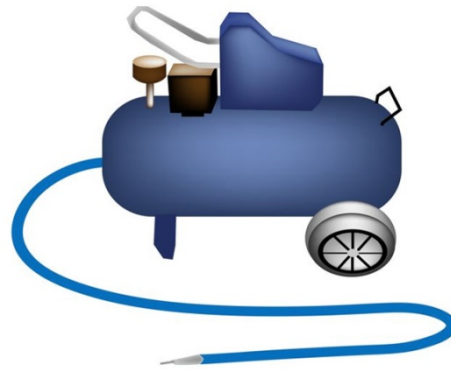
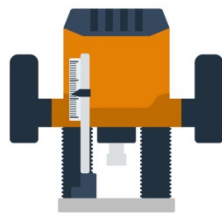


MECHATRONICS



Mechatronics Training Lab



About SES

An Edtech industry leader and innovator, **SES Scientific Educational Systems**, goes above and beyond to supply educators and learners with the best educational systems, including **Neulog**, **Degem Systems**, **MultiCenter** and **MagiClass**.

Renowned for their ability to cater to numerous fields, sectors and segments, SES systems spread across a wide spectrum, offering unique solutions in the fields of **electronics, microcontrollers, telecommunication, autotronics, mechatronics, pneumatics, hydraulics, CNC machines, refrigeration and air-conditioning, green energy, computerized systems, science, robotics, logger sensors and STEM**.

Each proprietary SES system and device is perfectly designed and manufactured from the highest quality materials in accordance with all safety requirements and regulations. SES is a quality assured firm with the certification of ISO-9001:2015.

SES solutions are used in over 50 countries worldwide by professional developers for high-level technological commercial products and both governmental and private institutions covering educational programs for universities, colleges, vocational training centers and schools, high schools, junior high schools and primary schools.

Mechatronics training program

Mechanical systems turn into electronic embedded systems. Electronics, microcontrollers and programmable logic controllers (PLC) are the basis of sensors, control and driving systems.

Mechanical systems use electric motors, sensors, electronic actuators.

The mechanic profession requires knowledge in electronics and controllers.

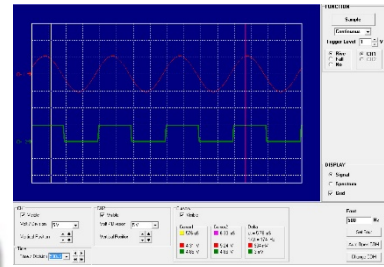
Knowledge of mechanical elements such as pneumatic systems, hydraulic systems, transmissions, levers and so on is still needed.

Robotics is a very important discipline of mechatronics. Robotics is the discipline that combines electricity, electronics, sensors, mechanics and coding units.

The mechatronics program includes the following disciplines:

- Basic electronics
- Pneumatics systems
- Hydraulics systems
- CNC machines

Electronics with EB-3000 universal trainer



- EB-3000 supports every stage of electronics study, which is a must for almost every profession in: **electronics, electricity, mechatronics, automotive, instrumentation, process control**, etc.
- The system includes: **5-voltages power supply, 2 voltmeters, ammeter, frequency counter, logic probe, logic analyzer, 2-channel digital oscilloscope, function generator** (sine, triangle and square signals).
- The system contains also: 3.2" color graphic display with touch panel, keyboard, 10 relays for inserting faults.
- The system provides USB wire communication with the PC for:
 - ✧ Virtual instrument **D-Scope** software that controls the system function generator and graphic display of the scope signals.
 - ✧ Microprocessor and microcontroller editor, assembler, C compiler and debugger development software.
- The plug-in cards are connected to the trainer through a 48-contact, very low resistance industrial connector.
- Each plug-in card has its own controller for automatic identification by the main platform, for saving its required configuration and for automatic self-diagnostics while plugging it in.
- Experiment manual and courseware (including theory) for every card.
- Various electronics study programs for Mechatronics, for Autotronics, for Electrical Machines and Electricity using EB-3000 and its plug-in experiment cards are available.

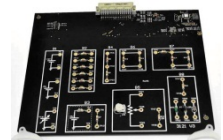
Electronics topics for Mechatronics

- Direct current, Ohm's Law and electrical power
- Kirchhoff's laws and electric circuits
- Resistors and potentiometers
- Semiconductor – diodes, LEDs, Transistors
- Magnetism, Alternate current
- Transformers, motors and generators
- Capacitors and inductors
- Electronic systems
- Sensors and actuators
- Converters (ADC, DAC)
- Microcontroller programming

EB-3000 Basic electronics cards

Electricity and Electrical Circuits

- EB-3121 Ohm and Kirchhoff Laws and DC circuits
EB-3122 Norton, Thevenin and superposition
EB-3123 AC circuits, signals and filters
EB-3124 Magnetism, electromagnetism, induction and transformers



Semiconductor Devices

- EB-3125 Diodes, Zener, bipolar and FET transistors characteristics and DC circuits
EB-3126 Bipolar and FET transistor amplifiers
EB-3127 Industrial semiconductors – SCR, Triac, Diac and PUT
EB-3128 Optoelectronic semiconductors – LED, phototransistor, LDR, 7-SEG



Motors, Generators and Inverters

- EB-3141 Analog, PWM DC motor speed control, step motor control, generators
EB-3142 Motor control – optical, Hall Effect, motor closed control
EB-3143 AC-DC and DC-AC conversion circuits
EB-3144 3 Phase motor control



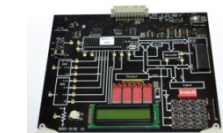
Digital Electronics

- EB-3151 AND, OR, NOT, NAND, NOR, XOR logic components & Boolean algebra
EB-3152 Decoders, multiplexers and adders
EB-3153 Flip-flops, registers, and counters sequential logic circuits
EB-3154 555, ADC, DAC circuits



Microprocessor/Microcontroller Technology

- EB-3191 Introduction to microprocessors and microcontrollers



The document '**Electronics Training Labs**' describes the specifications of the EB-3000 universal training system and the EB-3000 electronics cards.

