

TEN-TEC
TEN - TEC

**OPERATOR'S
MANUAL**

**ARGONAUT
515**

<u>CONTENTS</u>		
SECTION	TITLE	PAGE
I	INTRODUCTION	1-1
	CONDENSED OPERATING INSTRUCTIONS	1-1
	SPECIFICATIONS	1-3
II	DETAILED OPERATING INSTRUCTIONS	2-1
	General	2-1
	Rear Panel Connections	2-2
	Front Panel Controls	2-3
	GENERAL OPERATING NOTES	2-5
	Calibration And WWV Reception	2-5
	FULL TEN METER COVERAGE	2-6
	IF YOU HAVE TROUBLE	2-6
	BLOCK DIAGRAM	2-7
	III	ALIGNMENT AND SERVICE
Pilot Light Replacement		3-1
Dial Cord Replacement		3-1
Dial Calibration		3-2
Disassembly		3-2
MAIN CHASSIS WIRING DIAGRAM		3-4
FIGURE 1 - TOP VIEW		3-6
FIGURE 2 - BOTTOM VIEW		3-7
FRONT END 80262		3-8
VFO 80289		3-12
TX-RX MIXER 80535		3-16
I-F BOARD 80208		3-18
AUDIO POWER AMPLIFIER 80274		3-20
SSB GENERATOR 80131		3-22
RF POWER AMPLIFIER 80185		3-25
LOW PASS FILTER/SWR BRIDGE 80260		3-26
CONTROL BOARD 80537		3-27
WARRANTY AND SERVICE POLICY		Insert

SECTION I

INTRODUCTION

The Argonaut opens a whole new world of excitement and fun in Amateur Radio. We think you will find QRP a welcome change. Five watts are only 2½ S-units below 150 watts for the same conditions. When skip is favorable and QRM light, you will not be conscious of using low power.

The small size (1/5 cubic foot) makes it ideal for portable operation in a motel, camper, trailer, or mobile operation in your car, boat or plane. As a result of its low power requirement, a 12 volt lantern or automobile battery will provide many, many operating hours. An ac pack, available as an accessory, will provide 117 VAC operation. You can choose ssb or cw on any ham band between 3.5 and 30 MHz.

On the following pages you will find a set of condensed operating instructions. These are sufficient to place the Argonaut in operation. We do, however, highly recommend a thorough reading of the detailed instructions and the theory of operation. Only by a complete understanding of all controls can the Argonaut be used to its maximum capabilities.

CONDENSED OPERATION INSTRUCTIONS

The following instructions will enable the operator to quickly place the Argonaut in operation. For a more comprehensive description of the controls and their functions, read the detailed operating instructions.

REAR APRON CONNECTIONS AND CONTROLS

- +12 VOLTS IN JACK - Use a 12 to 14 volt, dc power source capable of delivering one ampere, negative ground.
- ANTENNA JACK - 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 Argonaut with an antenna tuner, such as the **TEN-TEC Model 247**.
- MIC JACK - If ssb operation is intended, use a high impedance dynamic, crystal or ceramic microphone. Use a standard 1/4" stereo plug -- tip to Push-To-Talk switch, band to microphone, and sleeve to common ground.
- KEY JACK - If cw operation is intended, connect a straight key, bug or electronic keyer.
- ACCESSORIES - Dummy plug with jumper between pins 4 and 5 must be inserted into socket.

FRONT PANEL CONTROLSA.) Tune-Up

- 1.) Select desired band with BAND switch.
- 2.) Tune dial to approximate frequency desired.
- 3.) Set METER switch to FWD position.
- 4.) Turn unit on by pushing POWER ON-OFF knob in.
- 5.) Advance MODE switch to LOCK position.

- 6.) Rotate DRIVE control clockwise for full scale meter reading.
- 7.) Check antenna match by rotating METER switch to REV position and noting SWR reading. SWR should be below 3:1 for best operation. If it is not, use antenna tuner or adjust antenna system for better match.

B.) Operation - CW

- 1.) Reset MODE switch to CW position.
- 2.) To transmit, merely key the Argonaut for complete break-in operation.
- 3.) To receive, adjust af and rf controls for desired audio level, and peak received signal with RESONATE control.
- 4.) For OFFSET tuning procedure, refer to the detailed operating instructions.

C.) Operation - SSB

- 1.) Reset MODE switch to SB-N position.
- 2.) Set DRIVE control so that with the push-to-talk switch closed, voice peaks just cause the RF Light Emitting Diode (LED) in bezel to flash. Do not advance DRIVE beyond this setting.
- 3.) To receive, adjust af and rf controls for desired audio level after peaking signal with RESONATE control.

REAR PANEL CONNECTORS AND CONTROLS

ANTENNA JACK - 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 Argonaut with an antenna tuner, such as the KRM-TSC Model 347.

MIC JACK - If an operation is intended, use a high impedance dynamic, crystal or ceramic microphone. Use a standard 1/4" stereo plug -- tip to TUNE-TO-TALK switch, band to microphone, and sleeve to common ground.

KEY JACK - If cw operation is intended, connect a standard key, plug or electronic keyer.

RESONATOR - Dummy plug with jumper between pins 4 and 5 must be inserted into socket.

FRONT PANEL CONTROLS

A.1. Tuning

- 1.) Select desired band with BAND switch.
- 2.) Tune dial to approximate frequency desired.
- 3.) Set WATER switch to FWD position.
- 4.) Turn unit on by pushing POWER ON-OFF knob in.
- 5.) Advance MODE switch to LOCK position.

SPECIFICATIONS

RECEIVER

- SENSITIVITY - Less than 0.35 uV for 10 dB S+N/N.
- SELECTIVITY - 2.4 kHz at 6 dB down. 1.7:1 shape factor at 6/50dB.
- INPUT - Low impedance unbalanced coaxial.
- OUTPUT IMPEDANCE - 8 ohm speaker or headphones. (High or low impedance headphones can be used.)
- AUDIO POWER OUTPUT - 1 watt at 8 ohms with less than 2% distortion.
- SPURIOUS RESPONSE - More than 50 dB down.
- AUTOMATIC GAIN CONTROL - For 100 dB change in input signal, output changes less than 6 dB.
- OFFSET TUNING - With pull-out defect switch. Approximately \pm 4 kHz.

TRANSMITTER

- DC POWER INPUT - 5 watts PEP; 5 watts cw.
- RF POWER OUTPUT - 2 watts minimum, 50 ohm resistive load.
- OUTPUT IMPEDANCE - 50 to 75 ohms.
- TRANSMIT-RECEIVE OPERATION - Ssb: Push To Talk; Cw: Instant break-in.
- CW SIDETONE - Internally switched. Operates only in cw mode. Level and pitch adjustable.
- MICROPHONE INPUT - High impedance. Crystal, ceramic or dynamic.
- CARRIER SUPPRESSION - 40 dB from single tone output.
- SIDEBAND SUPPRESSION - 30 dB down from a single tone output at 1 kHz.

GENERAL

- FREQUENCY COVERAGE - 3.5-4.0; 7.0-7.5; 14.0-14.5; 21.0-21.5; 28.0-28.5; 28.5-29.0 MHz. Accessory crystals for 29.0-29.5 and 29.5-30.0 MHz.
- VFO STABILITY - Less than 20 Hz change per degree F, averaged over a 40° change from 70° to 110°, after 30 minute warmup.
- MODES OF OPERATION - Normal sideband; Reverse sideband; Cw.
- DIAL CALIBRATION - \pm 5 kHz, 80 through 10 meters.
- TUNING RATE - Approximately 20 kHz per revolution of main tuning knob.
- SEMICONDUCTORS - 34 Transistors, 2 Mosfets, 6 ICs, 20 Diodes, 3 LEDs.
- POWER REQUIREMENTS - 12-14 VDC regulated to 10% with 1 A load.
- DIMENSIONS HWD - 4½" x 13" x 7½".
- CONSTRUCTION - Aluminum chassis, front and rear panels, top and bottom. Cylolac side panels.
- NET WEIGHT - 6 pounds.

SPECIFICATIONS

FRONT PANEL CONTROLS

Receiver RESONATE; OFFSET (pull-off); Two BAND switches; RF GAIN; AF GAIN/POWER (pull-off); MODE switch; METER switch; DRIVE; MAIN Tuning knob.

REAR APRON CONNECTIONS

ANTENNA jack; PHONES jack; MIC jack; DIAL LIGHT ON-OFF switch; KEY jack; AUX +12 VOLTS; +12 VOLTS IN jack; 2 AMP fuse; ACCESSORIES connector.

TRANSMITTER

DC POWER INPUT - 5 watts FET; 5 watts CW.
RF POWER OUTPUT - 5 watts minimum, 50 ohm resistive load.
OUTPUT IMPEDANCE - 50 to 75 ohms.
TRANSMIT-RECEIVE OPERATION - SSB; Push To Talk; CW; Instant break-in.
CW KEYSTONE - Internally switched. Operates only in CW mode. Level and pitch adjustable.
MICROPHONE INPUT - High impedance. Crystal, ceramic or dynamic.
CARRIER SUPPRESSION - 40 db from single tone output.
SIDE BAND SUPPRESSION - 30 db from a single tone output at 1 kHz.

GENERAL

FREQUENCY COVERAGE - 3.5-4.0; 7.0-7.5; 14.0-14.5; 21.0-21.5; 28.0-28.5; 35.0-35.5 MHz. Accessory crystals for 39.0-39.5 and 43.0-43.5 MHz.
VFO STABILITY - Less than 30 Hz change per degree F, averaged over a 30 minute period from 70° to 110°, after 30 minute warming.
MODE OF OPERATION - Normal sideband; Reverse sideband; CW.
DUAL CALIBRATION - 1.5 kHz, 80 through 10 meters.
TUNING RATE - Approximately 20 kHz per revolution of main tuning knob.
SEMICONDUCTORS - 34 Transistors, 2 Mosfets, 6 ICS, 10 Diodes, 3 LEDs.
POWER REQUIREMENTS - 12-14 VDC regulated to 1.25 with 1 A load.
DIMENSIONS SHG - 4 1/2" x 13" x 7 1/2".
CONSTRUCTION - Aluminum chassis, front and rear panels, top and bottom. Cosmic side panels.
NET WEIGHT - 6 pounds.

SECTION II

DETAILED OPERATING INSTRUCTIONS

GENERAL

The Argonaut is the first miniaturized transceiver incorporating a full array of operating features. It operates on ssb/cw over the five popular Amateur H.F. bands including 1 MHz of the 10 meter band. Accessory crystals, Models 212 and 213, extend coverage to 30.0 MHz.

QRPP

This is the designation given to communication with output power of 5 watts or less. There are thousands of Amateurs who have found QRPP to be an enjoyable hobby. Clubs have been formed and contests are frequently conducted.

Five watts and less can work anywhere in the world under favorable propagation and interference conditions. The following general observations might be helpful:

- 1.) Select the highest frequency band that is completely open.
- 2.) Call loud stations. We assume two-way skip which would also enhance your signal. Remember that 5 watts is 2.5 S-units below 150 watts so if you call an S-9 signal yours will be S-6/7 if antennas are equal.
- 3.) Choose a part of the spectrum that is not heavily populated. A QRPP signal, especially a clean readable Argonaut signal, sometimes gets through QRM but in general, it is better to stay out of QRM.
- 4.) Don't call CQ except during favorable band conditions. There is a tendency for others to call strong signals.
- 5.) Call and sign a little longer than when running high power. On CW send a little more slowly. With phone, announce clearly.

QRPP is not push-button communication. Because it does take skill and technique it is an exciting and challenging facet of Amateur Radio.

MOBILE OPERATION

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

When used with an alternator charged battery, start the vehicle's engine before turning Argonaut on. This avoids applying a voltage surge caused by momentarily open voltage regulator contacts.

Normally, there will be negligible noise introduced through the DC power leads. If it should occur, it can be eliminated by inserting the low voltage winding of a filament transformer in the power lead.

FIXED STATION

The Argonaut 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 lantern or storage battery.

PORTABLE

The diminutive size and light weight of the Argonaut makes it an ideal traveling companion.

A 12 volt lantern battery (or two six volt batteries in series) will last many hours. To conserve battery power, be sure to switch off the dial light when not needed. Using headphones or reducing audio volume will conserve power. SSB will require less power than CW. The battery will give optimum results down to 10.5 volts.

Antennas are a matter of choice and convenience. A mobile whip antenna may be used with a suitable ground system (radials) or excellent earth ground. Matched, resonant dipoles are fine if there is a support for them. A random length "long wire" is also effective but must be matched with an antenna tuner (Model 247 or equivalent). In any event, the SWR should be 3:1 or better.

REAR PANEL CONNECTIONSPOWER SUPPLY

The Argonaut requires a supply of 12-14 volts capable of approximately one ampere peaks. The unit will operate satisfactorily, at reduced power and sensitivity down to +10½ volts. It may be operated with any mobile installation having a 12 volt negative ground electrical system. When operating mobile it may be necessary to install a small choke in series with the +12 volt lead to eliminate alternator whine or generator noise. The secondary of a low voltage filament transformer or choke of similar current rating will work satisfactorily. For portable operation, the Argonaut may be powered by a 12 volt lantern battery or small storage battery.

ANTENNA

Any matched antenna presenting 50-75 ohms will work satisfactorily. Random length antenna or open wire fed systems will require a matching system similar to the TEN-TEC Models. Any of the popular mobile antennas will operate without any special matching. If it is not mounted on a car, a good ground system or counterpoise should be provided. The Argonaut output is designed for an unbalanced feed system. The coax shield is connected to the shell of a phono plug and the center conductor is connected to the pin of the phono plug.

MICROPHONE

The input has been designed for a high impedance ceramic, crystal or dynamic microphone. The cable should be terminated in a ¼" diameter stereo phone plug. The shield and/or ground lead is connected to the barrel. The push-to-talk switch is connected to the tip and the microphone to the band.

The push-to-talk switch operates with respect to ground. The microphone gain control in ssb is the DRIVE control. The DRIVE control should be advanced, under normal operation, until the RF indicator in the dial bezel just begins to flash on voice peaks. The transmitter gain varies from band to band. This may require changing the DRIVE setting for proper operation.

KEY

The key actuates a series of circuits on the control board that supply voltages to the various transmit and receive circuits. When the key is closed, bias is removed from the receiver stages and applied to the transmit stages. The antenna is changed from receive to transmit with a PIN diode. There is a short time constant in the audio muting circuit to eliminate any clicks while keying. It is not long enough to interfere with the complete break-in operation of the Argonaut. The cw sidetone operates only when the MODE switch is in the CW position.

