Project Six

Lie Detector

A real lie detector, or *polygraph*, is a complex and sensitive piece of electronic equipment that logs several physical responses at the same time as the subject undergoes a battery of questions. A real polygraph, such as the ones a government agency might use, would usually include circuitry to monitor blood pressure, pulse, respiration, breathing rhythms, body temperature and skin conductivity, and even brain waves. The simple version of the lie detector presented here, based on the very old designs, measures only skin conductivity, although it could be used in conjunction with many of the other projects in this chapter to create a much more elaborate lie detector.

The lie-detector schematic shown in Figure 6-1 is surprisingly simple considering that it does a very good job of measuring the subject's skin conductivity. The two transistors form a very-high-gain amplifier that measures a tiny amount of current that will pass along the surface of the subject's skin as he or she holds onto the test probes. Since skin does not conduct if it is completely dry, the more the subject perspires, the higher will be the reading on the analog meter. Since it is a known fact that we perspire a little more when we lie, the tester can grill the subject and then look for small changes on the meter. Since the amplifier is so sensitive and we all have differing levels of skin conductivity, the variable resistor (VR1) can adjust the initial setting so that the meter is pointing to the middle of its range before the test begins. If the subject tries to relax too much, this will cause the meter reading to drop and could be interpreted as the subject trying to trick the test. A higher reading following a question would indicate that the subject may be lying and perspiring more than normal.

The circuit is so simple that you probably can forego the breadboarding process and build it right onto a bit of perf board. As shown in Figure 6-2, there are only two transistors and two resistors on the board. The only change you might need to make is the addition of a resistor in series with your analog meter if it happens to shoot all the way to the end even when the adjustment VR1 is all the way down. If your analog meter fails to move much at all, then you might have to increase the voltage by adding another 9-V battery in series with the current battery to make 18 V. Likely, your meter will be fine with this circuit, but it really depends on the impedance and rated voltage of the tiny coil inside. Most analog meters will respond to a very tiny voltage, even if their readouts say something like "kiloamperes" or "megavolts"!

