DAVCO ELECTRONICS INCORPORATED

TECHNICAL MANUAL

DR-30 COMMUNICATIONS RECEIVER

ADVANCED SOLID-STATE COMMUNICATIONS

DAVCO ELECTRONICS, INC., TALLAHASSEE, FLORIDA

OPERATION

INSTALLATION

SERVICE

MANUAL

DR-30
COMMUNICATIONS RECEIVER

WARRANTY

All DAVCO products are warranted for six months from the date of shipment against defects in material or workmanship under normal use and service. Should any product prove defective during the warranty period, it will be repaired or replaced at no charge by DAVCO ELECTRONICS, INC.

This warranty shall apply only to the original purchaser unless the transfer of ownership is reported in writing to the Service Department of DAVCO ELECTRONICS, INC., prior to the appearance of the defect.

This warranty is not voided by work done in accordance with DAVCO recommended service procedures and with the recommended tools and instruments.

This warranty is totally voided by (a) use of corrosive flux or solder; (b) obvious evidence of physical abuse; or (c) failure to follow instructions regarding connections. DAVCO ELECTRONICS, INC., is not liable for consequential damages.

#696

1-3.

CERTIFICATION

DAVCO ELECTRONICS, INC., certifies that this instrument was thoroughly tested and inspected prior to shipment from the factory. When shipment was made the instrument was free from any defect and met all published specifications.

SSB-CW SENSITIVITY

All measurements made with Hewlett-Packard model 606B Signal Generator with calibration traceable to National Bureau of Standards and other equipment of industrial standards.

Signal level, in microvolts, required at antenna input for a signal-noise-to-noise ratio of 10 db; medium (2.1 kc mechanical filter) selectivity.

9.8 Mc	.3	28.8 Mc	.3
3.8 Mc	.3	29.3 Mc	.3
7.3 Mc	.3	29.8 Mc	.3
14.3 Mc	.3	50.3 Mc	.5
21.3 Mc	.3	A ____ Mc	
28.3 Mc	.3	B ____ Mc	

MODIFICATIONS	COVERAGE	PRESELECTOR SETTING
BAND A		
BAND B		
OTHER		

ZEL


DAVCO
MODEL DR-30 RECEIVER
WWV
95
35
B
A
50
29
21
28
28.5
.5
.6
.7
.8
.9
1.0
A
B
AGC
HOLD
"S" UNITS
ANL LEVEL
RF GAIN
AM
USB
LSB
SELECTIVITY
.5
2.1
5
PRESELECTOR
PUSH
STBY
NOTCH TUNE
0
-5
+5
AF GAIN
FREQUENCY
CAL
LT.
OFF

DR-30 COMMUNICATIONS RECEIVER

You have chosen one of the finest pieces of electronics equipment available. Like most radio receivers, the DR-30 can be operated with a minimum of experience, and, with the DR-30, better than average results will be achieved. The provision of a slow tuning rate, effective Automatic Gain Control, and excellent selectivity assure superb and simple performance under normal conditions.

Operation under marginal conditions of noise, band crowding, and weak signals offers a challenge to equipment and operator alike. The DR-30 is designed specifically to meet these conditions and you, the operator, can quickly learn your part of the team-work. You'll find an almost unlimited number of tuning techniques to meet any condition.

We suggest that you read very carefully the following sections on connecting your receiver and that you follow the instructions. When you have the receiver ready for operation, connect it to an antenna--or a piece of wire--and simply experiment. Try all the controls; see what they do. Listen to foreign broadcast stations, WWV and amateur transmissions on AM, CW, and SSB. After a few minutes of listening you'll be better prepared for a careful reading of the following detailed description of control functions and circuit operation. By a thorough understanding of each receiver feature, you'll be able to take advantage of the highly unusual capabilities of the equipment.

Your DR-30 receiver is a precision instrument incorporating the latest state-of-the-art design features. Your experience with it will allow it to earn your respect. Put it to all the tests: you'll continue to be happy with its versatility, its reliability, and its superlative performance.

DAVCO ELECTRONICS, INC.

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1-7. General Technical Description

The DAVCO DR-30 is a double conversion superheterodyne receiver employing 38 solid-state devices in circuitry designed for maximum, uncompromising performance and versatility.

The DR-30, in its standard form, gives full coverage of all amateur frequencies between 3.5 and 50.5 Mc., with provision for other coverages between 3.0 and 54 Mc. at the user's option. Three selectivity choices are provided for AM, SSB, and CW reception. Other standard features include a built-in T notch, a crystal calibrator, and a noise blanker.

The DR-30 utilizes field-effect transistors in the RF stage and in the first mixer. The unusually low noise of these transistors provides exceptional weak-signal reception; the DR-30 sounds quiet between stations, and the unique capability of the field-effect transistor in resisting overloading and cross-modulation coupled with the high sensitivity gives superb performance.

The variable selectivity is provided by three IF transformers, three ceramic Transfilters, a 455 kc. crystal filter, and a 2.1 kc. Collins mechanical filter. Switching is effected through switching diodes operated by DC from the front panel. Each selectivity choice is designed for exceptional skirt rejection and the optimum bandwidth for reception in each receiver mode.

The noise-blanker is designed particularly for CW and SSB use, providing a dramatic improvement in the reception of CW and SSB under the most difficult conditions. The performance of the blanker permits virtual elimination of impulse noises reaching the receiver from vehicle ignitions, power lines, and electrical equipment. It is usually possible to extract extremely weak signals of perfect intelligibility even when noise causes very high S-meter readings. Operation is very simple: set the front-panel threshold control until noise disappears.

Both the noise limiter and T-notch circuits are in the IF portion of the receiver. These circuits prevent the actuating of the AGC system by interference and so eliminate any desensitizing of the receiver by undesired signals or noise.

The compactness of the DR-30 is achieved, in part, by the use of special toroid coils in the VFO and RF circuitry. For a given Q, a toroid is much smaller, requires less shielding, and is more stable than an ordinary coil.

The DR-30 can be used with the chassis at either positive or negative ground. There is diode protection from an incorrect power supply connection. Muting provisions and built-in RF protection make it compatible with any existing equipment.

Varying input voltages have no effect on stability. The panel lights can be switched off to reduce drain while operating from batteries. The audio output matches a wide variety of speaker and earphone impedances. Output jacks on the rear of the receiver give access to the crystal oscillators, the VFO, and the mechanical filter for use with companion transmitters or home-built equipment. A front-panel switch wired to the rear connection plug permits control of other accessories such as a phone patch or an antenna relay.

The DR-30 is designed for mobile, fixed, and portable operation under the demands of continuous commercial service and under extreme environmental conditions.

1-8. General Mechanical Description

The DAVCO DR-30 receiver is designed and manufactured to the standards reserved for scientific instrumentation. The same care and precision used in the production of optical and precision measurement equipment are employed throughout DAVCO manufacturing operations.

The basis of the DR-30 is the solid, 3/16 inch thick aluminum extrusion used for the chassis. The extrusion is milled to provide holes, slots, and surfaces for the attachment of parts and subassemblies. The inherent rigidity of the extrusion contributes to the superb mechanical and frequency stability of the DR-30.

The subassemblies mounted to the chassis include

(1) The wiring harness composed of the plug-in module connectors, the controls, and the between-module wiring. All the wiring is TEFLON insulated so that servicing or modifications can be undertaken without fear of burnt insulation from soldering.

(2) The main tuning drive for the DR-30 is an aluminum block milled to closer than one-thousandth of an inch tolerances. The drive mechanism couples directly from the tuning knob to the main tuning capacitor. Attached to the milled block are four precision-ground ball-bearing races in which the tuning shafts with their integral pinion gears rotate. Also on the pinion shafts are the two 64-pitch spring-loaded split antibacklash gear assemblies. The two-step reduction gives a tuning ratio of 81:1. A small flywheel on the first shaft is employed to achieve smooth tuning and to permit rapid band excursions.

(3) A dial-drag knob located just below the main tuning knob allows the operator to apply an adjustable amount of friction to the tuning mechanism. The dial-drag is most useful in locking the dial for fixed-frequency applications and in mobile operation when the operator might accidentally jar the tuning knob. With no drag applied, tuning is virtually effortless and, even in band-scanning, operator fatigue is eliminated.

(4) The dial pointer is driven by a cord wound on a threaded shaft. The thread of the shaft allows the cord to wind in only one way, and calibration cannot shift. Since the cord moves only the dial indicator, not the tuning capacitor, cord life is virtually unlimited.

(5) The panels, subpanels, and brackets which hold the controls and other parts are made of stainless steel.

(6) The band-change switch, part of the RF module assembly, is a top-quality ceramic unit.

(7) All the active electronic circuitry of the DR-30 is mounted on subassemblies which plug into the main harness assembly. The modules slide into the slots in the chassis extrusion which guide them to the harness receptacles and hold them solidly. The circuit module boards are of glass-epoxy construction. Each of the nine modules is described in section VI of this manual.

(8) The receiver is provided in a scratch-resistant case of enamel textured 1/16 inch aluminum but can be easily removed from the case for custom installation.

1-9. Specifications

Double conversion superhet, fully transistorized; crystal controlled first oscillator, ten crystals supplied for frequencies below:

3.5 - 4.050 Mc.
7.0 - 7.550 Mc.
9.5 - 10.050 Mc.
14.0 - 14.550 Mc.
21.0 - 21.550 Mc
28.0 - 28.550 Mc.
28.5 - 29.050 Mc.
29.0 - 29.550 Mc
29.5 - 30.050 Mc
50.0 - 50.550 Mc

plus two extra switch positions for optional 550 kc. segments

SENSITIVITY: better than .6 uv for 10db s/n; 1 uv for .3 watts audio.

SELECTIVITY: SSB: 2.1 kc Collins mechanical filter
AM: nominal 5 kc broad IF
CW: 200 cycle xtal filter in series with mechanical filter for improved skirt rejection.

STABILITY: negligible warm-up change; less than 100 cps change per hour; less than 25 cps for 20% power supply variation.

TUNING: spring-loaded split-gear drive unit, backlash-free; flywheel loading for large band excursions; adjustable dial drag and lock.

CALIBRATION: internal 100 kc crystal calibrator supplied; slide-rule dial has 5 kc markings, hair-line pointer; tuning knob has 2 kc marks on perimeter; internal frequency shift for sideband compensation.

SPURIOUS RESPONSES: images and IF down at least 60 db below 22 Mc.; at least 35 db, 22-54 Mc. Internal spurious less than equivalent 1 uv signal at input in ham bands.

FREQUENCY READOUT: significant figure (Mc) appears in indicator window, is color coded as to whether .000-.550 Mc or .500-1.050 section is in use. Provides direct calibration with accessory crystals.

DETECTORS: linear AM detector; separate product detector for SSB and CW; crystal controlled BFO-carrier generator for USB and LSB.

AGC: full action on all modes of operation; has fast attack characteristic; panel switch selects fast release (.015 seconds) for AM or break-in, medium (.2 sec.) or slow release (.8 sec.) for SSB and CW. Audio output varies 8 db change for 80 db change in RF input. AGC action is delayed to 5 microvolts.

NOISE LIMITER: true blanking type action occurs before selectivity lengthens pulses; has separate ANL amplifier and detector, diode noise gate. Front panel control.

RF STAGE: low-noise premium field-effect RF amplifier and mixer; input and output circuits employ high-Q toroidal inductors.

REJECTION NOTCH: tunable notch provides up to 60 db rejection of undesired carrier.

AUDIO: .6 watt at 5% distortion; max 1 watt. Output impedance 8 to 45 ohms speaker; 600 ohm earphones preferred.

INTERMEDIATE FREQUENCIES: 1st IF: 2.405-2.955 Mc (variable, tracked), 2nd IF: 455 kc.

SEMICONDUCTOR COMPLEMENT:
23 bi-polar transistors
2 field-effect transistors
10 signal diodes
1 power diode
2 zener regulator diodes

POWER REQUIREMENTS: 12 volts DC; 300 ma. maximum with panel lights (switch operated).

SIZE: 4" H, 7 1/8" W, 6" D. Weight 7 pounds

2-1. Unpacking

This instrument was inspected both mechanically and electrically prior to shipment. Performance data from these tests is registered in section 1-2 of this manual.

Carefully remove the receiver from its packing material. The receiver may be lifted from its container by the tape handle lying across the front panel. As soon as the receiver is sufficiently raised, grasp it firmly. Do not rely on the tape handle for transfer to a working space or inspection surface.

Examine the receiver carefully for any signs of damage which may have occurred in transit. If any signs of such damage appear, file a claim immediately with the carrier and notify DAVCO ELECTRONICS, INC., of the apparent nature of the damage. Retain all shipping labels and packing materials.

You will note a package of small connectors and other parts. Check the contents of this package against the list below and report any shortage to DAVCO ELECTRONICS, INC. Additional connectors may be purchased from any radio parts supplier.

PARTS LIST

2 100-125 mfd electrolytic capacitors
1 8-connector Jones Plug (2 in export shipments)
3 RCA phono plugs (6 in export shipments)
1 length 2-conductor speaker wire
1 short length bare wire
2 lengths colored hook-up wire
1 lockwasher (8-32)
1 wing nut (8-32)
1 instruction manual
extra crystals, if any, are installed in the receiver unless otherwise noted.

Please refer to section 1-3 of this manual for details concerning any modifications of this particular receiver and factory-installed crystals. Also check the serial number on the rear panel of the receiver against that shown in section

2-2. Preparation for Use

Connecting the DR-30 for operation is simple. You should read the summary below covering power supplies, antennas, and speakers, then wire the connector plug, read the more detailed discussions of installation, and put the receiver in service. You will find that an understanding of the receiver's capabilities will assist you in choosing which type of power supply, speaker, and other connections are most suitable for your own installation.

For operation the DR-30 must be connected to (a) an appropriate power source, (b) a speaker or earphones, and (c) an antenna/ground system. The power and speaker connections are made through the 8-connector Jones Plug on the rear panel. The antenna/ground connections are made through the other real panel connections provided.

Power Source: The DR-30 operates from 12-16 volts DC. Stability is not affected by variation of input voltages within this range. Although voltages to critical circuits such as oscillators are internally regulated by zener diodes, a correct supply should have good filtering and either regulation or an adequate reserve output. Improper filtering is indicated by a loud hum from the speaker. To determine regulation, measure the voltage under a full load of high output with the panel lights on. The voltage should not drop below 11.5 volts on loud audio nor rise above 15 volts with little audio.

Any power source used must meet these general requirements:

A. A nominal 12 volt minimum DC output under a load of 100 milliamperes or more.

B. Regulation or reserve output so that the output does not vary more than from 12 volts under load to 15 volts with no load.

Also essential for AC sources are

C. Good filtering.

D. Isolation from the AC line to eliminate any shock hazard.

The following power sources will provide the proper voltage:

A. A battery-pack (flash-light cells, for example).

B. A 12 volt automobile electrical system or a 6 volt system plus extra batteries.

C. The DAVCO DR-30s AC/battery-pack power supply.

D. A transformer-type homebuilt AC power supply.

E. A lab, service bench, or other commercial DC power supply.

The above power sources are discussed in detail in following sections.

Speaker: The DR-30 audio system operates most effectively with a 45 ohm loudspeaker load, but a 16 or 8 ohm speaker can be used with only a slight loss in audio output capability. A 3.2 ohm speaker is not recommended.

An automobile speaker can usually be used with the DR-30 if instructions regarding connection (see section 2-8) are followed. An intercom, TV replacement, or high-fidelity speaker will also give good performance. You should not expect adequate performance or power-handling capability from a tiny portable-radio replacement speaker. If you are purchasing a speaker for use with the DR-30, use the notes in section 2-10 as a guide.

2-3. Electrical Connections

Connections for the external power source (battery or power supply) and speaker are made by use of the 8-connector "Jones Plug" on the rear of the unit. Red, black, and paired white wire is provided for the first connection: choose your own colors and lengths for custom installation.

Jones Plug wiring

pin 1: no connection
pin 2: no connection
pin 3: jumper to pin 4
pin 4: jumper to pin 3
pin 5: one side of speaker
pin 6: Negative supply in series with STBY switch for muting purposes; oscillators remain functioning when off or on. If no external muting is employed, jumper to pin 8.
pin 7: POSITIVE (+) power connection
pin 8: NEGATIVE (-) power supply connection

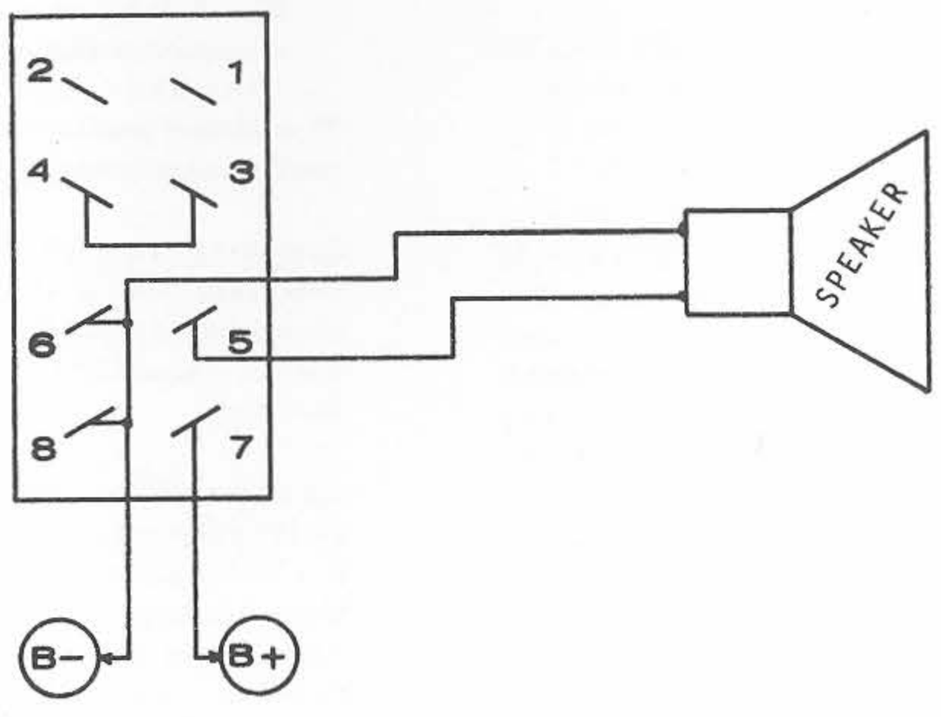
The other side of the speaker goes to pin 8 or pin 6 depending upon the muting system used; use the one which provides least pop when going to the STBY mode. Note that this means that one side of the speaker is connected directly to the NEGATIVE power supply connection; see speaker and power supply sections in this booklet for further information.

Before proceeding any farther, continue reading about power supply requirements, speakers, antennas and other matters in the pages which follow.

DO NOT PLUG IN THE JONES PLUG YET!

BACK VIEW

MALE JONES PLUG



2-4. Operation--The First Time

Double check the polarity and chosen color coding of the power wiring. Solder the wires to the Jones Plug terminals. Make the battery-power supply connections and the loudspeaker connections as indicated.

Insert the Jones Plug in the receptacle on the rear of the receiver. Plug some antenna (use a phono connector) in the ANT I jack. (If a piece of wire is used temporarily in a steel frame building, make an effort to drape it out a window.)

Turn on the DR-30 with the panel switch on the AF Gain control. Move the panel lights switch to the LT position to see that the lights are working. (A polarity diode at the power supply input connection prevents operation and damage from incorrect connection.)

PULL the RF Gain Control "out"; this is the STBY switch and the receiver does not operate with the control pushed "in".

Be sure the Notch Tune, the RF Gain, and the ANL Level control are fully counter-clockwise. Choose your band of operation; turn the preselector until the pointer matches the band in use, and, with the audio gain turned up, peak receiver or antenna noise heard at that frequency.

Most controls are self-explanatory, so tune in various signals to get to know the applicable controls. After achieving some familiarity read the remaining portion of this manual for further details concerning exact control functions.

2-5. Typical Control Settings

SINGLE SIDEBAND RECEPTION

AGC HOLD: in "hold" position--to the right
RF GAIN: fully counterclockwise; pulled "out"
PRESELECTOR: peaked on desired frequency: fine adjustment for peaking on noise.
AUDIO GAIN: advanced until background noise is audible
SELECTIVITY: 2.1 kc.
FUNCTION SWITCH: usually LSB for 3.5 and 7 Mc bands; USB for others.
NOTCH TUNE: fully counterclockwise
ANL LEVEL: fully counterclockwise
TUNING: operating in the SSB portion of an amateur band, very slowly adjust the tuning control until a voice signal sounds natural. If no tuning adjustment results in a natural sound, try changing the function switch to the other SB position.

The sharpness of the notch makes this tuning critical. Retuning the main tuning control necessitates retuning the notch.

If noise is present, advance the ANL LEVEL control as suggested in the Control Function section.

CW RECEPTION

Controls as in SSB reception, but the selectivity control may be in the 2.1 or .5 kc position. When the narrow filter is used, note that one particular audio tone stands out when tuning; this tone corresponds to the center of the filter bandpass and is the point where the S-meter will read highest. This is a very sharp filter and is most effective for digging a weak station from the midst of a number of stronger ones or for listening in the presence of considerable noise. The Notch and ANL should be used when required.

AM RECEPTION

FUNCTION SWITCH: AM position
SELECTIVITY: 5 kc if conditions permit; otherwise treat as if signal were SSB.
NOTCH TUNE: The notch is extremely useful for receiving AM under normal, crowded conditions. The noise limiter can cause distortion, and is of limited effectiveness on AM. However, the effectiveness of the noise limiter can be improved somewhat by reducing the RF input (turning the RF Gain clockwise) until the AGC is not actuated (little or no S-meter indication).

When using the notch in AM reception, note that elimination of either the desired or the undesired carrier stops the whistle: make sure you null the undesired carrier.

2-6. What to Expect From the DR-30

The DR-30 is a high-performance receiver designed to bring you the maximum ease and pleasure under any operating conditions. To take full advantage of your DR-30's capabilities, please remember that the signals you receive will be influenced by several factors.

First, they will be stronger if you use a good antenna and will be rather weak if you use only a short piece of wire. The DR-30 has superb sensitivity; it can compensate very well for short antennas, but there is no substitute for an adequate installation.

Second, the strength of signals on various frequencies varies with the time of day. The lower ranges, 3.5, 7, and 10 Mc., are strongest in the late afternoon, evening, night, and very early morning hours. The higher frequencies, 14, 21, 28, and 50 Mc., are stronger during the daylight hours.

During the evening your DR-30 will offer good reception of the low frequency bands even when used with a minimum antenna. During your first operation of the DR-30, listen for foreign broadcast stations on the 10 and 7 bands and then for amateurs using AM, CW, and SSB on the 7 Mc. band. If your first operation is in the daytime, you will find a number of amateur stations on the 7 and 14 Mc. bands.

Third, even in your first temporary connection be sure to use a ground for the equipment. During your first operation you will be learning to use the DR-30; don't handicap yourself by choosing conditions that are not typical of those under which you'll be doing most of your operating.

Fourth, if you use a poor antenna your location will affect reception. City areas often have high radio noise levels, but the noise blanker circuitry of the DR-30 is specifically designed to provide the best possible communications under such conditions. The use of this control will pull in signals that cannot be heard on other receivers.

Also, a metal-frame building will shield the antenna from signals. Try to have the antenna outside if at all possible.

Fifth, signal levels on most bands are great enough to keep the DR-30's S-meter well towards its higher ranges when a reasonable antenna is used and when operating conditions are normal. The weaker signals will move the S-meter only a little but will usually be quite clear and readable.

You will find that after only a few minutes practice the operation of the DR-30 controls is quite simple. Usually you'll just choose the mode of operation and the band, peak the preselector, and tune in the stations. The automatic gain control built into the receiver makes use of the volume control rarely necessary.

The other controls on the receiver, including the Notch-tune, the ANL level, selectivity, etc., are provided for use when conditions are challenging. A little more experience will teach you proper use of these circuits, and you'll be surprised at the capabilities the DR-30 shows under the most trying conditions.

The DR-30 is designed for pleasure in operating. It provides the best possible combination of operating simplicity with extra performance. Each circuit and feature has been provided without compromising other circuits. The construction techniques and components used assure the maximum in trouble-free enjoyment of these capabilities.

2-7. Battery Operation

The DR-30 performs very well on battery power packs, and such sources are recommended for fixed station as well as for portable operation. The use of batteries reduces or eliminates power-line carried noise and interference. In some installations this advantage may outweigh the slight expense of periodic battery replacement.

The DAVCO DR-30s power pack contains holders for nine type D cells, a battery level indicator, a 110 volt power supply, and a speaker. A front panel switch selects AC or battery operation.

A compact and convenient battery pack for portable use can easily be assembled at home using

A. Two six volt lantern cells (Eveready 510S or equivalent) plus a D size flashlight battery in series.

B. Nine size D flashlight cells in series. Convenient holders may be obtained in most radio stores.

The above combinations will give about three months intermittent operation (two or three hours a day) if the panel lights are not used.

C. Nine size C flashlight batteries in series.

Battery life will be cut to about half the above.

Please note the following cautions:

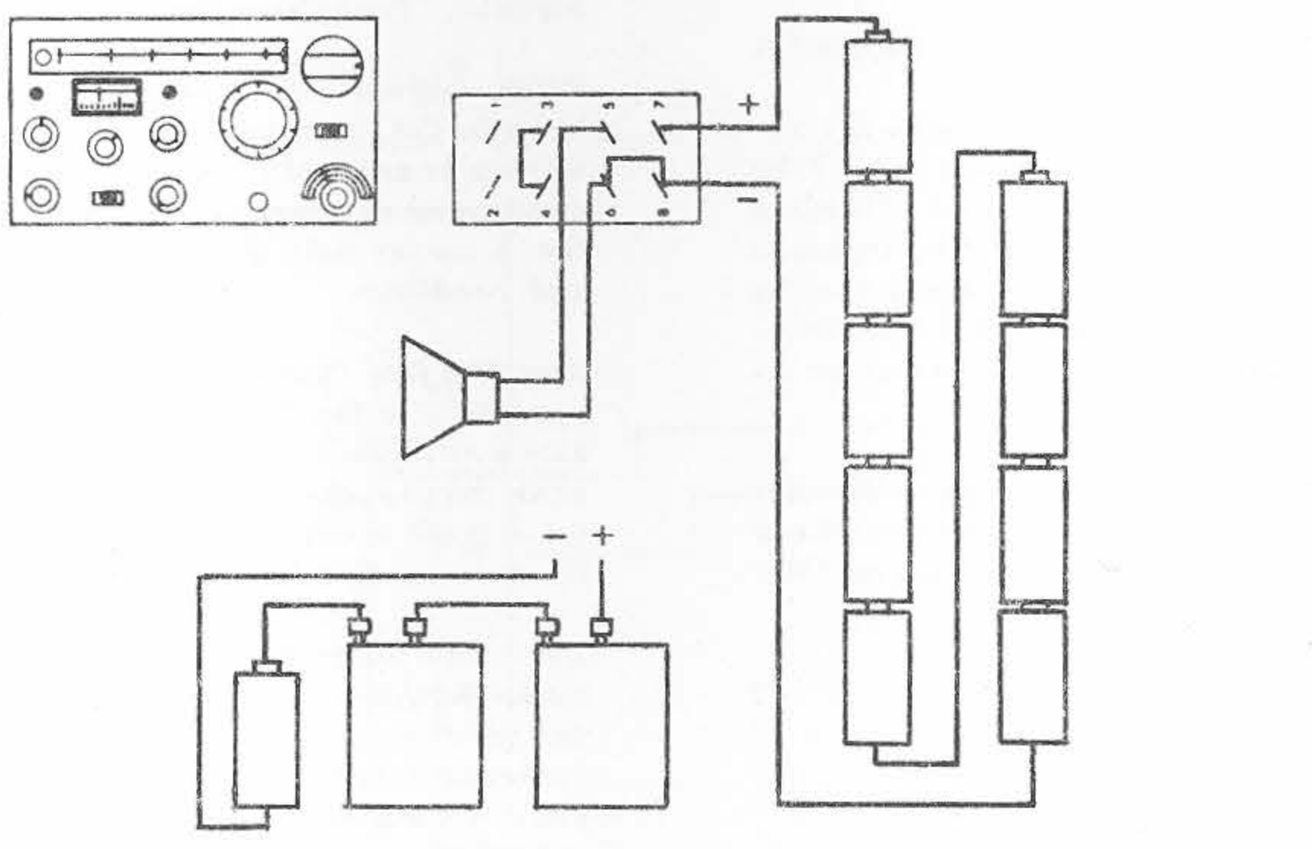
1. The panel lights on the DR-30 consume more power than the rest of the entire receiver system. In battery operation use the lights as sparingly as possible to extend battery life.

2. Batteries are quite sensitive to temperature extremes. Any temperature comfortable for the operator will not harm the batteries, but they should be protected nonetheless.

3. Almost all batteries bought off-the-shelf will show less than the rated voltage. After a short period of operation under load the voltage may be down considerably even though the batteries can continue to be used for some time. Therefore it is strongly recommended that a battery pack consist of a nominal 13.5 volt battery combination rather than a nominal 12 volt combination.

4. If power supply voltages exceed 13.5 volts by a great amount, the S-meter readings will tend to be too high. Make allowances for this effect if you use higher voltages.

A diode inside the receiver prevents damage should you connect the receiver power leads to the wrong polarities. Although the dial lights will operate, you will hear no stations and the S-meter will not be at the zero position. Remove the power leads immediately and connect them correctly, following the charts provided.



6 VOLT LANTERN CELLS
1.5 VOLT FLASHLIGHT CELL

9 1.5 VOLT FLASHLIGHT CELLS IN SERIES

2-8. Mobile Installation

Most mobile installations are in automobiles with 12 volt electrical systems. To utilize this system, determine the polarity of the automobile chassis by examining the battery and its cables. One cable will lead from a battery terminal to the automobile chassis and the terminal will be marked + or -, indicating the polarity. Set the toggle switch on the rear of the receiver to match the receiver chassis polarity to that of the automobile, up for a positive ground system and down for a negative one. Connect the receiver as shown in the appropriate diagram.

The low power consumption of the receiver allows the use of almost any wiring available. Suitable wiring runs to the cigarette lighter, to the ignition switch, and to any other electrically operated accessories. Be careful, of course, to choose a non-switched source. The "cold" power lead can be connected to almost any point on the automobile chassis not mounted on plastic or otherwise insulated, but for best results a wire of 20 gauge or larger should be run directly to a battery terminal.

