

updating the Collins 32S-1

Never being satisfied with the *status quo* when it comes to any radio equipment I've ever owned, I eventually succumbed to the urge to modify my recently acquired Collins 32S-1 transmitter. The modifications described here include the following:

1. BFO generation of the CW carrier
2. Voltage regulation of the PTO and HFO
3. Control of the keyed wave shape
4. A spotting switch (CW CAL)
5. The ability to monitor the final-amplifier plate (cathode) currents individually
6. Alterations to the tone oscillator

The modifications were made to bring the performance of the 32S-1 up to the standards of its successor, the 32S-3, without incurring an expenditure of some \$300-\$400 in the process.

Table 1 identifies the components involved in the modifications discussed here. Schematics and parts lists should be changed accordingly to reflect these changes, since removed components will have their identities transferred to newly installed pieces that correlate with those used in the 32S-3.

BFO CW generation

The 32S-1 generates its CW carrier with a tone fed from the tone oscillator through the mechanical filter (much like whistling into the mike or feeding AFSK into the mike jack on RTTY). The frequency of the tone used in the 32S-1 was chosen specifically so that its second harmonic falls well outside the mechanical-filter passband. However a weak residual signal still exists, and it has been heard on occasion at some distance.

The 32S-3, uses the BFO signal to generate the CW carrier, eliminating this residual signal. The resultant on-the-air signal is much cleaner and sounds much more like a true CW signal when compared with that of the 32S-1.

Installing this feature requires extra switching capabilities, which must be performed by the EMISSION

switch, S8. The 32S-1 has four wafers on this switch, while the 32S-3 has five. Here are some ways in which this additional switching may be handled; a separate 4 PDT toggle switch may be used; S8 may be entirely replaced; or the existing switch may be disassembled and a new index and wafer added. Although the first possibility was initially pursued, I found it to be inconvenient. The most satisfactory arrangement was to replace the index assembly and add an additional wafer to S8.

The MIC GAIN pot and switch must also be replaced with a new unit using two pots commonly controlled and switch S14. The additional pot controls the cathode bias (CW DRIVE) on the rf amplifier, V6. Both parts are available from Collins; the switch is part no. CPN 259-1628-000 and the dual pot and switch is part no. CPN 376-2648-0000.

First, replace the existing MIC GAIN pot with the new dual unit. Note that space is at a premium, and the possibility of a shorted terminal strip lug exists next to V12. To avoid this, mount a two-lug terminal strip on the opposite side of the crystal board and secure it with the self-tapping screw that holds another two-lug strip. Remove the B+ ends of R60, L20, and the B+ feed wire (green/white) from their original location. Attach them to the new terminal strip. The now empty lug may be bent over to clear the pot and switch R8/S14.

Mount a single-lug terminal strip under the hardware securing the two ground lugs between V13 and V4. Lift C20 (0.01 μ F) from ground and connect it to the strip. Route a length of RG-174/U cable from this junction to the vicinity of S8. Lift R39 (V6, pin 7) from ground and connect that end to a single-lug strip that has its ground lug straightened and soldered to the ground shield/barrier across V6. From this same point, run a wire to R8B and install a new R71 (68k/2W) between this lug and the terminal lug near V5 where R29 and R30 (4.7k/2W) connect to the +275-volt line (red/white wire).

From R8B run another wire to S8-B lugs 9 and 10, which are then connected in parallel. In the 32S-1

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these two lugs are empty, as are those on the wafer to which R87 (470 ohms) is attached. Connect the empty lug of R8B to ground.

Connect a 33-ohm resistor (new R70) to V2A pin 9. Remove the BFO input cable. At this time S8 should be modified or replaced. Assuming the index and wafer are to be replaced and added, remove the switch and thread some bare wire through the rivet holes (which secure the switch contacts on wafers 1 through 4) at two points 180 degrees apart to prevent the spacers from separating from the wafers. Then the existing index may be removed, replaced, and the 5th wafer added with little effort.

Wire the switch as shown in **fig. 1**. Run a wire from S8B lug 11 (presently empty) to V10 pin 1 to prevent premature VOX relay dropout on CW.

ALC modification

Unlike the 32S-1, the 32S-3 does not use ALC in the CW position. During CW, switch selection S8G-5 grounds the midpoint of ALC capacitors C83 and C142. This change may be added to the modified

table 1. Component identification for the 32S-1 mods described in the text.

