

SECTION 3

ADJUSTMENT AND OPERATION3.1. 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.

<u>WWV</u> <u>Frequency</u>	<u>Dial</u> <u>Setting</u>	<u>Oscillator</u> <u>Frequency</u>	<u>Oscillator</u> <u>Harmonic</u>
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.

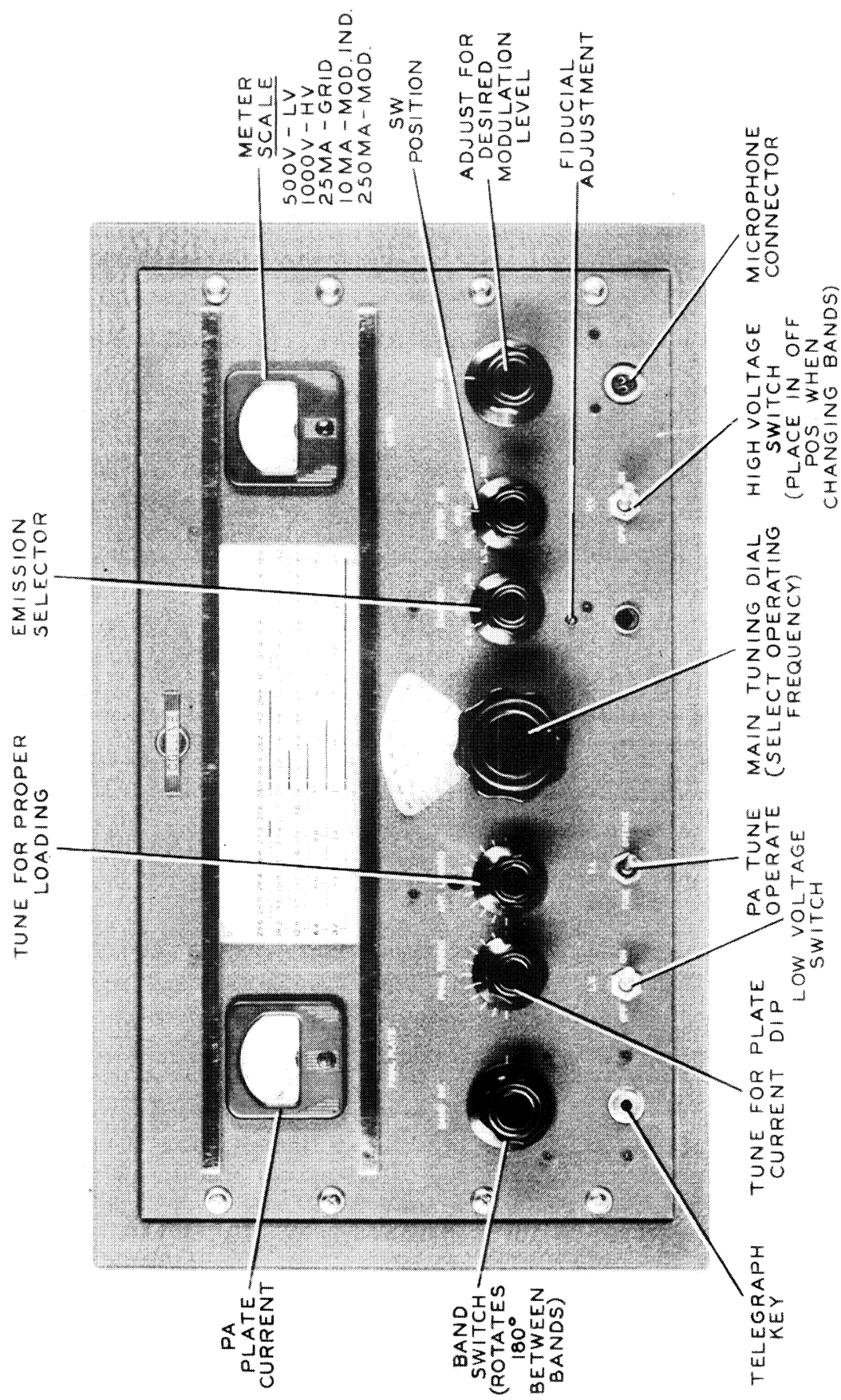


FIGURE 3-1 32V-2 CONTROL FUNCTIONS

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 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:

<u>METER SWITCH POSITION</u>	<u>CIRCUIT METERED</u>	<u>FULL SCALE DEFLECTION READS</u>
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 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 thru 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 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 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 and return the FINAL TUNING to 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 - 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 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.)

