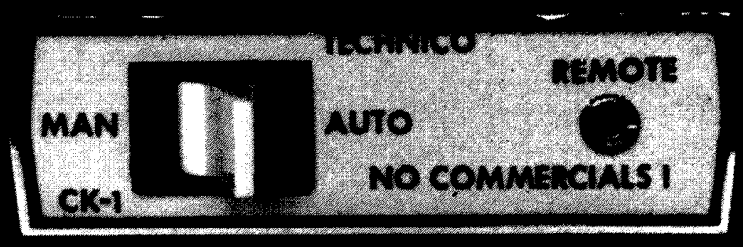
BUILD THIS AUTOMATIC COMMERCIAL EDITOR FOR YOUR VCR



ATTENTION, ALL FANS OF BLACK-AND-white movies! If you like to tape those late-night classics for viewing at a more reasonable hour, you'll love this gadget. It detects color commercials, and stops your VCR (*V*ideo *C*assette *R*ecorder) while they are running. Then, when the commercials are over and the film begins again, the VCR restarts and continues to record. As a result, all the commercials are automatically edited out of the movie, and you can enjoy it without breaks.

Using the device is simplicity itself. You just connect two cables from it to the recorder's VIDEO OUT and PAUSE jacks. Then you turn it on, and start the recorder. The rest is automatic.

Besides removing commercials from black-and-white movies, this commercial editor offers several fringe benefits. For example, by eliminating commercials, the recorder uses less tape. That means that shorter (and less expensive) tapes can be used to record longer programs. (In my area, a one-hour tape will record almost 1½ hours of movies!) Still other features are a five-minute timeout, and a jack for your remote pause control.

The five-minute timeout feature restarts the recorder if the commercials run over five minutes at a time. That feature is included because some recorder manufacturers recommend that their machines be left in the PAUSE mode for no more than five minutes. Longer than that can damage the tape, or cause excessive head wear, so the timeout feature protects both your tape and VCR. And, although the editor uses the PAUSE jack on the VCR, you can still use your remote PAUSE control as the editor contains its own jack.

You can build your own commercial editor in just a few evenings. Only four IC's are used, and there are only two easy calibration adjustments to be made. The only test equipment you need is an analog VOM and an RF signal-generator. (Don't be too concerned if you don't have the signal generator—there are ways around that, as you'll see.)

How it works

The automatic commercial editor works by detecting the presence or absence of the *color burst* signal, which accompanies all color broadcasting, but which is not transmitted (usually) when the material is in black-and-white. When that signal appears, a relay in the editor closes and switches the recorder to the PAUSE mode. When the color commercials are over, the color-burst signal disappears, and the relay opens. That switches the VCR to RUN, and recording resumes. When the next commercial appears, the cycle repeats all over again.

Note that the program being recorded must be black-and-white for the editor to work (otherwise the color-burst signal will be present at all times). If the film is in color, the first five minutes of program or commercials will not be recorded. After that time, because of the timeout feature, both commercials and program will be recorded.

Some readers, no doubt, are wondering whether this editor can be made to work with color programs. The answer is that it is not likely. The reason, we found—after extensive research—is that there is not enough difference between color commercials and color programs, which makes detecting color commercials very hard to do. So forget about an editor for color-program commercials...at least for now.

Now let's take a look at the inside of the editor. Refer first to Fig. 1. There are three main circuit-blocks: an AGC-controlled amplifier, a comparator, and a timer. We'll discuss them one at a time.

The AGC-controlled amplifier comes first. The signal from the recorder's VIDEO OUT jack is supplied to the input of the editor. That video signal consists of horizontal sync, vertical sync, video, and a color-burst signal. The only portion that we are interested in is the color-burst, which is really a few cycles—a burst—of a 3.579545-MHz signal. That signal tells the TV receiver that it is receiving a color transmission, and determines what the

colors are, and how bright they are. To use it, we must amplify the color burst and filter out the rest.

Bandpass filter BPF1 separates the 3.579545-MHz (from here we'll call it 3.58 MHz for short) signal from the rest of the video, and that signal is amplified by IC1. The output from IC1 drives another bandpass filter, BPF2, which peaks the 3.58-MHz signal farther. Finally, the output from that filter is detected by D1 and converted to pulsating DC. The DC biases transistor Q1, which serves as an automatic gain control (AGC). The AGC-voltage controls the gain of IC1 via resistors R4 and R1 and, as a result, the output from D1 is at a constant amplitude whenever a color signal is present.

In our application, however, the color-burst signal itself is not used. Instead, the voltage drop across R4 is detected, which brings us to the second part of the circuit, the comparator.

The comparator circuit used here is rather unusual. To prevent false triggering, several circuit twists have been added. Resistors R6 and R7 provide a 0.26 volt hysteresis, and resistor R5 and capacitor C11 are used to introduce a short time-delay. The result of those additions to the circuit is to prevent noise—which can come from the video—from falsely triggering the device.

