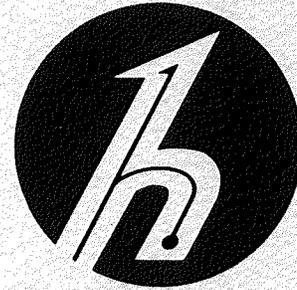


J.W. BRANTNER



hallicrafters

OPERATING AND SERVICE INSTRUCTIONS

TRANSMITTER
RECEIVER
TRANSCEIVER
MODEL FPM-200

WARRANTY

"The Hallicrafter's Company warrants each new radio product manufactured by it to be free from defective material and workmanship and agrees to remedy any such defect or to furnish a new part in exchange for any part of any unit of its manufacture which under normal installation, use and service discloses such defect, provided the unit is delivered by the owner to our authorized radio dealer, wholesaler, from whom purchased, or, authorized service center, intact, for examination, with all transportation charges prepaid within three hundred and sixty-six days from the date of sale to original purchaser and provided that such examination discloses in our judgment that it is thus defective.

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

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

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

the hallicrafters co.

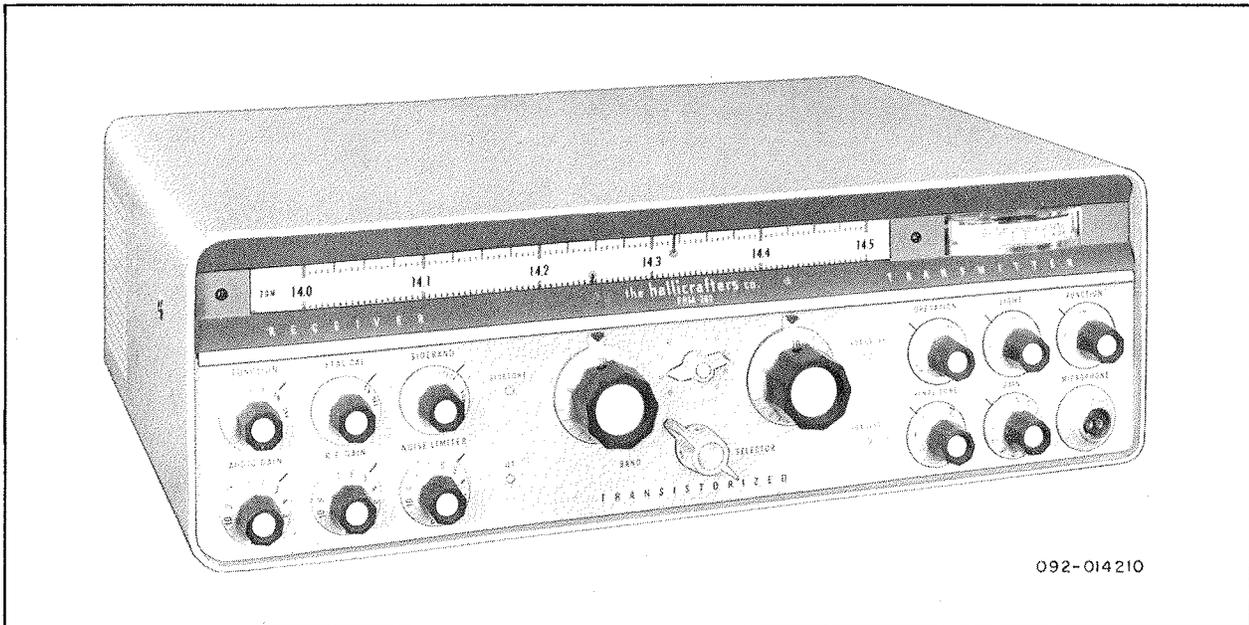


Figure 1. View of Model FPM-200.

TECHNICAL SPECIFICATIONS

MODES OF OPERATION	AM, SSB, and CW
POWER SOURCE	12 volts DC (negative ground)
ASSOCIATED EQUIPMENT.....	Model P-200 AC Power Supply, and Model MR-200 Mounting Rack supplied. Microphone (dynamic type recommended) and CW key not supplied.