The sidetone volume is independent of the front panel volume control. Volume and pitch may be set to the desired level with the printed circuit potentiometers located on the audio board. A finger access hole is provided in the bottom plate for this purpose.

TEN-TEC keyers, Models 645 and 670 are ideally suited for use with the Argonaut 515, as are all other TEN-TEC keyers. An auxiliary +12 volt jack is provided next to the KEY jack to power these models.

AUDIO

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

ACCESSORIES

This socket gives access to the +12 volts, the audio line and the "T" voltage which is present only in the transmit mode. To maintain continuity of the audio channel, the dummy plug with jumper between pins 4 and 5 must be inserted. If Model 208-A Notch/CW Filter is used, remove the dummy plug and insert cable attached to the Model 208-A into this socket.

PANEL LIGHTS

A slide switch is located on the rear of the unit to turn the panel lamps on or off. This allows a minimum drain when the unit is operated from a battery supply.

FRONT PANEL CONTROLS

RF/AF CONTROLS

The RF gain controls the bias to the receiver rf amplifier. This is used primarily to reduce the susceptibility to overload in the presence of extremely strong signals. The AGC will be dependent on the rf gain setting. The AF control controls the input to the power amplifier stage.

To minimize AGC popping, with RF fully clockwise, adjust the AF control setting while receiving a strong station to a level just a bit louder than desired. Then, control the level of this and all other stations to the desired level with the RF control.

MODE SWITCH

SB-N is the sideband normally in use on all bands. It will provide upper sideband on 20, 15 and 10 meters and lower sideband on 40 and 80 meters. The proper sideband is automatically selected by using either the sum or difference frequency in the mixer. The opposite or reverse sideband can be selected on the MODE switch, (SB-R), when needed.

The CW position connects the sidetone and disables the balanced modulator. The receiver is operated on the normal sideband. The transmitted signal is automatically offset 750 Hz from the received signal. This compensates for the BFO beat note and allows the transmitter to be on the frequency of the received signal.

The LOCK position is used for tune-up or antenna measurement purposes. It places the transmitter on the cw frequency and energizes the T/R circuits.

DRIVE CONTROL

This control determines the gain of the balanced modulator and is used to set the proper drive to the final amplifier. Overdrive on any band will not cause damage to the Argonaut. It will, however, result in an increased current drain for a given output. Excessive current, in turn, may result in chirpy cw signals and distorted ssb.

METER SWITCH

The meter switch selects between an S-Meter or SWR forward/reverse indication. The switch is placed in the forward position and the transmitter turned on to LOCK. Adjust DRIVE until full scale is achieved. Switch to the reverse position to read the standing wave ratio (SWR).

BANDSWITCH AND MAIN TUNING

The main tuning knob carries a dial skirt marked in 1 kHz increments up to 100 kHz. This scale is used in determining the frequency of operation within the 100 kHz segment noted on the slide rule dial. The lower scale is used when operating on 3.5, 28.5 and 29.5 MHz bands and the upper scale for all others.

Since the VFO tuning shaft is raised from chassis potential to eliminate frequency jumping caused by poor grounding of the shaft, there is a small hand capacity effect on frequency when either the skirt or knob insert is touched. To reduce this effect to negligible proportions, grasp only the plastic portion of the main tuning knob when tuning or use the finger depression.

RESONATE CONTROL

The RESONATE control operates a mechanical assembly that permeability tunes the receiver rf amplifier circuits. This is the only tuning required when changing bands. The transmitter section does not require any adjustments.

OFFSET TUNING

The OFFSET control tunes the receiver independently of the transmitter. A push-pull switch is attached to disable the function in the out position. It is more convenient to leave the control in operation and set to mid position (zero offset). It is then instantly available when needed. The dial bezel LED marked OT indicates when the circuit is in use.

Due to a small residual voltage being present across the OFFSET control when disabled, a very slight frequency shift may be noticed when rotating the control between its extremes. This is normal and can be used to advantage for very fine frequency adjustment of the received signal.

DIAL POINTER ZERO SET

When calibrating at any 100 kHz point, the slide rule dial pointer may be set exactly to the scale marking with the aid of the serrated disc knob protruding from the bottom of the case. It is located between the main tuning knob and the RF GAIN control. This adjustment need be made only occasionally as the string system ages, since the pointer is not intended for exact indications of frequency, but rather as a segment indicator telling which 100 kHz segment you are tuned to. Accurate frequency determination is made by use of the 0-100 kHz dial skirt.

- 1.) When the METER switch is set to the S MTR position, incoming signal strength can be determined, provided the rf gain control is advanced to maximum.
- 2.) The S-Meter will deflect to full scale in the transmit mode. This is normal.
- 3.) The RESONATE control should be re-peaked whenever the operating frequency is changed by approximately 50 kHz or more on the low frequency bands.
- 4.) When changing bands, or going to the opposite ends of the 80 meter band, the DRIVE control should be reset so as to maintain maximum output without overdrive.
- 5.) Although improper antenna will not damage the Argonaut, we suggest careful tune-up for maximum performance.
- 6.) In CW transmit mode, the carrier is automatically offset by 750 Hz. In so doing, the transmitted frequency is exactly the same as the received signal, (assuming OFFSET control is in center position or defeated), when the received signal is tuned to provide a 750 Hz beat note.
- 7.) In SB-R mode, the dial calibration will be off by approximately 2.5 kHz due to carrier oscillator shift. If accurate calibration is desired in this mode, it is suggested that a crystal calibrator be used and the dial skirt re-zeroed.
- 8.) In mobile operation, start the engine before turning transceiver on.
- 9.) The VFO in the Argonaut, like any LC oscillator, may be affected by stray ac magnetic fields cutting the coil windings. When installing the transceiver, locate any ac operated equipment that may generate these fields as far as practical from the Argonaut. Power supplies, electric clocks, rotator control boxes are common sources of trouble. Since the Argonaut VFO is located front and center, the most common cause of FMing is placing such accessories on top of the unit. A check of the purity of a received cw signal should be made at the time of installation.

CALIBRATION AND WWV RECEPTION

The broadcasts of WWV and WWVH may be received on 10 and 15 MHz for purposes of checking the accuracy of the dial skirt setting, or for propagation reports and time determination. To receive the 15 MHz signal:

- 1.) Set BAND switch to 21.0 MHz.
- 2.) Rotate main tuning dial so that frequency readout is 21.000 MHz.
- 3.) Tune the RESONATE control to the image frequency located almost fully CCW (between the 3.5 and 7.0 markings).
- 4.) If WWV is not heard, tune around this frequency a bit until it is received, providing that 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 21 MHz antenna.
- 5.) Zero beat the WWV signal, rotate dial skirt to zero while holding the large knob and set dial pointer to line up with lowest scale marking if required.
- 6.) Since the Argonaut 515 has a crystal mixed VFO system, this calibration will hold for all bands to the accuracy of the crystals used (.002% or better), and providing that the VFO is properly aligned.

To receive the 10 MHz WWV signal, use same procedure but tune to the image on the 28.000 MHz band. Frequency readout should be 28.000 at the point of WWV zero beat. Since 10 MHz cannot be fully peaked with the RESONATE control, it requires that this control be set fully CCW and that a stronger signal be present at the antenna terminals than the 15 MHz signal. Calibration accuracy can also be checked using the Canadian Standards station at 7.3350 MHz.

For accurate calibration across all bands, Model 206-A Crystal Calibrator can be inserted into the antenna line to provide check points every 25 kHz. Its signal is pulsed for easy identification.

FULL TEN METER COVERAGE

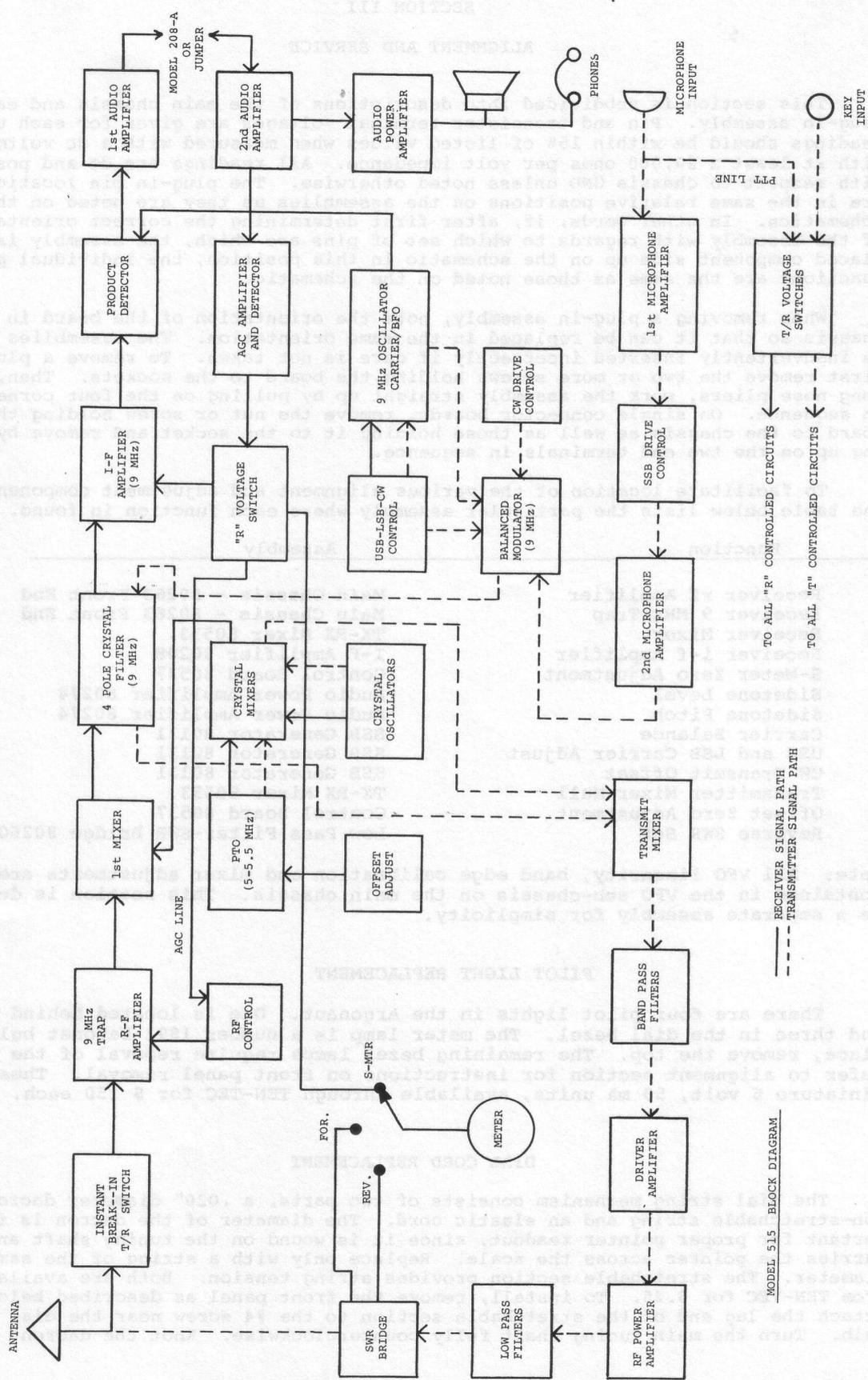
Model 515 as shipped from the factory has crystals installed which permit operation between 28.0 and 29.0 MHz. Two additional crystals are available as accessories which extend coverage to 30.0 MHz. Model 212 Crystal provides coverage in the 29.0 to 29.5 MHz segment and Model 213 in the 29.5 to 30.0 segment.

To install either or both of these crystals first remove the four screws holding the speaker bezel to the bottom plate. Remove all other bottom screws except those holding the bail on. Bring the speaker up and out of the cutout enough so that the bottom plate can be slid back several inches, bringing the dual crystal socket into view. To correlate band switch designations with correct frequencies, insert Model 212 into socket nearest the wired in crystals and Model 213 into socket farthest away. Crystals are marked with operating frequencies and TEN-TEC part numbers as follows:

Model 212	14.990 MHz	Pt. No. 48009
Model 213	15.490 MHz	Pt. No. 48010

IF YOU HAVE TROUBLE

SYMPTOM	POSSIBLE CURE
Argonaut dead. No dial lights. Receiver and transmitter inoperative.	Make sure power switch is on. Check 2 A fuse. Check power supply or battery for proper voltage. Check cable between supply and IN jack.
Set dead in receive but transmits.	Check if phones are plugged in disabling speaker. Make sure dummy plug is inserted in the ACCESSORIES socket.
Set dead. Dial lamps light but no transmit or receive on 10 meters. Other bands OK.	Check position of 10 meter BAND switch. Accessory crystals needed for 29.0 and 29.5 positions.
Power on/off switch inoperative. Stays on at all times.	Cable from supply plugged into AUX jack instead of IN jack.
Set seems alive but received signal weak or non-existent. Transmits normally with high SWR.	Check antenna system and cables. Try dummy load to see if problem is in antenna system. Check settings of antenna tuner if used.
Transmitter does not key in CW. No sidetone.	Check MODE switch. It must be in CW position for CW operation.
No sidetone. Transmits normally.	Check to see if sidetone level thum pot is advanced far enough.
Transmitter does not come on in SSB. Normal in LOCK or CW modes.	Check PTT switch in microphone. Check microphone cable and plug.



MODEL 515 BLOCK DIAGRAM

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 noted otherwise. The plug-in pin locations are in the same relative positions on the assemblies as they are noted on the schematics. 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 orientation. 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. On single connector boards, remove the nut or screw holding the board to the chassis as well as those holding it to the socket and remove by pulling up on the two end terminals 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 - 80263 Front End
Receiver 9 MHz Trap	Main Chassis - 80263 Front End
Receiver Mixer	TX-RX Mixer 80533
Receiver i-f Amplifier	I-F Amplifier 80208
S-Meter Zero Adjustment	Control Board 80537
Sidetone Level	Audio Power Amplifier 80274
Sidetone Pitch	Audio Power Amplifier 80274
Carrier Balance	SSB Generator 80131
USB and LSB Carrier Adjust	SSB Generator 80131
CW Transmit Offset	SSB Generator 80131
Transmitter Mixer Null	TX-RX Mixer 80533
Offset Zero Adjustment	Control Board 80537
Reverse SWR Set	Low Pass Filter-SWR Bridge 80260

Note: All VFO linearity, band edge calibration and mixer adjustments are contained in the VFO sub-chassis on the main chassis. This section is described as a separate assembly for simplicity.

