

# S/1 NEWS

Mark, K6BE/5, has designed an automatic tank circuit RF voltage control and amplified screen ALC control which will eliminate all problems concerning high SWR with the CX7. S/1 NEWS, Volume II, Number 10 briefly described his system and included schematics and a few notes. This issue of S/1 NEWS is devoted to a detailed description of Mark's system including construction, installation, and alignment data. We are publishing this with Mark's permission even though he has submitted an article to "Ham Radio" magazine - our newsletter can hardly be called a "magazine"...

We should note some changes between this article and the notes from the Volume II, Number 10 issue:

1. The loading capacitor RF detector is mounted in the upper PA compartment rather than the lower as previously noted.
2. Two feedthrough capacitors are utilized at the PA box to bring out the outputs of the loading and tuning capacitor RF detectors.
3. There is a minor power supply modification to prevent damage to the ALC amplifier in the event of screen supply problems.

Operating instructions are part of the attached article but are also reproduced below:

A. BROADBAND OPERATION. Adjust the drive (OUTPUT) control so that the ALC (DRIVE) meter indications are about 1.0 when the radio is keyed or under normal voice operation.

B. MANUAL OPERATION. (1) Set the drive (OUTPUT) control to 10 o'clock. (2) Tune the PA tuning and loading for maximum output. (3) Check to see that the ALC (DRIVE) meter indicates at least 1.0. If not, increase drive so that it does and repeat step 2. (4) During operation, set the drive for ALC (DRIVE) indications of about 1.0.

C. PRECAUTIONS. (1) Do NOT turn the bandswitch or broadband/manual switch while transmitting. (2) Do NOT operate for more than a few seconds with the plate circuit out of resonance. (3) When using the receiver only, and when turning the bandswitch or broadband/manual switch, disable the transmitter by keeping all three transmit VFO buttons out and drive control at minimum.

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Along with the unsurpassed delight in operating a Signal/One CX7, hangs the specter of the following troubles with the final; the system described below banishes them all in one fell swoop.

1. When operation is attempted using the broadband circuits with a high SWR, damage usually occurs to the loading padder capacitors. This can happen even when the transmitter is operated for only a second; for example, if a few dits are accidentally keyed into the wrong antenna.

2. Under high SWR conditions, or during manual tune-up while loading adjustments are being made, the screen current often rises far beyond the maximum allowable limit. This causes tube failure, internal arcing, and driver and power supply damage.

3. Even under normal operation into a proper load, there is a spike in the RF output, occurring at the beginning of a transmission, which causes arcing in the PA circuit components. This arcing commonly causes burnt contacts in the bandswitch and broadband switch, requiring extensive repairs.

4. When used as a driver for a linear amplifier, the amplifier relay is often slower than the CX7 circuits. This means that while the amplifier is switching, the CX7 operates into an open circuit, causing all the above problems associated with high SWR.

SYSTEM PERFORMANCE. With this system, the CX7 may be used with any antenna, or even no antenna (signal reports may be low!), with no damage to the radio, in either broadband or manual. It allows on-the-air operation with high SWR, at automatically reduced input. Manual tuning is greatly simplified: instead of the usual method of gradually increasing the drive while constantly monitoring the screen current and adjusting the loading, the drive may be turned up and the PA controls quickly adjusted for maximum output, while the new circuit automatically keeps the screen current under control.

THEORY OF OPERATION. The system consists of the following three components: (1) A DC amplifier added to the screen ALC circuit. (2) A RF level detector added to the final amplifier manual and broadband tuning capacitors. (3) A RF level detector added to the final amplifier manual and broadband loading capacitors.

The original design includes a "screen ALC circuit" which, however, never functions, due to the currents and voltages involved. The amplifier corrects this situation by adding the necessary gain. The same amplifier is also used to enable the ALC circuits in the driver to control the RF levels in the PA, thus eliminating the arcing and component damage. The control signal for the screen current is provided by the power supply circuit in the original design. The control signals for the tuning and loading capacitor RF levels are provided by the added PA detectors. A block diagram of the entire system is shown in Figure 1.

THE ALC AMPLIFIER. The amplifier circuit is shown in Figure 2. It is a straight-forward DC amplifier, providing ALC voltage for the original

driver ALC circuits. The three diodes isolate the three separate inputs. The three miniature trimmer controls separately set the ALC thresholds for each of the three operating parameters controlled. The PA grid ALC functions as originally designed, with no modification. At 15 ma. screen current (the suggested limit), there will be either 3 or 1.5 volts at the screen input, depending on whether a nixie or an LED counter is installed in the radio. R1 is adjusted so that this voltage is reduced to the voltage level needed to turn on transistor Q1.

