INSTRUCTION BOOK

32V-3

AMATEUR TRANSMITTER

COLLINS

COLLINS AMATEUR EQUIPMENT GUARANTEE

The Collins Amateur equipment described herein is sold under the following guarantee:

Collins agrees to repair or replace, without charge, any equipment, parts, or accessories which are defective as to design, workmanship, or materials, and which are returned to Collins at its factory, transportation prepaid, provided:

(a) Buyer has completed and returned to Collins promptly following his purchase the Registration Card included in the Instruction Book furnished with the equipment.

(b) Notice of the claimed defect is given Collins within 90 days from the date of purchase and goods are returned in accordance with Collins' instructions.

(c) Equipment, accessories, tubes, and batteries not manufactured by Collins or from Collins' designs are subject to only such adjustments as Collins may obtain from the supplier thereof.

(d) No equipment or accessory shall be deemed to be defective if, due to exposure or excessive moisture in the atmosphere or otherwise after delivery, it shall fail to operate in a normal and proper manner.

(e) Any failure due to use of equipment in excess of that contemplated in normal amateur operations shall not be deemed a defect within the meaning of these provisions.

The guarantee of these paragraphs is void if equipment is altered or repaired by others than Collins or its authorized service center.

No other warranties, expressed or implied, shall be applicable to said equipment, and the foregoing shall constitute the Buyer's sole right and remedy under the agreements contained in these paragraphs. In no event shall Collins have any liability for consequential damages, or for loss, damage or expense directly or indirectly arising from the use of the products, or any inability to use them either separately or in combination with other equipment or materials or from any other cause.

IMPORTANT! It is necessary that the business reply card included herewith be filled out and mailed to the Company promptly in order for this guarantee to be effective.

HOW TO RETURN MATERIAL OR EQUIPMENT. If, for any reason, you should wish to return material or equipment, whether under the guarantee or otherwise, you should notify us, giving full particulars including the details listed below, insofar as applicable. If the item is thought to be defective, such notice must give full information as to nature of defect and identification (including part number if possible) of part considered defective. (With respect to tubes we suggest that your adjustments can be speeded up if you give notice of defect directly to the tube manufacturer.) Upon receipt of such notice, Collins will promptly advise you respecting the return. Failure to secure our advice prior to the forwarding of the goods or failure to provide full particulars may cause unnecessary delay in handling of your returned merchandise.

ADDRESS:

Collins Radio Company
Sales Service Department
Cedar Rapids, Iowa

INFORMATION NEEDED:

(A) Type number, name, and serial number of equipment
(B) Date of delivery of equipment
(C) Date placed in service
(D) Number of hours of service
(E) Nature of trouble
(F) Cause of trouble if known
(G) Part number (9 or 10 digit number) and name of part thought to be causing trouble
(H) Item or symbol number of same obtained from parts list or schematic
(I) Collins' number (and name) of unit sub-assemblies involved in trouble
(J) Remarks

HOW TO ORDER REPLACEMENT PARTS. When ordering replacement parts, you should direct your order as indicated below and furnish the following information insofar as applicable. To enable us to give you better replacement service, please be sure to give us complete information.

ADDRESS:

Collins Radio Company
Sales Service Department
Cedar Rapids, Iowa

INFORMATION NEEDED:

(A) Quantity required
(B) Collins' part number (9 or 10 digit number) and description
(C) Item or symbol number obtained from parts list or schematic
(D) Collins' type number, name, and serial number of principal equipment
(E) Unit sub-assembly number (where applicable)

ADDENDA 32V-3

The schematic diagrams of transmitters with serial numbers 561 and above should show the jumper removed and a coil, L-114, connected between contacts 4 and 5 of switch S101E. In addition, capacitor C146 should be removed from the schematic. The part number of L-114 is 505 9138 002.

In transmitters with serial numbers listed below, the VFO has been changed to a Model 70E-8B and a transformer to energize the filament of the VFO tube has been mounted on the rear access plate. The filament of the VFO is now biased negative 25 volts to eliminate possibility of hum modulation of the VFO.

754	875	908	962	994
788	877	909	963	995
800	878	910	964	996
807	879	912	966	997
810	880	914	967	998
811	881	916	968	999
813	883	917	970	1000
839	884	919	971	1001
841	886	920	973	1002
843	887	929	975	1004
848	888	933	976	and all above
850	889	934	977	
854	890	935	978	
855	891	937	979	
857	892	938	982	
859	895	941	983	
862	896	942	984	
863	897	943	985	
864	898	944	987	
865	899	945	988	
867	900	950	989	
871	902	955	990	
872	905	956	991	
873	906	957	992	
874	907	959	993	
		961		

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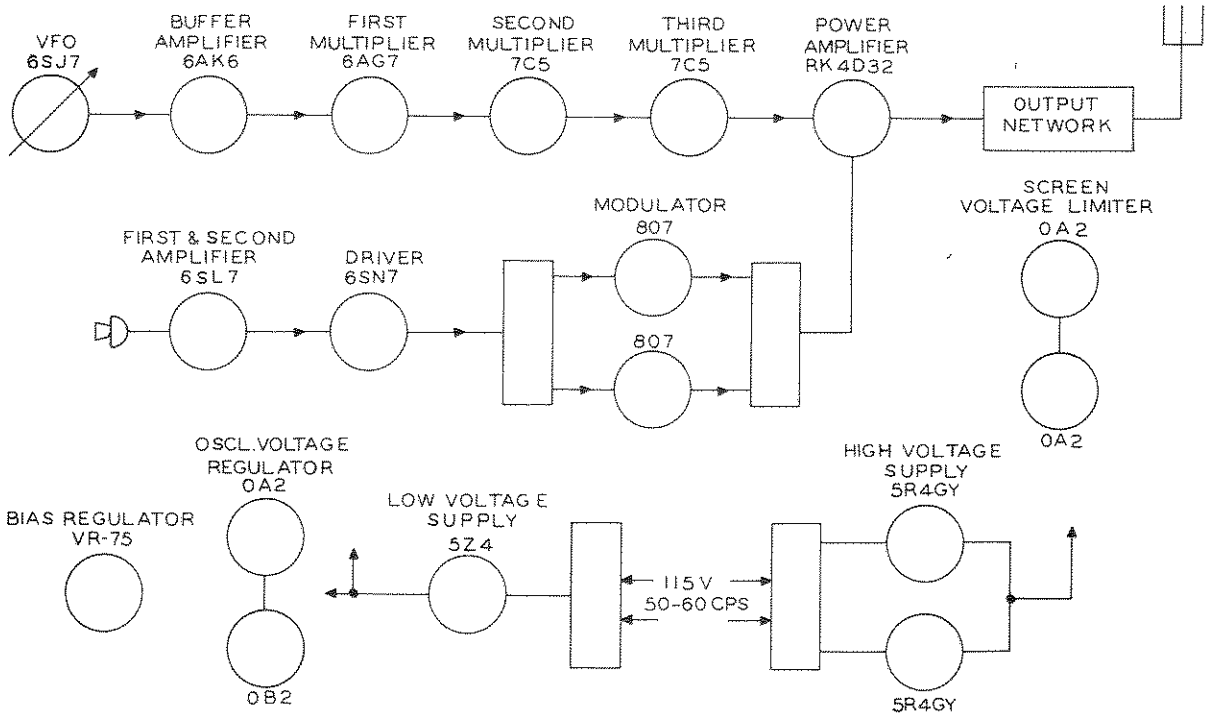


Figure 1-1 Model 32V Amateur Transmitter

SECTION 1

GENERAL DESCRIPTION

1.1. GENERAL.

1.1.1. This instruction book describes the installation, operation, and maintenance of the Collins 32V-3 amateur transmitter.