PILOT LIGHT REPLACEMENT

There are four pilot lights in the Argonaut. One is located behind the meter and three in the dial bezel. The meter lamp is a number 1892 bayonet bulb. To replace, remove the top. The remaining bezel lamps require removal of the front panel. Refer to alignment section for instructions on front panel removal. These bulbs are miniature 6 volt, 50 mA units, available through TEN-TEC for \$.50 each.

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 dial bulb. Turn the main tuning shaft fully counterclockwise. Knot the dacron

string around the small pin in the tuning shaft and put one turn, counter-clockwise, on the shaft. (String should lead off from the bottom of the shaft toward upper right corner of panel.) Run string under pin on zero adjusting mechanism (after centering serrated knob), around the two plastic pulleys to the right of the S-Meter and then to the left across the top of the panel. Temporarily tape end to top edge of panel near RESONATE control.

Attach one end of elastic cord to the #4 lug located on screw that is right-center on panel. Squeeze lug with pliers to secure elastic. Run cord left, over first pulley and under second pulley located below RESONATE control. Then run upward toward pulley between RESONATE and OFFSET controls. Without stretching cord in the least, form a loop at the left side of top pulley, using the small metal band from old assembly. Pass free end of the dacron string that was taped to panel through this loop and feed both string and elastic cord around this last pulley so that string runs parallel to top edge of panel. Adjust string length so that elastic stretches to the point where the two come together directly over OFFSET control shaft. Secure the two with a knot in the dacron. (This will pre-stretch the elastic about one inch.) Cut excess dacron string off.

Attach the plastic dial pointer to string portion near the knot by hooking string around the two hooks on pointer, with the string passing under the long vertical bar. Slide pointer along string so that it is exactly 1/2 inch to right of center of OFFSET shaft when tuning shaft is fully CCW and zero set mechanism centered. If pointer tends to ride off the panel at the bottom, rotate it several times on a horizontal axis to pre-load it with a twist in the string.

Make sure string around the shaft is in the narrow groove and is as close to the panel as possible. As shaft is turned clockwise, the string should wind evenly without one turn going over the other. Otherwise, indexing will be somewhat off at the top end of the scale.

DIAL CALIBRATION

The PTO oscillator dial skirt is attached to the control shaft by means of a friction clutch. By holding the knob firmly, the skirt can be rotated to calibrate it to zero setting when using a crystal calibrator or WWV, as described elsewhere in this manual. At the time of shipment, the skirt is accurately set. However, if in turning the tuning knob, the fingers touch the skirt with an appreciable force, the skirt may deviate from its true setting.

If it is necessary to realign the bands for position or linearly, refer to the service section covering the VFO oscillator.

DISASSEMBLY

1.) REMOVAL OF TOP

Remove the two screws at the extreme edges of the rear of the top. Slide the top back and out of the grooves in the side panels.

2.) REMOVAL OF BOTTOM PLATE

Remove the four screws holding the speaker bezel. Slip speaker through the cutout in bottom plate. Two small notches in large cutout facilitate this operation. Remove the six screws in the bottom plate that remain. Also remove two screws on one side of back plate that secures back to one side panel. Gently force side panel outward so that bottom plate can be removed from side groove. It will then come free of unit. Bail need not be removed.

3.) FRONT PANEL REMOVAL

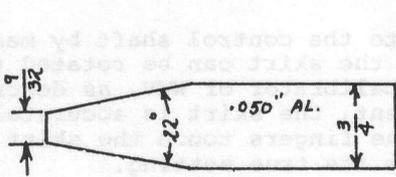
Dial cord and band switch linkage are between front and sub panels. Front panel removal required to service these items.

Remove all knobs and dial skirt. Skirt is a friction fit to the VFO shaft and can be removed by pulling away from panel. Remove the two screws in the bottom lip of the front panel. Loosen two screws located at the top rear of sub panel near each side panel. It will be necessary to remove top of unit to gain access to these screws. Carefully lift the front panel off while gently spreading side panels out.

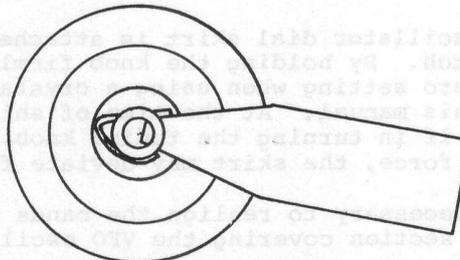
4.) DIAL SKIRT REMOVAL AND REPLACEMENT

The main tuning dial skirt is friction mounted to the shaft and can be easily removed by pulling it straight off the shaft after the plastic knob is removed. The felt washers between knob and skirt provide a slight amount of friction to eliminate any backlash between the two.

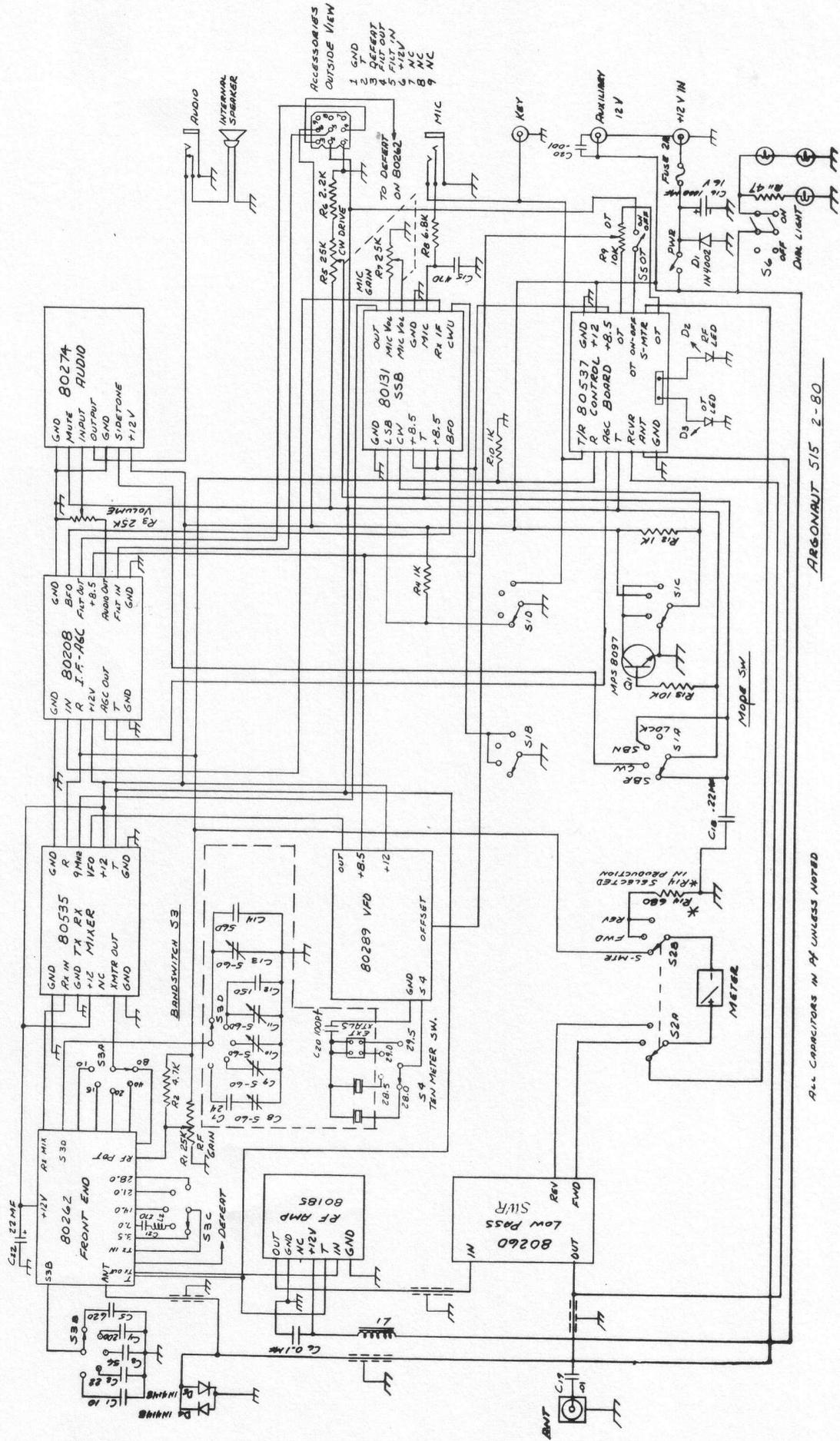
To replace the dial skirt, either a specially constructed tool as shown below, or a screwdriver with a blade width of approximately 9/32" can be used. With the tool, spread the "D" spring on the skirt hub so that the straight portion does not show through in the hub bore. If the tool tip shows in the bore, this is OK for now. Start the skirt on the shaft, with the tool handle pointing downward in relation to the front panel. This puts the handle of the tool 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.



