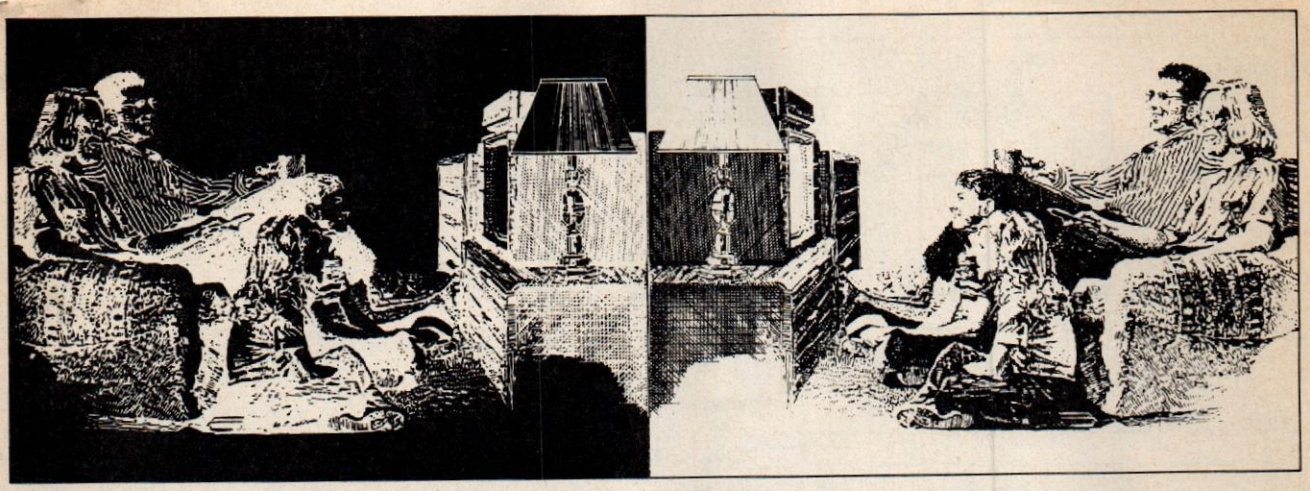


REMOTE CONTROL POWER SWITCH

Turn appliances on and off using any remote control with these IR switches.

JAIME LASSO*

IN RECENT YEARS, IT HAS BECOME easier than ever for an electronics hobbyist to build infrared (IR) remote-control devices. However, most IR systems are still too complex because they need tuning and encoding of some kind. If you're looking for a project that can be thrown together quickly and still work the first time you power it up, then try our universal appliance remote control receiver.

The device lets you control room lighting—or other line-powered devices—with any TV or VCR remote control. Since there's no need to build a transmitter, the project is simple; all you have to worry about is building a receiver.

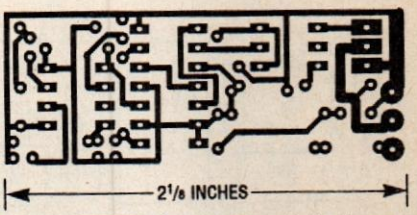
Have you ever sat down to watch TV and forgot to turn on the room light? Well, now you don't have to wait for your kids or wife to walk by—you can do it yourself, instantly, since you already are holding the TV remote in your hand.

*Jaime Lasso is an applications engineer for Motorola, Inc.

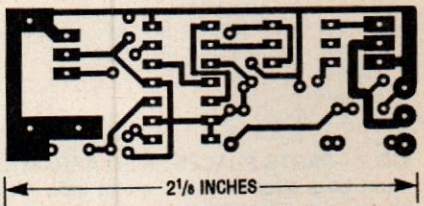
How it works

Most TV remote controls transmit a coded signal consisting of short bursts of a higher frequency (between 30 and 60 kHz). In our case, we don't care about the coded signal. All we care about is the very first pulse that the remote control transmits. Referring to the schematic in Fig. 1, IR pulses are detected by the combination of D1 (a Motorola infrared detector diode MC821) and IC1 (a Motorola MC3373 infrared amplifier/detector), which are the heart of the circuit. Those two components capture the pulse, demodulate it, clean it up, amplify it, and get rid of the power-line IR emissions, which are abundant in most areas.

Infrared signals are detected by the reversed-biased photodiode D1, and processed by amplifier-detector IC1, which provides a clean pulse at its output pin 1. This low-going pulse triggers a one-shot monostable multivibrator IC2-a (half of an MC74HC74) whose Q output (pin 5), in turn, goes low and stays low for about 2 seconds. The time is determined by C5 and R4, and it can be varied to change the time delay of the timing cycle.



