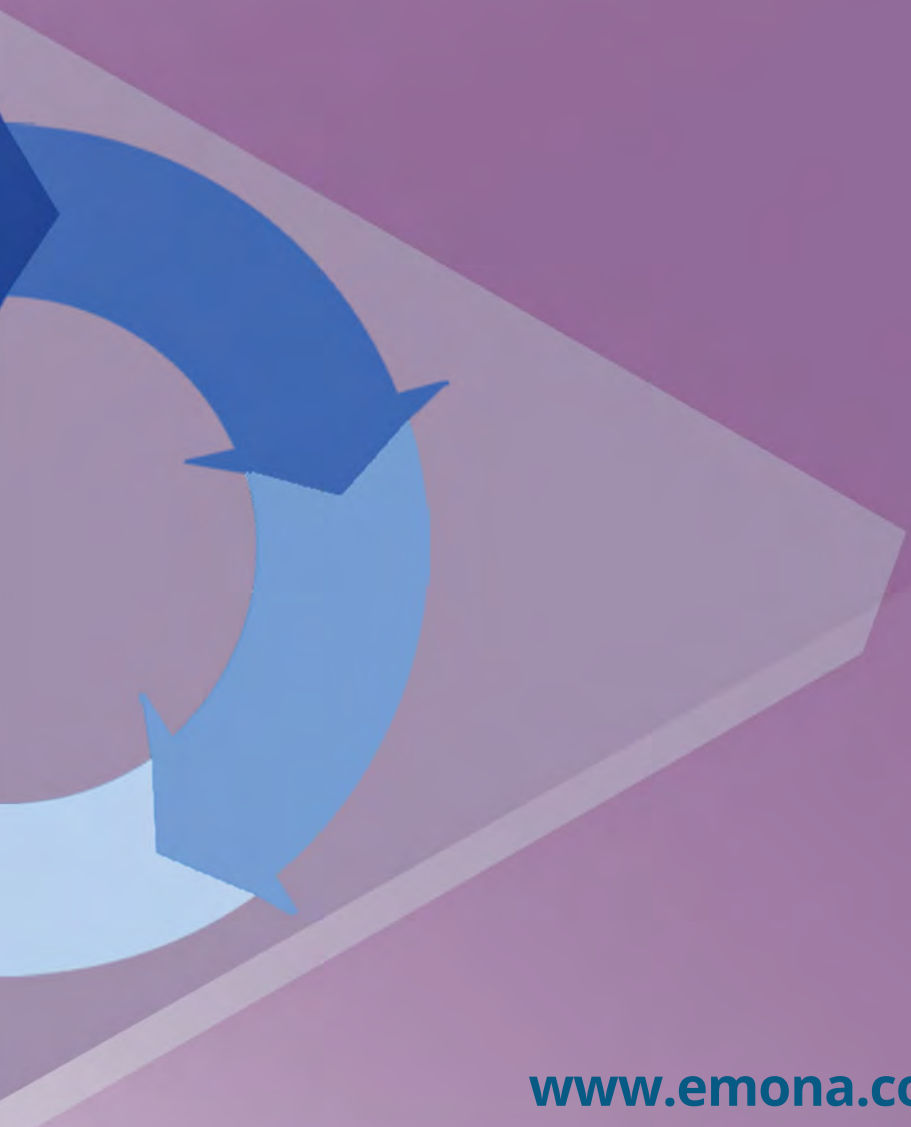
EMONA
INSTRUMENTS PTY LTD

ELECTROTECHNOLOGY & INDUSTRIAL SKILLS TRAINING EQUIPMENT

2020 SHORT FORM

Electrical Installation Tester
Electrical Machines
PLCs & Control Systems
Solar PV & Wind Energy
Industry 4.0
Robotics & Automation
Micro CNC & Manufacturing
Hydraulics & Pneumatics
Test & Measuring Instruments



www.emona.com.au

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Welcome to the Emona Instruments “Electrotechnology & Industrial Skills” shortform catalogue.

Established in 1979, Emona is a leading Australian high technology engineering company specialising in electronics, electrical, education and additive manufacturing equipment. All products are supported by our engineering qualified sales engineers and backed-up by component level repair and calibration technical services.

PowerTest 200

Multifunction tester designed for the professional electrician.

The **PowerTest 200** multifunction tester has been designed to meet the complex requirements of experienced electricians, with safety features and an easy to use interface that also makes it a great choice for those new to installation testing.

Features including Seaward's 'no-trip' loop impedance testing, auto RCD testing and a remote test probe make it ideal for efficient and accurate testing.

The toolbox-style carry case means leads and accessories can be quickly and easily stored, whilst the padded neck strap, ergonomic design and large dial ensure that the unit is comfortable, practical and easy to use.

Protection and warnings

The **PowerTest 200** was designed with user safety at the forefront. When carrying out a 'dead' test the unit issues a visual and audible warning if it detects a mains supply. The LED backlight will change from blue to red and stop any ongoing tests, and the large LCD display gives good visibility of results, even in difficult lighting conditions.

For your peace of mind, the **PowerTest 200** is also fully protected against damage when accidentally connected to a wrong test setting, and meets all of the safety and performance requirements of AS/NZS3017,

Why buy the PowerTest 200?

- Non-trip loop impedance testing
- Auto RCD testing
- Ergonomic design
- Large easy-to-use dial
- Comfortable neck strap
- Toolbox-style carry case
- Remote test probe

KEEPING PEOPLE SAFE FOR OVER 35 YEARS

SEAWARD
ELECTRICAL SAFETY TESTING & MEASURING

PowerTest 200

Multifunction tester designed for the professional electrician.

Key Features:

- Voltage measurement up to 440V
- Continuity test with autostart and null facility to zero out lead resistance
- Insulation resistance measurement with 250, 500 & 1000V test voltages
- RCD testing: Trip time, trip current (0.5, 1, 2 and 5 times the rating, dependent on device), auto test and ramp test
- Test RCDs in auto mode and simply recall the test results once finished
- Loop impedance and PSC or PFC readings can be shown on one screen
- Non-trip loop impedance
- Loop impedance - high current with auto start and direct readout of PSC
- Phase rotation test will indicate the correct phase sequence
- Integrated socket probe for easier testing
- Large backlight screen improving visibility even in difficult lighting conditions

Standard Accessories

The PowerTest 200 is supplied with the following accessories as standard:

- Padded neck strap
- Professional carry case
- Mains lead
- 1.2M black test lead
- 1.2M red test lead
- 1.2M green test lead
- Black crocodile clip
- Red crocodile clip
- Green crocodile clip
- Remote probe with test buttons
- 6 x MN1500 (LR6) (AA) 1.5v batteries
- Spare 1.6A 1000v HRC FF fuse
- User manual

KEEPING PEOPLE SAFE FOR OVER 35 YEARS

SEAWARD
ELECTRICAL SAFETY TESTING & MEASURING

PowerTest 200

Multifunction tester designed for the professional electrician.

Technical Specification:

Voltage	
Range	0V to 440V
Accuracy	+/- 5% +/- 2digits from 0 to 100Hz
Resolution	1V
Continuity	
Range	0.01Ω to 200Ω
Accuracy	+/-2% +/-5 digits
Resolution	0.01Ω to 1.99Ω
	2.0Ω to 19.9Ω
	20Ω to 200Ω
Test Voltage	>4Vdc >25Vdc Open Circuit
Test Current	>200mA
Compliance	IEC61557-4
	IEC61557-10
Insulation	
Test Voltage	250V/ 500V/ 1000V
Range	0.05MΩ to 200MΩ
Accuracy	+/-5 % +/-5 digits
Resolution	0.01MΩ to 19.9MΩ
	2.0MΩ to 19.9MΩ
	20MΩ to 200MΩ
Test Current	1mA
Compliance	IEC1557-2
	IEC1557-10
RCD Trip Time Test	
Range	0ms to 2000ms
Accuracy	+/-5% +/-2 digits
RCD Trip Time Test (Continued)	
Range	0 to 2000ms ½ 1x
	0 to 300ms 1x general (500ms selective)
	0 to 40ms 5x
Test Current	10mA/ 30mA/ 100mA (½, 1x, 2x, 5x current)
	300mA/ 500mA (½, 1x current)
Compliance	IEC1557-6
	IEC1557-10
RCD Trip Current / Ramp Test	
Test current	-5% to 5% IΔn and 5IΔn (AUS/NZ variant)
Test Current	-10% to 0% 0.5IΔn, 0% to +10% IΔn and 5IΔn
Step Size	0.1*Δn
Step Duration	300ms
Compliance	IEC61557-6
	61557-10
Non-Trip Loop Impedance	
Range	0.01Ω to 2000Ω
Typical Accuracy	+/- 5% +/-12 digits (to 1.99Ω) +/-5 digits (to 2000Ω)
Resolution	0.01Ω to 1.99Ω
	2.0Ω to 19.9Ω
	20Ω to 2000Ω
Test Current	<15mA RMS
High Current Line Impedance	
Range	0.01Ω to 2000Ω
Typical Accuracy	+/-5% +/-5 digits
Resolution	0.01Ω to 1.99Ω
	2.0Ω to 19.9Ω
	20Ω to 2000Ω
Test Voltate Phase to Neutral	190V to 260Ω
Phase to Phase	328V to 440V
Test Current	3.5A Peak
Loop Test PFC Measurement	
Range	1A to 26kA
Accuracy	+/-5% +/-5 digits
Range	1A to 999A
	1kA to 26kA

KEEPING PEOPLE SAFE FOR OVER 35 YEARS

SEAWARD
ELECTRICAL SAFETY TESTING & MEASURING

PowerTest 200

Multifunction tester designed for the professional electrician.

Line Test PSC Measurement

Range	1A to 26kA
Accuracy	+/- 5% +/- 5 digits
Range	1A to 999A 1kA to 26kA

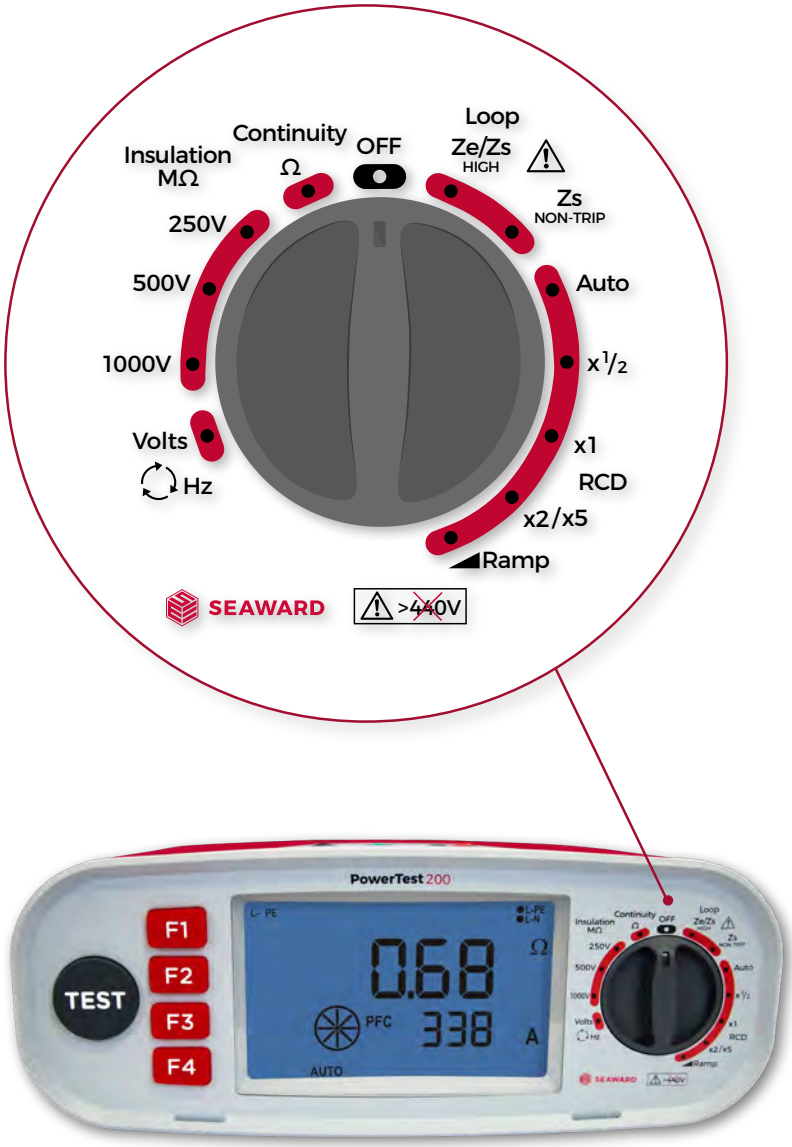
General Specification:

Category of Tester
300V Category III

Battery Requirements
6x MN1500 (LR6) (AA) 1.5v

Instrument Weight and Dimensions

Weight (approx.)	836g 1.84lb
Dimensions (approx.)	260 x 55 x 105mm 10.2 x 2.2 x 0.4"



Part Number:

PowerTest 200 (Standard accessories included)

414A917

KEEPING PEOPLE SAFE FOR OVER 35 YEARS

SEAWARD
ELECTRICAL SAFETY TESTING & MEASURING

EM ELECTRICAL MACHINES

Modern electrical machines system

This new solution is an intuitive and exciting way for students to explore the characteristics of electrical machines, in the form of electric motors and generators, which form part of our everyday lives; from the motor in our smartphones, buzzing to indicate a 'silent' message to the generator in a nuclear power station feeding power into the national grid for all our household appliances.

The equipment can be controlled either using manual controls on the control box or by using a set of PC-based applications. *Please note, manual control requires the use of separate voltage and current meters.*

To succeed in the study of this course, students should have previously studied (or should be currently studying) BTEC Level 3, Unit 1 (Engineering Principles) or should have equivalent knowledge at Level 2. A good grounding in GCSE level mathematics and science (Physics) is also desirable.

A full student manual is included, and equipment is supplied in our standard storage trays.

Electrical Machines Curriculum

Learning objectives / experiments:

- How to safely operate electrical machines.
- The function and operation of test meters and the dynamometer.
- How to determine current, voltage and power in DC, single phase AC and three phase AC circuits.
- How to measure torque, power output and efficiency of an electrical machine.
- The operation of DC motors and generators.
- The control of DC motors and generators.
- The operation of single-phase AC machines.
- The operation of the universal motor.
- The operation of a brushless motor.
- How to calculate the synchronous speed and slip on a single-phase AC motor.
- The operation of three phase AC induction motors.
- Speed control of a three phase AC induction motor using variable frequency drives.
- The operation of three phase AC permanent magnet generators (PMGs).
- The difference between real power, apparent power and reactive power and why power factor is important.
- How to calculate the efficiency of a system.
- Evaluate three phase electrical machines connected in 3-wire star and 3 wire delta configurations.

Curriculum mapping

- Unit 15 of the BTEC National award in Engineering: Electrical machines
- Unit 31 of BTEC Higher National: Electrical systems and fault finding
- Unit 21 of BTEC Higher National: Electrical machines
- Unit 43 of BTEC Higher National: Further machines and drives
- Unit 45 of BTEC Higher National: Industrial systems

Electrical machines level 3 - BTEC unit 15

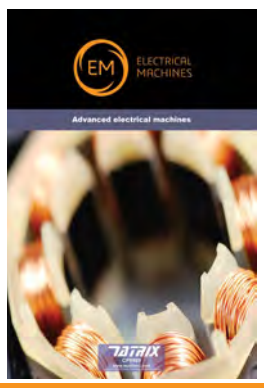
This learning resource – when used with the Matrix Modern Electrical Machines system – teaches students the basics of electrical machine operation, their speed / torque characteristics, relevant mathematical relationships including torque, power, and slip, and details of the circuits and power supplies needed to drive them. Machines include Dynamometer, DC motor, Dynamo, single and three phase induction motor, shunt motor and series motor, Three phase generator, and Brushless DC motor.

Electrical installation level 3

This learning resource – when used with the Matrix Modern Electrical Machines system – teaches Electrical Installation students the basics of electrical machine operation, their speed / torque characteristics and the circuits and power supplies needed to drive them. Machines include Dynamometer, DC motor, single and three phase induction motor, shunt motor and series motor.

MATLAB and electrical machines level 5 – university undergraduate year 2

This learning resource – when used with the Matrix Modern Electrical Machines system – teaches students how to use MATLAB to measure the characteristics of electrical machines, how to define the characteristics using a mathematical model and to verify that model using test results. A full MATLAB compatible Application Programming Interface for the control unit is supplied. Machines include Dynamometer, DC motor, Dynamo, single and three phase induction motor, shunt motor and series motor, Three phase generator, and Brushless DC motor.

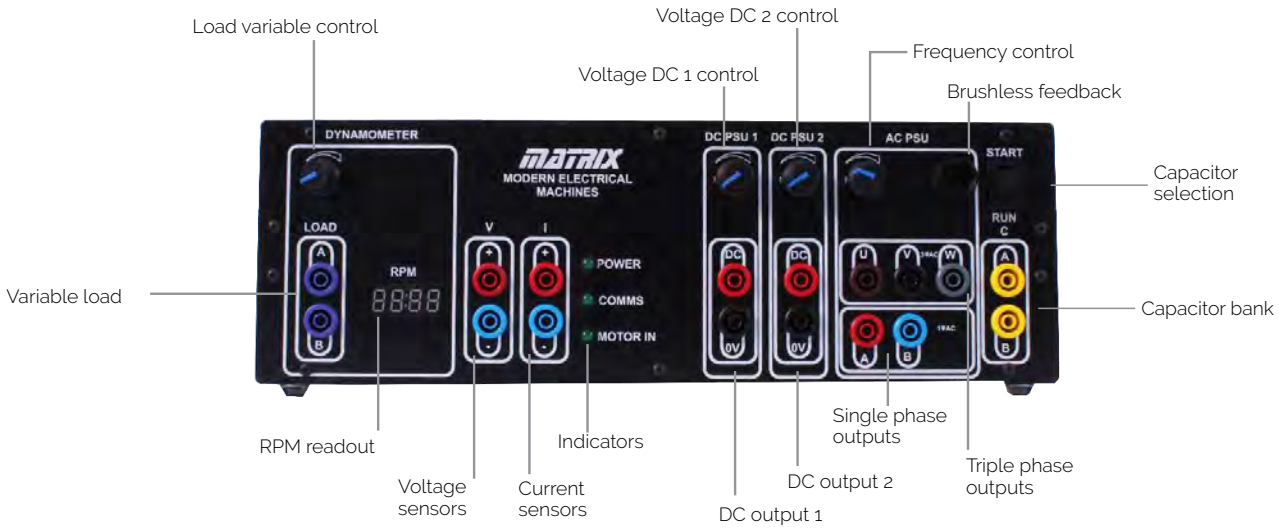


Electrical machines level 5 – university undergraduate year 2

This learning resource – when used with the Matrix Modern Electrical Machines system – introduces students to more advanced concepts and models of electrical machines and focuses particularly on building equivalent circuits of machines. Machines include Dynamometer, DC motor, Dynamo, single and three phase induction motor, shunt motor and series motor, Three phase generator, and Brushless DC motor.

