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10th Edition, 15 November 1961



**Rockwell
International**

instruction book

**Collins 32S-1
Transmitter**

**Collins Telecommunications
Products Division
Electronic Systems Group
Rockwell International
Cedar Rapids, Iowa 52406**

Printed in the United States of America



publications engineering

SERVICE BULLETIN

COLLINS RADIO COMPANY

Cedar Rapids, Iowa 52406

EQUIPMENT SERIES: 32S

BULLETIN NO. 3

DATE 8-8-60

Page 1 of 4

(1st Revision 10-1-60)

EQUIPMENT TYPE: 32S-1, 32S-2

SUBJECT: ADD VOX RELAY TIME CONSTANT CONTROL.

NOTE: This revision supersedes and replaces 32S Service Bulletin 3 dated 8-8-60. Changes are indicated by black lines in margin

Modifying Transmitters 32S-1/2 according to this bulletin will allow the time constant of the vox control relay to be adjusted. Adjusting the time constant will enable the operator to obtain a more uniform operation of the relay by compensating for variations in microphone and voice characteristics. Increasing the time constant will increase the time between the last spoken word or keyed character and the release of the relay; decreasing it will have converse effects.

MODIFICATION PROCEDURE:

Refer to figure 1 for circuit changes.

1. Remove feet from cabinet.
2. Lift lid and remove the two unpainted screws from top rim of front panel.
3. Slide unit out of cabinet.
4. Remove and discard 10-megohm resistor R86 connected between V11, pin 9 and ground. Refer to figure 2.
5. Remove and discard 0.022-uf capacitor C119 connected between V10, pin 5 and vox relay K1. Replace with 0.047-uf capacitor (931-0295-00). Use sleeving (152-1613-00) on leads. Refer to figure 2.
6. Solder an 18-inch length of wire (439-7036-00) to V10, pin 7 and another 18-inch length to V10, pin 5. Lay wires along chassis and through cable grommet hole (in corner near front panel) to the top of the chassis.
7. With unit in upright position, remove VOX GAIN control knob and mounting hardware. Do not unsolder.
8. Mount new VOX TIME CONSTANT control (376-7206-00) in bracket (546-7972-002) using the knob and hardware included in kit.

(1st Revision 10-1-60)

9. Place VOX TIME CONSTANT control bracket over the shaft of the VOX GAIN control and insert VOX GAIN control in its original position. Tighten mounting hardware. Refer to figure 3.
10. Solder one of the 18-inch wires to center terminal of VOX TIME CONSTANT control.
11. Solder remaining 18-inch wire to the counterclockwise (viewed from shaft end) terminal of VOX TIME CONSTANT control as shown in figure 3.
12. Reassemble unit.

ADJUSTMENT PROCEDURE:

1. To set control, place VOX TIME CONSTANT control to midrange (approximately) and the VOX and ANTI-VOX controls fully counterclockwise.
2. Speak into the microphone and advance the VOX GAIN until satisfactory vox action is attained. Continuing to speak into the microphone, rotate the VOX TIME CONSTANT control in either direction to achieve the desired release delay.
3. As the control is rotated counterclockwise to shorten release time, there will be some reduction in vox sensitivity. It may be necessary to advance the VOX GAIN control.
4. Set the ANTI-VOX control as covered in 32S-1 or 32S-2 instruction books.

PARTS REQUIRED:

Modification Kit 546-7968-00 which consists of:

QTY	DESCRIPTION	COLLINS PART NUMBER
1	Mounting Bracket, Resistor	546-7972-002
1	Resistor, Variable - 10 meg	376 7206-00
1	Capacitor, 0.047 uf \pm 10% - Fixed paper dielectric	931-0295-00
1	Nut, Plain Hex - 3/8-32	313-0061-00
1	Washer, Lock - 3/8	373-0085-00
1	Knob	281-0069-00
3 (ft)	Wire, no. 22 electrical, white-green	439-7036-00
0.3 (ft)	Insulation Sleeving, electrical	152-1613-00

For modification parts, price quotations (minimum order charge is \$15.00), and availability contact Collins Radio Company, Service Parts Department, Cedar Rapids, Iowa 52406. All parts orders must specify the Collins modification kit number, or part numbers, quantity required, and reference this service bulletin.

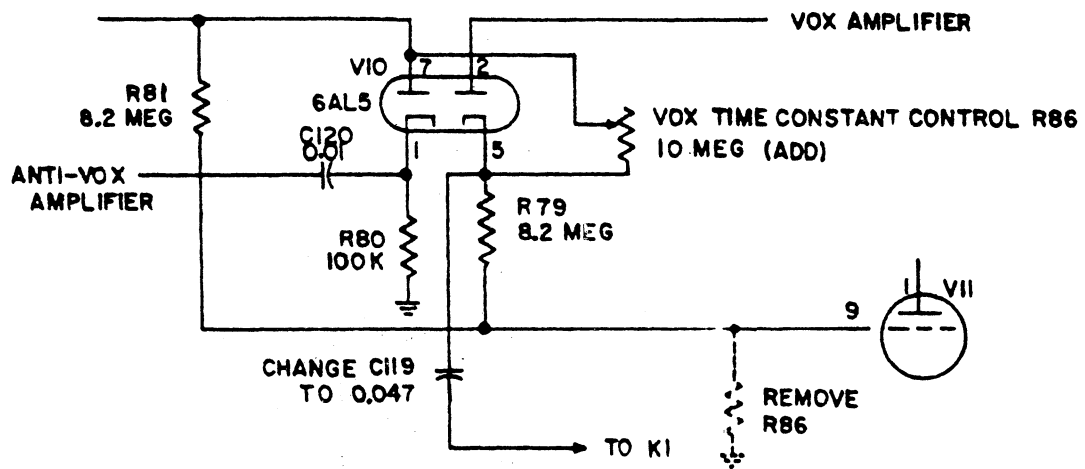


Figure 1. 32S-1/2 VOX Time Control Circuit Changes

(1st Revision 10-1-60)

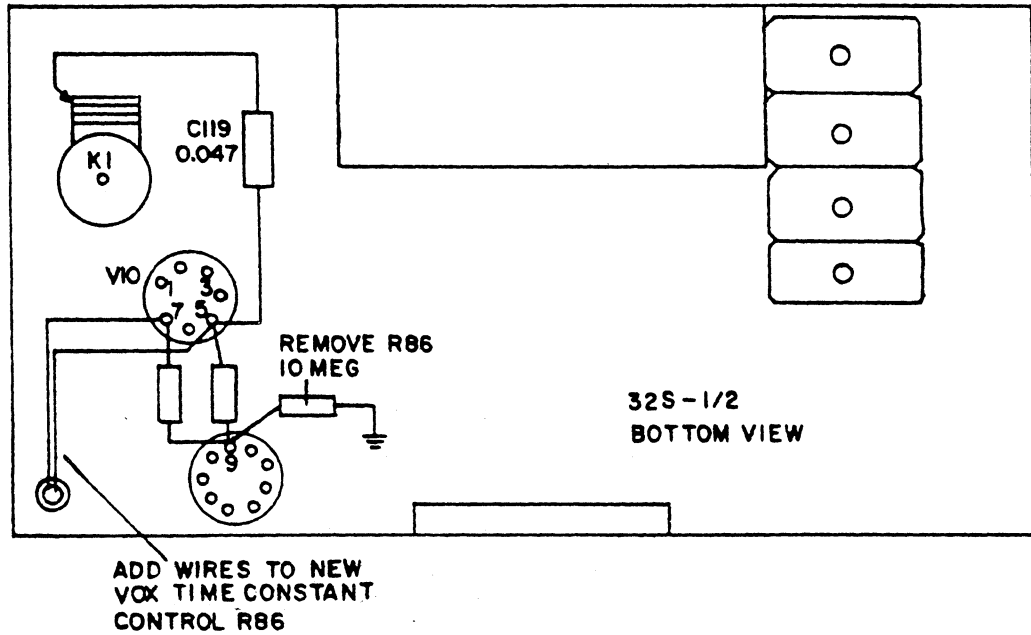


Figure 2. Parts Location - After Modification

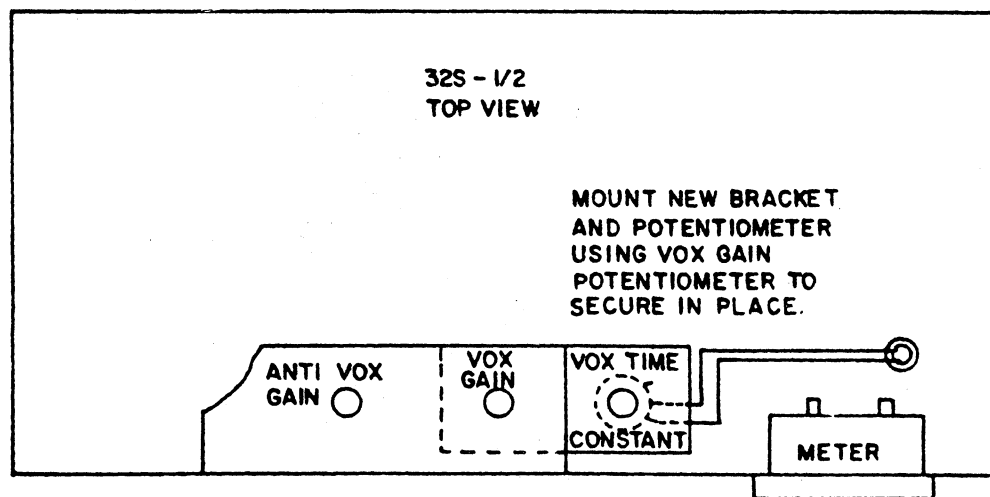


Figure 3. Mounting VOX Time Constant Control



SERVICE BULLETIN

EQUIPMENT SERIES: 32S

BULLETIN NO. 4A

DATE: 2-20-62

Page 1 of 4

EQUIPMENT TYPE: TRANSMITTERS 32S-1, 32S-2

SUBJECT: TO IMPROVE CW OPERATION

THIS SERVICE BULLETIN SUPERCEDES 32S SERVICE BULLETIN NO. 4, DATED 8-21-61. TO ENSURE FULL EFFECTIVENESS OF THE MODIFICATION IN THIS BULLETIN, UNITS WHICH DO NOT HAVE THE FOUR DIODES (CR1, CR2, CR3, AND CR4) IN THE BALANCED MODULATOR SHOULD HAVE THE MODIFICATION IN 32S SERVICE BULLETIN NO. 2 INSTALLED.

The modifications described in this service bulletin are to provide improved CW operation of the transmitters. They consist of eliminating the spurious r-f signal that may be transmitted along with the main signal, and eliminating a short carrier "burst" that may occur immediately upon closing of the vox relay.

MODIFICATION PROCEDURE:

Refer to figures 1, 2, and 3 for physical location of components and circuit changes made by this modification.

1. Remove Phillips-head screws and four feet from bottom of cabinet.
2. Lift lid and remove the two unpainted Phillips-head screws in the top rim. Slide unit out of cabinet.
3. Turn unit bottom side up with front panel toward operator.
4. Solder a short piece of bus wire across 470K-ohm resistor R70. R70 is located at the left edge of the chassis near relay K1 and soldered between terminal 4 of terminal strip TS25 and terminal 3 of adjacent terminal strip TS26A. (Refer to figure 3.)

NOTE: If the modification in bulletin no. 4 has been installed previously, omit step 4.

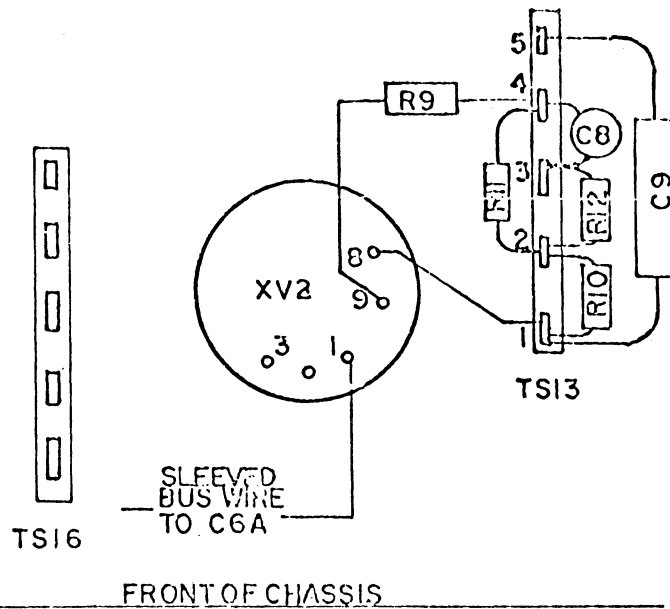
5. Change C115 from a 0.01- to a 0.05-uf capacitor (913-3679-00). This capacitor is located across the KEY jack on back of unit. (CW waveshape characteristics are affected by this capacitor, and the operator may change its value to suit his preference.)
6. Remove 0.01-uf capacitor C8 which is connected between terminals 3 and 4 of TS13.
7. Remove 180K-ohm resistor R11 which is connected between terminals 2 and 4 of TS13.

8. Remove 15K-ohm resistor R12 which is connected between terminals 2 and 3 of TS13.
9. Remove 220-ohm resistor R10 which is connected between terminals 1 and 2 of TS13.
10. Remove wire which is connected from pin 1 of tube V2 to (+) side of 8-uf dual-section fixed electrolytic capacitor C6A. This capacitor is located adjacent to the BFO TEST.
11. Install new 10K-ohm resistor R11 (745-3394-00) from pin 1 of tube V2 to terminal 2 of TS13.
12. Install new 4-uf capacitor C8 (183-1783-00) from pin 1 of tube V2 to terminal 3 of TS13 with plus (+) lead connected to pin 1. It might be advisable to check if any possibility exists in which the (+) lead might short out to another component, if so, sleeve lead with insulation removed from lead of old C8.
13. Connect no. 22 AWG red (439-7068-00) from terminal 2 of TS13 to feed-through capacitor, C137, on PA grid compartment.
14. Install new 1K-ohm resistor R10 (745-1352-00) between terminals 1 and 3 of TS13.
15. Disconnect lead of 220K-ohm resistor R9 which is connected to terminal 4 of terminal strip TS13 and reconnect to terminal 3 of TS13. (The other end of R9 is connected to pin 9 of V2.)
16. Replace unit and four feet to cabinet.
17. Readjust balance modulator as detailed in the 32S-1/2 Instruction Book, paragraph 4.4.10.

PARTS REQUIRED: Modification kit 549-5108-00 which consists of the following items:

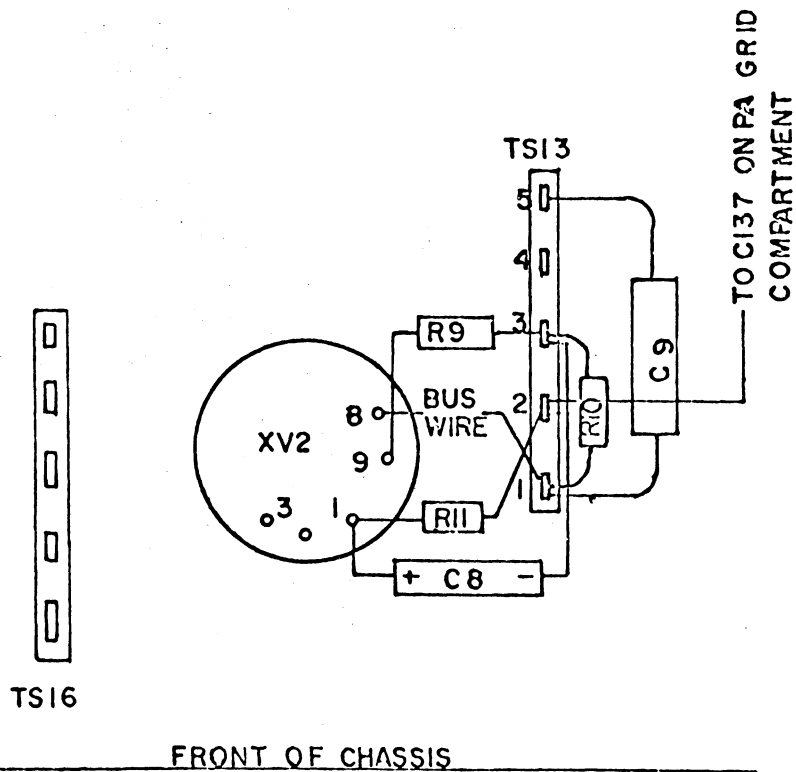
<u>Qty</u>	<u>Description</u>	<u>Collins Part Number</u>
1	Resistor, 1K-ohm, 1/2 watt	R10 745-1352-00
1	Capacitor, 4-uf, 350 volt	C8 183-1783-00
1	Resistor, 10K-ohm, 1 watt	R11 745-3394-00
1	Capacitor, 0.05-uf	C115 913-3679-00
0.8 (ft)	Wire, #22 AWG red Teflon insulated	439-7068-00

For modification parts, price quotations (minimum order charge is \$15.00), and availability contact Collins Radio Company, Service Parts Department, Cedar Rapids, Iowa 52406. All parts orders must specify the Collins modification kit number, or part numbers, quantity required, and reference this service bulletin.



BEFORE MODIFICATION

NOTE: Position of wires and components may vary slightly due to production changes.



AFTER MODIFICATION

Figure 1. Physical Location of Cathode Follower Components Affected By This Modification.

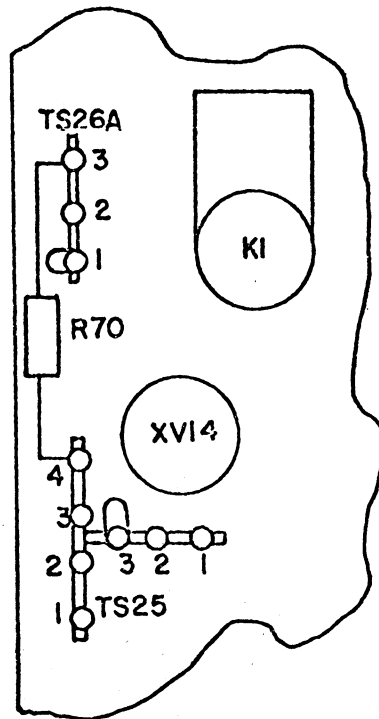


Figure 2. Physical Location of R70 on 32S-1/2 Chassis

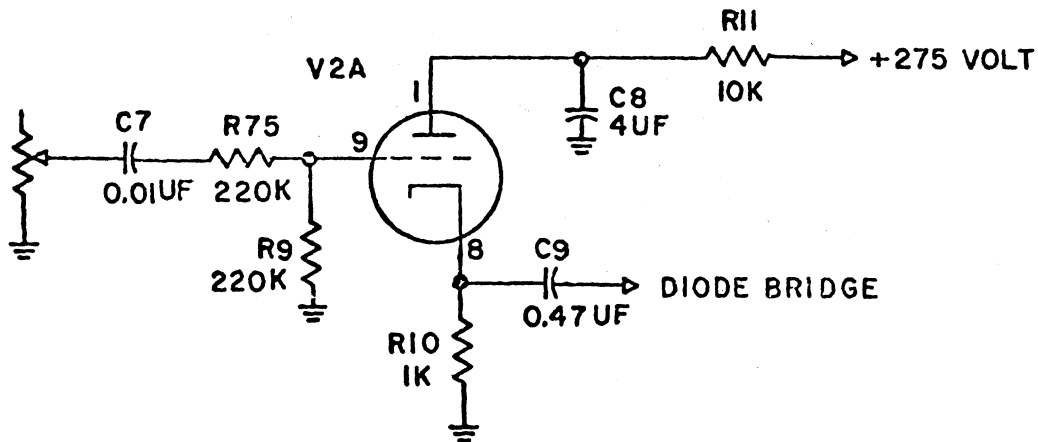


Figure 3. Cathode Follower Circuitry in 32S-1/2 After Modification

SERVICE INFORMATION LETTER

AMATEUR PRODUCTS S-LINE

32S-1 TRANSMITTER (522-1169-000)
KWM-2 TRANSCEIVER (522-1611-000)

SERVICE INFORMATION LETTER 1-75

OVERCOME INSTABILITY CAUSED BY AGING

On 27 July 1971, Amateur Product Line Information Letter No 28 was issued which contained the following information:

Some 32S-1 Transmitters and early KWM-2 Transceivers are beginning to exhibit various forms of instability that fails to respond to usual corrective efforts.

