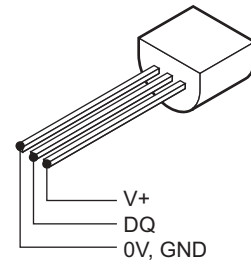# DIGITAL TEMPERATURE SENSOR KIT

Introduction

The DS18S20 is a digital temperature sensor that will output temperatues between –55 to + 125 degrees Celsius. This makes it simple to solder to wires or printed circuit boards.

The advantages of a digital temperature sensor are principally with it's precision output. As the sensor outputs a calibrated digital reading, the output is an exact temperature in degrees Celsius. This means no other components, such as an analogue to digital converter, are required within the electronic circuit to calibrate or amplify the signal. This is much simpler to use than, for instance, a simple thermistor which provides a non-linear resistance change with temperature variation, which makes it very difficult for students to calibrate 'exact' temperature thresholds within their projects.
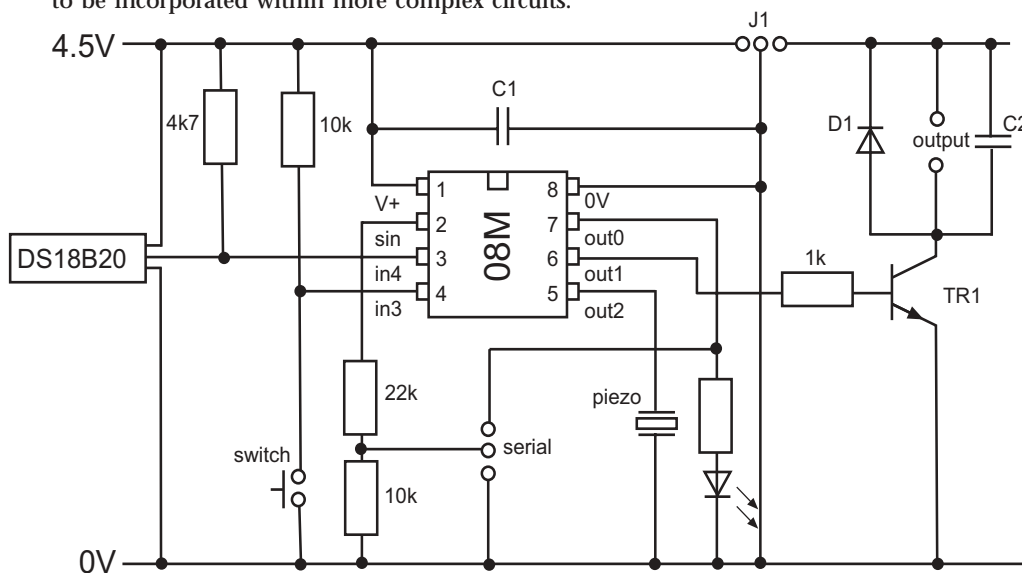
It will also fit within the thin stainless steel tubes commonly used for thermo-couples, making an instantly waterproof case.

Using a digital temperature sensor

The communications protocol used by the temperature sensor is fairly complex, because data is sent in both directions along a single-wire. For this reason it is common to use a microcontroller to communicate with the sensor.

The basic circuit for the temperature sensor is shown below. Note that this circuit could be used as shown to, for instance, switch on a fan when the temperature rises above a certain threshold value, but is really provided as a 'building-block' to be incorporated within more complex circuits.

The circuit is based around an 8 pin microcontroller, the low-cost PICAXE-08M. The circuit is fairly self-explanatory and includes the following features:

temp sensor	-	(input 4) for reading the signal from the DS18B20 sensor
switch	-	(input 3) optional digital input switch (active low)
piezo sounder	-	(output 2) for generating 'beep' sounds for user feedback
output pin	-	(output 1) for driving an output device such as solenoid or motor
output LED	-	(output 0) indicator to show temperature value

Using the PICAXE Software

Important Note
The kits are provided with a PICAXE-08M microcontroller that has not already been programmed, and so it is necessary to program the microcontroller before use.

