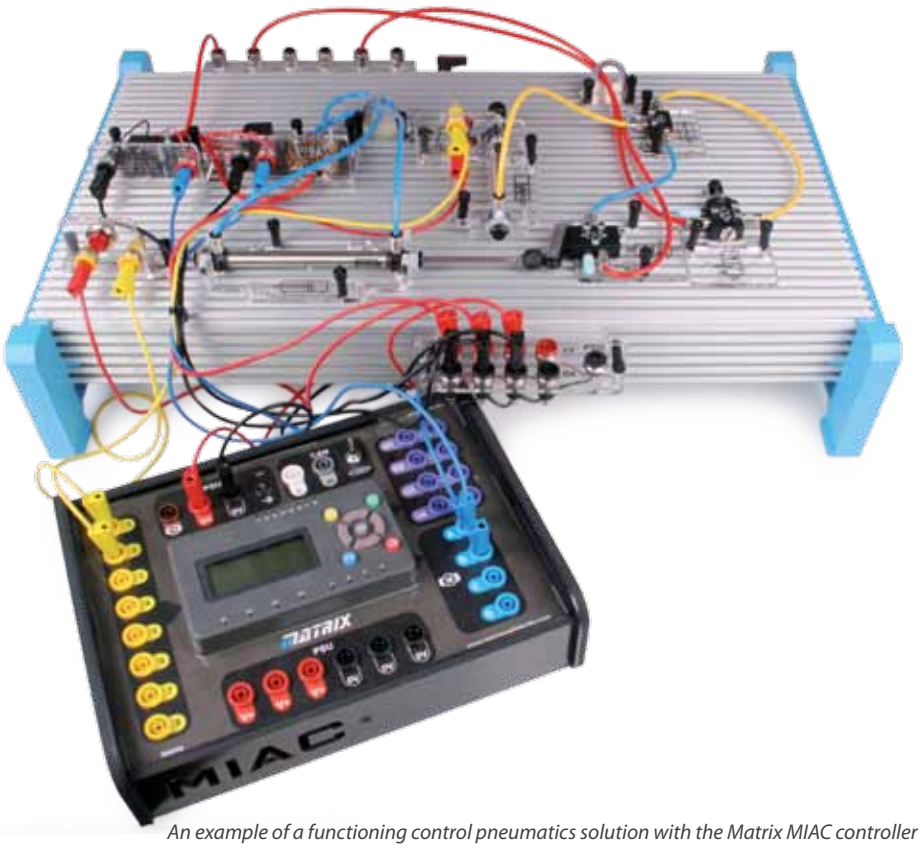
AUTOMATICS

5

Contents



An example of a functioning control pneumatics solution with the Matrix MIAC controller

What is Automatics?

Simplifying pneumatics and automation

Automatics is a range of products that simplifies the process of teaching and learning about pneumatics and automation systems.

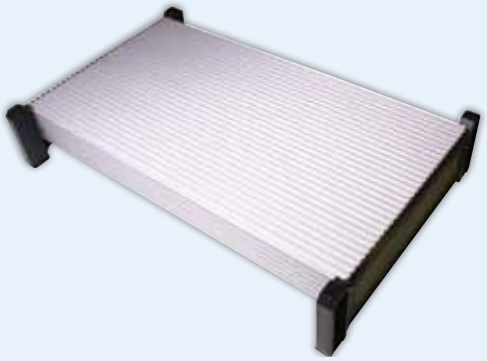
The Automatics range consists of around 100 separate rugged components that mount onto a stable aluminium platform. Components are clearly marked with the appropriate pneumatic or electrical symbol. Students take the rugged components, mount them to the platform using plastic 'tee' bolts, and connect the components together with nylon tubing to build working pneumatic circuits.

They then use the curriculum provided to carry out experiments in pneumatic and electronic control.

Disciplines include:

- Pneumatics
- Automation
- Design technology

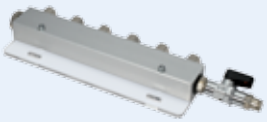
The Automatics range includes:



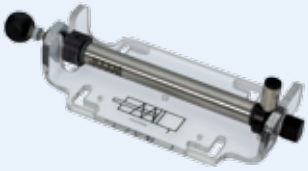
A rugged aluminium platform

To which students add...