A common cause is capacitor C56 in the 32S-1 and C123 in the KWM-2. These are axial-lead ceramic feed-through capacitors which are mounted immediately to the right of the 6CL6 driver tube in the PA cage. As they age, they become frequency sensitive.

At one time the typical symptom of a defective capacitor was for the transmitter to operate properly on all bands except for 15 meters, where it would oscillate. More recent reports include almost any set of instability symptoms you might describe.

The conclusion is, that if an older unit comes in for servicing that shows instabilities, this capacitor should be changed before other repair efforts are made. For a number of years a mica feed-through capacitor (912-5232-000) has been used in the 32S-3 and KWM-2 with complete success. The hole will have to be enlarged to accommodate the new capacitor.

Another problem that is difficult to determine involves instability and eventually oscillation appearing first on the 80 meter band, and then including 40, etc. This is caused by the fact that over a period of time aluminum will become covered with oxide. In spite of finger-stock between the shield cans over the rf coils and bandswitch wafers, the cans eventually become floating which allows feedback to occur.

Correction is simple. Merely loosen the hex nuts that lie under the slug rack, shift the position of the shield cans, and retighten the nuts. This regrounds the shields and usually the instability disappears.

SERVICE INFORMATION LETTER

AMATEUR PRODUCTS S-LINE

KWM-2/2A TRANSCEIVERS (522-1611-000/522-1792-000)
 32S-1/2/3/3A TRANSMITTERS (522-1169-000/522-1488-000/
 522-2955-000/522-2958-000)
 75S-1/2/3/3A/3B/3C RECEIVERS (522-1168-000/522-1489-000/
 522-2562-000/522-2664-000/522-3316-000/
 522-3317-000)

SERVICE INFORMATION LETTER 2-75

EXTENDED OPERATING RANGE

The region between 5.0 and 6.5 MHz has always been defined as unsuitable for operation with the S-Line and KWM-2A equipments due to spurious signals inherent in the equipment. Many requirements for operation in that frequency segment have caused a complete study and resulted in the following list of acceptable operations in that range.

<u>DIAL ZERO</u>	<u>ACCEPTABLE OPERATION</u>	<u>HF CRYSTAL MHz</u>	<u>COLLINS CRYSTAL PART NUMBER</u>
5.0 MHz	5.0 - 5.2 MHz	8.155	290-9017-000
5.1 MHz	5.1 - 5.3 MHz	8.255	290-9227-000
5.2 MHz	5.2 - 5.4 MHz	8.355	290-9018-000
5.3 MHz	5.3 - 5.5 MHz	8.455	None
5.4 MHz	5.4 - 5.6 MHz	8.555	290-9019-000
5.5 MHz	5.5 - 5.7 MHz	8.655	None
5.6 MHz	5.6 - 5.770 MHz	8.755	290-9020-000
5.7 MHz	5.7 - 5.830 MHz	8.855	None
5.8 MHz	5.8 - 5.9 MHz	8.955	290-9021-000
5.9 MHz	5.9 - 5.970 MHz	9.055	None
6.0 MHz	6.0 - 6.035 MHz	9.155	290-9022-000
6.0 MHz	6.165 - 6.2 MHz	9.155	290-9022-000
6.1 MHz	6.230 - 6.3 MHz	9.255	None
6.2 MHz	6.3 - 6.4 MHz	9.355	290-9023-000
6.3 MHz	6.370 - 6.5 MHz	9.455	None
6.4 MHz	6.430 - 6.6 MHz	9.555	290-9024-000

Frequency bands of non operation are:

5.970 to 6.0 MHz
 6.035 to 6.165 MHz
 6.2 to 6.230 MHz

SERVICE INFORMATION LETTER 2-75

The lowest operating frequency can be extended below 3.4 MHz to at least 3.32 MHz and usually as low as 3.3 MHz.

<u>DIAL ZERO</u>	<u>OPERATING RANGE</u>	<u>HF CRYSTAL MHZ</u>	<u>CRYSTAL PART NUMBER</u>
3.3 MHz	3.3 - 3.5 MHz	6.455	290-9229-000
3.2 MHz	3.3 - 3.4 MHz	6.355	290-9178-000

To order crystals directly from crystal manufacturers: Specify: The hf crystal MHz frequency, and crystal type CR-18/U per MIL-C-3098B except temperature range 0° to +60° inclusive.

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SECTION I INSTALLATION

1.1 UNPACKING.

Carefully lift the transmitter out of the packing material. Examine for visible damage. If transmitter has been damaged in shipment, save box and packing material and notify the transportation company. Fill out and mail the guarantee card. Check that all tubes and crystals are properly seated in sockets. Check tuning controls and switches for freedom of action. Remove shipping blocks from 516F-2 Power Supply and plug in tubes.

1.2 MOUNTING AND CABLING.

Connect transmitter to receiver, power supply, and antenna as shown in figures 1-1, 1-2, or 1-3. The RG-58C/U cables may be identified by their slightly

larger diameter and 2-inch shorter length. Use the r-f cables where shown. The smaller microphone cables are satisfactory for a-f or control functions. Connect microphone or key as shown in figure 1-1. The 32S-1 is connected for use with a high-impedance phone patch such as the one in the 312B-4 Station Control. If phone patch operation using low-impedance phone patch, such as Collins 189A-2, is desired, modify 32S-1 as follows: Disconnect the shielded wire (white with brown tracer) from the MIC jack, and connect the center conductor to pin 8 of V1. Connect its shield to the center terminal on the terminal strip mounted near V1, pin 9. Check for continuity between PHONE PATCH jack J3 and pin 8 of V1. When using 516F-1 Power Supply with 32S-1, remove R114 from pa screens to ground and connect a shorting wire across R113 in series with screen lead.

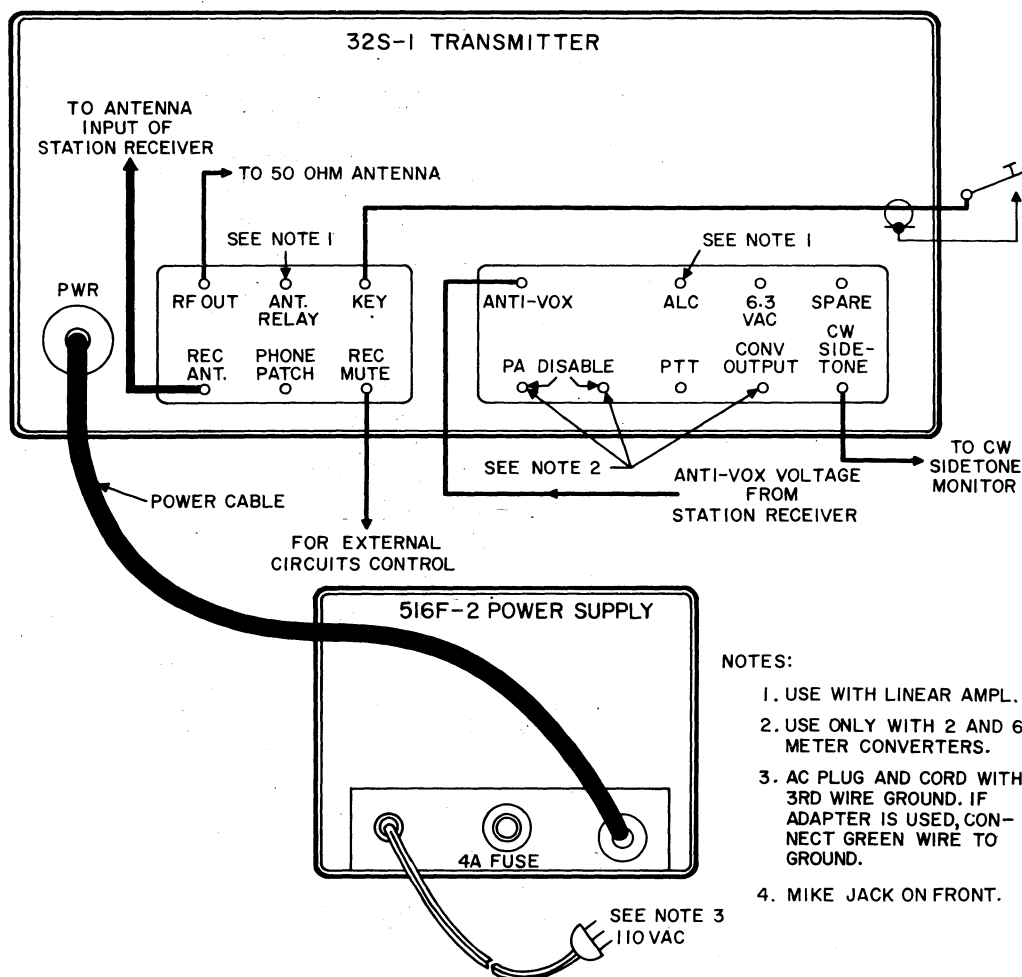
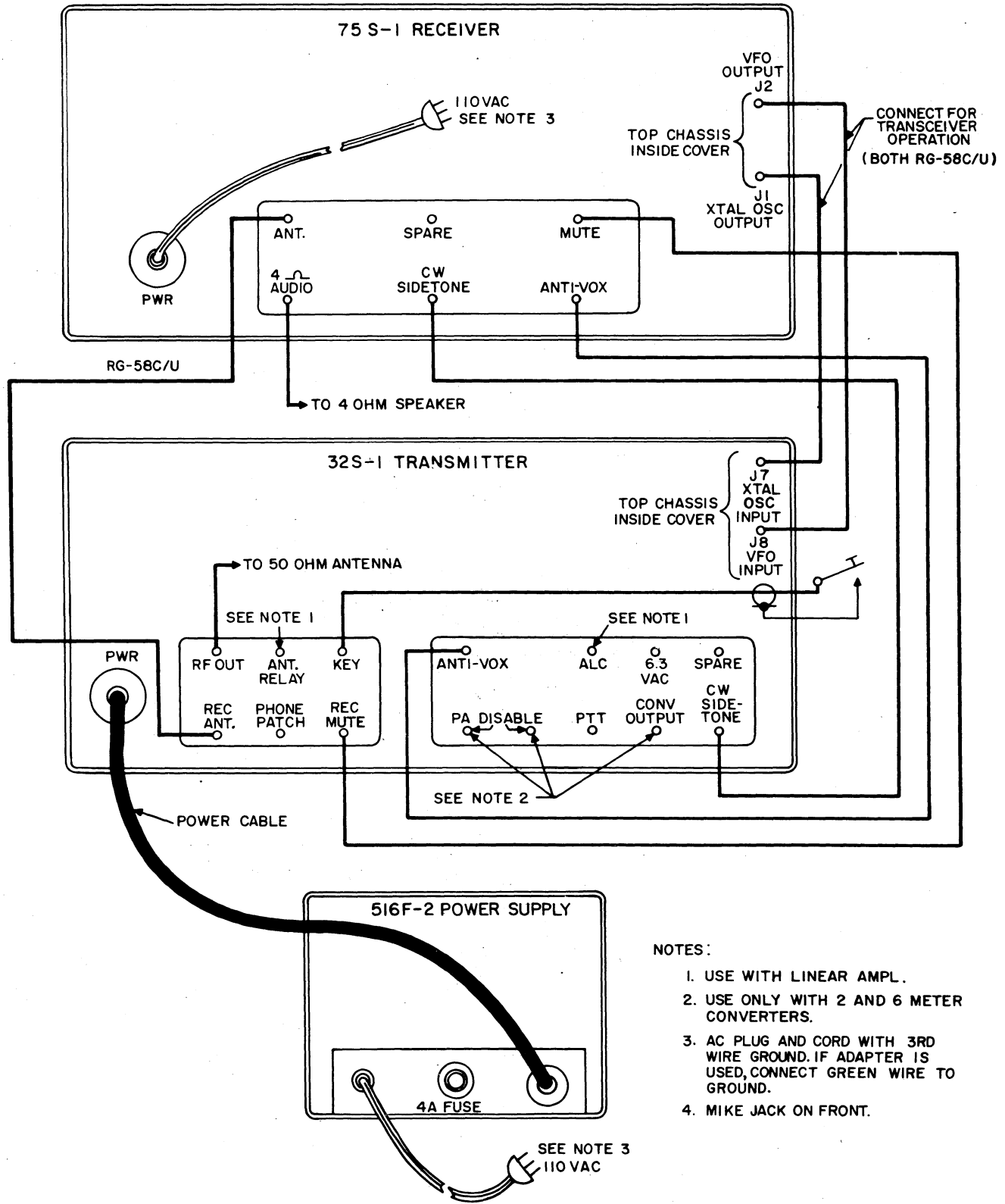


Figure 1-1. External Connections

SECTION I
Installation



- NOTES:
1. USE WITH LINEAR AMPL.
 2. USE ONLY WITH 2 AND 6 METER CONVERTERS.
 3. AC PLUG AND CORD WITH 3RD WIRE GROUND. IF ADAPTER IS USED, CONNECT GREEN WIRE TO GROUND.
 4. MIKE JACK ON FRONT.

Figure 1-2. Receiver-Transmitter Interconnections

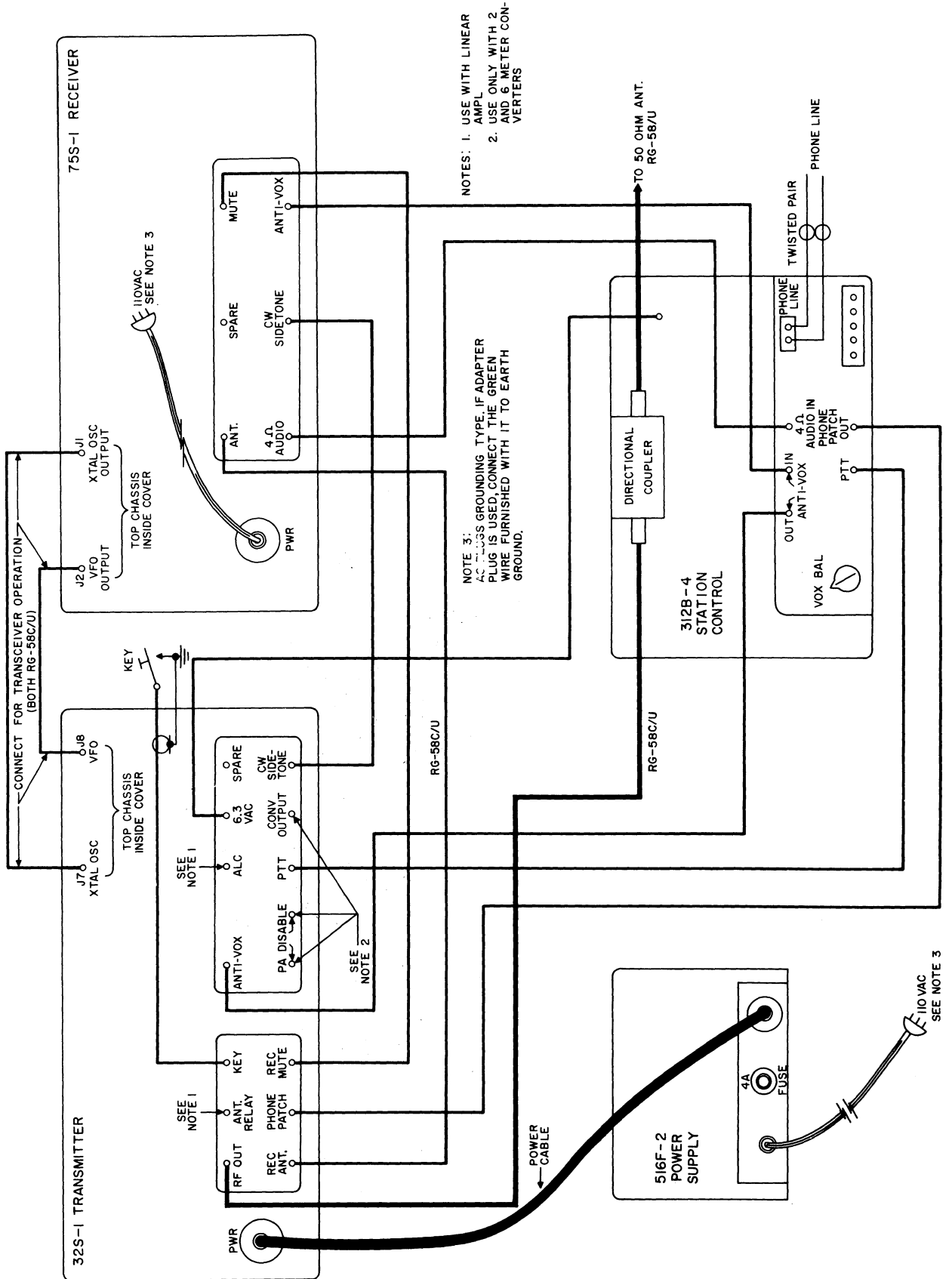


Figure 1-3. Station Interconnections

SECTION II
Operation

1.3 INITIAL CHECKS.

Set MIC GAIN control full counterclockwise, FREQ CONTROL switch to TRANS VFO, EMISSION switch to USB or LSB. Open top of transmitter, and set VOX GAIN control full counterclockwise until switch S10 closes. Set METER switch to P. A. PLATE position, and read the no-signal PA plate current. It should be approximately 40 ma. If plate current is other than 40 ma, adjust the BIAS ADJUST potentiometer on power supply chassis to set plate current at

40 ma. When finished, open S10 by turning VOX GAIN clockwise until switch clicks.



Do not set no-signal PA plate current too low; amplifier linearity will be degraded. Do not set too high; PA plate dissipation will be exceeded and tubes damaged.

SECTION II OPERATION

2.1 CW TUNING.

- Set controls as shown in figure 2-1.
- Set EXCITER TUNING (2) and P.A. TUNING (4) to desired band.
- Set tuning dial (3) to desired frequency within band. For example, if BAND switch (7) is set to 14.0, and the desired frequency is 14.195 mc. set dial to 195. To read frequency, add the dial setting to the BAND switch setting. As an example, if the BAND switch is set to 3.8 and the dial is set to 5, the frequency is 3.805 mc. If the BAND switch is set to 3.8 and the dial is set to 170, the frequency is 3.970 mc.

