COLLINS

instruction book

Cedar Rapids Region | *Collins Radio Company, Cedar Rapids, Iowa*

32V-2
Transmitter

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COLLINS RADIO COMPANY

32V-2 ADDENDA

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-2 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. Since the impedance across the L section inductance reaches fairly high values so does the voltage, and in certain cases, the addition of modulation to the carrier causes the output capacitor to arc across. It has been found that this voltage can be decreased to a point where this is no longer occurs by lowering the inductance of the 28-mc portion of the L section inductor. The decrease in filter action by such a move is slight.

This modification, which is included in the 32V-2's (after serial no. 1325), is fortunately a simple one and can be readily accomplished by the customer. The task is to change the uppermost tap on L404 so that the inductance will consist of 8 turns from the top end of the coil instead of 11. An examination of this inductance will readily show that it is a simple task to move the lead that goes to the eleventh turn from the top to the eighth.

Another source of difficulty that is occasionally encountered is the failure of the fixed ceramic loading capacitors in the pi section network. Unfortunately, the solution of this problem is not so simple and requires an understanding by the customer of the variables involved.

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-2 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 frequently results in an excess current through 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-2 to the antenna tuner. The tuning procedure is as follows:

Disconnect the coaxial line from the antenna tuner link and terminate it in a noninductive resistor whose value is the same as the Z_0 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 noninductive 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.

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 loading capacitors will not be operated at excessively high values of current.

2/1/50

At the end of the 32V-2 production on January 25, 1951, a revision was instigated which was to be used on the 32V-3 and on any future 32V-2 if the production was reactivated. This change is recommended to any 32V-2 user.

In place of C406, use two 470 uuf capacitors, C406 and C407, in series. Part number 936 0226 00.

In place of old C407, use two 910 uuf capacitors, C408 and C409, in series. Part number 936 0246 00.

In place of old C408, use two 470 uuf capacitors, C410 and C411, in series. Part number 936 0226 00.

1-25-51

TABLE OF CONTENTS

TABLE OF CONTENTS (Cont.)

LIST OF ILLUSTRATIONS

Figure 1-1. Model 32V Amateur Transmitter

SECTION 1

GENERAL DESCRIPTION

1.1. GENERAL.

1.1.1. This instruction book has been prepared to assist in the proper installation, adjustment, operation, and maintenance of the Collins 32V-2 amateur transmitter.

The type 32V-2 is a transmitter designed for those amateurs who want medium power, bandswitching, and VFO control in a small cabinet. It may be used for either permanent or portable installations. All that is needed for putting it into operation is a 115-volt a-c source, an antenna, and a key or microphone. The 32V-2 can also be used to drive a kilowatt final amplifier.

The 32V-2 transmitter is designed for table mounting. The complete transmitter is housed in a single cabinet 21-1/8 in. wide, 12-7/16 in. high and 13-7/8 in. deep and weighs approximately 105 lb. Ventilating openings are provided in the back, two sides and bottom of the cabinet to assure adequate ventilation for all heat producing elements.

The components of the transmitter are so arranged that unit construction is possible, and they are broken down in five units as follows:

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-2. Quick band change is accomplished by bandswitching on all stages. The permeability tuned circuits of the 1st, 2nd, and 3rd multipliers have their tuning controls 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 arranged to that the high voltage cannot be applied until the low voltage circuits have been energized. A push-to-talk switch, associated with the microphone, may be used to apply the high voltage instead of the HV toggle switch for added convenience.

A CW sidetone oscillator is incorporated in this unit with which CW transmissions can be monitored.

An additional feature, the receiver muting connection, can be used to silence a type 75A receiver during CW transmission for CW break-in operation.

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, the master oscillator operates continuously with the HV switch on, and the CW sidetone oscillator is connected to the audio amplifier stages. On CAL position, a signal of strength suitable for zero-beating with incoming signals may be heard in the associated receiver without operating 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.

The AUDIO GAIN control is used to control the level of modulation and the strength of CW sidetone output.