Pneumatics topics

▪ Basic pneumatics

- * Manually operated valves
- * Single and double acting cylinders
- * Air-spring, air-air and double pilot valves
- * Control circuit with air spring and check valve
- * Flow control and speed regulation methods
- * Semi-automatic and automatic control systems
- * Integrated sensor control
- * Time delay pneumatic circuits and components
- * Operation of two cylinders in parallel

▪ Advance pneumatics and logic

- * Air sliding principle
- * Air motor
- * Venturi principle
- * Pneumatic manipulator
- * Logic OR, AND, NOT, NOR, NAND gates
- * Pneumatic timer in a heat sealing application
- * Logic memory
- * Trigger control circuit with a T flip-flop
- * Clamping and drill control circuit
- * Cascade circuits
- * Sliding table and drilling system

▪ Basic electro-pneumatics

- * Series and parallel electrical circuits
- * Electromagnet and its applications
- * Series and parallel control for a double acting cylinder
- * Semi-automatic actuator circuit
- * Reed switch as a contact multiplier
- * Use of a relay in an electrical control circuit
- * Self-holding relay in an emergency stop circuit
- * Automatic control using a relay memory
- * On-delay and off-delay timer circuits
- * Safety operation circuits

- **Advance electro-pneumatics**

- * Hall Effect sensor
- * Optical, capacitive and inductive proximity sensors
- * Control circuit with two spring return solenoid valves
- * Logic and electrical cascade circuits
- * Sequence control and timing circuits
- * Cascade electronic counter design
- * Stepper motor and control circuit

- **Programmable logic controller (PLC)**

- * Introduction to the PLC ladder diagram
- * Series and series-parallel control circuits
- * Use of internal PLC coil, self-hold and break priority
- * Relay memory, programming a sequence
- * On delay and off delay timers and control circuits
- * Three piston cascade counter circuits
- * Design and programming exercises for applications:

Pneumatics equipment

- **PN-3401 – Pneumatics Master Board**

- * 4 rack units
- * 2 pressure gauges
- * 3 pneumatics taps
- * Air reservoir regulator
- * Power switch and power supply 12V outlets



- **PN-3410 – basic pneumatics including:**

- **PN-3411 – Basic Pneumatics I**

- * Flow meter 20-200 SCFH
- * Flow control with check valve
- * Check valve
- * Manual valve, 3/2 way with spring returned pushbutton
- * 5/2 way spring returned piloted valve



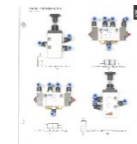
- **PN-3412 – Basic Pneumatics II**

- * Double acting cylinder 20x100 mm
- * Double acting cylinder 12x50 mm
- * Directional 5/3 way position valve, closed center
- * Reservoir



- **PN-3413 – Basic Pneumatics III**

- * Manual valve, 3/2 -way spring returned with mushroom pushbutton
- * 5/2 way double piloted valve (2 each)
- * Manual valve 3/2 way with push-button



- **PN-3414 – Basic Pneumatics IV**

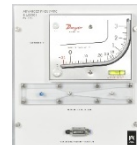
- * Roller lever valve, 3/2 way (4 each)
- * One way trip operated spring returned valve,
- * 3/2 way Spring returned cylinder 12x50 mm



- **PN-3420 – advanced pneumatics & logic including:**

- **PN-3421 – Advanced Pneumatics & Logic I**

- * Inclined-vertical water column pressure gauge
- * Transparent Venturi tube block
- * Vacuum actuator / suction block



- **PN-3422 – Advanced Pneumatics & Logic II**

- * Air motor
- * Load and torque measuring device
- * Transparent air bearing



- **PN-3423 – Advanced Pneumatics & Logic III**

- * Pneumatic time delay valve
- * Pneumatic signal indicators (2)
- * Quick exhaust valve



- **PN-3424 – Advanced Pneumatics & Logic IV**

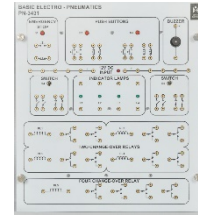
- * AND elements (2)
- * OR elements (2)
- * NOT element
- * Memory elements (2)



▪ **PN-3430 – basic electro-pneumatics including:**

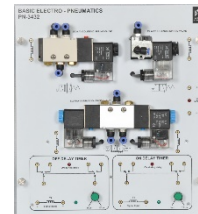
PN-3431 – Basic Electro-Components I

- * Emergency stop push button
- * Pushbuttons (2), 4 contacts: NC (2), 2 NO (2)
- * DPDT switches (2)
- * Relays, 2 change-over contacts (4)
- * Relay, 4 change-over contacts
- * LED indicators (4)
- * Buzzer