A compressor



A manifold

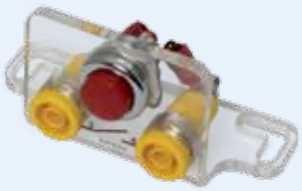


Cylinders

Mechanical valves

Electrical valves

Connectors



Switches and sensors

A controller

Pneumatic tubing

Electrical cables

Automatics platform

The extruded aluminium platform provides a solid foundation to which the other components are fixed. It is large enough to provide a comfortable work area for the largest of the circuits in our curriculum worksheets.

Reliability and robustness

Automatics has been designed from the ground up to suit the classroom environment. The pneumatic components are identical to those used by real engineers, but we have cleverly adapted them so that students can construct automation systems speedily and without requiring any tools.

Simple to connect

The compressed air supply is distributed using plastic tubing that is easily cut to length. This simply pushes into the component connectors. To release the tube, simply depress the connector collar and pull out the tube.

Carriers and symbols

Each component is secured to a clear acrylic carrier. The carrier is printed with a product code for easy identification, and the industry standard symbol for the part. Slots in the carrier allow for easy positioning in any orientation on the platform.

Tee-bolt fixings

Components are attached to the slots on the sturdy aluminium platform using plastic tee-bolts. These are easily secured and released without requiring any tools, allowing components to be quickly positioned and held firmly in place.

4mm connectors

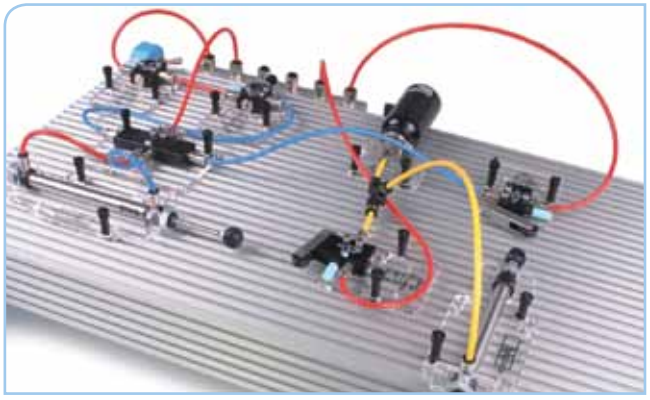
For components which require electrical connections, we have used standard 4mm single pole connectors which are suitable for 'safety' shrouded plugs. Suitable leads are provided when you purchase any kit of components.

Full curriculum support and courseware

Our Automatics courseware CD ROM contains a complete student centered interactive course on pneumatic system design. High quality worksheets are supplied in electronic format on CD ROM with each kit. Worksheets are all free of charge and contain clear well written instructions for each experiment. Teachers can hand students a full manual, or can print just the worksheets required.

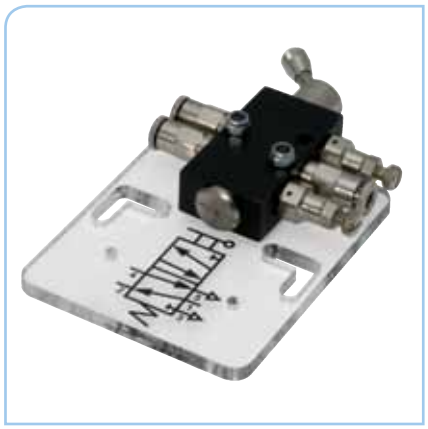
Software and control system support

Students learn to design control pneumatics systems using Matrix's Flowcode software which is based on flow charts. Control systems are based on our MIAC controller which is designed with education in mind.



A typical Automatics project

All pneumatic fittngs are quick release



Circuit symbol clearly printed on each carrier

Quick release tee-bolts

Standard 4mm cables used for all electrical connections

Automatics is more than just a range of hardware - it also offers a suite of learning resources that assist both students and educators to maximise the educational value of the equipment.