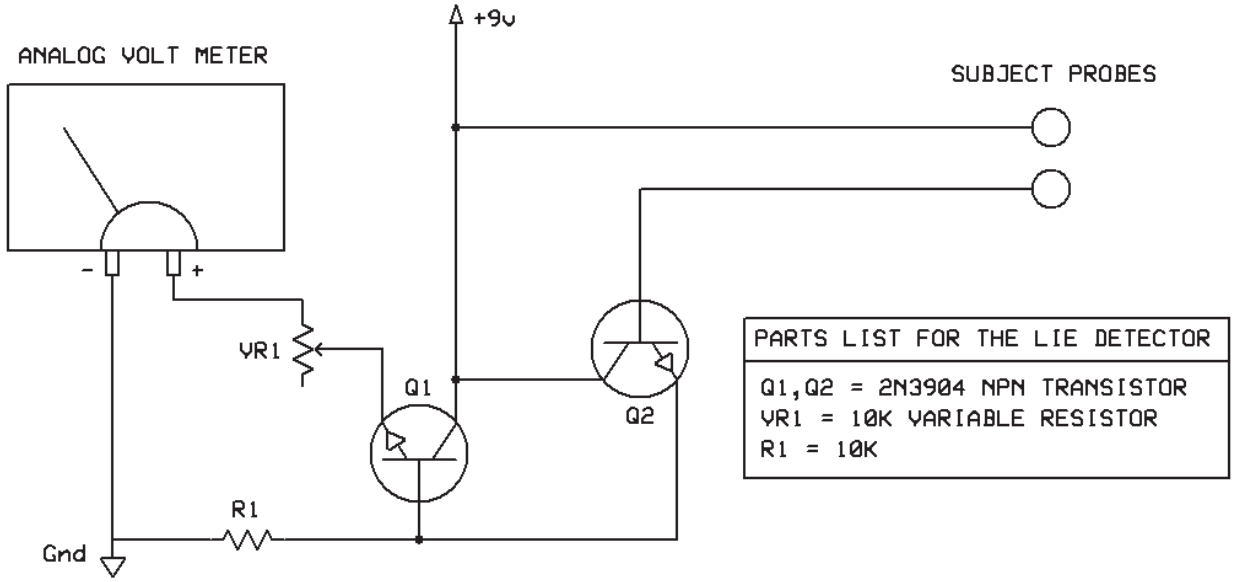

Figure 6-1 *The lie-detector schematic.*

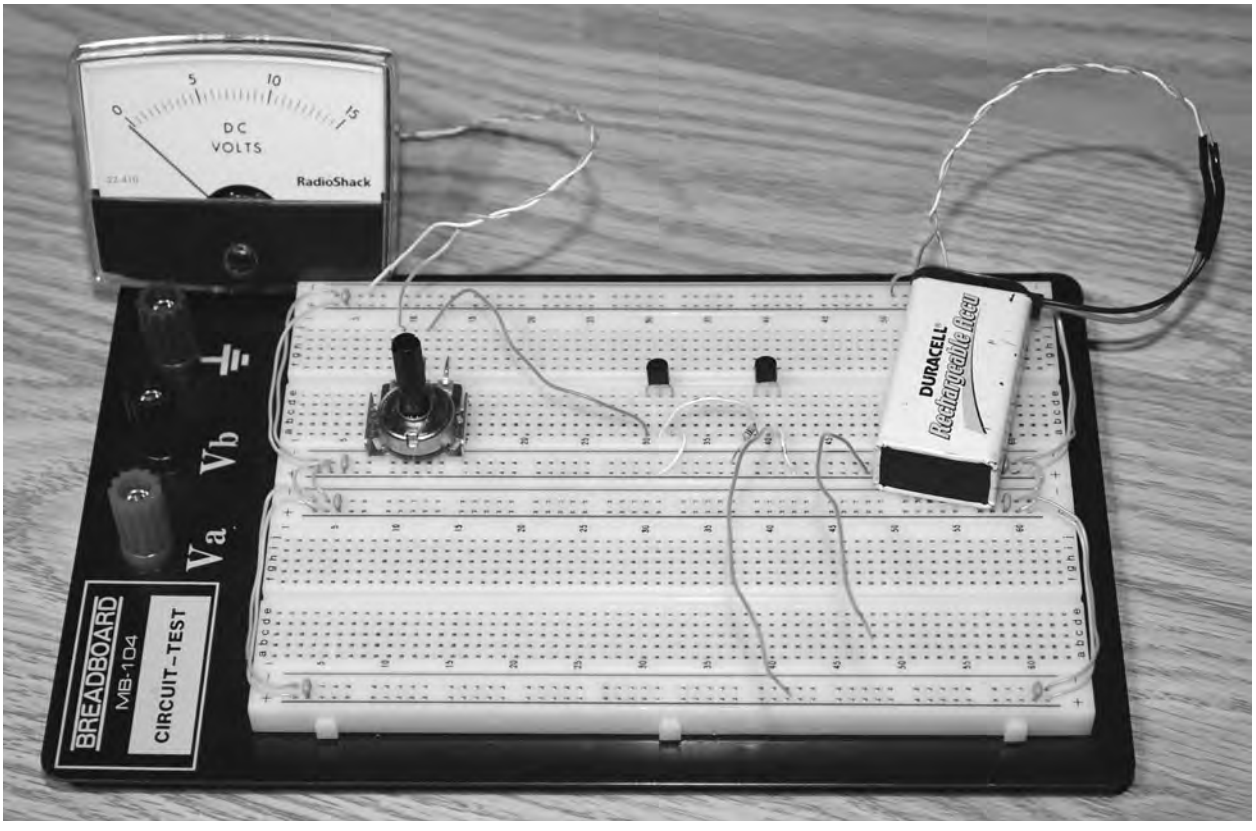

Figure 6-2 *The lie detector on a perf board.*

Analog meters can be quite costly to buy brand new, so you might want to do a little scrounging to find one to play around with. Second-hand shops often carry old stereo gear that may have one or more analog meters. Another source might be an old CB radio, battery tester, analog multimeter, or any other appliance from the 1970s or 1980s that had to display some value. Now that LEDs and semiconductors cost pennies, expensive mechanical display devices are very hard to find on mass-produced consumer electronics.