1.2. REFERENCE DATA.

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

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

PA Plate Power Input: The nominal rated power input of the 32V-2 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
1	6SL7GT	CW Sidetone Oscillator
2	OA2	Screen Voltage Limiters

SECTION 2

INSTALLATION

2.1. UNPACKING.

After the unit has been removed 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. 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. Sufficient clearance at the sides should be provided for full circulation of air.

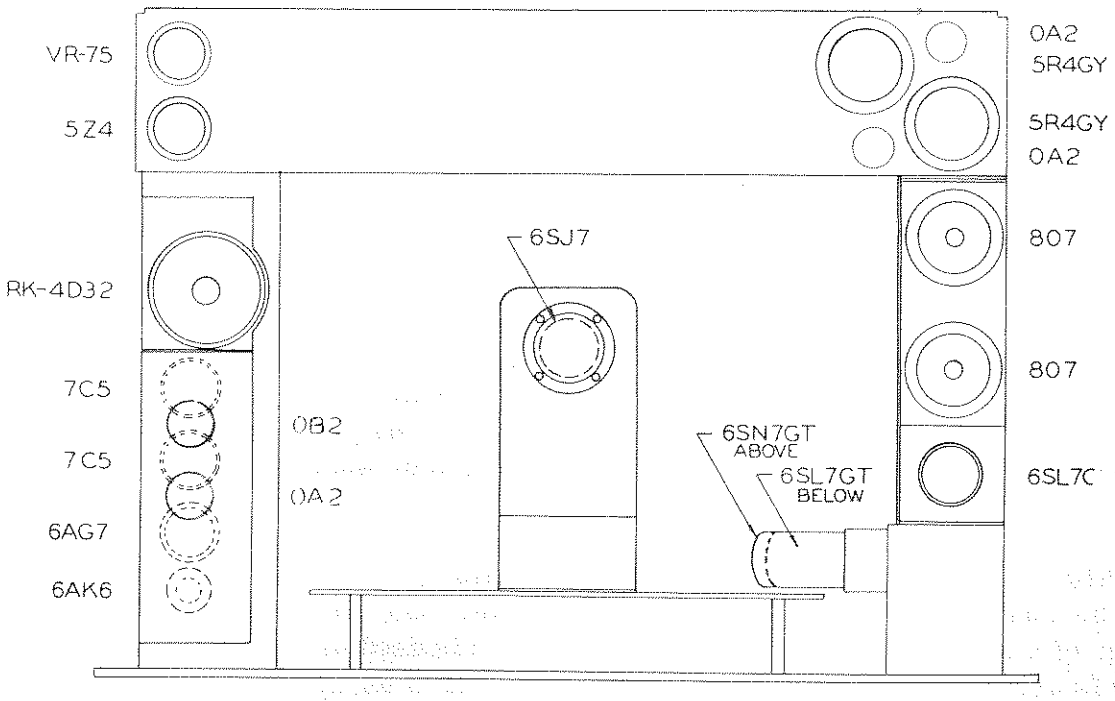

Figure 2-1. Tube Placement Diagram

2.3. EXTERNAL CONNECTIONS.

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

(1) AC Power Line
(2) Microphone and Key
(3) Radiation System
(4) Remote Relay
(5) Receiver Disabling Circuit
(6) CW Sidetone
(7) Receiver Muting

2.3.1. POWER LINE. - The 32V-2 operates from a 115-volt, single-phase, 50/60 cycle power source. The supply line should be checked for these specifications. The maximum power required from the line is 500 watts. 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 of 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 where 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 terminals 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 since the relay voltage present could damage certain types of microphones.

The telegraph key is plugged into the key jack, J101, on the front panel.

2.3.3. RECEIVER DISABLING CIRCUIT. - Terminals 13 and 14 on the rear terminal strip (E308) 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 terminals 13 and 14 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 7, 8, 9, and 10 on the rear terminal strip may be used for operating an antenna change-over relay or a relay for turning on the plate power of a power amplifier stage when the 32V-2 is used as an exciter. If a 115-volt a-c type relay is used, connect the leads from the relay coil to terminals 7 and 10. In this manner, the relay coil will be energized through 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 10 to control the operations of the remote relay through the contacts of the transmitter relay.

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 AC power outlet while making connections to the rear terminal strip.

