

**TEN-TEC**

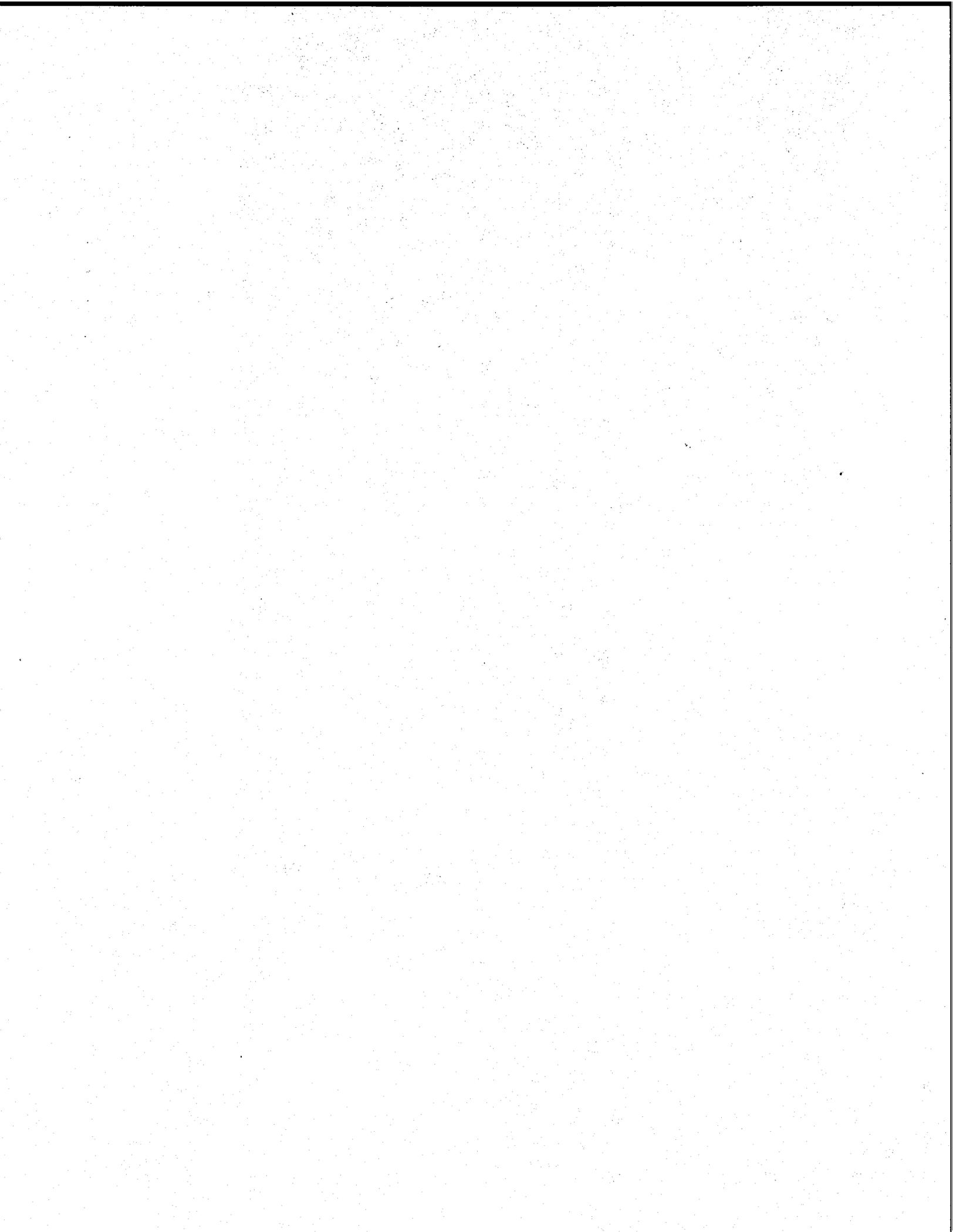
**OWNER'S  
MANUAL**

**TRITON I  
& TRITON II**



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## SECTION I

## INTRODUCTION

The TRITONS are medium powered transceivers employing the latest techniques in solid state technology. Unique balun type transformers couple each rf stage insuring efficient energy transfer without the need to resonate or tune. Individual elliptical type output filters for each band reduce harmonic and TVI components to a low value.

The TRITONS are extremely versatile. Although essentially a fixed station, they are equally at home when used mobile or portable. They operate from 12-14 volts DC or from 115/230 volts AC with an external power supply.

As you become more familiar with the operation of your TRITON you will value the built-in operating conveniences more and more. "Tune-O-Matic" band changing completely eliminates transmitter tune-up. The panel meter automatically switches from an "S" meter to a relative rf power meter when transmitting. The normal side-band is selected for you, whether it be upper or lower, according to the band in use. Indicator lights are provided for offset tuning and automatic level control, and the crystal calibrator is pulsed for easy identification. These are just a few of the many features you will come to enjoy. All in all, the TRITONS are designed for active serious amateurs.

## CONDENSED OPERATING INSTRUCTIONS

The following instructions will enable the operator to quickly place the TRITON in operation. For a more detailed description of the controls and their functions, refer to SECTION II.

REAR APRON CONNECTIONS

**+12 VOLTS IN** - Use a 12 to 14 volts DC power source capable of delivering 9 amperes for the TRITON I, 18 amperes for the TRITON II. Negative ground. Pin connections to the power socket: Pins 1 & 2 - Power switch. Pins 3 & 4 - Negative 12 volts (GND). Pins 5 & 6 - Positive 12 volts. (Use both pins for minimum contact resistance, and 12 or 14 gauge wire.)

**ANTENNA** - Connect a 50 to 75 ohm, unbalanced resonant antenna such as a beam, dipole or vertical. Balanced antennas and those with higher impedances should be matched to the TRITON with an antenna tuner or similar network.

**MIC** - If SSB operation is intended, use a high impedance dynamic, crystal or ceramic microphone. Use a standard ¼" stereo phone plug -- tip to PTT switch; band to microphone; barrel to ground. (Use shielded cable.)

**KEY** - If CW operation is intended, connect a straight key, bug or electronic keyer.

FRONT PANEL CONTROLSA.) Tune-Up; CW or SSB

1. Select desired band with BAND switch.
2. Tune dial to frequency desired.
3. Set SWR switch to FORWARD position.
4. Rotate MODE switch to LOCK position.

5. Rotate DRIVE control until ALC light glows.
6. Switch SWR switch to REVERSE and check SWR. For efficient operation SWR should be less than 3 to 1. If it isn't, make alteration to antenna system to reduce SWR.
7. Switch to desired mode--SSB or CW. Adjust DRIVE control under normal operation (while depressing key or speaking into microphone) until ALC indicator lights.
8. Peak RESONATE control for maximum receiver sensitivity on the desired band.

#### B.) Operation - General

1. With the SWR switch in FORWARD position, the meter will operate as a signal strength indicator when receiving. It will automatically switch to a relative rf output meter when transmitting. Maximum output will occur at full scale on the meter. In order for SWR to be accurately read in REVERSE position, it is necessary that the DRIVE control be advanced so that full power is obtained.
2. OFFSET tuning operation for receiving off the transmitted frequency is indicated by the OT indicator light. This light will go out during transmit, indicating that the OFFSET is disabled while transmitting. It may be permanently disabled even while receiving by pulling the OFFSET knob out.
3. Adequate drive is indicated by the ALC light. Drive should be adjusted to just illuminate the lamp during voice peaks and during CW operation.
4. The TRITON is designed for full break-in CW operation.
5. A pulsed crystal calibrator is incorporated to spot 100 kHz intervals. A push-pull switch is located on the RF control. When operating, the rf amplifier is desensitized for easy calibrator identification.
6. Although improper antennas will not damage the TRITON, we suggest an SWR below 3 to 1 be achieved for maximum performance.

#### MOBILE OPERATION

The TRITON is ideally adapted to mobile operation in a car, boat, plane or other vehicle. It operates from a 12 volt battery source and is self-contained except for key, microphone and antenna.

When using an alternator charged battery, start the vehicle's engine before turning the transceiver on. This prevents any voltage surge caused by momentarily open voltage regulator contacts from being applied to the circuits.

#### FIXED STATION

The TRITON with conventional antennas will perform with distinction in any ham shack. With a linear, the power can be increased to anything desired - up to the legal limit.

For an emergency or stand-by station it will operate for long periods with a 12 volt storage battery.

PORTABLE

The small size and light weight of the TRITON makes it an ideal traveling companion.

Antennas are a matter of choice and convenience. A mobile whip antenna may be used with a suitable ground system (radials) or an excellent earth ground. Matched resonant dipoles are fine if there is a support for them. Random length "long wires" are also effective but must be matched with an antenna tuner. In any event, try to maintain a 3 to 1 SWR, or better.

## SPECIFICATIONS

GENERAL

FREQUENCY COVERAGE - 3.5-4.0, 7.0 to 7.5, 14.0 to 14.5, 21.0 to 21.5, 28.0 to 30.0 MHz.

FREQUENCY STABILITY - Less than 100 Hz after 15 minutes warm-up.

DIAL CALIBRATION -  $\pm 2$  kHz from nearest 100 kHz calibration point. Accuracy slightly less on 10 meters.

TUNING RATE - Approximately 25 kHz per knob revolution, 80 through 15 meters. 100 kHz per revolution on 10 meters.

POWER REQUIREMENTS - 12-14 VDC regulated to 5% or better. TRITON I: 500 mA receive, 9 A max transmit. TRITON II: 500 mA receive, 18 A max transmit.

SEMICONDUCTORS - TRITON I: 60 transistors, 29 diodes, 1 IC. TRITON II: 62 transistors, 31 diodes, 1 IC.

PC BOARDS - 14 plug-in type, 3 integral.

CONSTRUCTION - Rigid aluminum chassis and sub-panels. Aluminum case. Cylolac side panels. Cream front panel, walnut vinyl top and end trim.

DIMENSIONS - HWD 4-1/2" x 13-5/8" x 13".

NET WEIGHT - 12 lbs.

RECEIVER

SENSITIVITY - Less than 0.3 uV for 10 dB signal-plus-noise to noise ratio.

SELECTIVITY - 2.5 kHz at 6 dB down. 1.7 to 1 shape factor at 6/50 dB.

INTERMEDIATE FREQUENCY - 9 MHz, crystal lattice filter.

ANTENNA INPUT - Low impedance, unbalanced.

AUDIO OUTPUT - 1 watt at 8 ohms with less than 2% distortion. Built-in speaker, external speaker/phones jack.

SPURIOUS RESPONSE - More than 50 dB down.

AUTOMATIC GAIN CONTROL - For 100 dB change in input signal level, output changes less than 10 dB.

OFFSET TUNING - With pull-out defeat switch and indicator light.

CALIBRATOR - 100 kHz crystal type. Pulsed tone.

S METER - Automatically switched on when receiving.

CW FILTER - Optional accessory. 150 Hz bandwidth centered at 750 Hz, shape factor 7.2 at 6/60 dB, two selectable responses. Model 245.

#### TRANSMITTER

DC POWER INPUT - TRITON I: 100 watts. TRITON II: 200 watts.

RF POWER OUTPUT - Typical. TRITON I: 50 watts. TRITON II: 100 watts.

OUTPUT IMPEDANCE - 50-75 ohms, unbalanced.

MICROPHONE INPUT - High impedance crystal, ceramic or dynamic.

T/R SWITCHING - Push-to-talk on SSB. Complete break-in on CW.

CW SIDETONE - Internally generated and adjusted for level. Operates only in CW mode.

SSB GENERATOR - 9 MHz, crystal lattice filter, hot carrier diode bridge mixer.

AUTOMATIC LEVEL CONTROL - Amplified, with indicator light.

METER - Indicates relative power output and SWR.

CARRIER SUPPRESSION - 40 dB from single tone output.

SIDEBAND SUPPRESSION - 30 dB down from a single tone output at 1 kHz reference.

#### FRONT PANEL CONTROLS

Receiver RESONATE, OFFSET (Pull-off), BAND switch, RF gain, AF gain. ON-OFF POWER switch, MODE switch, SWR switch, DRIVE, CALIBRATE switch, Main tuning knob.

#### REAR APRON CONNECTIONS

ANTENNA, + 12 VOLTS IN, MIC, PHONES/SPEAKER, PHONE PATCH, SIDETONE, REC. ANT., PTT, KEY, EXT T/R, AUX 12 VDC, MUTE (normally open and normally closed).

#### INTERNAL CONTROLS

"S" meter adjust. Sidetone volume. Crystal calibrator adjust.

SECTION II  
DETAILED OPERATING INSTRUCTIONS

POWER SUPPLY

The TRITONS require a supply of 12-14 VDC capable of supplying 9 or 18 amperes, for the TRITON I or TRITON II respectively. They may be operated with any mobile installation having a 12 volt negative ground electrical system. They may also be powered from an AC power supply, such as TEN-TEC Models 251, 261 for the TRITON I, or Models 252, 262 for the TRITON II.

For optimum mobile performance it is recommended that a separate cable of at least 12 gauge wire be run from the battery to power the TRITONS. The TRITON I requirements are within the specifications of most cigar lighter circuits. However, the voltage drop encountered in the lighter adaptor contacts may adversely affect performance. It is also good practice to strap the TRITON chassis to the automobile chassis with as short a length of flexible, heavy, copper braid as possible. A ground lug is provided on the rear apron for this purpose.

For fixed station installations, the cable length from power supply to TRITON should be as short as possible, and again, made from 12 gauge or larger wire. The chassis should be strapped to a good earth ground system, as should all other equipment, both as a personnel hazard precaution, and for optimum performance.

A power switch is located on the AF control and is wired only to pins 1 and 2 of the 6 pin socket on the rear apron. The switch is not in series with the power leads to the TRITON. This arrangement allows the power switch to be used in the 12 volt DC circuit when operating from a battery, or in the primary circuit of a 115/230 volt power supply, just by constructing the power cable for the intended switch function. For battery operation, the positive power lead is wired through the switch to the TRITON. For AC operation, the switch need not be used if it is desired that the transceiver be switched on and off at the power supply. Or the switch may be connected in series with the 115/230 volt lead to the power supply if the switching function is desired at the TRITON location. In this instance, the power supply AC switch should be permanently positioned in the ON position. The supply can be located remote from the operating position. The TEN-TEC power supplies designed for use with the TRITONS already have provisions for easily inserting the TRITON power switch in series with the primary circuit.

For battery and AC operation, the power connections are as follows:

<u>BATTERY</u>		<u>CONNECTIONS</u>	<u>AC SUPPLY</u>	
Pin:	Connect to:		Pin:	Connect to:
1	+12 VDC		1	AC Line (One side)*
2	Pins 5 & 6		2	Power Supply Line*
3	Ground		3	Ground
4	Ground		4	Ground
5	Pin 2		5	+12 VDC
6	Pin 2		6	+12 VDC

\*-The other side of the AC line should be connected to the other Power Supply line directly. For TEN-TEC supplies, connect Pin 1 on TRITON end to Pin 1 on supply end, and Pin 2 on TRITON end to Pin 2 on supply end.

Always tie Pins 3 and 4 together and Pins 5 and 6 for lowest contact resistance.

The + 12 VDC line is fused and a high power diode is connected across this line to ground in a normally reverse-bias polarity. Under these conditions the diode does not conduct. If, however reverse polarity voltage is applied to the TRITON, the diode conducts heavily and blows the fuse, thereby protecting the transistors and electrolytic capacitors.

#### ANTENNA

Any matched antenna presenting 50 to 75 ohms impedance to the TRITON will load satisfactorily. Random length antennas and open wire feed systems will require a matching system. The popular mobile antennas will operate without special matching. When they are used as a portable antenna, a good ground system or counterpoise should be provided. The TRITON output is designed for an unbalanced feed system. The coax shield is connected to the shell and the center conductor to the pin of the coax plug.

#### MICROPHONE

This input circuit has been designed for a high impedance ceramic, crystal or dynamic microphone. The cable, which should employ shielding for all leads, is terminated with a standard 1/4" stereo type phone plug. The shield and/or ground is connected to the barrel. The PTT switch is connected to the tip, and the microphone to the band. Failure to shield both the microphone and PTT leads may result in rf getting into the audio circuits.

Since the crystal lattice filter is common to both the receiver and transmitter circuits, any audio signal picked up by the microphone while receiving may be applied through the system and appear in the audio output. This is most noticeable when the microphone is placed on the operating table near the speaker. Acoustic feedback will result and may cause sustained oscillations. To completely eliminate any microphone pickup, it is recommended that a SPDT switch be used for the PTT switch in the microphone, and that the microphone signal line be shorted to ground during receive. The TEN-TEC Model 215 microphone has such an arrangement.

The PTT switch operates with respect to ground. When transmitting, the switch is closed.

#### KEY

The key actuates a series of circuits on the CONTROL BOARD that supply operating voltages to the various transmitter and receiver stages. When the key is closed, bias is removed from the receiver stages and applied to the transmitter. The receiver antenna circuit is also grounded during transmit with a reed relay. There is a small time constant in the audio muting circuit to eliminate clicks in the speaker while keying. It is not long enough to interfere with the complete break-in operation of the TRITON. The CW sidetone and key operate only when the MODE switch is in either the CW-1 or CW-2 position. The sidetone volume is independent of the AF volume control. It may be set to the desired level with the printed circuit thumb potentiometer accessible through the hole in the bottom plate.

#### SPEAKER/PHONES

A jack is provided for an external speaker or for headphones. When in use the internal speaker is automatically disconnected. The amplifier output is designed for an 8 ohm load but will operate satisfactorily with high impedance phones or speakers with 4 to 16 ohms impedance.

#### AUX 12 VDC

This jack may be used to power external equipment such as an electronic keyer. It is connected to the + 12 VDC line after the protective fuse. If an AC supply is employed, its current capacity must be great enough to supply the TRITON requirement plus that of any equipment powered through the AUX 12 VDC jack.

MUTE N.O. \* MUTE N.C.

These jacks are provided to supply a short to ground for muting an external receiver, or for controlling the T/R function of a high power linear amplifier. A SPDT relay provides this function. When transmitting, the N.O. contacts will close, and the N.C. contacts will open. Both options are provided to cover all receiver and linear designs. A drop-out delay is incorporated in the relay circuit, and is adjustable with a thumb potentiometer located on the relay board. Since this relay does not control any internal functions in the TRITON, the delay is factory set for maximum delay to reduce its cycling to a minimum. It should be adjusted for a suitable delay only when external equipment is controlled by the TRITON mute circuit.

EXT. T/R

This jack is intended to actuate a high power linear amplifier. It is derived from a second set of contacts on the mute relay. One side of this switch is at ground potential, and therefore it cannot be used to switch the 115/230 volt line. The drop-out delay is the same as that described in the MUTE paragraph above. Contacts are rated at 28 volts and 2 amperes, DC resistive load, or 100 VAC.

REC. ANT.

This jack provides an antenna connection to a separate receiver, and shorts to ground when transmitting.

SIDETONE

The output from the audio amplifier is connected to the SIDETONE jack. It may be used to provide a monitor when a separate receiver is employed. Turn the TRITON AF gain fully CCW to eliminate any signals from the TRITON receiving section getting into the sidetone channel.

PTT

This jack is in parallel with the push-to-talk line on the microphone jack and may be used as an external transmit/receive station switch. It is operable only in the SSB modes.

PHONE PATCH

This jack parallels the microphone input for easy connection to an external phone patch adaptor.

FRONT PANEL CONTROLSRF/AF

The RF gain controls the bias to the receiver rf amplifier. There is approximately 50 dB gain reduction from maximum to minimum. This control is used primarily to reduce the susceptibility to overload in the presence of extremely strong signals. The AGC action will be dependent on the setting of this control.

The AF control adjusts the input to the audio power amplifier stages.

MODE

The SB-N setting of this switch is used for SSB transmissions on the normal side of the carrier frequency. It will provide lower sideband signals on 80 and 40 meters and upper sideband on 20, 15 and 10 meters. This is accomplished by using either the sum or difference frequency in the mixer. The opposite or reverse sideband can be selected by rotating the MODE switch to the SB-R position.

Two CW positions are indexed on the MODE switch, CW-1 and CW-2. The TRITON, as shipped from the factory, will receive signals in the CW mode only in the CW-2 position. The transmitter will function in both the CW-1 and CW-2 positions, however. As shipped, the bandwidth in the CW-2 position is identical with that in the SSB modes, that is, 2.5 kHz. When the Model 245 CW filter accessory is installed into the TRITON, the CW-2 position then provides a bandpass curve peaked at 750 Hz with reduced response on either side. In the CW-1 position, the full 150 Hz wide filter is connected into the circuit which provides very sharply attenuated skirts. CW-2 should be used when QRM is not a factor, when tuning to a desired received signal or when the signals on either side of the centered signal are to be monitored. CW-1 will greatly attenuate signals slightly removed in frequency from 750 Hz, eliminating adjacent channel QRM, and will also reduce the amount of QRN and annoying high frequency audio signals. In mobile operation, it will be found that the CW-2 position can be used for SSB reception with reduced high frequency ignition noise components. In the CW positions, the sidetone signal is fed into the audio system. Its level can be adjusted with the thumb potentiometer located through the access hole in the bottom plate. In CW, the transmitted frequency is automatically offset 750 Hz from the received signal. This compensates for the BFO beat note of the received signal and puts the transmitter exactly on the received frequency. 750 Hz was chosen as the offset to correlate with the center frequency of the Model 245 CW Filter. When the received signal is peaked on the S meter, the beat note will be 750 Hz.

The LOCK position of the MODE switch is used for system checks and SWR measurements. It energizes the transmitter on the CW frequency, in the key-down condition, but does not key the sidetone oscillator. The DRIVE control adjustment for CW operation can be made in the LOCK position, but the setting of this control does not necessarily hold for SSB transmissions. Microphone sensitivity, closeness of the mic to the lips and loudness of the speech all determine the DRIVE setting for SSB.

#### SWR SWITCH

In the FORWARD position, the meter will indicate incoming signal strength on receive and automatically switch to a relative power output meter on transmit. Normal output is indicated by a full scale reading. The meter circuit is peak reading and will therefore provide the same deflection for CW and SSB transmissions. The internal circuitry has been adjusted so that by switching to the REVERSE position (with full scale CW reading on FORWARD) the SWR can be measured.

#### DRIVE

Both microphone gain and CW level are adjusted with the DRIVE control. For SSB, advance the control under normal speech operation until the ALC indicator lights on voice peaks. For CW, advance the control until the ALC indicator lights. The setting should be the same whether dits, dahs or a continuous signal is used. The relative power out as indicated on the meter will change under these three types of transmission due to the instant break-in feature, so the ALC indicator method of adjusting the drive is recommended.