FOIL PATTERN for the IR switch shown in Figs. 2 and 4.



FOIL PATTERN for the IR switch shown in Figs. 3 and 5.

The time delay is necessary to convert the fast tone bursts from the transmitter into longer logic pulses that we can handle more easily. Once a signal is detected, IC2-a essentially latches on and remains low long enough for the incoming pulses to stop coming in. Once the cycle is over, IC2-a is again able to receive IR signals. That first

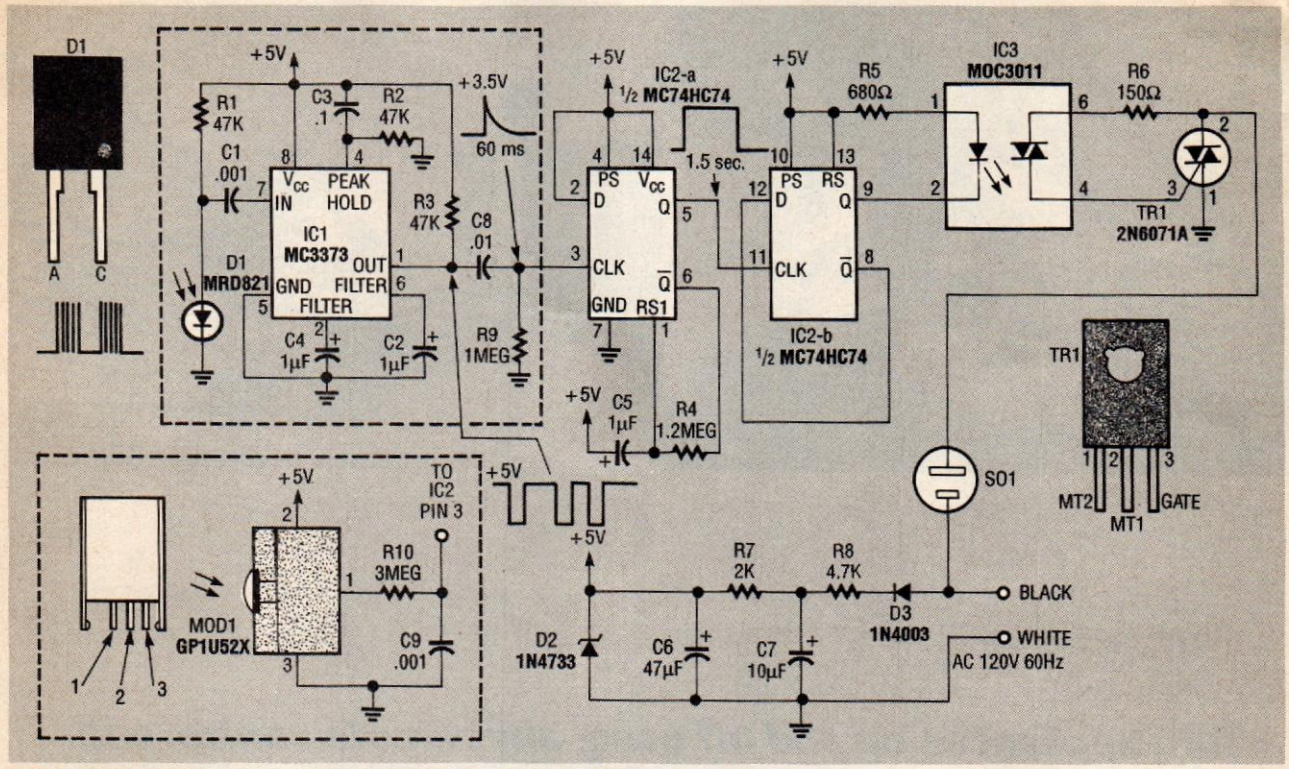


FIG. 1—THIS CIRCUIT WILL RESPOND TO ANY IR SIGNAL. Pulses are detected by detector diode D1 and infrared amplifier/detector IC1.