ARGONAUT 515 2-80

ALL CAPACITORS IN PF UNLESS NOTED

Argonaut 515 - Main Chassis Wiring

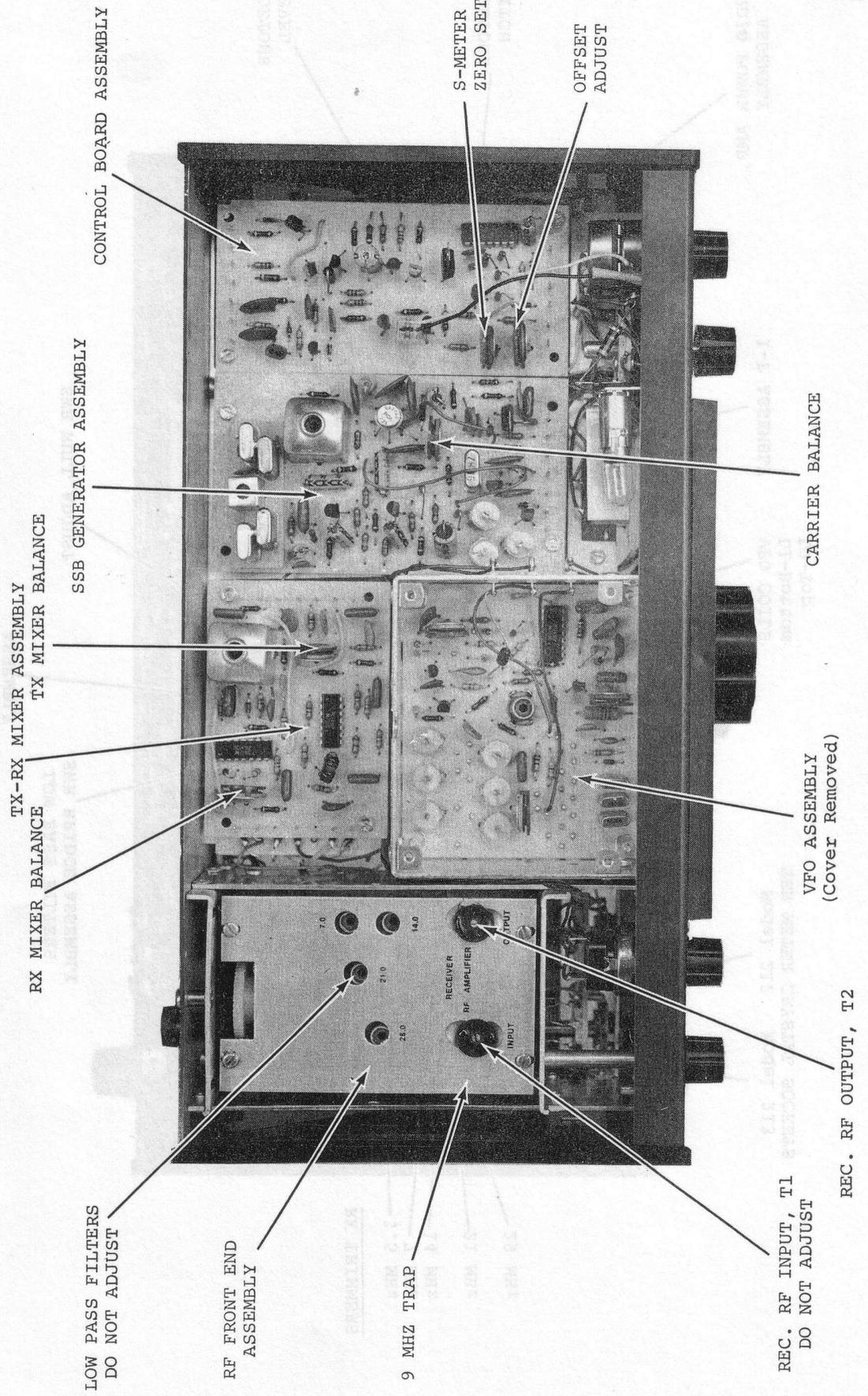


FIGURE 1 - TOP VIEW

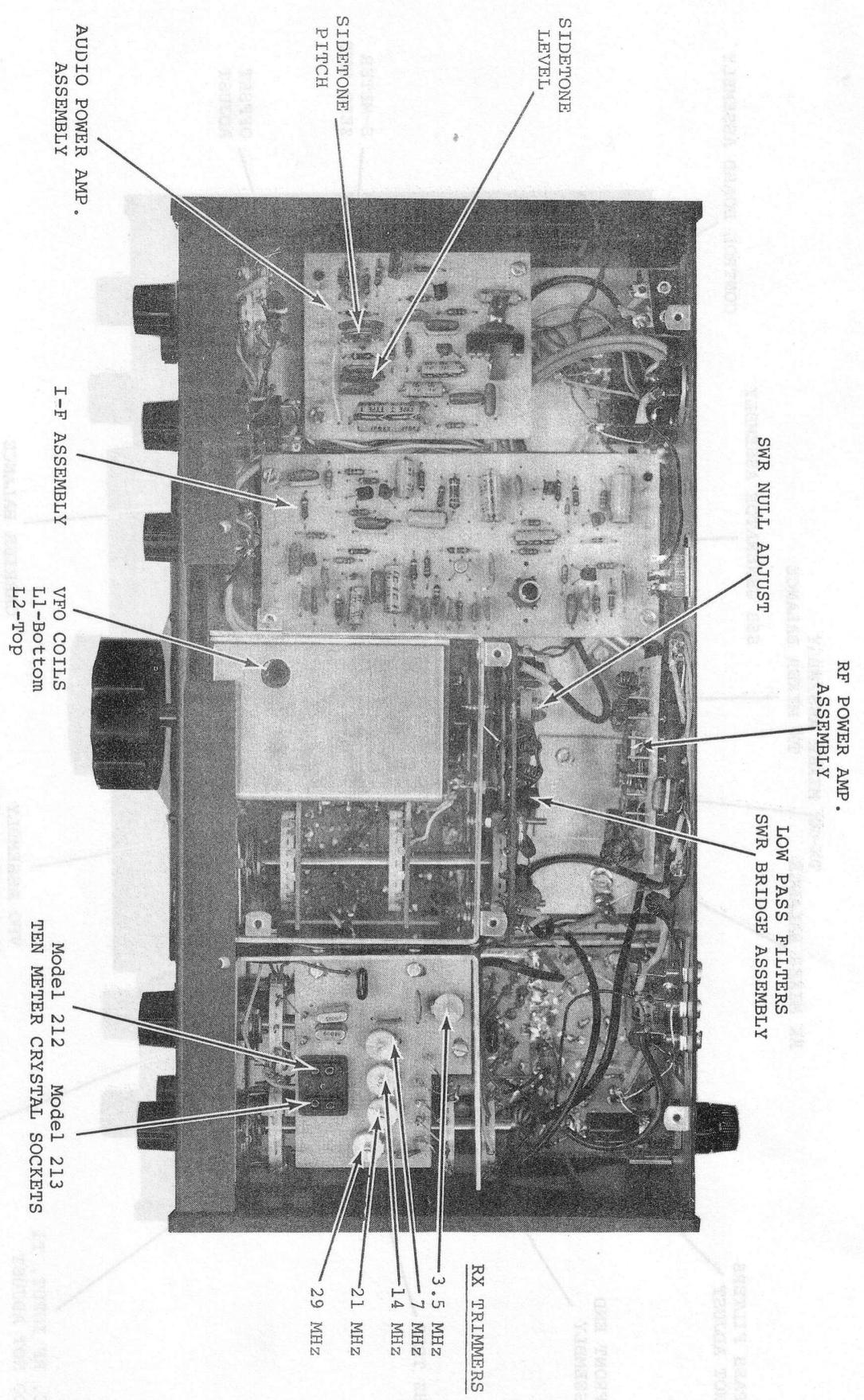


FIGURE 2 - BOTTOM VIEW

80262 FRONT END

RECEIVER R.F. AMPLIFIER

The rf amplifier in the receiving section is located on the FRONT END sub-chassis 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. 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 rf pot 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 also varies this voltage.

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 3.5 MHz. Frequency to 3.5 MHz.
- 3.) Temporarily connect a .01 uF capacitor from the 3.5 MHz 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 3.5 MHz trimmer.
- 4.) Set the frequency to 4.0 MHz, connect the .01 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 aligns and tracks the 3.5 MHz band and transformer settings for all other bands.
- 6.) Switch to 7.0 MHz, set the frequency to mid-band. (7.15 MHz). Connect the .01 uF capacitor from the 7.0 MHz 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 7.0 MHz trimmer for maximum output.
- 7.) Using the same procedure, align the 14.0, 21.0 and 28.0 MHz bands at 14.2, 21.2 and 29 MHz.

9 MHZ TRAP

- 1.) Set receiver to 7.0 MHz band and the RESONATE control for maximum output.
- 2.) Without changing the settings, tune signal generator to 9 MHz and increase signal out until a signal is heard. Tune trimmer C2 for a null. This capacitor is located on the top of the board and is accessible with a long narrow screwdriver inserted between the rack top plate and the side of the sub-chassis, near the INPUT, T1, transformer. (See Figure 1)

TRANSMITTER DRIVER AND FILTERS

This assembly also carries the transmitter driver stages and a set of wide band-pass filters that are switched into the input terminal of the driver stages

via switch S3C. The transformers are factory tuned and should require no field adjustments. Since they are overcoupled transformers, they require an elaborate sweep generator setup for adjustment, and so it is recommended that field adjustment be avoided.

The transmitter drivers consist of Q2 and Q3, which are RC coupled and biased to the "on" condition with the application of the "T" voltage to the bias line.

Transistor Voltages - (RF gain control fully clockwise.)

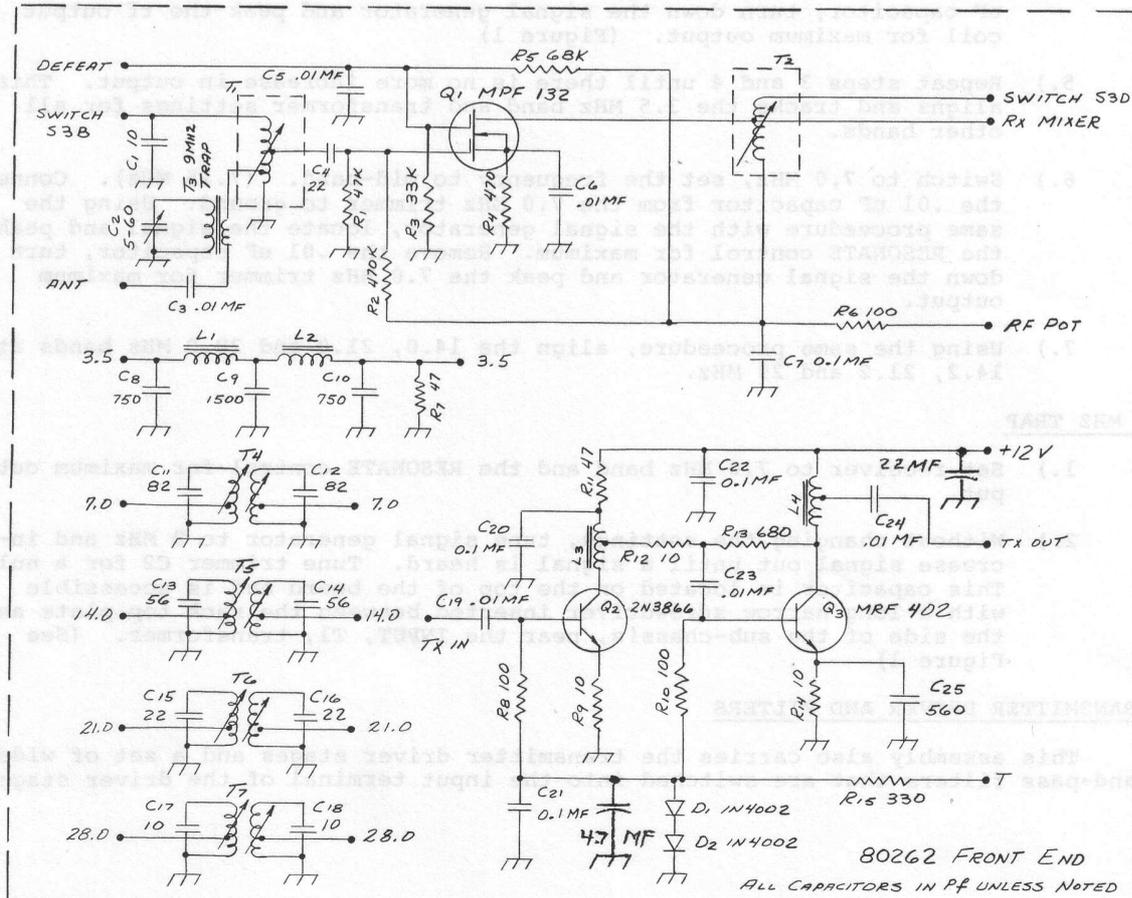
Q1 MOSFET		T	R
Drain, Pin 1		0.15	8.5
Gate 2, Pin 2		.05	3
Gate 1, Pin 3		.05	0.8
Source, Pin 4		0.15	2

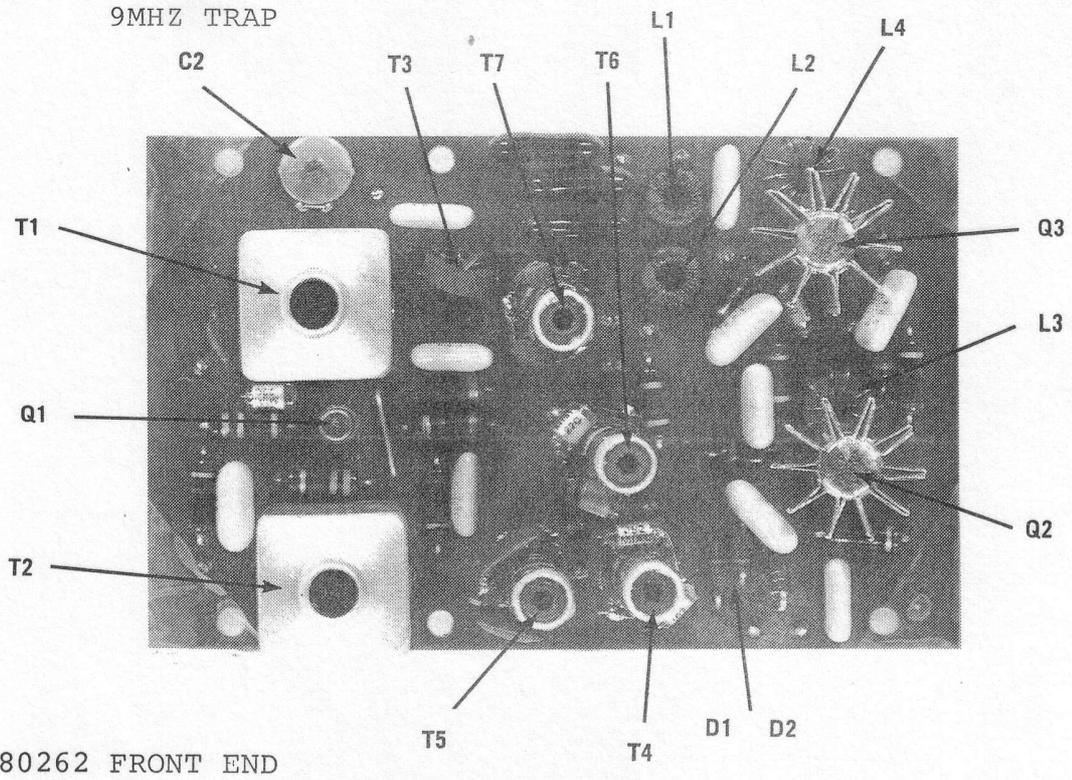


Transistor	Collector		Base		Emitter	
	Transmit	Receive	Transmit	Receive	Transmit	Receive
Q2	10.5	13	1.3	0.1	0.5	0
Q3	13	13	1.1	0.1	0.4	0



Pins viewed from bottom of circuit board.





80289 VFO

The variable frequency oscillator produces proper injection frequencies for the transmitter and receiver circuits, using a 9 MHz i.f. system. This is accomplished by utilizing a permeability tuned master oscillator for all bands, operating between 5.0 and 5.5 MHz whose output is mixed in an IC double balanced mixer with signals from a crystal oscillator. Crystal frequencies are selected by the BAND switches. The 14 MHz band uses the 5.0 to 5.5 MHz directly.

Output from the mixer is filtered for each band with double tuned resonant circuits and then sent to a darlington follower stage. Frequencies for the various bands are as follows:

<u>BAND (MHz)</u>	<u>VFO OUTPUT (MHz)</u>
3.5	12.5-13.0
7.0	16.0-16.5
14.0	5.0- 5.5
21.0	12.0-12.5
28.0	19.0-19.5
28.5	19.5-20.0
29.0	20.0-20.5
29.5	20.5-21.0

The permeability tuned oscillator (PTO) is housed in the main tuning coil housing on a separate, sealed PC board. It is noted on the schematic as sub-assembly 80278. The main coil, L3, is shunted with L2 and has L1 in series. Adjustment of these two slug tuned coils, which are both on the same coil form, determines the linearity and band edge points. L2 is the coil nearest the aluminum cover when viewing the VFO assembly from the bottom.

PTO ALIGNMENT

1. Connect frequency counter to VFO output terminal located on bottom rear edge of VFO sub-chassis. See photograph. Couple counter as lightly as possible while obtaining reliable indication. Counter should have input sensitivity rating of at least 100 mV.
2. Set BAND switch on TRITON to 14.0 MHz and power transceiver in receive mode. Disable OFFSET by pulling knob out.
3. Set main tuning shaft 25 kHz up from full counterclockwise position as indicated on dial skirt. Dial skirt should be zeroed and dial pointer should indicate close to left index scale mark, and within range of being set to index with serrated zero-set knob.
4. Observe counter reading and if it is not 5.000 MHz, slightly touch up L2 slug. Slug position in the coil should be such that a clockwise rotation of the slug decreases frequency.
5. Run tuning knob up scale and note counter readings at each 100 kHz of increase. If readings are within ± 5 kHz, linearity is within specifications. However, in most all cases, linearity may be improved, especially if frequency reading at 5.500 MHz is not exactly aligned, or if all deviations from the first setting are in the same direction.
6. If VFO range is compressed, i.e. reading on counter at what should be 5.5 MHz is less than this, reset tuning to 5.0 position, turn L2 slug a fraction of a turn clockwise and then compensate for this decrease in frequency by turning L1* slug also clockwise for a 5.0 MHz counter reading. Repeat step 5 to see if correction was sufficient or too much.
7. If range of VFO is expanded instead of compressed, compensation in the opposite direction is indicated. This is accomplished by turning slugs in opposite direction.

*NOTE: To reach L1 slug without upsetting position of L2 slug, use the tuning tool with reduced shank that is provided with TRITON. Also note that L2 is used to adjust spread of VFO range and L1 to bring frequency to correct value.

OFFSET ADJUSTMENT FOR 21.0 and 28.0 MHz BANDS

To eliminate band edge birdies on these two bands, the crystal oscillator frequencies are chosen 10 kHz lower than what normally would be needed compared to the other bands. The variable PTO oscillator compensates for this deviation by switching in varactor diode, D3, by means of switch S1B. The amount of varactor capacitance inserted is controlled by the amount of DC voltage applied through potentiometer, R22. To set this adjustment, proceed as follows:

1. Set BAND switch to 14.0 and frequency on dial to 14.000.
2. Connect counter to VFO output as above. Counter should read 5.000 MHz.
3. Switch BAND switch to 21.0 band and without moving setting of main tuning knob, adjust R22 (see photograph) so that counter reads 12.000 MHz.

