Engineering and Technical Teaching Equipment

Modular System for the Study of Sensors with PLC Control

PLC-BS

Available with PLC, as:
- **PANASONIC**
- **SIEMENS**
- **MITSUBISHI**
- **ALLEN BRADLEY**
- **OMRON**

Etc...

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PRODUCTS
60.- MECHATRONICS & COMPUMECHATRONICS

Test Modules


PLC-BS2


PLC-BS3


PLC-BS4


PLC-BS5

PLC Unit


AE-PLC-PAN Unit required
(not included in the supply)

+


PLC Programming Software
(not included in the supply)


Computer required
(not included in the supply)

Teaching Technique used

ICAI. Interactive Computer Aided Instruction Software System


Instructor Software

+


Student Software

Test Modules


PLC-BS6


PLC-BS7


PLC-BS9


PLC-BS10

INTRODUCTION

Sensors or transducers are devices that transform a physical quantity into an electrical signal. This capability has made them highly relevant in various technological fields such as industry, automotive, aeronautics, robotics, medicine, etc. Control of the industrial processes with a Programmable Logic Controller (PLCs) allows improve the control, the flexibility and the productivity of the processes.

The Modular System for the Study of Sensors with PLC Control, "PLC-BS", have been designed to obtain the necessary knowledge for the understanding of the operation with different sensors technologies and control of simple processes by PLC.

The "PLC-BS" modules are provided with a set of practical exercises, through which students will understand how different sensors work and how perform a process control with a PLC.

GENERAL DESCRIPTION

The Modular System for the Study of Sensors with PLC Control, "PLC-BS", are a large number of modules that show the operation of different sensors to understand the sensor control applications of different technologies, applied to common measurement and control systems such as temperature, flow, pressure, deformation, velocity, etc. The "PLC-BS" are designed to work with PLC control and offer an introduction to PLC units that work with a sensor signal and control an actuator.

The "PLC-BS" modules, designed by EDIBON, allow the user to learn about the basic concepts of different sensors (operation, sensor calibration, etc.) and the basic operation of a Programmable Logic Control (PLC) unit without any previous knowledge or experience.

ISO 9001: Quality Management (for Design, Manufacturing, Commercialization and After-sales service)

European Union Certificate (total safety)

Certificates ISO 14001 and ECO-Management and Audit Scheme (environmental management)

Certificate and Worlddidac Member

PLC-BS2. **Temperature Test Module for PLC**

GENERAL DESCRIPTION

The "PLC-BS2" has been designed to study the use and applications of temperature sensors as a measure device and how to perform a temperature control through a PLC. The unit is equipped with a half-open space in whose interior there are one lamp that heat the inside of the module and a series of temperature sensors of different technologies placed in different positions. One of the temperature sensors output signal is conditioned to be connected to the PLC. The temperature inside the module can be controlled by the PLC, depending on the signal obtained from the temperature sensor.

Included elements: the included elements of the "PLC-BS2" unit are:

- FACO. Power Supply.
- BS2. Temperature Test Module.

Required elements: the required elements to operate with the "PLC-BS2" unit are:

- AE-PLC-PAN-UB. PANASONIC PLC Base Unit.
- PLC-PAN-K1. PANASONIC PLC Kit 1.
- PLC-PAN-K2. PANASONIC PLC Kit 2.

*** Available PLC models of different manufacturers: PANASONIC, SIEMENS, OMRON, MITSUBISHI, ALLEN BRADLEY, etc.**

SPECIFICATIONS

- FACO. **Power Supply:**

  Fixed outputs DC: + 5 V, ± 12 V, 1 A.

  Variable outputs DC: ± 12 V, 0.5 A.

  AC output: 12 V or 24 V.

  Connection to the PLC-BS modules through 25 pin Sub-D connectors.

  LED's voltage indicators.

  Robust construction.

- BS2. **Temperature Test Module:**

  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): 250 V – 10 A. N.O. contact. Switching voltage: 12 V.

