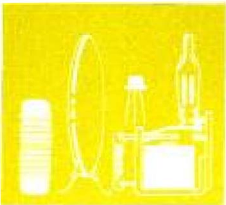


PARTS PROFILES

By DON LANCASTER

COMPONENTS OF THE MONTH

"PARTS PROFILES" IS INTENDED TO PROVIDE YOU WITH EXCITING INFORMATION ABOUT UNUSUAL OR LITTLE KNOWN ELECTRONIC COMPONENTS AND DEVICES THAT ARE INEXPENSIVE, INTERESTING, AND USEFUL. THESE PRODUCTS WILL USUALLY ENABLE YOU TO BUILD MORE INTERESTING PROJECTS AT LESS COST, IN LESS TIME, AND WITH IMPROVED PERFORMANCE. ITEMS COVERED ARE AVAILABLE NATIONALLY OR FROM AT LEAST ONE RELIABLE SOURCE OF SUPPLY.

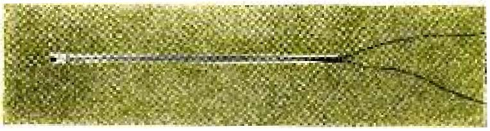
$1 EXPERIMENTER'S THERMISTOR

Here's a $1 thermistor that can be used in an electric thermometer, a liquid level controller or alarm, a time delay relay, and many other devices. The EMC4 thermistor, which is made by Fenwal Electronics, consists of a 2"-long glass tube containing a temperature-sensitive bead at the very tip of the tube. Thus, the temperature of a liquid can be monitored with great accuracy by simply immersing the tip into the liquid.

At room temperature (75°F), the thermistor's resistance is about 135,000 ohms; but for every one-degree (F) change in temperature, its resistance decreases by about 2.5%. When immersed in a liquid, the thermistor responds to temperature change in a fraction of a second. In air, it takes approximately 30 seconds.

For some applications, great care is required to limit the amount of current going to the thermistor. For other applications, current is used to deliberately heat up the thermistor for special effects. Before you set out to design a circuit, you must decide beforehand which technique best suits your application.

The bead temperature of this thermistor



rises two degrees above ambient temperature for every milliwatt of power dissipated. Thus, for accurate temperature measurements, the thermistor current must be kept low enough to limit power dissipation to well below one milliwatt, unless the self-heating effect is desired.

Fig. 1. Basic circuit of electric thermometer using EMC4 thermistor. Operating range is 0° to 115° F.

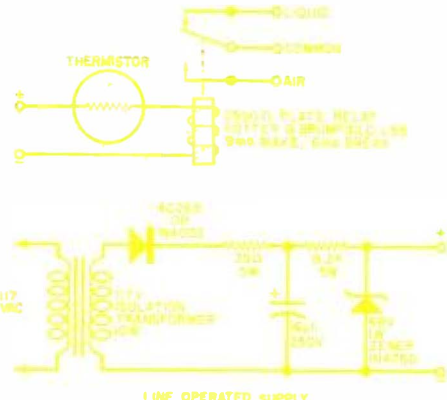


Fig. 2. Circuit of liquid level indicator can be line or battery operated. Actual supply voltage is determined essentially by relay used.

Fig. 3. This time-delay circuit can be adjusted to provide a delay of 0.5 to 15 seconds from turn-on.

Figure 1 shows an electric thermometer consisting of a couple of mercury cells, a d.c. microammeter, a thermistor, and a push-button switch (optional). At room temperature, the circuit current is about 20 microamperes, and the self-heating power is approximately 50 microwatts. This low power raises the bead temperature by only 1/20 of a degree. The circuit has a range of 0° to 115° F, and can be calibrated against a good thermometer. One big advantage of the electric thermometer is that the sensor and monitoring meter can be separated by hundreds of feet, using ordinary copper wire between them, with no loss either in sensitivity or accuracy. This is not true of thermocouple-type temperature meters.

Another application, using the self-heating effect of the thermistor, is shown in the liquid level indicator circuit of Fig. 2. Operation is based on the relatively good conductivity of liquids (especially water) as opposed to air, which is a poor conductor. Thus, when we self-heat a thermistor which has been immersed in a liquid, most of the excess heat is rapidly carried away by the liquid, and the thermistor stabilizes at essentially ambient temperature. Under these conditions, the thermistor has a *low* resistance in air (because it is hot) and a *high* resistance in liquids (because it runs cooler).

A sensitive relay and a thermistor are connected across either a battery supply or the line-operated power supply shown in Fig. 2. The component values have been chosen to give a 10-ma. current in air, and less than 3 ma. in liquid. Both of these currents are easily sensed by the relay used. If it is desired to use a different relay, the supply voltage must be appropriately regulated.

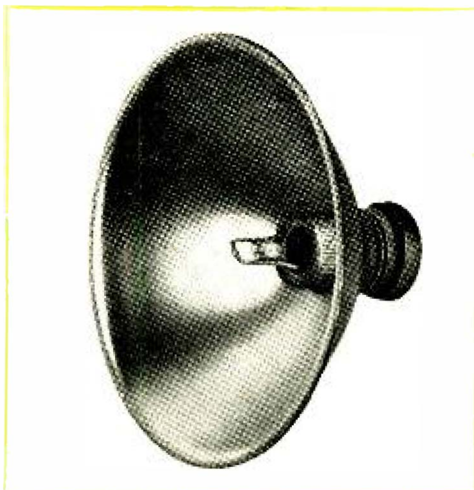
What can you do with a liquid level control? Lots of things. For example, with the relay contacts connected to a buzzer or solenoid valve, you can use this device as an automatic level control for bird baths, fountains, or swimming pools, or simply as an alarm to tell you when the bathtub is full. Two or more of these indicators can be used at different heights in a tank to serve as a *high-low* indicator, or as a depth gauge.

