MIAC-01

Now you are in control

- General purpose industrial controller
- Full graphical programming language supplied
- A wide variety of applications

MATRIX

Introduction

What does it do?

MIAC (Matrix Industrial Automotive Controller) is an industrial grade control unit which can be used to control a wide range of different electronic systems. It has a number of applications in industry and learning.

Benefits

- Flexible and expandable
- Easy to program with flowcharts, C or Assembly code
- Physically and electrically rugged

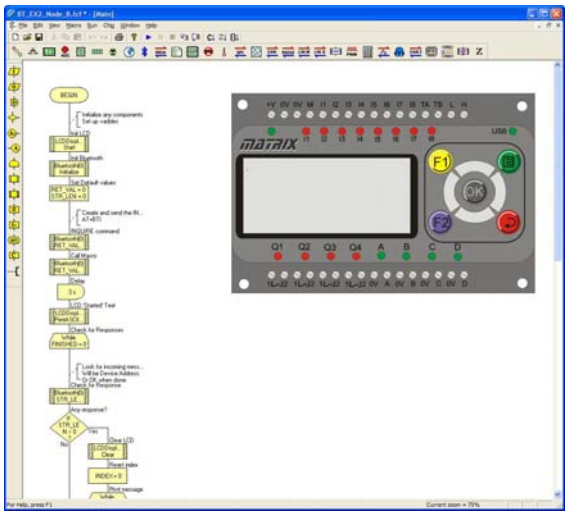
Features

- Programmable from USB
- Compatible with Flowcode and C
- 8 digital or analogue inputs
- 4 relay outputs, 4 motor outputs with speed control
- 4 line LCD display and control keys
- Lab View and Visual Basic compatible

Description

The MIAC is a fully specified industrial electronic controller designed to operate off 12 or 24V. It has 8 analogue or digital inputs, 4 high current relay outputs and 4 motor outputs. The MIAC is housed in an attractive, rugged, anthracite grey plastic moulding. It has two physical mounting options: it can be mounted onto a 30mm 'top hat' DIN rail, or it can be mounted directly onto any surface using the 4 screw holes provided.

The MIAC unit has screw terminal connector inputs across the top and bottom of the unit, has several input buttons for user control, and also has a 4 line 16 character alphanumeric display on the top of the unit to display system status and assist users.



Flowcode- the graphical programming language

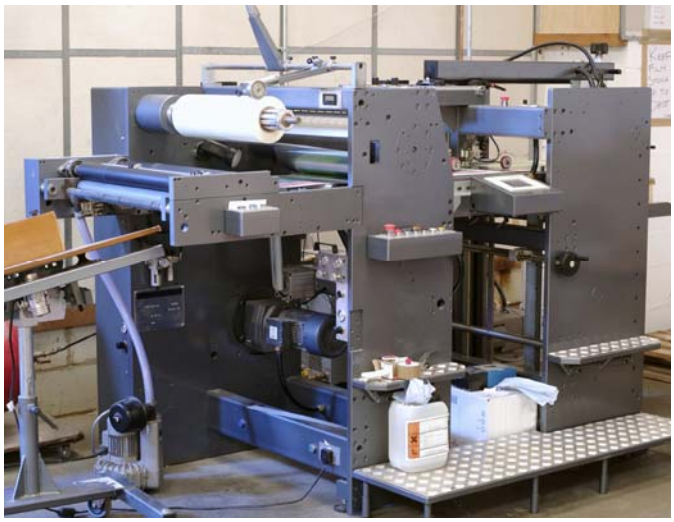
The unit is programmed directly from a PC's USB port and is compatible with the Flowcode graphical programming language. Users can develop a program using Flowcode, press the Reset button on the back of the unit, and the program will automatically download and start. The MIAC can also be programmed in C and assembly code, or any program that is compatible with PICmicro microcontrollers.

MIAC is equipped with a fully operational CAN bus interface so that several MIACs can be networked together to form wide area electronic systems.

A DLL and sample programs are provided to enable MIAC to be used with PC based control programs like LabView, Visual Basic, C++ etc.

MIAC applications

Industrial applications



MIAC is a fully specified industrial controller suitable for a wide variety of system control applications in automation, manufacturing,, test, and control. The physical characteristics allow for mounting on industry standard DIN 'top hat' rails or the device can be mounted directly onto any surface. The input output circuitry has been developed with industrial control in mind, taking into account the noisy electrical environments and the rugged physical and electrical requirements of the shop floor. The flexibility of the unit make it a useful addition to the industrial engineer's standard toolbox kit.