32S-3 part no.	original 32S-1 part no. value	modified 32S-1 part no. value	location
C81	not used	C81 0.005 μ F	second mixer
C115	C115 0.01 μ F	C115 0.33 μ F	keying circuit
R17	R17 33k/1W	R17 5k/10W	voltage regulator
R70	R70 470k/1/2W	R70 33 ohm/1/2W	V2A
R71	R71 470k/1/2W	R71 68k/2W	B +

32S-1 by simply adding a jumper wire from S8G-1 and -2 to S8G-5 (**fig. 2**). Now, during CW operation, the GRID CURRENT position (instead of ALC) is monitored, and the MIC GAIN control is adjusted to obtain a grid current reading of 1 to 2 dB on the meter while sending a series of dots.

keying circuit and CW calibrate

The 32S-3 keying circuit provides some manual control of the keyed wave shape, **fig. 3**. The spotting feature (CW CAL) may be installed coincidentally. The CW CAL function switch should be front-panel mounted for ease of operation. The KEY SHAPE control, R123, may be located under the lid of the 32S-1 exciter on the bracket containing the VOX controls, or a separate bracket can be made and attached to the power-amplifier cage with self-tapping screws. Most of the other components are mounted on the terminal strips from which the 32S-1 keying circuit components will be removed. The addition of a single three-lug terminal strip (center ground) between K1 and V14 ensures that all components are securely mounted.

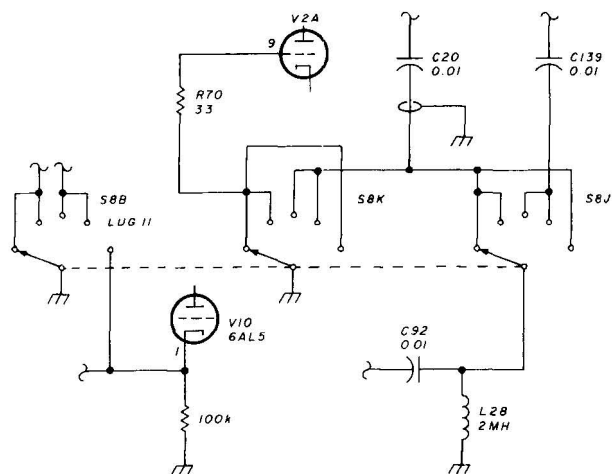


fig. 1. Schematic of the BFO generated CW showing modification of switch S8 to eliminate the weak residual signal in the 32S-1 when in the CW mode.

R70, R71, and R72 may be removed from the terminal strips at the bottom left of the chassis and R125 mounted in place of R72; R126 in place of R71; and R124 in place of R70. Remove relay K1's lead and mount it onto the newly installed terminal strip.

Instead of using the multiple-leaf switch and 250k pot arrangement of the 32S-3 for the CW CAL function, a fixed resistor and three-pole rotary switch were used (**fig. 4**). The rotary (or toggle) switch has a more positive action and doesn't require constant depression to activate the desired function. A value of 68k resulted in a satisfactory over-all spotting level and this resistor was secured to the two innermost lugs of a 5-lug (center-ground) terminal strip mounted with its ground lug soldered to the ground lug of the strip behind K1 and at right angles to it. (The other lugs will be used in the regulated voltage modification.)

Mount the 3PDT switch (S13) on the front panel between the FREQUENCY CONTROL and MIC GAIN shafts. Center the holes 87 mm (3-7/16 inches) from the top of the panel. If done carefully it will appear to have been factory installed.

For ease of wiring and installation I recommend that the FREQUENCY CONTROL switch be temporarily removed. Unsolder and tie back the green/white

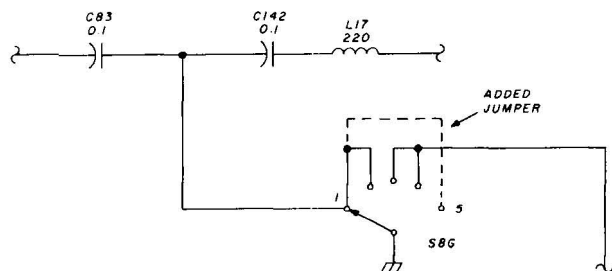


fig. 2. A jumper wire is added to switch S8-G to ground ALC voltage during CW operation.

wire at S9E-1. Wire the remaining circuit according to **fig. 4**.