  Capillary thermostat:

  Temperature range: 0 °C – 90 °C. Max. bulb temperature: 150 °C. Socket current: 15 A, 250 V AC. N.C. contact.

  Thermocouples:

  Three 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 – 250 °C.

  Feedback sensor for PLC control:

  Conditioning signal circuit of a temperature sensor.

  Voltage output range: 0 – 10 Vdc.

Cables and Accessories, for normal operation.

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

Each module may operate independently of another.

PLC-BS2. **Temperature Test Module for PLC**

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.

6.- Using the analog inputs and outputs of the PLC to read and write analog signals.

7.- Read the temperature sensor signal with the PLC.

8.- Manual control of the actuator through the PLC.

9.- PID control of the temperature value through the PLC.

10.-Observe the effects of the temperature control to changes in the PID parameters.

REQUIRED SERVICES

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

DIMENSIONS AND WEIGHTS

PLC-BS2:

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

PLC-BS3. **Pressure Test Module for PLC**

GENERAL DESCRIPTION

The "PLC-BS3" has been designed to study the pressure measurement techniques and control application with a PLC. This unit is equipped with a pressure chamber with several sensors, with different uses and applications, adjusted to measure the pressure changes inside the chamber and control the pressure with a PLC. One of the pressure sensor output signals is conditioned to be connected to the PLC. The equipment works with a compressor and a manometer connected next to a regulating valve that can adjust the maximum pressure inside the chamber. On both sides of the pressure chamber there are two diaphragms where displacement sensors are connected to measure the pressure valve. The pressure inside the chamber can be controlled by a PLC, controlling the air supply depending on the pressure values obtained from a sensor.

Included elements: the included elements of the "PLC-BS3" unit are:

- FACO. Power Supply.
- BS3. Pressure Test Module.

Required elements: the required elements to operate with the "PLC-BS3" unit are:

- AE-PLC-PAN-UB. PANASONIC PLC Base Unit.
- PLC-PAN-K1. PANASONIC PLC Kit 1.
- PLC-PAN-K2. PANASONIC PLC Kit 2.

*** Available PLC models of different manufacturers: PANASONIC, SIEMENS, OMRON, MITSUBISHI, ALLEN BRADLEY, etc.**

SPECIFICATIONS

- FACO. **Power Supply:**
  - Fixed outputs DC: + 5 V, ± 12 V, 1 A.
  - Variable outputs DC: ± 12 V, 0.5 A.
  - AC output: 12 V or 24 V.
  - Connection to the PLC-BS modules through 25 pin Sub-D connectors.
  - LED's voltage indicators.
  - Robust construction.

- BS3. **Pressure Test Module:**
  - Painted steel box. Connection diagrams for each transducer are represented graphically.
  - Linear positioning sensor (Potentiometer):
    - Resistor range: 500 Ω – 5 KΩ. Operation force: 200 – 750 g.
  - LVDT sensor:
    - Sensibility: 780 mV/mm. Power voltage: 5 – 12 Vdc. Total path: 2.5 mm.
  - Differential pressure sensor:
    - Measurement range: 0 – 30 psi. Sensibility: 3.33 mV/psi. Overpressure: 60 psi. Power supply range: 10 – 16 Vdc.
  - Two strain gauges mounted in a Wheatstone bridge:
    - Nominal resistor: 25 °C: 120 Ω. Gauge factor: 2.00 – 2.1 typical. Nominal resistor tolerance: +-0.5 %.
  - Manometric pressure sensor:
    - Measurement range: 0 – 30 psi. Sensibility: 3.33 mV/psi. Overpressure: 60 psi. Power supply range: 10 – 16 Vdc.
  - Absolute pressure sensor:
    - Measurement range: 2 – 30 psi. Sensibility: -11 mV/psi. Overpressure: 60 psi. Power supply range: 10 – 12 Vdc.
  - Air compressor (located inside the steel box): Air flow: 10 l/min. Pressure: 1.83 Kg/cm^2. Power supply: 220 V, 50/60 Hz.
  - Feedback sensor for PLC control:
    - Signal conditioning circuit of a pressure sensor.
    - Voltage output range: 0 – 10 Vdc.