PN-3432 – Basic Electro-Pneumatics II

- * Spring return solenoid valve, 3/2 way
- * Spring return solenoid valve, 5/2 way
- * Double solenoid valve, 5/2 way
- * Timer relay, 1 to 10 seconds ON delay, 4 contacts
- * Timer relay, 1 to 10 seconds OFF delay, 4 contacts



PN-3433 – Basic Electro-Pneumatics III

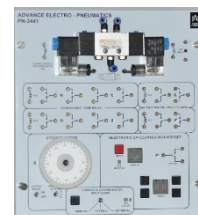
- * Cylinder, double acting 12x50 mm
- * Cylinder, double acting, with permanent magnet for reed switch activation 12x50 mm
- * Cylinder, single acting 12x50 mm
- * Electrical limit switches, roller type (3)
- * Proximity sensor, magnetic reed switch type
- * Inductive sensor
- * Optical sensor
- * Fault insertion



▪ **PN-3440 – advanced electro-pneumatics including:**

PN-3441 – Advanced Electro-components I

- * Digital electronic counter
- * Double solenoid valve 5/2 way
- * Stepper motor
- * Relay 4 change over contacts (2 each)
- * Relay 2 change over contacts (2 each)



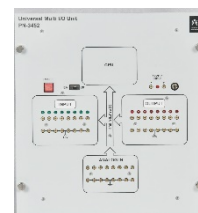
▪ **PN-3451 – Programmable Logic Controller (PLC)**

- * Supports ladder diagram programming
- * 8 digital inputs
- * 6 digital outputs
- * USB interface to student PC



▪ **PN-3452 – USB Multi I/O unit**

- * 8 digital inputs with indicating LEDs and high voltage protection
- * 8 digital/analog outputs with indicating LEDs
- * 8 analog inputs
- * 2 analog outputs
- * USB interface to student PC
- * Supports programming in ladder diagram (PLSES), logo icons (SESLOGO), Basic, C and C51



▪ **PN-3481 – 20 Liter Air Compressor**

Air supply section including:

- * Service unit (pressure regulator and air filter)
- * Main shut off valve
- * Manifold with shut-off valve
- * Measuring instruments section
- * Pressure gauge 0-10 bar, 0-150 PSI

Hydraulics topics

▪ Basic hydraulics

- * Familiarization with the hydraulic power unit and main platform
- * Installation and maintenance of the power unit and main platform
- * Relation between flow rate and pressure
- * Adjustable pressure relief valve to limit pressure
- * Compensated flow control valves
- * Non-return and pilot check valves
- * Double acting cylinder in two-way movement application

▪ Advanced hydraulics

- * Operation of a differential cylinder
- * Two speed cylinder system
- * Pilot pressure adjustable relief valve
- * Two speed piston stroke
- * Hydraulic motor and control circuit
- * Hydraulic accumulator
- * Testing and adjusting pressure control valves and cylinders
- * Designing a simple hydraulic system

▪ Basic electro-hydraulics

- * Series and parallel control
- * Use of a relay in an electrical control circuit
- * The relay as a memory device with self-holding and break priority
- * Push button switch, limit switch and pressure switch applications
- * Self-holding relay as a memory device
- * Automatic actuator circuit

▪ Advanced electro-hydraulics

- * On-delay and off-delay timer control circuits
- * Optical, capacitive and inductive sensors
- * Safety operation circuit
- * Semi-automatic drill system
- * Control circuit with electronic counter
- * Electro-hydraulic control circuit
- * Electro-hydraulic control circuit with a counter

- **Programmable logic controller (PLC)**

- * Introduction to the PLC ladder diagram
- * Series and series-parallel control circuits
- * Use of internal PLC coil, self-hold and break priority
- * Relay memory, programming a sequence
- * On delay and off delay timers and control circuits
- * Three piston cascade counter circuits
- * Design and programming exercises for applications

Hydraulics equipment

■ HYD-3501 – Hydraulics Master Board

- * 4 rack units
- * External power adaptor
- * 12V power supply
- * 2 pressure gauges
- * 3 hydraulic taps
- * Power switch
- * Hydraulic supply outlets
- * Check valve
- * Adjustable relief valve
- * 12 VDC outlet to measure hydraulic motor speed
- * Oil flow meter device



■ HYD-3510 – basic hydraulics including:

HYD-3511 – Basic hydraulics I

- * Variable flow control needle valve
- * Double acting cylinder
- * Variable flow control valve with check valve (one way flow-control valve)
- * Single acting cylinder



HYD-3512 – Basic hydraulics II

- * 3/2-way spring return valve
- * 4/2-way spring return valve
- * 4/3-way tandem center directional valve



HYD-3513 – Basic hydraulics III

- * Pilot check valve
- * Two-way flow control valve
- * Check valve (non return valve)
- * Adjustable pressure relief valve



■ HYD-3520 – advanced hydraulics including:

HYD-3521 – Advanced Hydraulics I

- * Pilot pressure relief valve
- * 3-way flow control valve



HYD-3523 – Advanced Hydraulics III

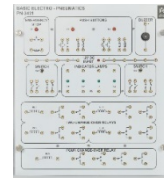
- * Hydraulic accumulator
- * Axial piston hydraulic motor