The amplifier is constructed on a small circuit board which is epoxy cemented to the driver board. Diode A5CR2, which is in the screen ALC line, is removed, and the amplifier is connected into the circuit in its place, using the circuit board pads to which the diode had been connected. Operating voltage for the amplifier is obtained from the driver board.

RF LEVEL DETECTORS. The circuits for the RF level detectors are shown in Figure 3 and 4. They are identical except for the RF voltage dividers. The dividers were chosen to provide approximately 3 volts at the amplifier trimmers, which requires about 10 volts at the detector diodes. Thus dividers providing 100 times and 30 times attenuation were chosen, corresponding to 1000 volts and 300 volts peak RF at the tuning and loading capacitors, respectively. These levels are merely nominal; the exact thresholds are set by the trimmers.

CONSTRUCTION DETAILS. Amplifier: The amplifier is constructed on a 2" by 1.3" piece of Keystone type 4230 glass epoxy board, P pattern, 0.1" grid. It is epoxy cemented to the driver along a line extending from R19 to pin 262. Terminals 2 and 3 are fitted with Amp connectors as used throughout the CX7. The other four terminals are fitted with leads connecting to the driver board. The trimmers are BOURNS type 3386H-1-103. Transistors are mounted in sockets, Augate type 8059-2G1.

Tuning Capacitor RF Detector. Parts C3, D1, R1, and C4 are mounted on a miniature terminal strip fastened to the left side of the upper PA box, above the insulator for tie point E29. Capacitors C1 and C2 are connected between the terminal strip and E29; they are 1000 V. NPO discs, Sprague type 10TCC-V22. C3 is a silver mica. C5 is a feed-through mounted at the center top on the front of the upper PA box. Resistor R2 is attached directly to C5 with a short lead, for good filtering.

Loading Capacitor RF Detector. Parts C2, D1, R1 and C3 are mounted on a miniature terminal strip on the front of the upper PA box, near the broadband switch. Capacitor C1 is a 1000 V. NPO disc, Sprague type 10TCC-V50, connected between the terminal strip and the wiper on the loading capacitor (front) section of the broadband switch (this is the lug with wire 493 leading to tie point E32). Capacitor C2 is a silver mica. Feed-through C4 is mounted above the terminal strip. Resistor R2 is connected between the terminal strip and C4.

Power Supply Modification. When the ALC amplifier is installed, diode CR7 on the driver should be checked. If there has been any trouble in the screen supply, this diode will probably be open and must be replaced. To prevent similar damage to the ALC amplifier, change R6 on the power supply board to 3 watts, and add a 100 ohm, 1/2 watt, resistor between the screen supply rectifiers and pin 152. Also, a 1/8 Amp fuse in the screen lead to the PA is recommended.

ADJUSTMENT. Screen current. In the receive mode, use a bench power supply to apply approximately -3 or -1.5 VDC (depending on the counter) at the screen input on the amplifier. Adjust the power supply voltage to obtain a 15 ma. reading on the screen meter. Switch the meter to ALC ("Drive") and adjust R1 to obtain 1.0 on the meter.

RF Levels. Turn R2 and R3 to minimum. Realign the broadband circuits. On each band, running full power in broadband into a 50 ohm dummy load, measure the DC voltage obtained at the two RF level amplifier inputs. Select the band which produces the highest tuning capacitor RF level. On this band, while running full power, advance R2 until the output just begins to drop, then back off R2 so that there is no reduction in output. Select the band for the loading capacitor and repeat the procedure for R3.

OPERATION. The drive ("Output") control should be set so that ALC ("Drive") meter indications are about 1.0 when the radio is keyed, or under normal voice conditions. The ALC meter will indicate whenever a grid current, screen current, tuning capacitor RF level, or loading capacitor RF level threshold has been reached, whichever of the four is reached first. For manual tune-up, advance the drive somewhat beyond the point where ALC indication is normally obtained, and adjust the PA controls for maximum output.

