



Salvage It!



BY JULIAN EDGAR

Salvaging & using common thermostats

Thermostats are attached to or buried in lots of consumer items and are easy to salvage. Here's a look at the common types and some hints on how they're used.

NEEED TO CONTROL A FAN, heater or pump on the basis of temperature? It's a common requirement that can be achieved using an electronic circuit with a thermocouple or thermostat input.

However, it's much cheaper and easier to use a thermostat salvaged from a junked consumer item. Whether you need to switch at room temperature or 200°C, the thermostat doesn't have to cost you a cent.

How they work

A thermostat is basically an adjustable temperature switch. Nearly all thermostats that you can salvage work in a similar way.

A special piece of metal – called a bi-metallic strip – is the basis of the

design. As its name suggests, this strip is actually two different metals joined together. These two metals have different expansion rates so as they are heated, one gets longer faster than the other. This causes the strip to bend.

When it has bent far enough (ie, it's hot enough!), it breaks the connection between two electrical contacts, turning off the circuit. The switching temperature is varied by using a threaded rod to vary the distance between the electrical contacts and the bimetallic strip.

As you can imagine, in this type of design the electrical contacts open and close very slowly. In certain applications, this could cause arcing, so many thermostat designs use a "snap action" approach, where a small leaf

spring causes the contacts to quickly snap open or snap closed once the trip point has been reached.

Another type of thermostat uses a remotely-mounted "bulb". This comprises a small copper cylinder (usually about as big as a short pencil) which is connected to the main switch mechanism by small-bore copper tube. The tube and the bulb are filled with a liquid or gas that expands as it gets warm and the resulting fluid pressure activates the switch.

Common consumer goods in which bimetallic strip thermostats are used include oil-filled electric space heaters, electric frypans and clothes irons. Remote bulb thermostats are used in old electric water bed heaters. Table 1 shows the characteristics of each of these types.

Selecting a thermostat

Scrounge a few of the abovementioned consumer items (eg, during a council clean-up) and in no time at all you'll have more thermostats than you know what to do with! So let's



You could pay lots for a professional looking thermostat like this... or instead use a salvaged frypan thermostat and a handful of other components to make your own for nearly nothing.



Electric frypan thermostats use a stainless steel probe that can be inserted through the wall of a pipe or into liquids. They can be adjusted to trip at temperatures from about 40-200°C.

Rat It Before You Chuck It!



Whenever you throw away an old TV (or VCR or washing machine or dishwasher or printer) do you always think that surely there must be some good salvageable components inside? Well, this column is for you! (And it's also for people without a lot of dough.) Each month we'll use bits and pieces sourced from discards, sometimes in mini-projects and other times as an ideas smorgasbord.

And you can contribute as well. If you have a use for specific parts which can easily be salvaged from goods commonly being thrown away, we'd love to hear from you. Perhaps you use the pressure switch from a washing machine to control a pump. Or maybe you salvage the high-quality bearings from VCR heads. Or perhaps you've found how the guts of a cassette player can be easily turned into a metal detector. (Well, we made the last one up but you get the idea . . .)

If you have some practical ideas, write in and tell us!

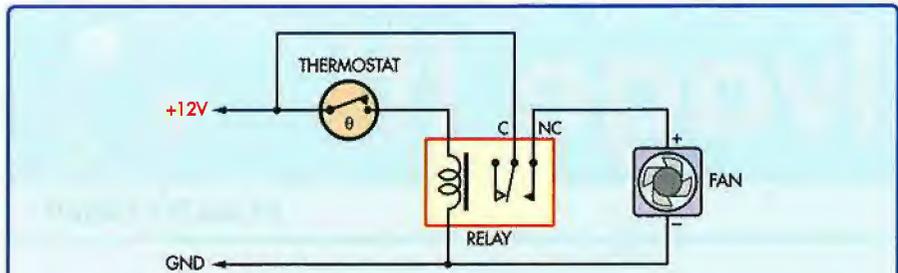


Fig.1: most thermostats are normally closed designs – ie, they open when the set-point temperature is reached. But by using a double throw relay, it's possible to turn on something when the thermostat opens, as shown here. This circuit shows how to switch on a 12V DC fan at temperatures above the thermostat set-point.