Switch pi S101H, located at the rear of the band switch, can be used to automatically operate antenna selector relays, etc., as the band switch is turned. Connections to this switch section will have to enter the cabinet through a ventilation slot at the side of the cabinet.

2.3.5. CW SIDETONE. - Any 500-ohm or higher impedance headphone or 500- to 1000-ohm speaker can be connected between terminals 16 and 12 (gnd) at the rear of the unit for sidetone output. The sidetone will be operative when the EMISSION switch is in the CW position. Sidetone pitch is controlled from within the top door while the volume is controlled by the AUDIO GAIN control.

2.3.6. RECEIVER MUTING. - If a Collins Model 75A receiver is used for receiving, CW break-in operation can be improved by connecting terminal B on the receiver to terminal 15 on the 32V and terminal G to terminal 12 (gnd). This connection mutes the receiver audio when the key is pressed, and the receiver NOISE LIMITER switch is in the IN position. For CALIBRATION, the receiver limiter switch should be in the OUT position.

2.3.7. RADIATION SYSTEM. - The output network will match impedance of 26 to 300 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 PL-259 52-ohm coaxial connector. Do not feed antennas which are multiplies of 1/2 wave in length directly from the antenna terminals; rather, use an external antenna tuner. Random length antennas must not fall on exact odd multiples of 1/4 wave length long but should be 10 to 20% longer or shorter. A Type 315E-1 Balun Transformer (not supplied) may be used to feed a balanced antenna system.

2.3.8. EXTERNAL ANTENNA TUNER (Not Available).

To feed balanced transmission lines, tuned or untuned, couple the transmitter to the transmission line with a simple tuned circuit illustrated on following page.

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 2-2 illustrates an antenna tuner which will function satisfactorily in this application. The impedance of the transmission line is matched by choosing proper taps on the inductances L1 and L2. The coupling link is coupled as tightly as possible, and all loading adjustments are done with the LOADING control on the 32V-2. 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.