MIXER OUTPUT ADJUSTMENTS

The double tuned circuits connected to mixer output on all but the 14.0 MHz band are wide band, overcoupled resonant circuits that are best aligned using a sweep oscillator system. Because they are wide band, realignment is seldom necessary except in the case where a tuned circuit component is replaced. Only if realignment is definitely indicated should the following alternate procedure be used.

1. Connect an rf oscilloscope and/or rf voltmeter to VFO output.
2. Transformer T1 is adjusted using the 28.0 MHz band. It is necessary that both 28.0 and 29.5 MHz crystals be installed in the TRITON. If T1 does not need alignment, proceed to step 5.
3. Set TRITON to 28.000 MHz. Adjust both top and bottom slugs of T1 for maximum output at 19.000 MHz. Being overcoupled, one adjustment will affect the other.
4. Note voltmeter reading and switch to 30.0 MHz. If reading is appreciably lower, touch up top slug and recheck at 28.0 MHz. When properly tuned, the frequency response should peak near each frequency extreme with a shallow dip in the center. Readjustments of both slugs may be necessary to achieve the proper passband curve.
5. Output voltage should be no less than 200 mV at any frequency and may range up to 300 mV. If this is not the case, adjust R27, the crystal injection adjustment, for 200 mV at the lowest point. Caution: Too high an output voltage setting will not improve performance but will increase unwanted mixer products.
6. Capacitors C7 through C12 are used to peak VFO output in the center of the 3.5, 7.0 and 21.0 MHz bands. Set TRITON to 3.75 MHz and peak C9 and C12. Check output at 3.5 and 4.0 for symmetry and run frequency through this range to determine double peaked response. Make minor adjustments to C9 and C12 until desired curve is obtained.
7. Set frequency to 7.2 MHz and peak C8 and C11. Check output across frequency band of 7.0 to 7.3 MHz.
8. Set frequency to 21.2 MHz and peak C7 and C10. Check curve.

MIXER BALANCE

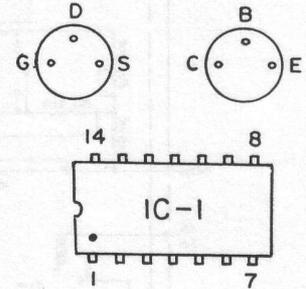
To balance mixer input for minimum crystal oscillator feedthrough, proceed as follows:

1. Connect rf voltmeter to VFO output.
2. Disable PTO by connecting a .01 mfd capacitor between the output lug of the PTO subassembly (not VFO assembly) and chassis. The output lug is the one of four in line that is farthest from the front of the TRITON, mounted on one side of the small aluminum housing. The bottom view photograph indicates the general area of this terminal.

3. Set BAND switch to 28.0 MHz and adjust R2 potentiometer for minimum voltmeter reading.

Semiconductor Voltage Readings (BAND switch 3.5 MHz)

Transistor	Collector Drain	Base Gate	Emitter Source
Q1 MOSFET	12.8	6.8	7.1
Q2	12.8	7.1	6.4
Q3 MOSFET	7.8	-2.2	0
Q4	5.4	1.2	0.5
Q5	8.0	2.2	2.3

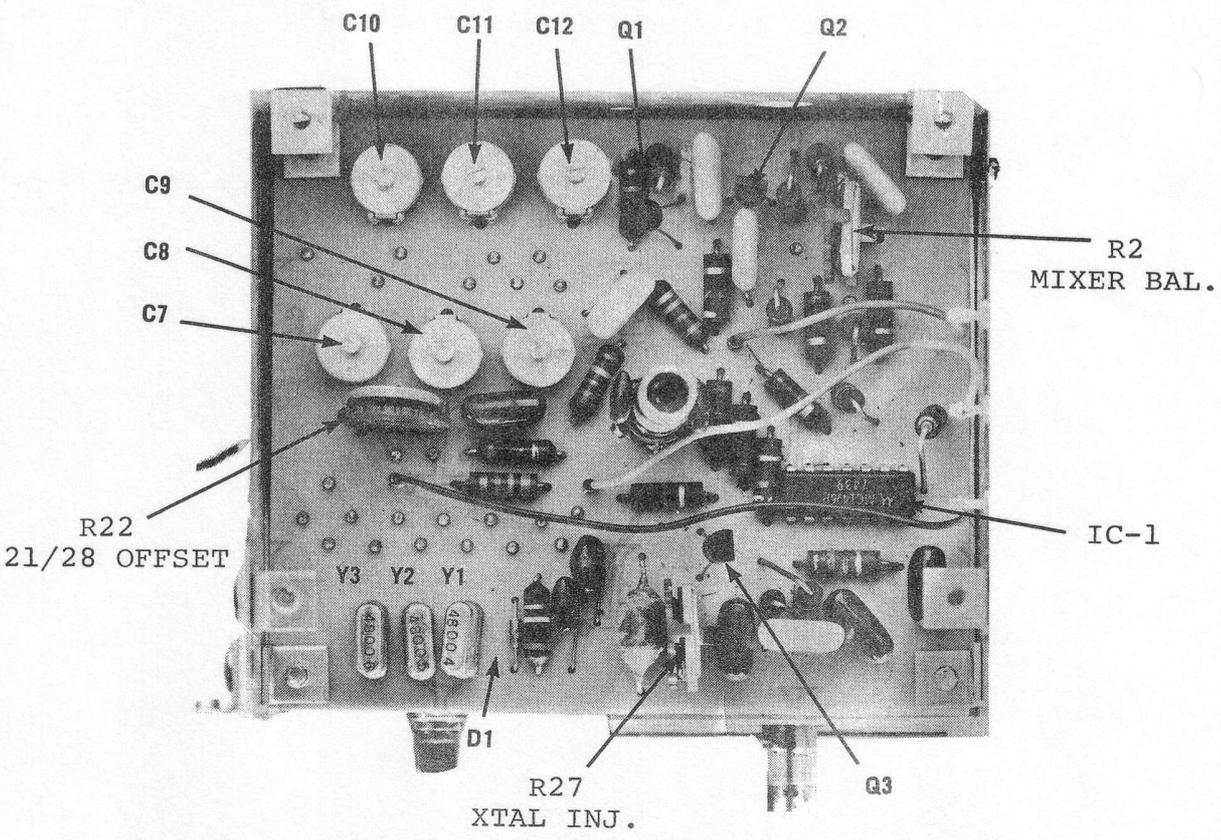
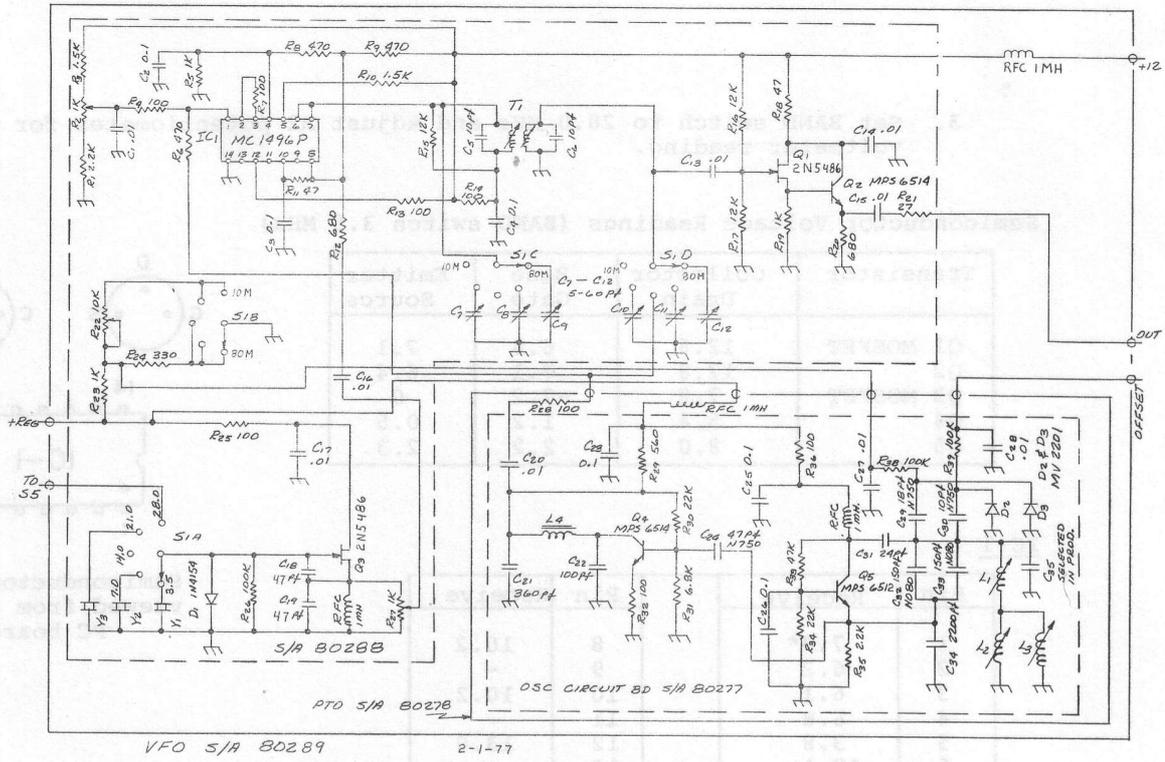


IC-1

Pin	Receive	Pin	Receive
1	7.0*	8	10.2
2	6.2	9	-
3	6.1	10	10.2
4	6.8	11	-
5	3.8	12	13.0
6	13.1	13	-
7	13.1	14	0

Semiconductor pins viewed from top of PC board.

*Depends on setting of R2.



80277 VFO

80535 TX-RX MIXER

The receiver mixer is built around a differential, double balanced integrated circuit. The input is untuned and brought out to a terminal through a 100 pf capacitor. The output is a single tuned circuit lightly coupled through a 22 pf capacitor to the output pin. This provides a good match to the crystal filter which has 470 ohms input impedance. R1 nulls the birdie at 21.230 MHz.

The transmitter mixer also consists of a similar integrated circuit. The output of this balanced mixer is loaded with a center-tapped coil and output is taken from one side. Balance potentiometer R13 is adjusted for minimum VFO feed through on odd harmonics.

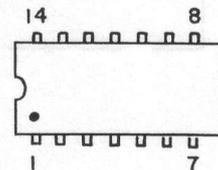
The two mixers are interconnected on the terminal board so that there is only one terminal for the 9 MHz crystal filter and one terminal for the VFO injection. The mixers are switched on and off with the R and T voltages from the control board.

Pin Voltage Readings - (No signal conditions, SB-N mode, RF fully CW.)

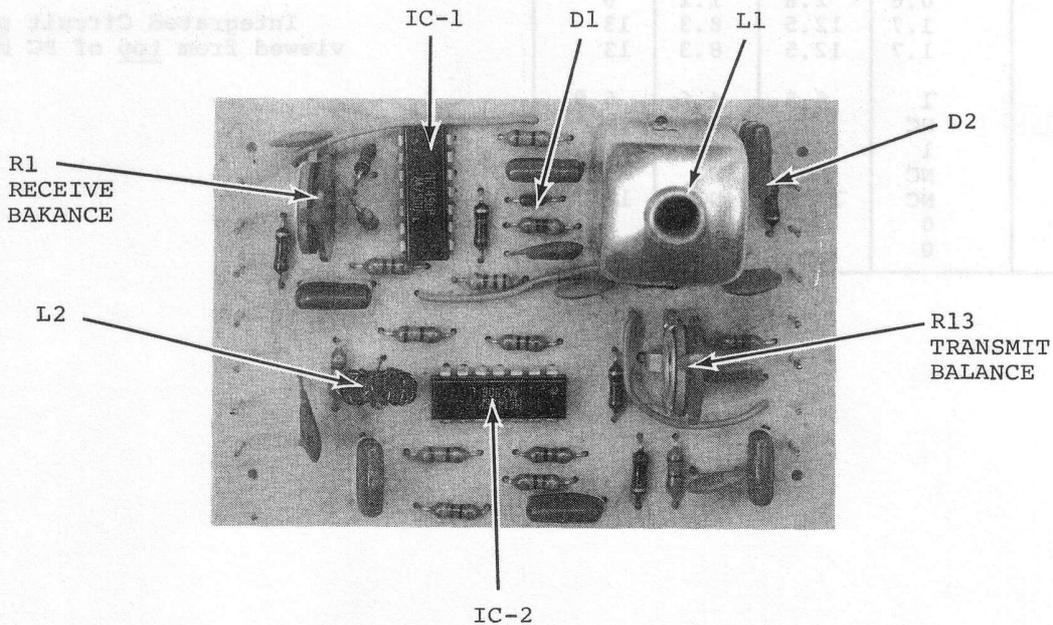
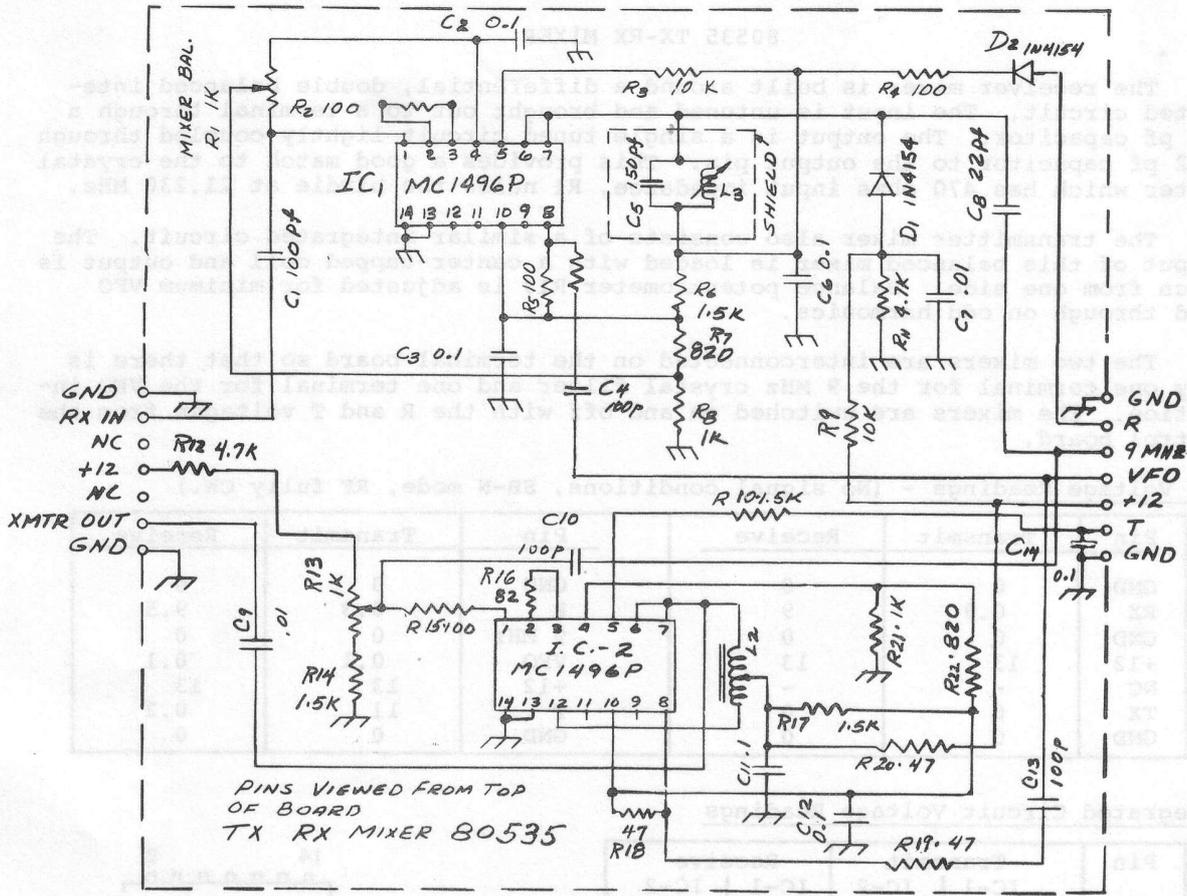
Pin	Transmit	Receive	Pin	Transmit	Receive
GND	0	0	GND	0	0
RX	0.3	9	R	0.3	9.5
GND	0	0	9 MHz	0	0
+12	13	13	VFO	0.1	0.1
NC	-	-	+12	13	13
TX	0	0	T	11	0.2
GND	0	0	GND	0	0

