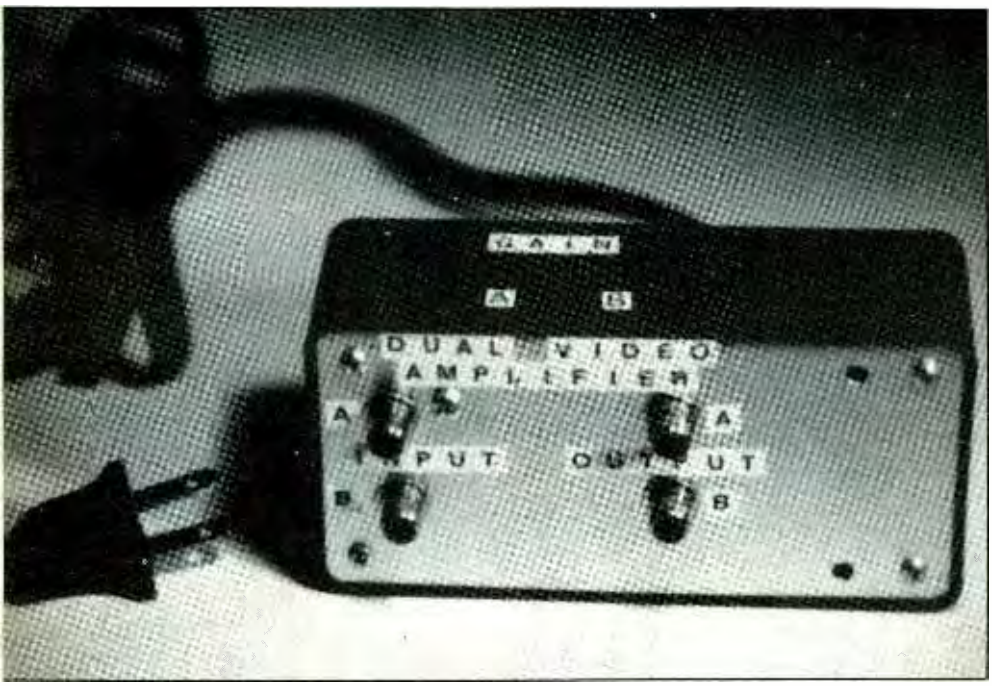
A Dual Video Amplifier

Allows you to use two VCRs with one TV receiver/monitor and dub from one VCR to the other without swapping cables or slipping switches



By Michael J. Keryan

According to a recent survey, 25 percent of new VCR sales in 1986 are expected to be to second-time VCR buyers. Furthermore, two-VCR users are more likely to buy a new top-of-the-line TV receiver/monitor combination with direct audio and video inputs. This can lead to a common problem —connecting two VCRs to a TV receiver/monitor while retaining the ability to dub high-quality pictures from VCR to VCR, all without having to swap cables or flip switches.

There are, of course, several commercial products that will solve the problem, though most are rather expensive. An alternate route is to build and use the Dual Video Amplifier accessory described here. Cost of the project is about $25. Although the amplifier circuit to be described is very simple and low in cost, it is of very high quality. In operation, it doesn't degrade the color or sharpness of the picture.

Some Background

A starter system usually contains a single VCR and an ordinary color TV receiver. With this arrangement, there's hardly ever any problem with hookup, since there isn't much you can do other than record and play back tapes. Changing to a TV receiver/monitor is a step up. Using the direct video and audio inputs in this arrangement (Fig. 1) results in better sound and picture quality.

Adding a second VCR to an existing VCR-TV receiver/monitor system may sound like an extravagance if you still haven't bought your first VCR. Many VCR owners are installing a second unit, mainly to be able to copy tapes. Recording of two programs being aired at the same time when you can't view either at air time, may be a compelling second reason for installing that second VCR. Yet another reason is to back up a different-format machine. For example, you might have a Beta-format machine but are finding it more and more difficult to find Beta tapes for rent locally. The solution is to back up the Beta VCR with a much more popular VHS VCR. This way, you get the best of both worlds without sacrificing the investment you made for your original machine.

