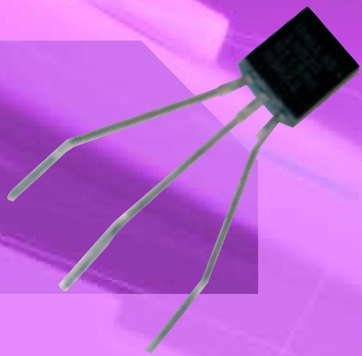
# PRACTICAL PICAXE
## PART 8

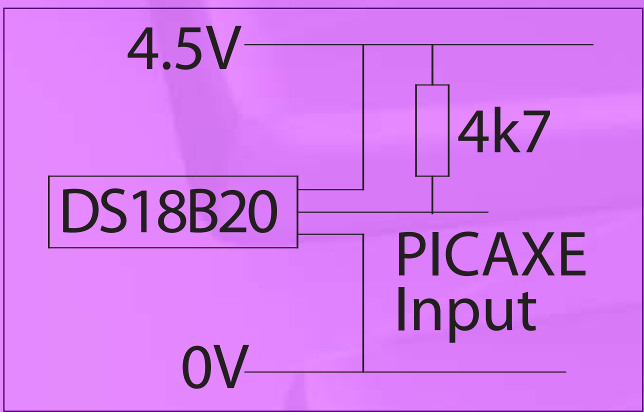


## Ideas for Inputs and Outputs

**John Cook takes us through this, his last article in the present series as he assembles together a few useful and intriguing ideas for inputs and outputs.**

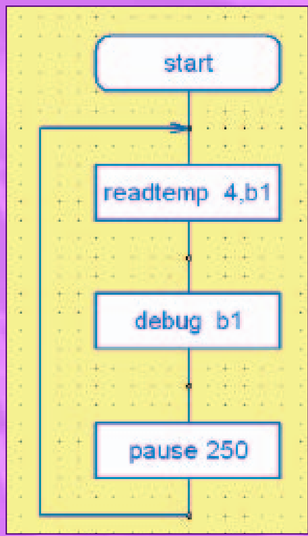
We will look at a few useful inputs and outputs that colleagues may not have used or even been aware of. For many years I used ORP 12 light-dependent resistors and latterly the smaller low priced version from TR EL1 002A. For projects that required heat sensors I struggled with various thermistors with varying amounts of success. The DS18B20 digital temperature sensor is an easy to use very accurate device that looks like a plastic transistor.

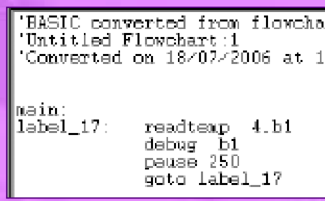
The advantage of a digital temperature sensor is the precision of the output from -55 to +125 degrees Celsius. As the sensor outputs a calibrated digital reading, the output is an exact temperature in degrees Celsius. This is far simpler to use than a thermistor which provides a non linear resistance change with temperature variation, this makes calibrating exact temperature thresholds very difficult for students.



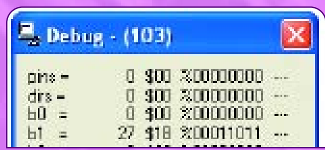

The circuit requirements are very simple, the two outer legs connected to V+ and 0V. The middle leg is connected to a PICAXE Input with a 4k7 resistor. Please note that the temperature sensor will not work with the basic PICAXE 08 and PICAXE 18 but does work with the PICAXE 08M and the PICAXE 18A or 18X. Due to the protocols associated with this sensor it requires two way flow of information and so will not work with pin 3, the input pin, of the PICAXE 08M.

To test the sensor, produce a simple flowchart.

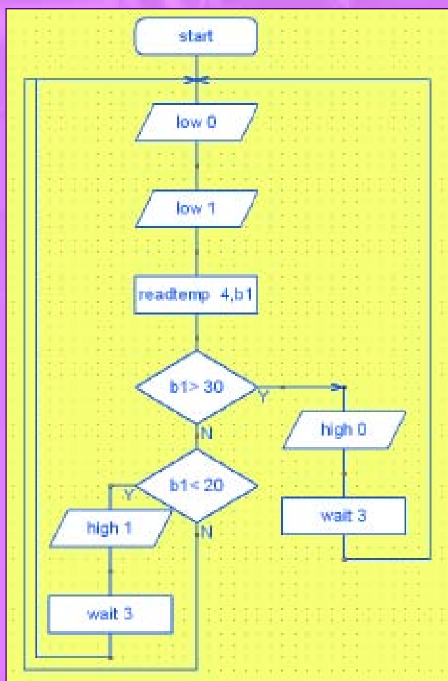



Download the programme in the usual way and the temperature value will be constantly displayed on screen.




Students can then proceed to create their own programme which could be switching on a cooling fan, pump, visual display or digital readout. A typical application might be opening a greenhouse ventilator with a suitably geared motor when a set temperature has been exceeded and switching on a heater when the temperature falls below a set value.

