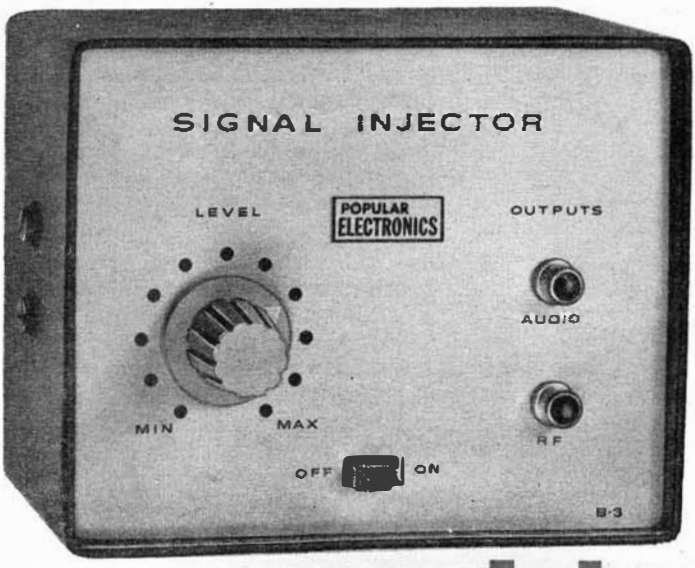


Build a Signal Injector

QUICK WAY
TO CHECK
AUDIO CIRCUITS

BY DON LANCASTER

THE SIGNAL INJECTION technique, most electronics technicians agree, is the quickest way to troubleshoot radio receivers and audio equipment. Using a signal injector, he can check an entire unit with only one hookup—no matter how complex the receiver or amplifier. Time-consuming voltage or ohmmeter checks are required only when the faulty stage is located.

Whether you plan to use it on the job or at home to keep your own equipment in working order, you will find many uses for the "IC Signal Injector" described here. This Injector is basically a battery-powered 1000-Hz multivibrator that generates square waves. The amplitude of the output square waves is continuously variable and is great enough, with the amplitude control wide open, to drive or test a loudspeaker. The Injector also provides a wide band-width r.f. signal which is extremely useful in testing AM receivers.

Construction. As you can see from the schematic diagram in Fig. 1, the circuit of the IC Signal Injector is very simple. However, since it does employ an integrated circuit with closely spaced pin leads, it is essential to use a printed circuit board. You can obtain a prepunched and etched board from the source listed in the Parts List, or you can make your own with the aid of the etching guide provided in Fig. 2.

Install the components on the board as shown in the photo in Fig. 3, paying particular attention to the orientation of the indexing groove on *IC1*. Use a low-wattage, fine-pointed tool when soldering component leads to the foil pattern on

IC EXPERIMENTER'S CORNER

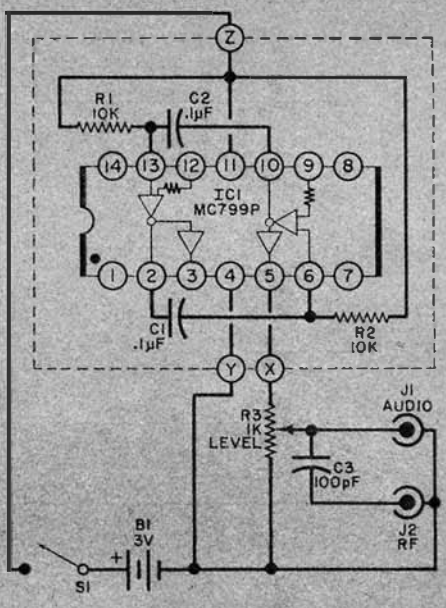


Fig. 1. One-IC circuit provides both audio and r.f. tracing signals; each output signal is continuously variable in amplitude.

PARTS LIST

B1—Two 1.5-volt D cells in series
C1,C2—0.1-μF, 10-volt disc capacitor
C3—100-pF disc capacitor
IC1—MC799P or HEP571 dual-buffer integrated circuit (Motorola)
J1,J2—Phono jack
R1,R2—10,000-ohm, ¼-watt resistor
R3—1000-ohm linear-taper potentiometer
S1—S.p.s.t. slide or toggle switch
Misc.—Keystone #176 battery holder; control knob; 5" x 4" x 2½" case; spacers; #6 machine hardware; hookup wire; solder; etc.
Note—The following items are available from Southwest Technical Products Corp., Box 16297, San Antonio, TX 78216: etched and drilled printed circuit board, $1.78; complete kit of parts, including prepunched vinyl-clad case but less batteries, $7.30, postpaid in U.S.A.

the PC board, and apply heat only long enough to allow the solder to flow.

Next, mount *R3*, *C3*, *S1*, and *J1* and *J2* on the front panel. Use ⅜"-long spacers and #6 machine hardware to fasten the circuit board to the front panel in the position shown, and interconnect with hookup wire all components and the circuit board.

Battery *B1*, two 1.5-volt D cells connected in series, can be mounted to the rear panel of the enclosure with a dual-cell holder. However, if you plan to use another type of d.c. supply (see sidebar), make the hookup wires connected to *S1* and ground on the circuit board as long as necessary.