The type 32V-3 transmitter is a small, compact, VFO controlled unit featuring complete bandswitching and is capable of CW and phone operation on all amateur bands between 3.5 and 29.7 megacycles. Final plate power input of 120 watts phone and up to 150 watts CW is possible. Extra shielding and filtering is employed to minimize possibility of interference to other services. In fringe areas where television signals are very weak, certain installations may experience interference. In this event a low-pass filter such as the Collins Model 35C-2 should be installed in the antenna lead at the transmitter. Installation of a high-pass filter in the television receiver antenna lead may prove helpful.

The 32V-3 transmitter is designed for table mounting. The complete transmitter is housed in a single cabinet 21-1/8" wide, 12-1/4" high and 13-13/16" deep and weighs approximately 110 lbs. Openings are provided to assure adequate ventilation for all heat producing elements.

Transmitter components are divided into the five units named below:

70E-8A Oscillator
R-F Unit
Output Network
Speech Amplifier and Modulator
Power Supply

All wiring is independent of the cabinet, and the complete unit may be removed from the cabinet for inspection or maintenance.

Complete coverage of the 80, 40, 20, 15, 11 and 10 meter bands is obtained with the 32V-3. Quick band-change on all stages is accomplished by bandswitching. Tuning controls of the permeability tuned circuits of the 1st, 2nd and 3rd multipliers are ganged with the oscillator. The final tank consists of impedance matching network with two separate controls located on the front panel, one for tuning and one for loading.

Two heavy duty toggle switches control the low voltage and high voltage circuits. The switches are so arranged that the high voltage cannot be applied until the low voltage circuits have been energized.

For convenience in applying high voltage, a push-to-talk switch associated with the microphone may be used instead of the HV toggle switch.

A meter selector switch on the front panel enables the operator to meter all important circuits of the transmitter. This switch can be rotated to five different positions. Each position inserts a meter into the selected circuit to be metered. A separate meter reads FINAL AMPLIFIER plate current only. The CW-CAL-PH switch is used to select the type of emission desired and to calibrate the accuracy of the dial reading against a known standard frequency. In the CW position, the modulator is disabled and the master oscillator operates continuously with the HV switch on. In the "CAL" position a signal of strength suitable for zero-beating with incoming signals may be heard in the associated receiver without operation of the final amplifier. On phone position, the key is closed and the modulator is operative. Keying is accomplished by means of grid block keying of the buffer stages. This keying is done on the buffer and first and second multiplier stages.

1.2. REFERENCE DATA.

Power Source: 115 volts ac 50/60 cps single phase.

Power Input Requirements: The maximum overall input power requirement is 500 watts at 90% power factor.

PA Plate Power Input: The nominal rated power input of the 32V-3 is 120 watts on phone and 150 watts CW.

Audio Distortion: Audio distortion is less than 8% at 90% modulation with a 1000 cps input frequency.

Frequency Response: Within 2 db from 200-3000 cps.

1.3. TUBE COMPLEMENT.

Quantity	Tube Type	Function
1	6SJ7	Oscillator
1	6AK6	Buffer Amplifier
1	6AG7	First Multiplier
1	7C5	Second Multiplier
1	7C5	Third Multiplier
1	4D32	RF Power Amplifier
1	6SL7	Audio Amplifier
1	6SN7	Audio Driver
2	807	Modulators
1	5Z4	LV Rectifier
2	5R4GY	HV Rectifier
1	VR-75	Bias Regulator
2	0A2	Screen Voltage Limiters

SECTION 2

INSTALLATION

2.1. UNPACKING.

After removing the unit from the packing box, inspect the unit for loose screws or bolts. Be certain all controls, such as switches, dials, etc. work properly. In case of damage, file all claims promptly with the transportation company. If a claim for damage is to be filed, the original packing case and material must be preserved. To assure the clearing away of all packing or blocking materials, remove the transmitter from its cabinet. When removing the transmitter, support the rear of the chassis to prevent breaking the interlock switch on the right rear edge. Check all tubes to see that they are fully in their sockets. See figure 2-1 for tube placement.

2.2. PLACING TRANSMITTER.

The console type cabinet is designed to be placed on the operating table along with the receiving equipment. Allow enough space at the rear for making the necessary external connections and for replacement of fuses. Provide sufficient clearance at the sides for full circulation of air.

2.3. EXTERNAL CONNECTIONS.

Place the two power switches in the off position before attempting to make any external connections. These connections are as follows:

(1) AC Power Line
(2) Microphone and Key
(3) Radiation System
(4) Remote Relay
(5) Receiver Disabling Circuit
(6) Remote Push-To-Talk

2.3.1. POWER LINE. - The 32V-3 operates from a 115 volt, single phase, 50/60 cycle power source. The maximum power required from the line is 500 watts. Check the power line to see that it meets these specifications. Insert the 115 volt plug into a convenient standard outlet.

2.3.2. MICROPHONE AND KEY. - The microphone plug is inserted in the microphone jack, J201, on the front of the transmitter. Make sure the clamping ring on the microphone plug is tightly turned on the thread around the input receptacle. Push-to-talk control connections are made to pin number 2 to ground in the microphone plug if the microphone being used is equipped with a push-to-talk switch. When using a microphone that does not have such a switch, the transmitter can still be controlled from a remote position by running a pair of leads from terminal 11 and 12 on the rear terminal strip (E308) to a switch box located at some point convenient to the operator.

CAUTION

Do not get the microphone and push-to-talk connections reversed when assembling the microphone plug as the relay voltage present could damage certain types of microphones.

2.3.3. RECEIVER DISABLING CIRCUIT. - Terminals 24 and 25 on a rear terminal strip are connected to normally closed contacts on the carrier control relay and are to be used for connections to the receiver disabling circuit. Remove the jumper on the receiver terminals and connect to these two terminals. The receiver can then be made inoperative when the push-to-talk switch is pressed, or whenever the HV switch is operated.

2.3.4. REMOTE RELAY CONNECTIONS. - Terminals 8, 9, 22 and 23 at the rear of the terminal strip may be used for operating an antenna change-over relay, or (when the 32V-3 is used as an exciter) they may be used as a relay for turning on the plate power of a power amplifier stage. If a 115 volt a-c type relay is used, connect the leads from the relay coil to terminals 22 and 23. In this manner, the relay coil will be energized thru contacts 8 and 9 of relay K301 whenever the push-to-talk switch or HV switch is operated. If a d-c type of relay is used, remove the jumper from terminals 8 and 9 and use terminals 9 and 23 to control the operation of the remote relay through the contacts of the transmitter relay.