#### CALIBRATE

The calibrator produces a distinctive pulsed tone at 100 kHz intervals. The on-off switch is located on the RF control. With the calibrator operating, the incoming signal is attenuated approximately 50 dB for easier identification. To calibrate the TRITON tune the main tuning knob to the 100 kHz point closest to the desired frequency and zero beat the pulsed tone. If the dial skirt does not read zero, hold the large tuning knob with one hand, to prevent rotating, and rotate the dial skirt so that it does register zero. The transmitter is then calibrated to an accuracy of better than  $\pm 2$  kHz for 50 kHz either side of this frequency. On the 10 meter band, the dial skirt readout represents 400 kHz per revolution. Therefore, the 100 kHz points should occur at skirt readings of 0, 25, 50 and 75.

### BAND SWITCH

The BAND switch selects the Amateur bands of 80, 40, 20, 15 or 10 meters. It switches the main VFO frequency, the receiver tuned circuits and the transmitter interstage and output band-pass filters.

### RESONATE

The RESONATE control operates a mechanical assembly that permeability tunes the receiver rf amplifier circuits. This control should be peaked on the received signal, and has no effect on any of the transmitter circuits. This is the only tuning required when changing bands or frequency.

The band notation around the knob is only meant as a general indicator of the correct position for this control, and the correct peak will be found to move a substantial amount from one end of the 80 meter band to the other, for example, and to a lesser degree for the other bands. It is possible to peak the control on an image frequency or the internal 9 MHz oscillator on all but the 80 meter band, and care should be taken to see that the correct peak is tuned in. For instance, the 9 MHz signal can be peaked on the 40 meter band counterclockwise from the desired 14 MHz peak. Also, the image on the 15 meter band occurring about 15 MHz can be found counterclockwise from the desired 21 MHz peak. (It is this peak that is used when receiving WWV at 15 MHz.) And on the 10 meter band, the 10 to 12 MHz image is heard fully counterclockwise, although it is not fully peaked. (WWV at 10 MHz may sometimes be heard using this image.)

### OFFSET TUNING

The OFFSET control tunes the receiver independently of the transmitter by a small amount. A push-pull switch, attached to the OFFSET control, disables this circuit when pulled out. It is more convenient to leave the OFFSET control in operation and set to mid rotation, where the amount of offset is zero. It is then instantly available when needed. Offset is advantageous when several stations are being worked in a roundtable and all stations are not exactly on the same frequency. The received stations can then be zeroed in with this control without upsetting the frequency of the transmitter. Also, it is very useful in working DX where the DX station is working contacts slightly off his frequency.

The indicator on the front panel marked OT lights when the OFFSET circuit is switched on. (You will notice that the OFFSET and indicator show that the circuit is not operating whenever the TRITON is transmitting.)

### WWV

Broadcasts of WWV and WWVH may be received on 15 and 10 MHz for purposes of checking the crystal calibrator accuracy and for its calibration. To receive the 15 MHz signal, tune the TRITON as follows:

1. Set BAND switch to 15 meters.
2. Turn the slide rule dial and frequency readout skirt to zero.
3. Tune the RESONATE control to the image frequency located almost fully CCW (between the 40 and 80 markings).
4. By tuning around this setting a bit, WWV will be heard if the band is open. If you have a choice of antennas, it may be that one will pick up 15 MHz better than another, and not necessarily the 15 meter antenna.
5. Zero beat the WWV signal, rotate the dial skirt to zero while holding the large tuning knob, and check the calibrator accuracy by turning it on. The calibrator pulsed zero beat should coincide with the zero beat from WWV.

6. If the calibrator does not zero beat with WWV, the small trimmer capacitor on the CALIBRATOR PC board should be touched up with an insulated plastic alignment tool so that it does. A metal bladed screw driver will adversely affect the adjustment and should not be used.

To receive the 10 MHz WWV signal, repeat the above steps, but use the 10 meter band. Since this frequency usually cannot be fully peaked with the RESONATE control, it requires a stronger signal than the 15 MHz signal.

#### OPERATING HINTS

1. The speaker is most effective when the TRITON is placed on a hard surface and the two front snap-up legs are extended. With the legs down, adequate sound quality is still produced when the unit is set on a hard surface. However, in mobile operation, where the speaker may be muffled by the seat cushion or floor rug, an external speaker may be necessary.
2. When setting up the station, provide adequate ventilation for the heat sink on the rear apron. Do not confine the TRITON to a small volume without forced ventilation to circulate the cool air around the heat sink.
3. When operating RTTY, SSTV or other high duty-cycle modes, it is recommended that a small fan be directed on the heat sink. The sink temperatures may reach as high as 200° F. still within ratings for the output transistors, but certainly not enough to cause a serious burn if touched.
4. The TRITON can be operated as a 10 watt QRP transceiver by simply jumpering the rf around the output stage, and removing operating voltages from the final to conserve DC power. A short length of RG-174U cable with female phono connectors on both ends is required. Remove the two coax cables that plug into the shielded output assembly and jumper them together using the extra cable. It may be more easily accomplished by drilling a hole through the chassis to pass this cable from the top to the bottom sections. Both the bias and +12 volt leads should be unsoldered from the two feedthrough pins on the same assembly, and taped to prevent shorting together or to other circuits or ground. Operating procedures do not change. However, the ALC, relative power meter and SWR meter will not operate and some other means of determining adequate drive should be used. A QRP power meter/SWR bridge in the antenna line would serve this purpose.
5. In mobile operation, a phenomenon may be observed which at first appears to be frequency instability, but which in reality is not. The symptoms are a quick, fm type of frequency shift in both a received signal and the transmitted frequency. The shift lasts only about a second or so, and quickly returns to the original frequency. With cw reception, the beat note will change in pitch several hundred Hertz or so, and with ssb, the incoming signal will appear to sag in frequency. The cause of this condition has been found to be magnetized steel expansion joints, or reinforcing rods in the road bed. When the car passes over these joints, the magnetic field around them cuts the VFO coils so that voltage is generated in the coils. This has the same effect as slightly changing the value of inductance. The higher the speed of the vehicle, the more pronounced the effect. Also, interstate highways generally do not have many of these steel joints and the effect may be noticeable only on overpasses. But in metropolitan areas, many magnetized beams have been encountered---in some instances every forty or fifty feet.

6. The VFO oscillator in the TRITON, like any LC tuned oscillator, is adversely affected by ac magnetic fields cutting the coil turns. The oscillator output is frequency modulated at the line frequency, causing a "dirty" cw note and/or poor ssb audio quality in both transmit and receive modes. When installing these transceivers locate any ac operated equipment that may generate magnetic fields, such as power supplies, electric clocks, keyers, rotator controls, other station accessories, etc. as far as possible from them. Since the VFO is located front and center, the most common cause of FMing is from placing keyers, small power supplies or electric clocks on top of the transceiver. However, large power supplies may cause interference even when placed adjacent to the transceiver. A check on the purity of received cw signals should be made at the time of installation.
  
7. Due to the possibility of high voltage transients being generated in the output rf amplifier during band switching, changing bands should not be attempted while transmitting power to the load. Either place the transceiver in the receive mode or be certain of a "key-up" condition in the cw mode. YOU RISK THE POSSIBILITY OF DESTROYING THE OUTPUT TRANSISTORS IF THIS PRECAUTION IS NOT OBSERVED.

## MODIFICATION FOR USE WITH FULL BREAK-IN LINEARS

In order to achieve full break-in performance, available with the Alpha 77 Linear Amplifier, a slight modification to the receiving antenna circuit is necessary. This modification should be used only with linears that provide the full break-in feature and effectively short out the receiving antenna line in their T/R switching circuits. If this is not done effectively, there is a good possibility that rf energy feeding back into the receiver will damage the TRITON rf amplifier.

The modification consists of converting the SIDETONE jack to an additional receiving antenna jack which connects directly to the TRITON receiver input, instead of going through the relay and output filter networks. To further protect the receiver input, back to back silicon diodes are connected across the newly established antenna line. Proceed as follows:

- 1.) Locate the two shielded cables going to the REC ANT jack. One goes to REC ANT pin on the SWR-ALC assembly 80194. The other goes to the RF AMP assembly 80166 in the RESONATE rack mechanism.
- 2.) Disconnect only the lead going to the RF AMP assembly at the REC ANT jack.
- 3.) Disconnect the lead going to the SIDETONE jack and tape the end so that it does not short to surrounding components or chassis.
- 4.) Solder the inner conductor of the freed cable to the vacated terminal on the SIDETONE jack. Also solder the shield of this cable to the ground lug on the jack. Take care so that the heat of the soldering iron does not melt the inner conductor insulation to cause a short in the cable.
- 5.) Solder a silicon diode from the SIDETONE terminal to the ground lug with the diode cathode connected to the ground lug.
- 6.) Solder a second diode to the same two points with the anode to the ground lug.

To connect the revised jacks to the linear:

- 1.) Connect the TRITON output from the ANTENNA connector to the Linear rf input jack.
- 2.) Connect a cable between the revised SIDETONE jack (now the receiving antenna jack) and the T/R jack on the Linear designated "receiver antenna". Note: The TRITON jack marked REC ANT is not used with this system.

To operate the TRITON barefoot, it is required that the receiver input be re-connected to the T/R switching system in the TRITON. To do this, connect a short jumper cable made from RG-174/U cable and two phono plugs between the SIDETONE and REC ANT jacks.

## SECTION III

## ALIGNMENT AND SERVICE

This section is subdivided into descriptions of the main chassis and each plug-in assembly. Pin and transistor terminal voltages are given for each unit. Readings should be within 15% of listed values when measured with a dc voltmeter with at least a 20,000 ohms per volt impedance. All readings are dc and positive with respect to chassis GND, unless stated otherwise. The plug-in pin locations are in the same relative positions on the assemblies as they are noted on the schematic diagrams. In other words, if, after first determining the correct orientation of the assembly with regards to which set of pins are which, the assembly is placed component side up on the schematic in this position, the individual pin functions are the same as those noted on the schematic.

When removing a plug-in assembly, note the orientation of the board in the chassis so that it can be replaced in the same position. The assemblies can be inadvertently inserted incorrectly if care is not taken. To remove a plug-in, first remove the two or more screws holding the board to the sockets. Then, with long nose pliers, work the assembly straight up by pulling on the four corner pins in sequence.

To facilitate location of the various alignment and adjustment components, the table below lists the particular assembly where each function is found.

Function	Assembly
Receiver rf Amplifier	Main Chassis
Receiver 9 MHz Trap	Main Chassis
Receiver Mixer	TX-RX Mixer 80190
Receiver i.f Amp.	I.F.- AGC 80208
S Meter Zero Adjust	Control Board 80193
Crystal Calibrator Adjust	Xtal Calibrator 80170
Sidetone Level	Audio Pwr. Amp. 80130
Carrier Balance	SSB Gen. 80131
USB and LSB Carrier Adj.	SSB Gen. 80131
CW Trans. Offset	SSB Gen. 80131
Transmitter Mixer Null	TX-RX Mixer 80190
ALC Level	SWR-ALC 80194
Forward Power Meter Set	SWR-ALC 80194
Reverse SWR Set	SWR-ALC 80194
External T/R Relay Delay	Offset Light-T/R 80191

Note: All VFO linearity, band edge calibration and multiplier components are an integral part of the VFO section located on the main chassis. This section is described as a separate assembly for simplicity, however.

## MAIN CHASSIS

The main chassis contains all panel controls, the VFO section, receiver rf amplifier, (which is permeability tuned), the final transmitter amplifier and sockets and inter-socket wiring for the plug-in assemblies. Access to these components is by removal of the top and bottom covers.

Pilot Lamp Replacement - The ALC and OFFSET lamps are accessible by removal of the front panel, and the three dial scale lamps by further removal of the plastic bezel. See removal instructions below. These five bulbs are miniature 6 volt, 50 mA units, available through TEN-TEC for \$.50 each. The meter lamp is a standard 14 volt bayonet type 1813 or 1892.

Dial Cord Replacement - The dial string mechanism consists of two parts, a .020" diameter dacron, non-stretchable string and an elastic cord. The diameter of the dacron is important for proper pointer readout, since it is wound on the tuning shaft and carries the pointer across the scale. Replace only with a string of the same diameter. The stretchable section provides string tension. Both are available from TEN-TEC for \$.25. To install, remove the front panel as described below. Attach the lug end of the stretchable section to the #4 screw near the ALC bulb. Turn the main tuning shaft fully counterclockwise. Knot the dacron string around the small pin in the tuning shaft and put on one turn, counterclockwise. (String should lead off from the bottom of shaft toward upper right corner of panel.) Run string around the two nylon pulleys to the right of the S meter and then left, across the top of the panel toward the RESONATE control. Temporarily tape the end to the panel to hold it in position. Now run the elastic cord toward RESONATE control, under lower pulley to right of the RESONATE control, up and over the top pulley. Thread the free end through the left top hole in the dial pointer and secure with a small wire band so that without any stretch in the cord, the pointer is positioned approximately one inch to the left of the flat headed screw located at the upper right of the RESONATE control. Cut off any excess cord. Attach the dacron string through the right hole in the dial pointer and knot it so that the pointer is exactly over the flat headed screw when the shaft is fully CCW. This will preload the stretch cord by one inch.

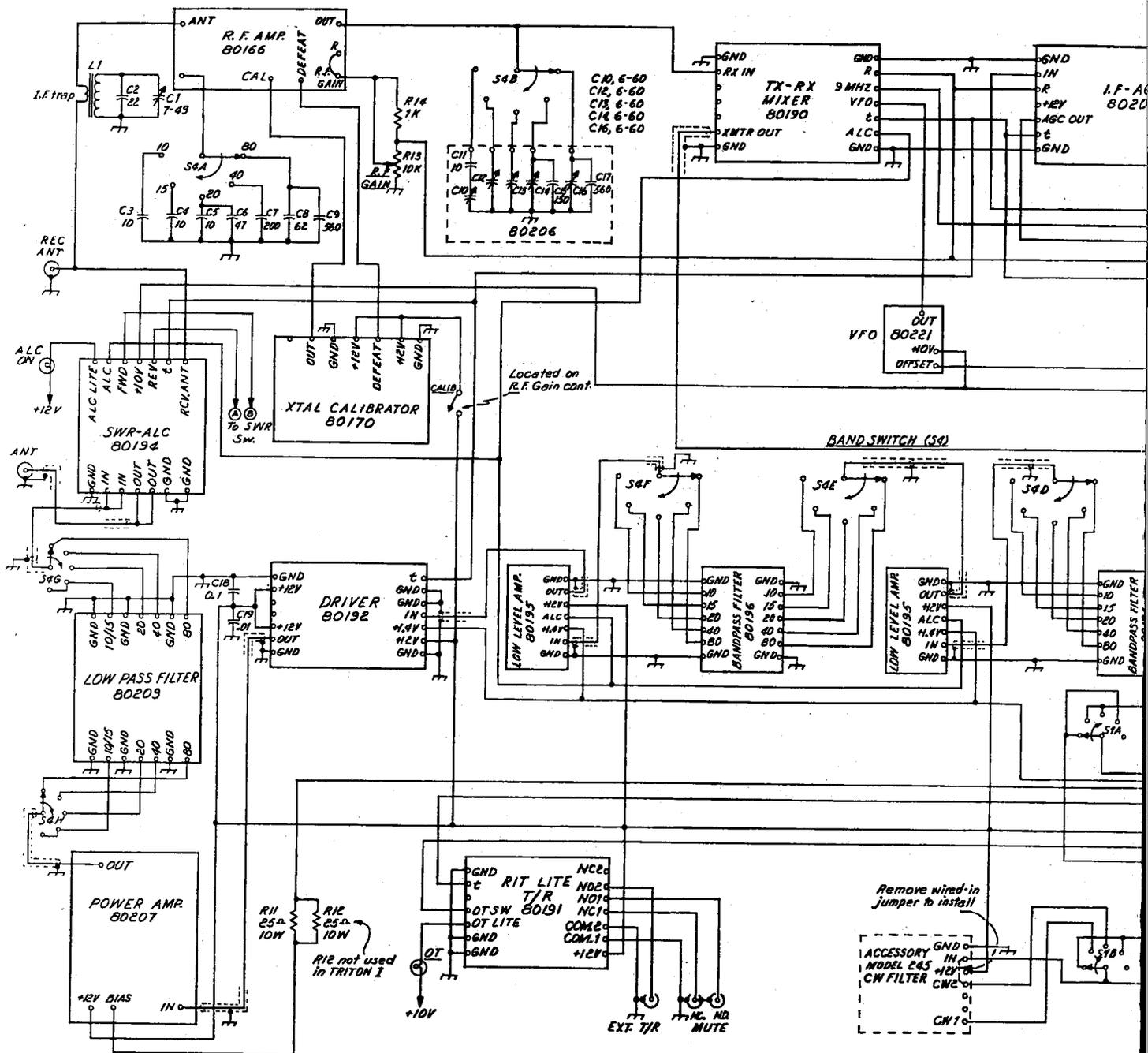
Make sure that the string around the shaft is in the groove and as close to the panel side as possible. As the shaft is rotated clockwise, the string should wind evenly in the groove. If the pointer tends to ride away from the panel at the bottom, rotate it several times on the horizontal axis to pre-load it with twist in the string.

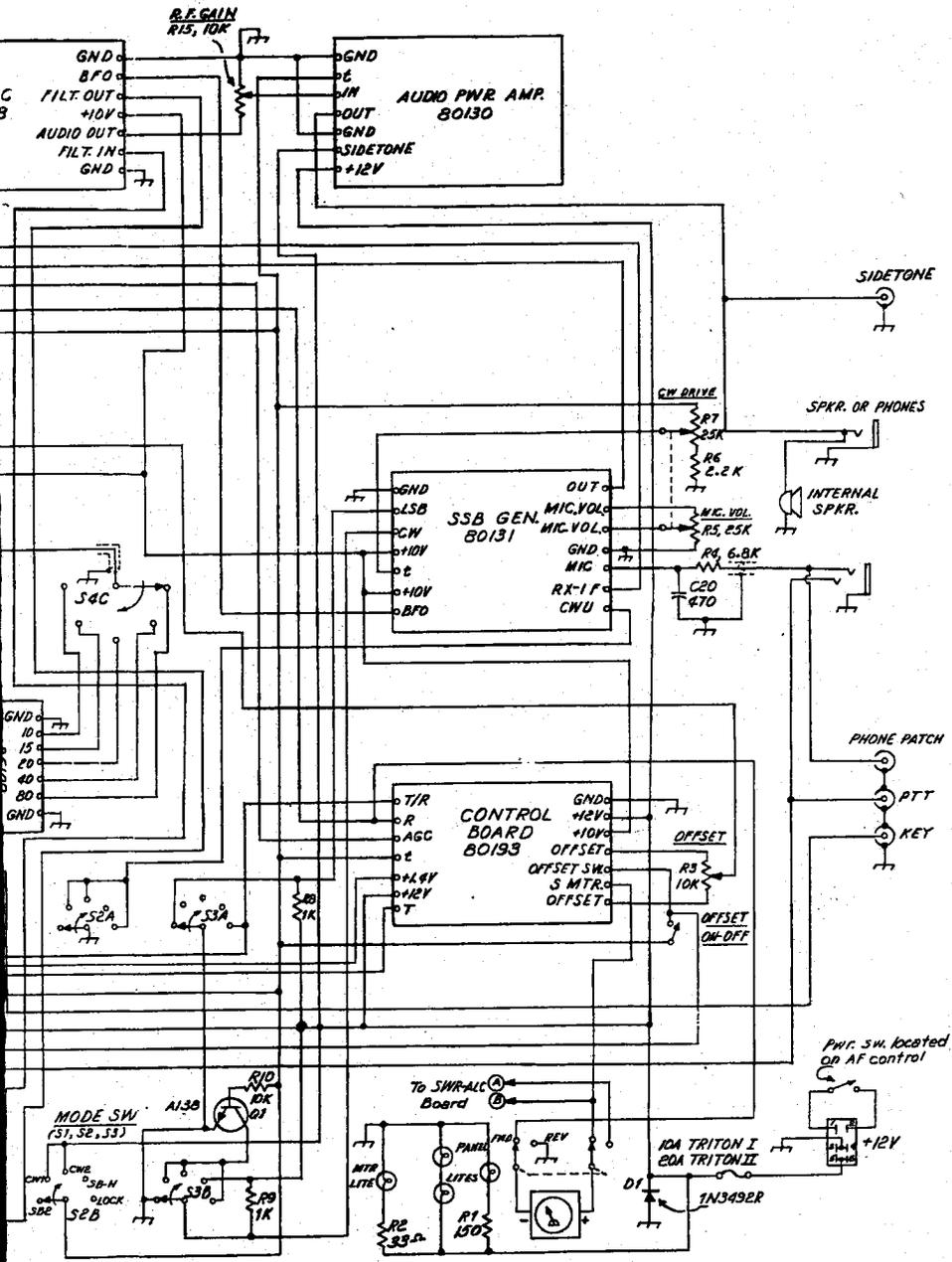
Fuse Replacement - The fuse located on the back panel protects the TRITON from overload and reverse polarity conditions. Replace with a 3 AG, fast blow type of similar rating. For the TRITON I, use a 10 amp. rating, for TRITON II, a 20 amp. fuse.

Removal of Top - Remove the two screws at the rear of the top. Slide the top back and out of the grooves in the side panels.

Removal of Bottom - Remove the four screws holding the speaker grille. Lift out the speaker and unsolder the wires from the terminals. Remove the eight remaining screws that hold the bottom. Slide the bottom back and out of the grooves in the side panels.

Removal of Front Panel - First remove top as described above. Then remove the inside screw on each side that goes through the sideplates of the main chassis into the plastic side panels. These screws are located near the top of the unit. Remove the BAND switch knob after loosening the set screw with a small flat bladed screwdriver. Remove the main tuning knob and the RESONATE knob, using a 4-40 Allen wrench provided. The remaining small knobs pull straight off. It may be necessary to pry them off with a screwdriver, being sure to protect the front panel from scratches with a cloth or cardboard under the screwdriver shaft. The 0-100 dial skirt is a friction fit and may be pulled straight off. (See Service Note SN-4-505 at the end of this section for replacement instructions.) Turn the unit over and remove the four screws in the bottom lip of the front panel. Slightly spread the two side panels and remove the front panel from the grooves. Unsolder the white wire going between the pilot lamps and the switch on the RF control. The panel may then be separated from the TRITON.