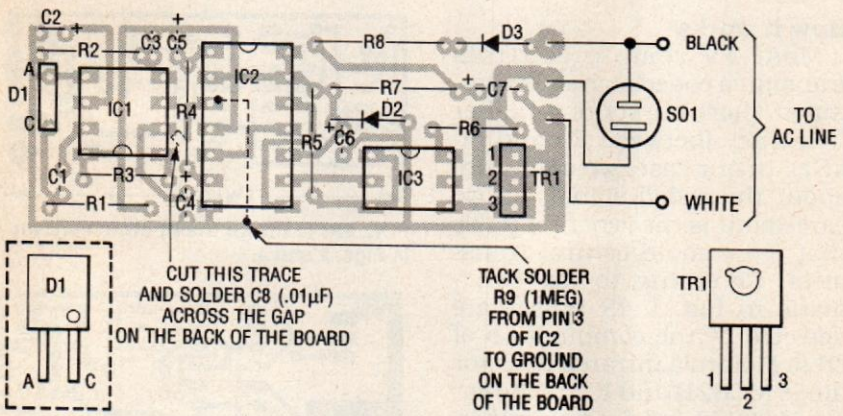


FIG. 2—PARTS-PLACEMENT DIAGRAM for the IR switch that contains D1 and IC1. TR1 must be placed with its metal side facing away from board, and the side of the photodiode (D1) with the dot on it must also face away from the board.

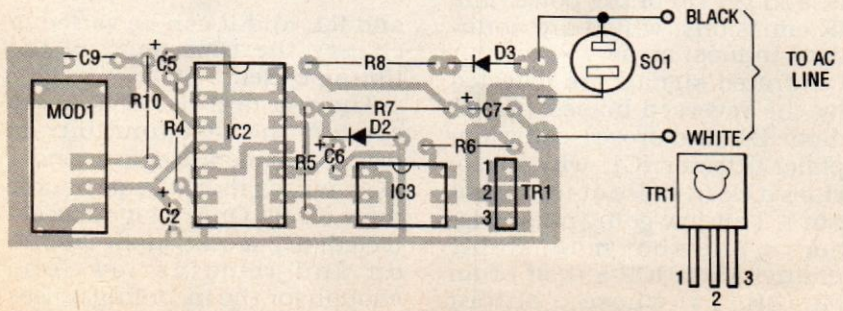


FIG. 3—PARTS-PLACEMENT DIAGRAM for the IR switch that contains MOD1. Use only the parts shown on this board, and disregard the parts that are used only on the other board.

pulse sets and resets flip-flop IC2-b, whose output (pin 9) powers the LED inside optocoupler IC3 (a Motorola MOC3011), which turns on the triac inside IC3. That turns on triac TR1, which supplies power to AC socket SO1 and the load.

When an IR signal is received once more, the Q output of IC2-b changes state, which disables the gate of TR1. Consequently, the next time the AC line voltage approaches zero, TR1 shuts off and so does the appliance plugged into SO1.

The IR detection circuitry—IC1 and the components surrounding it, shown inside the dashed box—can be replaced by the GP1U52X IR module (MOD1), also shown in a dashed box. The Sharp GP1U52X module (also available from Radio Shack as catalog No. 276-137) is an IR detector circuit by itself. You can use the parts that are easiest for you to get. Both circuits have a range of about 20 feet.

Assembly

Each of the two IR detection circuits makes use of a different PC board, so we've provided the

Continued on page 90

continued from page 44

foil patterns for both. Figure 2 shows the parts-placement diagram for the board that contains IC1, and Fig. 3 shows the one containing MOD1. The Parts List contains a listing of all parts for both boards—simply use only the parts shown on each board. Note that the PC board shown in Fig. 2 requires that a trace be cut and that two parts (C8 and R9) be tack-soldered to the back of the board. The procedures are detailed in Fig. 2.

When installing triac TR1, place it with its metal side facing away from board, and place the side of the photodiode (D1) with the dot on it so that is also faces away from the board—in other words, the dot must face the received signal.

The finished units are so compact that an enclosure is not necessary, although they should be properly insulated. A large-diameter piece of heat-shrink tubing can be used to enclose the entire board. That method permits the whole assembly to be placed inside an electrical switch box, an outlet box, or even a wall. The author's friend used double-sided tape to secure the units to overhead rail lamps throughout his house, making it very easy to turn the lights on and off by remote control. Figure 4 shows a finished board containing IC1, and Fig. 5 shows one with the IR module, with and without heat-shrink tubing. Note that the IR signal passes right through the white heat-shrink tubing.