If you turn up the variable resistor and grab hold of the probe wires, your analog meter should jump to the end of its range in a hurry. If the meter fails to respond, try turning the variable resistor the other way in case you have the wiper lead connected in reverse. If there is still no response (unlikely), connect the probe wires together to drive the amplifier to its maximum value. If the meter still fails to move, then it is either not working or requires a lot more voltage to move the needle. If you are having the opposite problem and can't turn the variable resistor down enough to get the meter below the halfway mark, then add a resistor in series with the meter. A 1K resistor would be a good one to start with. Figure 6-3 shows the response you want to get—the meter at the halfway point after adjusting the variable resistor. You should be able to make the meter swing all the way over by wetting your finger or just by putting a lot of pressure on the probe wires.

Your analog meter likely will have a scale measuring amperage, voltage, or some other value unrelated to our biologic subject. It is actually very easy to make a replacement readout plate just by cutting out something you made in a computer paint program and then affixing it to the original plate. The plastic cover can be popped off by placing a small screwdriver or blade in the tiny slots to pry it off the backing plate, but be careful not to damage the sensitive meter or any of its moving parts once the cover has been removed. Figure 6-4 show the replacement readout plate I made that is a bit

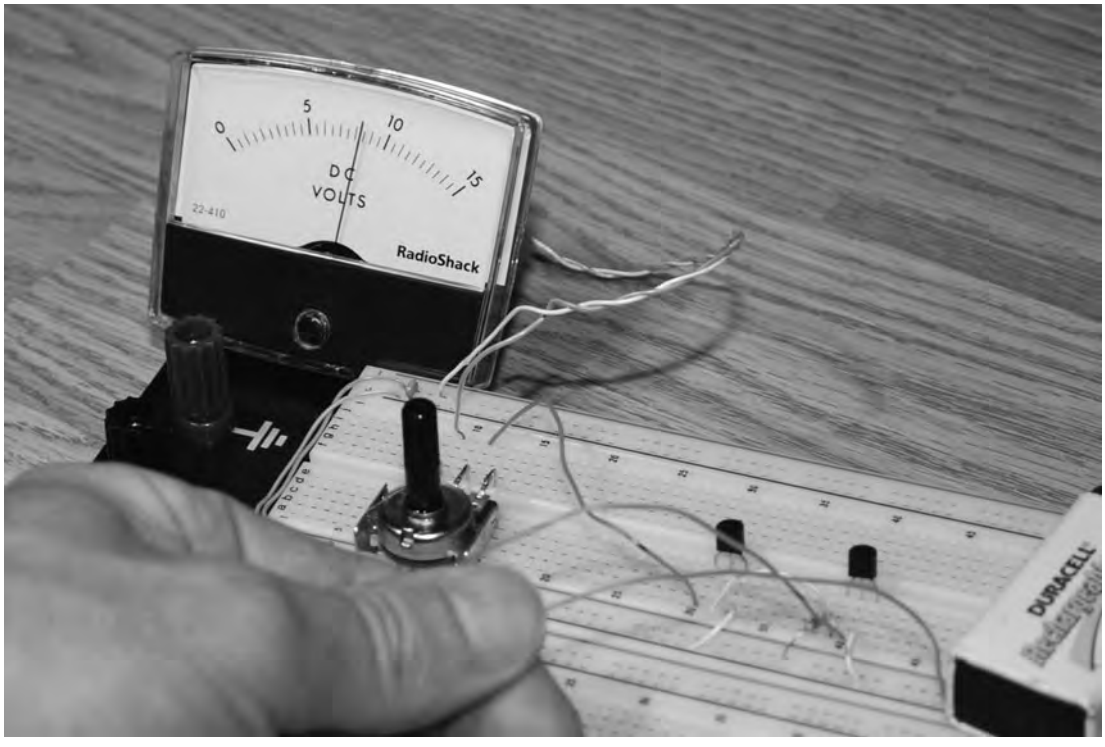

Figure 6-3 *Testing the range of the analog meter.*

Figure 6-4 *Making a replacement readout plate.*

more on the "funny" side of things because I planned to use my lie detector just for kicks. You can make your readout say whatever you like, but try to create three distinct zones so that you can have your needle point to the center point when adjusted properly. Remember, a low reading will indicate either a bad connection between subject and probes or a subject trying to fake the result, and a high reading will indicate above-normal perspiration or a lie.

Once you have your clear plastic cover pried from the backing plate, simply glue or tape your new display over the old one, as shown in Figure 6-5. You do not have to remove the original reading plate because there will be plenty of room between the needle and the original plate to insert your paper display as long as it is glued down flat. I used a small dab from a glue stick to hold the new readout in place so that it can be removed easily at any time without damaging the original plate. Again, be careful when working inside the meter because that tiny needle is very easy to bend or break.

