

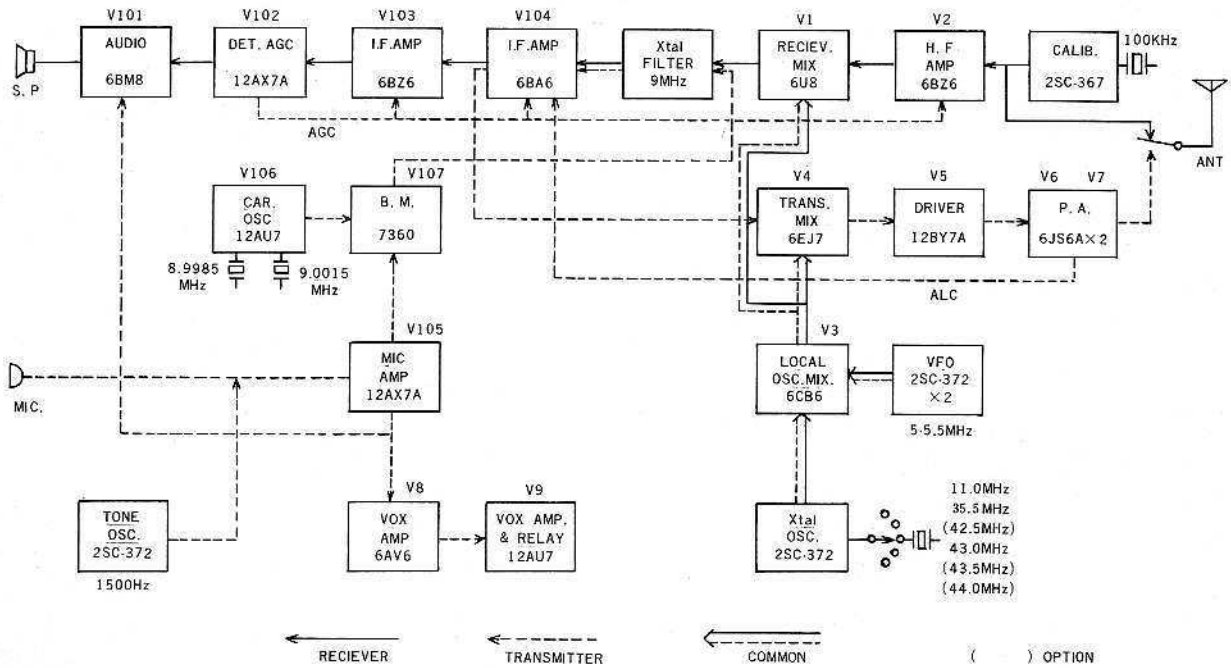
INSTRUCTION MANUAL

FT-250

SOMMERKAMP ELECTRONICS GMBH

GERMANY

BLOCK DIAGRAM



FT-250 SSB TRANSCEIVER

The SOMMERKAMP FT-250 Transceiver, for HF amateur bands 80 through 10 meters, is a precision built high performance transceiver providing SSB (USB and LSB selectable), CW and AM modes of operation, with a two-tone power of 240W (approx. 300W speech peak input).

High stability is obtained by use of a well designed heterodyne VFO, and the specially designed 9 MC crystal filter ensures good voice quality.

Its compact size, light weight, and attached carrying handle make it very suitable and convenient for both home and portable use.

Other features include VOX, 100 kc calibrator, ± 5 kc receiver offset (clarifier) tuning and easy connection for use of our FLDX-2000 Linear Amplifier.

SOMMERKAMP FP-250 matching AC power supply with built-in speaker is especially designed for use with FT-250 Transceiver. A 12V DC supply, the DC-250, provides for mobile or field use.

GENERAL SPECIFICATIONS

| | |
|--------------------------------------|---|
| Modes | A3J SSB (USB-LSB), A3h (AM), A1 (CW) |
| Input power | 240W |
| Frequency range | 3.5-4; 7-7.5; 14-14.5; 21-21.5; 28.5-29. (crystals optionally available for ranges 28-28.5; 29-29.5; 29.5-30 MC) |
| Antenna impedance | 50-75 ohms |
| Frequency stability | After warm-up, within 100 cps/ every 30 minutes |
| Carrier suppression | -40 dB |
| Sideband suppression | -50 dB at 1000 cps |
| Third order intermodulation products | -30 dB (P.E.P.) |
| Bandwidth occupation | 99.8% |
| A.F. bandwidth | 300-2700 cps |
| Receiver sensitivity | 0.5 uV input S/N 10 dB |
| Selectivity | 2.3 kc (-6 dB), 4 kc (-60 dB) |
| I.F. interference ratio | 50 dB |
| Image ratio | 50 dB |
| Audio output | 1W at 10% distortion |
| Audio output impedance | 8 ohms and 600 ohms |
| Power supply | AC or DC with separate power supplies |
| Tubes & semiconductors | 16 tubes, 15 diodes, 7 transistors |
| Dimensions | 13¼" (335m/m) wide, 5½" (140m/m) high, 11" (280m/m) deep |
| Weight | 17.5 lbs (8 kg) |

FP-250 SPECIFICATIONS

| | |
|--------------------|--|
| Semiconductors | 13 diodes |
| Dimensions | 8" (200m/m) wide, 5½" (140m/m) high, 11" (280m/m) deep |
| Weight | Approx. 22 lbs (10 kg) |
| Speaker (built-in) | 12.8 x 7.7 cm |
| Supply voltage | 100V/110V/117V/200V/220V/234V 50–60 cps |

DC-250 SPECIFICATIONS

Matching DC power supply

| | |
|----------------|---|
| Semiconductors | 4 transistors 9 diodes |
| Dimensions | 8" wide, 2¾" high, 8 ⁷ / ₈ " deep |
| Weight | Approx. 6.6 lbs |
| Power source | DC-12V, 12.5A (receive), 15A (transmit), 27A (transmit 100W peak) |

CIRCUIT DESCRIPTION

It can be seen from the block diagram that many sections are common for both receiving and transmitting. For an easier understanding of the operation, the receiving and transmitting sections will be described separately.

Receiving Section

Signal from ANT terminal passes through antenna RX/TX relay to ANT input tuned circuit to grid 1 of RF amplifier tube V2, 6BZ6. Signal is amplified, and through the next tuned circuit on the grid of receiver mixer tube V1, 6U8, pentode section. Local oscillator signal is applied to cathode of this mixer and the I.F. signal appears at mixer plate. The I.F. signal then passes through the 9 MC crystal filter to the two stage amplifier V104, 6BA6, V103, 6BZ6 and thence to V102A, ½12AX7 power grid detector. This detector acts as a product detector, with BFO signal applied to its cathode, when receiving CW and SSB. V102B, ½12AX7 functions as an anode detection type amplifier of AGC. With no signal applied plate current is zero with plate voltage zero. When signal is applied, plate current develops, resulting in a negative plate voltage which is applied through diode D103 to AGC line. Circuit provides suitable AGC characteristics of fast attack, slow decay for SSB and CW. Internal resistance of diode is low in forward direction and high in reverse direction. AGC voltage is applied to RF and IF stages so that a wide range of signal levels can be handled.

Detector output is fed to silicon diodes D101, D102, ANL, then via AF gain control, through 6BM8 AF output tube to speaker.

Transmitting Section

Output of carrier oscillator V106, 12AU7 is injected to first grid of V107, 7360 balanced modulator, and audio signal from mic. Amp. to modulating grid of BM. Suppressed carrier DSB is developed at plate of BM. This signal then passes through the crystal filter XF101 which eliminates one sideband thus resulting in a SSB signal, 9 MC.

For AM transmission (sideband with carrier insertion, the BM becomes unbalanced due to switching circuitry, permitting carrier to pass through, and also carrier frequency is shifted by means of a varicap diode circuit so that carrier passes freely through filter passband. Amount of carrier insertion level is adjustable by AM carrier control VR8.

For CW transmission, audio is disabled, and similarly as for AM, the BM is unbalanced and carrier frequency shifted to allow full carrier to pass through filter.

In the TUNE condition, a 1500 cps signal from the audio tone oscillator TR503 is applied to the BM. This provides a convenient tuning signal near filter center frequency. Level of signal is controlled by mic. gain control.

The 9 MC signal after passing through the filter is amplified by IF amplifier tube V104, 6BA6, thence to grid of mixer tube V4, 6EJ7, together with local oscillator signal. The resultant difference between these two frequencies appears at plate tuned circuit of mixer and is the transmitting ham band output signal frequency. On 14 MC band, additive mixing is used.

This signal is amplified by V5, 12BY7 tuned driver and finally to power amplifier tubes V6/V7, 2 x 6JS6A, and antenna. Power amplifier V6/V7 operate in class AB2 for maximum power output.

The AC audio component of PA grid current, when overdriven by signal peaks, is rectified by diodes D4/D5 to provide an ALC (Automatic Level Control) voltage to the IF amp. stage thus reducing its gain and maintaining low distortion.

The PA Pi network plate circuit provides attenuation to the higher order harmonics and enables easy, flexible adjustment of impedance matching to antenna feedline.

On phone, PTT and VOX control is available. On VOX, a sample of signal from microphone is applied to grid of V8 then to V9A, rectified by diode D2, SH-1 producing a positive bias on to grid of V9B relay tube, causing plate current to flow and relay to actuate.

On CW, "straight" or "break-in" keying methods are available. Break-in produced by keying audio oscillator tone applied to VOX amp. as well as transmitter bias line. The relay switches bias on V107, V4, V5, V6 and V7.

Tone signal also can be heard from speaker while keying, thus providing sidetone monitoring.

OSCILLATOR CIRCUITS

In the FT-250 crystal oscillators are used for carrier generation and the bandswitched heterodyne oscillator, together with a self-controlled oscillator for VFO which is at a frequency low enough to obtain good stability. Other oscillators included are 100 kc crystal calibrator and audio tone oscillator. An optional crystal oscillator and components are available for fixed channel operation.

1. Carrier crystal oscillator

V106, 12AU7 double triode with crystals 8998.5 kc and 9001.5 kc, one in each triode section. With sideband selector switch at NORMAL, carrier crystal 8998.5 is operative for 7 and 14 MC band, and 9001.5 for 3.5, 21 and 28 MC. When the selector switch is in REVERSE position then the carrier crystal oscillator sections are changed.

Carrier oscillator operates as the BFO when in receive mode.

On AM & CW, crystal 9001.5 is used and its frequency is lowered 200 cps by diode switch D104, 1S1007, bringing carrier into filter passband.

2. Bandswitched heterodyne oscillator

This is a crystal oscillator using silicon type 2SC372 transistor, and is operative on bands 7, 21 and 28 MC. 10 M band crystal is included for 28.5–29 MC, and positions are available for other three optional ranges for full coverage of 10 M.

3. VFO self-oscillator

A transistorised Colpitts circuit with 2SC372 oscillator and 2SC372 buffer. It has linear tuning over the range 5–5.5 MC. A passband filter circuit at output is tuned to pass the 5–5.5 MC range. Varicap diode D401, 1S145 permits CLARIFIER control ± 5 kc on receiving.

4. Crystal calibrator oscillator

Transistor oscillator 2SC367 with 100 kc crystal, and diode type 1S1007 harmonic generator provides accurate check points every 100 kc on main dial.