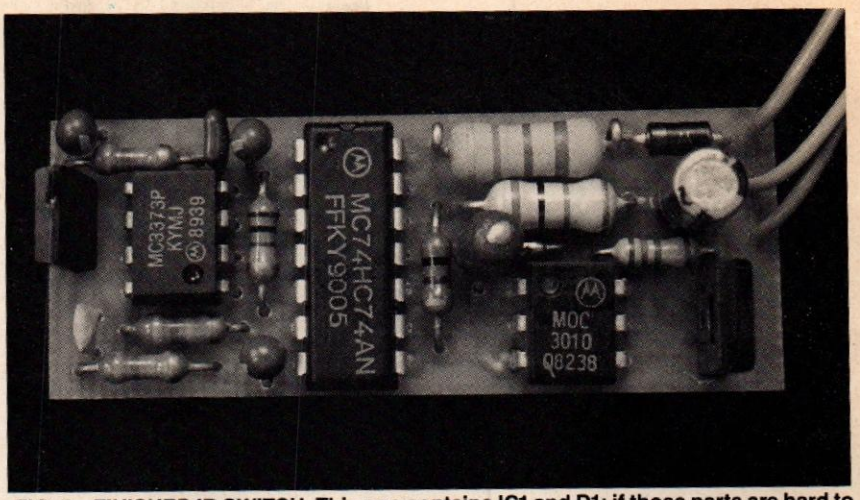


FIG. 4—FINISHED IR SWITCH. This one contains IC1 and D1; if those parts are hard to find, you can build the one shown in Fig. 5.

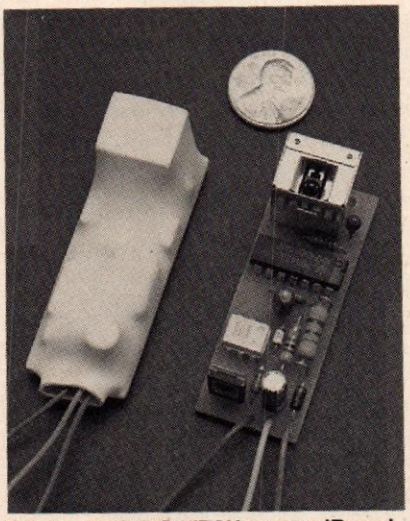


FIG. 5—THIS IR SWITCH uses an IR module instead of IC1 and D1. It's shown here with and without heat-shrink tubing. The IR signal passes right through the white heat-shrink tubing.

PARTS LIST

All resistors are ¼-watt, 5%, unless otherwise noted.
R1–R3—47,000 ohms
R4—1.2 megohms
R5—680 ohms
R6—150 ohms
R7—2000 ohms, ½-watt
R8—4700 ohms, 2 watts
R9—1 megohm
R10—3 megohms
Capacitors
C1, C9—0.001 µF, ceramic
C2, C4, C5—1 µF, tantalum electrolytic
C3—0.1 µF, ceramic
C6—47 µF, tantalum electrolytic
C7—10 µF, 50 volts, electrolytic
C8—0.01 µF, ceramic
Semiconductors
IC1—MC3373 infrared amplifier/detector (Motorola)
IC2—MC74HC74 D-type flip-flop
IC3—MOC3011 optocoupler (Motorola)
D1—MRD821 infrared detector diode (Motorola)
D2—1N4733 5-volt Zener diode
D3—1N4003 diode
TR1—2N6071A triac
MOD1—GP1U52X IR module (available from Radio Shack, part number 276-137)
Miscellaneous: PC board, heat-shrink tubing, wire, solder, etc.
Note: A kit for the infrared receiver (the one containing IC1) is available for $12.95 from DC Electronics, P.O. Box 3203, Scottsdale, AZ 85271-3203. Call (800) 423-0070 or (602) 945-7736.

Last word

To use the unit, point a TV or VCR remote control at the IR detector and push any button on the remote. Be sure to release the button immediately, otherwise you will turn off the appliance if you exceed the built-in delay of the receiver. You can use the "0" key by itself to avoid having your TV or VCR respond to the signal—or any other key if the "0" button has some specific function assigned to it.

A word of caution: If you ever have to service the appliance that's plugged into this device, be sure to unplug or disconnect the appliance from this device rather than just turning it off with the remote. The reason is because this circuit switches the neutral AC lead (white) rather than the "hot" lead (black). Because the circuit operates in that way, an AC voltage is always present inside a plugged-in appliance.

