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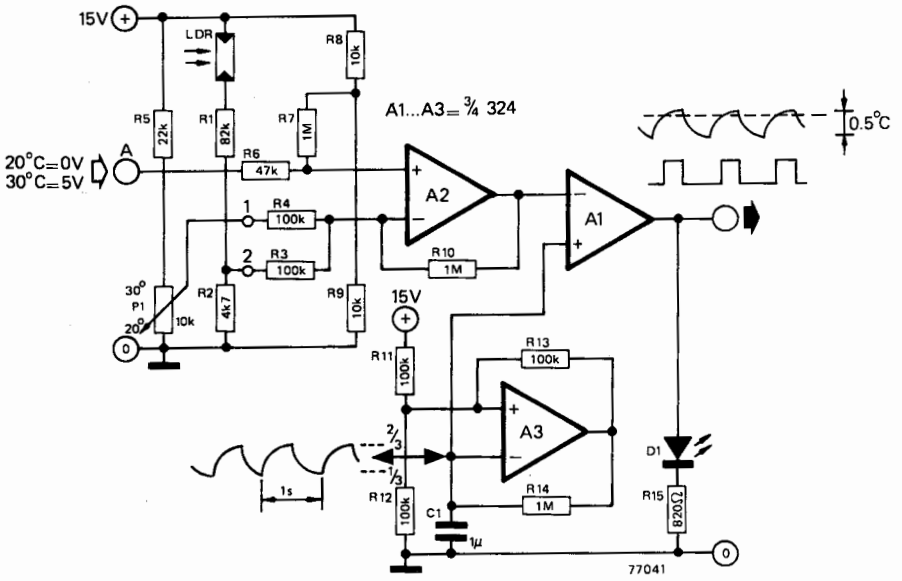
thermostat



Although primarily designed to keep the water in an aquarium at a constant temperature, this circuit is also suitable for a number of other applications.

The circuit described here represents only the control section of the thermostat. In addition a temperature sensor and a triac relay, which at periodic intervals supplies the heating element with voltage, are necessary to complete the thermostat proper.

A simple temperature sensor is provided by the NTC sensor described elsewhere in this issue, or by the temperature-voltage converter in Elektor 5, July/August 1975.

A suitable triac circuit which triggers at the zero-crossing point (i.e. when the load voltage and current are small, thus preventing interference and contact wear) is the solid state triac relay described in Elektor 11, March 1976, or, the 'solid state relay' described elsewhere in this issue.

The thermostat functions as follows: the water temperature is measured by the sensor (the NTC or diode), which is fixed to the glass on the outside of the aquarium by insulating tape. Since only three amplifiers are needed for the control circuit of the thermostat, the remaining amplifier can be used to construct the NTC sensor. The voltage supplied by this circuit is compared in A2 with the preset value of P1 and the LDR, and then amplified by a factor of 10. The amplified voltage is then compared in A1 with the triangular voltage produced in A3. The result is a squarewave output voltage, which triggers the triac circuit for longer or shorter periods.

The desired reference temperature can be set by means of P1. The circuit also contains a second input which is sensitive to light. This has the effect of raising the reference voltage of the thermostat so that the aquarium is allowed to get warmer during the day. With the component values shown in the diagram, the increase in temperature (the size of which depends on R1 and R2) is approx. 2°C. The LDR may also be omitted if required.

The 15 V supply is not critical, and providing that it is properly smoothed it need not be stabilised. The current consumption for the circuit is 3 mA, which rises to 6 mA when light falls upon the LDR, and to 15 mA when the LED at the output lights up.

A certain amount of attention should be paid to the safety of the circuit; for this reason the NTC is placed on the outside of the tank, and the triac relay should be fitted with an opto-isolator so that there is no direct electrical connection between the input and the mains.