This PICAXE program lights the LED if the temperature is too high. When the temperature is to low the output is switched on (e.g. to switch on a heater)

```
init:
     low 0              ' outputs off
     low 1


main:
     sound 2,(50,50)    ' click piezo
     readtemp 4,b1      ' read temperature
     if b1 > 30 then too_hot
     if b1 < 20 then too_cold
     goto init          ' ok so switch everything off

too_hot:
     high 0        ' LED on
     goto main


too_cold:
     high 1        ' heater on
     goto main
```
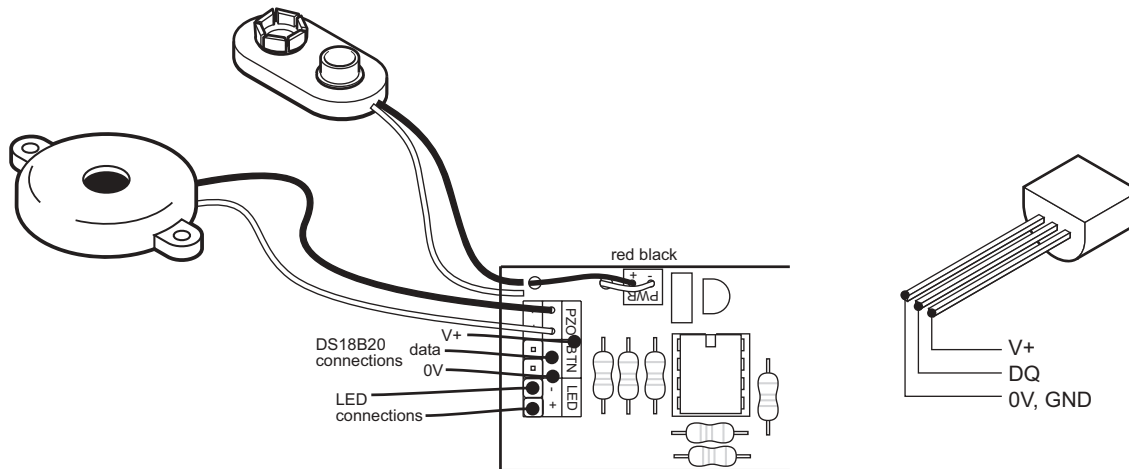
Sensor Test Program

This PICAXE displays the temperature value constantly on-screen.

```
main:
     readtemp 4,b1      ' read temperature
     debug b1           ' display on screen
     pause 250          ' short pause
     goto main
```

AXE113 – Temperature Sensor Kit Assembly Instructions

Contents:

R1	4k7 resistor (yellow violet red gold)
R2	1k resistor (brown black red gold)
R3	330 resistor (orange orange brown gold)
R4,R5	10k resistor (brown black orange gold)
R6	22k resistor (red red orange gold)
D1	1N4001 diode
C1	100nF polyester capacitor
LED1	5mm LED
Q1	BC548B transistor
PZ	piezo sounder
CT2,3	2 pin terminal block (may be supplied as 4 way - snap into 2x2)
CT4	stereo download socket
IC1	PICAXE-08M microcontroller and 8 pin socket
IC2	DS18B20 digital temperature sensor
PCB	printed circuit board, battery snap and 4.5V battery box
	Note that part C2 is not required for this project.

Assembly:

1. Solder the resistors and the diode D1 in position, ensuring the white bar of the diode is to the right.
2. Solder a resistor leg as a link between the two outer + holes on jumper J1.
3. Solder the 8 pin IC socket in position and insert the microcontroller.
4. Solder the capacitor C1 into position.
5. Solder the transistor Q1 into position, ensuring correct orientation of curved edge. Solder the LED in the LED position at the left side of the board.
6. Solder the digital temperature sensor via wires to the board as shown in the digram above. Note the pads are unmarked on the board.
7. Solder the piezo in position, red wire to +, black wire to -.
8. Solder the stereo download socket into position, ensuring it 'clicks' flat onto the PCB.
9. Solder the terminal blocks into position. connect the battery snap to the power connector CT2 (V+ red, 0V black)