The NATIONAL
NC 303
COMMUNICATIONS RECEIVER

EST. ® 1914

STANDARD FORM WARRANTY

ADOPTED BY THE RADIO MANUFACTURERS ASSOCIATION, INC.

This equipment is warranted to be free from defective material and workmanship and repair or replacement will be made of any part which under normal installation, use and service discloses defect, provided the unit is delivered by the owner to the manufacturer or through the authorized radio dealer or wholesaler from whom purchased, intact, for examination, with all transportation charges prepaid to the factory, within ninety days from the date of sale to original purchaser, and provided that such examination, discloses in the manufacturer's judgment that it is thus defective.

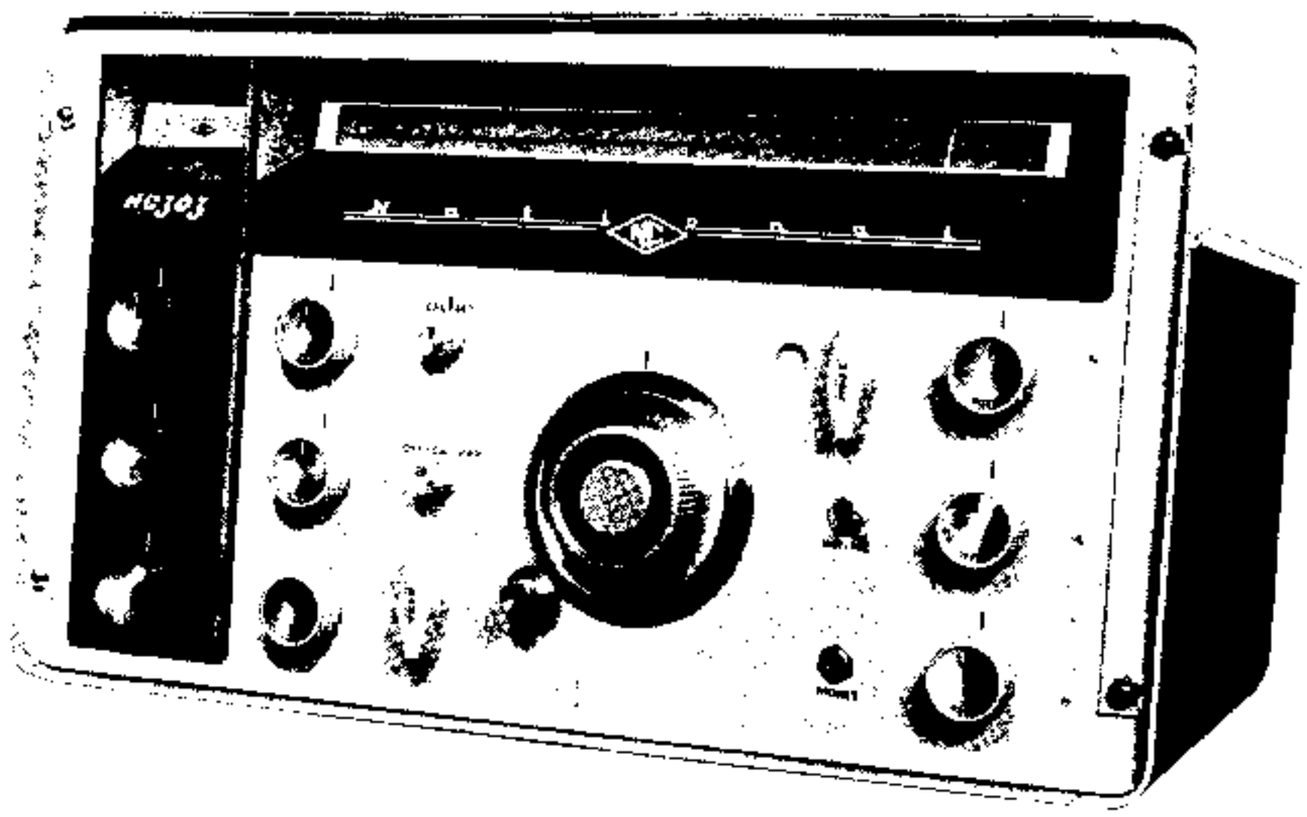
This warranty does not extend to any radio products which have been subjected to misuse, neglect, accident, incorrect wiring, improper installation, or to use in violation of instructions furnished by the manufacturer, nor extend to units which have been repaired or altered outside of the factory, nor to cases where the serial number thereof has been removed, defaced or changed, nor to accessories used therewith of other manufacture.

Any part of a unit approved for remedy or exchange hereunder will be remedied or exchanged by the authorized radio dealer or wholesaler without charge to the owner.

This warranty is in lieu of all other warranties expressed or implied and no representative or person is authorized to assume for the manufacturer any other liability in connection with the sale of their radio products.

National Company, Inc. reserves the right to make any

INSTRUCTION MANUAL
for the



NATIONAL NC303
COMMUNICATIONS RECEIVER

SECTION 1 DESCRIPTION

1.1 GENERAL

Your National Model NC-303 is an amateur-band receiver incorporating all the design features necessary to provide optimum performance consistent with present day operating requirements. Elimination of general frequency coverage and all circuits not pertinent to amateur operation has enabled National to produce a compact, efficient receiver with the built-in rugged dependability characteristic of National Company products. Contributing to the utility of the receiver are a Q multiplier rejection notch, an S-meter, variable IF selectivity plus selectable SSB with a fast-attack — slow-release AGC circuit, a muting circuit, a heterodyne detector, and separate noise limiters for AM and for SSB and CW reception. These operational features as well as basic design improvements result in a receiver with exceptional oscillator stability, high sensitivity, and extreme versatility.

Your NC-303 features a double-conversion superheterodyne circuit employing 15 tubes including the rectifier, voltage regulator and current stabilizer. Through careful selection of intermediate frequencies, excellent selectivity and image rejection have been achieved. Frequency coverage includes the 160, 80, 40, 20, 15, 11 and 10 meter bands plus the "X" band. The "X" band functions as a tunable IF in the 30- to 35-megacycle range for use with broad-band crystal converters available from the National Company. Individual scales provide direct reading calibration for 6, 2 and 1¼ meters. Each amateur band has an individual calibrated dial scale. Tuning is facilitated by the fact that only the calibrated dial scale that is in use is visible. Band-scanning is accomplished with ease as a result of the use of a heavily-weighted tuning knob coupled to a free-moving gear train. The tuning knob has a rim-drive vernier to aid in fine tuning. Careful attention to mechanical design has resulted in tuning action without any trace of backlash.

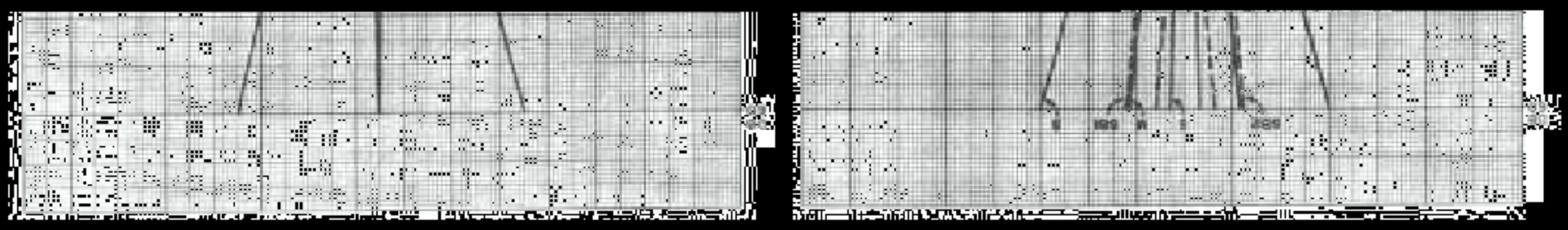
The outward appearance of the receiver is completely modern and functional. Cabinet and panel construction permits the receiver to be removed from the cabinet and rack mounted without the addition of any parts other than mounting hardware. Adequate ventilation is provided by the use of convection cooling through holes in the chassis and perforated cabinet lid.

1.2 FREQUENCY COVERAGE

Your NC-303 tunes all the amateur bands from 160 [illegible] to 35 m band designated

1.4 IF SELECTIVITY

The IF passband may be set at S(400 cps), SBI(2 kc), SB2(2 kc), M(3.5 kc), or B(8 kc) at the operator's



1.11 CONVERTERS AND CABINET

The National NC-300C1, NC-300C2 and NC-300C6A broad-band, crystal-controlled converters tune the 1¼-, 2-, and 6-meter bands respectively. The slide rule dial of your NC-303 incorporates three separate dial scales to provide direct-reading frequency calibration when the converters are used with the receiver. All operating voltages required by the converters are available at the accessory socket of your NC-303.

The National NC-303 converter cabinet is designed to provide a convenient and attractive means of mounting the converters. From one to three converters may be mounted in the cabinet which matches the receiver cabinet and is identical in size to the NC-303 speaker cabinet. A four-position switch is mounted on the front panel to permit operation of the receiver or any one of the three converters without changing connections to the receiver or antenna.

1.12 S-METER

The S-meter gives the operator a true indication of relative strength of incoming signals. The meter is calibrated in S units from 0 to 9 and in decibels from S-9 to 40 db over S-9. A potentiometer is provided on the chassis to zero-set the meter.

1.13 TUBE FUNCTIONS

The following table lists the types and functions of all tubes used in your NC-303:

TUBE TYPE	FUNCTION
6BZ6	RF Amplifier
6AH6	HF Oscillator
6BA7	First Mixer
6BE6	Second Converter
12AX7	Q Multiplier
6BJ6	First IF Amplifier
6BJ6	Second IF Amplifier
6AL5	AM Detector, Noise Limiter, AGC
6AL5	SSB-CW Noise Limiter
6BE6	Product Detector
12AT7	S-meter Amplifier and AF Amplifier
6AQ5	Audio Output Amplifier
5Y3GT	High Voltage Rectifier
OB2	Voltage Regulator
4H4-C	Current Stabilizer
1N1692	AGC Clamp Diode

1.14 POWER REQUIREMENTS

Your NC-303 requires a 105-130 volt, 50/60 cycle AC source of supply. Power consumption is approximately 70 watts.

1.15 CALIBRATOR SOCKET

A socket is provided on the chassis to permit insertion of the National XCU-303 or XCU-300 crystal calibrator unit. When the OFF-CAL-WWV switch on your NC-303 is in the CAL position 100 kc markers are generated for checking dial calibration. When it is in the WWV position, the calibrator can be checked against the 10 mc WWV signal. Calibration of the crystal calibrator frequency against WWV is available only with the XCU-303 calibrator.

1.16 ACCESSORY SOCKET

The accessoty socket provided at the left rear corner of the chassis is designed to accept suitable external accessories within the power limitations of 1.5 amperes at 6.3 volts AC and 25 milliamperes at 150 volts DC. See the schematic diagram for pin connections. Refer to Section 3 for instructions on the use of external accessories.