CAUTION. - Terminals on E-308 are not filtered for TV1.

CAUTION. - Do not use the RECEIVER DISABLING CIRCUIT AND REMOTE RELAY CONNECTIONS for conducting large currents, as damage to the relay contacts may result.

CAUTION. - For safety reasons, remove the 115 volt plug from the a-c power outlet while making connections to the rear terminal strip.

2.3.5. RADIATION SYSTEM. - The output network will match resistive loads of 26 to 200 ohms on all bands. It will tune out inductive or capacitive reactances normally encountered. The output network is unbalanced with respect to ground and may be used to feed directly into unbalanced systems. Connection to the antenna transmission line is made by means of a UG-21B/U (Amphenol 82-61) 50 ohm coaxial connector. Do not end feed antennas which are multiples of 1/2 wave in length directly from the antenna terminals; rather, use an external antenna tuner. Refer to "The ARRL Antenna Handbook" or any other good antenna handbook for antenna constructional information. To prevent accidental shocks, attach a ground wire to the lower left hand (Viewed from the cabinet rear) bolt that holds on the largest rear terminal cover.

2.3.6. EXTERNAL ANTENNA TUNER. (Not Available) To feed balanced transmission lines, tuned or untuned, couple the transmitter to the transmission

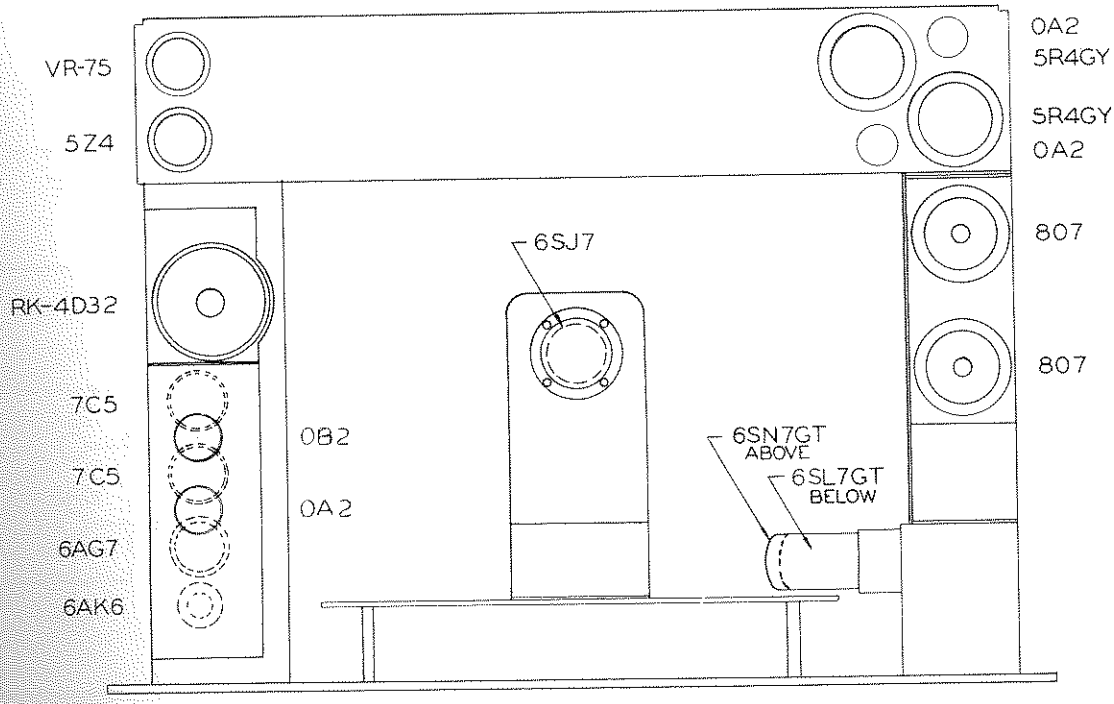


Figure 2-1 Tube Placement Diagram

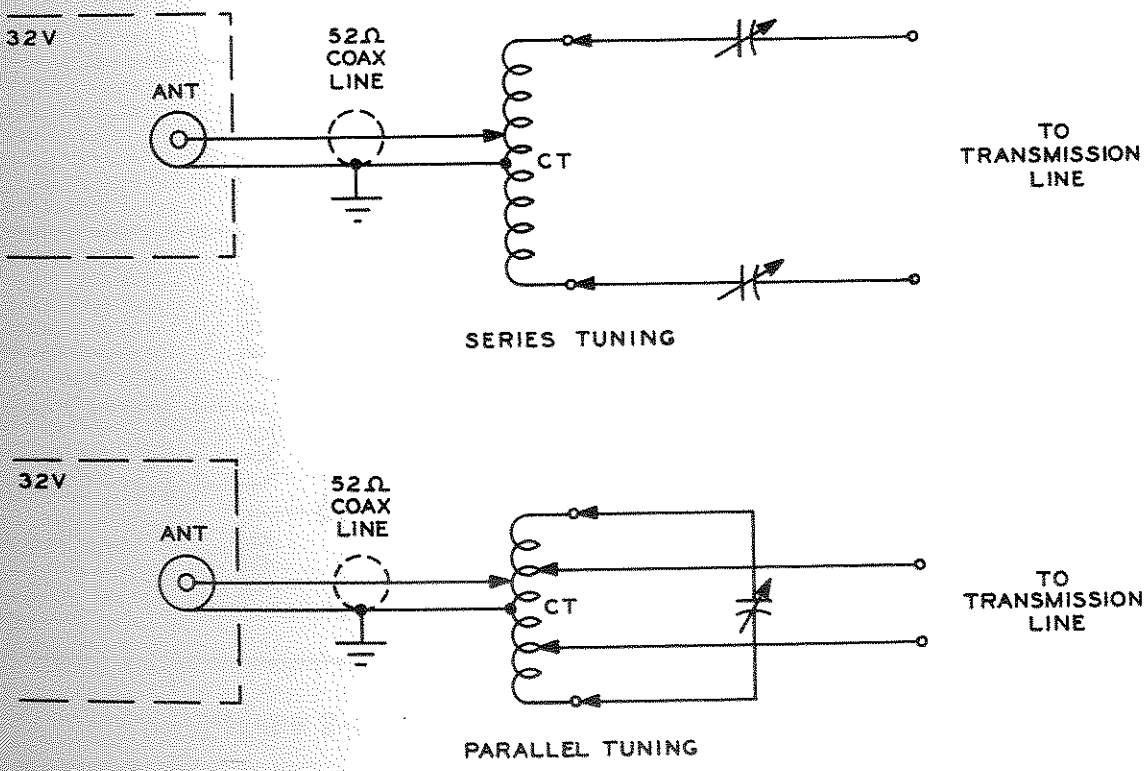


Figure 2-2 Typical Antenna Tuner

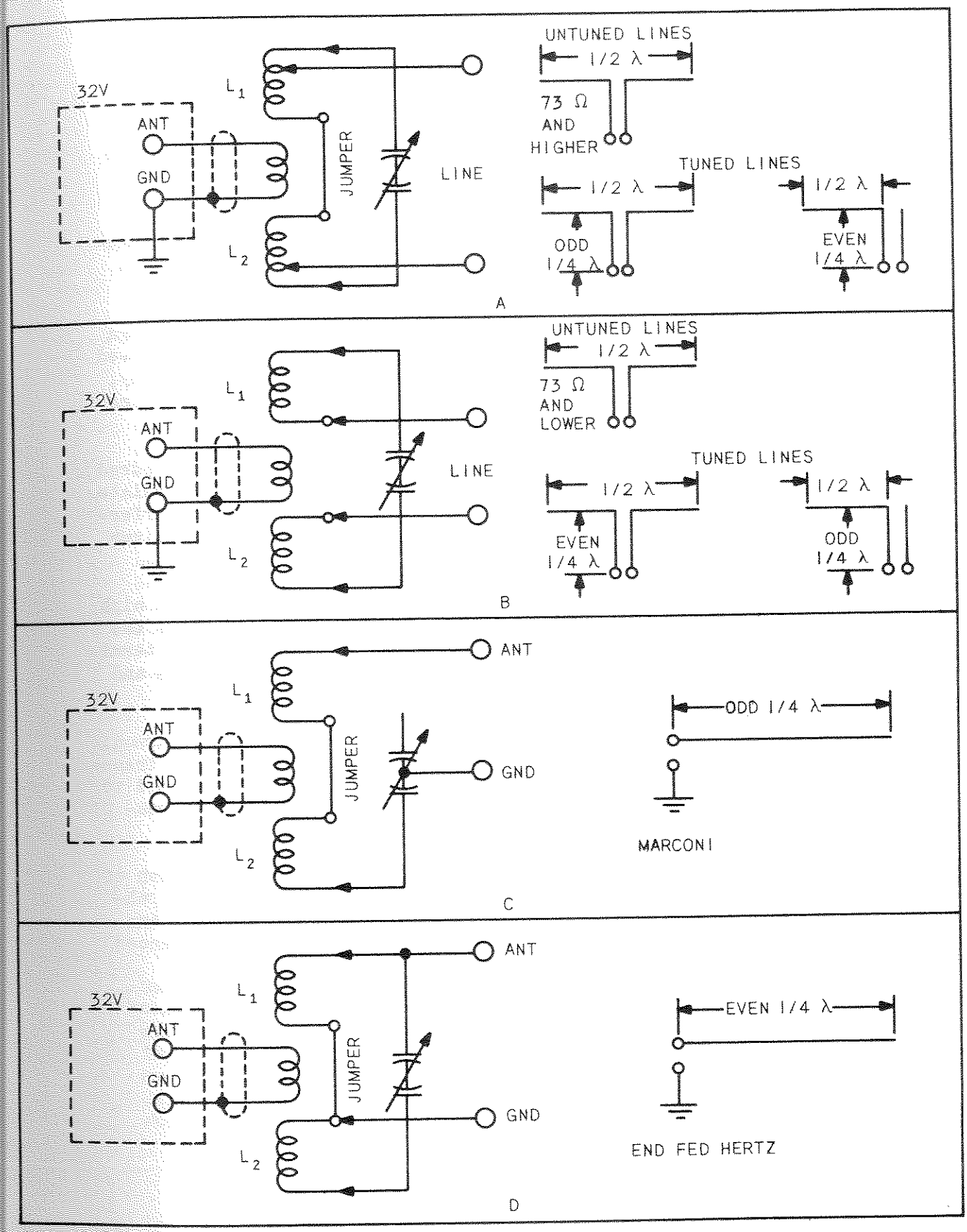


Figure 2-3 Typical Antenna Tuner Circuits

TELEVISION INTERFERENCE

The design of the 32V-3 transmitter is such that spurious radiation has been reduced to a low value, particularly on television frequencies.

The rf unit is completely shielded in a metal box inside the main cabinet. Most circuits passing through the cabinet are filtered for attenuation at television frequencies. These features minimize direct radiation from the cabinet and external leads.

Spurious radiation from the antenna is attenuated by careful design of the rf circuits. In the power amplifier the use of a pi section followed by a L section is effective in reducing harmonics of the carrier frequency. Use of a coaxial transmission line from the transmitter to the transmitting antenna is recommended.

However, when a television receiver is operated within a few hundred feet of a powerful transmitter, even though the transmitter does not radiate an interfering signal on the TV channel, it is to be expected that interference may be caused by lack of enough selectivity in the television receiver input circuit.

In such cases, improve the receiver selectivity by installing a high pass filter at the receiver antenna terminals. If a booster is used at the television receiver, install the high pass filter at the antenna input terminals of the booster and use very short leads between the booster output and the television receiver input.

If the interferance persists and proves to be high frequency harmonic output of the transmitter, install a low pass filter as closely to the transmitter antenna connector as possible. The transmitter cabinet is punched to mount a Collins Type 350-2 low pass filter which has a least 70 db attenuation to all outputs 54 megacycles or higher.