5. AF oscillator

Phase shift type with 2SC372 transistor, generating audio tone signal at 1500 cps supplies transmitter tune-up signal and CW sidetone monitoring.

LOCAL OSCILLATOR MIXER CIRCUIT

VFO output is applied to grid 1 of V3, 6CB6 mixer and heterodyne oscillator output to cathode. Resultant beat frequency is selected in plate tuned circuit.

METER CIRCUIT

Meter is 1 mA movement, and is connected to 2nd IF stage to read change in cathode voltage of V103, resulting from variations of AGC voltage, to indicate receiver "S" units. Meter is automatically switched by relay RL101, on transmitting, to indicate relative power output, PA cathode current, and ALC voltage. Meter scale is fully calibrated, and transmitter metering functions PO, IC and ALC are selected by panel mounted slide switch.

VOLTAGE REGULATOR CIRCUIT

The voltage regulator circuit, mounted on a print board, provides 9 volts for all transistor oscillators. Two transistors are used, 2SC372 and 2SC367 together with two zener diodes 1S331 and 1S336, and voltage level can be set by adjustment of variable resistor VR501.

CONNECTIONS FOR USING FL-DX-2000 LINEAR AMPLIFIER

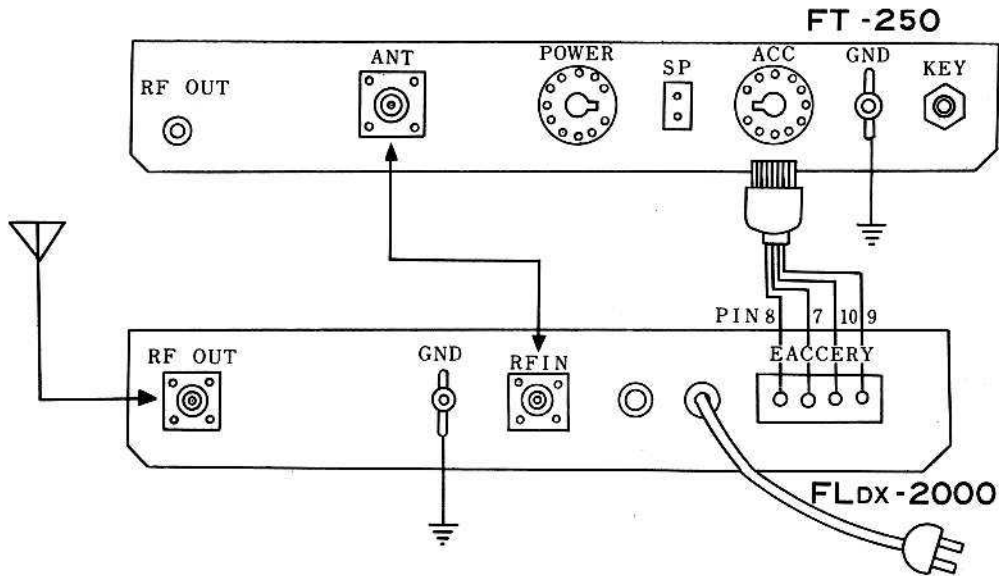
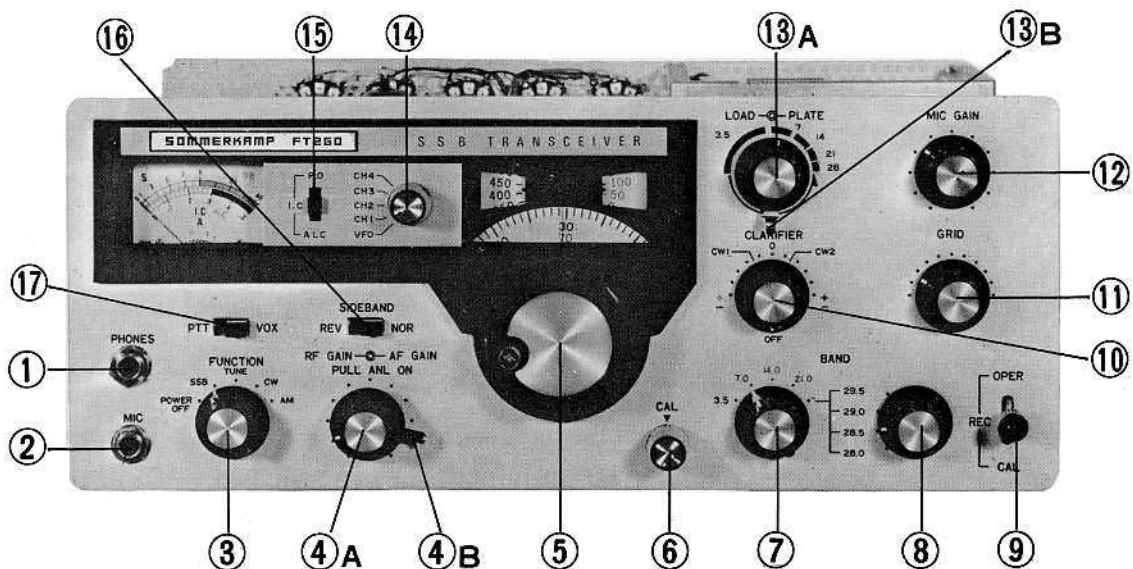


Diagram shows correct connections for using the FL-DX-2000 Linear Amplifier with the FT-250.

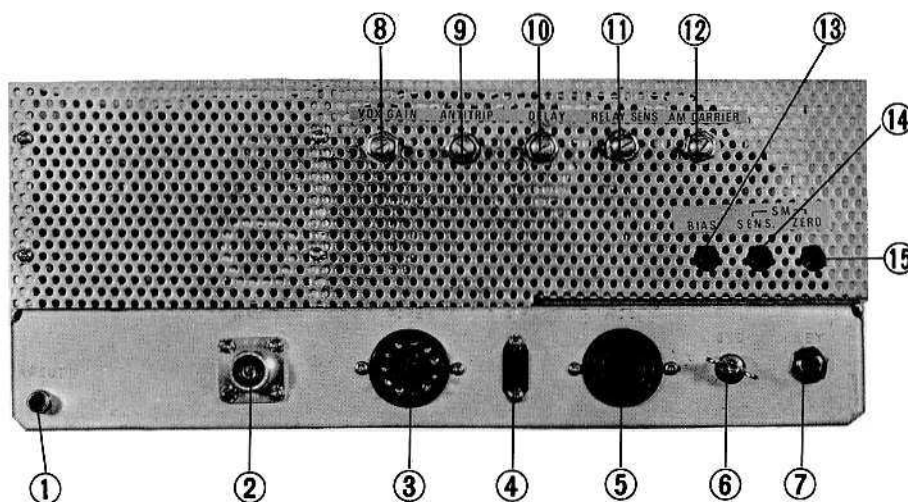
FRONT PANEL CONTROLS



1. Phones Headphone socket.
When plug is inserted into socket, speaker is automatically disconnected.
2. Mic. Microphone socket. 3 contact T.R.S. type.
3. Function Function switch.
OFF AC power removed from power supply.
SSB Selects SSB operation.
TUNE Places TX in tune-up condition.
CW Selects CW operation.
AM Selects AM operation.
- 4A. AF Gain, Pull-ANL-On Knob
- 4B. RF Gain Level control
5. VFO Control knob and vernier drive.
One revolution of knob covers approx. 15 kc. Upper windows give 50 kc points with 0–500 markings. The vernier scale is marked in 1 kc steps, 0–100.
6. Cal This is a locking knob used to set dial calibration in conjunction with the 100 kc calibrator. With transceiver in receiving condition, the vernier dial is turned to “0” and locked by a half turn of this CAL locking knob. 100 kc calibrator is switched on with control No. 9 then the VFO knob is rotated to a 100 kc point so that calibrator beat note is heard, then adjusted for zero-beat. Locking knob is then released.
- 7 & 8. Band Bandswitch, marked for bands in MC. Red colors indicate that red scale is to be used on VFO dial. The various 28 MC ranges are selected by knob No. 8, when No. 7 is at its fully lockwise position.
9. Oper-Rec-Cal Lever switch. Selects functions of calibrator receiving and transmitter operation.
10. Clarifier Clarifier adjustment. Provides ± 5 kc variation of receiver tuning (“off-set-tuning”) When switched to OFF, then receiving and transmitting frequencies are the same.

- | | | |
|------|------------------------------|---|
| 11. | Grid | Controls RF tuning of receiver and drive tuning of transmitter. |
| 12. | Mic. Gain | Controls microphone amp. level. On TUNE it becomes a tuning level control. |
| 13A. | Plate | Knob. Adjusts PA plate tuning. |
| 13B. | Loading | Lever. Adjusts PA plate loading. |
| 14. | Fix VFO SELECT | For switching from VFO to crystal control operation for fixed channel working. This knob is operative only when optional fixed channel switch and kit is installed. |
| 15. | PO-IC-ALC | Meter selector switch. Switches meter functions' for transmitter metering. |
| 16. | Sideband | Sideband selector slide switch. In the NORMAL position, LSB is produced on 3.5 and 7 MC and USB on 14, 21 and 28 MC. In the REV position, USB is produced on 3.5 and 7 MC, and LSB on 14, 21 and 28 MC. |
| 17. | PTT-VOX | Slide switch. Selects PTT or VOX functions. |
-

REAR PANEL CONTROLS & CONNECTIONS



| | | |
|-----|------------------------|--|
| 1. | RF Out | Provides low level RF drive for FTV-650 VHF transverter. |
| 2. | ANT | Antenna coax socket. |
| 3. | Power Supply Connector | (see P. 18 for details) |
| 4. | Speaker Socket | |
| 5. | Accessory Socket | (see P. 18 for details) |
| 6. | Earth Terminal | |
| 7. | Key Socket | |
| 8. | VOX Gain | Adjusts VOX sensitivity. |
| 9. | Anti-Trip | Adjusts VOX anti-trip level. |
| 10. | Delay | Adjusts "hold-in" time of VOX |
| 11. | Relay Sens | Adjusts operating level of VOX relay. |
| 12. | AM Carrier | Adjusts level of re-inserted carrier for AM operation. |
| 13. | Bias | Adjusts bias on PA tubes. |
| 14. | Meter Sens | S-meter sensitivity control. |
| 15. | Meter Zero | Adjusts S-meter zero setting. |

OPERATION

Step 1 of Operation

| | |
|--------------|--|
| FUNCTION | POWER OFF |
| RF-AF-GAIN | RF maximum clockwise AF about half on |
| BAND | Set to desired band |
| CLARIFIER | OFF |
| PLATE | Set to desired band |
| LOADING | Minimum loading |
| METER SWITCH | IC |
| OPER-REC | REC |
| SIDEBAND | NORMAL |
| MIC GAIN | OFF |
| CAL | In released position |

1. Set controls as shown below

First check that all cable connections are correct and that antenna of correct frequency and impedance within the range of the Pi-net (50–100 ohms) (coax output) is connected to the transceiver. AC power plug should not be connected until all preliminary checks are carried out.

Turn power on with function switch to SSB position. Panel lamps should light and S-meter needle will show a full scale reading then slowly return to “0” as set warms up. This can be accepted as an indication that the set is then ready for operation.

Tune GRID for noise peak.