SECTION 2 INSTALLATION

2.1 GENERAL

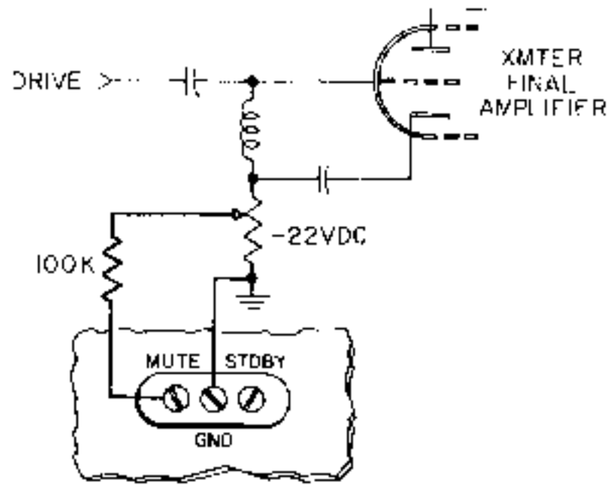
All installation procedures are described in this section. Figure 2 locates connection points on the receiver and depicts typical installations. Before proceeding with installation, raise the hinged cover of your receiver and make sure that all tubes are seated firmly in their sockets.

2.2 LOUDSPEAKER

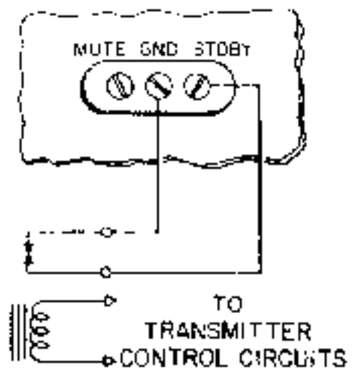
A National type NTS-2 speaker or any permanent magnet dynamic speaker with a 3.2-ohm voice coil may be connected to the speaker terminals. No polarity need be observed.

2.3 CHANGEOVER RELAY

A terminal marked RELAY is mounted at the rear of your receiver. When the XMT-REC switch is set at XMT, the two RELAY terminals are shorted. Thus, they may be used to complete any external relay circuit whether it be AC or DC so long as the circuit require-

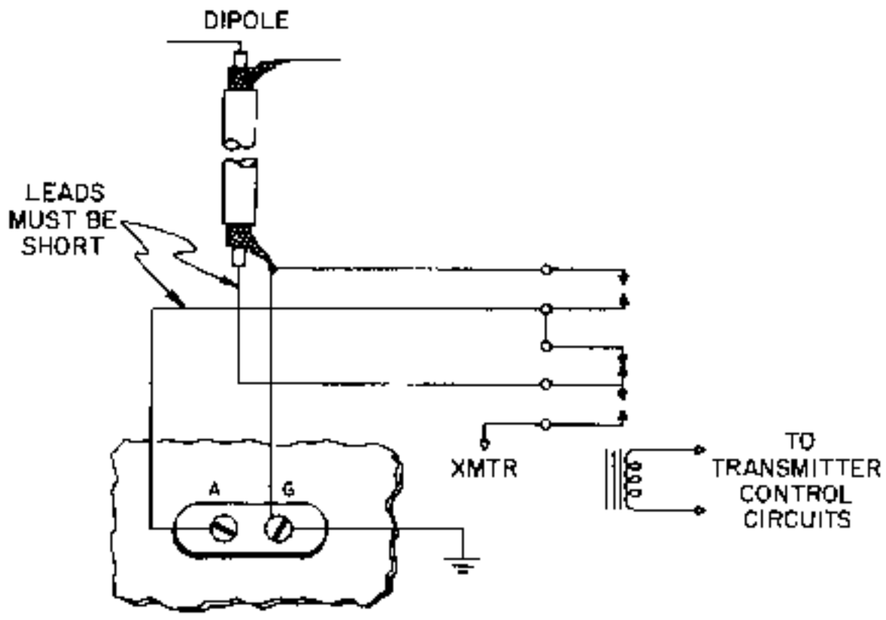


GRID BLOCK METHOD

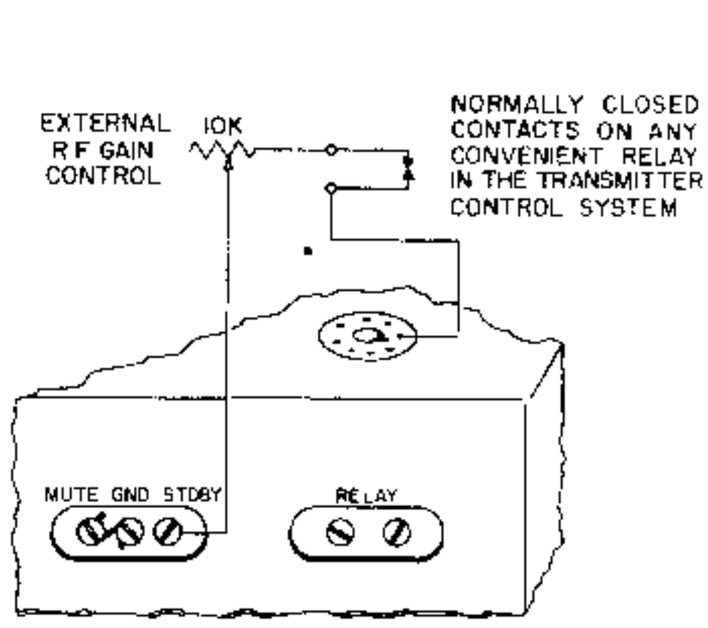


RELAY METHOD

RECOMMENDED MUTING INSTALLATIONS



RECOMMENDED ANTENNA CHANGEOVER AND SHORTING RELAY INSTALLATION



METHOD OF WIRING EXTERNAL RF GAIN CONTROL

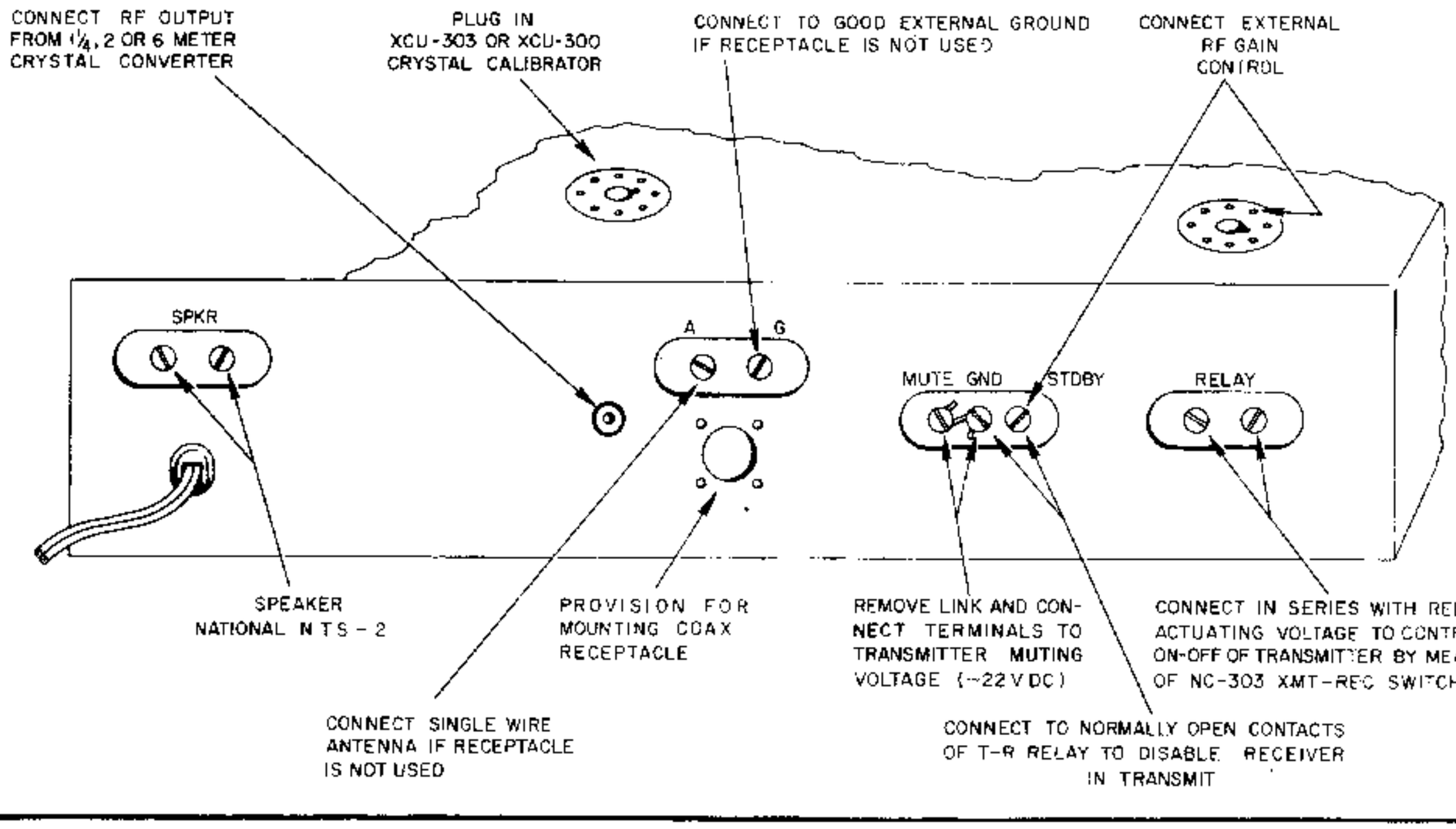


Figure 2. Typical Installation Plan

ments do not exceed 5 amps at 125 volts AC. A typical circuit might consist of a 110-volt AC antenna change-over relay in parallel with the transmitter plate supply relay, with one side of the AC line broken by the NC-303 RELAY connector strip. When connected in this manner the XMT-REC switch on the receiver front panel performs all the required change-over operations for the entire station.

2.4 MUTING

A MUTE-GND-STDBY terminal strip is mounted at the rear of the receiver. These three terminals provide for two entirely different methods of receiver muting during transmitting periods. With no external connections made to the strip, the receiver will be muted whenever the XMT-REC switch is placed in XMT position. If muting is not desired (for transmitter monitoring etc.) a jumper wire may be connected between STDBY and GND. The receiver now operates regardless of the XMT-REC switch position. For remote switching of the receiver, connect leads from the remote switch to the STDBY and GND terminals leaving

Any of the popular dipoles, beams etc., which are fed with 50- to 70 ohm coaxial cable will be ideal. In installations where it is desired to use an already existing antenna with a 300-ohm balanced feedline, an antenna coupler such as a balun can be used to match this antenna to the 70-ohm unbalanced input of your NC-303. The balun may be either a quarter-wave section of coax or a pair of balun coils.

NOTE

If the receiver is used in close proximity to the transmitting equipment some provision must be made to short the antenna terminals to ground during transmitting periods to prevent damage to the antenna coils. This is most easily accomplished by means of a relay connected to the antenna terminals and ground. The relay should be located within six inches of the antenna terminal strip to prevent excessive pick-up.

A chassis hole is located close to the A-G terminal strip to permit attachment of a flange-mounted coax receptacle. Removal of the lead from terminal A and reconnection to the center terminal of the receptacle will then enable the user to utilize an antenna coax

SECTION 3 OPERATION

CW and SSB signals will be obtained with the ANL control set between the 6 o'clock and 10 o'clock positions depending upon the signal strength of the received signal. The CW-SSB limiter is double-ended and clips both positive and negative noise peaks. Noise conditions will vary with localities, so the limiting level is a matter of personal choice.