A color-burst signal applied to the input of the editor causes a voltage drop across resistor R4. When that voltage exceeds 0.26 volt, and lasts for at least 100 ms, comparator IC2 will be triggered, and its output will go from high to low. It will stay low for at least 100 ms after the color burst disappears, and that brings us to the third circuit block.

The last bit of circuitry is a five-minute timer, built around IC3. Whenever the output of IC2 goes low, both IC3 and the relay receive power. The relay closes immediately and, if the output of IC2 does not go high within 5 minutes, IC3 times out, removing power from the relay. The relay contacts, of course, control the VCR's PAUSE function.

Now that you have a basic understanding of how the project works, let's look at Fig. 2, the schematic diagram.

The AGC-controlled amplifier is at the top of the schematic. The video signal is input through C1. Coil L1, with capacitors C2 and C3, is peaked for the 3.58-MHz color-burst signal. The two capacitors also provide impedance matching to IC1. That IC is a differential input/output IF amplifier. It amplifies the signal by up to 60 dB, and its output appears across C6 and L2. That network is also tuned to 3.58 MHz, and provides greater selectivity. The amplified signal is detected by D1, and the color burst appears across R2 and C8. The DC component of the burst biases Q1, which draws current through R4. Capacitor C9 is included to prevent Q1 from amplifying the AC component of the color-burst signal so only a DC signal

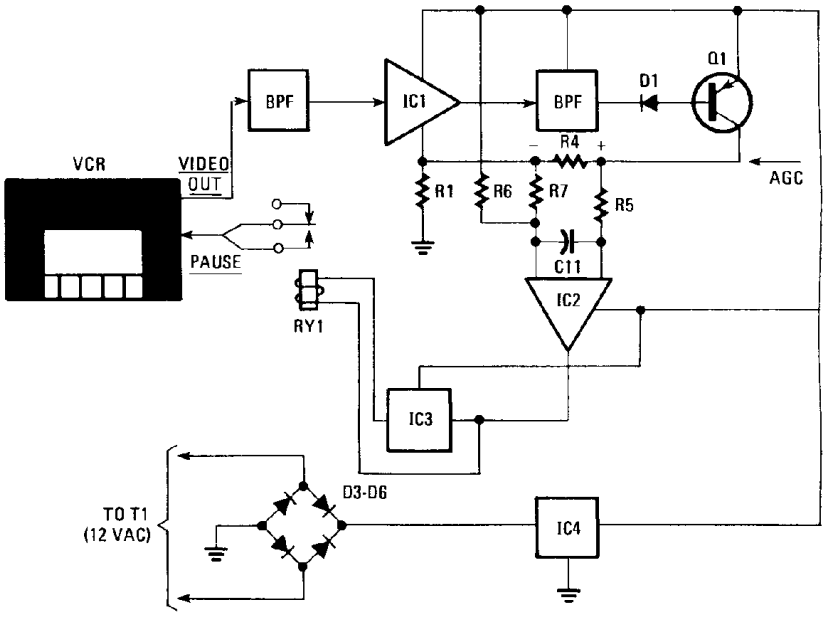


FIG. 1—BLOCK DIAGRAM OF COMMERCIAL EDITOR shows three principal sections: AGC-controlled amplifier, comparator, and timer.

is produced by Q1. From R4, that signal goes to IC1, where it controls the gain of the amplifier. In addition, IC1 also provides a 5-volt DC bias for the comparator; that 5-volt DC bias appears on pin 5 of IC1 and is necessary for the comparator to work properly.

Comparator IC2 monitors the voltage drop across R4. Resistors R6 and R7 form a voltage divider, biasing pin 2 of IC2 0.26-volt higher than the other input (pin 3). Thus, the voltage across R4 must equal or exceed the 0.26-volt hysteresis to trigger IC2. That extra circuitry was added to improve noise immunity.

With no color burst present, the output of IC2 will be high. When a color burst is present, though, there will be a voltage drop across R4. Typically, that will be 0.3 to 1.0 volt, depending upon the color intensity. When the voltage drop exceeds 0.26 volt, the comparator's output will go low. That, in turn, will trigger the timer circuitry.

In addition, the C11/R5 time-delay circuit provides a short time-delay (about 100 ms) before the comparator is triggered. That prevents noise spikes from triggering the comparator.

The output of the comparator drives a five-minute-timer circuit. Whenever pin 7 of IC2 goes low, a ground is provided for the IC3 circuitry, and that, in effect, applies power to the timer. Capacitor C14 and resistor R9 provide a trigger pulse for the timer, which causes relay RY1 to close, and C13 to charge slowly through R8. After about five minutes, the capacitor is sufficiently charged to trigger IC3, which opens RY1. Of course if the commercials last less than five minutes, the output of IC2 goes high sooner. In that case, the timer starts all over the next time it receives power. Note that the relay contacts are connected to the PAUSE jack on the recorder.