The following publications contain information on the elimination of television interference at the receiver: The Radio Amateur's Handbook published by The American Radio Relay League, West Hartford, Connecticut; and Television Interference, published by Remington Rand Laboratory of Advanced Research, South Norwalk, Connecticut.

line through a simple, tuned circuit. This arrangement will match a wide range of impedances. It will also add further attenuation to harmonics causing TVI, providing it is completely shielded. Figure 2-3 illustrates an antenna tuner that will function satisfactorily in this application. The impedance of the transmission line is matched by proper choice of taps on the inductances L1 and L2. The coupling link is coupled as tightly as possible and all loading adjustments are made by means of the LOADING control on the 32V-3. On the 15, 11, and 10 meter bands, the number of turns in the coupling coil should not exceed one turn; two turns may be necessary on the 20 meter band.

a. UNTUNED HIGH IMPEDANCE TRANSMISSION LINE. - If the line has a characteristic impedance of 73 ohms or more, employ parallel tuning of the antenna coils L1 and L2. For parallel tuning, close the jumper between the antenna coils. Transmission line taps then should be set on the same turns as the capacitor taps to start with, varied toward the center of the coils until proper loading is obtained. In this type of operation, low values of capacitance and high values of inductance for the operating frequency generally are best. See illustration A., figure 2-3.

b. UNTUNED LOW IMPEDANCE TRANSMISSION LINES. - Transmission lines having a characteristic impedance of less than 50 ohms require series tuning of the antenna coils. This is done by opening the jumper between the coils and moving the transmission line tap arms to the inside coil turns. The capacitor taps should set at the outside turns and varied toward the inside turns until proper loading is obtained. Higher values of tuning capacity usually work out best in this type of operation. See illustration B., figure 2-3.

c. VOLTAGE FED TUNED LINES. - Transmission lines that have high voltage points at the tuner should be connected and tuned according to specified instructions in paragraph a. above. These lines should be cut to exact multiples of a quarter wave in length.

d. CURRENT FED TUNED LINES. - Transmission lines having high current at the tuner end should be connected and tuned according to instructions given in paragraph b. above. These lines should also be cut to exact multiples of a quarter wave in length.

e. QUARTER WAVE MARCONI. - Series tuning is indicated for quarter-wave Marconi antennas. In this type of operation, connect the antenna tuning circuit so that the two sections of the antenna coil and one-half of the antenna tuning capacitor are in series. To do this, place a grounding jumper to the rotor of the antenna tuning capacitor, connect the antenna to one end of the antenna coil, connect one stator of the tuning capacitor to the other end of the antenna coil and disconnect the other stator completely. See illustration C., figure 2-3. In event r-f

voltage appears on the cabinet, it can be minimized by extending the ground wire to 1/2 wave length and series tuning it until resonance is obtained.