Integrated Circuit Voltage Readings

Pin	Transmit		Receive	
	IC-1	IC-2	IC-1	IC-2
1	0.5	3.8	2	3.8
2	0	2.8	1.2	3.3
3	0	2.8	1.4	3.3
4	0.5	3.5	2.5	3.7
5	0.6	2.8	1.1	0
6	1.7	12.5	8.3	13
7	1.7	12.5	8.3	13
8	1	6.5	4.6	6.9
9	NC	NC	NC	NC
10	1	6.5	4.6	6.9
11	NC	NC	NC	NC
12	NC	12.5	NC	13
13	0	0	0	0
14	0	0	0	0



Integrated Circuit pins viewed from top of PC board.



TX-RX MIXER 80535

80208 I.F. BOARD

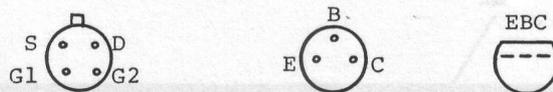
The 9 MHz i.f. amplifier is a single stage consisting of Q1 and transformer T1. The input is not tuned. The output of the i.f. stage feeds a low distortion product detector, Q2. The recovered audio is amplified by transistors Q3, Q4 and Q5. The output of the audio preamplifier drives an audio derived 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 208 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	5.5	5.5
R	0.2	9.5	FILTER OUT	0	0
+12	13	13	+8.5	8	8
AGC OUT	0	0.4	AUDIO OUT	0	0
t	9	0	FILTER IN	0	0
GND	0	0	GND	0	0

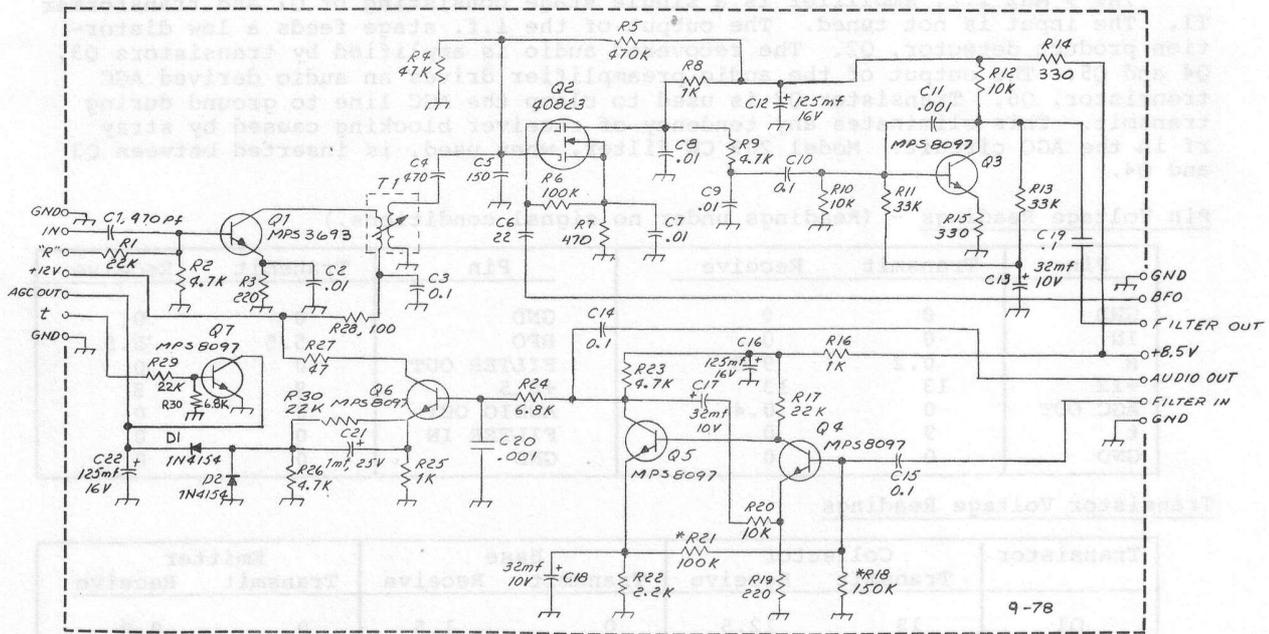
Transistor Voltage Readings

Transistor	Collector		Base		Emitter	
	Transmit	Receive	Transmit	Receive	Transmit	Receive
Q1	13	12.5	0	1.5	0	0.8
Q3	4.7	4.5	0.6	0.6	.05	.05
Q4	2	2.2	0.6	0.6	.05	.05
Q5	4	4	2	2.2	1.3	1.3
Q6	13	13	4	4	3.4	3.4
Q7	0	0.3	0.6	0	0	0
Q2 Source = 1.5		Drain = 12	Gate 1 = 0.65		Gate 2 = 1.5	



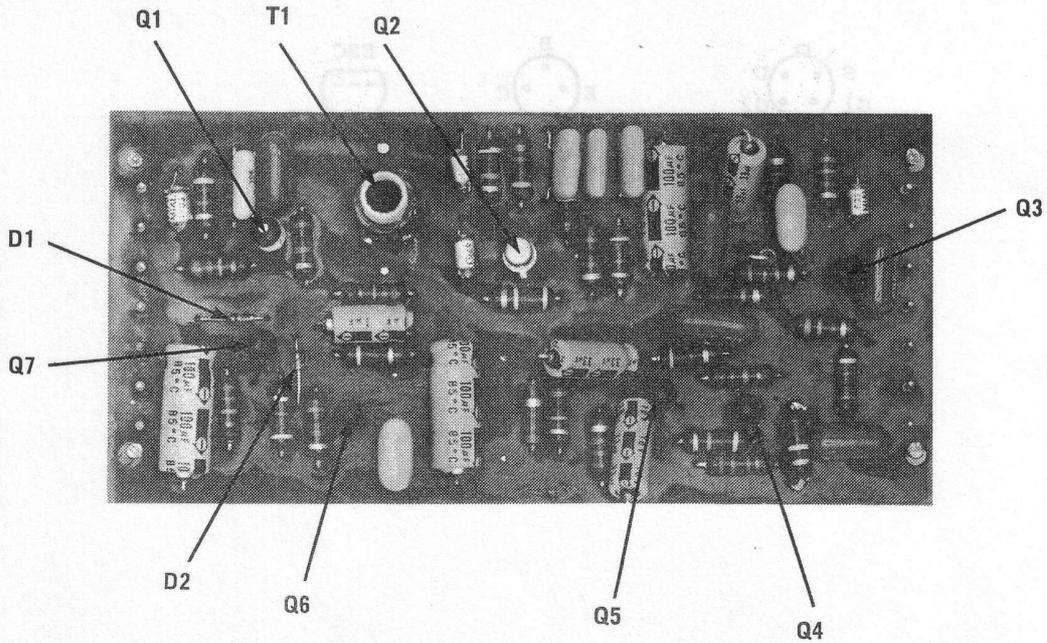
Pins viewed from bottom of PC board.

80208 I.F. BOARD



Pins viewed from top of board.

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



80208 I.F. BOARD

80274 AUDIO POWER AMPLIFIER

Integrated circuit, IC-1, contains the complete audio power and preamplifier. Input is applied to pin 2 and output taken from pin 8. Input signal may be from one of two sources, the received signal which is applied to the INPUT terminal and passes through the muting circuit when open or from the sidetone oscillator consisting of Q2 and Q3.

Input signal is shorted to ground whenever muting transistor, Q1, is put into the conducting state. This occurs in the transmit mode by the application of the "T" voltage to its base circuit through D1. C1, R1 and R2 form a short RC circuit to slightly delay the turn-on time of the audio signal.

The sidetone oscillator is a relaxation type made up of unijunction transistor Q2. C5, in conjunction with R8 and pitch control R7 determine the frequency. Q3 is the turn-on switch, controlled by the application of the SIDETONE voltage to its base. The SIDETONE control voltage is the "T" voltage, but it is applied only in the CW position of the MODE switch. Sidetone level is adjusted by R5. The sidetone signal is prevented from being muted along with the incoming signal by isolating resistor R4.

Pin Voltage Readings - (No signal conditions, CW mode, Drive fully CCW)

Pin	Transmit	Receive
GND	0	0
T	11	0.2
INPUT	0	0
OUTPUT	0	0
GND	0	0
SIDETONE	11	0.2
+12	13.8	13.8

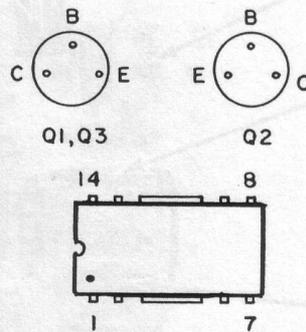
Semiconductor Voltage Readings - (CW mode.)

Transistor	Collector		Base		Emitter	
	Transmit	Receive	Transmit	Receive	Transmit	Receive
Q1	0	0	0.7	0	0	0
Q2	8.3	8.1	4.5	2.4	0	0
Q3	0	0	0.7	0.2	0	0

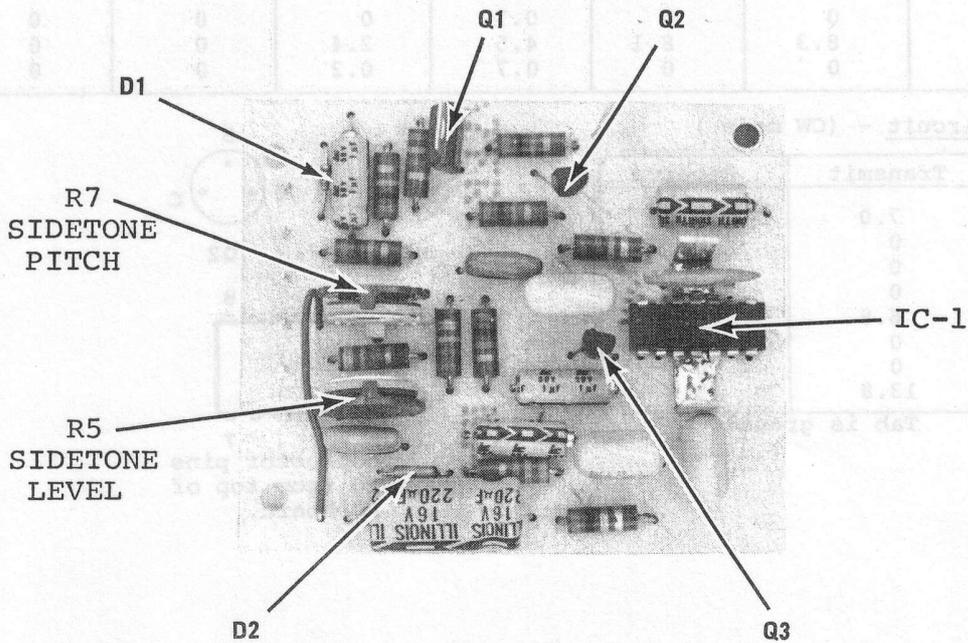
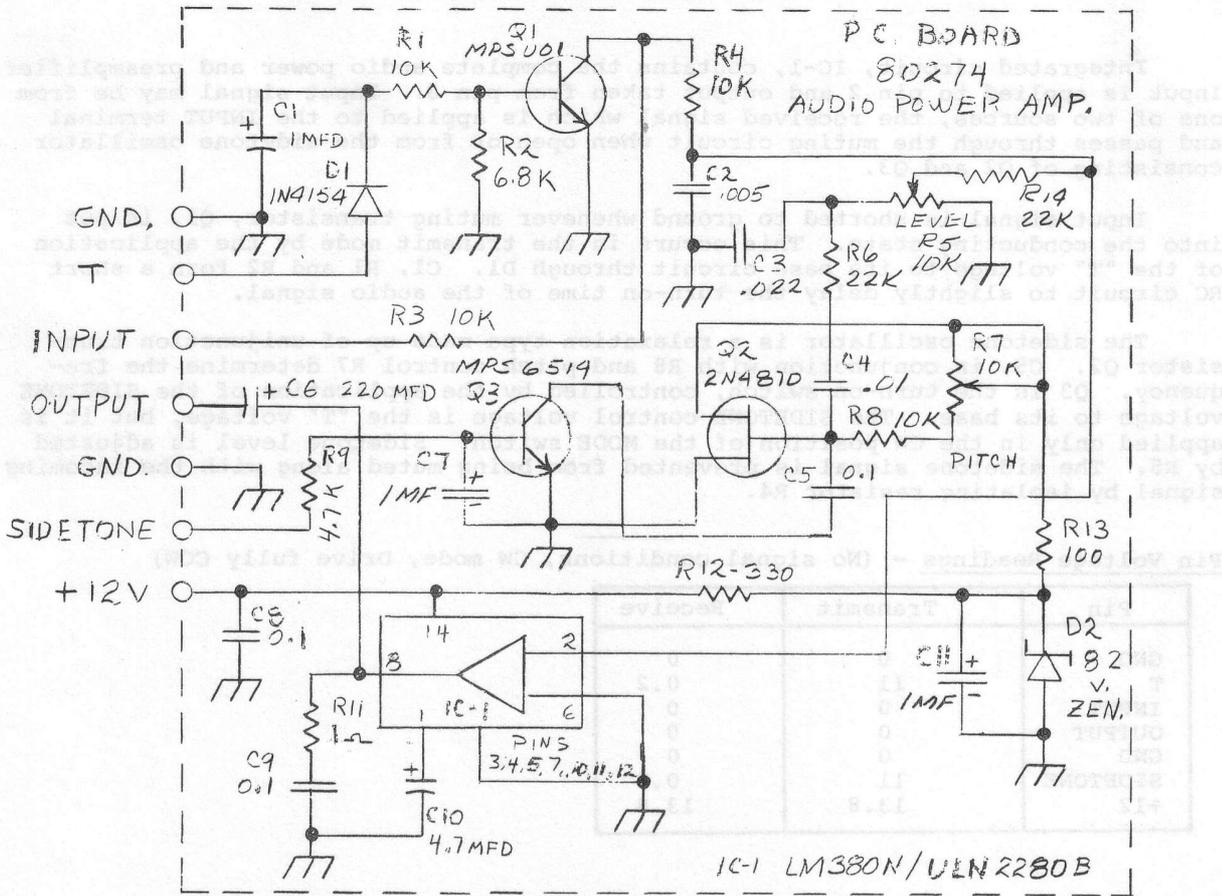
Integrated Circuit - (CW mode.)