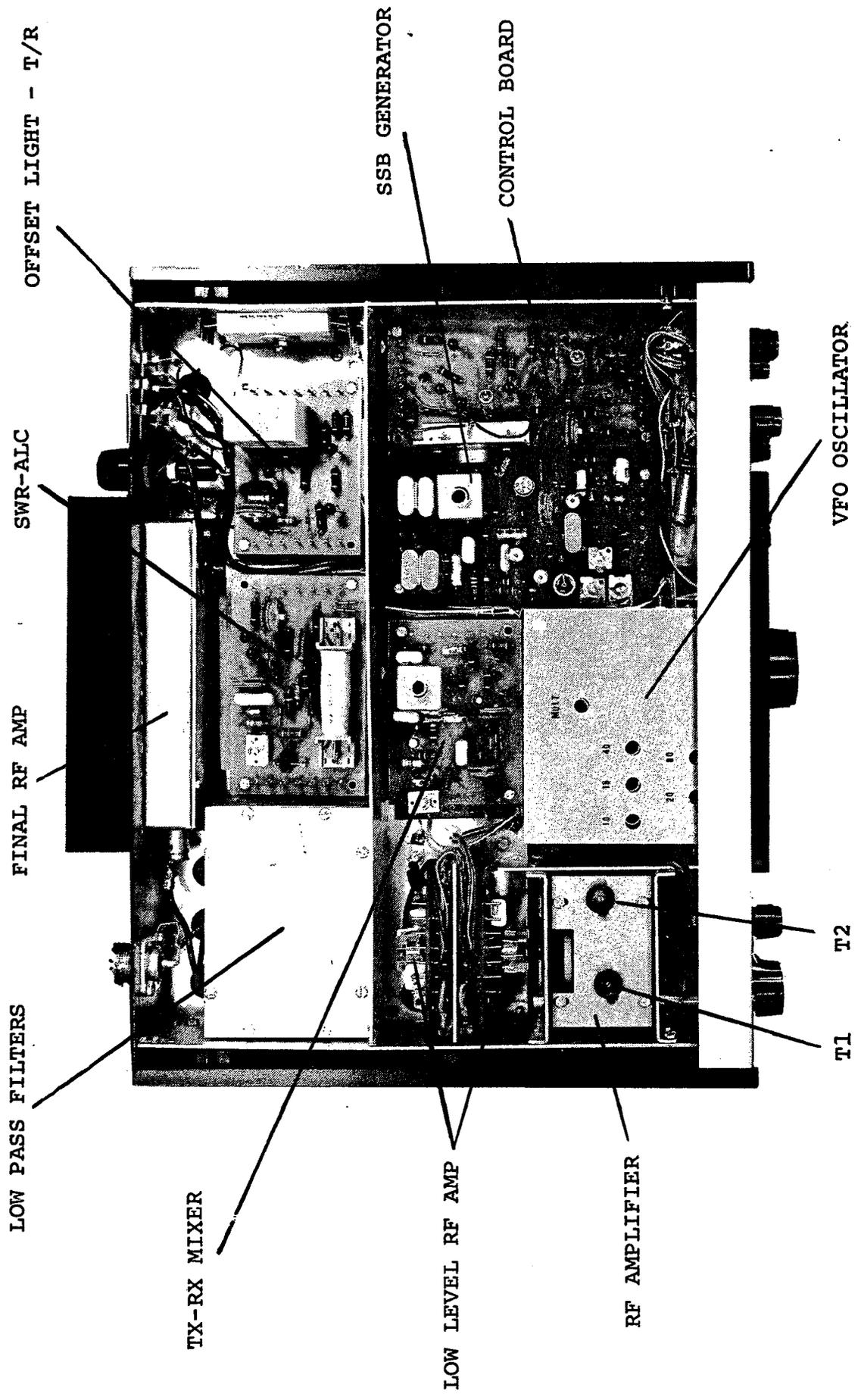


FIGURE 1 - TOP VIEW

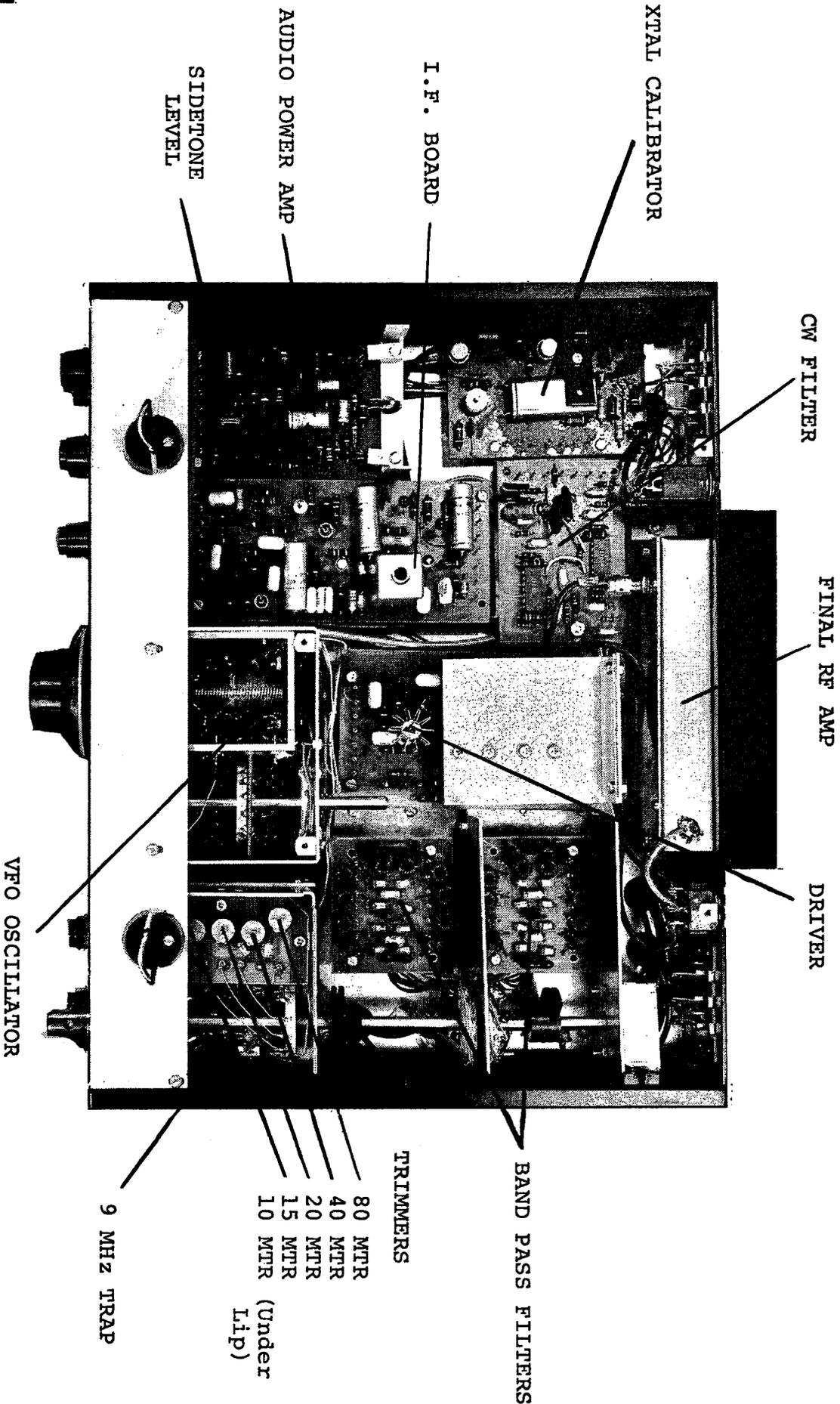


FIGURE 2 - BOTTOM VIEW

## 80166 R.F. AMPLIFIER

The rf amplifier in the receiving section is located on the RESONATE subchassis containing the permeability tuning rack. This subassembly is a part of the main chassis. It consists of a single stage dual gate MOSFET, Q1. Antenna coil, T1, and mixer coil, T2, are gang tuned with the mechanical rack mechanism. The corresponding capacitors are not included on the PC board, with the exception of C2, the 10 meter antenna capacitor. A set of five fixed capacitors are switched across T1, and a set of five trimmer capacitors, located on a separate board under the amplifier board, are switched across T2.

The stage is powered from the "R" terminal, which is nominally 10 to 12 volts at full rf gain. The AGC system decreases this voltage as signal level increases, thereby decreasing the stage gain. The RF control is also fed by the "R" voltage and varies the bias on one of the gates, pin 2.

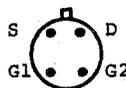
When the crystal calibrator is energized, a transistor on that assembly switches on and presents a low impedance to the DEFEAT terminal, thereby reducing the gain by about 25 dB. Also, the calibrator output signal is loosely coupled to the drain terminal, pin 1, through the "gimmick" capacitance.

To align the tuned circuits, proceed as follows:

- 1.) Connect a Ballantine or other suitable ac meter to the receiver audio output.
- 2.) Connect a signal generator to the antenna. Set bandswitch to 80 meters. Frequency to 3.5 MHz.
- 3.) Temporarily connect a .01 uF capacitor from the 80 meter trimmer to ground. (Figure 2) Set signal generator level to several hundred microvolts and tune it to 3.5 MHz. Rotate the RESONATE control for a peak on the ac meter. Disconnect the .01 uF capacitor, turn the signal generator down to about 1 microvolt and peak the 80 meter trimmer.
- 4.) Set the frequency to 4.0 MHz, connect the .1 uF capacitor, turn up signal generator and tune it until a signal is heard at 4.0 MHz. Rotate the RESONATE control for a peak in output. Disconnect the .01 uF capacitor, turn down the signal generator and peak the rf output coil for maximum output. (Figure 1)
- 5.) Repeat steps 3 and 4 until there is no more increase in output. This align and tracks the 80 meter band.
- 6.) Switch to 40 meters, set the frequency to mid-band. Connect the .01 uF capacitor from the 40 meter trimmer to ground. Using the same procedure with the signal generator, locate the signal and peak the RESONATE control for maximum. Remove the .01 uF capacitor, turn down the signal generator and peak the 40 meter trimmer for maximum output.
- 7.) Using the same procedure, align 20, 15 and 10 meters.

Transistor Voltages - (RF gain control fully clockwise.)

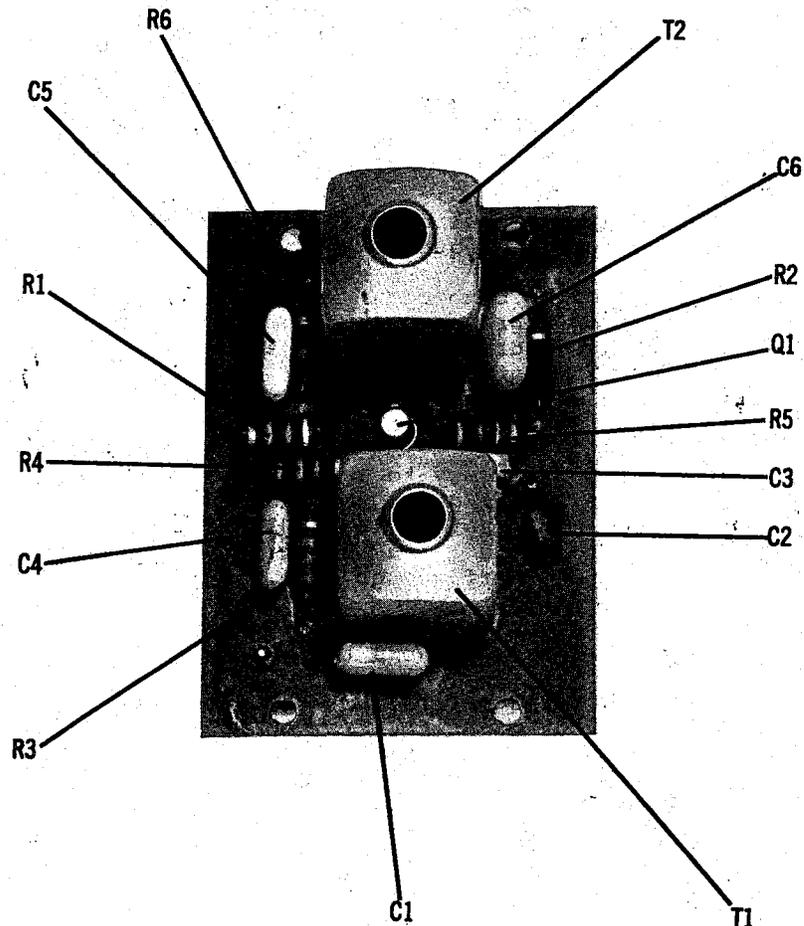
Source, Pin 4: 1.5v  
 Drain, Pin 1: 9.2v  
 Gate 1, Pin 3: 0.8v  
 Gate 2, Pin 2: 3.0v



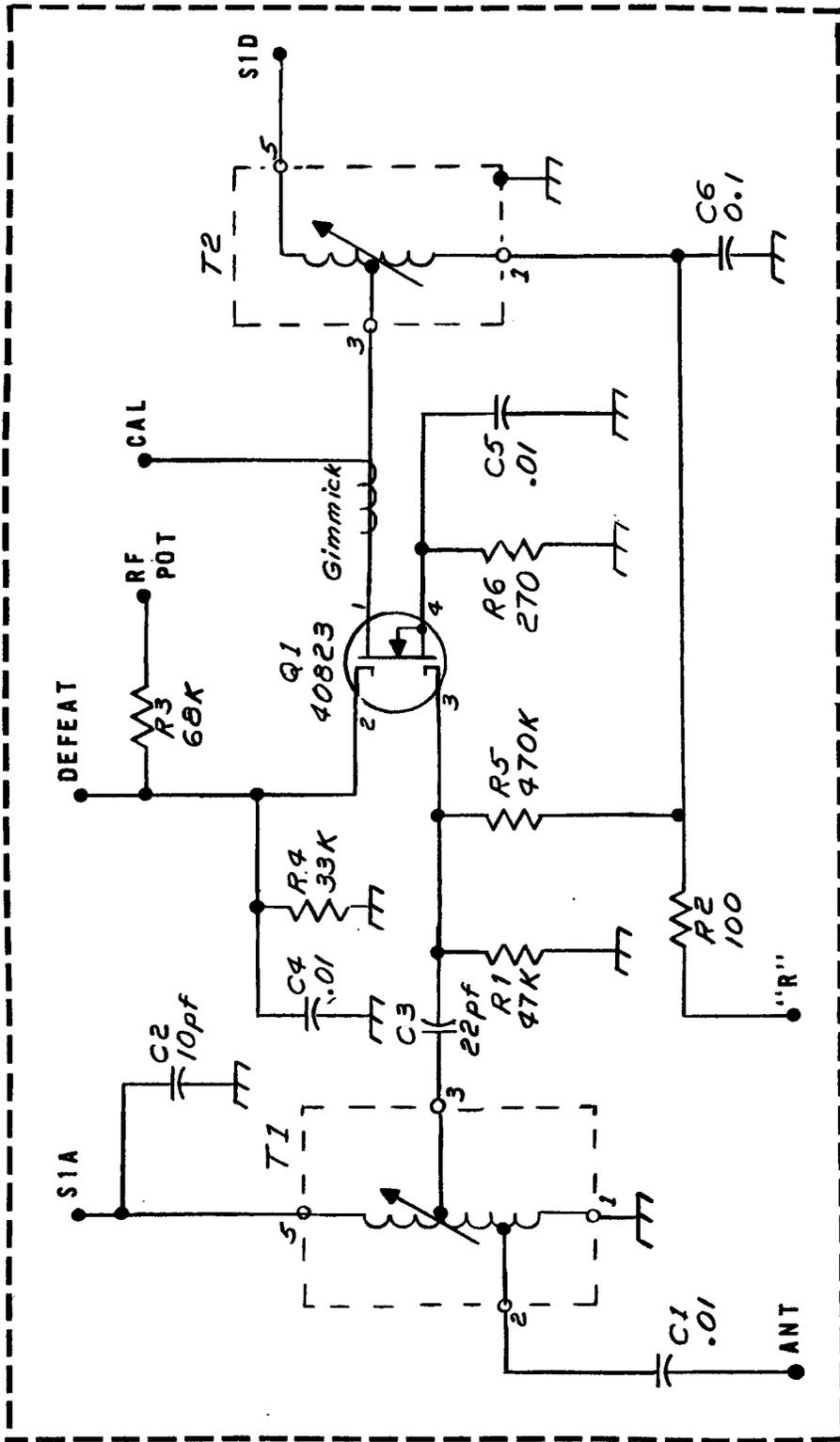
Pins viewed from bottom of circuit board.

9 MHz Trap

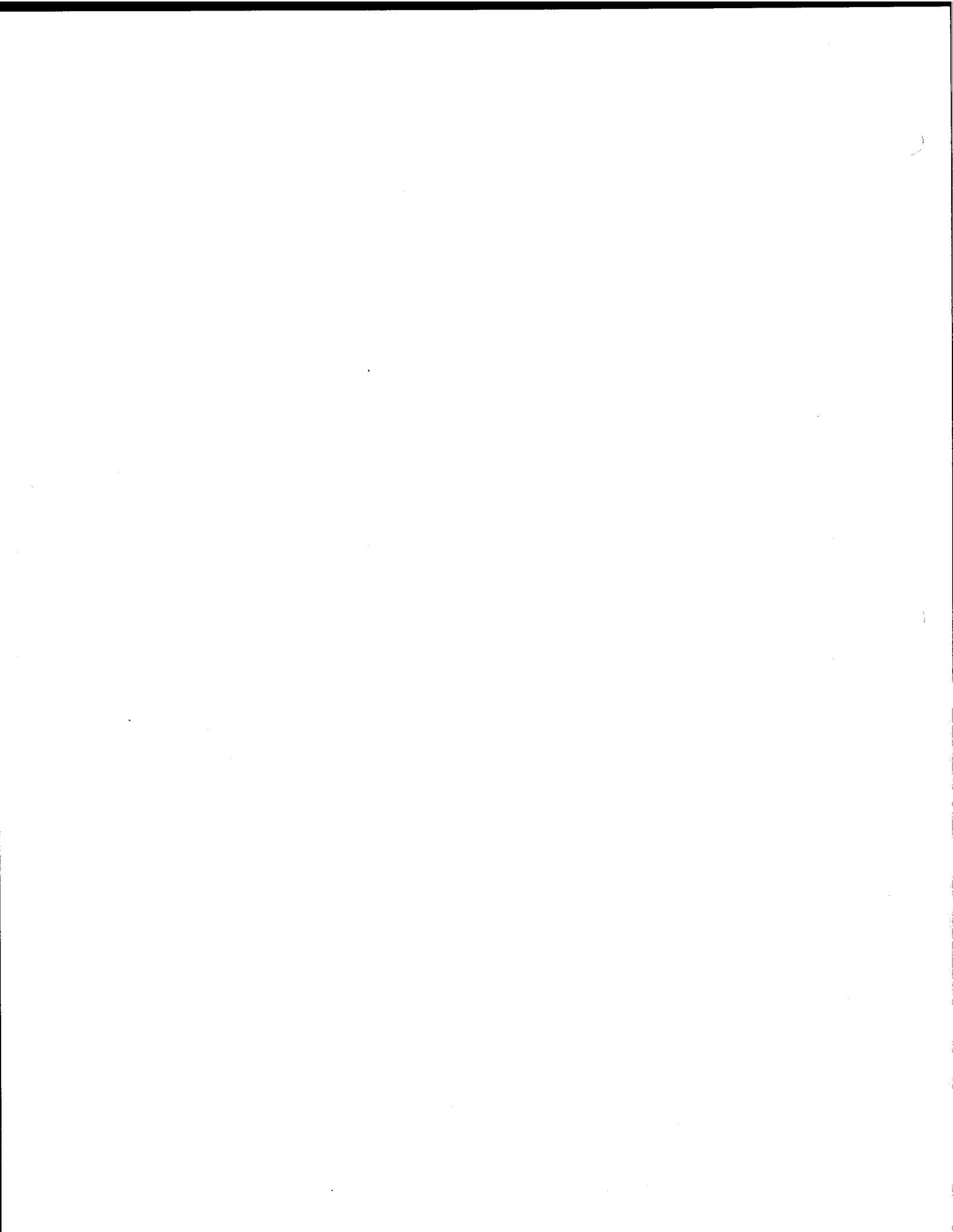
- 1.) Set receiver to 40 meters and the RESONATE control for maximum output.
- 2.) Without changing the settings, tune the signal generator to 9 MHz and increase the output until a signal is observed. Tune the trimmer (Figure 2) for a null. This capacitor may be located either on the under side of the PC board or on top of the board. Access to the bottom mounted trimmer is by removing the side panel. Top mounted trimmers are accessible through the hole punched in the rack top plate.



80166 R.F. AMPLIFIER



**PT. NO. 80166**  
**R.F. AMPLIFIER**



## OSCILLATOR

The variable oscillator produces the proper injection frequencies for a transceiver, transmitter or receiver using a 9 MHz I.F. system. Q2 is the basic oscillator followed by Q3 as a buffer. Transistor Q4 is used as a multiplier. Offset tuning has been incorporated using the junction capacity of Q1 as the capacitor.

Tuning is accomplished by varying the inductance of L11. The proper frequencies are obtained by changing the basic oscillator frequency and by using the correct multiple. Table I shows the basic frequency, multiple and injection frequency.

TABLE I	BAND	BASIC FREQUENCY MHz	MULTIPLE	INJECTION FREQUENCY MHz
	80	6.250-6.500	X2	12.5-13.0
	40	5.333-5.500	X3	16.0-16.5
	20	5.000-5.500	X1	5.0- 5.5
	15	6.000-6.250	X2	12.0-12.5
	10	6.333-7.000	X3	19.0-21.0

The basic frequencies for all bands are close together. Therefore, the linearity of tuning is maintained on all bands. The frequency range and band edge can be adjusted with coils L1 through L10. For instance, on 80 meters, to increase the tuning range, increase the inductance of L2 (move bottom slug CCW) and decrease the inductance of L1 (move top slug CCW). To decrease the range the procedure is reversed (move both slugs CW). The same procedure holds for 40 through 10 meters. All coils L1 through L10 are located beneath the openings in the top cover.

### MULTIPLIER TUNING

Set the oscillator to 10 meters and the frequency to 6333 kHz. Peak both the bottom and top slugs in T1 for 19 MHz. Set the oscillator to 7000 kHz and check the output. It should be close to that obtained at 19 MHz. If necessary, repeak the top slug slightly. This is an over coupled double-tuned transformer and will require a little care in obtaining the proper passband. When properly tuned it should peak toward each frequency extreme with a shallow dip in the center. The other bands are tuned with the trimmer capacitors located on the circuit board. It is important that 10 meters is properly adjusted before proceeding with other bands. Switch the oscillator to 15 meters and the frequency to 6.000 MHz. Peak both C14 & C15 for 12.0 MHz and check the output. The multiplier passband is set to pass both 80 and 15 meters. This will be a frequency range of 12.0 to 13.0 MHz. The two peaks of the over-coupled transformer will fall at 12.0 and 13.0 MHz. The output at the high frequency of 15 meters should coincide with the output at the low frequency end of 80 meters and will be about 3 dB

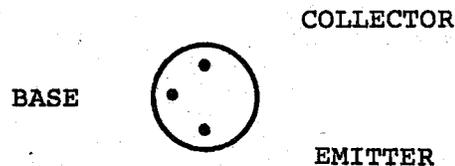
below either extreme. Switch to 80 meters and check the output at 13.0 MHz. If necessary, repeak C15 for maximum. On 40 meters, the multiplier only has to pass 16.0 to 16.5 MHz. It is only necessary to set the frequency to 5.367 MHz and peak both C13 and C16 for maximum output at 16.1 MHz. This should provide the proper injection across the 40 meter band.