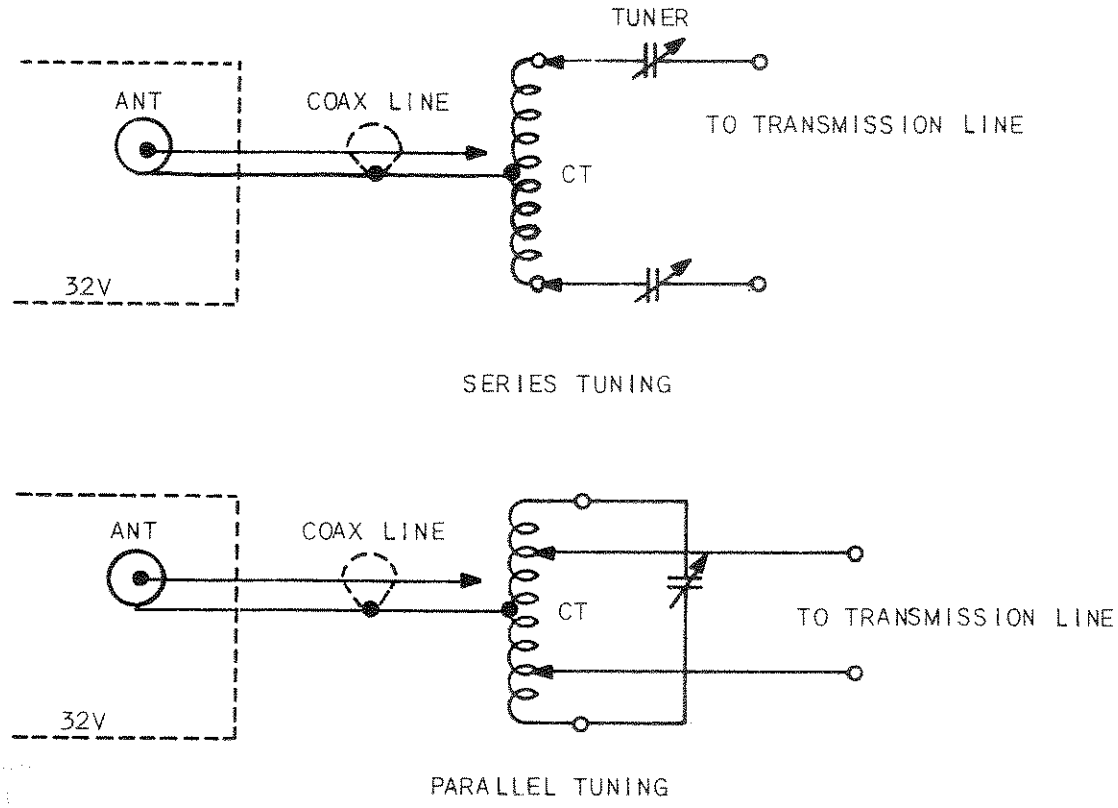

Figure 2-2. Typical Antenna Tuner

a. UNTUNED HIGH IMPEDANCE TRANSMISSION LINE. - If the line has a characteristic impedance of 73 ohms or more, parallel tuning of the antenna coils L1 and L2 should be employed. For parallel tuning, the little jumper seen above the antenna coils should be closed. The transmission line taps should be set on the same turns as the capacitor taps to start with, then varied towards the center of the coils until proper loading is obtained. The transmission line taps are those at the top of the coils while the capacitor taps are those nearer the bottom. 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 small jumper above the coils and moving the transmission line tap arms to the inside coil turns. The capacitor taps should be set at the outside turns and varies 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 which have a high voltage point at the transmitter should be connected and tuned identically with instructions given in a. above. It is recommended that tuned lines be cut to multiples of a quarter wave in length.