CAL-SET (Dial Pointer Adjustment) — This control provides calibration correction for each band when used with an XCU-303 or XCU-300 crystal calibrator. With the mode switch at CW and the crystal calibrator switched on, tune your receiver to zero beat at any 100-kc point of the band, any slight error in dial reading may be corrected by turning the CAL-SET control to move the pointer to the desired 100-kc dial position. This is a mechanical adjustment of the dial pointer and in no way affects the receiver's oscillator frequency.

ANT (Antenna Trimmer) — This control is included to provide a means of matching the RF tuned circuits to varying antenna impedances. After the desired signal

produce maximum S-meter readings. If desired, the ANT can be peaked on noise without signal.

for CW reception when the SELECT control is in the S position.

SELECT — IF amplifier selectivity is determined by the position of this control. Position S provides the extremely-sharp selectivity required for CW reception on crowded bands. In this position, a selectivity bandwidth of 400 cps centered at 80 kc is obtained. Positions SB1 and SB2 allow instantaneous selection of sidebands for SSB and AM operation with the proper bandwidth necessary for high-quality interference-free reception. Positions SB1 and SB2 each have a bandwidth of 2000 cps and are centered on approximately 81.5 and 78.5 kc respectively. Position M provides the optimum bandwidth for good-quality interference-free AM reception. In this position, a bandwidth of 3500 cps centered on 80 kc is obtained. Position B allows high-quality reception where interference is not a problem and provides a wide bandwidth for net or VHF operation. The bandwidth in this position is 8000 cps centered on 80 kc.

teristics of the audio circuits is permitted by the TONE control. This control is a switch with four positions of

received, although the XCU-300 calibrator will continue to furnish the 100 kc test signal with the calibrate switch in the WWV position.

TUNING — The tuning knob provides a 40-to-1 ratio for ease in selecting the desired signal as indicated on the slide-rule dial. Frequency increases with clockwise rotation of the knob. The tuning knob has a rim-drive vernier which provides an additional 7 to 1 ratio to aid in fine tuning. Inward pressure against the vernier engages it with the tuning knob, pulling outward on the vernier disengages it. The tuning knob has a calibrated scale on its outer edge for logging purposes. CAUTION: Do not force the dial pointer against the extreme ends of the dial scale. Rough usage may upset calibration.

XMT-REC — This is a two-position toggle switch which may be set at XMT to mute the receiver during standby and/or transmitting periods. In addition, it will turn the transmitter on and off if the RELAY terminals at the rear of the receiver have been connected to provide this function. Since the XMT-REC switch performs

by using a standard two-circuit phone plug. There is no DC voltage associated with the headphone circuit. The loudspeaker is automatically silenced when the phone plug is inserted.

RFG (RF Gain Control) — The sensitivity of the receiver is adjusted by means of this control. It controls the gain of the RF amplifier and second IF stages. The AC switch which turns your NC-303 on and off is mounted on the RFG control. When this control is rotated to its maximum counter-clockwise position the AC power is shut off. Rotating the control slightly in the clockwise direction will actuate the switch, turning the receiver on and further clockwise rotation will increase the receiver sensitivity until maximum is reached at the full clockwise position.

3.2 SINGLE-SIDEBAND RECEPTION

The instructions in steps 1 through 18 adjust your NC-303 receiver for normal reception of SSB phone signals.

the receiver across the desired signal until the audio output is normal and clearly understandable.

16. Set SELECT control to SB1 or SB2. In one position the signal level will increase and show improved signal-to-noise ratio. In the other position the signal level will be missing, or greatly attenuated. Select the position which produces the loudest signal.

17. Set AFG control to produce the desired listening level.

18. Set TONE control to the position giving the desired audio response.

19. To shut down the receiver, turn the RFG control fully counter-clockwise. Power is now removed from your entire receiver.

The AFG control should be used in most cases to adjust the audio output level. The RFG control setting obtained in Step 12 will permit accurate S-meter readings to be obtained on modulation peaks, and should normally not be changed unless operation is shifted to another band, where steps 12 through 17 should be repeated. Position SB1 provides upper sideband reception on the 160-, 80- and 40-meter bands; position SB2 for lower sideband signals on these bands. The sidebands are reversed on the 20-, 15-, 11- and 10-meter bands.

Various types of interference which may be encountered due to adverse receiving conditions can be minimized by adjusting the following controls in the manner described.

Heterodyne Interference: Turn DEPTH control clockwise to approximately 180°-200°. Turn NOTCH control to minimize heterodyne interference. Readjust DEPTH and NOTCH controls alternately until the heterodyne disappears. The quality of the desired signal will be essentially unimpaired.

Atmospheric and Impulse Type Noise: Turn ANL control clockwise until the best compromise between interference reduction and signal clipping is reached. For extremely heavy noise conditions it is often helpful to set the TONE control at HI.

3.3 AM PHONE RECEPTION

The instructions in steps 1 through 16 adjust the receiver for the normal reception of AM phone signals.

1. Set ANL control at OFF.
2. Set MODE switch at AM.
3. Set DEPTH control at OFF.
4. Set TONE control at N.
5. Set OFF-CAL-WWV switch at OFF.
6. Set XMT-REC switch at REC.
7. Set IF SELECT control at position M.
8. Set BAND switch to the desired frequency range as indicated by the slide-rule dial scale.
9. Set center dot on CAL-SET knob at the front panel mark.
10. Turn RFG control slightly clockwise. Power is now applied to the receiver. Allow at least two minutes for the tubes to reach operating temperature before proceeding.
11. Rotate the RFG control further clockwise until background noise causes the S-meter to read approximately 1 S-unit.
12. Turn AFG control to produce the desired background noise.
13. Rotate TUNING control until the desired signal is located. Adjust the TUNING control very carefully for maximum S-meter reading.
14. Turn ANT control to obtain maximum S-meter reading. This control may be set, in the absence of a signal, by adjusting it to obtain peak output from the background noise.
15. Set AFG control to produce the desired listening level.
16. Turn TONE control to a position giving the desired audio response.

The AFG control should be used in all cases to adjust the audio output level. The RFG control setting may require readjustment for true S-meter readings. Refer to paragraph 3.5. Position B of the SELECT control will minimize the amount of retuning necessary during net or roundtable reception.

Various types of interference which may be encountered due to adverse receiving conditions can be minimized by adjusting the following controls in the manner described.

Heterodyne Interference: Turn DEPTH control clockwise to approximately 180°-200°. Turn NOTCH control to minimize heterodyne interference. CAUTION: two points of minimum interference will usually be noted. One is the correct minimum, where the interfering carrier is rejected. The other minimum occurs when the desired carrier is rejected, which results in unintelligible output. Always select the minimum interference point that leaves the quality of the desired signal essentially unimpaired. Readjust NOTCH and DEPTH controls alternately until the heterodyne disappears.

Atmospheric and Impulse Type Noise: Turn the ANL control slightly clockwise until the switch clicks. The automatic AM noise limiter is now in operation and a definite reduction of noise interference will be noted. Further rotation of the ANL control will have no effect on AM signals. For extremely heavy noise conditions it is often helpful to set the TONE control at HI.

3.4 CW RECEPTION

The instructions in steps 1 through 18 adjust the receiver for normal reception of CW signals.

1. Set ANL control at OFF.
2. Set MODE switch at CW.
3. Set DEPTH control at OFF.
4. Set TONE control at N.
5. Set OFF-CAL-WWV switch at OFF.
6. Set XMT-REC switch at REC.
7. Set SELECT control at S.
8. Set AFG control fully clockwise.
9. Set CWO control at approximately [illegible]

If CW operation with AGC and S-meter operation is desired, turn the MODE switch to SSB. Then advance the RFG control as indicated in 3.2 and use the AFG control to set the output level. Note that the fast-attack — slow-release AGC circuit automatically keeps the RF gain of the receiver at the proper level at all times.

Your NC-303 will exhibit pronounced single-signal properties which may be demonstrated by tuning the receiver to the other side of zero-beat so that the pitch is the same as before, and observing the marked reduction in output. The Q multiplier is not needed for CW reception because of the extreme sharpness of IF selectivity with the SELECT control in the S position.

An important aid to CW operation of an amateur station has been included in your NC-303. It is frequently desirable for the operator to monitor his own transmitted signal while sending CW. To accomplish this, two gain controls adjusted for two different signal levels are necessary. The additional control may be mounted on the station control panel adjacent to the transmitter controls or at any other convenient location. Connect the control as shown in Figure 2.

Severe Fading: The ANL control can also be used on CW to provide an almost constant signal level on severely fading signals. To utilize this feature, set the RFG control for desired signal level near the bottom of the fade. Use the ANL control to clip the CW signal slightly above the desired level. The clipped signals do not materially affect readability of the CW signal.

3.5 MEASUREMENT OF SIGNAL STRENGTH

Signal strength measurements referenced to the local ambient noise level are made by following the instructions given below. It should be noted that the S-meter of your NC-303 follows the average signal level very closely in all modes of operation and does not merely indicate the AGC characteristics of the receiver. Thus, the S-meter pointer may indicate zero between words of a single sideband transmission while the background noise remains low due to the long release time of the AVC.

1. Set RFG control fully clockwise and the MODE switch at AM.

2. Set SELECT switch to M.

5. Set RFG control so that the meter reads halfway between 0 and S-1.

6. Tune in the desired signal. The S-meter will indicate the strength of the received signal in S-units from 1 to 9 or in decibels above the S-9 level from 0 to 40 db. These readings will remain accurate until the RFG control is moved or the receiver is switched to a different band.

The S-meter circuit compensator requires adjustment only when it is impossible to obtain a zero reading with no antenna connected and the RFG control turned fully counter-clockwise. See Section 4.4 for adjustment procedure.

Design of the S-meter actuating circuit is such that a signal stronger than that necessary for full-scale deflection cannot cause the meter pointer to come into violent contact with its stop pin thus preventing possible bending of the meter pointer.

When the MODE switch is in the SSB position, CW signal strength can be measured by following the procedures given in 3.4. Measurement of the signal strength of CW signals cannot be made with the MODE switch in the CW position.

4.2 2ND IF AMPLIFIER, Q MULTIPLIER AND HETERODYNE DETECTOR ALIGNMENT

The second intermediate frequency of your NC-303 with great accuracy. The IF transformers are tuned by means of adjustable ferrite cores.

minimum output. It may also be necessary to adjust the DEPTH control to get maximum rejection.