In a mobile installation always use a fuse in the "hot" battery lead to protect the automobile system when the receiver is not connected and while it is being installed. Without this protection the power leads for the receiver can short out, damaging the leads and draining the battery.

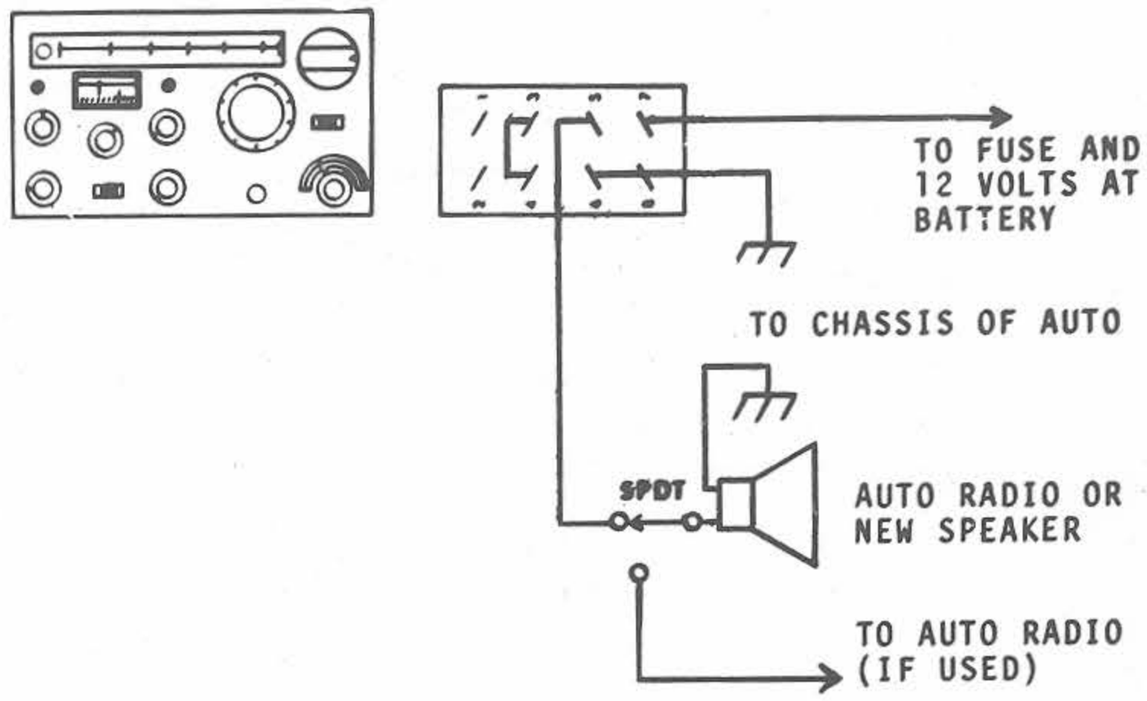
The most convenient way to operate the receiver in a car with a six volt system is to install a six volt lantern cell in series with the car's own battery supply. Be sure to install the extra battery cell in a place which is not subjected to abnormally high temperatures. Carefully observe the car's polarity and install the battery in series in the "hot" lead, proceeding as above.

Speakers: One side of the speaker connection to the receiver is also the negative power supply connection. Therefore in an automobile with negative ground one speaker lead can simply be grounded to the automobile chassis when a speaker other than the automobile radio speaker is used. In a positive-ground car, however, neither speaker lead should be grounded to the automobile chassis, and two separate leads should be used.

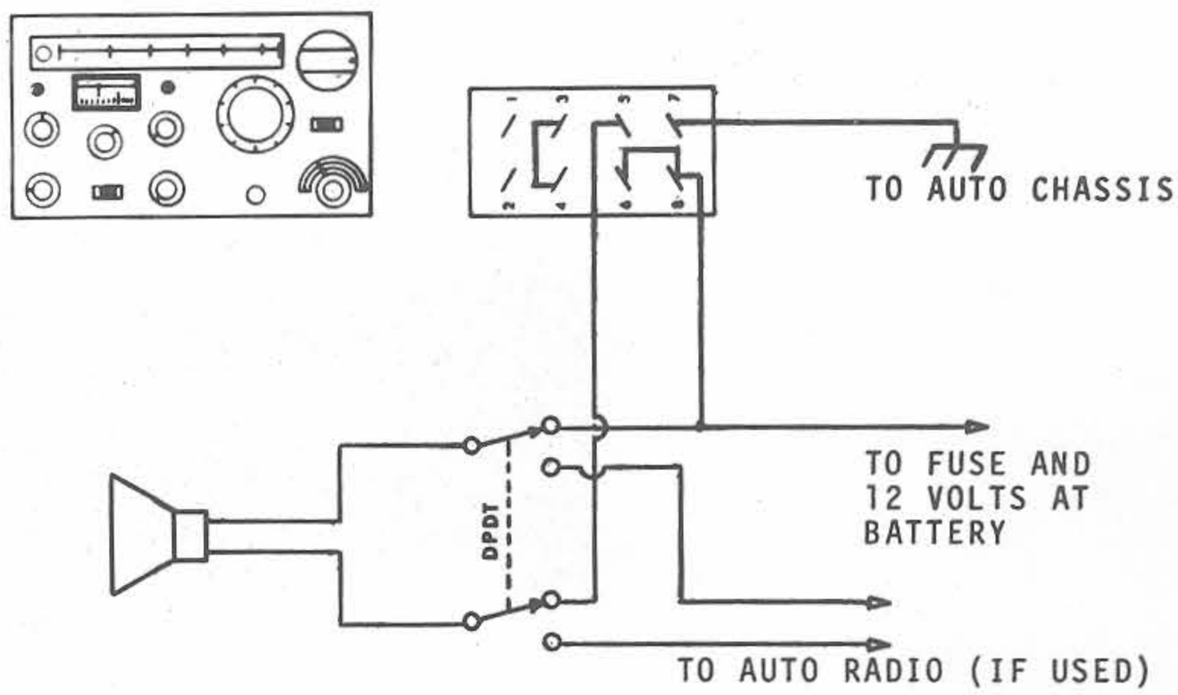
When using a car radio speaker, it is not possible to parallel the outputs of the two receivers. A double-pole/double-throw switch must be installed to disconnect completely the receiver not in use. In a positive ground car it may also be necessary to unground one side of the speaker and run a separate lead to each terminal from the changeover switch.

Note: If ignition noise is a problem, independent battery operation rather than use of the car's system may substantially reduce or eliminate the difficulty.

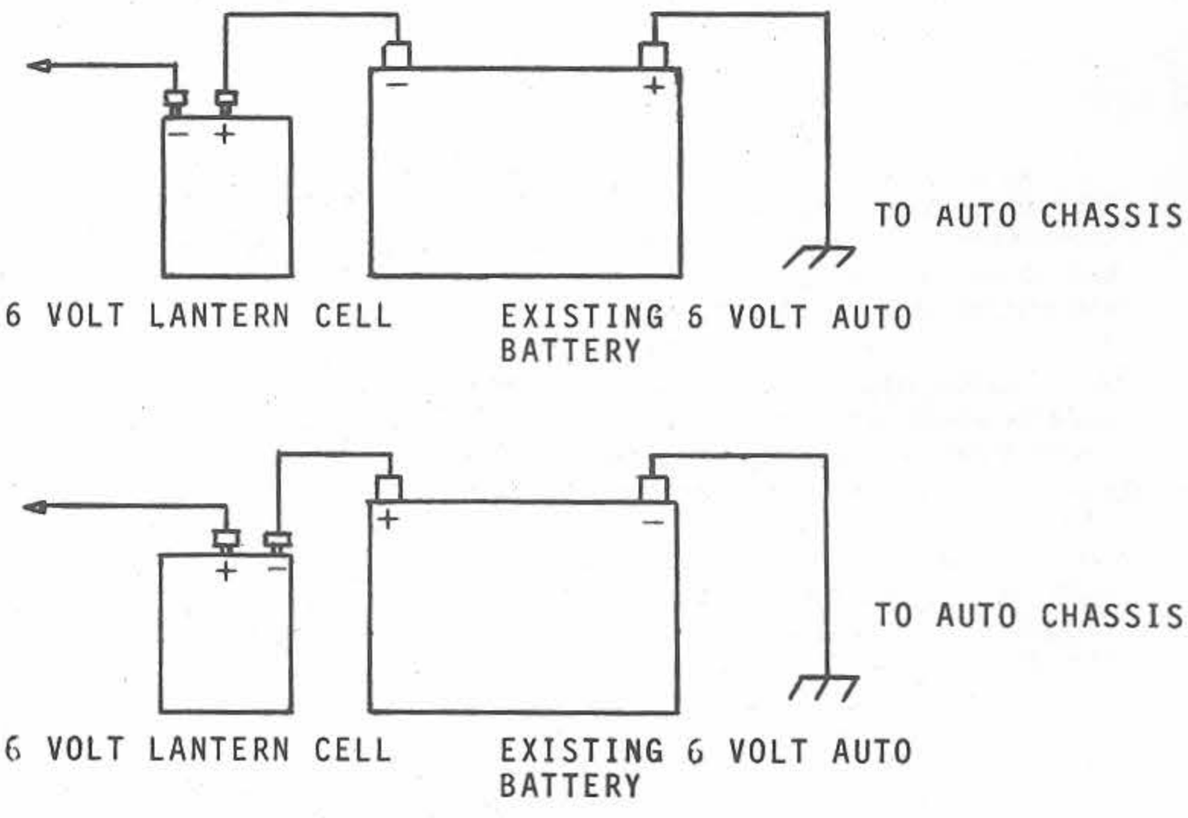
INSTALLATION IN 12-VOLT NEGATIVE-GROUND AUTOMOBILES



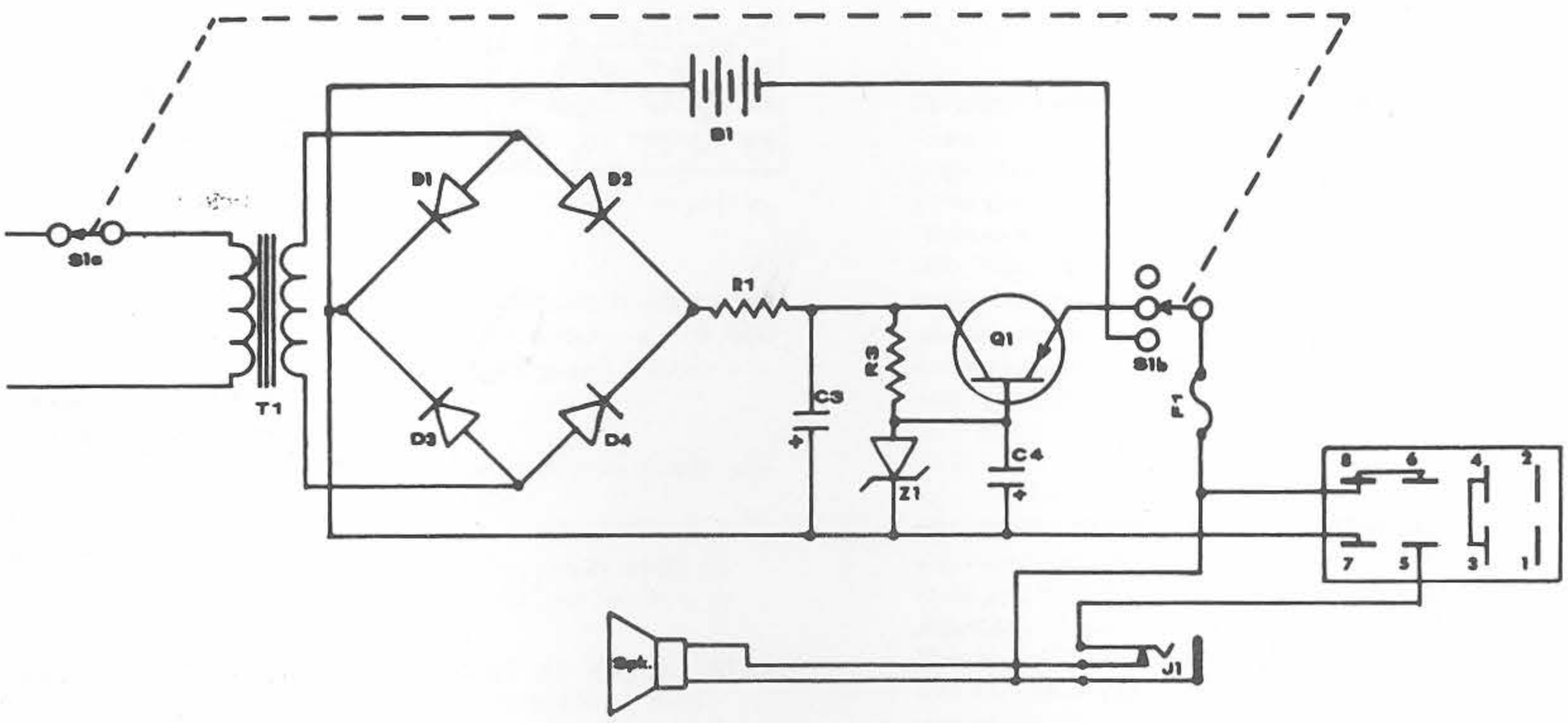
INSTALLATION IN 12-VOLT POSITIVE-GROUND AUTOMOBILES



6-VOLT POSITIVE-GROUND AUTOMOBILE INSTALLATION



2-9. A. C. Power Supplies



Although we recommend battery operation of the DR-30, the owner may avoid the periodic expense of replacing batteries by using a small, easily constructed power supply, to provide the desired 13.5 volts dc from an ac line.

A suitable supply can be built very inexpensively with locally available components. The DR-30-s supply built by DAVCO contains a circuit similar to #1 below, a loudspeaker, and holders for nine D cells.

Note: For many builders, the availability of components will be the deciding factor as to the choice of supplies. Supply #1 below will cost about $17.00, supply #2 about $13.00.

Power Supply #1:

This power supply is fully regulated electronically, so it is more suitable than #2 as a general-purpose supply both for the DR-30 and for other station accessories within the limits of its power rating.

Power Supply #2:

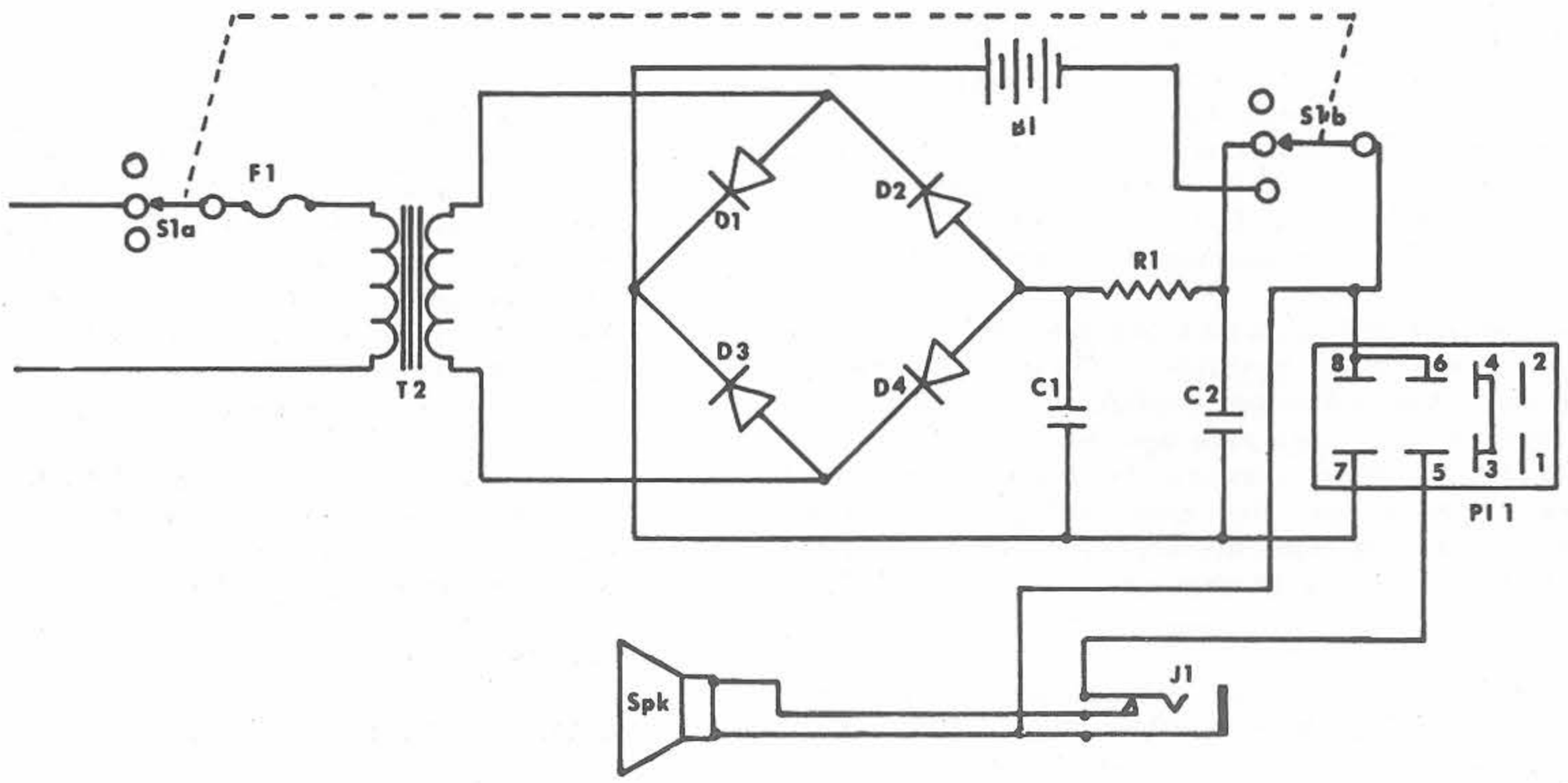
This unregulated supply uses a minimum of components and provides quite satisfactory operation. It has enough reserve output to allow the internal regulators of the DR-30 to provide stable operation.

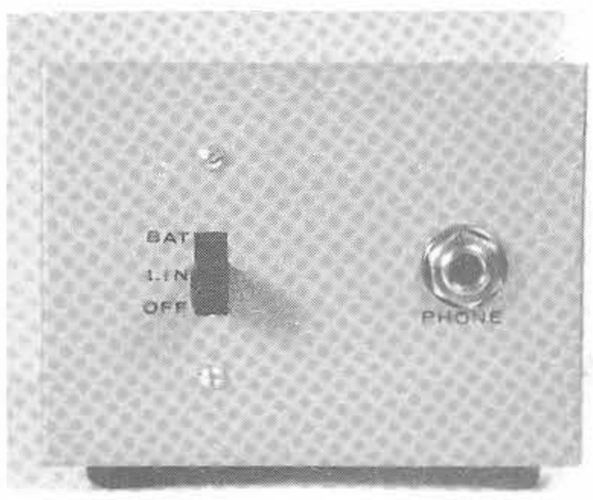
A simple chassis layout is shown in the photographs. Component arrangement is not critical and can be varied to suit your application.

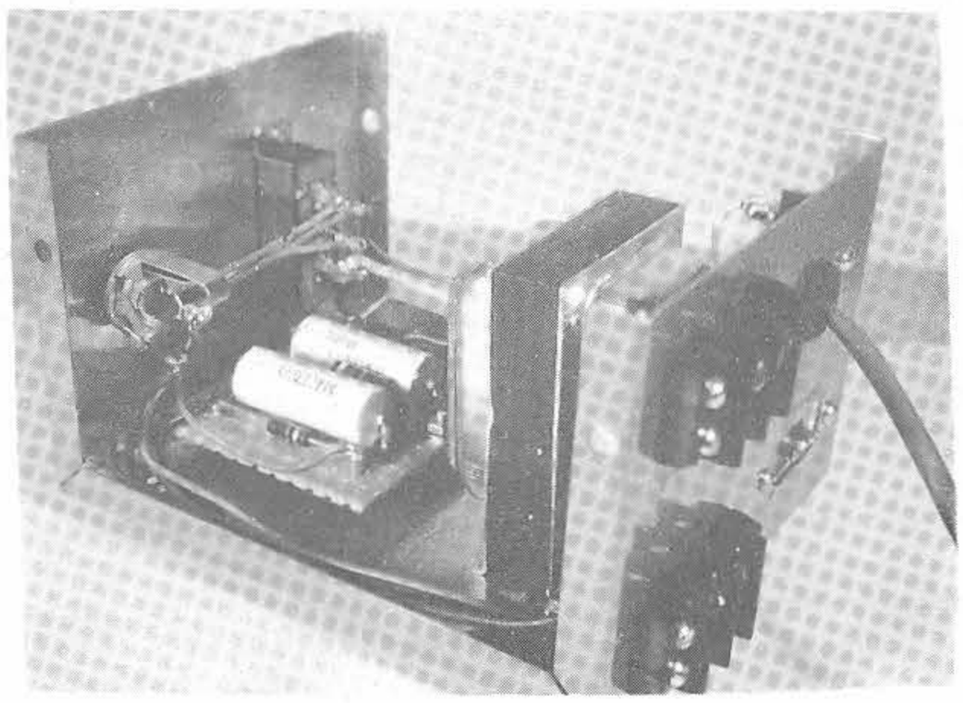
Notes on Components

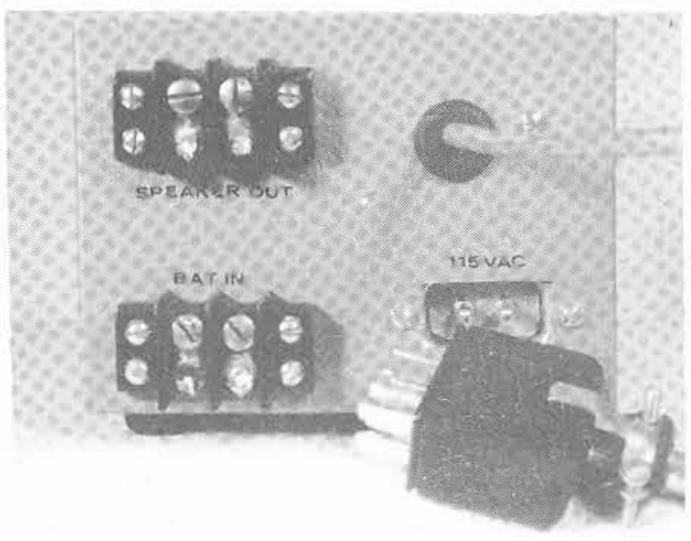
CR1: Silicon rectifier, rated at 250 ma. or more, with voltage rating (piv) 50 volts or more.

CR2: Zener diode, rated at 1 watt or more, with zener voltage of 13.6 volts. If a 13.6 volt unit is not available, use two 6.8 volt diodes in series or some other combination totaling 13 to 14 volts.









C1, C2: Electrolytic capacitors readily available from distributors of electronic components. If necessary, add two or more capacitors in parallel to obtain the desired capacitance. Capacity values greater than those indicated are quite suitable.

Q1: Power transistor. Any general purpose audio power transistor, type PNP germanium, can be used if its power rating exceeds 5 watts. This transistor must be mounted on a heat sink. Use either a commercial extruded aluminum one or bolt the transistor to the power supply chassis, employing a mounting kit that insulates the transistor from the chassis.

Note: In power supply #1, the potentiometer R3 should first be set for maximum resistance. With the supply unloaded, adjust R3 so that the zener diode Z1 draws 50 ma. of current.

R 1	Resistor 3.90 ohm	1 W
R 2	Resistor Vara 500 Ohm	5W WW
C 1	Cap. 1000 Mfd.	20 V
C 2	Cap. 1000 Mfd.	20 V
C 3	Cap. 1000 Mfd.	35 V
C 4	Cap. 125 Mfd.	1 V
D 1, 2		
D 3, 4	Silicon Diode 250 Ma.	50 PIV
Z 1	Zener Diode 13.5-14 V	1 W
Q 1	Power Transistor	PNP
	HEP 200, GE 3 or equivalent	
T 1	Filament Transformer 12 V	2 Amp.
	Merit P-2959 or equivalent	
T 2	Filament Transformer 24V	1 Amp.
	Merit P-2962 or equivalent	
J 1	Phone Jack 2 cond. Closed Circuit	
	Switchcraft Little Jax Type 12A or equivalent	
F 1	Fuse Holder	
	Littlefuse Type 357001	
F 1	Fuse 3 A G 1/2 Amp.	
S 1	Switch Slide DPDT	
	Chassis Minibox 5"L 4"W 3"H	
	Bud CU2105	

2-10. Loudspeakers

The DR-30 audio system is at its best with a 45 ohm loudspeaker load, but 8 or 16 ohm speakers can be used with considerable success. A 3.2 speaker is not recommended.

A loudspeaker chosen for communications reception need not be of the highest quality. However, intelligibility of signals is related to the fidelity of reproduction, and certain minimum standards must be met. When possible use a large speaker with inherent good fidelity: the bandwidth-limiting devices built into the DR-30 are more than adequate for shaping the audio response.

A good speaker choice is an intercom speaker with as large a cone size as possible. These speakers are readily available in 45-ohm configurations, as are replacement or rear-seat auto speakers which are also recommended. Many inexpensive mail-order house speaker systems are also quite effective. Always choose the speaker with the higher impedance, if you have a choice. I.e., a 16 ohm speaker is preferable to a 4 or 8 ohm one.

Most small speakers, such as those sold for portable radio replacement, have neither the quality nor the power-handling capacity desirable for use with the DR-30. Low efficiency speakers such as the AR, KLH or acoustic-suspension types are not recommended.

Any speaker, regardless of type or size, should be mounted in an enclosure. The voice quality from an unmounted speaker is invariably tinny and the poor fidelity is not only distracting but actually interferes with good intelligibility. The enclosure should have a back although there may be ports on the front, back, or sides. (If a wall-mount enclosure is chosen, it will probably have an open back. Covering the back with a book or blanket will usually improve the quality; if so, cut a back and attach it permanently.)

When connecting the speaker in mobile installations, in muting systems, or with other equipment, remember that one lead always goes to the negative power supply connection.

No damage to the receiver will result if it is operated without a speaker.

2-11. Earphones

Since there are almost as many earphone connectors as there are sources of earphones, no jack is provided on the DR-30. However, you can readily connect a jack matching your earphones to the leads from the Jones Plug used for speaker connection. In addition, the DR-30s power pack provides a front-panel two-connection phone jack.

Any low impedance earphone can be used with the DR-30 although a magnetic type with impedance as close to 300-600 ohms as possible is the most suitable. If in doubt, try the earphone in question: no damage to the receiver will result if it is improper.

2-12. Grounding

A stud and wing nut (6-32) are provided on the rear of the receiver for grounding purposes. Any station's equipment should be safely grounded with heavy copper braid or wire to a cold water pipe or an earth ground to prevent shock hazard.

In addition, since the DR-30 can be used without connection to household wiring, it is important to note that for optimum performance the receiver should be grounded in the best method possible, even while operating from batteries. When coaxial feed line is used from the antenna, or when a good balanced antenna is employed, battery operation may be possible without a ground. Remember, however, that a radio on the end of a long piece of wire isn't a complete circuit, RF or otherwise, and that a ground is an essential part of the system.

Although the great sensitivity of the RF amplifier stages can under some conditions produce excellent reception when not grounded, the full potential of the DR-30 in weak signal reception as well as in various image and IF rejection characteristics is realized only when a satisfactory antenna and ground system are employed.

2-13. Antennas

The DR-30 is a receiver of exceptional sensitivity. It is designed for use with a 50-70 ohm antenna, such as are designed for transmitting. Like a transmitter, the receiver can be used on a random-length wire antenna, but only with degraded performance unless a simple antenna tuner is employed.

The RF stage of the DR-30 will provide excellent performance on any antenna which is even marginally adequate for reception of the desired frequencies, including resonant mobile antennas, dipoles, beams, and most long wire antennas.

It may on occasion be desirable to operate on random short lengths of wire, although such "antennas" do not provide optimum performance.

These "antennas" may at a desired frequency present a load of 1,000 ohms or more, which should be transformed to the input impedence of 50 to 70 ohms of the DR-30 or any similar receiver to improve performance.

The impedences can be matched by a simple adapter consisting of an L-network section made of a coil and a capacitor, as below.

C1 can be any small broad-cast band tuning capacitor such as those used for the main tuning of imported portable receivers. The greatest possible capacity swing is desirable and may be obtained by paralleling two or more capacitor sections.

L1 can be a small coil of 30 to 50 turns of #28 wire wound on an old IF transformer core or any other iron of ferrite rod. Taps should be provided at each 10th turn for adjustment to the correct range.

Please note that on any adequate antenna the adaptor is not needed and its use is not recommended.

2-14. Connections with Transmitters

Any communications receiver should be protected from unusually high RF level, as extreme RF energies can melt coax cables, burn out controls, overheat RF coils and/or cause the breakdown of other components.

The solid-state construction of the DR-30 does not make it more sensitive to high RF energies than conventionally built receivers; to the contrary. it is very well protected indeed, and, under proper operating conditions, no difficulties will occur.

However, no matter how many times you've connected a receiver before, we request that you refresh your knowledge of normal muting precautions by reading the paragraphs below. A few minutes now may save an embarrassing mistake five minutes from now.

The DR-30 contains small diodes in the input circuit to the RF stage which prevent normal RF levels from damaging the receiver. However, these diodes do not protect the receiver from a direct application of transmitter energy to the antenna terminals.

Therefore, never feed RF energy directly from a transmitter into a receiver antenna connector. This warning may seem obvious, but accidents can happen. Be especially careful when making a temporary antenna connection to an existing station. Don't let anyone push the transmit button, no matter how rare the DX is, until a proper changeover provision has been made!

Changeover from transmit to receive is usually accomplished by removing the receiver from the antenna and simultaneously short-circuiting the receiver's antenna input circuit. This procedure will provide complete protection for the receiver, but be sure that the changeover occurs quickly enough to prevent any RF energy from the transmitter from entering the receiver.

Suitable changeover devices are, among others, commercially available coax relays and manual changeover switches operated as part of the station control.