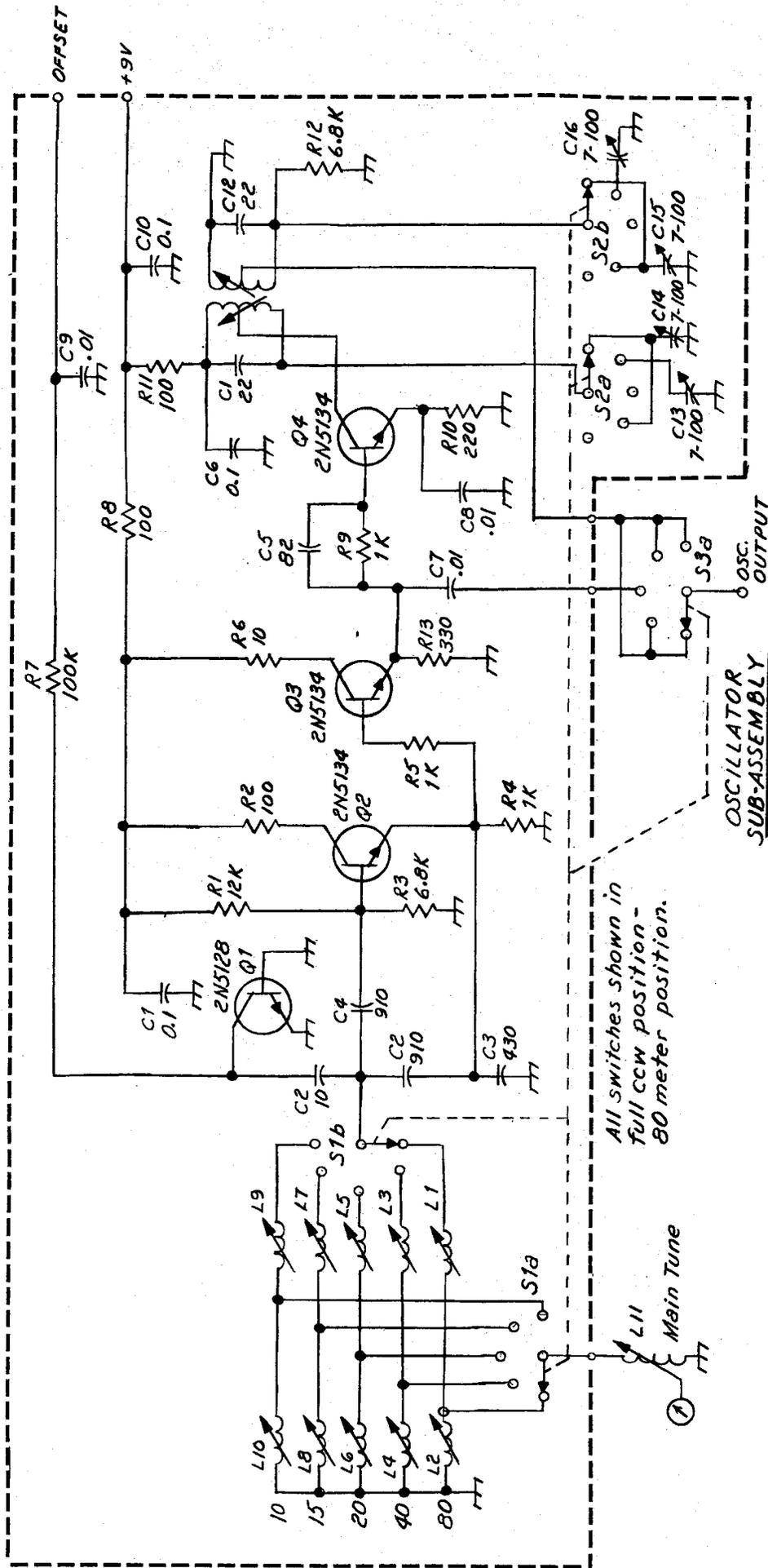
The OFFSET tuning may be connected to a +9V regulated supply if it is not to be used. The offset range will vary from band to band due to the multiplier. For a voltage swing from +3V to +6V it will vary approximately  $\pm$  2kHz on 20 meters,  $\pm$  4 kHz on 80 and 15 meters and approximately  $\pm$  6 kHz on 40 and 10 meters.

#### VOLTAGE READINGS

	COLL	BASE	EMITTER
Q1	9.0	0	0
Q2	8.0	2.6	3.2
Q3	8.2	3.0	2.4
Q4	8.0	2.0	3.2

The above measurements were taken with a VTVM. Offset connected to +9V. Transistor pin arrangement viewed from the bottom of the circuit board.



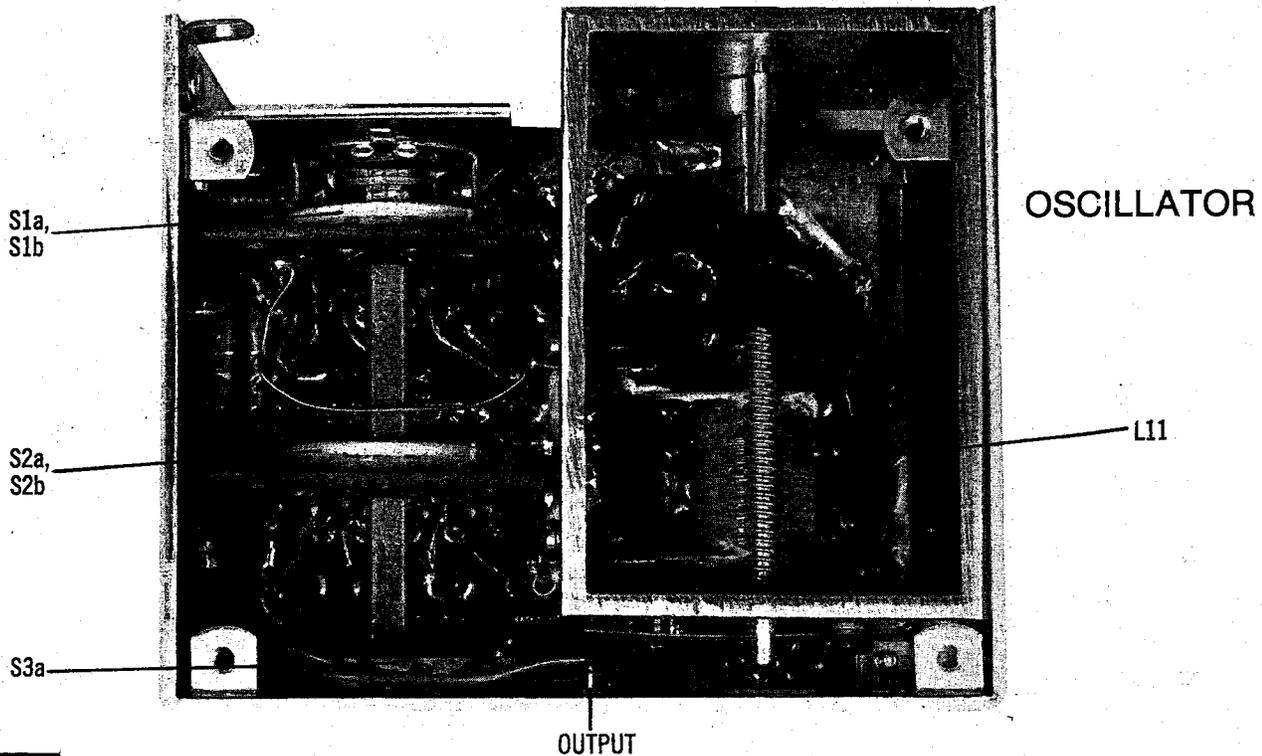
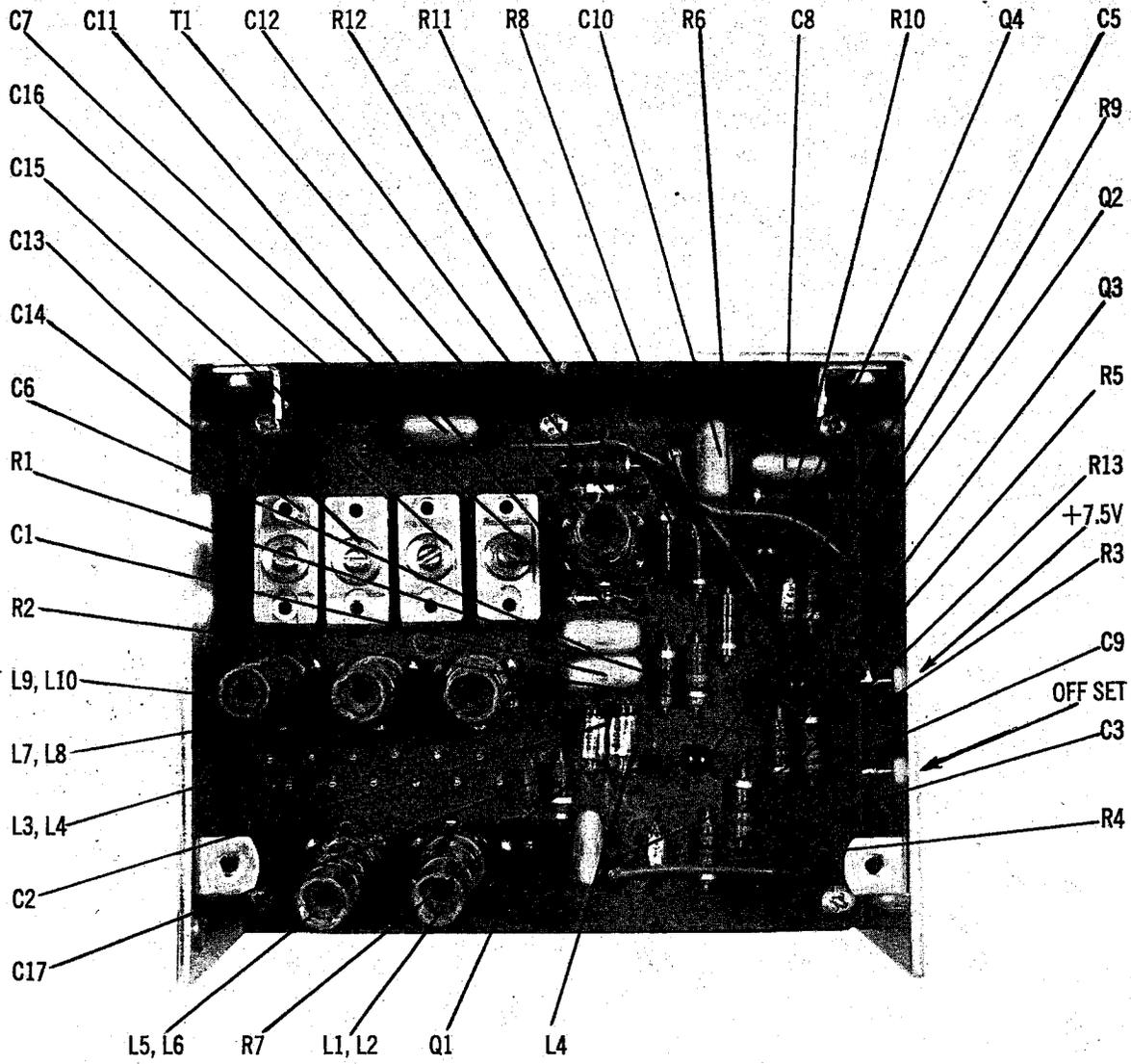


All switches shown in full ccw position - 80 meter position.

OSCILLATOR SUB-ASSEMBLY

Main Tune

OSC. OUTPUT



## 80190 TX-RX MIXER

Receiver Mixer - A protected dual gate field effect transistor serves as the receiver mixer. The VFO is fed to gate number two and the signal to gate number one. The output is a single tuned circuit. Alignment is not critical. Tune L1 for maximum received signal.

Transmitter Mixer - The transmitter section consists of a low level 9 MHz amplifier followed by a double balanced hot carrier diode mixer. The mixer balance is set as follows: BAND switch: 20 meters. DRIVE: Full CCW. MODE: lock. FREQUENCY: 14.0 MHz. Using an oscilloscope or sensitive rf voltmeter connected across the antenna, adjust R7 for a null. Next tune C2 for a null and recheck R7. It may be necessary to "rock" both C2 and R7 for best null.

The low level 9MHz amplifier Q2 is one of the ALC controlled stages. Transistor Q3 acts as a variable emitter resistor for Q2. This reduces the gain by reducing the current through Q2 and by increasing the feedback in that stage.

Pin Voltage Readings - (RF control fully clockwise)

Pin	Transmit	Receive	Pin	Transmit	Receive
GND	0	0	GND	0	0
RX IN	0	9	R	0	10
NC	-	-	9MHz	0	0
NC	-	-	VFO	0	0
NC	-	-	t	12	0.2
XMTR OUT	0	0	ALC	4.2	4
GND	0	0	GND	0	0

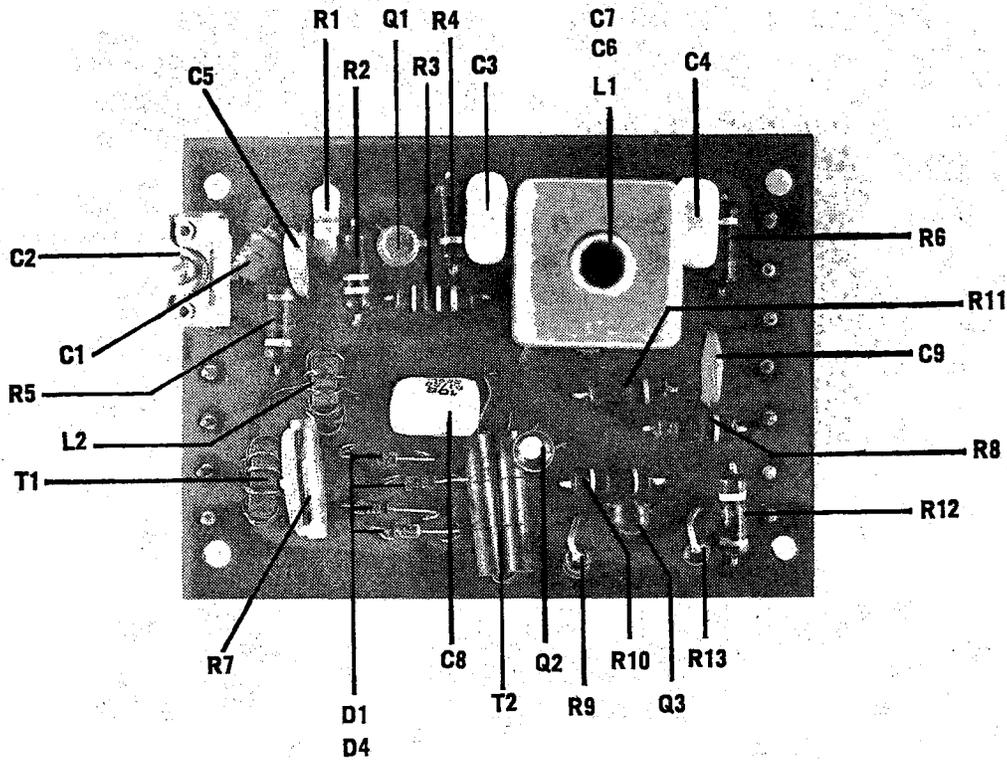
Transistor Voltage Readings

Transistor	Collector		Base		Emitter	
	Transmit	Receive	Transmit	Receive	Transmit	Receive
Q2	12	0.2	1.5	0	0.8	0
Q3	0.4	0	1.2	0.8	0.4	0

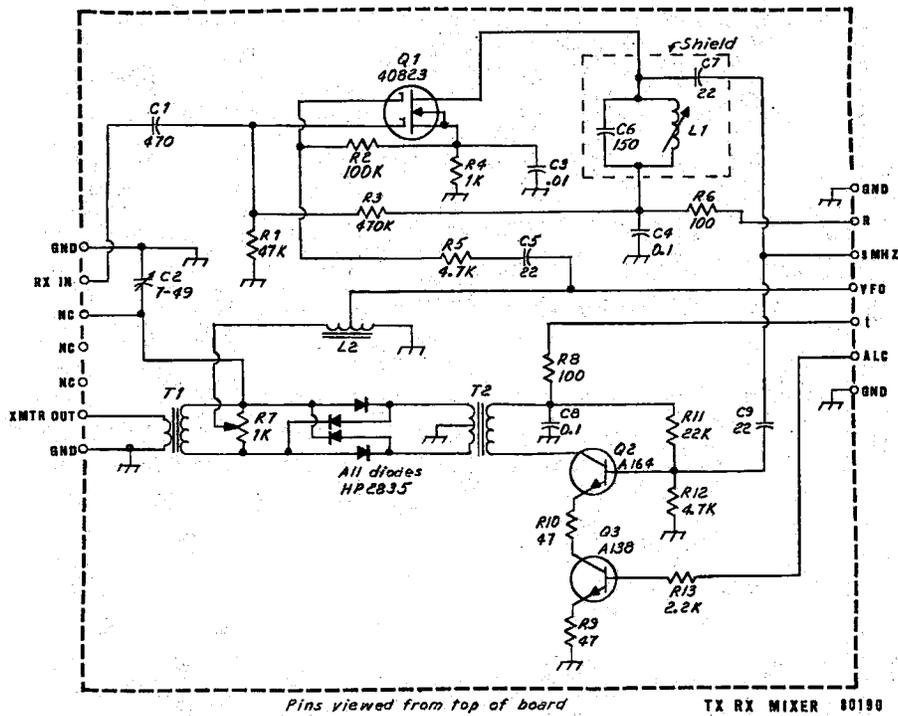
Q1 Source = 1.0v : Drain = 10v : Gate 1 = 1.0v : Gate 2 = 0.8v



Pins viewed from bottom of circuit board.



# TX-RX MIXER 80190



## 80208 I.F. BOARD

The 9MHz i.f. amplifier is a single stage consisting of Q1 and transformer T1. The input is not tuned. The output of the i.f. stage feeds a low distortion product detector, Q2. The recovered audio is amplified by transistors Q3, Q4 and Q5. The output of audio preamplifier drives an audio derived AGC transistor, Q6. Transistor Q7 is used to clamp the AGC line to ground during transmit. This eliminates any tendency of receiver blocking caused by stray rf in the AGC circuit. Model 245 CW filter, when used, is inserted between Q3 and Q4.

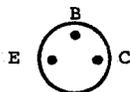
Pin Voltage Readings - (Readings under no signal conditions.)

Pin	Transmit	Receive	Pin	Transmit	Receive
GND	0	0	GND	0	0
IN	0	0	BFO	6.0	6.0
R	0	10	FILT OUT	0	0
+12	13	13	+10V	10	10
AGC OUT	0	0.5	AUDIO OUT	0	0
t	12	0.2	FILT IN	0	0
GND	0	0	GND	0	0

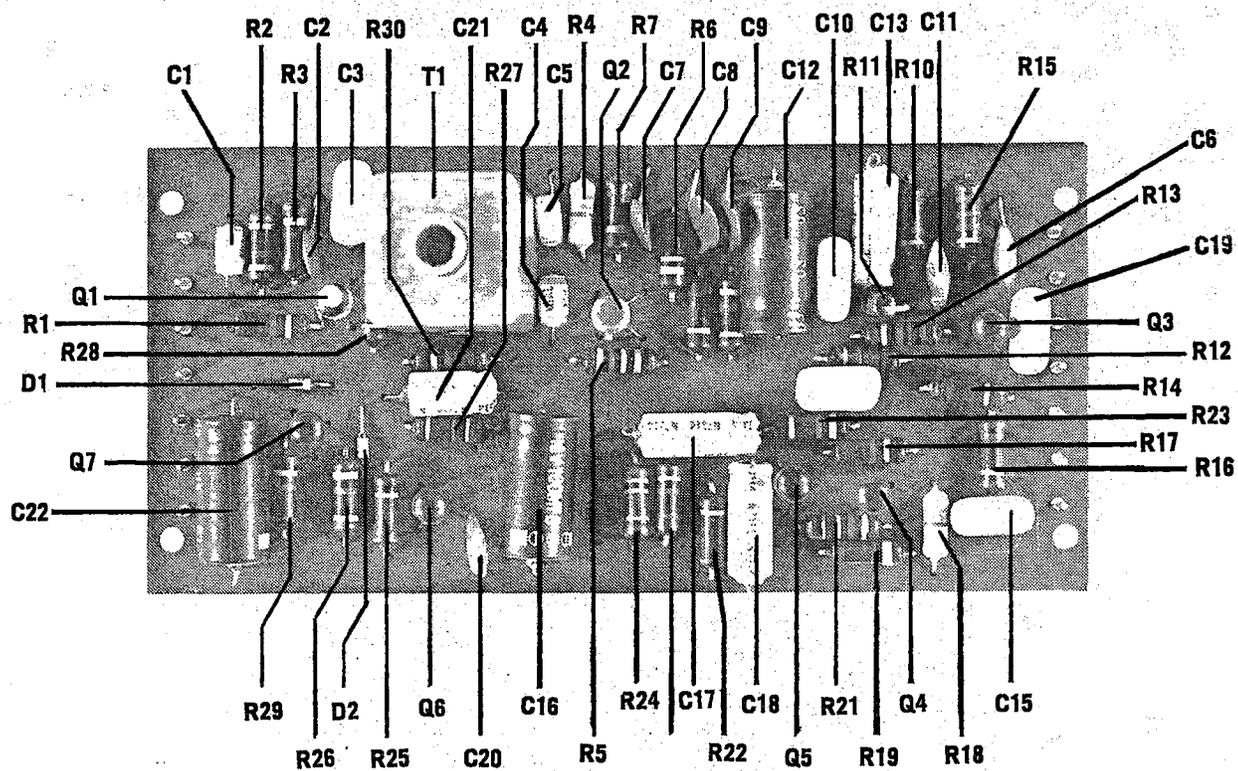
Transistor Voltage Readings

Transistor	Collector		Base		Emitter	
	Transmit	Receive	Transmit	Receive	Transmit	Receive
Q1	12.5	12.5	0	1.4	0	0.8
Q3	5.0	5.0	0.6	0.6	0.1	0.1
Q4	2.1	2.2	0.6	0.6	.05	.05
Q5	5.0	5.0	2.1	2.2	1.6	1.6
Q6	13	13	5.0	5.0	4.4	4.4
Q7	0	0.5	0	0.6	0	0

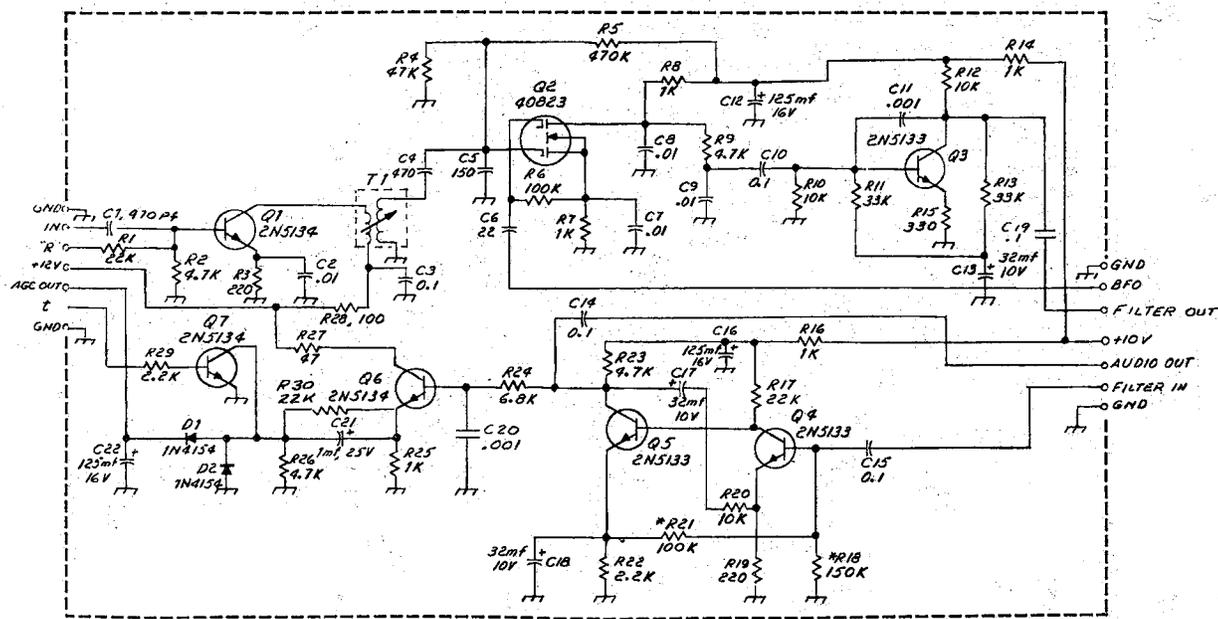
Q2 Source = 1.2 : Drain = 7.0v : Gate 1 = 1.2 : Gate 2 = 0.7



Pins viewed from bottom of circuit board.