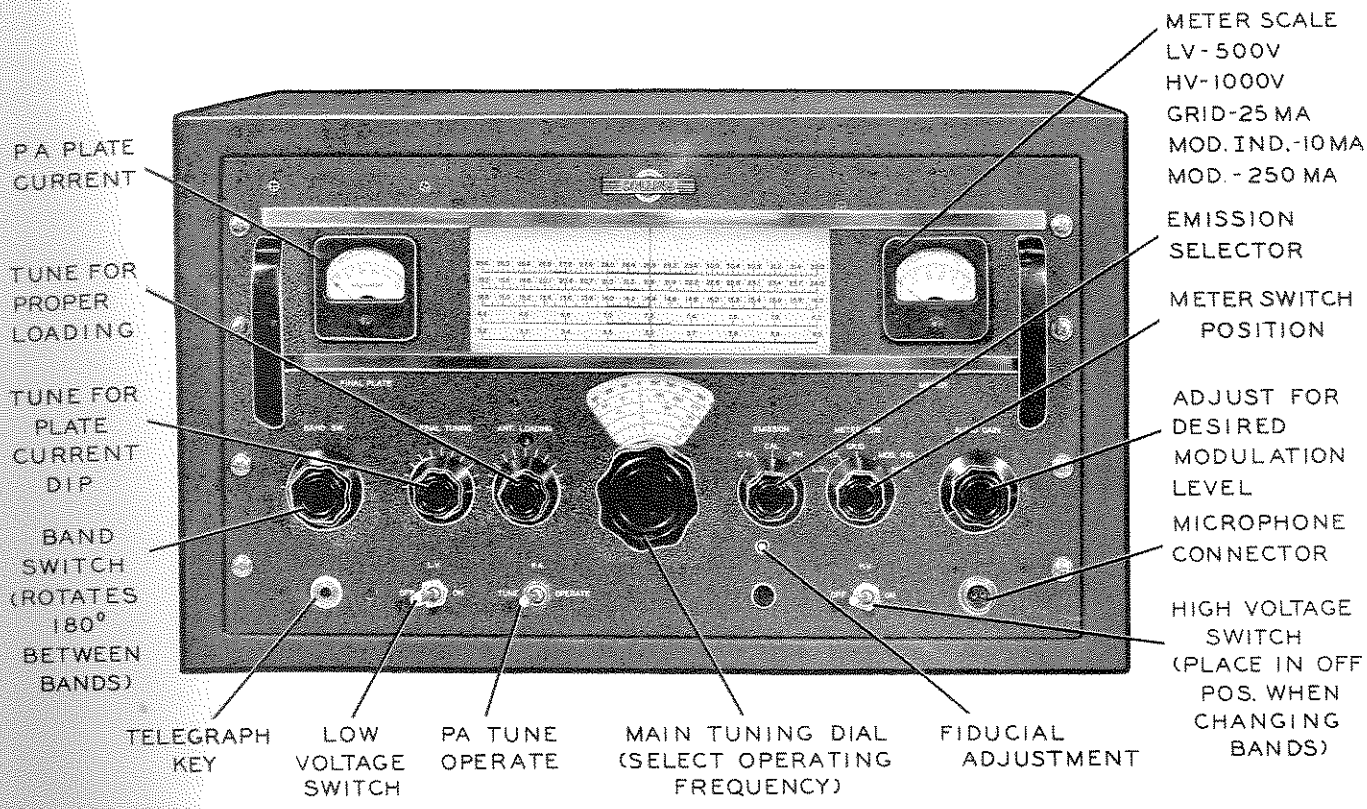
f. END FED HALF WAVE. - This tuner can be used to tune this type of antenna also. Employ parallel tuning for this type of operation. Connect the antenna to one end of the antenna coil, make a ground connection to the inside turn of one of the antenna coils and close the jumper between the coils. The tuning capacitor taps should be equally spaced from each end of the antenna coils for proper tuning at the operating frequency. See illustration D., figure 2-3.

2.3.7. ANTENNA TUNER ADJUSTMENT. - After recognizing the high order of filtering that it was necessary to incorporate in an amateur transmitter operating in close proximity to television receivers, Collins engineers designed an output network to be used in the 32V-3 which should offer a great deal of attenuation to high order harmonics. In order to do this, it was necessary that an additional "L" section filter be added to the existing pi section. This new section contributes a great deal of filter action, but also offers some disadvantages. The first apparent difficulty noted is the apparent sharpness of tuning on the high frequency bands, particularly 28 mc. It must be recognized that this is inherent in any tuned filter where a high degree of selectivity is needed, and the fact that it does tune so sharply indicates that it is operating properly.

The pi section network was designed so that when used with the L section, a suitable range of impedances could be satisfactorily matched. The extreme cases were tabulated and the resulting voltages and currents were calculated. These voltages and currents were of such a magnitude as to not exceed the ratings of the components. However, when the customer connects the 32V-3 to an antenna system, frequently the standing waves are of such a nature as to reflect sufficient reactance so that the assigned endpoints of impedances are exceeded. This may result in an excess current thru the loading capacitors and subsequent failure.

However, when adequate precautions are taken, this problem can be greatly reduced. These precautions may be described simply by stating that they are directed in such a manner as to insure a flat 52 or 72 ohm line from the 32V-3 to the antenna tuner. The tuning procedure is as follows.

Disconnect the coaxial line from the antenna tuner link and terminate it in a non-inductive resistor whose value is the same as the Z_o of the coaxial line, and whose power rating is sufficient to dissipate 50 watts or so for prolonged periods. The transmitter should then be tuned and loaded to the proper point in the "tune" position. The unit should then be momentarily switched to the operate position to see that the final plate current reading is correct. In the event that non-inductive resistors are not available, it is possible to use a 100 watt lamp and obtain a SWR of about 1.5/1 on a 52 ohm line.