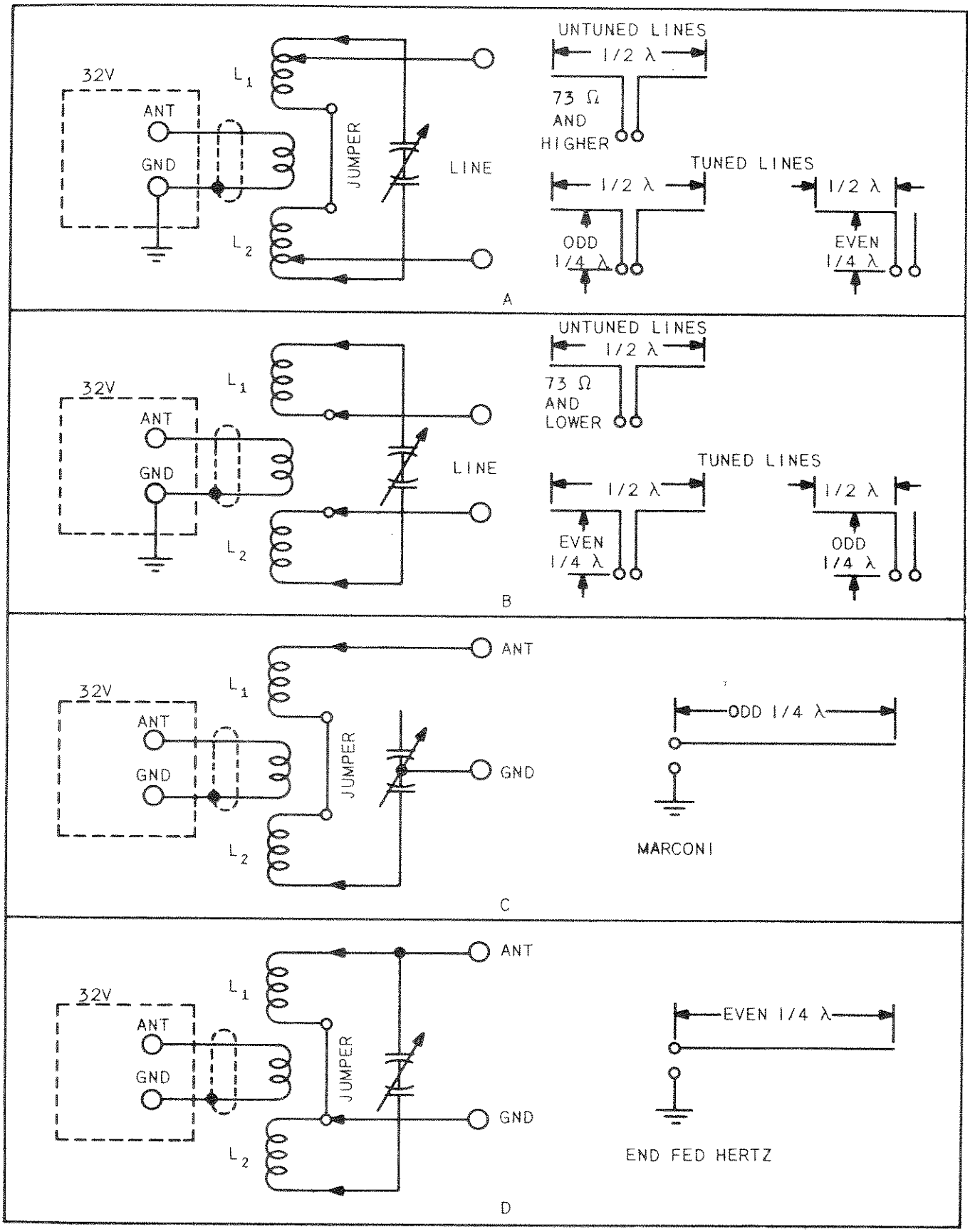

Figure 2-3. Typical Antenna Tuner Circuits

d. CURRENT FED TUNED LINES. - Transmission lines having high current at the transmitter end should be connected and tuned identically with instructions given in 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, the antenna tuning circuit should be connected 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. (Place a piece of insulation material between the tap rotor and the coil turns.) 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. Parallel tuning should be employed for this type operation. The antenna should be connected to one end of the antenna coil, a ground connection should be made to the inside turn of one of the antenna coils, and the little jumper on top of the coils should be closed. 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.

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-2 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. - The 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 operating the equipment.