Modern electrical machines

ELECTRICAL MACHINES



Our new modern electrical machines system is a revolutionary way of safely studying the characteristics of different motor types in a learning environment. Observations of alternative market offerings are:

- They are too expensive
- They are too complicated
- They take up too much space in a department – often with a dedicated room
- They are often not electrically safe

With this in mind we have developed a range which has the following features:

- Safe operation: all moving parts covered
- Electrical machines including those found on the following page
- Machines which operate on 24V power, AC or DC
- Manual (reduced specification) or full PC control
- Electronic measurement of voltage, current and power in DC and AC
- DC power supply included
- AC power supply single and three phase supply with variable frequency included
- All machines are small footprint, low power
- All equipment can be easily stored and packed away
- Full documentation and experiments included

Above: The machines can be controlled manually, using the control box provided or through a PC based environment. Different panels are used, dependent on the motor type being studied.

This kit includes the following equipment:

- Dynamometer with integrated load cell and rotary encoder
- DC Permanent Magnet Motor (also used as a DC Permanent Magnet Generator)
- DC Shunt Motor (also used as DC Separately Excited Motor & Generator and DC Shunt Generator)
- DC Series Motor (also used as an AC/Universal Motor)
- AC Single Phase Induction Motor
- AC Three Phase Induction Motor (Star and Delta configurations)
- Brushless DC Motor (also AC Three Phase Permanent Magnet Synchronous Motor & Generator).
- Integrated power supply and control box
- PC-based applications for advanced control of the motors

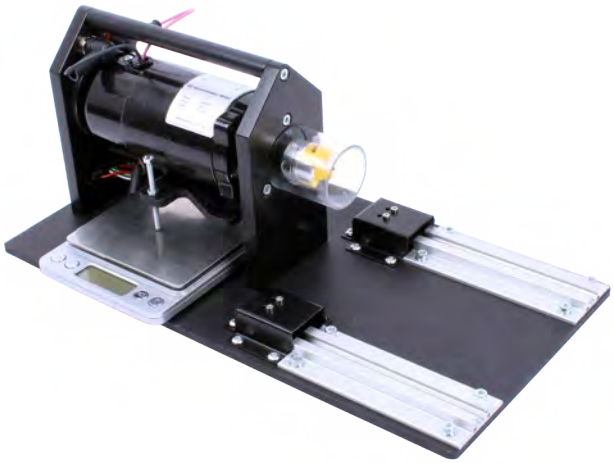
Control box features:

- Select DC, single-phase AC and 3-phase AC outputs
- Integrated voltage and current measurement
- Adjustable resistive loads for dynamometer and series winding resistor
- Switchable start and run capacitors

Ordering information

Modern electrical machines system	EM6637
Corresponding curriculum	CP6490

Electrical machines motor specifications



Dynomometer

The Dynamometer is made up of a long shafted Permanent Magnet DC machine free rotating between bearings mounted in a cradle. One side of the machine can be coupled to any of our test machines using a push fit safety coupling housed in a plastic tube which ensures that no moving parts are accessible. The Dynamometer cradle takes torque measurements in both directions of rotation: anti-clockwise with a spring balance, and clockwise with a strain gauge linked to the control unit. The Dynamometer is fitted with two 4mm shrouded safety connectors which are used to add an electrical load to the machine and are also used as a DC machine (24V 50W) when testing machines as generators.

Three Phase motor

The three phase 24V 35W induction motor has a 2 pole wound stator. Connection for each winding is provided on 4mm shrouded safety connectors.

Single Phase motor

The single phase 24V 35W induction motor has a 4 pole wound stator with two windings for start and run. Connection is provided on 4mm shrouded connectors with a common terminal, start terminal and run terminal.

Requires an external capacitor to start rotation.

DC motor

The 24V 50W Permanent magnet DC motor is a simple machine with two magnetic poles for the stator and a wound rotor with carbon brushes.

The machine is fitted with 4mm shrouded connectors.

Electrical machines motor specifications

Shunt motor

The shunt motor is a 24V device with a 2 pole wound stator a wound rotor with carbon brushes. Rotor and stator connections are made on separate 4mm shrouded connectors so that the field and armature can be excited by separate DC power supplies.

Universal motor

The series motor can be driven from 24V AC or 24V DC and has a 2 pole wound stator and a wound rotor with carbon brushes.

Rotor and stator connections are made on separate 4mm shrouded connectors.

Brushless motor

The Brushless DC motor is a small 24V 52 watt device with 8mm shaft and safety coupling. The 6 pole device is driven by a 24V three phase supply and has Hall effect sensors to sense rotor position.

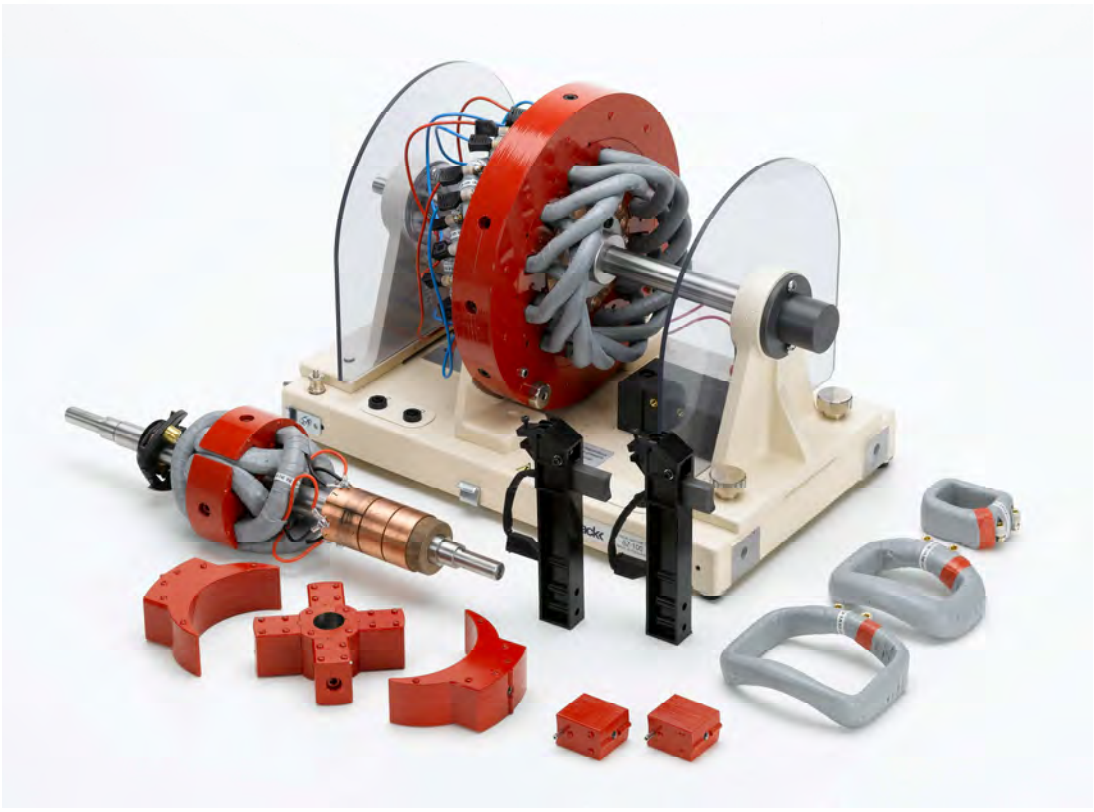
The machine is fitted with 4mm connectors for drive and a 5 way connector for Hall sensors.

Instruments

Fluke 115 True RMS Digital Multimeter	HP1324

Tektronix digital oscilloscope	HP8067

Dissectible Machines System 62-005



The Powerframes Dissectible Machines System components form a complete trainer that covers a wide range of generators and motors – d.c., Single and Three Phase a.c. and Stepper. The trainer is built around the unique Feedback Dissectible Machine, which is designed to introduce students to the principles of electrical motors and generators.

The trainer includes power supplies, drives and control equipment, loading and instrumentation modules that are all provided in the form of panels. These panels can easily be slotted in and out of a purpose-designed, bench-standing frame. The frame is constructed from an advanced, fibre-loaded, rigid plastic material which is electrically insulated for safety.

The trainer provides a dynamic approach to understanding electrical machines principles and construction covering a wide range of student levels from vocational to graduate Engineer. The Dissectible Machine has been designed so that the characteristics of the machines that can be assembled closely represent those of their industrial equivalents.

The trainer is supplied with a printed manual also on CD, which provide a wide range of step-by-step theory, courseware and experiment assignments, using the versatile and extensive dissectible machine.

The components in the system that make up the trainer are available separately, enabling customers to configure a trainer that suits their needs.

Features

- Fully functional, multi-part constructional machines kit
- Creates a practical and realistic machines tutor
- Over 50 types of machine may be assembled
- From vocational to graduate engineer level
- Inherently safe
- Fully developed course curriculum

System Benefits

- Covers dc and ac single and 3-phase motors and generators
- Allows machine construction to be examined
- High level of electrical and mechanical safety built-in
- Low cost installation - suitable for bench-top use
- Portable machine and system components
- Modular concept provides flexibility for individual requirements
- Choice of conventional or virtual instruments
- Provided with in-depth teaching manual

Curriculum Coverage

The unique Dissectible Machine System enables students to construct and investigate over fifty different machine assemblies.

The System may be used to study a wide range of topics, from the principles of magnetic circuits and electrical machine theory through to 3-phase synchronous machines.

Students are able to see clearly the component parts of the machine and how they are interconnected, both electrically and mechanically. They may assemble machines from these component parts and then investigate the operation and characteristics of them.

- Electrical machine constituent parts
- Electromagnetic principles
- Elementary machine principles
- d.c. motors and generators
- Series, shunt and compound types
- a.c. single and three phase motor and generators
- Series, universal, single phase capacitor, split phase and repulsion motor
- Synchronous motors and generators – single and three phase
- Split field, shaded pole and stepper motors
- Electrical Machines faults

System components

- Baseplate
- Frame Ring
- Shaft
- Coupling
- Fixed & removable bearing housings
- Wound Stator
- Squirrel Cage Rotor
- Hand Crank
- Centrifugal Switch
- Brush holders & brushes
- Commutator/Slip Rings
- Interpoles
- Armature Poles & Hub
- Field poles
- Armature, Field & Interpole coils
- Compound Field Coils
- Tools and Hardware

The focus of this system is a fully dissectible experimental machines kit. This allows over fifty machine assemblies to be built covering a wide range of a.c. and d.c., Single and 3-Phase motor and generator assemblies. The machines that may be assembled use low voltages, have protected rotating parts and operate at relatively low power levels, minimising the risk of accidents. Nominal operating voltages are 50 V d.c. and 125 V a.c.

The separate field poles, Interpoles, armature poles, hub, 12-slot stator and squirrel cage rotor are made from electrical steel laminations riveted together. The coils are wound from synthetic enamel-covered copper wire and wrapped with a strong cloth-base tape. Each has 'coil finish' and identification bands. A stainless steel shaft of high corrosion resistance is supported by plain and self-aligning ball race bearings. These are held in aluminium alloy housings fixed to a cast aluminium baseplate. The shaft speed can range from very low values up to 3,600 rev/min (a.c. machines), or 5,000 rev/min (d.c. machines) according to the application. The Commutator, slip rings and brush gear are of simple design to facilitate armature assembly and give good accessibility. A sturdy component storage panel is provided for easy inventory control.

Assemblies

The following studies and machines assemblies may be investigated:

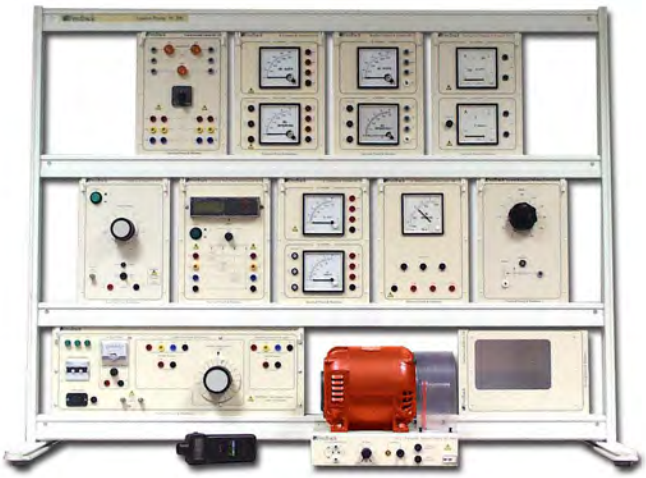
- Introduction to electromagnetism
- Machine operating principles
- Elementary a.c. and d.c. generators

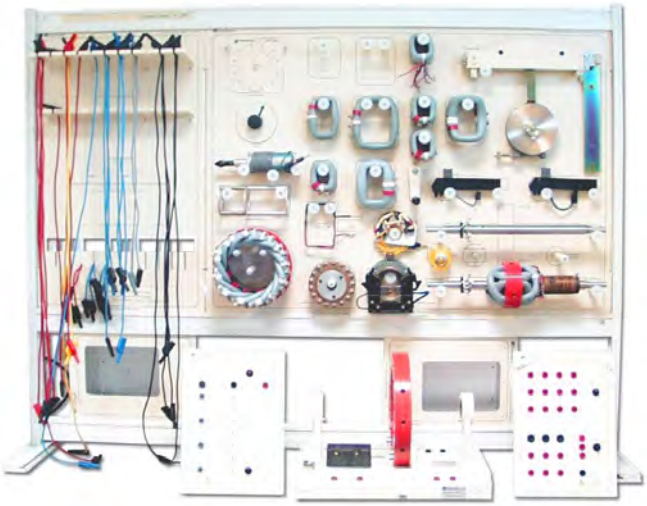
Machines with and without interpoles:

- d.c. series motor
- d.c. compound motor
- d.c. shunt motor
- d.c. shunt generator
- d.c. series generator
- d.c. compound generator
- d.c. separately excited generator

- Single phase a.c. induction motor, squirrel cage, 2 pole and 4 pole
- Single phase a.c. series universal motor
- Single phase a.c. repulsion motor
- Single phase a.c. synchronous motor/generator, 2 pole and 4 pole
- Single phase a.c. generator, rotating field
- Single phase a.c. generator, rotating armature
- 3-phase ac induction motor, squirrel cage, 2 pole and 4 pole
- 3-phase ac synchronous motor, 2 pole
- 3-phase ac synchronous generator, 2 pole
- a.c. brushless generator
- Stepper motors
- Shaded pole induction motor
- Split field series motor
- Dynamic braking of a d.c. motor
- Power factor correction of a.c. motors
- Synchronisation
- Synchronous motor characteristics
- Pole-changing induction motor
- d.c. shunt motor faults
- 4 pole induction motor faults

Dissectible Machine System 62-005





The complete Dissectible machines trainer 62-005 provides all the components to perform the full range of student assignments.

The bench-top, free-standing frames divide the equipment into two distinct areas. One frame specially holds all the component parts of the Dissectible Machine on an inventory control panel that includes connecting lead storage, component storage for couplings and nuts and bolts etc.

The second frame houses the workstation. It consists of a wide range of a.c. and d.c. meters, resistive and capacitive loads and power supplies. Fixed and variable a.c. and d.c. supplies are provided and require a three phase supply input of 400 – 415 V a.c. from a five wire system. Total power requirement is 6 kVA.

Features

- Complete training system
- Comprehensive students manual that covers:
  - magnetic principles to three phase machines
  - conventional instrumentation pointer type and digital meters
  - d.c. single phase an three phase motors and generators
  - machines construction from component parts
  - protected supplies, meters and connecting leads
  - safety cover for dissectible machine and couplings
  - safety earthing system

Loading Equipment

Both electrical and mechanical loading devices are provided in the system. The electrical loading is carried out with variable resistance loads and a resistor/capacitor unit for a.c. single phase and three phase machines.

The mechanical loading is by a friction (Prony) brake, which is calibrated for quantitive measurement.

MV1054 Torque Meter System

Terco has a wide range of Torque Measuring Systems. It is always possible to find a good solution to measure torque when testing a motor. On the following pages you will find different ways of measuring torque, power and speed for electrical machines.

The picture shows MV1054 Digital Torque, Speed and Shaft Power Meter mounted on MV1004 Machine bed between MV1028 DC machine and MV1008 Synchronus machine

MV1054 Digital Torque-, Speed- and Shaft Power Meter

MV 1054 is a modern torque meter based on the latest sensor technology. It comprises a magnetically based contactless torque sensor together with data acquisition and a display unit for torque, speed and shaft power.
The sensor unit consists of a magnetically encoded torsion shaft with a magnetically based contactless sensor, together with a data acquisition unit with 15 bit resolution. (see pages 20-22).
Torque measurement is performed/presented within the range -17.50Nm - +17.50Nm with exceptionally high accuracy including stand still torque as it is possible to lock the shaft with a specially attached bar *). Speed measurement is performed/presented within the range -3000- +3000rpm and the shaft power is calculated and presented within the range -5.50kW- +5.50kW.

Technical Specifications

Technical Data

Nominal torque	+/-17.50Nm
Max. mechanical torque	25Nm
Nominal shaft power	+/-5.50kW
Nominal speed	0 - 3000rpm
Data acquisition protocol	Modbus RTU 8N2
Baud Rate	9600kB/19200kB
Power supply	220-240VAC
1-phase, 50-60Hz	

Dimensions / Weight
Sensor Unit

Dimensions	200x190x146mm
Length of mounting plate	200mm
Length incl couplings	170mm
Length incl shaft cover	250mm
Shaft height (to center)	162mm
Weight	5kg

Display Unit

Dimensions	340x250x150mm
Weight	5kg

MV 1054 Sensor Unit

*) Shaft lock

MV 1054 Display Unit

Test Machines

The characteristics and data of Terco electrical machines are similar to those of larger machines.
The Terco test machines have a robust construction with more iron and copper than normal to enable overloading.
Approximately 20 % overload is possible for a maximum duration of 10 minutes without damaging the machines.
Terco machines boost higher saturation limits than machines with less iron.
Please pay attention to the weight of Terco machines in comparison with other suppliers machines.
The weight will give you an indication of how much iron and copper the machines have compared to other producers of the same power (ca 1kW).