Cables and Accessories, for normal operation.

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

Each module may operate independently of another.

PLC-BS3. **Pressure Test Module for PLC**

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.

7.- Using the analog inputs and outputs of the PLC to read and write analog signals.

8.- Read the pressure sensor signal with the PLC.

9.- Manual control of the actuator through the PLC.

10.-PID control of the pressure value through the PLC.

11.-Observe the effects of the pressure control to changes in the PID parameters.

REQUIRED SERVICES

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

DIMENSIONS AND WEIGHTS

PLC-BS3:

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

PLC-BS4. **Flow Test Module for PLC**

GENERAL DESCRIPTION

The "PLC-BS4" has been designed to study the flow measurement techniques and control with PLC. This unit is equipped with two tanks assembled on a structure with a pumping system that allows pumping the water from the reservoir tank, through the measurement transducer system, to the main tank being able to vary the flow. One of the flow sensor output signals is conditioned to be connected to the PLC.

The flow can be controlled by a PLC managing the pumping system, depending on the values obtained by a flow sensor.

Included elements: the included elements of the "PLC-BS4" unit are:

- FACO. Power Supply.
- BS4. Flow Test Module.

Required elements: the required elements to operate with the "PLC-BS4" unit are:

- AE-PLC-PAN-UB. PANASONIC PLC Base Unit.
- PLC-PAN-K1. PANASONIC PLC Kit 1.
- PLC-PAN-K2. PANASONIC PLC Kit 2.

*** Available PLC models of different manufacturers: PANASONIC, SIEMENS, OMRON, MITSUBISHI, ALLEN BRADLEY, etc.**

SPECIFICATIONS

- FACO. **Power Supply:**

Fixed outputs DC: + 5 V, ± 12 V, 1 A.

Variable outputs DC: ± 12 V, 0.5 A.

AC output: 12 V or 24 V.

Connection to the PLC-BS modules through 25 pin Sub-D connectors.

LED's voltage indicators.

Robust construction.

- BS4. **Flow Test Module:**

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: 240 Vac. Switching voltage DC: 120 Vdc.

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: 5 Vdc. Measurement range: 0.25 – 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 – 1 psi. Sensitivity: 16.7 mV/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 – 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.

Feedback sensor for PLC control:

Signal conditioning circuit of a flow sensor.

Voltage output range: 0 – 10 Vdc.

Cables and Accessories, for normal operation.

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

Each module may operate independently of another.

PLC-BS4. **Flow Test Module for PLC**

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 themodule hole board system, as a necessary parameter todetermine volume.

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

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

7.- Using the analog inputs and outputs of the PLC to read and write analog signals.

8.- Read the flow sensor signal with the PLC.

9.- Manual control of the actuator through the PLC.

10.-PID control of the flow value through the PLC.

11.-Observe the effects of the flow control to changes in the PID parameters.

REQUIRED SERVICES

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

DIMENSIONS AND WEIGHTS

PLC-BS4:

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

PLC-BS5. **Ovens Test Module for PLC**

GENERAL DESCRIPTION

The "PLC-BS5" has been designed to study the temperature measurement techniques inside a sealed place, such as an oven and how to perform a temperature control through a PLC. This module is equipped with an oven that contains a heating element and a changeable speed fan than enables to modify the oven time constant. The oven has four equal thermocouples placed on different heights, a platinum resistance thermometer, a thermistor and a semiconducting mechanism sensitive to temperature. One of the temperature sensors output signals is conditioned to be connected to the PLC. The temperature inside the oven can be controlled with a PLC through the signal obtained from a sensor.