Although you can connect the probes just about anywhere on the subject's body, the old "sweaty

Figure 6-5 *Gluing the new display over the old one.*

palms of a liar" factor certainly applies to this device. I found a few steel rings at the local hardware store and then soldered wires to them, as shown in Figure 6-6, to make a good pickup for the subject's palms. The goal is to affix the probes to your subject in such a way that they make good contact with the skin but do not allow the subject to change the pressure on the probes, which would cause a false readout. By placing the rings on the subject's palms as he or she holds the hands palms up, you get a good connection without allowing the subject to grip or manipulate the pressure between the metal and the skin. If your subject has particularly dry hands, you can try placing the rings further up his or her arms or use elastic to apply a fixed amount of pressure to the probes.

For such a sparsely populated circuit board, there are sure a lot of wires coming from it. The analog meter, power switch, battery, probes, and variable resistor are all connected to the functional circuit shown in Figure 6-7, ready to be installed in some type of cabinet. I also decided to connect my probe leads through a ⅛ stereo jack so that I could create multiple probe sets to allow the use of variously shaped probes. You also could connect multiple probes to your subject as long as they are the same on each side of the body. On a real polygraph machine, many probes are connected to the subject for more accurate results.

There are two ways you can mount the analog meter in your project box: behind a square hole or over the top of the lid with only the "can" stuck through the lid. Making a square hole that looks good requires a bit of patience as well as the notching tool shown in Figure 6-8. To use a notching tool, trace the area to be cut out, and then drill a hole in each corner large enough to insert the tool's cutting blade. The notching tool allows you to "nibble" out small square bites from thin metal or plastic cabinets to create square or straight-edge holes. An easier way to mount an analog meter is just to cut a hole large