The test machines have a foundation providing accurate alignment laterally and an accurate shaft height of 162 mm. Guides and plastic rails below the foundation simplify alignment and enable good positioning maneuverability on the machine bed. Special clamps are used to secure the machines to the machine bed. Connection is made via 4 mm safety terminal sockets mounted on a terminal panel showing the internal connections of the machine. Other voltages than those shown can be arranged on request.

MV1006 DC-Machine

The machine has a shunt and a series winding and can be connected as shunt motor, series motor, compound motor, shunt generator, series generator or compound generator.

MV 1006 has also commutating poles (interpoles) which improve the characteristics of the machine. The machine is mounted on a 10 mm thick anodized aluminium plate to be placed on the machine bed.

Suitable shunt rheostat : MV1905.

General Data	MV1006-225	MV1006-226
Generator	1.2 kW 1400 rpm	1.2 kW 1700 rpm
Shunt motor	1.0 kW 1400 rpm	1.0 kW 1700 rpm
Series motor	1.0 kW 1150 rpm	1.0 kW 1400 rpm
Rotor	220 V 5.5 A	220 V 5.5 A
Excitation	220 V 0.55 A	220 V 0.55 A

The series winding has an extra terminal at 2/3 of the winding.

Moment of inertia	J = 0.012 kgm^2 (approx.)
Dimensions	465 x 300 x 310 mm Shaft height 162 mm
Weight	45 kg

MV1007-405 Induction Motor Slip Ring

The machine is a 3-phase slip-ring asynchrous motor with means to connect a rotor starter to be used for starting.Terminals on anodized front panel with symbols and electrical data.

General Data	50 Hz	60 Hz
Power	1.1 kW,	1.1 kW,
Speed	1440 rpm, 50 Hz	1680 rpm, 60 Hz
Star connection	380-415 V, 3.2 A	380-415 V, 3.2 A
Delta connection	220-240 V, 5.5 A	220-240 V, 5.5 V
Secondary	260 V, 3.0 A	260 V, 3.0 A
Moment of inertia	J = 0.012 kgm^2 (approx.)	
Dimensions	465 x 300 x 310 mm, Shaft height 162 mm	
Weight :	42 kg	

MV1007-695 Induction Motor Slip Ring

As MV1007-405 but for 380-415 V 3-phase, Delta, 50-60 Hz

MV1008 Synchronous Machine

The machine has a DC excited cylindrical rotor, operating on voltages up to 220 V DC (maximum excitation). The advantages rising from this type of machine are measurements and characteristics corresponding to those of larger machines and the excitation voltage is readily available in most laboratories. An additional damping winding will counteract and also facilitate return to synchronism if the rotor falls out of phase. The damping winding also allows the motor to be started as an asynchronous motor before energizing the field.

Suitable excitation rheostat : MV 1905.

General Data	MV1008-235	MV1008-236	MV1008-405	MV1008-406
Synch. Gen.	1.2 kVA x 0.8	1.2 kVA x 0.8	1.2 kVA x 0.8	1.2 kVA x 0.8
Synch. Motor	1.0 kW 1500 rpm	1.0 kW 1800 rpm	1.0 kW 1500 rpm	1.0 kW 1800 rpm
Star conn.	220-240 V 3.5 A	220-240 V 3.5 A	380-415 V 2.0 A	380-415 V 2.0 A
Delta conn.	127-140 V 6.1 A	127-140 V 6.1 A	220-240 V 3.5 A	220-240 V 3.5 A
Excitation DC	220 V 1.4 A	220 V 1.4 A	220 V 1.4 A	220 V 1.4 A
Moment of inertia	J = 0.012 kgm^2 (approx.)			
Dimensions	465 x 300 x 310 mm, Shaft height 162 mm			
Weight	39 kg			

MV1008-235 and -405 are designed for tests on 50 Hz networks.
MV1008-236 and -406 are designed for tests on 60 Hz networks.

MV1027 Synchronous Machine

The machine has a DC excited rotor with salient poles, operating on voltages up to 220 V DC (maximum excitation)
The advantages rising from this type of machine are measurements and characteristics corresponding to those of larger machines and the excitation voltage is readily available in most laboratories. An additional damping winding will counteract oscillations and also facilitate return to synchronism if the rotor falls out of phase.
The damping winding also allows the motor to be started as an asynchronous motor before energizing the field.

Suitable excitation rheostat : MV1905.

General Data	MV1027-235	MV1027-236	MV1027-405	MV1027-406
Synch. Gen.	1.2 kVA x 0.8	1.2 kVA x 0.8	1.2 kVA x 0.8	1.2 kVA x 0.8
Synch. Motor	1.0 kW 1500 rpm	1.0 kW 1800 rpm	1.0 kW 1500 rpm	1.0 kW 1800 rpm
Star conn.	220-240 V 3.5 A	220-240 V 3.5 A	380-415 V 2.0 A	380-415 V 2.0 A
Delta conn.	127-140 V 6.1 A	127-140 V 6.1 A	220-240 V 3.5 A	220-240 V 3.5 A
Excitation DC	220 V 1.4 A	220 V 1.4 A	220 V 1.4 A	220 V 1.4 A
Moment of inertia	J = 0.012 kgm^2 (approx.)			
Dimensions	465 x 300 x 310 mm, Shaft height 162 m			
Weight	39 kg			

MV1027-235 and -405 are designed for tests on 50 Hz networks.
MV1027-236 and -406 are designed for tests on 60 Hz networks.

MV1300 Power Pack

This power supply unit is especially adapted for laboratory experiments on electric machines and power systems. It can be used where variable or fixed AC or DC is required and is particularly suited to the laboratory experiments with Terco´s torque meters and test machines. It is designed to slide under the lab table so that controls and connections are in a comfortable working position.
The contactor for variable voltages has a safety limit switch which eliminates switching on high voltages by mistake, thus protecting students and equipment especially when working on electrical machines.
All outputs are fused by MCB´s and have load switches.
The Power Pack has also Earth Leakages Circuit Breaker (ELCB).

General Data

MV1300-235 Supply voltage 220-240 / 127-140 V 50 / 60 Hz 3-ph.
MV1300-405 Supply voltage 380-400 / 220-230 V 50 / 60 Hz 3-ph.
MV1300-415 Supply voltage 415 / 240 V 50 / 60 Hz 3-ph.

Output voltage	DC fixed	220 V 3.5 A
	DC variable	0-220 V 16 A
	AC fixed	230/133 V 10 A 3-ph
	AC variable	3 x 0-230 V 10 A 3-ph
Standard	Fixed AC	230 V 10 A
Dimensions	660 x 435 x 790 mm	
Weight	103 kg	

MV1302 Power Pack

Same as MV 1300-405 but with the following data

Output voltage	DC fixed	220 V 3.5 A
	DC variable	0-220 V 16 A
	AC fixed	400 / 230 V 10 A 3-ph
	AC variable	3 x 0-400 V 8 A 3-ph
Supply voltage	380-400 / 220-230 V 50 / 60 Hz 3-ph	

MV1304 Power Pack

As MV1300-415 but with the following data

Output voltage	DC fixed	220 V 3.5 A
	DC variable	0-220 V 16 A
	AC fixed	415 / 240 V 10 A 3-ph
	AC variable	3 x 0-415 V 10 A 3-ph
Supply voltage	415 / 240 V 50-60 Hz 3-ph	

MV1903 Synchronizing Device

The equipment includes 1 zero voltmeter, 1 circuit breaker, 3 signal lamps and terminal bolts.
With MV 1903 it is an easy matter to synchronize synchronous machines to networks.

General Data	MV1903-235	MV1903-405
Zero Voltmeter	2 x 140 V	2 x 220 V
Circuit Breaker	16 A 500 V	16 A 500 V
Synch. Lamps	130 V with resistor	220 V with resistor
Supply Voltage	220-240 / 127-140 V 50-60 Hz	380-415 / 220-240 V 50-60 Hz
Dimensions	315 x 240 x 90 mm	
Weight	3 kg	

Other voltages can be supplied on request.

MV1100 Load Resistor

MV1100 Load resistor contains three ganged resistors with continuous spindle regulation. The resistors are connected to terminals for 3-ph, single-phase or DC-voltage. The current in the resistor is limited by tubular wire fuses in each phase. The unit has handles and wheels for simple and quick movement and is enclosed in a perforated metal cabinet. A cooling fan is placed at the bottom of the resistor.

MV 1100-235 Cooling fan supply 230 V AC 50 - 60 Hz
MV 1100-116 Cooling fan supply 110 V AC 60 Hz

General Data

3-phase 3.3 kW, continuously adjustable.

Star connection	400 / 230 V 0.8-5 A
Star connection	230 / 133 V 0.5-5 A
Delta connection	400 / 230 V 2.4-8.7 A
Delta connection	230 / 133 V 1.3-8.7 A
DC parallel connection	220 V 2.3-15 A

Overload capacity, brief duration, approx. 20 %.

Dimensions	630 x 250 x 890 mm
Weight	46 kg

MV1101 Load Reactor

Enclosed in a strong metal cabinet. The front panel has mimic diagram, terminals, fuses and electrical data. The unit can be used on 1- and 3-phase systems. 12 step regulation.

General Data

2.5 kVAr, 50-60 Hz

V	Connection	Hz	A
230	star	50	0.2-2.2
230	delta	50	0.6-6.6
400	star	50	0.4-3.8
230	star	60	0.2-1.9
230	delta	60	0.5-5.6
400	star	60	0.3-3.3

Dimensions	510 x 220 x 320 mm
Weight	40 kg

MV1102 Load Capacitor

Housed in a metal cabinet. Electrical data and symbols on the front panel with terminals and fuses. This unit can be used on 1- and 3-phase systems. 6 step regulation.

General Data

2.8 kVAr at 50 Hz, 3.3 kVAr at 60 Hz.

V	Connection	Hz	A
230	star	50	0.4-2.4
230	delta	50	1.2-7.2
400	star	50	0.7-4.2
230	III (parallel)	50	2.1-12.6
230	star	60	0.5-2.8
230	delta	60	1.4-8.6
400	star	60	0.8-5.0
230	III (parallel)	60	2.5-15

Dimensions	185 x 370 x 170 mm
Weight	7 kg

MV1003 Mobile Test Bench

For mobile use, the torque meter or brake system and test machines with machine bed are placed on a mobile bench having one folding leaf, one fixed shelf and four wheels, of which 2 can be locked.

Dimensions of the folding leaf
1490 x 400 x 30 mm

Dimensions
1500 x 600 x 840 mm

Weight 55 kg

The MV1003 Mobile Test Bench is equipped with the MV1036 Torque Meter, MV1008 Synchronous Machine, MV1004 Machine Bed and MV1025 Tachometergenerator. Beside, are Power Pack MV1300 and flexes. Under is one test motor on pallet.

MV1700 Stationary Laboratory Bench

For stationary use, the torque meter or brake system with machine bed and test machine are placed at the rear of the stable laboratory bench.
The front of the bench is used to connect equipment and instruments.

See also page 5.

Dimensions 2000 x 800 x 850 mm
Weight 30 kg

The Laboratory Bench is equipped with a motor/generator set together with the Torque measuring system MV1054. Beside you find the Power Pack MV1300 and under is a testmachine on pallet.

Laboratory Flexes with Safety Plugs

Safety lead with 2 covered spring plugs of 4 mm diameter, with stiff protection sockets covering the plugs, and 4 mm diameter axial bushings moulded with Polypropylen, fixed to 1.5 mm^2 copper thread, PVC isolated, outer diameter 4 mm. Colours black, red, blue, yellow, green/yellow. Rated current 16 A.

MV1800-HF Flex Set of 120 leads. Area 1.5 mm^2

2 colours

Length	25 cm	50 cm	100 cm	200 cm
Red	10	20	20	10
Blue	10	20	20	10

MV1801-HF Flex Set of 200 leads. Area 1.5 mm^2

5 different colours, red, yellow, blue, black and yellow/green, in 4 different lengths, 25, 50, 100 and 200 cm, 10 of each.

Length	25 cm	50 cm	100 cm	200 cm
Red	10	10	10	10
Yellow	10	10	10	10
Blue	10	10	10	10
Black	10	10	10	10
Yellow/green	10	10	10	10

MV1830-HF Flex Set of 100 leads. Area 1.5 mm^2

Set of 100 leads in 5 different colours, red, yellow, blue, black, yellow/green, and 4 different lengths, 25, 50, 100 and 200 cm, 5 of each.

Length	25 cm	50 cm	100 cm	200 cm
Red	5	5	5	5
Yellow	5	5	5	5
Blue	5	5	5	5
Black	5	5	5	5
Yellow/green	5	5	5	5

Separate Flexes. Area 1.5 mm^2

Please note, each Ref. No. refers to a pack of 10 leads.

Length	25 cm	50 cm	100 cm	200 cm
Red	MV1802-HF	MV1807-HF	MV1812-HF	MV1817-HF
Yellow	MV1803-HF	MV1808-HF	MV1813-HF	MV1818-HF
Blue	MV1804-HF	MV1809-HF	MV1814-HF	MV1819-HF
Black	MV1805-HF	MV1810-HF	MV1815-HF	MV1820-HF
Yellow/Green	MV1806-HF	MV1811-HF	MV1816-HF	MV1821-HF

MV1904 Flex Stand

For suspension of laboratory flexes. The stand has 12 slots between parallel tubes with space for 10-15 laboratory flexes in each slot. Flexes of length 200 cm are suspended in a separate position above the stand. This rigid stand has a heavy steel plate pedestal.

General Data

Height	1170 mm
Weight	9 kg

Compact "all in one instrument" for AC measurements

MV1939 AC Power Energy Meter

The Terco MV1939 AC Power Energy Meter is a practical solution for the study of 1, 2 and 3-Phase AC power systems up to 500VAC/10A.

A microprocessor-based energy meter provides the user with an instant overview of the relevant three or four-wire, 3-Phase network parameters in balanced or unbalanced networks.

The simplified connection process means your laboratory experiments can be set up and taken down in just minutes, leaving more time to investigate and understand the characteristics and ambiguities of 3-Phase power networks.

The Terco MV1939 AC Power Energy Meter enables the measurement and visualization of a wide range of parameters in the study of symmetrical as well as non-symmetrical networks, such as: phase voltages, phase-to-phase voltages, line currents, mean three-phase current, mean three-phase voltage, mean phase-to-phase voltage, three-phase active, reactive and apparent powers, mean three-phase power factors.

The visualization of parameters is distributed over several pages (default preset to display five pages) where each page simultaneously displays four parameters.

The power Energy Meter is furthermore equipped with a standardized industrial data acquisition protocol (Modbus) and is compatible with the MV2609 Terco DAQ software (MV1943 Computer Interface is necessary).

The MV2609 Terco DAQ software utilizes control and a real time graphical presentation programme incorporating data manipulation and export to Excel capabilities.

Technical Specifications

Power supply	220-240VAC, 50/60Hz
Measurement ratings	
Voltage, V	500VAC max
Current, I	10AAC max
Reactive Power	5 kVAr
Active Power	5 kW
Cos Phi	0-1-0
Communications	
Serial interface	RS485
Transmission protocol	Modbus RTU8N2
Baud Rate	19200kB

Environmental Conditions

Ambient temperature	0...55°C
Air humidity	25...95% (no condensation)
Size and weight	
W x H x D	255 x 205 x 335mm
Weight	10kg

Compact "all in one instrument" for DC measurements

MV1941 DC Measuring Unit

The Terco MV1941 DC Measuring Unit is a practical solution for the study of DC circuits up to 350VDC/12ADC.

Microprocessor-based display instruments provide the user with an instant overview of DC voltage and current levels on two separate channels simultaneously.

The simplified connection process means your laboratory experiments can be set up and taken down in just minutes, leaving more time to investigate and understand the characteristics and ambiguities of the circuits being investigated.

Robust components provide a good level of protection against incorrect connection, mishandling and carelessness.

The DC Measuring Unit is furthermore equipped with a standardized industrial data acquisition protocol (Modbus) and is compatible with the MV2609 Terco DAQ software (MV1943 Computer Interface is necessary).

The MV2609 Terco DAQ software utilizes a real time graphical presentation programme incorporating data manipulation and export to Excel capabilities.

Technical Specifikations

Power supply	220-240VAC, 50/60Hz
Measurement ratings	
Voltage, V	350VDC max
Current, I	12ADC max
Communications	
Serial interface	RS485
Transmission protocol	Modbus RTU8N2
Baud Rate	19200kB

Environmental Conditions

Ambient temperature	0...55°C
Air humidity	25...95% (no condensation)
Size and weight	
W x H x D	255x205x335mm
Weight	7kg

Phase Cop 2 Phase Sequence Indicator

Tester for determining the direction of rotation or phase sequence in 3-phase systems.

- 3 LEDs indicate whether or not the 3-phase conductors are live
- Very large voltage and frequency range
- Simple operation
- Rugged design
- Permanently connected cables with contact-protected connector plugs, three plug-on test probes and one plug-on alligator clip

Voltage range	90-660 V
Frequency	45-1000 Hz
Dimensions	70 x 105 x 40 mm
Weight	0.3 kg

Electrical Machines Laboratory standard setup

Classic (approx. 1 kW) Experiment Voltage 3 x 230 V AC, 4 Lab Stations.
Supply Voltage : 3 X 400 V or 3 x 230 V AC (MV 1300-405 is changeable).