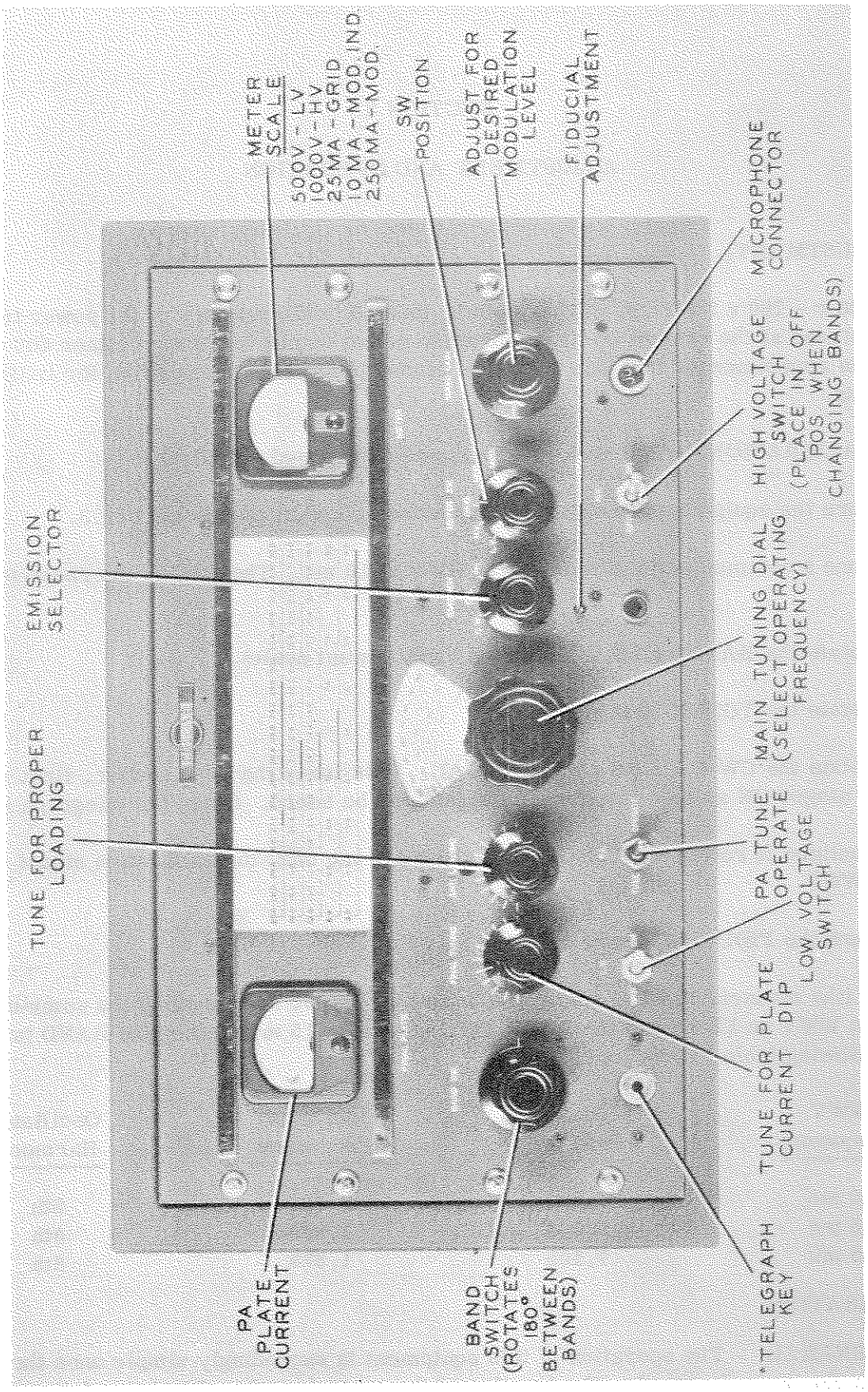

Figure 3-1. 32V-2 Control Functions

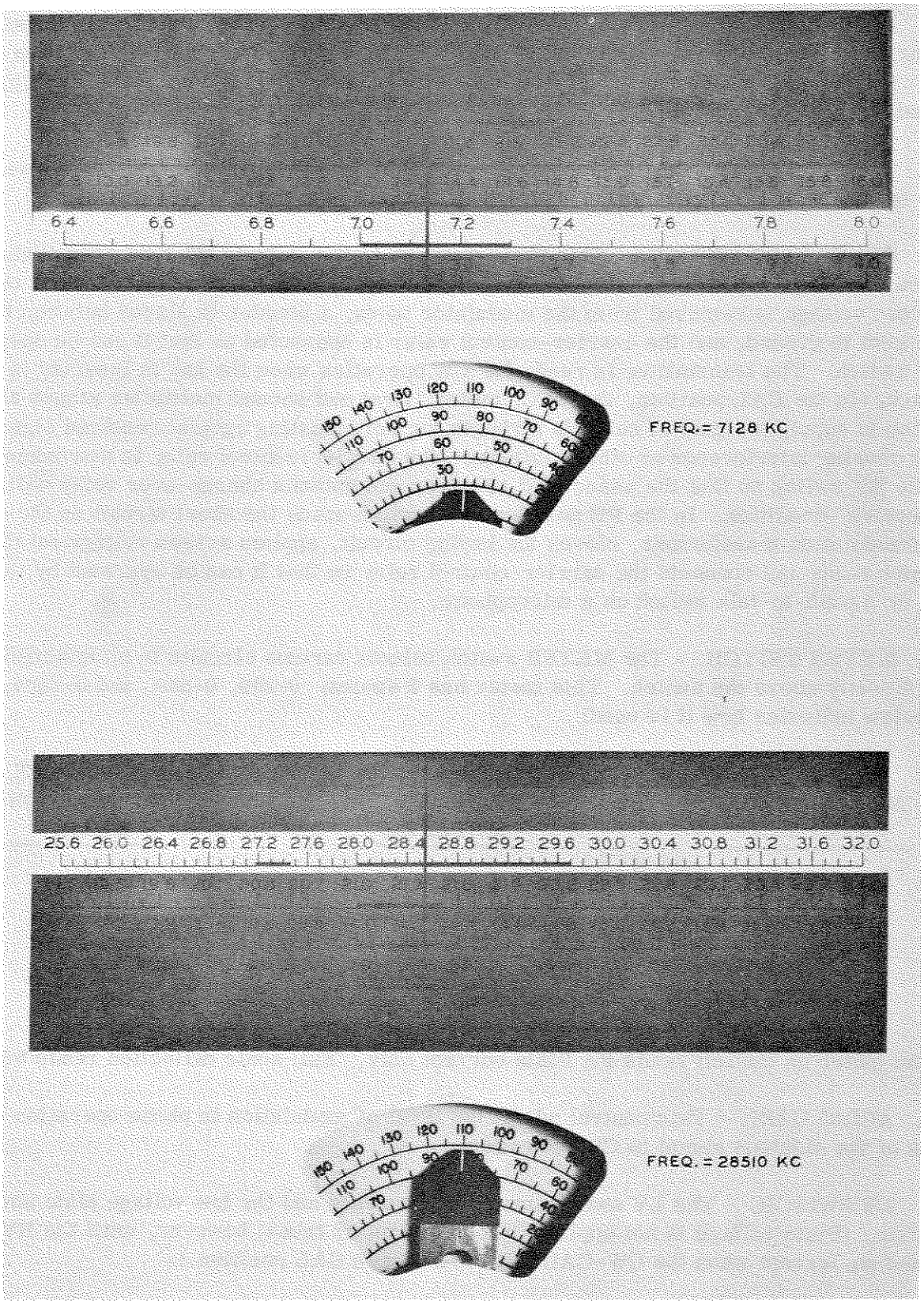

Figure 3-2. Typical Dial Readings

3.2.2. FUNCTION OF CONTROLS.

a. BAND SWITCH. - This control selects the proper tuning elements in all stages for 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, first and second 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 change-over 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 adjust the level of modulation in phone operation and the volume of the sidetone signal in CW operation.

f. LV SWITCH. - The LV switch turns the filaments and the low voltage plate and bias supply on. (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 positions 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 screw driver 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 V - 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 PA plate.

m. SIDETONE PITCH. - The sidetone pitch control is located within the cabinet near the modulator tubes. This adjustment should be set at the position which produces the most desirable tone according to individual taste.

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 operating 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.

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 was 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 v - 700 v switch at rear (55 ma on the 700 v position). Advance the AUDIO GAIN control while speaking in normal tones into the microphone 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 modulating 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 v - 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 AND CW
600 v	240	580	10	50	180
700 v	240	720	10	55	220

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 from the low frequency bands to 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 for 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-2 to understand the functioning of his transmitter more fully. This section should be read and understood before any extensive servicing is attempted.