MIAC is certified to DVE0631 and EN50178/EN60068.

Sensing, monitoring and control

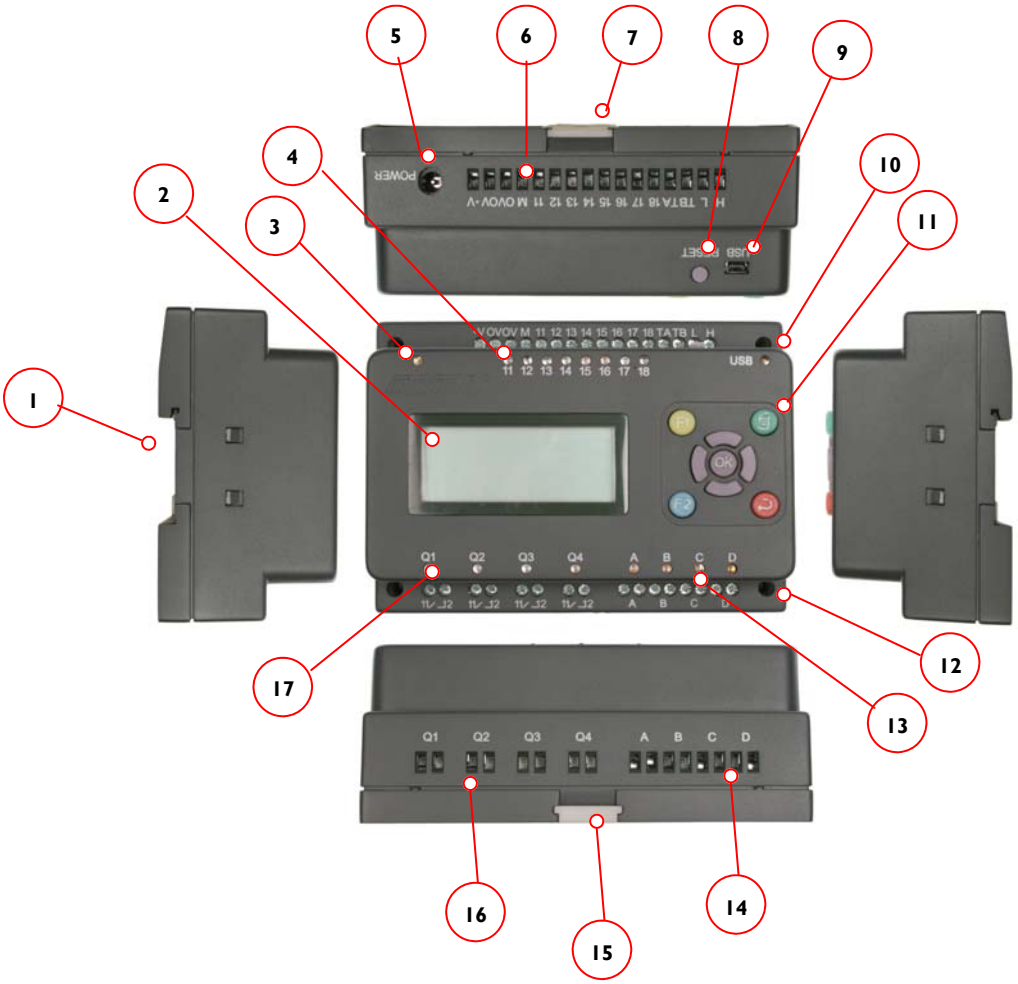
MIAC is equipped with 8 inputs which can be used in environments where real world quantities need measuring and processes controlling. Inputs are compatible with a wide range of 0 - 10V industrial analogue and digital sensors. Flowcode software provided with MIAC allows for easy arbitration between analogue and digital inputs and decision making in control programs.