Included elements: the included elements of the "PLC-BS5" unit are:

- FACO. Power Supply.
- BS5. Ovens Test Module.

Required elements: the required elements to operate with the "PLC-BS5" unit are:

- AE-PLC-PAN-UB. PANASONIC PLC Base Unit.
- PLC-PAN-K1. PANASONIC PLC Kit 1.
- PLC-PAN-K2. PANASONIC PLC Kit 2.

*** Available PLC models of different manufacturers: PANASONIC, SIEMENS, OMRON, MITSUBISHI, ALLEN BRADLEY, etc.**

SPECIFICATIONS

- FACO. **Power Supply:**

  Fixed outputs DC: + 5 V, ± 12 V, 1 A.

  Variable outputs DC: ± 12 V, 0.5 A.

  AC output: 12 V or 24 V.

  Connection to the PLC-BS modules through 25 pin Sub-D connectors.

  LED's voltage indicators.

  Robust construction.

- BS5. **Ovens Test Module:**

  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 500 W. The heating element power supply is of 0 – 30 V 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:

  Four thermocouples placed inside the oven, each one of them at a different height. Temperature range: -184 °C – 400 °C.

  Platinum resistance thermometer:

  Platinum resistance temperature detector, suitable for measuring air and gas temperatures. Temperature range: -70 °C – 600 °C. Resistance (0 °C): 100+/-0.1 Ω.

  Thermistor:

  NTC thermistor for temperature measurement and control, with great sensitivity and stability. Resistance at 25 °C: 5.8 KΩ. Temperature range: -40 °C – 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.

  Feedback sensor for PLC control:

  Signal conditioning circuit of a temperature sensor.

  Voltage output range: 0 – 10 Vdc.

Cables and Accessories, for normal operation.

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

Each module may operate independently of one another.

PLC-BS5. **Ovens Test Module for PLC**

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.- Using the analog inputs and outputs of the PLC to read and write analog signals.

9.- Read the temperature sensor signal with the PLC.

10.-Manual control of the actuator through the PLC.

11.-PID control of the temperature value through the PLC.

12.-Observe the effects of the temperature control to changes in the PID parameters.

REQUIRED SERVICES

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

DIMENSIONS AND WEIGHTS

PLC-BS5:

- 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.)

PLC-BS6. **Liquid Level Test Module for PLC**

GENERAL DESCRIPTION

The "PLC-BS6" has been designed to study the liquid level measurement and control techniques of a tank through a PLC. This unit is equipped with two tanks with sensor of different technology for level measurement. One of the level sensor output signals is conditioned to be connected to the PLC. Each tank has an individual DC pump, which can be used to pump liquid from one tank to another. The level control of liquid can be controlled by PLC depending on the obtained signals from a sensor.

Included elements: the included elements of the "PLC-BS6" unit are:

- FACO. Power Supply.
- BS6. Liquid level Test Module.

Required elements: the required elements to operate with the "PLC-BS6" unit are:

- AE-PLC-PAN-UB. PANASONIC PLC Base Unit.
- PLC-PAN-K1. PANASONIC PLC Kit 1.
- PLC-PAN-K2. PANASONIC PLC Kit 2.

*** Available PLC models of different manufacturers: PANASONIC, SIEMENS, OMRON, MITSUBISHI, ALLEN BRADLEY, etc.**

SPECIFICATIONS

- FACO. **Power Supply:**

Fixed outputs DC: + 5 V, ± 12 V, 1 A.

Variable outputs DC: ± 12 V, 0.5 A.

AC output: 12 V or 24 V.

Connection to the PLC-BS modules through 25 pin Sub-D connectors.

LED's voltage indicators.

Robust construction.

- BS6. **Liquid level Test Module:**

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 – 1 psi. Sensibility: 16.7 mV/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: 240 Vac, 120 Vdc.

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 3 Vdc – 0 Vdc. Power supply: 5 Vdc. Load current: 20 mA max. at 125 °C.