In addition to the above provision, it may be necessary to turn off the receiver circuitry while transmitting, since a powerful transmitter can still cause an audible leakage of signal into the receiver. In this case, arrange the switching relay or other device so that the circuit between pins 6 and 8 on the Jones plug is broken during transit. Doing so disconnects the voltage to several of the receiver circuits so that signals can't leak through. Or, for non-automatic changeover, push the stand-by switch on the front panel of the receiver.

For further information, refer to the ARRL Handbook section on "Receiver Protection and Muting", the Radio Handbook (Editors and Engineers) section on "Transmitter Keying and Control", or the RSGB Handbook, 3rd edition, pages 250-252. Also, each of the amateur journals frequently publishes articles on station control circuits.

Many persons prefer to use different antennas for receiving and transmitting, thus avoiding a physical changeover of antenna connections. We encourage this practice if the following normal precaution is observed:

Always use some device, such as the external diode limiter described in the RSGB Handbook (page 252) or an electronic receiver input limiter as mentioned in numerous articles in amateur journals, to prevent RF damage to receiver leads and components. This precaution becomes extremely important at power levels of several hundred watts.

Many operators have successfully employed the DR-30 at high power levels without any protection whatsoever. However, because antenna characteristics vary immensely, it is not possible to give factory specifications for permissable operating powers. The practice is not recommended and is not covered by warranty.

For those who insist upon operating without protection, the following suggestions are important:

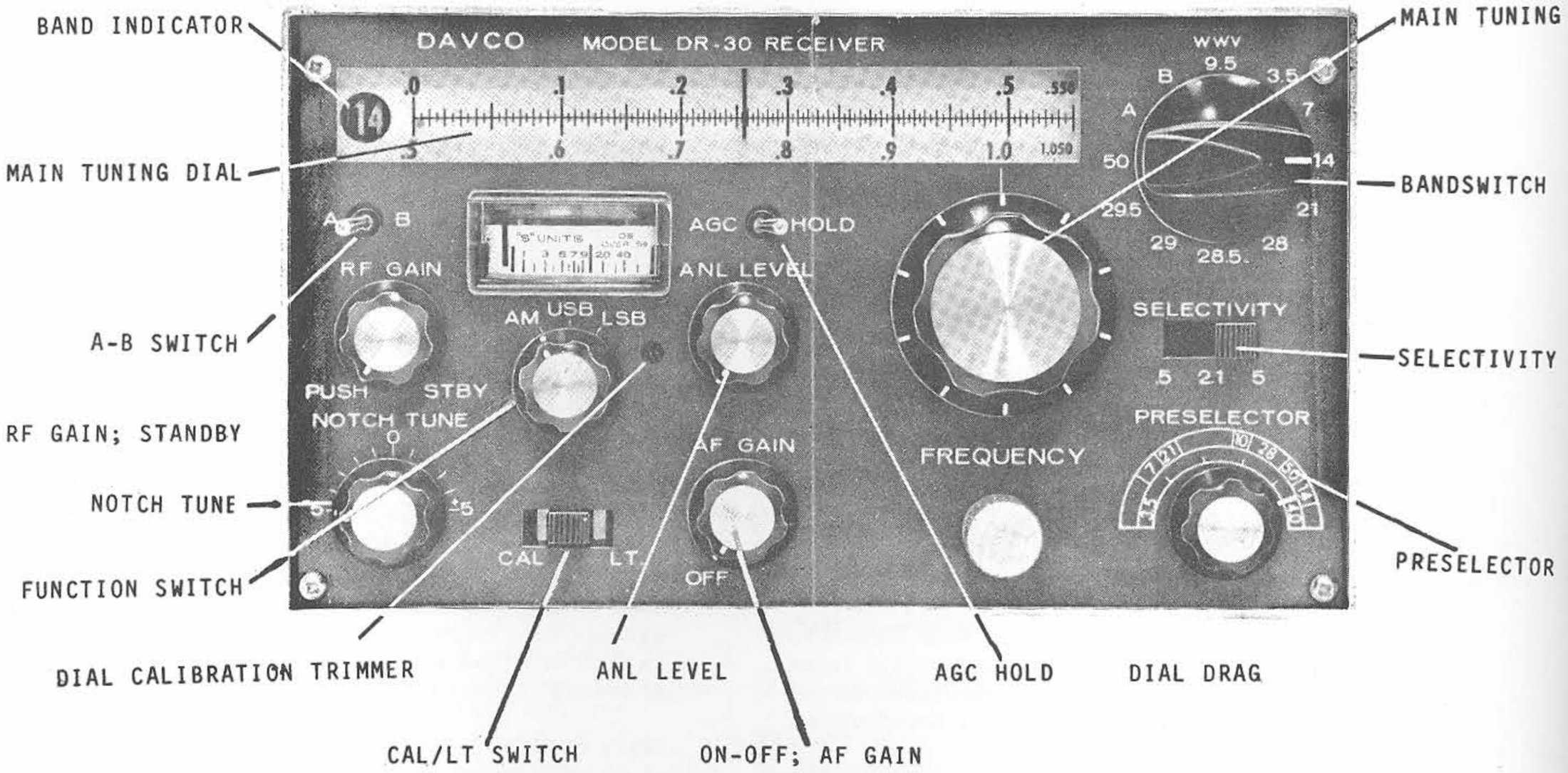
(1) Orient the transmitting and receiving antennas at an angle to each other. Do not attempt to run them parallel to each other for a long distance; high RF voltages will develop in the receiver antenna and the radiation pattern of the transmitting antenna will also be negatively affected.

(2) Separate the antennas from each other as much as possible.

(3) Be sure that a suitable ground is used for the receiver, as well as for the transmitter.

Note: The stand-by switch is in series in the circuit between pins 6 and 8. Turning the receiver to stand-by, by either the front panel switch or by the switching relay between the two pins, leaves the BFO, the VFO, the crystal conversion oscillator, and the filter amplifier still in operation so that they can be used with a companion transmitter or an accessory.

3-1. Control Identification Photograph



3-2. Controls in Detail

ON-OFF. --Rotate the AF Gain Control to the right to turn the unit on.

AF GAIN. --Varies the audio output; increased volume clockwise.

RF GAIN. --Actually an attenuator in series with the antenna, permitting adjustment of the amplitude of the signal reaching the RF stage. The maximum receiver sensitivity is obtained when the control is fully COUNTERCLOCKWISE. Turning the control to the right increases the attenuation, not the sensitivity.

STBY. --When the RF Gain control is pushed "in," voltages to circuits other than oscillators is turned off; the oscillators remain functioning for use with other equipment. This control effectively mutes the receiver when desired. Terminals on the Jones Plug also permit muting by a relay or external switch.

FUNCTION SWITCH. --A three position rotary switch with the following action:

AM---the AM detector is in use

USB --the product detector is in use and the USB crystal in the BFO is connected.

LSB --product detector is in use, LSB crystal in the BFO is connected, and the VFO frequency is shifted so that the dial calibration remains essentially constant.

AGC HOLD. --This toggle switch allows the operator to select the decay time of the Automatic Gain Control system. The center position, for fast decay, is used for AM reception and band-scanning. The right "hold" position is effective in eliminating "thumps" and "clicks" in SSB and CW reception of strong signals, and the decay time is such that the AGC does not bring up the background noise between syllables of speech. The left position provides medium-hold time.

ANL LEVEL. --Adjusts the threshold of the noise blanking action on SSB and CW. The ANL is most effective on ignition-type noise. To activate, advance the control clockwise until the noise disappears but not so far as to reduce the desired signal.

A-B SWITCH. --The A-B switch is a SPDT center-off toggle unit with its center pole connected to the positive side of the receiver power.
As provided, the A-position of this switch functions as a "tone control" for reduction of the high audio frequencies. The tone control function can be removed for other use of the control by clipping or unsoldering the white wire to the switch.

A lead to the connection is provided so that the B position can control accessory equipment such as the antenna switching relay, a phone patch, if not exceeding the maximum 5 amps and 115 volts rating of the switch.

BAND INDICATOR. --The significant megacycle figure for the band in use appears here. The frequency to which the receiver is tuned is indicated on the main tuning dial.

MAIN TUNING DIAL. --When the number in the INDICATOR window is red, read the red dial (.500 to 1.050 Mc.) scale and use the megacycle figure in the window. When the figure is white, read the black dial scale (.0 to . 550 Mc.).

BANDSWITCH.--This switch chooses the frequency band in use, as indicated by the front panel markings and the drum BAND INDICATOR which appears in the window. The switch is continuously rotating.

MAIN TUNING. --The main tuning knob couples through a ball-bearing gear train to the main tuning capacitor. The indications on the skirt of the knob are 2 kc. each.

CAL-LT SWITCH. --The DPDT switch has a center-off position. In the CAL position, the internal 100 kc crystal calibrator is in operation. To allow the calibrator signal to reach the RF stage and to attenuate the signals from the antenna to avoid confusion, the RF Gain Control should be rotated to the right as far as necessary. The calibrator should be turned off when not in use to avoid undesired responses.
The LT. position turns on the panel lights. The lights more than double the power consumption, so it's recommended that they be used sparingly during operation from batteries.

PRESELECTOR. -- Tunes the RF input and output circuits to the desired frequency. In normal use, tune the preselector until the pointer is toward the MC marking corresponding to the band in use. Make the final fine adjustment by listening to the antenna noise or observing the S-meter on a received signal. Note that it is possible to tune the preselector to an image frequency and thereby cause incorrest reception: always start in the range of the marked frequencies. The preselector should be re-peaked when making a wide frequency excursion within the band, especially when operating on the lower bands.

DIAL LOCK. --The small knob just below the main tuning knob allows the operator to place an adjustable amount of friction in the main tuning mechanism. It should be adjusted for the appropriate dial "feel" which suits the operator. Turning this knob firmly can nearly lock the dial for fixed-frequency applications. The most frequent use of the drag mechanism is in mobile operation where finer tuning resolution can be achieved when some friction is used.

NOTCH TUNE. --The Notch Tune control adjusts the frequency of the rejection notch in the IF passband. This notch is capable of rejecting any single interfering heterodyne or carrier. The adjustment is critical. When not in use, the control should be turned to the 9 o'clock position.

SELECTIVITY. --The three choices of IF selectivity are provided for optimum interference rejection and fidelity on SSB, AM, and CW. Approximate bandwidths are indicated; refer to the technical description for details.

SCREWDRIVER ADJUSTMENTS:

DIAL TRIMMER: Next to the Function switch on the front panel.

Allows the operator to correct the dial calibration by about + or - 5 kc. Rarely used except to compensate for long-term aging of components. A small screwdriver should be used.

NOTCH DEPTH CONTROL: on the rear panel in the lower middle of the small panel section: accessible through a hole in the panel. Use a small screwdriver. This is a factory setting and should rarely need attention. See maintenance section for detailed instructions on depth setting.

CRYSTAL CALIBRATOR TRIMMER: Accessible through a hole in the panel near the right-hand side of the back. This screwdriver control is used to adjust the crystal calibrator so that its harmonic at 10 Mc falls exactly in zero-beat with the 10 Mc signal received from WWV. See instructions in maintenance section.

3-3. Back Panel Connections

There are seven phono-type connectors provided on the rear of the DR-30. The use of two of these for the standard antenna and the 6 meter antenna is discussed in the section on antennas.

The other five connectors provide access to various oscillators and filters in the receiver for use with companion transmitters or other accessories. Details of these circuits are as follows:

BFO connector: This connector gives output from the BFO, which is suitable for use as a carrier generator in SSB transmission. The approximate amplitude of the signal from this point is 250 mvolts, and the impedance is a nominal 500 ohms. Any connection to this point should have an input impedance of 1000 ohms or greater to reduce loading. Normal use would be into the base of a common-emitter BFO amplifier. A blocking capacitor is provided within the receiver.

The BFO operates even with the standby switch in the "off" position. This connection point also provides access to the 455 kc IF of the receiver, and is suitable for a panadaptor connection or for feeding a signal to an accessory. However, most panadapters will respond to the BFO signal itself when it is turned on. Panadaptors such as the Heath HO-13 are quite satisfactory when coupled to this circuit through a capacitor of about 50pf, when the BFO is turned off. Naturally, this signal is obtained after the selectivity circuits, so your panadaptor will show the signal after it passes through the IF.

FIL in.
FIL out. These connectors provide input and output access for the Collins mechanical filter and its associated crystal filter and amplifier. Input impedance of the stage is about 3000 ohms and the output impedance is about 1000 ohms. To prevent loading the circuit, any connections made to this point should have a higher impedance than those listed above. Note that the output is through a switching diode (D7). To turn this diode "on" so this signal can pass through it, you must connect a 10k or 12k ohm resistor from the output connection to the minus power supply voltage (12 volts). This addition can be made either externally or inside the receiver on the wiring harness: connect the resistor from FILTER BOARD PIN C to FILTER BOARD PIN A. (See board page for pin layout).

The input also passes through a switching diode. A biasing network is provided internally for turning this diode "on". Pins 3 and 4 on the Jones Plug allow external switching of this diode by a companion transmitter.

VFO Output:

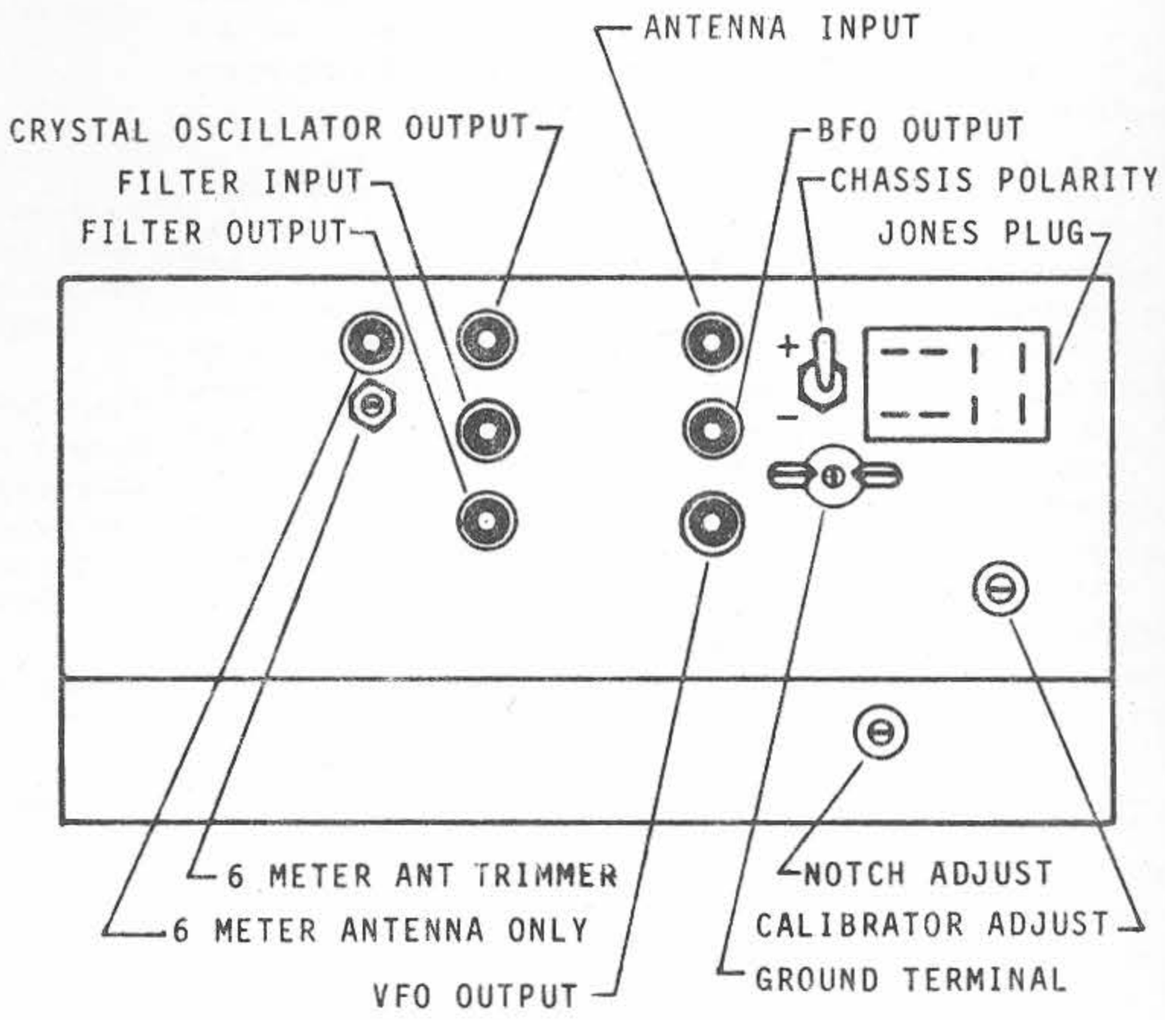
This connection provides output from the VFO, or main tuning oscillator. ANY CONNECTION TO THIS JACK MUST BE DC BLOCKED. That is, a small blocking capacitor (.01 mfd) must be connected in series with the output (inner connector). In all cases, shielded coax cable of a miniature type should be used for carrying this signal to an accessory.

The approximate output level of the oscillator signal is about 50 mv. The output impedance is around 2000 ohms, and a higher input impedance circuit should be used to amplify or isolate this signal. Do not load this circuit: any change in VFO amplitude reaching the second mixer may decrease the receiver gain.

The output frequency of the VFO is in the range 1950 kc-2500 kc. Note that the VFO tunes in the opposite direction from the received signal; that is, the lower the VFO frequency, the higher the received signal frequency. (See block diagram).

Xtal Out:

This jack provides connection to the output from the crystal first conversion oscillator. This is a low level output of about 300 mv at an impedance of about 1000 ohms. Any connection to this jack should be DC blocked with a small capacitor (.01 mfd). This amplifier or circuit to which this signal is fed should have a high impedance to avoid loading. We suggest a simple field-effect transistor amplifier.



3-4. Choosing Extra Crystal Ranges

The DR-30 is supplied with 10 crystals which provide coverage as noted in Section 1-9. In addition, the receiver has provision for adding extra crystals in the A and B bandswitch positions, thus allowing coverage of two more 550 kc segments in the range of 3 to 54 Mc.

When you are choosing extra bands for installation, keep these points in mind:

A. For direct calibratio· you must choose bands which start either on a megacycle or a half-megacycle, for example, 12.500 - 13.050 Mc, 52.000 - 52.550 Mc. You then need to remember only the "color" and the significant megacycle figure to allow a direct readout of receiver frequency.

If it is absolutely necessary to cover an odd frequency band, try to simplify the readout by starting on a band which begins with a 100 kc point. For example, the US Citizen's Band includes channels which run from 26.965 Mc to 27.255 Mc. Direct readout could be obtained by using two bands (26.500 - 27.050 and 27.000 - 27.550 Mc.) A more practical coverage, though, is 26.900 - 27.450 Mc in one band; you use 27 as the significant megacycle, read the black dial scale, and subtract 100 kc from the figure read.

B. The frequency coverage of the RF stage presents certain slight limitation on the coverage. The top frequency limit is about 54 megacycles. The bottom frequency limit is 3.000 Mc. Any ranges between these frequencies can be covered satisfactorily with one exception:

The preselector is such that it cannot tune the full range of 3.000 to 3.550 in one section, although any 250 kc of range can be tuned quite satisfactorily. Therefore, if you desire reception of special frequencies in this range, you will connect the preselector for the segment desired.

C. The frequency of the crystal required is obtained by adding 2.955 Mc to the frequency which you desire as the bottom of the tuning range. Examples: coverage of the range 15.000 - 15.550: Crystal frequency 17.995 Mc. Coverage of 26.900 - 27.450 Mc: Crystal frequency 29.855 Mc.

See section 4-6 for full details on installing extra crystals.

The DR-30 can be supplied with ranges other than the 10 standard ones for amateur reception on a special-order basis. The general requirements above may be used as a guideline in choosing frequencies for these bands. Other receiver models, with such features as UHF coverage and fixed channel (non-tunable) reception are available for commercial users.

3-5. Reception Hints

The National Bureau of Standards station, WWV, broadcasts time, frequency, and radio wave propagation notices throughout the day, offering the operator information that can greatly increase his effectiveness.

With the exception of a four-minute silent period beginning at forty-five minutes past the hour, WWV broadcasts in a repeated five-minute cycle. For the first two minutes of each cycle, you receive a constant modulation of either 440 cycles per second or 600 cycles per second, superimposed on which are ticks exactly one second apart. During the third minute the broadcast is a digital code containing information for professional users. Also in each five-minute cycle the exact Eastern Standard Time is announced, followed by a propagation prediction for the next twelve hours for trans-oceanic paths. The propagation notice consists of the letter n, u, or w ("no warning," "unstable conditions," or "ionospheric disturbance" respectively) and a number between one and nine. The higher numbers indicate more favorable conditions, low numbers more difficult ones.

Thus an operator can ascertain the exact time, his dial calibration, and the predicted conditions simply by tuning WWV at 10.000 Mc. as provided on the DR-30.

A Canadian station, CHU, at 7.335 Mc. announces the time in English and French each minute; between announcements, ticks indicate one-second intervals.

Short-Wave Broadcast Band Reception with the DR-30

The frequencies in the DR-30 include several foreign broadcast bands: the 31 meter band (9.5 to 10.050 Mc.), the 80 and 40 meter bands shared between amateur and broadcast service, and the 15 meter band which gives partial coverage of the SW band that includes 21.400 to 21.750 Mc.

The DR-30 can be equipped with supplementary coverages, as indicated in section 3-4, for other short-wave broadcast bands.

Reception of foreign broadcasts depends upon propagation conditions. As a rule, the lower frequencies are best received at night, the higher frequencies in the daytime.

Programs on the broadcast bands are often very interesting. Details of the stations and programs can be found in Popular Electronics, Electronics Illustrated, and in the World Radio & TV Handbook, published in Denmark and available in the US from Gilfer Associates, P. O. Box 239, Park Ridge, New Jersey, 07656.

4-2. Detailed Technical Description

The DR-30 receiver is a double-conversion superheterodyne unit with frequency coverage of 12 one-half megacycle bands in the range of 3.5 to 54 megacycles.

Signals from the antenna input J1 pass through the RF GAIN CONTROL and thence to a low-impedance tap on the antenna input coil L1. This high-Q toroidal inductor is tuned by the preselector capacitor to a frequency of approximately 6.5 Mc. to 17 Mc. For frequencies lower than this range, capacitors are connected across the toroid by the bandswitch S1; for higher frequencies, inductors are connected. The RF amplifier, Q1, is a field-effect transistor (Type K1504). The field-effect transistor is characterized by a high operating impedence, and is a voltage-operated device similar to a tube. This voltage-operation allows maximum preselector selectivity, since no compromise between power transfer and Q is necessary as would be the case with normal (bipolar) transistors. In addition, the transfer characteristics of the field-effect transistor approach very closely the theoretical square-law configuration, and performance under conditions which lead to cross-modulation and overloading in other devices is markedly superior. Since the field-effect transistor is a majority-carrier device, the shot-noise noted in bipolar transistors is absent; this field-effect transistor allows extremely low-noise operation even to the UHF region. The output from the RF amplifier is via a tuned circuit similar to the input circuit.

The high frequency conversion oscillator, Q2, is operated in the fundamental mode from crystals up to 18 Mc., and as an overtone oscillator above 18 Mc. using the collector load as a resistor for fundamental operation and a tuned circuit for overtone. A different tunable collector circuit is provided for each overtone crystal range. The first conversion oscillator is fed to an oscillator amplifier, Q4, which provides correct amplitude and impedance matching for the first mixer.

Signals from the xtal oscillator and the RF amplifier are combined in the first mixer. The first mixer is also a field-effect transistor stage, so that the high performance in weak-signal reception and rejection of undesired effects made possible in the RF amplifier are not lessened. The crystal oscillator frequencies on each band are higher than the received signal, and the output range from the mixer is 2.405 to 2.955 Mc. This range is fed to a high-Q tuned circuit tracked to the VFO by one section of the main tuning capacitor, C2. A first IF amplifier, Q4a, follows this circuit.

The VFO, or tuning oscillator, Q9, covers a range of 1.950 - 2.500 Mc. and utilizes a high-Q toroidal inductive element for extreme stability. Note that, because of the choice of xtal frequencies, when the VFO frequency goes "up," the received frequency goes "down". An amplifier-buffer stage (Q10) for the VFO provides isolation for the tuning oscillator, and the voltage supply to the VFO is regulated by a separate zener regulator.

The second mixer combines the VFO and IF and has an output of 455 kc. Tunable IF transformers precede and follow a 455 kc amplifier (Q6), and several fixed-tuned ceramic 455 kc filter-resonators provide additional selectivity.

The output of the 455 kc amplifier is fed to the noise limiter amplifier (Q7) which increases the amplitude and rise time of the noise pulses which reach it. Since the effective selectivity is still rather broad at this point, no significant noise pulse lengthening has taken place, as would be the case if the noise were not eliminated until after the highly selective IF filters. A noise amplifier-detector further processes the noise pulse, providing a pulse output which is used to turn "off" the switching diode gate (D3) for the duration of the noise pulse and this effectively mutes the receiver during this time. Noise pulses are thereby prevented from actuating the AGC circuits or reducing the receiver sensitivity. The ANL level control adjusts the bias on the gating diode and therefore the noise limiter threshold.

Following the pulse gate several diodes, D4, 5, 7, .8, 10, make up a switching network which changes the signal path to the various selectivity paths; DC biasing is applied to the diodes to turn them on or off as required. The broad selectivity incorporates three ceramic 455 kc filter resonators plus three IF transformers; the 2.1 kc selectivity path uses the Collins mechanical filter, while the narrowest path for CW reception uses a 455 kc xtal filter in series with the mechanical filter. Other switching diodes are used in the circuit for connecting the mechanical filter to the connector jacks on the rear of the receiver for use with a companion transmitter or other units.

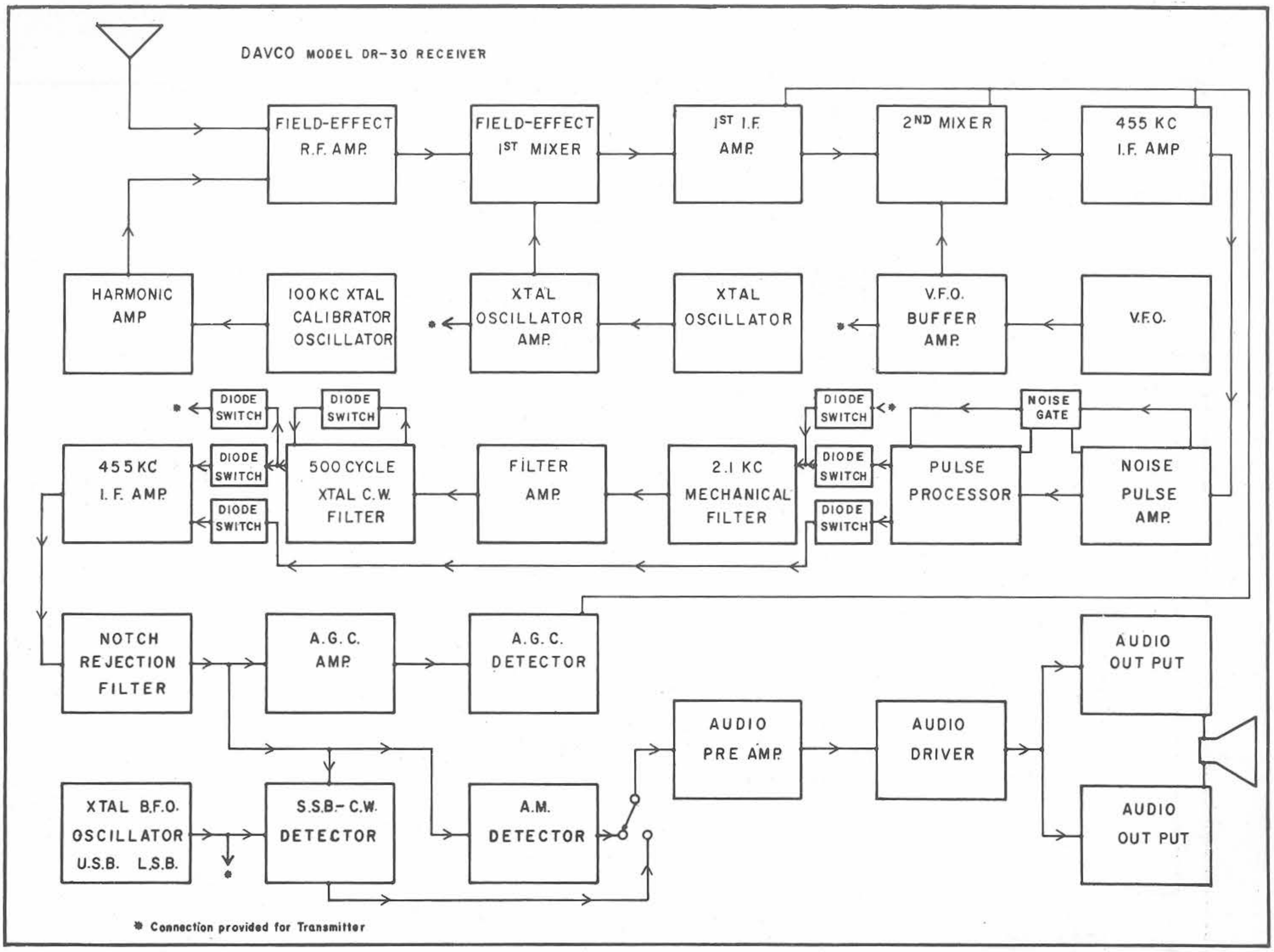
One additional 455 kc IF amplifier (Q12) follows the filters, and precedes the rejection notch circuit. A back-panel screwdriver notch depth control is factory pre-set for best results. This notch is tunable across the IF passband and provides up to 60 db rejection of an interfering carrier. Since, like the noise limiter, the notch eliminates the interference before it reaches the AGC circuitry of the receiver, the AGC is not actuated by the interference but only by the desired signal. The receiver is, therefore, operating at the optimum sensitivity for the desired signal, not the QRM-QRN.