In operation the transmitter must be properly tuned for CW operation for the CW CAL function to be enabled; it will not work on ssb.

The KEY SHAPE control (R123) should be adjusted to eliminate key clicks created by the rapid rise of the keyed signal. The effect of this control will be fully appreciated when the transmitted signal is monitored on an oscilloscope. The control should be adjusted to round the leading edge of the waveshape slightly.

Additional shaping of the waveform on the trailing edge may be accomplished by adding capacitance in two places: between the key line to ground and between the junction of R33/R37 and ground in the

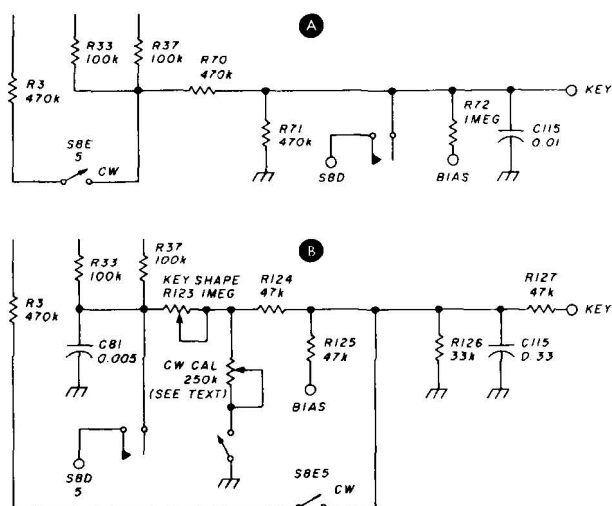


fig. 3. Keying circuits of the 32S-1 (A) and 32S-3 (B). By modifying the 32S-1 as described, you can have control of the keyed waveform within limits. The CW CAL feature is a handy addition. It won't work on ssb, however.

first mixer, V5. Some experimentation should provide a wave with the desired characteristics, with values of $0.025 \mu\text{F}$ (C115-A) and $0.005 \mu\text{F}$ (C81) being a good starting point in their respective positions. See **fig. 5**.

A difference will be noticed between on-the-air signals when using a transistor-output keyer versus a bug or relay-output keyer; the transistor provides a softer signal and you might use considerably more key-line capacitance with a bug or relay-output keyer, depending on personal preference and speed. Too much capacitance at high speeds tends to slur the code elements.

voltage regulation

In the 32S-3, the 6AL5 ALC rectifier was deleted and solid-state devices used in the ALC circuit. This

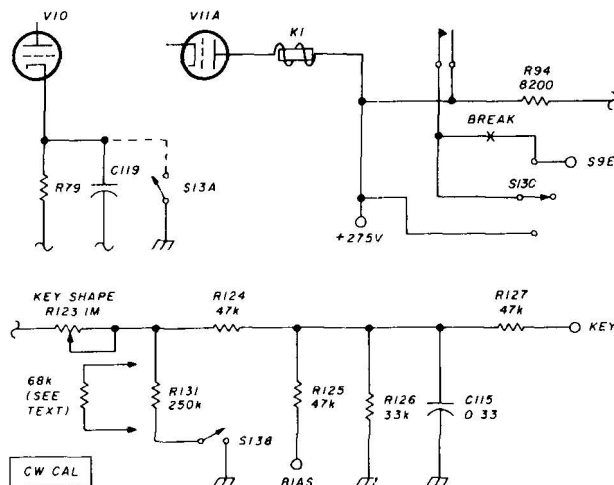


fig. 4. Modifications to the CW CAL circuit. A fixed resistor and a 3-pole rotary switch provide more positive action. It isn't necessary to hold down the switch to activate the desired function.

freed socket V13, which was used to hold an OA2 tube to supply the regulated voltage for the oscillators. I found it simpler to use a 140-volt, 10-watt zener (1N3010A) for the regulator. They are inexpensive and eliminate the need to free V-13's socket, with the problems of rewiring the ALC circuit and finding space for more parts.

An advantage of the zener is its ease of mounting. Mount CR9 (**fig. 6**) on the perforated wall of the bottom side of the power-amplifier cage by enlarging one of the holes to accept the 10-32 threaded stud of CR9. Mount a dropping resistor (new R17, 5k/10W) on the terminal strip installed previously to the rear of K1. (Note: The original R17 must be removed according to the following steps.)

