Controlled Base Unit (BSPC) or Base Unit (BSUB).

DIMENSIONS AND WEIGHT

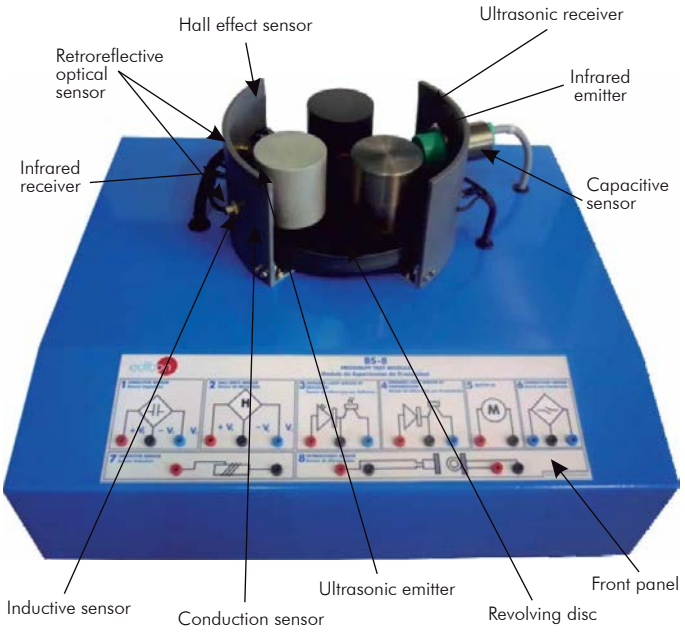
- Dimensions: 405 x 300 x 250 mm. approx. (15.94 x 11.81 x 9.84 inches approx.)
- Weight: 5.5 Kg. approx. (12.12 pounds approx.)

BS-8. **Proximity Test Module:**

GENERAL DESCRIPTION

This Module has been designed to teach techniques to detect the proximity of objects, focusing on the distance at which each sensor is able to detect the object and the type of material it can detect.
In the upper part there is a revolving disc on which the objects to be detected are placed. All sensors are situated in front of the disc on walls perpendicular to the disc, so that when the disc turns with an object on it, it will pass in front of each of the module sensors.
A dc motor moves the disc at different speeds, which allows studying the maximum frequency the sensor is able to detect.
Elements included in the module:

- Proximity capacitive sensor.
- Hall effect sensor.
- Retroreflective optical sensor.
- Infrared transmission sensor.
- Motor DC.
- Conduction sensor.
- Inductive sensor.
- Ultrasonic sensor.



SPECIFICATIONS

Painted steel box.
Connection diagrams for each transducer are represented graphically.
DC Motor: Nominal power supply: 12Vdc.
Proximity capacitive sensor:
It can detect metallic objects.
Detection distance: 10 mm. Output: 10-60V Imax = 200mA. Power supply voltage: 10-60V.
Hall effect sensor:
Proximity switch using the Hall effect, switching when there is a magnetic field. Power supply voltage: 5Vdc. Magnetic flux density: works at 22 mT (35mT max).
Retroreflective optical sensor:
Emission narrow beam GaAs IR Emitter. Detection narrow beam IR Photodetector.
Emitter: VF(max): 1.7, VR (min): 3V., radiation power: 4.8mW, peak wavelength: 935nm. Receiver: Vc (max): 12Vdc., Ic (min): 8mA., Darkness current: 100nA.
Transmission infrared sensor:
Emission narrow beam GaAs IR Emitter. Detection narrow beam IR Photodetector.
Emitter: VF (max): 1.7, VR (min): 3V., radiation power: 4.8mW., peak wavelength: 935nm. Receiver: Vc (max): 30V., Ic (min): 8mA., Darkness current: 100nA.
Conduction sensor:
Proximity sensor with plate sensible to magnetic fields. Contact material: Rhode. Output: NO-NC. Breaking voltage: 400V. DC or AC current (max) 0.6Amp.
Inductive sensor:
Sensor that gives variations in the output voltage as a variation of the magnetic field, caused by the near ferromagnetic material movement.
Inductance: 12mH. Winding Resistance: 130 Oh. Detection distance: 2mm.
Ultrasonic sensor:
Transmitter sensibility: 106 dB. Receiver sensibility: -65 dB. Resonance frequency: 40kHz. Operation distance: 40 cm. Output voltage: 20V rms.
Sensor connections with the Base Unit and with power supplies are through 2 mm. terminals located in the front panel of the Test Module.
Manuals: It is supplied with the following manuals: Required Services, Assembly and Installation, Starting-up, Safety, Maintenance & Practices Manuals.
Each module may operate independently of one another.