Two pumps:

The volume supplied by these pumps can be regulated varying the dc voltage value with which they are supplied. Power supply: 12 Vdc (max. voltage). Nominal volume: 1 l/min. Nominal current: 1 A DC.

Feedback sensor for PLC control:

Signal conditioning circuit of the tachometer.

Voltage output range: 0 – 10 Vdc.

Cables and Accessories, for normal operation.

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

Each module may operate independently of another.

PLC-BS6. **Liquid Level Test Module for PLC**

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.
7.- Using the analog inputs and outputs of the PLC to read and write analog signals.
8.- Read the tachometer signal with the PLC.
9.- Manual control of the actuator through the PLC.
10.-PID control of the angular speed value through the PLC.
11.-Observe the effects of the angular speed control to changes in the PID parameters.

REQUIRED SERVICES

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

DIMENSIONS AND WEIGHTS

PLC-BS6:

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

PLC-BS7. **Tachometers Test Module for PLC**

GENERAL DESCRIPTION

The "PLC-BS7" has been designed to study the linear and angular speed measurement techniques through a PLC. This unit is equipped with a miniature motor to move an axle at different speeds, being able to adjust de motor speed by changing the voltage that is supplied to the actuator motor. The speed of rotation can be measured using the various measuring transducers that are fixed to the axle. The tachometer output signal is conditioned to be connected to the PLC. The axle speed is controlled by the PLC in function of the signal obtained by a tachometer.

Included elements: the included elements of the "PLC-BS7" unit are:

- FACO. Power Supply.
- BS7. Tachometer Test Module.

Required elements: the required elements to operate with the "PLC-BS7" unit are:

- AE-PLC-PAN-UB. PANASONIC PLC Base Unit.
- PLC-PAN-K1. PANASONIC PLC Kit 1.
- PLC-PAN-K2. PANASONIC PLC Kit 2.

*** Available PLC models of different manufacturers: PANASONIC, SIEMENS, OMRON, MITSUBISHI, ALLEN BRADLEY, etc.**

SPECIFICATIONS

- FACO. **Power Supply:**

Fixed outputs DC: + 5 V, ± 12 V, 1 A.

Variable outputs DC: ± 12 V, 0.5 A.

AC output: 12 V or 24 V.

Connection to the PLC-BS modules through 25 pin Sub-D connectors.

LED's voltage indicators.

Robust construction.

- BS7. **Tachometer Test Module:**

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

DC Motor:

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

Inductive Sensor:

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

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

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 – 400 mV for Vs=12 VDC.

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 – 5 V for Vs=5 VDC.

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

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 – 7 V. Output voltage: -0.5 to 7 Vdc. Output current per channel: -1 – 5 mA. Velocity: 30000 r.p.m.

Feedback sensor for PLC control:

Signal conditioning circuit of the tachometer.

Voltage output range: 0 – 10 Vdc.

Cables and Accessories, for normal operation.

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

Each module may operate independently of one another.

PLC-BS7. **Tachometers Test Module for PLC**

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.

8.- Using the analog inputs and outputs of the PLC to read and write analog signals.

9.- Read the tachometer signal with the PLC.

10.-Manual control of the actuator through the PLC.

11.-PID control of the angular speed value through the PLC.

12.-Observe the effects of the angular speed control to changes in the PID parameters.

REQUIRED SERVICES

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

DIMENSIONS AND WEIGHTS

PLC-BS7:

- 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.)

PLC-BS9. **Pneumatic Test Module for PLC**

GENERAL DESCRIPTION

The "PLC-BS9" has been designed to study the control and handling techniques of a pneumatic actuator through a PLC. The actuator is a double acting pneumatic cylinder that allows moving a platform. The displacement of the piston axle is detected by a linear displacement sensor LVDT. The position of the pneumatic cylinder is controlled by two proportional electronic valves. The pressure difference between the piston inlets is measured by a differential pressure sensor and the supply of compressed air is provided by a compressor. The pneumatic cylinder position is controlled by PLC depending on the obtained signals from the position sensor.