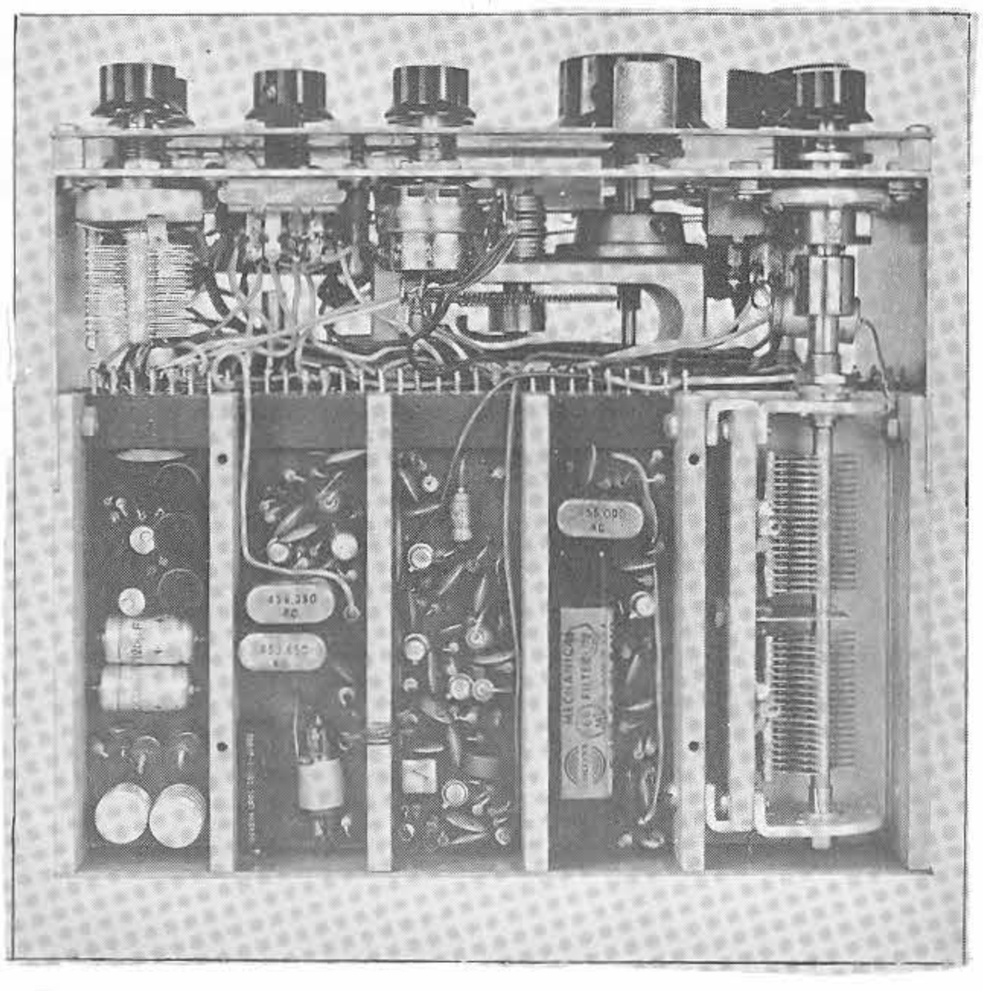
Following the notch circuit is the AGC isolation amplifier, Q20, which prevents the AGC detector (Q21) from causing distortion in the other detectors. The AGC detector itself operates in a "bootstrap" arrangement to provide the fast-attact adjustable-hold characteristics which are desired. The output of the AGC amplifier varies with signal strength from full B- to 1 volt negative; this control voltage is fed via a voltage divider to the RF stage, the 1st IF amplifier, the 2nd mixer, and the 1st 455 kc amplifier, and is also sent to the S-meter. Hold action for the AGC is adjusted by changing the RC constant of the hold circuit.

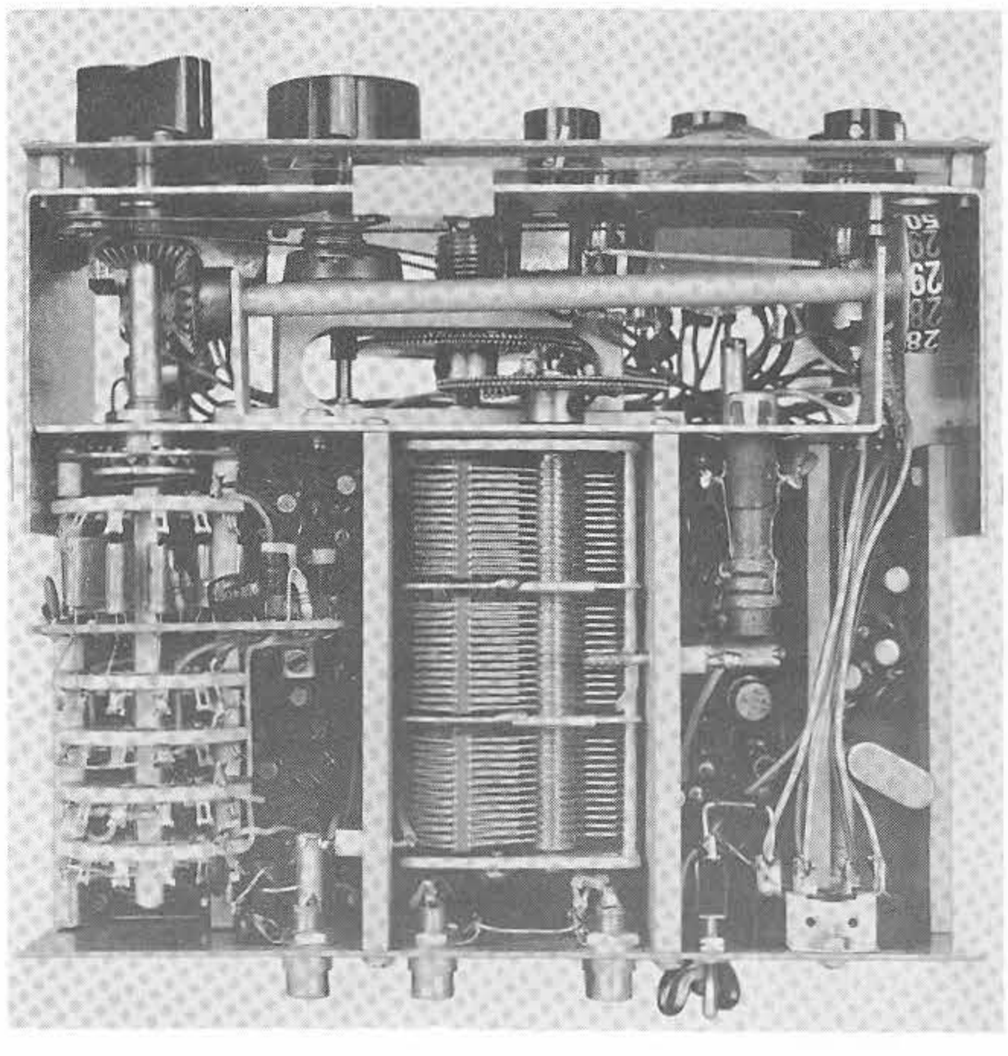
For CW and SSB reception, a crystal BFO-carrier generator signal (Q19), chosen in relation to the passband of the mechanical filter, is injected into the product detector (Q18). A circuit in the VFO shifts the frequency to compensate for the USB and LSB signal-frequency shift. For AM reception, a low-distortion AM detector (Q13) is employed.

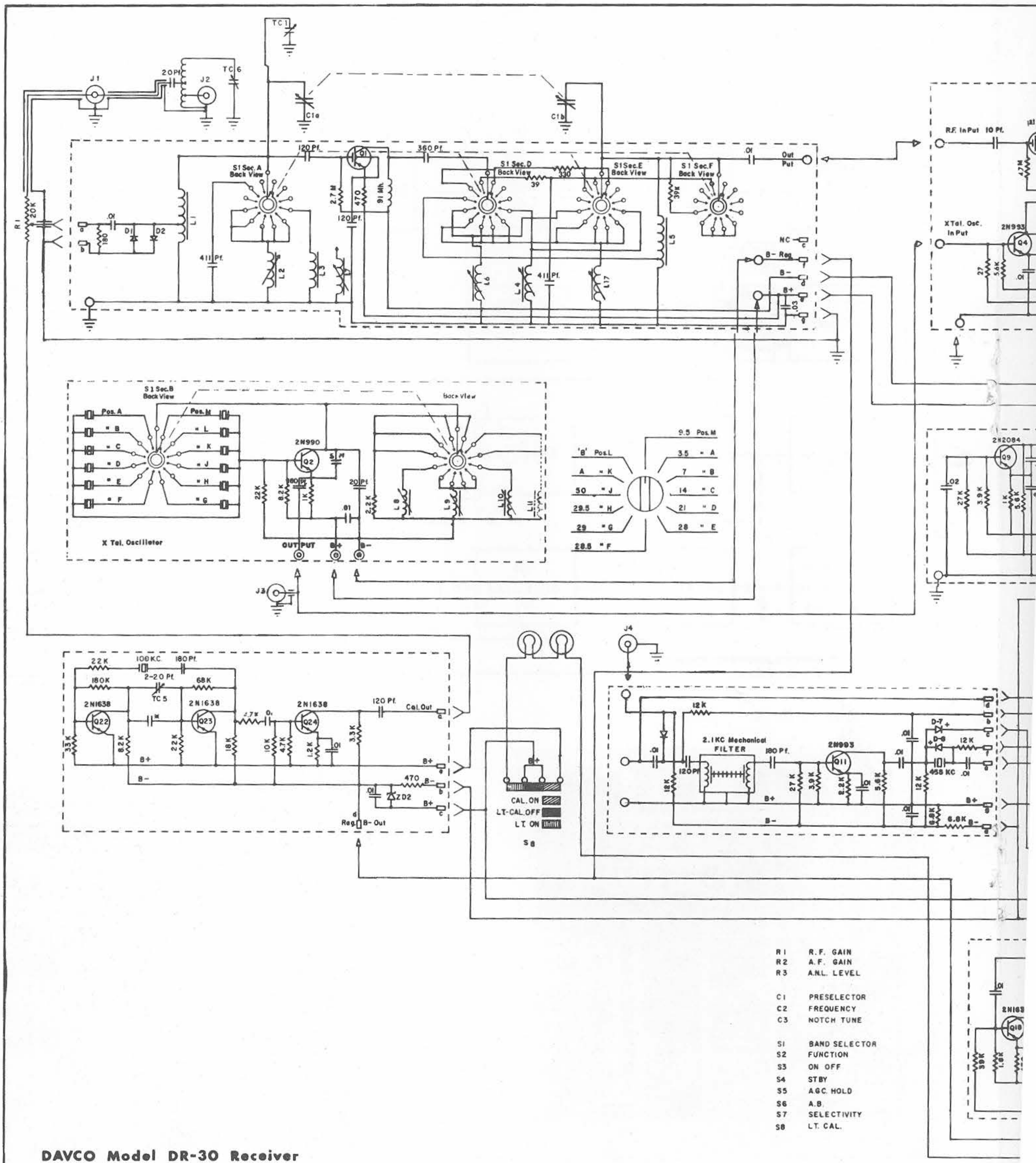
The function switch, in addition to shifting the VFO and the BFO crystals, selects the output of one or the other detectors, feeding it to the audio preamplifier and thence to the AG Gain control. An additional audio preamp and driver stage then provide the signal for the push-pull transformerless audio output circuit which is designed for low distortion and good communications quality.

DAVCO MODEL DR-30 RECEIVER

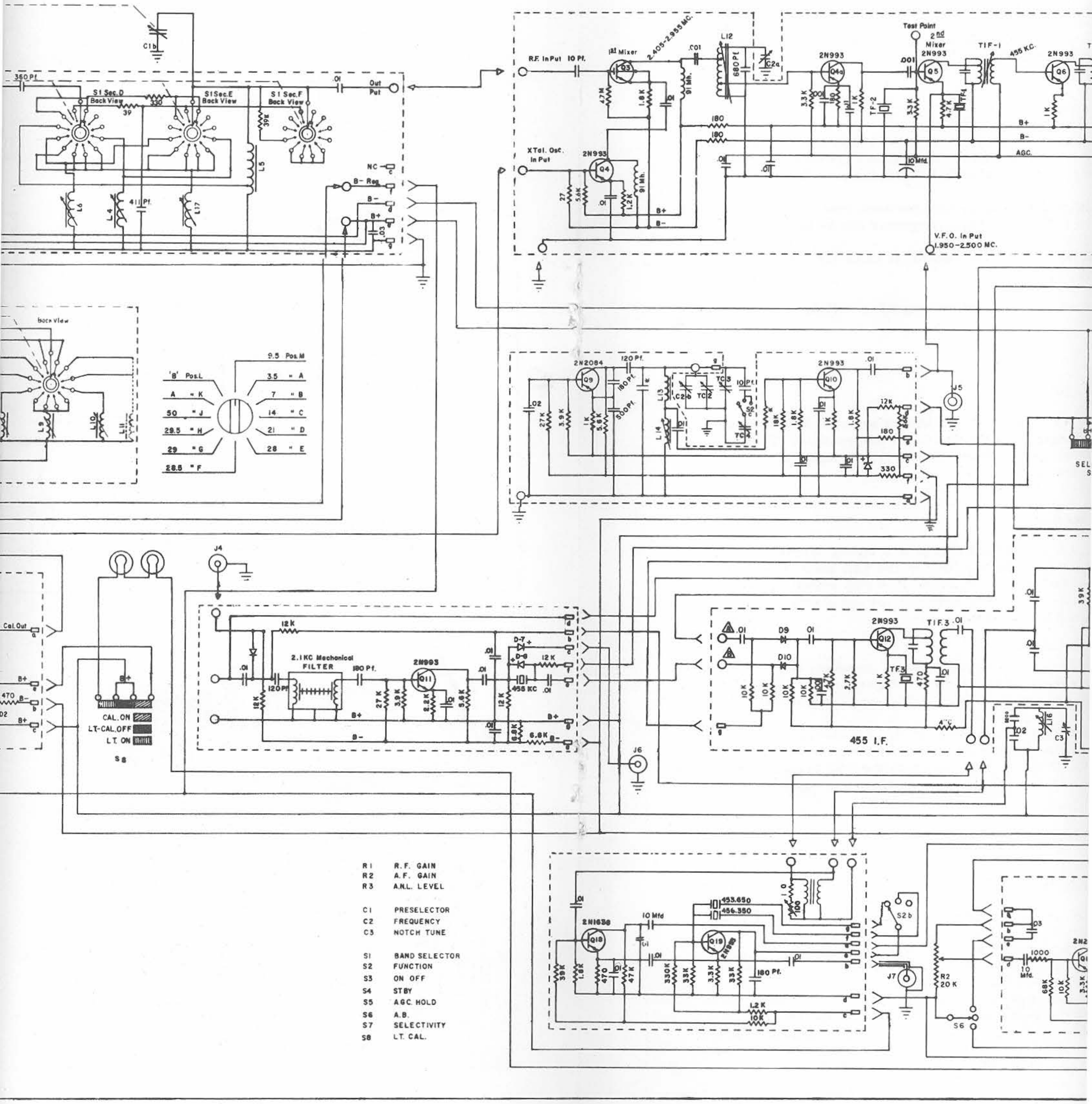


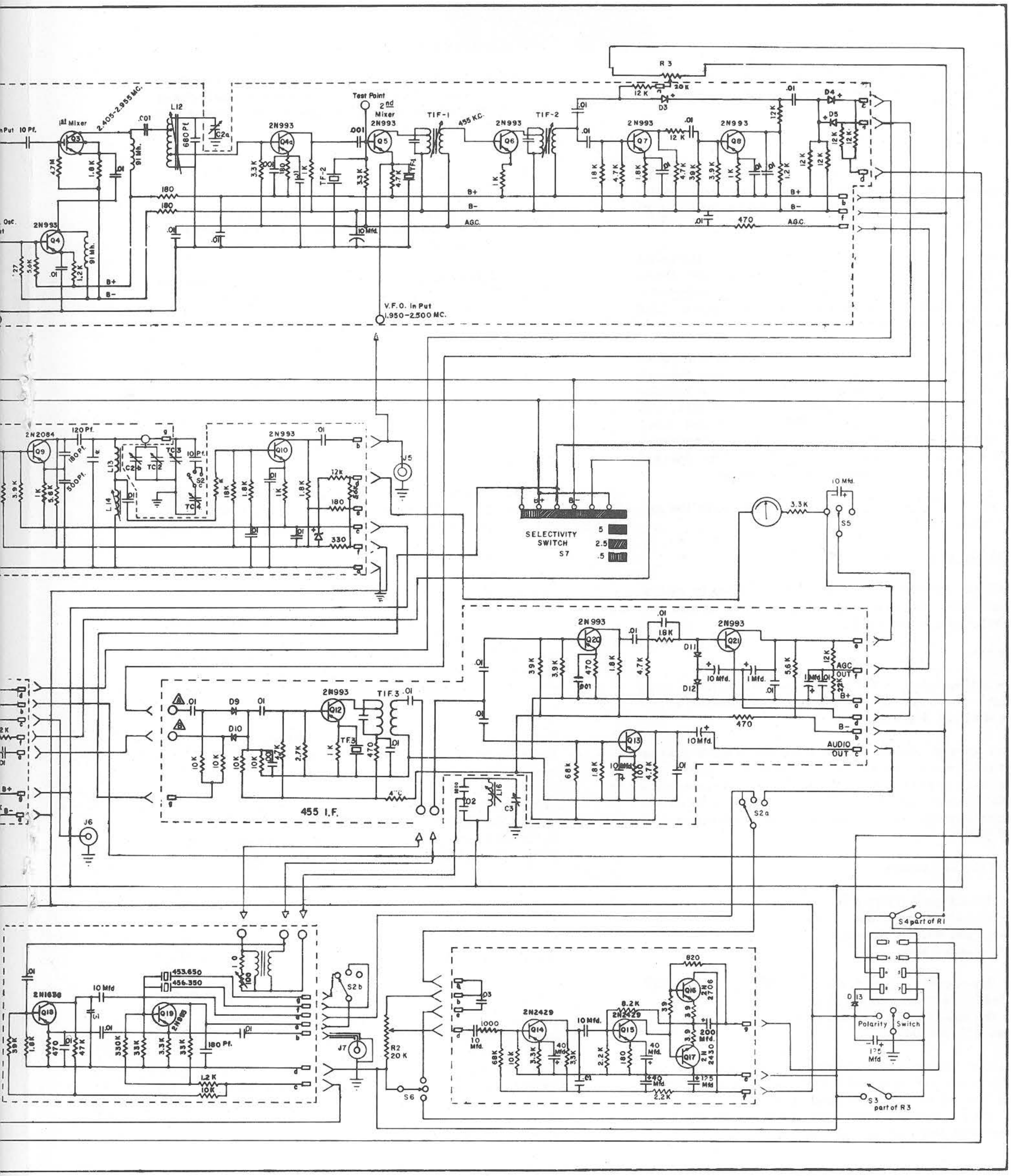






DAVCO Model DR-30 Receiver


C1b
360 Pf.
S1 Sec.D Back View
S1 Sec.E Back View
S1 Sec.F Back View
39
330
39K
.01
Out Put
L5
L6
L4
411 Pf.
L17
NC
B- Reg.
B-
B+
.03
Back View
L9
L10
L11
'B' Pos.L
A = K
50 = J
29.5 = H
29 = G
28.5 = F
9.5 Pos.M
3.5 = A
7 = B
14 = C
21 = D
28 = E
R.F. In Put 10 Pf.
1st Mixer
2N993
Q3
2.405-2.955 MC.
.001
L12
680 Pf.
C2a
Test Point
2nd Mixer
2N993
Q5
TIF-1
455 K.C.
2N993
Q6
Q4a
47M
1.8K
91 Mh.
180
180
3.3K
.001
1K
TF-2
3.3K
4.7K
TF-4
1K
B+
B-
AGC.
10 Mfd.
XTal. Osc. In Put
2N993
Q4
27
5.6K
1.2K
91 Mh.
B+
B-
V.F.O. In Put
1.950-2.500 MC.
2N2084
Q9
120 Pf.
180 Pf.
500 Pf.
L13
C2
TC2
TC3
10 Pf.
S2
TC4
L14
.02
27K
3.9K
1K
5.6K
18K
1.8K
2N993
Q10
.01
12K
180
330
J5
J4
12K
2.1KC Mechanical FILTER
120 Pf.
180 Pf.
2N993
Q11
27K
3.9K
2.2K
5.6K
12K
456 KC
.01
D-7
D-8
12K
6.8K
6.8K
B+
B-
J6
2N993
Q12
TIF-3
.01
D9
D10
10K
10K
10K
10K
2.7K
1K
TF3
470
455 I.F.
Cal. Out
B+
470
B-
.02
CAL. ON
LT-CAL. OFF
LT. ON
S8
R1 R.F. GAIN
R2 A.F. GAIN
R3 A.N.L. LEVEL
C1 PRESELECTOR
C2 FREQUENCY
C3 NOTCH TUNE
S1 BAND SELECTOR
S2 FUNCTION
S3 ON OFF
S4 STBY
S5 AGC. HOLD
S6 A.B.
S7 SELECTIVITY
S8 LT. CAL.
2N1638
Q18
Q19
10 Mfd
453.650
456.350
39K
1.8K
470
47K
330K
33K
3.3K
33K
180 Pf.
1.2K
10K
J7
S2b
R2 20K
S6
1000
10 Mfd.
68K
10K
3.3K
Q3


1st Mixer
2.405-2.955 MC.
L12
680 Pf.
C2a
.001
2nd Mixer
Test Point
TIF-1
455 KC.
TIF-2
R 3
20 K
12 K
D3
D4
D5
B+
B-
AGC.
470
10 Mfd.
V.F.O. In Put
1.950-2.500 MC.
2N2084
120 Pf.
180 Pf.
500 Pf.
10 Pf.
L13
L14
TC
TC2
TC3
S2
J5
330
SELECTIVITY SWITCH S7
5
2.5
.5
S5
AGC OUT
AUDIO OUT
455 I.F.
TIF.3
TF3
D9
D10
D11
D12
J6
S2a
S2b
S4 part of R1
S3 part of R3
Polarity Switch
D13
R2 20 K
S6
453.650
456.350
2N1636
2N2429
2N 2706
2N 2430
820
8.2 K
200 Mfd.
125 Mfd.
40 Mfd.
2.2K

4-5. Routine Maintenance

T-notch

Because of component aging, it may be necessary to re-null the T-notch (notch tune control) circuit every twelve to eighteen months.

Procedure:

Using the wide selectivity position and the BFO in the LSB position, tune in either a strong signal or the calibrator until a high frequency audio tone reads about S9 on the S-meter.

Null the signal with the T-notch control. At the notch you should detect a faint remnant of the carrier; those with sharp ears will notice that the 2nd or 3rd harmonic of the tone predominates over the original pitch. The S-meter should fall back to zero.

If this radical nulling does not occur, slowly and carefully adjust the T-notch pitch control accessible through the small hole in the lower back panel until you achieve a null. The control is a ten-turn potentiometer; you need not use an insulated screwdriver. You should, however, slightly retune the main tuning or the notch tune control to make sure that the signal is in the deepest part of the null while making the adjustment.

Note: Perform the nulling operation only with the receiver installed in its case.

Crystal Calibrator

The 100 kc. crystal calibrator is factory set to match WWV at 10 Mc. Occasionally, component aging may require resetting of the crystal.

Procedure:

Choose a time when WWV is received strongly and consistently. Turn the BFO to the LSB position and zero-beat it with the WWV carrier.

Note: be sure to choose a time when the WWV signal is not modulated with its 440 or 600 cycle modulation. It is very easy to zero-beat with the modulation rather than with the carrier and thus introduce a 440 or 600 cps error in the crystal setting! See section 3-5 for information on WWV.

Turn on the calibrator.

Rotate the RF gain control to the right so that the calibrator signal is received. If the crystal is correctly adjusted, you will be in zero-beat; if not, you will hear a low frequency tone.

Adjust the crystal oscillator to zero-beat by turning the small trimmer capacitor which projects through the grommet in the lower right portion of the back panel. This is a fine adjustment.

If a larger adjustment is required, remove the case from the receiver and make the rough adjustment by turning the white trimmer capacitor on the calibrator board, CT9. Reinstall the case and make the final adjustment with the case on.

Notch Center Frequency

The notch center frequency will rarely require adjustment. Although removal of the case will slightly change the frequency at which the null appears, the change should not affect operation.

Procedure:

If it is necessary to reset the center frequency, use a TV or radio alignment tool (small hex type) to adjust the slug in the variable T-notch inductor, L16.

With the BFO in the LSB position, tune in a strong carrier until a low audio frequency can be heard.

Set the Notch Tune Control at about the 11 o'clock position.

Adjust the slug until the signal is nulled.

SB Shift

The VFO frequency is shifted when the function switch is changed from the USB to the LSB position. Therefore, insofar as possible, the carrier remains at the same calibration.

Procedure:

To check the SB shift, tune in a strong carrier from the calibrator. Set the BFO to the LSB position and zero-beat the signal. Turn the Function switch to the USB position. Any difference in the audio tone indicates a slight SB shift error.

For maximum accuracy, adjust the SB shift with the VFO set in the most frequently used portion of the band. The factory alignment uses .8 Mc. on the tuning dial.

The trimmer capacitor, TC4, is switched into the circuit in the USB position. Zero-beat the carrier again in the LSB position. Switch to the USB position and adjust TC4 until the carrier is again zero-beat.

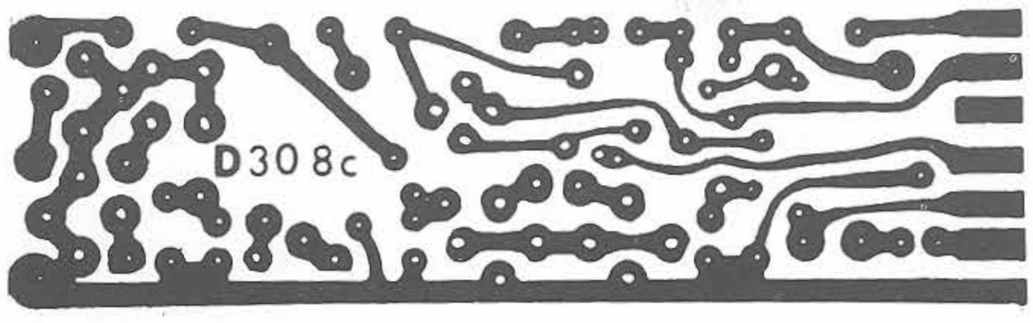
Further Routine Maintenance

Every twelve to eighteen months, apply a very small amount of a thick, silicon-base grease, such as Pfleuger Reel-lube, to the small pinion gear where it engages the large tuning gear. Use the smallest possible amount and apply it with a matchstick or a toothpick. If the receiver has been exposed to a great deal of dirt or dust, first clean the gears with a solvent such as the spray coolant sold in electronics shops for freezing components. Simply remove the old grease and any dirt that may be mixed with it. Then apply the new lubrication.

4-6. Extra Crystal Installation

This Section revised January, 1967
See Addendum A

4-7. RF Module



The RF module contains the RF amplifier FET, Q1, its biasing circuitry, and tuned circuit elements.

Q1 the RF amplifier transistor, is an IGFET, P-channel, low-noise UHF device, employed in a common-source configuration. The transistor is not controlled by the AGC but instead is biased at the most desirable point for eliminating cross-modulation.

Also on the board are the protective diodes, D1 and D2, which ground out any excessive RF voltages applied to the receiver.

The bandswitch wired to the RF module switches in the appropriate inductors or capacitors for coverage of the various frequencies provided in the receiver.

Service Notes:

The bandswitch and RF board are wired together. Removal of the pair of assemblies is quite simple if the following step-by-step instructions are followed.

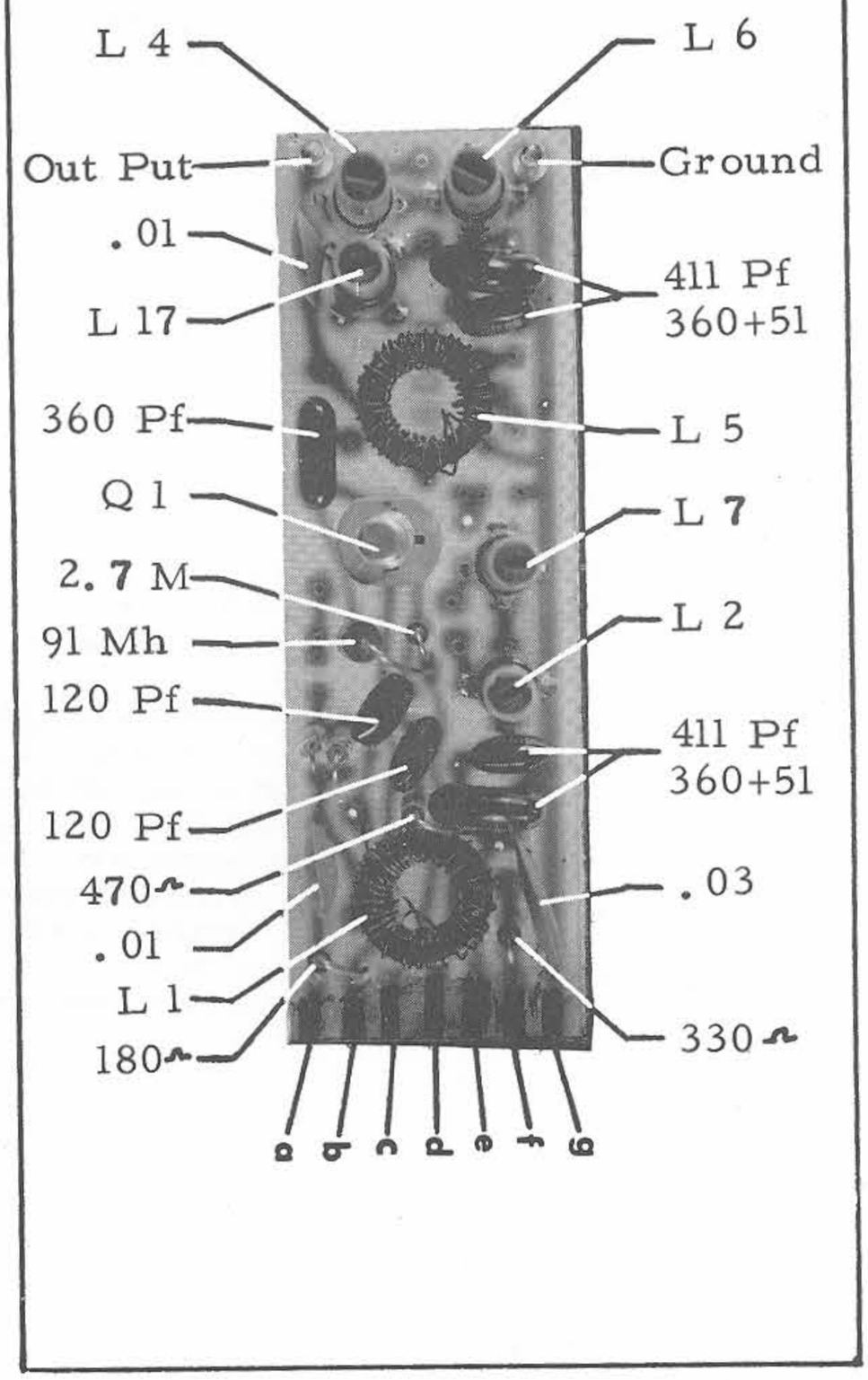
(1) Remove the back panel by removing the six screws and the two bolts holding the Jones plug. Unsolder the Connector wire from the Teflon feedthrough to the XTAL OUT jack.