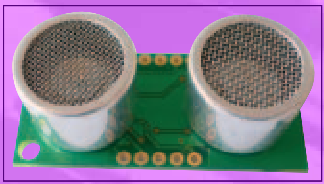


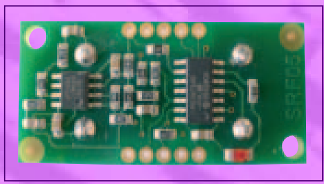

This programme has the sensor on input 4, of a PICAXE 08M. If the temperature exceeds 30°C then output 0 is switched on; if the temperature drops below 20°C then output 1 is turned on. Obviously suitable interfacing is required as described in the previous articles.

This small device could be housed in numerous ways and could provide the solution to many students' projects.

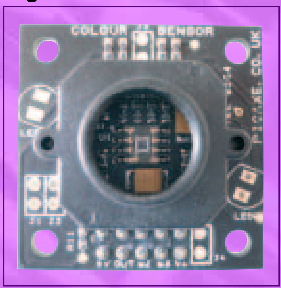
## Alternative sensors

Two other sensors that may be useful for high flyers in KS4 or more likely KS5 students are an ultrasonic range sensor and a colour sensor. The ultrasonic range sensor is sensitive enough to detect a 3cm broom handle at a distance of over 2m.





This device requires a 5V power supply and has an effective range from 3m down to 3cm. The trigger Input is connected to a PIC output pin which creates a sonic burst, via a 'pulsout' command. The Echo Output, connected to an input pin, is set high for the time it takes the sonic burst to be returned. The length of the echo pulse is then divided by 6.2 to give a value in cm.




This Colour Sensor is a complete RGB (red green blue) module for colour detection and sorting purposes.

The basic principle is that white light is an equal mixture of red, green and blue light. All other colours are varying mixes of the basic three colours. This sensor can by cycling though various options to decide the RGB content of a sample and hence its colour.

## Radio Control Servo Output

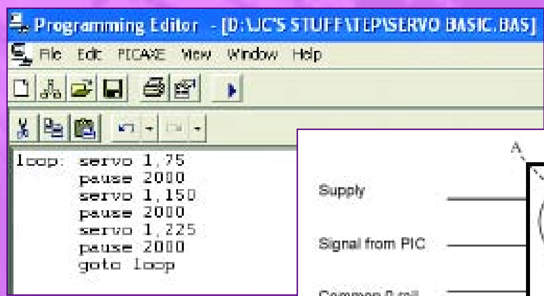
Servos have been used by modellers for many years to accurately control their models whether they are land, water or air based.

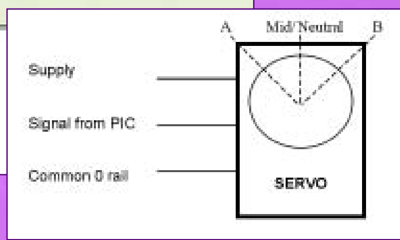
This example shows two servos being used to control the rotors on an electric helicopter.

They have not been used by large numbers of students in schools is probably due to their cost. Like everything else servos have improved over the years and the cost is now within reach of most student budgets. With only a three wire connection and lightweight and small size they are set to be a popular alternative to stepper motors in applications in project work.

The small servo was bought second hand from a model shop for just £4 but the one on the right was obtained off an internet site for 99p!

Servos are a means of very accurate position control and have certain advantages over stepper motors. Servos are a very accurate motor and gearbox assembly that can be repeatedly moved to the same position due to their internal position sensor. They are operated by pulses of 0.75 to 2.25ms every 20ms; and this typically gives about a 120° rotation. Giving a pulse of 1.50ms would send the servo to its mid point. An advantage of servos over stepper motors is the ease with which they can be programmed and the fact that they do not over-run and lose their datum point as stepper motors can, especially if rotated quickly. A downside is that the servo can only be programmed in basic rather than on a flowchart. The commands are simple and should not be beyond a KS 4 student studying Systems and Control where they have to include a mechanical output.




This simple programme would move the servo to end A for 2 seconds, then the mid position for 2 seconds and then the other end B for 2 seconds the process then repeated in a loop. Servos are quite 'noisy' devices and require large currents so in most cases require their own power supply but with the Ov rail connected (commoned) to the PIC Ov rail.

Look out for more work on servos in future issues.

I would like to thank colleagues for their emails and interest in the current series and wish all teachers and students well in continuing to develop PIC based work in D&T.

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

You can find all the previous articles on the TEP website these include:

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| 3 | Security projects | Issue 8 |
| 4 | Security and Control | Issue 9 |
| 5 | Controlling Motors | Issue 10 |
| 6 | Using analogue inputs | Issue 11 |
| 7 | Stepper Motor Control | Issue 12 |
| 8 | Making Music | Issue 14 |