Finally, there's a simple 12-volt power supply. A wall-plug transformer supplies about 14-volts AC to D3–D6; from there the voltage is filtered by C15. It is regulated to 12-volts DC by IC4.

PARTS LIST—EDITOR

All resistors ¼-watt, 5% unless otherwise specified
R1–R3—10,000 ohms
R4—1000 ohms
R5, R6—1 megohm
R7—48,000 ohms
R8—10 megohms
R9—100,000 ohms
Capacitors
C1—10 pF, ceramic disc
C2—220 pF, ceramic disc
C3—470 pF, ceramic disc
C4, C5, C7, C8, C14, C17, C18—0.01 μF, ceramic disc
C6—150 pF
C9, C10, C12—0.1 μF, ceramic disc
C11—0.1 μF, Mylar
C13—22 μF, 16 volts, low-leakage electrolytic
C15—470 μF, 25 volts, electrolytic
C16—10 μF, 16 volts, electrolytic
Semiconductors
IC1—MC1350 IF amplifier
IC2—LM311 comparator
IC3—555 timer
IC4—78L12 12-volt regulator
Q1—2N3906 or equivalent
D1—1N6263 Schottky signal-diode *or* 1N60 germanium diode
D2–D6—1N4002
RY1—12-volt SPDT relay, 400-ohm coil (Mouser 43BC001 or equivalent)
L1, L2—10 μH adjustable shielded coil (J.W. Miller 9052 or equivalent)
P1—RCA phono plug
P2—subminiature phone plug
J1—subminiature phone jack
S1—SPST toggle switch
T1—12 VAC, 250 mA, wall-plug transformer
Miscellaneous: PC board, IC sockets, RG-174 coaxial cable, case, wire, solder, etc.

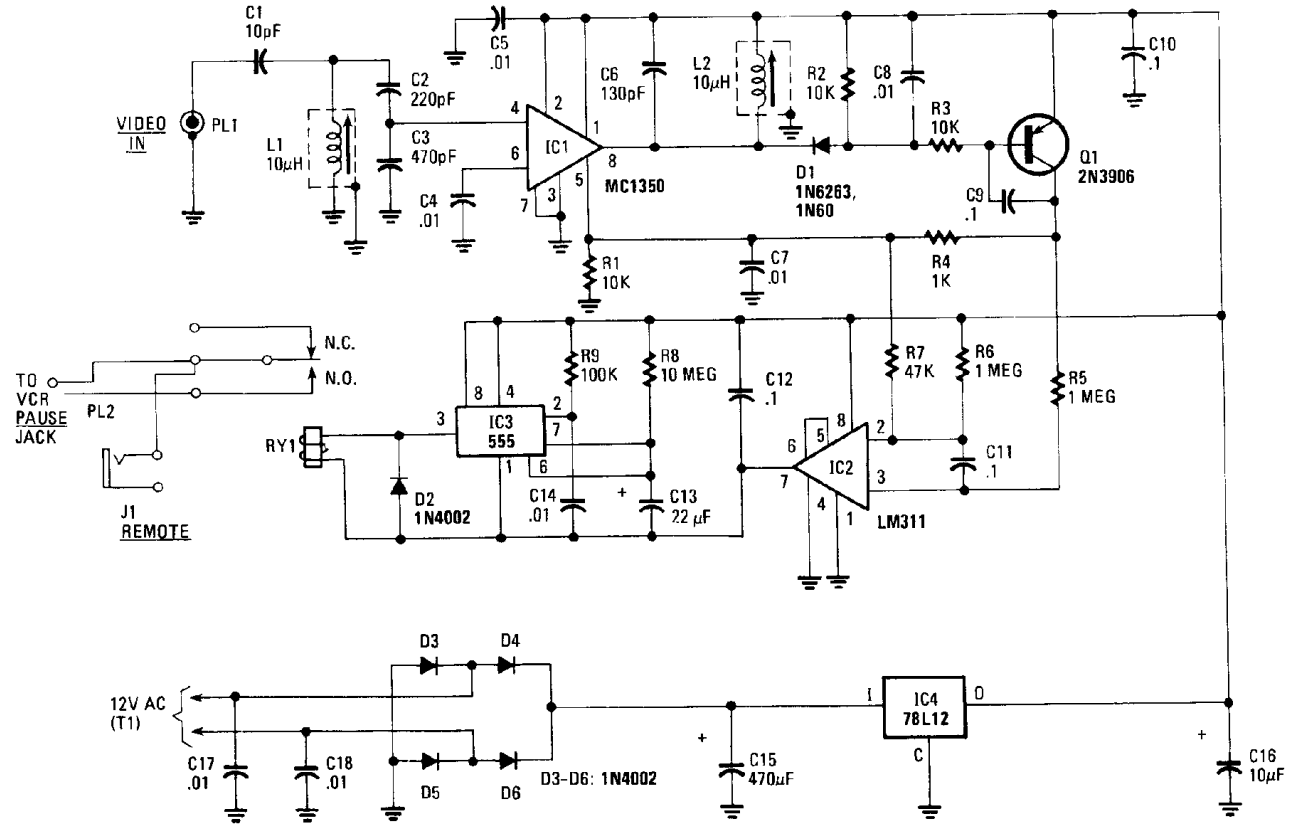


FIG. 2—AGC-CONTROLLED AMPLIFIER is preceded by two bandpass filters that isolate 3.579545-MHz color-burst signal.