At first glance, it might appear that everything should plug together with no problems, since the TV receiver/monitor has two sets of video and audio inputs. Indeed, initial hookup *is* simple, as shown in Fig. 2. With this arrangement, you can direct the output of either VCR into the TV receiver/monitor. The rub is that this arrangement doesn't permit direct dubbing between VCRs. To be able to dub, you must juggle cables, unplugging the source VCR's cables from the TV receiver/monitor and

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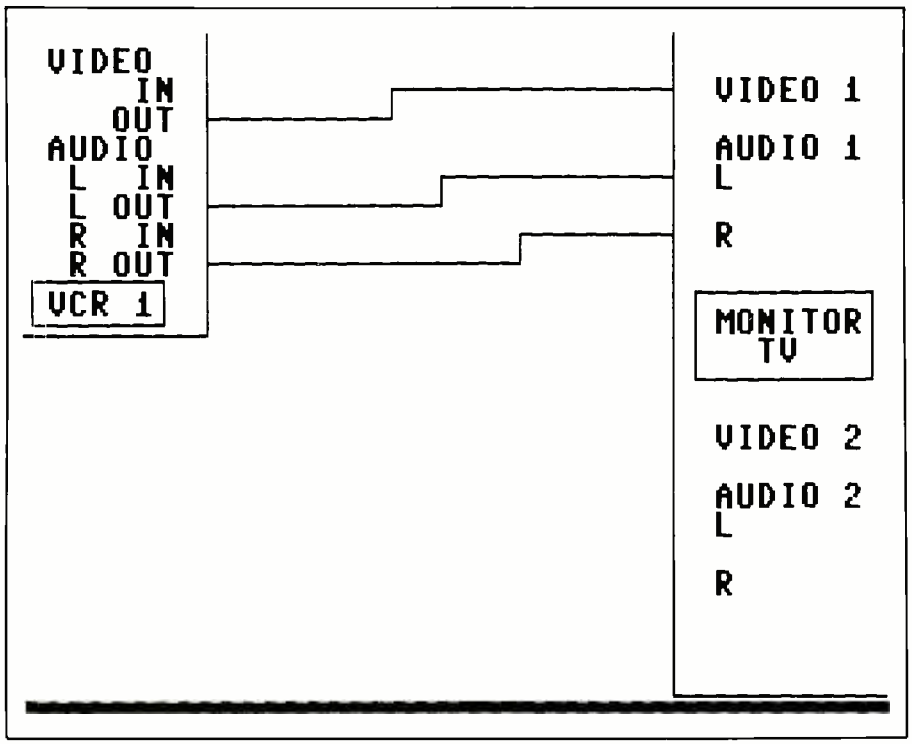

Fig. 1. Hookups for a single VCR and TV receiver/monitor.

plugging them into the other VCR's input jacks. Try doing that a number of times in the usually cramped quarters while trying to read black-on-black jack identification labels under the usual poor lighting!

An alert electronics enthusiast might see a possible solution at his local Radio Shack store—Y-type phono-plug adapters that split the signal from a single cable so that it can feed two inputs. This arrangement is shown in Fig. 3. It's a solution of sorts, but hardly practical. While the audio might be fine, the video will be much less than perfect. In fact, it's likely to be terrible if you're used to getting good pictures from your video system.

Using the Fig. 3 arrangement, the picture from either VCR will be only about half as bright as it was before installing the Y adapters, both directly on-screen and when copying a tape. The reason for this should be obvious. A video signal from a VCR is designed to drive only one 75-ohm video input. Feeding this signal to two 75-ohm inputs in parallel halves the impedance so that the VCR is now looking at 37.5 ohms. The result is a substantially reduced signal level going into both the TV receiver/monitor and the second VCR.