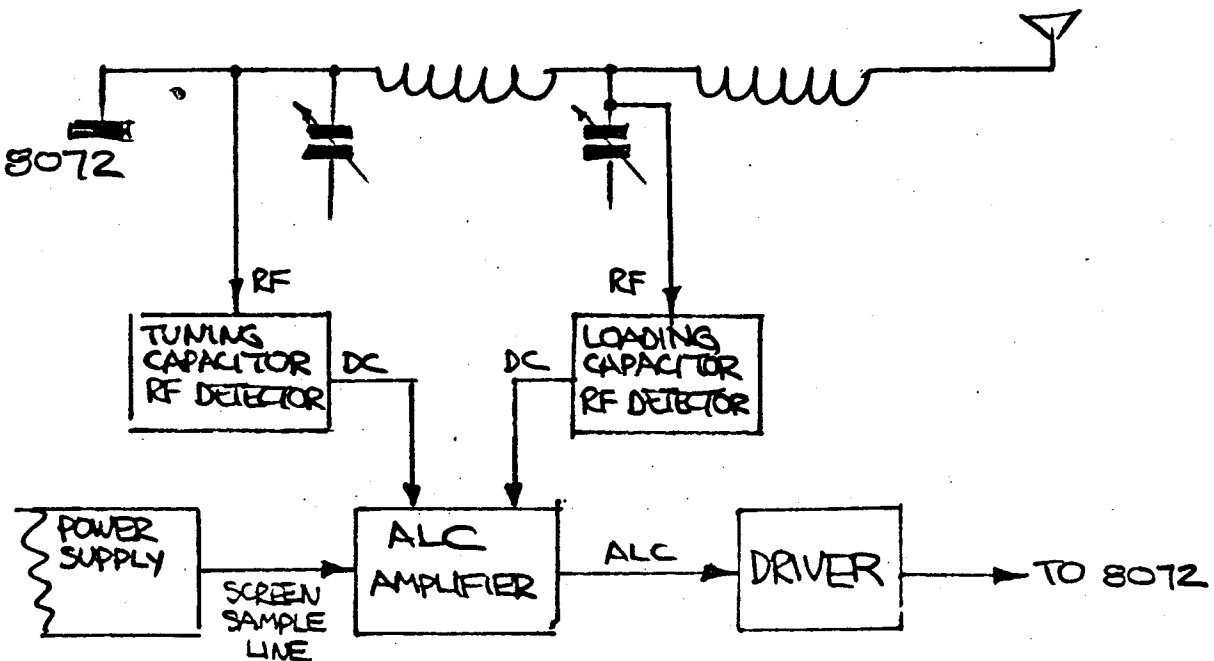
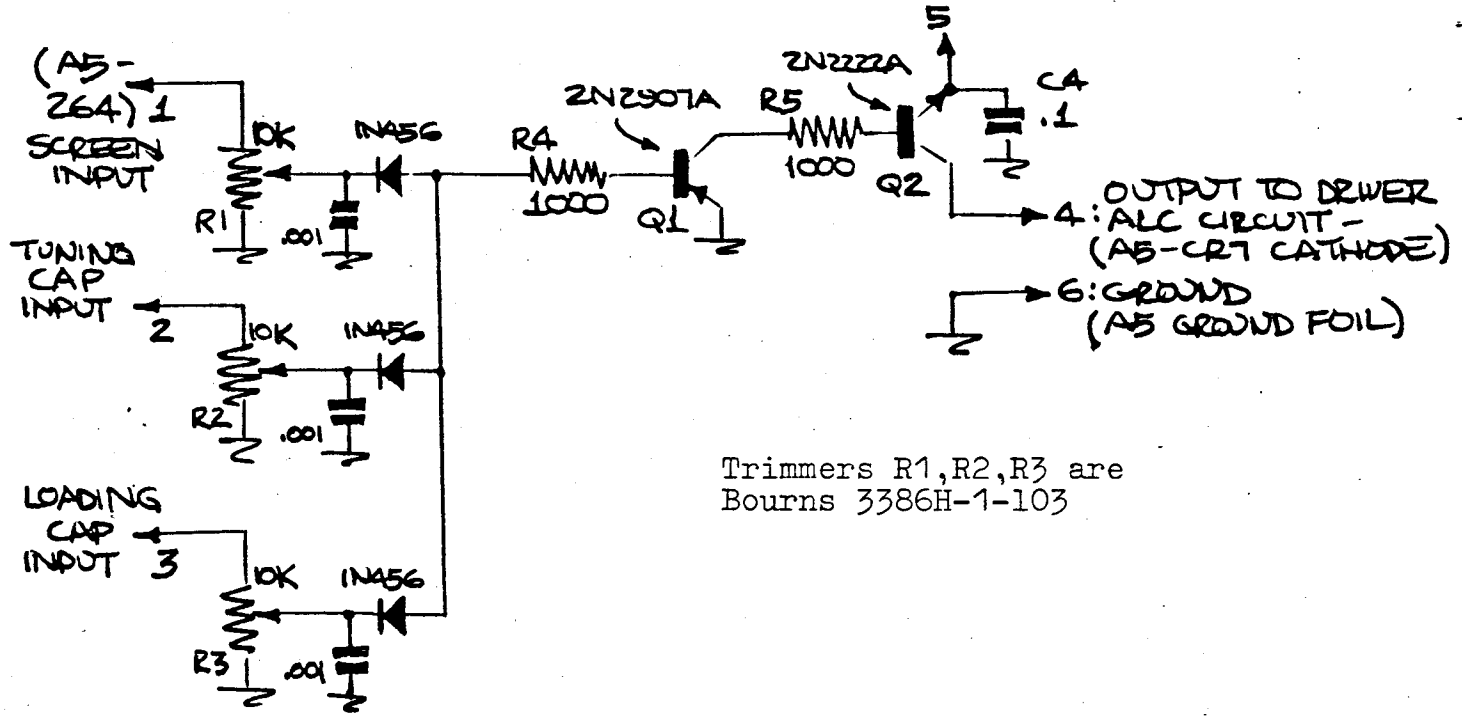


