

# Noiseless Switching for Hi-Fi

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*Use of light-coupled photocell device permits remote control of volume and switching without any noise.*

THE tremendous improvements in high-fidelity electronics, especially in regard to stereophonic sound, have made possible excellent sound reproduction. This, in turn, has focused attention on the problem of eliminating all extraneous sounds and noises that mar reproduction. With today's sophisticated units even the "click" of a switch has become an annoyance. The use of light-coupled, instead of direct, switching can eliminate this noise and, at the same time, significantly reduce costs in remote switching applications.

## Remote Control for Stereo

A small unit for the remote control of stereo, which incorporates an "on-off" switch and two controls (one for level and one for balance), is shown in Fig. 1. This unit is connected to the stereo pickup, radio, tape recorder, or phonograph through small-gauge, inexpensive wires which need not be shielded. The length of the wire is not critical so the remote control can be placed any reasonable distance from the set. The wires introduce no noise or hum no matter what their length, making the control ideal for large halls, theaters, hotels, and other locations where con-

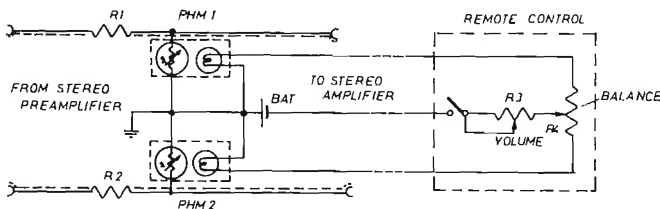


Fig. 2. Circuit of the light-controlled remote volume control.

Fig. 3. Light-controlled units used for remote switching.

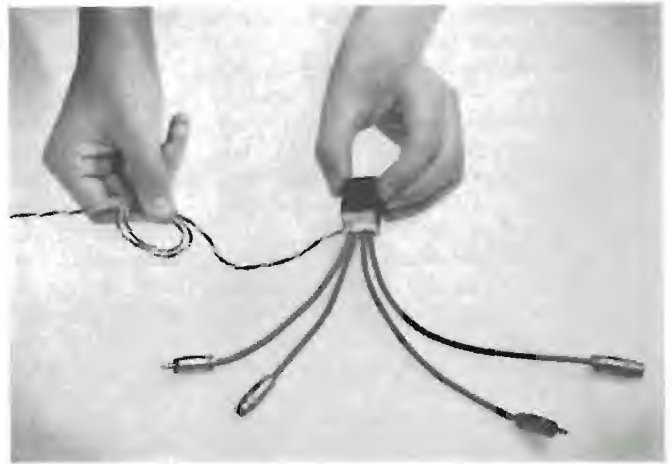
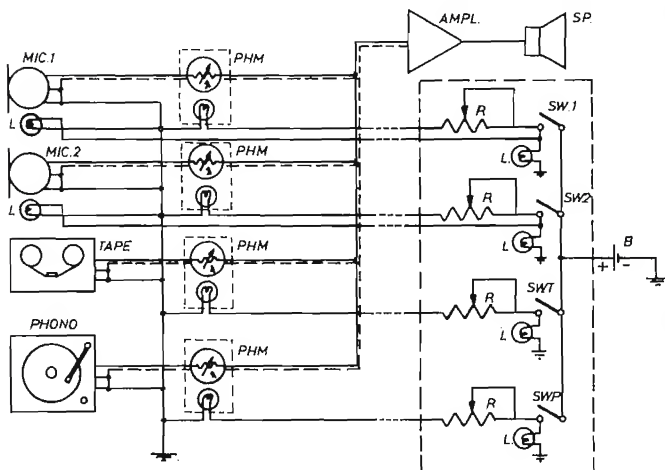


Fig. 1. The "Photomod" remote control unit for stereo use.

venience of control dictates wire runs over long distances.