Why not use switches to send the video signals to only one input at a time? This is another impractical solution if the objective is to keep things as simple as possible. Considering the complexity of the typical two-VCR system, this switching could very well make the entire system incredibly difficult to use.

The perfect solution is one you never have to bother keeping track of once you've installed it. All you really need is to isolate the video inputs with buffer amplifiers. This is what you'll find in commercial video enhancer/stabilizer accessories sold as commercial products for $100 or more. If you want and need the extra functions provided by the enhancer/stabilizer and are willing to spend the money for the separate accessories you need for each VCR, you've found your solution. However, if you really don't need the extra features and would like to save a bundle of money, the Dual Video Amplifier

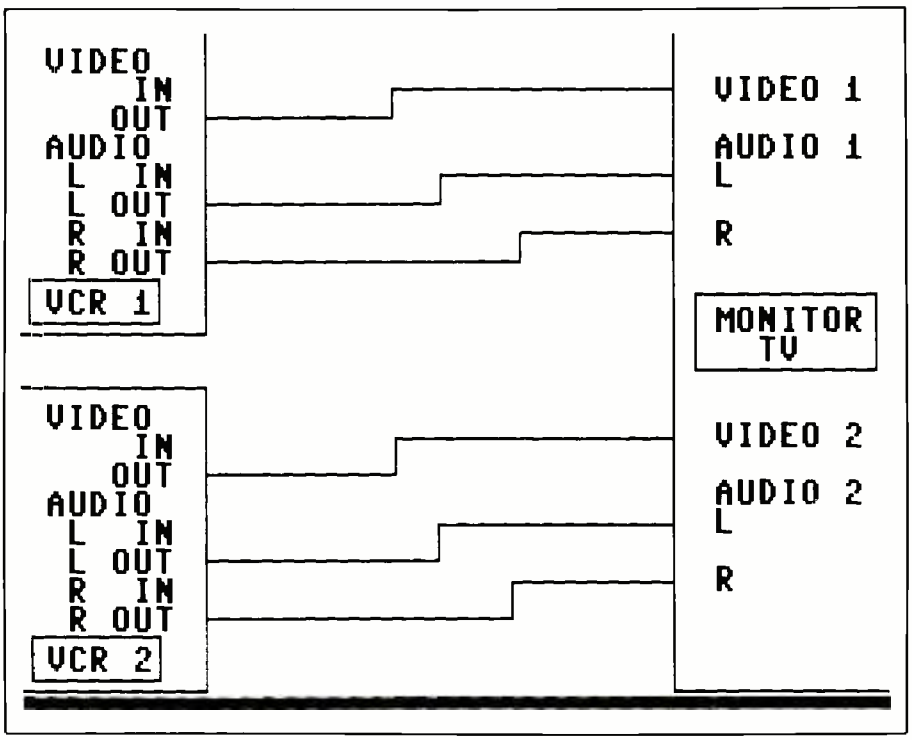

Fig. 2. Feeding two VCRs to a TV receiver/monitor; copying from one VCR to the other can not be done.