# I.F. BOARD 80208



Pins viewed from top of board.

\* Adjust for 6 Volts at collector of output 2N5133, Q5. 80208 I.F. BOARD

## 80130 AUDIO PWR AMPLIFIER

Transistors Q1, Q3, Q4 and Q5 comprise a dc coupled complementary audio amplifier. Sufficient feedback, both ac and dc, is used to insure stability and provide extremely low distortion. Transistor clamp Q6 reduces the gain over 70 dB with a positive 10 volts applied to terminal "T". Transistor Q2 operates as an audio oscillator to monitor keying. It is activated by applying a positive keyed voltage to the pin labeled SIDE TONE. A side tone level control is provided on the circuit board to set the monitor level. Any speaker impedance above 4 ohms works satisfactorily.

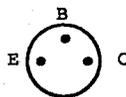
Pin Voltage Readings - (No signal conditions.)

Pin	Transmit	Receive
12v	13	13
SIDETONE	0	0
GND	0	0
OUTPUT	0	0
INPUT	0	0
t	12	0.2
GND	0	0

Transistor Voltage Readings (MODE switch in CW-2)

Transistor	Collector		Base		Emitter	
	Transmit	Receive	Transmit	Receive	Transmit	Receive
Q1	0.6	0.6	5.8	5.8	6.4	6.4
Q2	13	13	5.7*	0.1	5.2*	0
Q3	7.0	7.0	0.6	0.6	0	0
Q4	13	13	7.2	7.2	7.1	7.1
Q5	0	0	7.0	7.0	7.1	7.1
Q6	0	0	0.7	0	0	0

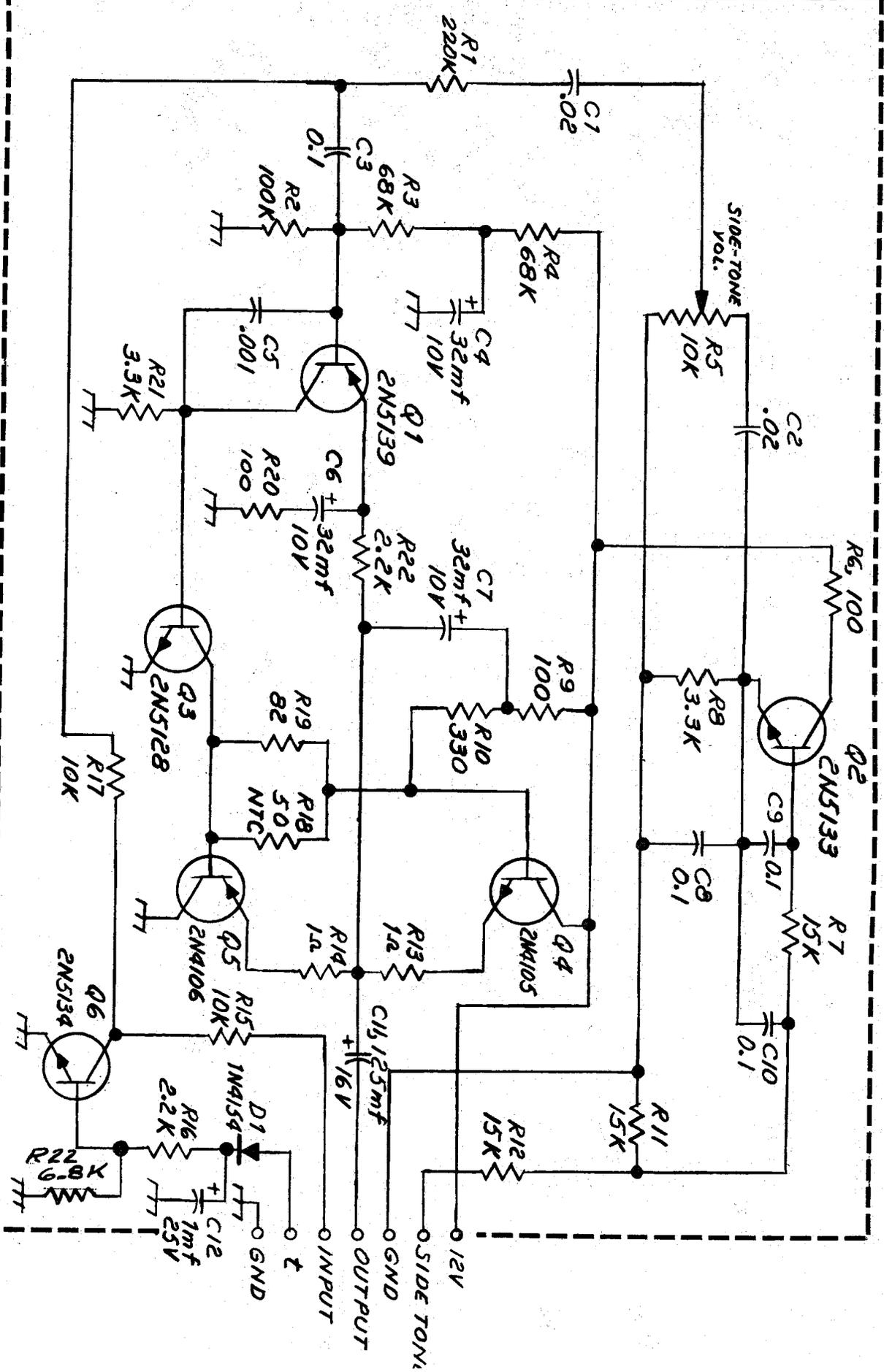
\* Key Down reading

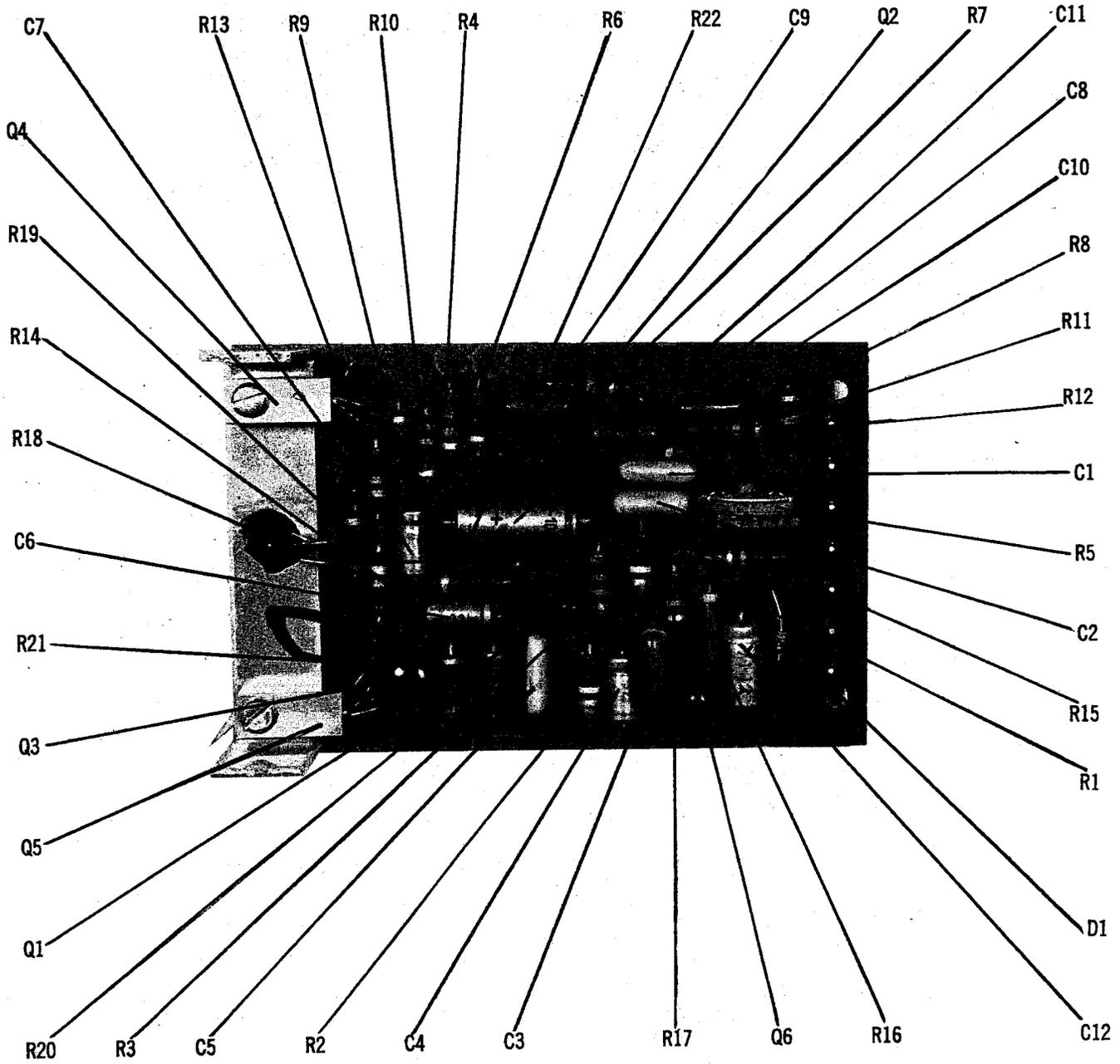


Pins viewed from bottom of circuit board.

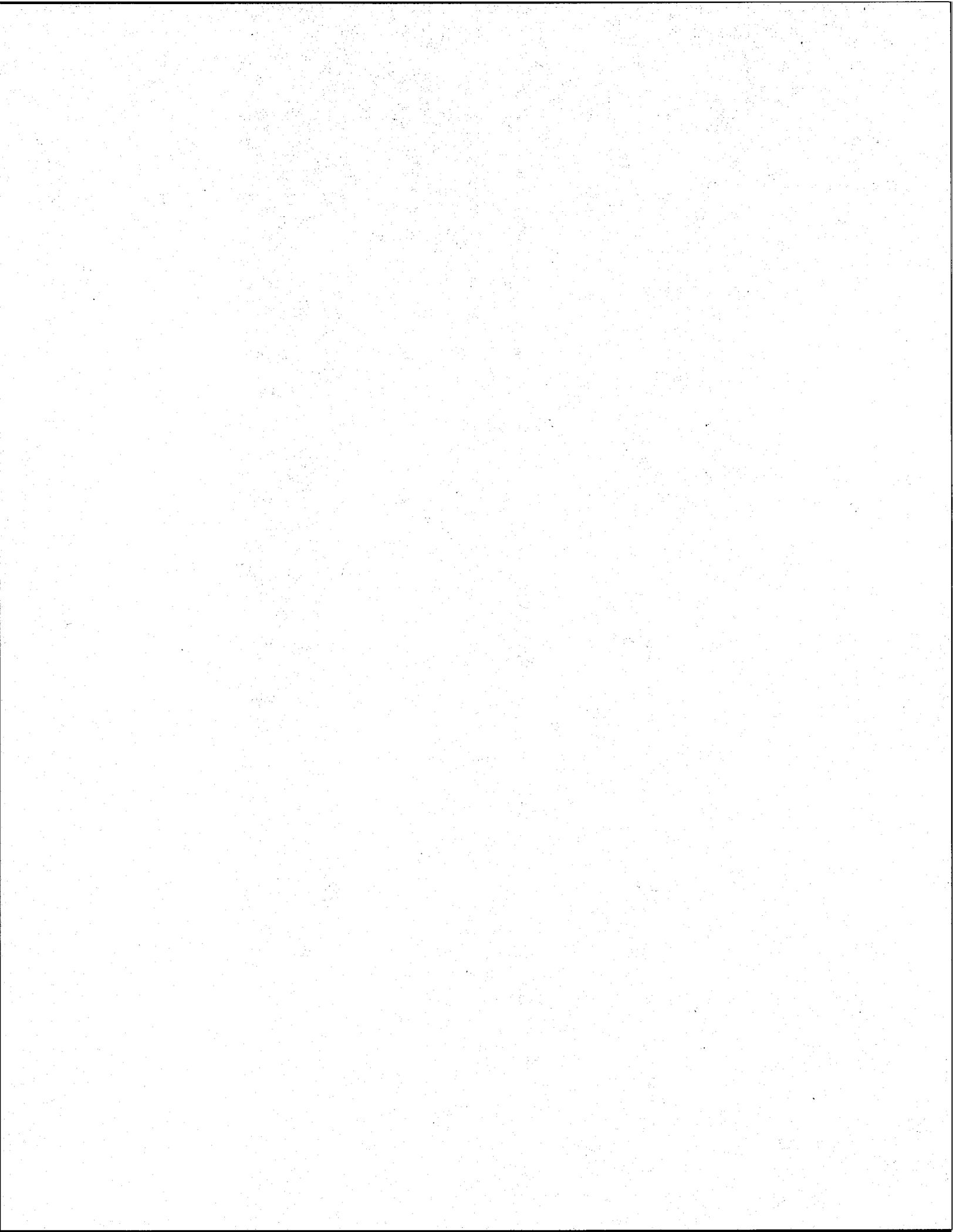
Pins viewed from top of board.

80130 AUDIO POWER AMP.





AUDIO POWER AMP



## 80170 CRYSTAL CALIBRATOR

Transistor Q1A is a crystal controlled oscillator operating at 100 kHz. It is set to the correct frequency by adjusting the capacitive load with C1, usually checked against WWV. The output of this oscillator is fed to a Schmitt trigger consisting of Q2A and Q2B, where it is transformed into a square wave. This output, in turn, is differentiated into a very sharp spike by C6 and R8. The resulting waveform is rich in harmonics which extend beyond 30 MHz.

So as to be easily discernable, the calibrator output is pulsed at a rate approximating three pulses per second. This is accomplished by effectively shorting the output to ground with Q4, which in turn is switched on and off by the unijunction oscillator, Q3.

Q1B serves to reduce the gain of the RF amplifier by presenting a low impedance across the control gate of the dual gate MOSFET. When the calibrator is switched off, by removing the +12 VDC, Q1B also loses its positive base voltage, and hence removes the short from the RF gain circuit.

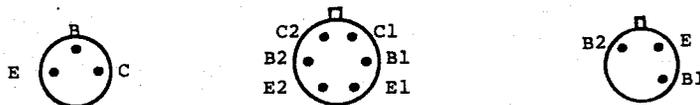
Pin Voltage Readings (Receive mode.)

Pin	On	Off
NC	-	-
OUT	0	0
GND	0	0
+12	13	0
DEFEAT	0	3.0
+12	13	0
GND	0	0

Transistor Voltage Readings (Calibrator in ON mode.)

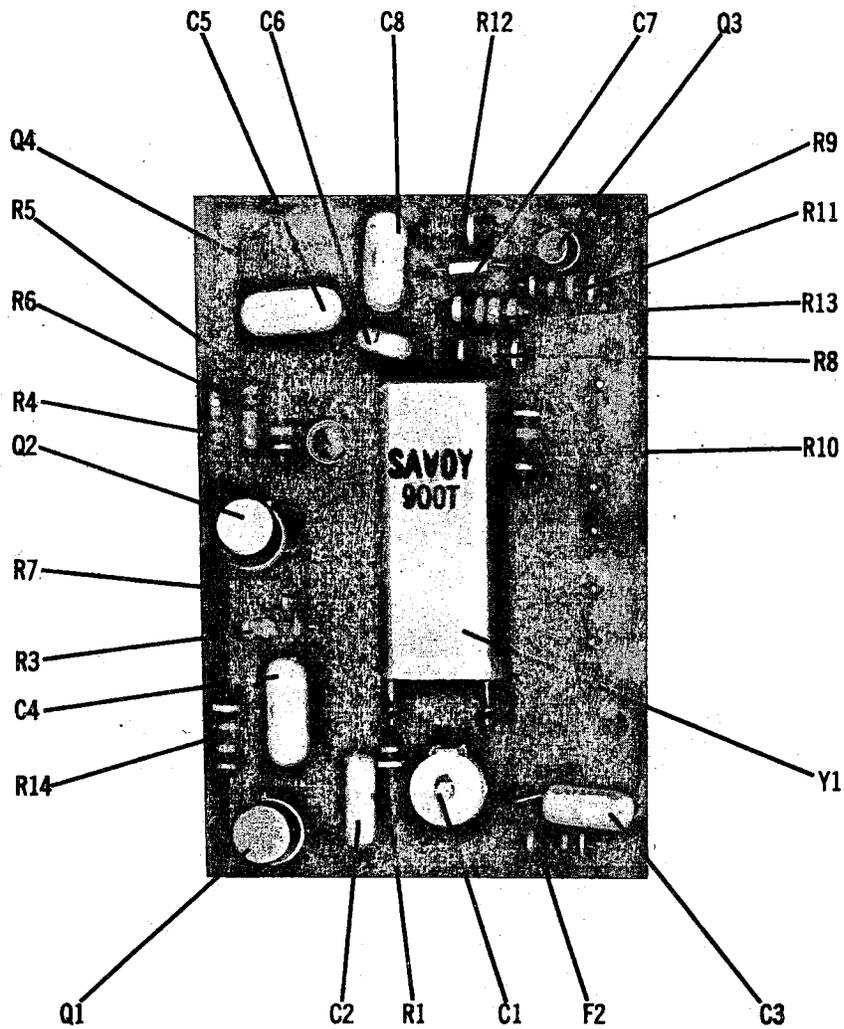
Transistor	Collector	Base	Emitter
Q1A	2.5	0.6	0
Q1B	0	0.6	0
Q2A	9.0	-0.06	0.6
Q2B	1.0	-1.1	0.6
Q4	0	0.6	1.0

Q3 E = 6.4v : B1 = 0.1v : B2 = 13v



Pins viewed from bottom of circuit board.





80170 CRYSTAL CALIBRATOR

3-23

Blank

## 80131 SSB GENERATOR

Transistor Q1 operates as a crystal controlled carrier generator. Capacitors C1, C2 and C3 set the crystal to the proper frequency for USB, LSB and CW. Capacitor C1 sets the crystal to the high frequency side of the filter passband. A positive 8 to 12 V at terminals "LSB" and "CW" will cause transistor switches Q2 and Q3 to place capacitors C2 and C3 in the circuit. These capacitors will set the crystal to the low frequency side of the filter passband. Both the upper and lower frequency carriers are positioned approximately 15 dB down on the filter skirts. For CW operation, the "CW" pin is brought to ground with a suitable switch. This removes capacitor C3 and places the generator in the filter passband. Frequency change is approximately 750 Hz. The total output of the oscillator is brought out to a terminal pin for use as a BFO. A portion of this output is fed to the balanced modulator, CA3053. The balanced modulator is an integrated circuit differential amplifier. Using an integrated circuit insures good balance under varying voltages and temperatures. The balanced modulator output passes through a four crystal filter terminated in 470 ohms. Transistors Q4 and Q5 are used as a microphone amplifier.

Alignment - Proper alignment of the SSB generator requires the use of a frequency counter and either an rf VTVM or oscilloscope with a response extending to 9 MHz. T1 is first peaked in the center of the pass band of the crystal filter and then C1, C2 and C3 are adjusted to set the carrier oscillator frequencies to the upper and lower skirts for SSB operation and 750 Hz up from the lower skirt for CW transmitting. Frequency adjustments should be kept within  $\pm 20$  Hz.

- 1.) Connect the frequency counter to the junction of R6 and R7. R7 is the 150 ohm resistor in the oscillator emitter lead. If there is no dc blocking capacitor in the input of the counter, connect the input through a .01 uF capacitor.
- 2.) Jumper the CWU terminal pin on the SSB assembly to chassis ground.
- 3.) Connect either the VTVM or oscilloscope to the OUTPUT pin terminal on the assembly.
- 4.) Set MODE switch to SB-R position and power the TRITON.
- 5.) Adjust capacitor C1 for a frequency reading of 9,001,500 Hz. This adjustment is a temporary one to place the oscillator in the center of the pass band.
- 6.) Peak T1 for maximum reading on the VTVM or 'scope. Reading should be approximately 0.5 to 1 volt, rms.
- 7.) VTVM or 'scope may now be disconnected. Remove CWU jumper.
- 8.) Readjust C1 now for 9,003,500 Hz.
- 9.) Set MODE switch to LOCK position, DRIVE control fully CCW. Adjust C2 for 9,000,600 Hz.
- 10.) Set MODE switch to SB-N position, DRIVE fully CCW. Adjust C3 for 8,999,850 Hz.
- 11.) Repeat steps 8, 9 and 10 in sequence until no further adjustments are necessary. C2 and C3 both determine the 9,999,850 Hz frequency and both affect the C1 setting slightly, so re-adjustment of all three usually is necessary after any one is changed.
- 12.) Reconnect the VTVM and null the carrier in SB-N position with the CARRIER BALANCE trimpot, R10.

Pin Voltage Readings - (SB-N mode, no signal.)

Pin	Transmit	Receive	Pin	Transmit	Receive
GND	0	0	OUTPUT	0	0
LBS	7.0	7.0	MIC VOL	0	0
CW	13	13	MIC VOL	0	0
+10 V	10	10	GND	0	0
t	0*	0	MIC	0	0
+10 V	10	10	RX I.F.	0	0
BFO	6.0	6.0	CWU	6.6	6.6

\*In LOCK mode, variable between 1.0 and 12 V, depending on position of DRIVE control.

