MATRIX

MIAC

E-system design suite

Contents

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What is the MIAC e-system design suite?

MIAC modules and software allow designers
to quickly develop control and data-logging
systems

Each MIAC module contains a block of electronics which you would typically find in an industrial electronic control or data acquisition system.

The 10 modules in the range connect together using the CAN bus. The modules can be positioned next to each other or several hundred metres apart. Power is applied locally. The modules also link into a wide range of other communications systems: GSM, Bluetooth, TCP/IP, ZigBee, etc.

The system is programmed using Flowcode software. Flowcode is a graphical programming environment based on flowcharts. Flowcode includes 'drivers' for all of the MIAC modules making programming the system easy.

Communication between modules is taken care of by Flowcode. To add a module (or second MIAC) to the system just add the module to the Flowcode simulation. Flowcode takes care of low level CAN bus commands so no understanding of CAN is needed.

MIAC modules are compatible with a wide range of industrial sensors and add-ons that sit on 35mm 'top hat' DIN rails.

The great advantage of the MIAC system is that it provides a very flexible set of parts that can be used to create a vast range of electrical systems in a very short time.

Simple
- Flowcode's drag and drop interface means that no programming experience is needed
- Expand your system just by adding modules
- The system connects using CAN bus, but no knowledge of CAN is required

Rugged
- 12 or 24V control operation
- Meets IEC60950-1 industrial standard
- Switch up to 240V AC

Scalable
- Add up to 4 MIACs and 40 other modules within the Flowcode work space for simple networks
- Use a full CAN protocol to extend your network to 100 MIACs and numerous expansion modules
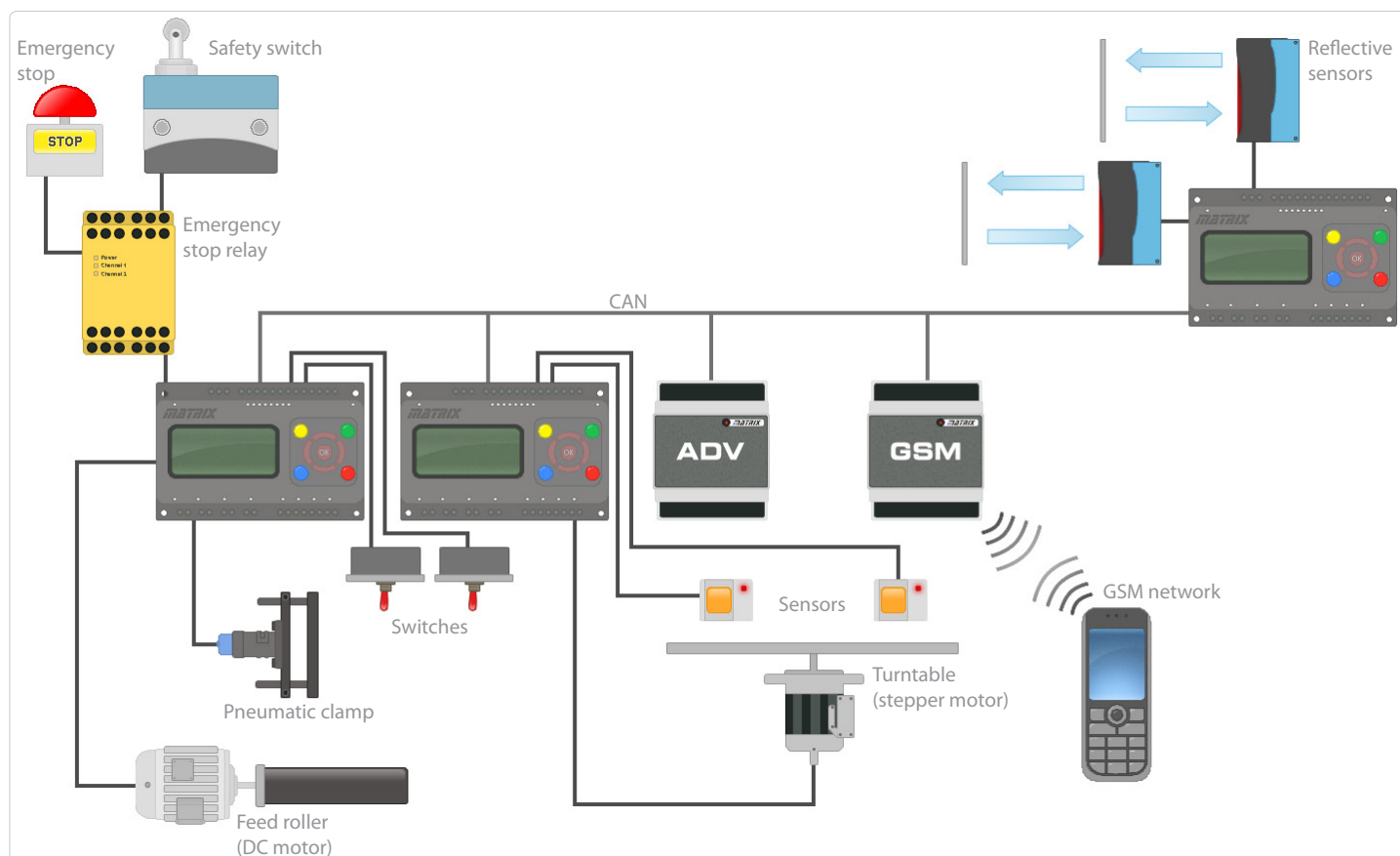- Grow your system as your needs change

Expandable
- Connect to industrial sensors, controllers and other DIN mounted subsystems
- Link to other systems using TCP/IP, ZigBee, RS485, etc.
- Link to your PC using Bluetooth, USB, RS232, etc.

Flexible
- Used in education and in industry
- Link to PC via USB and control with other software packages like LabView, C++, etc.

Applications

Emergency stop

Safety switch

Reflective sensors

Emergency stop relay

☐ Power
☐ Channel 1
☐ Channel 1

CAN

ADV

GSM

Switches

Sensors

GSM network

Pneumatic clamp

Turntable
(stepper motor)

Feed roller
(DC motor)

This system controls an automatic industrial manufacturing cell and communicates fail and operating conditions to the supplier via the GSM network.

SD

BT

ADV

ADV

Spirometer

Blood pressure

Heart rate monitor

Tablet PC

Weighing scales
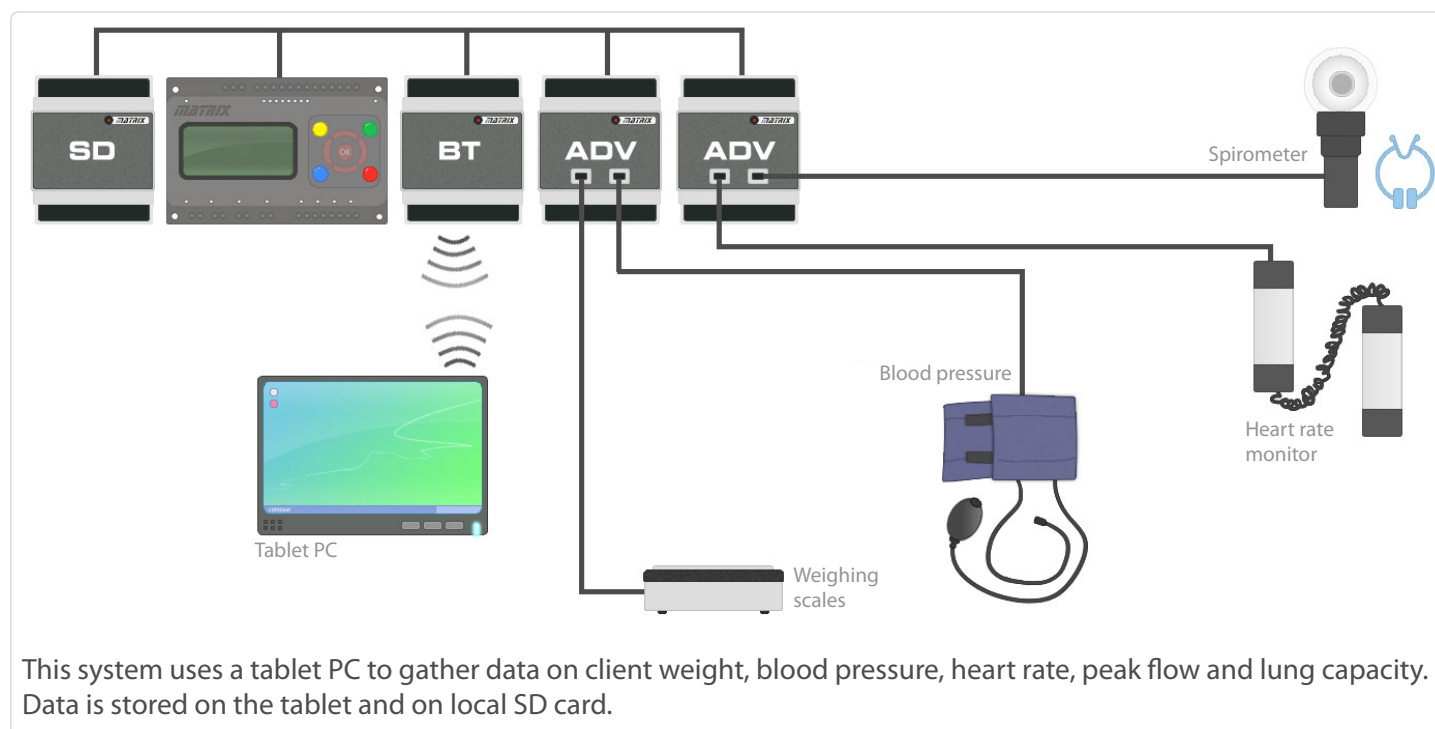
This system uses a tablet PC to gather data on client weight, blood pressure, heart rate, peak flow and lung capacity. Data is stored on the tablet and on local SD card.

4

Alarm

Motor

Roller shutter door

Controls

Sensors

Z

Air conditioning

Z

Switches

Z

Lights

Z

Temperature humidity sensor

Z

Internet

CAN

INT

Z

Alarm

Office window blinds

Doors

Access control keypad

Z

This control system uses ZigBee and the internet to allow control of lights, security, temperature and building access.

Flowcode design software

MIAC is fully compatible with Flowcode 5 - 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 dialogue boxes when prompted. Then Flowcode compiles the flowchart into code that is downloaded to the MIAC which executes the program.

To assist first time users a range of off-the-shelf routines are provided, which allow system developers to get up and running without any knowledge of how 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.

A simulation model is provided within Flowcode 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 allows expansion modules to be incorporated into the design with ease - just drag a module onto the panel space and access a full suite of routines for each expansion module with no need to understand the low level protocols that make the system work.
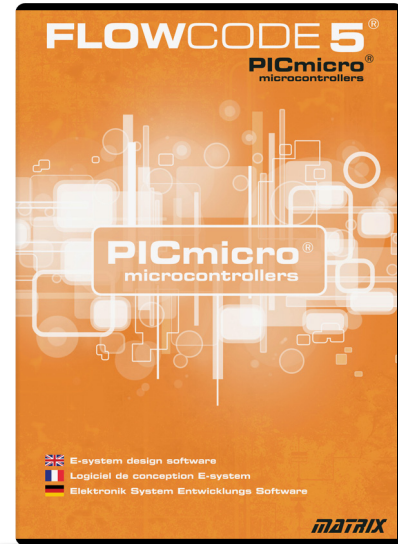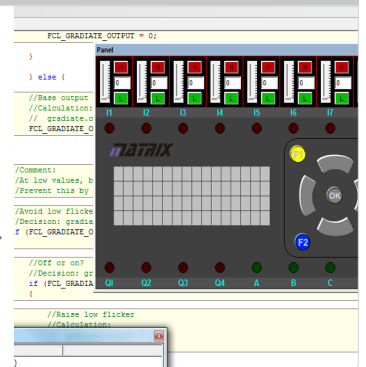
DESIGN

1 Flowcode contains standard flowchart icons and electronic components that allow you to create a virtual electronic system on screen. Drag and drop icons and components to create a program, then click on them to set properties and actions.
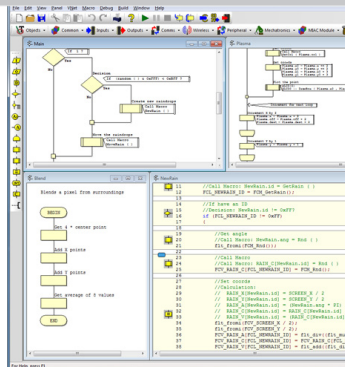
SIMULATE

2 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.

TEST

3 Compile and download to your system with one button click. Use the FlowKit In Circuit Debug tool to see your program working on screen and on the MIAC system.

DEPLOY

4 When you are happy with your design, transfer your code into a fully functioning electrical datalogging and control system using MIAC technology. Press the reset button and your program starts to run.
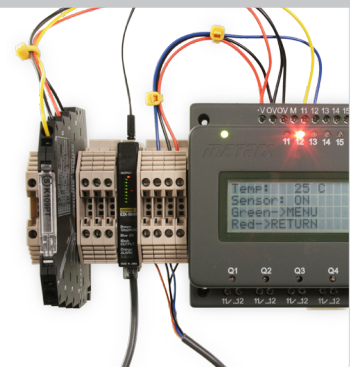
Flowcode 5 is available in the following languages:

Benefits

* Flexible and expandable
* Easy to program with flowcharts, C or assembly code
* Physically and electrically rugged

Features

* Programmable from USB
* 8 digital or analogue inputs
* 4 relay outputs, 4 transistor outputs with PWM
* Compatible with LabView, Visual Basic and C compilers

The MIAC is a fully specified industrial electronic controller designed to operate off typical industrial control voltages: 0 -10V inputs, 24V motor outputs, 240V switching relays. MIAC has 8 analogue or digital inputs, 4 high current relay outputs and 4 transistor 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 35mm '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. It has several input buttons for user control and a 4 line 16 character alphanumeric display.

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 many MIACs can be networked together to form wide area electronic systems. The CAN bus parameters are adjustable, so you can interface the MIAC with existing networks.
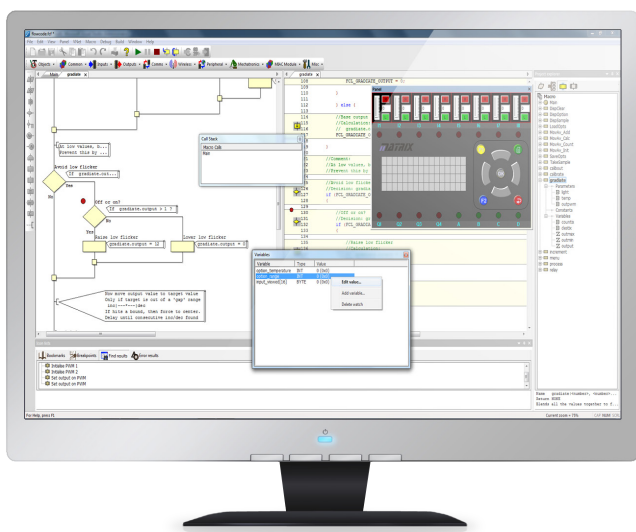
A DLL and sample programs are provided to enable MIAC to be used with PC based control programs like LabView, Visual Basic, C++ etc.

Expansion

The MIAC range includes a number of expansion module options which connect to each other using the CAN bus. Flowcode 5 includes software drivers that allow these expansions to be used within the Flowcode environment No knowledge of CAN bus is required - Flowcode deals with this behind the scenes.

Certified to IEC60950-1

Ordering information	
MIAC controller	MI0235
Cased MIAC with 4mm shrouded sockets	MI0245
Adjustable DC power supply	HP5328

Flowcode- the graphical programming language supplied with MIAC

System design with MIAC

Lab sensors

There are over 50 lab sensors in the MIAC range which allow users to capture data as varied as pH, temperature, salinity and acceleration. Lab sensors are connected to the Advanced Expansion Module using two sockets on the front of the module. Industrial sensors with standard 0 - 10V outputs can be connected directly to the MIAC inputs.

Radiation and oxygen sensors with the Advanced Expansion Module

Expansion modules

MIAC is compatible with a range of expansion modules which bring advanced wired and wireless communications technology to MIAC systems. The Flowcode design environment takes care of low level CAN bus communications allowing seamless expansion for most modern communication protocols - at a chip and system level. See pages 9-10 for details of the expansion modules available.

The GSM Expansion Module

Scaleable input/output

MIAC is scaleable; so if you need more input/outputs in your design, just add another MIAC to your system. For simple systems the Flowcode design environment takes care of low level CAN bus communications. Larger systems can be designed with complete control over the CAN bus protocol and can incorporate up to 200 MIACs and numerous other communication and expansion modules.

Industrial sensors and components

MIAC is compatible with standard industrial grade sensors that give outputs in the 0 - 10V range. Sensors that fit onto DIN rails are compatible with MIAC. MIAC is also compatible with a vast range of industrial parts such as motor controllers, dimmers, high current relays etc. that are also DIN rail compatible.

Basic Expansion Module

This module allows users to interface with MIAC technology to conventional TTL level systems. The unit includes a number of I/O lines including PWM outputs for motor control. 12 bit ADC inputs for precision analogue work, 2 x PWM outputs for motor control.

- 18 x TTL level I/O pins
- 2 x PWM outputs
- 5 x ADC inputs

MI1493

Advanced Expansion Module

This module allows users to interface with MIAC technology to conventional TTL level systems, and also includes other expansion features. The unit includes a number of I/O lines including PWM outputs, 12 bit ADC inputs, 2 x PWM outputs, several TTL level serial buses and 2 x 12 bit DAC outputs. The unit also has interfaces for two external lab sensors and a real time clock.

- 16 x TTL level I/O pins
- Real time clock
- SPI bus, I²C bus, TTL level serial bus
- 2 x external sensor inputs
- 2 x DAC outputs, 2 x PWM outputs, 5 x ADC inputs

MI3486

Serial Expansion Module

This module is designed to allow users to interface MIAC technology to conventional TTL level systems and to allow users access to commonly used serial buses. The unit includes RS232 bus interfaces as well as TTL level serial buses (SPI, I²C and USART). The unit also includes a number of TTl level I/O lines and a FAT16/32 compatible SD card for data storage.

- 18 x TTL level I/O pins
- 2 x PWM outputs, 5 x ADC inputs
- SPI bus, I²C bus, TTL level serial bus
- RS232 interface
- SD card socket

MI8447

Industrial Comms. Module

This module includes interfaces for RS485 communications and TCP/IP communications. Connection to RS485 is via screw terminals. TCP/IP connection is available on a standard CAT5 socket. The module is fitted with a CAN bus interface and also allows access to several 5V microcontroller I/O lines.

- 4 x TTL level I/O pins
- 2 x ADC inputs
- RS485 interface
- Ethernet interface

MI4823

ZigBee Expansion Module

Two versions of the ZigBee Expansion Module are available: ZigBee coordinator and ZigBee router. Each contains a wireless ZigBee control module and access to several TTL level microcontroller I/O lines.

- 6 x TTL level I/O pins
- 4 x ADC inputs
- ZigBee interface (either coordinator or router/end node)
- Built-in antenna
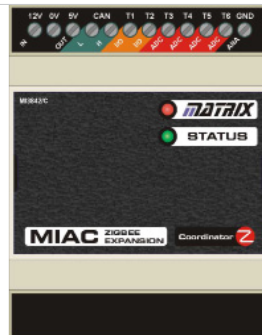
MI3842C/R

Bluetooth Expansion Module

This module adds Bluetooth functionality to a MIAC system. The class 1 Bluetooth module has a transmit power of 6dBm which should give a 100 yard transmission range at a data transfer rate of 100Kbps. The unit also includes several TTL level I/O lines.

- 6 x TTL level I/O pins
- 4 x ADC inputs
- Bluetooth transceiver
- Built-in antenna

MI4855

GPS Expansion Module

This module includes a highly sensitive ,fast access time Global Positioning System receiver which allows developers to build systems that can identify their own location. A high sensitivity antenna is included in the expansion module. The unit also includes a FAT16 compatible SD card interface and several TTL level I/O lines.

- 6 x TTL level I/O pins
- 4 x ADC inputs
- GPS receiver
- Built-in antenna
- SD card socket
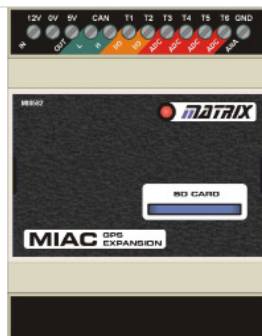
MI8582

GSM Expansion Module

This module is fitted with a quad band GSM unit which can be used for voice and data transmission. A highly sensitive internal antenna optimises the range of the module. The front of the unit is fitted with 3.5mm jack sockets for a standard hands-free adaptor and a SIM card socket. The unit also includes several TTL level I/O lines.

- 6 x TTL level I/O pins
- 4 x ADC inputs
- Quad band GSM transceiver
- SIM card slot
- Built-in antenna

MI4897

MIAC modules with 4mm connectors

These MIAC expansion modules are fitted into a rugged plastic case and are fitted with 4mm shrouded connectors so that standard 'banana' leads can be used for making all the relevant connections. Note that not all connections on the MIAC are presented on 4mm connectors.
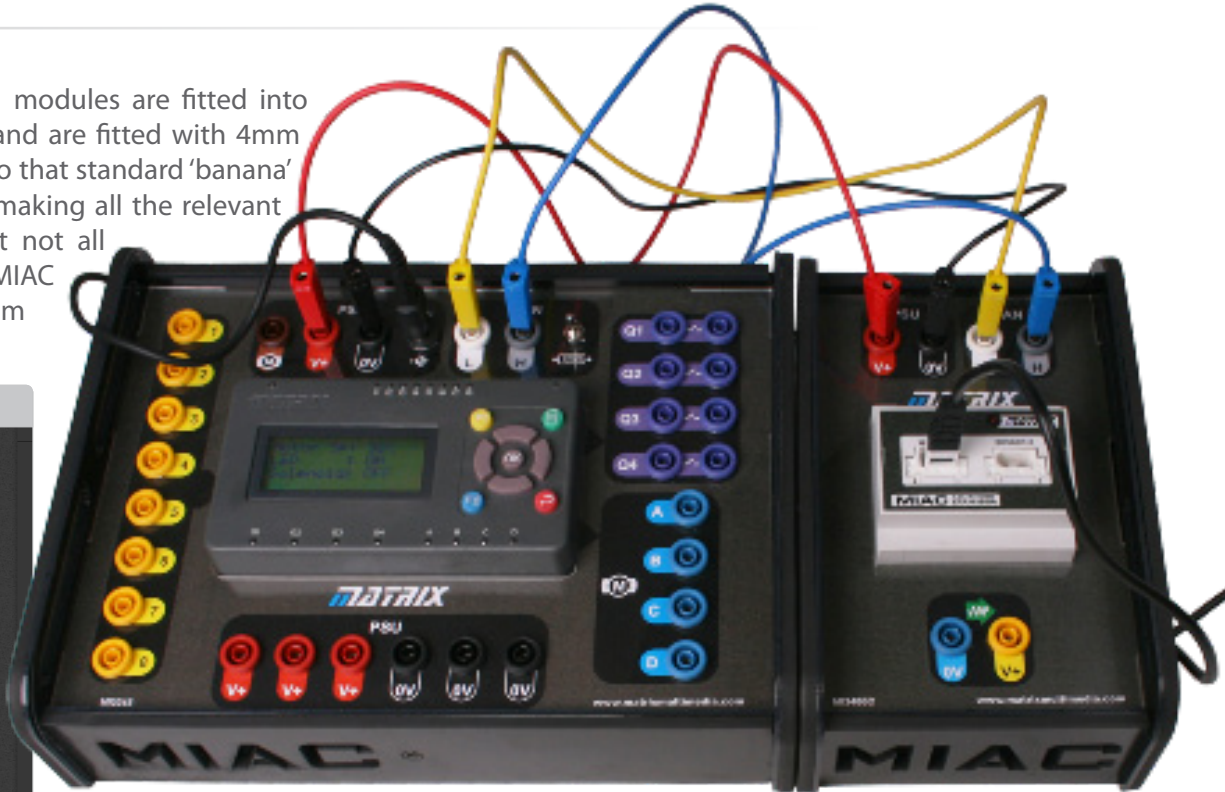
Advanced

Cased MIAC with cased advanced expansion module

MI0245

Bluetooth

GPS

Industrial comms.

GSM

Serial

ZigBee

Ordering information

Cased MIAC with 4mm shrouded sockets	MI0245
Cased Advanced expansion module	MI3955
Cased Bluetooth expansion module	MI5983
Cased GPS expansion module	MI8534
Cased GSM expansion module	MI5197
Cased Industrial comms. expansion module	MI9512
Cased Serial expansion module	MI2839
Cased ZigBee expansion module	MI6922C/R

FlowKit In Circuit Debug board

The FlowKit can be connected to MIAC to provide a real time debug facility where it is possible to step though the Flowcode program on the PC and step through the program in the MIAC at the same time. This function is available with Flowcode 5 or later.

Benefits
• A fast way to solve programming problems
• Seamless program and debug

Features
• Compatible with MIAC systems via the USB lead (included with FlowKit)
• Available for Flowcode 5 and later
• Allows start, step and play of programs
• Allows users to see and alter variable values

Whilst Flowcode simulation allows debug of a system to a first pass, FlowKit takes debug to a new level by running the program in the hardware and on screen at the same time. The system is controlled from within the Flowcode environment where controls allow users to start, stop, pause and step through their program one icon at a time. Under user control the Flowcode software shows the location of the program in the flowchart, the value of all variables in the program, and allows users to alter the variable values when the program is paused.
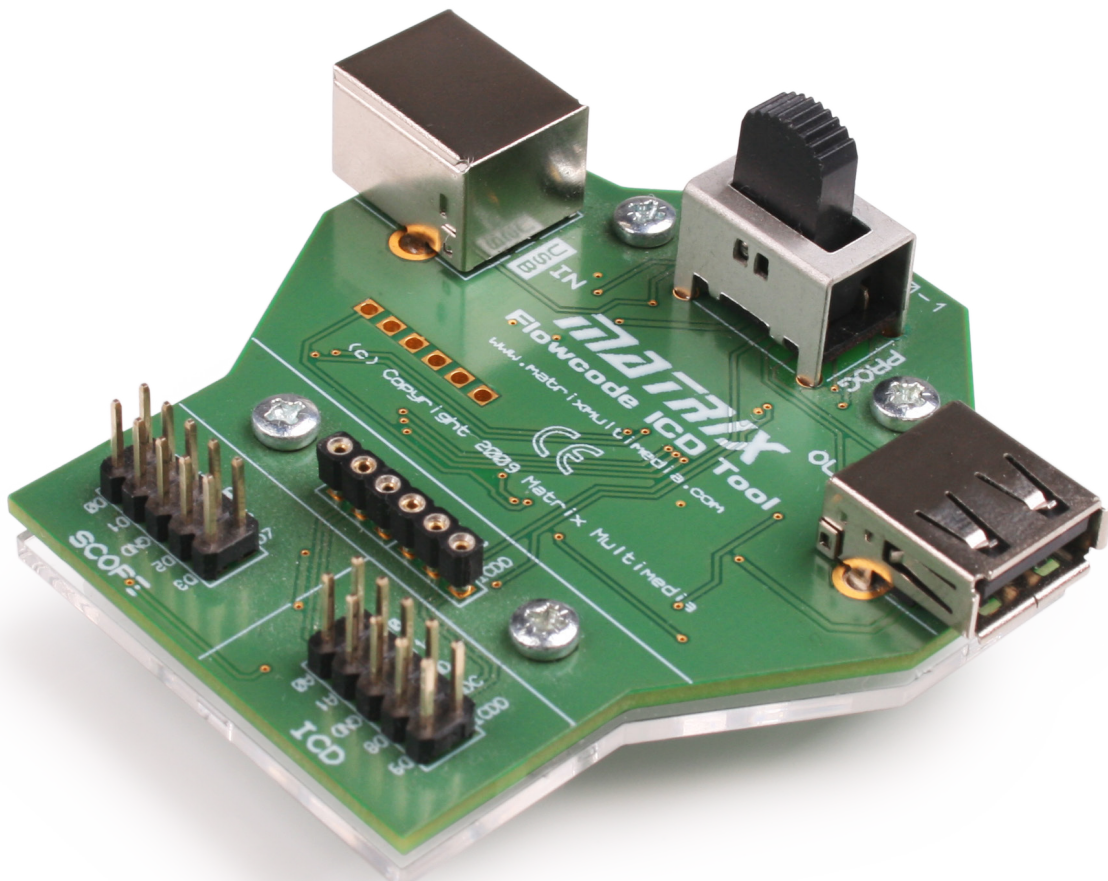

Using FlowKit with MIAC

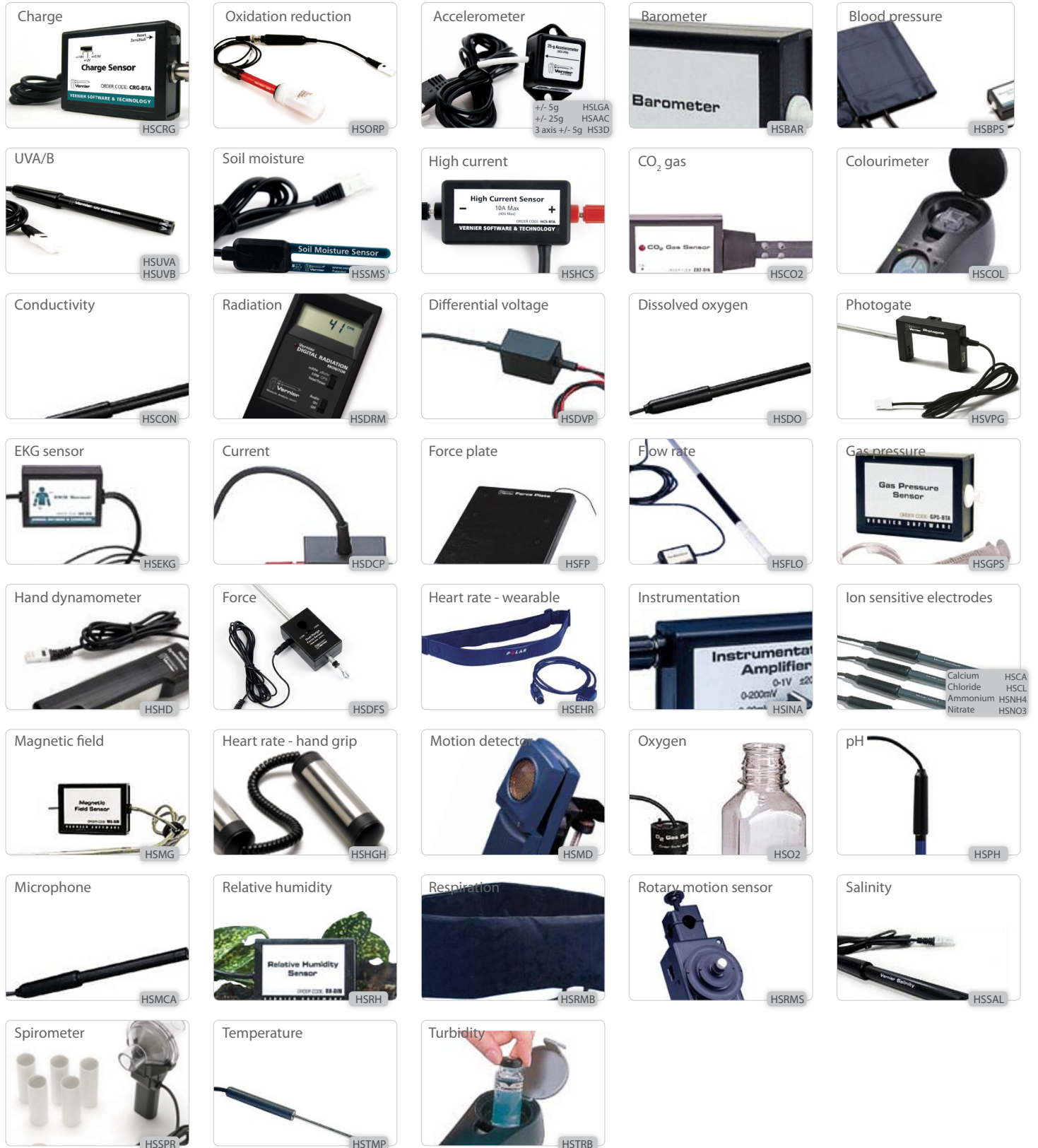| Ordering information	
FlowKit In-Circuit Debug board	HP299

Lab sensors

The MIAC Advanced Expansion module has two Left Hand Analogue sockets to enable the connection of a wide range of Vernier™ Lab Sensors.

Both sockets accept analogue voltage (0-5v), pulse and resistive sensor types, such as Force Plates, Heart Rate Monitors and Temperature Probes.

Please note that they do not support the digital interface based sensors that use the Right Hand Digital type connectors.

Charge	Oxidation reduction	Accelerometer	Barometer	Blood pressure
HSCRG	HSORP	+/- 5g HSLGA +/- 25g HSAAC 3 axis +/- 5g HS3D	HSBAR	HSBPS

UVA/B	Soil moisture	High current	CO₂ gas	Colourimeter
HSUVA HSUVB	HSSMS	HSHCS	HSCO2	HSCOL

Conductivity	Radiation	Differential voltage	Dissolved oxygen	Photogate
HSCON	HSDRM	HSDVP	HSDO	HSVPG

EKG sensor	Current	Force plate	Flow rate	Gas pressure
HSEKG	HSDCP	HSFP	HSFLO	HSGPS

Hand dynamometer	Force	Heart rate - wearable	Instrumentation	Ion sensitive electrodes
HSHD	HSDFS	HSEHR	HSINA	Calcium HSCA Chloride HSCL Ammonium HSNH4 Nitrate HSNO3

Magnetic field	Heart rate - hand grip	Motion detector	Oxygen	pH
HSMG	HSHGH	HSMD	HSO2	HSPH

Microphone	Relative humidity	Respiration	Rotary motion sensor	Salinity
HSMCA	HSRH	HSRMB	HSRMS	HSSAL

Spirometer	Temperature	Turbidity
HSSPR	HSTMP	HSTRB

Screw terminal inputs
Top hat rail retainer clip - upper

2.1mm power jack

POWER

H L TBTA18 17 16 15 14 13 12 11 M OVOV+V

USB RESET

Reset / run switch   USB socket

Power LED

Input status LEDs

+V OVOV M 11 12 13 14 15 16 17 18 TATB L H

USB transfer LED

11 12 13 14 15 16 17 18

USB

16 character x 4 line LCD display

Top hat rail mounting recess

Power LED

Relay output status LEDs

Q1   Q2   Q3   Q4   A   B   C   D

Motor status LEDs
M3 mounting holes

J1 J2   J1 J2   J1 J2   J1 J2   A   B   C   D

Relay output screw terminals

Q1   Q2   Q3   Q4   A   B   C   D

Motor output screw terminals

Top hat rail retainer clip - lower

Power supply	12 - 16V, <2A
Inputs	8
Inputs usable as analogue inputs	8 - 0 to 12V
Analogue input sensitivity	10mV
Input impedance	10kΩ
Input voltage low	0V - 3V
Input voltage high	>7.5V
Max input voltage range	-30V, +45V
Relay outputs	4
Relay output ratings	8A at 240VAC, 30VDC
Transistor outputs (source and sink)	4
Transistor output (per channel)	500mA

Max transistor output - all channels	1.75A
Transistor thermal shutdown	>500mA
PWM outputs, sensitivity	A, C, 0.4%
Power supply	12/16V at 100mA
Storage temperature	-40 to +70C
Transistor supply voltage (M)	6 - 24V, 4A
Operating temperature	-5 to 50C
Programming interface	USB
Processor	PICmicro 18F4550, 32K ROM, 2K RAM @48MHz
CAN bus processor	MCP2515 @20MHz

Certified to IEC60950-1

MATRIX

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