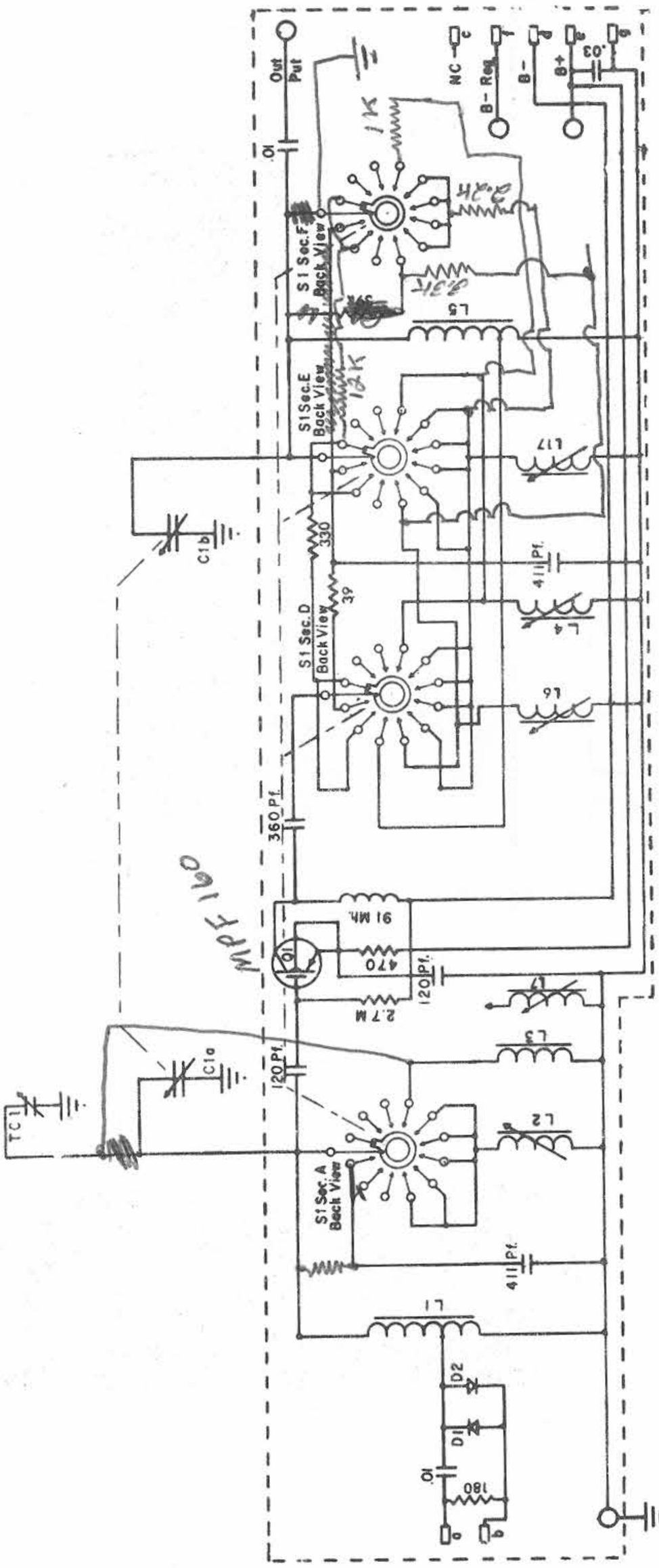
(2) Allow the panel to swing down out of the way with the coax cables holding it near the receiver.

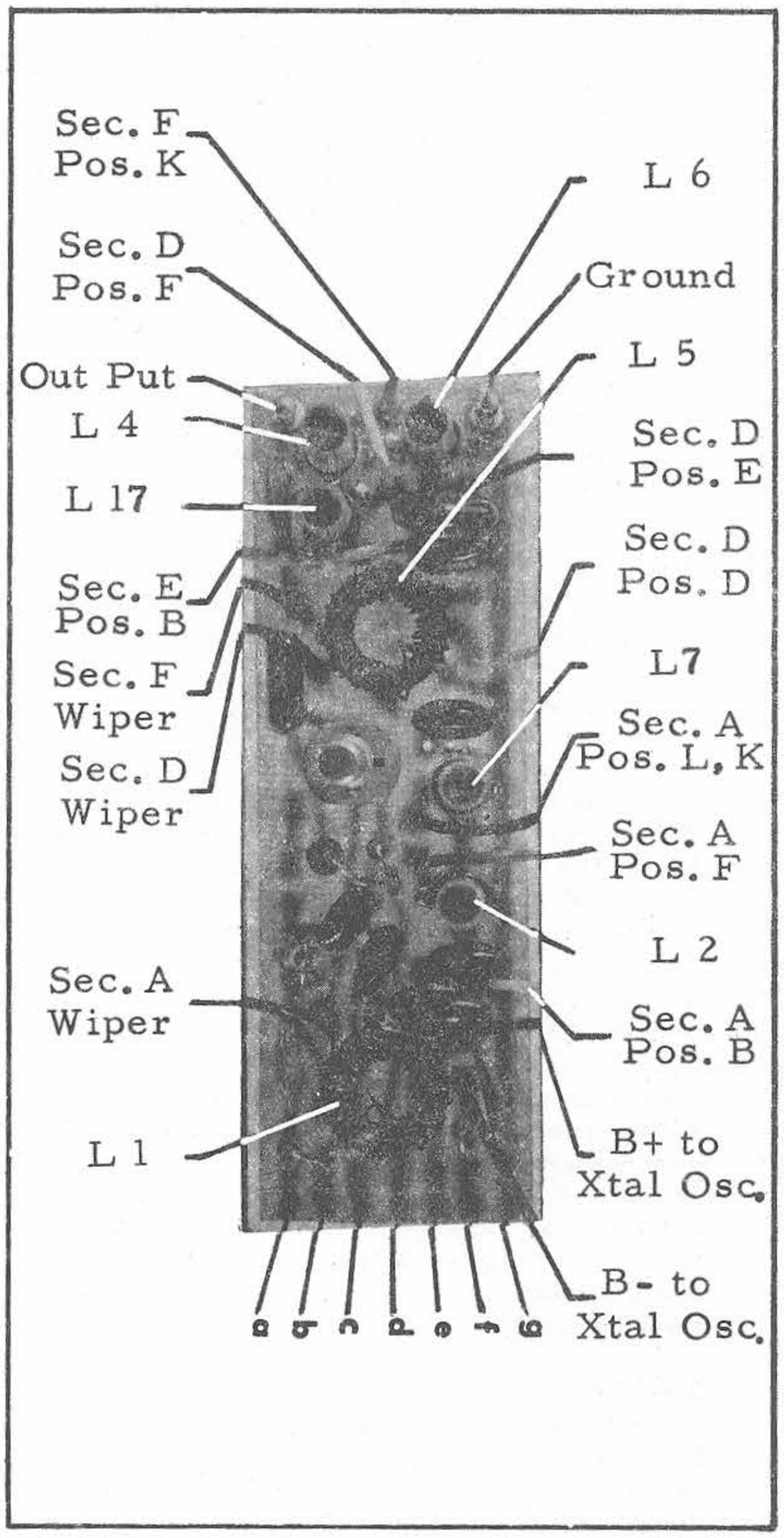
(3) Loosen the setscrew for the mitre gear on the bandswitch shaft; also loosen the large nut holding the bandswitch to the bracket. Remove the bandswitch knob

(4) Unsolder the brown wires coming through the chassis from the preselector capacitor; unsolder the yellow wire from the crystal oscillator to the Teflon feedthrough; unsolder the jumper from the end of the RF board to the end of the first IF board.

(5) Slide the assembly out.




Out Put
.01
NC
B- Reg.
B-
B+
.03
1K
S1 Sec.F Back View
S1 Sec.E Back View
S1 Sec.D Back View
S1 Sec.A Back View
L5
L17
L4
L6
L3
L2
L1
330
39
360 Pf.
411 Pf.
91 MH
470
120 Pf.
2.7 M
180
C1a
C1b
TC1
D1
D2
MPF 102


Sec. F Pos. K
Sec. D Pos. F
Out Put
L 4
L 17
Sec. E Pos. B
Sec. F Wiper
Sec. D Wiper
Sec. A Wiper
L 1
L 6
Ground
L 5
Sec. D Pos. E
Sec. D Pos. D
L7
Sec. A Pos. L, K
Sec. A Pos. F
L 2
Sec. A Pos. B
B+ to Xtal Osc.
B- to Xtal Osc.
a
b
c
d
e
f
g

4-8. First IF Module

The first IF module contains 5 transistors and one FET, comprising the mixers, the noise blanker, and other circircuitry.

The first mixer, Q3, is an N-channel insulated-gate field effect device. The use of the FET for a mixer provides lowest possible cross-modulation along with an extremely low noise figure and high conversion gain. The input impedance of the mixer is very high, around 1 megohm. The output of the mixer is at the first intermediate frequency range, 2.405 to 2.955 Mc., and is fed to a high-Q selective circuit which is tuned and tracked by one section of the main tuning capacitor. The signal at the first IF is amplified by Q4a and goes to the second mixer.

The second mixer, Q5, has in its base circuit a ceramic filter, TF2, which traps any 455 component present at that point. In the emitter circuit another ceramic filter, TF1, provides high gain for the mixer at 455 kc and helps establish the IF passband. Q6 is a normal 455 kc. IF amplifier and TIF1 and TIF2 are single-tuned IF transformers.

The noise blanker employs two stages of amplification and wave-shaping, Q7 and Q8, which speed up, amplify, and detect the noise pulses entering the receiver. The resulting voltage is fed to the diode gate, D3, which is in series with the IF string. A noise pulse can therefore turn off the gate for the duration of the noise, allowing signals to pass unaltered. The level at which the noise blanking occurs is controlled by the setting of the ANL level control, R3. Under normal operating conditions, the control remains so that the diode is fully on. D4 and D5 are selectivity path switching diodes which are turned on or off by dc bias provided at the selectivity switch, S7.

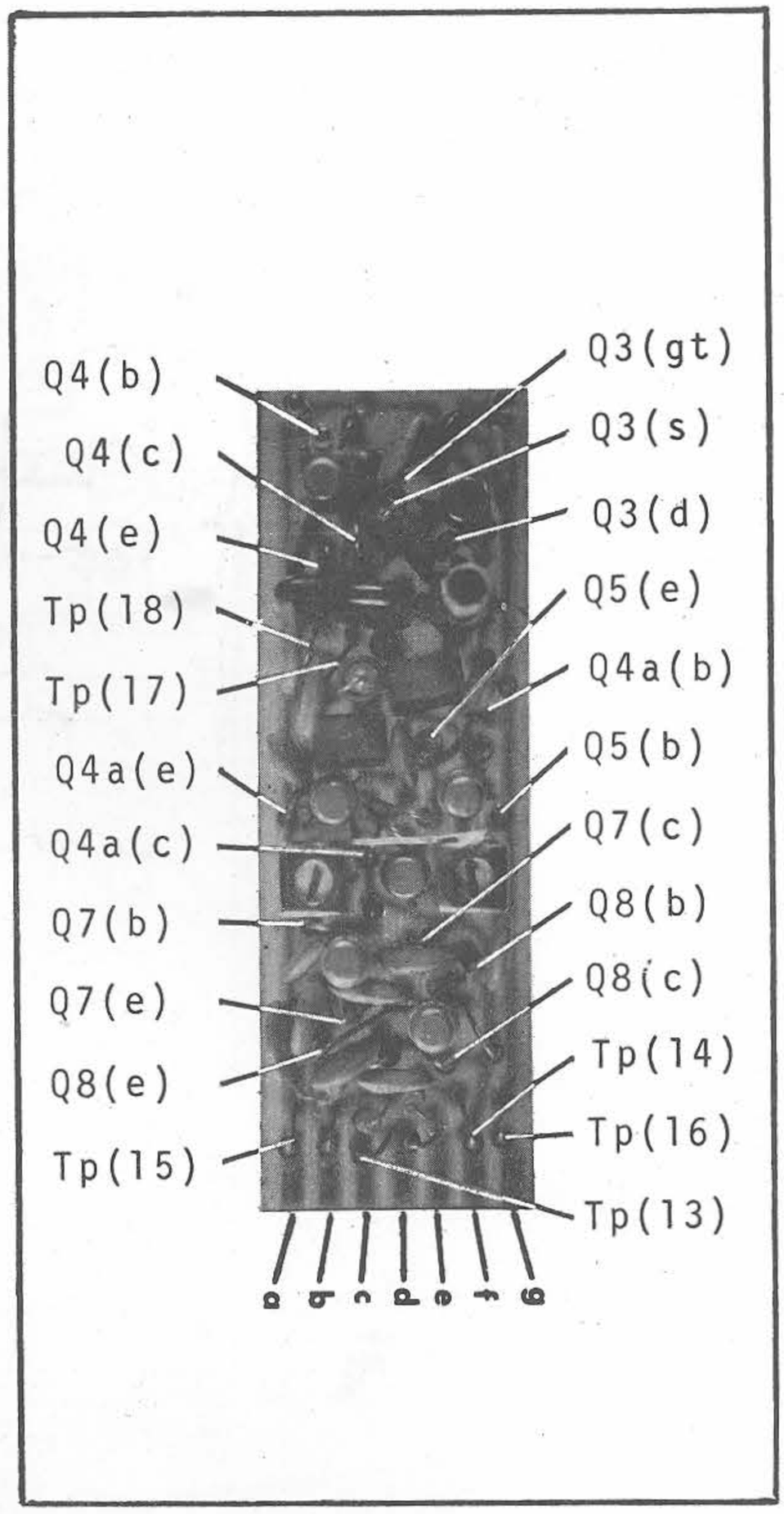
Service Notes:

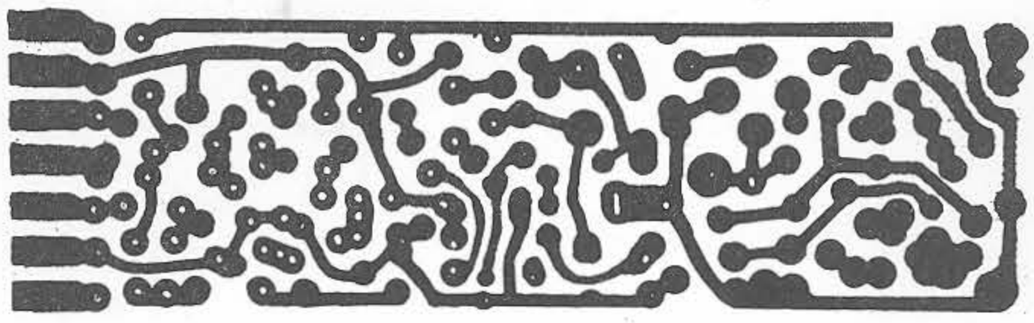
This board can be checked almost entirely through dc voltage measurements and the use of a 455 kc. signal generator. An important dc point is the AGC voltage at the test point, the base of Q5. Any variation from normal may mean a shorted transistor (Q4a, Q5, or Q6), a grounded coax from the VFO connector to the emitter of Q5, or a malfunctioning AGC detector (Q21 on the 455 module).

Signal tracing with a 455 kc. generator should begin at the same test point. CAUTION: Use a small capacitor (.01 mfd) to DC block any signal generator probe before using it. A very low level of signal is required at this point; around 30 microvolts is adequate.

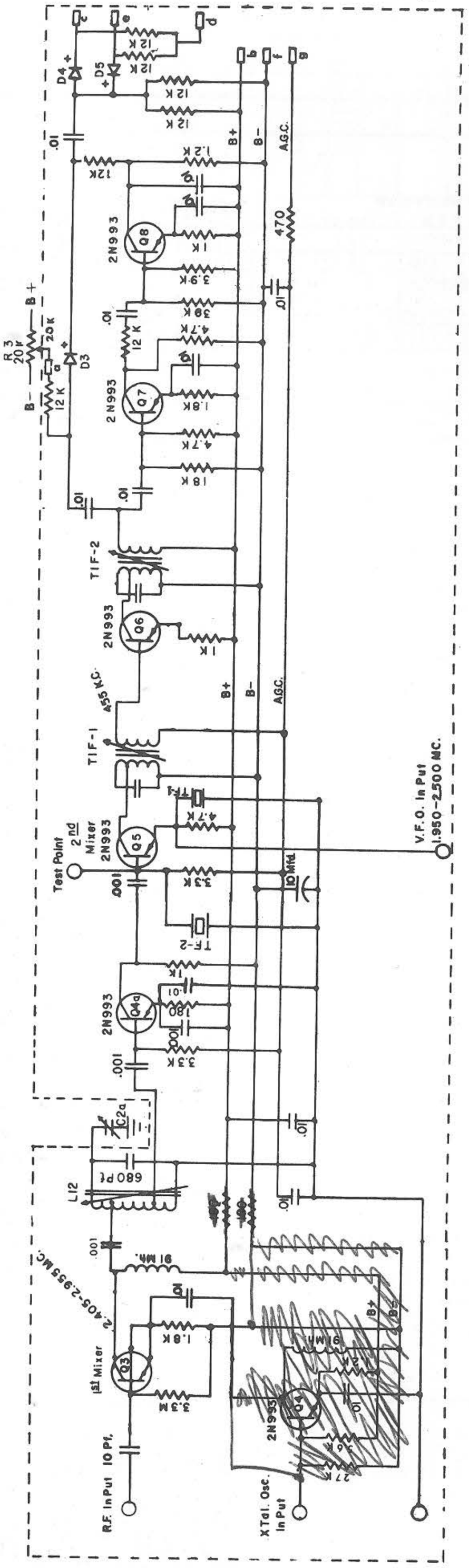
Further injection points are the base of Q7 and pin c or e on the wiring harness.

Injection of signal at the first intermediate frequency may also be done at the test point, at the connection from the first IF to the main tuning capacitor (at the Teflon feedthrough on the chassis), at the input to the first mixer, and at the Teflon feedthrough connection for the oscillator.

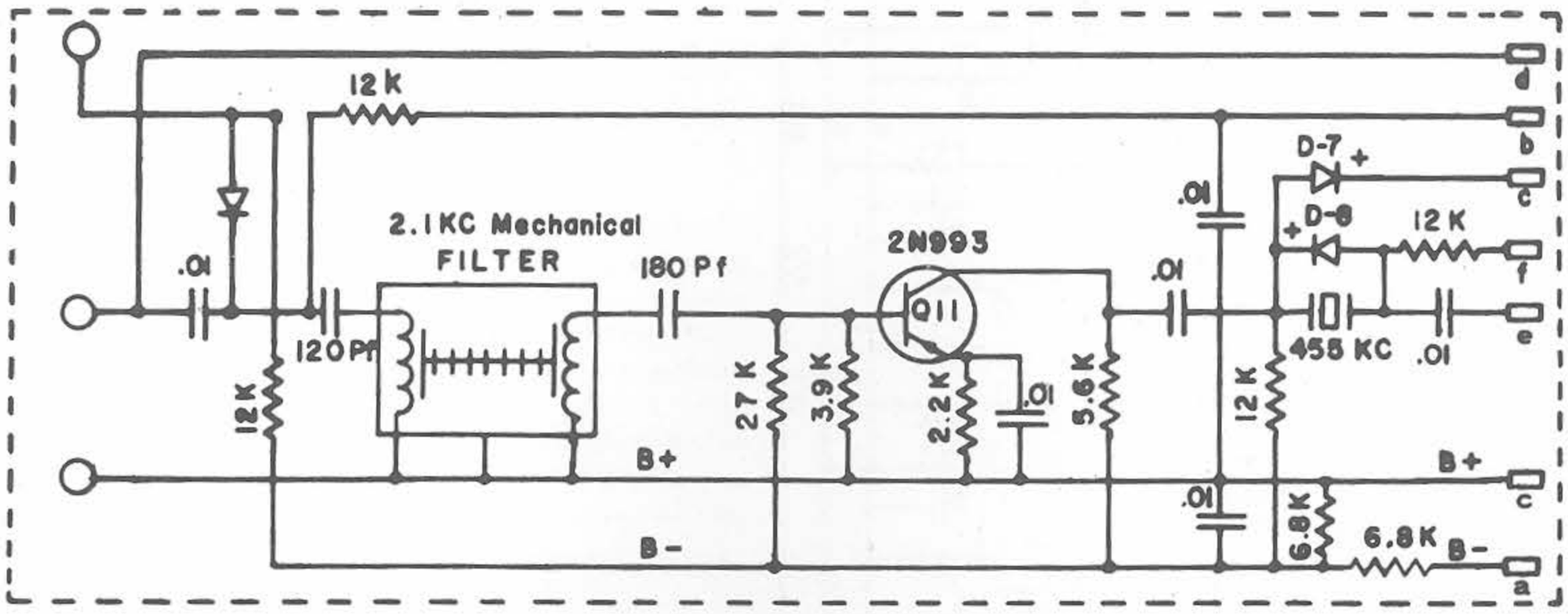




4-8. First IF Module



4-9. Mechanical Filter Module



The circuitry on this module provides two narrow filter selectivities: a Collins 2.1 kc mechanical filter and a narrow crystal filter designed expressly for CW reception.

The diodes D6, D7, and D8 are employed in signal-switching circuitry which, by application of different DC bias voltages from the selectivity switch, route the signal through or around the filters. Q11 is a common-emitter amplifier stage whose amplification is adjusted so that each selectivity path has the same gain.

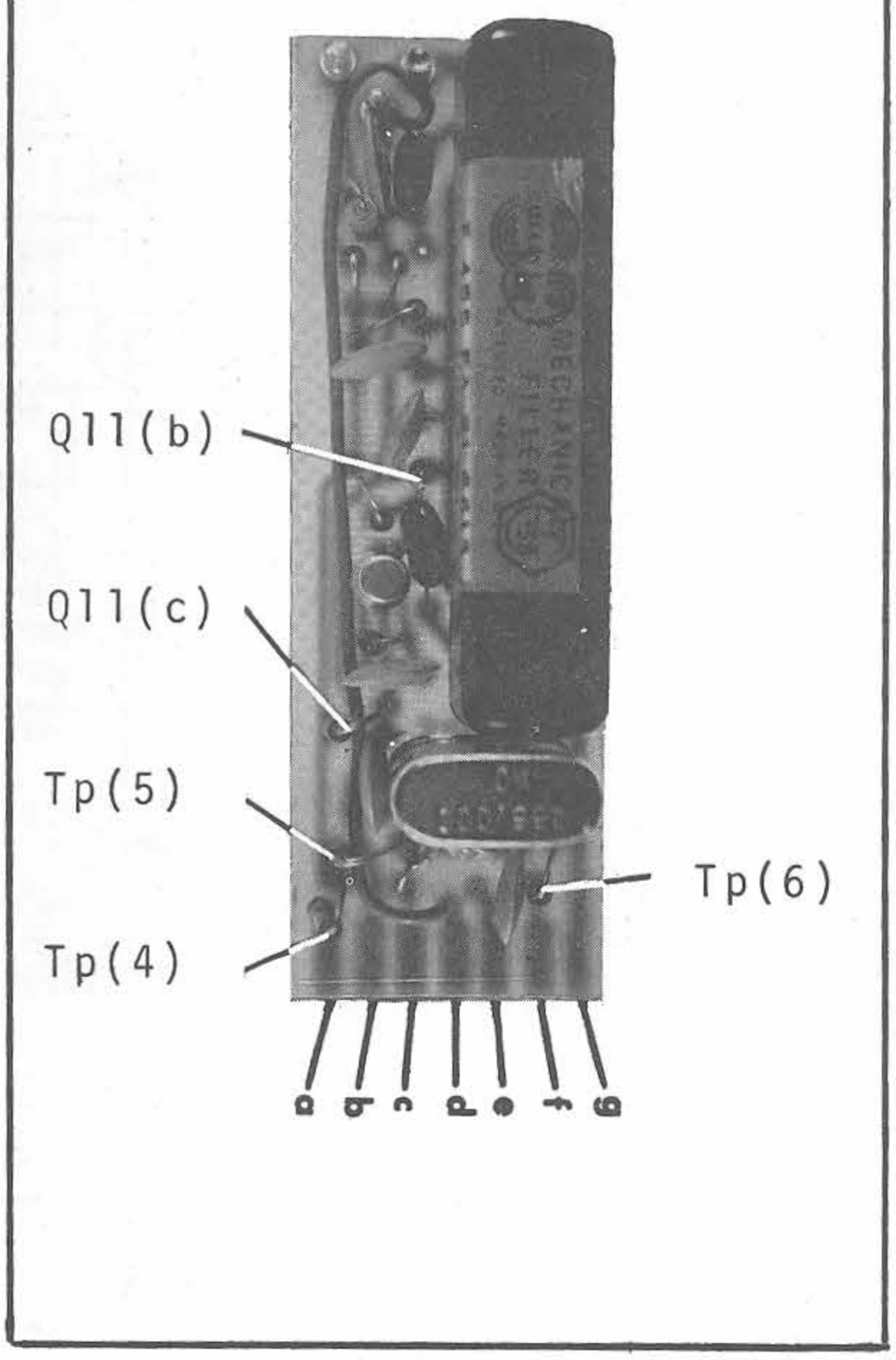
Additional connections are provided through the diode switches for operation of external equipment. Note that for correct receiver operation, a jumper must be placed from pin 3 to pin 4 on the rear-panel Jones plug.

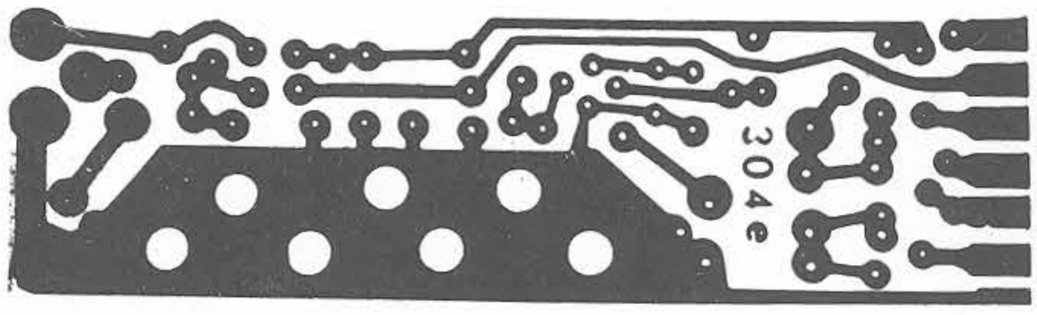
Service Notes:

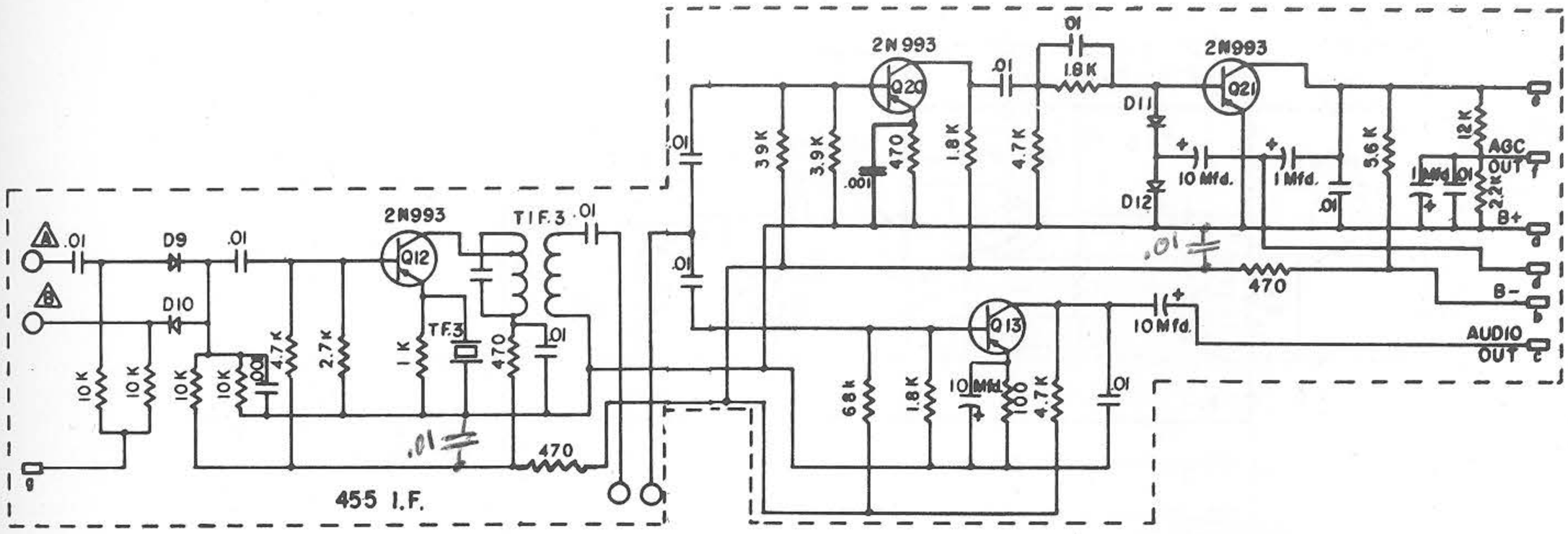
A low frequency crystal or the Collins mechanical filter may fail from excessive physical shock. If this failure occurs, it will be difficult to pass any signal at all through the narrow IF selectivity.

