

# ACTIVE FILTER

## IMPROVES MORSE CODE READABILITY

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Outboard filter for low-cost rigs improves selectivity and reduces interference

**F**OR learning or brushing up on Morse Code skills, it's hard to beat listening to and trying to "read" CW transmissions right off the air. Even though high transmission speeds and, sometimes, sloppy keying may make these signals frustrating for beginners, machine-perfect code at calibrated speeds is sent by W1AW, home station of the American Radio Relay League. The schedule of transmissions is given in the table; all you need to listen in is a general-coverage receiver with a bfo—providing that it is selective enough.

If your receiver is not selective enough, the Code Filter described in this article should help. It is meant to be connected between a receiver's audio output and a user's headphones (or audio amplifier) to sharpen the apparent selectivity and eliminate the interference that would otherwise make CW hard to read. The design is active, with a bandpass centered on 600 Hz and narrow enough to greatly reduce the effect of interference at neighboring frequencies. The center frequency of 600 Hz was chosen to provide a pleasant, nonfatiguing tone for the user.

**Circuit Operation.** The circuit, shown in Fig. 1 consists of a cascaded pair of active stages formed by op amps IC1 and IC2. With the component values shown, the bandpass peaks at about

600 Hz and is 100 Hz wide at the -6-dB points.

The frequency-determining components are R2, R3, C2, and C3 connected to IC1, and R6, R7, C4 and C5 with IC2. Corresponding components of each

stage should be closely matched to keep the two filters at the same peak frequency and bandpass. Components not affecting frequency may have  $\pm 20\%$  tolerance in their values.

Because of its high input impedance,

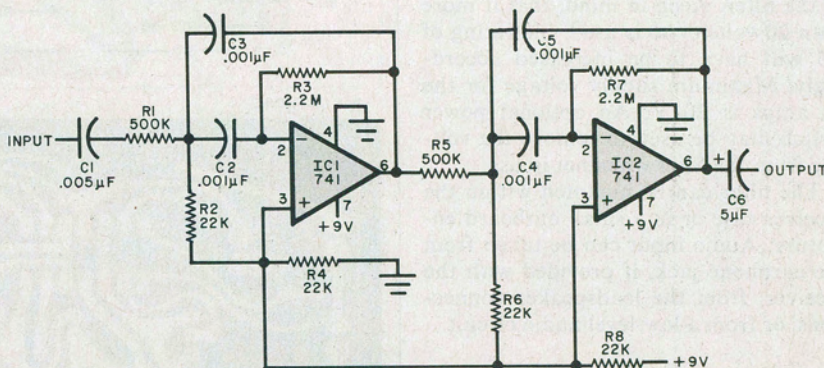


Fig. 1. Circuit for the Code Filter consists of cascaded pair of active stages formed by op amps IC1 and IC2.

### PARTS LIST

C1—0.005- $\mu$ F capacitor  
 C2,C3,C4,C5—0.001- $\mu$ F capacitor (C3 and C5 must be closely matched)  
 C6—5- $\mu$ F, 25-V electrolytic  
 IC1,IC2—741 op amp  
 R1,R5—500-k $\Omega$ , 1/4-W resistor  
 R2,R4,R6,R8—22-k $\Omega$ , 1/4-W resistor

R3,R7—2.2-M $\Omega$  resistor (must be closely matched)  
 Misc.—8-pin IC socket (2, optional), spst switch (optional), battery holder and connector, suitable connector for audio jack, small enclosure, mounting hardware, etc.

