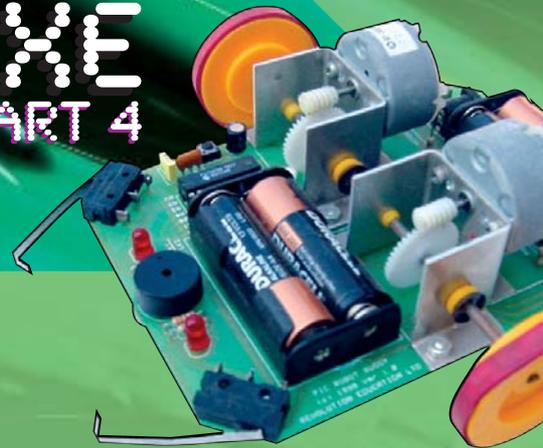# PRACTICAL PICAXE
PART 4

Controlling Motors

John Cook builds on his previous article on motor control and takes us a step further with some useful ways to control and drive motors in robot vehicles using PICAXE and some practical advice on motors. All the circuits can also be found for this and previous articles on the TEP website at www.tep.org.uk
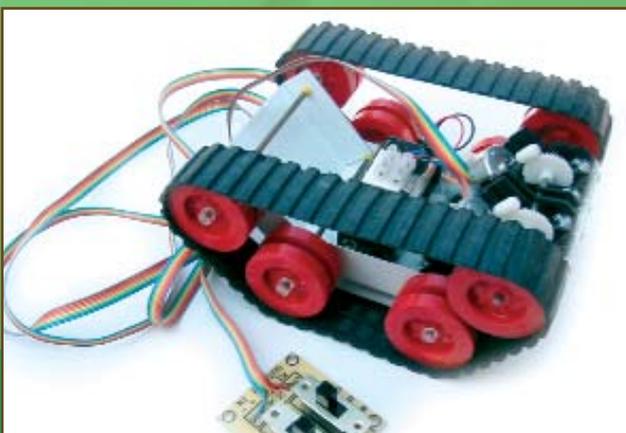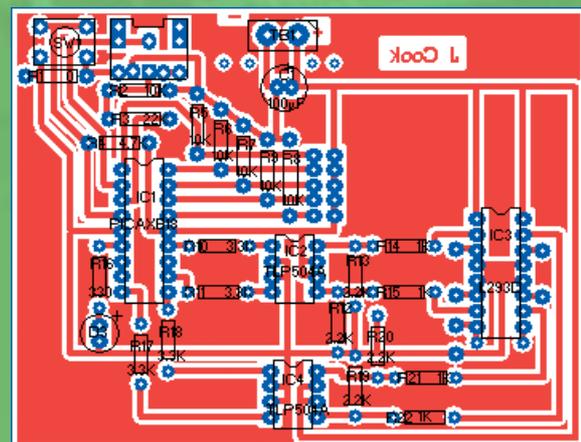
My first introduction to PIC's was a one-day course, run by Clive Seagar, where we built and programmed a buggy using the then new **Chip Factory**. I was struck by the ease with which programmes could be produced and downloaded. Shortly after, I ran a few INSET sessions for TEP using some loaned Chip Factories and buggies. Whilst I had the kit I decided to see what impact PIC's would have with my year 10 System and Control Pupils just before they were about to begin their major projects. This very quick introduction resulted in the pupils deciding to go 100% down the PIC route, establishing the norm for years to follow.

There is still a lot of mileage to be gained from buggies and walkers. My recent experience with year 9 pupils at **Harper Adams**, article in last News & Views, reminded me of the fun and excitement that these projects can develop.

TEP produce this **Magic of Engineering** tracked vehicle operated via an umbilical wire from two double pole double throw switches. The original design was great in straight lines but tight turns were impossible due to the amount of friction produced by the tracks. After a bit of product analysis, pupils quickly decided upon various solutions, such as the one below which will turn on the spot, is fairly fast and fun to drive over various terrains.

The next logical step was to produce a vehicle that can operate independently, removing the need for the umbilical. This would demonstrate clear progression and offer the potential for extension work.
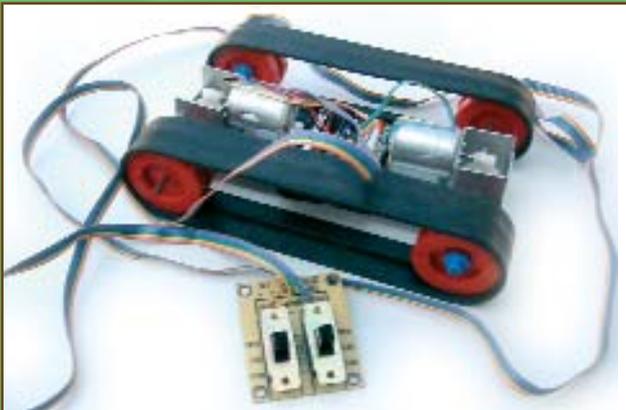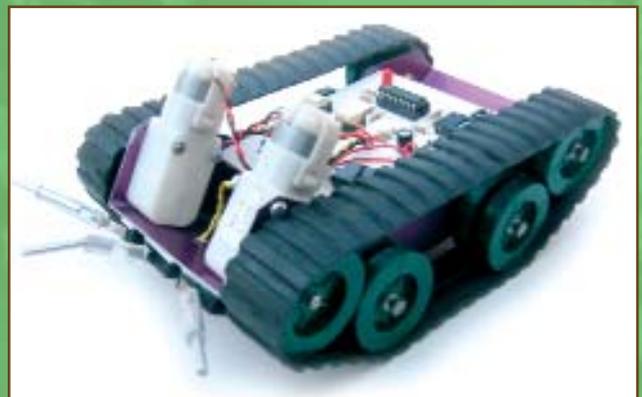
My last article introduced motor control via a motor driver chip, **L293D** and used an **opto-isolator** to prevent noise from stopping the PIC Programme running correctly. In order to access top marks at GCSE controlling one motor is sufficient, using one half of the L293D, but in order to steer a vehicle requires two motors thus utilising the motor driver to its full. The **PCB Wizard** example shows the full use of the L293D chip and two opto-isolator chips. Whilst it is possible to buy a quad opto-isolator, I prefer to limit the number of different components used.

There are a couple of small points worth mentioning, **pin 8** and **9** of the motor driver chip are coupled together with a wire link to provide the same battery supply to each motor using the pads below the pins. The pad joined to the left of pin 8 allows for a separate power supply positive connection and the pad directly below the **0v** connection.

If only one power supply is used then the pad joined to pin 8 needs to be connected to the positive supply at some convenient point such as the terminal on the on/off switch.

The real world view shows the pupils the correct orientation of the components. For colleagues with no facilities to manufacture their own PCB's I have produced a couple of examples using **High Power Project Boards** available from TEP.

There are numerous ways in which vehicles can be programmed, one simple method is to drive both motors forward until a sensor, such as a micro switch, is activated and the vehicle then reverses slightly and then turns away.

This example shows the two motors being driven forward, **let pins = 80**, then there is a 50 millisecond pause after which a check of the three micro switches is carried out. If no switches have been activated then the buggy continues forward. In effect the programme is checking the micro switches every 50 milliseconds. If the left micro switch hits an obstacle then the programme goes to **sub0**, where both motors are reversed for 200 milliseconds and then the left motor alone turns the vehicle to the right away from the obstacle. The same happens if the right micro switch is hit, the programme goes to **sub2** turning the vehicle to the left. If the centre micro switch hits something directly in front of it the programme goes to **sub1** which reverses both motors for 500 milliseconds and then turns the vehicle through 90 degrees by making one motor go forward and the other

reverse for 800 milliseconds. The end of all the subroutines is joined back to the start. The key to success is to know which inputs are connected to which pins and which outputs drive the motors forward and reverse. The timings are a matter of experimenting until the desired performance is achieved. Thankfully with PICAXE there is no need to remove the chip for reprogramming. The programme is then converted to basic using the 'convert to basic' option under the flowchart heading.

The programme can then be downloaded to the chip in the normal way.

There is no end of possibilities for design whether they are walkers (my thanks to **Keiron McGeever** for this one) or why not try the new knobbly tyres from Teaching Resources.

The examples I have used in this article have used the **clunk click gearbox** and the fairly recent **economy gearboxes** both from Teaching Resources. The clunk click gear boxes are easy to use with young pupils but for real control the economy gearboxes offer a lot of potential. They come in two different gear ratios, 120:1 and 200:1. The 120:1 are great if you are driving the standard size wheels but are too fast for large wheels where I would recommend the 200:1.

A problem I encountered with these gearboxes is attaching wheels or cams directly. I produced a silver steel punch, the same section as the spindle and used a press drill to produce the necessary shaped hole. This works fine but seriously reduces the clearance distance between the gearbox and cam or wheel.

A better way is to use a 2.5mm tap to thread the existing hole on the gearbox shaft and then sandwich the cam or wheel between two star washers, apply some thread lock and screw the wheel onto the end of the shaft with a 2.5 mm bolt.

Once the thread lock has set, the result is a very positive drive arrangement.

➡ **For further help or assistance you can email John Cook at:**
jcooklggs@hotmail.com