Included elements: the included elements of the "PLC-BS9" unit are:

- FACO. Power Supply.
- BS9. Pneumatic Test Module.

Required elements: the required elements to operate with the "PLC-BS9" unit are:

- AE-PLC-PAN-UB. PANASONIC PLC Base Unit.
- PLC-PAN-K1. PANASONIC PLC Kit 1.
- PLC-PAN-K2. PANASONIC PLC Kit 2.

*** Available PLC models of different manufacturers: PANASONIC, SIEMENS, OMRON, MITSUBISHI, ALLEN BRADLEY, etc.**

SPECIFICATIONS

- FACO. **Power Supply:**

Fixed outputs DC: + 5 V, ± 12 V, 1 A.

Variable outputs DC: ± 12 V, 0.5 A.

AC output: 12 V or 24 V.

Connection to the PLC-BS modules through 25 pin Sub-D connectors.

LED's voltage indicators.

Robust construction.

- BS9. **Pneumatic Test Module:**

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

Proportional valves (1 and 2):

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

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

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

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

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.

Feedback sensor for PLC control:

Signal conditioning circuit of the position sensor.

Voltage output range: 0 – 10 Vdc.

Cables and Accessories, for normal operation.

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

Each module may operate independently of one another.

PLC-BS9. **Pneumatic Test Module for PLC**

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.

5.- Using the analogs input and outputs of the PLC to read and write analog signals.

6.- Read the position sensor signal with the PLC.

7.- Manual control of the actuator through the PLC.

8.- PID control of the cylinder position through the PLC.

9.- Observe the effects of the position control to changes in the PID parameters.

REQUIRED SERVICES

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

DIMENSIONS AND WEIGHTS

PLC-BS9:

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

PLC-BS10. **Light Test Module for PLC**

GENERAL DESCRIPTION

The "PLC-BS10" has been designed to study different light measurement techniques and control light intensity through a PLC. This equipment is composed of a lamp whose intensity can be controlled according to the voltage applied and a series of transducers for the measurement of light intensity. One of the light sensor output signal is conditioned to be connected to the PLC. The light intensity can be controlled by a PLC managing the lamp light intensity, depending on the values obtained by a light sensor.

Included elements: the included elements of the "PLC-BS10" unit are:

- FACO. Power Supply.
- BS10. Light Test Module.

Required elements: the required elements to operate with the "PLC-BS10" unit are:

- AE-PLC-PAN-UB. PANASONIC PLC Base Unit.
- PLC-PAN-K1. PANASONIC PLC Kit 1.
- PLC-PAN-K2. PANASONIC PLC Kit 2.

*** Available PLC models of different manufacturers: PANASONIC, SIEMENS, OMRON, MITSUBISHI, ALLEN BRADLEY, etc.**

SPECIFICATIONS

- FACO. **Power Supply:**

  Fixed outputs DC: + 5 V, ± 12 V, 1 A.

  Variable outputs DC: ± 12 V, 0.5 A.

  AC output: 12 V or 24 V.

  Connection to the PLC-BS modules through 25 pin Sub-D connectors.

  LED's voltage indicators.

  Robust construction.

- BS10. **Light Test Module:**

  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.

  Feedback sensor for PLC control:

  Signal conditioning circuit of a luminosity sensor.

  Voltage output range: 0 – 10 Vdc.

Cables and Accessories, for normal operation.

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

Each module may operate independently of one another.

PLC-BS10. **Light Test Module for PLC**

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.- Using the analog inputs and outputs of the PLC to read and write analog signals.
7.- Read the light sensor signal with the PLC.
8.- Manual control of the actuator through the PLC.
9.- PID control of the light intensity value through the PLC.
10.-Observe the effects of the light intensity control to changes in the PID parameters.