Adjust main tuning dial for signal.

Peak GRID for maximum S-meter reading.

Careful tuning is necessary to obtain correct tone of SSB signal. If the received signal is on opposite sideband then move REV-NOR switch to REV.

A beat note indicates an AM signal being received. In this event turn function switch to AM.

Adjust AF gain for comfortable listening volume. Sometimes a slight reduction of RF gain will obtain clearer reception.

2. Transmitter tuning

Transmitter should be tuned into a 50 ohm dummy load, but it may be tuned on an antenna provided that the band is clear, and no interference will result to other stations. Take care to ensure that transmitter frequency is adjusted within limits of band in use.

DO NOT OPERATE TRANSMITTER with no load connected otherwise PA tubes could be damaged.

Disconnect microphone, meter switch to IC, MIC gain off, control switch to PTT, function SSB. Then when REC-OPER switch is moved to OPER, and using power supply of 600V HT, the meter will indicate the PA resting current.

This should be 60 MA, if not, then adjust bias control at rear.

Now turn FUNCTION switch to TUNE, advance MIC gain to obtain a small increase in meter reading, up to about 100 MA, and adjust GRID for maximum IC. Note that the setting for the GRID control will be virtually the same as was found for receiving. Reduce MIC gain if IC rises abnormally high.

Adjust PLATE for minimum dip in IC. Switch meter to P.O. and adjust PLATE and LOAD controls in turn for maximum RF power out. IC should dip to about 70/80% of the off-tune current for best loading condition. At maximum input the IC is about 350 MA, but refrain from using this high current for longer than a few seconds, therefore make all adjustments quickly. During tune-up, switch REC-OPER switch off periodically to reduce the time transmitter is on with high IC.

While it is permissible to tune transmitter using meter on P.O. position, it is recommended that an external SWR meter be connected between antenna socket and feedline, not only to check matching of transceiver to antenna feedline and observation of

transmitter RF output, but so that transceiver meter can be left in IC position for constant monitoring of PA current. Any abnormal rise-in IC can then be noted and quickly corrected.

3. Transmission

SSB (A3J)

Insert microphone plug of PTT microphone. (If microphone does not have a PTT switch, then short out PTT terminals on plug and control transceiver with REC-OPER panel switch.)

Turn REC-OPER switch to OPER.

While speaking, adjust MIC gain for correct IC meter "kick-up". Switch meter to ALC and check that needle does not rise above limit of green section of scale on speech peaks. Indicated IC will be about half the tuning IC, i.e. about 150 MA on peaks. Attempting to obtain more power by "forcing" or overdriving the transmitter will obtain only an insignificant increase in strength and will result in a distorted signal with possible radiation of spurious emissions. Keep MIC gain down, speak fairly closely to microphone to reduce background noise pick up, and try to maintain an even level of speech.

Do not have VOX gain control set too high otherwise operation will be unstable. If anti-trip control is advanced too far, then VOX will lose sensitivity. Set anti-trip to a position where it is just preventing speaker noise from "triggering" the VOX. If VOX fails to function, check that microphone has sufficient sensitivity and if OK then replace V9 and re-adjust relay sensitivity control.

CW (A1)

Remove microphone plug. For CW operation on 7 and 14 MC, place Sideband switch in REV position otherwise drive will be low. The varicap diode is connected to only one carrier crystal (9001.5 kc) and this diode's operation shifts carrier within filter passband. Use clarifier control only for changing or tuning-in the received signal, e.g. small readjustment to retune a drifting signal or adjusting pitch of received signal. Once main VFO control has been set to frequency of desired contact it should not normally be altered, otherwise each station will be retuning and moving through the band.

For break-in operation set control switch to VOX, and adjust VOX delay, etc. to suit requirements. Do not hold key down for long periods otherwise PA tubes can be damaged. Use CW IC at 250 MA. MIC gain will control sidetone level.

AM (A3h)

Place function switch on AM, MIC gain to "0". Set AM carrier control at rear to give IC of 150 MA. Adjust MIC gain so that speech deflects meter a further 5-10 MA. As for CW set control to REV for 7 and 14 MC bands. PTT or VOX can be used in the same way as for SSB operation.

ALIGNMENT

The FT-250 has been correctly aligned at factory and, under normal circumstances, re-alignment should not be necessary except after a long period of use. The alignment of such modern, sophisticated equipment as this requires the correct test instruments and should not be attempted unless one has had a reasonable amount of experience in such alignment techniques.

DANGER—Before any work is attempted, remember that high voltages are employed in this equipment, so—**TAKE CARE!**

1. Equipment required

VTVM with RF probe
RF standard signal generator
AF signal generator
Multi-Tester 20,000 ohms/V or more
Frequency meter
Dummy load 50 ohms
Suitable alignment tools

2. Voltage and resistance measurement

Refer to tables on Pages 20, 21 and 22.

Note that measurement figures obtained could vary slightly from those shown, particularly a low resistance testing meter is used. Always turn off power, remove AC plug, completely discharge all filter condensers, and wait until valves are cold before taking resistance measurements.

3. Voltage regulator

The V.R. is mounted on a printed circuit board and supplies a regulated output of 9V, adjustable by the pre-set type miniature pot VR501. If output cannot be brought up to the 9V level it may be due to a fault in components on the printed circuit board, e.g. transistors or zener diode, or supply voltage below 11V.

4. VFO alignment

On the red scale, "0" – 5 MC and "500" = 5.5 MC.

Switch off crystal heterodyne oscillator by placing bandswitch on 3.5 or 14 MC band. Clarifier OFF.

Use frequency meter for alignment, although this can be done, with care, if beats are heard every 100 kc using the crystal calibrator.

Coarse alignment is by adjustment of trimmer TC401.

The piston type trimmer TC402 is for adjustment of temperature compensation. If turned clockwise then compensation becomes greater. If TC402 is adjusted then TC401 must be re-adjusted to maintain calibration.

For precise adjustment of dial linearity, careful adjustment (by bending) of end rotor plates of main tuning condenser as necessary.

VFO injection to grid 1 of V3, 6CB6 should be 0.5V or more over full VFO range, measured with VTVM and RF probe. To obtain same frequency of clarifier at "0" as at "OFF", adjust VR7.

5. Heterodyne crystal oscillator

Apply RF probe to Pin 2 of V3, and with bandswitch at 28.5, adjust L202 for maximum meter reading.

On 21 MC band adjust TC202.

On 7 MC band adjust TC201.

If optional 10 meter range crystals are added use type HC18U crystals with wire leads soldered into marked positions on heterodyne oscillator print board.

Adjust appropriate trimmer condensers for 10 meter crystals.

6. Calibrator 100 kc

Adjust frequency with TC301 by checking against WWV, with aid of separate receiver.

7. Pre-mixer (VFO mixer)

This is V3, with output plate tuned circuit to select resultant beat of VFO and heterodyne oscillator (or VFO frequency in case of 3.5 and 14 MC bands).

This alignment should be carefully done as other frequencies can appear at output, VFO, etc. This alignment is explained in transmitter alignment section. Refer to chart, Page 14, for correct output frequencies.

RECEIVER ALIGNMENT

| Band | Mixed Frequency |
|------|-----------------|
| 3.5 | 5 – 5.5 MHz |
| 7.0 | 16 – 16.5 " |
| 14.0 | 5 – 5.5 " |
| 21.0 | 30 – 30.5 " |
| 28.5 | 37.5 – 38 " |
| 29.0 | 38 – 38.5 " |
| 29.5 | 38.5 – 39 " |
| 28.0 | 37 – 37.5 " |

1. Audio output stage

Connect audio generator with 1000 cps output of 0.1V level to moving arm terminal of AF gain control, and with control at maximum volume, and output of 1 watt should be obtained from the 6BM8, V101.

2. AGC

Function switch to AM, RF gain maximum, then S-meter should read "0" with antenna socket shorted. Set VR102 (AGC adjust) so that it is at a point just before S-meter needle commences to rise above "0". Now adjust meter sensitivity control so that, with S.G. 50 uV signal to antenna socket meter will read S9. Open circuit output of

S.G. will be 100 uV dropping to 50 uV when S.G. is connected to antenna socket, due to loading effect of receiver. Now set function switch to SSB, short out antenna socket, and meter should read "0", but if not then adjust the compensation capacitance (C165) between pin 2 and pin 8 of V102 to make meter read minimum deflection.

3. I.F. amplifier

Connect signal generator at 9,000 kc and adjust tuning for maximum S-meter reading at center of filter passband by observing S-meter at same time as tuning S.G. frequency. Now adjust L101, L102, L103, L104 for maximum meter reading.

4. Receiver mixer

This is V1 6U8 (alternative types 6EA8, 6GH8). Connect RF probe to pin 8, cathode of triode section, and adjust grid tuning. Oscillator injection should read greater than 0.5V on every band. Adjust trap coil L22 for minimum beat at 21.3 MC. This adjustment should occur within one turn of the core slug. L1 is trap coil for 3.5 and 14 MC bands and should be adjusted so that no oscillation in these bands. Use a plastic alignment tool so that no damage will result to the internal hexagon type slugs.

5. RF amplifier

Connect S.G. to antenna. On 3.5 MC band set VFO to "0" on black scale and GRID to second point up from its anticlockwise position. Apply 3500 kc signal and adjust L7 and L12 for maximum S-meter reading. Use plastic alignment tool. 7 MC band, VFO to "0" on red scale, GRID at same point as for 3.5 MC, S.G. at 7000 kc. Adjust TC1 and TC2 for maximum.

14 MC band, VFO to 250, GRID at center position, S.G. at 14250 kc. Adjust L10 and L15 for maximum.

21 MC band, VFO to 250, GRID at center, S.G. at 21250 kc. Adjust L9 and L14 for maximum.

28.5 MC band, VFO to 250, GRID one point back from center, S.G. at 28750 kc. Adjust L3 and L8 for maximum.

On either 7 or 14 MC bands, apply 9 MC signal of sufficient level to give a S-meter reading, then adjust L2 for minimum dip in S-meter reading.

TRANSMITTER ALIGNMENT

The transmitter uses many common receiver circuits, therefore it is necessary to first correctly align the receiver section. A 50–75 ohms dummy load must be used on the transceiver during transmitter alignment. Take care to avoid touching H.V. points!

1. Balanced modulator

Function switch to TUNE, meter to P.O., tune transmitter for maximum reading. (Keep IC down by use of MIC gain.)

Now function to SSB, MIC gain to zero, and adjust VR106 for minimum reading. For

most sensitive indication, connect RF probe to dummy load, or use another receiver and observe its S-meter reading.

Then switch to opposite sideband position, and readjust VR106. Repeat several times for best result. If there is a marked difference between the two positions then adjustment of carrier oscillator or crystal filter may be required.

2. Crystal filter

The filter is aligned once in receiver alignment, but further alignment in this section (transmitting) is necessary.

At the TUNE position adjust L103, L104 and L105 for maximum output. Keep drive reduced to a fairly low level for the most accurate determination of the maximum peak. In order to examine filter characteristics, set function to SSB and connect an A.F. generator to MIC jack, then take a curve of the A.F. response, (in effect, the filter passband), by plotting between 300–2500 cps. If output level changes no more than 3 dB then it is OK. Repeat on reverse sideband. If the two curves do not match then slight adjustment of each carrier crystal frequency is necessary to bring the two curves together in their frequency limits. If carrier is too close to 9000 kc filter center frequency then high audio frequencies will be attenuated. If carrier too far removed then low frequencies will be attenuated. Carrier frequency adjustment is by TC101 and TC102.