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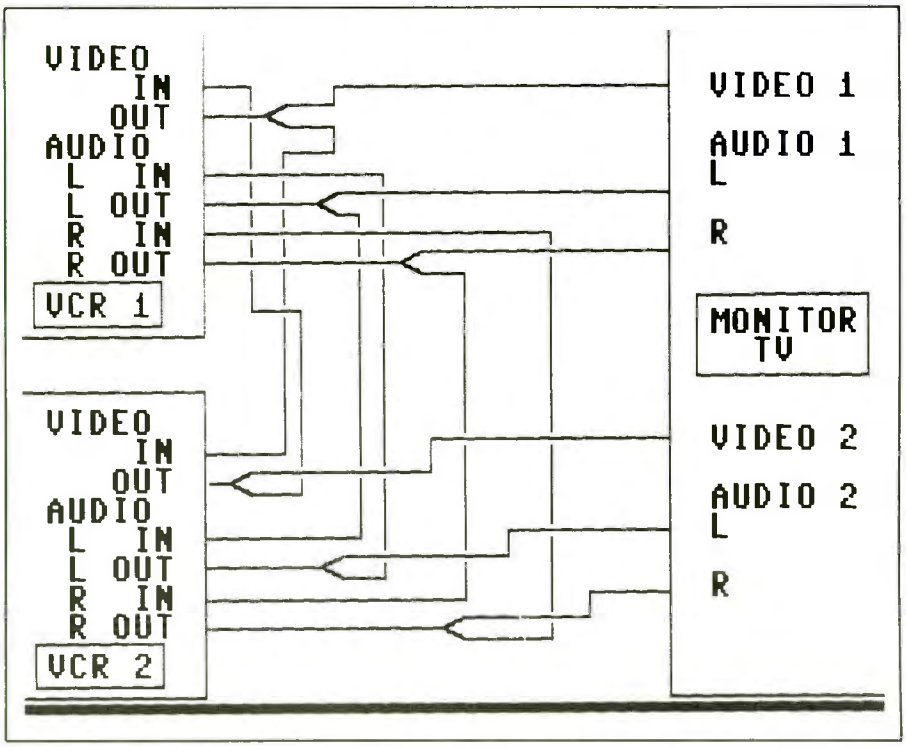

Fig. 3. Feeding two VCRs to a TV receiver/monitor; copying from one VCR to the other can be done.

accessory to be described is by far the best solution in terms of performance, ease of use and cost.

About the Circuit

As shown in Fig. 5, the dual video amplifier consists of two distinctly separate sections—the dual amplifiers themselves, built around *IC1*, and the power supply whose output is regulated by *IC2*. Because each video amplifier channel has its own separate gain control, the project allows you to adjust signal levels from all video sources (tuner, VCR 1 and VCR 2) so that the pictures from all are the same brightness.

Input impedance for each video amplifier channel is approximately 5,000 ohms. This is high enough to assure that no significant reduction in picture signal results when the amplifiers are paralleled with the 75-ohm input of a VCR.

Video signals from VCRs or other sources are fed through *C1* and *C2* to the respective op-amp inputs. The values of these coupling capacitors are large to assure good low-frequency picture quality. With capacitors lower in value than the 250 microfarads specified, you may detect brightness variations from top to bottom of the screen.

An LM359 is a good choice for *IC1*. It was selected for its excellent high-frequency response and high crosstalk rejection. While most other op amps begin to attenuate the signal by the time the frequency reaches the higher audio range and are virtually worthless at 1 MHz, the LM359 delivers useable performance out to 20 MHz or more. Don't substitute a different op amp for the LM359.

Gain controls *R5* and *R6* permit you to vary the gain of the op amps from 0 to about 2 in the respective video amplifier channels. Operating these controls permits you to adjust the picture as desired. As you adjust *R5* and *R6*, you'll notice that they affect both brightness and contrast.

Resistors *R8* and *R9* serve as a voltage divider that provides a bias voltage for the op amps. If you wish, you can replace these two resistors with a single 500-ohm potentiometer that will allow you to experiment with the picture/sync ratio.

My project has no power switch for the simple reason that I'm using my TV receiver/monitor's switched ac accessory outlet to turn on and off the power whenever I turn on and off the receiver/monitor. Since I need the video amplifiers only when viewing a VCR program, this works out fine for me. If your TV receiver/monitor doesn't have a switched outlet or you have another application in mind, you may wish to add *S1* to allow you to switch on and off power to your video amplifier.

Any power supply that can deliver between 5 and 22 volts dc can be used with the project. This allows you to use a different power supply from that shown in Fig. 5. If you do use a different supply, however, make sure the output from the power transformer is at least 3 volts greater than the potential you want at the output of the regulator.

You might think that a power supply with an output of 15 volts or more is preferable to one with a lower-voltage output, but it isn't. A low-voltage power supply is preferred for two reasons. Firstly, it keeps heat losses to a minimum. Secondly, it calls for lower-voltage components that are less expensive than their higher-voltage counterparts.