A convenient source of +275 volts is the terminal of C137 on the PA-cage wall; it has the 100-ohm/1/2-W resistor attached.

Modify the PTO and HFO circuit as follows. Remove the original R17 (33k/1W) and substitute

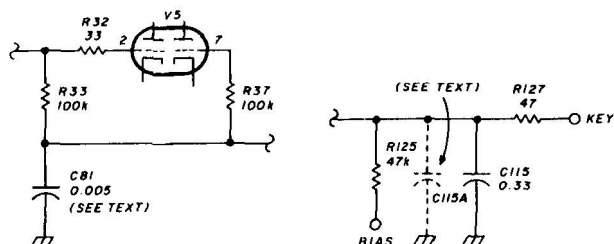
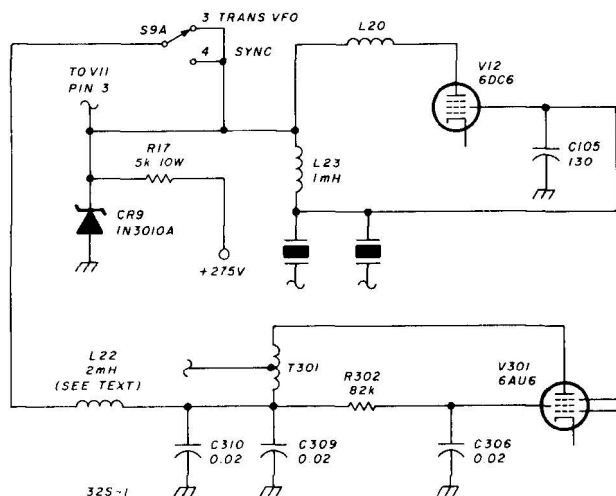


fig. 5. Improved keying wave is provided by this change. The added capacitances improve shaping of the signal trailing edge. Capacitances C115A and C81 (respectively $0.25 \mu\text{F}$ and $0.005 \mu\text{F}$) are good starting points. Some experimentation might be needed to provide desired waveform characteristics.



L22 (2-mH). R17 is located close to C57 and the shield can. Run a wire from CR9 past the crystal board and up through the grommet to S9. At S9, locate the red/white/green/blue wire that connects to L22's B+ end. Cut the black jumper connecting the two S9 wafers (+275 volts) and attach the +140-volt line to the commoned lugs, 3 and 4, TRANS VFO and SYNC (fig. 6).

One of the two green/white wires on S9's rear wafer supplies +275 volts to the HFO, V12. Locate this wire, disconnect it at S9 rear, and move it to the +140-volt line on lugs 3 and 4. Disconnect R60 (47k) completely. Install L23 (1 mH) in its place. This completes this modification.

the-air CW signal, its frequency may be altered to provide a more pleasant monitoring note. This note is purely a matter of personal preference, so some experimentation may be necessary. In my case, a 100-pF mica capacitor was paralleled with C110.

**separate plate-current
monitoring of the power amp**

Unsolder R52 (1k). (Note: This value may differ from unit to unit.) R52 is attached to the copper strap joining the cathode pins of the two 6146s. Cut and remove the strap from between the tubes. Attach a length of hookup wire to each of the pins from which the strap was removed and route them toward the perforated wall of the PA cage. Mount a 4-lug termi-

fig. 8. Modifications to provide separate power-amplifier monitoring. Now you can monitor tube balance and identify tubes that may be going soft.

NOTE: BREAK AT POINTS X

nal strip inside the enclosure toward the rear of the chassis with 4-40 (M3) hardware and wire as shown in **fig. 8**. Mount the DPDT switch, S15, directly beneath the meter. For ease of access the meter should be removed before drilling the mounting hole. Use a miniature toggle switch in this location, which is almost unnoticeable.

No interpolation of the readings is necessary since the cathode voltage/resistance ratios are unchanged. Tube balance, which is necessary in all parallel-tube amplifiers, is readily observed, and a soft tube may be easily spotted. The cathode currents of the individual tubes should track within + 10 per cent to satisfy a balanced condition.

closing remarks

The incorporation of these mods into the Collins 32S-1 provided performance that rivals that of the more costly 32S-3. It's given a new lease on life to a veteran of some 18 years and has saved a couple of ***hundred dollars in the process!***

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