The internal CAN bus circuitry - and accompanying Flowcode CAN bus software - allow multiple MIACs to be networked together across a factory floor to add sensors up to 500m away from the central host, and to form wide area sense and control systems for food processing, liquid flow monitoring and control, alarm

Education and training

MIAC is designed with ease of use and education/ training in mind. The combination of flexible inputs, both relay and motor driver outputs in one package, , internal short circuit protection, and LED status indicators on all inputs and outputs, make the MIAC an ideal controller for many fields of technical and automotive education. Flowcode software is well recognised as a leader in educational technology world-wide. Flowcode includes full simulation modes that allow students to 'see' their program working on-screen before downloading, and includes 'drivers' for MIAC so that students with no previous programming experience can develop complex electromechanical systems using the combination of MIAC and Flowcode. Flowcode is available in more than 20 languages so that students can program MIAC in their own language.

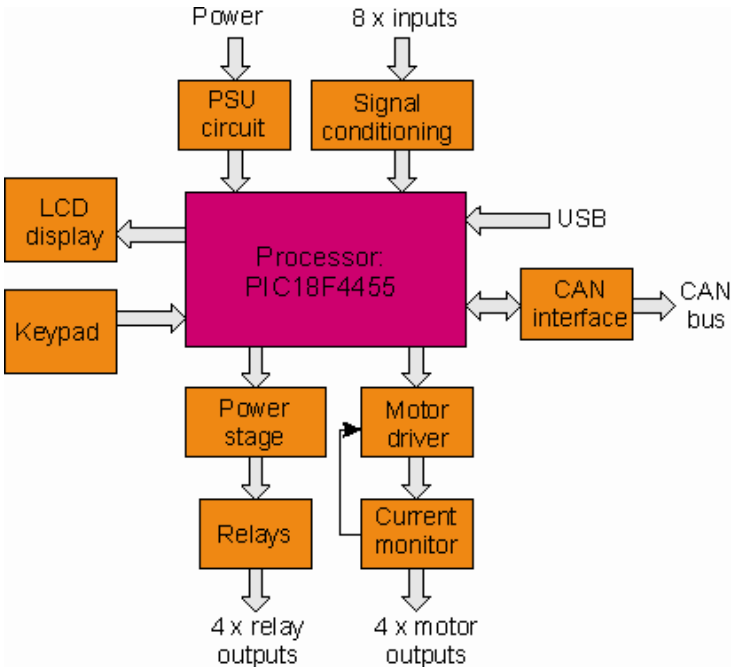
Hardware details



Key

1. Top hat rail mounting recess
2. 16 character x 4 line LCD display
3. Power LED
4. Input status LEDs
5. 2.1mm power jack
6. Screw terminal inputs
7. Top hat rail retainer clip - upper
8. Reset / run switch
9. USB socket
10. USB transfer LED
11. Control keys
12. M3 mounting holes
13. Motor status LEDs
14. Motor output screw terminals
15. Top hat rail retainer clip - lower
16. Relay output screw terminals
17. Relay output status LEDs

Internal schematic



Internally the MIAC is powered by a powerful 18 series PICmicro device which connects directly to the USB port for fast programming. The PIC device is pre-programmed with a bootloader and a Windows utility is provided which allows programmers to download PIC compatible hex code into the device.

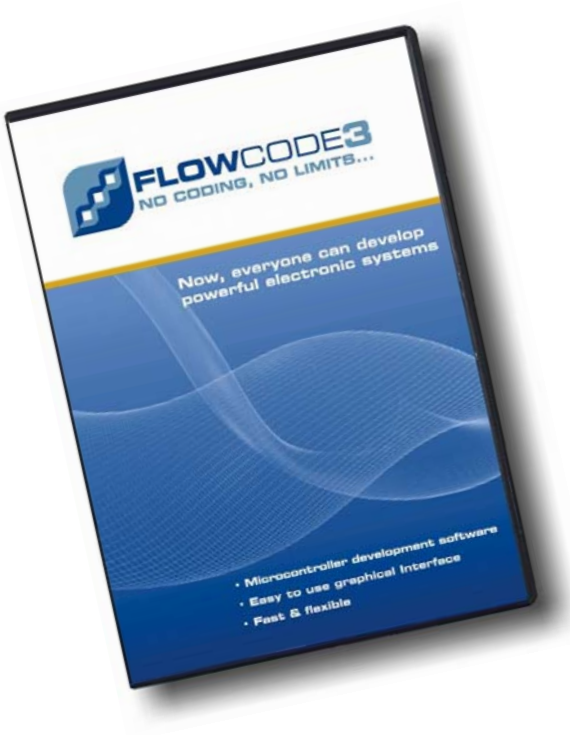
Inputs are fed into a signal conditioning circuit which allows them to be used as both analogue and digital inputs. (Not optically isolated.) Signal conditioning powers the topside LEDs which show analogue inputs at the appropriate brightness.