3. Driver stage

Set up transmitter on TUNE, but keep level down to safe limit by adjustment of MIC gain control, then adjust driver coils and trimmer condensers for peak in output, as in receiver section alignment.

REDUCTION OF POWER OUTPUT TO 10W OR 50W LEVELS

The FT-250 is designed for 100W output but can be connected for lower output levels. For 50W, disconnect S.G. wire between V6 and V7, so that only V6 is then in use. IC readings will be half of those for 100W.

For 10W, after carrying out above modification, then power transformer HT secondary must be tapped down from 480 to 240V

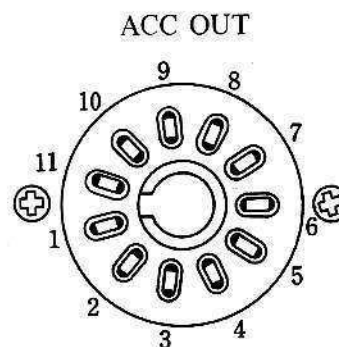
Chart shows operating conditions for the different power levels.

| | 100W | 50W | 10W |
|-----------------|---------------------|-------------|-------------|
| Final Tube | 2 Tubes in Parallel | Single Tube | Single Tube |
| Voltage | 600V | 600V | 300V |
| SSB Resting IC | 60mA | 30mA | 30mA |
| TUNE Maximum IC | 350 – 400mA | 175 – 200mA | 160 – 180mA |
| AM Operation IC | 160mA | 80mA | 80mA |

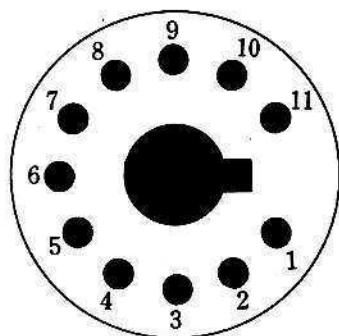
IMPORTANT:

Heater voltage to final tubes 6JS6A is supplied through a jumper wire between pin 1 and 2 of accessory plug, so the accessory plug must be placed in the accessory socket to provide this heater voltage.

- | | |
|-----------------|----------------------------|
| 1. 6JS6A heater | 7. ALC input |
| 2. 12.6V heater | 8. Ground |
| 3. +150V | 9. Relay close on transmit |
| 4. +300V | 10. Relay common |
| 5. +600V | 11. Relay close on receive |
| 6. -100V | |



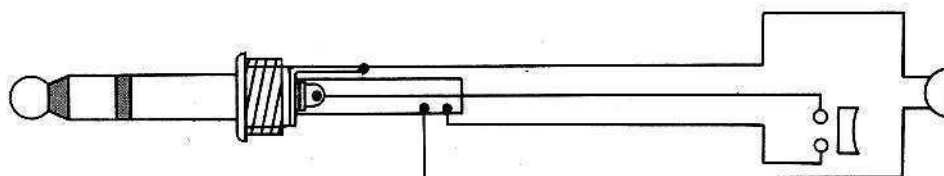
Power socket connection



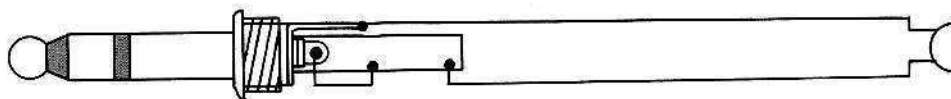
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|---------------|
| 1. -100V |
| 2. E |
| 3. +300V |
| 4. +800V |
| 5. H COMMON |
| 6. H AC 12.6V |
| 7. H COMMON |
| 8. H AC 12.6V |
| 9. LINE |
| 10. LINE |
| 11. +150V |

Plug connection

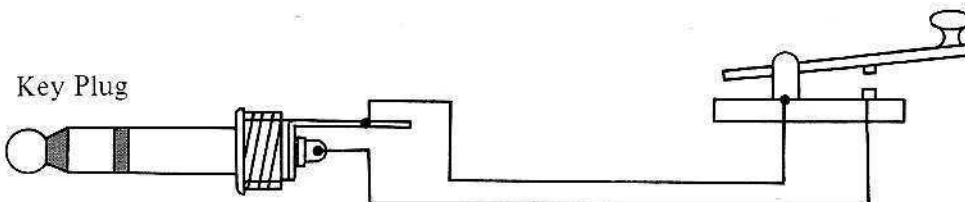
Mic Plug (PTT)



Mic Plug



Key Plug

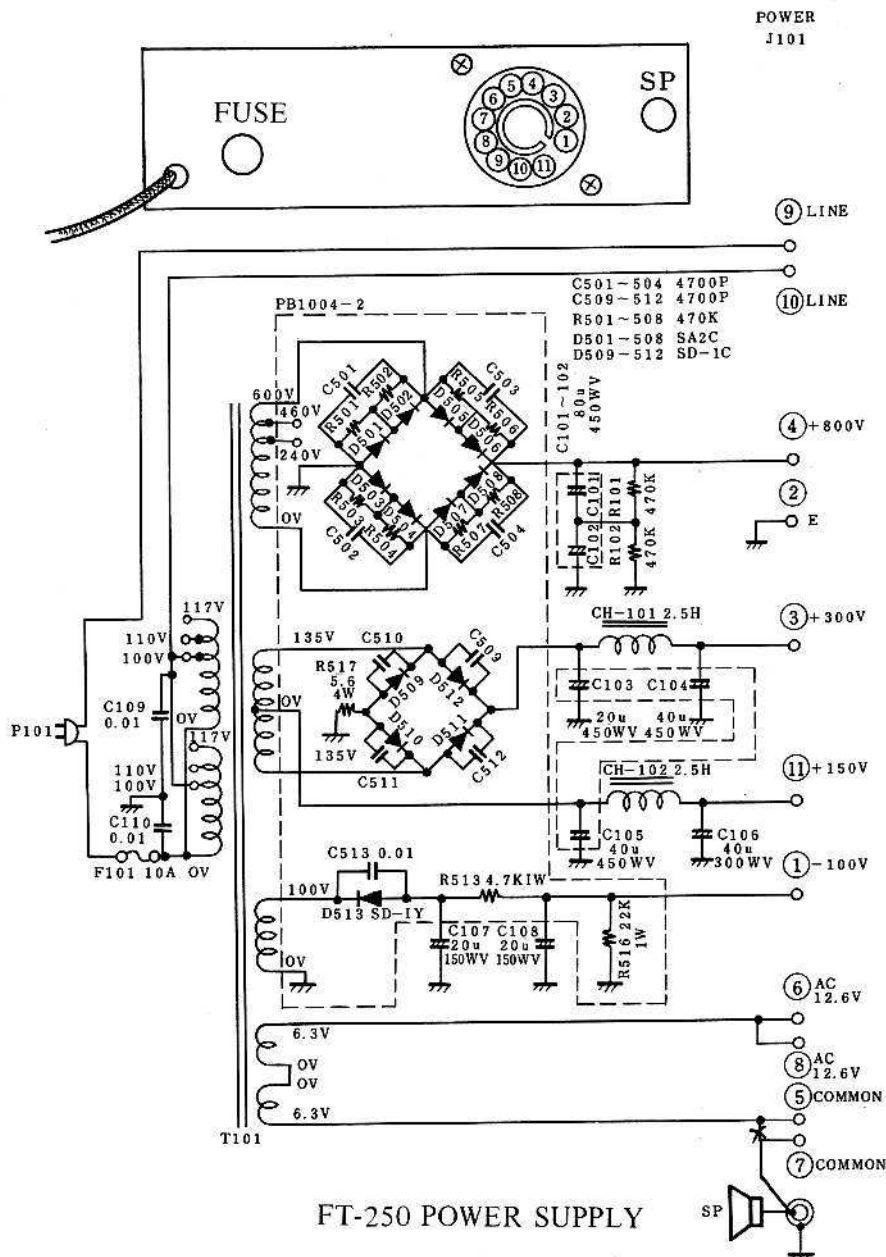


FP-250 POWER SUPPLY WITH SPEAKER

The FP-250 AC power supply is designed especially for the FT-250 Transceiver. A dynamic speaker is included within the power supply cabinet. Refer to circuit diagram below for details. Note that the major HT winding is tapped 240, 460 and 600, providing DC outputs of 300V, 600V or 800V to the final tubes. However, for the FT-250, 600V DC is sufficient for rated output. If 800V is used then the input will be excessive—use only on 600V DC maximum.

Bias section has only half wave rectifier as current drain is very small.

Heater winding, $2 \times 6.3\text{V}$, 6A, is connected in series to provide 12.6V at 6A.



RECEIVE 7MHz SSB NORMAL

単位(V)

| | TUBE | PIN | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|------|--------|-----------|------|-----------|------------|------------|-----------|------|-----|------------|------|-----|------------|----|
| V 1 | 6U8 | | 150 | -1.8 | 33 | AC 6.3 | 0 | 145 | 1 | 14.5 | 13.5 | | | |
| V 2 | 6BZ6 | | -0.1 | 0.8 | AC 12.6 | AC 6.3 | 140 | 60 | 0 | | | | | |
| V 3 | 6CB6 | | -0.2 | 2 | AC 6.3 | 0 | 145 | 40 | 0 | | | | | |
| V 4 | 6EJ7 | | 0 | -90 | 0 | AC 12.6 | AC 6.3 | 0 | 145 | 0 | 0 | | | |
| V 5 | 12BY7A | | 0 | -90 | 0 | AC 12.6 | 0 | — | 350 | 320 | 0 | | | |
| V 6 | 6JS6A | AC 6.3 | 0 | 150 | 0 | -90 | — | — | — | -90 | 0 | 150 | AC 12.6 | |
| V 7 | 6JS6A | 0 | 0 | 150 | 0 | -90 | — | — | — | -90 | 0 | 150 | AC 6.3 | |
| V 8 | 6AV6 | 0 | 1 | 0 | AC 6.3 | — | — | 110 | | | | | | |
| V 9 | 12AU7 | 25 | -0.5 | 0 | AC 6.3 | AC 6.3 | 140 | 0.35 | 55 | AC 12.6 | | | | |
| V101 | 6BM8 | 0 | 10 | 0 | AC 6.3 | AC 12.6 | 330 | 140 | 1 | 65 | | | | |
| V102 | 12AX7 | -0.2 | -95 | -95 | AC 12.6 | 0 | 150 | -1.5 | 0 | — | | | | |
| V103 | 6BZ6 | -0.1 | 1 | AC 6.3 | AC 12.6 | 145 | 100 | 1 | | | | | | |
| V104 | 6BA6 | -0.1 | 1.2 | 0 | AC 6.3 | 145 | 110 | 1.2 | | | | | | |
| V105 | 12AX7 | 110 | 0 | 1 | AC 12.6 | 0 | 140 | 0 | 0 | — | | | | |
| V106 | 12AU7 | 0 | -3.5 | 6 | 0 | 0 | 130 | 0.15 | 6 | AC 6.3 | | | | |
| V107 | 7360 | 0 | 150 | -95 | AC 6.3 | 0 | 150 | 150 | 30 | 30 | | | | |