Pin	Transmit	Receive
1	7.0	7.0
2	0	0
6	0	0
7	0	0
8	6.8	6.8
9	0	0
13	0	0
14	13.8	13.8

Tab is ground.



Semiconductor pins viewed from top of PC board.



80274 AUDIO AMPLIFIER

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. When terminal CWU is grounded (CW and LOCK modes), the modulator is purposely unbalanced to allow the CW carrier to pass through.

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 passband 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 ± 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 μ F 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 apply power.
- 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 passband.
- 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 readjustment 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.)

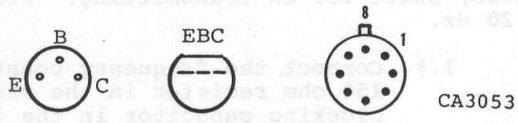
Pin	Transmit	Receive	Pin	Transmit	Receive
GND	0	0	OUTPUT	0	0
LBS	7	7	MIC VOL	0	0
CW	13	13	MIC VOL	0	0
+8.5	8	8	GND	0	0
T	9*	0	MIC	0	0
+8.5	8	8	RX I.F.	0	0
BFO	5.5	5.5	CWU	5.5	5.5

*In LOCK mode, variable between 1 and 9 V, depending on position of DRIVE control.

Transistor Voltage Readings

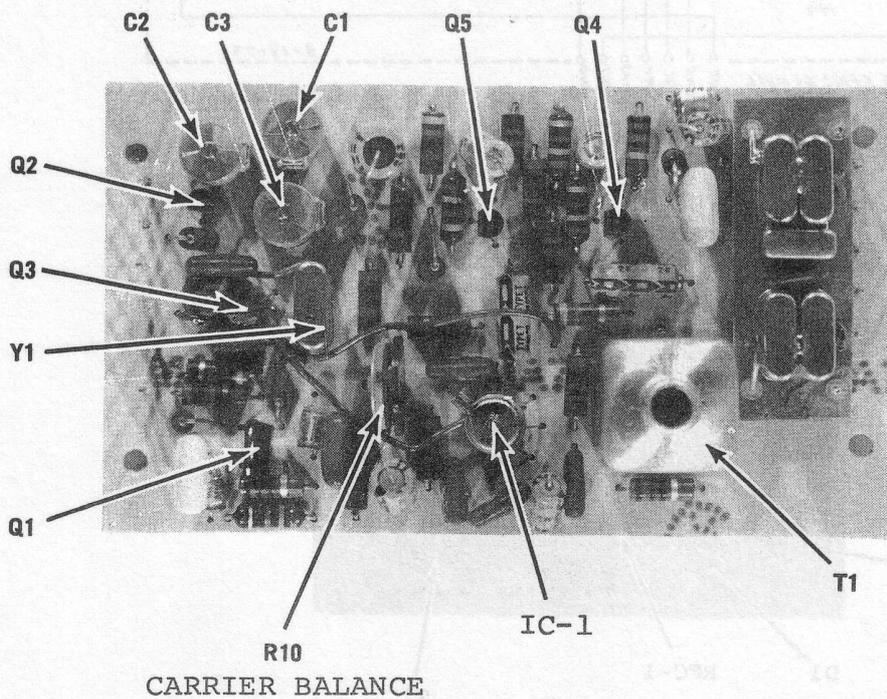
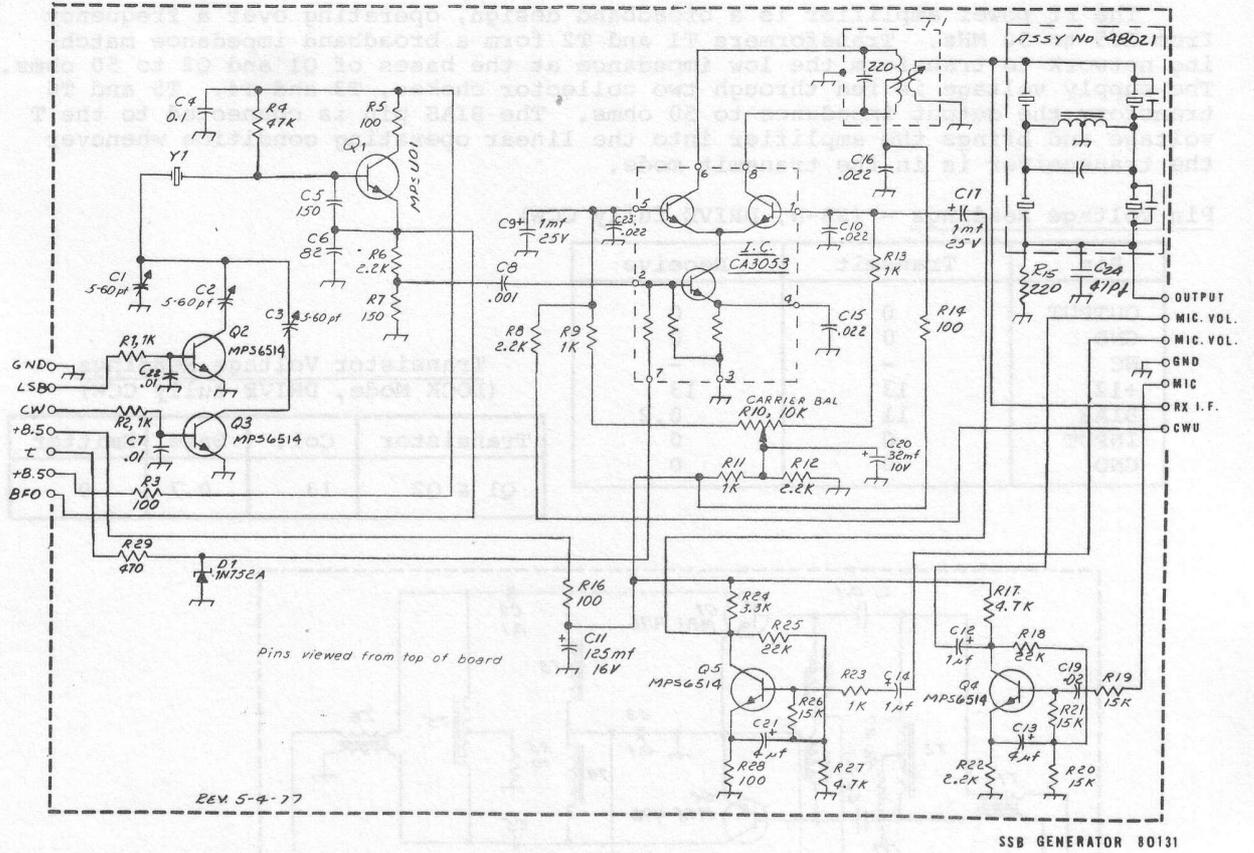
Transistor	Collector		Base		Emitter	
	Transmit	Receive	Transmit	Receive	Transmit	Receive
Q1	7.5	7.5	5.5	5.5	5.5	5.5
Q2	0	0	0.8	0.8	0	0
Q3	0	0	0.8	0.8	0	0
Q4	4.5	4.5	1.8	1.8	1.2	1.2
Q5	4.3	4.3	0.7	0.7	0.1	0.1

IC-1	Transmit	Receive
Pin 1	5	5
Pin 2	1.9	0
Pin 3	0	0
Pin 4	1.2	0
Pin 5	5	5
Pin 6	8	8
Pin 7	5.6*	0
Pin 8	8	8



Pins viewed from bottom of circuit board.

*In LOCK position voltage between 0.5 and 5.6 volts, depending on position of DRIVE control.



80185 RF POWER AMPLIFIER

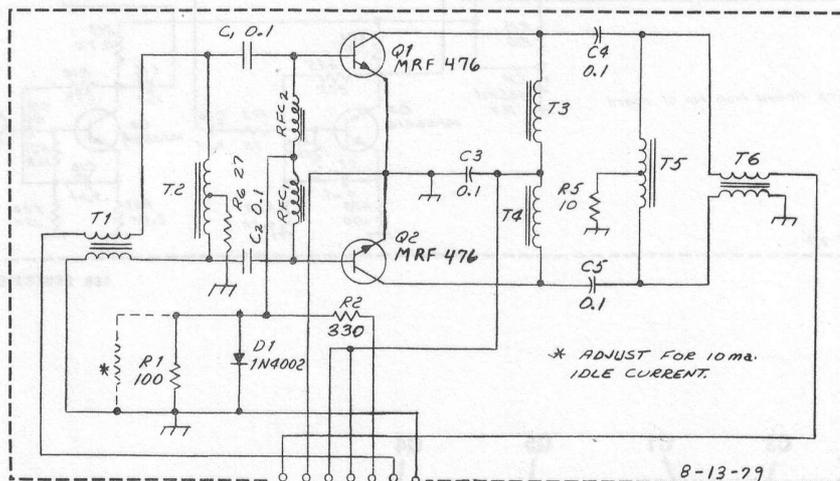
The rf power amplifier is a broadband design, operating over a frequency from 1.5 to 30 MHz. Transformers T1 and T2 form a broadband impedance matching network to transform the low impedance at the bases of Q1 and Q2 to 50 ohms. The supply voltage is fed through two collector chokes, T3 and T4. T5 and T6 transform the output impedance to 50 ohms. The BIAS pin is connected to the T voltage and brings the amplifier into the linear operating condition whenever the transceiver is in the transmit mode.

Pin Voltage Readings - (SB-N, DRIVE fully CCW)

Pin	Transmit	Receive
OUTPUT	0	0
GND	0	0
NC	-	-
+12	13	13
BIAS	11	0.2
INPUT	0	0
GND	0	0

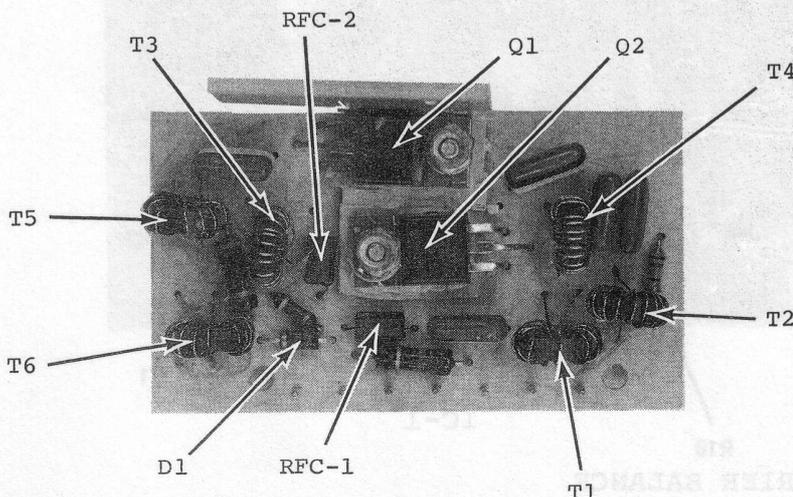
Transistor Voltage Readings
(LOCK Mode, DRIVE fully CCW)

Transistor	Col.	Base	Emitter
Q1 & Q2	13	0.7	0



T1&T2-16t Bifilar #28 CF102 Q1 mat'l.
T3&T4-16t #28 CF102 Q1 mat'l.
T5&T6-16t #28 Bifilar CF102 Q1 mat'l.
D1 1N4002
R1 100
R2 330
R3 27
R4 10
R5 10
R6 27
C1 0.1
C2 0.1
C3 0.1
C4 0.1
C5 0.1
Q1 MRF 476
Q2 MRF 476
T1 T2 T3 T4 T5 T6
D1
R1 R2 R3 R4 R5 R6
C1 C2 C3 C4 C5
Q1 Q2
RFC-1 RFC-2
* ADJUST FOR 10mA IDLE CURRENT.
8-13-79