4.2. CIRCUIT DESCRIPTION.

4.2.1. R-F 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 bend). 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 2×	3.5 mc 1×	3.5 mc 1×
40M	3.5 mc 2×	3.5 mc 1×	7 mc 2×
20M	3.5 mc 2×	7 mc 2×	14 mc 2×
15M	5.75 mc 3×	10.5 mc 2×	21 mc 2×
11M	6.8 mc	13.6 mc 2×	27 mc
10M	7 mc 4×	14 mc 2×	28 mc 2×

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 excepting 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 26 to 600 ohms. It is also effective in reducing harmonic output of the transmitter. The screen grid and plate of the 4D32 are both modulated in phone transmission. 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, and obtained from the low voltage supply and 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 the 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 low voltage plate supply and the filament of all tubes in the transmitter. The T301 is energized by closing the LV switch, S304. Three separate windings on transformer T301 furnishes filament power to the tubes. The low voltage plate supply employs a type 5Z4 rectifier tube in a full wave circuit with a two-section choke input filter. This supply has a total output voltage of approximately 315 volts; 240 volts is supplied to the audio amplifier, oscillator, buffer and multiplier stages. Bias voltage for the modulator and final amplifier stage is furnished by this supply. It also supplies voltage for the operation of relay K301.

4.2.5. RECEIVER MUTING CIRCUIT. - Users of the Collins Model 75A receiver can take advantage of the CW muting circuit contained therein. This muting is accomplished by blocking the noise limiter circuit in the receiver with a positive voltage. In the 32V-2 transmitter, this positive voltage is obtained from the voltage drop across the cathode resistor of the second multiplier tube, V103. The receiver limiter switch should be in the OUT position during CALIBRATION adjustments of the 32V-2 and in the IN position when muting is desired on CW operation.