As a final example to show the almost limitless applications of the thermistor, consider the time delay relay circuit of Fig. 3. It provides a delay of from 0.5 to 15 seconds from the time it is turned on, depending on the setting of the potentiometer which varies the current through the thermistor. The more current, the faster the thermistor heats up, and the sooner the resistance drops low enough to cause the relay to pick up. Depending on the choice of relay contacts, the relay can "make" contact only *after* the time lapse, or only *during* the delay time. This circuit can be used for displays, as a phototimer, motor starter, or for an automatic light control to give you 15 seconds to get down the hallway before the light goes out.

You can get data sheets and application notes direct from the manufacturer, Fenwal Electronics, 63 Fountain St., Framingham, Mass., upon purchase of the thermistor which retails for $1. The EMC4 Thermistor Manual and a list of local distributors are available, free, from the manufacturer.

INFRARED PHOTOCELLS RESPOND TO HEAT

Smart crooks can spot ordinary burglar alarms using conventional photoelectric controllers a mile away. But you can trap these experts with Infrared Industries' infrared photocells that operate in total darkness. Or you can use these photocells to make heat-sensing flame detectors for fire alarms or safety monitors. Because infrared photocells respond to heat instead of



light, they can be used in numerous "secret" applications.

An infrared photocell consists of a small chunk of lead sulfide (galena) mounted at the focus of a mirrored parabola the size of a large flashlight reflector. In the absence of high infrared radiation, it has a resistance of about 1 megohm. In the presence of a light source, such as a match, photoflood lamp, or flashlight, the photocell resistance drops to as low as 200,000 ohms. This 5-to-1 change ratio is quite sufficient to activate a two-transistor relay circuit such as the one described in Lou Garner's "*Super-Sens*" in the November, 1965 issue of POPULAR ELECTRONICS.

The light source can be masked with an infrared filter (supplied with the photocell) that passes only infrared light, giving an invisible beam of heat energy that behaves the same as visible light. If you were to look directly at the light source, you would see only a dark red glow. By properly positioning the light source, even this glow could become unnoticeable. If you put the filter over the photocell instead of over the light source, the photocell would ignore all background illumination and respond only to the infrared energy.

If the photocell is positioned so that it can "look" straight at the beam, its resistance will drop. But if the beam is interrupted, say, by an intruder, its resistance immediately goes up again. This change in resistance can be used to operate a relay. Depending on whether the controlled device is to be turned *on* or *off*, it is then only necessary to choose the proper relay contacts for the desired control.

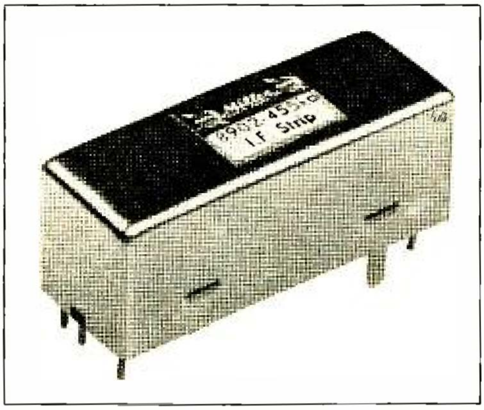
The parabolic shape of the photocell housing makes it highly directional. If this directivity feature is not desired, the experimenter can choose other photocell units that are not equipped with the parabola and filter, at a saving in cost. Mirrors or smooth metal plates can be used to reflect the beam around corners.

There's practically no end to the number of applications to which the infrared photocells lend themselves. Just remember that they behave essentially the same as the more familiar cadmium sulfide photocells, in that their resistance goes down as the incident energy goes up. Remember also that the infrared photocell has a bilateral characteristic, and can be powered by a low-voltage a.c. source, or by a d.c. source. And finally, remember that cadmium sulfide cells are most responsive to orange light while lead sulfide cells (infrared photocells) are most responsive to long-wave heat radiation.

Manufactured by the Photoconductor Division of Infrared Industries, Inc., 63 Fourth Avenue, Waltham, Mass., the B3 SA19 MF photocells with filters are available from Allied Radio (# 7 Z 628, in their industrial catalog) and other parts distributors for $5.75 each.

455-KC. I.F. AMPLIFIER MODULE

A fully assembled and prealigned 455-kc. integrated i.f. amplifier module containing a ceramic filter, two transformers, two transistors, one diode, and associated resistors and capacitors, has been put out by the J. W. Miller Company. The strip is said to



provide a gain of 55 db, an 8-kc. bandwidth at 6 db, and operate on 2 milliamperes from a 6-volt d.c. source.

Measuring a scant ½" x ½" x 1½", the module is ideal for such applications as the i.f. amplifier in a subminiature superhet AM receiver, in the second conversion stage of CB equipment, and as a high-gain i.f. amplifier for radio control gear. The module can also be used as a lock-in amplifier, and as a precision measuring device in carrier control equipment as well as in other industrial instrumentation apparatus.

For ordinary AM radio applications, the experimenter need only design up to the mixer output, and then pick off the audio signal at the receiver volume control. The module has its own a.g.c. circuit and provisions for a tuning meter. A choice of input transformer taps optimizes operation for straight amplification or conversion. The case readily comes apart for special requirements, but numerous taps are brought out to allow the engineer or experimenter to conduct a variety of tests or experiments.

The 455-kc. i.f. module (Miller 8903) is available from parts distributors including Lafayette Radio (34 R 8603) and Allied Radio (60 U 099) for $5.75. Data sheet and schematic are supplied with each unit. —30—