▪ **HYD-3530 – basic electro-hydraulics including:**

PN-3431 – Basic Electro-Components I

- * Emergency stop push button
- * Pushbuttons (2), 4 contacts: NC (2), 2 NO (2)
- * DPDT switches (2)
- * Relays, 2 change-over contacts (4)
- * Relay, 4 change-over contacts
- * LED indicators (4)
- * Buzzer



HYD-3532– Basic Electro-hydraulics II

- * 4/3-way double pilot valve (closed center)
- * 3/2-way spring return solenoid valve

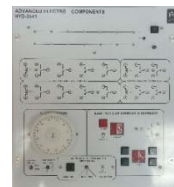
HYD-3534– Basic Electro-hydraulics IV

- * 4/2-way valve solenoid - solenoid

▪ **HYD-3540 – advanced electro-hydraulics including:**

HYD-3541 – Advanced Electro-components I

- * Digital electronic counter
- * Stepper motor
- * Relay 4 change over contacts (2 each)
- * Relay 2 change over contacts (2 each)



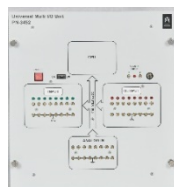
▪ **PN-3451 – Programmable Logic Controller (PLC)**

- * Supports ladder diagram programming
- * 8 digital inputs
- * 6 digital outputs
- * USB interface to student PC



▪ **PN-3452 – USB Multi I/O unit**

- * 8 digital inputs with indicating LEDs and high voltage protection
- * 8 digital/analog outputs with indicating LEDs
- * 8 analog inputs
- * 2 analog outputs
- * USB interface to student PC
- * Supports programming in ladder diagram (PLSES), logo icons (SESLOGO), Basic, C and C51



CNC machines topics

▪ CNC Lathe machine topics

This course introduces students to the CNC lathe machine. The students are exposed to industrial processes and control. The objectives of the course include teaching the students how to operate the lathe, and how to apply the program instructions in a logical sequence to produce a product.

- * System description
- * G-code and M-code
- * Installing the LATHE software
- * Operating the system
- * Monitor description
- * Turning processing
- * Arches
- * Turning the rod
- * Project processing
- * CAD-CAM design and processing (optional)

▪ CNC Milling machine topics

This course introduces students to the CNC Milling machine. The students are exposed to industrial processes and control. The objectives of the course include teaching the students how to operate the lathe, and how to apply the program instructions in a logical sequence to produce a product.

- * System description
- * G code and M code
- * Operating the MILL software
- * Operating the entire system
- * Monitor description
- * Slot processing
- * Arches
- * Profile processing
- * Pocket processing
- * Drill processing
- * Project processing
- * CAD-CAM design and processing (optional)

CNC Equipment

TP-3714 – CNC lathe machine training system

- Z axis (110mm)
- X axis (45mm)
- Distance between centers – 180mm
- Spindle speed (500 - 3000 rpm)
- Mechanical resolution $\pm 0.1\text{mm}$
- Spindle bore (10mm taper ISO no.1)
- Spindle motor (DC)
- Chuck (3 jaws)
- X and Z axis step motors (12V DC)
- Turning diameter (30mm)
- Emergency stop button
- Transparent door with limit switch
- Low voltage LED lighting
- USB communication to PC
- Operating voltage (100-240 VAC, 50/60 Hz)
- Emergency stop button
- Emergency stop by door limit switch
- G&M code LATHE software
- Solidcam software for CAD-CAM design and processing (optional)



TP-3715 – CNC milling machine training system

- X axis (110mm)
- Y axis (110mm)
- Z axis (40mm)
- Spindle speed (500-3000rpm)
- Table surface (150 x 230mm)
- Spindle motor (DC)
- X, Y and Z axis step motors
- Spindle bore (10mm, Morse taper no. 1)
- Emergency stop button
- Turning diameter (30mm)
- Emergency stop button
- Low voltage LED lighting
- USB communication to PC
- Operating voltage (110-240 VAC external switching supply)
- General dimensions (650 x 590 x 590mm)
- G&M code MILL software
- Solidcam software for CAD-CAM design and processing (optional)



PN-3400 Pneumatics trainer specifications

The PN-3400 Pneumatics Trainer, basic unit comprises a compact desktop universal master board (PN-3401), four sets of industrial pneumatics (PN-3410, 3420, 3430, 3440) component boards and comprehensive theory and practice manuals.

PN-3401 – Pneumatics master board

- Size (W x H x D): 575 x 490 x 455 mm
- 4 rack units
- 12V power supply
- 2 pressure gauges
- 3 pneumatics taps
- Air reservoir regulator
- Power switch
- Power supply 12V outlets
- External power adaptor



PN-3481 – Air compressor

Air supply section including:

- Service unit (pressure regulator and air filter)
- Main shut off valve
- Manifold with shut-off valve
- Pressure gauge 0-12 bar, 0-180 PSI
- 0.75 HP (0.55 KW)
- Operating pressure 8 bar
- 110 L/Min
- 10 m 8 mm hose

PN-3410 – Basic pneumatics panels

PN-3411 – Basic Pneumatics I

- Flow meter 20-200 SCFH
- Flow control with check valve
- Check valve
- Manual valve, 3/2 way with spring returned pushbutton
- 5/2 way spring returned piloted valve