TRANSMIT 7MHz SSB NORMAL

単位(V)

| | TUBE | PIN | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|------|--------|-----------|------|-----------|------------|------------|-----------|------|-----------------|------------|-----|-----|------------|----|
| V 1 | 6U8 | | 150 | -80 | 145 | AC 6.3 | 0 | 150 | 0 | 0 | -60 | | | |
| V 2 | 6BZ6 | | -60 | 0 | AC 12.6 | AC 6.3 | 145 | 0 | 0 | | | | | |
| V 3 | 6CB6 | | -0.2 | 2 | AC 6.3 | 0 | 145 | 40 | 0 | | | | | |
| V 4 | 6EJ7 | | 2.2 | 0 | 2.2 | AC 12.6 | AC 6.3 | 0 | 145 | 120 | 0 | | | |
| V 5 | 12BY7A | | 5 | 0 | 0 | AC 12.6 | 0 | — | 330 | 240 | 0 | | | |
| V 6 | 6JS6A | AC 6.3 | 0 | 150 | 0 | -50 | — | — | — | -50 | 0 | 150 | AC 12.6 | |
| V 7 | 6JS6A | 0 | 0 | 150 | 0 | -50 | — | — | — | -50 | 0 | 150 | AC 6.3 | |
| V 8 | 6AV6 | 0 | 1 | 0 | AC 6.3 | — | — | 110 | | | | | | |
| V 9 | 12AU7 | 25 | -0.5 | 0 | AC 6.3 | AC 6.3 | 100 | 0.4 | PTT1.5 VOX15 | AC 12.6 | | | | |
| V101 | 6BM8 | -80 | 10 | 0 | AC 6.3 | AC 12.6 | 330 | 140 | 1.5 | 140 | | | | |
| V102 | 12AX7 | -0.2 | -95 | -95 | AC 12.6 | 0 | 120 | -1.5 | 0 | — | | | | |
| V103 | 6BZ6 | -60 | 0 | AC 6.3 | AC 12.6 | 150 | 120 | 0 | | | | | | |
| V104 | 6BA6 | 0 | 1.2 | 0 | AC 6.3 | 140 | 110 | 1.2 | | | | | | |
| V105 | 12AX7 | 105 | 0 | 1 | AC 12.6 | 0 | 105 | 0 | 1 | — | | | | |
| V106 | 12AU7 | 0 | 3.5 | 6 | 0 | 0 | 130 | 0.15 | 6 | AC 6.3 | | | | |
| V107 | 7360 | 1.8 | 90 | -1.3 | AC 6.3 | 0 | 110 | 110 | 30 | 30 | | | | |

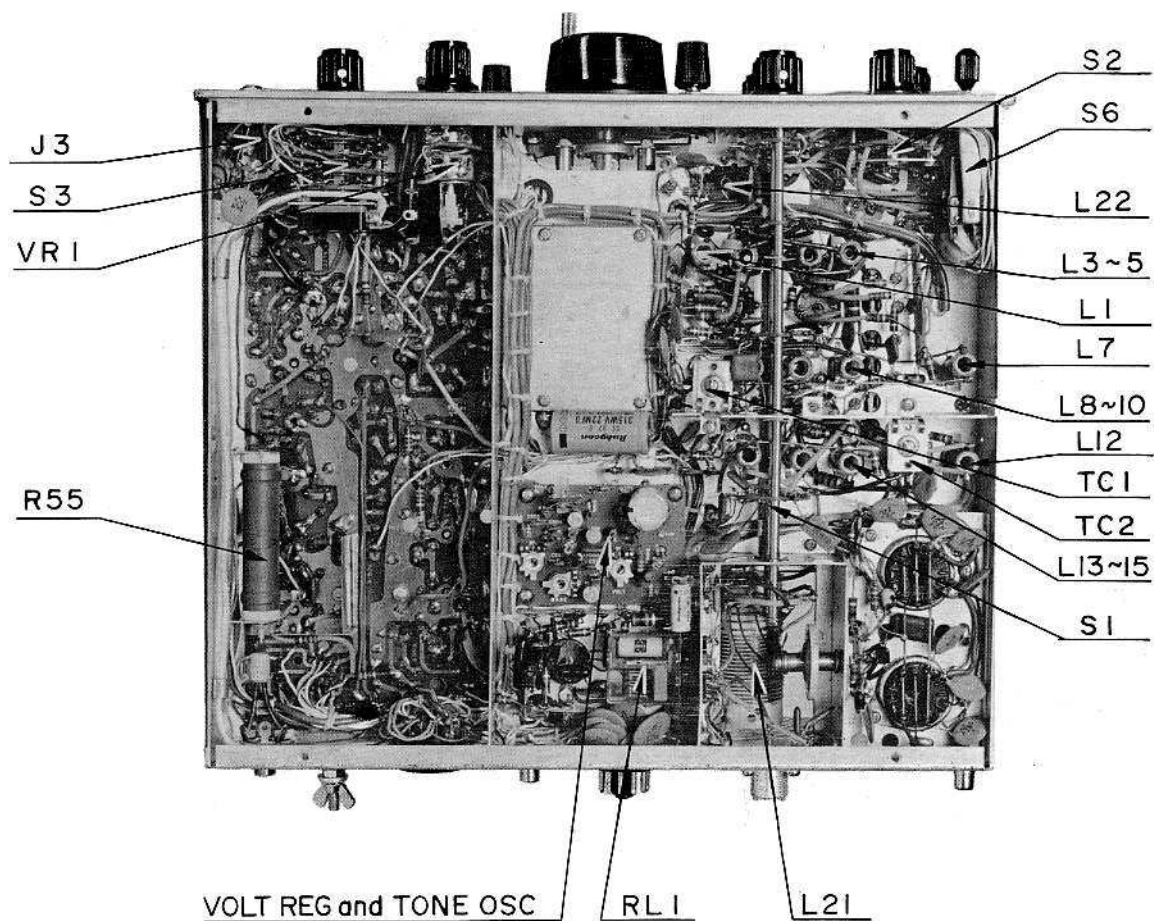
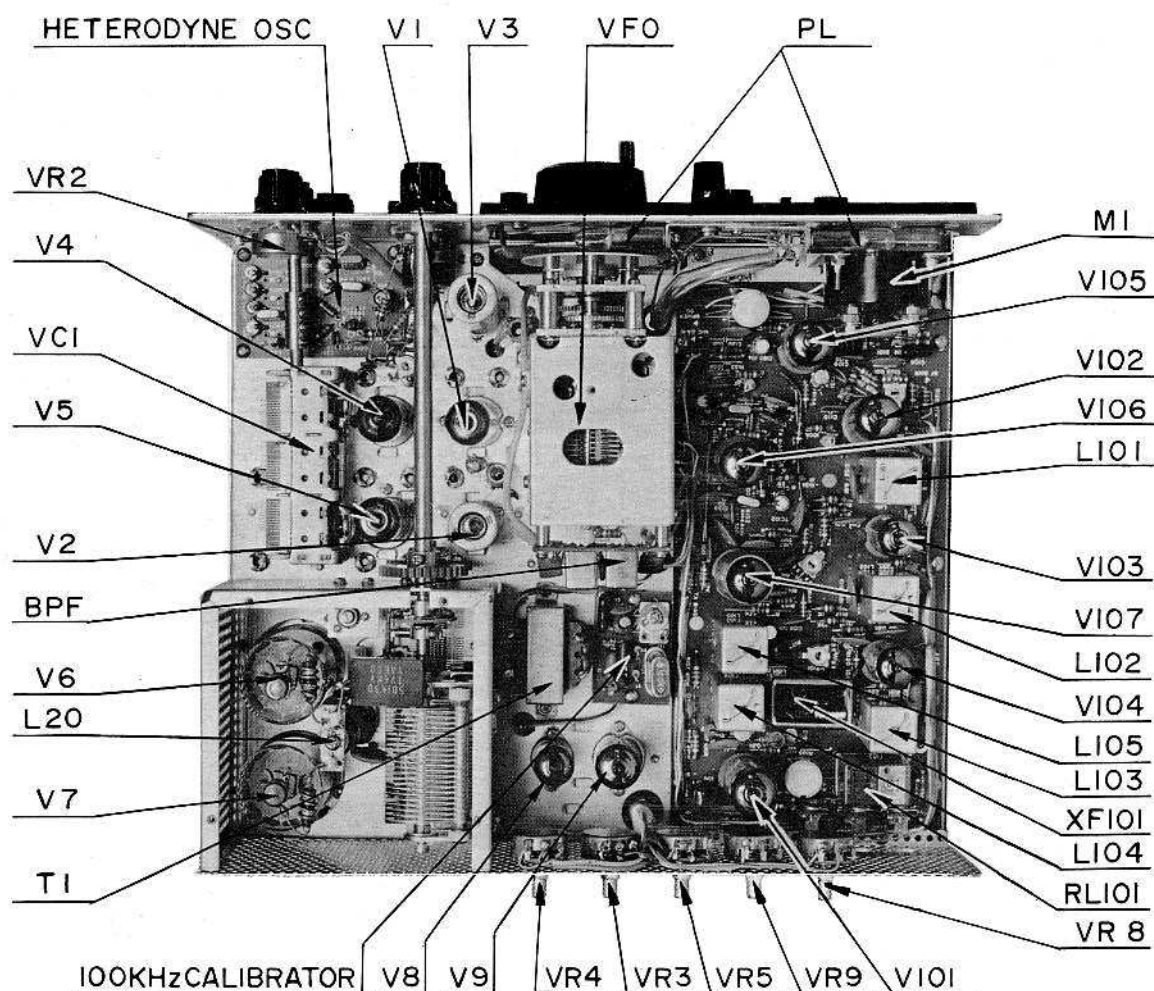
RESISTANCE 7MHz SSB NORMAL

単位(Ω)

| | TUBE | PIN | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|------|--------|--------|--------|------|------|---|------|------|------|------|------|----|----|----|
| V 1 | 6U8 | | 8K | 500K | 500K | 0 | 0 | 9K | 1K | 1K | 100K | | | |
| V 2 | 6BZ6 | | 3.5M | 100 | 0 | 0 | 9K | 20K | 0 | | | | | |
| V 3 | 6CB6 | | 1.5K | 1K | 0 | 0 | 9K | 280K | 0 | | | | | |
| V 4 | 6EJ7 | | 470 | 220K | 470 | 0 | 0 | 0 | 9K | 18K | 0 | | | |
| V 5 | 12BY7A | | 200 | 170K | 0 | 0 | 0 | 0 | ∞ | ∞ | 0 | | | |
| V 6 | 6JS6A | | 0 | 0 | 8K | 0 | 100K | — | — | — | 100K | 0 | 8K | 0 |
| V 7 | 6JS6A | | 0 | 0 | 8K | 0 | 100K | — | — | — | 100K | 0 | 8K | 0 |
| V 8 | 6AV6 | 0-250K | 2.2K | 0 | 0 | — | — | 110K | | | | | | |
| V 9 | 12AU7 | 110K | 3.3M | 0 | 0 | 0 | 15K | 1-3M | 8K | 0 | | | | |
| V101 | 6BM8 | 470K | 390 | 220K | 0 | 0 | ∞ | 9K | 4.7K | 220K | | | | |
| V102 | 12AX7 | 3.3M | 1.3M | 330K | 0 | 0 | ∞ | 100K | 4 | 0 | | | | |
| V103 | 6BZ6 | 3.3M | 75 | 0 | 0 | 0 | 9K | 15K | 0 | | | | | |
| V104 | 6BA6 | 3.3M | 100 | 0 | 0 | 0 | 9K | 15K | 0 | | | | | |
| V105 | 12AX7 | 110K | 0-250K | 2.2K | 0 | 0 | 110K | 220K | 2.2K | 0 | | | | |
| V106 | 12AU7 | ∞ | 85K | 1K | 0 | 0 | 10K | 85K | 1K | 0 | | | | |
| V107 | 7360 | 1K | 160K | 600K | 0 | 0 | 35K | 35K | 55K | 55K | | | | |