Figure 6-6 *Making probes for the subject's hands.*

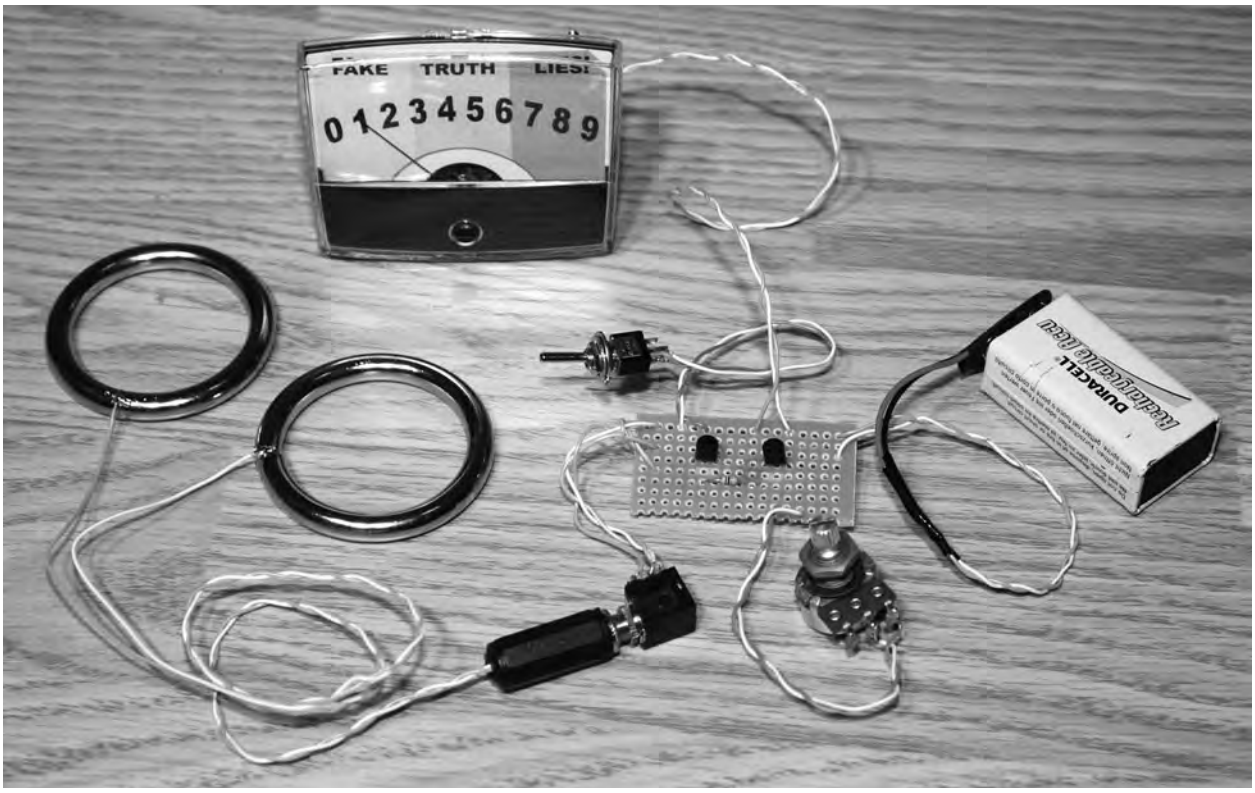

Figure 6-7 *The circuit ready to be installed into a cabinet.*

Figure 6-8 *A notching tool is great for cutting square holes.*

enough for the mechanical body part to fit through the lid, and let the display area cover the hole. This method is simple, but then you see the nondisplay area under the meter, which does not look as professional. Since the plastic cabinet I planned to use was much too thick for the notching tool, I chose the easy way out!

Like Agent Mulder from the *X-Files* once said, "The truth is out there." And with your new lie detector, you can cut through the deception and misinformation. After a bit of hole drilling, the completed lie detector shown in Figure 6-9 was ready for action. Of course, with my analog meter reading "Fake, Truth, or Lies," it is obviously more of a party gag than a tool I intend to use to interrogate my "enemy spies." You actually could combine this device with some of the other biofeedback devices shown earlier in this chapter to create a much more comprehensive lie-detection system, but you also will require the knowledge needed to decode all the feedback received from your subject. The art of using a polygraph is so controversial that some countries do not even consider it a valid test, and often those with knowledge of how the device works can learn to fool the tester.

I'm sure that you will find some useful application of your simple lie-detector unit and have some fun at the same time. If you make the unit look "real" enough, then it might be just as effective at "extracting" the truth as its big brother, the polygraph machine. Sometimes the risk of having a lie exposed is enough! In Section Two we will explore the dreaming world.

Figure 6-9 *Ready to uncover the truth (or lies)!*