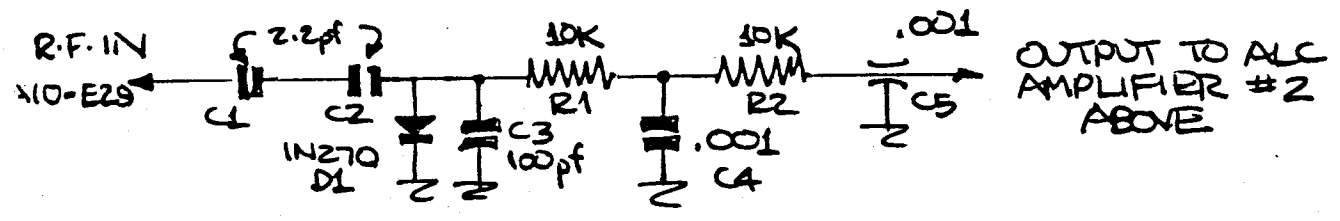
FIGURE 1

ALC AMPLIFIER

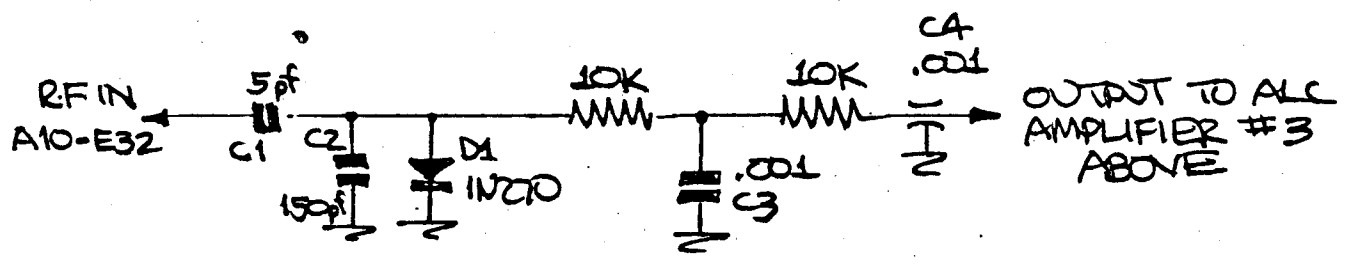
-15V (A5-256)



TUNING CAP R.F. DETECTOR



LOADING CAP R.F. DETECTOR



1. The ALC Amplifier (built on a small 2 x 1.3" PC board) is epoxyed to the RF driver PC board as described in the text.
2. The RF detectors are mounted on miniature terminal strips on the upper PA box as described in the text.

FOR SALE

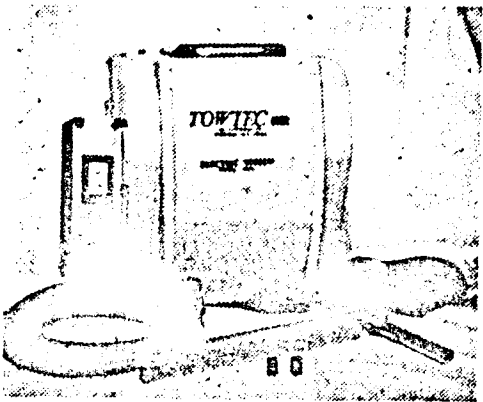
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