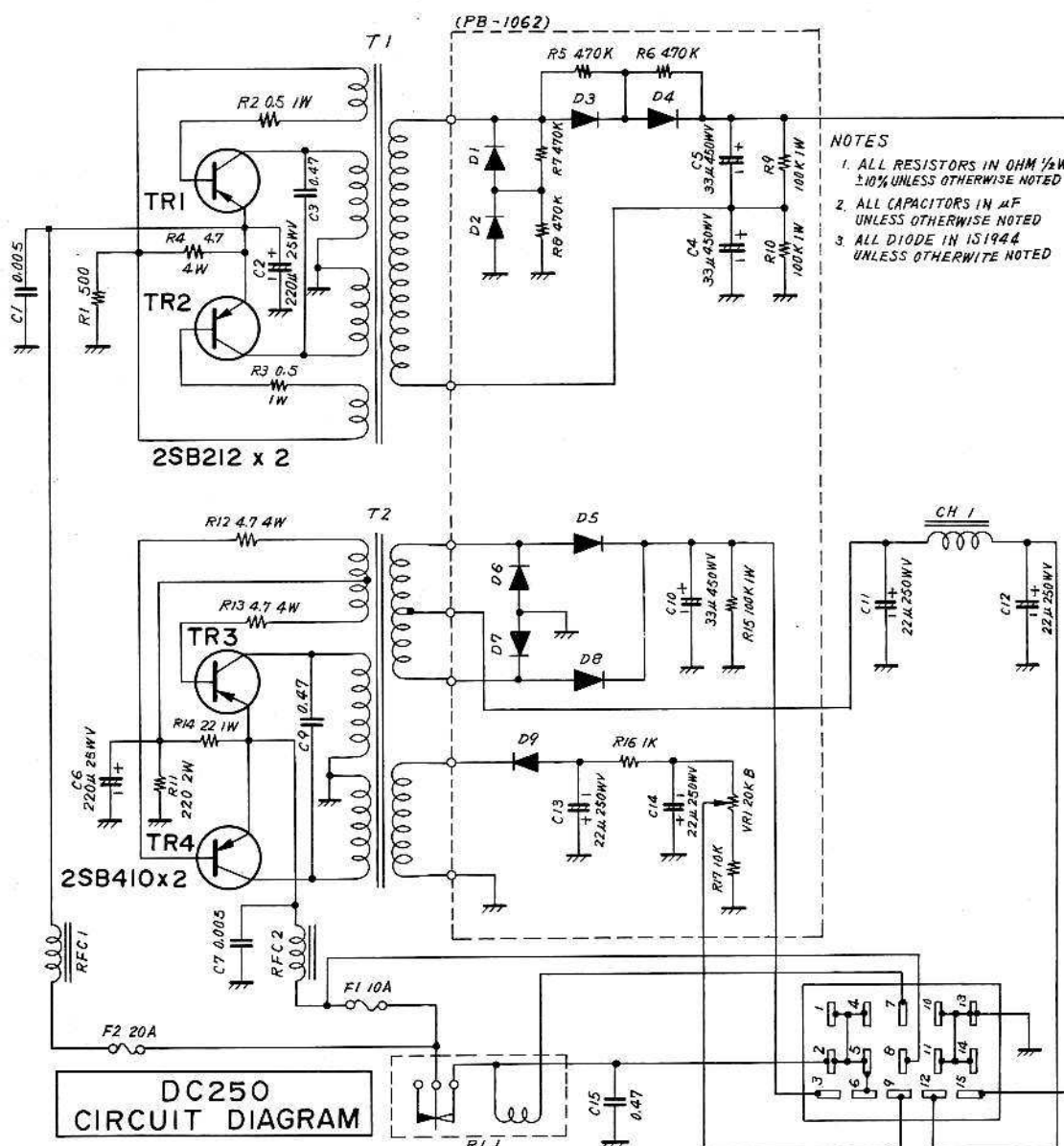
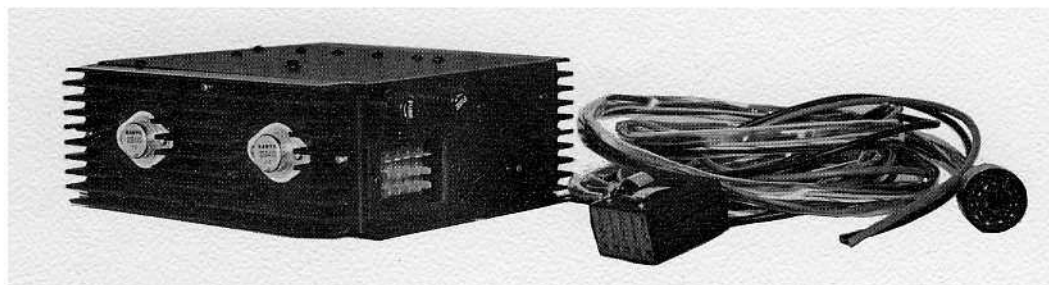
| FT -250 PARTS LIST | | | R - RESISTOR | |
|---|--------------|------------------|---|------------------|
| C - CAPACITOR | | | 63 | 22Ω ½W |
| 167 | FM | 2P 500WV ±10% | 66, 68, 70, 71 | 56Ω ½W |
| 26, 63, 161 | FM | 5P 500WV ±10% | 67, 69 | 56Ω 1W |
| 402 | FM | 8P 500WV ±10% | 115 | 68Ω ½W |
| 12, 17, 21, 42, 44, 112, 139 | FM | 10P 500WV ±10% | 10, 25, 120, 411, 412, 513 | 100Ω ½W |
| 11, 99, 119, 132, 141, 403, 417 | FM | 20P 500WV ±10% | 60 | 120Ω 1W |
| 406 | FM | 30P 500WV ±10% | 48, 510 | 150Ω ½W |
| 23, 62 | FM | 40P 500WV ±10% | 301, 408, 410 | 220Ω ½W |
| 22, 28, 36, 138, 170 | FM | 50P 500WV ±10% | 145, 203 | 330Ω ½W |
| 91, 92, 604 | FM | 60P 500WV ±10% | 101 | 390Ω 1W |
| 38 | FM | 70P 500WV ±10% | 45, 204 | 470Ω ½W |
| 134 | FM | 80P 500WV ±10% | 501, 503 | 560Ω ½W |
| 16, 20, 31, 35, 49, 79, 89, 90 122, 127, 142, 113, 116, 117 123, 154 | FM | 100P 500WV ±10% | 21, 22, 28, 32, 53, 106, 117 123, 137, 138, 139, 148, 502 | 1 K ½W |
| 39, 148, 149, 204, 305 | FM | 150P 500WV ±10% | 29, 41, 122, 602, 504 | 1.5K ½W |
| 605 | FM | 170P 500WV ±10% | 3, 27, 43, 54, 59, 134, 160 405, 409 | 2.2K ½W |
| 32, 40 | FM | 200P 500WV ±10% | 402 | 3.3K ½W |
| 408 | FM | 250P 500WV ±10% | 102, 126, 147, 159, 201, 505, 509 | 4.7K ½W |
| 37, 133, 140, 511 | FM | 300P 500WV ±10% | 55 | 5 K 10W |
| 30, 601, 603 | FM | 350P 500WV ±10% | 406 | 8.2K ½W |
| 409, 410 | FM | 470P 500WV ±10% | 1, 9, 30, 46, 52, 62, 64, 72, 73 111, 114, 118, 163, 302, 403 | 10 K ½W |
| 2, 43, 64, 109, 110, 128, 163 168, 169, 303 | FM | 500P 500WV ±10% | 57 | 10 K 1W |
| 61, 415 | FM | 680P 500WV ±10% | 24 | 15 K ½W |
| 60 | FM | 1000P 500WV ±10% | 33, 403 | 18 K ½W |
| 33, 34, 301 | FM | 2000P 500WV ±10% | 130, 154, 512 | 22 K ½W |
| 4, 14, 18, 68, 121, 144, 157 | DISC | 0.001 500WV | 11, 407, 603 | 22 K 2W |
| 3, 9, 13, 15, 19, 24, 25, 27, 45 47, 48, 51, 53, 54, 56, 57, 65 66, 69, 73, 75, 78, 87, 88, 94 102, 105, 108, 114, 115, 118 120, 125, 126, 129, 130, 136 137, 143, 145, 146, 147, 150 152, 153, 156, 158, 159, 162 202 | DISC | 0.01 500WV | 36, 38, 404, 506, 511 | 33 K ½W |
| 46, 50, 401, 405, 407, 411, 416 418, 504, 505, 507, 509, 510 | DISC | 0.01 50WV | 37, 39, 40, 42, 47, 119, 128 143, 144, 146, 149, 151-153 164-166, 507 | 47 K ½W |
| 72, 74, 80-83, 95, 96, 97, 171 203, 205, 206, 207, 304 | DISC | 0.05 50WV | 2, 5, 6, 19, 14, 56, 65, 110, 112 131-133, 136, 140, 155, 156 303 | 100 K ½W |
| 164 | DISC | 0.005 500WV | 150 | 150 K ½W |
| 506 | DISC | 0.002 50WV | 103, 104, 108, 109, 116, 121 | 220 K ½W |
| 59, 70, 71, 76 | DISC | 4700P 1.4KV | 125 | 330 K ½W |
| 6, 67, 151 | MYLAR | 0.05 250WV | 20, 23, 26, 105, 135, 141, 142 157, 158 | 470 K ½W |
| 7, 8, 106, 107, 124, 302 | MYLAR | 0.1 50WV | 7, 8, 127 | 1 M ½W |
| 41 | MICA | 50P 1KV | 18, 51 | 1.5M ½W |
| 55 | MICA | 100P 1KV | 107 | 2.2M ½W |
| 58 | MICA | 500P 3KV | 4, 124, 129 | 3.3M ½W |
| 413 | CERAMIC | 3P 500V UJ | VC - VARIABLE CAPACITOR | |
| 414 | CERAMIC | 9P 500V UJ | 1. PRESELECTOR | (330P + 20P) × 3 |
| 404 | CERAMIC | 20P 500V UJ | 2. PLATE | 300P |
| 131, 155, 160 | ELECTROLYTIC | 10μ 10WV | 3. LOAD | 340P × 2 |
| 502, 503, 508 | ELECTROLYTIC | 10μ 15WV | 401 VFO | 30P × 2 |
| 5 | ELECTROLYTIC | 10μ 16WV | TC - TRIMMER CAPACITOR | |
| 29 | ELECTROLYTIC | 20μ 300WV | 1, 2 | 50P MICA |
| 85, 93 | ELECTROLYTIC | 1μ 150WV | 3 | 10P 1.5KV. AIR |
| 101 | ELECTROLYTIC | 30μ 15WV | 101, 102 | 10P CERAMIC |
| 104 | ELECTROLYTIC | 30μ 150WV | 201-206 | 20P CERAMIC |
| 111 | ELECTROLYTIC | 10μ 350WV | 301 | 50P CERAMIC |
| 501 | ELECTROLYTIC | 470μ 16WV | 401 | 30P AIR |
| 98 | CERAMIC | 100P 3KV | 402 | 10P × 2 AIR |
| 103 | MP | 0.01μ 400WV | TR - TRANSISTOR | |
| | | | 201, 401, 402, 502 | 2SC372 |
| | | | 301, 501 | 2SC367 (2SC735Y) |