	Code	Description	Qty	page
Torque Meter System				
	MV1054	Digital Torque-, Speed- and Shaft Power Meter	4	5
	MV1028-225	DC-Machine, 2.2 kW complete with interpoles 220V	4	6
Test Machines				
	MV1006-225	DC-Machine 1 kW 220 V 50 Hz	4	8
	MV1007-405	Induction Motor slip-ring *) 1.1kW 400/230V 50-60Hz 1.1kW	4	8
	MV1008-235	Synchronous Machine, 230 V Y 50 Hz 1.2 kVA x 0.8	4	9
	MV1009-405	Induction Motor Squirrel Cage *), 400/230V 50-60 Hz 1,1 kW	4	10
		*) Asynchrous Machines		
Power, Loads and Accessories				
	MV1004	Machine Bed	4	10
	MV1055	Spacer Shaft	4	10
	MV1905	Shunt Rheostat	8	10
	MV1300-405	Power Pack 3-ph, supply 400 V, out 230 V	4	11
	MV1903-235	Synchronizing Device 220-240 V 50-60 Hz	4	11
	MV1417	Terminal Board	4	12
	MV1500	Load Switch, 3-pole 16A	4	12
	MV1502	Reversing Switch	4	12
	MV1503	Star-Delta Starter for 3-ph Machines	4	12
	MV2636	Starter AC- and DC-Motors, Classic	4	12
	MV1100-235	Load Resistor 3-ph 3.3 kW	4	13
	MV1101	Load Reactor, 3-phase, 2.5 kVAr	4	13
	MV1102	Load Capacitor, three-phase 2.8 kVAr	4	13
	MV1700	Stationary Laboratory Table	3	14
	MV1003	Mobile Test Bench	1	14
	MV1830-HF	Flex Set, 100 Safety Leads, Safety Plugs	4	15
	MV1904	Flex Stand	4	15
Instruments				
	MV 1939AC	Power Energy Meter	4	16
	MV 1941	DC Measuring Unit	4	17
	Phase Cop 2	Phase Sequence Indicator	4	17
Options Electrical Machines				
	MV1027-235	Synchronous Machine, salient poles, 230 V Y 50 Hz	4	9
		For other eletrical machines see pages		30-37
Other Accessories see pages				38-37
Data Acquisition and Control Software see pages				20-22

Equipment Lists

Torque Meter Set, Digital

Suitable equipment when using MV1054 Torque measuring unit. One of each product, unless otherwise indicated below.

MV1054	Torque and Power Meter
MV1028	DC Machine (alt. MV 1034)
MV1003	Mobile Test Bench (alt. MV 1700)
MV1004	Machine Bed
MV1005	Pallet for Machines (3 pcs)
MV1006	DC Machine
MV1007	Slip Ring Motor
MV1008	Synchronous Machine
MV1009	Squirrel Cage Motor
MV1010	Flywheel
MV2636	AC and DC Starter
MV1100	Load Resistor
MV1101	Load Reactor
MV1102	Load Capacitor
MV1300	Power Pack (alt. MV 1302 or MV 1304)
MV1903	Synchronizing Unit
MV1417	Terminal Board
MV1500	Load Switch
MV1502	Reversing Switch
MV1503	Star-Delta Switch
MV1905	Shunt Rheostat (2 pcs)
MV1830	Lab Flex Set (alt. MV 1830-HF)
MV1904	Flex Stand

Electrical Torque Meter Set, Analogue Dial

Suitable equipment when using MV1036 Torque measuring unit. One of each product, unless otherwise indicated below.

MV1036	Electric Torque Meter (alt. MV 1026)
MV1003	Mobile Test Bench (alt. MV 1700)
MV1004	Machine Bed
MV1005	Pallet for Machines (3 pcs)
MV1006	DC Machine
MV1007	Slip Ring Motor
MV1008	Synchronous Machine
MV1009	Squirrel Cage Motor
MV1010	Flywheel
MV2636	AC and DC Starter
MV1025	Tachogenerator with cover
MV1100	Load Resistor
MV1101	Load Reactor
MV1102	Load Capacitor
MV1300	Power Pack (alt. MV 1302 or MV 1304)
MV1903	Synchronizing Unit
MV1417	Terminal Board
MV1500	Load Switch
MV1502	Reversing Switch
MV1503	Star-Delta Switch
MV1905	Shunt Rheostat
MV1830	Lab Flex Set (alt. MV 1830-HF)
MV1904	Flex Stand

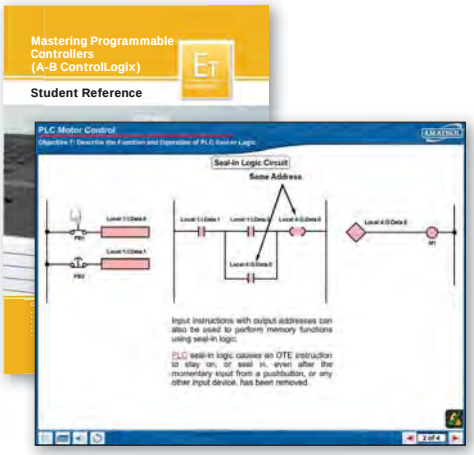
Portable PLC Learning System - Allen Bradley CompactLogix

990-PAB53

EMONA ET ELECTRONICS

990-PAB53

Student Reference Guide



Interactive Multimedia Curriculum

Portable Workstation

Learning Topics:

- Basic Panelview Plus Terminal Operation
- Panelview Plus Application Editing
- PLC Program Operations
- PLC Programming
- PLC Motor Control
- PLC Timer and Counter Instructions
- Event Sequencing
- Program Control Instructions
- Math and Data Instructions
- Analog Inputs
- Analog Outputs
- Variable Output Applications

Amatrol's PLC Learning System (990-PAB53) is a portable solution for when there is a need to teach PLCs where there is limited space such as in a conference room, lab area, or even a shop floor desk! Its compact size and durable case also provide for safe storage when your limited space must be used for teaching other subjects or when the system must be transported to a different location in the facility for use.

Learners use the powerful Allen-Bradley CompactLogix 5300 PLC, PanelView Plus terminal, and networks throughout the curriculum to build basic skills, such as program editing, to more advanced skills, such as analog output scaling.

The system's highly-interactive multimedia curriculum takes the learner through 14 modules covering 89 skills that provides an unmatched breadth and depth of knowledge and skill building! Only Amatrol can provide this level of training using a compact, portable workstation!

AMATROL®

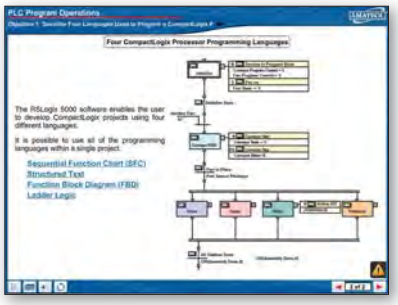
Technical Data

Complete technical specifications available upon request.

Portable Case
Suitcase: 28.8" L x 20.1" W x 14.8" D
Durable ABS Plastic
Workstation on Mounted Panel
Circuit Breaker
Master Control Relay Circuit
Allen Bradley Compact Logix 5300
24 VDC Power Supply
12 VDC Power Supply
I/O Simulator
1 Green Normally-Open Pushbutton
1 Red Normally-Closed Pushbutton
2 Black Normally-Open Pushbuttons
4 Two-position Selector Switches
6 Red Indicators
1 Yellow Indicator
1 Green Indicator
1 Potentiometer for Analog Input Adjustment
Thermostatic Temperature Application
Analog Temperature Application
Reversing Motor Starter Application
Variable Speed Motor Control Application
Stepper Motor Control Application
Power Cord
Student Curriculum (M11136)
Instructor Guide (C11136)
Install Guide (D11136)
Student Reference Guide (H11136)
Additional Requirements:
See http://www.amatrol.com/support/computer-requirements
Utilities Required:
120/220 VAC, 60 /50 Hz, Power Outlet

Rich Applications: Basic Through Advanced

The 990-PAB53 Learning System enhances learning through a wide array of real world applications that allow students to actually see their programs control real systems. In addition to a discrete I/O simulator with switches and indicators, the 990-PAB53 includes application circuits and components for thermostatic temperature control, analog temperature control, reversing constant-speed motor control, variable speed motor control with feedback, and stepper motor homing and commissioning. These circuits include basic and advanced applications starting with discrete I/O projects and extending to projects involving analog I/O.



Interactive Multimedia

Modern Curriculum with PanelView Plus Terminal and Networking

The 990-PAB53 curriculum teaches modern PLCs with the PanelView Plus terminal and networking introduced in the basic skills and applied throughout the curriculum. Learners cover a wide variety of program commands beyond timers and contacts, such as stepper motor control, Pulse-Width Modulation (PWM) control, and analog control. This is made possible by the extensive Amatrol curriculum and the modern features of the Allen-Bradley CompactLogix 5300 PLC. Featuring a wide range of analog, discrete, data, and networking commands, learners will quickly develop relevant and critical skills to be job ready in modern industry environments.

Portable Learning On The Go!!

The 990-PAB53 is a mobile training platform that can be used to deliver training where needed, easy to store and transport. It features a sturdy portable case with wheels and a handle for easy movement. The 990-PAB53 can easily be used in conference rooms, at a plant floor desk, in a lab - pretty much wherever you need. The cover is quickly removed to enable the case to sit firmly upright on a table surface for any learner to use. The cover also locks so that the workstation can be safely stored when not in use.

Complimentary Student Reference Guide

A sample copy of the PLC Learning System's Student Reference Guide is included with the system for your evaluation. Sourced from the PLC multimedia curriculum based on the Allen-Bradley CompactLogix 5300, the Student Reference Guide takes the entire series' technical content contained in the learning objectives and combines them into one perfect-bound book. Student Reference Guides supplement these courses by providing a condensed, inexpensive reference tool that learners will find invaluable once they finish their training making it the perfect course takeaway.

If you would like to inquire about purchasing additional Student Reference Guides for your program, contact your local Amatrol Representative for more information.

Options for Expanded Learning

The 99-FTSAB53 Portable PLC Troubleshooting Learning System can be added to your 990-PAB53 to further expand learning opportunities. The optional 99-FTSAB53 focuses on PLC troubleshooting, features 35+ electrical faults, and utilizes FaultPro. Amatrol's FaultPro is the industry's premier program utilizing electronic faults, FaultPro 4.0 covers topics such as solving software problems, testing input devices, and troubleshooting power supply problems. Only Amatrol has the ability to insert faults electronically, utilizing FaultPro, to create a real-world troubleshooting experience.

AMATROL®

Level/Flow Process Control Learning System

T5552

EMONA

Pc

PROCESS CONTROL

T5552

Student Reference Guide

Optional Multimedia Curriculum

Learning Topics:

- Process Control Concepts
- Safety
- Manual Control
- Instrument Tags
- Piping and Instrumentation Diagrams
- Loop Controllers
- Final Control Elements
- Level Measurement
- Liquid Level Control
- Methods of Automatic Control
- Basic Flow Measurement and Control
- Control Loop Performance

Amatrol's Process Control Level and Flow Learning System (T5552) teaches two of the most common types of process control systems, flow and liquid level, and the basic concepts on which other systems are based. Learners study how to calibrate, adjust, install, operate, and connect these process control systems. The T5552 offers learners the ability to practice both manual and automatic control on a process control system, as well as study both open-loop and closed-loop systems. Process control systems provide precise control of liquids and gases in a wide variety of industrial applications including power generation, petrochemicals, and manufacturing.

The T5552 features industrial quality components mounted and plumbed in a closed loop circuit to control the water flow rate between two tanks or the liquid level in one tank. All of this is combined on a heavy duty, welded steel bench-top workstation that fits through a standard door! In order to fully utilize the system and maximize knowledge growth, Amatrol's world-class curriculum intricately describes basic process control components to ensure that learners understand the function and operation of each valve, transducer, and controller and the role that they play in a process control loop.

AMATROL®

Technical Data

Complete technical specifications available upon request.

Workstation: 66" L x 46" H x 28" W
Welded steel tube construction
Centrifugal Pump
Electric Motor, single phase
Proportional Control Valve, pneumatically-operated
I/P Converter, 4-20ma input
Pneumatic Regulator and Pressure Gauge
Reservoir Tank, 10 gal.
Process Tank, 5 gal.
2-Compartment Baffle
Drain Valve, ball type (2)
2-Way Valves (2)
Liquid Level Transducer
Float Switches, SPST (2)
Piping Network
Pump Flow Control Valve
Pump Valve
Control Mode Valve (2)
Flow Meter, rotameter type
Pressure Gauges, 0-30 psig (4)
Flow Transducer, paddlewheel type
Process Meter
4-20ma Input
Alarm Relay Outputs, SPDT (2)
Scalable Output Displays
Digital Display, 3.5 digit
Programmable
PLC I/O Interface
Discrete Inputs (8) & Outputs (8)
Analog Inputs (8) & Outputs (8)
Relay Control Unit
Control Relays, DPDT
Selector Switch Inputs, 2-position (4)
Output Indicators,(4)
Pump Contractor Relay, 24 VDC
Solenoid Valve Output Interface
Curriculum (BB270)
Instructor's Guide (CB270)
Install Guide (DB270)
Multimedia (MB270)
Student Reference Guide (H19708)
Additional Requirements:
Computer: http://www.amatrol.com/support/computer-requirements
Water
Required Utilities:
120 VAC
Compressed air

Real-World Controllers

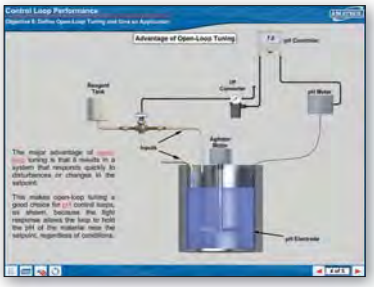
The T5552 features three types of controllers on its control panel: relay control for automatic on/off liquid level control, the PID controller for variable electronic control of either liquid level or flow, and PLC control for both on/off and PID control of the system. These controllers allow learners to practice process control procedures using both automatic and manual controls.

T5552 Control Panel

This learning system is extensively instrumented, enabling learners to observe the system's operation and more clearly understand the effects of external disturbances and their own adjustments. The T5552 includes pressure gauges upstream and downstream of each major component, rotameter-type flow meter, and a multifunction electronic process meter.

Process Control Curriculum with Unmatched Breadth and Depth

Amatrol's key partnerships with industry and educational leaders aided in finding a perfect balance between theoretical knowledge and real-world skills in order to produce a comprehensive level/flow process control curriculum that can be self-guided or taken in a classroom environment. Specifically, this curriculum covers process control safety, instrument tags, piping and instrumentation diagrams, and level measurement, then moves into system control functions such as liquid level control, automatic control methods, basic flow measurement and control, and control loop performance.



Optional Interactive Multimedia

Amatrol also offers an optional version of this curriculum in an interactive multimedia format. Utilizing 3D graphics, text, and audio, this highly interactive course thoroughly engages learners in the world of process control.

Additional Transducers and Control Valves for Expanded Level and Flow Knowledge

T5552-F1 Smart Flow Transmitter

Learners can also easily interchange optional transducers and valves with the standard ones by using hand-tightened pipe unions and plug-in electrical connections. The T5552 includes two standard transducers, level and flow, and allows for additions from the T5552-F1, such as Smart Flow Transmitter, Pitot Tube Flow Transducer, Venturi Flow Transducer, and Orifice Plate Flow Transducer. The T5552 can also expand to include the Ultrasonic Liquid Level Learning System (T5552-L1).

Expand Process Control Knowledge through Additional Learning Systems

In addition to the T5552, Amatrol offers other equally impressive process control learning systems, such as Thermal Process Control (T5553), Analytical Process Control (T5554), and Pressure Process Control (T5555).

T5552, T5553, and T5554 connected and controlled by the 890-PEC-B (left)

Student Reference Guide

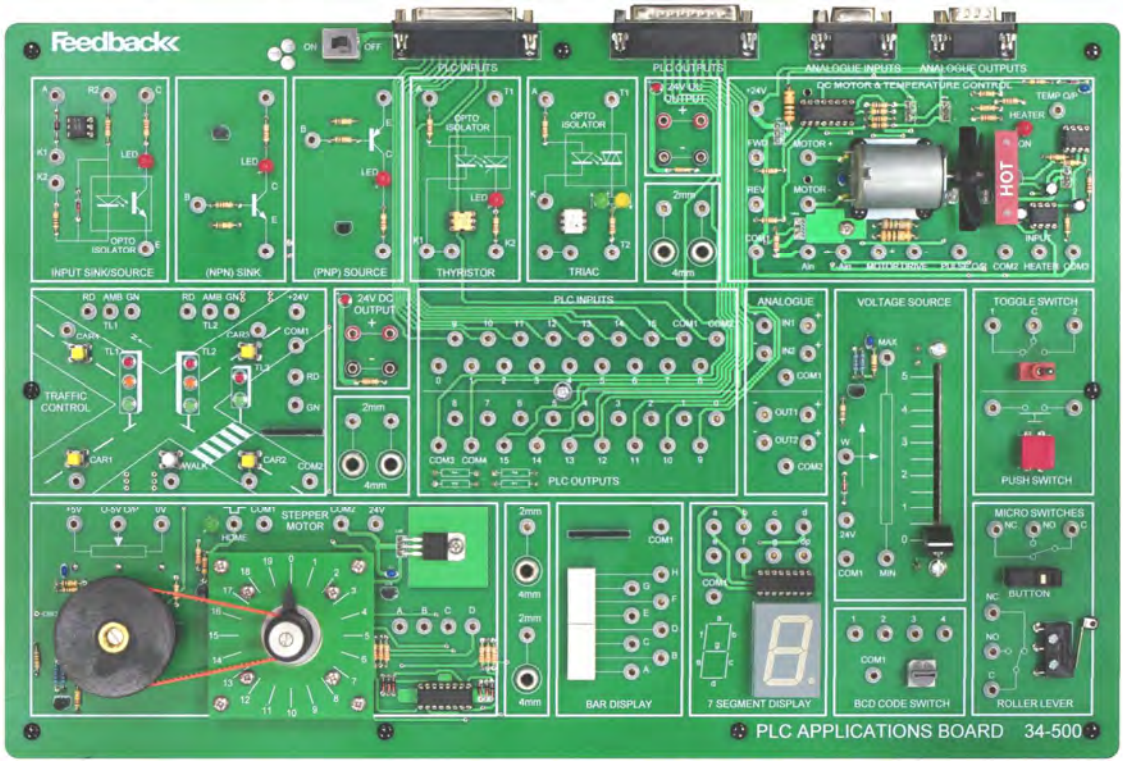
Student Reference Guide

A sample copy of the Process Control Learning System's Student Reference Guide is also included with the system for your evaluation. Sourced from the system's multimedia curriculum, the Student Reference Guide takes the entire series' technical content contained in the learning objectives and combines them into one perfect-bound book. Student Reference Guides supplement this course by providing a condensed, inexpensive reference tool that learners will find invaluable once they finish their training making it the perfect course takeaway.

If you would like to inquire about purchasing additional Student Reference Guides for your program, contact your local Amatrol Representative for more information.