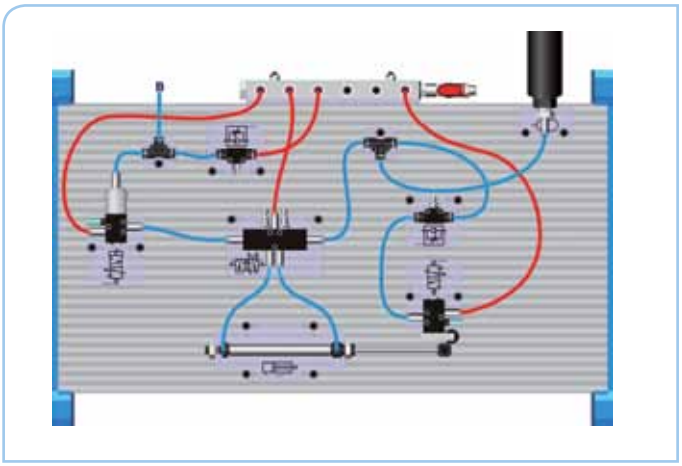
The curriculum CD

Our curriculum CD-ROM includes a set of .pdf workbooks that provide lesson plans, student worksheets and teacher's notes for a variety of courses that can be used individually or as a coherent series.

Each workbook is professionally written by experienced teachers who have used the Automatics hardware in a real learning environment.

Ordering information	
Automatics essentials	AW2080
Electro-pneumatics	AW2079
Control pneumatics	AW4956
Control pneumatics plus	AW4957

Students are guided through each subject in a logical sequence with clear, concise learning objectives at each stage, complete with quizzes and short tests by which their progress can be assessed.



For each curriculum objective, there is a worksheet designed to be printed and handed out to students, with areas set aside for them to enter the results and conclusions of their experiments.

Throughout each worksheet, pictures and diagrams of the Automatics hardware are used to make setting up the experiments easy. Examples from real world applications help students to understand the context of what they are learning, helped by our use of internationally recognised symbols for all of the components.

The curriculum CD, complete with every Automatics course, is provided free with every kit.

5

Simplifying kit selection

While it is perfectly possible to assemble your own custom collection of Automatics parts, there is a much simpler way to ensure that you have everything you need.

For each of our curriculum courses, we have put together kits of parts that include almost everything that you need to be able to teach a course.

This has several advantages over buying separate components...

- It takes the hard work out of choosing the appropriate equipment.
- You will receive generous quantities of 'consumables' such as pneumatic tubing and fixings.
- Power supplies and tools are included where necessary.
- Shipped in sturdy ABS plastic storage trays.
- Programmable items, such as the MIAC controller, are pre-programmed with all of the programs that you'll need to complete our curriculum courses.

And, naturally, every curriculum and kit of components is extensively tested here at Matrix; so you can be sure that every worksheet experiment will work as intended!

Solutions

A 'solution' is a stand-alone set of equipment that provides everything necessary to teach an associated curriculum course.

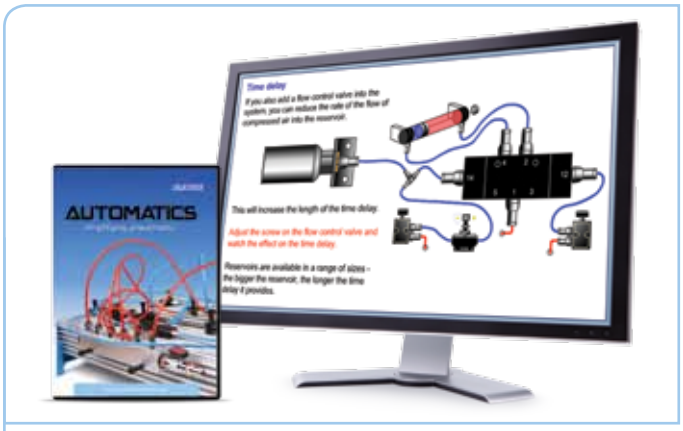
In addition, solutions can be used to provide a 'core' of essential components which can be expanded with more specialist parts once the basic principles have been mastered.