Assembly

The commercial editor is intended to be built on a small PC board. In fact, you *must* use a PC board. If you don't, the AGC-controlled amplifier will probably oscillate, making it impossible to adjust the unit.

Figure 3 shows the foil pattern for the single-sided PC board, and Fig. 4 the parts-placement diagram. Start by positioning the board foil-side down so it faces the same way as the board shown in Fig. 4.

Start assembly with the IC sockets. Install 8-pin sockets at IC1, IC2, and IC3 as shown, and carefully solder them in place.

The coils and the relay are installed next. Install a coil at L1, and push it flush with the board; then solder it in place. Similarly, install L2. Finish up by installing relay RY1 in the appropriate position. Be sure to push it flush with the board before soldering.

The resistors are installed next. Start by installing R1 (10K) next to L2. Then install another 10K resistor at R2, and still another 10K resistor at R3 as shown. Move over to the IC2 socket and install R4 (1K) near it. (Be careful not to put it in the R5 position!) Then install R5 (1 megohm) between R4 and the IC2 socket. Move to the right of the IC2 socket and install R7 (47K). Again, make sure it's in the right place. After that, install R6 (1 megohm) next to R7. Move down to the IC3 socket for the remaining resistors. Install R8 (10 megohms) just to the left of the socket. Then move down and install R9 (100K). That finishes up the resistors. Check your work carefully, and correct any mistakes you may find.

Install the capacitors next. Start by mounting C1 (10 pF) next to L1. Be sure to push the part flush with the board before soldering its leads in place. Then install C2 (220 pF) next to L1 in the same manner. Similarly, install C5 (0.01 μF) as shown. After that, install C3 (470 pF) between L1 and the IC1 socket. Move to the left of the IC1 socket and install 0.01 μF capacitors at C4 and C7.

Continue by installing C10 (0.1-μF ceramic disc) next to L2. Move to the

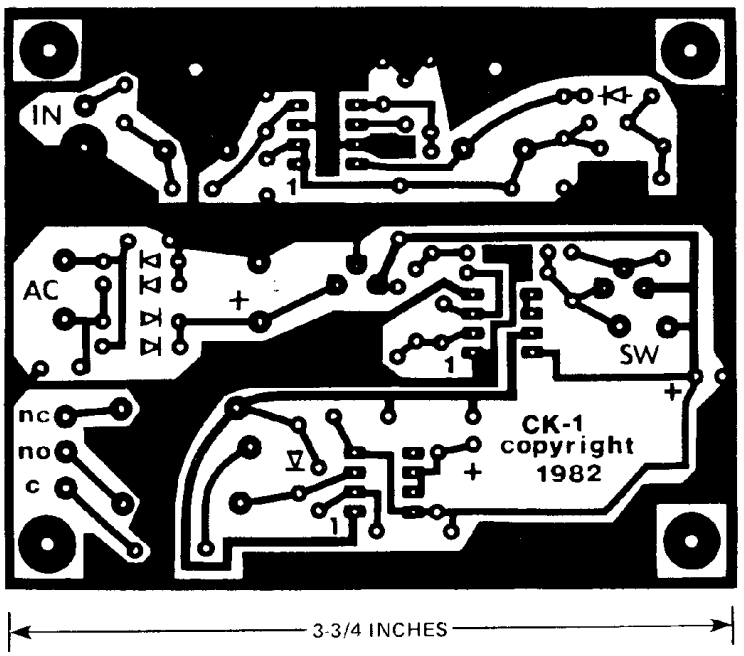


FIG. 3—FULL-SIZE foil pattern for single-sided editor PC board.