Transistor Voltage Readings

Transistor	Collector		Base		Emitter	
	Transmit	Receive	Transmit	Receive	Transmit	Receive
Q1	9.5	9.5	5.5	5.5	6.2	6.2
Q2	0	0	0.8	0.8	0	0
Q3	0	0	0.8	0.8	0	0
Q4	5.7	5.7	2.2	2.2	1.6	1.6
Q5	5.0	5.0	0.8	0.8	0.1	0.1

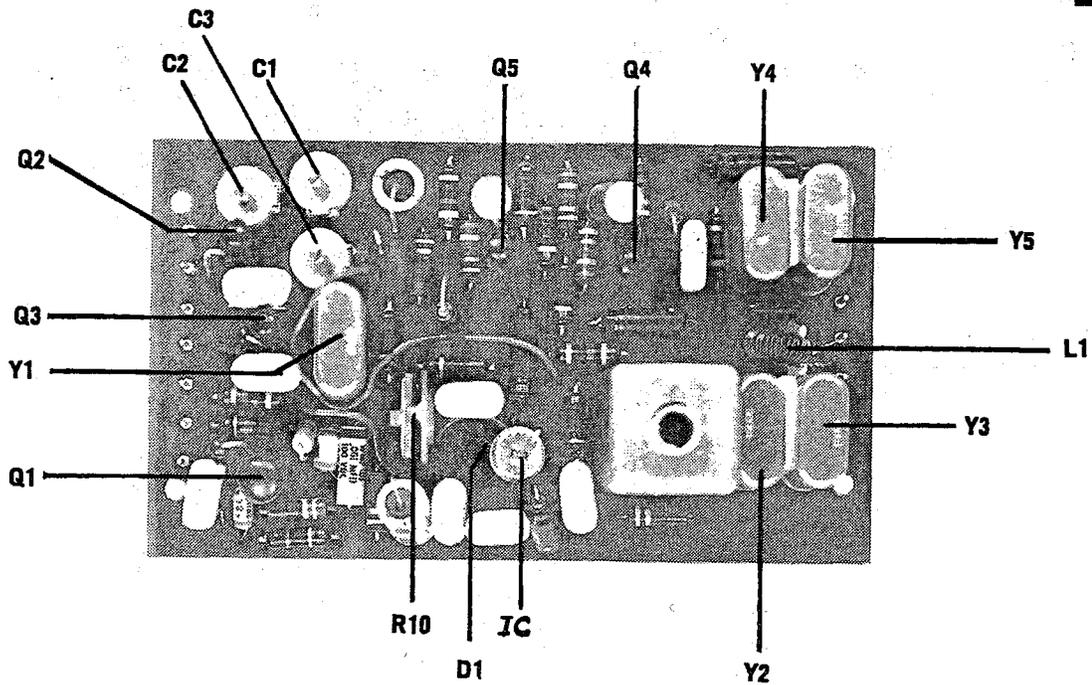
IC-1

	Transmit	Receive
Pin 1	6.5	6.5
Pin 2	1.9	0
Pin 3	0	0
Pin 4	1.2	0
Pin 5	6.5	6.5
Pin 6	10	10
Pin 7	0*	0
Pin 8	10	10

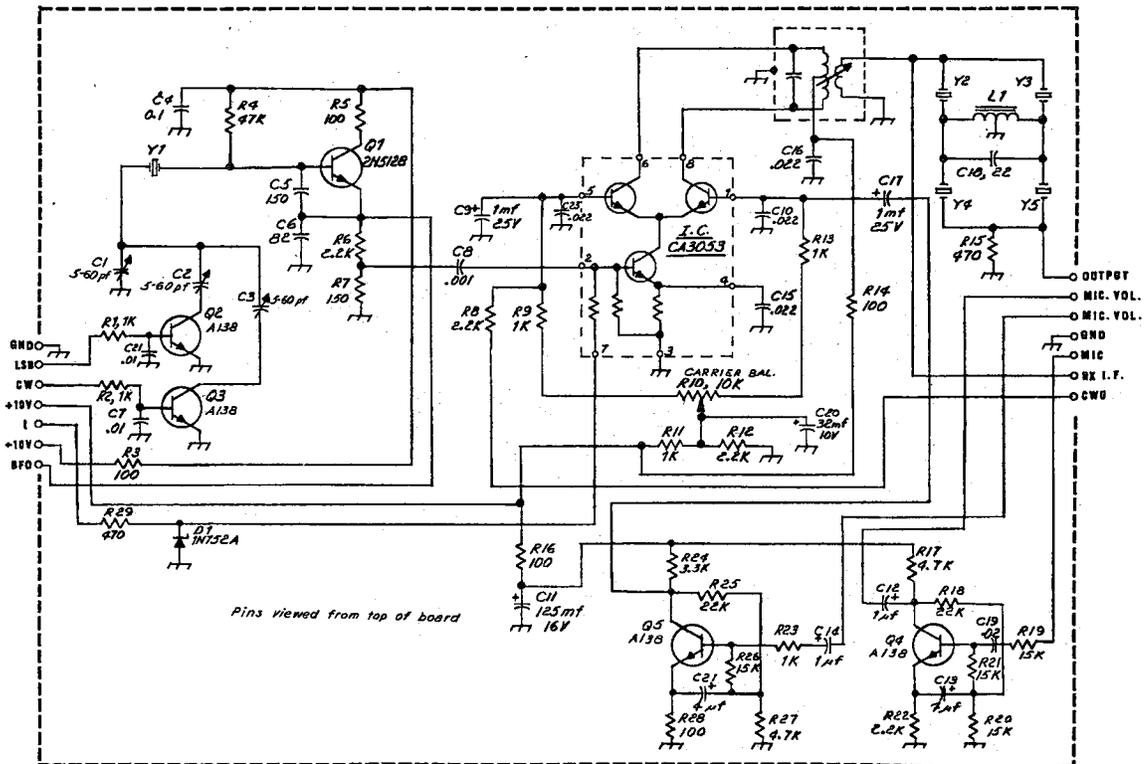
\* In LOCK position voltage between zero and 5.6 volts, depending on position of DRIVE control.



Pins viewed from bottom of PC board.



# SSB GEN 80131



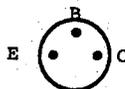
SSB GENERATOR 80131

80195 LOW LEVEL RF AMP.

Two low level rf amplifiers are used following the mixer and between band-pass filters. These stages are broadband and cover the range of 3.0 to 30.0 MHz. Transistor Q2 is an ALC control element. It reduces the gain of Q1 as the ALC voltage is reduced. R5 and L1 are used to level the gain over the low end of the frequency range.

Pin Voltages - (Drive control at zero.)

Pin	Transmit	Receive
GND	0	0
OUT	0	0
+12	13	13
ALC	4.2	4.0
1.4V BIAS	1.4	0
IN	0	0
GND	0	0



Pins viewed from bottom of PC board.

80192 DRIVER

The Driver board contains three stages of amplification. All stages are broadband in nature and will cover the frequency range of 3.5 to 30.0 MHz. The input and output impedances have been designed for 50 ohms.

The first stage operates in class "A". A stiff bias of 1.4 volts is applied to the base during transmit. The first stage idles at a current of approximately 50 mA. The second stage, Q2 & Q3, is a push-pull, class A amplifier. Its bias is also derived from the 1.4 volt supply during transmit. The second stage idles at approximately 100 mA. The last stage, Q3 and Q4, operates in Class AB push-pull. Bias is set by diode D1, and the output stage idles at approximately 15 mA (no signal). The output matching network, L3-L4-L5 & L6, is a broadband transmission line design.

Pin Voltage Readings - (All readings are taken in the transmit SSB mode and under no-signal conditions. DRIVE control fully CCW.)

Pin	Transmit	Pin	Transmit
GND	0	GND	0
+12	13	OUT	0
+1.4	1.4	+12	13
IN	0	NC	-
GND	0	NC	-
GND	0	+12	13
t	12	GND	0

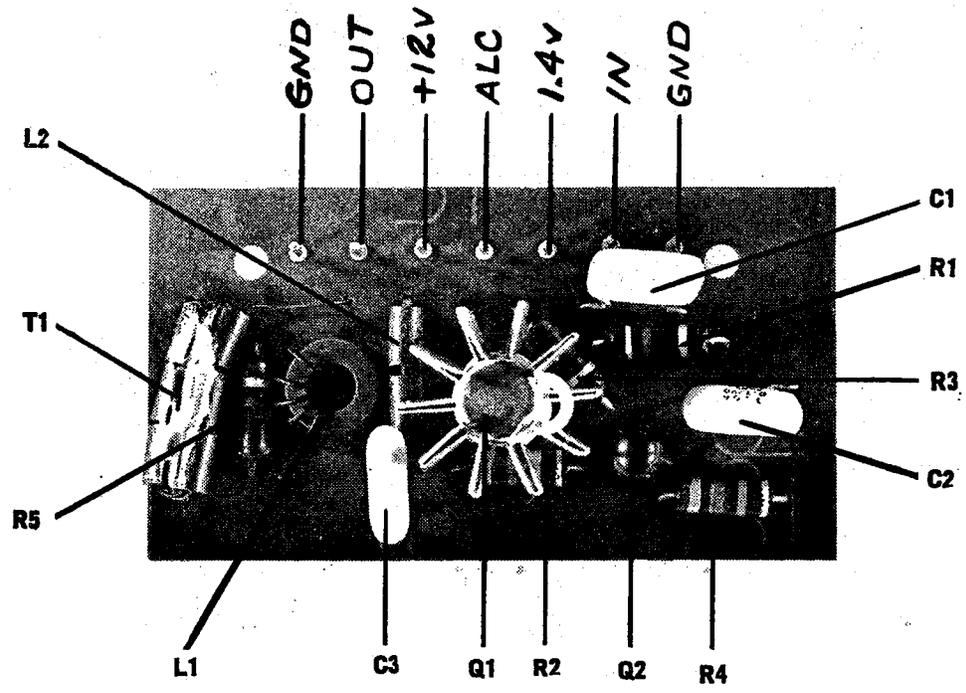
Transistor Voltage Readings

Transistor	Collector	Base	Emitter
Q1	13	1.3	0.6
Q2	13	1.3	0.6
Q3	13	1.3	0.6
Q4	13	0.6	.01
Q5	13	0.6	.01

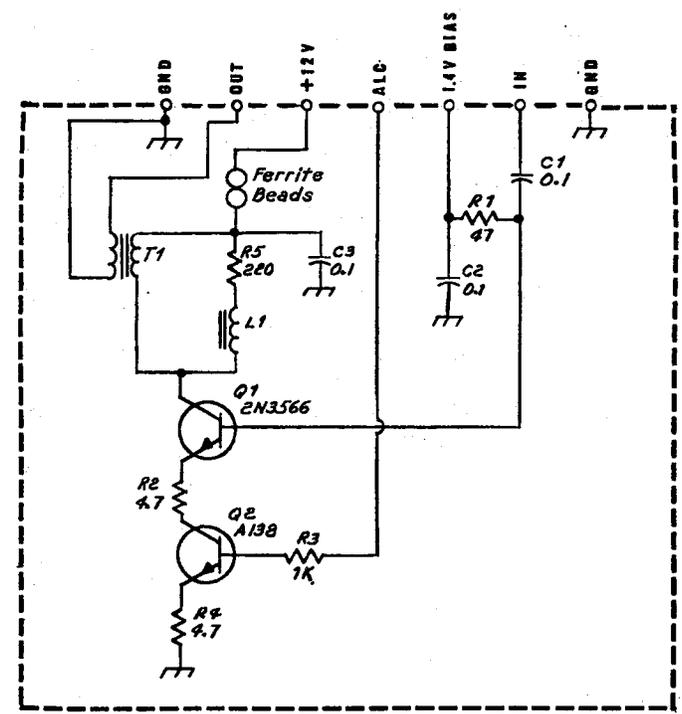


Pins viewed from bottom of PC board.

3-28

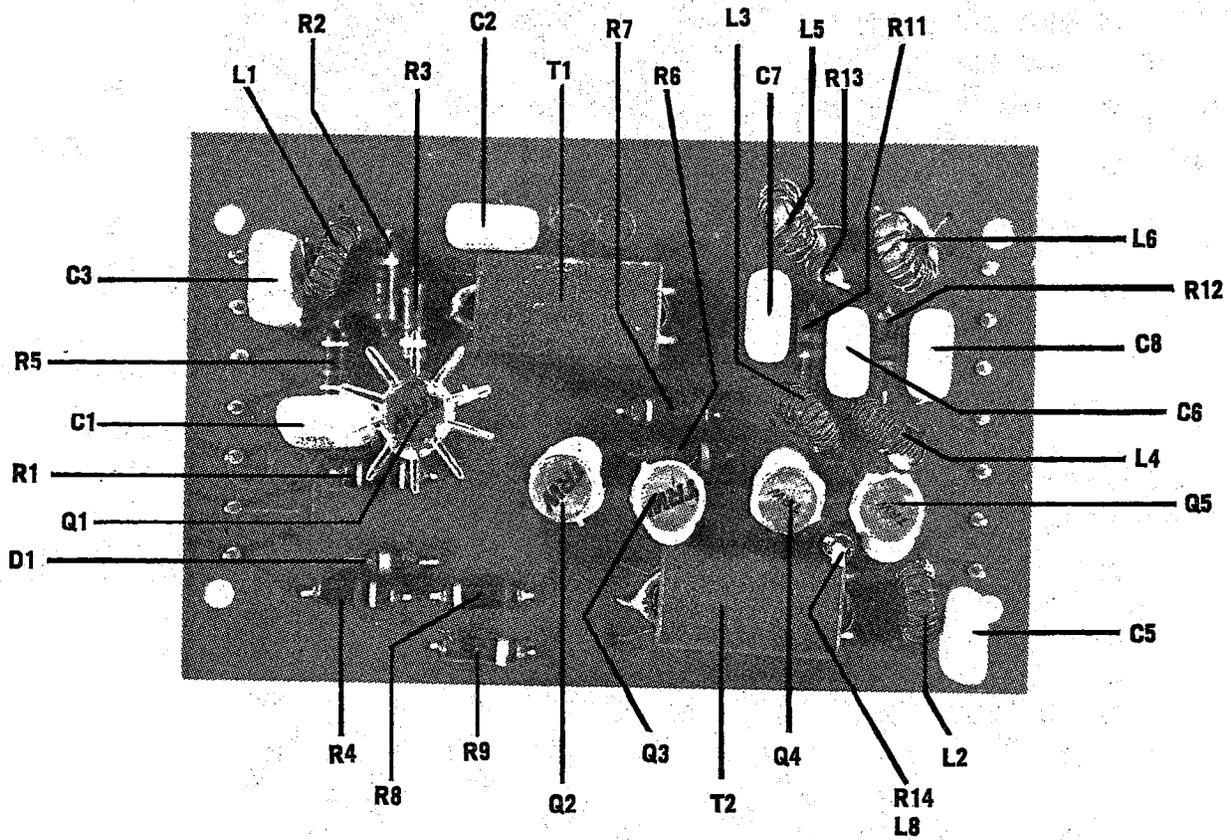


### LOW LEVEL R-F AMP 80195

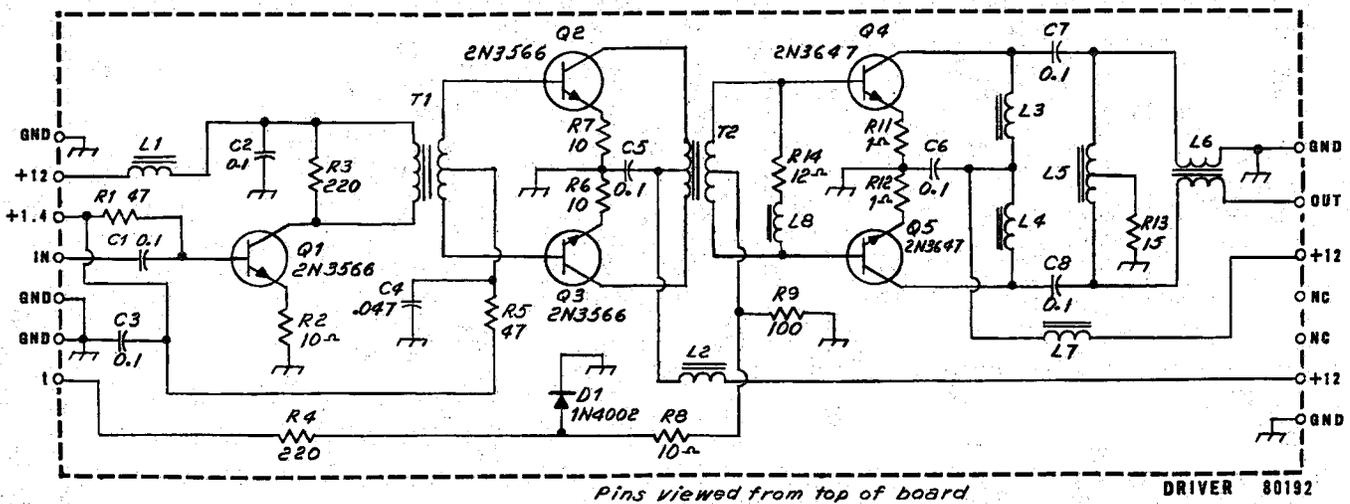


Pins viewed from top of board LOW LEVEL R F AMP 80195

21 T



# DRIVER 80192

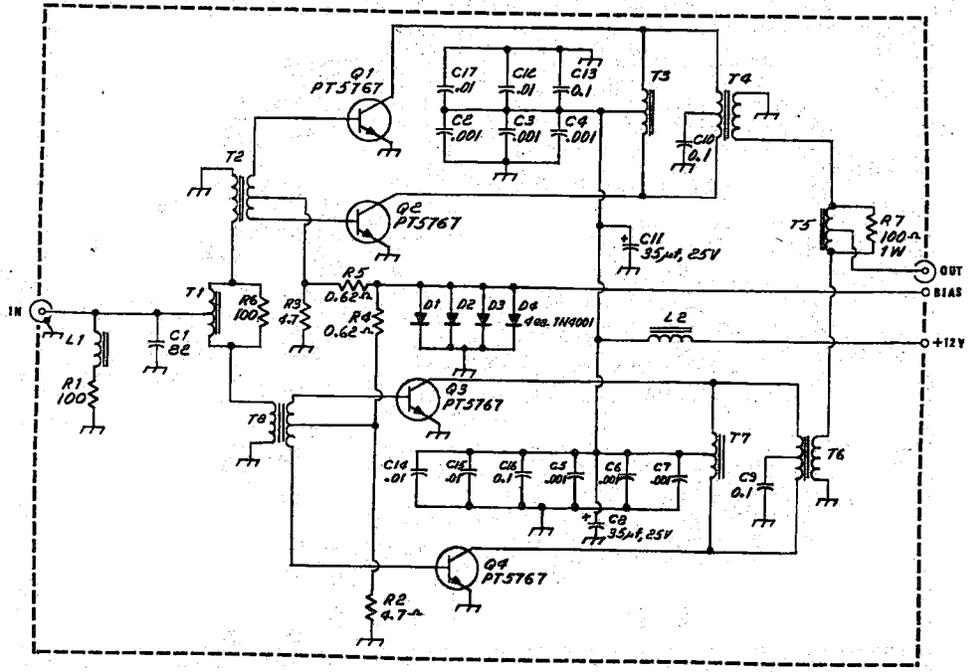
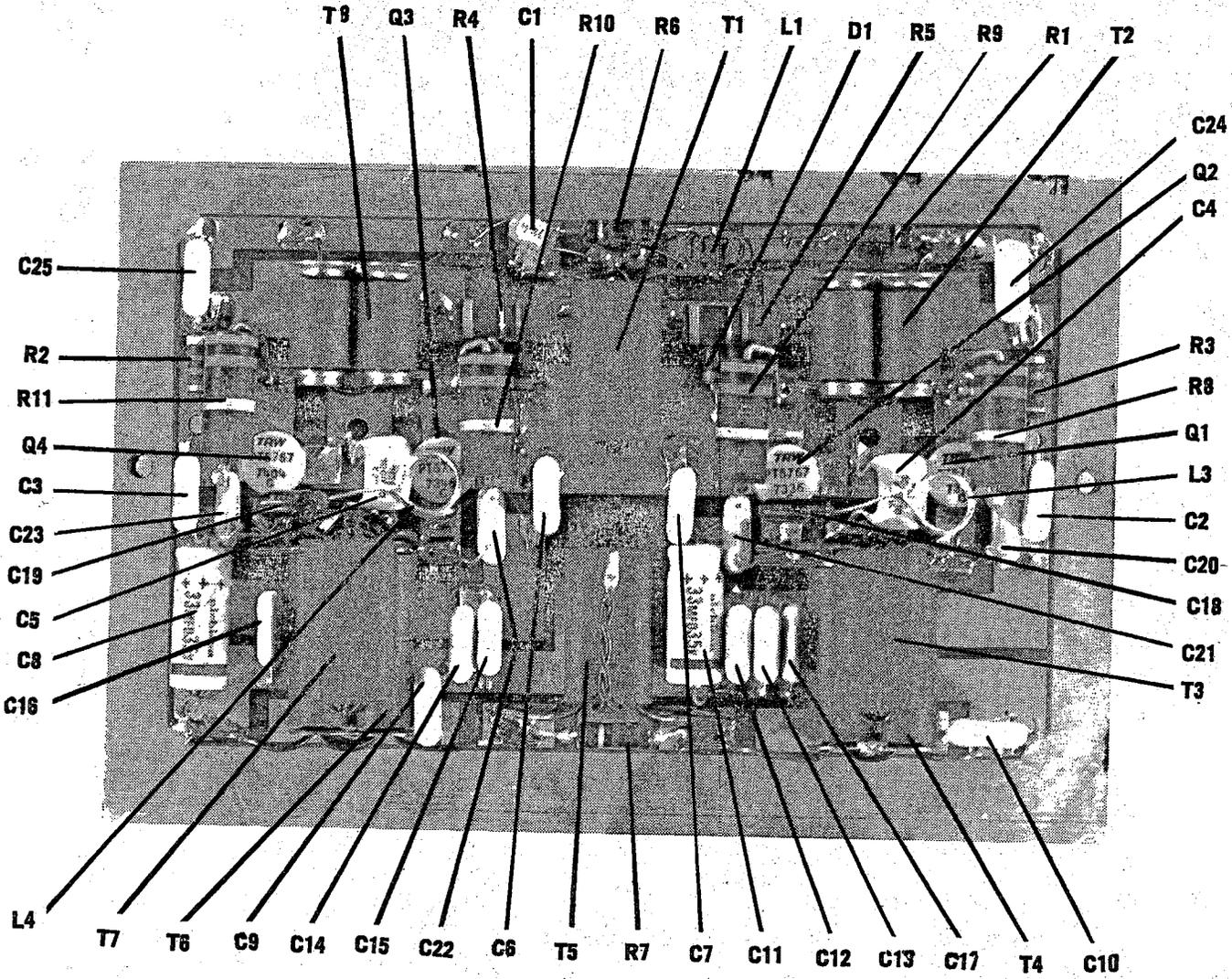


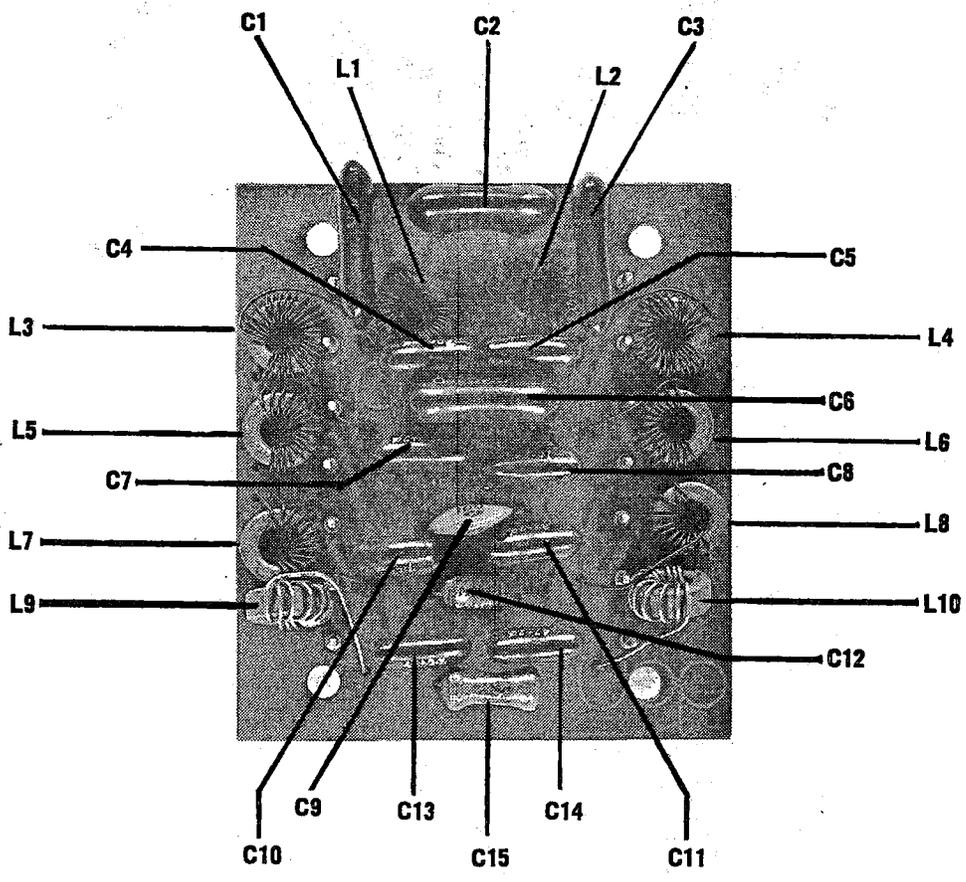
## 80207 FINAL RF AMP

The TRITON I final amplifier has two power transistors in a broadband push-pull configuration. It is capable of a conservative 100 watts input over the range of 3.5 to 30 MHz. Due to the push-pull configuration, the even harmonics are attenuated by approximately 40dB. A low pass filter (part number 80209) follows the power amplifier. Individual filters with the appropriate cut-off frequency are switched into the circuit for each band. The TRITON II final amplifier is a combination of two TRITON I amplifiers using a coupler at the input and output to add them together. The low pass filters following either the TRITON I or TRITON II are designed to match the amplifier output to a nominal 50 ohm load.

