BY SAM GOLDWASSER

Repairing Remote Controls

WELCOME TO THE FIRST INSTALLMENT OF THE ALL NEW SERVICE CLINIC. AS YOU CAN SEE FROM THE BYLINE, MY NAME IS SAM GOLDWASSER. THOSE OF YOU THAT FREQUENT THE INTERNET MIGHT BE FAMILIAR WITH MY ONLINE repair and troubleshooting guides, located at http://www.paranoia.com/~filipg/REPAIR/, and mirrored at several sites around the world. If not, perhaps a little introduction would be in order.

An electrical engineer by profession, I have always had a passion for fixing mechanical and electronic devices. As a kid, household appliances represented the beginning of my fascination with technology. It wasn't long before the workings of the TV were of more interest to me than the shows on its screen. Naturally I had to see what was inside everything. Fairly soon, I figured out that getting things back together again was generally not that much more difficult than disassembling them in the first place. That insatiable curiosity and unending search for challenges continue to this day.

After a long and varied career in engineering, teaching, and business, these days I am an independent engineering consultant, but spend much of my time helping others on the Internet newsgroups; writing the Internet repair and troubleshooting guides mentioned above, as well as other articles; providing free repairs for those who cannot afford professional service; and doing other things that I find interesting. For now, this is more fun and much more rewarding than a real job.

With that out of the way, lets turn to our first topic.

Remote Control Repair

Fifteen years ago, a wireless remote

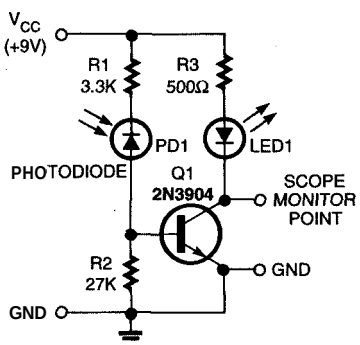
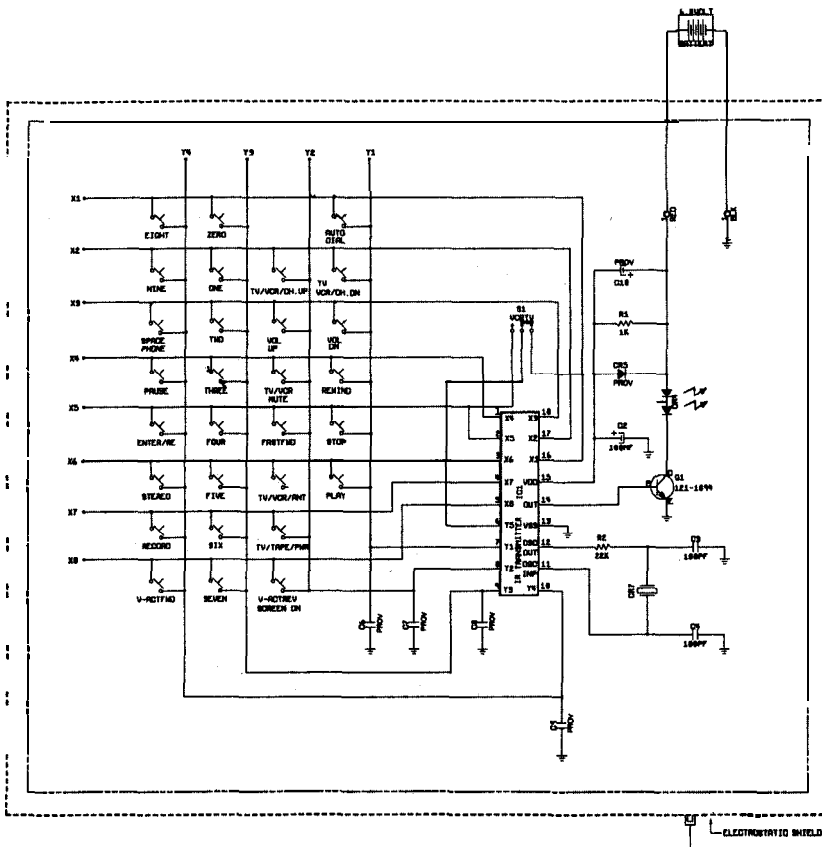


FIG. 1-THIS IR DETECTOR CIRCUIT could be used for testing IR remote controls, CD-player laser diodes, and other low-level, near IR emitters. Component values are not critical. Test points are provided for use with an oscilloscope.