AMATROL®

PLC Trainer 34-500



Introduction

Programmable Logic Controllers (PLCs) are used extensively in many manufacturing processes and control applications being readily programmed and reprogrammed when variations in the controlled process are required. The Feedback PLC Trainer and PLC Applications offer extensive training in basic PLC structure, identifying types of input and output options and programming from simple to more advanced routines including Ethernet communications. The Feedback range of PLC products offers a choice in both cost and complexity such that those with little or no knowledge can start with the PLC Trainer and progress through to complex systems with their more challenging programming requirements. All applications in this range are readily inter-changeable (Plug and Play) through the use of plug leads once the PLC has been configured. In the case of the PLC Trainer, the PLC hardware structure allows for expansion of the core digital unit with the addition of analogue modules and the option of a Human Machine Interface (HMI) over Ethernet. This extends the learning into the programming and application of such devices.
The Feedback trainers are supported with a user manual, program examples and solutions.

Description

The Feedback PLC Trainer offers the training required to understand and apply both PLC hardware and software programming through the structured students' manual that provides a progressive level of learning. The manual deals with the fundamentals of PLC hardware and software through to basic program writing and more advanced applications, finally to motor control. The PLC Trainer is an A3 size board that is divided into many individual smaller areas. Each one of these areas contains a number of components that are described and applied to gain an appreciation of their application. PLC programs are available for Allen Bradley, Mitsubishi and Siemens. See back page for PLC Pack options.

Features

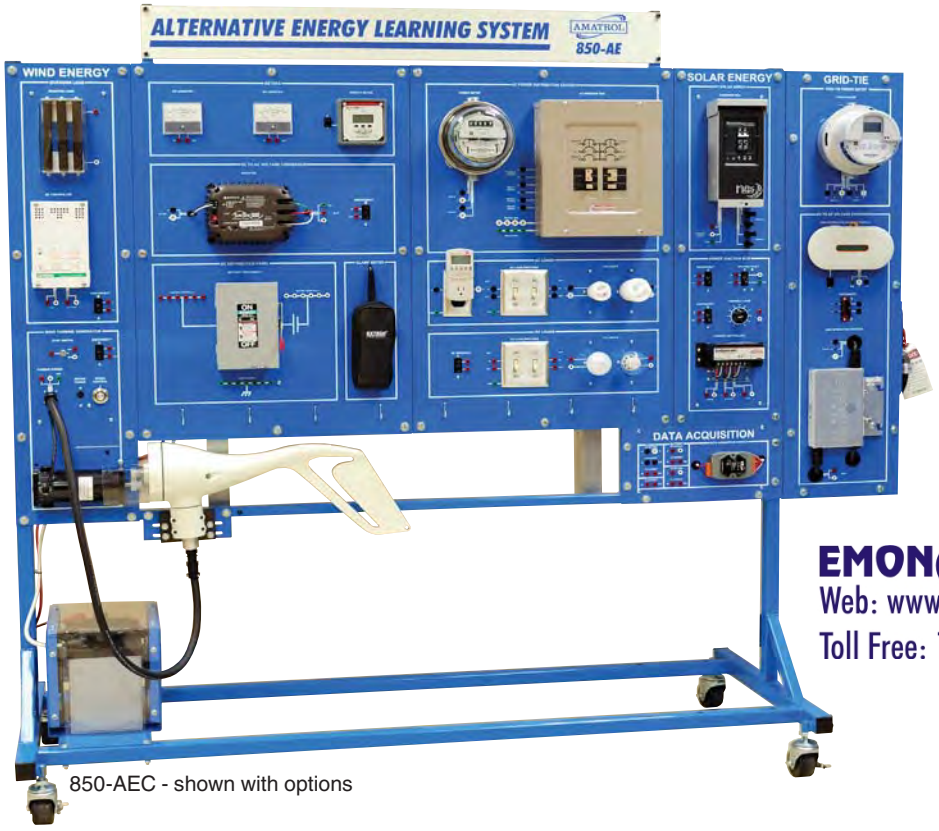
- Complete integrated range (Plug and play with cabled system)
- Low cost start up with 34-501/34-502
- Mitsubishi, Siemens & Allen Bradley PLC choices
- Large number of exercises covered from the basics to more complex applications
- Programming examples provided
- PLC Trainer curriculum relevant to BTEC National syllabuses
- Common PLC connectivity between Trainers simplifies connections
- External connection highway by D type connector leads
- On board connections by 2 mm plug leads for the PLC Trainer
- Specially designed for those with little or no knowledge of PLCs
- Large number of exercises covered from the basics to more complex applications
- 14 areas of components to study
- Programming examples provided
- External connections by D type connector leads
- On board connections by 2 mm plug leads
- Content relevant to BTEC National NQF Level 3 and BTEC Higher National – H1 NQF Level 4
- Extensions to Analogue I/O and HMI

Curriculum Coverage

- Down loading and up loading programs
- Selecting inputs and outputs
- Input and output data processing
- Implementing simple instructions
- Logic functions AND, OR, and inverse
- Understanding Flags
- Understanding registers
- Using timers
- Using counters
- Writing programs to operate devices and control processes
- Simple logic configurations with LED output
- Input from a code switch to internal counter value
- Input from a code switch to seven segment display
- LED count sequence 1, 2, 4, 8 etc
- LED count sequence 1, 10, 100 etc
- LED Traffic light sequencing, single and dual ways (Cross roads)
- Stepper motor drive sequencing, forward and reverse
- Stepper motor positioning to a desired point and home position
- Stepper motor drive sequencing with counter and display
- DC Motor speed PWM control

ALTERNATIVE ENERGY LEARNING SYSTEM – WIND AND SOLAR

850-AEC



850-AEC - shown with options

The demand for qualified solar and small wind technicians is rising, as more consumers and businesses apply solar energy and small wind systems in their communities. Many employers prefer employment candidates who are certified. Amatrol's 850 series Alternative Energy Learning System supports the learning necessary to prepare for portions of the solar and small wind certifications offered by such certifying groups as NABCEP (North American Board of Certified Energy Practitioners), SWCC (Small Wind Certification Council), and ETA (Electronics Technicians Association).

CURRICULUM IS THE KEY TO LEARNING

Learning Topics:

- Safety
- Solar Panel Operation
- Solar Panel Performance
- PV Array Connection
- Wind Turbine Operation
- Wind Turbine Performance
- Wind Turbine Connection
- Solar/Wind Batteries
- Charge Controllers
- Inverters
- Balance of System Components
- AC/DC Solar Systems
- AC/DC Wind Systems
- Energy Conservation and Demand
- System Performance

The 850-AEC Alternative Energy Learning System teaches students key skills needed for job success in small wind and solar. Students will learn hands-on skills they can use on the job. Critical skill areas covered are system connection, operation, and programming of solar PV (photovoltaic) and small wind systems in commercial and residential applications.

The Amatrol Alternative Energy Learning System - Wind and Solar includes a mobile workstation with solar PV components, small wind components, multimedia student curriculum, and teacher's assessment guide. The mobile workstation is equipped with pre-mounted components for easy inventory. Wind turbine and solar panels also allow for outside use with expansion capability for teaching grid-tie and data acquisition. Amatrol also offers alternate workstation configurations for either small wind or solar individually.

DESIGNED FOR LEARNING

Convenient Indoor / Outdoor Use

The Amatrol 850-AEC Learning System's wind and solar circuits can be used indoors with sun and wind simulators, or outdoors via the detachable solar panel array or client-supplied external wind and solar sources. The solar array easily disconnects from the workstation and sets up outdoors. The 850 Learning System can also be connected to client-supplied roof-top solar panels or wind turbines with the addition of optional interface connections.

85-SPA1 - Solar PV Array Station

85-SPS1 – Solar PV Sun Simulator

Real World Components: Multiple Panel Array and Modern Communications

Real world components commonly found in commercial and residential environments to help make learners job ready are showcased in the 850-AEC. For example, the 850 is equipped with a combiner box and a multiple panel solar array, allowing learners to connect panels in series and parallel. The MPPT charge controller, which is the most common controller used today, allows programming and communications from an LCD panel that are typical of current practices. The 400W wind turbine and diversion load controller are commonly found in small wind applications.

850-AEC Turbine

850-AEC Combiner Box

Interactive Multimedia Curriculum

Interactive, multimedia curriculum is included with the 850-AEC that enables it to support self-paced student learning or a traditional class setting as a presentation tool. The interactive, multimedia curriculum uses a competency-based instructional design that teaches industry standard skills. Eye popping graphics, 3D animations, video, audio and complete text explanations combine with strong interactivity to engage students and appeal to a variety of learning styles.

85-GT1 Grid-Tie Learning System

Grid Interactive and Data Acquisition Options

Amatrol's 850-AEC Learning System for wind and solar offers a number of options that can greatly expand the capability of the system. The 85-GT1 Grid-Tie Learning System - Solar features a single phase inverter that enables the system to connect to the classroom grid, typical of PV systems being installed today.

The 85-ADA1 Data Acquisition Learning System – Wind and Solar features a multi-point data acquisition module, PC software, and sensors that monitor voltage and current in various parts of both wind and solar circuits, enabling students to study operation via data analysis. Both options are panel-mounted units that easily add to the 850 workstation.

85-ADA1 Data Acquisition Learning System

TECHNICAL DATA

System Configurations
- Solar DC charge-controlled
- Solar AC stand-alone
- Wind DC charge-controlled
- Wind AC stand-alone
- Hybrid wind and solar

Workstation
- Welded and braced steel tube frame
- Dimensions: 72in (183 cm) L x 72in (183 cm) H x 28in (71 cm) W
- Swivel casters (4) with (2) locking
- Wind component circuit panel
- Solar component circuit panel
- Central component circuit panel
- Solar/wind battery, AGM type, 120 Ah, 12 volt
- Connector lead set
- Lockout/tagout set

Wind Component Circuit Panel
- Wind turbine, 400W horizontal
- Wind turbine simulator drive
- Simulator drive speed control
- Simulator drive power switch
- Diversion load controller
- Resistive load
- Stop switch
- Disconnect switches with circuit breakers (2)

Solar Component Circuit Panel
- Charge controller, MPPT type
- Combiner box
- Ground fault protector
- Disconnect switch with circuit breaker (2)
- Variable load control for solar array

Central Component Circuit Panel
- Inverter, single phase
- Utility power meter, analog
- AC load center with circuit breakers
- DC distribution section
- Battery disconnect switch
- Clamp-on multimeter
- Wattmeter
- DC ammeter, analog (2)
- Remote monitor LCD display, ethernet connection
- AC lamps (3)
- DC lamp holders (2)
- DC lamps (3)
- DC lamp holders (2)
- DC load switches (2)
- AC load switches (2)
- AC receptacle, dual
- AC disconnect switch
- DC disconnect switch

Instructor's Assessment Guide, C20103
Installation Guide, D20103
Multimedia, PC-Based Student Curriculum, M20103

Requires:
85-SPA1 – Solar PV Array Station
85-SPS1 - Solar PV Sun Simulator
PC – Windows XP or higher, see http://www.amatrol.com/support/computer-requirements

Options:
85-GT1 – Grid-Tie Learning System - Solar
85-ADA1 – Data Acquisition Learning System – Solar / Wind
950-SC1 – Solar Concepts Learning System (multimedia)
950-WC1 – Wind Concepts Learning System (multimedia)

20097 – Solar PV Interface (connect existing PV array)
20098 – Solar PV Extension Cable (for external array use)
20099 – Wind Turbine Interface (connect existing wind turbine)

SOLAR PV TROUBLESHOOTING LEARNING SYSTEM

950-SPT1

EMONA Instruments
Web: www.emona.com.au
Toll Free: 1800 632 953

Required 95-SPA1

Installing and maintaining solar photovoltaic (PV) systems requires hands-on skills and troubleshooting ability across the types of PV systems commonly used such as AC, DC, and grid-connected. Budding engineers and designers need to understand the technologies used in these systems as well.

CURRICULUM IS THE KEY TO LEARNING

Learning Topics:

- Module Operation
- PV Module Performance
- PV Array Connection
- Solar Batteries
- DC Solar PV Systems
- Charge Controllers
- AC Solar PV Systems
- PV Inverters
- Grid-Connected Systems
- Energy Conservation & Demand
- Solar PV System & Component Sizing
- Solar PV System Performance
- Troubleshooting Components
- System Troubleshooting
- PV Maintenance

Amatrol's 950-SPT1 Solar Photovoltaic Troubleshooting Learning System allows students to develop the specialized skills and knowledge needed for working with the common types of PV systems. The 950-SPT1 teaches students connection, operation, programming, and troubleshooting of AC/DC and grid-connected systems. The curriculum is PC-based multimedia that is highly interactive. It allows students to use the learning style best for them – reading, listening, visual. The 950-SPT1 supports the NABCEP (North American Board of Certified Energy Practitioners) test for Certified Solar Photovoltaic System Installer.

The 950-SPT1 includes all components needed to develop hands-on, job-ready skills: all solar specific components as well as balance of system items. The learning system contains a mobile workstation, component panels with breakers, combiner box, MPPT charge controller, lamps, batteries, meters, grid-connected inverter, a fault insertion system, PC-based multimedia student curriculum, and instructor's assessment guide. The required 95-SPA1 two-panel array provides a complete solar PV troubleshooting experience.

DESIGNED FOR LEARNING

Student Reacting to Electrical Fault

Computerized Fault Insertion

At the heart of a technician's skill set is the ability to troubleshoot a system. The 950-SPT1 is equipped with a wide array of electrical faults that allow instructors to replicate realistic system and component failures. For the 950-SPT1, Amatrol uses electronic fault insertion so that instructors can easily insert faults and track the student's troubleshooting results. Electric fault insertion prevents component damage while allowing instructors to see student progress. Instructors can identify specific areas the student needs to improve and target those areas. It also allows instructors to set-up faults ahead of time, allowing students to perform self-directed study when appropriate.

Balance of System Components – Replicates Real World PV System

Developing installation and troubleshooting skills for PV systems requires all the components commonly found in these systems. Elements included on the 950-SPT1 such as power distribution panels, a combiner box, disconnects, and circuit breakers are essential to create realistic systems and troubleshooting situations.


Circuit Breaker

Combiner Box

Grid-Connected and Micro Inverters

Solar applications are increasingly including grid-connected capability. In fact, grid-connected is the most common type of PV system being purchased today. This is a key component that allows maximum economic return – owners can sell excess power to the utility. Likewise, when solar power is not sufficient, additional power is often needed from the electrical grid.

Amatrol's 950-SPT1 includes a micro inverter in addition to the grid-tie inverter. This is also a very popular option that is frequently used to assign an inverter to each PV string. Both of these inverters are required to teach skills across all major types of AC systems including stand-alone AC, grid-connected AC, and grid-connected AC with storage.


Grid-Connected & Micro Inverters


Mate & Network Cables

Modern Communications and Programming

Modern solar technology installations frequently include network communications. The inverters and charge controller on Amatrol's Solar PV Troubleshooting enable students to learn how to network system components. Students also learn how to troubleshoot at the system level as well. The inverter and charge controller feature many modern programming capabilities which allow students to learn how to program the more sophisticated systems they are likely to encounter.

Mobile, Multiple PV Panels (Required 95-SPA1 Solar PV Array Station)

The required PV array for the 950-SPT1 contains multiple panels so that students can learn to connect a realistic array. Most solar technology applications have multiple panels. Students need to learn about the effects of series and parallel connections, which require more than one panel. Additionally, the 95-SPA1 Solar PV Array Station is mobile, allowing instructors to take advantage of sunny days without having to move the entire trainer. The array is equipped with sun simulation as well to enable indoor use.

TECHNICAL DATA

PV Systems Configurations

Pre-mounted components that allow creation of the following PV systems:

- DC charge controlled
- AC stand-alone
- AC grid-connected without battery backup
- AC grid-connected with battery backup

Mobile Workstation

- Dimensions 72" (183 cm) L x 72" (183 cm) H x 28" (71 cm) W
- Swivel casters (4) with 2 locking
- Square tube steel, welded and braced

Component Panels

The panels include the following components:

- DC disconnect switch with breaker
- AC disconnect switch with breaker
- Battery bank disconnect Switch with breaker
- Grid-tie inverter, 2.5kW
- MPPT charge controller with built-in programming interface
- Remote programmer unit for both charge controller and inverter
- Software for programming and monitoring
- Combiner box
- Bypass diode
- DC Distribution panel with breakers
- AC Distribution panel with breakers
- Utility power meters
- Ground fault detection and interruption device
- Surge arrestor
- DC-AC inverter
- AC lamps
- DC lamps
- DC-powered fan
- Manual switches
- Battery bank interface connection panel
- Batteries, AGM sealed type, 12 volt
- Lockout / tagout kit
- Interface connector to separate PV array
- Connector lead set
- Multi-meter
- Clamp-on ammeter
- Wattmeter

Fault Insertion System

- Faults to recreate actual component and system failure
- Troubleshooting test points for systems-level troubleshooting without disassembling components
- Electrical fault insertion using a computer-based fault insertion system, which includes PC-based software for control and tracking.