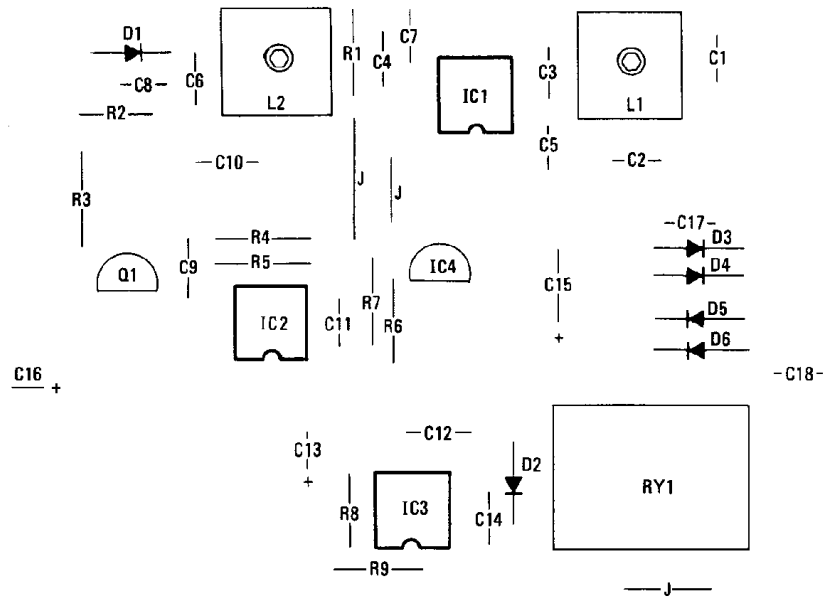


FIG. 4—BE SURE TO OBSERVE polarities of critical components. Be especially careful to install relay correctly.

other side of L2 and install C6 (150 pF). Then install C8 (0.01 μF) next to the 10K resistor. Make sure that C8 goes into the correct holes. After that, install C9 (0.1-μF ceramic disc) between the resistors.

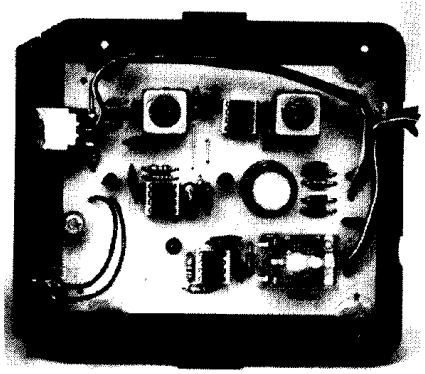


FIG. 5—COMPLETED circuit board should look like this. Board can be installed in small plastic clock-case.

Then move to the left edge of the board and install C16 (10 μF). Be careful to install this capacitor the right way; it's polarized. Similarly, install C13 (22 μF) next to the 10-megohm resistor. Then move up and install C11 (0.1-μF Mylar) between the IC2 socket and the 47K resistor. Continue by installing C12 (0.1 μF) above the IC3 socket and, after that, install C14 (0.01 μF) to the right of the IC3 socket. Move to the right center of the board and install C15 (470 μF) as shown. Be sure that this polarized part is inserted properly, then push it flush with the board and solder the leads in place. Finish up by installing C17 and C18 (0.01 μF). Carefully check your work before going any further. Be sure to check the polarities of the three electrolytics, and correct any mistakes before continuing.

Install the diodes next. Start with D3-D6. Install the four diodes as shown, then solder them in place. Move over to RY1, and install D2 as indicated. Finally, move to the top left corner of the board and

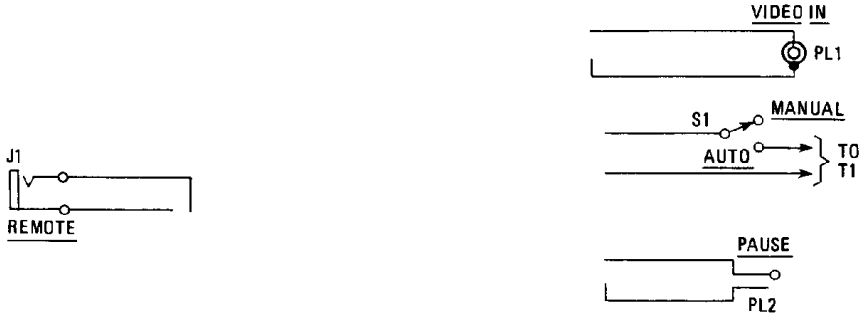


FIG. 6—OFF-THE-BOARD connections. Use RG-174 coax for VIDEO IN cable.

The following are available from Technico Services, 1920 W. Commonwealth Ave., Box 20HC, Fullerton, CA 92633: kit of all parts, *less case*, (CK-2), $54.00 plus $3.50 postage & handling (nonrefundable); PC board only (CK-1), $10.00, postpaid; assembled and tested calibration tool (3.58-MHz signal generator) (CAL-3), $10.00, postpaid. California residents please add 6% tax.

install D1. Again, check your work and correct any mistakes before continuing.

There are three wire jumpers, identified as "J," to be installed, and they come next. Use leftover resistor leads and bend them to fit, insert them, and solder them in place. Start with the two jumpers next to L2. Before soldering them in place, be sure to position them so that they don't touch. Finish up by installing the last jumper next to RY1.

Next come the IC voltage-regulator and the transistor. Install IC4 (78L12) first. Be sure that the flat side of the case is positioned as shown before soldering the leads in place. Then install Q1. Again, make sure that the flat side of the case is positioned as shown.