The outputs from the PIC processor are fed into a power stage which provides current amplification before feeding them to 4 separate relays. Fusing for relay circuits should be provided externally. Additional outputs are fed into a motor driver stage and current monitor with shutdown circuitry which limits the output current and protects the motor driver chip in case of short circuits. Output status is reflected by topside LEDs - for motor outputs LED brightness reflects motor speed / PWM ratio.

The PIC processor also connects to a two wire CAN bus driver circuit which allows several MIACs to be connected together to form an industrial control network.

Control and monitoring of processes is facilitated by a 4

Flowcode software



MIAC is fully compatible with Flowcode 3 - one of the world's most advanced graphical programming languages. The great advantage of Flowcode is that it allows those with little experience to create complex systems in minutes. Flowcode achieves this in two steps: firstly users drag and drop flowchart symbols onto the screen, and fill in the dialog boxes when prompted. Then Flowcode compiles the flow chart into code that is downloaded to the MIAC which executes the program.

To assist first time users a range of off the shelf routines is provided that allows system developers to get up and running without any knowledge of how the circuitry inside the MIAC works.

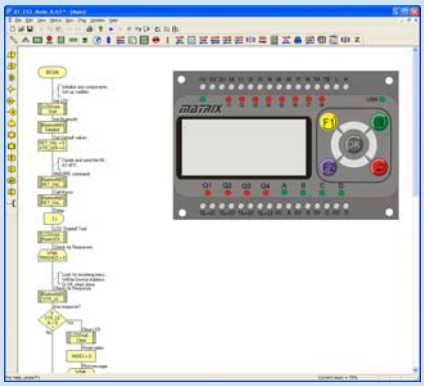
In addition a 12 page starter guide shows how to develop a range of programs from turning a single output on through to motor speed adjustment under keypad control.

Within Flowcode a simulation model is provided that shows step by step program execution along with a complete simulation of the MIAC unit. This assists in both learning how the MIAC operates, and in developing programs.

Flowcode is available in many languages including: Danish, Dutch, English, Finnish, French, German, Greek, Spanish, Italian, Mandarin, Romanian, Hungarian, Solvenian, Vietnamese and Thai only).

A Professional version of Flowcode 3 is shipped with each MIAC unit.

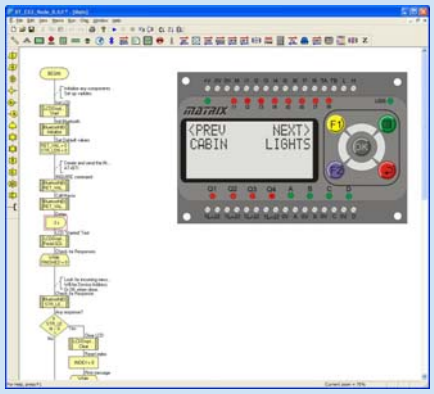
Design



Flowcode contains standard flow chart icons and electronic components that allow to you to create a virtual electronic system on screen. Drag icons and components onto the screen to create a program, then click on them to set properties and actions.

- Easy to use interface
- Allows complex programs to be developed and managed quickly
- All I/O and expansion options are supported in Flowcode

Simulate



Once your system is designed you can use Flowcode to simulate it in action. Test MIAC functionality by clicking on switches or altering sensor or input values, and see how your program reacts to the changes in the electronic system.

- Simulation aids understanding
- Debug before download
- Shorten the design cycle

Download

When you are happy with your design click one button to send the program directly to the MIAC device. Press the reset button and your program starts to run.

- One button download
- Fast action
- Flexible and expandable

Support

Sample files

To help you get started with programming the MIAC a wide range of sample programs are available - from getting your first input to using the customisable keypad to control motor speed.