The following adjustment is necessary when the tube

turn NOTCH control 90° counter-clockwise from mid position (lowest frequency). Advance DEPTH control to its maximum clockwise position. Lift up receiver

ALIGNMENT CHART

STEP	BAND	ADJUST SIGNAL SOURCE TO:	SET RECEIVER TO:	ADJUST TO RECEIVE TEST SIGNAL	ADJUST FOR MAXIMUM OUTPUT

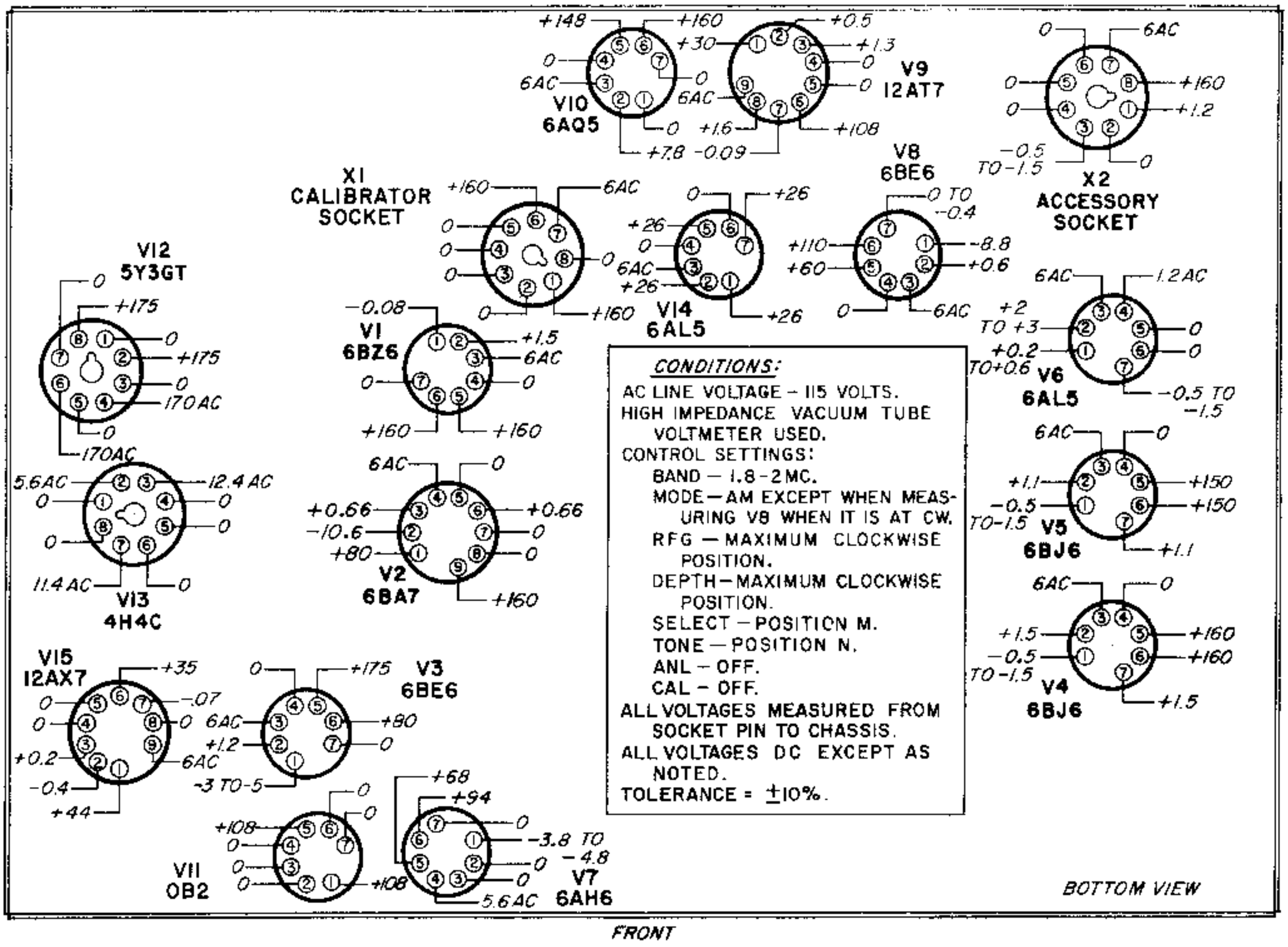


Figure 4. Tube Socket Voltages

(3) Set the MODE switch at AM.

(4) Set the DEPTH at OFF.

(5) Set the SELECT control at position S.

(6) Set the RFG control fully clockwise.

The S-meter of the receiver will be used as the indi-

and the limited range of the trimmers, images will not be readable on your NC-303 so no special precautions need be taken in this regard.

4.4 S-METER ADJUSTMENT

The S-meter balancing resistor R44 is used to obtain a zero meter reading in the absence of signal input to the receiver. To make this adjustment set the controls as follows: Set the RFG control at mid range. Set the

4.6 DIAL CORD STRINGING

In the event of breakage of the dial scale actuating cord or the dial pointer cord, the instructions shown on Figure 5 should be studied with care before attempting replacement. Failure to carry out these instructions correctly will result in incorrect indications of band setting and frequency. The dial scale in view at the front panel MUST correspond to the frequency range being tuned.

4.7 TUBE REPLACEMENT

Tubes which become weak or defective should be replaced. In the case of the 4H4-C current regulator, a type 6V6 may be used as a temporary substitute. This substitution will sacrifice some of the current regulating qualities provided by the 4H4-C but will keep the receiver operative. Type 4H4-C regulators are not generally available at most supply houses. A replacement can be obtained from National Co. or any National Co. authorized service station. A type 4H4 will not provide the required regulating action.

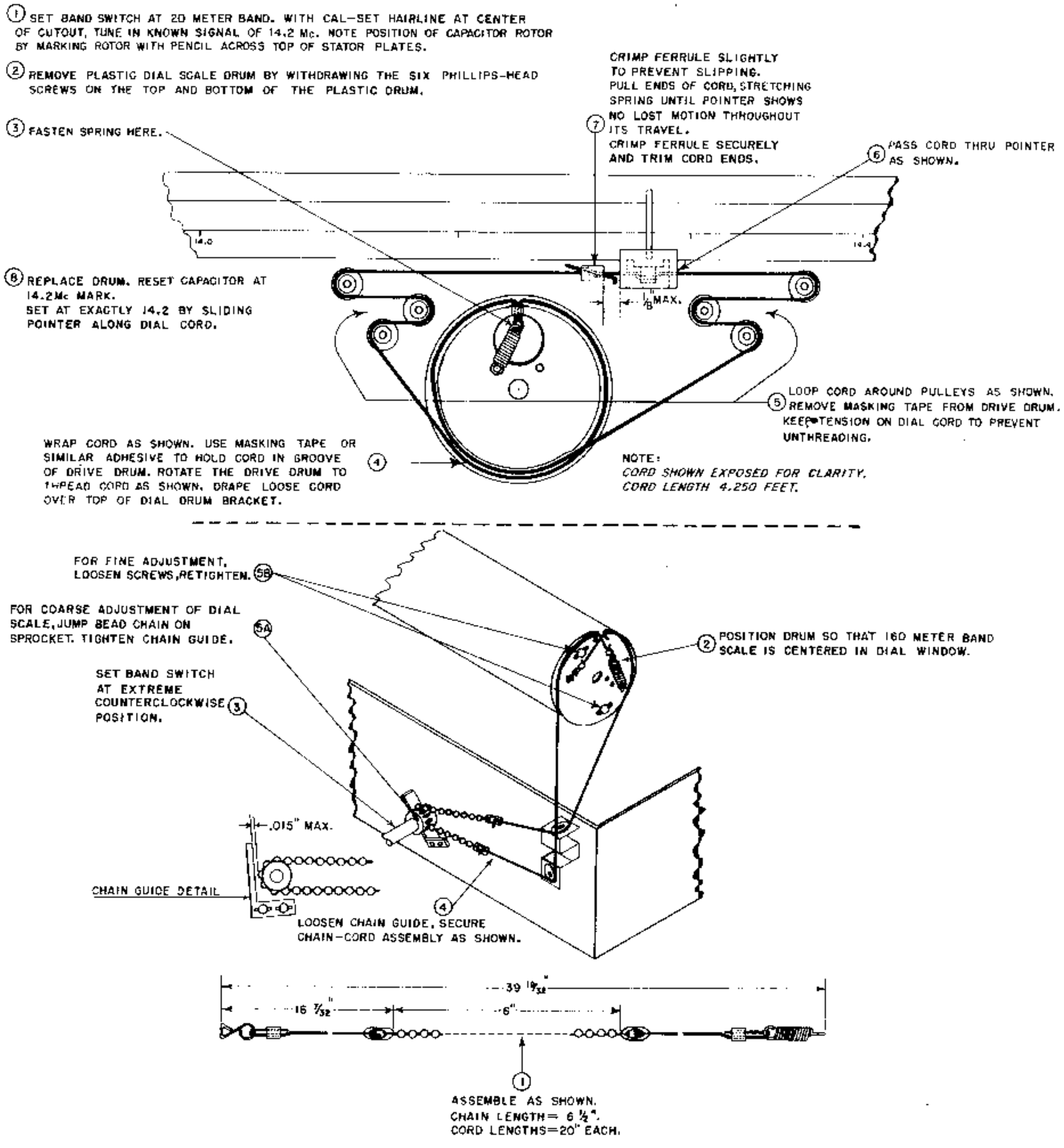


Figure 5. Cord Stringing Guide

NC-303 PARTS LIST

CAPACITORS

SYM-BOL	DESCRIPTION	NATCO TYPE
	All capacitors ±10%, 500 vdcw unless otherwise noted.	
C1	Air Variable: 3 sections	C11779
C1A	7.4-40.3 mmf, part of C1	
C1B	7.4-40.3, mmf, part of C1	
C1C	14.4-80.7 mmf, part of C1	
C2	Antenna Trimmer	A12502
C3	Ceramic: 100 mmf	D-825-C-304

SYM-BOL	DESCRIPTION	NATCO TYPE
C18	Paper: 0.022 mmf ±10%, 400 vdcw	NCP-2-223-K
C19	Disc: 0.01 mmf −0% +100%, 500 vdcw	2-C14-Z5V-103-GMV
C20	Trimmer, Air: 100 mmf	A12501
C21	Mica: 680 mmf ±5%, 500 vdcw	NCS-19-681-J-5
C22	Mica: 120 mfd ±2%, 300 vdcw	NCS-15-121-G-3
C23	Mica: 150 mfd ±2%, 300 vdcw	NCS-15-151-G-3
C24	Ceramic: 10 mmf	CCC-21-SL-100-F

PARTS LIST (CONT'D)

CAPACITORS (CONT'D)