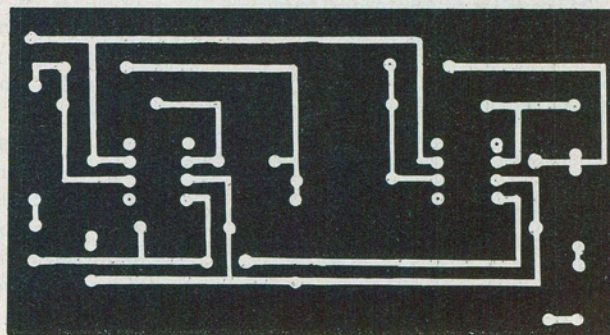
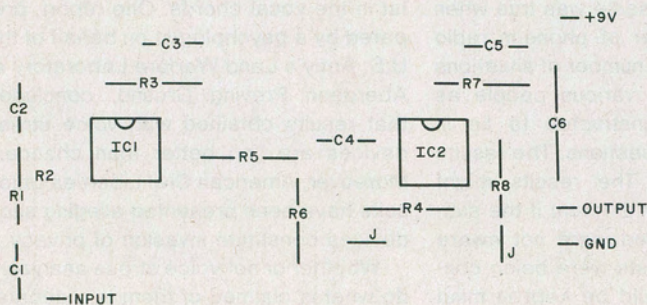


Fig. 2. Component placement guide for the Code Filter is shown at left, and actual-size pc board foil pattern is at right.

## active filter

the filter will not appreciably load any circuit to which it is connected. The audio output can feed loads as low as 300 ohms without degrading the filter performance. (Most hi-fi phones have lower impedances and will not work.)

**Construction.** Although a pc board is not a necessity, an actual-size foil pattern and component installation is shown in Fig. 2. If desired, the circuit can be created using Wire-Wrap or any other assembly technique.

Since the circuit requires only 1.2 mA when operating, a conventional 9-volt battery will have a reasonably long life. If the receiver being used for code reception has a power supply between 5 and 30 volts, this voltage can be used to power the filter. Keep in mind, that if more than 20 volts or so is used, the rating of C6 will have to be increased accordingly. Maximum supply voltage for the op amps is 30 V. An optional power switch may be used to remove the voltage from the filter when not in use.

The filter can be mounted within the receiver case or in a small outboard enclosure. Audio input can be taken from the earphone jack, if provided with the receiver, from the loadspeaker connections, or from a low-level audio circuit.

### W1AW CODE PRACTICE SESSIONS

	EST	PST
<b>Speeds:</b>	5, 7½, 10, 13, and 15 wpm	
<b>Mon.</b>	9 a.m., 7 p.m.	6 a.m., 4 p.m.
<b>Tues.</b>	4 p.m., 10 p.m.	1 p.m., 7 p.m.
<b>Wed.</b>	9 a.m., 7 p.m.	6 a.m., 4 p.m.
<b>Thur.</b>	4 p.m., 10 p.m.	1 p.m., 7 p.m.
<b>Fri.</b>	9 a.m., 7 p.m.	6 a.m., 4 p.m.
<b>Sat.</b>	4 p.m., 10 p.m.	1 p.m., 7 p.m.
<b>Sun.</b>	4 p.m., 10 p.m.	1 p.m., 7 p.m.

<b>Speeds:</b>	10, 13, 15, 20, 25, 30, and 35 wpm	
<b>Mon.</b>	4 p.m., 10 p.m.	1 p.m., 7 p.m.
<b>Tues.</b>	9 a.m., 7 p.m.	6 a.m., 4 p.m.
<b>Wed.</b>	4 p.m., 10 p.m.	1 p.m., 7 p.m.
<b>Thur.</b>	9 a.m., 7 p.m.	6 a.m., 4 p.m.
<b>Fri.</b>	4 p.m., 10 p.m.	1 p.m., 7 p.m.
<b>Sat.</b>	7 p.m.	4 p.m.
<b>Sun.</b>	7 p.m.	4 p.m.
<b>Frequencies:</b>	1.835, 3.58, 7.08, 14.08, 21.08, 28.08, 50.08, 147.555 MHz.	

**Use.** With the filter connected to the receiver audio, and a suitable amplifier or headphones connected to the filter output, tune in the desired CW transmission, and note the very sharp "peak" that occurs with filter use. It becomes very easy to "fine tune" the receiver, or its bfo, to produce a clean CW signal at the filter output. A dramatic falloff of interfering signals indicates that the filter is working properly. ◇