The example list includes:

OUT1	simple relay Q1 output
OUT2	relay Q1 on for 10 seconds after F1 pressed
OUT3	relay Q1 on until sensor 1 reached half scale
DISPLAY1	shows how simple display messages are made
DISPLAY2	shows how all four lines of the display can be used
DISPLAY3	shows how the display and the keypad are used to control programs
DISPLAY4	shows how the display and keypad are used to enter parameters using up, down, left and right keys and for more complex menu systems
SENSOR1	shows analogue temperature sensor values on the LCD display
SENSOR2	shows how a digital proximity sensor us used to activate a machine using Q1
MOTOR1	shows simple motor control
MOTOR2	shows speed control of one motor under keypad control
MOTOR 3	shows stepper forwards and backwards control
MOTOR4	shows stepper speed control
MOTOR5	shows how an external rotary encoder is used to achieve speed control of a motor
CLOCK1	shows a real time clock implementation
CLOCK2	shows real time clock implementation with keypad time and date adjustment
GARAGE1	shows garage door implementation
ALARM1	shows burglar alarm implementation
ALARM2	shows burglar alarm implementation with remote CAN connected unit
GARAGE2	shows integration of GARAGE1 with ALARM2
PRESS1	shows operation of a stamping press with two operator safety switches
LVINT	LabView interface
VBINT	Visual Basic interface

Each of these is accompanied, where relevant, by a wiring diagram showing how the MIAC is connected into the system

Continuing support

To help you get going with MIAC as fast as possible a 'Getting started' guide has been produced.

- This MIAC unit
- How to access the macro routines that control inputs, outputs, the keypad and the display
- Where you can get additional resources to help you to develop your programming skills further

In addition to this MIAC is backed up by an online forum where you can pose questions to our technical team.

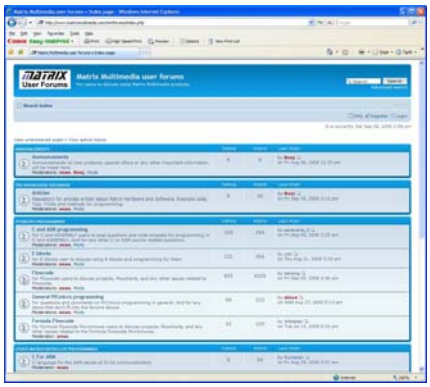
Getting started

To help you get going with MIAC as fast as possible a 'Getting started' guide has been produced.

This is a simple 12 page document that shows you step-by-step how to:

- How to mount the unit on a top hat rail
- How to mount the unit onto another surface
- How to connect the unit using screw terminals
- How to write your first simple program
- How to transfer the program to the MIAC unit
- How to access the macro routines that control inputs, outputs, the keypad and the display
- Where you can get additional resources to help you to develop your programming skills further

In addition to this MIAC is backed up by an online forum where you can pose questions to our technical team.

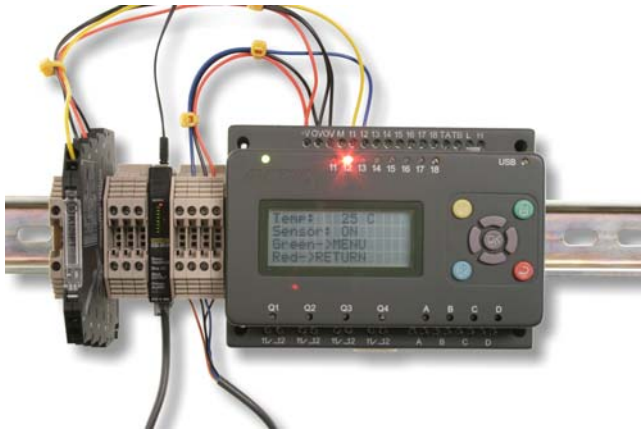


Unlimited support via our web forum

Expansion and interfacing

Industrial sensors

MIAC is compatible with standard industrial grade sensors that give outputs in the 0 to 10V range. Sensors that fit onto DIN rails are compatible with MIAC as can be seen from the photograph on the right.