PN-3412 – Basic Pneumatics II

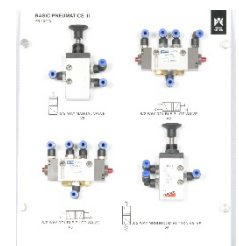
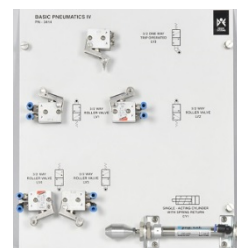
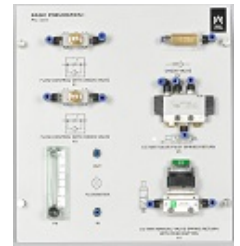
- Double acting cylinder 20 x 100 mm
- Double acting cylinder 12 x 50 mm
- Directional 5/3 way position valve, closed center
- Reservoir

PN-3413 – Basic Pneumatics III

- Manual valve, 3/2 -way spring returned with mushroom pushbutton
- 5/2 way double piloted valve (2 each)
- Manual valve 3/2 way with push-button

PN-3414 – Basic Pneumatics IV

- Roller lever valve, 3/2 way (4 each)
- One way trip operated spring returned valve
- 3/2 way Spring returned cylinder 12x50 mm



Topics covered:

- 3/2 manually operated valve
- Operation of a single acting cylinder
- Double acting cylinder
- 5/2 way double pilot valve
- Control circuit with air spring and check valve
- Flow control operation with a flow meter
- Speed regulation method
- Speed regulation of a double acting cylinder
- Semi-automatic control system
- Automatic control circuit
- Pneumatic control circuit for a grinding machine
- Automatic double acting cylinder circuit
- Time delay pneumatic circuit with a reservoir
- Integrated delay using pressure discharge
- Operation of a press with two cylinders
- Control circuit for two double acting cylinders
- Operation of two cylinders in parallel
- Double control circuit with two cylinders

PN-3420 – Advanced pneumatics & logic panels

PN-3421 – Advanced Pneumatics & Logic I

- Inclined-vertical water column pressure gauge
- Transparent Venturi tube block
- Vacuum actuator/suction block

PN-3422 – Advanced Pneumatics & Logic II

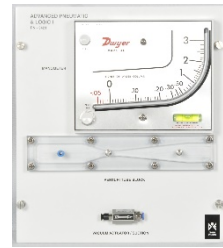
- Air motor
- Load and torque measuring device
- Transparent air bearing

PN-3423 – Advanced Pneumatics & Logic III

- Pneumatic time delay valve
- Pneumatic signal indicators (2)
- Quick exhaust valve

PN-3424 – Advanced Pneumatics & Logic IV

- AND elements (2)
- OR elements (2)
- NOT element
- Memory elements (2)



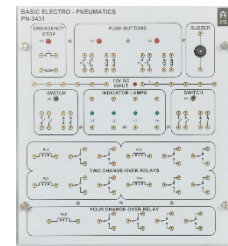
Topics covered:

- Pneumatic control of a punch machine
- Air sliding principle
- Air motor
- Venturi principle
- Pneumatic manipulator
- Logic OR gate
- Pneumatic timer in a heat sealing application
- AND gate
- "Two hands on" safety control
- NOT gate
- NOR gate
- NAND gate
- Logic memory
- Trigger control circuit with a T flip-flop
- Clamping and drill control circuit
- Cascade circuit
- Sliding table and drilling system

PN-3430 – Basic electro-pneumatics including

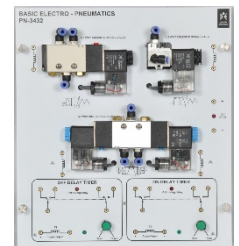
PN-3431 – Basic Electro-Components I

- Emergency stop push button
- Pushbuttons (2), 4 contacts: NC (2), 2 NO (2)
- DPDT switches (2)
- Relays, 2 change-over contacts (4)
- Relay, 4 change-over contacts
- LED indicators (4)
- Buzzer



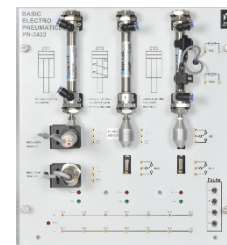
PN-3432 – Basic Electro-Pneumatics II

- Spring return solenoid valve, 3/2 way
- Spring return solenoid valve, 5/2 way
- Double solenoid valve, 5/2 way
- Timer relay, 1 to 10 seconds ON delay, 4 contacts
- Timer relay, 1 to 10 seconds OFF delay, 4 contacts



PN-3433 – Basic Electro-Pneumatics III

- Cylinder, double acting 12x50 mm
- Cylinder, double acting, with permanent magnet for reed switch activation 12x50 mm
- Cylinder, single acting 12x50 mm
- Electrical limit switches, roller type (3)
- Proximity sensor, magnetic reed switch type
- Inductive sensor
- Optical sensor
- Fault insertion
- Power supply 12V outlets



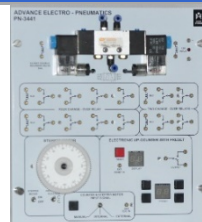
Topics covered:

- Series connected electrical circuits
- Series and parallel electrical circuits
- Electromagnet and its applications
- Electro-pneumatic stamping press
- "One-by-one" feed system
- Series and parallel control for a double acting cylinder
- Semi-automatic actuator circuit
- Reed switch as a contact multiplier
- Using the relay as an electric switch
- Contact inversion using a change-over relay contact
- Use of a relay in an electrical control circuit
- Self-holding relay in an emergency stop circuit
- Relay vibrator circuit
- Automatic control circuit to activate a cylinder
- Automatic control using a relay memory
- Pneumatic elevator
- On-delay timer circuit
- Off-delay timer
- Control circuit with off and on delay timers
- Safety operation circuit
- Optical proximity sensor
- Capacitive proximity sensor
- Inductive proximity sensor

PN-3440 – Advanced electro-pneumatics including

PN-3441 – Advanced Electro-Components I

- Digital electronic counter
- Double solenoid valve 5/2 way
- Stepper motor
- Relay 4 change over contacts (2 each)
- Relay 2 change over contacts (2 each)



Topics covered:

- Pick boring system
- Control circuit with two spring return solenoid valves
- Logic circuit
- Electrical cascade circuit
- Sequence control
- Split control simulation
- Basic timing circuit
- Shortened cascade method
- Cascade counter simulation
- Counting with two cylinders
- Cascade counter design
- Electronic counter
- Stepper motor and control circuit

PN-3451 – Programmable logic controller (PLC)

- Supports ladder diagram programming
- 8 digital inputs
- 6 digital outputs
- Manual fault insertion
- USB interface to student PC

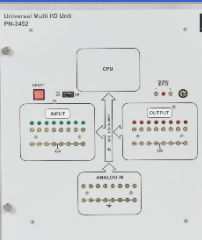


Topics covered:

- Introduction to the PLC ladder diagram
- Series and series-parallel control circuits
- Use of internal PLC coil, self-hold and break priority
- Relay memory, programming a sequence
- On delay and off delay timers and control circuits
- Three piston cascade counter circuits
- Design and programming exercises for applications:
- Cutting machine, manipulator, block machine
- Bottle closing machine, packing cans in boxes
- "Two hands" safety control

PN-3452 – USB multi I/O unit

- 8 digital inputs with indicating LEDs and high voltage protection
- 8 digital/analog outputs with indicating LEDs
- 8 analog inputs
- 2 analog outputs
- USB interface to student PC
- Supports programming in ladder diagram (PLSES) and C language



HYD-3500 Hydraulics trainer specifications

The HYD-3500 Hydraulics Trainer, basic unit comprises a compact desktop universal master board (HYD-3501), four sets of industrial hydraulics (HYD-3510, 3520, 3530, 3540) component boards and comprehensive theory and practice manuals.

HYD-3501 – Hydraulics master board

- Size (W x H x D): 575 x 490 x 455 mm
- 4 rack units
- External power adaptor
- 12V power supply
- 2 pressure gauges
- 3 hydraulic taps
- Power switch
- Hydraulic supply outlets
- Check valve
- Adjustable relief valve
- 12 VDC outlet
- Oil flow meter device



HYD-3581 – Hydraulic power unit

Hydraulic supply section with:

- Oil tank 9L
- ON-OFF electrical switch
- Pressure regulator (20-100 PSI)
- Pressure relief valve
- Oil flow 2.2-2.5 L/Min
- Pressure gauge (0-100 PSI)
- 1.5 Hp, 1400 RPM



HYD-3510 – Basic hydraulics including

HYD-3511 – Basic hydraulics I

- Variable flow control needle valve
- Double acting cylinder
- Variable flow control valve with check valve (one way flow-control valve)
- Single acting cylinder

HYD-3512 – Basic hydraulics II

- 3/2-way spring return valve
- 4/2-way spring return valve
- 4/3-way tandem center directional valve

HYD-3513 – Basic hydraulics III

- Pilot check valve
- Two-way flow control valve
- Check valve (non-return valve)
- Adjustable pressure relief valve



Topics covered:

- Familiarization with the hydraulic power unit and main platform
- Installation and maintenance of the power unit and main platform
- Relation between flow rate and pressure
- Adjustable pressure relief valve to limit pressure
- Controlling flow direction on 3/2 and 4/2-way valves
- Two-way compensated flow control valve
- One-way compensated flow control valve
- Non-return (check) valve
- Pilot check valve operation
- Double acting cylinder in two-way movement application

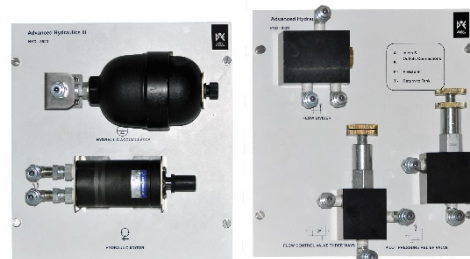
HYD-3520 – Advanced hydraulics including

HYD-3521 – Advanced Hydraulics I

- Pilot pressure relief valve
- 3-way flow control valve

HYD-3523 – Advanced Hydraulics III

- Hydraulic accumulator
- Axial piston hydraulic motor



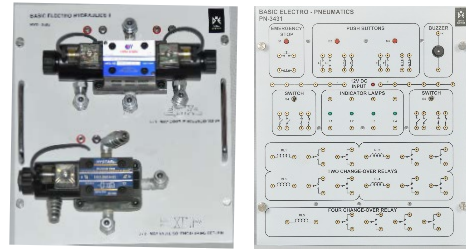
Topics covered:

- Operation of a differential cylinder
- Two speed cylinder system
- Pilot pressure adjustable relief valve
- Two speed piston stroke
- Hydraulic motor and control circuit
- Hydraulic accumulator
- Testing and adjusting a pressure control valve
- Testing a 4/3-way tandem valve
- Testing a double acting cylinder
- Operating a double acting cylinder with a hydraulic motor
- Designing a simple hydraulic system

HYD-3530 – Basic electro-hydraulics including

PN-3431 – Basic Electro-Components I

- Emergency stop push button
- Pushbuttons (2), 4 contacts: NC (2), 2 NO (2)
- DPDT switches (2)
- Relays, 2 change-over contacts (4)
- Relay, 4 change-over contacts
- LED indicators (4)
- Buzzer



HYD-3532– Basic Electro-hydraulics II

- 4/3-way double pilot valve (closed center)
- 3/2-way spring return solenoid valve

HYD-3534– Basic Electro-hydraulics IV

- 4/2-way valve solenoid – solenoid



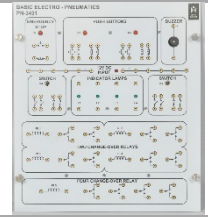
Topics covered:

- Familiarization with the hydraulic power unit
- Installation and maintenance of the power unit
- Series connections
- Series and parallel control
- The relay as an electrical contact multiplier
- The relay as an electrical switch
- The relay as an electrical contact inverter
- The relay as a memory device with self-holding and break priority
- Activate a double-acting cylinder with a push button
- Self-holding relay as a memory device
- Automatic actuator circuit
- Step-by-step control of a hydraulic clamp
- Pressure switch
- Stop movement of a double-acting cylinder using a push button
- One-by-one feed system

HYD-3540 – Advanced electro-hydraulics including

HYD-3541 – Advanced Electro-Components I

- Digital electronic counter
- Stepper motor
- Relay 4 change over contacts (2 each)
- Relay 2 change over contacts (2 each)



Topics covered:

- Pick boring system
- Control circuit with two spring return solenoid valves
- Logic circuit
- Electrical cascade circuit
- Sequence control
- Split control simulation
- Basic timing circuit
- Shortened cascade method
- Cascade counter simulation
- Counting with two cylinders
- Cascade counter design
- Electronic counter
- Stepper motor and control circuit

PN-3451 – Programmable logic controller (PLC)

- Supports ladder diagram programming
- 8 digital inputs
- 6 digital outputs
- Manual fault insertion
- USB interface to student PC

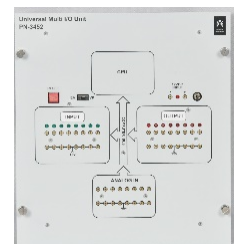


Topics covered:

- Introduction to the PLC ladder diagram
- Series and series-parallel control circuits
- Use of internal PLC coil, self-hold and break priority
- Relay memory, programming sequence
- On and off delay timers, control circuits
- Three piston cascade counter circuits
- Design and programming exercises for applications:
- Cutting machine, manipulator, block machine, Bottle closing machine, packing cans.
- "Two hands" safety control

PN-3452 – USB multi I/O unit

- 8 digital inputs with indicating LEDs and high voltage protection
- 8 digital/analog outputs with indicating LEDs
- 8 analog inputs
- 2 analog outputs
- USB interface to student PC
- Supports programming in ladder diagram (PLSES) and C language



TP-3714 CNC lathe machine specifications

TP-3714 is a compact, desktop unit designed to introduce the student to the world of the CNC turning machine. The training system exposes the student to the historical development of CNC, to standard G-code and to the use of the computer to control the machine.

Through practical, hands-on activities, the unit enables the student to produce milled products with a reasonable degree of accuracy.

TP-3714 is a simple maintenance machine that requires only cleaning and lubrication according to the instructions in the user manual.



Technical characteristics:

- Z axis (110mm)
- X axis (45mm)
- Distance between centers – 180mm
- Spindle speed (500-3000 rpm)
- Mechanical resolution $\pm 0.1\text{mm}$
- Spindle bore (10mm taper ISO no.1)
- Spindle motor (DC)
- Chuck (3 jaws)
- X and Z axis motors (Stepper type; 12V DC)
- Turning diameter (30mm)
- Transparent door with limit switch
- Low voltage LED lighting
- USB communication to PC
- Operating voltage (100-240 VAC, 50/60 Hz)
- General dimensions (650 x 590 x 590 mm)
- Cabinet for protection against shavings
- Emergency stop button
- Emergency stop by door limit switch
- Tail stock for material

Learning program:

- System description
- G-code and M-code
- Installing the D-LATHE software
- Operating the system
- Monitor description
- Turning processing
- Arches
- Turning the rod
- Project processing

Supplied accessories:

The learning unit is supplied with the following accessories:

- 5 Perspex cylinders (100 x 20 mm)
- 2 Cutting knives (HSS 1/4")
- Chuck key
- Drill for center hole
- External power supply
- Allen key set
- Cleaning brush
- Software application and soft copy teacher guide for MS-Windows PC (PC is not included)
- Live center
- USB cable

Required accessories:

- Personal computer with MS Windows

Safety features:

The following safety features are provided by the learning unit:

- The unit has an 'Emergency Stop' push button that cuts off all electricity to the unit when pressed.
- The door around the spindle and material has limit switches that prevent any operation of the machine when the door is open.

