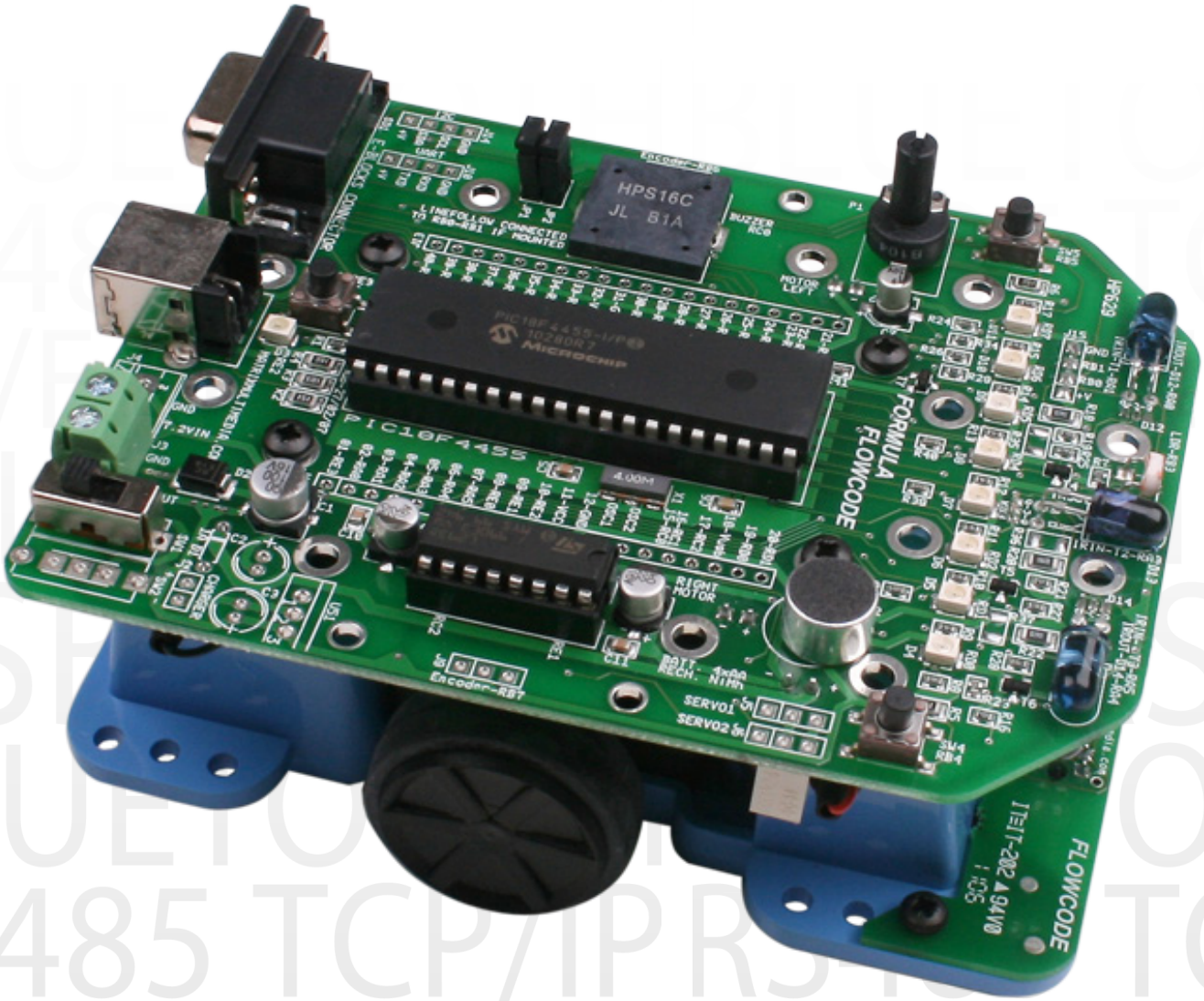
FORMULA
FLOWCODE



Introduction

Formula Flowcode is a robot vehicle which is used to teach robotics, and to provide a platform for competing in robotic events.

Benefits

- A low cost, all inclusive solution
- Can also be used for mechanical studies
- A highly motivating approach to learning

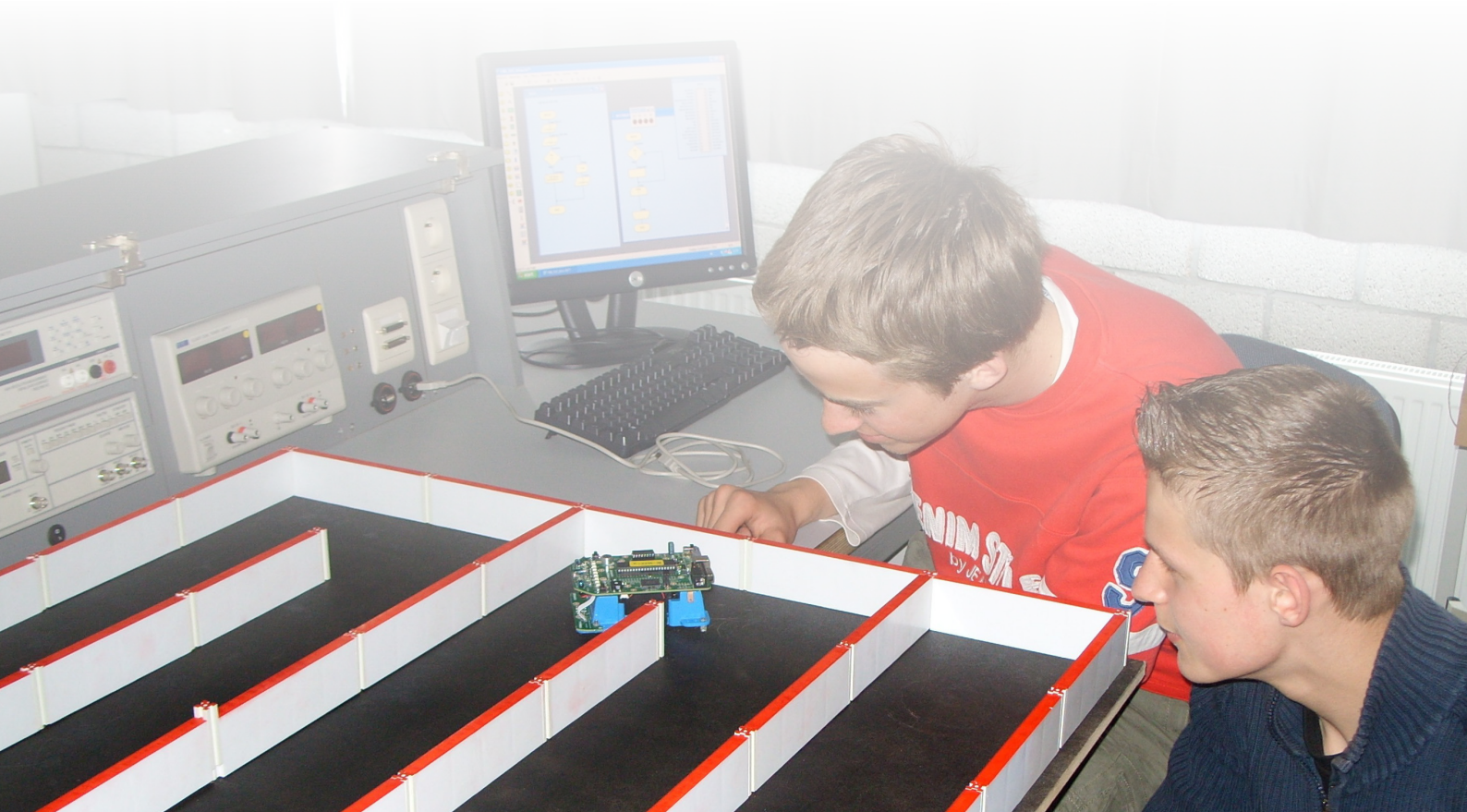
Features

- USB programmable
- High technical specification
- Micromouse competition compatible
- Can also be programmed in C and Assembly
- A2 line following track is provided

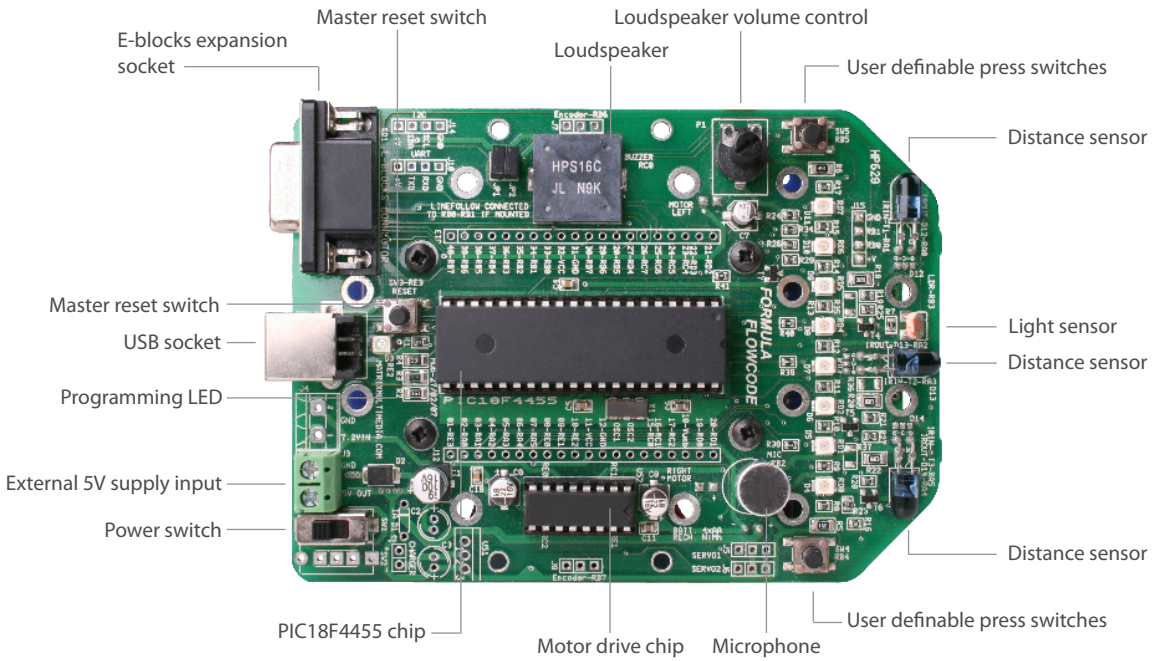
This maze solving robot has been designed to provide a motivating platform for learning robotics for all ages. The robot addresses the requirements of technology education in schools and colleges and the electronic circuit board can also be used for mechanical projects at 16+. The high specification two wheel robot is powered from rechargeable batteries and is compatible with the function limited version of Flowcode graphical programming software - available in twenty languages. Flowcode's drag and drop interface allows students with no previous programming experience to create a wide range of programs for the robot. Simply develop the program, simulate its functionality on-screen and then click on a button to download the program to the robot via USB. The robot is designed to allow learners to complete a range of programming tasks with increasing levels of difficulty, building their understanding as they progress through the tasks.

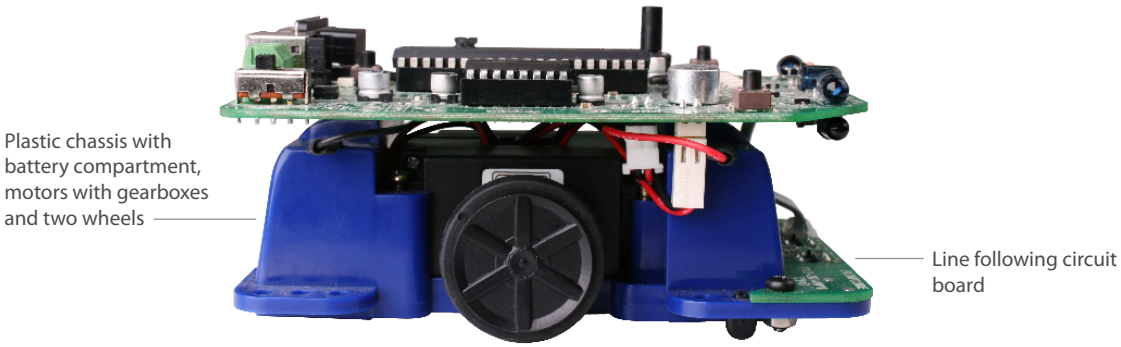
The technical specification of Formula Flowcode is impressive: it uses an advanced PICmicro 18 series microcontroller with internal precision motor controller circuitry, has three infrared distance sensors, line following sensors on a separate circuit board, a speaker, audio level sensor, light sensor, two spare switch inputs, eight user programmable LEDs and various expansion buses - including an E-blocks port.

"Lego NXT is a great product. This is better - it actually teaches students how robots think and work"
Bart Huyskens
St. Joseph's College, Belgium



Package details





Chassis

Speed	5 - 20cm/s
Size	130 x 80 x 37cm
Motor	MRM - GM03 with gearbox
Battery	AA x 4

Controller circuit board

CPU	PIC18F4455
Outputs	8 x user definable LEDs, power LED, one bit speaker
Inputs	2 push-to-make switches, sound level sensor
Motor driver	L293D
Distance sensors	TSAL5100, BPV11F transceivers
Line followers	TCRT5000 on daughter board
Power	4 x AA rechargeable NiMH

Controller circuit board

Windows XP, Windows Vista, Windows 7, Windows 8

Pack contents

Plastic moulded chassis and gearbox
Controller circuit board
4 x M3 posidrive self-tapping screws
User guide

Assembly requirements

Chassis is built and tested in the factory. The controller circuit board is built and tested in the factory. Final assembly using posidrive screwdriver is all that is required. No soldering required.

Formula Flowcode is micromouse competition compatible

Formula Flowcode software specification

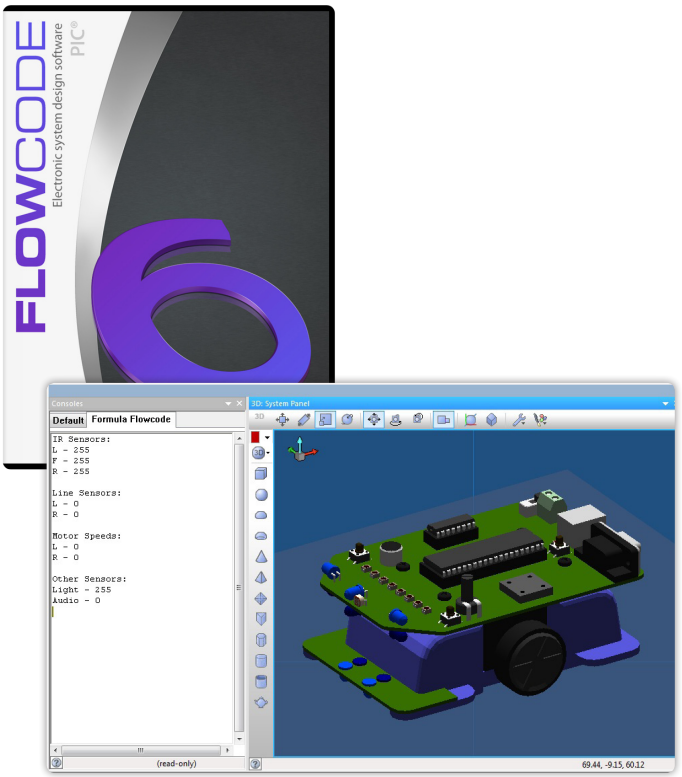
The robot is compatible with the function limited version of Flowcode but is best used with the full version, which contains full simulation of the Formula Flowcode chassis.

Formula Flowcode software

The Formula Flowcode robot is compatible with Flowcode; one of the world's most advanced graphical programming languages for microcontrollers.

The great advantage of Flowcode is that it allows those with little experience to create complex electronic systems in minutes. Flowcode achieves this in three steps: firstly users drag and drop flowchart symbols onto the screen, and fill in the dialogue boxes when prompted. Then users can simulate the program within Flowcode and view the results on the robot simulation panel. Finally, Flowcode compiles the flowchart into code that is downloaded to a PICmicro microcontroller which executes the program.

Flowcode is available in twenty languages, including English, Finnish, French, German, Italian, Dutch and Spanish.

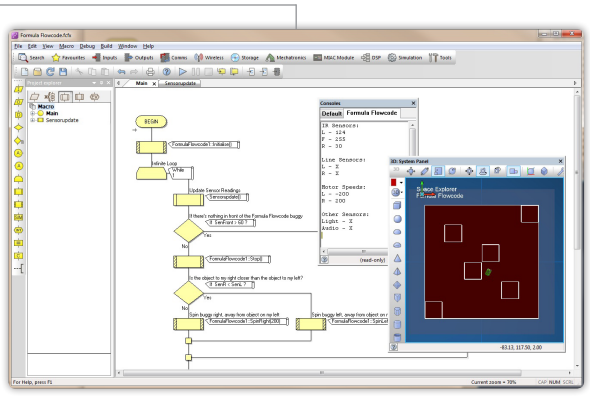


Flowcode simulation

Design

Flowcode contains standard flowchart icons and electronic components that allow 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.

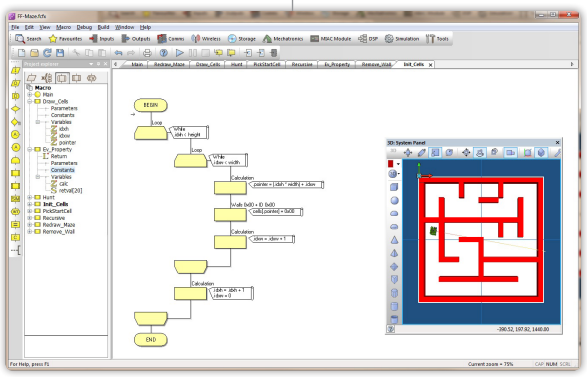
- Easy to use interface
- Allows complex programs to be developed and managed quickly
- All robot I/O and expansion options are supported in Flowcode



Simulate

Once your system is designed you can use Flowcode to simulate it in action. Test the system's functionality by clicking on switches or altering sensor 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 Formula Flowcode robot. Remove the USB lead and press the reset button and your program starts to run.

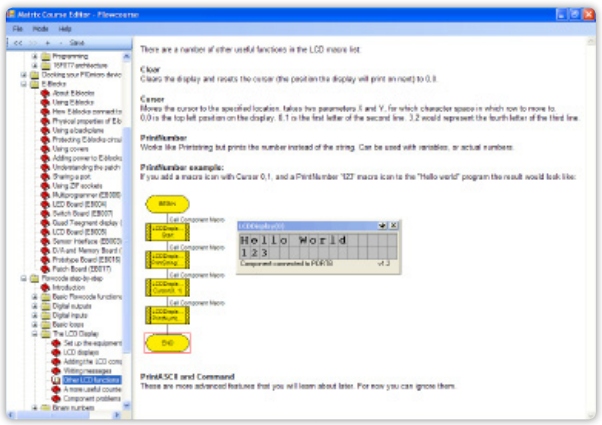
- One button download
- Compiles to C and Assembly
- Link in your own C files

Curriculum and support

Curriculum

As background learning material the course 'An introduction to microcontroller programming' is available. This course includes a wealth of material on PICmicro microcontrollers, their operation, circuitry and project work. It also includes a large section on developing programs using Flowcode which covers, inputs, outputs, loops, decisions, macros, memory, string handling and much more.

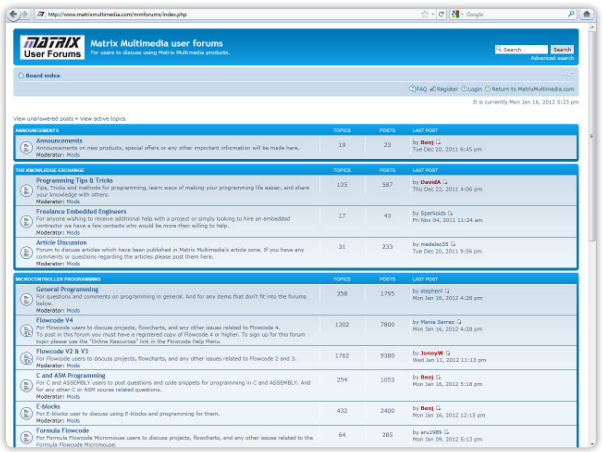
At the time of going to press this is only available in English. This course is available free of charge on the learning centre at www.matrixtsl.com.



The course 'An introduction to microcontroller programming' provides background material on developing electronics systems with Flowcode

Support

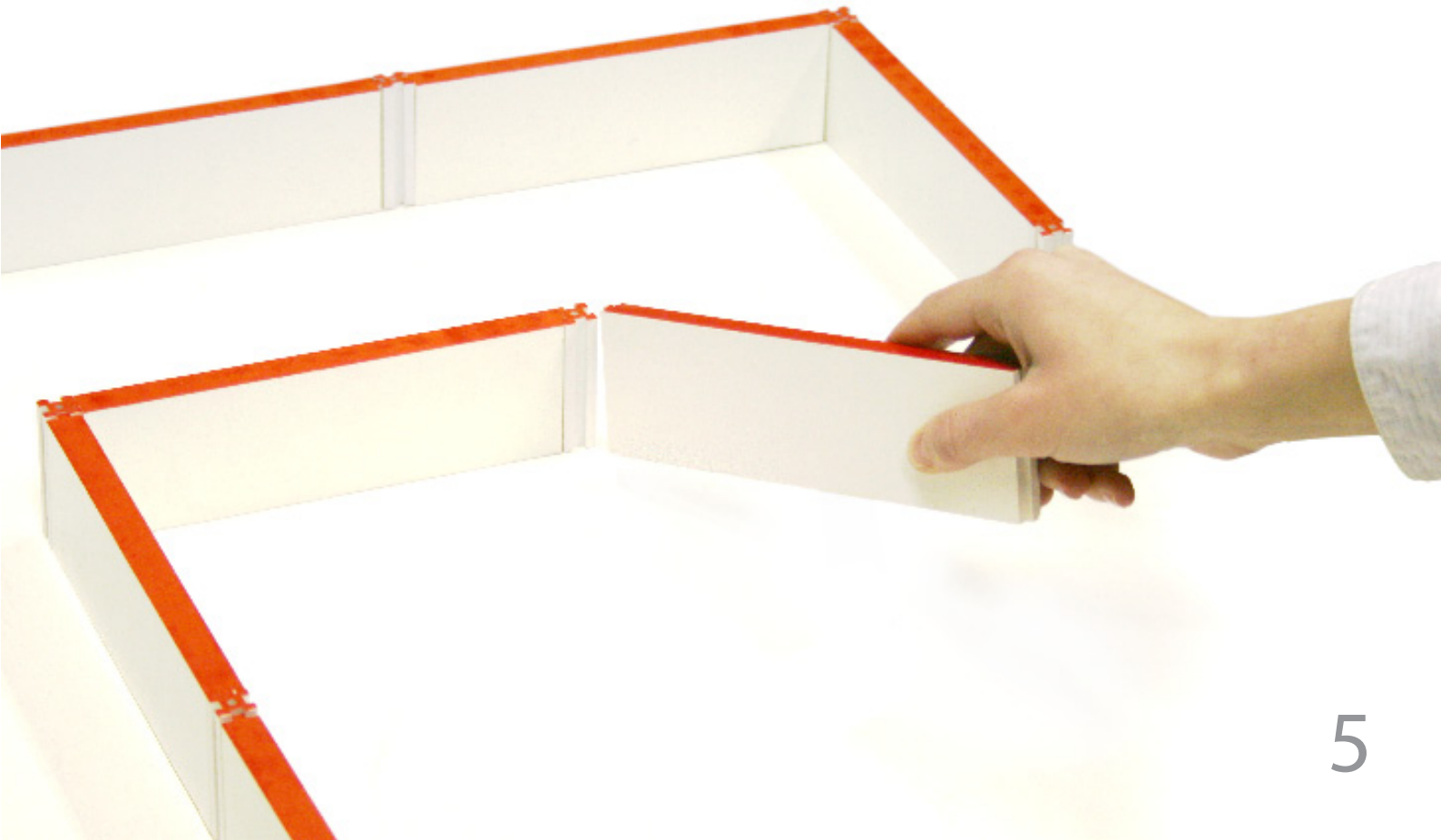
User support for Formula Flowcode is available on the Matrix TSL forums where users can ask each other questions and swap programs.



Support is delivered using the Matrix TSL forums

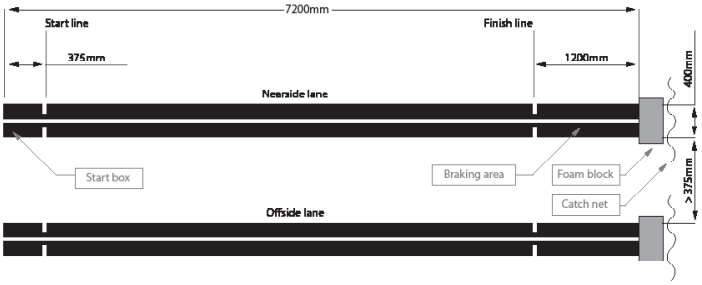
User guide

A user guide is shipped with Formula Flowcode which includes assembly instructions, installation instructions, the circuit diagram and operation.

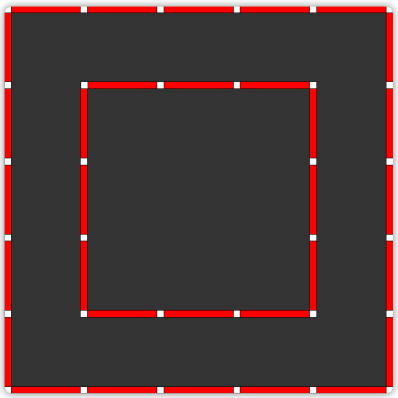


Challenges

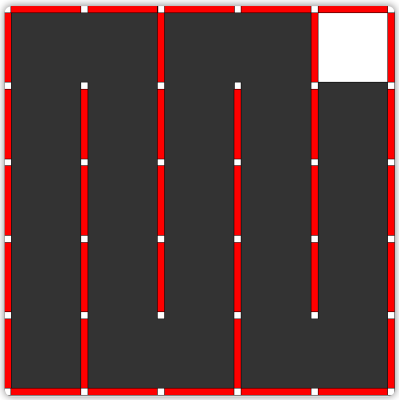
Formula Flowcode is named after the Formula Ford racing competition where cars are all identical and winning only comes down to the driver's skill. In this case winning comes down to the programming skills of the user. As you might expect there are a number of separate challenges that users have to complete to increase their skill level. These challenges start with getting a single LED to light up, and finish with full maze solving using a custom made chassis, with wheel encoders etc. This is the really clever idea behind Formula Flowcode - it is great for complete beginners to robotics and electronics, and it will also provide a considerable challenge to those studying for degrees in electronics and computer science. Many challenges are possible, the 10 prescribed challenges can be seen on the right:



The drag race, made with electrical tape on a white surface



The Daytona 5, a simple maze based race



The lefty, a more complex maze based race

LEDs and switches 1
Use switches and LEDs to understand inputs, output and binary operation.

Robopop 2
Use the loudspeaker to generate tones and even music themes.

Driving the motors 3
Program the robot to drive the motors with a specific speed and direction so that predetermined figures such as a triangle, a square, a circle or a spiral are made.

Follow the line 4
Follow an unknown line (closed figure, white line on black background) as fast as possible. The fastest mouse wins

See the light 5
The robot shall be placed as far away from the light as possible, not facing the light. The robot needs to find its way to the light, as fast as possible, and stop in the white rectangle in front of the light without hitting the wall.

Drag race 6
Travel as fast as possible over a straight course, following a white line, then brake and stand still before hitting the end wall. **This is a competition event.**

Daytona race 7
Do three laps around the maze as fast as possible, the fastest mouse wins. One second will be added for every time you hit a wall or make a 'touch'. **This is a competition event.**

Lefty 8
Solve a known maze as fast as possible using the wall-following technique. Stop on the white square. One second will be added for evert time you hit a wall or make a 'touch'. **This is a competition event.**

Full maze 9
Solve an unknown maze by mapping it first and then driving the fastest courses as fast as possible. The fastest run out of five runs counts. **This is an advanced competition event.**

Customise 10
Build your own chassis from scratch and carry out the full maze exercise. **This is an advanced competition event.**

Expansion options

E-blocks

The Formula Flowcode robot is fitted with holes at 20mm intervals and a full expansion port on a D-type E-blocks connector. These features mean that it is possible to add an E-blocks board to the chassis to extend its functionality: for example an additional LCD display or a Bluetooth communications board.

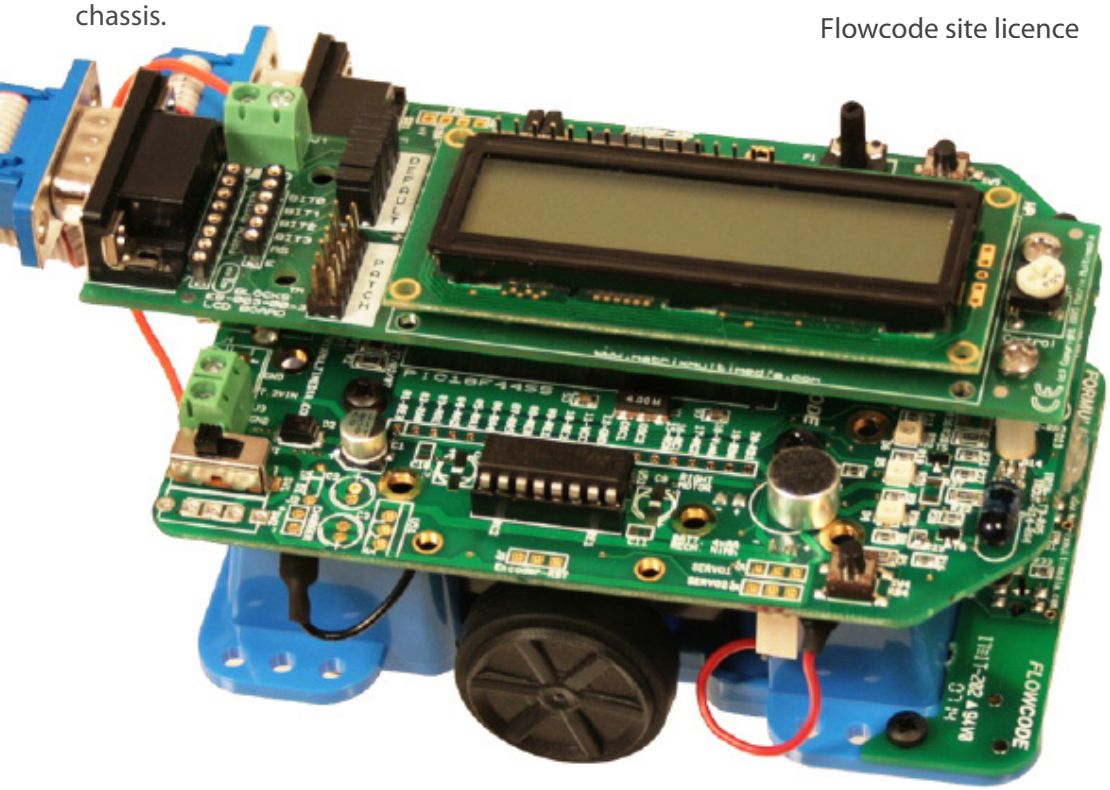
Other expansion

The E-blocks connectors exposes the communications port of the chassis so that it is also possible to add a wider range of accessories including ultrasonic, image, speech etc. Servo motor connectors are also available to provide additional robotics functions.

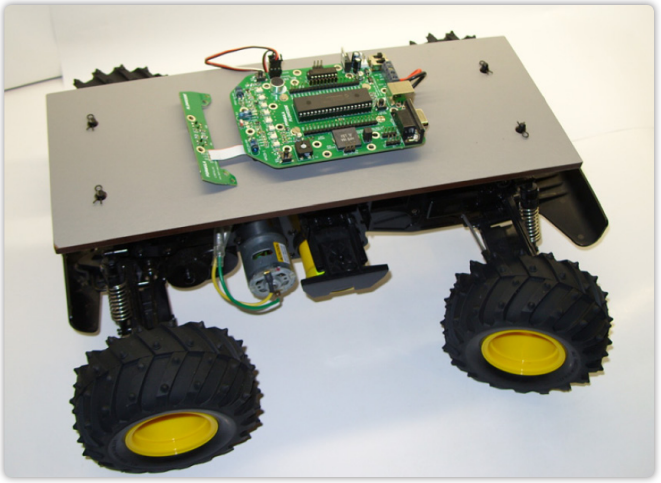
Mechanical engineering work

The Flowcode controller circuit board is designed so that it can be used on a mechanical chassis, other than the one supplied as standard, using expansion features such as additional connections for servo motors, and wheel encoder inputs.

This makes the chassis suitable for use as part of a course where students study both electrical and mechanical engineering. In these courses students are tasked with designing their own chassis using custom made metal parts and higher specification motors. This approach also allows students to develop their expertise further with full international standard mazes being solvable with the chassis.



Formula Flowcode is compatible with E-blocks, like the LCD board shown here



Students can use the controller circuit board as a basis mechanical engineering design work

Upgrade with additional E-blocks

LCD display	EB005
Graphical display	EB084
Keypad	EB014
Bluetooth board	EB024
Power supply	HP5328

Upgrade to a full version of Flowcode

Flowcode professional	FC6AC01NEPIC
Flowcode 10 user	FC6AC10NEPIC
Flowcode site licence	FC6AC50NEPIC

FlowKit In Circuit Test board

The FlowKit can be connected to hardware systems to provide a real time debug facility where it is possible to step through the Flowcode program on the PC and step through the program in the hardware at the same time. This function is available with Flowcode for PICmicro V.4.2 or later.

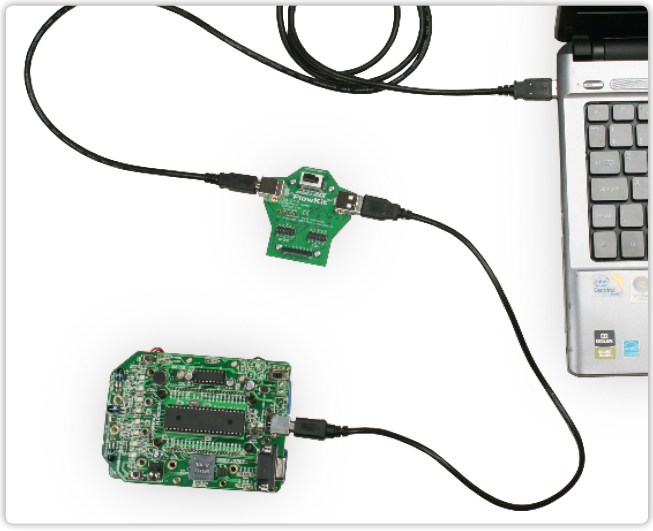
Benefits

- Helps to solve programming problems
- Seamless program and debug

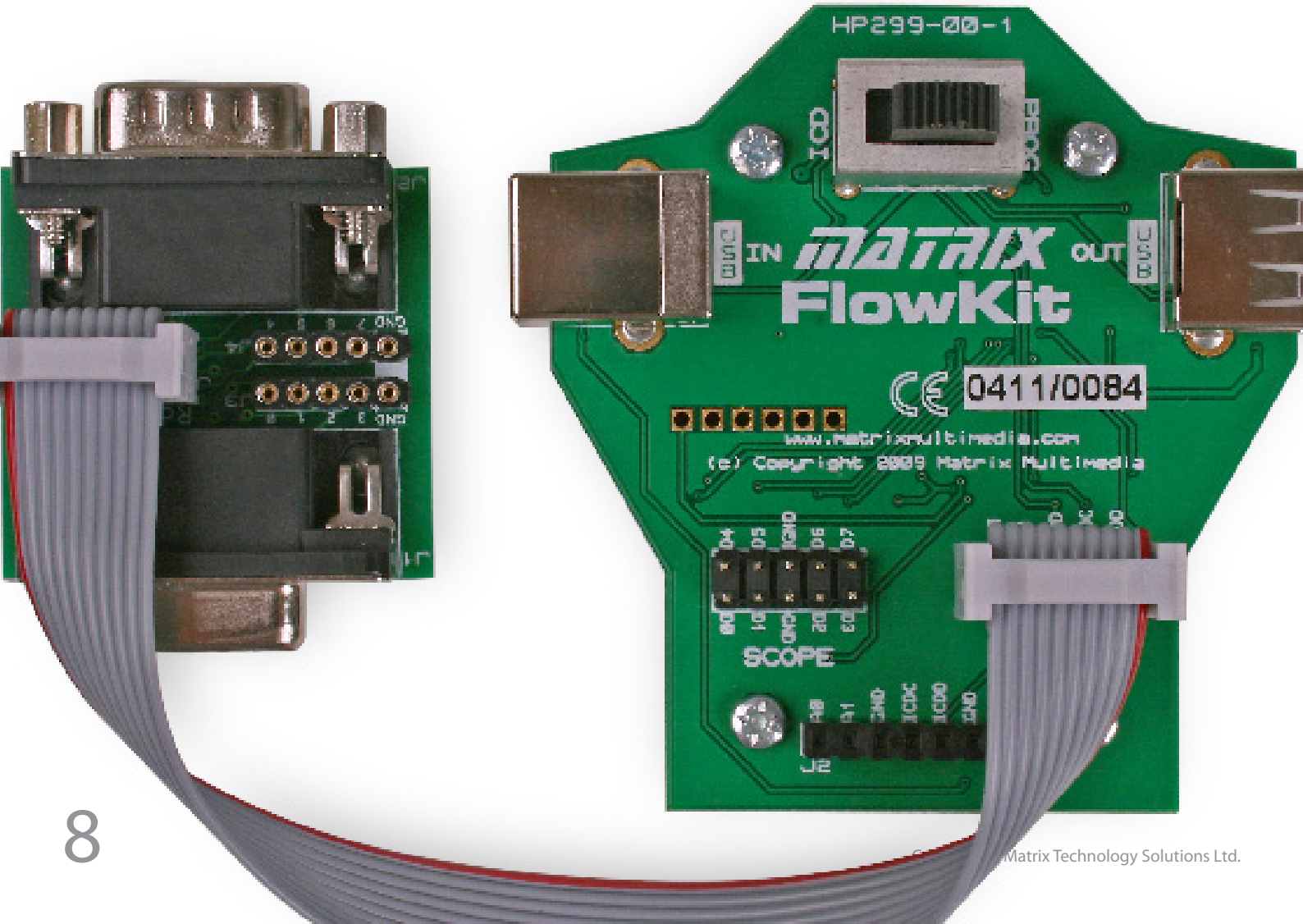
Features

- Compatible with ECIO, MIAC and Formula Flowcode systems via the USB lead
- Available for Flowcode for PICmicro 4.2 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 the 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.



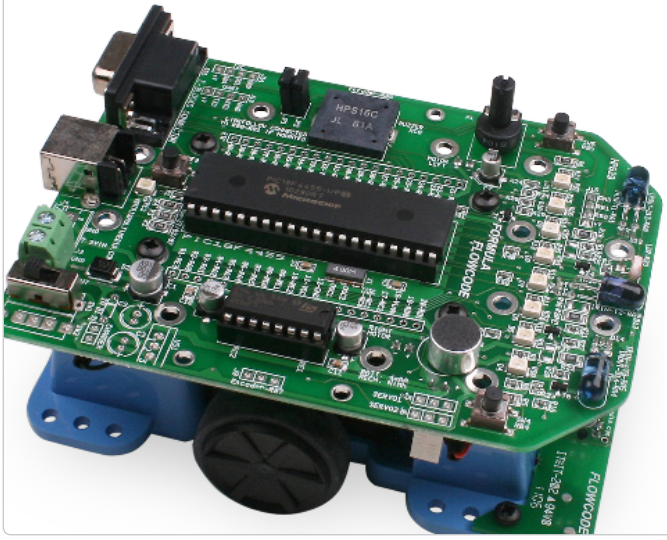
Using FlowKit with Formula Flowcode



Products and purchase options

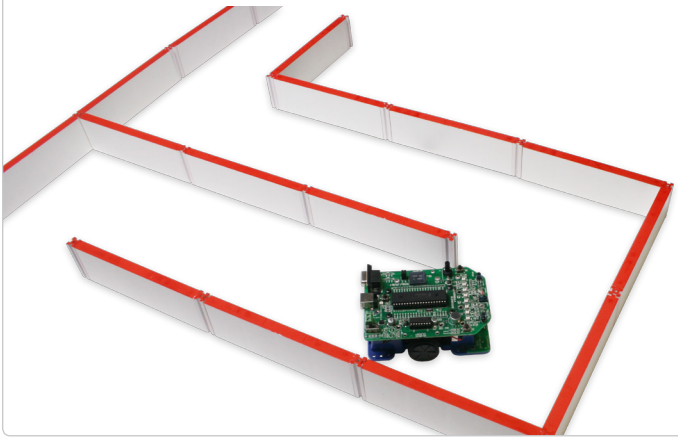
Formula Flowcode HP794

Individual Formula Flowcode kits - includes built and tested controller board and plastic chassis with gearbox. Works with the function limited version of Flowcode which is available from our website.



Maze walls HP458

These walls and posts are designed to allow you to create a maze of your own. Each wall measures 168 x 12 x 50mm. 30 walls and posts are included in the pack which allows you to make a 5 x 5 cell maze.



Chassis only HP295

Starter class bundle HP926

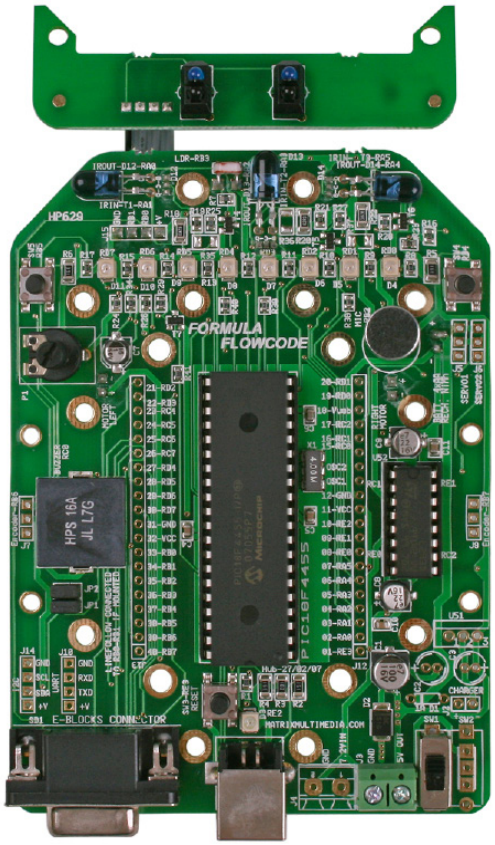
Includes 5 Formula Flowcode kits, 1 set of maze walls, a storage tray and a copy of the 'Introduction to microcontroller programming' course. Sufficient for 10 students working in pairs. Compatible with challenges 1 to 5.

Pro class bundle HP454

Includes 10 Formula Flowcode chassis kits, 1 set of maze walls, a site licence of Flowcode V6 professional software (worth £700). A copy of the 'Introduction to microcontroller programming' course, 5 LCD displays, 4 IDC cables and two storage trays. Sufficient for 20 students working in pairs. Compatible with all challenges.

Circuit board only EB629

This is the built and tested controller circuit board from Formula Flowcode.



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