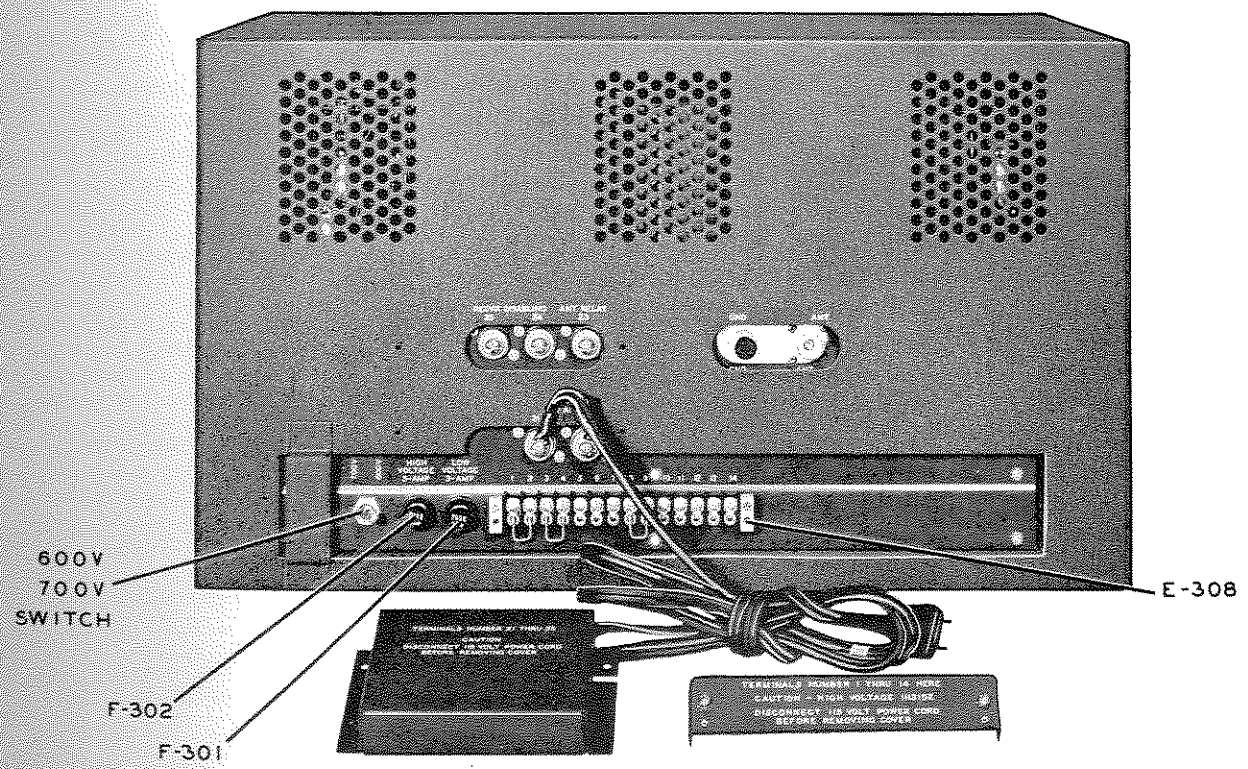


Figure 3-1 32V-3 Control Functions

The coaxial line should then be connected through a series variable capacitor to the antenna tuner link of one turn on 10, 15 and 20 meters, two turns on 40 meters and three on 80 meters. The antenna tuner is resonated with the transmitter and the link reactance tuned out with the coaxial line series capacitor. The feeders should then be moved in equal increments out from the center, with the tuned circuit resonated, until the same loading condition exists that was noted with the dummy load. This will set up the desired condition where the transformation of impedance from the coaxial line is from 52 or 72 ohms to the antenna impedance. If this is done no standing waves will exist on the coaxial line and the loading capacitors will not be operated at excessively high values of current.

2.3.8. 35C-2 FILTER INSTALLATION. - If a 35C-2 Low Pass filter is used, install as indicated in the 35C-2 book. Make the interconnecting coax lead as short as possible and clean the paint from around the mounting holes so that the case is well grounded.

ADJUSTMENT AND OPERATION

SECTION 3

ADJUSTMENT AND OPERATION

3.1. ADJUSTMENT.

3.1.1. 600 v - 700 v SWITCH. - This switch, located in the primary of the power transformer, has been placed at the rear of the transmitter to select output voltages of either 600 or 700 volts. It is recommended that this switch be placed in the 600 volt position for initial adjustments.

3.1.2. CALIBRATION. - To check dial calibration, proceed as follows:

a. Turn the equipment ON as outlined in steps a. and b. paragraph 3.2.3.

b. Tune a communications receiver to WWV at 10 mc. The BFO in the receiver should be OFF.

c. Rotate the BAND switch to 80 meter band. (lowest scale)

d. Rotate the TUNING dial to 4.0 mc.

e. Rotate the CW-CAL-PH control to CAL. This turns the VFO, buffer, first and second multiplier stages ON so that a calibration signal can be heard. Close the telegraph key.

f. Continue to rotate the TUNING dial about 4.0 mc until the calibration signal is zero beat with WWV.

g. Turn the FIDUCIAL screw until the hair line is on 4.0 mc.

h. In like manner, the dial can be calibrated on 15,000 kc by setting the communications receiver at WWV on 15 mc and the 32V-3 TUNING dial at 15 mc on the 20M BAND position. See the following table.

WWV Frequency	Dial Setting	Oscillator Frequency	Oscillator Harmonic
10 mc	4,000	2,000	5th
15 mc	15,000	1,875	8th
15 mc	7,500	1,875	8th

3.2. OPERATION.

3.2.1. GENERAL. - Operation of this equipment is exceedingly simple once the functions of the controls are understood. The function of the controls is hereby given, followed by a step-by-step procedure for operation of the equipment.

3.2.2. FUNCTION OF CONTROLS.

a. BAND SWITCH. - This control selects the proper tuning elements for all stages of the amateur band upon which operation is desired. The knob rotates 180 degrees between adjacent bands. Clockwise rotation selects higher frequency bands. The band selected is indicated by the band lighted slide rule dial.

b. TUNING Control. - This control operates both the slide rule dial and the vernier dial to select the exact frequency upon which operation is desired.

c. CW-CAL-PH Switch. - This three-position switch selects the type of emission required. In the CW position, the secondary of the modulation transformer is short circuited, the screen voltage is removed from the modulator tubes, a bleeder is placed between the PA screen grid to ground and the carrier-control relay is connected so that it can be operated by the HV switch. The transmitter is ready for CW operation when the key is inserted in the KEY jack. In the CAL position, the VFO, buffer, and three multiplier stages are in operation to supply a signal of suitable strength for zero-beating against received signals without causing interference to other stations. The carrier control relay is disconnected from the HV switch so that the associated receiver and antenna changeover relay will be in the "Receive" condition. In the PH position, the switch opens the short circuit on the secondary of the modulation transformer, closes the keying circuit, applies screen voltage to the modulator tubes and connects the carrier control relay so that it can be operated by the HV switch or a push-to-talk switch on a microphone.

d. METER Switch. - The METER switch selects various circuits to be metered by the meter directly above the switch. This meter has 3 scales: 0-250; 0-500 and 0-1000. The table below indicates how it is used:

METER SWITCH POSITION	CIRCUIT METERED	FULL SCALE DEFLECTION READS
LV	Low voltage	500 volts
HV	High voltage	1000 volts
GRID	PA grid current (DC)	25 ma
MOD IND	Mod. grid current	10 ma
MOD	Mod. plate current	250 ma

The meter on the left reads PA Plate current only. Full scale deflection reads 500 ma.

e. AUDIO GAIN. - This control adjusts the level of modulation in phone operation.