Light-emitting diode *LED1* is an optional power-on indicator. If you prefer, you can omit the LED and current-limiting resistor *R10*.

Construction

Owing to the project's very simple design and low component count, construction is also very simple. Aside from having to keep all wiring as short as possible, there's nothing particularly difficult about building the project.

You can point-to-point wire the

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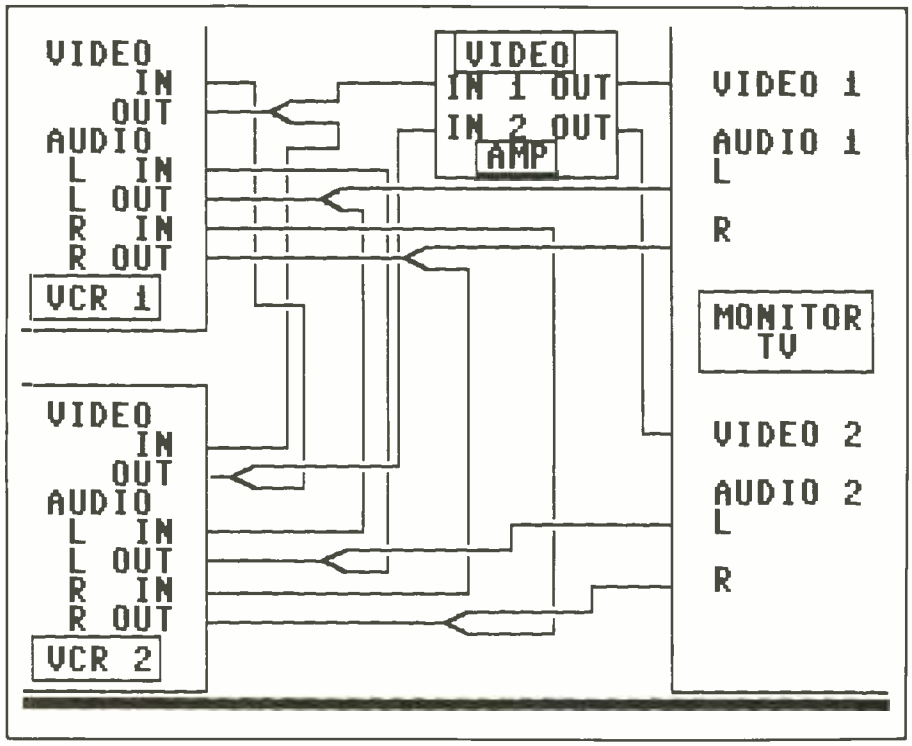

Fig. 4. Feeding two VCRs to a TV receiver/monitor; copying can be done and video amplification assures that no loss in picture quality occurs.