REQUIRED SERVICES

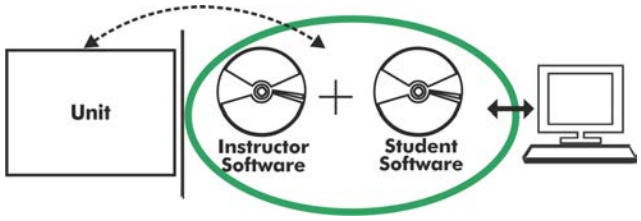
- Electrical supply: single-phase, 220 V/50 Hz or 110 V/60 Hz.

DIMENSIONS AND WEIGHTS

PLC-BS10:

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

ICAI. Interactive Computer Aided Instruction Software System:



With no physical connection between unit and computer, **this complete software package consists of an Instructor Software (EDIBON Classroom Manager -ECM-SOF) totally integrated with the Student Software (EDIBON Student Labsoft -ESL-SOF).** Both are interconnected so that the teacher knows at any moment what is the theoretical and practical knowledge of the students.

Instructor Software

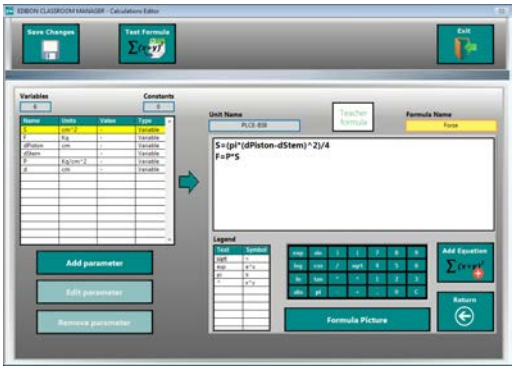
- ECM-SOF. EDIBON Classroom Manager (Instructor Software).

ECM-SOF is the application that allows the Instructor to register students, manage and assign tasks for workgroups, create own content to carry out Practical Exercises, choose one of the evaluation methods to check the Student knowledge and monitor the progression related to the planned tasks for individual students, workgroups, units, etc... so the teacher can know in real time the level of understanding of any student in the classroom.

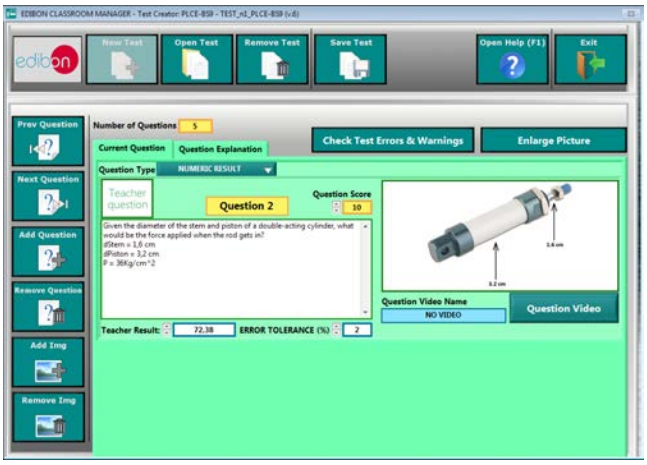
Innovative features:

- **User Data Base Management.**
- **Administration and assignment of Workgroup, Task and Training sessions.**
- **Creation and Integration of Practical Exercises and Multimedia Resources.**
- **Custom Design of Evaluation Methods.**
- **Creation and assignment of Formulas & Equations.**
- **Equation System Solver Engine.**
- **Updatable Contents.**
- **Report generation, User Progression Monitoring and Statistics.**

ECM-SOF. EDIBON Classroom Manager (Instructor Software) Application Main Screen



ECAL. EDIBON Calculations Program Package - Formula Editor Screen



ETTE. EDIBON Training Test & Exam Program Package - Main Screen with Numeric Result Question

ERS. EDIBON Results & Statistics Program Package - Student Scores Histogram

Optional

Student Software

- ESL-SOF. EDIBON Student Labsoft (Student Software).