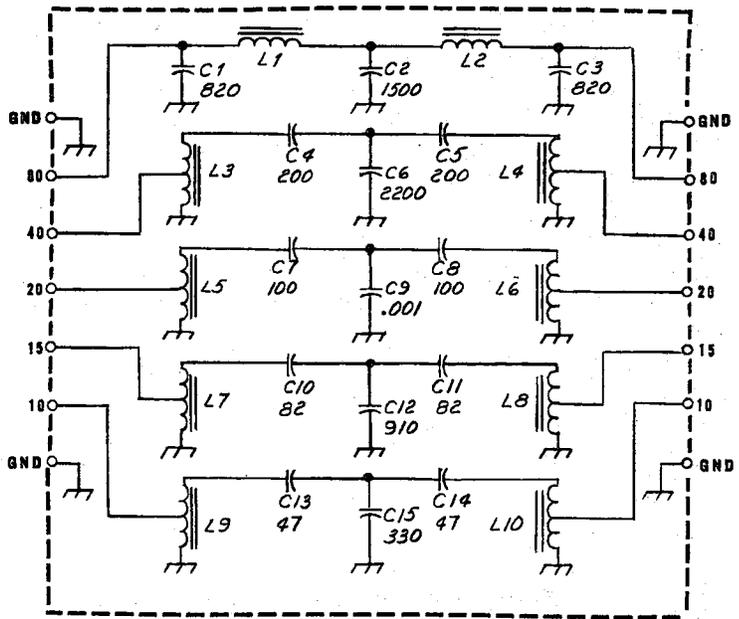
Transistor Voltages - (LOCK mode, DRIVE fully CCW.)

Transistor	Collector	Base	Emitter
Q1 - Q4	13	0.6	0





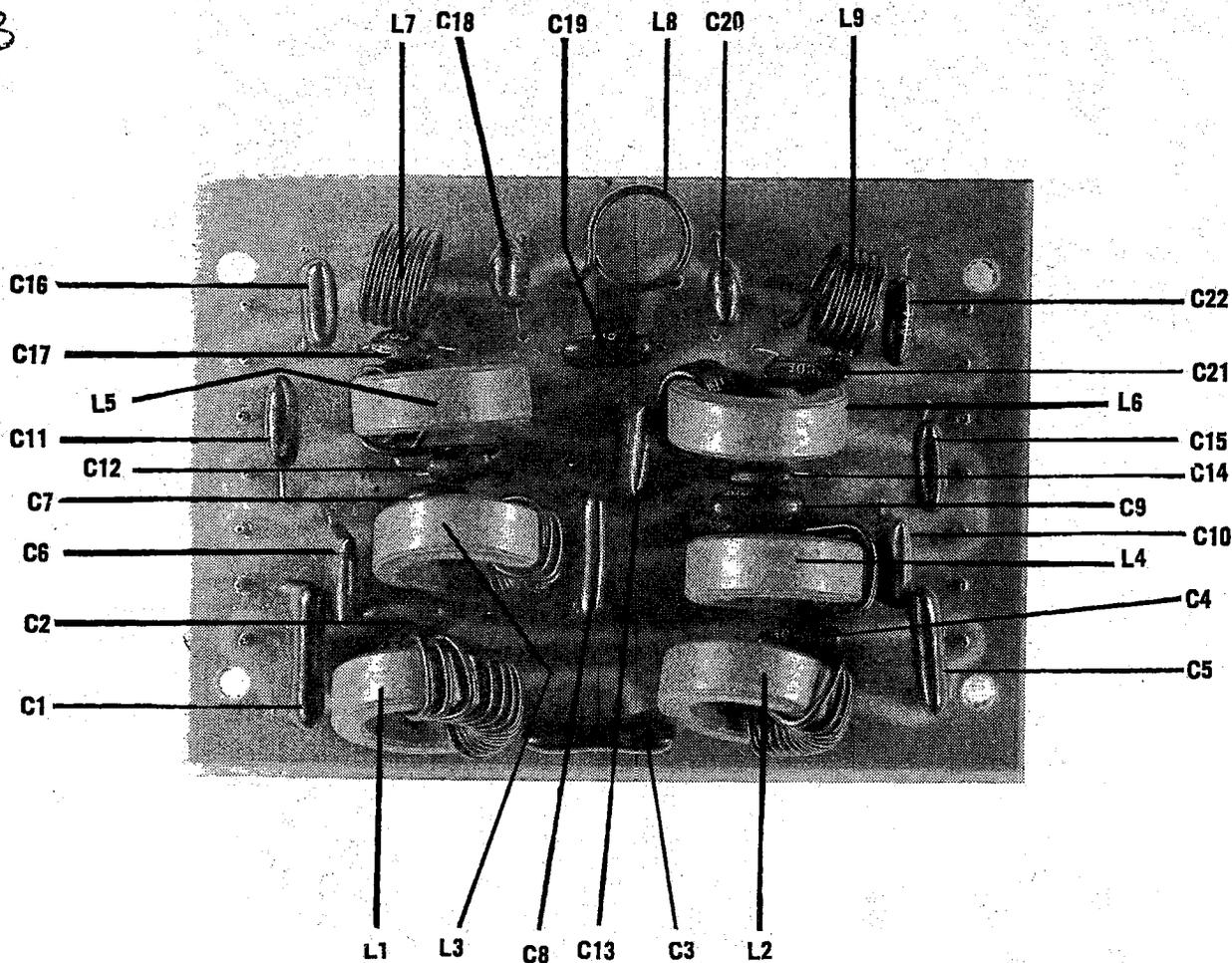
### BANDPASS FILTERS 80196



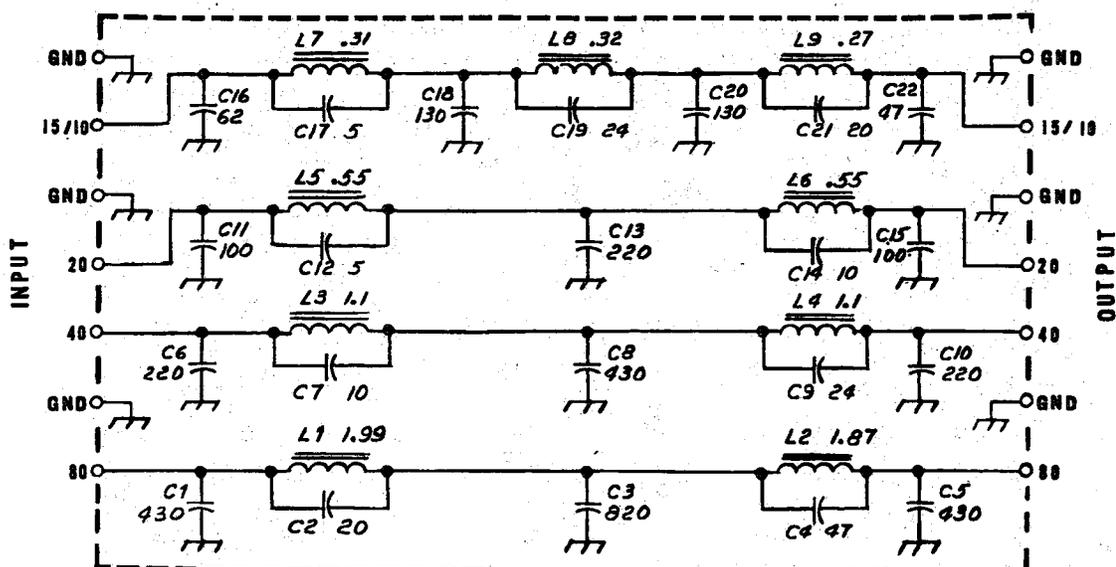
*Pins viewed from top of board*

BANDPASS FILTERS 80196

3-33



### LOW PASS FILTER 80209



Pins viewed from top of board. LOW PASS FILTER 80209  
 All capacitors in pf.  
 All inductors in  $\mu$ h.

80194 SWR-ALC

The TRITON ALC is controlled by sensing the output power. Q1 operates as an emitter follower to isolate the high impedance SWR bridge from the ALC control circuits. When the ALC voltage set by potentiometer R11 exceeds the Zener voltage of D7 transistors Q2 and Q3 conduct causing the ALC voltage to drop. Resistor R7 and the ALC light are used as the collector load for transistors Q2 & Q3. When maximum power output is reached, the ALC control voltage drops and the ALC light operates.

Forward - In transmit the panel meter is automatically switched to read forward power. It is not calibrated in watts and is intended as a relative indication only. The meter is set to full scale with potentiometer R8 when the TRITON is operating at rated power.

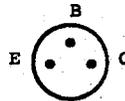
Break-In - Full cw break-in is available in the TRITON. The transmitter section is connected directly to the antenna socket. The receiver is connected to the antenna through relay K1. When transmitting, the relay grounds the receiver input. There is a time delay built into the transmitter so that the receive input is grounded before the transmitter is turned on. Diodes D4 and D5 are across the receiver input for transient protection.

Pin Voltage Readings - (No signal conditions, DRIVE control CCW.)

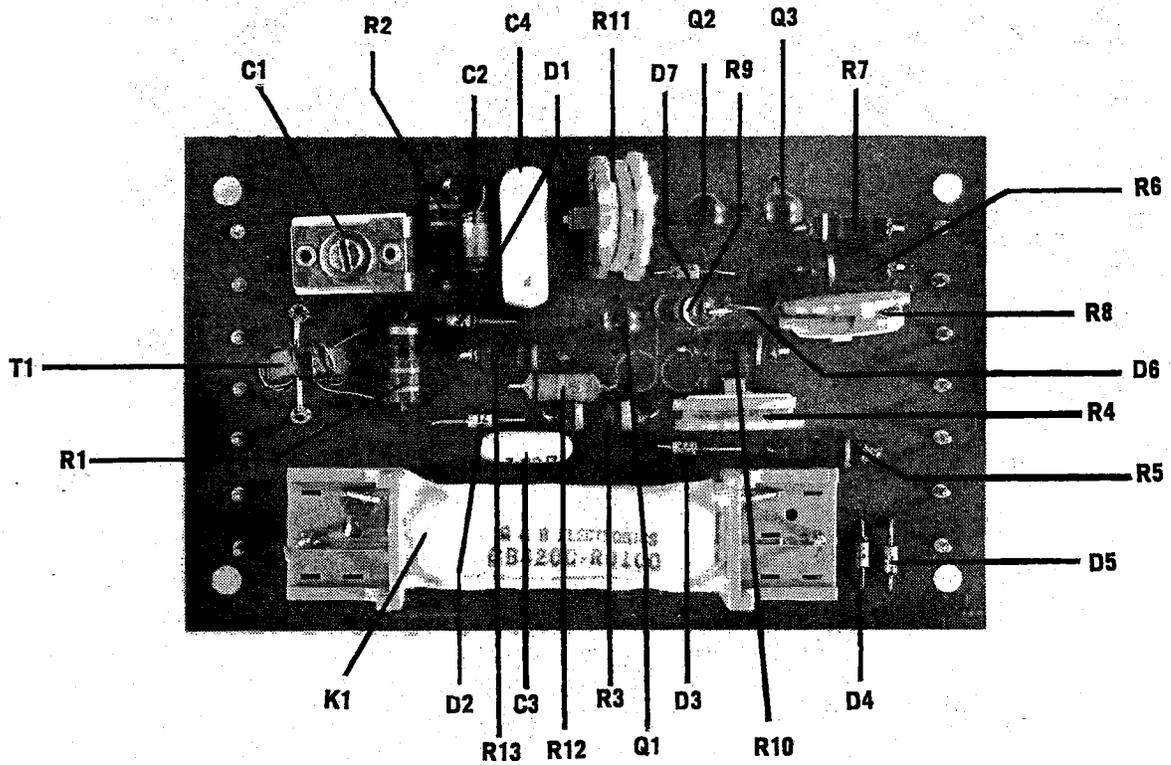
Pin	Transmit	Receive	Pin	Transmit	Receive
GND	0	0	ALC LIGHT	13	13
IN	0	0	ALC	4.2	4.0
IN	0	0	FWD	0.1	10
OUT	0	0	+10V	10	10
OUT	0	0	REV	0	0
GND	0	0	t	12	0.2
GND	0	0	RCV ANT	0	0

Transistor Voltage Readings

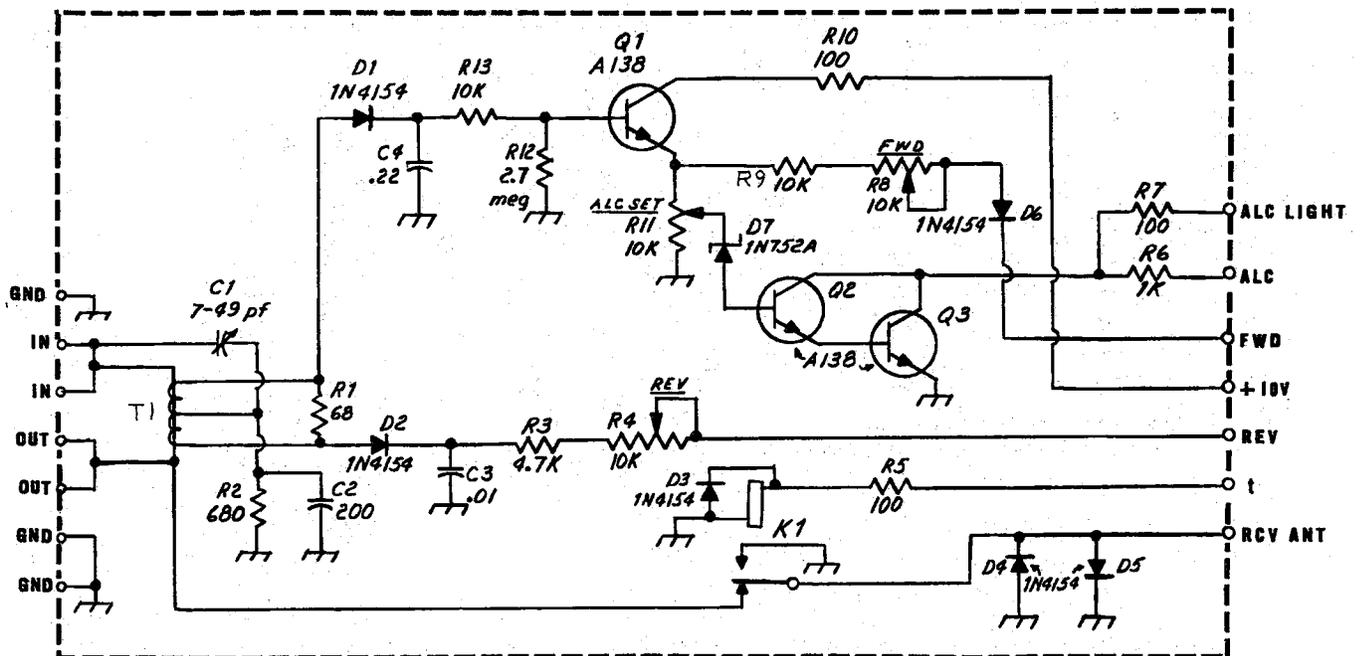
Transistor	Collector		Base		Emitter	
	Transmit	Receive	Transmit	Receive	Transmit	Receive
Q1	10	10	0	0	0	0
Q2	13	13	0.2	0.2	.05	.05
Q3	13	13	.05	.05	0	0



Pins viewed from bottom of PC board.



## SWR-ALC 80194



*Pins viewed from top of board*

SWR-ALC 80194

## 80191 OFFSET LIGHT-T/R

A light has been added to the offset tuning circuit to indicate when the offset is in operation. The control pin (OT ON-OFF) is connected to the switch on the OFFSET control, R3 (main schematic). When the knob is pulled out (off position) the OT ON-OFF pin goes to a positive voltage. This allows Q2 to conduct and drop the voltage to the base of Q3. Transistor Q3 is turned off and the OT light goes out. The OT ON-OFF pin and offset circuit are connected to the transmit bias line so that the offset is automatically removed during transmit.

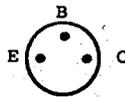
TR Relay - This section of the board is intended for use with external equipment, such as a linear or receiver, and does not perform any function necessary to the operation of the TRITON. The control voltage is taken from the transmit bias. A delayed relay drop-out is adjustable with thumb potentiometer R8, located on the circuit board. It is not intended that this relay be used for instant break-in with a high power linear.

Pin Voltage Measurements - (OFFSET knob in)

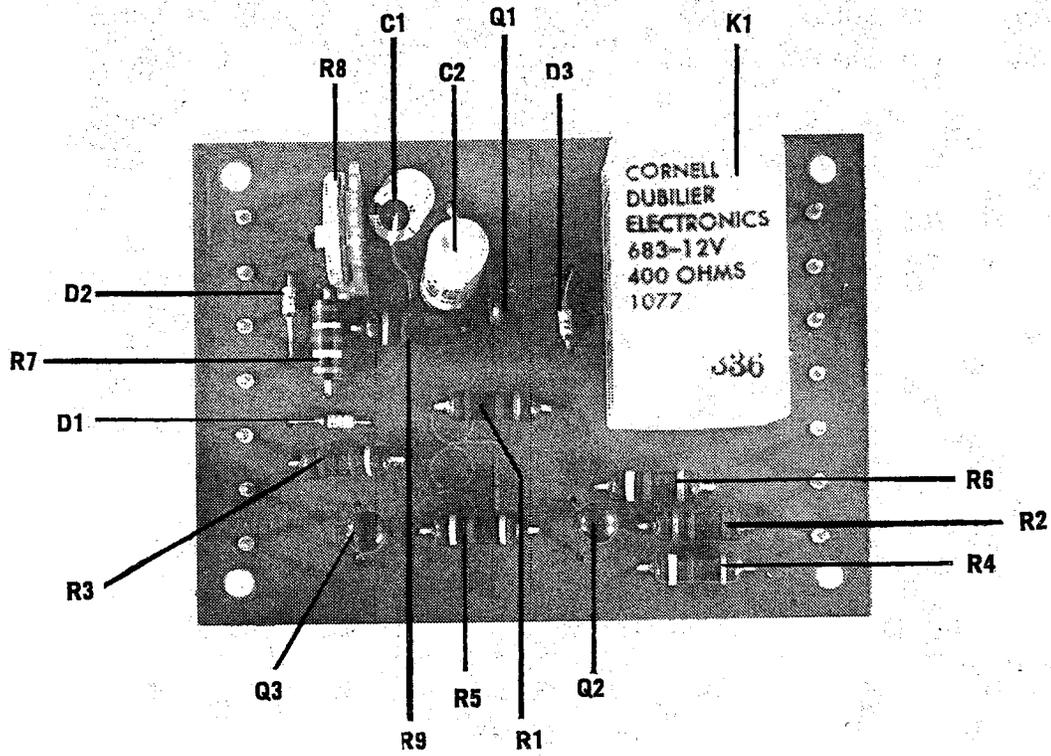
Pin	Transmit	Receive	Pin	Transmit	Receive
GND	0	0	NC2	0	0
t	12	0	NO2	0	0
NC	-	-	NO1	0	0
OT ON-OFF	12	0	NC1	0	0
OT LITE	10	4.8	COM2	0	0
GND	0	0	COM1	0	0
GND	0	0	+12	12	12

Transistor Voltages

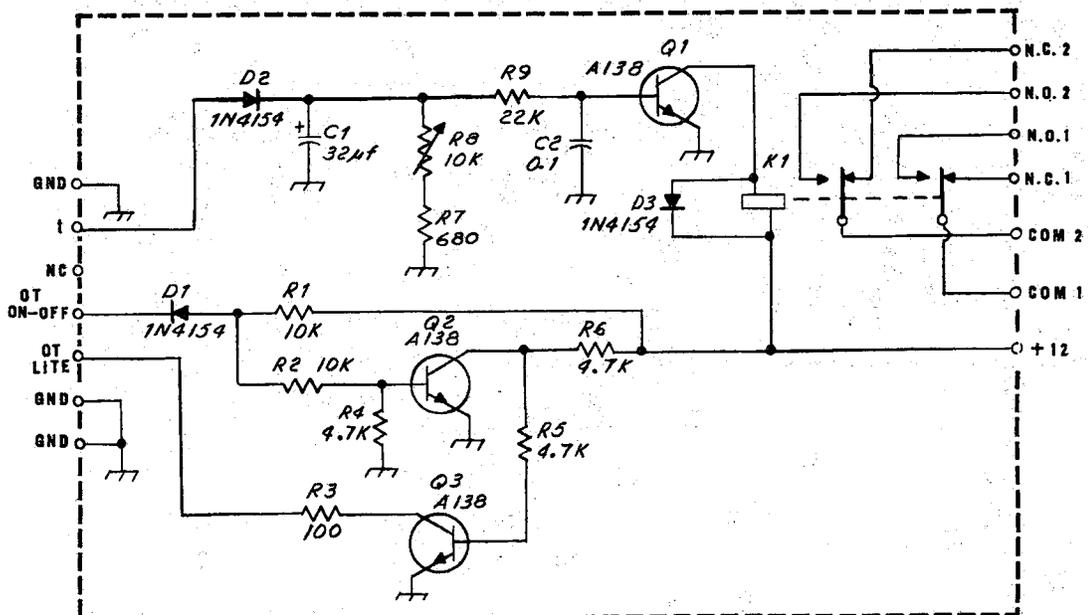
Transistor	Collector		Base		Emitter	
	Transmit	Receive	Transmit	Receive	Transmit	Receive
Q1	0.2	13	0.7	0	0	0
Q2	0	6.6	0.7	0.2	0	0
Q3	10	0.2	0	0.8	0	0



Pins viewed from bottom of PC board.