MIAC on a top hat rail with industrial sensors

Networking

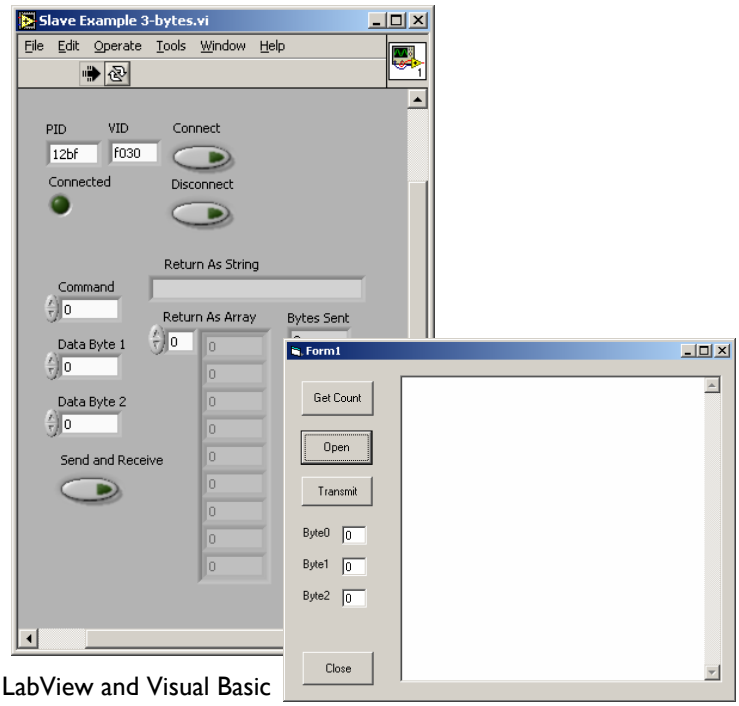
MIAC is supplied with an industrial standard CAN bus interface. This allows you to develop systems including a large number of MIACs up to 500 metres apart. Flowcode software for MIAC is compliant with both CAN 1 and CAN 2 standards which will also allow you to interface the MIAC into other systems using the CAN interface.

These features make the MIAC unit ideal for educational projects like this vehicle electrical simulator.

Automotive training panel running with two CAN connected MIAC devices.

Use with LabView, Visual Basic and other packages

MIAC can easily be integrated with third party PC based control packages like Lab View and Visual Basic. This is enabled by a DLL and a suite of sample programs that can be downloaded to the MIAC to provide a fully controllable slave device from PC based applications.



LabView and Visual Basic programs running on a MIAC

MIAC for learning

The 4mm connection panel consists of a MIAC housed in a rugged plastic case with 4mm shrouded connectors which are internally connected to all of the input outputs of the MIAC (except CAN bus terminations). This allows rapid development of circuits based on the MIAC up to mains voltages. (The lack of CAN bus terminations means that communication between MIAC units on the CAN bus only operates within a lab.)

This configuration will be particularly useful in educational labs where a variety of 4mm equipment and components already exists.

In this format the MIAC unit will have applications in:

- Science
- Technology
- Electronics
- Mechanical engineering
- Automotive engineering
- Chemical engineering

Code: MI0245

Course materials

It is out intention to develop a wide range of curriculum material including:

Logical thinking and control

An introduction to programming the MIAC with Flowcode and the basic electrical circuits that are used in control systems. This will encourage basic logical thinking, fault finding, and develop skills in understanding open can closed loop control theory and applications.

Control for electrical applications

Building on from the logical thinking unit this course will provide a more advanced understanding of programming using flow charts. This course will also allow students to understand various industrial sensors and actuators that are used in control systems.