EXERCISES AND PRACTICAL POSSIBILITIES

1.- How to use a capacitive sensor to detect metal objects as the pass in front of the sensor.
2.- To use a Hall effect sensor as an element to detect the presence of magnetic objects.
3.- Retroreflective optical sensor. To use an optical sensor that works through infrared light reflection.
4.- Infrared sensor by transmission. To detect objects using an Infrared sensor by light beam interruption.
5.- Conduction sensor. To detect magnetic objects using a REED switch sensor.
6.- To detect the presence of ferrous object using an inductive sensor.
7.- Ultrasonic sensor. To detect metallic and non-metallic object using high frequency sounds.

REQUIRED SERVICES

- Computer Controlled Base Unit (BSPC) or Base Unit (BSUB).

DIMENSIONS AND WEIGHT

- Dimensions: 405 x 300 x 250 mm. approx. (15.94 x 11.81 x 9.84 inches approx.)
- Weight: 10 Kg. approx. (22 pounds approx.)

BS-9. **Pneumatic Test Module:**

GENERAL DESCRIPTION

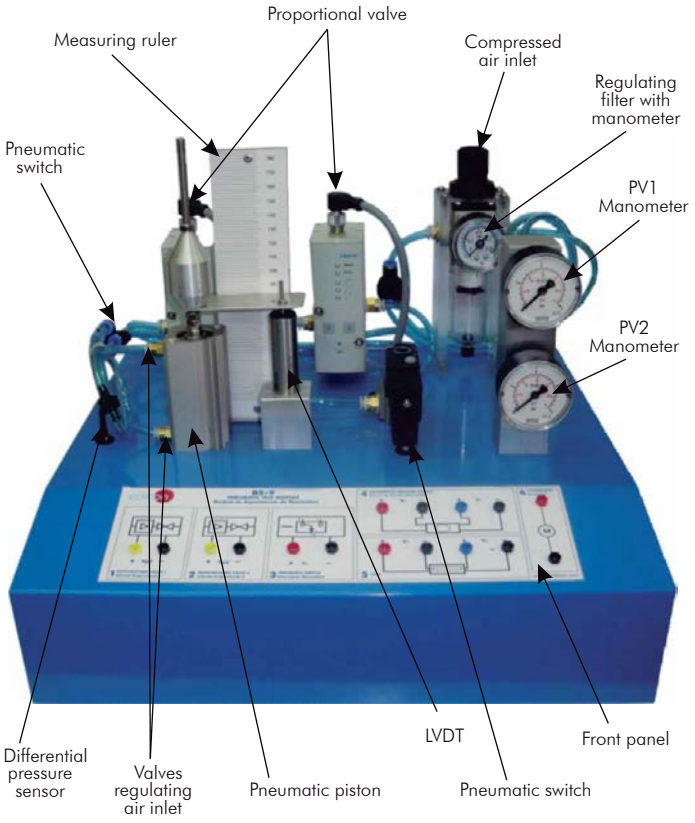
The Pneumatics Test Module "BS-9" has been designed to teach techniques of control and handling of a pneumatic piston.

All connections of the different BS-9 mechanisms will have output through a group of 2 mm. terminals. They are placed in the front panel of the test module with a diagram representing their functions.

A double-action pneumatic piston is used to move a platform placed on the upper part of the piston axle. The control of the air inlet to the piston is carried out using two proportional electronic valves. There is a differential pressure sensor is connected between both pneumatic piston air inlets. This way the pressure difference between both inlets can be obtained any time. At one of the air inlets to the piston there is connected in series a pneumatic switch that works as air output in the circuit. An compressor, located inside the steel box, must provide the compressed air needed for this unit to operate. A LVDT sensor will indicate the displacement of the pneumatic piston axle.

Elements in the test module are:

- Two Proportional valves.
- Differential pressure sensor.
- Pneumatic switch (2 positions).
- Linear displacement sensor (LVDT).
- Regulating filter with manometer.
- Manometer indicator of pressure in proportional valve 1.
- Manometer indicator of pressure in proportional valve 2.
- Air compressor (located inside the steel box).



SPECIFICATIONS

Painted steel box.

Connection diagrams for each transducer are represented graphically.

Proportional valves (1 and 2):

Nominal voltage: 24Vdc. Pressure range: 8 bar maximum, 0 to 6 bar control. Linearity: 1% full scale.

Differential pressure sensor: Measurement range: 0 to 30 psi. Sensitivity: 3.33mV/psi. Power-supply range: 10 to 16 Vdc.

Pneumatic switch: Activation: 20 to 24Vdc. Positions: 2. Maximum pressure: 6 bars.

LVDT Sensor: Power-supply voltage: 9 to 24Vdc. Sensitivity: 60mV/mm/10Vdc.

Regulation filter: Manual drainage. Maximum input pressure: 8 bars. Flux: 14.5 dm^3/s.

Air compressor:

Air flow: 10 l./min. Pressure: 1.83 Kg/cm^2.

Sensor connections with the Base Unit and with power supplies are through 2 mm. terminals located in the front panel of the Test Module.

Manuals: It is supplied with the following manuals: Required Services, Assembly and Installation, Starting-up, Safety, Maintenance & Practices Manuals.

Each module may operate independently of one another.