As you can see, the board is essentially complete and should look almost like the one in Fig. 5. All that is left to do is install the IC's and attach the cables.

Start with the IC's and install IC1 (MC1350) first. Be sure to position it properly before you plug it in. Then install IC2 (LM311) in the same manner and, finally, IC3 (NE555). Be sure to check the IC's for proper installation before continuing.

Finish up by installing the cables (refer to Fig. 6). Start with the video-input cable. Cut a two-foot length of RG-174 coaxial cable, then strip and tin each end. Attach PL1 (RCA phono plug) to one end. Then connect the other end to the board. Note that the shield goes to the heavier ground foil on the board.

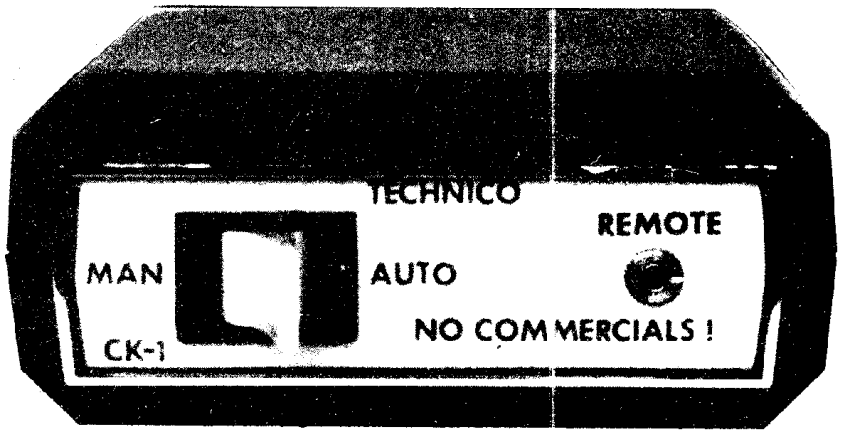
After that, connect the transformer leads. Measure about four inches from the *end* of the cable that is attached to T1 and cut *just one* of the wires at this point. Connect switch S1 at that point. Solder the free ends of the T1 cable to the appropriate pads on the circuit board.

Next, cut a two-foot piece of two-conductor wire (a short length of speaker wire will do). Attach PL2 (subminiature phone plug) to one end, and connect the other end of the cable to the board as shown.

Finish up the cable installation by wiring J1. Cut two two-inch lengths of hookup wire and solder them to J1 (subminiature phone jack). Then connect the other ends to the pads on the board.

That completes assembly of the editor's PC board. Once you've carefully checked your work, the next step is to align the device. That will be just one of the topics we'll cover in the next part of this article. R-E

With this handy accessory you can make commercial-free tapes of your favorite black-and-white movie classics and TV programs.



GARY McCLELLAN

Part 2 NOW THAT YOUR COMmercial editor is almost complete, you can begin the final adjustments and assembly.

Adjustments

Before making the final adjustments use an alignment tool to preset the L1 and L2 coil-slugs to mid-position; that's close to the correct adjustment for them.

There are two ways you can make your adjustments. One method is to use an RF signal-generator with an output at 3.579 MHz along with an analog voltmeter. The other method, which is just as good, is to use a low-cost calibration tool designed specifically for this application together with the analog voltmeter. That tool, a simple single-frequency RF signal generator, will be described in the section on "Options."

Do not attempt to use an off-the-air video signal to make the adjustments—the signal level varies too much for accurate results. With that precaution in mind, let us proceed.

Both methods use the same easy-to-perform procedure. Start by plugging T1 to a nearby AC outlet; then turn on S1. The relay should click if all is well. Connect your analog voltmeter across R4 and set it to the 1-VOLT DC range. The meter must read zero with no signal applied. Then connect either your RF signal generator or the calibration tool to P1 (VIDEO IN). Set the RF signal generator for 3.579 MHz. The calibration tool requires no adjustment, but you'll need a nine-volt battery to power it.

Adjust the RF-level control on either signal source for about 0.1- to 0.3-volt-DC on the meter; then slowly adjust L1 for maximum output. Be sure to use a nonmetallic alignment tool for this; metal causes detuning, which can lead to misadjustment. As necessary, reduce the RF level so that the output stays at or below 0.3 volt. You should be able to get a sharp peak.

Next, carefully adjust L2 for maximum output, again reducing the RF level as necessary to keep the meter reading at or below 0.3 volt. That adjustment should also peak-up nicely. If you have any problems making the adjustments, send a self-addressed, stamped envelope to the supplier indicated in the Parts List. You'll receive a free troubleshooting guide, which should solve your problems. Finish by carefully touching up L1, and then L2. When you are satisfied that both coils are peaked, you are finished. Remove the analog voltmeter and the signal source.