If the gain is low and the board "rattles" when shaken after removal from the set, you should suspect failure of one of these components. For a simple test, inject a 455 kc. signal generator at harness connection D and tune through the range while switching from one path to another.

If gain is low but the bandpass is correct, check all voltages on the board, particularly those of the transistor connections. Also check the switching diode circuitry of the 455 module to be sure that the failure is not in that circuitry rather than on the filter module.







This subassembly contains four stages. Q12 is a tuned 455 kc IF amplifier. TF3 is a ceramic transfilter employed as an emitter bypass.

Q13 is the low-distortion AM detector.

Q20 is a buffer and amplifier for the AGC system of the receiver. This stage is operated at a low gain level by use of a small emitter bypass capacitor which reduces the stage gain and raises the input impedance of the stage. The function of the stage is to isolate the AGC detector from the other detectors so that the AGC detector cannot reflect distortion into the other detectors.

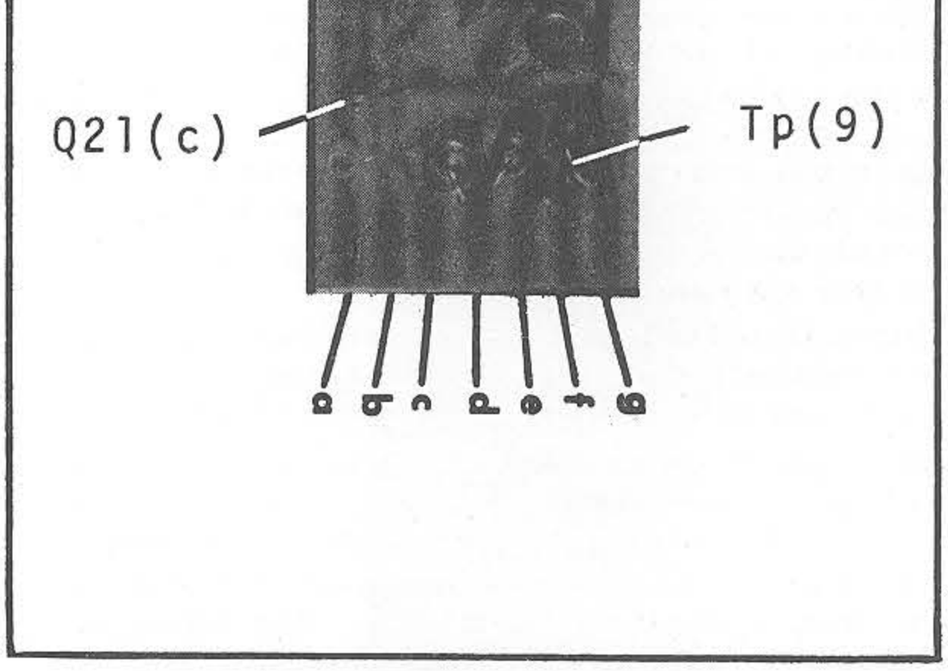
Q21 is the AGC detector. This stage is designed so that the 455 kc input is detected and the collector current increases with an increase in the signal level applied to a transistor. The increasing current causes a voltage drop across the collector resistor network; the result is a positive-going voltage with increasing signal. The collector of Q21 swings from about 11 volts to 1 volt with changing signal levels. This voltage is applied to the S-meter and is also fed to a voltage divider which gives an approximate 9:1 reduction in the output voltage swing. The divided voltage is fed to several IF stages as the control voltage.

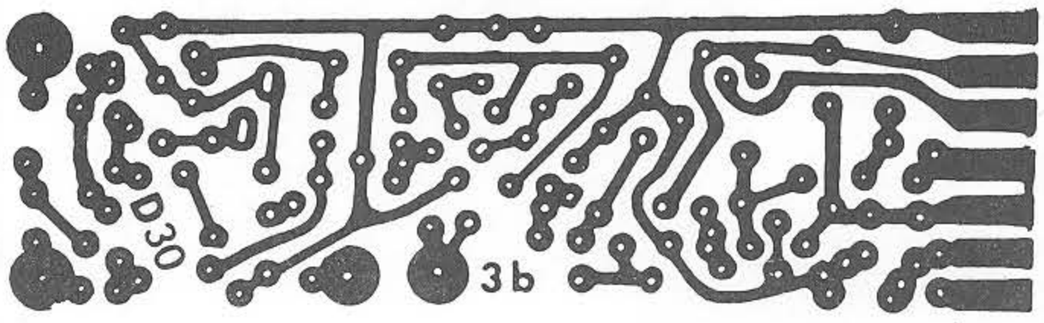
The AGC detector has fast-attack characteristics at all times. The speed with which voltage returns to the no-signal level after removal of the signal depends upon the time-constand of a feedback loop from the collector to the base of Q21. D11, D12, the base resistors, and the electrolytic capacitors of the hold circuits establish this time-constant. Three positions of hold time are provided and are chosen by means of the AGC HOLD toggle switch on the front panel. The three choices given are (1) 10 mfd capacitor only for long hold (right position), (2) two 10 mfd capacitors in series, for an approximate 5 mfd, for medium hold (left position), and (3) the 1 mfd capacitor only for short hold time (center position).

The other capacitors and resistors associated with the voltage divider and Q21 are filters which remove the IF component from the dc voltage fed back to the earlier stages.

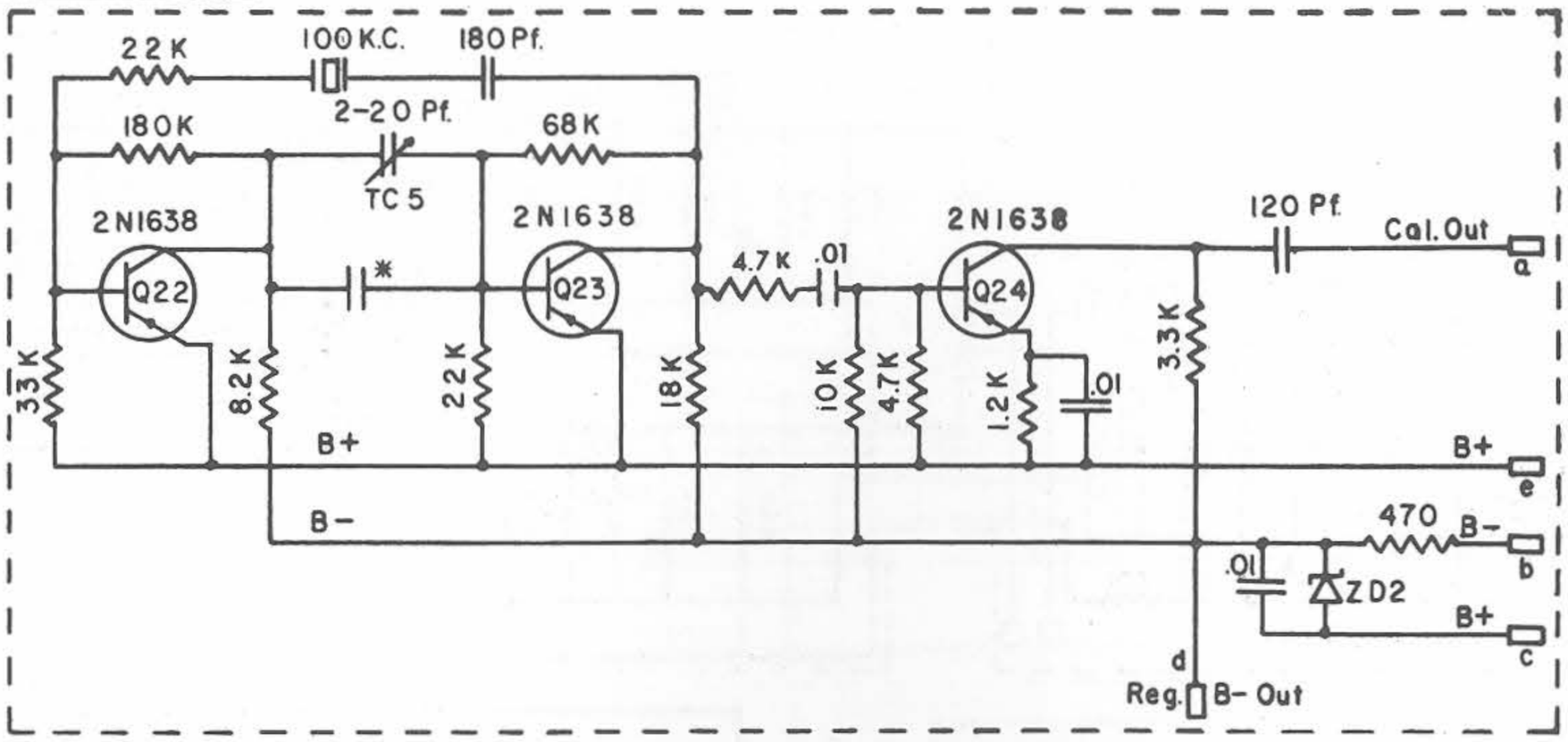
Service Notes:

The AGC detector output should not be shorted to the chassis or to any other connections at the board, at the S-meter, at the AGC hold switch, or at any other point. Doing so can cause failure of Q21; the cure is replacement of the transistor. Normal precautions should be taken to prevent such short circuits.





4-11. Calibrator Module



The crystal calibrator circuit is an amplifier feedback type of oscillator in which the feedback path is from the collector of Q23 to the base of Q22 through the crystal. The impedance of the crystal at series resonance is low enough to permit feedback of sufficient amplitude to start and maintain oscillations. The 22,000 ohm resistor limits the power dissipated in the crystal to well below its rated maximum.

Q24 is a high-gain untuned amplifier stage which raises the output level of the crystal oscillator while also clipping the waveform to a highly distorted, harmonic-rich wave shape. Useful harmonics are provided for receiver calibration at the receiver's highest frequencies.

ZD2 is a 6.8 volt zener regulator diode. The voltage from this zener diode is fed to the calibrator circuit and also to the BFO board and the first conversion (crystal) oscillator board. The calibrator is switched off and on by connecting the plus side of the power to the board, i.e., the minus side is always "on" so that the zener diode is used.

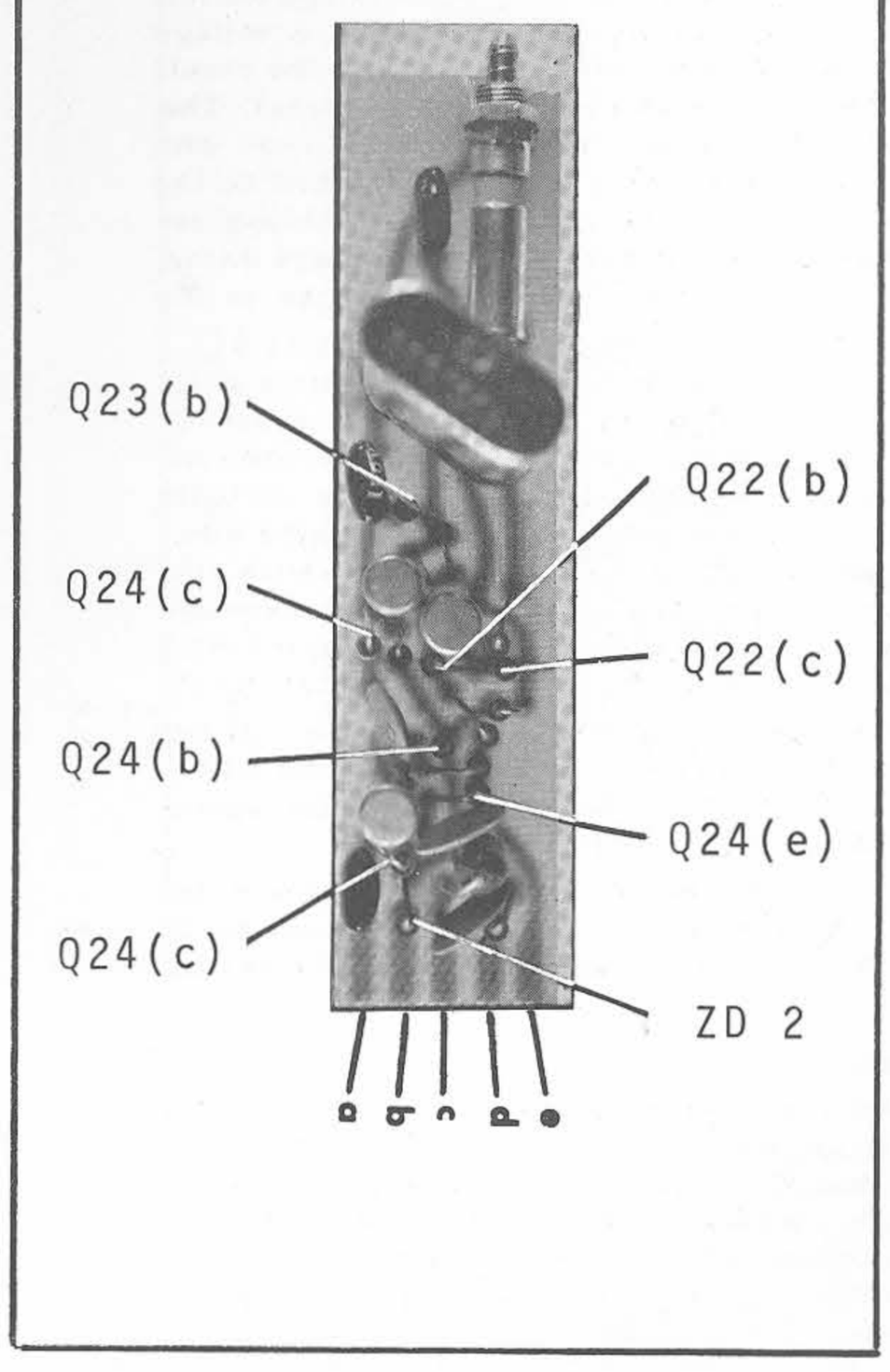
Service Notes:

This circuit is quite trouble-free, and voltage measurements on the transistor connections will usually locate any difficulty. If all voltages are essentially correct, replace the crystal or the board.

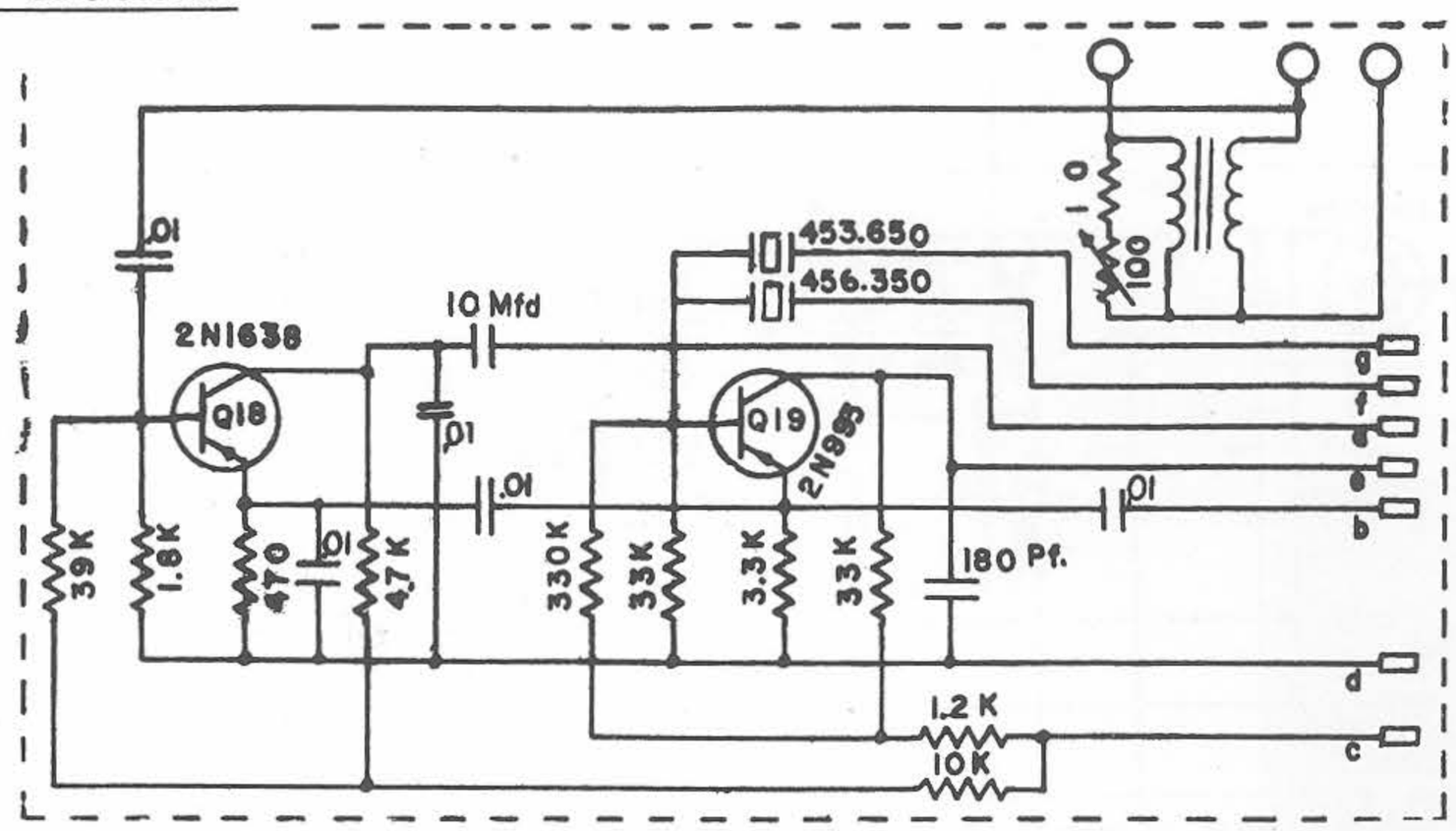
The zener can fail only if an extreme current load is placed on it, for instance, if the regulated line to one of the boards should be shorted accidentally. Take precautions that such shorts do not occur.

If the zener should fail, the receiver will react as though it were completely inoperative. The zener can be replaced with any suitable type of 1/4 watt or higher.

Since the zener tends to short out, rather than opening, when failing, it may be possible to make an emergency repair simply by clipping the zener lead at the component. This action will provide unregulated voltage to the oscillators and will affect stability. Therefore, the zener should be replaced as soon as possible.



4-12. BFO Module



The BFO module contains the crystal-controlled BFO/ carrier generator, the product detector used for SSB and CW reception, and certain components of the rejection-notch circuit.

Q19 is the crystal oscillator transistor. Crystals of 453.650 kc. and 456.350 kc. are employed for LSB and USB reception respectively. The crystals are chosen by the function switch S2. The output of this oscillator is fed to the rear connection jack BFO OUT for use with external equipment and also goes to the product detector Q18.
Also on this module is the mutual inductor L which is a portion of the T-notch, and the notch depth control, a 100 ohm ten-turn potentiometer.
Power for operation of this module is derived from the regulated line originating at the zener diode on the calibrator module, assuring that the frequency will be stable with varying input voltages and that the amplitude of the crystal oscillator signal will remain constant. This latter point is of special importance when the BFO is used as a carrier generator feeding a balanced modulator for transmission, as it is possible for changing oscillator signals to unbalance such mixers.

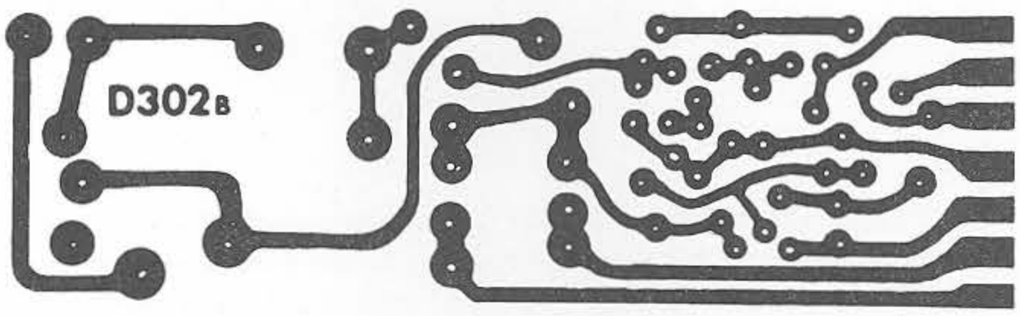
Service Notes:

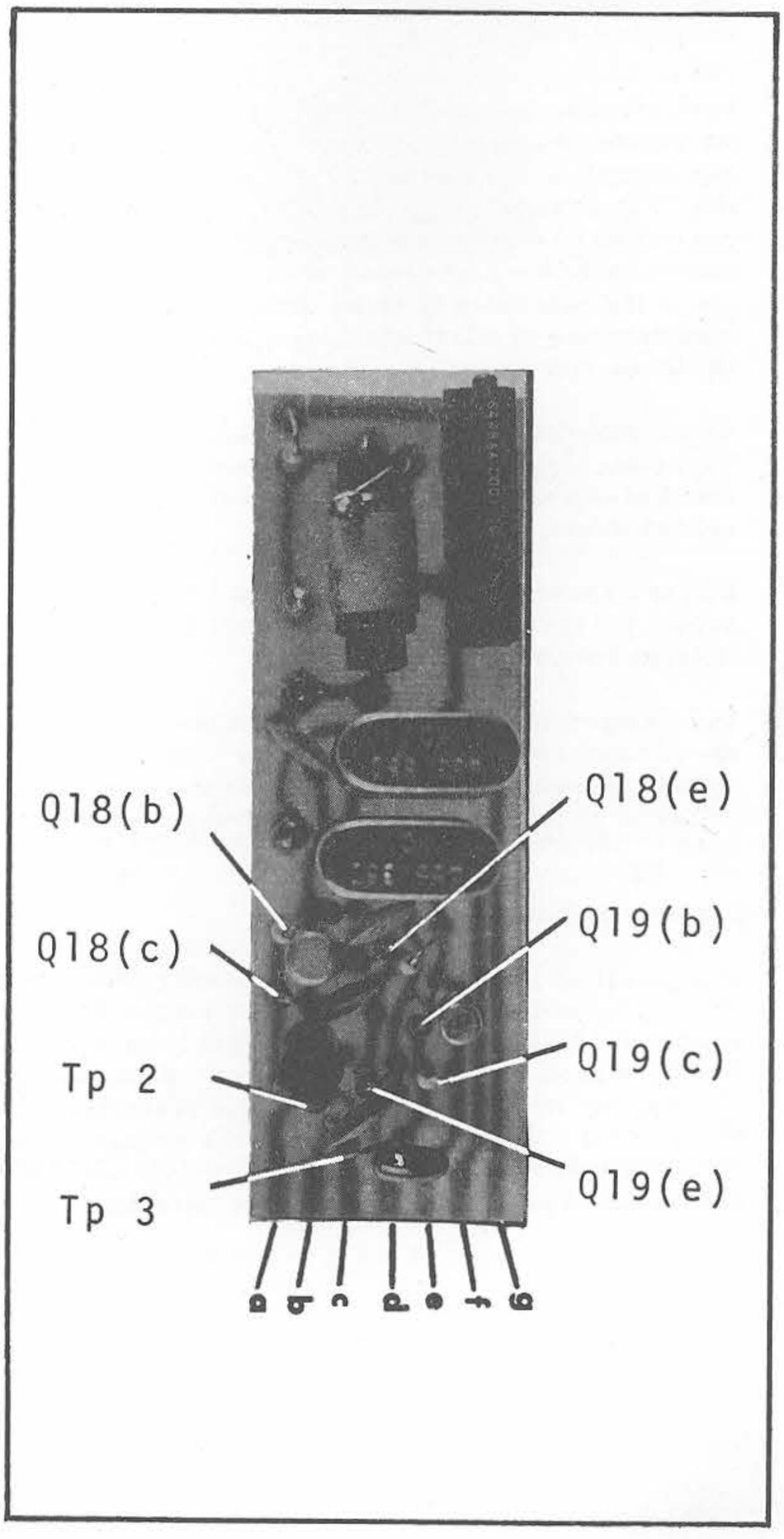
Any low-frequency crystal is subject to damage from extreme physical shock. The only remedy is replacement of the crystal.

If the BFO fails, the audio heard from the receiver will sound similar to that received when the function switch is in the AM position. There will, however, be some distortion and loss of output. Should both the LSB and the USB positions fail, check the crystal and the connections to the function switch by shorting across pins e and g for the LSB crystal or pins e and f for the USB crystal.

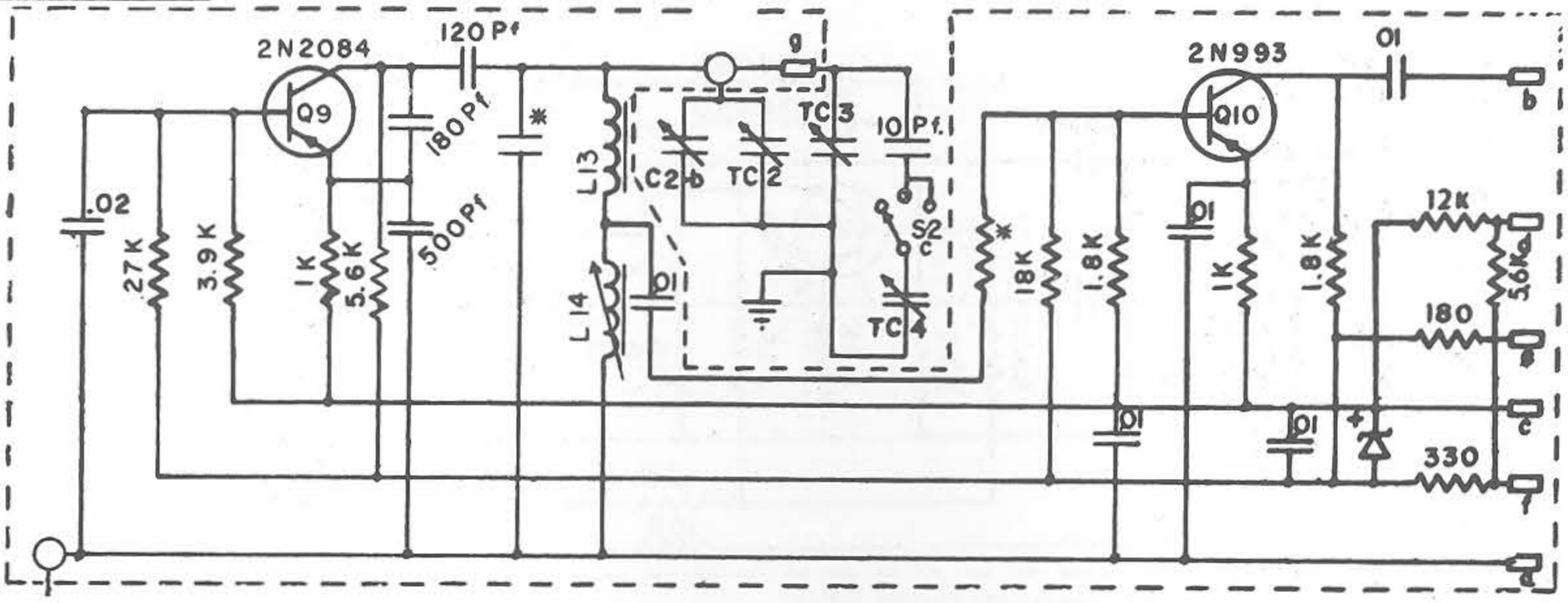
Caution: Be careful in unsoldering the connections to the terminals from the 455 board. The wires are Teflon insulated and cannot be damaged by overheating. However, the T-notch coil is near by and can be damaged if touched with a hot soldering iron.

If the T-notch is damaged, an emergency repair can be made by shorting out the T-notch circuit and jumpering the solder lugs together. Some reduction of gain will occur but may be partially compensated by returning the IF transformer, T1F3.





4-15. VFO Module



The VFO module contains the highly-stable variable oscillator used for the second frequency conversion of the DR-30 and an isolation amplifier for the oscillator. The tuning oscillator is also suitable for use as a transmitter frequency-control VFO.

Q9 is employed as the tuning oscillator in a common-base circuit. Feedback is applied from the collector to the emitter through the voltage divider, consisting of the two dipped-mica capacitors. The inductive element for the VFO circuit consists of L13, a high-Q toroidal inductor, and L14, a small tunable inductor which is connected on the low-impedance end of the toroid. The output of the oscillator is taken from the junction of these inductors and in effect provides a low-impedance tap on the tuned circuit.

Transistor Q10 is used as a buffer-amplifier for the VFO. This stage isolates the tuning oscillator from strong signals and establishes the correct injection voltage for the second mixer, Q5.

ZD1 is a zener diode which provides a 6.8 volt regulated supply for the VFO and buffer circuits despite variations in input voltage to the receiver.

The bridge network across pin d of the board provides the correct voltage for the S-meter with no signal. The voltage is approximately the same as that present at the collector of the AGC detector Q21 when no signal is present.

Service Notes:

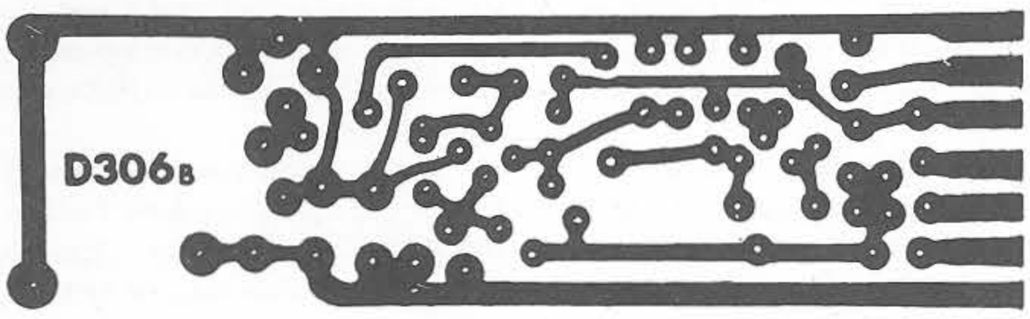
The output of ZD1, the voltage regulator, must not be shorted to the chassis or to the power supply lines of the receiver. Such shorts can cause breakdown of the diode. In such a case, emergency repairs can often be made by clipping one lead of the diode and thus restoring voltage to the VFO. Note, however, that the voltage stability of the receiver will be very badly affected and that the zener should be replaced as soon as possible.