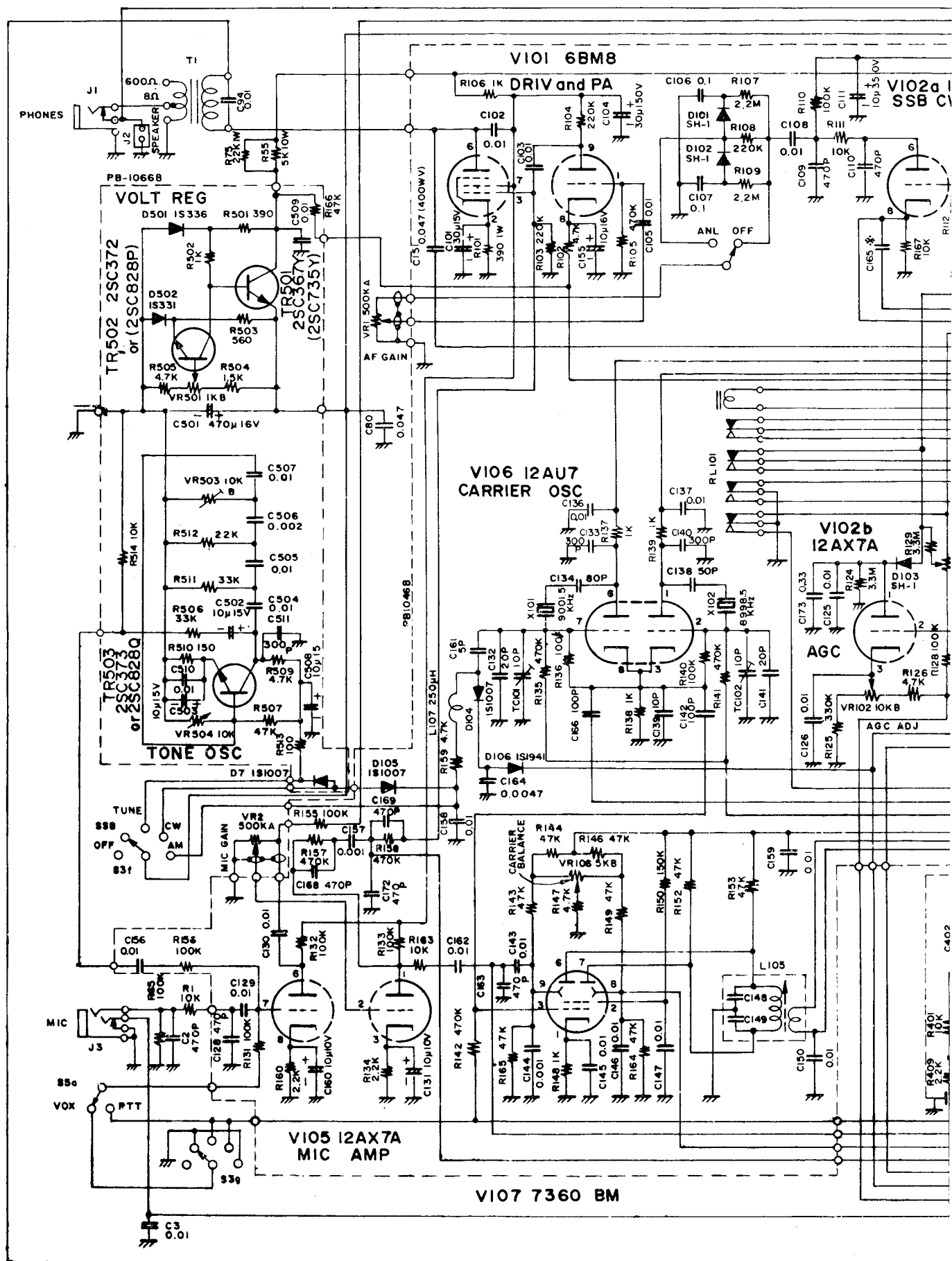
| | | | |
|-------------------------------|-----------------------|-------------------------------|---------------------------------|
| 503 | 2SC373 | S - SWITCH | |
| D - DIODE | | 1. BAND SW 1 | RS 5-10-5 |
| 1-5, 101, 102, 103, 106 | SH-1 (1S1941) SILICON | 2. BAND SW 2 | RS 1-2-4 |
| 6, 7, 104, 105, 301 | 1S1007 GER. | 3. FUNCTION | RS 4-8-5 |
| 401 | 1S145 VARI CAP | 4. SIDE BAND | |
| 501 | 1S336 ZENER | 5. VOX/PTT | |
| 502 | 1S331 ZENER | 6. OPR/REC/CAL | |
| VR - VARIABLE RESISTOR | | 7. ALC/IC/PO | |
| 1 AF GAIN + RF GAIN | 500K-A+10K-C 1/8W | 8. FIX SELECT (OPTION) | |
| 2 MIC GAIN | 500K-A 1/8W | 9. POWER | |
| 3 ANTI TRIP | 100K-B 1/4W | —FP - 250— | |
| 4 VOX GAIN | 500K-A | C - CAPACITOR | |
| 5 DELAY | 3M-B 1/4W | 101, 102 | ELECTROLYTIC 47 μ x 2 450WV |
| 6 CLARI FIER | 50K-B 1/4W | 103-105 | ELECTROLYTIC 33 μ x 3 450WV |
| 7 RFA | 20K-B 1/50W | 106 | ELECTROLYTIC 40 μ 300WV |
| 8 CARRIER | 3M-B 1/4W | 107, 108 | ELECTROLYTIC 20 μ 150WV |
| 9 RELAY SENS | 3K-B 1/4W | 109, 110 | DISC 0.01 1.4KV |
| 101 ALC ADJ | 2K-B 1/50W | 501-504, 509-513 | DISC 4700P 1.4KV |
| 102 AGC ADJ | 10K-B 1/50W | 513 | 0.01 500WV |
| 103 BIAS | 20K-B 1/25W | R - RESISTOR | |
| 104 SM SENS | 5K-B 1/25W | 101, 102, 501, 502, 503, 504 | 470K 1/2W |
| 105 SM ZERO | 500-B 1/25W | 505, 507 | |
| 106 CARRIER BALANCE | 5K-B 1/50W | 513 | 4.7K 1W |
| 501 VOLT ADJ | 1K-B 1/50W | 516 | 22K 1W |
| 502 TONE OUT ADJ | 10K-B 1/25W | 517 | 5.6K 4W |
| 503 TONE ADJ | 10K-B 1/50W | D - DIODE | |
| 504 TONE OSC ADJ | 10K-B 1/50W | 501-508 | 10D10 SILICON |
| RL - RELAY | | 509-512 | 1S1944 SILICON |
| 1 ANT | AE3254 100V | 513 | 1S1943 SILICON |
| 101 VOX | AE3254 100V | T - TRANSFORMER | |
| XF - CRYSTAL FILTER | | 101 | POWER |
| 101 | XF-9 9MC | CH - FILTER CHOKE | |
| X - CRYSTAL | | 101, 102 | 2.5H 150mA |
| 101 | HC-18/U 9001.5 KC | F - FUSE | |
| 102 | 8998.5 KC | 101 | 5A (100V) 3A (200V) |
| 201 7 m | 11.0 MC | —FIX CH OPTION— | |
| 202 21 m | 35.0 MC | TR - TRANSISTOR | |
| 203 28 mA | 42.5 MC | 701 | 2SC-372 |
| 204 28 mB | 43.0 MC | D - DIODE | |
| 205 28 mC | 43.5 MC | 701 (A), 701 (B) | 1S145 |
| 206 28 mD | 44.0 MC | C - CAPACITOR | |
| 301 CAL | HC-13/U 100 KC | 701 | FM 100P 500WV |
| PL - PILOT LAMP | | 702, 703, 705 | DISC 0.01 500WV |
| 1, 2 | 15V | 704 | FM 250P 500WV |
| T - TRANSFORMER | | R - RESISTOR | |
| 1 | OPT 5K:600, 8 | 701 | 22K 1/2W |
| M - METER | | 702 | 3.3K 1/2W |
| 1 | MRA-45 0.5mA | 703 | 220 1/2W |
| PB - PRINTED BOARD | | 704 | 470 1/2W |
| PB-1046 | GENERATOR | 705 | 10K 1/2W |
| PB-1061 | VFO | TC - TRIMMER CAPACITOR | |
| PB-1016 | CALIBRATOR | 701-704 | 20P CERAMIC |
| PB-1044 | VFO BPF | | |
| PB-1066 | VOLT REG | | |
| PB-1041 | HETERODYNE OSC | | |