SYM-BOL	DESCRIPTION	NATCO TYPE
C38	Paper: 0.047 mfd ±20%, 400 dcwv	NCP-4-473-M
C39	Paper: 0.047 mfd ±20%, 400 dcwv	NCP-4-473-M
C40	Paper: 0.1 mfd ±20%, 400 vdcw	NCP-4-104-M
C41	Disc: 0.01 mfd −0% +100%, 500 vdcw	2-C14-Z5V-103-GMV
C42	Mica: 220 mmf ±5%, 300 vdcw	RCM-15-B-221-J-3
C43	Mica: 150 mmf ±2%, 300 vdcw	NCS-15-151-G-3
C44	Mica: 150 mmf ±2%, 300 vdcw	NCS-15-151-G-3
C45	Not Used	
C46	Not Used	
C47	Ceramic: 240 mmf ±2%, 300 vdcw	A14157
C48	Ceramic: 12 mmf ±5%, 500 vdcw	CC-20-UJ-120-J
C49	Ceramic: 15 mmf	D825D-467
C50	Mica: 470 mmf	J665-56
C51	Ceramic: 0.01 mfd +100% −0%, 500 vdcw	K946-2
C52	Air Variable: 12-100 mmf	A12501
C53	Mica: 470 mmf	J665-56
C54	Ceramic: 100 mmf	D825C-304
C55	Mica: 33 mmf	NCS-19-330-K-5
C56	Paper: 0.01 mfd ±20%, 400 vdcw	NCP-4-103-M
C57	Ceramic: 47 mmf	CCC-20-SL-470-K
C58	Mica: 3600 mmf ±5%, 300 vdcw	NCS-19-362-J-3
C59	Mica: 470 mmf ±10%, 500 vdcw	NCS-19-471-K-5
C60	Paper: 0.01 mfd ±20%, 400 vdcw	NCP-4-103-M
C61	Paper: 0.47 mfd ±20%, 200 vdcw	NCP-2-474-M
C62	Electrolytic: 40-40-40-20 mfd, 250 vdcw	C19458-3
C63	Mica: .001 mfd ±20%, 1000 vdcw	RCM-30-B-102-M-10
C64	Ceramic: 4 mmf ±0.2 mmf	CCC-20-CL-040-C
C65	Mica: 0.001 mfd ±20%, 1000	RCM-30-B-102-M-10
C66	Mica: 0.001 mfd ±20%, 1000 vdcw	RCM-30-B-102-M-10
C67	Disc: 0.01 mfd, 500 vdcw	2-C14-Z5V-103-GMV
C68	Mica Variable: 4 sections, each 5-80 mmf	A12493
C68A	Part of C68	
C68B	Part of C68	
C68C	Part of C68	
C68D	Part of C68	
C69	Mica Variable: 4 sections, each 5-80 mmf	A12493
C69A	Part of C69	
C69B	Part of C69	
C69C	Part of C69	
C69D	Part of C69	
C70	Air Variable: 2.8-19.7 mmf	A12744
C71	Air Variable: 2.8-19.7 mmf	A12744
C72	Air Variable: 2.8-19.7 mmf	A12744
C73	Air Variable: 2.8-19.7 mmf	A12744
C74	Air Variable: 2.8-19.7 mmf	A12744
C75	Air Variable: 2.8-19.7 mmf	A12744
C76	Air Variable: 2.8-19.7 mmf	A12744
C77	Air Variable: 2.8-19.7 mmf	A12744

PARTS LIST (CONT'D)

CAPACITORS (CONT'D)

SYM-BOL	DESCRIPTION	NATCO TYPE
C78	Paper: 0.022 mfd ±10%, 400 vdcw	NCEP-223-K-4
C79	Not Used	
C80	Not Used	
C81	Not Used	
C82	Ceramic: 100 mmf	D825C-342
C101	Ceramic: 10 mmf ±5%, 500 vdcw	CCC-20-SL-100-J
C102	Ceramic: 12 mmf ±5%, 500 vdcw	CCC-20-SL-120-J
C103	Paper: .033 mfd ±10%, 200 vdcw	NCEP-333-K-2
C104	Mica: 6200 mmf	NCS-20-622-G-1

PARTS LIST (CONT'D)

CAPACITORS (CONT'D)

SYM-BOL	DESCRIPTION	NATCO TYPE
C122	Ceramic: 4 mmf ±0.2 mmf, 500 vdcw	CCC-20-CH-040-C
C123	Ceramic: 4 mmf ±0.2 mmf, 500 vdcw	CCC-20-CH-040-C
C124	Disc: 0.01 mfd, −0% +100%, 500 vdcw	2-C14-Z5V-103-GMV
C125	Mica: 1000 mmf	NCS-20-102-K-5
C126	Electrolytic: 1 mfd, 450 vdcw	E-338-10
C127	Paper: 0.1 mfd ±20%, 200 vdcw	NCP-2-104-M
C128	Paper: 0.1 mfd ±20%, 200 vdcw	NCP-2-104-M
C129	Disc: 0.01 mfd, −0% +100%, 500 vdcw	2-C14-Z5V-103-GMV
C130	1 mfd ±20%	B25548

RESISTORS

	10% tolerance ½ watt unless otherwise noted.	
R1	Fixed: 1 megohm	RC-20-BF-105-K
R2	Fixed: 33 ohms ±20%, ½ w	RC-20-BF-330-M
R3	Fixed: 150 ohms	RC-20-BF-151-K
R4	Fixed: 180 ohms	RC-20-BF-181-K
R5	Fixed: 47,000 ohms	RC-20-BF-473-K
R6	Fixed: 220,000 ohms ±20%, ½ w	RC-20-BF-224-M
R18	Fixed: 1 megohm	RC-20-BF-105-K
R19	Fixed: 1 megohm	RC-20-BF-105-K
R20	Fixed: 100 ohms ±5%, ½ w	RC-20-BF-101-J
R21	Fixed: 430 ohms ±5%, ½ w	RC-20-BF-431-J
R22	Fixed: 120 ohms	RC-20-BF-121-K
R23	Fixed: 2200 ohms	RC-20-BF-222-K
R24	Fixed: 1 megohm	RC-20-BF-105-K
R25	Fixed: 56 ohms ±5%, ½ w	RC-20-BF-560-J

PARTS LIST (CONT'D)

RESISTORS (CONT'D)

SYM-BOL	DESCRIPTION	NATCO TYPE
R38	Fixed: 68,000 ohms ±20%, ½ w	RC-20-BF-683-M
R39	Fixed: 100,000 ohms	J569-49
R40	Fixed: 68,000 ohms ±20%, ½ w	RC-20-BF-683-M
R41	Fixed: 820 ohms	RC-20-BF-821-K
R42	Fixed: 270,000 ohms	RC-20-BF-274-K
R43	Fixed: 33,000 ohms	RC-20-BF-333-K
R44	Variable, wire-wound 1,000 ohms	A12166
R45	Fixed: 3300 ohms	RC-20-BF-332-K
R46	Fixed: 120 ohms	RC-20-BF-121-K
R47	Not Used	
R48	Fixed: 270,000 ohms ±20%, ½ w	RC-20-BF-274-K
R49	Fixed: 470,000 ohms ±20%, ½ w	RC-20-BF-474-M
R50	Fixed: 470,000 ohms ±20%, ½ w	RC-20-BF-474-M
R51	Variable: 1 megohm	B23484
R52	Fixed: 270 ohms ±10%, 2 w	RC-42-BF-271-K
R53	Fixed: 33 ohms ±20%, 2 w	RC-42-BF-330-M
R54	Fixed: 10,000 ohms	RC-20-BF-103-K
R55	Fixed: 470,000 ohms	RC-20-BF-474-K
R56	Fixed: 10,000 ohms ±20%, ½ w	RC-20-BF-103-M
R57	Fixed: 4.3 ohms ±5%, 1 w	K098-48
R58	Fixed: 4.7 megohms	RC-20-BF-475-K
R59	Fixed: 10,000 ohms	RC-20-BF-103-K
R60	Fixed: 100 ohms ±20%, ½ w	RC-20-BF-101-M
R61	Fixed: 100,000 ohms	RC-20-BF-104-K
R62	Fixed: 150 ohms ±10%, 2 w	RC-42-BF-151-K

SYM-BOL	DESCRIPTION	NATCO TYPE
R63	Fixed: 2.2 ohms ±10%, 1 w	K098-24
R64	Fixed: 150 ohms ±10%, 2 w	RC-42-BF-151-K
R65	Fixed: 1500 ohms ±5%, ½ w	RC-20-BF-152-J
R66	Fixed: 1000 ohms ±5%, ½ w	RC-20-BF-102-J
R67	Fixed: 220,000 ohms	RC-20-BF-224-K
R68	Fixed: 10,000 ohms	RC-20-BF-103-M
R69	Fixed: 220,000 ohms	RC-20-BF-224-K
R70	Variable: 100,000 ohms including S6	A13597-2
R71	Fixed: 1800 ohms	RC-20-BF-182-K
R72	Fixed: 470,000 ohms	RC-20-BF-474-K
R73	Fixed: 100,000 ohms	RC-20-BF-104-K
R74	Fixed: 220,000 ohms	RC-20-BF-224-K
R75	Fixed: 10 ohms	RC-20-BF-152-K
R76	Fixed: 1500 ohms	RC-20-BF-152-K
R77	Fixed: 47,000 ohms	RC-20-BF-474-K
R78	Fixed: 27,000 ohms ±5%, ½ w	RC-20-BF-274-J
R79	Fixed: 68 ohms	RC-20-BF-680-K
R80	Fixed: 47,000 ohms	RC-20-BF-474-K
R81	Fixed: 4700 ohms	RC-20-BF-472-K
R82	Variable: 50,000 ohms including S4	B23425
R83	Fixed: 68,000 ohms	RC-20-BF-683-K
R84	Variable, wire-wound: 100,000 ohms	B23425
R85	Fixed: 4700 ohms	RC-20-BF-472-K
R86	Fixed: 68,000 ohms	RC-20-BF-683-K
R87	Fixed: 4700 ohms	RC-20-BF-472-K

MISCELLANEOUS

SYM-BOL	DESCRIPTION	NATCO TYPE
E1	Knob: ANL	B23092
E2	Knob: Tone	B23079
E3	Knob: Select	B23080
E4	Knob: Zero	A23275
E5	Knob: CWO	B23082
E6	Knob: AFG	B11805
E7	Knob: Antenna Trimmer	B23083
E8	Knob: OFF-CAL	A23275
E9	Knob: Band Switch	C11916-2
E10	Knob: Main Tuning	B13599-2
E11	Knob: Mode	C11917-2
E12	Knob: Depth	B23078
E13	Knob: Notch	B23081
E14	Knob: RFG	B11806
F1	Fuse: 2 amps, 250 v	F135-4
I1	Lamp, S Meter: type 47	A12285
I2	Lamp, Dial: type 47	A12285
I3	Lamp, Dial: type 47	A12285
I4	Lamp, Dial: type 47	A12285
J1	Phone Jack	A12241
J2	Converter Input Jack	A11998
L1	RF Choke: 4 microhenries	B14904
L2A	Inductor, Variable iron core; T3 primary; part of T3	
L2B	Inductor, variable iron core; T3 secondary; part of T3	
L3A	Inductor, variable iron core; T4 primary; part of T4	
L3B	Inductor, variable iron core; T4 secondary; part of T4	
L4	Not Used	

SYM-BOL	DESCRIPTION	NATCO TYPE
L5	Inductor, variable iron core, 80 kc	B12415
L6	Inductor, variable iron core, 80 kc, Q multiplier	C23320
L7	Inductor, variable iron core, 80 kc	B12414
L8	Not Used	
L9	Inductor, variable iron core, 80 kc	B12414
L10	Inductor, variable iron core, 80 kc	B12414
L11	Not Used	
L12	Inductor, variable iron core, 80 kc	B12414
L13	Inductor, variable iron core, 80 kc	B12414
L14	Not Used	
L15	RF Choke; 750 microhenries	SA-2868
L16	Inductor, variable iron core, part of T6	
L17	Not Used	
L18	Inductor, 20 meter image trap	B16653
M1	S meter: 0-1 ma, illuminated	C12323
O1	Dial Assembly	C12713
O2	Calibrated Dial	C11564-2
O3	Dial Mounting Drum	C11756
O4	Dial Pointer	A11814
O5	Dial Cord Assembly	A11966
O6	Dial Drum Cord Assembly	B13000
P1	A.C. Power Cord and Plug	B22132-4