The soft copy teacher guide contains the essential theory and detailed procedures for each hands-on activity.

TP-3715 CNC milling machine specifications

TP-3715 is a compact, desktop unit designed to introduce the student to the world of the CNC milling machine. The training system exposes the student to the historical development of CNC, to standard G-code and to the use of the computer to control the machine.

Through practical, hands-on activities, the unit enables the student to produce milled products with a reasonable degree of accuracy.

TP-3715 is a simple maintenance machine that requires only cleaning and lubrication according to the instructions in the user manual.



<p>Technical characteristics:</p> <ul style="list-style-type: none"> ▪ X axis (110mm) ▪ Y axis (110mm) ▪ Z axis (40mm) ▪ Spindle speed (500-3000rpm) ▪ Table surface (150 x 230mm) ▪ Spindle motor (DC) ▪ X, Y and Z axis motors (Stepper type; 12 VDC) ▪ Spindle bore (10mm, Morse taper no. 1) ▪ Emergency stop button ▪ Low voltage LED lighting ▪ USB communication to PC ▪ Operating voltage (110-240 VAC external switching supply) ▪ General dimensions (650 x 590 x 590mm) 	<p>Learning program:</p> <ul style="list-style-type: none"> ▪ System description ▪ G code and M code ▪ Operating the DMILL software ▪ Operating the entire system ▪ Monitor description ▪ Slot processing ▪ Arches ▪ Profile processing ▪ Pocket processing ▪ Drill processing ▪ Project processing <p>Supplied accessories:</p> <p>The learning unit is supplied with the following accessories:</p> <ul style="list-style-type: none"> ▪ 5 plastic blocks, 90 x 80 x 20mm ▪ Milling tool, 3mm ▪ Milling tool, 6mm ▪ Key-type drill chuck MT 1-3/8-24 (assembled) ▪ Drill chuck arbor MT 1-3/8-24 UNF (assembled) ▪ External power supply ▪ Cleaning brush ▪ Software application and soft copy teacher guide for MS-Windows PC (PC is not included) ▪ USB cable <p>Required accessories:</p> <ul style="list-style-type: none"> ▪ Personal computer with MS Windows 	<p>Safety features:</p> <p>The following safety features are provided by the learning unit:</p> <ul style="list-style-type: none"> ▪ The unit has an 'Emergency Stop' push button that cuts off all electricity to the unit when pressed. ▪ The door around the spindle and material has limit switches that prevent any operation of the machine when the door is open. <p>The soft copy teacher guide contains the essential theory and detailed procedures for each hands-on activity.</p>
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SES Training LABs

The training labs are based on learning-by-doing, which makes the students learn more quickly and remember what they have studied by performing practical experiments. They provide the students high profession skills and the knowledge on how to improve their chance of employment and earning capacity.

The manuals and courseware that accompany each course provide the theory background and experiments.

Electronics Training Lab

This modular laboratory is aimed for the **Electronics** profession, but also for technology disciplines that are also based in electronics, such as: **Electricity, Mechanics, Automotive, Robotics, Automation, Process control.**

Autotronics Training Lab

This modular laboratory is aimed for the five stages that comprise the automotive program: **Basic and automotive electronics, Car sub-systems simulators, Car sub-systems demonstrators, Car diagnostic and troubleshooting methods, Troubleshooting faults in a real car.**

Mechatronics Training Lab

This modular laboratory is aimed for the mechatronics program which includes the following disciplines: **Basic electronics, Pneumatics systems, Hydraulics systems, CNC machines.**

Refrigeration and Air-Conditioning Training Lab

The Refrigeration and Air-Conditioning training lab covers actual components and their interconnection, related functions, operation, diagnosis and repair methods through safe, hands-on practical activities.

Technology Preparation Training Lab

The Technology Preparation (Tech Prep) laboratory is a classroom-integrated laboratory consisting of educational modules covering a wide range of subjects such as: **Green energy, Computerized systems, Basic electronics, Basic communication, Mechanical systems.**

Science Training Labs

These laboratories (for primary, secondary and high schools) introduce the students to the computerized sensors world, **nature and industry processes** and **nature laws**. It will help them understand modern technologies such as: **home and medical appliances, wearing sensors, precise agriculture** and more.

Robotics Training Labs

The robotics programs (for primary, secondary and high schools) help students to build innovation and creativity skills. The idea is to make the students understand how systems work, to believe that they can improve them and be able to realize their ideas.

MultiCenter Training Lab

The MultiCenter offers a variety of selected interactive learning environments, with a large range of topics and activities such as: **Science, Technology, Graphic Design, Digital Music, Robotics, Computer Technologies** and much more for all sectors of society, cultures, different socio-economic groups and different age groups – from very young children to senior citizens.



Our Training Labs:

SCIENCE

ROBOTICS

ELECTRONICS

ELECTRICITY

TELECOMMUNICATION

AUTOTRONICS

MECHATRONICS

MULTICENTER

SCIENCE & ROBOTICS

TECHNOLOGY PREPARATION

REFRIGIRATION & AIR-CONDITIONING

MECHATRONICS