NOTE

Since CW is generated by a tone, the actual transmit frequency is 1.35 kc higher than the dial reading.

- Set MIC GAIN (6) to 1/4 full scale (9:00 o'clock) and adjust EXCITER TUNING until some grid current is indicated on the meter. Using the left hand on the MIC GAIN control and the right hand on the EXCITER TUNING control, reduce microphone gain and adjust exciter tuning until the grid current peaks sharply.

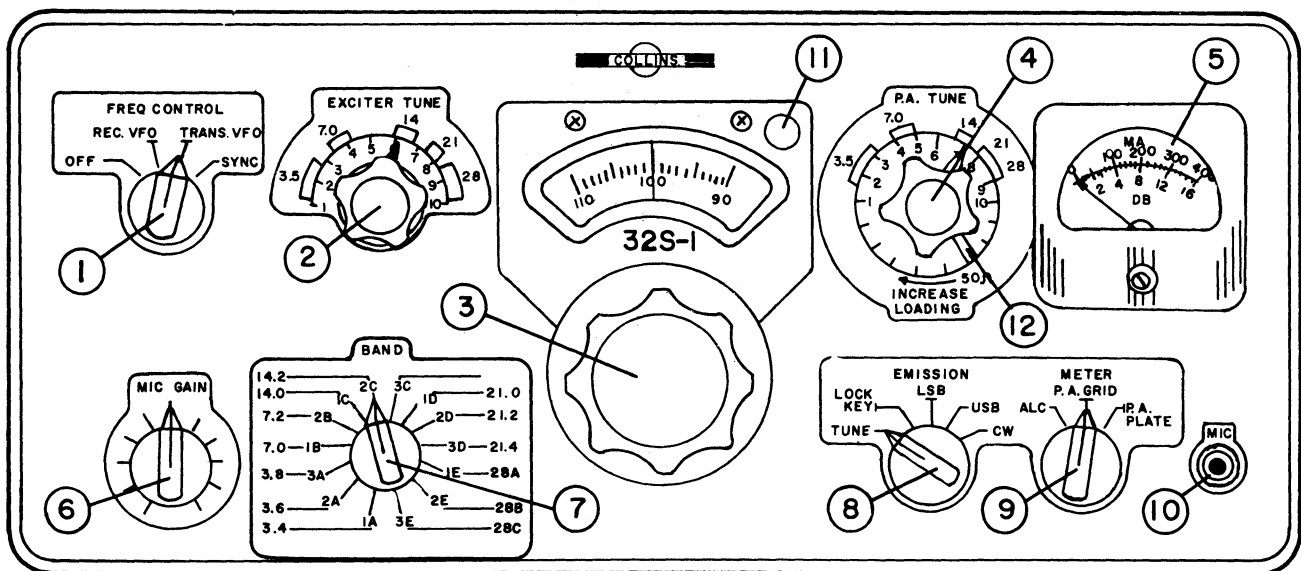


Figure 2-1. Panel Controls

e. Set METER switch (9) to P.A. PLATE position, and dip plate current with P.A. TUNING control (4).

f. Set EMISSION switch (8) to LOCK KEY position, and advance MIC GAIN control to approximately 3/4 full scale (about 3:00 o'clock). Plate current should be 230 ma at dip if antenna is 50 ohms and feed line is flat. If the feed line does not present 50 ohms (resistive) to the transmitter, adjust the INCREASE LOADING control (12), redipping plate current with the P.A. TUNING control (4) after each loading adjustment, until the power amplifier loads to 230 ma at the plate current dip.

g. Set EMISSION switch (8) to CW and the transmitter is ready for CW operation. While sending a series of dots, adjust MIC GAIN control (6) to obtain an alc indication of about 3 db on the meter (5). (Be sure METER switch (9) is in ALC position.)

h. If break-in CW is desired, open the top cover and turn the VOX GAIN control clockwise until the vox relay operates with the key. The keying is performed by operation of the vox circuits and the vox relay. If it is desired to change the release time constant, adjust the VOX TIME CONSTANT potentiometer, R86. Clockwise rotation of this control increases the release time. This control is located on a bracket under the top cover, near the meter. For rapid, nonbreak-in CW, connect an external switch or foot-switch to PTT jack J4.

i. If the transmitter is connected with a 75S-1 Receiver, as shown in figure 1-2, and it is desired to zero beat the transmitter to a frequency tuned on the receiver, proceed as follows:

Set receiver OFF-STBY-OPR-CAL switch to STBY. Set transmitter FREQ CONTROL switch (1) to SYNC position. Set both transmitter and receiver to same sideband. Slowly tune the transmitter vfo until the beat note sounds like a canary chirping. When the frequency of chirps is two or three per second, the transmitter is zero beat with the receiver within two or three cycles per second. This is a fine tuning adjustment and must be done slowly and carefully. If the microphone in use is very sensitive and omnidirectional, turn the receiver A.F. GAIN control down to eliminate the extraneous beat notes which may appear near the zero frequency. The desired chirp will be higher pitched. When the transmitter is tuned to the exact frequency of the receiver and the two frequencies are at zero phase difference there will be no output. Set the zero set knob on the 32S-1 to agree with the receiver. Switch the transmitter FREQ CONTROL (1) to TRANS VFO, and the receiver and transmitter are ready for operation on the same frequency.

j. If the 32S-1 is to be operated in key-down continuous exciter service, limit plate loading to 200 ma.

2.2 SSB TUNING PROCEDURE.

a. Set up as in paragraph 2.1, steps a through i. Plug in microphone.

b. Set EMISSION switch (8) to desired sideband (USB or LSB).

c. Set METER switch (9) to ALC.

d. While talking into microphone, advance the MIC GAIN (6) until the meter indicates about 6 db average (lower scale). Peaks may be much higher. If vox circuits transfer between words, increase the release time constant by turning the VOX TIME CONSTANT control (under top cover) clockwise. If less release time is desired, turn the control counterclockwise.

e. For push-to-talk operation, make sure the VOX GAIN control (under top cover) is turned clockwise until the switch just clicks open.

f. For vox operation, talk steadily into the microphone, and advance the VOX GAIN control until the vox relay operates with speech input to microphone.

g. To adjust anti vox, adjust receiver a-f gain for normal speaker operation with receiver tuned on signal.

h. If loudspeaker output causes transmitter vox circuits to operate, advance the ANTI-VOX GAIN control in clockwise direction, and set to a level just above point at which receiver loudspeaker output no longer keys transmitter circuits into operation.

i. It may be necessary to increase vox gain slightly after anti-vox is set.

j. The transmitter is ready for SSB operation.

k. If the transmitter is connected with a 75S-1 Receiver, as shown in figure 2-1, and it is desired to zero beat the transmitter to a frequency tuned on the receiver, proceed as in paragraph 2.1, step i.

l. If 32S-1 is used as exciter for a linear amplifier, set bias to produce 50 ma no-signal plate current and load plate current to only 200 ma. If the linear amplifier in use requires less than 80-100 watts PEP, use a power attenuator to reduce output level to that required as drive for the linear amplifier.

2.3 OPERATION AS TRANSCEIVER WITH 75S-1 RECEIVER.

a. Connect 32S-1 and 75S-1 as shown in figure 1-1 or 1-2.

b. Set FREQ CONTROL (1) on 32S-1 to REC VFO position.

c. Set OFF-STBY-OPR-CAL switch (1) on 75S-1 to STBY position.

d. Set both BAND selectors to same desired band and both EMISSION switches (8) to same position (either USB, LSB, or CW).

NOTE

When the 32S-1 and 75S-1 are connected together in transceiver service and the FREQ CONTROL switch is in REC VFO position, transmitter frequency is controlled by receiver oscillators. *Both* receiver and transmitter *must* have BAND switches and EMISSION switches set to same position. If the transmitter FREQ CONTROL switch (1) is set to TRANS VFO position, the two units may operate on different frequencies within the same 200-kc band. Do not attempt operation in transceiver service with any other receiver not having the same frequency mixing scheme.

e. Adjust the PRESELECTOR (2) of the 75S-1 for maximum signal or noise output.

SECTION II
Operation

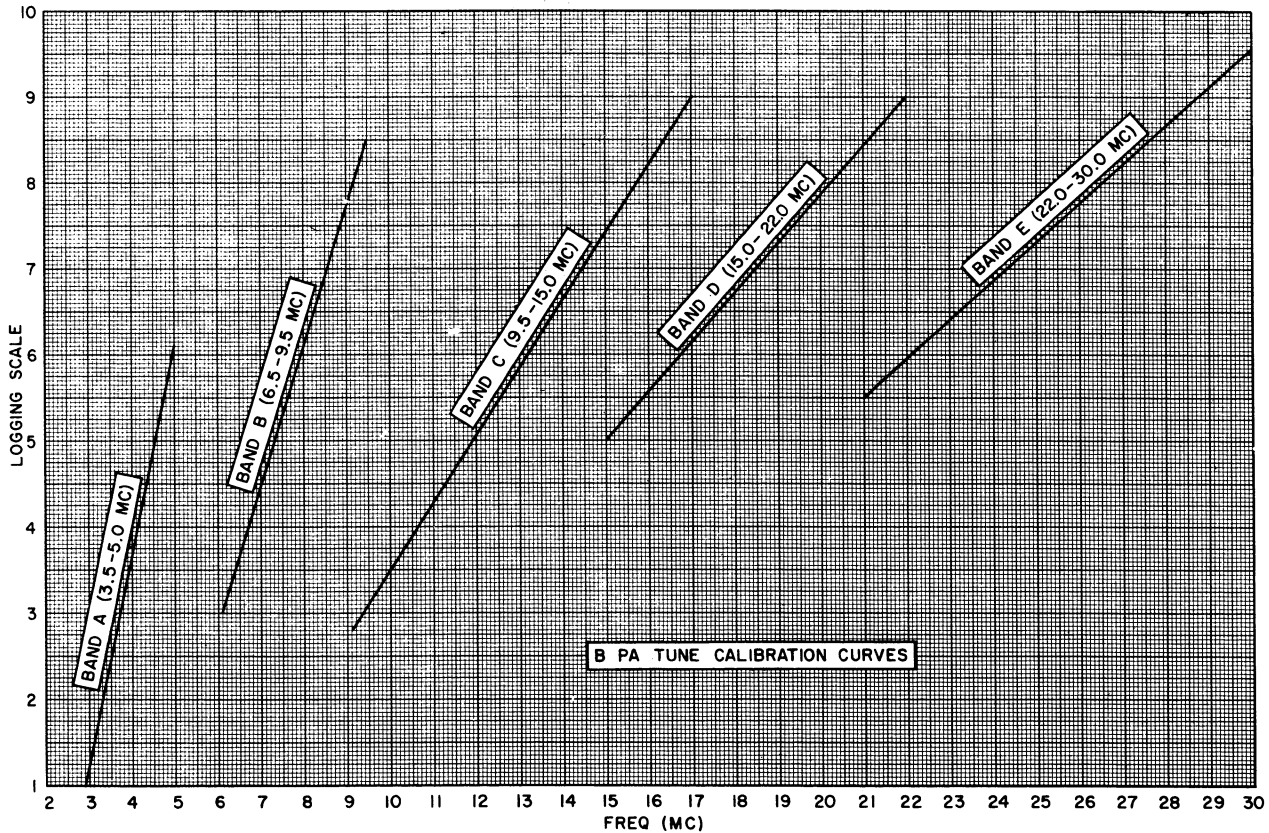
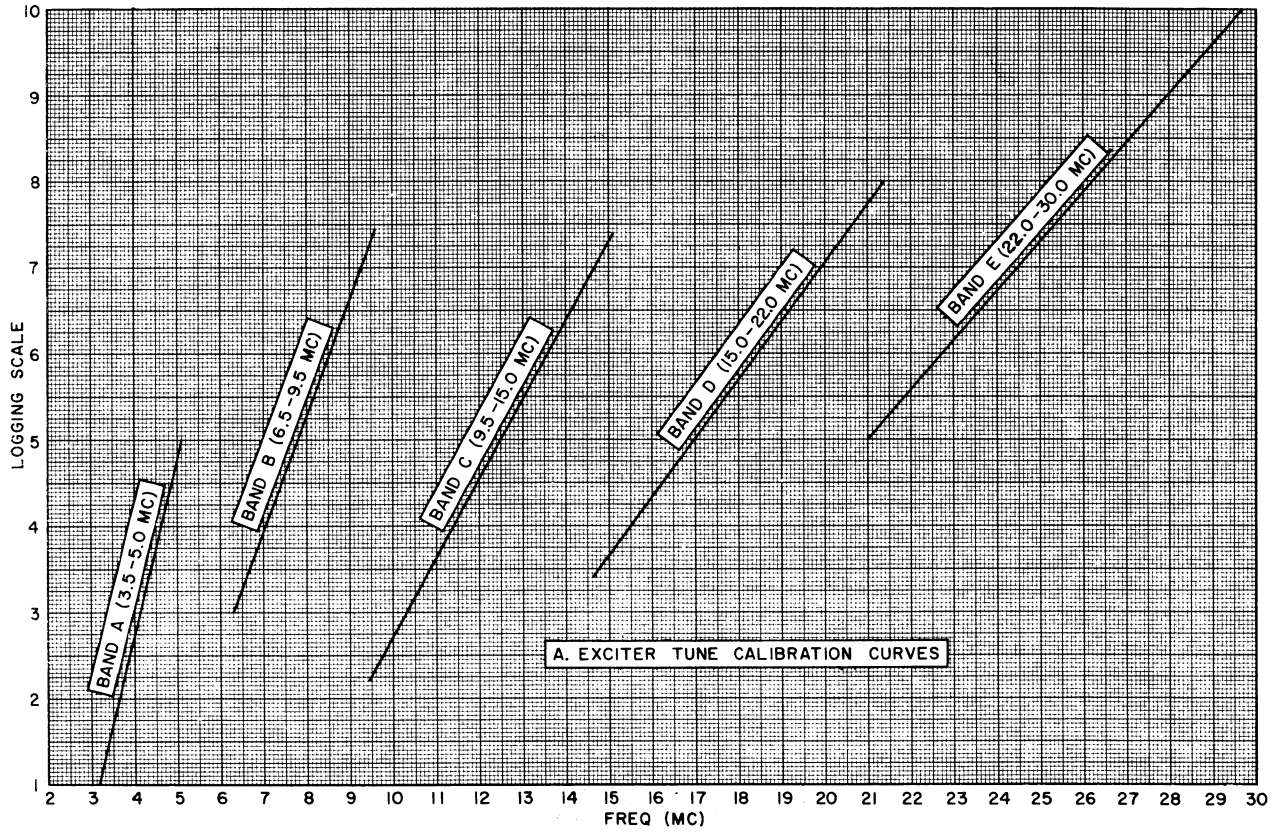


Figure 2-2. Calibration Curves

- f. Place the EXCITER TUNING (2) and the P. A. TUNING (4) controls in approximate band position.
- g. Set the transmitter EMISSION switch (8) to TUNE position. Sidetone will be heard in the speaker.
- h. Set the METER switch (9) to P. A. GRID position.
- i. Increase the MIC GAIN control (6) setting as necessary, and peak the grid current with the EXCITER TUNING control (2).
- j. Set the METER switch (9) to P. A. PLATE position, and dip the PA plate current with P. A. TUNING (4).
- k. Set the EMISSION switch (8) (on 32S-1) to LOCK KEY position, and complete the loading procedure as in paragraph 2.1, steps g through i.
- l. During operation across the selected band, peaking the desired receive signal with the receiver PRE-SELECTOR will peak the high frequency oscillator injection signal to the second balanced mixer. Adjust transmitter EXCITER TUNING for peak PA grid current.

CAUTION

If transmitter frequency is changed by any great amount, be sure to redip the power amplifier plate current and check the loading. This will be most important on the 80- and 40-meter bands. Some operating experience will indicate the amount of frequency excursion possible without readjustment.

When operating 32S-1 and 75S-1 in transmitter service, do not operate transmitter while receiver is tuned outside band limits; transmitted signal will be out of band. In this service, transmit frequency is always the same as receive frequency. Keep receiver tuned within the band, or return receiver to frequency within band before transmitting.

m. To restore both units to normal operation, remove the two patch cables connecting oscillator signals, replace P1 in J7 on the transmitter chassis, and replace the 100-ohm load plug, P1, in the XTAL OSC OUTPUT jack, J1, on the receiver chassis.

2.4 OPERATION OUTSIDE AMATEUR BANDS.

All amateur bands are completely covered except the 10-meter band for which only one crystal is furnished (for 28.5 to 28.7 mc). Two extra sockets are provided for additional crystals in this band.

The transmitter can be operated at other frequencies outside the specified amateur bands (MARS frequencies) or at other 10-meter frequencies by plugging the proper crystals into the mounting board. Figure 2-2 shows calibration curves, and figure 2-3 shows crystal socket locations. Select these crystals as follows.

CAUTION

Avoid operation between 5.0 mc and 6.5 mc. In this range the second harmonic of the variable i-f frequency is nearly the same as desired frequency. Some of this energy will pass through the tuned circuits and become spurious emission.

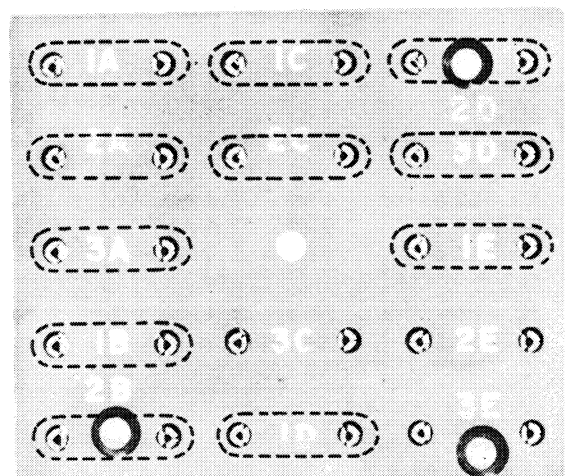


Figure 2-3. Crystal Socket Locations

- a. If the lower edge of the desired 200-kc band is less than 11.80 mc, the required crystal frequency is equal to the lower edge of the desired band plus 3.155 mc. As an example, if the desired band is 4.0 to 4.2 mc, 4.0 mc plus 3.155 mc equals 7.155 mc.
- b. If the lower edge of the desired 200-kc band is 12.000 mc or higher, the required crystal frequency is half the sum of the lower desired band edge and 3.155 mc. As an example, if the desired band is 14.4 mc to 14.6 mc,

$$\frac{14.4 + 3.155}{2} = 8.7775 \text{ mc.}$$

The plate circuit of the oscillator is tuned to twice the crystal frequency when required injection frequencies are this high.

c. Substitute or extra crystals should be plugged into the appropriate socket on the mounting board according to the best location in one of the five bands. The example cited in step b above should place the crystal in one of the sockets marked C. If additional 10-meter crystals are used, they should be plugged into the sockets marked E. Table 2-1 lists crystal socket designations, switch positions (BAND), crystal frequencies furnished, and frequency range limitations. For extra coverage crystals available, see section VI, Parts List.