f. LV Switch. - The LV switch turns on the filaments and the low voltage plate and bias supply. (Plate voltage is not applied to the r-f exciter tubes, however, until the HV switch is turned on, except when the CW-CAL-PH switch is on CAL position.)

g. HV Switch. - The HV switch turns on the high voltage supply and connects plate voltage to the r-f exciter tube through operation of carrier control relay K301. The push-to-talk connections are in parallel with this switch.

h. FINAL TUNING. - This control is used to obtain resonance of the PA plate circuit. It must be reset after each adjustment of the ANT. LOADING controls.

i. ANT. LOADING. - This control is used to obtain correct antenna tuning and loading. Start with this control in position number 1. Usually the 80-meter band will load up on position 1, 2, or 3, the 40-meter band on 4, the 20-meter band on 5, the 15-meter band on 6, and the 10 and 11-meter bands on position 6 of the loading control.

j. TUNE-OPERATE SWITCH. - This switch inserts some resistance in the primary of the power transformer in the TUNE position to reduce plate voltage during the tuning procedure. This switch should always be used to protect the power amplifier tube in off resonance conditions.

k. FIDUCIAL. - This control, a small screwdriver adjustment located directly under the CW-CAL-PH knob, is used to move the vernier dial

index during calibration adjustments. Once it has been set, further adjustment will be unnecessary over long periods of time.

l. 600 - 700 v SWITCH. - This switch, located at the rear of the chassis, is used to select either 600 or 700 volts (approx.) for application to the plate.

3.2.3. OPERATION PROCEDURE.

a. Operate the LV switch to the ON position. Allow two minutes for the tubes to heat.

b. Turn the AUDIO GAIN to the counterclockwise stop. (off)

c. Turn the ANT. LOADING control to position 1. (minimum loading)

d. Place the CW-CAL-PH control in the position indicating the desired emission.

e. Rotate the BAND switch to the band containing the desired operation frequency.

f. Rotate the TUNING dial to the desired frequency.

g. Place the Meter selector switch in the GRID position and close the telegraph key. (If PH emission was selected, it will not be necessary to close the key.)

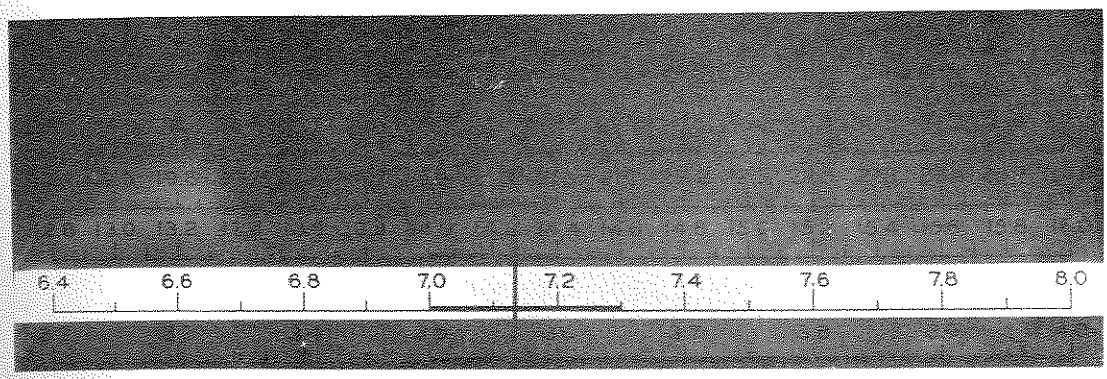
h. Place the TUNE-OPERATE switch in the TUNE position.

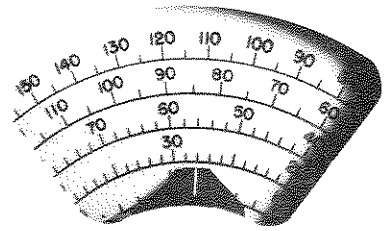
i. Observing the FINAL PLATE meter, turn the HV switch ON and quickly turn the FINAL TUNING to resonance, i.e. minimum plate current dip.

j. Observe the GRID current reading on the right hand meter. This should be between 5 and 15 ma.

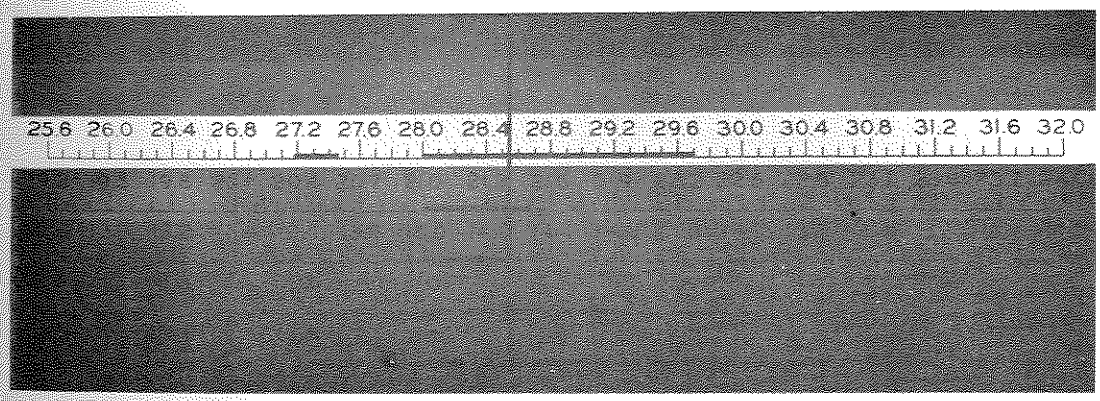
k. Operate the ANT. LOADING control clockwise until approximately 125 ma loading is obtained while keeping FINAL TUNING at resonance. Repeat this procedure until 125 ma reading is obtained with complete resonance of PA. If it is impossible to load to 125 ma PA plate current, rotate the ANT. LOADING control clockwise until proper loading is obtainable.

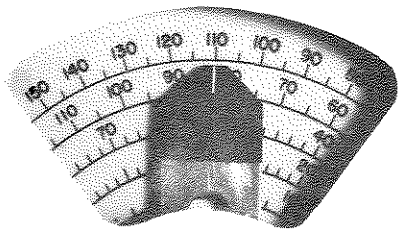
l. Place the TUNE-OPERATE switch in the OPERATE position and load the PA to 180 ma with the ANT. LOADING control maintaining resonance with the FINAL TUNING control.





FREQ.= 7128 KC





FREQ. = 28510 KC

Figure 3-2 Typical Dial Readings

WARNING

Operation of this equipment involves the use of high voltages which are dangerous to life. Observe all safety regulations. Do not change tubes or make adjustments inside equipment with the high voltage supply ON. Do not depend upon door interlocks for protection but always turn the high voltage supply OFF. SWITCH TO SAFETY.

m. If CW emission is selected, the telegraph key can be opened and the transmitter keyed. If PH (phone) emission is selected, turn the METER switch to MOD. and observe the static (resting) modulator plate current. This should be about 50 ma for the 600 v position of the 600 - 700 v switch at rear (55 ma on the 700 v position). While speaking in normal tones into the microphone, advance the AUDIO GAIN control until the modulator plate current swings to about 100 ma on peaks. This will result in approximately 100% modulation with voice input. If desired, a more exact check of modulation level can be made with an oscilloscope while observing the proper meter swing for the voice of the individual operator.