# OFFSET LIGHT-T/R 80191



Pins viewed from top of board.

OFFSET LIGHT - T/R 80191

## 80193 CONTROL BOARD

The Control board provides the necessary bias voltages for the transmitter and receiver stages. It also contains the S meter adjust, offset tuning voltages, a low current regulated 10 volt supply, and the AGC control circuit.

Transmitter Bias - Transistors Q1, Q2, Q3 and Q4 form a complementary switch that controls the transmitter bias. Pins "t", "T" and +1.4 are near zero volts during receive. When the T/R pin is grounded, "t" goes to +11.4 volts, "T" goes to +10.8 volts and the +1.4 pin goes to +1.4 volts. The voltage at this pin is determined by the two diodes D2 and D3. This voltage must be between 1.1 volts and 1.5 volts for proper operation of the transmitter stages.

Receiver Bias - Transistors Q5, Q6 and Q7 form a second complementary switch to control the receiver bias and provide the AGC. When receiving, pin "R" is at +11.4 volts. When the T/R pin is grounded, pin "R" goes to zero.

AGC Operation - The AGC voltage from the I.F. board 80208 is connected to the pin marked AGC. When a strong signal is received, the small positive voltage at the AGC pin starts to turn on Q6. This in turn, lowers the voltage at the "R" pin and reduces the gain of the receiver. Diode D1 isolates the AGC action of the "R" section from the transmit bias section while still retaining the desired voltage changes when the T/R pin is grounded.

S Meter - Potentiometer R12 sets the S meter zero by providing a reference voltage equal to the no-signal "R" voltage. The meter is connected between this reference voltage and the "R" voltage. As the "R" voltage is reduced during AGC action, the meter reads the relative signal strength. Resistor R13 sets the full scale reading. Transistor Q8, diodes D4 and D5 switch the meter to read forward power during transmit.

Pin Voltage Readings - (No antenna signal: OFFSET knob in.)

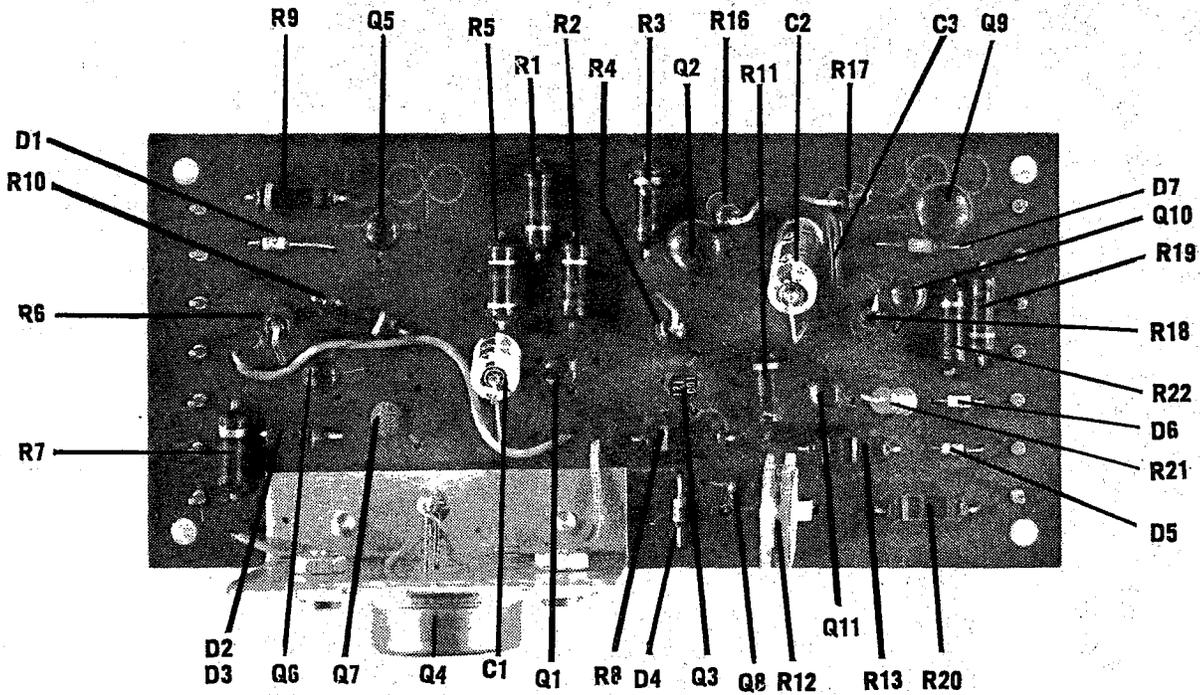
Pin	Transmit	Receive	Pin	Transmit	Receive
T/R	0	10	GND	0	0
R	0	10	+12	13	13
AGC	0	0.5	+10	10	10
t	12	0.2	OFFSET	5.2	6.8
+1.4	1.4	0	OFFSET ON-OFF	12	0.2
+12	13	13	S MTR	0	10
T	11	0	OFFSET	5	3.4

Transistor Voltage Readings

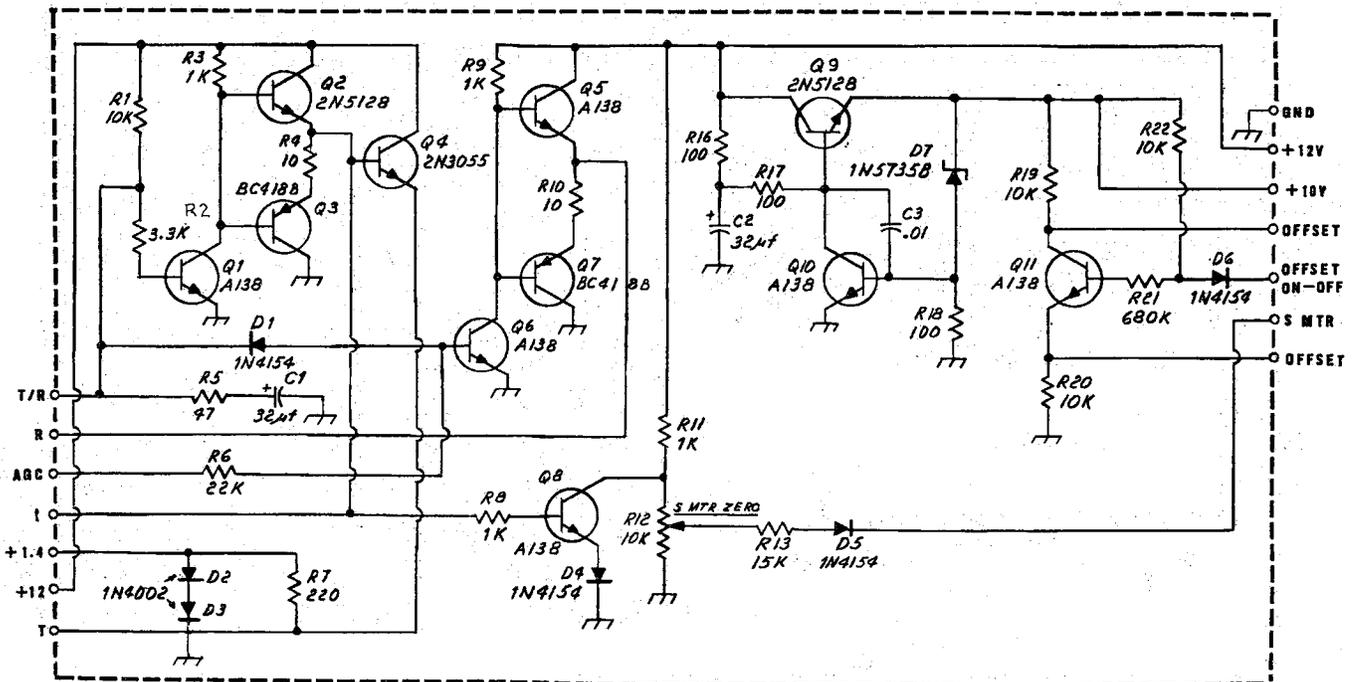
Transistor	Collector		Base		Emitter	
	Transmit	Receive	Transmit	Receive	Transmit	Receive
Q1	12	0	0	0.7	0	0
Q2	13	13	12	0	12	0.2
Q3	0	0	12	0	12	0.2
Q4	13	13	12	0.2	11	0
Q5	13	13	0.7	10.5	1.0 0.1	10
Q6	0.7	10.5	0	0.5	0	0
Q7	0	0	0.7	10.5	0.1	10
Q8	0.9	11	1.6	0.2	0.9	0
Q9	13	13	10.5	10.5	10	10
Q10	10.5	10.5	0.6	0.6	0	0
Q11	5.2	6.8	5.6	0.8	5.0	3.4



Pins viewed from bottom of PC board.



# CONTROL BOARD 80193



Pins viewed from top of board

CW FILTER, MODEL 245

The Model 245 CW Audio Filter is an accessory intended for use with TEN-TEC TRITON transceivers. The filter is a plug-in PC board assembly containing four active operational amplifier stages, each stage output available at one of the seven pins of the connector. The other pins are used for input, ground and +12 VDC connections.

When installed in the TRITON transceiver, either one or all four of the stages can be selected with the MODE switch on the TRITON. The CW-1 position of this switch will insert all four stages, resulting in a 150 Hz wide band-pass centered at 750 Hz. The CW-2 position selects only one stage so that the skirt attenuation is much less.

SPECIFICATIONS

- BANDWIDTH - 150 Hz at half power point, 1.45 kHz at - 60 in CW-1 position.  
260 Hz at half power point, 2.8 kHz at - 20 dB in CW-2 position.
- SHAPE FACTOR - 7.2 to 1 at 6/60 dB in CW-1 position.
- CENTER FREQUENCY - 750 Hz.
- INPUT IMPEDANCE - 220 k.
- OUTPUT IMPEDANCE - Less than 10 ohms.
- POWER SUPPLY - +12 VDC @ 2 mA.
- INSERTION GAIN - App. 2.5 dB.

INSTALLATION in TEN-TEC TRITON transceivers

The Model 245 is easily installed in the TRITONS, which already have provisions for accepting the PC assembly along with proper switching to select two response curves. The filter location is on the bottom side of the TRITON chassis, near the CRYSTAL CALIBRATOR PC assembly. To remove the bottom plate and install the filter, proceed as follows:

- 1.) Remove the sheet metal screws holding the plastic speaker bezel to the bottom plate.
- 2.) Remove the screws holding the bottom plate to the plastic sides and the two in the central portion of the plate.
- 3.) Slide the bottom plate to the rear and off of the unit, feeding speaker wire between bottom plate and final amplifier heat sink.
- 4.) The speaker can be fed through the cutout in the bottom plate. Two notches in the large hole provide clearance.
- 5.) Locate the unused 7 pin PC board socket near the calibrator assembly. With diagonals, clip off the blue jumper wire connecting pins 1 and 4 on this socket. Do not disturb the connections of the other wires to these lugs.
- 6.) Unplug rf connector going into final rf amplifier.
- 7.) Plug the Model 245 in the socket with the hollow tubular standoff going over the 4-40 screw in the chassis.
- 8.) Secure the assembly by running a 4-40 nut on the screw and inserting the 4-40 screw provided with the filter into either one of the two holes on the socket end of the PC board.
- 9.) Reconnect rf connector and attach bottom plate.

Operational Check

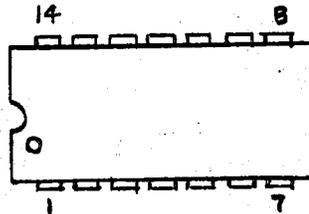
To check the filter operation, reassemble the bottom plate and speaker in reverse order to that given above. Power the TRITON with the MODE switch in the SB-N position. Adjust the audio level so that off-station background noise is received at a comfortable level. The hiss and noise will contain a broad range of frequencies, especially the highs. Switch to CW-2 and the highs should be noticeable reduced in level. Then switch to CW-1 and all of the hiss should be removed, leaving only the hollow sound of frequencies around 750 Hz. This verifies that the filter and MODE switch are working properly.

Pin Voltage Readings - (Receive mode.)

Pin	Volts
IN	0
GND	0
+12	13
OUT 1	0
OUT 2	6.5
OUT 3	6.5
OUT 4	0

Integrated Circuit Voltage Readings-(Both units.)

Pin	Volts
1	6.5
2	6.5
3	NC
4	0
5	NC
6	6.5
7	6.5
8	NC
9	13
10	6.5
11	NC
12	6.5
13	13
14	NC



Pins viewed from top of PC board.



TEN-TEC ARGONAUT/TRITON  
SERVICE NOTE

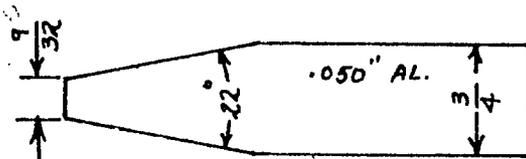
Subject: Installation of main dial skirt on shaft.

With the newly designed friction spring dial skirt assembly, re-installation of the skirt on the shaft becomes somewhat of a problem without the special tool used at TEN-TEC. The reason for the difficulty is that the straight portion of the heavy spring that rides on the outer portion of the brass shaft need be displaced above the shaft while pushing the skirt on. To do this with the shaft partially coming through the hub is difficult at best, and no apparent access to the rear portion of the hub, where the spring is located, is apparent.

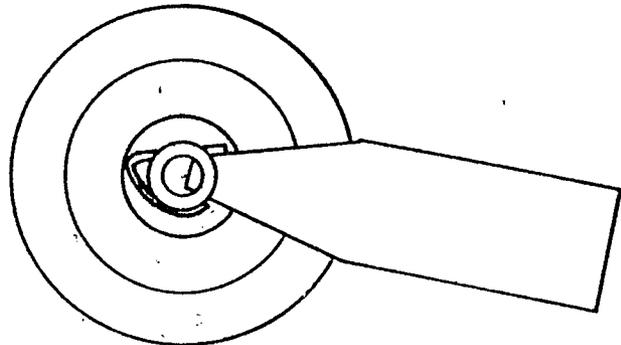
The skirt can easily be re-installed with the aid of a spreading tool that is detailed below. The tool is a wedge of sheet metal, such as aluminum, or can be phenolic plastic. Thickness should be no greater than about .050" so that the tip will fit in the spring slot on the hub. The flat dimension of  $9/32$ " should be held fairly closely, since this determines the amount the spring will be deformed prior to insertion of the skirt.

To use the tool, spread the straight portion of the spring by wedging the tool tip in the plastic hub slot, so that the two angled edges of the tool rest on the spring and the hubgroove valley. The amount the spring is stretched should be enough so that the spring is not visible through the hub bore. If the tool tip shows in the bore, this is OK for now.

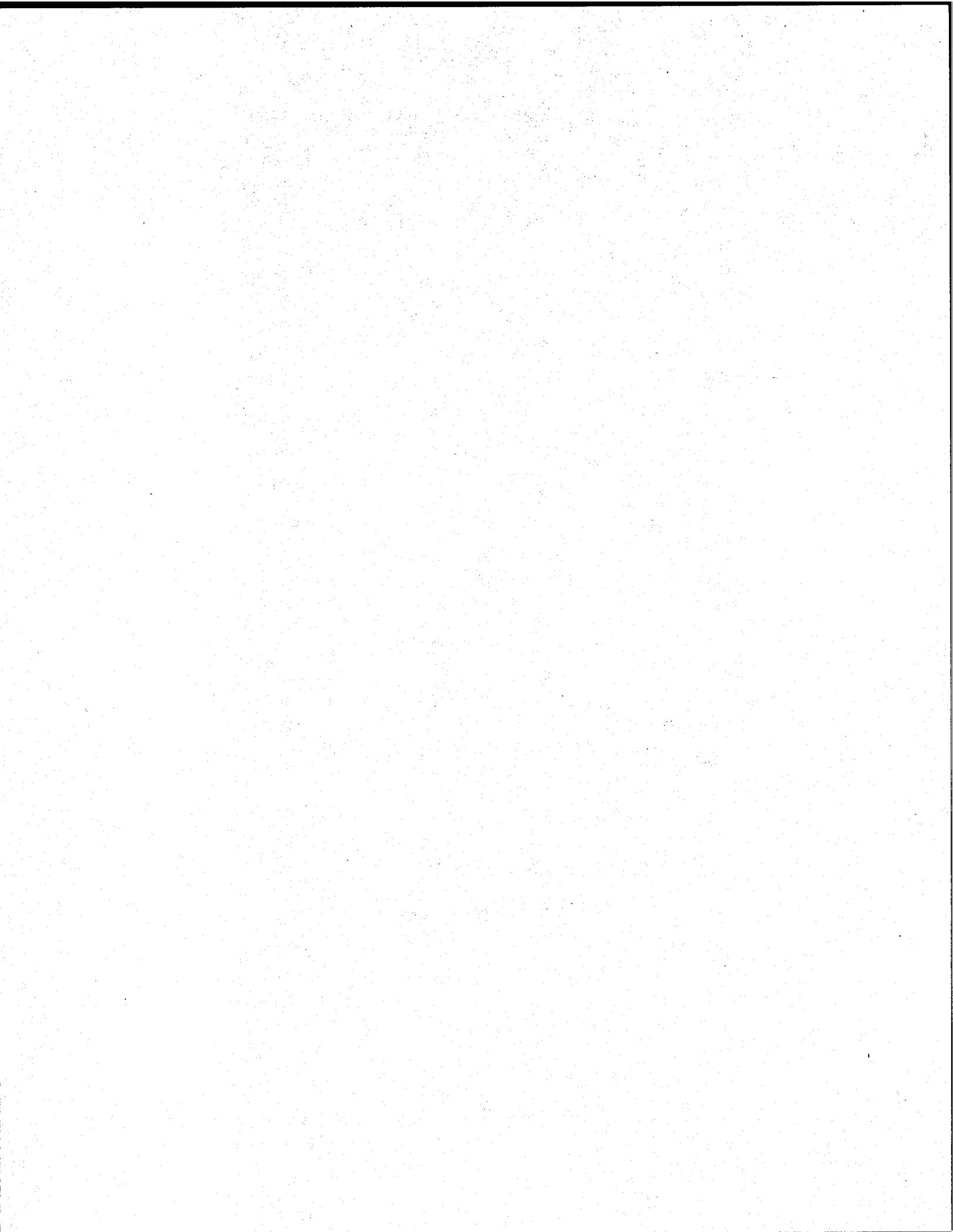
Now start the skirt on the shaft, with the tool handle pointing downward in relation to the front panel. This puts the handle out in the open. Push the skirt on the shaft until the tip of the tool in the hub bore hits the brass portion of the two diameter shaft. While maintaining inward pressure on the skirt, slowly remove the tool from the groove by using a rotational motion on the handle. As the tip is pulled from the hub bore, it will allow the skirt to be pushed on the shaft before the spring can regain its unstressed condition. Seat the skirt as far as it will go.



Dimensional details  
of insertion tool.



Rear view of dial skirt  
with tool inserted.



Ten-Tec, Inc.  
1185 Dolly Parton Parkway  
Sevierville, TN 37862  
Repair Service: (865) 428-0364

#### LIMITED WARRANTY AND SERVICE POLICY, U.S.A. AND CANADA

Ten-Tec, Inc., warrants this product to be free from defects in material and workmanship for a period of one (1) year from the date of purchase, under these conditions:

1. **THIS WARRANTY APPLIES ONLY TO THE ORIGINAL OWNER.** It is important that the warranty registration card be sent to us promptly.
2. **READ THE MANUAL THOROUGHLY.** This warranty does not cover damage resulting from improper operation. Developing a thorough understanding of this equipment is your responsibility.
3. **IF TROUBLE DEVELOPS** we recommend you contact our customer service group direct at the address or phone number shown above. It has been our experience that factory direct service is expeditious and usually results in less down-time on the equipment. Some overseas dealers do offer warranty service and, of course, have our complete support.
4. **EQUIPMENT RETURNED TO THE FACTORY** must be properly packaged, preferably in the original shipping carton(s). You pay the freight to us and we prepay surface freight back to you. Canadian customers must have proper customs documentation sent with incoming repair equipment. Duties or fees charged due to improper documenting are the responsibility of the owner of the equipment.
5. **EXCLUSIONS.** This warranty does not cover damage resulting from misuse, lightning, excess voltages, polarity errors or damage resulting from modifications not recommended or approved by Ten-Tec. In the event of transportation damage, a claim must be filed with the carrier. Under no circumstances is Ten-Tec liable for consequential damages to persons or property caused by the use of this equipment.
6. **TEN-TEC RESERVES** the right to make design changes without any obligation to modify equipment previously manufactured, or to notify owners of changes to existing equipment.
7. **THIS WARRANTY** is given in lieu of any other warranty, expressed or implied.

#### SERVICE OUTSIDE OF THE U.S.A. OR CANADA

Many of our international dealers provide warranty service on the equipment they sell. Many of them also provide out of warranty service on all equipment whether they sold it or not. If your dealer does not provide service or is not conveniently located, follow the procedure outlined above. Equipment returned to us will be given the same attention as domestic customers but roundtrip freight expense, customs and broker fees will be paid by you.

Part no. 74244