SECTION III
Principles of Operation

TABLE 2-1. CRYSTAL FREQUENCIES AND OPERATING BANDS

BAND SWITCH POSITION	FREQUENCY BAND	CRYSTAL SUPPLIED	CRYSTAL SOCKET CONNECTED	TOTAL COVERAGE
1A - 3.4 2A - 3.6 3A - 3.8	3.4 - 3.6 mc 3.6 - 3.8 mc 3.8 - 4.0 mc	6.555 mc 6.755 mc 6.955 mc	1A 2A 3A	A 3.4 - 5.0 mc
1B - 7.0 2B - 7.2	7.0 - 7.2 mc 7.2 - 7.4 mc	10.155 mc 10.355 mc	1B 2B	B 6.5 - 9.5 mc
1C - 14.0 2C - 14.2 <i>Blank</i>	14.0 - 14.2 mc 14.2 - 14.4 mc As selected	8.5775 mc 8.6775 mc Not furnished	1C 2C 3C	C 9.5 - 15.0 mc
1D - 21.0 2D - 21.2 3D - 21.4	21.0 - 21.2 mc 21.2 - 21.4 mc 21.4 - 21.6 mc	12.0775 mc 12.1775 mc 12.2775 mc	1D 2D 3D	D 15.0 - 22.0 mc
1E - 28A 2E - 28B 3E - 28C	28.5 - 28.7 mc As selected As selected	15.8275 mc Not furnished Not furnished	1E 2E 3E	E 22.0 - 30.0 mc

2.5 OPERATION WITH 75A-4.

Mute 75A-4 by connecting REC MUTE on 32S-1 to pins 1 and 2 on E-3 terminal board on rear of 75A-4 (connect braid to pin 1 and center wire to pin 2). Operate with 75A-4 in standby condition. Feed 75A-4 500-ohm audio to ANTIVOX input on 32S-1. Calibrate

or zero beat using SYNC position of FREQ CONTROL switch same as with 75S-1.

2.6 OPERATION WITH 75A-4 AND 312B-4.

Connect and operate same as paragraph 2.5 (above) except feed 500-ohm audio from 75A-4 to ANTIVOX jack on 312B-4. Also feed 4-ohm audio to 312B-4.

SECTION III PRINCIPLES OF OPERATION

3.1 BLOCK DIAGRAM.

Refer to figure 3-1. The transmitter uses heterodyne exciter principles with crystal-controlled bfo, high-frequency oscillator, and highly stable vfo. The low-frequency i-f is 455 kc, and the high-frequency i-f is a 200-kc wide band-pass circuit. The 32S-1 may be connected in transceiver service with the companion 75S-1 Receiver. Figure 7-1 is a schematic diagram of the transmitter, and figure 7-2 is a schematic diagram of the 516F-2 Power Supply.

3.2 A-F CIRCUITS.

Microphone or phone patch input is connected to the grid of first audio amplifier V1A, amplified, and coupled to the grid of the second audio amplifier, V1B. Output from V1B is coupled to the grid of cathode follower V2A across MIC GAIN control. Output from the cathode follower is fed to the resistive balance point of the balanced modulator. In TUNE, LOCK KEY, and CW positions of the EMISSION switch, output from the tone oscillator, V11B, is fed to the grid of the second audio amplifier. Amplified tone oscillator signal is taken from the plate of V1B to the grid of the vox amplifier and the CW sidetone jack, J19.

3.3 BALANCED MODULATOR AND LOW-FREQUENCY I-F CIRCUITS.

Audio output from the cathode of V2A is fed to the junction of CR3 and CR4. Bfo voltage is fed to the slider of the carrier balance potentiometer, R14. Both upper and lower sideband output from the balanced modulator are coupled through i-f transformer T2 to the grid of the i-f amplifier, V3. Output from the i-f amplifier, V3, is fed to the mechanical filter, FL1. The pass band of FL1 is centered at 455 kilocycles.

This passes either upper or lower sideband, depending upon the sideband polarity selected when the EMISSION switch connects bfo crystal Y14 or Y15. The single-sideband output of FL1 is connected to the grids of the first balanced mixer in push-pull.

3.4 BALANCED MIXERS.

The 455-kc single-sideband signal is fed to the first balanced mixer grids in push-pull, the plates are connected in push-pull, and the vfo signal is fed to the grids in parallel. The mixer cancels the vfo signal energy and translates the 455-kc single-sideband signal to a 2.955- to 3.155-mc single-sideband

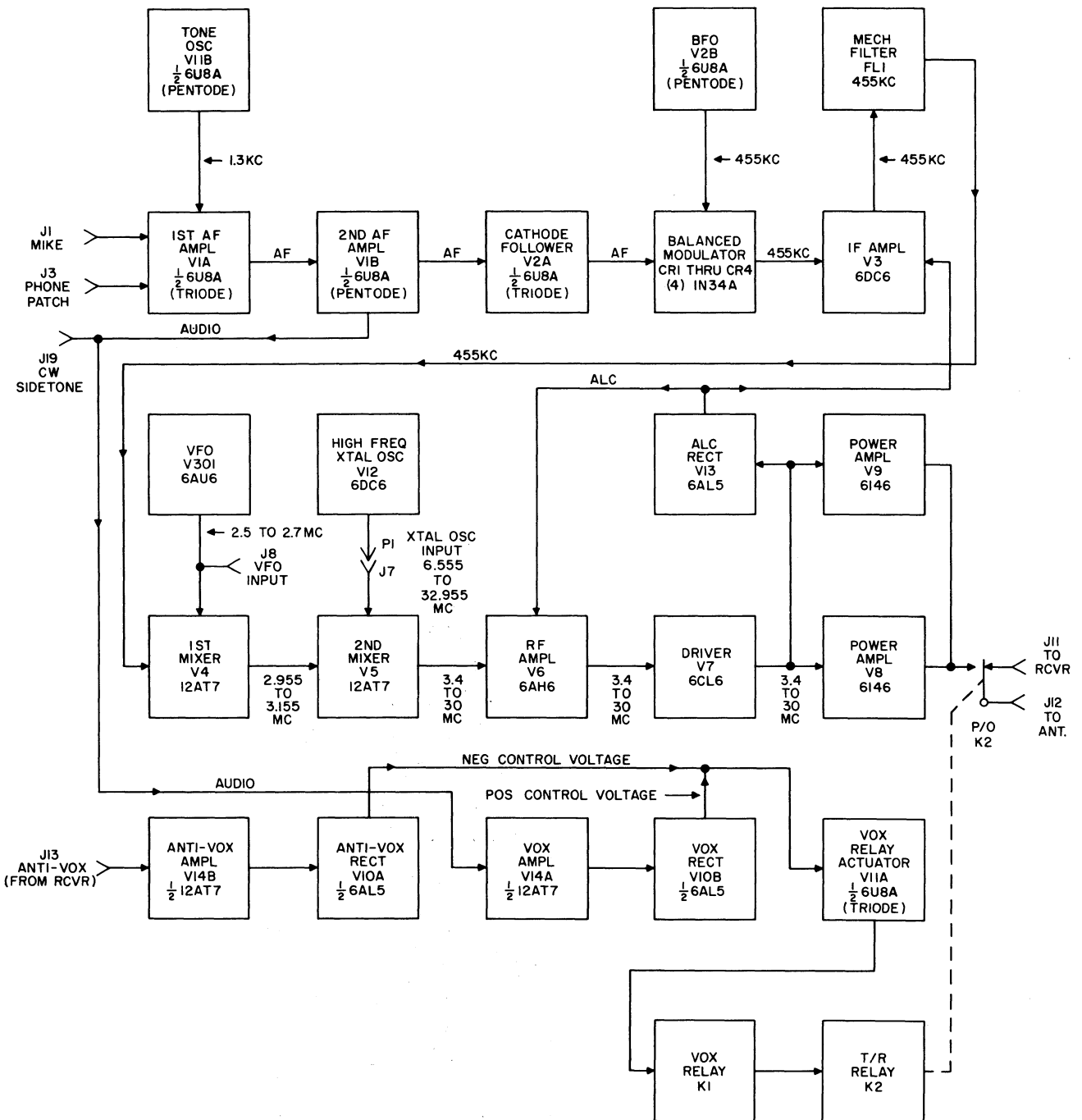


Figure 3-1. Block Diagram

carrier signal. This signal is the band-pass i-f frequency. The coupling network between the plate of the first mixer and the grid of the second balanced mixer is broadbanded to provide a uniform response to the band-pass i-f frequency. The band-pass i-f signal is fed to one of the grids of the second balanced mixer, and the high-frequency injection signal from the crystal oscillator V12 is fed to the signal input cathode and to the other grid. This arrangement cancels the high-frequency injection signal energy within

the mixer and translates the band-pass i-f signal to the desired operating band.

3.5 R-F CIRCUITS.

The slug-tuned circuits coupling V5 to V6, V6 to V7, and V7 to the power amplifier are ganged to the EXCITER TUNING control. The signal is amplified by the r-f amplifier, V6, and the driver, V7, to drive the power amplifier, V8 and V9. Output from the parallel power

SECTION III Principles of Operation

amplifiers is tuned by a pi-network and applied to the antenna through contacts of transmit-receive relay K2. Negative r-f feedback from the PA plate circuit to the driver cathode circuit permits a high degree of linearity at the high power level of the PA tubes. Both the driver and PA stages are neutralized to insure their stability.

3.6 CONTROL CIRCUITS.

3.6.1 ALC CIRCUIT.

Detected audio from the power amplifier grid circuit is rectified by V13, and the negative d-c output is fed to the alc bus. A fast-attack slow-release dual time constant is used to prevent overdriving on initial syllables and to hold gain constant between words. The fast time constant alc is applied to V6, and the slow time constant alc is applied to V3. If the companion 30S-1 Power Amplifier is used with the 32S-1, alc output from the 30S-1 is fed back to the alc bus.

3.6.2 VOX ANTI-VOX CIRCUITS.

Output from the second audio amplifier, V1B, is fed to the grid of the vox amplifier, V14A, through the VOX GAIN control, R74. This audio input is amplified by V14A and rectified by vox rectifier V10B. When the positive output of V10B is high enough to overcome the negative bias on V11A grid, the vox relay is actuated to turn the transmitter on. Receiver output is fed from J13 through the ANTI-VOX GAIN control, R85, to the grid of anti-vox amplifier V14B. Output from V14B is rectified by anti-vox rectifier V10A to provide the negative bias necessary to keep the transmitter disabled during receive periods. The anti-vox circuit provides a threshold voltage to prevent loudspeaker output (picked up by the microphone circuits) from tripping the vox circuits into transmit. ANTI-VOX GAIN control R85 adjusts the value of the anti-vox threshold so that loudspeaker output will not produce enough positive d-c output from the vox rectifier to exceed the negative d-c output from the anti-vox rectifier and cause V11A to actuate vox relay K1. Speech energy into the microphone will cause the positive vox voltage to overcome the negative anti-vox voltage and produce the desired action of K1. Contacts of relay K1 control relay K2, key line, PA and driver screens, receiver muting circuits, oscillator plate-voltages, and the high-voltage relay in the d-c supply.

3.7 OSCILLATORS.

3.7.1 TONE OSCILLATOR.

The tone oscillator is used for tuneup and CW operation and consists of an RC phase-shift oscillator opera-

ting at approximately 1350 cps. Its output is fed to the audio amplifier and is switched by the bfo signal in the balanced modulator to provide continuous wave r-f at the grids of the first mixer. The oscillator is turned on when EMISSION switch section S8C is in TUNE, LOCK KEY, or CW position.

3.7.2 BEAT-FREQUENCY OSCILLATOR.

The bfo is crystal controlled at either 453.650 kc or 456.350 kc, depending upon whether Y14 or Y15 is selected by EMISSION switch section S8F. These crystal frequencies are matched to the pass band of the mechanical filter, FL1, so the carrier frequency is placed approximately 20 db down on the skirts of the filter response. This 20-db carrier suppression is in addition to the 30-db suppression provided by the balanced modulator.

3.7.3. VARIABLE-FREQUENCY OSCILLATOR.

The vfo uses fixed capacitors, a permeability-tuned variable inductor, and fixed inductors to provide the tuning range of 2.5 to 2.7 mc. The frequency-determining network is composed of capacitors C301, C302, C303, and C305, and inductors L301, L302, and L303. Capacitor C303 is paralleled by trimmer capacitor C308 and diode CR301 connected in series. A d-c bias voltage is applied to the diode through an r-f isolation resistor, R303. When LSB emission is selected, negative bias is applied to CR301 which switches C308 out of the circuit. Selection of USB emission applies positive bias to CR301, causing it to conduct which switches C308 into the circuit. Proper adjustment of C308 shifts the vfo output frequency by an amount equal to the frequency separation of the two bfo crystals. This allows selection of either sideband without changing the suppressed-carrier frequency of the exciter r-f output.

3.7.4 HIGH-FREQUENCY CRYSTAL OSCILLATOR.

The high-frequency crystal oscillator, V12, is crystal controlled by one of 13 crystals selected by BAND switch S11. Output from the high-frequency crystal oscillator is fed to the second mixer. This frequency is always 3.155 mc higher than the lower edge of the desired transmit band. This high-frequency injection signal is crystal fundamental frequency for all desired output signals below 12 megacycles, but for operating frequencies higher than 12 megacycles, the crystal frequency is doubled in the plate circuit of the oscillator.

4.3 VOLTAGE AND RESISTANCE MEASUREMENTS.

Table 4-2 lists voltage and resistance measurements on all tube sockets except that of V301. *Do not open* the oscillator can. Measurements were taken under following conditions:

- a. All measurements with vtvm and with all tubes in sockets.
- b. Resistances of less than one ohm listed as zero.
- c. Voltage measurements made with the tube under test operating normally, vox switch S10 closed, no power output.
- d. Resistance measurements made with power supply plug removed from J10.

e. All measurements made from socket pin to ground.



Do not attempt any measurements of power amplifier plate voltage without special high-voltage test probe. Voltage here is 800 volts d-c. Do not make any other voltage or resistance measurements on 32S-1 with high voltage applied. Remove high-voltage rectifier from socket in power supply.

TABLE 4-2. VOLTAGE AND RESISTANCE MEASUREMENTS

TUBE		PIN NUMBER									PLATE CAP
		1	2	3	4	5	6	7	8	9	
V1	D-C V	54	0	54			135	0.9	1.5	0	
	A-C V				6.3						
	Ohms	72K	490K	62K	1.8	1.2	90K	470	680	1 meg	
V2	D-C V	160	-5.5	110			190	0	88	86	
	A-C V				6.3	0					
	Ohms	35K	1 meg	250K	1.6	2.2	110K	0	16K	400K	
V3	D-C V	0.52	+1.1			275	122	0			
	A-C V				6.3						
	Ohms	3.5 meg	220	1.2	1.8	75K	40K	0			
V4	D-C V	225	-0.12	4.2			230	-0.12	4.3		
	A-C V									6.3	
	Ohms	31K	57K	900	1.8	1.8	31K	57K	900	2.2	
V5	D-C V	215	-2.5	1.25			215	-2.9	+1.2		
	A-C V									6.3	
	Ohms	31K	1 meg	220	1.8	1.8	31K	1 meg	220	2.2	
V6	D-C V	0.7	0			215	120	+0.8			
	A-C V				6.3						
	Ohms	4.2 meg	0	1.8	2.2	35K	145	180			
V7	D-C V	2.8	0	142			270	0	142	0	
	A-C V				6.3						
	Ohms	100	10K	110K	1.2	0.7	33K	0	110K	10K	
V8	D-C V	+0.1	0	+290	+0.1	-5.8	+0.1	0	0		800
	A-C V		6.3								
	Ohms	20	0.7	15K	2.0	165K	2.0	0	0		
V9	D-C V	+0.1	0	290	+0.1	-58	+0.1	0	0		800
	A-C V							6.3			
	Ohms		1.2	15K	2.0	165K	1.9	0	0		
V10	D-C V	0	0			+0.5	0	-0.8			
	A-C V			6.3							
	Ohms	100K	100K	1.7	1.3	18 meg		18 meg			

SECTION IV
Service Instructions

TABLE 4-2. VOLTAGE AND RESISTANCE MEASUREMENTS (Cont)

TUBE		PIN NUMBER									PLATE CAP
		1	2	3	4	5	6	7	8	9	
V11	D-C V	180	0	268 (4)			260 (4)	18 (5)	5.0	0	
	A-C V Ohms	45K	290K	150K	6.3 1.7	1.3	80K	1100 (2)	400 (3)	10 meg	
V12	D-C V	-2.4 to -5.0 (1)	0			275	85	0			
	A-C V Ohms	100K	10	6.3 1.8	2.2	74K	120K	0			
V13	D-C V	-0.4	-0.4			0	0	-0.7			
	A-C V Ohms	Inf	Inf	1.8	6.3 2.2	0		4 meg			
V14	D-C V	155	0	2.4			155	0	2.5	0	
	A-C V Ohms	80K	1 meg	1.3	1.2	1.3	80K	1.1 meg	1K	6.3 1.7	

(1) Varies with band, (2) open on USB and LSB, (3) 1500 ohms with S10 open, (4) 150 v on TUNE, LOCK KEY, and CW., (5) 4 v on TUNE, LOCK KEY, and CW.

4.4 ALIGNMENT PROCEDURES.

4.4.1 TEST EQUIPMENT REQUIRED.

A signal generator, vacuum-tube voltmeter, and a 100-watt, 50-ohm dummy load are required for complete alignment and neutralization. If only touch-up alignment is necessary, and if transmitter develops 50 to 60 volts r-f at PA grids, alignment with PA grid current indication is satisfactory.

4.4.2 455-KC I-F ALIGNMENT. (Refer to figure 4-1 for location of adjustments.)

a. Disconnect the high voltage (800 volts) from the transmitter by removing the high-voltage rectifier tube from the power supply.

b. Disable the screen circuit of the PA tubes by unsoldering one end of the jumper between P.A. DIS-ABLE jacks, J9 and J5.

c. Connect the r-f probe of a vtm across mechanical filter input (junction of C140 and R106 on terminal strip near i-f amplifier V3).

d. Set **FREQ CONTROL** switch to **TRANS VFO**. Set **EMISSION** switch to **TUNE** position.

e. Set **MIC GAIN** full counterclockwise.

f. Any voltage appearing on the vtm is due to carrier. Adjust carrier balance potentiometer R14 for minimum vtm indication. This is a coarse adjustment.

g. Advance **MIC GAIN** until vtm indicates approximately one volt.

h. Peak primary and secondary of T2. Disconnect vtm.

4.4.3 BAND-PASS I-F ALIGNMENT.

a. Connect signal generator output between pin 2 of the first mixer, V4, and ground. Connect r-f probe of vtm between junction of C30 and R32 and ground. This point is in the grid circuit of the second mixer, V5.

b. Tune the signal generator to 3.055 mc. Make a swamping tool by connecting a 1000-ohm resistor and a 0.01-uf capacitor in series and connecting clips to their free pigtails. Connect this swamping tool across terminal 3 (secondary winding) of T1 and ground. This terminal is connected to the T1 end of coupling capacitor C3.

c. Turn on transmitter. Set **FREQ CONTROL** switch to **REC VFO**, and set **EMISSION** switch to **TUNE**.

d. Keep vtm indication at about 0.5 volt by adjusting signal generator output, and peak the primary of T1 and peak L4 with tuning tool such as Walsco 2543. The primary slug for T1 is in the bottom of the can.

e. Remove the swamping tool from the secondary of T1, and connect it across the primary of T1 (between pins 1 and 6 of the first mixer, V4). Peak the secondary of T1 (top of shield can). Remove swamping tool.