MISCELLANEOUS (CONT'D)

SYM-BOL	DESCRIPTION	NATCO TYPE
S1	Band Switch: 8 wafers, 13 poles, 8 positions	
S1A	Wafer: 2 poles, 8 positions	B12376
S1B	Wafer: 2 poles, 8 positions	B12373
S1C	Wafer: 1 pole, 8 positions	B12372
S1D	Wafer: 1 pole,	B12372

SYM-BOL	DESCRIPTION	NATCO TYPE
S6	Limiter Switch: SPDT; mounted on R70	
S7	Tone Switch: 1 wafer, 1 pole, 4 positions	B23006
S8	Mode Switch, 1 wafer	B12371-2
S9	A.C. Switch: SPST; mounted on R37	
S10	Smit-Rec Switch, DPDT toggle	A13663-2

PARTS LIST (CONT'D)

MISCELLANEOUS (CONT'D)

SYM-BOL	DESCRIPTION	NATCO TYPE
T15	1st Oscillator Transformer: 40 meter band	B14908
T16	Antenna Transformer: 20 meter band	B15300

SYM-BOL	DESCRIPTION	NATCO TYPE
TB1	Antenna Terminal Board	E265-27
TB2	Speaker Terminal Board	A12617
TB3	Relay Terminal Board	A12616

INSTRUCTIONS FOR THE NATIONAL XCU-303 DELUXE CRYSTAL CALIBRATOR

GENERAL

The XCU-303 Deluxe Crystal Calibrator Unit is designed expressly for use with your NC-303 receiver. In addition to providing crystal controlled marker frequencies every 100 kilocycles over the entire tuning range of your NC-303, the Deluxe Calibrator provides for direct calibration of the 100th harmonic of the 100-kilocycle frequency against WWV (10 mc). The calibrator consists of an electron-coupled 100-kilocycle crystal oscillator, and a 10-megacycle mixer. The mixer converts the beat between WWV and the 100th harmonic of the oscillator to 7.07 megacycles. This frequency is marked in red on the 40-meter dial scale of your NC-303.

INSTALLATION

The XCU-303 Deluxe Crystal Calibrator is installed in the NC-303 receiver by plugging the unit into the Crystal Calibrator Socket, X-1, on top of the chassis. A short antenna (10 to 30 feet long, depending upon geographical location) should be connected to the ANTENNA binding post on top of the XCU-303 Calibrator.

OPERATION

The XCU-303 Deluxe Crystal Calibrator provides a means of checking the accuracy of the frequency calibration of your NC-303 against a secondary frequency standard whose accuracy is controlled by WWV. The front-panel mounted calibrate switch marked OFF CAL

7-megacycle (40 M) band. Tune your NC-303 to the red mark on the dial scale. The beat between the 100-kilocycle oscillator and WWV should be heard. Adjust the trimmer capacitor at the top of the XCU-303 Deluxe Calibrator for zero beat between the 100-kilocycle oscillator and WWV. The 100-kilocycle oscillator is now at exactly 100 kilocycles. This adjustment may be checked as frequently as desired.

To check the calibration accuracy of your NC-303 on any band except 6, 2 or 1¼ meters, tune in the desired marker frequency with the MODE switch set at CW and the CWO knob marker at 12 o'clock, and zero beat the receiver with the desired marker. If the slide-rule dial does not read accurately, correction should be made by adjusting the front-panel mounted CAL-SET control. Only a slight adjustment of the CAL-SET control should be necessary. If calibration is far off, the RF coils associated with the band being checked probably require realignment and reference should be made to Section 4.

NOTE

The XCU-303 should not be used on 6, 2 or 1¼ meters because the calibrator does not supply an output through the converters.

ALIGNMENT OF THE XCU-303 MIXER

If the beat between the 100-kilocycle harmonic and WWV does not appear exactly at the 7.07 megacycle red mark on the NC-303 dial, the slug adjustment of

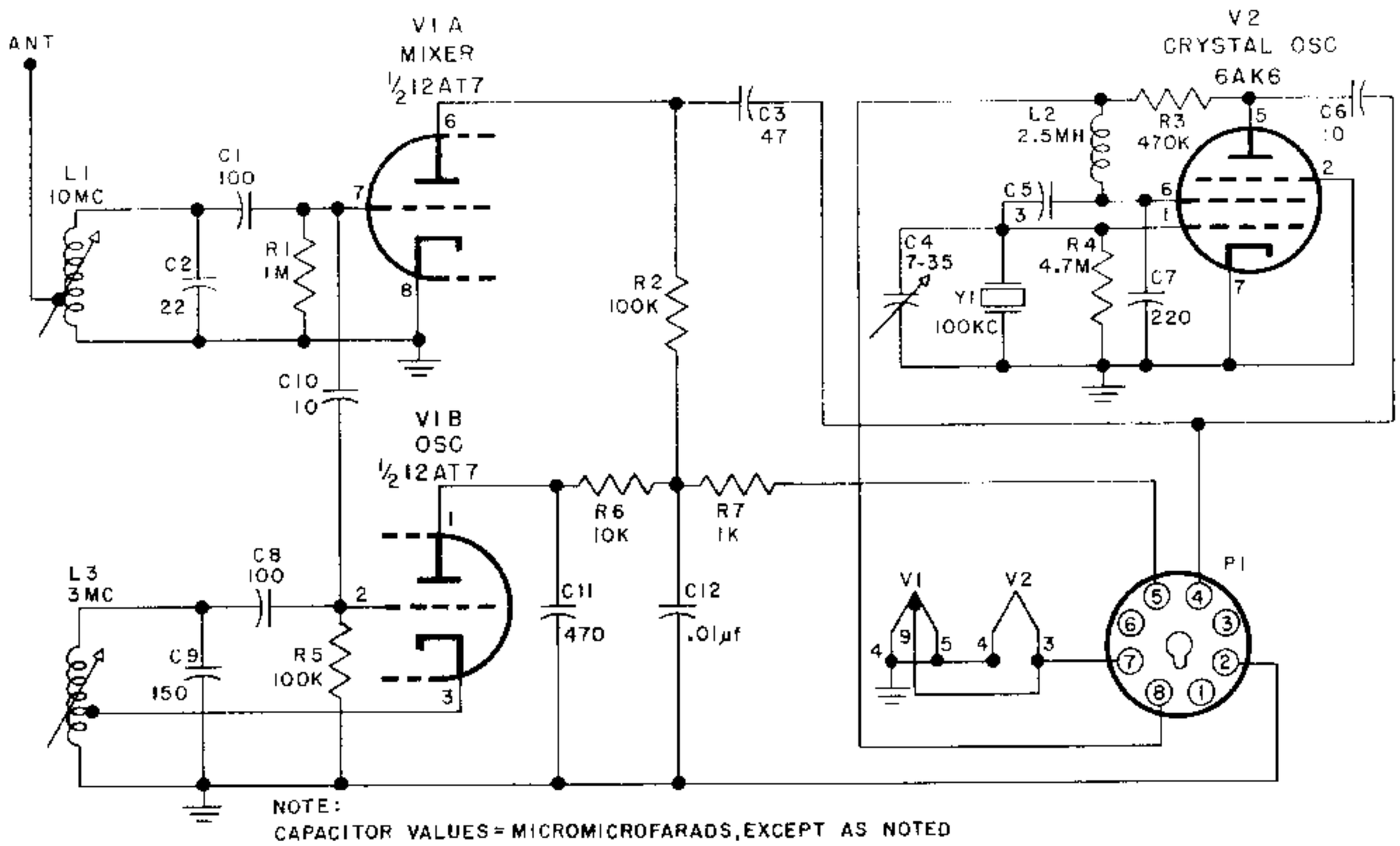
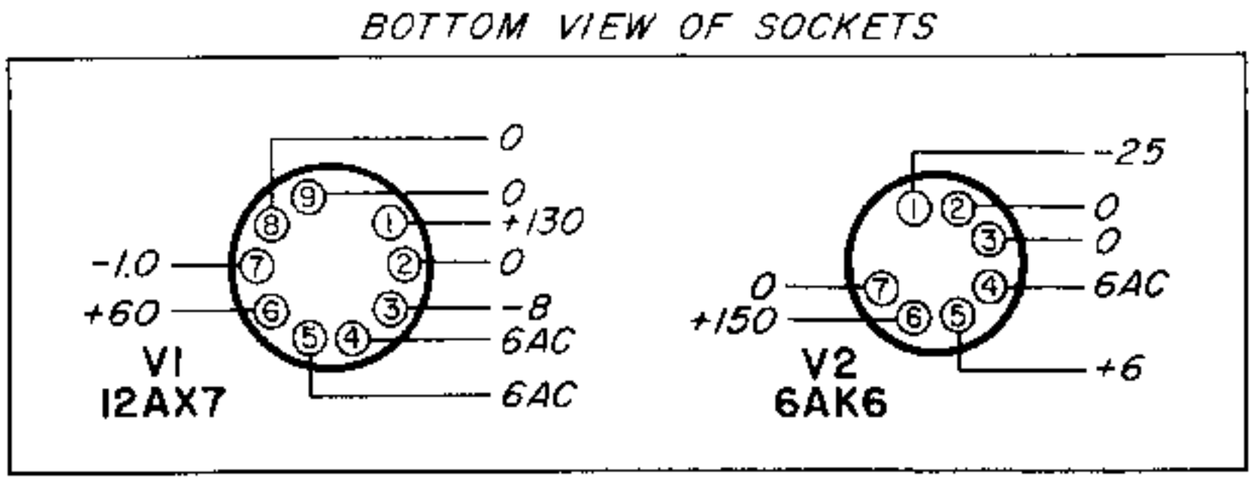


Figure 6. XCU-303 Schematic Diagram

XCU-303 PARTS LIST

SYM-BOL	DESCRIPTION	NATCO TYPE
C1	Disc, 100 mmf, 500 vdcw	2C11Z5P-101-K
C2	Ceramic, 22 mmf	CCC2OUJ220K
C3	Ceramic, 47 mmf	CCC2OUJ470K
C4	Variable, 7-35 mmf	E311-4
C5	Mica, 3 mmf, 500 vdcw	NCS-15-030-X-5
C6	Ceramic, 10 mmf	CCC2OUJ100F
C7	Mica, 220 mmf, 500 vdcw	NCS-20-221-J-5
C8	Disc, 100 mmf, 500 vdcw	2C11Z5P-101-K
C9	Ceramic, 150 mmf	CCC32PH151K
C10	Mica, 10 mmf, 500 vdcw	NCS-15-100-X-5
C11	Disc, 470 mmf, 500 vdcw	2C14Z5V-103-GMV
C12	Disc, .01 mmf	2C14Z5V-103-GMV
L1	Coil, 10 mc	B23895
L2	Choke, 2.5 mh	SA-3080

SYM-BOL	DESCRIPTION	NATCO TYPE
L3	Coil, 3 mc	B23896
P1	Octal	K783-1
R1	Fixed, 1 megohm, ½ w	RC20BF105K
R2	Fixed, 100 K ohms, ½ w	RC20BF104K
R3	Fixed, .47 megohms, 1 w	RC30BF474K
R4	Fixed, 4.7 megohms, ½ w	RC20BF475K
R5	Fixed, 100 K ohms, ½ w	RC20BF104K
R6	Fixed, 10 K ohms, ½ w	RC20BF103K
R7	Fixed, 1 K ohm, ½ w	RC20BF102K
V1	12AT7	12AT7
V2	6AK6	6AK6
Y1	Quartz crystal, 100 kc	A16126



CONDITIONS:

AC LINE VOLTAGE — 115 VOLTS
HIGH IMPEDANCE VACUUM TUBE VOLTMETER USED.
CONTROL SETTINGS:
1. OFF – CAL – WWV SWITCH IN WWV POSITION
ALL VOLTAGES MEASURED FROM SOCKET PINS TO CHASSIS.
ALL VOLTAGES ±10%.
ALL VOLTAGES DC EXCEPT AS NOTED.