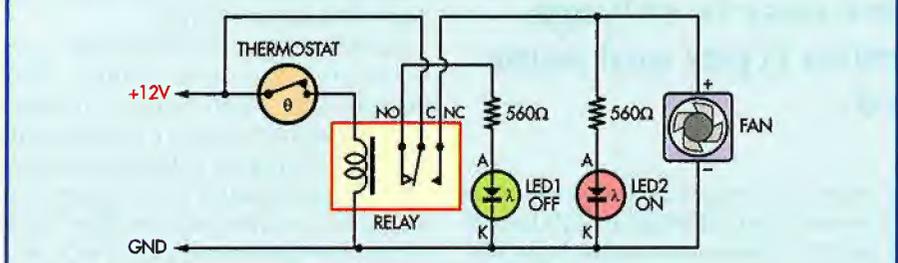


Fig.2: when a relay is used, adding LEDs to show the operating status of the thermostat is easy. In this case, LED1 lights when the fan is off, while LED2 lights when the fan is on.

take a look at the characteristics of each design.

Frypan thermostat: electric frypans (and electric woks) use a thermostat that's integrated into the module that plugs into the handle. The module has a knob on it (for setting the temperature) and a stainless steel probe, about the length of your little finger (but a bit smaller in diameter).

These thermostats can be set to operate from about 40-200°C. Their design makes them suitable for applications where the probe needs to remotely sense temperature; eg, by being pushed through a grommet and into a pipe. The hysteresis (ie, the difference between the switch-on

and switch-off temperatures) is fairly small and they react quite quickly to temperature changes.

Both “snap-action” and “slow-moving” thermostats are used in frypans, with later models more likely to be the “snap-action” type. It's very easy to tell if you're salvaging a snap-action thermostat: hold the control box up to your ear as you slowly turn the knob. If you hear a satisfying “click”, you know you're got a snap-action type.

Clothes iron thermostats: clothes irons also use bi-metallic thermostats. And despite being controlled by a knob or lever placed on top of the iron, the thermostat is mounted deep inside the iron. In fact, one end of the bime-

tallic strip is actually bolted to the aluminium baseplate.

These thermostats are “snap action” types and react more slowly than frypan thermostats (to ignore short-term temperature spikes). As a result, their hysteresis is also larger. Typically, they are suitable for sensing temperatures from about 60-200°C.

Because they don't use a remote probe, this type of thermostat is useful when the temperature of the general environment needs to be sensed.

Oil-filled heater thermostats: as with clothes iron thermostats, oil-filled heater thermostats are designed to sense the temperature of their environment and don't have a sensing probe. These thermostats are quite sensitive, have a small hysteresis and work at room temperatures, making them ideal for activating fans inside electrical equipment.

Water bed heater thermostats: these thermostats use a remote bulb, allowing temperature sensing at a point remote from the thermostat itself. They can be set very precisely over the 25-50°C range, are quite sensitive and have a small hysteresis. However, the bulb

Table 1: Characteristics Of Common Thermostats				
	Electric Frypan Thermostat	Clothes Iron Thermostat	Oil-Filled Heater Thermostat	Water Bed Thermostat
Temperature Range	Wide (40-200°C)	Fairly wide (60-200°C)	Narrow (5-50°C)	Narrow (25-50°C)
Hysteresis	Small	Large	Small	Small
Sensitivity	Medium	Low	High	High
Action	Many not snap action	Most snap action	All snap action	All snap action
Sensing	Short stainless steel probe	Whole thermostat	Whole thermostat	Remote copper bulb



Every discarded electric iron has a thermostat mounted inside. These snap-action thermostats can be used to switch at temperatures from about 60-200°C.

may be too bulky for some applications and the sensing tube cannot be altered in length.

Using thermostats

Nearly all thermostats open when

the trip-point is reached. This is because they were designed to control heating elements that need to be switched off when the temperature rises sufficiently. In other words, they're "normally closed" (NC) designs.

Take Care With Mains Voltages!

Although thermostats can be used to directly control mains voltages, we've covered only low-voltage DC switching in this article.

Make sure that you're up to speed with mains power wiring before attempting to use salvaged thermostats in high voltage applications. If you don't know what you're doing, the results could prove fatal!

Only the one pair of contacts is provided, so what do we do when want to turn something on (rather than off) when the trip-point is reached? This is easily achieved with a double-throw relay and Fig.1 shows how it's wired.

It's also easy to add a couple of LEDs to indicate the switching status of the thermostat. Fig.2 shows how to do this. In this case, LED1 lights when the fan is off (thermostat closed), while LED2 lights when the fan is running (thermostat open).

The two 560Ω resistors limit the current through each LED to about 18mA. **SC**