How To Use. To test the IC Signal Injector, close *S1* and connect a small 3.2- or 8-ohm loudspeaker to the AUDIO jack on the front panel. Rotate LEVEL control fully clockwise; you should hear a 1000-Hz tone coming from the speaker. An

HOW IT WORKS

Integrated circuit *IC1* in Fig. 1 is a dual inverting buffer. Each input has two outputs, one low- and the other high-level. The low-level outputs are cross-coupled to each buffer input through capacitors *C1* and *C2* and charging resistors *R1* and *R2* to form an astable multivibrator.

One high-level output is fed to level control *R3* and AUDIO jack *J1* as a 1000-Hz signal. Internal isolation between low- and high-level outputs prevents heavy loads—or even short circuits—from stalling or radically shifting the operating frequency of the multivibrator.

Capacitor *C3* couples only the high-frequency energy (derived from the harmonic-rich leading edges of the square waves generated by the multivibrator) of the audio waveform to RF jack *J2*. At *J2*, there is available a series of impulses that can be used for signal injection and other AM radio receiver work.

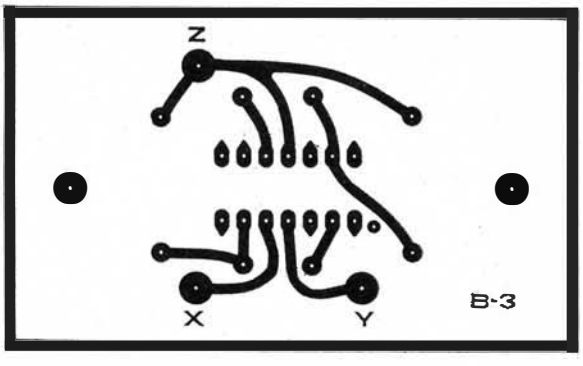
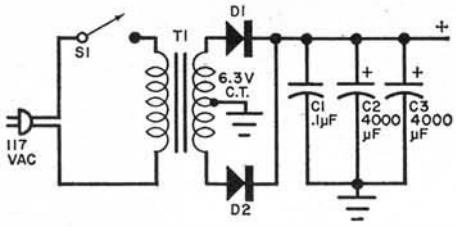


Fig. 2. Actual size circuit board etching guide is designed to accommodate components not mounted on front panel of the project. Isolated dots locate mounting holes.

IC EXPERIMENTER'S POWER SUPPLY

The low-voltage power supply whose schematic is shown here can be used with any and all of the "IC Experimenter's Corner" projects presented in this series. Note that the supply has full-wave rectification and very good filtering to supply a stable d.c. voltage source for the IC projects. Output voltage from the supply is approximately 6.3 volts d.c.

The power supply can be assembled by any conventional method, including point-to-point wiring. Very few components are used and they are relatively small in size. Hence, the supply can be fit inside any of the enclosures suggested for the various projects.



PARTS LIST

C1—0.1-μF disc capacitor
C2,C3—4000-μF, 15-volt electrolytic capacitor
D1,D2—25 PIV, 1.5-ampere silicon diode
S1—S.p.s.t. slide or toggle switch
T1—6.3-volt, center-tapped filament transformer (Stancor No. P-6134 or similar)
1—line cord with plug
Misc.—Hardware, hookup wire, solder, etc.
Note—A kit of parts for the power supply is available at $4.50 postpaid from Southwest Technical Products Corp., 219 W. Rhapsody, San Antonio, TX 78216.

alternate test method would be to connect the audio output of the injector to an audio system, setting the LEVEL control as needed, and listen for the tone.

The output from the RF jack on the injector is rich in harmonics to allow the checkout of the front ends in most receivers, including those that operate in the standard AM broadcast spectrum.

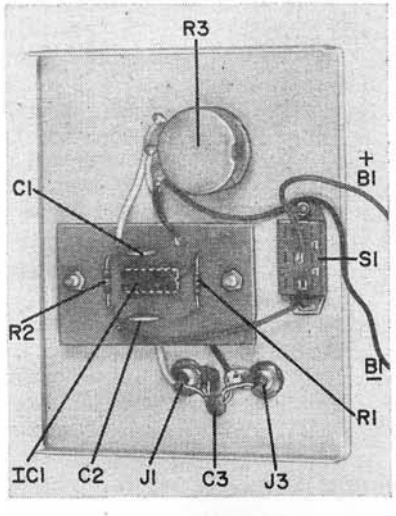


Fig. 3. Pay particular attention to location of notch on IC1 during assembly of project. Mount C3 between J1 and J2.

For example, assume you want to troubleshoot a faulty AM transistor radio receiver. First check the receiver's battery under load with a voltmeter. If it checks out good, proceed to your signal injection tests:

First inject the audio signal into the speaker, directly across the speaker terminals. If you hear the tone, the speaker is in operating order. Then, stage by stage, work back toward the front end of the receiver until the signal ceases to be heard from the receiver, at which time you will have located the faulty stage. (Note: when injecting into the audio circuits, use the audio output; for the i.f. and r.f. stages, use the r.f. output.) You should end up at the antenna input if the receiver is in perfect operating order.

If you wish to change the audio frequency of the tone, you can change the values of *C1* and *C2*. Higher capacitance values decrease the signal frequency, and vice versa.

Current drain for the IC Signal Injector is on the order of 80 mA at 3 volts d.c., assuring long life from a battery supply, especially if you use heavy-duty alkaline cells. If you prefer a built-in power supply, however, you can build your own by referring to the schematic diagram shown in box above. Or, you can use any good bench supply capable of delivering 1.6 to 6 volts d.c. at about 100 mA for full-load operation. -30-