Multimedia, PC-Based Student Curriculum, M20104
Instructor's Assessment Guide, C20104


95-SPA1

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Tabletop Smart Factory Mechatronics

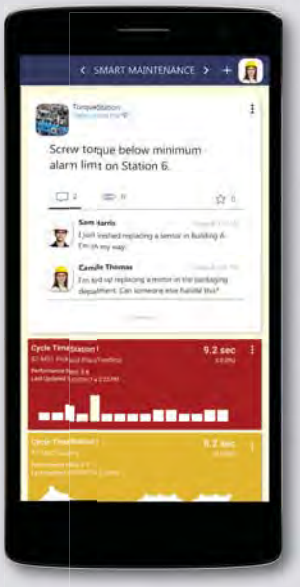
Hands-On Smart Factory Training With Industrial Sensors, I/O Link, and Cloud-Based Software

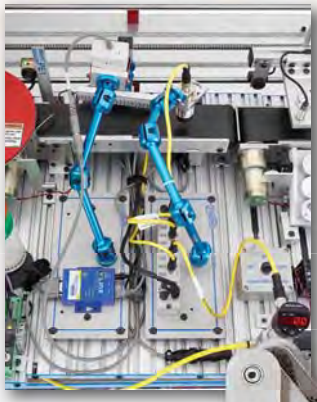
Hands-On Smart Performance

Visual Communication

87-TVCAB

- Visual Communications Software
- Mobile App Download
- Cloud-Based SCADA





87-TMS5AB1 and 87-TBR1AB

Smart Sensors

87-TMS5AB1

- RFID
- Photoelectric Sensor
- Pressure Sensor
- I/O Link Master
- Conveyor

Barcode Reader

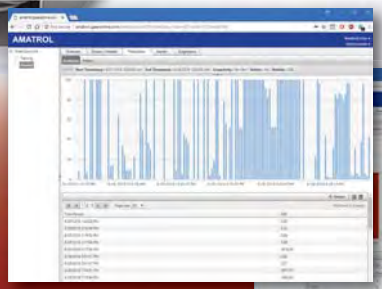
87-TBR1AB

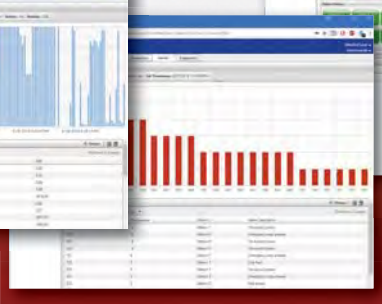
- Barcode Reader
- Ethernet-to-Serial Interface

Ethernet

87-TENAB82

- 24-port Unmanaged Ethernet S
- 8-port Managed Ethernet Switc





Manufacturing Execution

87-TMEAB

- Manufacturing Execution Software
- Cloud Hosting
- Control Multiple Sensors with One Program

Maintenance And Analysis

Amatrol Brings the Fourth Industrial Revolution Into Your Classroom!

Amatrol's Tabletop Mechatronics Smart Factory Learning System combines technology from the Industial Internet of Things (IIoT) such as smart sensors, cloud-based software, I/O Link, and mobile apps with traditional mechatronics equipment. This hands-on equipment and corresponding eLearning curriculum will catch future and current workforce members up with the cutting edge of manufacturing.

87-TMS5AB1 and 87-TBR1AB

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PLC Troubleshooting

990-PABCL1F

- I/O Link Interface for Mechatronics System Status
- Allen-Bradley L16 Processor
- FaultPro for electronically inserted fault troubleshooting

World-Class Interactive Multimedia Curriculum

Amatrol's multimedia curriculum utilizes text with voiceovers, pictures, videos, stunning 3D animations, and interactive quizzes. For specifics on Mechatronics multimedia, see the back page of this brochure.

Teach Industry 4.0 In Your Classroom

The world of Advanced Manufacturing is undergoing a new revolution as more businesses turn to Smart Factory technology to aid in the effectiveness, analytics , process efficiency, and communication within their facilities.

Tabletop Smart Factory Curriculum

Ethernet

87-TENAB82

- Industrial Networks
- Ethernet IP Addresses
- Network Performance
- Managed Switch Ethernet
- Switch Diagnostics

Barcode Reader

87-TBR1AB

- Barcode Operation
- Scan Accuracy
- Ethernet-to-Serial Interface
- Barcode Programming
- Function Blocks

Smart Sensors

87-TMS5AB1

- RFID Programming
- RFID Operation
- Photoelectric Sensors
- Pressure/Vacuum Sensors

Visual Communication

87-TVCAB

- Cloud-Based Data Acquisition
- SCADA Operation
- Configuring Cloud-Based SCADA
- Maintenance Management Operation
- Configuring Maintenance Management

Manufacturing Execution

87-TMEAB

- Order entry
- Scheduling
- Schedule Status
- Production Statistics
- Alarms

PLC Troubleshooting

990-PABCL1F

- Controller Operations
- PLC Program Operations
- PLC I/O Testing
- Event Sequencing
- Processor Troubleshooting

Amatrol's Industry 4.0 Fundamentals

The Tabletop Smart Factory is part of Amatrol's Industry 4.0 Fundamentals multi-course program. Amatrol's Industry 4.0 Fundamentals (I4F) program is a multi-course program designed to introduce students to Industry 4.0 and prepare them to pursue exciting careers related to Industry 4.0 technologies. I4F is divided into four courses: Introduction to Mechatronics, Industrial Control Systems, Robot Operations and Programming, and Industrial Internet of Things.

I4F Learning Systems

- Smart Factory Tabletop Mechatronics
- Portable AC/DC Electrical (990-ACDC1)
- Portable Electrical Control (990-EC1)
- Portable Pneumatics (990-PN1)
- Portable Measurement Tools (990-MES1)
- Robotics 1 &2 (96-ROB1 & ROB2)
- Portable Hydraulics 1 (990-BH1)
- CNC Machines (96-CNC1)
- Skill Boss (95-MSB)
- Portable Electronic Sensor (990-SN1)

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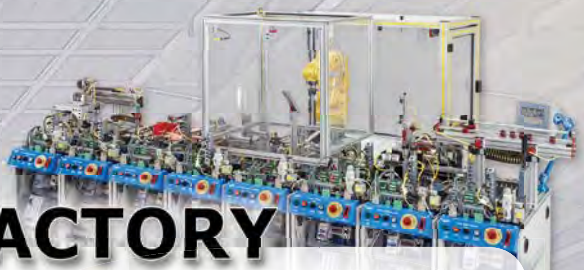
SMART FACTORY

AMATROL®

INDUSTRY 4.0

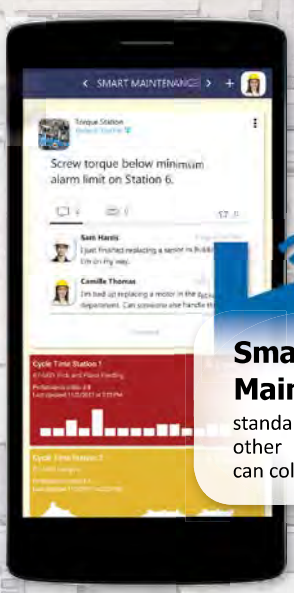
Smart Factory



Amatrol's "Smart Factory" is a fully connected & flexible manufacturing system that connects its physical systems, operational information, & human assets to control manufacturing, maintenance, inventory, & supply chain operations. Amatrol's in-depth curriculum teaches all aspects of smart factory maintenance & operation in a self-directed, interactive format.

Smart Production

Amatrol's Smart Production software teaches how smart factories perform customized (personalized) manufacturing and make data and data analytics available via the internet to improve system performance. Amatrol's Smart Factory assembles a pneumatic valve in various configurations based on orders entered. The valve can be ordered with a plastic or metal valve body & either a 3-way or 4-way spool.



Smart Maintenance

Smart Maintenance software utilizes smart device information to automatically trigger maintenance operations. Amatrol's Smart Factory uses industry standard software to connect users directly to the automated system & each other to create a real-world environment where maintenance team members can collaborate to resolve issues quickly and effectively.

AMATROL®

Smart Sensors

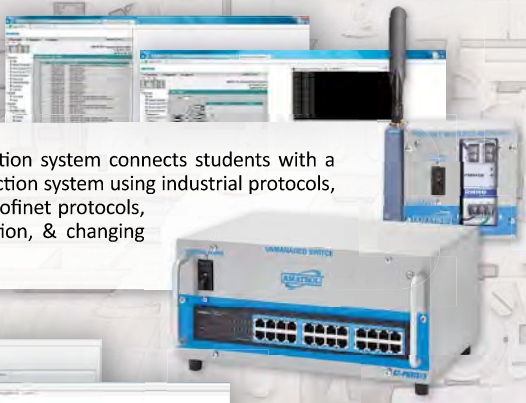
Amatrol utilizes multiple smart devices on the Smart Factory that communicate via Ethernet & I/O Link protocol providing flexible manufacturing, predictive maintenance, & data analytics capabilities.

Smart Product ID

Amatrol's Smart Factory incorporates smart product identification devices, such as vision systems & bar code readers, which trigger "intelligent" actions including parts tracking, production history, sorting, part accept/reject, & inventory control.

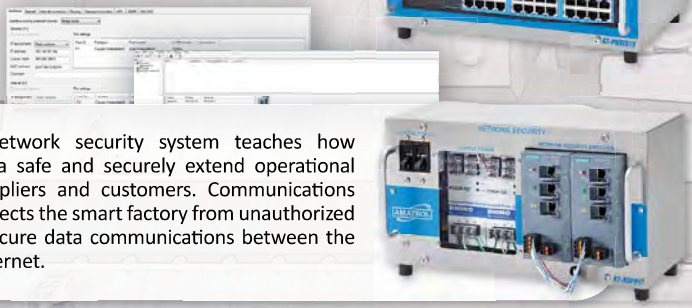
Network Communications

Amatrol's communication system connects students with a fully functional production system using industrial protocols, such as Ethernet & Profinet protocols, for real-time control, program transfer, data collection, & changing programs on the fly.



Network Security

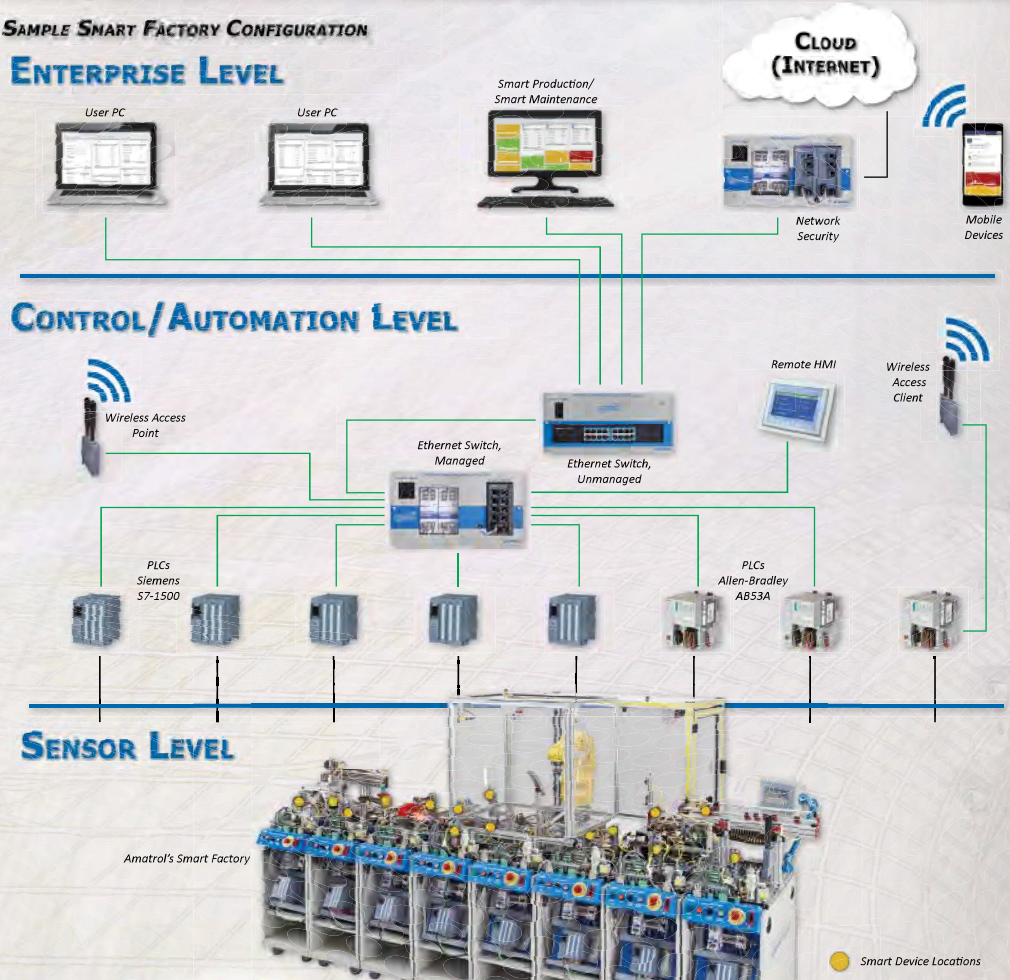
Amatrol's network security system teaches how to keep data safe and securely extend operational data to suppliers and customers. Communications security protects the smart factory from unauthorized outside access & provides secure data communications between the plant-wide network & the internet.



Smart Factory Skills are Key to a Rewarding Career!

Smart factories require highly trained technicians that can set up, operate and maintain all aspects of these systems. Amatrol's self-paced, interactive curriculum, provides individuals with the tools needed to prepare them for a successful career in this field.

Sample Smart Factory Configuration



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Email: contact@amatrol.com • www.amatrol.com

SIF-400

Smart Innovative Factory

The training system for Industry 4.0

Menu

INTERNET OF THINGS SOLUTION

Please contact us to purchase

This Internet of Things solution is designed to allow students to give consideration to current trends in technology.

- Suitable for BTEC Higher National Unit 45: Industrial systems
- Suitable for Internet of Things related courses at level 3 and beyond

MORE VIEWS


Description
Resources

Description

This Internet of Things solution is designed to allow students to give consideration to current trends in technology, including the future of industrial systems (with Industry 4.0 in mind), the impact of digital developments, the increase of wireless and remote control and the Internet of Things.

Our IoT kit comes with a basic guide, to using our Raspberry Pi based MIAC(s) with Node-RED - a flow-based IDE for visual programming for wiring together hardware devices, APIs and online services as part of the Internet of Things. Users of this kit send and receive data remotely via Wi-Fi using pre-built internet communication services.

The IoT solution also includes a small selection of Locktronics parts for example work, the pre-written guide is available through the resources in our online learning centre.

Learning objectives

- Development of Raspberry Pi based IoT applications
- Development of cloud-based IoT applications
- Exchanging data between IoT devices and cloud-based applications
- Utilising Node-RED as an IoT platform for learning and development
- Security implications for IoT
- Remote datalogging, sensing and control

Resources

Resource	Version	Type
CP6844 - Internet of Things (for MI0899)	1	

Introducing
KINOVA® Gen3 lite

The new standard in professional robotics for education

Bring your curriculum to the next level and give more students hands-on experience with these professional robots.

Easy to configure and program, the Gen3 lite is ideal to teach robotics manipulation to students across multiple disciplines (Mechatronics, Automation, Engineering, Computer Science, Manufacturing, etc.) and with all levels of robotics expertise.

5 ways to accelerate and simplify teaching with Gen3 lite

- Faster time from theory to actual robotic applications
- Adaptable for all levels of programming knowledge
- Fast and easy to install and share between classrooms and labs
- An open API, plus compatible with ROS, C++ and Python
- Intuitive Web interface from any desktop or mobile device

PLUG & PLAY

ULTRA LIGHTWEIGHT

SAFE & USER FRIENDLY

PORTABLE

POWER EFFICIENT

KINOVA® Gen3 lite
Technical Specifications

GENERAL

Weight	5.4 kg
Payload	500 g
Maximum reach	760 mm
Degrees of freedom	6
Maximum Cartesian translation speed	25 cm/s
Actuator joint range	+/- 155 to 160°
Power supply voltage	18 to 30 VDC, 24 VDC nominal
Average power	20 W
Ingress Protection	IP22
Operating temperature	0 °C to 40 °C
Sensors	Postion, current, voltage, temperature, accelerometer and gyroscope

INTERFACES

Software	KINOVA® KORTEX™
Internal communications	1 x 100 Mbps Ethernet
API compatibility	Window 10, Linux Ubuntu 16.04, ROS Kinetic
Programming languages	C++, Python
Basic interfaces	USB-A, micro USB, Ethernet, Wi-Fi
Control system frequency	1 kHz
Low-level control	Position, velocity, current
High-level control	Cartesian position/velocity, joint position/velocity

* Specifications have not been validated and are subject to change.

OP-04_2019-10-R01

Kinovarobotics.com
info@kinovarobotics.com
514-277-3777

AllCode robot arm production cell

Our robot arm production cell consists of a rugged servo controlled 6 degrees of freedom arm bolted to a base plate and a mat that provides a range of exercises mimicking industrial robot arm production cells. The arm itself delivers accurate and repeatable movement with base rotation, single plane shoulder, elbow, wrist motion, a functional gripper, and a wrist rotator. The arm is controlled by a dsPIC microcontroller with combo board (16 switches, 16 LEDs, 2 line 16 character LCD, quad 7-seg display and sensors), colour sensor board and Bluetooth board from our E-blocks range. The board can be programmed directly from Flowcode for dsPIC, or Microchip's MPLAB. A full Flowcode simulation is available free of charge. The control system is also shipped with a full Application Program Interface so that the robot can be controlled using any Bluetooth enabled device such as a PC, Android, or Apple MAC device using a range of software applications including C++, LabView, Python, and App Inventor as well as remote applications over the web. The kit is supplied with a number of coloured counters which can be moved by the arm into different locations in the work cell. A teacher's guide is available for download from our web site.

Learning objectives / experiments:

- Robot cell design and programming
- Microcontroller programming
- Sensors and actuators in robotics
- Kinematics: 3D movement in robotic systems
- Web based control
- Programming in many languages

Curriculum mapping:

- Suitable for unit 6 of the BTEC National: Microcontroller systems for engineers
- Suitable for unit 15 of BTEC Higher National: Automation, robotics and PLCs
- Suitable for unit 38 of the BTEC National: Web site production to control devices

Ordering information

AllCode robot arm production cell	RB6231
Corresponding curriculum	CP8656

See Formula AllCode section for full details

Curriculum mapping

- Suitable for unit 6 of the BTEC National: Microcontroller systems for engineers
- Suitable for unit 15 of BTEC Higher National: Automation, robotics and PLCs
- Suitable for various City & Guilds qualifications at Level 2 and beyond

Learning objectives / experiments:

- Programming mobile phones
- Football algorithm development

Curriculum mapping

- Suitable for technology or computer science syllabuses.

Introduction to Robotics

This training solution provides a course in robotics with a sequence of staged exercises including line following and maze solving. The course makes use of the high-specification Formula AllCode robot which can be programmed with a number of languages on various operating systems including Flowcode, App Inventor, Python and LabView. This is great for introducing students to programming and robotics in a fun and motivating way with huge scope for further work and competitions. The solutions are supplied with a large double-sided task mat and a set of maze walls.