Figure 7. XCU-303 Calibrator Socket Voltages

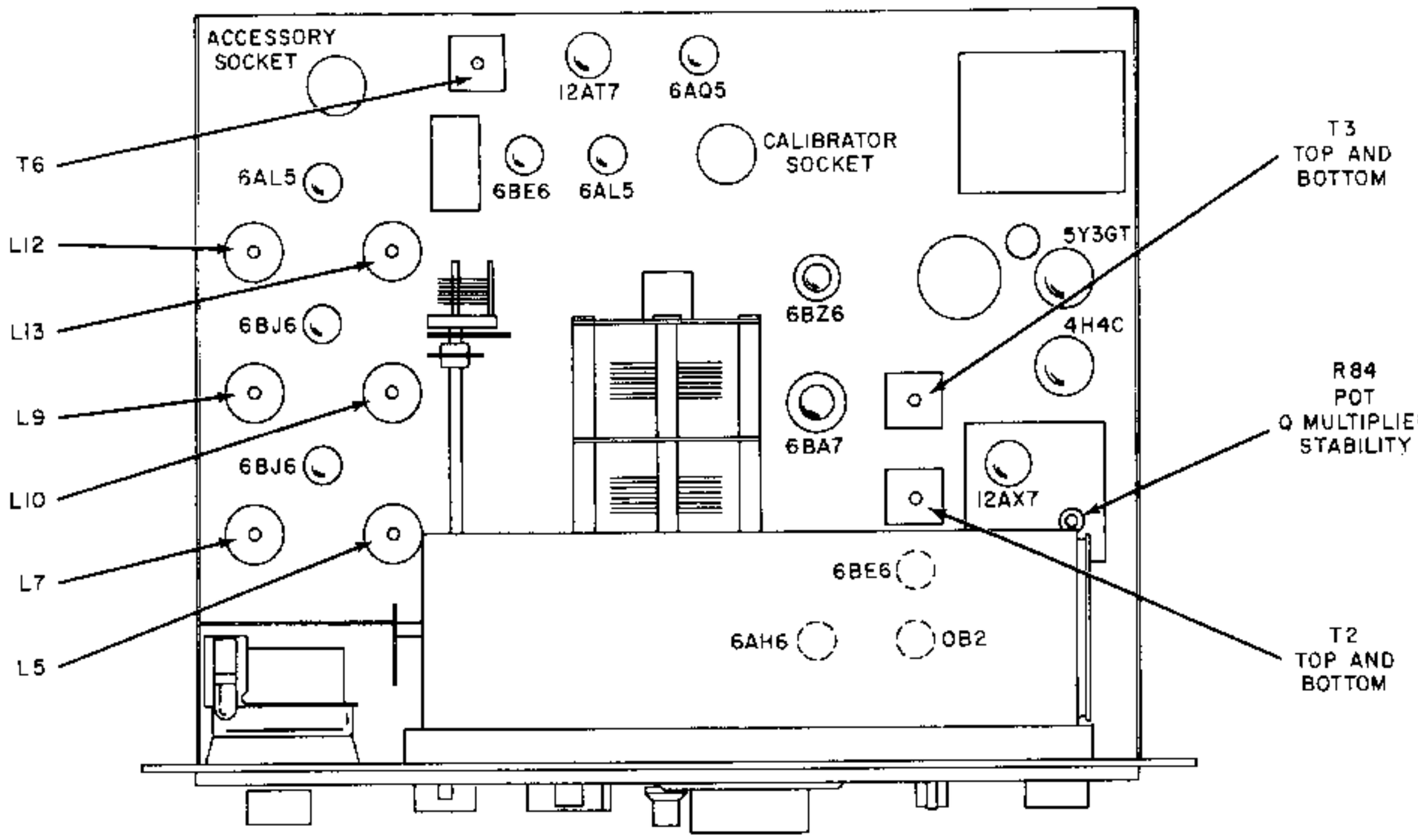
INSTRUCTIONS
FOR THE
NATIONAL XCU-300
CRYSTAL CALIBRATOR UNIT

GENERAL

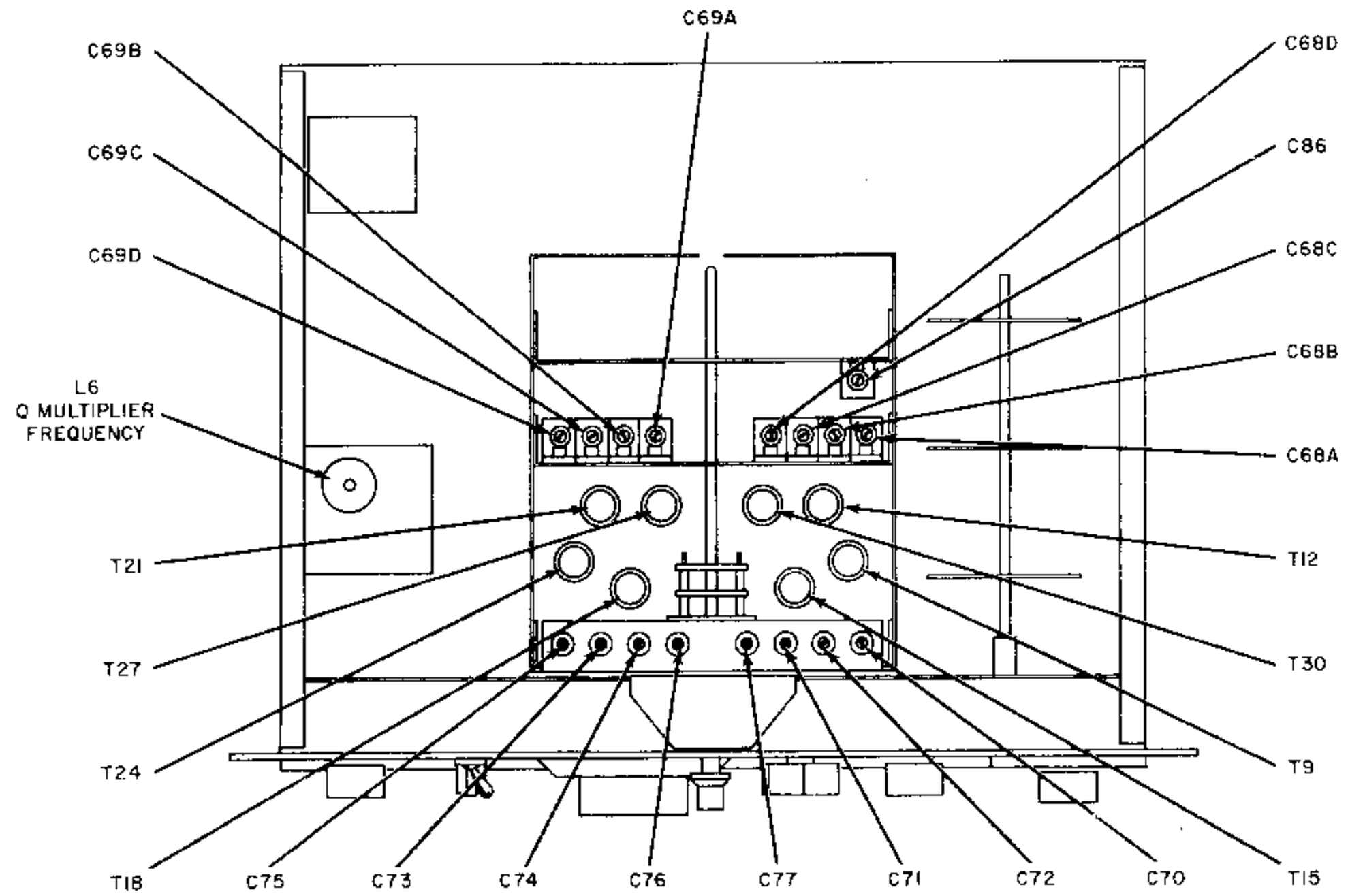
The type XCU-300 Crystal Calibrator may be used successfully with your NC-303. No provision to calibrate the 100-kilocycle oscillator against WWV is provided, however, the XCU-300 Calibrators are set to zero beat with WWV at the factory and will accurately maintain marker frequencies for your NC-303. The XCU-300 calibrator will continue to operate normally when the OFF-CAL-WWV switch is moved from the

OPERATION

The XCU-300 Crystal Calibrator provides a means of checking the accuracy of the frequency calibration of the receiver. The front-panel mounted OFF-CAL-WWV switch connects B-plus to the calibrator for instantaneous service. To check calibration accuracy tune in the desired marker signal with the MODE switch set at CW and the CWO knob set at 12 o'clock. Zero beat the receiver with the harmonic marker. If the