With sine wave input, the modulator plate current will read about 200 ma for 100% modulation.

With the METER switch set to MOD. IND. a slight kick of the needle indicates approximately 100% modulation on voice peaks. This is useful as an alternate method of indicating modulation level since no deflection occurs on the meter until the modulation level reaches approximately 55%. The level at which the meter kicks depends somewhat upon the loading of the final amplifier and characteristics of the modulator tubes.

NOTE

In step g. above, the key plug can be pulled from the key jack since this is a closed circuit type jack.

CAUTION

When changing BANDS, place the HV switch in the OFF position. Also place the PUSH-TO-TALK switch in the OFF position.

NOTE

If the 600 - 700 v switch is placed in the 700 v position, the PA plate current should be 220 ma.

3.2.4. TYPICAL METER READINGS. (PH position without modulation.)

POSITION OF S305	LV	HV	GRID	MOD	FINAL PLATE BOTH PHONE & CW
600 v	240	580	10	50	160
700 v	240	720	10	55	200

3.2.5. DIAL CALIBRATION. - When changing BANDS, the proper scale on the slide rule dial is illuminated automatically as the BAND switch is rotated. At the same time, the vernier dial fiducial moves up or down the vernier dial face and stops at the corresponding scale to which the slide rule dial is positioned.

The dial is read by combining the vernier dial reading with the slide rule dial reading. The exact method varies somewhat for the low frequency bands and the high frequency bands and can best be learned by referring to figure 3-2.

3.2.6. ANTENNA LOADING TABLE. - This table indicates the approximate position for the antenna loading control when loading into various antenna impedances on the different bands.

	POSITION OF ANT. LOADING CONTROL (for resistive loads)			
FREQ MC	26 ohm LOAD	50 ohm LOAD	100 ohm LOAD	300 ohm LOAD
3.5	2	2	2	2
4.0	3	3	3	4
7.0	4	4	4	4
7.3	4	4	4	4
14.0	5	5	5	5
14.4	5	5	5	5
21.0	6	6	6	6
21.45	6	6	6	6
27.2	6	6	6	6
28.0	6	6	6	6
29.7	6	6	6	6

SECTION 4

CIRCUIT DESCRIPTION

4.1. GENERAL. - The following paragraphs have been written to enable the owner of a 32V-3 to understand the functioning of his transmitter more full . This section should be read and understood before an extensive servicing is attempted.

4.2. CIRCUIT DESCRIPTION. -

4.2.1. RF CIRCUITS.

a. OSCILLATOR. - A type 6SJ7 tube is employed in a highly stabilized master oscillator circuit to generate the controlling radio frequency voltage. This frequency generating unit is a linearly - tuning permeability tuned oscillator with a range of 1.6 to 2 megacycles. Sixteen turns of the main tuning dial cover this range. This provides 50 KC per revolution of the second harmonic (3.2 to 4 mc band). With the end points properly set up, the tuning curve is linear within one dial division of the ideal tuning curve on any of the bands in the operating range. The oscillator circuit is compensated for temperature changes and is entirely enclosed in a heavy aluminum case.

b. INTERMEDIATE STAGES. - Following the master oscillator a type 6AK6 is employed in an untuned, Class A amplifier stage. This stage completely isolates the master oscillator from the remaining tuned stages. The 6AK6 drives a series of three frequency multiplier tubes, the first of which is a type 6AG7. The operating frequencies at the plate of the multiplier tubes for the different bands is given in the following table.

	1ST MULT. 6AG7	2ND MULT. 7C5	3RD MULT. 7C5
80M	3.5 mc	3.5 mc	3.5 mc
40M	3.5 mc	3.5 mc	7 mc
20M	3.5 mc	7 mc	14 mc
15M	5.75 mc	10.5 mc	21 mc
11M	6.8 mc	13.6 mc	27 mc
10M	7 mc	14 mc	28 mc

Plate screen and filament power for these stages is obtained from the low voltage power supply. Gang tuning of the multiplier stages is obtained by moving powdered iron cores, attached to a common platform, in and out of the plate coils which are wound to give linear tuning. This platform to which the iron cores are attached is also ganged to the master oscillator tuning for complete, single control tuning of the exciter stages. Band switching is accomplished by adding extra padding capacity across coils by

means of the band switch in all cases except that of the 14-mc output of the third multiplier where an inductance is switched in parallel with the existing 40 meter inductor to lower the tuning inductance for 14 mc output.

c. POWER AMPLIFIER STAGE. - A type 4D32 tetrode power amplifier tube is used in the PA stage. This tube always operates as a straight amplifier. The plate circuit is tuned by a combination pi-network and "L" network which is band-switched along with the multiplier stages. The combination network reduces the output impedance to around 50 ohms on all bands by means of inductance and capacitance switching. The output network will actually operate satisfactorily with antenna impedances in the range of 26 to 200 ohms. It is also affective in reducing harmonic output of the transmitter. During phone transmission, the screen grid and plate of the 4D32 are both modulated. Plate and screen voltage is obtained from the high voltage supply while filament power is obtained from the low voltage plate supply transformer. The tube is biased with 75 volts of fixed-bias plus some grid leak bias.

4.2.2. AUDIO CIRCUITS. - The first and second audio amplifier consists of a type 6SL7 tube operated as a cascade amplifier. A volume control, R205, is located in the grid circuit of the second amplifier stage. The driver stage employs a type 6SN7 tube with the two triode sections operated in parallel to drive the modulator stage. The modulator stage utilizes a pair of type 807 tubes connected in a push-pull circuit and operating class AB_2. The output of the modulator is coupled to the final amplifier by transformer, T202, to modulate the plate and screen of that stage. During CW operation, the secondary of the modulation transformer is shorted out by S302A. Bias for the modulator tubes is adjustable by R305, is obtained from the low voltage supply and is regulated by the voltage regulator tube, V304, type VR-75. The secondary of the modulation transformer has a 500-ohm tap provided for supplying 60 watts of audio power to an external load.

4.2.3. HIGH VOLTAGE SUPPLY. - The high voltage transformer is energized when the contacts of relay, K301, are closed. The high voltage supply employs two type 5R4GY rectifier tubes connected in parallel in a full wave circuit. The output is filtered by a single section choke input filter. This supply furnishes voltage for the plate and screen of the final amplifier and plate voltage for the modulator tubes. The amount of output voltage from this supply may be either 600 volts or 700 volts, depending on the position of the tap switch, S305, in the primary winding of the high voltage transformer, T302. For the same power input, the efficiency of the final amplifier improves with the higher operating voltage. The tube manufacturer recommends no more than 600 plate volts for phone operation, but this is for CCS rating. A pair of 15-ohm resistors are connected in series with HV plate transformer primary for "tune-up". These are shorted out when operating.

4.2.4. LOW VOLTAGE SUPPLY. - Transformer, T301 furnishes power for both the voltage plate supply and the filament of all tubes in the transmitter. T-301