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QST Issue: May 1989
Title: An Improved Circuit for Interconnecting the SB-200 Amplifier and Solid-State Transceivers
Author: Richard Jaeger, K4IQJ

Click Here to Report a Problem with this File connects the charged capacitor across the HO-10's HORIZONTAL INPUT jack. A voltage of 170 can be fatal to a solid-state device connected to the HORIZONTAL INPUT jack. Cure: Add two 2-µF, 200-WVDC capacitors and relocate C16 as shown in Fig 1B.

Modified in this way, the Heath HO-10 makes a fine tuning aid for digital communications. It's likely that other monitor scopes—and, for that matter, other vacuum-tube-based equipment—may have similar problems. Because of this, it's a good idea to check vacuum-tube gear for safe operation before connecting it to solid-state equipment.—*Dallas Williams, WA0MRG, PO Box 1, Sedgwick, CO 80749-0001*

AK7M: Although Dallas's equipment-compatibility hint may seem to be equipment-specific, it isn't. One of the first facts we learn about capacitors is that they can "block dc while allowing ac to pass." This quoted statement is a bit simplistic: A capacitor can block dc *only after it has charged to the dc voltage it's expected to block.* If the simplistic view were true, you could connect one lead of a 0.01-µF, 1-kV capacitor to, say, 500 V and grab the capacitor's free lead with no ill effect. In fact—and depending on how close your body is to ground potential—you may receive a short, *dangerous* jolt as the capacitor charges to 500 V *through you.* This happens because an uncharged capacitor "looks like" a short circuit until it charges.

Unplanned-for capacitor-charging effects may be no more than annoying. Have you ever put a pair of headphones on *before* plugging them into an unloaded solid-state audio amplifier and heard a deafening *thump* as you plugged the headphones in? Such thumps occur when an amplifier's dc-blocking output capacitor charges through the output transducer (your headphones or speaker). This situation can be more than an annoyance: I once blew the headphone-circuit blocking capacitor in a 1930s-vintage ham receiver merely by plugging in headphones. The capacitor had been on the verge of failure; the sudden charging-current pulse finished it off and caused a headphone pop that made my ears ring for several minutes. What would have happened if I'd plugged in a solid-state amplifier instead of headphones?

If component failure causes voltage to appear where it doesn't belong, the cure is simple: Replace the failed component. If suboptimal circuit design is the cause, the circuit can be modified for safer (or less annoying) operation. Audio thumps or clicks that occur when a load is connected or switched can often be cured simply by the addition of pull-down resistors at the "floating" side of culprit capacitors (Fig 1C).

INSULATION SUPPORTS AS RADIAL TIE-DOWNS

☐ Verticals are useful antennas for DX work on the low bands. For many hams, the tedious job of burying radials for a vertical-antenna ground system is a major drawback. Some studies have shown that radials laid *on* the ground, rather than buried in it, provide a more-efficient RF ground than buried radials. On-ground radials require special installation techniques, however: They must be securely fastened to the ground so that they do not trip people or foul lawn mowers.

For several years, I have successfully used insulation supports as on-ground-radial tie-downs. Insulation supports resemble very long, headless nails and are pointed at both ends. Designed to support thermal insulation between house floor joists, they are generally sold by building supply houses in 16- and 24-inch sizes at $12 to $15 per thousand.

Install the insulation supports on a given radial as follows: Lay the radial wire on the ground in its proper position. Prepare a dozen or so of the supports by bending them into a *U* shape. Drive these "staples" into the ground and over the radial every few feet along the radial. Space the staples closely enough along the length of each radial to secure the wire and keep flush with the ground.

The best time to install surface-mounted radials on a lawn is during colder months when grass is dormant: Turf will cover the radials as soon as warm weather arrives and the grass resumes growth. As a warm-weather alternative, mow the grass just before installing the radials.—*Drayton Cooper, N4LBJ, Bowling Green Presbyterian Church, PO Box 5, Bowling Green, SC 29703*

AN IMPROVED CIRCUIT FOR INTERCONNECTING THE SB-200 AMPLIFIER AND SOLID-STATE TRANSCEIVERS

☐ I encountered a problem similar to that discussed by James Hebert ("Using the SB-220 Amplifier with Solid-State Transceivers," *QST*, Jan 1988, p 45), when I sought to drive my Heath® SB-200 amplifier with a newly acquired Kenwood TS-940S transceiver. The hot contact of the SB-200's relay-control jack exhibits an open circuit voltage of −130 to ground; the short-circuit current of the SB-200's relay-control circuit is 50 mA. The open-circuit voltage could rise to as high as 170 under fault conditions in the SB-200. The Kenwood manual states that the TS-940's control relay is intended for low-current applications; I infer that "low current" also means "low voltage." As a result, I did not want to connect the SB-200's 130-V control line to my TS-940S. Instead, and in order to get on the air quickly, I used a relay between the TS-940S and SB-200. I wasn't satisfied for long: It seemed ridiculous—and rather noisy—to use the transceiver relay to drive another relay that finally switched *another* relay in the SB-200.