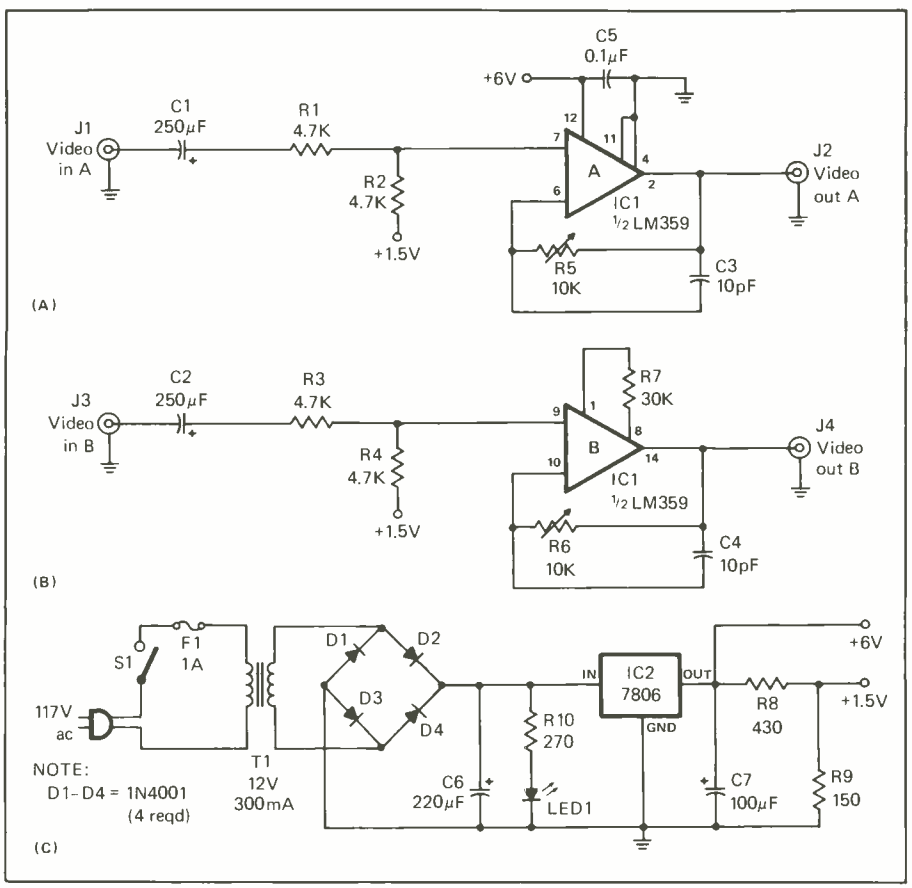

Fig. 5. Overall schematic diagram of Dual Video Amplifier.

circuit on two separate pieces of perforated board, one for the video amplifiers and the other for the power supply, using appropriate soldering hardware. Alternatively, you can design and fabricate a printed-circuit board to take the place of point-to-point wiring. In either case, it's a good idea to use a socket for *IC1*. When wiring the circuit, make sure you install the components with the proper orientation and polarities, as shown in Fig. 5, and use a heat sink with *IC2* to dissipate excessive heat.

Gain controls *R5* and *R6* can be ei-

PARTS LIST

Semiconductors

IC1—LM385 dual high-speed operational amplifier (do not substitute)
IC2—7805 +6-volt regulator
D1 thru D4—1N4001 rectifier diode or equivalent bridge rectifier assembly
LED1—Light-emitting diode

Capacitors

C1,C2—250-μF, 12-volt electrolytic
C3,C4—10- to 13-pF, 50-volt ceramic
C5—0.1-μF, 50-volt disc
C6—220-μF, 16-volt electrolytic
C7—100-μF, 16-volt electrolytic

Resistors (¼-watt, 10% tolerance)

R1 thru R4—4,700 ohms
R7—30,000 ohms
R8—430 ohms
R9—150 ohms
R10—270 ohms
R5,R6—10,000-ohm pc or panel-mount potentiometer (see text)

Miscellaneous

F1—1-ampere fuse
J1 thru J4—Phono jack
S1—Spst slide or toggle switch (optional; see text)
T1—12.6-volt, 300-mA transformer
Suitable metal or plastic box; fuse holder for F1; small heat sink for IC2; printed-circuit board or perforated board and soldering hardware; socket for IC1; control knobs for panel-mount potentiometers; rubber grommets; plastic strain relief (optional; see text); rubber feet or Velcro strips (see text); video cables; lettering kit; machine hardware; hook-up wire; solder; etc.