EXERCISES AND PRACTICAL POSSIBILITIES

1.- Proportional valves. To control electronically the vertical displacement of a double effect pneumatic piston using proportional valves.

2.- Differential pressure sensor. To use a pressure sensor for measuring the pressure difference between both pneumatic piston air inlets.

3.- Pneumatic switch. To deflect the air flow using a pneumatic switch.

4.- LVDT Linear Displacement Sensor. To measure pneumatic piston displacement using an excitation and DC output LVDT.

REQUIRED SERVICES

- Electrical supply: single-phase, 220V./50Hz or 110 V./60Hz.
- Computer Controlled Base Unit (BSPC) or Base Unit (BSUB).

DIMENSIONS AND WEIGHT

- Dimensions: 405 x 300 x 350 mm. approx. (15.94 x 11.81 x 13.78 inches approx.)
- Weight: 7 Kg. approx. (15.4 pounds approx.)

BS-10. **Light Test Module:**

GENERAL DESCRIPTION

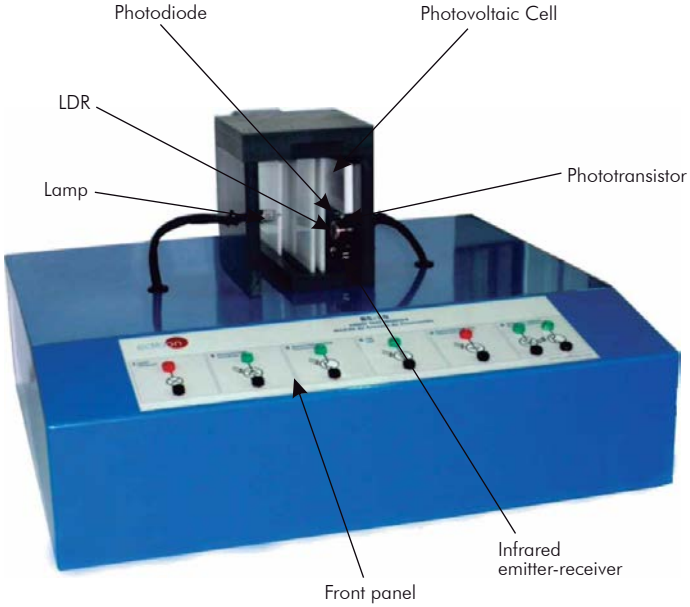
The objective of this module is to show some of the techniques used to measure light or illumination intensity.

The module is equipped with a lamp whose light intensity can be controlled by the variation of the voltage supplied.

This module has:

- Lamp.
- Photodiode.
- Phototransistor.
- Light Dependent Resistance (LDR).
- Photovoltaic Cell.
- Infrared emitter-receiver.

All the connections from the different transducers and the lamp are made using a group of 2 mm. terminals placed on the front panel of the test module with drawings describing their functions.



SPECIFICATIONS

Painted steel box.
Connection diagrams for each transducer are represented graphically.
Lamp:
Voltage: 12 V. Power 5 W.
Photodiode:
Power: 250 mW max. Sensibility: 0.34 A/N. This sensor converts light into either current or voltage, depending upon the mode of operation.
Phototransistor:
Current collector: 20 mA max. Peak wavelength: 570 nm. It also consists of a photodiode with internal gain.
Light Dependent Resistor:
Power dissipation: 250 mW max. Peak wavelength: 550 nm. A LDR is a resistor whose resistance decreases with increasing incident light intensity.
Photovoltaic Cell:
Power: 250 mW max. Peak wavelength: 550 nm. A photovoltaic cell converts solar radiation into direct current electricity.
Infrared emitter-receiver:
Power: 470 mW max. Max. current: 200 mA. Peak wavelength: 880 nm. This element consists of an IR emitter LED and IR phototransistor.
Sensor connections with the Base Unit and with power supplies are through 2 mm. terminals located in the front panel of the Test Module.
Manuals: It is supplied with the following manuals: Required Services, Assembly and Installation, Starting-up, Safety, Maintenance & Practices Manuals.
Each module may operate independently of one another.

EXERCISES AND PRACTICAL POSSIBILITIES

1.- Study of the equivalent electrical circuit of a photodiode. Study the V-I characteristic of a photodiode.

2.- Study of the normal operation mode of a photodiode. Study the "ON/OFF" operation (light switch) of a phototransistor.

3.- Measurement of light intensity using a solar cell.

4.- Study of the properties of light dependent resistors (LDR).

5.- Study of the operation of IR sensors.

6.- Study of a real application for controlling the light intensity using PID control elements.

REQUIRED SERVICES

- Computer Controlled Base Unit (BSPC) or Base Unit (BSUB).

DIMENSIONS AND WEIGHT

- Dimensions: 405 x 300 x 300 mm. approx. (15.94 x 11.81 x 11.81 inches approx.)
- Weight: 6 Kg. approx. (13.2 pounds approx.)

✱Specifications subject to change without previous notice, due to the convenience of improvements of the product.

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