As many workshops and laboratories may already have a suitable compressed air supply, an air compressor and conditioning unit is the only item that is not supplied as standard. We do however offer a suitable unit at very reasonable cost should you require it.

Add-on packs

Add-on packs are designed to extend the features of a core solution, to save you from having to purchase duplicate equipment if you intend to teach more than one curriculum course.

For example, the Automatics essentials solution can be extended with the Control add-on kit as your students progress from learning basic pneumatic principles to more advanced programmable control applications.



Automatics interactive courseware

The automatics interactive courseware is a complete pneumatics and automation curriculum in the form of an interactive PC application.

Students are guided through the construction of systems using onscreen simulations of the physical Automatics components and a simple drag and drop interface.

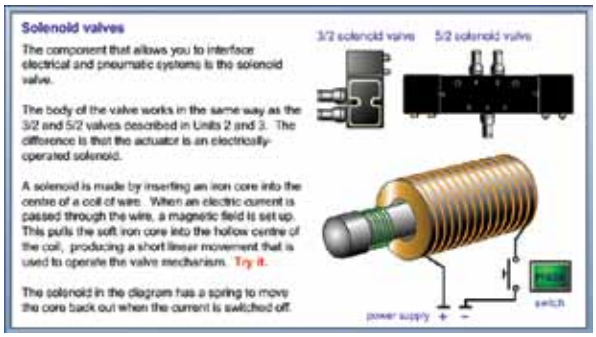
The courseware is a complete curriculum, covering everything from basic component identification and learning circuit symbols, through to the construction of complete automated systems.

The similarity between the graphical representation and real components then make it very simple for students to apply what they have learned when they are constructing real systems using the Automatics hardware solutions.

Automatics interactive courseware is compatible with all versions of Windows from Windows 95 upwards, and has very modest PC requirements. It is available with an educational site licence.

Learning objectives

- Single and double acting cylinders
- Three port valves, valve actuators, flow control valves, five port valves, pilot-operated five port valves
- Piston speed control with flow control valves.
- Semi-automatic return circuits, automatic return circuits and applications
- Reservoirs, time delays and applications, diaphragm valves, pressure decay sensing,
- AND and OR functions
- Sequential circuits and applications, cascade method
- Electrical control of pneumatics with solenoid valves, switches, toggle switches, microswitches, reed switches, and computer control
- Circuit diagrams and circuit symbols
- Force exerted by a cylinder and calculations
- Instroke and outstroke forces and calculations
- Construction of pneumatic and electropneumatic systems.



Virtual lab on solenoid valves

Ordering information	
Automatics interactive courseware site licence	AW20780

The Automatics essentials solution

This kit provides a complete introduction to pneumatic circuit design and construction. The curriculum pack includes a comprehensive set of worksheets that allow students to progress from first principles through to circuits of moderate complexity; including reciprocating circuits and generating sequences of movements.

The solution is intended for students in their early teens and older who are learning technology and engineering subjects. Tasks are designed to be suitable for pairs of students sharing a single kit. Everything you will need to teach the course is included in the solution pack, with the exception of an air compressor.

Learning objectives

- Understanding the different varieties of valves, and where each is appropriate in a system
- Understanding the basic types of cylinder, controlling speed, and the factors that influence power output
- Combining valves to produce logic functions
- Semi-automatic and automatic reciprocation
- Creating sequences of movements
- Using reservoirs to create time delays
- Air bleed and pilot operated circuits
- Component symbols and circuit diagrams
- Staying safe when using air at high pressure

Components included			
1	Cylinder, single acting	2	Cylinder, double acting
1	Valve, 3/2, button-spring	1	Valve, 3/2, lever-spring
4	Valve, 3/2, roller-spring	1	Valve, 3/2, diaphragm
1	Valve, 5/2, lever-spring	3	Valve, 5/2, pilot-pilot
1	Valve, shuttle	2	Valve, flow control
1	Reservoir	1	Automatics platform
1	Manifold	1	Tubing, red, 5 m
1	Tubing, yellow, 30 m	1	Tubing, blue, 30 m
4	Connector, tee junction	1	Tee bolts (pack of 50)
1	Tube cutting tool	1	Curriculum CD ROM
1	Set of storage trays		

Ordering information	
Automatics essentials solution	AW20801
You may also need...	
Compressor	AW30100

AW20792

Electro-pneumatics add-on kit

This kit supplements the Automatics essentials solution by adding a selection of electrically operated valves, and a range of sensors. By following the curriculum, students will learn how to use these new components to create systems in which pneumatics and electrical circuits are combined into complete systems.