4.4.4 R-F CIRCUITS ALIGNMENT.

For ordinary touch-up of alignment, it is only necessary to tune and load, in the normal manner, and then touch up the trimmer capacitor settings for maximum grid drive. Keep grid drive low with the **MIC GAIN** control. It is advisable to perform this alignment with the transmitter PA feeding a well-shielded dummy load. If r-f circuit components have been replaced, or if any extensive repairs have been made in the r-f section, proceed as follows:

a. Adjust C101, C41, C52, and C69 to 2/3 maximum capacity. Adjust C65 to 1/3 maximum capacity. Adjust all other ceramic trimmer capacitors, except CAR BAL capacitor, C11, at 1/2 maximum capacity. Make no changes in settings of neutralizing capacitors C55, C57, and C71. Figure 4-2 shows maximum-, minimum-, and half-capacity settings of ceramic trimmers.

b. Set BAND switch to 3.6, tuning dial to 100, and EXCITER TUNING to 2.1 on the logging scale. Set EMISSION switch to TUNE for all the following steps.

c. Connect the r-f probe of a vtm from PA tube grid (pin 5 of either tube) to ground.

d. Adjust MIC GAIN to produce approximately 15 volts indication on the vtm.

e. Adjust all slugs (except L11) for peak vtm indication. The driver plate circuit has two slug-tuned coils, L11 and L16. The slug at the extreme rear of the slug rack is L11. Do not adjust L11 at this time.



Be sure slugs are not tuned to the variable i-f frequency (3.155 to 2.955 mc).

f. Set BAND switch to 14.0, tuning dial to 150, and EXCITER TUNING control to 6.4 on the logging scale.

g. Adjust MIC GAIN for 15-volt vtm reading. Peak L11 and all 14-mc trimmers for maximum vtm reading. Keep vtm reading at 15 volts by adjusting MIC GAIN control as necessary.

h. Set BAND switch to 28A, tuning dial to 100, and EXCITER TUNING control to 9.0 on the logging scale.

i. Adjust MIC GAIN for 15-volt reading on vtm. Peak all 28-mc trimmers for maximum reading on the vtm, keeping the vtm reading at 15 volts with the MIC GAIN control.

j. Set BAND switch to 21.2, dial to 100, EXCITER TUNING to 7.8 on logging scale.

k. Peak all 21MC trimmers for maximum vtm reading. Keep the vtm indication at approximately 15 volts by adjusting the MIC GAIN control as necessary.

l. Set BAND switch to 14.0, dial to 150, EXCITER TUNING to 6.4 on the logging scale.

m. Peak all 14MC trimmers for maximum vtm reading. Keep vtm reading at approximately 15 volts by adjusting the MIC GAIN control as necessary.

n. Set BAND switch to 7.0, dial to 150, EXCITER TUNING control to 3.8 on the logging scale. Adjust MIC GAIN control for 15-volt reading on the vtm.

o. Peak all 7MC trimmers for maximum vtm reading, adjusting MIC GAIN as necessary to keep indication at approximately 15 volts.

p. Set BAND switch to 3.6, dial to 100, and EXCITER TUNING control to 2.1 on the logging scale. Adjust MIC GAIN for 15-volt reading on the vtm.

q. Peak all 3.5MC trimmers for maximum vtm reading, adjusting MIC GAIN control as necessary to keep indication at approximately 15 volts.

r. Remove the r-f probe. Touch up the trimmer adjustments on each band to compensate for r-f probe capacity. Use grid current as indication and adjust the MIC GAIN control as necessary to keep the indication low (between 2 and 6 db) on lower scale).



DO NOT change trimmer settings greatly, or the above procedure will have to be done over.

4.4.5 CRYSTAL OSCILLATOR ALIGNMENT.

a. This procedure is a refinement which peaks the oscillator plate circuit in the center of the 200-kc tuning range. Turn the tuning dial to 100.

b. Set BAND switch to 28A. Adjust EXCITER TUNING control for a peak on the PA grid current meter. Set EMISSION switch to TUNE. Increase MIC GAIN setting if necessary to obtain grid current indication.

c. Repeat the (E)28 trimmer in the crystal oscillator plate circuit.

d. Set the BAND switch to 21.2, and adjust EXCITER TUNING control for peak in grid current.

e. Repeat the (D)21 trimmer in the oscillator plate circuit.

f. Repeat this procedure with BAND switch settings of 14.0, 7.0, and 3.6.

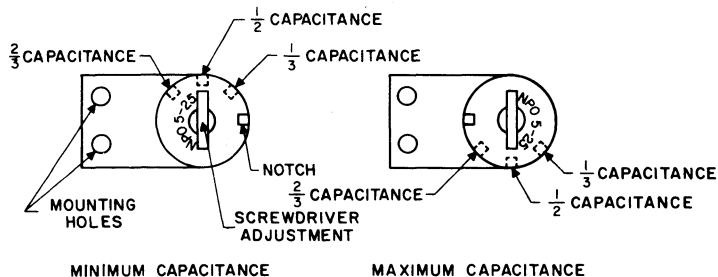


Figure 4-2. Ceramic Trimmer Capacitors

SECTION IV
Service Instructions

4.4.6 PA NEUTRALIZING.

- a. Disable PA plate and screen circuits as in paragraph 4.4.2, steps a and b.
- b. Connect a 50-ohm, noninductive, 100-watt dummy load to R.F. OUT jack J12.
- c. Connect vtvm r-f probe across 50-ohm dummy load.
- d. Set FREQ CONTROL switch to TRANS VFO, BAND switch to 28A, EMISSION switch to LOCK KEY, and METER switch to P.A. GRID. Set dial to 100.
- e. Advance MIC GAIN setting as necessary, and adjust EXCITER TUNING for peak PA grid current.
- f. Adjust P. A. TUNING control for maximum r-f voltage indication on vtvm. Adjust MIC GAIN as necessary to keep this indication below 0.5 volt.
- g. From bottom chassis, adjust the PA neutralizing capacitor, C71, for a dip in the vtvm indication. This voltage is PA plate feedthrough.
- h. Remove the r-f probe connection from the 50-ohm load.

4.4.7 DRIVER NEUTRALIZING.

- a. Restore high voltage to the PA tubes by replacing the rectifier tube. Reconnect the jumper between J5 and J9 PA DISABLE jacks.
- b. Remove the filament voltage to the driver tube, V7, by unsoldering the lead connected to pin 5. As an alternative, an old 6CL6 tube with no shorts and with pin 4 or 5 clipped off may be substituted for V7.
- c. Connect the r-f probe of the vtvm across the dummy load at J12.
- d. Set the FREQ CONTROL switch to TRANS VFO, BAND switch to 28A, EMISSION switch to LOCK KEY, and METER switch to P. A. PLATE.
- e. Set PA bias for 40-ma static plate current.
- f. Increase MIC GAIN setting, and adjust EXCITER TUNING and P. A. TUNING controls for maximum voltage across the 50-ohm load. This level will be less than 0.3 volt.
- g. Adjust the driver neutralizing capacitor, C57, for a voltage dip. This capacitor is located on the shield partition closest to the shield can. Refer to figure 4-1.
- h. Restore V7 to normal operation.

4.4.8 FEEDBACK NEUTRALIZING.

- a. Set FREQ CONTROL to TRANS VFO position, BAND switch to 28A position, EMISSION switch to TUNE, and METER switch to P. A. PLATE position.
- b. Adjust EXCITER TUNING control for a peak in PA plate current.
- c. Dip the PA plate current with the P. A. TUNING control.
- d. Repeat steps b and c above.
- e. Adjust the feedback neutralizing capacitor, C55, (below chassis) until the PA plate current dip and the grid current dip coincide. Readjust the MIC GAIN as necessary to hold PA grid current to midscale during this adjustment.
- f. Set BAND switch to 21.2, peak EXCITER TUNING control, and dip PA plate current with P. A. TUNING control.

- g. Check that PA plate current dip and PA grid current dip occur at same setting of P.A. TUNING control.
- h. Repeat this check on bands 14.2, 7.0, and 3.6.

4.4.9 VFO SIDEBAND FREQUENCY SHIFT
ADJUSTMENT.



Do not make this adjustment unless switching from one sideband to the other makes re-adjustment of tuning dial necessary to keep output signal from shifting. It will always be necessary, after this adjustment, to make carrier balance (null) adjustment given in paragraph 4.4.10 following.

- a. Set EMISSION switch to LSB, METER switch to P. A. PLATE, BAND switch to 14.0 and tuning dial to 100. Turn VOX GAIN (under top cover) full counterclockwise until switch clicks.
- b. Rotate CARRIER BAL potentiometer R14 to one end to allow carrier feedthrough.
- c. Adjust EXCITER TUNING control for maximum plate current, and dip the plate current with the P. A. TUNING control.
- d. Tune the station receiver to zero beat with the transmitter.
- e. Set EMISSION switch to USB, and adjust trimmer C308 (top of vfo can) for zero beat.

4.4.10 CARRIER BALANCE (NULL) ADJUSTMENT.

- a. Set BAND switch to 3.6. Set tuning dial to 100. Connect dummy load to transmitter output. Tune and load transmitter into dummy load.
- b. Set EMISSION switch to LSB position, and turn MIC GAIN control full counterclockwise.
- c. Connect an r-f vtvm across dummy load and set to lowest scale, or use the lowest scale on an r-f wattmeter connected in series with the load.
- d. Key the transmitter by turning VOX GAIN control counterclockwise until the switch clicks or by grounding the push-to-talk jack, J4. If vtvm indication is 0.2 volt or more, adjust CARRIER BAL potentiometer R14 and trimmer C11 until the vtvm indication is less than 0.2 volt. These adjustments interact, so adjust first one and then the other until neither produces any decrease in vtvm indication.
- e. Switch the EMISSION switch back and forth between LSB and USB positions and check that the carrier is balanced at less than 0.2 volt indication on vtvm. If the carrier is not balanced to less than 0.2 volt for either sideband, repeat step d until vtvm indication is less than 0.2 volt for either sideband.

4.4.11 ALC ZERO ADJUSTMENT.

- a. Set EMISSION switch to USB position. Tune and load the transmitter to 14.1 mc.
- b. Turn MIC GAIN control to minimum, and set METER switch to ALC position. Short PTT jack to ground.

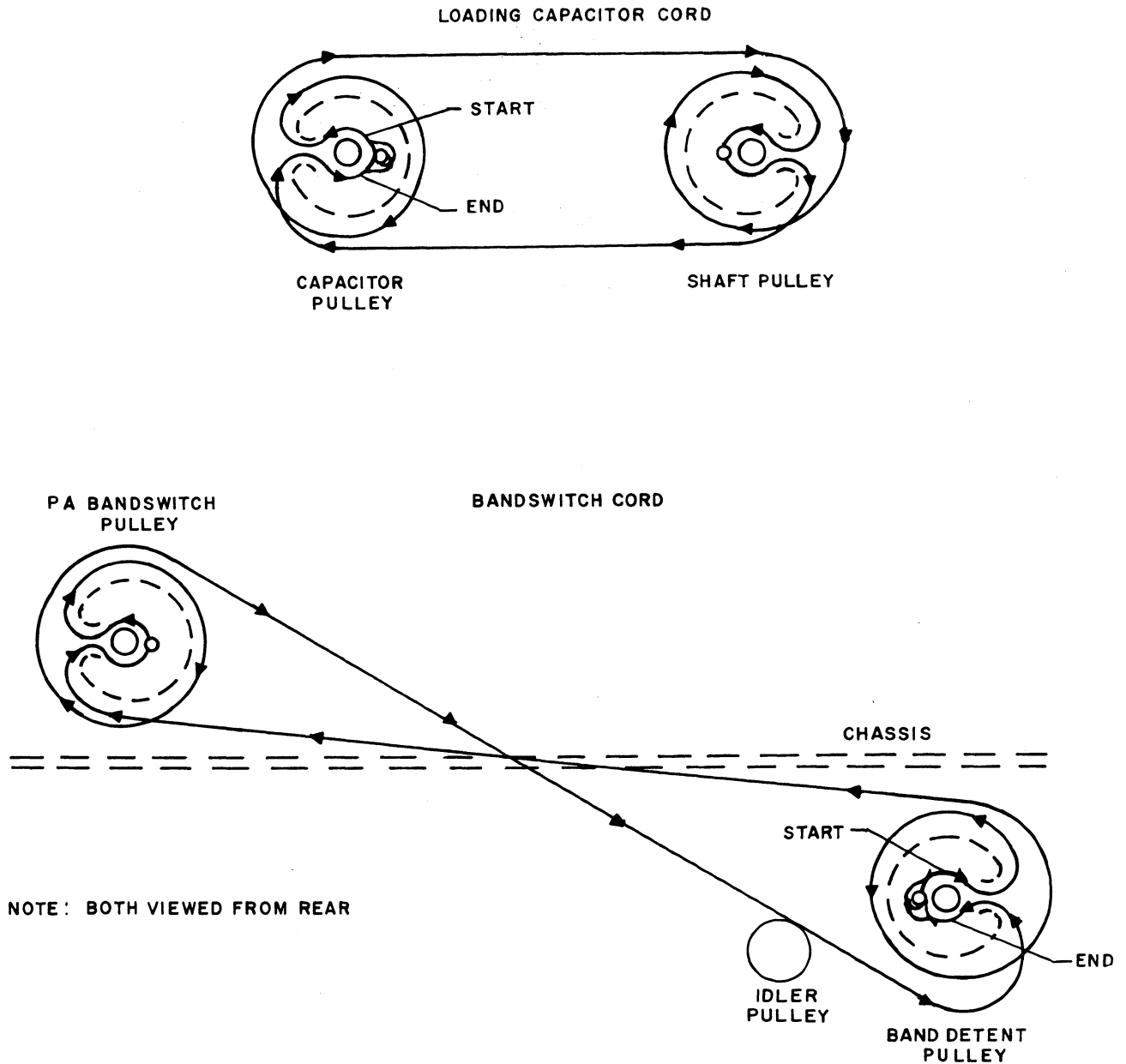


Figure 4-3. Dial Cord Stringing Diagram

c. Adjust ALC ZERO potentiometer (top chassis near V2) until meter indicates zero. Remove PTT short.

4.4.12 FIRST MIXER BALANCE ADJUSTMENT.

a. Tune and load the transmitter into dummy load at 14.1 mc. Loosely couple a general coverage communications receiver to the transmitter output. Tune the communications receiver back and forth across 14.555 mc until the signal is heard.

b. Adjust the mixer balance potentiometer, R27, and the trimmer, C26, for minimum output. These adjust-

ments interact, so adjust first one and then the other until neither produces any decrease in output.

4.4.13 VOX TIME CONSTANT MODIFICATION.

If a longer hold-in time constant is desired for vox operation, replace C119 with a 0.027 uf or a 0.033 uf capacitor.

4.4.14 VFO DIAL CALIBRATION.

In case the variable frequency oscillator in the 32S-1 has drifted and there is no end-point spread, it can be

SECTION IV
Service Instructions

calibrated by loosening the set screws on the dial hub and slipping the dial mechanism on the oscillator shaft until zero beat occurs at the center of the window. Use the 75S-1 and 32S-1 calibrating procedure, paragraph 2.1i. Make certain there is no end-point spread before making this adjustment; zero beat should occur at 0 and 200 on the dial without any readjustment of the hairline.

If there is end-point spread and zero beat does not coincide at 0 and 200 on the dial, make the following adjustments:

- a. Calibrate the 75S-1 at 200 on its dial. Calibrate the 32S-1 against the 75S-1 (near 200 on the 32S-1 dial).
- b. With ZERO SET knob, set hairline to 200.
- c. Calibrate the 75S-1 at 0 on its dial. Calibrate the 32S-1 against the 75S-1. Note difference in kilocycles between hairline and zero on 32S-1 dial (example 1.5 kc).
- d. Without moving the hairline, move the dial to the other side of zero at twice the noted error. (Example 3 kc.)
- e. Adjust L302 for zero beat. The slug-tuned inductor, L302, is accessible at the top of the vfo can.
- f. Move the hairline to zero.
- g. Check zero beat at 200 on the dial. If zero beat does not occur at exactly 200, repeat steps b through e.
- h. If, after adjustment of end points, the hairline is not vertical in the window, loosen the setscrews on the dial hub and move the dial with respect to the oscillator shaft so that zero beat occurs with the end points (0 and 200) set at center.
- i. After these adjustments of the vfo calibration, make the vfo sideband frequency shift adjustment according to paragraph 4.4.9.

4.5 DIAL CORD REPLACEMENT. (Refer to figure 4-3.)

4.5.1 BAND-SWITCH CORD.

a. Place BAND switch in position 2A. Remove all power from 32S-1 and remove PA compartment top cover. Short the PA plates to ground with a screwdriver blade. Check to see that the movable contacts of both S5 and S6 are at position 13 and 14. This may be determined by counting clockwise on the wafer from the S-mark, looking at the wafer on the side marked with the X, and beginning with the first position clockwise from the X-mark as 1. Count all positions, including the holes in the empty spaces where there are no lugs mounted.

b. Use a knife blade or small screwdriver to pry the tab open far enough to release the old cord. This tab is located on the inner face of the pulley. Remove the broken or defective cord from the bandswitch pulleys

near the front panel. One is located above the chassis and the other below the chassis. Loosen the idler pulley so it will not be in the way during restringing.

c. Replace the old cord with three feet of new cord from Collins part number 432100900. When ordering dial cord, be sure to state the desired length in feet.

d. String the cord according to the appropriate part of figure 4-3. **Make sure the cord turns do not overlap on the pulleys.** Pull the cord tight and tie to the tab. Make sure a short piece of spaghetti is slipped over the plastic covered cord so that it acts as extra insulation under the tab. This prevents r-f currents from melting the plastic and shorting the wire core to ground. Mash the tab down to clamp the cord securely. Tighten the idler to bring the cord to tension.

e. Check again that the switch sections S5 and S6 are properly positioned according to the instructions of step a above. If they are not, loosen the shaft coupler and turn the switch shaft to bring the contacts to proper position. Tighten the coupler.

f. Apply a little airplane cement on dial cord knots to help keep them tight. After cement is dry, trim the loose ends back NO CLOSER than 1/2 inch from knots.

4.5.2 LOADING CAPACITOR CORD.

a. Place INCR LOAD control at 10 on the logging scale. This positions the INCR LOAD control horizontally and points it at the meter. Remove all power from the 32S-1 and remove the PA compartment top cover. Short the PA plate caps to ground with a screwdriver blade. Check that the loading capacitor is fully meshed.

b. Use a knife or small screwdriver and pry the tab open far enough to release the old cord. Remove the broken or defective dial cord from the loading capacitor pulleys.

c. Replace the old cord with two feet of new cord from Collins part number 432100900. When ordering dial cord, be sure to state the desired length in feet.

d. String the cord according to the appropriate part of figure 4-3. **Make sure the cord turns do not overlap on the pulleys.** Pull the cord tight and tie to the tab. Make sure a short piece of spaghetti is slipped over the plastic covered cord so that it acts as extra insulation under the tab. This prevents r-f currents from melting the plastic and shorting the wire core to ground. Mash the tab down to clamp the cord securely.

e. Check to see that the INCR LOAD control is at 10 on the logging scale, and that the loading capacitor is fully meshed. If not, loosen the shaft coupler, mesh the capacitor plates manually, and tighten the coupler.

f. Dab a little airplane cement on the knots in the dial cords to help hold them tight. After the cement is dry, trim the loose ends back NO CLOSER than 1/2 inch from the knot.