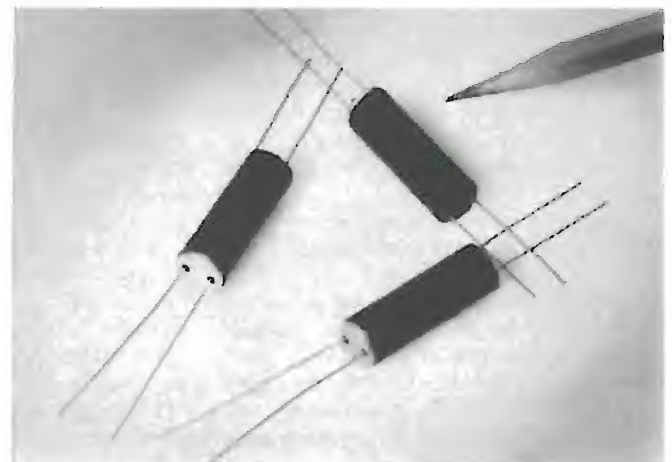
Installation of the stereo remote control is simple, as shown in Fig. 2. The control is inserted between the pre-amp and the amplifier. Two 47,000-ohm resistors, R1 and R2, are installed as shown. These resistors determine the amount of attenuation and are not critical. For solid-state stereo equipment these resistors may be replaced by ones having a lower value. A divider circuit from each channel is created by two "Photomods"—Clairex Type CLM5012—which incorporates a Clairex CL705L cadmium sulfide photocell and a 12-volt, 40 mA lamp. The photocells act as shunt resistances. With maximum voltage on the lamps, the resistance of the cells drops to about 400 ohms or less, providing attenuation of up to 40 dB.

Adjusting R3 will affect the light output of both lamps causing the level of both channels to vary (volume control). With the switch open, cell resistances may be many meg-ohms, leading to negligible insertion loss.

Resistor R4 acts as a balance regulator. Adjusting it makes one of the lamps brighter than the other, resulting in a different resistance in each channel. This changes the divider proportionately and results in a different output to each speaker. The small time lag in both the lamps and the photocells permits very smooth adjustment. Two 6-volt industrial batteries in series provide service for a year or more. The unit could draw power from the amplifier and the preamplifier, but the power drain is so small that it is simpler to use small batteries. As the batteries begin to fail, the range of control will diminish. As this occurs, the minimum volume level will increase as an indication of the condition of the batteries.

The remote control can not reduce volume to zero, a

Fig. 4. A grouping of three "Photomod" units is shown here.



reminder to turn the main unit "off". Maximum volume is determined by the setting of the volume control on the stereo system itself. Although a two-channel system is shown in Fig. 2, the remote-control unit can be expanded to handle as many channels as desired simply through the addition of "Photomods" and controls.

### Remote Switching

Basically the same technique as just described can be applied to remote switching for various inputs in high-fidelity systems. As shown in Fig. 3, the remote switch can be used to patch in a phonograph, tape deck, and one or more microphones. In this application the complete absence of noise, hum, or the on-off "click" of a switch in the microphones assures quiet, professional operation.

Each unit used has its own volume control and "on-off" switch. The separate volume control permits volume to be preset so that when the unit is turned on, no volume adjustments would have to be made. In addition, each switch has its own pilot light so that it can be determined at a glance which of the units is operating.

The wiring from the console to the remote-control unit is simple, requiring only inexpensive, small-gauge wire such as conventional bell wire. No shielding is required no matter how long the run, nor are intermediate amplifiers needed.

The variable resistor,  $R$ , is 2500 ohms and controls the volume of each unit through the lamp in the "Photomod" over a 10 to 1 range. The dark resistance of the photoresistor exceeds 100 megohms. Increasing the power to the lamp reduces cell resistance to 500 ohms and permits full power to come through. The unit used here is *Clairex* Type CLM5012, the same as used in the stereo remote-control unit. For extra-low impedance microphones, use of the Type CLM4012, which has a maximum "on" resistance of 50 ohms, would be preferable.

This remote-control unit may be expanded to handle any number of channels, or any mixing requirement. It can, for example, be located in the control room of an auditorium where a large number of microphones is used. Where required, "Photomods" may be incorporated into more sophisticated matching networks.

The "Photomod" photocell-lamp modules (Fig. 4) are available in a variety of stock models with "on" resistance as low as 40 ohms and "off" resistances exceeding 100 megs. Voltage ratings for the lamps may be 6, 12, or 24 volts for incandescent lamps. Two models are produced with neon glow lamps. These require 120 volts with a current limitation of 3 mA. ▲