Final assembly

If you like, you can now install the completed unit in a suitable case. A small plastic clock-cabinet works well. We do not recommend that you attempt to install the editor inside your recorder, because most machines don't have enough room for it.

Options

There are two simple accessories you can build for use with your commercial editor. The first is a 3.58-MHz signal generator to help in adjusting the unit and the other is an adaptor that allows you to use the editor with a VCR that has a pushbutton PAUSE control (the device was designed for VCR's with slide-switch controls).

The schematic of the signal generator is shown in Fig. 7. It's a very simple device; the only critical part is the crystal, which should be cut for 3.579545 MHz ±0.01%, parallel-resonant (20 pF). A crystal in an HC6/U case will fit nicely on the PC board shown in Fig. 8. Parts placement for the signal generator is shown in Fig. 9; the editor's input-cable plugs into J1.

If your VCR has a pushbutton remote control, you'll need the adaptor shown in Fig. 10. In use, photocell PC1 is placed over the PAUSE LED on the VCR. When relay RY1 closes—indicating that a commercial is being broadcast—pin 2 of EXCLUSIVE-OR gate IC1-a goes high (pin 1 is low at that point) and the output of that section of the IC also goes high. That

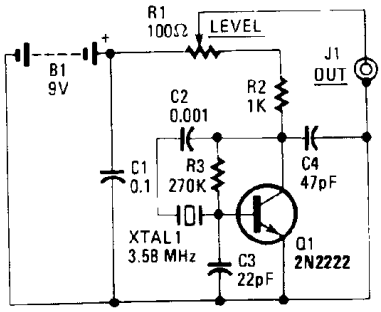


FIG. 7—IF YOU DON'T HAVE a signal generator, you can build this one to align the editor.

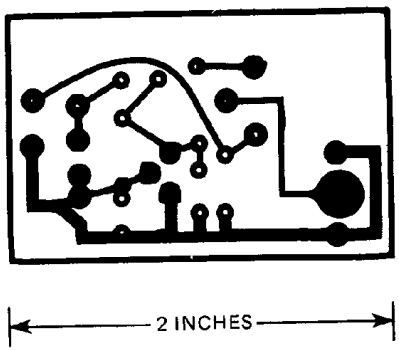


FIG. 8—FULL-SIZE foil pattern for signal generator.

PARTS LIST—PUSHBUTTON PAUSE-CONTROL

All resistors ¼-watt, 5% unless otherwise specified
R1, R2—27,000 ohms
R3—1 megohm
R4—10 megohms
R5—1000 ohms
R_x—see text
Capacitors
C1—0.1 μF, ceramic disc
C2—0.1 μF, Mylar
Semiconductors
IC1—4070 CMOS quad EXCLUSIVE-OR gate
Q1, Q2—VN10KM FET (Radio Shack 276-2070 or equivalent)
LED1—jumbo LED
D1—1N4148
PC1—photoresistor (Radio Shack 276-116 or equivalent)
Miscellaneous: perforated construction board, 9-volt battery, plug (PL1) and jack to fit recorder and editor, etc.

triggers the 2-Hz oscillator formed by IC1-b and IC1-c, which in turn, causes switching transistor Q1 to output a pulse to the VCR's PAUSE jack.

That pulse is interpreted by the VCR's microprocessor as a signal to stop the machine and to light the PAUSE LED. The illuminated LED causes 9 volts to flow through PC1, taking pin 1 of IC1-a high, and stopping the pulse generator. When the relay opens after the commercial(s), pin 3 of IC1-a goes high again (pin 1 is high and pin 2 is low) and another pulse is generated that causes the recorder to start up. Transistor Q2 and LED1 are optional—they substitute for the covered-up LED on the VCR to indicate when the

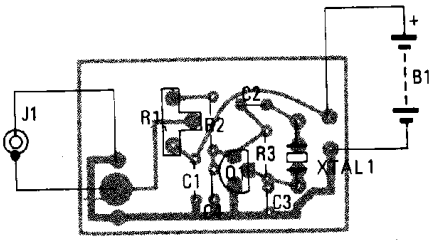


FIG. 9—OUTPUT JACK, J1, can be mounted on PC board by drilling out large foil pad *completely* and running resistor lead to trace leading to it.

machine is in a pause state.

Resistor R_x is required by many systems. To find out whether you need to include it, measure the resistance across the plug of your remote control with its

PARTS LIST—SIGNAL GENERATOR

All resistors ¼-watt, 5% unless otherwise specified
R1—100 ohms
R2—1000 ohms
R3—270,000 ohms
Capacitors
C1—0.1 μF, ceramic disc
C2—0.001 μF, ceramic disc
C3—22 pF, ceramic disc
C4—47 pF, ceramic disc
Semiconductors
Q1—2N2222
XTAL1—3.579545-MHz, parallel-resonant (20pF), HC6/U case
J1—PC-mount RCA phono jack
Miscellaneous: PC board, 9-volt battery, solder, etc.