SECTION V SPECIFICATIONS

5.1 32S-1 TRANSMITTER.

The 32S-1 Transmitter develops 100 watts output power (nominal) on all amateur bands between 3.5 and 29.7 mc. Input power is 175 watts PEP on SSB or 160 watts CW.

5.2 FREQUENCY COVERAGE.

The 32S-1 has band-switch positions and corresponding crystal sockets for 14 200-kc bands. Crystals are furnished for complete coverage of all amateur bands except 10 meters. One 10-meter crystal is furnished, and the crystal mounting block has extra sockets for two additional crystals. One other spare crystal socket and band-switch position are provided for an additional band between 9.5 and 15.0 mc. Other crystals may be substituted for those furnished to place the transmitter at other frequencies throughout the range.

5.3 REQUIREMENTS FOR OPERATION.

The transmitter requires the following power supply voltages:

- +800 volts d-c at 200 ma for PA plates
- +275 volts d-c at 175 ma for PA screens and low-voltage plates
- Bias voltage adjustable between -60 and -80 volts d-c
- 6.3 volts a-c at 6.0 amperes or
- 6.0 volts d-c at 6.0 amperes or
- 12.0 to 14.0 volts d-c at 3.0 amperes or
- 24.0 to 28.0 volts d-c at 1.5 amperes

These voltages may be supplied with Collins Power Supplies 516F-2 (a-c source), 516E-1 (12-volt d-c source), 516E-2 (24-volt d-c source), or 516F-1 with adapter cable. The antenna and feed system must present a 50-ohm load with swr not exceeding 2.0 to 1. Any high-impedance crystal or dynamic microphone and any key may be used with the 32S-1 Transmitter.

5.4 SPECIFICATIONS.

Size	6-9/16 inches high, 14-3/4 inches wide, 11-1/2 inches deep.
Weight	16 pounds.
Frequency range	3.4 to 30.0 megacycles. With crystals furnished, bands are as follows: 80 meters - 3.4 to 3.6 mc, 3.6 to 3.8 mc, and 3.8 to 4.0 mc. 40 meters - 7.0 to 7.2 mc, and 7.2 to 7.4 mc. 20 meters - 14.0 to 14.2 mc, and 14.2 to 14.4 mc. 15 meters - 21.0 to 21.2 mc, 21.2 to 21.4 mc, and 21.4 to 21.6 mc. 10 meters - 28.5 to 28.7 mc.
Mode.	Single sideband (either sideband selectable) or CW.
Type of service	SSB-continuous; CW -50% duty cycle.
Plate power input	175 watts PEP on SSB, 160 watts on CW.
Power output	100 watts PEP (nominal) into 50 ohms.
Microphone input impedance	High impedance.
R-f output impedance	50 ohms with not more than 2.0-to-1 swr.
Frequency stability	Total variation after warmup not more than 100 cps.

SECTION V
Specifications

- Calibration accuracy 1 kilocycle.
- Keying Break-in.
- Audio-frequency response 300-2400 cps \pm 6 db.
- Carrier suppression Carrier 50 db down on output signal.
- Unwanted sideband 50 db down from output signal.
- Oscillator feedthrough or mixer products (undesired) 50 db down from output signal.
- Second harmonic 50 db down from output signal.
- Third order distortion 30 db down from output signal.

5.5 TUBE, FUSE, AND SEMICONDUCTOR COMPLEMENT.

TABLE 5-1. TUBES, FUSES, AND SEMICONDUCTORS

SYMBOL	FUNCTION	TYPE
V1A	First audio amplifier	1/2 6U8A
V1B	Second audio amplifier	1/2 6U8A
V2A	Cathode follower	1/2 6U8A
V2B	Beat-frequency oscillator	1/2 6U8A
V3	I-f amplifier	6DC6
V4	First mixer	12AT7
V5	Second Mixer	12AT7
V6	R-f amplifier	6AH6
V7	Driver	6CL6
V9	Power amplifier	6146
V10	Vox/anti-vox rectifier	6AL5
V11A	Vox relay actuator	1/2 6U8A
V11B	Tone oscillator	1/2 6U8A
V12	Crystal oscillator	6DC6
V13	Automatic load control rectifier	6AL5
V14A	Vox amplifier	1/2 12AT7
V14B	Anti-vox amplifier	1/2 12AT7
V301	Vfo	6AU6
CR1, CR2, CR3, CR4	Balanced modulator	1N34A
CR301	Frequency shift switch	1N34A
F1	Power supply fuse	4 amp, 125 v

5.6 AVAILABLE ACCESSORIES.

TABLE 5-2. AVAILABLE ACCESSORIES

ITEM	FUNCTION	COLLINS PART NUMBER
312B-4 Station Control	Speaker, phone patch directional wattmeter, and station control	522-1167-00
MP-1	Mobile power supply for 12-volt source	597-0380-00
516F-2 AC Power Supply	A-c power supply	522-1170-00
*516F-1 AC Power Supply	A-c power supply	522-0847-00
Extra crystals	Additional band coverage	See section VI, Parts List
Cables	Extra patch cables	426-2027-00
351E-1 Mounting Frame	Mount for 32S-1	522-1479-00
351E-2 Mounting Frame	Mount for 312B-4	522-1480-00
PJ-068	Mike plug	361-0001-00

*Use with special cable adapter Collins part no. 543-8791-00.

SECTION VI
PARTS LIST

32S-1 Transmitter

ITEM	DESCRIPTION	COLLINS PART NO.
32S-1 TRANSMITTER		522-1169-00
C1, C4, C7, C8, C10, C13, C14, C15, C20, C21, C22, C32, C43, C44, C58, C59, C68, C73, C74, C75, C85, C92, C104, C106, C108, C112, C114, C116, C117, C120, C139, C140, C145, C148, C150 thru C155, C157 thru C164, C169 thru C172, C174	CAPACITOR, FIXED, CERAMIC; 0.01 uf plus 100% minus 20%, 500 vdcw	912-3013-00
C2, C18, C19, C54, C70	CAPACITOR, FIXED, MICA: 220 uuf ±5%, 500 vdcw	912-2840-00
C3, C31, C60, C84, C121, C179	CAPACITOR, FIXED, CERAMIC: 4700 uuf plus 100% minus 20%, 500 vdcw	913-3012-00
C5, C178	CAPACITOR, FIXED, CERAMIC: 0.02 uf plus 100% minus 20%, 500 vdcw	913-2142-00
C6	CAPACITOR, FIXED, DRY ELECTROLYTIC: dual section, 8 uf 300 vdcw, 25 uf 25 vdcw	183-1479-00
C9, C88, C173	CAPACITOR, PAPER: 0.5 uf plus 20% minus 10%, 200 vdcw	931-0169-00

ITEM	DESCRIPTION	COLLINS PART NO.
C11, C36, C37, C39, C41, C47, C48, C50, C52, C55, C64, C65, C67, C69, C71, C97, C99, C101	CAPACITOR, VARIABLE, CERAMIC: 8 to 50 uuf, 350 vdcw	917-1075-00
C12	CAPACITOR, FIXED, MICA: 33 uuf ±10%, 500 vdcw	912-2781-00
C16	NOT USED	
C17	CAPACITOR, FIXED, MICA: 180 uuf ±10%, 500 vdcw	912-2835-00
C23, C33, C34, C93	CAPACITOR, FIXED, MICA: 10 uuf ±10%, 500 vdcw	912-2754-00
C24	CAPACITOR: part of T1	
C25	CAPACITOR: part of T1	
C26, C35, C46, C63, C95, C96	CAPACITOR, VARIABLE, CERAMIC: 5 to 37.5 uuf, 350 vdcw	917-1073-00
C27	CAPACITOR: included in L4 shield can	
C28	CAPACITOR, FIXED, CERAMIC: 3 uuf ±1/2 uuf, 500 vdcw	916-0145-00
C29	CAPACITOR: included in L4 shield can	
C30, C45, C124, C131, C133, C168	CAPACITOR, FIXED, CERAMIC: 1000 uuf plus 100% minus 20%, 500 vdcw	913-3009-00
C38, C49, C66, C149, C156	CAPACITOR, FIXED, MICA: 51 uuf ±10%, 500 vdcw	912-2796-00
	CAPACITOR, FIXED, MICA: 680 uuf ±2%	

SECTION VI
Parts List

32S-1 Transmitter

ITEM	DESCRIPTION	COLLINS PART NO.
C51, C40	CAPACITOR, FIXED, MICA: 240 uuf $\pm 2\%$, 500 vdcw	912-2842-00
C53	CAPACITOR, FIXED, MICA: 360 uuf $\pm 2\%$, 500 vdcw	912-2854-00
C56, C62	CAPACITOR, FIXED, CERAMIC: 1000 uuf $\pm 10\%$, 500 vdcw	913-4061-00
C57	CAPACITOR, VARIABLE, CERAMIC: 1.5 to 10.5 uuf 350 vdcw	917-1071-00
C61, C72	CAPACITOR, CERAMIC: 10 uuf $\pm 10\%$, 2 KV	913-4507-00
C76, C123, C165	CAPACITOR, FIXED, CERAMIC: 0.001 uf plus 100% minus 20%, 200 vdcw	913-3537-00
C77	CAPACITOR, VARIABLE, AIR: 12.0 uuf min to 250.0 uuf max, 1000 v rms	920-0136-00
C78	CAPACITOR, FIXED, MICA: 20 uuf $\pm 10\%$, 500 vdcw	912-2766-00
C79, C105	CAPACITOR, FIXED, MICA: 130 uuf $\pm 5\%$, 500 vdcw	912-2825-00
C80, C135, C136	CAPACITOR, VARIABLE, MICA: 100 uuf to 500 uuf, 1000 vdcw	918-0006-00
C81	NOT USED	
C82, C83, C142	NOT USED	
C86	CAPACITOR: part of T2	
C87	CAPACITOR, FIXED, PAPER: 0.1 uf plus 20% minus 10%, 200 vdcw	931-0165-00
C89, C90, C94, C109, C175, C180	CAPACITOR, FIXED, MICA: 15 uuf $\pm 10\%$, 500 vdcw	912-2760-00
C91	CAPACITOR, FIXED, MICA: 1000 uuf $\pm 5\%$, 500 vdcw	912-3001-00
C98	CAPACITOR: part of T1	
C100	CAPACITOR, FIXED, MICA: 200 uuf $\pm 10\%$, 500 vdcw	912-2838-00
C102	CAPACITOR, FIXED, MICA: 270 uuf $\pm 10\%$, 500 vdcw	912-2847-00
C103	CAPACITOR, FIXED, MICA: 68 uuf $\pm 10\%$, 500 vdcw	912-2803-00
C107	CAPACITOR, FIXED, PAPER: 0.1 uf $\pm 10\%$, 400 vdcw	931-0299-00
C110	CAPACITOR, FIXED, MICA: 390 uuf $\pm 2\%$, 500 vdcw	912-2857-00
C111	CAPACITOR, FIXED, MICA: 430 uuf $\pm 2\%$, 500 vdcw	912-2970-00
C113	NOT USED	
C115	CAPACITOR, FIXED, CERAMIC: .05 uf, 100 vdcw	913-3679-00
C119	CAPACITOR, FIXED, PAPER: 0.047 uf plus 20% minus 10%, 200 vdcw	931-0295-00
C122	CAPACITOR, FIXED, MICA: 470 uuf $\pm 5\%$, 500 vdcw	912-2974-00
C125 thru C130	CAPACITOR, FIXED, CERAMIC: 500 uuf $\pm 10\%$, 500 vdcw	913-0998-00
C132	CAPACITOR, FIXED, MICA: 330 uuf $\pm 2\%$, 500 vdcw	912-2851-00
C134	CAPACITOR, FIXED, CERAMIC: 1.0 uuf $\pm 1/4$ uuf, 500 vdcw	916-0070-00
C137, C166, C167	CAPACITOR, FIXED, CERAMIC: 1000 uuf plus 90% minus 20%, 500 vdcw	913-1292-00
C141	CAPACITOR, TUBULAR, CERAMIC: 6.0 uuf $\pm 1/2$ uuf, 500 vdcw	916-0122-00
C143	NOT USED	
C144	CAPACITOR, FIXED, CERAMIC: 2 uuf $\pm 1/2$ uuf, 500 vdcw	916-0076-00
C146	CAPACITOR, VARIABLE, MICA: 15 uuf to 120 uuf, 1000 vdcw	918-0005-00
C147	CAPACITOR, VARIABLE, AIR: 13.5 uuf min to 452.3 uuf max ea section, 360 v ac, 60 cps min breakdown	920-0138-00
C165	CAPACITOR, FIXED, CERAMIC: 0.001 uf plus 100% minus 20%, 2000 vdcw	913-3537-00
C177	CAPACITOR, FIXED, DRY, ELECTROLYTIC: 4 uf, vdcw	183-1783-00
CR1, CR2, CR3, CR4	DIODE: germanium, type 1N34A	353-0103-00
DS1	LAMP, INCANDESCENT: 6.3 v, 0.15 amp, min bayonet base, T-3-1/4 bulb, clear Part of M1	262-3240-00
DS2	CORE, ADJUSTABLE TUNING: ferrite slug for tuning r-f coils	288-1662-00
E1, E2, E3, E4, E5	FILTER, BAND PASS: 455.0 kc oper freq, 454.30 to 455.70 kc bandwidth, 17,000 ohms input and output; Collins	526-9337-00
FL1	JACK, TELEPHONE: spring leaf, 2 conductor plug	358-1050-00
J1	JACK, TIP: accommodates 1/8 in. plug, ceramic insulation brass contacts	360-0088-00
J2, J3, J4, J5, J7, J8, J9, J11 thru J20	NOT USED	
J6	CONNECTOR, RECEPTACLE, ELECTRICAL: 11 pin male, phenolic insulation, 5 amp, straight shape	372-1757-00
J10	RELAY: 14,000 ohm coil 115 v dc cont arr 2C and 2A	972-1353-00

ITEM	DESCRIPTION	COLLINS PART NO.
K2	RELAY: 10,000 ohm coil, 115 v dc cont arr 2C	240-1914-00
L1, L5, L7, L10, L17 thru L20, L27	COIL, RADIO FREQUENCY: 220 uh, 0.1 amp	240-0037-00
L2, L3, L26	COIL, RADIO FREQUENCY: 2.0 mh	240-0084-00
L4	TUNING UNIT, RADIO FREQUENCY: 2.945 to 3.165 kc 1 adjustment; included with T1 as a set	278-1712-00
L6, L8	COIL, RADIO FREQUENCY: single layer wound, 13 turns #28 AWG wire; Collins	544-3135-002
L9, L28	COIL, RADIO FREQUENCY: 2.0 mh	240-0134-00
L10	COIL, RADIO FREQUENCY: 22 uh	240-0186-00
L11	COIL, RADIO FREQUENCY: single layer wound, 12 turns #28 AWG wire; Collins	543-8028-00
L12	COIL: part of Z1	
L13	COIL: part of Z2	
L14	COIL, RADIO FREQUENCY: single layer wound, 220 turns #32 AWG wire, wound on 1/2 in. dia by 3 in. lg ceramic form; Collins	546-8024-00
L15	COIL, RADIO FREQUENCY: 32 turns #18 AWG wire, ea turn tapped; 3 in. lg by 1 in. OD; Collins	506-7848-002
L16	COIL, RADIO FREQUENCY: single layer wound, 22 turns #28 AWG wire; Collins	543-8123-002
L21	COIL, RADIO FREQUENCY: single layer wound, 12 turns #28 AWG wire; Collins	544-3136-002
L22	NOT USED	
L24	COIL, RADIO FREQUENCY: 2.5 mh, 0.125 amp	240-2100-00
L25	COIL, RADIO FREQUENCY: 7-1/2 turns #14 AWG wire; Collins	543-8068-00
L29	P/O Z4	
L30	P/O Z5	
M1	MULTIMETER: 0-1 ma movement	458-0454-00
P1	CABLE ASSEMBLY: 8 in. lg, phono plug on one end	426-1809-00
P2	NOT USED	
P3	CABLE ASSEMBLY: 4 in. lg, phono plug on one end	426-1810-00
R1	RESISTOR, FIXED, COMPOSITION: 680 ohms $\pm 10\%$, 1/2 w	745-1345-00
R2	RESISTOR, FIXED, COMPOSITION: 47K ohms $\pm 10\%$, 1 w	745-3422-00
R3, R71, R91, R96, R100, R111, R113	RESISTOR, FIXED, COMPOSITION: 470K ohms $\pm 10\%$, 1/2 w	745-1464-00
R88	RESISTOR, FIXED, COMPOSITION: 1500 ohms $\pm 10\%$, 1/2 w	745-1359-00
R5, R60, R63, R76, R82	RESISTOR, FIXED, COMPOSITION: 47K ohms $\pm 10\%$, 1/2 w	745-1422-00
R6, R16, R24, R25, R33, R37, R38, R47, R61, R62, R78, R80, R105, R114, R117	RESISTOR, FIXED, COMPOSITION: 100K $\pm 10\%$, 1/2 w	745-1436-00
R7	RESISTOR, FIXED, COMPOSITION: 10K ohms $\pm 10\%$, 2 w	745-5694-00
R8	RESISTOR, VARIABLE, COMPOSITION: 500K ohms $\pm 30\%$, 1/4 w, with SPST switch	376-7403-00
R9, R59, R73, R100, R115	RESISTOR, FIXED, COMPOSITION: 220K ohms $\pm 10\%$, 1/2 w	745-1450-00
R10, R35, R36	RESISTOR, FIXED, COMPOSITION: 220 ohms $\pm 10\%$, 1/2 w	745-1324-00
R11	RESISTOR, FIXED, COMPOSITION: 180K ohms $\pm 10\%$, 1/2 w	745-1447-00
R12, R103	RESISTOR, FIXED, COMPOSITION: 15K ohms $\pm 10\%$, 2 w	745-5701-00
R13, R15	RESISTOR, FIXED, COMPOSITION: 270 ohms $\pm 10\%$, 1/2 w	745-1328-00
R14, R20	RESISTOR, VARIABLE, COMPOSITION: 250 ohms $\pm 30\%$, 0.2 w	376-4602-00
R17, R18	RESISTOR, FIXED, COMPOSITION: 33K ohms $\pm 10\%$, 1 w	745-3415-00
R19	RESISTOR, FIXED, COMPOSITION: 120 ohms $\pm 10\%$, 1/2 w	745-1314-00
R21, R116	RESISTOR, FIXED, COMPOSITION: 47 ohms $\pm 10\%$, 1 w	745-3296-00
R22	RESISTOR, FIXED, COMPOSITION: 39K ohms $\pm 10\%$, 1/2 w	745-1419-00
R23, R39	RESISTOR, FIXED, COMPOSITION: 180 ohms $\pm 10\%$, 1/2 w	745-1321-00
R26, R28	RESISTOR, FIXED, COMPOSITION: 560 ohms $\pm 10\%$, 1/2 w	745-1342-00
R27	RESISTOR, VARIABLE, COMPOSITION: 500 ohms $\pm 30\%$, 0.2 w	376-4603-00
R29, R30	RESISTOR, FIXED, COMPOSITION: 4700 ohms $\pm 10\%$, 2 w	745-5680-00
R31	RESISTOR, FIXED, COMPOSITION: 12K ohms $\pm 10\%$, 1/2 w	745-1398-00
R32	RESISTOR, FIXED, COMPOSITION: 33 ohms $\pm 10\%$, 1/2 w	745-1289-00