ESL-SOF is the application addressed to the Students that helps them to understand theoretical concepts by means of practical exercises and to prove their knowledge and progression by performing tests and calculations in addition to Multimedia Resources. Default planned tasks and an Open workgroup are provided by EDIBON to allow the students start working from the first session. Reports and statistics are available to know their progression at any time, as well as explanations for every exercise to reinforce the theoretically acquired technical knowledge.

Innovative features:

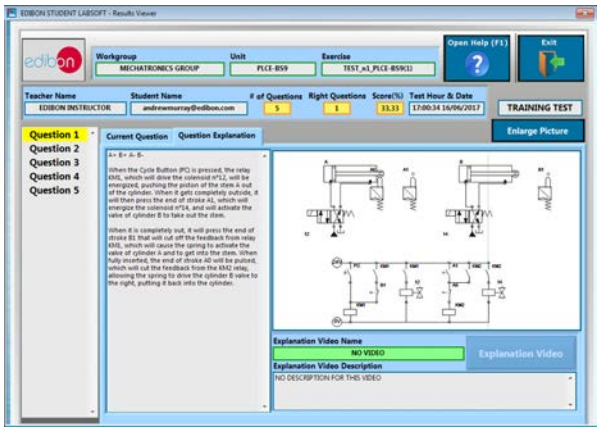
- **Student Log-In & Self-Registration.**
- **Existing Tasks checking & Monitoring.**
- **Default contents & scheduled tasks available to be used from the first session.**
- **Practical Exercises accomplishment by following the Manual provided by EDIBON.**
- **Evaluation Methods to prove your knowledge and progression.**
- **Test self-correction.**
- **Calculations computing and plotting.**
- **Equation System Solver Engine.**
- **User Monitoring Learning & Printable Reports.**
- **Multimedia-Supported auxiliary resources.**

ESL-SOF. EDIBON Student LabSoft (Student Software) Application Main Screen

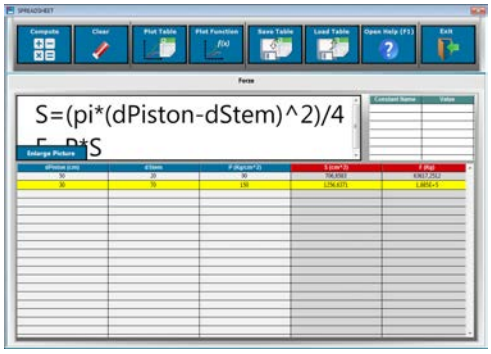
For more information see **ICAI** catalogue. Click on the following link:

www.edibon.com/en/files/expansion/ICAI/catalog

EPE. EDIBON Practical Exercise Program Package Main Screen



ERS. EDIBON Results & Statistics Program Package - Question Explanation



ECAL. EDIBON Calculations Program Package Main Screen

Available Student/Modules Software:

- ESL-PLC-BS2-SOF. EDIBON Student LabSoft for Temperature Test Module for PLC.
- ESL-PLC-BS3-SOF. EDIBON Student LabSoft for Pressure Test Module for PLC.
- ESL-PLC-BS4-SOF. EDIBON Student LabSoft for Flow Test Module for PLC.
- ESL-PLC-BS5-SOF. EDIBON Student LabSoft for Ovens Test Module for PLC.
- ESL-PLC-BS6-SOF. EDIBON Student LabSoft for Liquid Level Test Module for PLC.
- ESL-PLC-BS7-SOF. EDIBON Student LabSoft for Tachometers Test Module for PLC.
- ESL-PLC-BS9-SOF. EDIBON Student LabSoft for Pneumatic Test Module for PLC.
- ESL-PLC-BS10-SOF. EDIBON Student LabSoft for Light Test Module for PLC.

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

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REPRESENTATIVE: