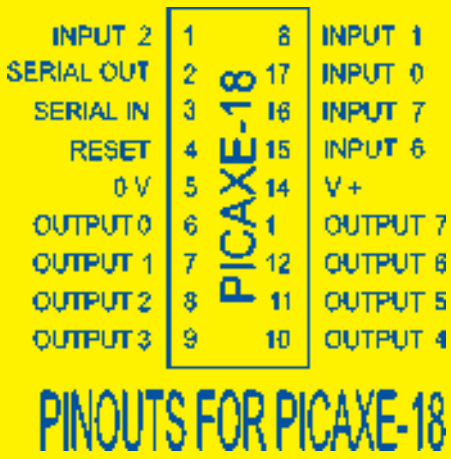
PRACTICAL PICAXE
PART 2

Security Projects

Following the work on the 8 pin PICAXE dice in the last issue of News and Views, John Cook gives us an alternative starting point for some interesting GCSE work. Readers are reminded that all PCB files featured in Johns articles can be downloaded from the TEP website at www.tep.org.uk

There must be a time in every teacher's career where you feel that there needs to be a change. Our pupils have been achieving good results in Systems and Control for many years but we were concerned that the standard of their major projects were really no better than their minor projects. A lot of time was spent on research at the expense of any real system development and we were beginning to question the educational value of what we were doing. Most of the time seemed to be spent producing a folio and a fancy case for what in reality was a basic circuit. We, like many other schools, used to spend considerable amounts of time after school, weekends and even holidays struggling to get projects working and finished. Pupils often found it a harrowing experience and not surprisingly did not want to continue with Design and Technology in the sixth form.

In 1999 we decided a radical change was needed and we abandoned 555 Timers and 741 Operational Amplifiers and embraced PIC Technology. One theme was chosen 'Security' and thanks to our local Crime Prevention Officer, who willingly came and talked to the girls and supplied relevant literature, we managed to complete the research section in a fortnight instead of a couple of months. We were able to teach the pupils and found the management of the pupil's progress far less stressful. The folios showed real system development rather than reams of 'neat nonsense'. No single model will ever suit everyone and I am certain that the model I am presenting here is far from perfect but it is a start that can evolve and be refined.



PINOUTS FOR PICAXE-18

The pinouts show there are eight outputs and five inputs, inputs 6 and 7 being analogue inputs.
The minimum circuit is shown in Fig 2.

The PIC must have all of the circuit in order to function correctly (see Fig. 2). All of the inputs must have the 10K 'pull down' resistors, even if all of them are not going to be used. The reset switch is useful if a programme hangs up, but the smoothing capacitor is, however essential. A PCB Wizard File was found on www.rev-ed.co.uk and this was to be the starting point for all pupils.

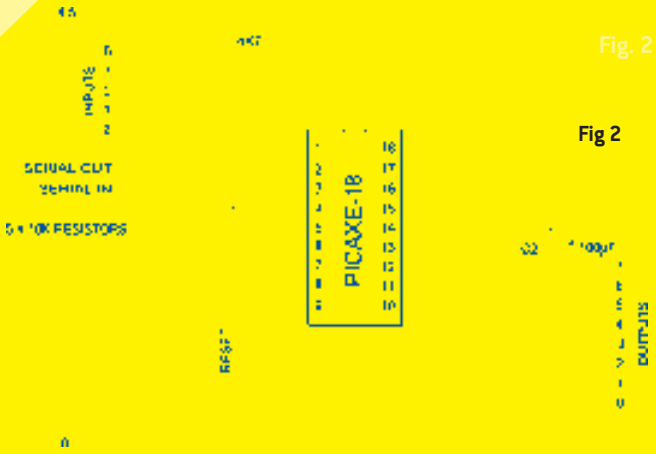
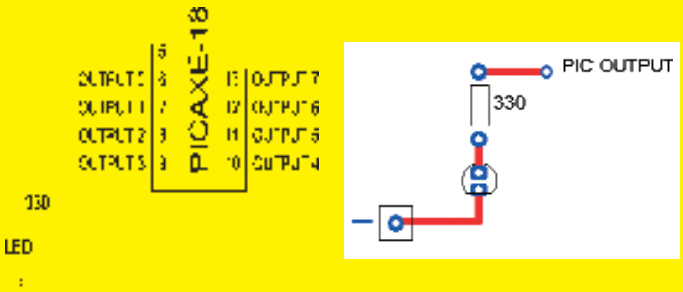


Fig. 2

Fig 2

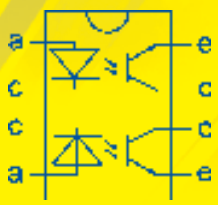
Pupils decided what aspect of security they were going to pursue and what inputs and outputs would be appropriate. One of the commonest was a bicycle alarm and this article will describe the way they achieved successful outcomes. All alarms tend to have a flashing LED as a deterrent. An LED module was produced, as shown below, and this could be connected to any output.



All other devices draw much more current than an LED and require some form of interface in order to supply the necessary voltage or current requirements. Buzzers, bells, relays, solenoids and motors are all electro-magnetic devices and as such require special treatment. These devices can cause the PIC to stop running. The reasons have been put down to noise or a dramatic voltage drop when they are activated. The best solution I have found is to use an opto-isolator, which interfaces between the device and the PIC.

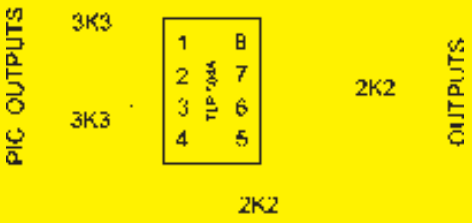
The pin out is shown below.

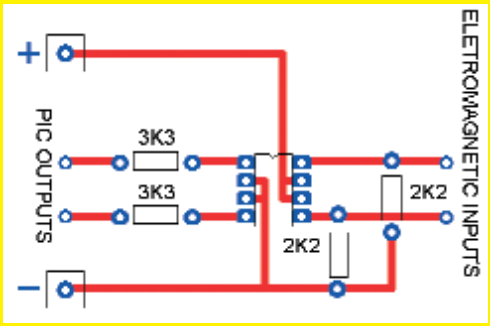
OPTO ISOLATOR TLP 504A



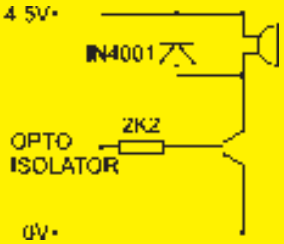
Inside this chip there are two opto-isolators. As can be seen there are two diodes that emit infra red light when current flows through them. There are two transistors whose bases are infrared light sensitive. When infrared light falls onto the base the transistors conduct, when no infrared light is present the transistors are insulators. Light can only travel in one direction and so this device blocks any "noise" flowing into the PIC.

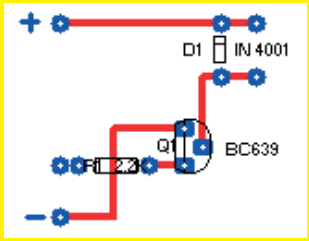
The circuit arrangement and PCB Wizard module for the opto-isolator is shown below.

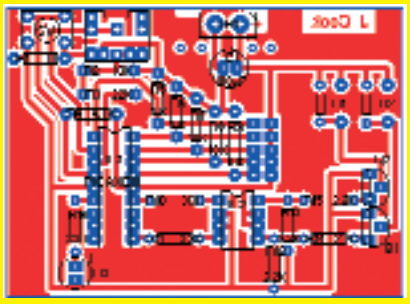


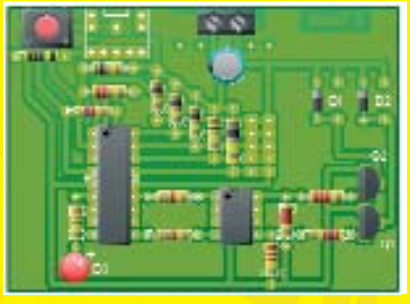


The outputs from the opto-isolator can then be connected to a power transistor such as the BC639.



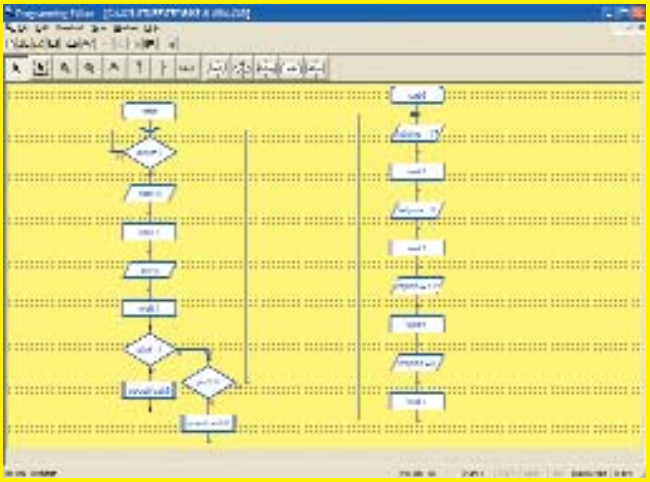


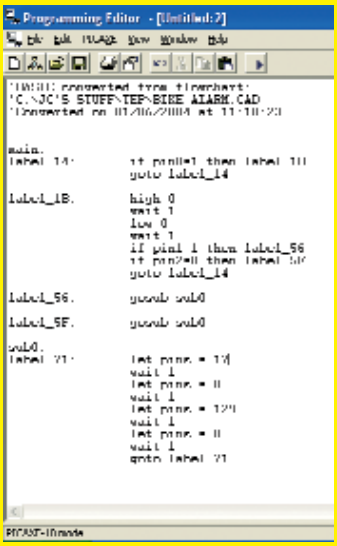




Pupils use these modules to create a variety of alarm circuits and using the PCB Wizard modules can quickly progress to circuit manufacture. Below is one possible bicycle alarm that has a key switch, tilt switch and chain switch as inputs and an LED, buzzer and light bulb as outputs.

There are numerous ways this alarm could be programmed but here is one possibility as a starting point.





This programme has the key switch on pin0, tilt switch on pin1, chain switch pin2, output0 is the LED, output4 is the bulb and output7 the buzzer. This can easily be converted to Basic.

This can now be downloaded via the serial port cable to the project board and tested before being encased. Here are a few pupil outcomes.

Canoe Alarm

Bicycle Alarms

Grandma remember to put the chain on!

Pushchair Alarm

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