To solve this problem, I designed an interface circuit (Fig 2) that uses a high-voltage, P-channel MOS power transistor—an IRF9612—as a switch. The IRF9612 has a source-to-drain breakdown voltage of 200, can switch up to 1.5 A, exhibits a channel resistance of 4.5 Ω when turned on, comes in a TO-220 plastic package, and costs $3.50/unit in small quantities. The IRF9612 also includes an integral drain-to-source protection diode capable of clamping transients that can result from switching inductive loads.

The circuit is powered by a 9-V battery, which provides enough voltage to drive the MOSFET in this low-current switching application. The 1-kΩ resistor limits the peak current flowing in the transceiver relay to approximately 9 mA and sets the MOSFET turn-on time to approximately 0.3 µs (this assumes that the MOSFET's effective input capacitance is 300 pF). The 470-kΩ resistor sets the turn-off time constant to 140 µs and limits the closed-circuit current to 20 µA. The 15-V Zener diode protects the transceiver should the MOSFET develop a gate-to-drain short circuit. (In that unlikely event, the Zener diode will limit the voltage applied to the transceiver to −24. If you intend to substitute a diode with a different Zener voltage for this part, remember that the Zener diode's breakdown rating must comfortably exceed the battery voltage [9

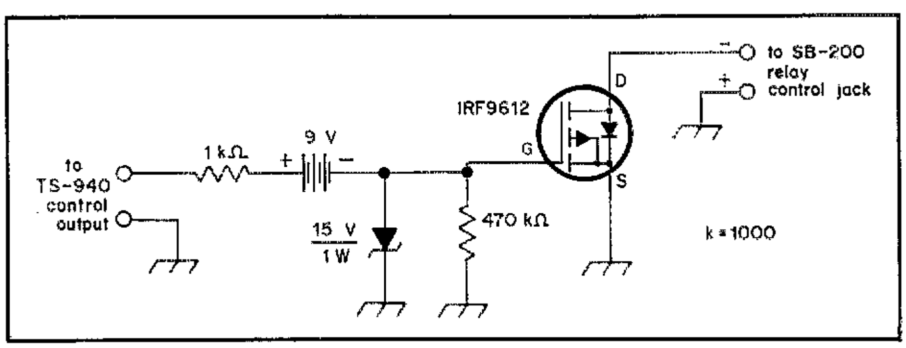

Fig 2—Richard Jaeger's solid-state transceiver-to-amplifier interface uses a power MOSFET instead of a relay for amplifier control. For amplifiers that use a *positive* relay-control voltage, reverse the polarity of the Zener diode and battery, and use an IRF612 N-channel MOSFET instead of the IRF9612.

in this application]).

I built the circuit on a piece of perfboard, mounted the board in a small metal box, and used shielded cable for connections between the interface box, amplifier and transceiver. Stray-RF problems have not occurred with this arrangement. Because the interface circuit is self-contained, the SB-200 and TS-940S need not be modified for operation with the interface.—*Richard C. Jaeger, K4IQJ, 711 Jennifer Dr, Auburn, AL 36830*

MORE ON MODIFYING GLOVES FOR INCREASED DEXTERITY AND BETTER FEEL

☐ When I read the suggestion about cutting the fingertips from work gloves (Ray Lustig, "Modified Work Gloves," *QST*, May 1988, p 40), it reminded me of something that may be of further value to your readers. As a police officer, I've learned a trick passed down from the old timers on the force: Cut a slit into the palm side of the glove's trigger finger to allow your trigger finger to slip out when you hold a pistol. Of course, this modification also allows the finger to be returned to the glove!

For doing antenna work in cold weather, a pair of gloves modified this way (perhaps the thumb and first finger of each glove, or at least these fingers on the glove for the dominant hand) would allow these fingers to be kept warm between instances of handling small parts.—*Harry Blesy, N9CQX, 7810 Central, River Forest, IL 60305*

SWITCHING AN 80/75-METER DIPOLE BETWEEN 80/75 AND 160 METERS

☐ A coax-fed 75/80-meter dipole can be used on the 160-meter band by connecting the dipole-feed-line inner conductor and shield together and feeding the coax and dipole as a random wire. Changing bands is inconvenient with this arrangement, however; moving from 75 or 80 meters to 160, for instance, involves disconnecting the antenna feed line, adding a shorting adapter to the feed-line connector, and connecting (or reconnecting) the shorted feed line to an antenna tuner.

Fig 3 shows my solution to this problem. When the BAND switch is thrown to 80/75, the coax line is connected to the transmitter, transceiver or antenna tuner as usual. When the BAND switch is thrown to 160, the inner conductor and shield of the coax feed line are connected together and to the center conductor of the TX OR TUNER connector. At the same time, the shell of the ANT jack is isolated from the TX OR TUNER connector shell.

Construct the switching adapter as shown in Fig 3. If you cannot locate a chassis-mount male connector for use as the TX OR TUNER connector, use a chassis-mount female connector in conjunction with a male-to-male adapter.