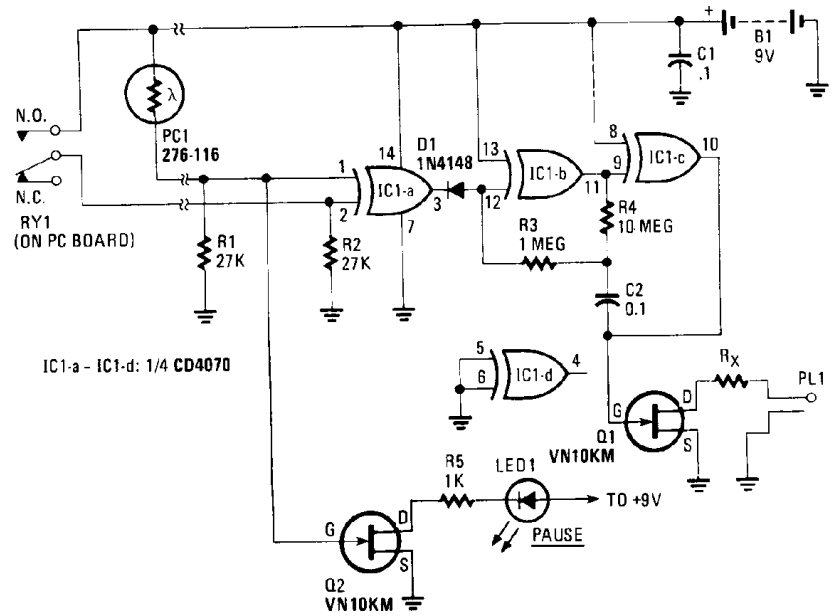


FIG. 10—BUILD THIS PAUSE-CONTROL converter if your VCR uses pushbutton-type controls.

The following are available from Technico Services, 1920 W. Commonwealth Ave., Box 20HC, Fullerton, CA 92633: kit of all parts, *less case*, (CK-2), $54.00 plus $3.50 postage & handling (nonrefundable); PC board only (CK-1), $10.00, postpaid; assembled and tested calibration tool (3.58-MHz signal generator) (CAL-3), $10.00, postpaid. California residents please add 6% tax.

PAUSE button depressed. If you get a reading, use a 5% resistor of that value (or close to it) for R_x. (Note: some VCR's, such as the Sony *SL-5000* will not need that resistor.)

The adaptor can easily be built on a 1½-inch square piece of perforated construction board. Use a length of 2-conductor speaker wire to connect PC1 to the board and use jacks and plugs of the appropriate size for connection to the editor and the VCR. Attach PC1 to the VCR by placing a piece of double-sided tape over the photocell. A hole should be cut out of the middle of the tape over the photocell and the assembly stuck over the VCR's LED PAUSE indicator.

Use

Operation of the editor is simplicity itself. Plug P1 into the VIDEO OUT jack on your recorder; then plug P2 into the PAUSE jack on the machine. If you have a remote pause-control, and wish to use it, plug it into J2 on the editor. If you are using the pushbutton-control option, follow the instructions in the "Options" section.

To record a black-and-white movie without commercials, perform the following steps in the order given. First turn on the editor using S1. That is done because the relay momentarily closes up on power-up, and that can stop the recorder unnecessarily . Then turn the recorder on, tune to the channel you want and push the RECORD lever or button. The VCR will now automatically stop during color commercials, and then restart when the movie resumes. That is all there is to it.

To tape commercial-free programs while you're away, simply leave the editor on and set the recorder's timer and channel-selector, and put the recorder

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COMMERCIAL EDITOR

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to the RECORD mode (note that in many machines the latter will be done automatically for you). At the preset time the recorder will start and tape the movie, but without the commercials. If you happened to select a color program, the editor will delete the first 4½ to 5 minutes of it, then tape the rest without stopping for commercials.

Finally, a few closing words about using the editor. Sometimes, when several commercials are shown in sequence, the color-burst signal is turned off between them. Also, the color burst may sometimes be present during those rare black-and-white commercials. Those circumstances depend on the particular practices of the TV station, and may result in the recorder starting and stopping several times during the commercials. In that case, you may see several very brief bursts of commercials on playback of your tape. That's to be expected, and does not indicate that there is anything wrong with the editor. **R-E**

COMMERCIAL EDITOR

Several errors seem to have crept into my "Automatic Commercial Editor" in the December 1982 issue of **Radio-Electronics**.

In Fig. 2, the REMOTE jack, J1, should be shown connected to the emitter and collecter leads of transistor Q1. Also, capacitor C6 should be shown as having a value of *150* pF, not 130 pF (it's correct in the Parts List).

Finally, in Fig. 6, J1 should be connected to the large pads just below Q1. Those pads can be seen clearly in Fig. 5.

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