ASK R-E

Write to Ask R-E, Radio-Electronics, 500-B Bi-County Blvd., Farmingdale, NY 11735

PICK UP THE BEAT

What kind of pickup device would I need to display a heartbeat on my oscilloscope? I've tried a stethoscope with an electret mike and a preamp, but was unable to pick up anything.—C. Tracey, Marion, VA

A standard oscilloscope isn't really the best display device for heartbeats because the persistence of the phosphor used in most CRT's isn't very high. That's a factor because, at an average of 70 beats per minute, you'd have to have the trace speed down somewhere about one sweep per second. A digital scope would be much better because the waveform could be stored and displayed until the next heartbeat was detected.

Regardless of the kind of scope you use, designing a pickup is a common problem. I'm surprised you weren't able to use the mike-and-stethoscope approach because there's no reason why you can't amplify the audio signal enough to meet the voltage requirements of most oscilloscopes. You didn't send in the circuit you used, but I'd be willing to bet that a bit of redesign would be in order.

If you want to raise the detected signal to logic levels, you can use the circuit shown in Fig. 1. It's the front end of a pulse meter I built some years ago, and it has worked reliably since then. The circuit is interesting because it uses an infrared detector as the pickup. The detector can be put anywhere on the body, but the best places are at the body's pulse points such as the neck or wrist.

When the heart pumps, there's an increase in blood volume in all the arteries of the body—from the major ones at the pulse points down to the small capillaries under the skin. The difference in blood density causes a change in the infrared reflectivity of the skin, and that can be detected by any phototransistor whose bandwidth extends into the infrared region.

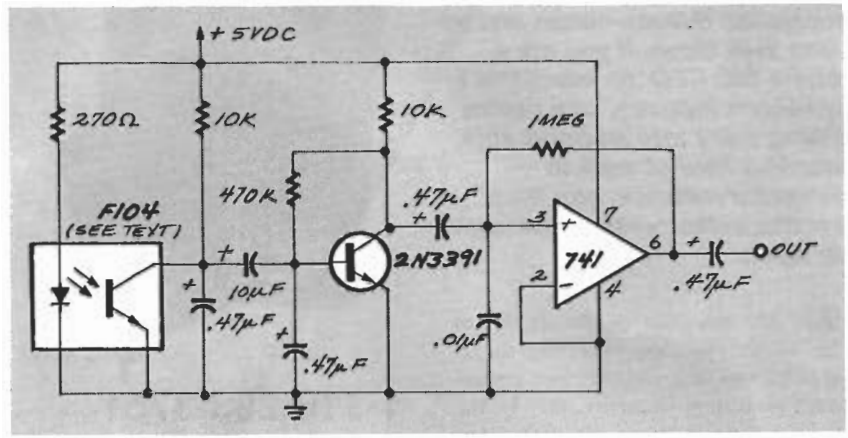

FIG. 1—TO RAISE A HEARTBEAT SIGNAL to logic levels, you can use this circuit. The infrared detector can be put anywhere on the body. When the heart pumps, the increase in blood volume causes a change in the infrared reflectivity of the skin, which can be detected by any infrared phototransistor.

The device I used as the detector was an F104 made originally by Fairchild. It's an infrared emitter and phototransistor mounted in a single plastic package. The openings for each part of the device, as shown in Fig. 2, face in the same direction so that the phototransistor can see the emitter's light only if it's reflected off a surface. When you put it against the skin, the infrared light penetrates the skin and the phototransistor senses the reflected changes in blood density each time the heart pumps a new volume of blood into the arteries.

The output of the circuit is high enough to function as the trigger signal for a standard 555, so you shouldn't have any trouble seeing it with an oscilloscope. If your scope's inputs are good enough, you might be able to pick up the signal off the collector of Q2 (or even right off the collector of the phototransistor), and get rid of the rest of the circuit. Good luck.

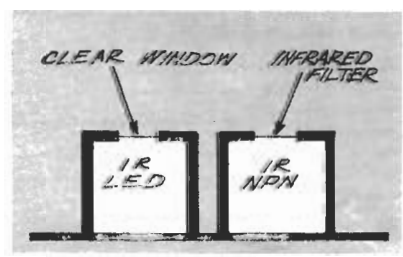

FIG. 2—BECAUSE THE OPENINGS for the infrared emitter and phototransistor face the same direction, the phototransistor can see the emitter's light only if it's reflected from a surface.

VIDEO MIXER

I have a video camera and a computer with a composite video output that I've been trying to mix together to get special effects. Is there some simple way that I can do that? I've tried several methods but haven't had any luck so far.—E. Guerard, Montreal, CA

Mixing video is very, very different from mixing audio. The video signal, as I've mentioned here on numerous occasions, is one of the most complex waveforms that exist.

Each line of video has both a data area (the picture), and a control area (the horizontal interval), as shown in Fig. 3. What you want to do when you mix two or more signals together is to combine the picture areas but still use only a single control area. Because the control area tells the TV where to turn on the electron beam on the right side of

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