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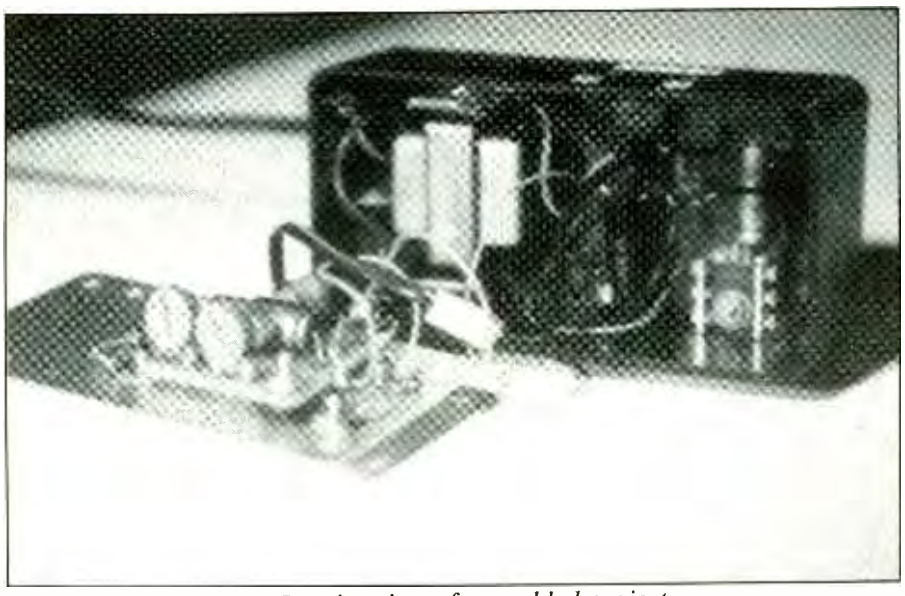

Interior view of assembled project.

ther pc-type trimmer potentiometers or standard or miniature panel-mount pots (as can be the 500-ohm potentiometer, if this is used in place of *R8* and *R9*). Panel-mount pots are more convenient if you anticipate having to frequently adjust the controls, though they do add to the cost of the project.

Use a plastic or metal box in which to house the project. Drill holes for mounting the jacks through one end and for mounting the circuit board(s) through the floor of the box. If you're using panel-mount potentiometers for *R5* and *R6* and/or have decided to replace *R8* and *R9* with a 500-ohm pot, drill the mounting holes for these components in locations where they won't interfere with the rest of the circuitry. Otherwise, drill access holes to these pots directly in line with their adjustment slots when the circuit board is in place.

Then drill a mounting hole for a toggle-type power switch or cut a rectangular slot and drill mounting holes for a slide-type switch, locating it where it won't interfere with the rest of the circuitry. Drill holes for the LED (if you're using it) and ac line cord, and a few extra holes to allow heat to escape.

Label the various jacks, controls, positions of the switch and the LED. If you use dry-transfer lettering, give it two or three *light* coats of clear acrylic spray to protect it.

Mount the circuit board(s) on the floor (using spacers) and the other components in their respective locations on the walls of the box. Line the LED and line cord holes with rubber grommets. Plug *LED1* into its grommet and pass the free end of the ac line cord through its rubber grommet. Tie a knot in the ac line cord about 4" from the free end inside the box or use a plastic strain relief.

When everything is mounted in its respective location (use spacers between the circuit board and floor of the box), refer to Fig. 5 and interconnect all off-the-board components to their respective points in the circuit.

Normally, the video amplifier would be mounted on the rear panel of the TV receiver/monitor with which it is to be used. If this is your intent, you can secure it in place with a couple of strips of Velcro epoxied to the back of the box and to the receiver/monitor's rear panel to hold it in place. Alternatively, you can simply place the box near your TV receiver/monitor or VCRs. In this case, place four self-stick rubber feet on the bottom of the box.

In Closing

Connecting your Dual Video Amplifier into your system is simple, as shown in Fig. 4. Use video-quality cables for all interconnects. Keep the cables as short as possible. Don't use audio cables! Long cables and audio cables will attenuate high frequencies, resulting in reduced picture sharpness.

The Dual Video Amplifier may have been designed to provide isolation when feeding a composite signal from each of two VCRs to a TV receiver/monitor and a VCR, but this isn't its only use. You can use it to isolate or amplify composite-video signals in other applications using VCRs, video cameras, computers, etc. The gain controls allow widely varying signal sources to be adjusted for optimum signal levels. **ME**

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