Be especially careful when adjusting TC4, the SB shift trimmer capacitor. Always perform this operation with the rear-panel chassis polarity switch in the POSITIVE GROUND position to prevent damage if your tuning tool should accidentally touch the zener lead while also touching the capacitor.

The VFO output is present at the rear-panel jack and can be monitored with an oscilloscope. Normal output level is 50 mv. Caution: dc block with a capacitor any connections made to this jack. Failure to do so may cause malfunction of the 2nd mixer, Q5.

Lack of VFO output can be caused either by a failure of Q9, which is unlikely, or by shorting the main tuning capacitor. Voltage measurements on the board should establish whether the transistor is operating properly. Voltage measurements will vary slightly with no oscil lation, but this variation does not suggest transistor failure but rather oscillation failure resulting from capacitor short-circuiting.

Caution: Shorting of Q5 may create the symptom of no output from the VFO OUT jack on the rear panel. Disconnect the coax to Q5 and recheck before concluding that the VFO, and not the mixer, is malfunctioning.



4-14. VFO Calibration

Original calibration or recalibration of the tuning oscillator of the VFO is a simple operation for anyone familiar with alignment procedures.

Three variables must be adjusted correctly for calibration:

(1) The "fixed" capacity of the circuit must be correct.
(2) The inductance of the circuit must be correct.
(3) The correct portion of the tuning capacitor's rotation must be used.

(1) Two trimmer capacitors are provided for adjustment of the "fixed" capacity of the circuit. The internal trimmer TC2 is used for rough adjustment; the panel calibrator TC3 is used for the final touchup. Observe the following precautions:

(a) Do not screw in the adjustment screws more than flush with the capacitor body. The flush position is the position of maximum capacity. Further insertion of the screw may cause it to fall out the other side.

(b) Be sure to use the internal capacitor in such a way that, after final adjustment, the external trimmer will not project so far out on the front panel as to interfere with the action of the function switch.

(2) The inductance of the circuit is roughly adjusted by moving the turns of wire on the VFO toroid. After rough adjustment the toroid is locked firmly by an application of Q-dope. Further adjustment is made by the tunable inductor located next to the toroid. The tunable inductor should be set in mid-range before the toroid is adjusted so that suitable adjustment in either direction is possible.

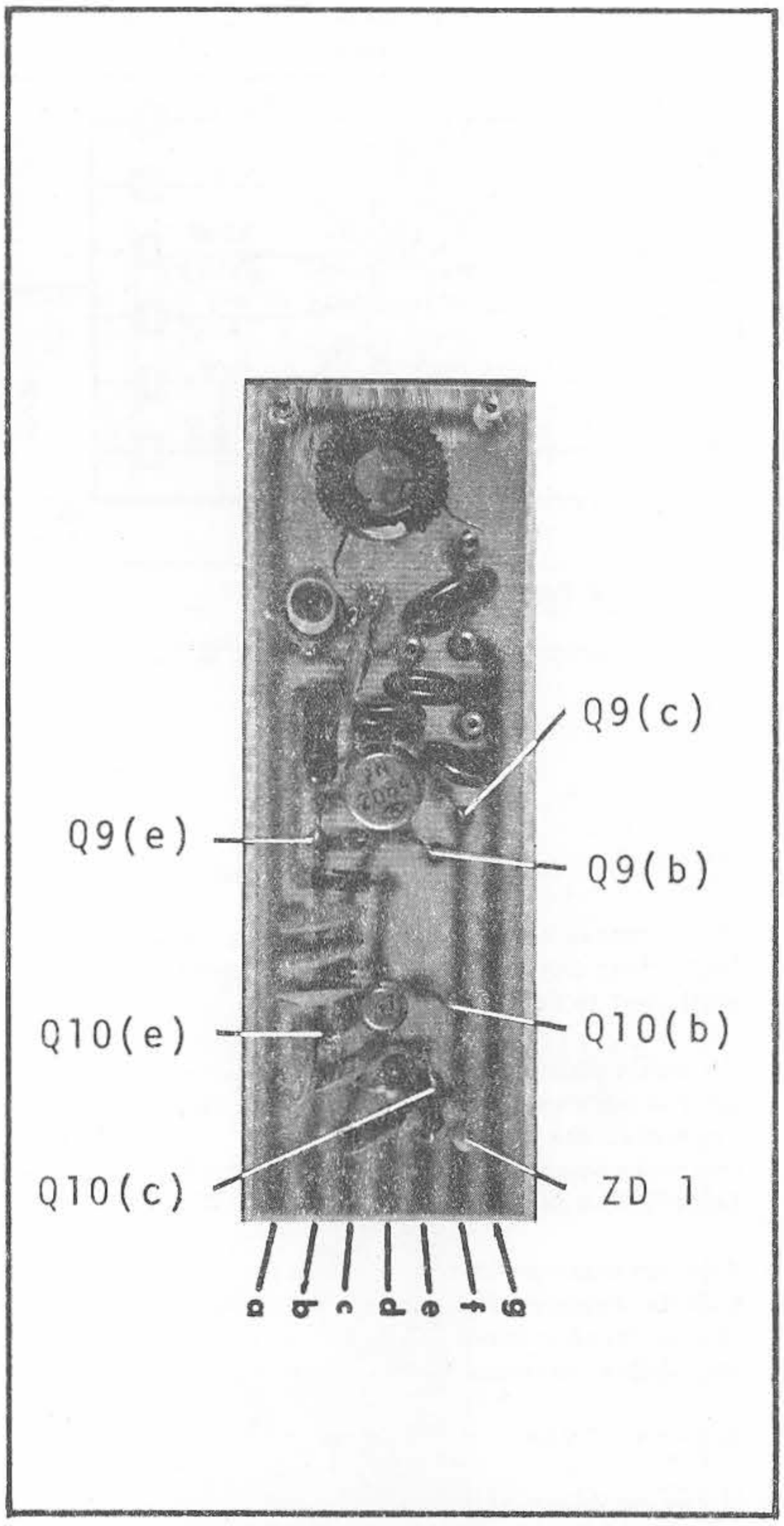
Which portion of the tuning capacitor is employed depends upon the relationship of the capacitor to the dial pointer. To establish which portion is to be used, set the dial at the top calibration point (.550 or 1.050), loosen the allen setscrew which holds the capacitor split gear, set the capacitor, and retighten the setscrew.

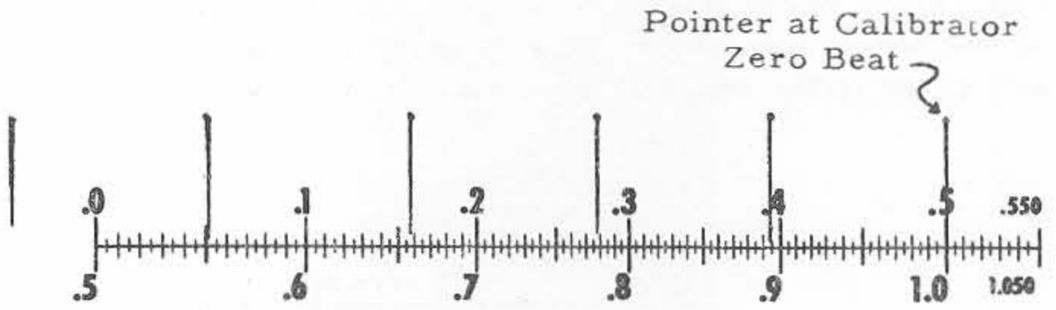
Alignment Procedure

Make sure that the crystal calibrator is set exactly on the carrier of WWV at 10 Mc. Adjust the trimmer capacitors and inductors until the pointer is exactly on 10 Mc. when the WWV signal is zero-beat with the BFO in the LSB position.

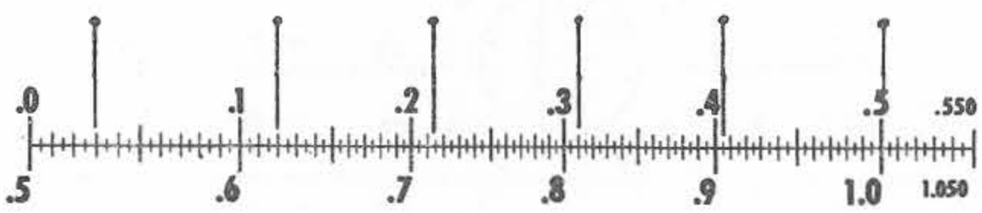
Turn the RF gain control to the right so that the calibrator is audible. The calibrator will provide signals at 100 kc. intervals. The alignment procedure consists of assuring that these signals coincide with the 100 kc. marks on the dial.

Follow standard alignment techniques. To increase the frequency coverage of the capacitor for a given dial pointer coverage, decrease the "fixed" capacity by adjusting TC2 and TC3. After making any change in capacitance, always return to the 1.000 Mc. mark at the top of the dial and correct the inductance so that the 100 kc. signal appears at the correct spot on the dial. See the chart below.

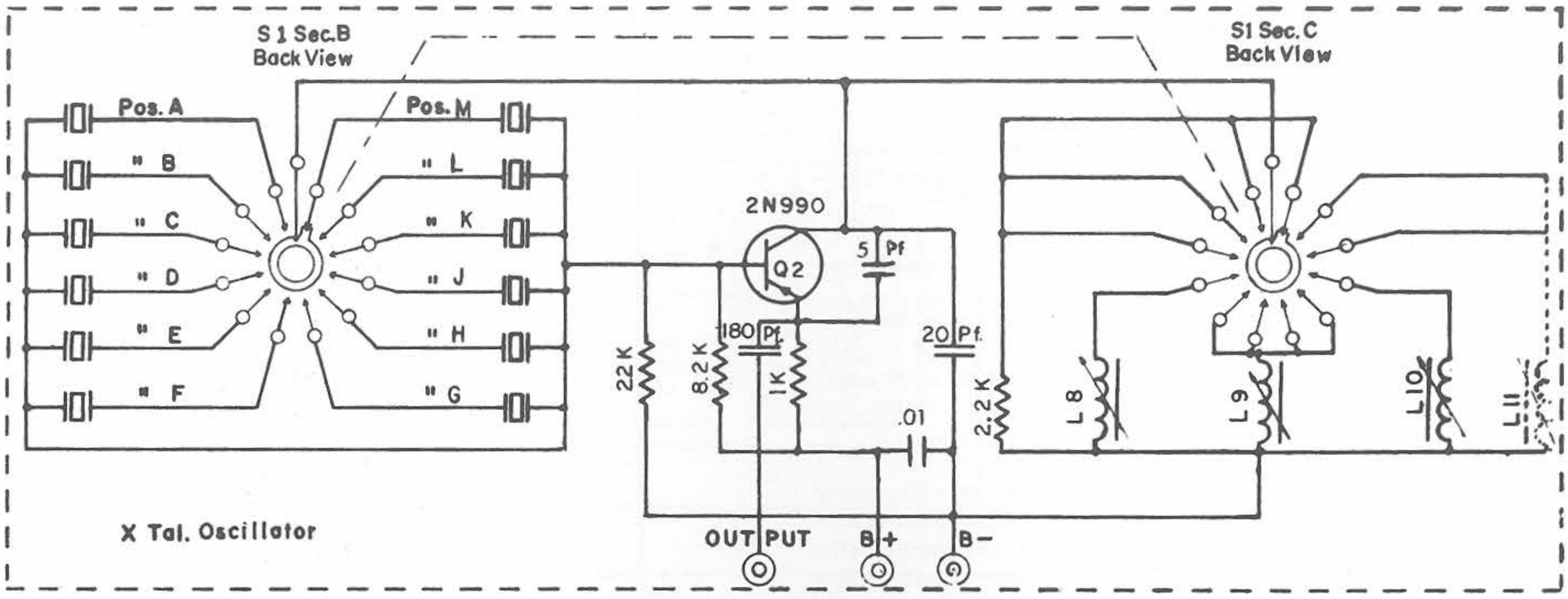




Decrease trim capacitors (Tc2, Tc3)
Increase Inductor (L 14)



Increase trim capacitors (Tc2, Tc3)
Decrease Inductor (L 14)



CRYSTAL OSCILLATOR MODULE

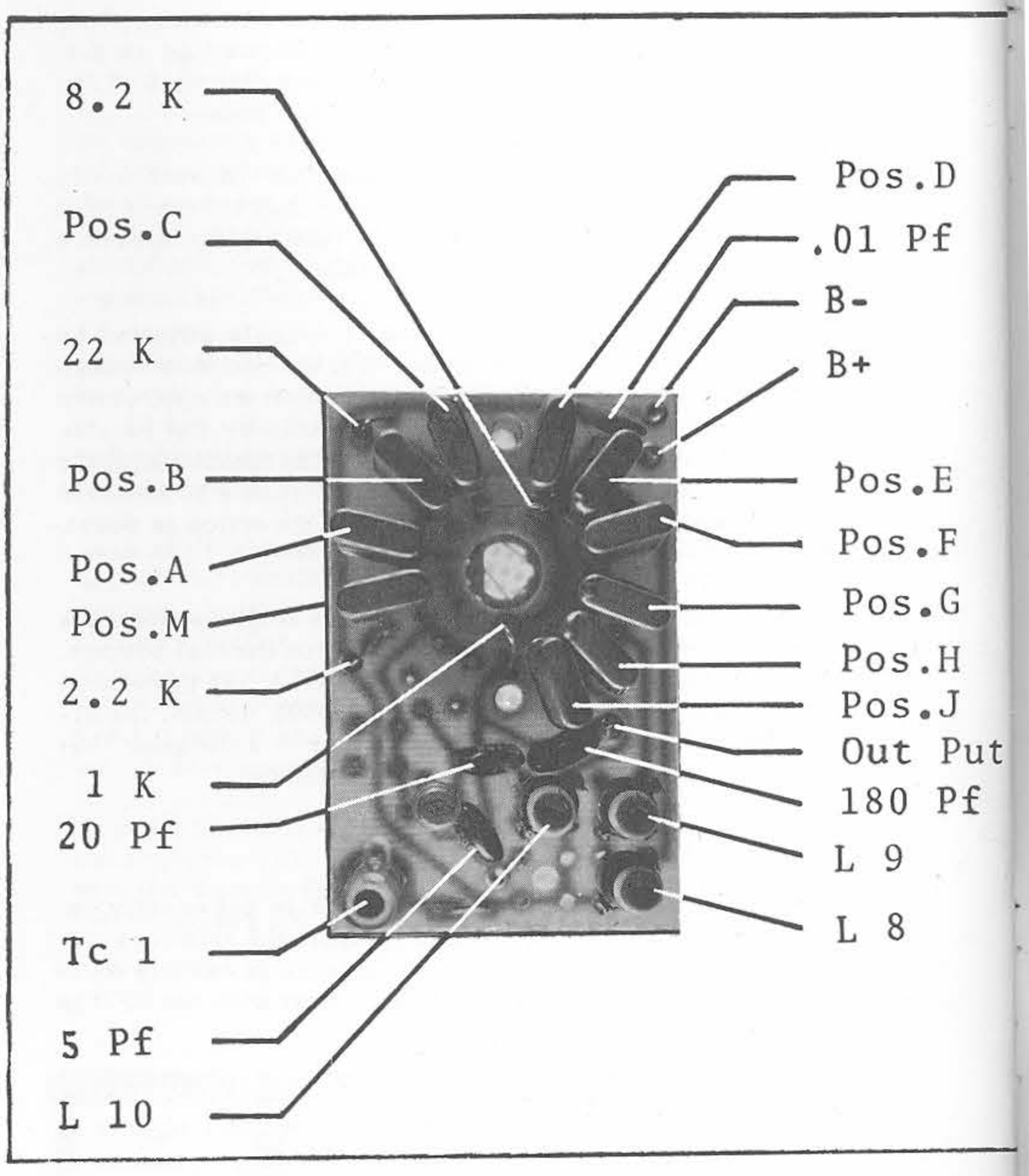
The crystal oscillator functions in either of two modes depending upon the type of crystal used and the circuitry switched in for that crystal.

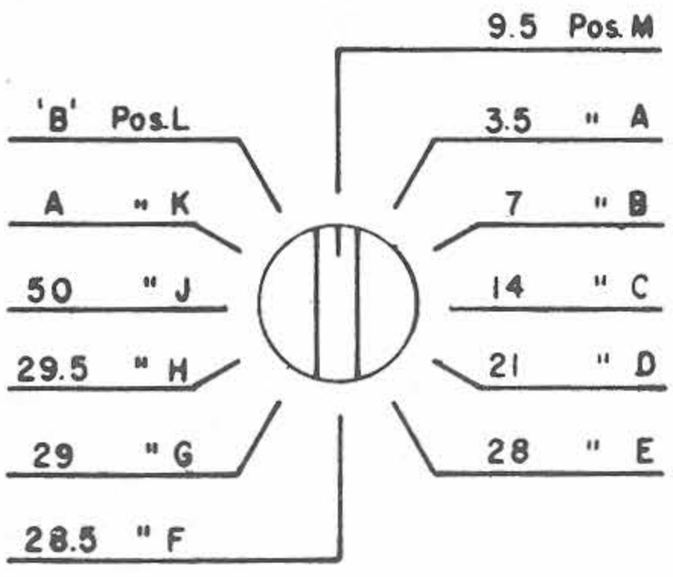
Crystals which function in the fundamental mode are employed at crystal frequencies below 18 Mc. For such crystals, the collector load of Q2 is a resistor. For overtone operation a tuned load, which places the oscillator into overtone function, is switched in.

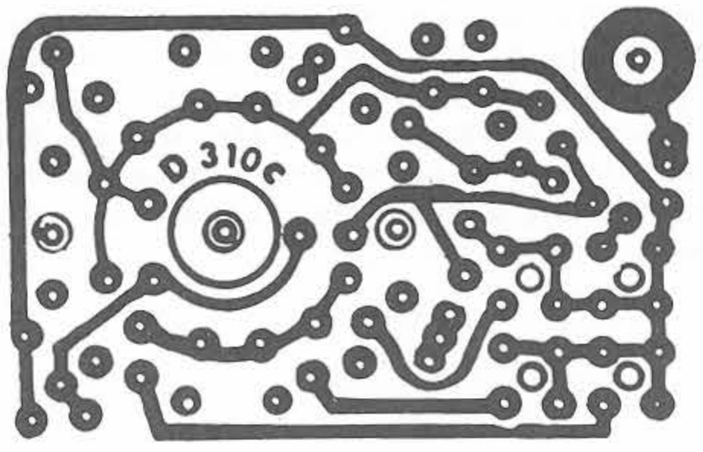
The crystal oscillator is provided with a regulated 6.8 volt dc supply originating at the zener diode circuit on the calibrator module. The regulated supply gives the oscillator extreme stability under varying input loads.

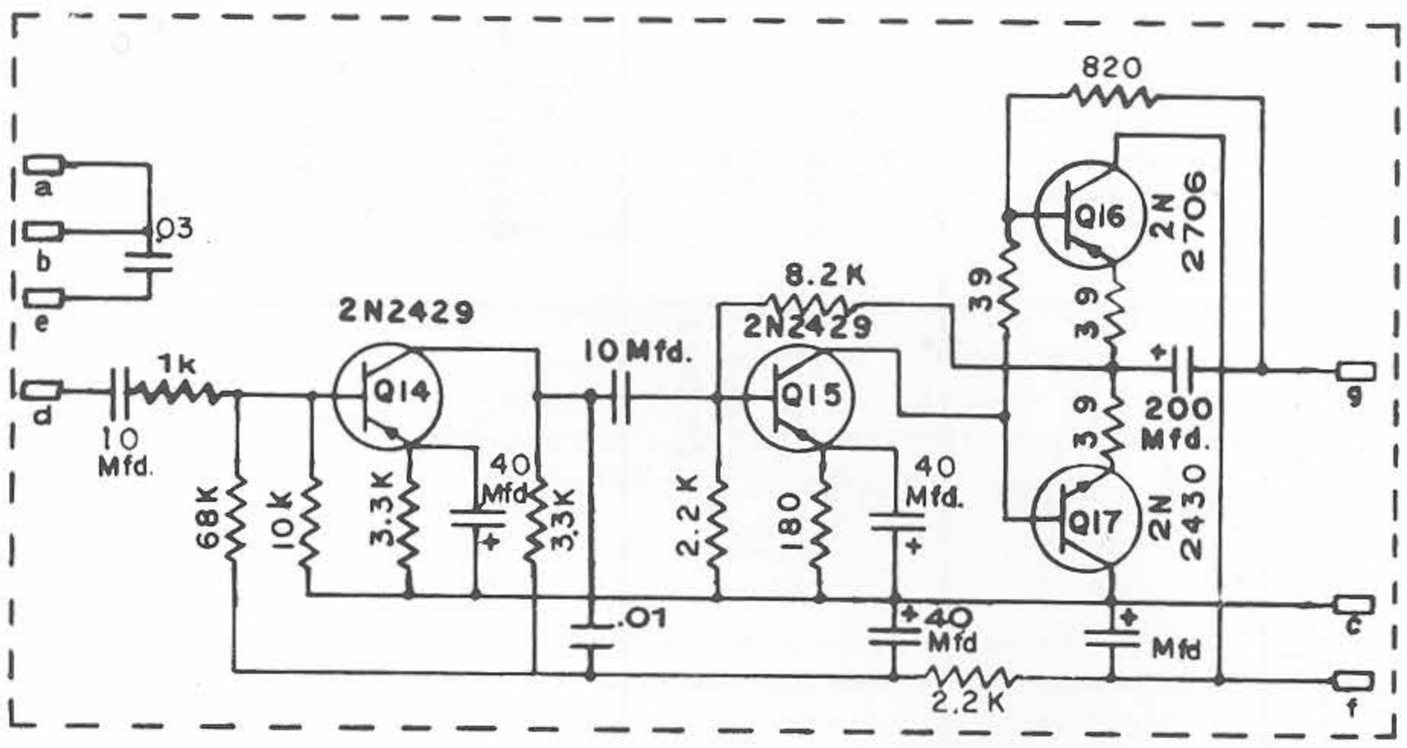
Service Notes:

If any problem arises, always check the voltage on the regulated line. The voltage should read between 5 and 7.5 volts on a VOM or VTVM. If the voltage is not in this range, check the calibrator module for malfunction of the zener regulator. Emergency repair suggestions are given in the calibrator module Service Notes.









The audio amplifier stages of the DR-30 are designed for good fidelity, low distortion, wide frequency response, and adequate power output for communications use under conditions of high ambient noise levels.

Q14 is employed as a preamplifier with an impedance appropriate for matching the two detectors. Q15 is the driver transistor, and Q16-Q17 are a matched complementary pair of output transistors. The output circuitry is transformerless and matches a wide range of speaker or earphone impedances. The current drain of the audio system is kept as low as possible when no signal is applied and rises as high as 120 ma. under conditions of maximum audio output.

The output of the audio stage is through a large capacitor which couples the transistors to the load. AC feedback is applied to the output stage and is derived from the load. DC feedback is derived from the output stage midpoint and is returned to the driver transistor base. The feedback helps assure minimum distortion and extended frequency response.

The .03 mfd capacitor connected to S6, when switched in, provides some degree of high-frequency attenuation in the preamp circuit. This "tone control" is most useful when the wide selectivity position is employed on AM reception and is quite effective in reducing background noise.

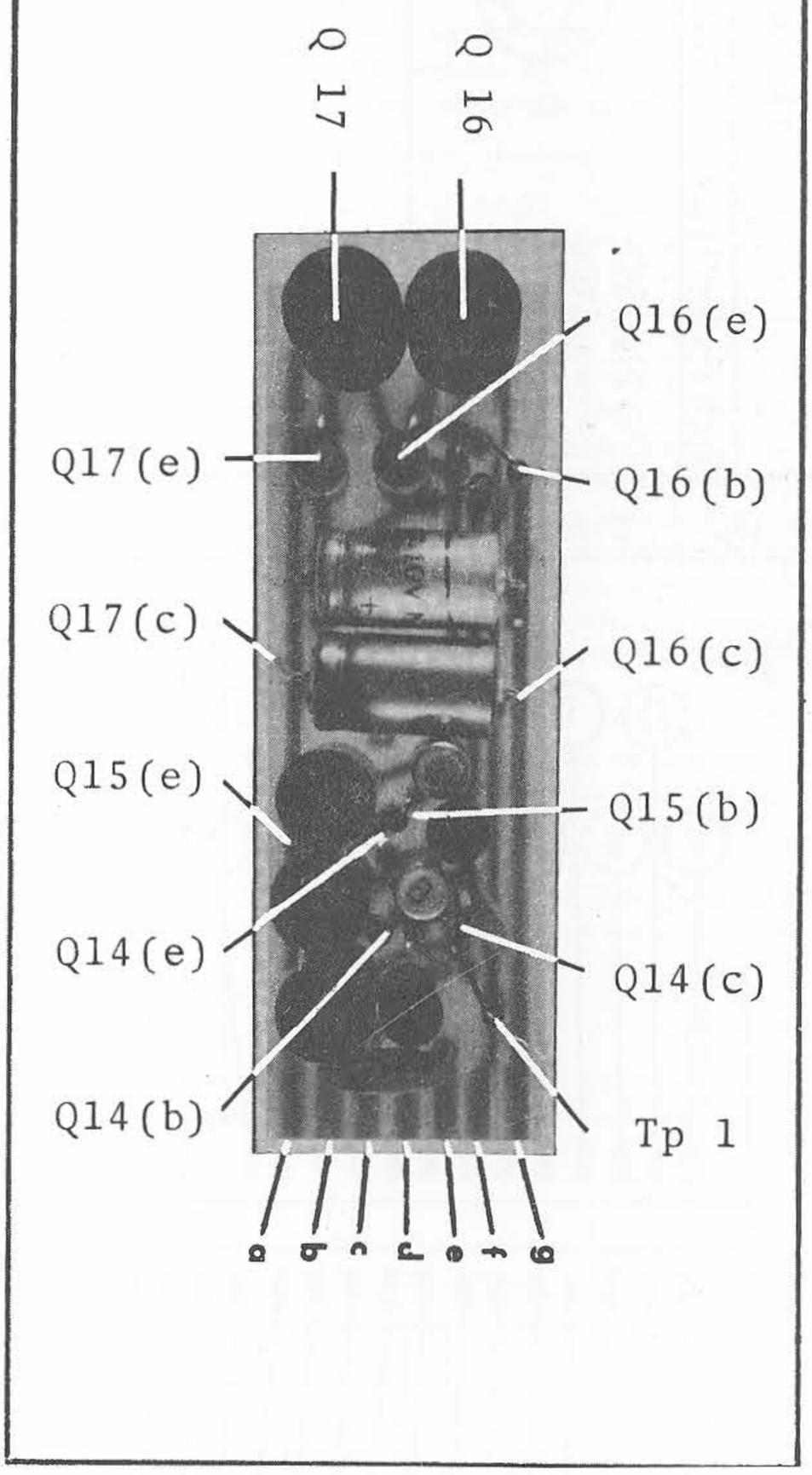
Low frequency performance of the audio stage is such that a good speaker system will reveal excellent response, allowing high-fidelity reception of shortwave broadcast stations.
Aside from the use of the tone control when desired, no attempt is made to limit frequency response of the audio to that essential for communications use. Instead, the IF passbands of the receiver are employed to limit the frequency when interference makes such limitation desirable. Thus, the wide selectivity position allows wideband audio response when conditions make its use practical.

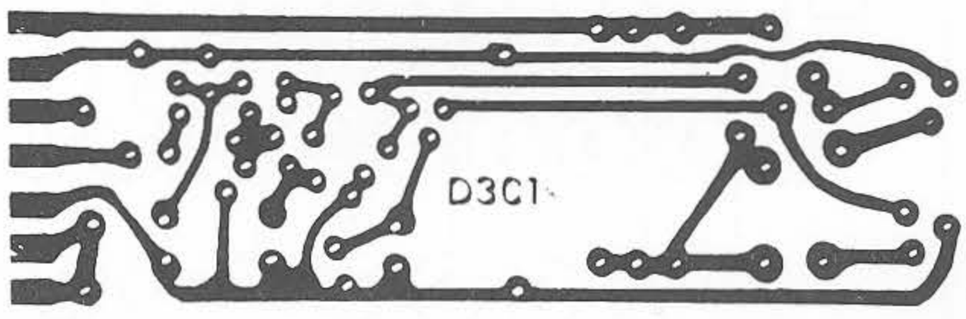
The output transistors are covered with black, turned aluminum heat sinks which successfully dissipate any heating that occurs in the transistors under high output conditions.

Note: in connecting the DR-30 to a high-fidelity music system, it is not necessary to bypass the audio output Stage. Set the audio gain control about 20% "on" and adjust the volume with the system's volume control. The receiver output can be fed to the tape input, high level phono input, or microphone input connections.

Service Notes:

This circuit is conservatively designed, and failures are extremely rare. Of course, no adjustments or recalibrations are necessary. The receiver can be operated under sustained high levels without any load presented to the terminals, but the output should not remain shorted for more than several minutes under high levels of operation. Momentary short circuits cause no damage.