Learning objectives / experiments:

- Microcontroller programming and robotics
- Programming concepts: input, system, output, loops, decision, subroutine, go to, calculations, delays, simple variables, A/D conversion
- Robotic components: switches, LEDs, light sensors, distance sensors, infrared sensors, audio level sensors, speaker, motor drivers, motors and gearboxes
- Robotic tactics including logo-like commands, power control, motion control and steering, motor characterisation, obstacle avoidance
- Progressive exercises include: light following, line following, song and dance, time trials, races, simple maze solving, creating custom mechanics

Ordering information

Formula AllCode deluxe kit	RB7971
Formula AllCode standard class set	RB7240
Formula AllCode deluxe class set	RB7518
Corresponding curriculum	CP5894

Formula AllCode football mat add-on

This football pitch is an add-on pack for our Formula Allcode which allows you to run football competitions to motivate and challenge your students. The pitch consists of a number of plastic walls that screw together to form the goals and corners, and a printed mat that goes underneath the walls. Ideally you would glue the mat to a plywood or MDF board. Two table tennis balls are included. Students are tasked with programming their mobile phones using App Inventor, or similar, to control their Allcode robots. Ideally 3 robots to a team.

Note: This add-on requires the Formula AllCode maze walls which feature in the RB7971, RB7240, RB7518 and are also available separately (see below).

Ordering information

Formula AllCode football mat add-on	RB4938
Maze walls	RB8962

Manufacturing engineering

The heart of our manufacturing engineering range is based on our new MicroCNC range of machines. The concept of these low cost CNC machines is simple: allow students to individually get lots of practice in manufacturing on a lower specification CNC machine before they progress to a more advanced industrial or educational machine. The machines are low voltage, low power, safe, easy to store and low cost. But don't be fooled: they are programmed just like production CNC machines, and the hours students spend on them really prepares students for CNC manufacturing.

We have developed an impressive learning process for students in this section:

- First, students design their parts using familiar CAD packages such as Autodesk, Solidworks or other software.
- Then, students take their designs to Deskproto or CamBam software (supplied by us), and use one of our MicroCNC machines alongside a Windows based G code editor to manufacture real parts.

This lower cost route to teaching design and manufacture using CNC technology gives students a great introduction to the principles of manufacturing engineering.

MicroCNC system controller and base plate

The MicroCNC system controller and base plate allows you to control our MicroCNC machines using a variety of software packages. The CNC system controller is compatible with our range of multi axis CNC machines. The base plate includes all power supplies and an industrial standard computer with stepper motor driver circuitry and a USB port for connection to your PC. The unit is fitted with a single IEC mains connector and includes a number of output sockets for the stepper motors of the CNC machines.

The individual machine components are easily fastened to the base plate, providing a solid and tidy machine which can easily be put away for storage. Windows compatible.

Ordering information

MicroCNC system controller and base plate	CN4079

2-axis MicroCNC lathe

The 2-axis MicroCNC lathe allows students to understand how G codes are used to control a CNC lathe. The two stepper motors and DC motor connect to our CNC system controller hardware to allow full control of the lathe using the G code file host software. Students can use the hardware and lathe to see how each G code command affects the lathe operation and they can create complex work pieces from wax cylinders.

This kit is stored in our standard plastic storage tray and can be assembled in minutes.

Learning objectives / experiments:

- Lathe construction and operation
- Simple G and M code protocol
- CNC machine operation using G codes
- Creation of milled parts using CNC technology

Supplied as a kit which needs modest assembly.

You will also need: MicroCNC system controller and base plate

Ordering information

2-axis MicroCNC lathe	CN2668
MicroCNC system controller and base plate	CN4079
Corresponding curriculum	CP7449

You will also need

CamBam software	CN8332/ CN2171

Curriculum mapping

- Suitable for unit 23 of BTEC Higher National: CAD/CAM
- Suitable for unit 43 of the BTEC National award in Engineering : Manufacturing CNC machine processes
- Suitable for various City & Guilds qualifications at Level 2 and beyond

Curriculum mapping

- Suitable for unit 23 of BTEC Higher National: CAD/CAM
- Suitable for unit 43 of the BTEC National award in Engineering : Manufacturing CNC machine processes
- Suitable for various City & Guilds qualifications at Level 2 and beyond

3-axis MicroCNC milling machine

The 3-axis MicroCNC milling machine allows students to understand how G codes are used to control a CNC operated milling machine. The three stepper motors and DC motor connect to our CNC system controller hardware to allow full control of the miller using the G code file host software. Students can use the hardware and software to see how each G code command affects the machine operation and create complex work pieces from polyurethane blocks or acrylic pieces.

Learning objectives / experiments:

- 3-axis CNC machine construction
- Simple G and M code protocol
- CNC machine operation using G codes
- Creation of milled parts using CNC technology

You will also need: MicroCNC system controller and base plate

Ordering information

3-axis MicroCNC milling machine	CN4234
MicroCNC system controller and base plate	CN4079
Corresponding curriculum	CP7449

You will also need

Deskproto CAM software	CN2498/ CN3075

Curriculum mapping

- Suitable for unit 23 of BTEC Higher National: CAD/CAM
- Suitable for unit 43 of the BTEC National award in Engineering : Manufacturing CNC machine processes
- Suitable for various City & Guilds qualifications at Level 2 and beyond

4-axis MicroCNC milling machine

The 4-axis MicroCNC milling machine allows students to understand how G codes are used to control a CNC operated milling machine. The four stepper motors and DC motor connect to our CNC system controller hardware to allow full control of the miller using the G code file host software. Students can use the hardware and software to see how each G code command affects the machine operation and create complex work pieces from polyurethane blocks or acrylic pieces.

Learning objectives / experiments:

- 4-axis CNC machine construction
- Simple G and M code protocol
- CNC machine operation using G codes
- Creation of milled parts using CNC technology

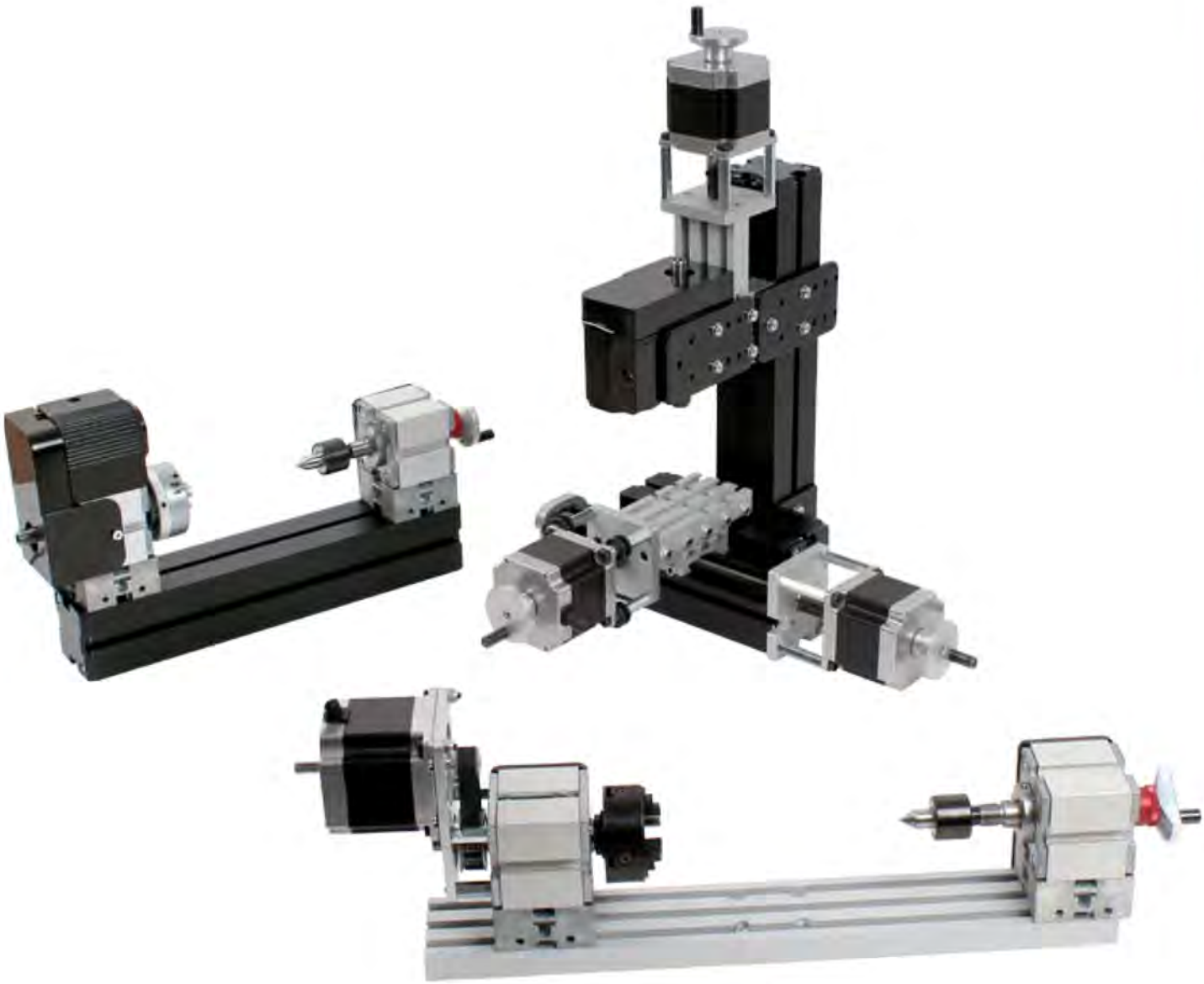
Supplied as a kit which needs modest assembly.
You will also need: MicroCNC system controller and base plate.

Ordering information

4-axis MicroCNC milling machine	CN8285
MicroCNC system controller and base plate	CN4079
Corresponding curriculum	CP7449

You will also need

Deskproto CAM software	CN2498/ CN3075



Complete MicroCNC set

This kit of parts allows students to assembly all four of our MicroCNC machines (only one at any one time). The kit is supplied with all necessary parts and is shipped with a full manual describing how each machine can be assembled. When combined with our system controller and base plate, students can then program each machine to manufacture parts in wax, acrylic and polyurethane blocks using G code editor supplier.

Learning objectives / experiments:

- Construction of a range of CNC machines
- G and M code commands and CNC programming
- Manufacturing a part using a G code editor
- Design of parts using a 3D package
- Manufacture of parts using a CAD CAM tool chain

You will also need the MicroCNC system controller and base plate

Curriculum mapping

- Suitable for unit 23 of BTEC Higher National: CAD/CAM
- Suitable for unit 43 of the BTEC National award in Engineering : Manufacturing CNC machine processes
- Suitable for various City & Guilds qualifications at Level 2 and beyond

Ordering information

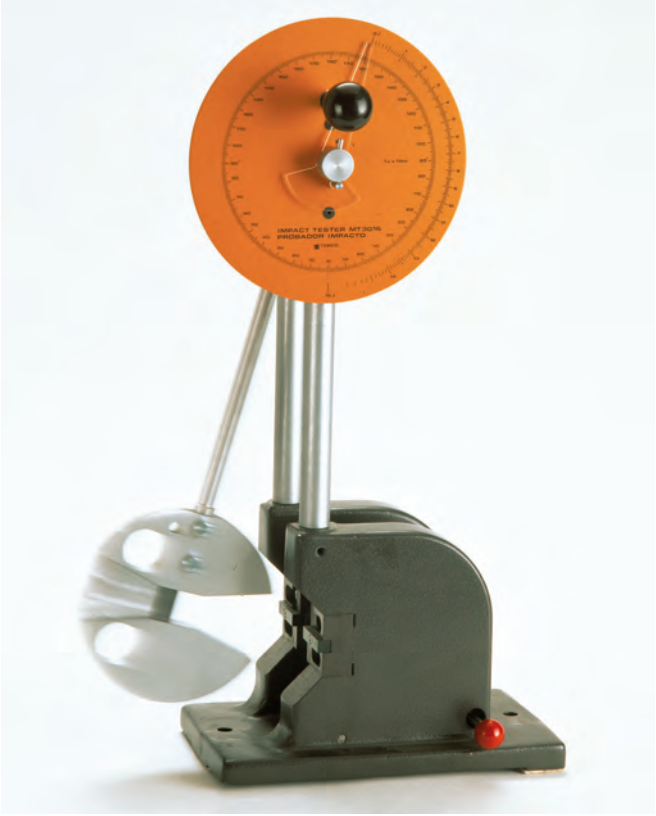
Complete MicroCNC set	CN3885
MicroCNC system controller and base plate	CN4079
Corresponding curriculum	CP7449

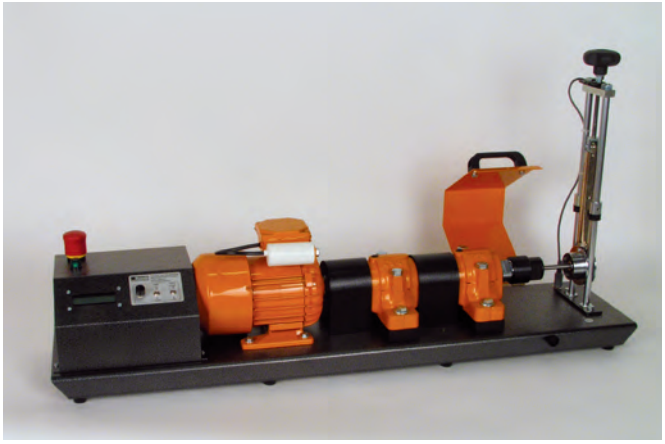
You will also need

Deskproto CAM software	CN2498/ CN3075
CamBam software	CN8332/ CN2171

TERCO

Material Testing Laboratory





MATERIAL TESTING LABORATORY

EQUIPMENT FOR TESTING STRENGTH OF MATERIALS

The equipment is of a conveniently small size which reduces costs. This makes it possible for schools and colleges to buy complete sets of equipment instead of only being able to afford one or two items. Large number of students can thus follow courses which were previously only available to a privileged few.

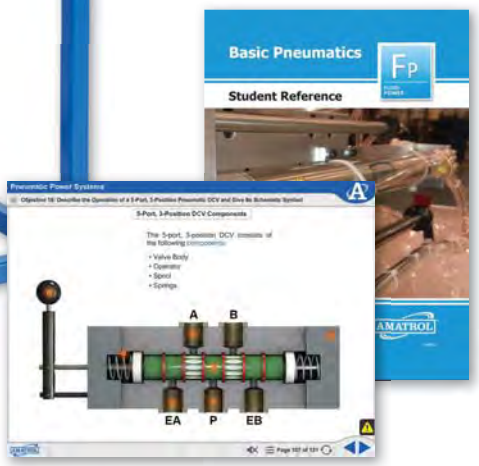
Ref.No.	
MT3005	Twist and Bend Testing Machine
MT3004-E	Strain Gauge Bridge
MT3017	Tensile and Brinell Testing Machine
MT3047	Computer Measuring Device
MT3007	Bending Test Set
MT3037	Universal Testing Machine
	Equipment List for MT3037
	Test Pieces
MTH500	Rockwell Hardness Tester
MTH600	Brinell Hardness Tester
MT3012-E	Fatigue Testing Machine
MT3016	Impact Tester

Basic Pneumatics Learning System - Single Surface Bench

850-P1

FP
FLUID POWER

850-P1



Interactive Multimedia Curriculum and Student Reference Guide

Learning Topics:

- Pneumatic Power Systems
- Basic Cylinder Circuits
- Basic Pneumatic Circuits
- Basic Motor Circuits
- Pneumatic Schematics
- Principles of Pneumatic Pressure and Flow
- Air Flow and Resistance
- Pneumatic Speed Control Circuits
- Air Flow Control and Measurement
- Flow Control Valves

Amatrol's Basic Pneumatics Learning System (850-P1) covers how to operate and install basic pneumatic systems, analyze performance, and design basic pneumatic circuits. Pneumatic power is a foundation of industry used in applications across fields like agriculture, pharmaceuticals, automation, and many more! The pneumatics training system requires a compressed air supply of dry, filtered shop air.

This hands-on pneumatics training system includes a mobile workstation, basic pneumatics panel, basic pneumatics instrumentation panel, and a pneumatic hose and fittings set. This system uses industrial quality components for durability and to help learners prepare for what they will encounter on the job. Learners will use these components to study major topic areas such as: pneumatic power systems, basic pneumatic circuits, principles of pneumatic pressure and flow, and pneumatic speed control circuits. The pneumatic training system covers basic pneumatic skills with the ability to add-on systems, such as Amatrol's Intermediate and Advanced Pneumatics Learning Systems, to expand the range of pneumatic knowledge and skills.

AMATROL®

Technical Data

Complete technical specifications available upon request.

Controls Technology Bench (850-CTB-B)
Basic Pneumatics Panel
- Air Motor Assembly
- Spring Return Cylinder Assembly
- Flow Control Assembly (2)
- Cylinder Assembly, 1 1/8-in.
- Lever-Operated Assembly
- Cylinder Assembly. 1 1/2-in.
- Rail Assembly, 10-in.
- Rail Assembly, 11-in.

Basic Pneumatics Instrumentation Panel
- Pressure Gauge Assembly (3)
- Filter Regulator Assembly
- Rotometer Assembly
- Manometer Assembly

Pneumatic Hose and Fittings Package (85-PHF)
- Hose Assembly, 42-in.
- Hose Assembly, 36-in. (2)
- Hose Assembly, 24-in. (4)
- Hose Assembly, 16-in. (4)
- Hose Assembly, 12-in. (2)
- Cross Assembly
- Basic Pneumatics Coiled Hose Assembly Tee (2)

Interactive Multimedia Curriculum (MB834)
Instructor's Guide (CB834)
Installation Guide (DB834)
Student Reference Guide (HB834)
Additional Requirements:
- Computer, see requirements: www.amatrol.com/support/computer-requirements

Utilities Required:
- Conditioned Shop Air, Dry and Filtered (2 CFM @ 100 PSI)

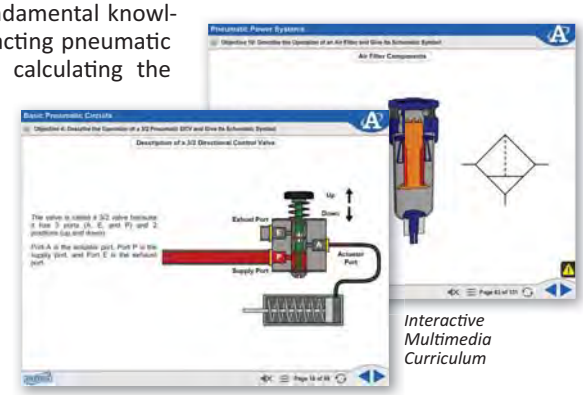
Build Hands-On Pneumatic Skills with Real-World Components

Industry Standard Components

Pneumatic training includes an array of pneumatic components including an air motor, cylinders, pressure gauges, filter regulator, rotometer, manometer, and many more! Learners will use these components to practice skills such as: use a cross to connect three circuit branches together; connect and operate a unidirectional pneumatic motor using a 3-way, manually-operated directional control valve; convert between gauge and absolute pressure; connect and read a flowmeter; and connect and operate a pressure port speed control circuit. This learning system also includes a mobile workstation constructed of heavy-duty welded steel that provides storage space for additional panels and a lockable drawer for pneumatic hoses storage.