The electrical components are connected together quickly and reliably using 4mm connectors, for which all of the necessary leads and accessories are provided. Electrical components are robustly mounted to the Automatics platform using the same 'tee' bolt system used for the pneumatic parts, and are printed with standard circuit symbols.

Working two to a kit, students follow the detailed worksheets to gain a comprehensive understanding of electro-pneumatics. By the end of the course, students will be able to create reciprocating and sequential circuits, and will have an understanding of how these are used to solve real world engineering problems.

Learning objectives

- Understand the operation of electrically controlled pneumatic valves
- Use of electrical switching to control circuit operation
- Using microswitches to sense cylinder position
- Sensing position without physical contact using reed switches
- Expressing electrical circuits using ladder diagrams
- Electrically operated reciprocal circuits
- Sequential control circuits
- Analysing real world problems and formulating solutions

Components included			
2	Reed switch and holder	2	Switch, push to make
2	Microswitch	1	Valve, 3/2, solenoid-spring
1	Valve, 5/2, solenoid -spring	2	Valve, double solenoid
6	Lead, 4mm plugs, black	6	Lead, 4mm plugs, red
1	Power supply	1	Curriculum CD ROM

Ordering information	
Electro-pneumatics add-on kit	AW20792

You may also need...	
Automatics essentials solution	AW20801

AW4955

5

Pneumatics control add-on kit

This kit extends your Automatics pneumatics solution by adding a powerful programmable microcontroller unit, the MIAC, together with the pneumatic components necessary to put it through its paces.

By following the included curriculum, students will learn how the combination of a controller and custom software can create powerful and flexible pneumatic systems.

Students will learn how to establish the state of a pneumatic machine using sensors, the use of logic to process that data, and the issuing of commands to the included solenoid valves.

Two versions of the curriculum are supplied. In the first, students use pre-programmed control systems supplied in the MIAC's built in memory. A more advanced course, Control plus, teaches students how to write their own programs for the controller.

Learning objectives

- Reading sensors and switches
- Issuing commands to the pneumatic circuits
- Learning the difference between digital and analogue signals
- Using flowcharts to visualise programs
- Program flow and decision making
- Programming sequences
- Using feedback to enhance reliability and improve safety

Control Plus

This curriculum introduces students to writing their own programs for the control system.

This is done using our Flowcode software - which makes programming easy by using graphical flowcharts. Note that you may need to purchase Flowcode separately.

Components included			
1	MIAC controller	2	Switch, push to make
1	Reed switch and holder	2	Valve, flow control
1	Light sensor	4	Valve, 3/2, solenoid-spring
1	Power supply	1	Power distribution carrier
6	Lead, 4mm plugs, red	6	Lead, 4mm plugs, black
2	Lead, 4mm plugs, yellow	1	Curriculum CD ROM

Ordering information	
Automatics control add-on kit	AW4955

You may also need...	
Automatics essentials solution	AW20801
Flowcode	See page 70

Cylinders

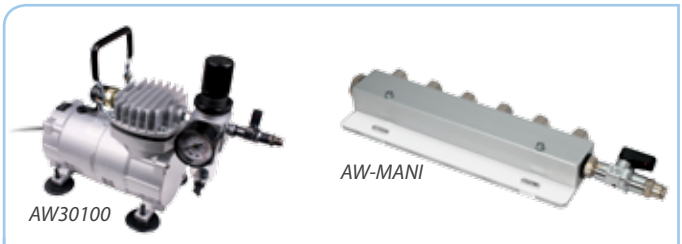
Cylinders provide the motive power of your pneumatic circuit. Single acting cylinders use a spring to return the piston to its rest position. All cylinders are a standard 10 mm diameter, the second figure represents the range of motion of the piston.