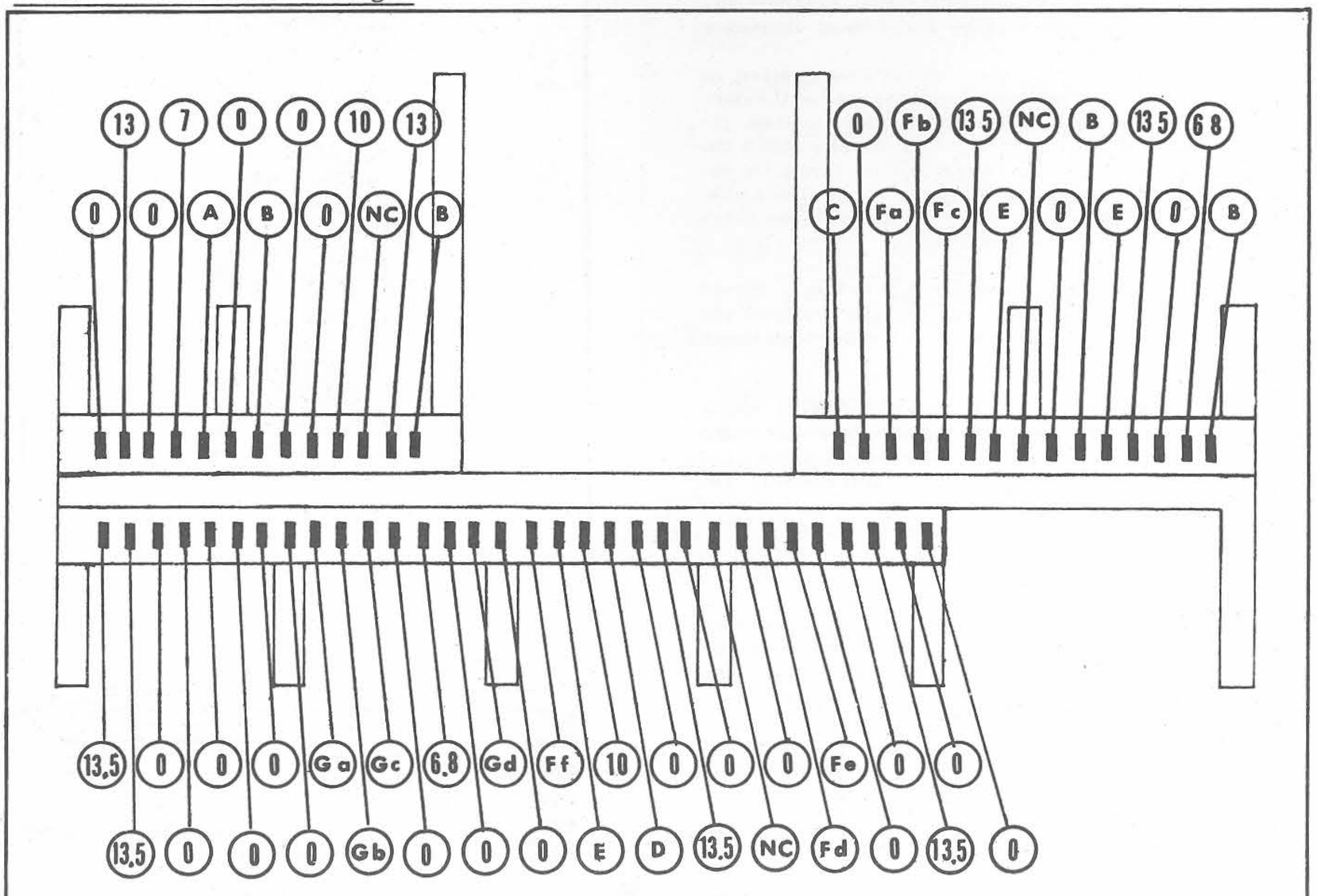
4-17. Transistor Base Diagrams

TRANSISTOR DIAGRAMS

Transistor Type	Symbol	Base Layout (bottom view)	Description
2N990 2N993			PNP Germanium
2N1638 2N2429 2N2706			PNP Germanium
2N2084			PNP Germanium
2N2430			NPN Germanium
K 1504			P-Channel (UHF) MOS Field-effect device
K 1004			N-Channel (UHF) MOS Field-effect device

e= emitter b= base C= collector SS= substrate

4-18. Connector Voltages



4-19. RF Alignment

Field Realignment of the DR-30

Field realignment of the RF stages of the DR-30 should never be necessary. However, the procedure employed at the factory is described below for those who use special versions of the DR-30 in professional applications.

The complete RF alignment procedure includes quantitative measurements of RF and complete-receiver performance. The DR-30 has so much reserve gain and sensitivity that perfunctory alignment techniques and instrumentation will produce an adequate receiver, but the extremely high performance capability of the unit can be achieved only when care and accurate instrumentation are used.

Equipment Required

A fine-quality signal generator, such as the Hewlett-Packard #616 or equivalent, covering at least 3.0 to 50.5 Mc.

50-ohm termination and pad for the signal generator

Output indicator, such as an audio VTVM

Principles of Operation of the RF Stage

The RF stage employs two high-Q tuned circuits, one between the antenna and the FET RF amplifier and one between the FET and the mixer. These two circuits must be aligned so that they resonate at the desired signal frequency when the bandswitch is in the correct position and the preselector capacitor is correctly tuned. Since the two coils are quite selective, they must be adjusted in the alignment procedure so that their resonant frequencies coincide exactly at all ranges of the preselector.

The toroidal inductors are of such inductance that, with a range of tuning capacitance of about 2 to 150 pf, their resonant frequency range is about 6.5 to 15 megacycles. Establishment of the correct inductance of each is a portion of the alignment procedure.

For frequencies below 6.5 Mc., the bandswitch connects fixed capacitors in paralled with the coils. For example, in the 80 meter band of the DR-30, 411 pf allows coverage of 3.5 to 4.1 Mc.

For frequencies above 15 Mc., the bandswitch connects small inductors in parallel with the toroids. Adjustment of these toroids is also part of the alignment procedure.

Alignment Procedures

Read the following instructions completely before attempting to align any portion of the RF stage. Because of the interrelationship of the components, it is imperative that the sequence of alignment be followed as described below. Any attempt to align one band requires the realignment of all bands following it in the procedure outline.

An experienced technician can complete the entire realignment operation in less than 15 minutes, but you must be cautioned not to attempt seat-of-the-pants alignment techniques.

The procedure below should also be followed any time a complete RF assembly is replaced on a plug-in subassembly basis. Only in the case of such replacement, incidentally, is it necessary to realign the basic toroids, i.e., to follow Procedures A and B.

Procedure A. Alignment of the RF Output Toroid

Set all receiver controls for normal AM reception.

(1) Disconnect the brown wire from lug A on the first bandswitch segment.

(2) Set the bandswitch to the 3.5 Mc. band position. Tune the receiver to the bottom of the 3.5 Mc. band. Feed a signal generator into the antenna jack.

(3) Adjust the signal generator amplitude so that there is a low S-meter reading of S5 to S7. This is the most sensitive portion of the S-meter range, and small changes of amplitude are readily noticed. You will use the S-meter as a signal-level detector throughout the alignment procedure.

Whenever the S-meter reading climbs above S7, reduce the signal generator amplitude to return it to the most sensitive range. For a very fine adjustment of alignment, use a detected audio signal as indicated on the audio VTVM but be very certain that the signal level is not strong enough to actuate the S-meter, and therefore the AGC circuitry of the receiver, at all. Remember that the AGC circuitry is very effective in masking changes of amplitude.

(4) With a dull insulated fiber or plastic tuning tool adjust the wires on the high impedance end of the output toroid until the signal-generator signal is peaked.

(5) Lock the turns of wire firmly with a generous application of Q-dope on the toroid and its wire.

The output toroid is now aligned.

[See Page 29 for Coil Location]

Procedure B. Alignment of the Input Toroid

(1) Reconnect the brown wire removed in Step 1 of Procedure A.

(2) Turn the bandswitch to 14 Mc. Tune in a signal from the signal generator at the middle of the 14 Mc. band, at about 14.2 Mc.

(3) Put your finger on the bandswitch connection which was unsoldered in Step 1 of Procedure A. (This reduces the effectiveness of the input toroid and allows you to find the peak of the output coil which was aligned in Procedure A.) Peak the preselector for maximum signal.

The output circuit is now resonant at the 14.2 Mc. signal frequency.

Leave the preselector tuned at the peak response. Don't change it! Remove your hand from the bandswitch connection.

(4) Adjust, as in Step 4 of Procedure A, the turns of the input toroid until a sharp peaking of the signal is heard.

You have now adjusted the input and output circuits to the same frequency, 14.2 Mc.

Note: At this point a person experienced in alignment will prefer to "rock" the preselector tuning in making the last fine adjustment of the input toroid. Alternately, the trimmer capacitor, TC1, may be adjusted while rocking the setting. DO NOT LOCK THE TOROID YET.

(5) Change the bandswitch to the 7 Mc. range and tune in the signal generator, which should be set to about 7.2 Mc.

Repeak the input toroid either by moving the turns or by adjusting the trimmer capacitor, The operation can be performed as above, by rocking the capacitor. This adjustment, like Step 4, is fairly critical, and the peak will be quite obvious.

You have adjusted the input and output toroid circuits to the same frequency, 7.2 Mc. You must now eliminate any "tracking" error between the two settings.

(6) If you decreased the inductance or increased the trimmer capacitance in performing Step 5, you must now do just the opposite to correct the overall tracking. Return to the 14 Mc. position and make a correction in the opposite direction with the trimmer capacitor.

Repeak the toroid.

Change again to 7 Mc. to be sure that the circuits are still peaked together. If not, again make the correction at 14 Mc. in the opposite direction from that needed for peaking 7 Mc. When the circuits are aligned, the preselector will peak sharply on both 7 and 14 Mc., and the gain and sensitivity will be virtually the same for both bands.

When the circuits are aligned, lock the input toroid with Q-dope.

The receiver is now fully aligned for the 3.5, 7, 10, and 14 Mc. bands.

Procedure C. Alignment of the 28 Mc. Range.

Turn the bandswitch to the 28 Mc. range and tune in a 28 Mc. signal on the signal generator. Set the preselector so that the pointer is towards the bottom (left) side of the 28 Mc. indication. With the tuning tool, adjust the inductor L2 on the RF board until the signal is peaked. Do not touch the preselector control.

Peak L17. Don't forget to reduce the signal generator as the procedure continues. When the peak is achieved, 28 Mc. is aligned.

Procedure D. Alignment of the 21 Mc. Range.

The 21 Mc. band uses the same input coil which was adjusted for 28 Mc. DO NOT ADJUST THIS COIL.

(1) Tune the receiver and generator in the 21 Mc. range.

(2) With your hand, ground lug A of the fifth section of the bandswitch. Peak the signal with the capacitor. You have now set the preselector for the 21 Mc. resonance of coil L2. Leave the preselector at that setting.

(3) Remove your hand from lug A. With the tuning tool peak the signal by tuning inductor L6. Again rock the preselector setting slightly as the final adjustment is made.

When the signal is peaked, the 21 Mc. band is aligned.

Procedure E. Alignment of the 50 Mc. Range.

Connect the signal generator to the 6-meter jack on the rear panel of the receiver.

Turn the bandswitch to the 50 Mc. position and, with the preselector tuned to the 50 Mc. indications, tune in a signal from the signal generator.

(1) Move the wires on the small toroid L3 until the signal is peaker. Lock the toroid wires with a generous application of Q-dope.

(2) With a screwdriver, peak the antenna trimmer capacitor TC6 while rocking the preselector control very slightly.

(3) Find the peak setting of the preselector and leave the control set there. Peak the inductor L4 with the tuning tool.

The 50 Mc. range is now aligned.

4-20. In Case of Difficulty

In almost every case of apparent malfunction of the receiver, external connections or operator techniques are found to be the source of the difficulty. Perform carefully each of the following procedures before removing the receiver from its case.

(1) Pull out on the standby switch/RF gain control. Check again to be sure that it is out. (Pushing it in turns the receiver to the standby position.

(2) Turn the RF gain control fully counterclockwise. Counterclockwise means to the left:

Note: the control operates in this fashion for a technical reason. However, it is opposite in action to many RF gain controls, and the low gain in the fully clockwise position can alarm the operator who has not read any portion of the manual before using the receiver.

(3) Check the antenna connection. It must be plugged into the correct jack before signals can be correctly heard. For all bands except 6 meters use the following:

For 6 meters only, use the antenna input jack marked "6 ant" as indicated:

(4) Check the power supply. If accidentally shorted, batteries can fail very quickly, and so-called "fresh" batteries often prove to be weak. They should always be measured under load, i.e., with the receiver and the panel lights turned on. If the voltage of the battery pack, as measured on a VOM or VTVM, is under 11.8 volts, the batteries are not adequate and should be replaced. See notes in section 2-5 on battery supplies.

(5) Check all Jones Plug connections. Note that jumpers must be installed in the plug or other muting provisions must be made.

(6) Under some circumstances, turning the ANL LEVEL control fully clockwise can cause distortion, apparant lack of gain, or other indications of receiver malfunction. Correctly used, the ANL is effective and easily operated, but you should return it to its fully counterclockwise (left) position when it is not in use.

The above steps will usually identify any operator mistakes. If a difficulty persists, perform the following operations to localize the problem.

Difficulties are rare in the DR-30 because conservative construction practices, top-quality components, and thorough quality-control measures are employed.

Each step in the following procedure is designed to provide information about the receiver functions and will also give data on associated circuitry such as antenna systems, power supplies, and other accessories. Proceed through the steps below until you fail to get the proper response. Do not attempt to bypass any steps in the operation.

Step 1

Turn on the set. Turn on the dial lights. They should be adequately bright, but not white-bright.

Put the AGC/hold switch in the right-hand "hold" position. Watch the S-meter while pushing in the RF gain control/standby switch and then while pulling it out. At the moment the switch is pulled out, the meter should rise rapidly to the right and then gradually fall back to the left-hand position. This test confirms the functioning of the AGC system and some of the internal voltages.

Step 2

Push the cal/lt switch to its left (cal) position. Set the bandswitch on the 10 Mc. position and tune the receiver to exactly 10 Mc. as indicated on the dial. Rotate the RF gain control to the right (clockwise) until it stops. Make sure that it is pulled out.

Set the other controls as follows:
- Selectivity at 5 kc. (right-hand position)
- ANL level at full left
- Notch tune at the 9 o'clock position
- Function switch at the LSB position
- Audio gain as required to hear the signal

Tune the preselector to the 10 Mc. position. You should hear the whistle of the calibrator signal, and the S-meter should read the calibrator signal nearly full scale.

When these responses occur, you can rotate the RF gain control fully counterclockwise (to the left), connect a proper antenna, and tune stations, as you have confirmed the operation of the receiver circuitry.

PACKING for SHIPMENT

If a DR-30 is to be repackaged for shipment, use the original shipping container and materials if possible. You may obtain a new shipping container by writing DAVCO and paying postage on the empty carton. If original packing is not used, observe the following instructions.

Wrap the receiver in a plastic bag or a cloth to prevent scratching the panels. Then wrap it in heavy brown paper. Pack the wrapped receiver in a strong shipping container which allows at least three inches on each side, the top, and the bottom of the receiver, and fill these spaces with shock-absorbing material. (Rolled newspaper, foam plastic, or strips of cardboard will suffice.) Be sure to fill the container adequately so that the receiver will not shift inside the container. Seal the container and mark it FRAGILE.

Do not return a receiver to the factory for service or modification without prior authorization from the Service Department. Attach a tag to the main tuning knob indicating the return address, serial number, and date of shipment to DAVCO. Enclose a note indicating the type of service required, and full return address, and shipping instructions. In all correspondence, refer to the instrument by model number and full serial number. Write for the authorized service station in your area.

4-21. Parts List

Description	Qty	DAVCO#	Sch. #
RF MODULE			
Circuit Board	1	D308C	
Diode: Germanium 1N60	2		D1, D2
Cap.: 51pf 100 v. dipped mica 5%	2		
Cap.: 120pf 100v dipped mica 5%	2		
Cap.: 360pf 100v dipped mica 5%	3		
Cap.: .01MFD 100v disc ceramic	2		
Resistor: 180 ohm 1/4 watt 10%	1		
Resistor: 330 ohm 1/4 watt 10%	1		
Resistor: 470 ohm 1/4 watt 10%	1		
Resistor: 39 ohm 1/4 watt 10%	1		
Resistor: 39K ohm 1/4 watt 10%	1		
Resistor: 2.2 meg. ohm 1/4 watt 10%	1		
Inductor: 91 microhenry, 50 ma. choke	1	D003CH1	
Inductor: Toroidal	1	D003TO2	L1
Inductor: Toroidal	1	D003TO3	L5
Terminal: Transistor socket	1	D003TS1	
Cap.: .03MFD 50v disc ceramic	1		
Terminal: solder; stake type	4	D003ST1	
Inductor: adjustable	1	D003CO1	L2
Inductor: adjustable	1	D003CO1	L3
Inductor: adjustable	1	D003CO1	L4
Inductor: adjustable	1	D003CO3	L6
Inductor: adjustable	1	D003CO1	L7
Inductor: adjustable	1	D003CO1	L17
Transistor: type ~~K1504~~ MPF 160 (FET)	1		Q1
FIRST IF MODULE			
Circuit Board	1	D307C	
Transistor: type 2N993	6		Q4a, Q5 Q6, Q7, Q8, Q4
Diode: Germanium 1N69	3		D3, D4, D5
Cap.: .01MFD 100v disc ceramic	13		
Cap.: .001MFD 100v disc ceramic	3		
Cap.: 680pf 100v dipped mica 5%	1		
Cap.: 10pf 100v dipped mica 5%	1		
Cap.: 10MFD(AMP) 16v electrolytic	1		
Filter: transfilter type TF-01A	2		TF1, TF2
Inductor: 91 microhenry, 50ma. choke	2	D003CH1	
Transformer: 455 kc IF	2	D003T11	
Inductor: adjustable	1	D003CO2	L12
Terminal: solder	6	D003ST1	
Resistor: 180 ohm 1/4 watt 10%	3		
Resistor: 330 ohm 1/4 watt 10%	1		
Resistor: 470 ohm 1/4 watt 10%	1		
Resistor: 1 K ohm 1/4 watt 10%	2		
Resistor: 1.2K ohm 1/4 watt 10%	2		
Resistor: 1.8K ohm 1/4 watt 10%	2		
Resistor: 3.3K ohm 1/4 watt 10%	2		
Resistor: 3.9K ohm 1/4 watt 10%	1		
Resistor: 4.7K ohm 1/4 watt 10%	3		
Resistor: 5.6K ohm 1/4 watt 10%	1		
Resistor: 12K ohm 1/4 watt 10%	7		
Resistor: 18K ohm 1/4 watt 10%	1		
Resistor: 27K ohm 1/4 watt 10%	1		
Resistor: 39K ohm 1/4 watt 10%	1		
Resistor: 4.7 meg. ohm 1/4 watt 10%	1		
Transistor: type K1004 (FET)	1		Q3
MECHANICAL FILTER MODULE			
Circuit Board	1	D304C	
Transistor: type 2N993	1		Q11
Diode: Germanium type 1N60	3		D7, D8 D17

Description	Qty	DAVCO#	Sch#
MECHANICAL FILTER continued			
Cap.:01MFD 100v. disc ceramic	6		
Cap.:180pf 100v. dipped mica 5%	1		
Cap.:120pf 100v. dipped mica 5%	1		
Resistor: 2.2K ohm 1/4 watt 10%	1		
Resistor: 3.9K ohm 1/4 watt 10%	1		
Resistor: 5.6K ohm 1/4 watt 10%	1		
Resistor: 6.8K ohm 1/4 watt 10%	2		
Resistor: 12K ohm 1/4 watt 10%	4		
Resistor: 27K ohm 1/4 watt 10%	1		
Crystal: 455.00 kc	1	D003XT2	
Filter: Collins type 455FA21	1		
Terminal: solder; stake type	3	D003ST1	
SECOND IF MODULE			
Circuit Board	1	D303B	
Transistor: type 2N993	4		Q12, Q20 Q21, Q13
Diode: Germanium 1N60	4		D9, D10, D11, D12
Cap.: .01MFD 100v disc ceramic	12		
Cap.: 1MFD 16v electrolytic	2		
Cap.: 10MFD 100v disc ceramic	3		
Cap.: .001MFD 100v disc ceramic	2		
Filter: transfilter type TF01A	1		TF-3
Transformer: IF	1	D003T11	TIF-3
Resistor: 12K ohm 1/4 watt 10%	1		
Resistor: 1.8K ohm 1/4 watt 10%	3		
Resistor: 5.6K ohm 1/4 watt 10%	1		
Resistor: 100 ohm 1/4 watt 10%	1		
Resistor: 470 ohm 1/4 watt 10%	4		
Resistor: 1K ohm 1/4 watt 10%	1		
Resistor: 2.7K ohm 1/4 watt 10%	1		
Resistor: 3.9K ohm 1/4 watt 10%	1		
Resistor: 4.7K ohm 1/4 watt 10%	3		
Resistor: 10K ohm 1/4 watt 10%	4		
Resistor: 2.2K ohm 1/4 watt 10%	1		
Resistor: 39K ohm 1/4 watt 10%	1		
Resistor: 68K ohm 1/4 watt 10%	1		
Terminal: solder; stake type	4	D003ST1	
CALIBRATOR MODULE			
Circuit Board	1	D305d	
Zener Diode 6.8v 10% 1/4 watt	1	ZD2	
Transistor: type 2N1638	3		Q22, Q23 Q24
Cap.: 120pf 100v dipped mica 5%	2		
Cap.: 180pf 100v dipped mica 5%	1		
Cap.: .01MFD 100v disc ceramic	3		
Resistor: 180 ohm 1/4 watt 10%	1		
Resistor: 470 ohm 1/4 watt 10%	1		
Resistor: 1.2K ohm 1/4 watt 10%	1		
Resistor: 2.7K ohm 1/4 watt 10%	1		
Resistor: 3.3K ohm 1/4 watt 10%	1		
Resistor: 4.7K ohm 1/4 watt 10%	2		
Resistor: 8.2K ohm 1/4 watt 10%	1		
Resistor: 10K ohm 1/4 watt 10%	1		
Resistor: 18K ohm 1/4 watt 10%	1		
Resistor: 22K ohm 1/4 watt 10%	2		
Resistor: 33K ohm 1/4 watt 10%	1		
Resistor: 68K ohm 1/4 watt 10%	1		
Resistor: 180K ohm 1/4 watt 10%	1		
Crystal: 100 kc	1	D003XT1	
Cap.: 320pf Cer. Var. Scdr. adj.	1	D003CV1	TC-5
BFO MODULE			
Circuit Board	1	D303	
Transistor: type 2N1638	1		Q18
Transistor: type 2N993	1		Q19
Cap.:180pf 100v dipped mica 10%	1		
Cap.: 10mfd 16v electrolytic	1		
Cap.:.01 mfd 100v disc. ceramic	4		
Resistor: 100 ohm 1/4 watt 10%	1		
Resistor: 470 ohm 1/4 watt 10%	1		
Resistor: 1.2K ohm 1/4 watt 10%	1		

Description	Qty	DAVCO #	Sch. #
BFO continued			
Resistor: 1.8K ohm 1/4 watt 10%	1		
Resistor: 3.3K ohm 1/4 watt 10%	1		
Resistor: 4.7K ohm 1/4 watt 10%	1		
Resistor: 33K ohm 1/4 watt 10%	2		
Resistor: 39K ohm 1/4 watt 10%	1		
Resistor: 330K ohm 1/4 watt 10%	1		
Crystal: 453.650 kc.	1	D003XT3	
Crystal: 456.350 kc.	1	D003XT4	
Resistor: 100 ohm, adjust. 10-turn	1	D003TP1	
Terminal: solder; Stake type	3	D003ST1	
Inductor: mutual	1	D003CH2	
Resistor: 10k ohm 1/4 watt 10%	1		
VFO MODULE			
Circuit Board	1	D306B	
Transistor: type 2N2084	1		Q9
Transistor: type 2N993	1		Q10
Zener Diode: 6.8v 10% 1/4 watt	1		2D-1
Cap.: 120pf 100v dipped mica 5%	2		
Cap.: 500pf 100v dipped mica 5%	1		
Cap.: .01MFD 100v disc ceramic	7		
Resistor: 330 ohm 1/4 watt 10%	1		
Resistor: 1k ohm 1/4 watt 10%	2		
Resistor: 1.8k ohm 1/4 watt 10%	2		
Resistor: 3.9k ohm 1/4 watt 10%	1		
Resistor: 5.6k ohm 1/4 watt 10%	3		
Resistor: 18k ohm 1/4 watt 10%	1		
Resistor: 27k ohm 1/4 watt 10%	1		
Inductor: toroidal	1	D003T01	L13
Inductor: adjustable	1	D003C01	L14
Terminal: soldering; stake type	7	D003ST1	
Cap.: 360pf 100v dipped mica 5%	1		
Resistor: 12k ohm 1/4 watt 10%	1		
Cap.: 180pf 100v dipped mica 5%	1		
Resistor: 180k ohm 1/4 watt 10%	1		
CRYSTAL OSCILLATOR MODULE			
Circuit Board	1	D310C	
Transistor: type 2N990	1		Q2
Cap.: .01MFD 100v. disc ceramic	1		
Cap.: 180pf 100v. dipped mica 5%	1		
Cap.: 20pf 100v. dipped mica 5%	1		
Cap.: 5pf 100v. dipped mica 5%	1		
Resistor: 22K ohm 1/4 watt 10%	1		
Resistor: 1K ohm i/4 watt 10%	1		
Resistor: 8.2K ohm 1/4 watt 10%	1		
Resistor: 2.2K ohm 1/4 watt 10%	1		
Terminal: soldering eyelet	5	D003ET1	
Inductor: adjustable	1	D003CO4	L8
Inductor: adjustable	1	D003CO5	L9
Inductor: adjustable	1	D003CO6	L10
Inductor: adjustable	1	D003CO7	L11
AUDIO MODULE			
Circuit Board	1	D301B	
Transistor: type 2N2429	2		Q14, Q15
Transistor: type 2N2707 mtc. pr.	1		Q16, Q17
Cap.: 125MFD 15 volts electrolytic	1		
Cap.: 200MFD 15 volts electrolytic	1		
Cap.: 40 MFD 15 volts electrolytic	3		
Cap.: 10 MFD 15 volts electrolytic	2		
Cap.: .03MFD 50 volt disc ceramic	1		
Resistor: 3.9 ohm 2 watt 5%	2		
Resistor: 39 ohm 1/4 watt 10%	1		
Resistor: 820 ohm 1/4 watt 10%	1		
Resistor: 180 ohm 1/4 watt 10%	1		
Resistor: 1K ohm 1/4 watt 10%	1		
Resistor: 2.2K ohm 1/4 watt 10%	2		
Resistor: 3.3K ohm 1/4 watt 10%	2		
Resistor: 8.2K ohm 1/4 watt 10%	1		
Resistor: 10K ohm 1/4 watt 10%	1		
Resistor: 68K ohm 1/4 watt 10%	1		
Heat Sink	2	D003HS1	
Cap.: .01MFD 100volts disc ceramic	1		

Description	Qty	DAVCO #	Sch. #
MISCELLANEOUS			
S-Meter 0-2MA	1	D003SM1	
Cap.: 250pf 15v Electrolytic	1		
Cap.: 3-18pf Ceramic Vara.	1	D003CV1	TC-6
Cap.: 20pf 100v. dipped mica 5%	1		
Inductor: Toroidal	1	D003TO4	L18
Cap.: 3-15pf Ceramic Vara.	1	D003CV1	TC-2
Cap.: Vara., 2-gang 0-140pf/ Sect.	1	D003CV3	C1
Lamps: Sylvania type 6ES	2		
Cap.: Variable, 0-100pf	1	D003CV4	C3
Cap.: 3-15pf Ceramic Vara.	1	D003CV1	TC-6
Switch: 3 position 3 pole slide	1	D003WH7	S7
Switch-Toggle: AGC Hold, spdt, Center-off	1		S5
Resistor: 2.7K ohm 1/4 watt 10%	1		
Cap.: 10pf 100v. dipped mica 5%	1		
Switch: Function 3p, 3p, Rotary	1	D003WH8	S2
Cap.: 10pf 100v. dipped mica 5%	1		
Switch-Toggle: Chassis Polarity spdt	1		S9
Resistor: Vara., 120Kohm 1/4 watt Z taper with push-pull switch	1	D003WH5	R1
Diode: silicon 500 MA 100PIV	1		D13
Cap.: 125pf 16v. Electrolytic	1		
Switch: 2-pole 3 position Slide (Cal-Lt)	1	D003WH6	S8
Switch: toggle spdt with center-off	1		S6
Resistor: Vara. 20K Z taper with spst switch (AF Gain)	1		R2
Resistor: Vara. 20K linear taper (ANL level)	1		R3
Cap.: 3-15pf Ceramic Vara.	1	D003CV1	TC-4
Inductor: Adjustable high-Q	1	D003CO4	L16
Cap.: .01MFD 100 v. disc ceramic	2		
Cap.: 1200pf 100v. dipped mica 5%	1		
Cap.: Vara. main tuning, 3 section 0-528pf/Section	1	D003CV3	C2
Connector, 8-contact female, Cinch-Jones	1		
Case	1	D003CA1	
Rubber Feet	5	D003RF1	
Knurled Knob	1	D003FB7	
Dial Lock	1	D003FB8	
Preselector Pointer	1	D003FB9	
Front Panel	1	D003PA3	
Window	1	D003FB6	
Small Back	1	D003PA4a	
Miter Gear	1	D003GE2	
Anti-backlash gear assembly	1	D003GE1	
Split Gear Spring	2		
Drive Unit Assembly	1	D003AL2	
Main tuning Knob	1	D003KN1	
Coax Clip	1	D003FB1	
Dial Pointer	1	D003FB2	
String Drum	1	D003FB3	
Small Knob	5	D003KN2	
Back Panel	1	D003PA4	
Connector: Phono Jack, panel	7	D003PA4	
Label	1	D003LA2	
Connector: teflon insulated feed-through	3		
Dial Plate	1	D003LA1	
Sub Panel	1	D003PA2	
Pulley Strip	1	D003PP5	
Vernier Drive Jackson Bros Type DAF	1	D003VD1	
Grommet, 1/4" od	2		

NOTES

- All pent ink changes to schematics were made at Davco.
- Fresh batts (9-"D" cells) gives S9+20 indication in stby.
- Front end sensitive to antenna load impedance on 80- was loaded down by Davco - may need to be further loaded to avoid oscillation.

This manual is augmented from time to time. Please keep the Service Department of DAVCO ELECTRONICS, Inc. informed of any change in your address so that you may receive the supplements.

In case of change of ownership, transfer of warranty will be made only if DAVCO is informed of the change within ten days by return of this card or by letter. Always refer to the receiver by full model number and serial number.

Former: Serial Number _____

Name _____

Address _____

_____

Zip Code _____

Change to:

Name _____

Address _____

_____

Comments:

Change of address ◯ ownership ◯

Former: Serial Number _____

Name _____

Address _____

_____

Zip Code _____

Change to:

Name _____

Address _____

_____

Comments:

Change of address ◯ ownership ◯

Former: Serial Number _____

Name _____

Address _____

_____

Zip Code _____

Change to:

Name _____

Address _____

_____

Comments:

Change of address ◯ ownership ◯

Please place in envelope
and mail to :

DAVCO ELECTRONICS, INC.
P. O. Box 2677
2024 South Monroe Street
Tallahassee, Florida 32304

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