32S-1 Transmitter

ITEM	DESCRIPTION	COLLINS PART NO.
R34	RESISTOR, FIXED, COMPOSITION: 2200 ohms $\pm 10\%$, 1/2 w	745-1366-00
R40, R107, R108	RESISTOR, FIXED, COMPOSITION: 10K ohms $\pm 10\%$, 1/2 w	745-1394-00
R41	RESISTOR, FIXED, COMPOSITION: 22K ohms $\pm 10\%$, 2 w	745-5708-00
R42, R92, R95	RESISTOR, FIXED, COMPOSITION: 100 ohms $\pm 10\%$, 1/2 w	745-1310-00
R43	RESISTOR: part of Z1	
R44, R45, R46, R49, R50, R51	RESISTOR, FIXED, COMPOSITION: 12 ohms $\pm 5\%$, 1/2 w	745-1271-00
R48	RESISTOR: part of Z2	
R52, R54, R77, R66, R83	RESISTOR, FIXED, COMPOSITION: 1000 ohms $\pm 10\%$, 1/2 w	745-1352-00
R53	RESISTOR, FIXED, COMPOSITION: 18K ohms $\pm 10\%$, 1/2 w	745-1405-00
R55	RESISTOR, FIXED, COMPOSITION: 680K ohms $\pm 10\%$, 1/2 w	745-1471-00
R56	RESISTOR, FIXED, COMPOSITION: 3.3 megohms $\pm 10\%$, 1/2 w	745-1499-00
R57, R65, R72, R75, R84, R101, R118	RESISTOR, FIXED, COMPOSITION: 1.0 megohms $\pm 10\%$, 1/2 w	745-1478-00
R58	RESISTOR, FIXED, COMPOSITION: 33K ohms $\pm 10\%$, 1/2 w	745-1415-00
R67	RESISTOR, FIXED, COMPOSITION: 270K ohms $\pm 10\%$, 1/2 w	745-1454-00
R68	RESISTOR, FIXED, COMPOSITION: 120K ohms $\pm 10\%$, 1/2 w	745-1440-00
R69, R64	RESISTOR, FIXED, COMPOSITION: 68K ohms $\pm 10\%$, 1/2 w	745-1429-00
R70	NOT USED	
R74	RESISTOR, VARIABLE, COMPOSITION: 500K ohms $\pm 30\%$, 1/4 w, incl spdt switch	376-7201-00
R79, R81	RESISTOR, FIXED, COMPOSITION: 8.2 megohms $\pm 10\%$, 1/2 w	745-1517-00
R85	RESISTOR, VARIABLE, COMPOSITION: 500K ohms $\pm 30\%$, 1/4 w	376-7202-00
R86	RESISTOR, VARIABLE, COMPOSITION: 10 megohms $\pm 30\%$, 1/4 w	376-7206-00
R87, R4	RESISTOR, FIXED, COMPOSITION: 470 ohms $\pm 10\%$, 1/2 w	745-1338-00
R64, R89, R112	RESISTOR, FIXED, COMPOSITION: 68K ohms $\pm 10\%$, 2 w	745-5729-00
R90	RESISTOR, FIXED, COMPOSITION: 15K ohms $\pm 10\%$, 1/2 w	745-1401-00
R93, R94	RESISTOR, FIXED, COMPOSITION: 8200 ohms $\pm 10\%$, 2 w	745-5691-00
R97	RESISTOR, FIXED, COMPOSITION: 3900 ohms $\pm 10\%$, 1/2 w	745-1377-00
R98	NOT USED	
R99	RESISTOR, FIXED, COMPOSITION: 2.2 megohms $\pm 10\%$, 1/2 w	745-1492-00
R102	NOT USED	
R106	RESISTOR, FIXED, COMPOSITION: 22K ohms $\pm 10\%$, 1/2 w	745-1408-00
R109	RESISTOR, FIXED, COMPOSITION: 47 ohms $\pm 10\%$, 1/2 w	745-1296-00
R113	RESISTOR, FIXED, COMPOSITION: 1200 ohms, 2 watts	745-5656-00
R114	RESISTOR, FIXED, WIRE WOUND: 15K ohms, 7 watts	710-9001-00
R119	P/O Z4	
R120	P/O Z5	
S1, S2, S3	SWITCH SECTION, ROTARY: 1 circuit, 14 position, 1 section, 1 moving contact, 8 fixed contacts	269-1980-00
S4	SWITCH SECTION, ROTARY: 2 circuit, 14 position, 2 moving contacts, 17 fixed contacts	269-1983-00
S5	SWITCH SECTION, ROTARY: 1 circuit, 14 position, 1 section, 2 moving contacts, 20 fixed contacts	269-1981-00
S6	SWITCH SECTION, ROTARY: 1 circuit, 14 position, 1 section, 2 moving contacts, 12 fixed contacts	269-1982-00
S7	SWITCH, ROTARY: 2 circuit, 3 position, 1 section, 2 moving contacts, 8 fixed contacts	259-0955-00
S8	SWITCH, ROTARY: 5 section, 5 position, 10 moving contacts, 60 fixed contacts	259-0954-00
S9	SWITCH, ROTARY: 8 circuit, 4 position, 2 section, 8 moving contacts, 32 fixed contacts	259-0953-00
S10	Part of R74	
S11	SWITCH, ROTARY: 1 circuit, 14 position, 1 moving contact, 15 fixed contacts	269-2023-00
S14	Part of R8	
T1	TRANSFORMER, INTERMEDIATE FREQUENCY: 2.945 to 3.165 kc frequency range; includes C24, C25 and C98	278-1712-00
T2	TRANSFORMER, INTERMEDIATE FREQUENCY: 455 kc nom includes C86	278-0276-00
V1, V2, V11	ELECTRON TUBE: type 6U8A	255-0328-00
V3, V12	ELECTRON TUBE: 6DC6	255-0226-00
V4, V5, V14	ELECTRON TUBE: type 12AT7	255-0205-00
V6	ELECTRON TUBE: type 6AH6	255-0191-00
V7	ELECTRON TUBE: type 6CL6	255-0216-00

ITEM	DESCRIPTION	COLLINS PART NO.
V8, V9	ELECTRON TUBE: type 6146	256-0101-00
V10, V13	ELECTRON TUBE: type 6AL5	257-0018-00
XDS1	LAMPHOLDER: miniature bayonet, clip mounting	262-1210-00
Y1 thru Y11	CRYSTALS: MIL-C-3098 type CR18/U, holder type HC-6 $\pm 0.005\%$ frequency tolerance	
	CRYSTAL FREQUENCY FOR OPERATING FREQUENCY	
Y1	6.555 mc	3.4 - 3.6 mc
Y2	6.755 mc	3.6 - 3.8 mc
Y3	6.955 mc	3.8 - 4.0 mc
Y4	10.155 mc	7.0 - 7.2 mc
Y5	10.355 mc	7.2 - 7.4 mc
Y6	8.5775 mc	14.0 - 14.2 mc
Y7	8.6775 mc	14.2 - 14.4 mc
Y8	12.0775 mc	21.0 - 21.2 mc
Y9	12.1775 mc	21.2 - 21.4 mc
Y10	12.2775 mc	21.4 - 21.6 mc
Y11	15.8275 mc	28.5 - 28.7 mc
Y12	NOT SUPPLIED	
Y13	NOT SUPPLIED	
	CRYSTALS: MIL-C-3098 type CR46/U, holder type HC-6/U $\pm 0.01\%$ frequency tolerance	
Y14	453.650 kc	290-8705-00
Y15	456.350 kc	290-8706-00
Z1, Z2	SUPPRESSOR, PARASITIC: 2 turns no. 16 AWG wire, 47 ohm resistor, 2 w; Collins	543-8022-002
Z3	SUPPRESSOR, PARASITIC: 6 turns no. 22 wire, 33 ohm resistor, 1/2 w	545-6146-00
Z4, Z5	SUPPRESSOR, PARASITIC: 4 turns #20 wire, 470 ohm resistor, 1/2 w	548-8217-00
	70K-2 OSCILLATOR	522-1093-00
	Consisting of following parts:	
C301	Select per operational requirement	
	CAPACITOR, FIXED, CERAMIC: 20 uuf $\pm 5\%$, 500 vdcw; Centralab no. DA933-022 (X)	913-0053-00
	CAPACITOR, FIXED, CERAMIC: 20 uuf $\pm 5\%$, 500 vdcw; Centralab no. DA933-006 (X)	913-0054-00
	CAPACITOR, FIXED, CERAMIC: 20 uuf $\pm 5\%$, 500 vdcw; Centralab no. DA933-007 (X)	913-0055-00
	CAPACITOR, FIXED, CERAMIC: 20 uuf $\pm 5\%$, 500 vdcw; Centralab no. DA933-008	913-0056-00
	CAPACITOR, FIXED, CERAMIC: 20 uuf $\pm 5\%$, 500 vdcw; Centralab no. DA934-017 (X)	913-0057-00
	CAPACITOR, FIXED, CERAMIC: 20 uuf $\pm 5\%$, 500 vdcw; Centralab no. DA934-018 (X)	913-0058-00
	CAPACITOR, FIXED, CERAMIC: 20 uuf $\pm 10\%$, 500 vdcw; Centralab no. DA934-023 (X)	913-0232-00
	CAPACITOR, FIXED, CERAMIC: 20 uuf $\pm 10\%$, 500 vdcw; Centralab no. DA934-024 (X)	913-0233-00
	CAPACITOR, FIXED, CERAMIC: 20 uuf $\pm 10\%$, 500 vdcw; Centralab no. DA934-025 (X)	913-0234-00
C302	CAPACITOR, FIXED, MICA: 1100 uuf $\pm 2\%$, 500 vdcw; Electromotive type DM-20	912-1747-00
C303	CAPACITOR, FIXED, MICA: 300 uuf $\pm 10\%$, 500 vdcw; Electromotive type DM-20	912-1748-00
C304	CAPACITOR, FIXED, MICA: 200 uuf $\pm 2\%$, 500 vdcw; Electromotive no. VCM15E201G	912-0514-00
C305	CAPACITOR, FIXED, CERAMIC: 100 uuf $\pm 2\%$, 500 vdcw; Centralab	913-0074-00
	CAPACITOR, FIXED, CERAMIC: 100 uuf $\pm 2\%$, 500 vdcw; Centralab no. DA933-017 (X)	913-0246-00
C306	CAPACITOR, FIXED, CERAMIC: dual section, ea section 0.01 uf plus 60 minus 40%, 250 vdcw; Centralab type DA148	913-2096-00
C307	CAPACITOR, FIXED, CERAMIC: 0.02 uf plus 60 minus 40%, 250 vdcw; Centralab type DA148	913-2097-00
C308	CAPACITOR, VARIABLE, CERAMIC: 5.0 uuf min to 37.5 uuf max, 350 vdcw; Erie Resistor type 557	917-1073-00
CR301	SEMICONDUCTOR DEVICE, DIODE: germanium, type 1N34A; Sylvania Electric	353-0103-00
L304	COIL, RADIO FREQUENCY: single layer wound, magnet wire, 3.30 uh; Jeffers Electronics type 102	240-0695-00
R301, R303	RESISTOR, FIXED, COMPOSITION: 0.10 megohms $\pm 10\%$, 1/2 w; MIL RC20GF104K	745-1436-00
R302	RESISTOR, FIXED, COMPOSITION: 82,000 ohms $\pm 10\%$, 1/2 w; MIL RC20GF823K	745-1433-00
T301	TRANSFORMER, RADIO FREQUENCY: pri 380 uhy nom, 790 kc; sec 2.7 uhy nom, 2.6 mc, Comm. Coil	240-0665-00
V301	ELECTRON TUBE: 6AU6 type; G.E.	255-0202-00