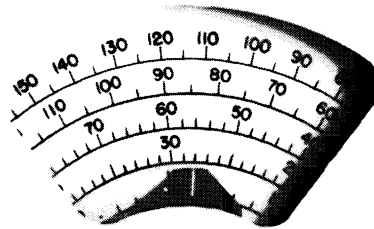
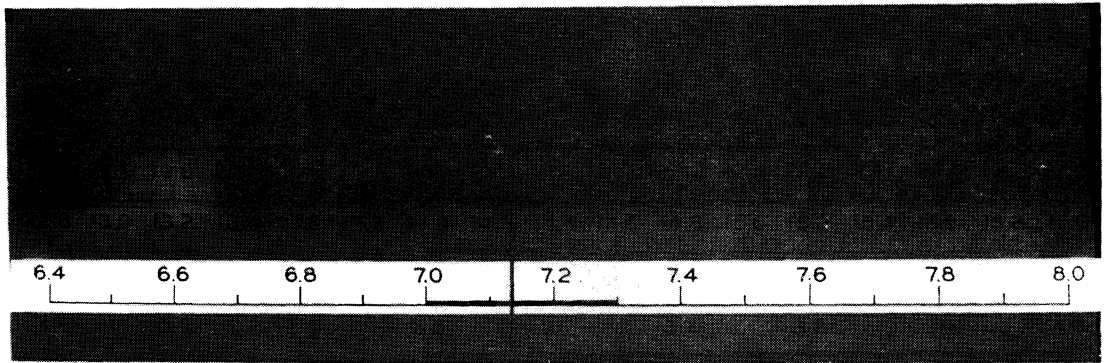
	<u>LV</u>	<u>HV</u>	<u>GRID</u>	<u>MOD</u>	<u>FINAL PLATE</u> <u>BOTH PHONE & CW</u>
600 v	240	580	10	50	180
700 v	240	720	10	50	220

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.

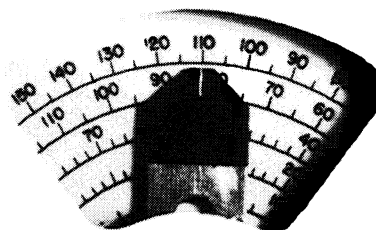
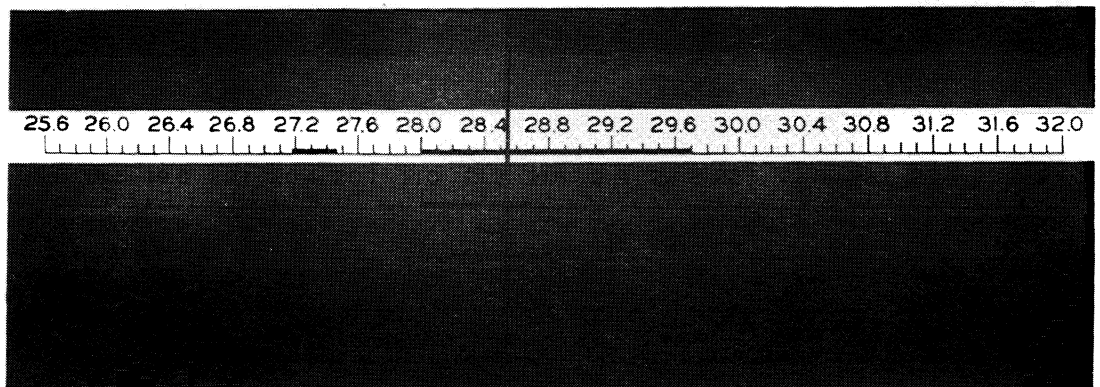
The dial is read by combining the vernier dial reading with the slide rule dial reading. The exact method varies somewhat from the low frequency bands to the high frequency bands and can best be learned by referring to figure 3-2.

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	600 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



FREQ. = 7128 KC



FREQ. = 28510 KC

FIGURE 3-2 TYPICAL DIAL READINGS

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. 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. <u>6AG7</u>	2ND MULT. <u>7C5</u>	3RD MULT. <u>7C5</u>
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 excepting the 14 mc output of the third multiplier where an inductance is switched in 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 AB₂. 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. 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.