Description	Part number
Cylinder, single acting, 10 × 40 mm	AW-C1040S
Cylinder, double acting, 10 × 80 mm	AW-C1080D

Tubing & connectors

Tubing is available in several colours, in bulk reels which are easily trimmed to length using the custom cutting tool. The connectors allow you to join lengths of tubing and create junctions.

Description	Part number
Tubing, 4mm, blue, 30 m length	AW23119
Tubing, 4mm, yellow, 30 m length	AW23124
Tubing, 4mm, clear, 30 m length	AW25688
Tubing, 4mm, red, 30 m length	AW23122
Tubing, 4mm, red, 5 m length	AW23123
Tube cutting tool	AW-CUTTER
Junction, equal tee	AW-EQTEE



Essentials

These are the basic components needed to supply pressurised air to your pneumatic circuits - and a sturdy physical platform to anchor everything in place.

Description	Part number
Compressor	AW30100
Manifold	AW-MANI
Platform	AW-PLATFORM
Tee-bolts and sleeves (pack of 50)	AW22876

Valves - mechanical

These valves are operated mechanically by buttons, levers, rollers, or air pressure. 3/2 valves control the flow from the source to a single destination. 5/2 valves allow the source to be switched between two destinations.

Description	Part number
Valve, flow control	AW-V22FC
Valve, mini shuttle	AW-V32MS
Valve, 3/2, button-spring	AW-V32BS
Valve, 3/2, roller-spring	AW-V32RS
Valve, 3/2, lever-spring	AW-V32LS
Valve, 3/2, diaphragm-spring	AW-V32DS
Valve, 5/2, lever-spring	AW-V52LS
Valve, 5/2, pilot-pilot	AW-V52PP

Valves - electrical

These valves are operated by solenoids for control by discrete electrical circuits, or by the MIAC microcontroller unit.

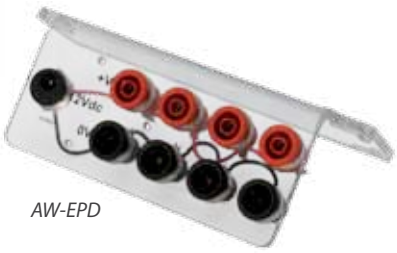
Description	Part number
Valve, 3/2 solenoid-spring	AW-V32ES
Valve, 5/2, double-solenoid	AW-V52EE

Reservoir

Create time delays in your pneumatic circuits by allowing pressure to gradually build up inside the reservoir.

Description	Part number
Reservoir 45cc	AW-RES45CC

AW-ESWP



AW-EPD

Electrical

Everything you need to integrate electrical and electronic control into your pneumatic systems.

Description	Part number
Reed switch and holder	AW-ERS
Switch, push to make	AW-ESWP
Microswitch	AW-EMS
Light sensor	AW-ELS
Power supply	HP2666
Power panel	AW-EPD
Lead, 4mm to 4mm, red	LK5603
Lead, 4mm to 4mm, black	LK5604
Lead, 4mm to 4mm, yellow	LK5607

MI0245

MI0235

MIAC

The Matrix Industrial Automation Controller (MIAC) is an integrated programmable microcontroller unit. Its features include :-

- 8 analogue or digital inputs
- 4 high current relay outputs
- 4 powerful transistor outputs (2 with PWM)
- 4 line, 16 column LCD display
- Keypad
- User programmable via USB
- Expandable via CAN communication bus
- Rugged ABS casing and shrouded 4mm sockets

You can design and upload your own custom programs for the MIAC using our Flowcode software. (see below)

Description	Part number
Cased MIAC with 4mm shrouded sockets	MI0245

AW20801

AW4955

Solutions

Our starter kit provides sufficient kit and teaching materials to learn the fundamental principles of pneumatic systems. As your students become more confident, you can then supplement this with the electro-pneumatics and/or control add-ons.

Description	Part number
Automatics essentials solution	AW20801
Automatics electro-pneumatics add-on kit	AW20792
Automatics control add-on kit	AW4955
Curriculum CD ROM	LK6492