SECTION VII ILLUSTRATIONS

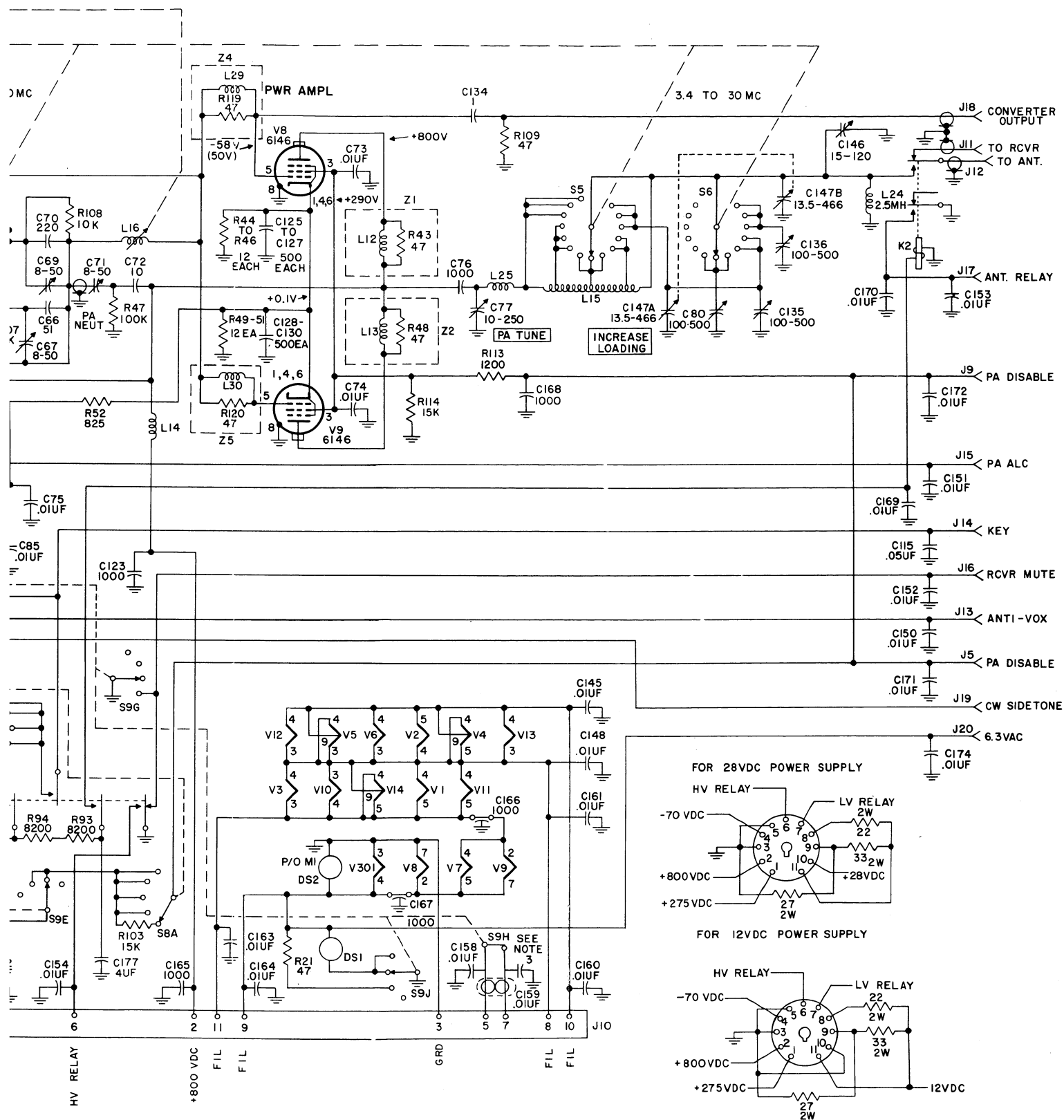
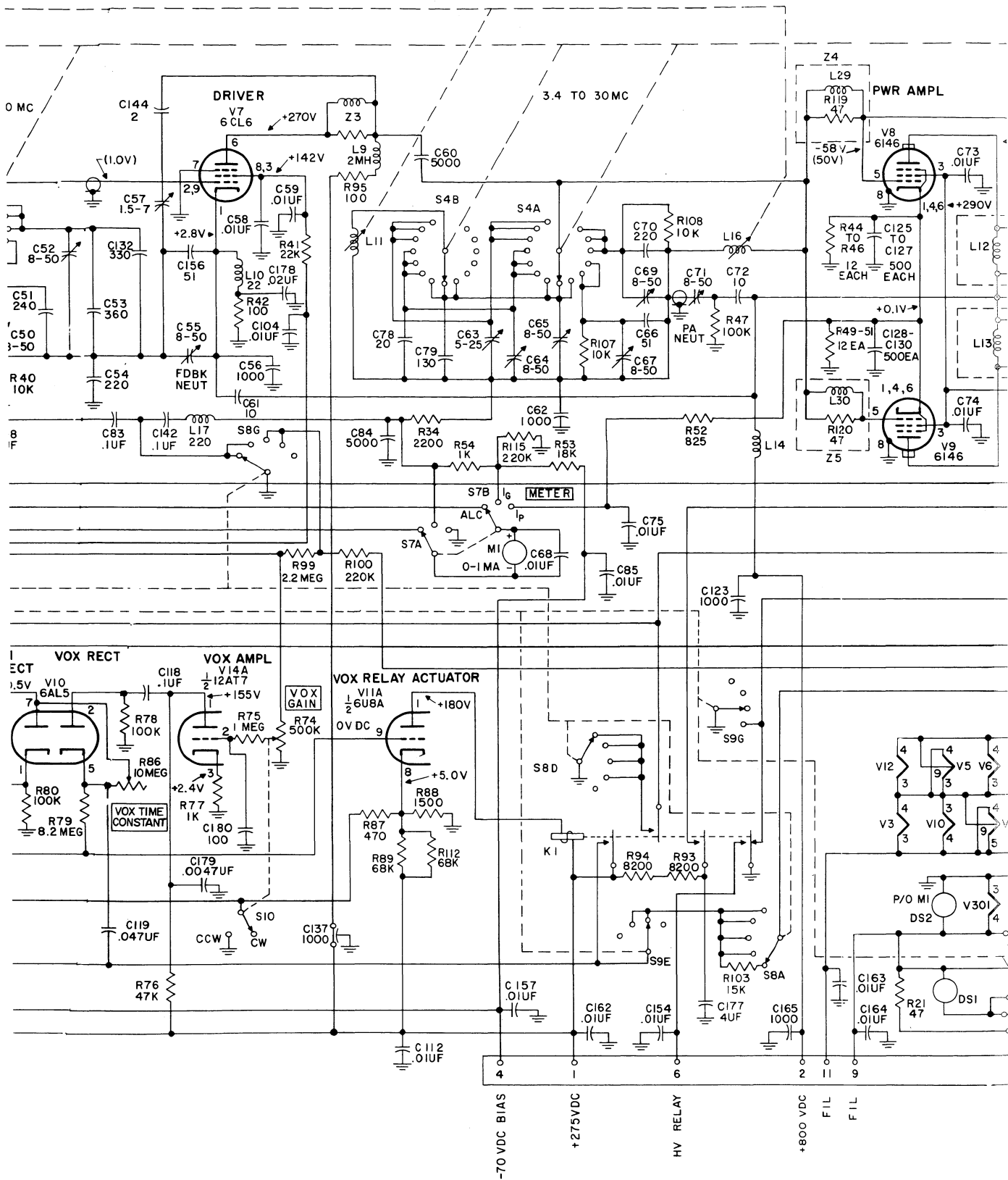
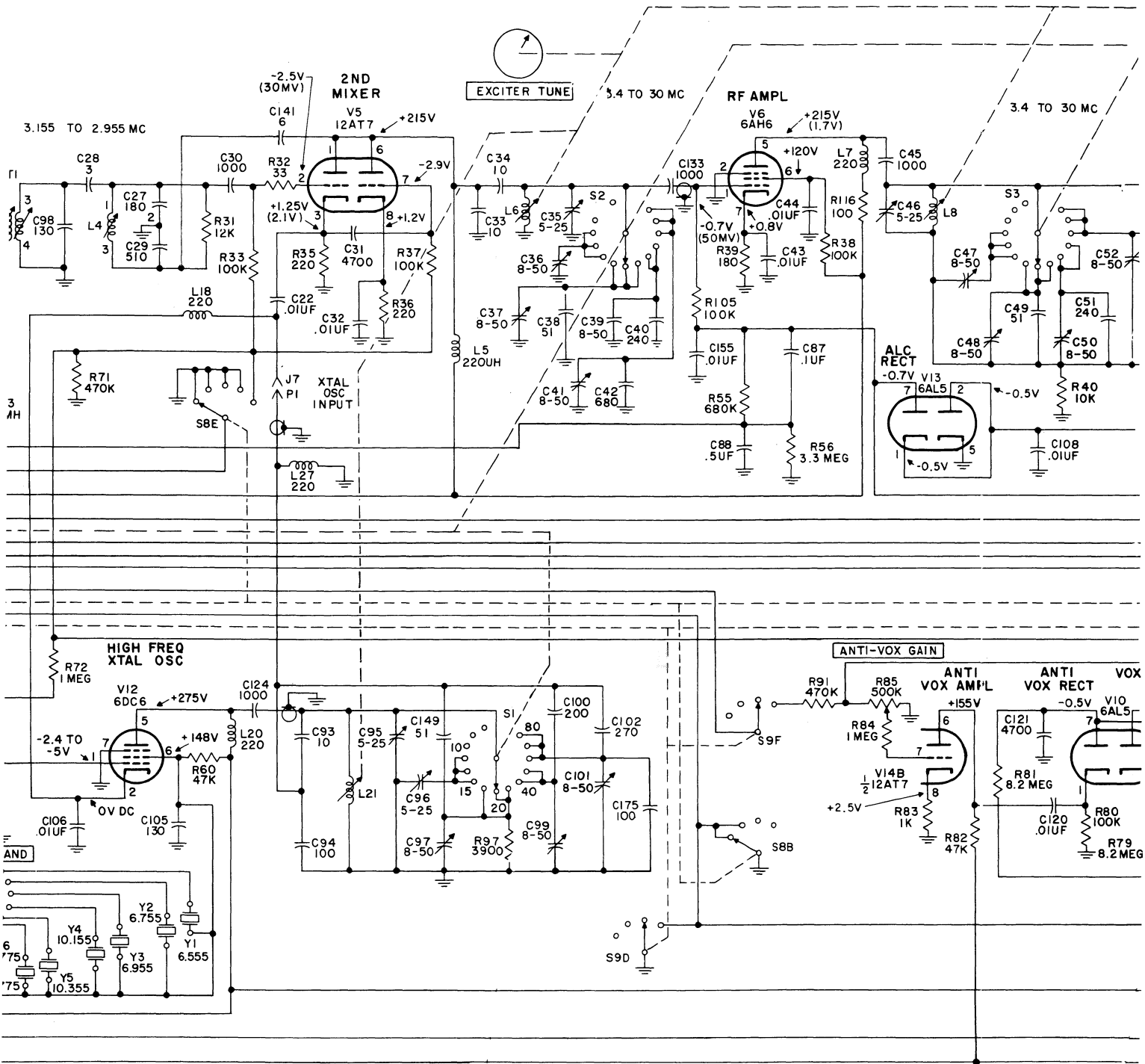
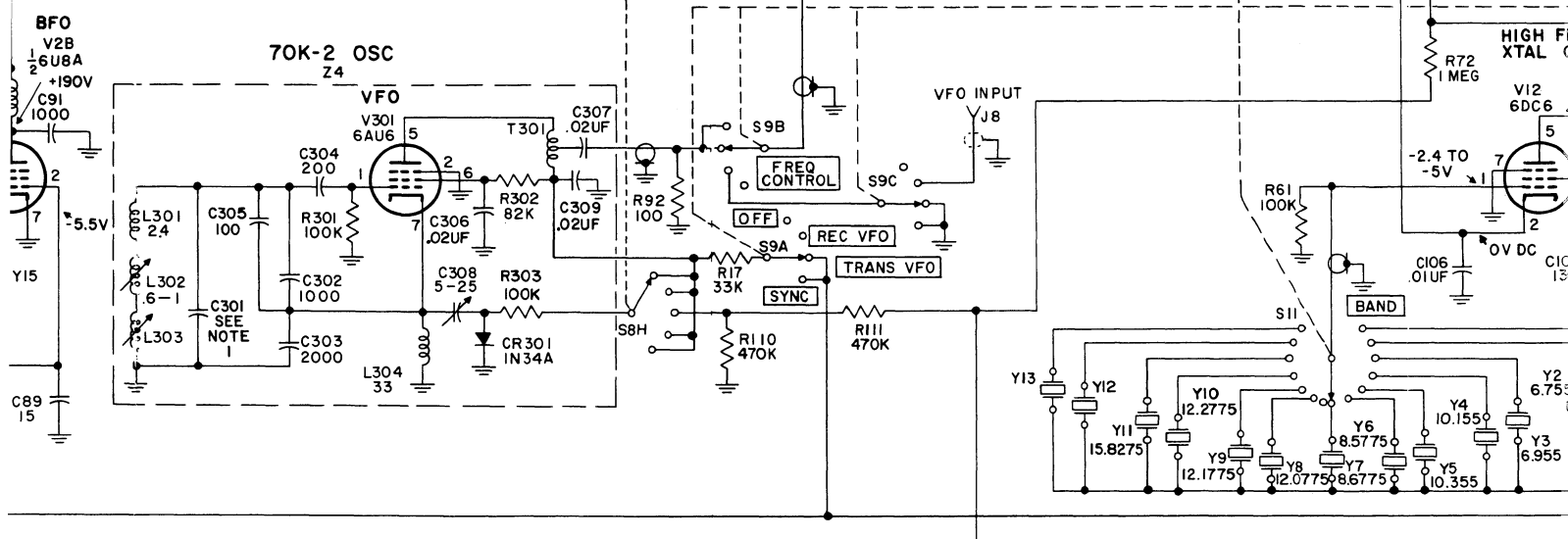
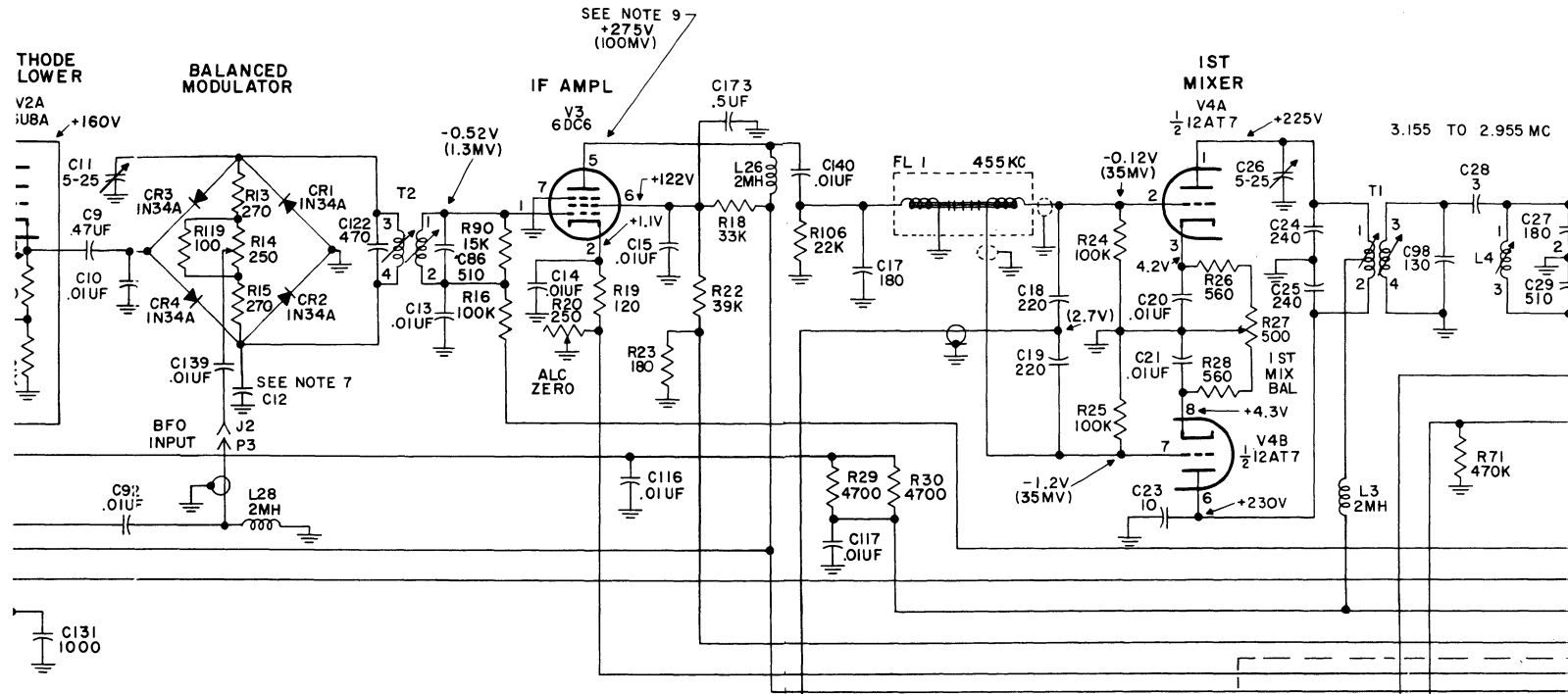


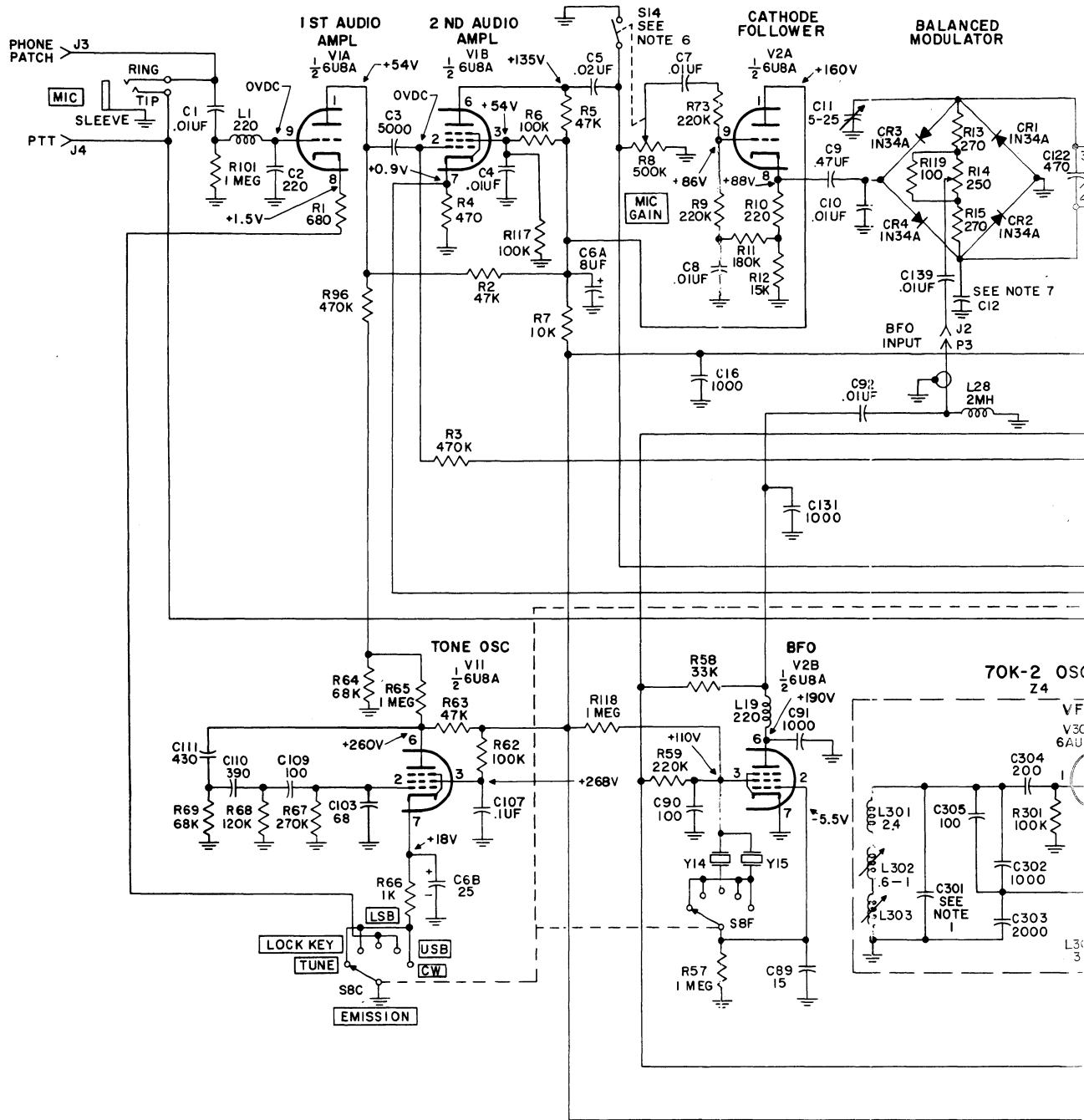
Figure 7-1. 32S-1 Transmitter, Schematic Diagram





- NOTES:
1. VALUE OF C301 SELECTED IN FINAL TEST.
 2. FREQUENCIES OF CRYSTALS Y12 AND Y13 CHOSEN BY CUSTOMER NOT FURNISHED WITH EQUIPMENT.
 3. SWITCH OPEN ONLY IN OFF POSITION.
 4. ALL SWITCHES ARE VIEWED FROM KNOB OR DRIVEN END.
 5. UNLESS OTHERWISE INDICATED ALL RESISTANCE VALUES ARE IN OHMS, ALL CAPACITANCE VALUES ARE IN UUF, AND ALL INDUCTANCE VALUES ARE IN UH.
 6. S14 IS CLOSED WHEN R8 IS IN MAXIMUM COUNTERCLOCKWISE POSITION.
 7. SELECTED IN PRODUCTION.
 8. THIS DRAWING, CURRENT AS OF 10-27-61
 9. VALUES IN PARENTHESES ARE NOMINAL RF VOLTAGES FOR NORMAL OPERATION.





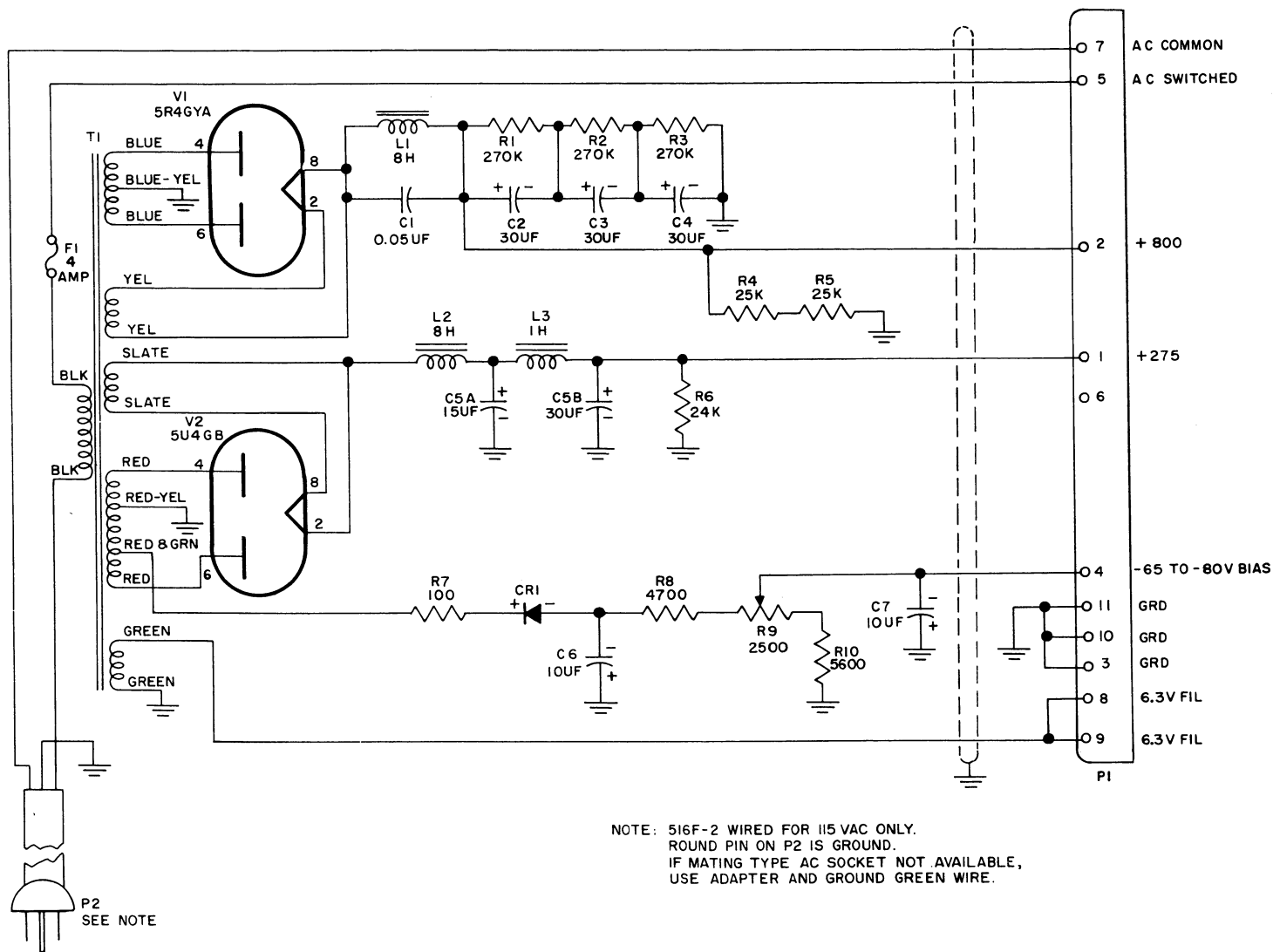


Figure 7-2. 516F-2 Power Supply, Schematic Diagram

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