INSIDE A TYPICAL TV/VCR remote control transmitter. This schematic is"for a unit made by Zenith.

control was a $50 or $100 option (in 1980 dollars) to a TV or VCR. Early units used ultrasonic or RF analog signals and could perform only limited functions. You were lucky to get anything beyond on/off, volume, and channel up/down.

Today, a remote control is standard even with low-cost, basic electronic equipment. Nearly all modern remotes use Infra-Red (IR) light for digital data transmission. Some have more buttons and functions than a personal computer! Unfortunately, those added features and functions sometimes come with a burden of its own-many remotes have row upon row of tiny, identical size buttons with no logical layout of functions. On the other hand, some are masterpieces of ergonomic engineering, almost operating by themselves.

There are two kinds of problems with remotes:

1. They seem to have legs of their own and disappear at the most inconvenient times.

2. They get abused by being dropped, dunked in Coke or beer, or chewed on by the pet tiger, or are left alone to develop dead, leaky batteries.

While there are some remotes that will respond to a whistle and beep back to identify their locations, most are the ordinary deaf, dumb, and blind variety. Unfortunately, I can not help you locate your missing remote. If you suffer from disappearing remote syndrome, a well-designed universal remote-on a tether-might make a good investment.

Fortunately, most actual problems with remotes can be solved relatively easily. First of all, it is important to recognize that most failures are of a physical nature. Since remotes operate on low voltages under non-stressful conditions, spontaneous electronic failure is relatively uncommon. In short, if you don't abuse your remote control, it is likely to go a long time between failures.

Testing Remotes

All troubleshooting begins with the simplest steps. Start by eliminating the obvious. First, confirm that your problem is not simply due to a selector switch in the wrong position or an accidental press of a key selecting VCR instead of TV If your broken unit is a universal type, make sure it has not simply forgotten its programming or codes-reinitialize it. A common cause of memory loss is the batteries failing

out or losing contact for an instant due to a fall or bump.

Also double check to be certain that you are using the correct remote. A lot of remotes look alike, and sometimes remotes for similar equipment from the same manufacturer can not be swapped.

Next, try to determine whether the problem is indeed in the remote itself and not the controlled equipment. The easiest way to do that is to temporarily program a universal remote to match your equipment. If that equipment then operates successfully, you can be pretty certain that the problem lies in the remote unit.

Diagnosing the Problem

To narrow down the problem, use an IR detector to determine if the remote is emitting an IR signal when each button is pressed. While such a device does not guarantee that the signal is correct, it eliminates most common problems from consideration. An IR detector card or an IR detector circuit (like the one shown in Fig. 1) is very handy for testing remote controls and other IR emitters. Another alternative is to use a camcorder: Some camcorders are sensitive to IR as well and will show a bright spot of light if aimed at a working source of IR.

Modern remotes use a pulse-code-modulated carrier to send the command. A typical carrier frequency is around 36- to 56-kHz, with each pulse consisting of multiple cycles (e.g., 20 for each bit) of that carrier. For buttons that repeat, typical rates are 10 to 20 Hz, and the entire code might actually be sent only when the button is first pressed with only a repeat code sent while it is held down. The carrier frequency and coding schemes have apparently not been standardized and vary quite a bit, even from device to device from the same manufacturer. Therefore, it is beyond the scope of this document to enumerate them all.

If more information is needed or desired, it is possible to monitor the waveforms with an oscilloscope. That could be done by monitoring internal signals of the remote including certain pins on the main IC as well as the LED or its driver. A simpler approach would be to monitor the signal across the transistor in the detector circuit of Fig. 1; the schematic includes test points for that purpose.

Speaking of the detector circuit, the only important point to keep in mind when building the circuit is to make sure that the LED is placed so that its light can't fall upon the photodiode. Select a photodiode that is sensitive to near IR (about 750 to 900 pm). You could also salvage one from an optocoupler or photosensor. Dead computer mice also use photodiodes that could be salvaged. Finally, a salvaged IR sensor module from a TV or VCR might also be used as an IR detector. Those usually operate from a single supply (5 V to 12 V is typical) and output a clean demodulated signal (you will not see the carrier, only the 1s and 0s).

Once we are certain that the remote is at fault, it is time to see if we can repair it, or if it is even worthwhile to do so. Unfortunately, as we have used up all of our room for now, that's a topic that will have to wait until next month. Until then, you can visit the sci.electronics.repair FAQ homepage which is located at http://www.paranoia.com/-filipg/REPAIR/. If you've got comments or questions, You can e-mail them to me at sam@stdavids.picker.com.