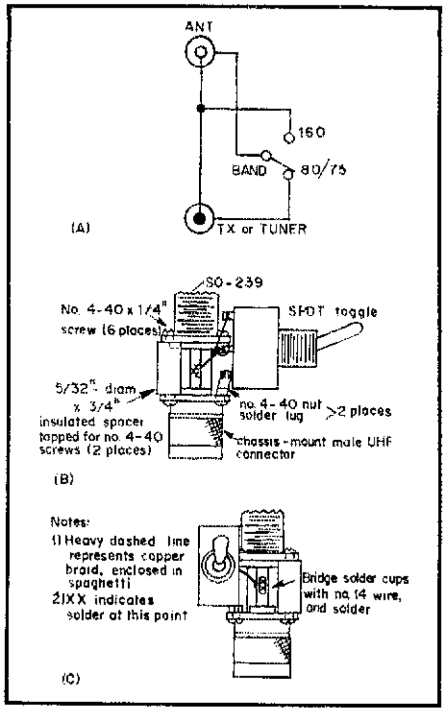

Fig 3—Robert Stein uses this arrangement to switch a coax-fed 75-meter dipole between dipole and random-wire modes. The BAND switch is a standard-sized toggle switch; don't use a miniature or subminiature switch in this application.

I have used this scheme at the 100-watt level without encountering arcing between the coax inner conductor and shield or between the BAND switch contacts. Nonetheless, be aware that RF voltage will be present *on the antenna feed-line shield* when a coax-fed 80/75-meter dipole is used as a 160-meter random wire—and don't touch the BAND switch when transmitting.—*Robert Stein, W6NBI, 1849 Middleton Ave, Los Altos, CA 94022*

BETTER SSB FOR THE COLLINS R-390A RECEIVER—REVISITED

☐ In my recent Hints and Kinks item, "Better SSB for the Collins R-390A Receiver" (*QST*, Jan 1989, p 38), every reference to the *R-390A* should read R-390. [The blunder was mine.—*AK7M*] The details of the modification and all circuit references described in that article apply only to the Collins *R-390* receiver, and *not* the R390A, because of the differences in their circuits.

Some receiver aficionados think that the R-390 and R-390A are identical except for their method of IF filtering. (The R-390 uses LC IF filtering; the R-390A uses mechanical filters and is generally considered to be more desirable because of this.) The R-390A is actually a pared-down R-390: It has one fewer RF amplifier and two fewer IF amplifiers than the '390. This seems to make the R-390 a little more sensitive than the '390A. The '390 and 390A also differ in their power supplies and tube complements. These differences make circuit modules and most parts non-interchangeable between the two receivers.

My modification concerns the R-390's AGC circuitry; the AGC circuits in the R-390 and R-390A are similar. Both receivers use 12AU7/5814 tubes for AGC-rectifier and AGC-time-constant functions; however, the part numbers and tube-pin references differ between the two receivers for the circuitry that serves these functions. Anyone wishing to improve the SSB performance of an R-390A by trying my modification should consult a schematic diagram of the '390A for circuit details. Please note that I have *not* attempted this modification on an R-390A; the basic idea should be applicable to this receiver, however.—*Ken Johnson, N5US, PO Box 10063, Austin, TX 78766*

A SIMPLE FIELD-STRENGTH METER

☐ Fig 4 illustrates a field-strength meter that can be used for antenna or matching-network tuning. It consists of a short dipole antenna, a detector and a digital multimeter (DMM). With A and A′ equal to about 2 feet, the field-strength meter provides adequate near-field sensitivity from 80 through 2 meters. (This is the range over which I've tried the circuit; the meter's actual useful range may be wider.)

I built my version of the detector on a small piece of copper-clad board and coated it with epoxy resin for permanent outdoor use. To minimize the pickup of feed-line radiation, I mount the meter antenna horizontally when sampling energy from my horizontal HF dipoles and vertically for use with my 2-meter groundplane antenna.—*Albert E. Weller, WD8KBW, 1325 Cambridge Blvd, Columbus, OH 43212*

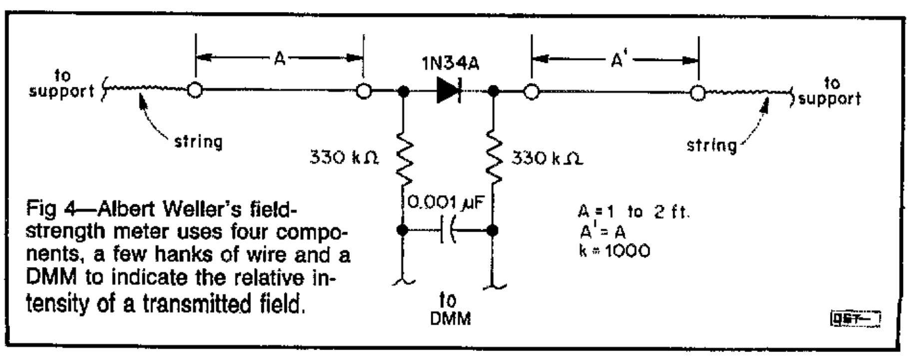

Fig 4—Albert Weller's field-strength meter uses four components, a few hanks of wire and a DMM to indicate the relative intensity of a transmitted field.