In-Depth Foundational Pneumatics Multimedia Curriculum

Pneumatic training's world-class pneumatics curriculum covers major topics including circuit connections, single-acting cylinder circuits, pneumatic leverage, pressure and volume, and speed control. Learners will study fundamental knowledge like: the operation of a double-acting pneumatic cylinder; the function of a muffler; calculating the force output of a cylinder in retraction; and the effect of actuator load changes on flow control valve operation. This multimedia curriculum includes stunning 3D graphics and video, audio voiceovers of all text, and interactive quizzes and exercises.



Interactive Multimedia Curriculum

Expand Your Pneumatics Learning Experience and Training Capacity

850-P1 with 85-IP and 85-AP

Additional pneumatics learning systems can be added to extend the capabilities of the pneumatics training system to intermediate and advanced levels. The included workstation accommodates three panels at the same time on its work surface and stores an additional four panels under the work surface. Additional Amatrol pneumatics learning systems include Intermediate (85-IP), Advanced (85-AP), and Electro-Pneumatic (85-EP). If you require a larger pneumatics training capacity with limited training space, Amatrol also offers the Controls Technology Learning System – Basic Pneumatics, Double-Sided (850-PD1) that doubles the training capacity of the pneumatics training system without taking up additional space.

Student Reference Guide

A sample copy of the Basic Pneumatics Student Reference Guide is also included with the system for your evaluation. Sourced from the system's multimedia curriculum, the Student Reference Guide takes the entire series' technical content contained in the learning objectives and combines them into one perfectly-bound book. Student Reference Guides supplement this course by providing a condensed, inexpensive reference tool that learners will find invaluable once they finish their training making it the perfect course takeaway.

AMATROL®
Certified ISO 9001:2015

2400 Centennial Blvd. Jeffersonville, IN 47130 USA 800.264.8285 812.288.8285 www.amatrol.com

BASIC HYDRAULICS LEARNING SYSTEM

850-H1

EMONA Instruments
Web: www.emona.com.au
Toll Free: 1800 632 953

The 850-H1 Basic Hydraulics Learning System introduces industry-relevant hydraulic skills while showing how they apply to fundamental hydraulic principles, such as pressure and flow; this signature Amatrol approach to curriculum reinforces both theory and practice to produce a well-rounded understanding of the topic. As an example, after completing this learning system, students will not only understand concepts like flow rate versus cylinder speed and pressure versus cylinder force, but also be able to operate, install, design, and troubleshoot basic hydraulics for various applications.

CURRICULUM IS THE KEY TO LEARNING

Learning Topics:

- Hydraulic Power Systems
- Basic Hydraulic Circuits
- Principles of Hydraulic Pressure and Flow
- Hydraulic Speed Control
- Pressure Control Circuits
- Pumps
- Hydraulic Schematics
- Relief, Check, and Flow Control Valves
- Meter-In, Meter-Out, and Flow Control Circuits
- Sequence Valves
- Pressure Reducing Valves
- Troubleshooting

The 850-H1 includes gauges, manifolds, cylinders, valves (relief/sequence, pressure reducing, check, directional control), flow meter, and hydraulic motor, as well as a 500 psi hydraulic power unit, manifold set with shutoff valve, and an Amatrol workbench. These components are all industrial quality not only to ensure durability, but also to help learners become better prepared for what they will encounter on the job. All Amatrol products are made from top-notch materials and carefully crafted (hand-welded and painted) to create tough, attractive, well designed learning systems that will facilitate learning and serve teachers and students for years.

Additional learning systems are also available to extend the capabilities of the 850-H1 System to intermediate (85-IH) and advanced levels (85-AH). The 85-IH introduces advanced hydraulic components (pilot-operated check valves, two-position directional control valves, telescoping cylinders, etc.), explains how each works, and then shows how they relate to real-world applications, while the 85-AH trainer teaches learners about hydraulic performance analysis and maintenance.

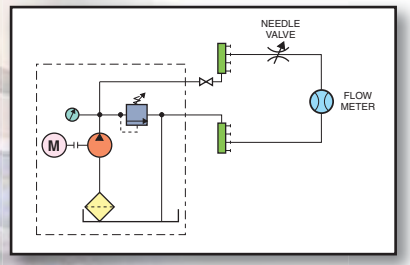
DESIGNED FOR LEARNING

Industrial Standard Components and Durable Workstation

Each 850-H1 system features standard industrial-grade components. This attention to quality gives learners experience they normally only get on the job by helping them recognize industrial components and troubleshoot them more effectively. The 850-H1's mobile workstation is constructed of durable welded steel to provide a sturdy, long-lasting learning station. Storage slots are located under the work surface where learners can conveniently store component panels until they are needed. Additionally, the system's orderly, user-friendly design helps learners to easily recognize how each component fits into a hydraulic circuit.

Hydraulic valve module in storage with swing-out hose rack to the side

Real-World Conditions

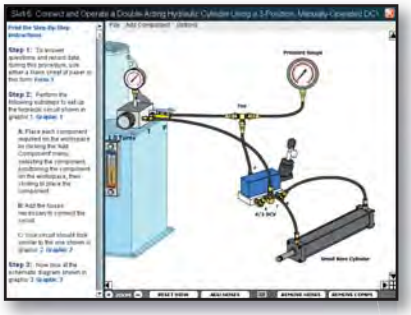


Schematic diagram for measuring needle valve flow rate

Within the 850-H1 curriculum, students will first learn about the physical principles of hydraulics and how hydraulic mechanisms are used in real world applications. From this building block, learners begin constructing hydraulic circuits, which gradually increase in difficulty and number of industry-standard components as the curriculum goes along. By taking this approach, learners will understand each component's function in a circuit, which makes troubleshooting easier in later lessons and on more advanced learning systems. Students will learn about pumps, gauges, hydraulic motors, cylinders, and numerous valves, including schematic symbols for each component, creating the ability to read and draw their own hydraulic schematics.

Optional Virtual Trainer

Amatrol's Basic Hydraulics virtual trainer (VB831) enhances the educational potential of this learning system by recreating hydraulic equipment in such realistic detail that learners can seamlessly transition to actual hands-on equipment. In fact, learners will perform the same tasks in a virtual environment that can be replicated on real-world hardware. This virtual trainer will teach skills that can help even more learners build toward a brighter future.



Small bore cylinder hydraulic circuit

Expanded Learning Options

Students can build on the skills they have acquired from the 850-H1 by moving onto the intermediate (85-IH) and advanced (85-AH) Amatrol Hydraulics Learning Systems, as well as the Electro-Hydraulics Learning System (85-EH) and Electro-Fluid Power Learning System (85-EF). The 85-EF covers electrical relay control of hydraulic and pneumatic systems, dealing with topics such as control transformers, fuses and circuit breakers, and solenoid operated directional control valves. The 85-EH concentrates solely on hydraulic systems in relation to electrical relay control through topics like pushbuttons, ladder diagram schematics, and selector switches.

The 850-H1 with 85-BH, 85-IH, and 85-EF

TECHNICAL DATA

Mobile Workstation
- Welded steel frame construction
- Dimensions 35 in (89 cm) H x 24 in (61 cm) W x 85 in (216 cm) L
- Heavy-duty lockable casters
- Slide-in storage racks for both circuit panel and instrumentation modules
- Drip pan, accommodating three circuit panel modules
- Drip pan drain
- Mounting slots for three instrumentation modules
- Hanging hose storage with separate drip pan
- Hydraulic pressure manifold, pre-plumbed to power unit, 4-port
- Shutoff valve
- Hydraulic return manifold, pre-plumbed to power unit, 4-port

Hydraulic Power Unit
- Flow rate: 2.5 GPM/ 9.5 LPM
- Maximum pressure: 500 psi/ 3450 kPa
- Pump, fixed gear type
- Electric motor, 1 hp
- Reservoir, 5 gal / 19 liters, suction filter, strainer type
- Relief valve, pilot-operated type
- Filler-breather cap
- Pressure gauge, 2 in, 0-1000 psi, liquid filled, safety relief
- Electric motor starter, with start and stop pushbuttons
- Power cord
- Hose line, plumbed to pressure manifold with shutoff valve
- Hose line, plumbed to return manifold
- Oil level gauge with temperature gauge

Basic Hydraulic Valve Module
- Mounting panel, horizontal, stainless-steel with (2) lift handles
- Directional control valve, 3-position, lever-operated, closed center
- Needle valve
- Pilot-operated relief / sequence valve
- Pressure reducing valve
- Check valves (2), one with fitting tees
- Hoses (12), with quick connect fittings
- Open end male quick connect fittings (2)
- Quick connect tees (2)

Basic Hydraulic Actuator Module
- Stainless-steel horizontal mounting panel with (2) lift handles
- Double acting cylinder, 1 1/8 in bore x 6 in stroke, with cam
- Double acting cylinder, 1 1/2 in bore x 4 in stroke, with cam
- Hydraulic motor, with flywheel
- Flow control valves (2), needle-valve type, integral reverse free-flow check valve
- Linear load device, providing friction, compression and tension, high impact resistance transparent guard
- Limit switch mounting tracks (2), positioned for cylinder cam operation

Hydraulic Instrumentation Module
- Mounting panel, vertical, steel
- Pressure gauges (3), 0-1000 psi range, liquid-filled, with blow-out relief
- Flow meter, 0-5 GPM range

Student Learning Activity Packet Set, BB831
Instructor's Guide, CB831

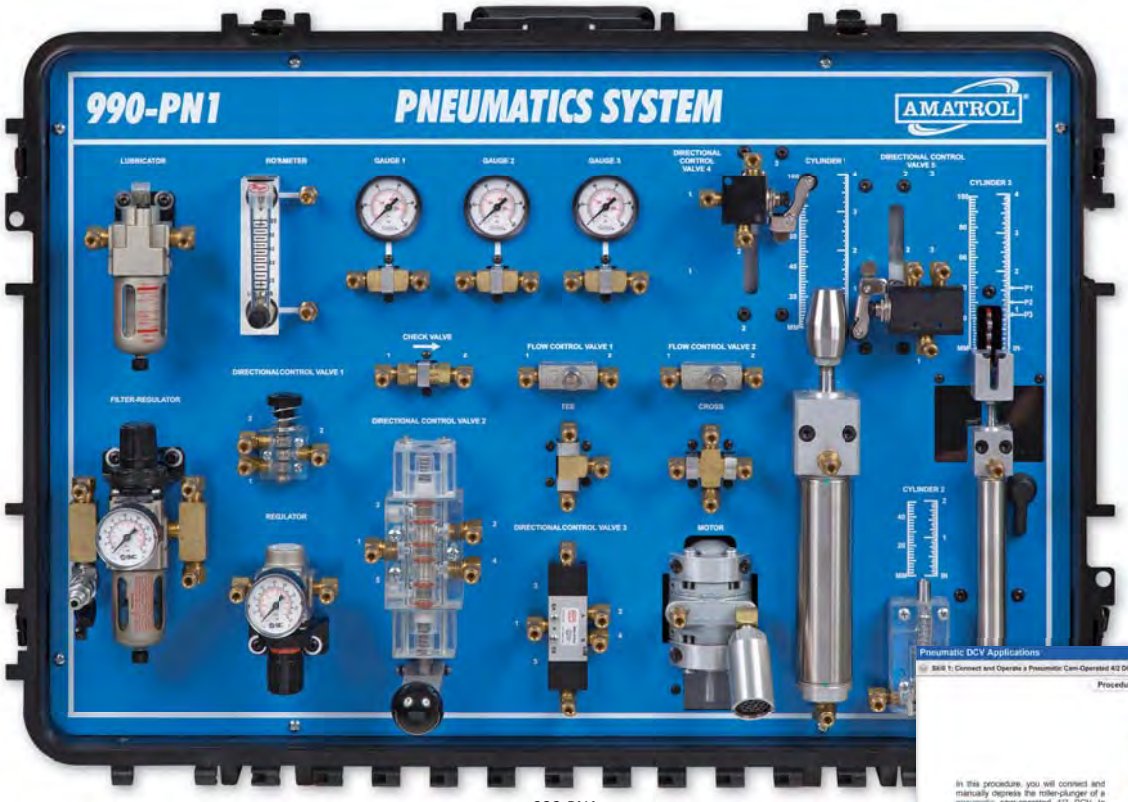
Power Requirements:
- 1-Phase, 110 VAC, 60 Hz, 6 Amps or
- 1-Phase, 230 VAC, 50 Hz, 6 Amps

Additional Required Items:
- Hydraulic oil: 10 gallons, 16391
- Hand tool package- hydraulic systems, 41220
- See http://www.amatrol.com/support/computer-requirements

Portable Pneumatics Learning System

990-PN1

FP
FLUID POWER



990-PN1

Interactive Multimedia Curriculum and Student Reference Guide

Learning Topics:

- Pneumatic Power Systems
- Pneumatic Circuits
- Schematics
- Pressure and Flow
- Air Flow and Resistance
- Speed Control Circuits
- Flow Control Valves
- Directional Control Valves
- Cam Valves
- Air Logic
- Pneumatic Maintenance

Amatrol's Portable Pneumatics Learning System (990-PN1) teaches basic and intermediate pneumatic concepts. Pneumatic power is a foundation of industry used in many applications across a wide variety of fields, such as agriculture, pharmaceuticals, and automation. Learners will gain critical hands-on experience operating pneumatic cylinders, flow controls, directional control valves, air motors, and pressure gauges. This system requires a compressed air supply, a Hand Tool Package (41221), and a computer.

This portable, highly-durable learning system features real-world pneumatic components, including a rotameter, pressure gauges, flow control valves, directional control valves, and much more! Users will learn to use pneumatic hoses included with the system to create working pneumatic circuits from schematics and practice skills, such as connecting and reading a flowmeter and operating a cam-operated sequence circuit. Amatrol's commitment to quality and detail ensures that learners will work with components they'll actually use on the job.

AMATROL®

Technical Data

Complete technical specifications available upon request.

Portable case
Rotameter
Pressure Gauges, 0-1000 PSI (3)
Lubricator
Pressure Regulator, Non-Relieving
Filter/Regulator, Manifold
Check Valve
Tee
Cross
Flow Control Valves (2)
Air Motor
Directional Control Valve, Lever
Directional Control Valve, Pilot
Directional Control Valve, Push Button
Directional Control Valve, 3/2 Cam
Directional Control Valve, 5/2 Cam
Large Double-Acting Cylinder, 1 ½" bore
Small Double-Acting Cylinder, ¾" bore
Single-Acting Cylinder
Loose Components Kit
- Micronic Filter Patch
- Impingement Device
- Syringe, 10cc
- Filter Element, 5 micron
- Filter Element, 20 micron
- Filter Element, 70 micron
- Lever Arm Link Assembly

Hose Kit
- 6" Hose Assembly
- 12" Hose Assembly
- 18" Hose Assembly
- 24" Hose Assembly
- 12" Hose with one quick connect

Multimedia Curriculum (M11139)
Instructor's Guide (C11139)
Install Guide (D11139)
Student Reference Guide (H11139)
Additional Requirements:
- Compressed Air Supply (2 CFM @ 100 PSIG)
- Hand Tool Package (41221)
- Computer (Visit www.amatrol.com/support/computer-requirements for details.)

Utilities:
- Electricity: 120VAC/60Hz/1 phase

Study Pneumatic Components and Practice on Real-World Equipment

Amatrol's Portable Pneumatics Learning System packs a full array of basic and intermediate pneumatic theory and skills into a powerful mobile workstation. Major topic areas include various pneumatic and speed control circuits, directional control valves, air flow and resistance, and flow control and cam valves. Learners will study, for example, the applications, schematic symbol, and operation of a 3/2 pneumatic directional control valve (DCV). They will then implement this knowledge by practicing the hands-on skill of using a 3/2 manually-operated DCV to operate a single-acting pneumatic cylinder.

Interactive Multimedia Demonstrates Hands-On Skills

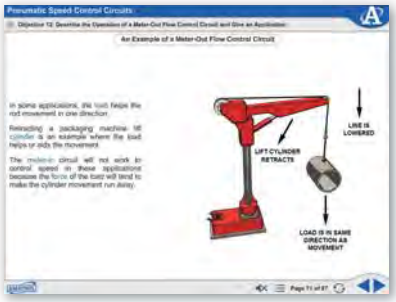
Air Filter on the 990-PN1

Learn Pneumatic Maintenance Skills

Because air is filled with contaminants, like dirt, pollen, and water vapor, pneumatic equipment may experience rusted pipes, worn parts, and broken seals if not properly and carefully maintained. On the 990-PN1, learners will study common sources of contamination, how the dew point and humidity can affect pneumatic equipment, and why eliminating air leaks is critical. They will also gain hands-on experience with skills like selecting and changing air filters, connecting and adjusting a lubricator, and calibrating gauges.

Engaging, Highly-Interactive Multimedia

Amatrol's curriculum features a highly-interactive, multimedia format that includes stunning 3D graphics and videos, voiceovers of all text, and interactive quizzes and exercises designed to appeal to learners with different learning styles. The 990-PN1's curriculum teaches learners a variety of basic and intermediate pneumatics concepts. For example, learners will study a variety of different types of speed control circuits and gain experience connecting and operating meter-out flow control circuits, as well as exhaust port, pressure port, and independent speed control circuits. The combination of theoretical knowledge and hands-on skills solidifies understanding and creates a strong basis for pursuing more advanced skills.



Interactive Multimedia with 3D Graphics

Student Reference Guide

A sample copy of the Pneumatics Student Reference Guide is also included with the system for your evaluation. Sourced from the system's curriculum, the Student Reference Guide takes the entire series' technical content contained in the learning objectives and combines them into one perfectly-bound book. Student Reference Guides supplement this course by providing a condensed, inexpensive reference tool that learners will find invaluable once they finish their training, making it the perfect course takeaway.

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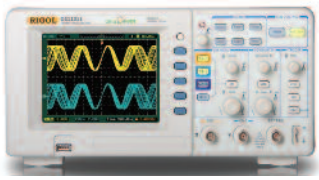

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