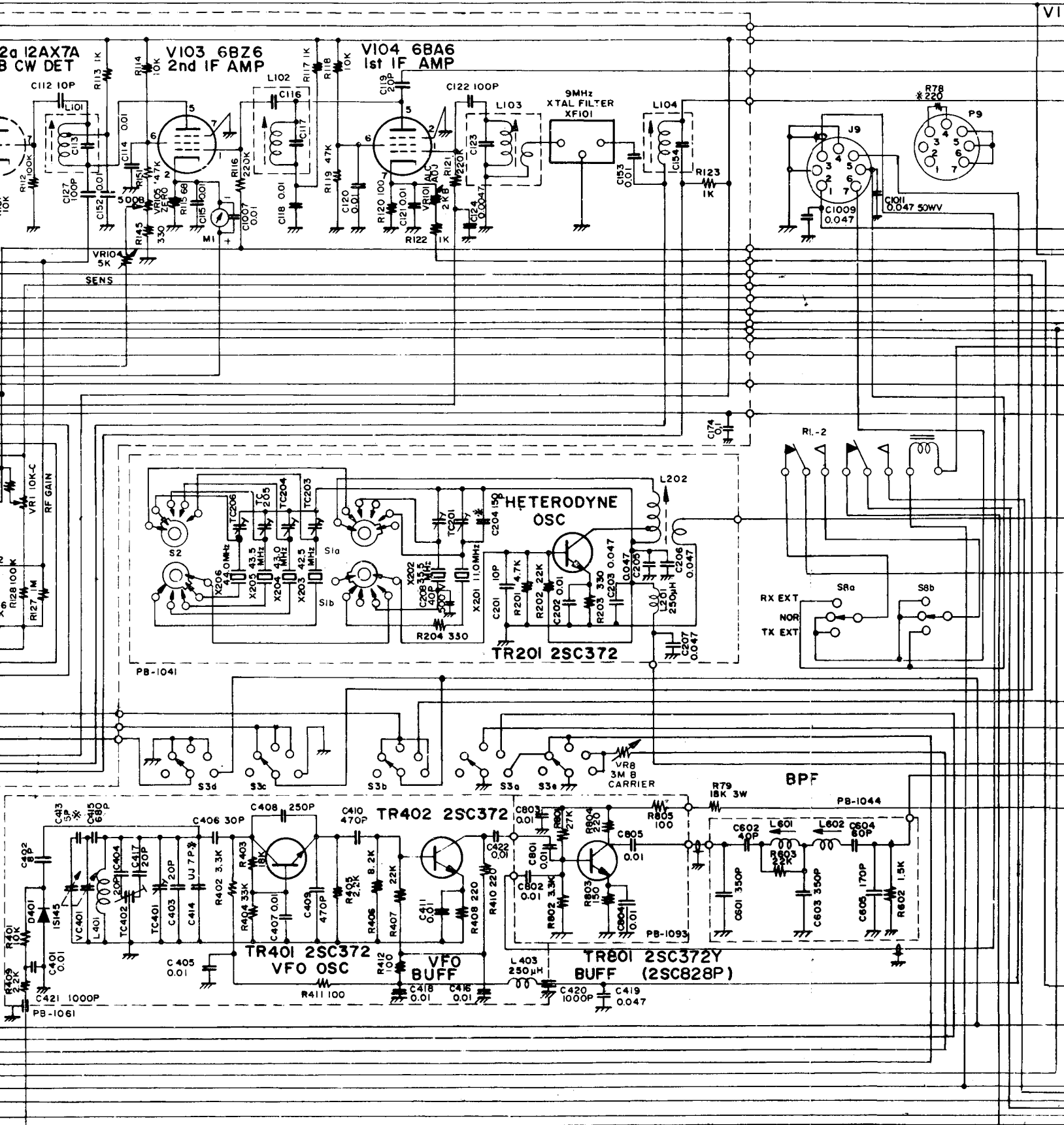


DC-250 DC POWER SUPPLY

The DC-250 DC mobile supply is designed for the FT-250 Transceiver. This supply provides all necessary voltages from 12 volt battery for mobile operation.

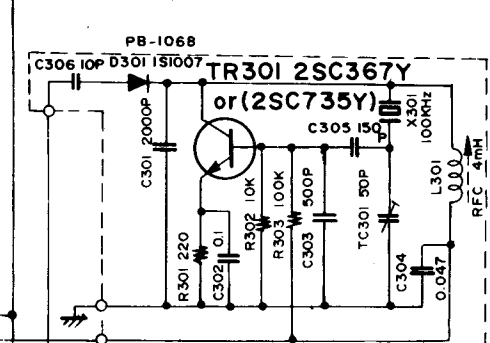
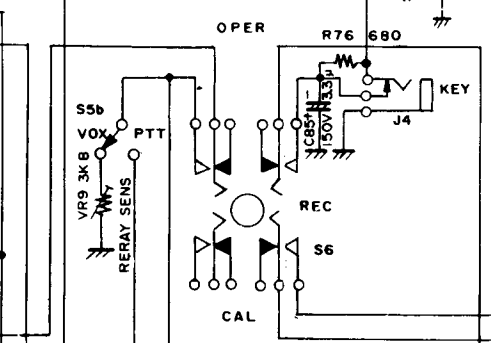
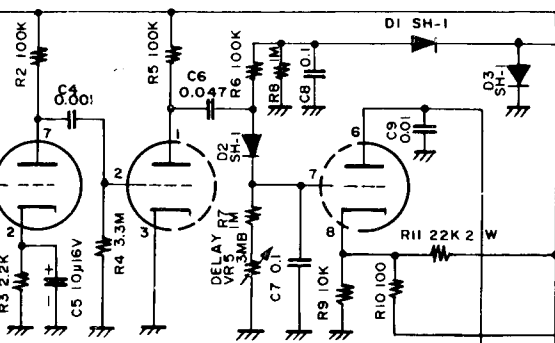




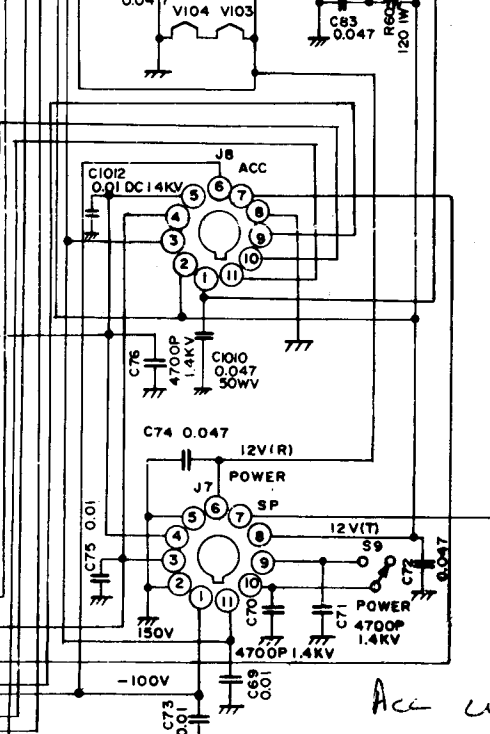
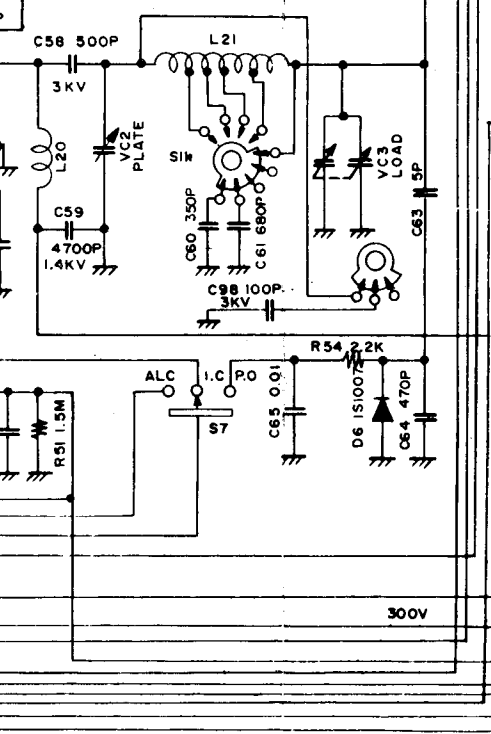
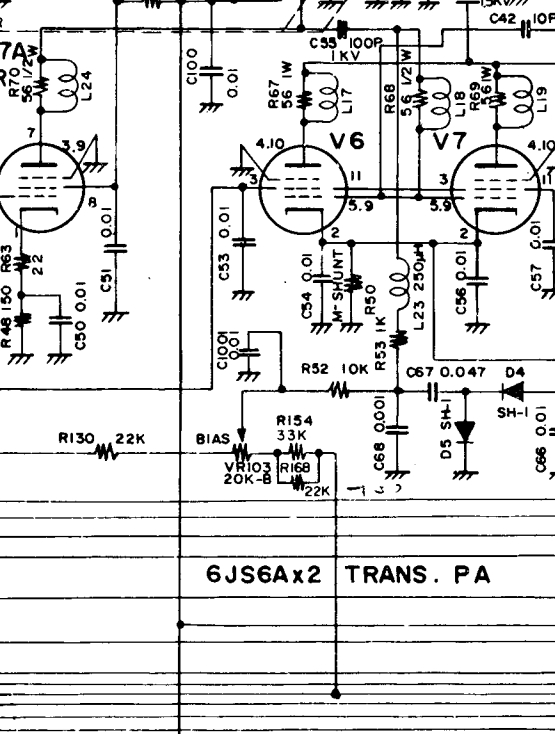
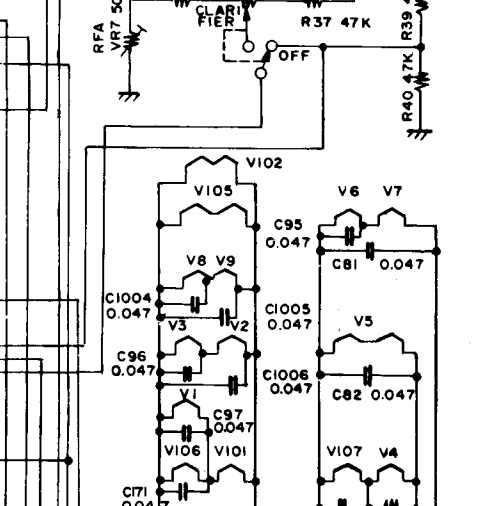
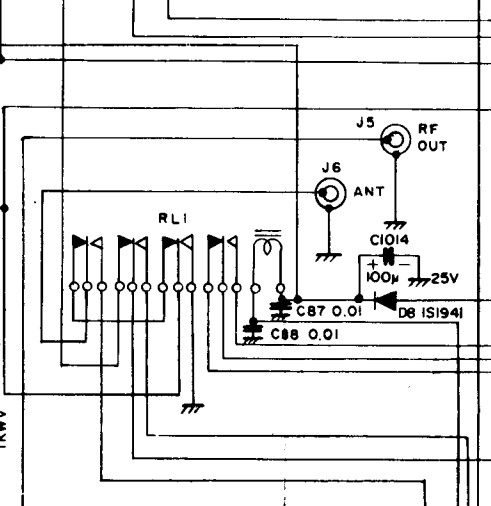
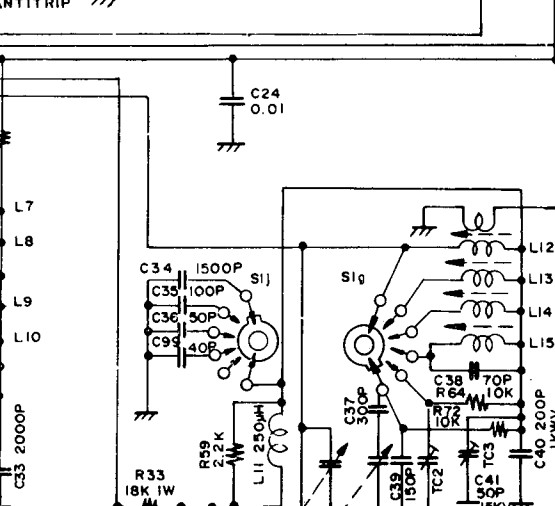




AV6 VOX AMP



V9a 12AU7 V9b RELAY CONTROL



D1 ~ D5
D101 ~ D103
D106

NOTES:

1. ALL RESISTORS IN OHM 1/2W $\pm 10\%$ UNLESS OTHERWISE NOTED.
2. ALL CAPACITORS IN μF UNLESS OTHERWISE NOTED.
3. * VALUE IS NOMINAL.

FT200/FT250

CIRCUIT DIAGRAM

335001

relays; 9 TX
10 Com
11 RX

Acc con

- 1 PA heater
- 2 12V AC
- 3 +150V
- 4 +300V
- 5 +600V
- 7 ALC
- 8 gnd
- 9, 10, 11 relay