TOP VIEW



BOTTOM VIEW

NC 303 ALIGNMENT CHART

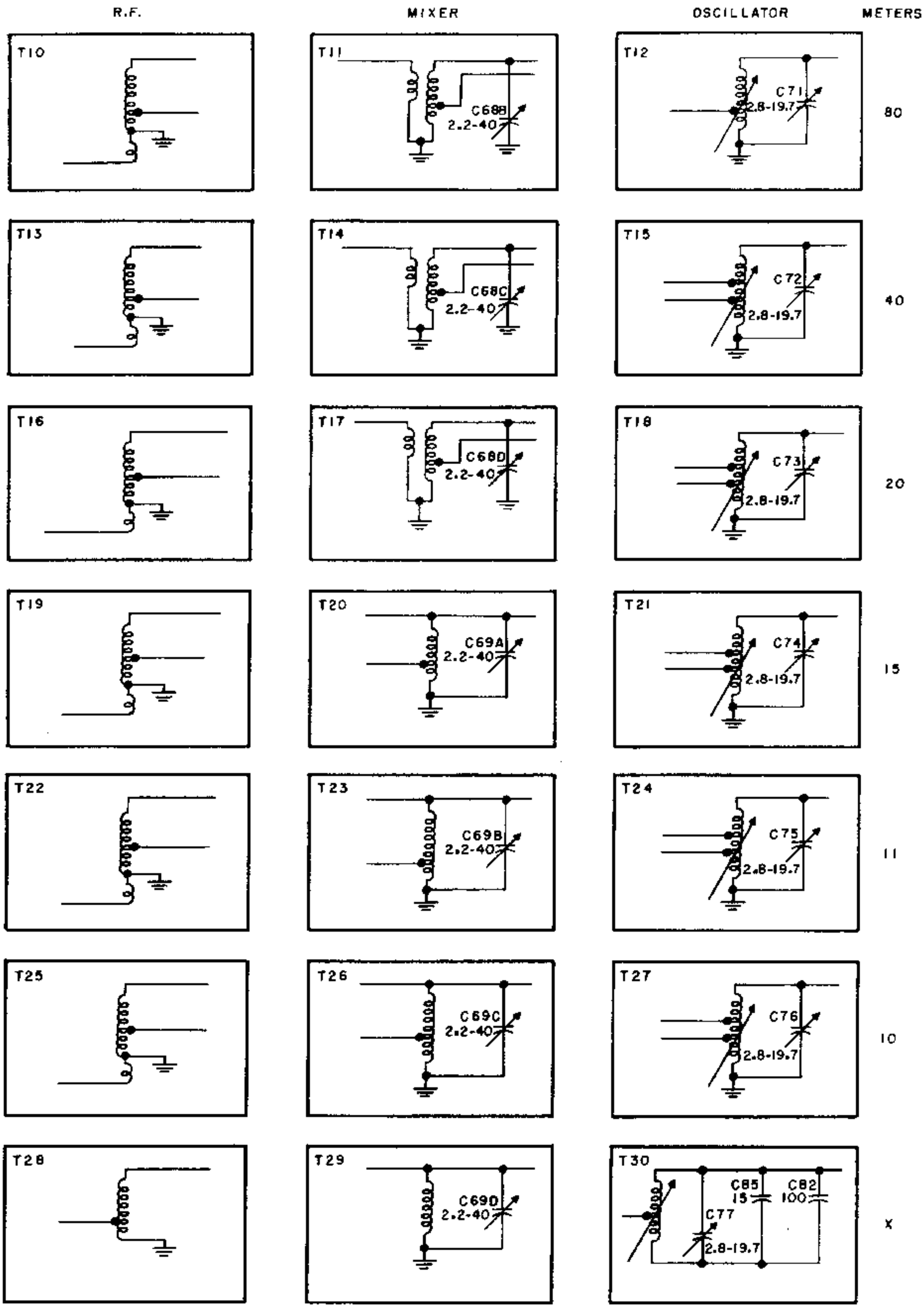
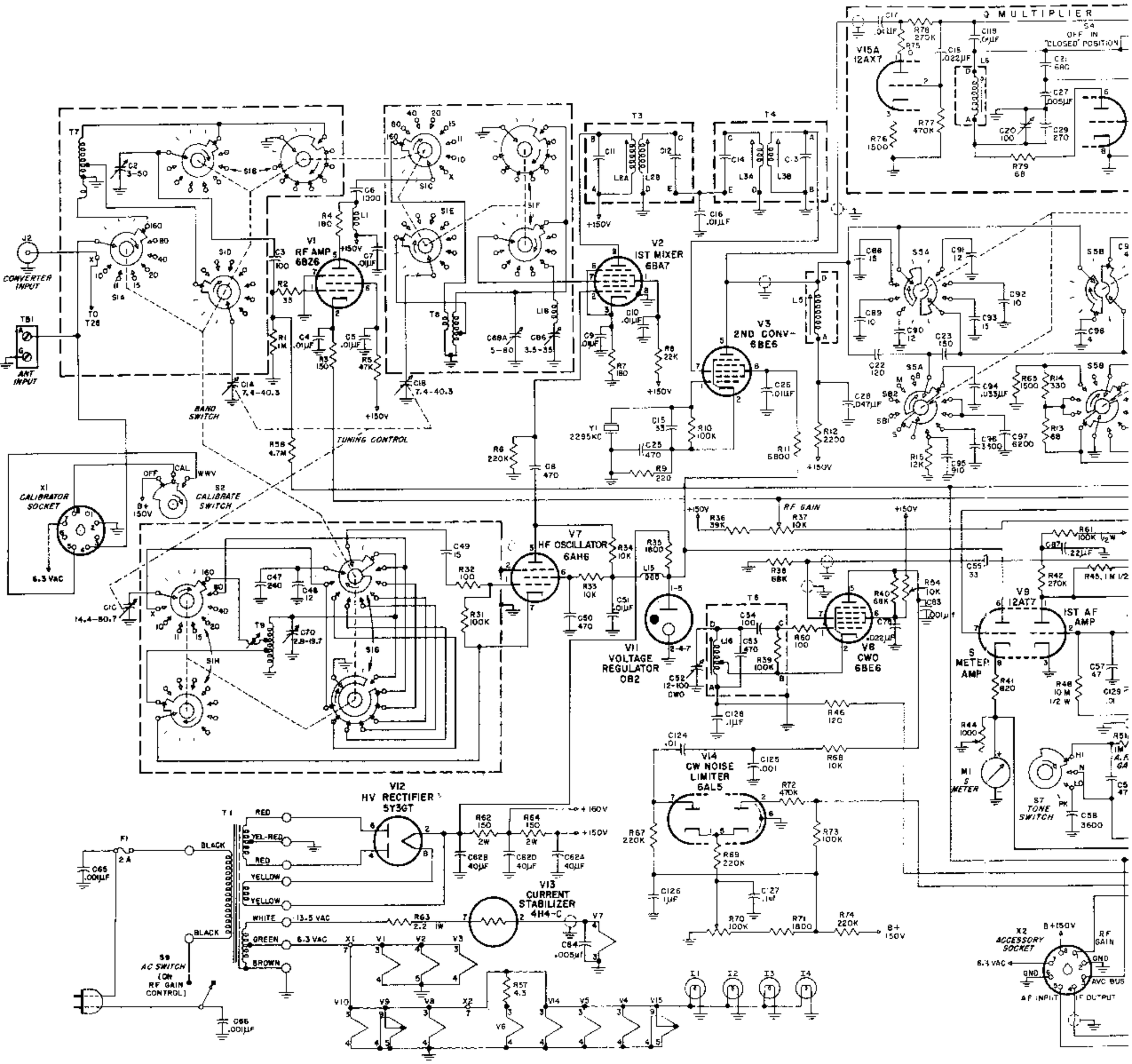
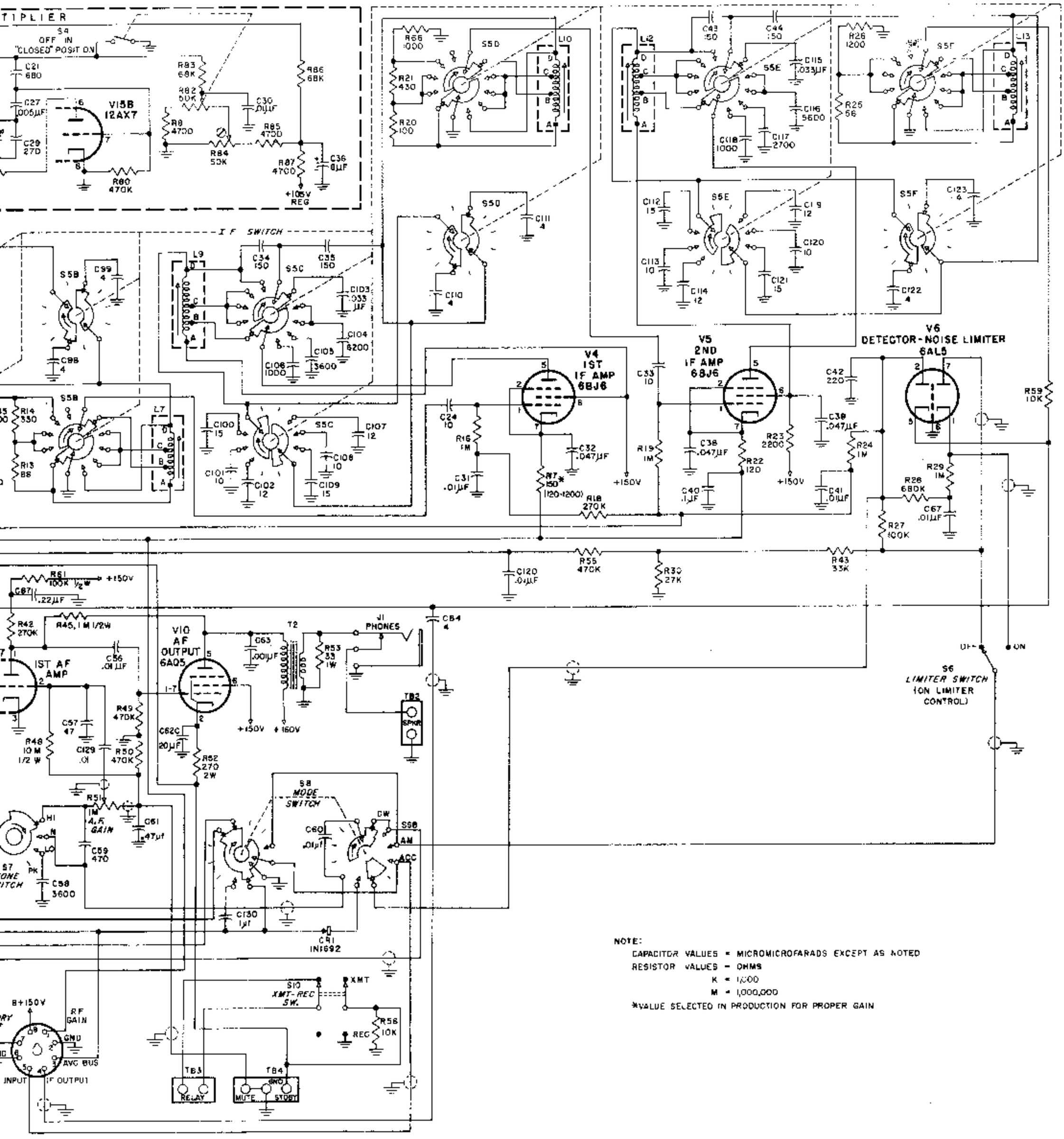


Figure 9. Transformer Schematics


Q MULTIPLIER
S4 OFF IN "CLOSED" POSITION
V15A 12AX7
J2 CONVERTER INPUT
TO T26
TB1 ANT INPUT
BAND SWITCH
TUNING CONTROL
V1 RF AMP 6BZ6
V2 1ST MIXER 6BA7
T3
T4
+150V
V3 2ND CONV- 6BE6
S54
S58
S55A
S59
S82
S81
S
V9 12AT7 1ST AF AMP
S METER AMP
M1 S METER
S7 TONE SWITCH
X1 CALIBRATOR SOCKET
6.3 VAC
S2 CALIBRATE SWITCH
OFF CAL WWV
B+ 150V
V7 HF OSCILLATOR 6AH6
V11 VOLTAGE REGULATOR 0B2
V8 CWO 6BE6
RF GAIN
V14 CW NOISE LIMITER 6AL5
V12 HV RECTIFIER 5Y3GT
V13 CURRENT STABILIZER 4H4-C
T1
F1 2A
S9 AC SWITCH (ON RF GAIN CONTROL)
RED
YEL-RED
YELLOW
WHITE
GREEN
BROWN
BLACK
13.5 VAC
6.3 VAC
X2 ACCESSORY SOCKET
AVC BUS
AF INPUT
IF OUTPUT



NOTE:

CAPACITOR VALUES = MICROMICROFARADS EXCEPT AS NOTED
RESISTOR VALUES = OHMS
K = 1,000
M = 1,000,000
*VALUE SELECTED IN PRODUCTION FOR PROPER GAIN