The number of applications for this circuit is virtually infinite. Aside from turning lights on and off, it can also turn older TV sets on and off. By connecting a relay to the output you can control just about anything. **R-E**

CPU running at 4.77 or 7.14 MHz, a CGA-level display, 1.5 MB of ROM, 1 MB of RAM, a serial port, a parallel port, and two PCMCIA slots. The screen measures a squashed 6.8" × 2.6", and is a nonbacklit LCD type. Though no match for a backlit, VGA screen, readability is quite good in decent light; contrast is much better than first-generation LCD's (e.g., the venerable Toshiba T1000).

The keyboard is compressed, but you can touch-type on it. The function keys are smaller than the regular keys, the spacebar is very narrow (about half normal width), and the On/Off switch is just above the BackSpace key, which makes it easy to turn the machine off inadvertently. However, the PPC has an auto-resume feature that instantly returns you to wherever you were the next time you power up. And speaking of power: *The PPC runs as long as ten hours on two standard AA cells.* It also has a lithium backup battery that allows you to change the main cells without losing memory contents.

The ROM contains DOS 5.0, Microsoft Works 2.0, and several personal management utilities, including a file manager, a daily planner, a to-do list, a card file, a calculator, and several others. Works is quite nice; it contains word processor, spreadsheet, database, and telecommunications modules, all of which are good enough for small, on-the-road jobs. The DOS implementation is incomplete, containing only a very limited subset of commands: Format, Doskey, Xcopy, Label, Print, Keyb, Attrib, and a special communications program, Interserve.

Interserve is intended to be a LapLink work-alike, but it lacks. (LapLink provides a fast, easy way of transferring files over serial or parallel links. One of its nicest features is the ability to clone itself across the wire, so you only need a copy on one machine to get started.) Interserve provides a similar capability, but it doesn't work very well. I couldn't get Interserve to clone itself without rebooting my desktop machine with no CONFIG.SYS or AUTOEXEC.BAT. Several very uninformative error messages aggravated the situation. In addition, it is necessary to load a device driver on one machine. You can't do it on the PPC (because CONFIG.SYS is ROM-based), so you have to do it on the desktop. That can be a major pain in the neck. I ended up copying LapLink over, even though it uses almost 100K of RAM.

The basic machine includes 1 MB of RAM, partitioned as 640K of conventional memory and a 384K battery-backed RAM drive (E). You can also add RAM via the PCMCIA slots; ZEOS sells 0.5, 1.0, and 2.0 MB cards for about $150, $250, and $450, respectively, and a 9600/2400 fax/modem card for $250. The PPC has no capability for floppy or hard disk drive, but external solutions that work off the parallel port are available as accessories. The PCMCIA market in general is about to explode, so be on the lookout for lots of interesting new products.

Mechanically, the screen swivels through about 160 degrees, so obtaining a good viewing angle is easy. A snap-out port cover conceals the nonstandard serial and parallel connectors, accessed by special cables. The PPC comes with the port-adapter cables, a DC power adapter, a padded carrying case, and a one-volume user's manual.

In spite of my frustration with Interserve, I really like the PPC. It is by far the smallest usable machine on the market; it is what earlier attempts by Atari and Poquet strove to be and failed. It won't do Windows, but it will last a cross-country flight. Cost is an issue. Adding a couple of megabytes brings the total over $1000, where low-end laptops with better screens and more storage can be had. However, those machines are larger and battery life is nowhere near that of the PPC.

The PPC represents a preemptive strike by ZEOS on the fledgling pen-input market. It will be interesting to see how PPC stacks up against the units coming from Apple, Sharp, and others. We'll keep you posted.

News Bits

Starlight Networks has introduced a network video server that claims to be able to serve 20 simultaneous video streams on Ethernet (coax and twisted pair), and that supports DVI, JPEG, MPEG, and AVI formats. IBM has committed $100 million to create a new company that will use cable-TV data channels to deliver on-demand video and data to business and eventually homes.

Sony finally introduced its long-awaited "Bookman," now officially known as the Multimedia CD-ROM Player. The device has a 5" screen, miniature keyboard, and ability to connect to a TV and printer. It plays audio CD's, and special multimedia titles. Microsoft is supplying the authoring tool, a version of the Multimedia Viewer. The new Sony joins Philips' CD-I, Tandy's VIS, and Commodore's CDTV as yet another CD-based mass-market multimedia machine, all of which are seeking market share and consumer dollars. This holiday season should provide first indications of which of these new technologies will survive. **R-E**