80185 R.F. POWER AMP.

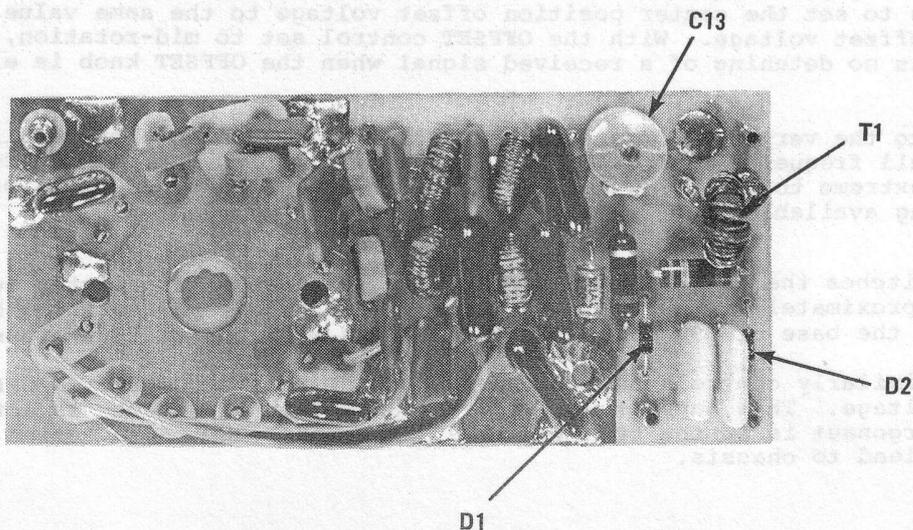
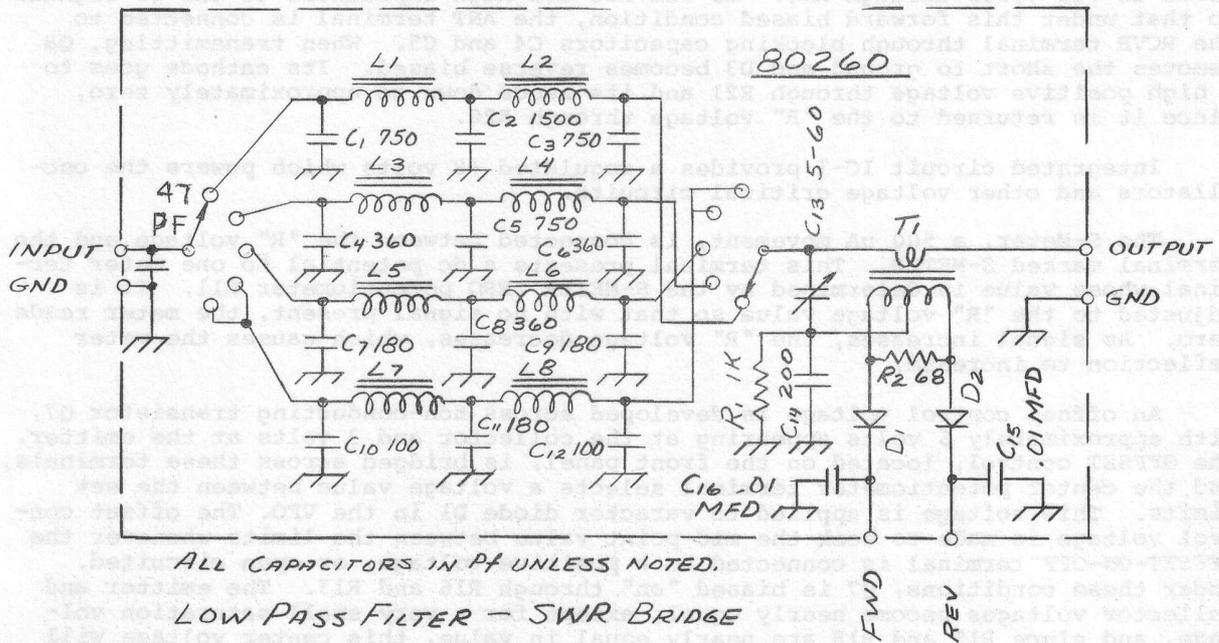


80260 LOW PASS FILTER - SWR BRIDGE

This PC assembly is an integral part of the main chassis and is mounted vertically on the outer back surface of the VFO oscillator sub-chassis. Rf output from the power amplifier is passed through one of four low pass filters as selected by the position of the BAND switch. The 21.0 and 28.0 MHz bands share a common filter. These filters greatly reduce the harmonic content from the raw output of the final amplifier.

Output from the selected filter passes to the antenna jack through T1, whose secondary feeds the SWR bridge circuit. C13 is adjusted for best null when observing REVERSE power on the meter at a frequency of 29.0 MHz, with a 50 ohm resistive dummy load connected to the antenna terminals. (Figure 2)

Since there are no pin terminals nor transistors on this assembly, no voltage measurements are required when servicing the unit.



80260 LOW PASS FILTER-SWR BRIDGE

Transistors Q1, Q2 and Q3 form a complementary switch. The output, connected to pin "T", is normally at ground potential. Transistors Q4, Q5 and Q6 form a similar switch, whose output is connected to pin "R". This output potential is normally at about +10 volts. The "T" voltage is used to bias the transmitting stages to the "on" condition, and the "R" voltage for biasing the receiver stages on. When the T/R pin is grounded, the potentials at "T" and "R" reverse, i.e. "T" goes to +10 volts and "R" to ground.

The receive bias switch, Q4, Q5 and Q6, is also used as an AGC amplifier. The positive AGC voltage, derived from the i-f assembly, is applied to the AGC pin, which controls the value of "R" voltage. As signal strength increases, the "R" value decreases. This circuit is independent of the value of the "T" voltage.

PIN diode, D3, acts as an rf switch in the receiver antenna line, which is controlled by Q8. In the receive mode, "R" voltage applied to the base of Q8 turns it on and effectively places its collector at ground potential. Doing so forward biases D3, since its cathode is tied to the collector through L1 and its anode to +12 volts through R20. L1 and R20 are high impedances to the rf signals so that under this forward biased condition, the ANT terminal is connected to the RCVR terminal through blocking capacitors C4 and C5. When transmitting, Q8 removes the short to ground and D3 becomes reverse biased. Its cathode goes to a high positive voltage through R21 and its anode down to approximately zero, since it is returned to the "R" voltage through R20.

Integrated circuit IC-1 provides a regulated +8 volts which powers the oscillators and other voltage critical circuits.

The S-Meter, a 500 uA movement, is connected between the "R" voltage and the terminal marked S-METER. This terminal presents a dc potential to one meter terminal whose value is determined by the S-METER ZERO potentiometer R11. It is adjusted to the "R" voltage value so that with no signal present, the meter reads zero. As signal increases, the "R" voltage decreases, which causes the meter deflection to increase.

An offset control voltage is developed across non-conducting transistor Q7, with approximately 6 volts appearing at the collector and 3 volts at the emitter. The OFFSET control, located on the front panel, is bridged across these terminals, and the center potentiometer terminal selects a voltage value between the set limits. This voltage is applied to varactor diode D1 in the VFO. The offset control voltage is made to seek the mid-point value between the limits whenever the OFFSET-ON-OFF terminal is connected to a positive voltage, or open circuited. Under these conditions, Q7 is biased "on" through R16 and R17. The emitter and collector voltages become nearly equal, except for a very small saturation voltage, and since R15 and R18 are nearly equal in value, this center voltage will approximate one half of the applied 8 volts. Condition for this to happen, i.e. OFFSET disabled, is in the transmitting mode when "T" voltage is applied to the ON-OFF terminal, or when the knob switch controlling OFFSET ON-OFF is opened. R18 serves to set the center position offset voltage to the same value as the disabled offset voltage. With the OFFSET control set to mid-rotation, adjust R18 so there is no detuning of a received signal when the OFFSET knob is either in or out.

Due to the very small residual saturation voltage of Q7, there will remain a very small frequency shift when the OFFSET is disabled and the control is varied from one extreme to the other. This variation is in the order of 5% of the frequency swing available when OFFSET is working.

Q9 switches the panel LED marked RF on whenever the transmitter output rf reaches approximately two watts. Rf voltage is sampled and rectified by D4 and applied to the base of Q9. The LED is in series with the emitter-ground path.

Q10 similarly controls the OT panel LED whenever the OFFSET ON/OFF terminal changes voltage. This happens whenever the OFFSET panel switch is actuated or when the Argonaut is in the transmit mode. The panel LED is in series with Q10's collector lead to chassis.

Pin Voltages - (RF gain fully CCW, DRIVE fully CCW, no signal conditions, CW mode, OFFSET knob in and centered)

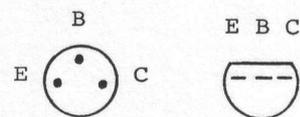
Pin	Transmit	Receive	Pin	Transmit	Receive
T/R	0	10	GND	0	0
R	0.5	9.5	+12	13	13
AGC	0	0.4	+8.5	8	8
T	11	0.2	OFFSET	3.5	5.3
RCVR	0	0	OFFSET ON/OFF	10	0
ANT	0	0	S-METER	0.5	9.5
GND	0	0	OFFSET	3.5	2

Transistor Voltage Readings

Transistor	Collector		Base		Emitter	
	Transmit	Receive	Transmit	Receive	Transmit	Receive
Q1	12	0	0	0.7	0	0
Q2	0	0	12	0	9	0
Q3	13	13	12	0	11	0.1
Q4	0.7	10.5	0	0.4	0	0
Q5	0	0	0.7	10.5	0.3	9.5
Q6	13	13	0.7	10.5	0.3	9.5
Q7	4.2	5.3	4.5	0.6	4.1	3
Q8	13	0.1	0.1	0.7	0	0
Q9	13	13	0	0	0	0
Q10	0.1	1.6	13	6.6	13	7.3

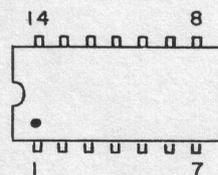
IC-1 Voltage Readings

Pin	Voltage	Pin	Voltage
1	-	8	-
2	8.2	9	-
3	8.0	10	8.2
4	7.1	11	13
5	7.1	12	13
6	7.1	13	10
7	0	14	-

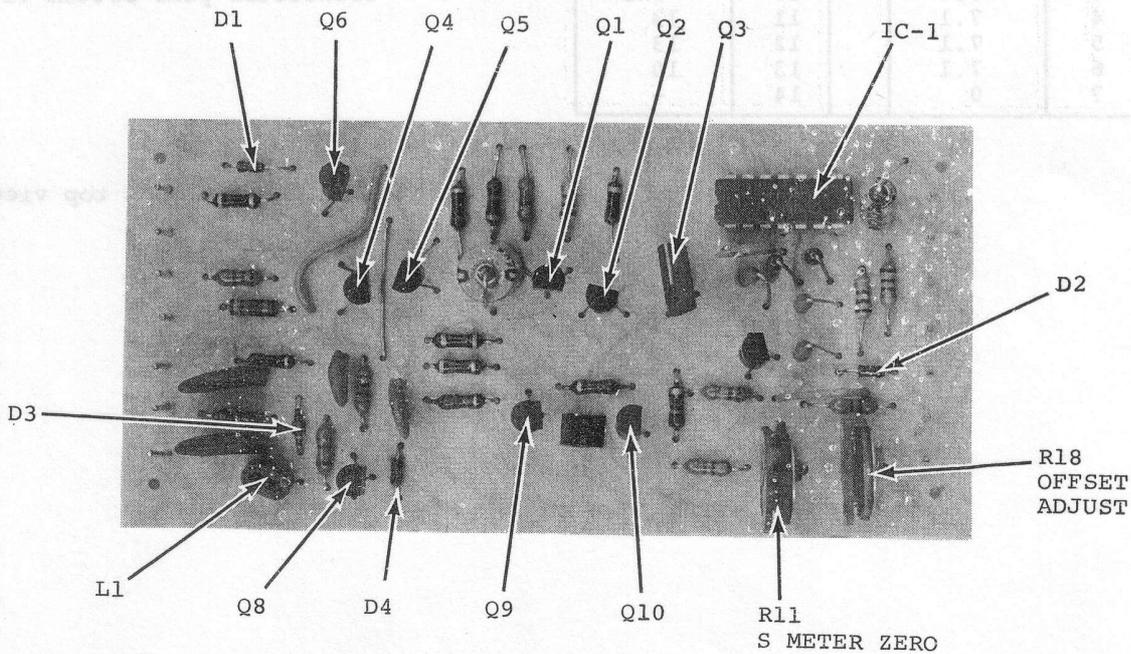
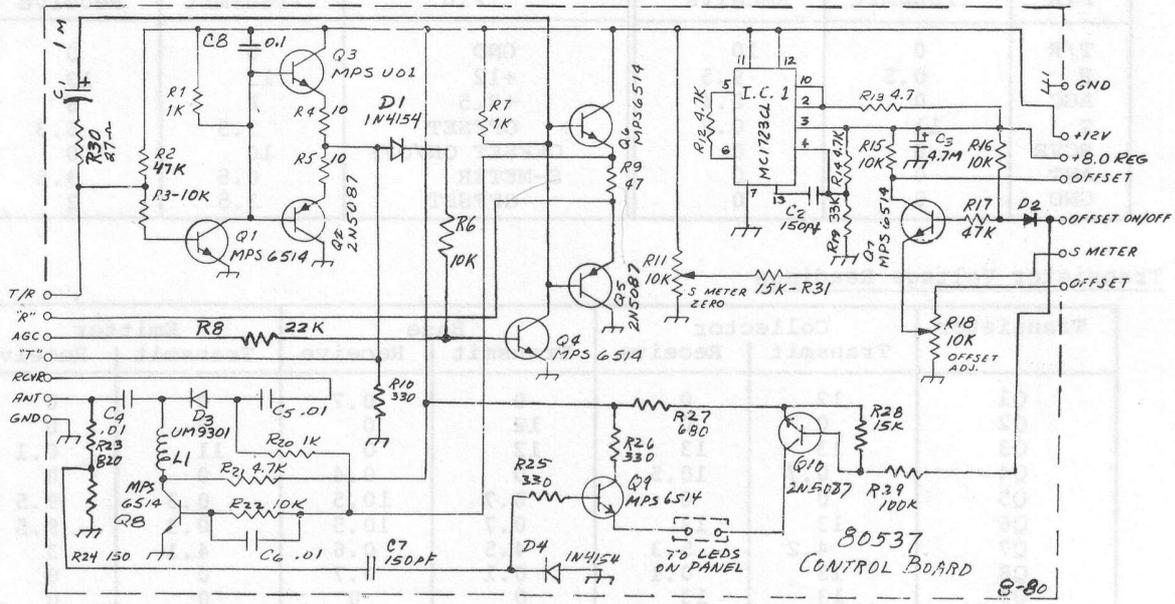


Transistor pins bottom view.

Integrated Circuit pins top view.



Pin Voltages - (See main telly CCW, DRIVE fully CCW, no signal conditions, CW mode, OFFSET knob in and centered)



80537 CONTROL BOARD

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