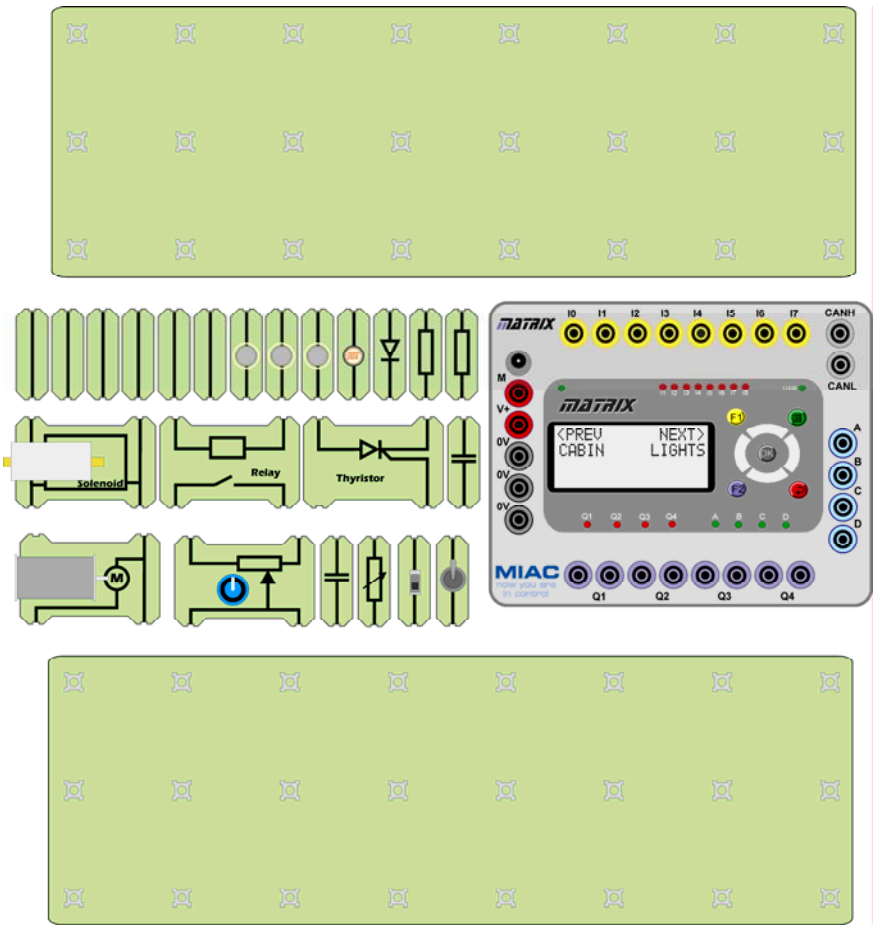
Automotive systems 1

This unit will give students an overview of all the major electronic and electrical components in a vehicle, their functions, connections and circuits they form. In this unit students will not perform any programming, but they will be required to download various programs and construct circuits using the MIAC unit.

Automotive systems 2

This unit will address computer networks used inside a car and the concepts of ECUs, and inter ECU communication using the CAN bus. In this unit students will not perform any programming, but they will be required to download various programs and construct circuits using the MIAC unit. This unit will require more than one MIAC for each student (or they can work in pairs) and will explain the fundamentals of how to look for faults inside a car.

Locktronics automotive kit



The MIAC is configured in exactly the same was as an Electronic Control Unit inside a car. This makes it the perfect system for teaching automotive students about the electrical systems that are present in vehicles.

The Locktronics automotive kit consists of a number of basic electrical components which allows students to develop a number of circuits that would be found in a car. Students can then develop programs in Flowcode or simply reprogram the MIAC using the pre-written programs provided.

Developing circuits in this way reinforces understanding of each of the major circuits used in a car, and how ECUs in the car operate, provides elementary fault finding experience, and can also give students experience of logical thinking.

More advanced students can use the integrated CAN bus connectors to connect one MIAC to another to simulate the CAN bus inside vehicles.

A full set of teacher's notes is provided along with example files for the MIAC unit. The teacher's notes included exercises for complete novices to automotive electrics, through to more advanced exercises for level 3 students.

Included in the kit are:

6 links
3 bulbs
1 light dependant resistor
1 thermistor
1 DC motor
1 solenoid
1 relay
1 thyristor
1 variable resistor
1 diode
2 resistors
2 capacitors
1 current probe
1 4mm to croc clips lead
2 8 by 3 Locktronics base boards
1 Professional version of Flowcode
1 push to make switch
1 toggle switch

Code LK2043

Technical specification

Inputs	8
Inputs usable as analogue inputs	8 - 0 to 12V
Analogue input sensitivity	10 bit - 10mV
Input impedance when used as an analogue input	xOhms
Input Voltage Low	0V – 3V
Input Voltage High	7.5V – 10V
Input impedance when used as a digital input	10K Ohms
Relay outputs	4
Relay output ratings	8A at 12 V 8A at 24V 8A at 240V AC
Motor control output ratings	2A at up to 24V DC
Motor control speed sensitivity	8 bit, 0.4%
Power supply	12/24V at 100mA
Storage temperature	-40 to +70C
Operating temperature	-5 to 50C
Processor	PICmicro 18F4455, 12K ROM, 2 K RAM
Clock speed	48MHz

Ordering codes

MIAC with Flowcode 3	MI0235
MIAC & 4mm shrouded sockets with Flowcode 3	MI1298
1A international power supply	HP5328
Flowcode	TEFLCSI3
CAN bus systems and operation—including storage trays, PSU and baseboard.	LK7629