FREQUENCY COVERAGE

<u>Band</u>	<u>Calibrated Range in MC</u>	<u>Step IF Freq.</u>	<u>Heterodyning Crystal Freq.</u>
WWV	9.7 to 10.2	1.450 MC	3.775 MC
80M	3.5 to 4.0	4.750 MC	7.075 MC
40M	6.8 to 7.3	1.450 MC	3.775 MC
20M	14.0 to 14.5	5.750 MC	3.425 MC
15M	21.0 to 21.5	12.750 MC	10.425 MC
10M	27.7 to 28.2	19.450 MC	17.125 MC
10M	28.2 to 28.7	19.950 MC	17.625 MC
10M	28.7 to 29.2	20.450 MC	18.125 MC
10M	29.2 to 29.7	20.950 MC	18.625 MC

FILTER AND SECOND IF FREQUENCY	2.325 MC
VFO RANGE	8.250 MC to 8.750 MC
TRANSISTORS	41
TUBES	3 plus 2 regulators
DIODES	49 including 14 power rectifiers
FREQUENCY STABILITY	0.009% maximum
DIAL CALIBRATION.....	Linear 1 KC
CALIBRATION ACCURACY	±1000 CPS after indexing to internal 100-KC standard

TECHNICAL SPECIFICATIONS (CONT)

RECEIVER

Sensitivity AM	Better than 3 microvolts for a 10-DB S+N/N
Sensitivity SSB	Better than 1 microvolt for 10 DB S+N/N
Selectivity	2.5 KC at 6 DB 6 KC at 60 DB
Audio Power Output	3 watts
Output Impedance	3.2 ohms and 500 ohms
DC Power Consumption	No Signal - 10 watts Maximum Audio Signal - 23 watts

TRANSMITTER

Output Power	SSB PEP - 70 watts to 100 watts CW - 60 watts to 90 watts AM CARRIER - 15 watts to 20 watts
Carrier Suppression	-50 DB
Unwanted Sideband Suppression	-50 DB
Hum and Noise	-40 DB
Distortion Products	-30 DB
Audio Input (Microphone)	0.004 volts RMS minimum

TRANSMITTER-RECEIVER POWER CONSUMPTION

Standby	30.0 watts
AM 100% Modulation	216 watts
SSB, No Signal	132 watts
SSB, Maximum Output	216 watts
CW, Maximum Output	288 watts

TRANSMITTER-RECEIVER

Dimensions	16 inches wide, 5 inches high, 11 inches deep
Weight	24.5 pounds
Shipping Weight	26 pounds

MOUNTING RACK

Dimensions	5.75 inches high, 2.5 inches deep, 14 inches wide
Weight	6 pounds
Shipping Weight	7 pounds

A.C. POWER SUPPLY /LOUD SPEAKER

Dimensions	7 inches wide, 5 inches high, 11 inches deep
Weight	27.5 pounds
Shipping Weight	29 pounds

SECTION I

GENERAL DESCRIPTION

1-1. INTRODUCTION.

The Hallicrafters Model FPM-200 Transmitter-Receiver/Transceiver is a complete, compact, self-contained radio station of advanced design. The versatility of the Model FPM-200 permits it to be operated as a fixed, portable, or mobile equipment. The unit is of the hybrid type using a combination of 41 transistors, three vacuum tubes, and two gas tubes. The power supply, the receiver circuits, and the low-level transmitter stages are completely transistorized. The high power stages of the transmitter use three vacuum tubes to develop the required power for transmitting and two gas tubes to regulate the screen voltage for the final amplifier stage. The Model FPM-200 equipment provides for amplitude modulated (AM), continuous wave (CW), and single-sideband (SSB) transmission and reception on the 80, 40, 20, 15, and 10 meter bands. An additional range is provided in the receiver for the reception of station WWV on 10 MC. Each tuning range is 500 KC, readable directly in kilocycles.

Two tunable oscillators (VFO's) are provided with selection to permit the equipment to operate as an independent transmitter and receiver on different frequencies within a given band, or to operate as a transceiver on one frequency--both functions being controlled by one oscillator.

A built-in, 100-KC crystal oscillator permits a front-panel adjustment for calibration of the VFO kilocycle dials.

Other features of this unit include an "S" meter which indicates receiver signal strength, as well as transmitter RF output level ... modular construction (glass epoxy circuit boards) ... upper and lower crystal lattice filters (2.325 MC) for transmitting and receiving ... adjustable noise limiter ... fast AGC for SSB operation ... single control transmitter tune-up ... blower for air circulation around tubes and internal power supply ... and keyed tone through SSB system for CW transmission.

SECTION II

INSTALLATION

2-1. UNPACKING.

Carefully remove the Model FPM-200 Transmitter-Receiver/Transceiver from the carton and packing material and examine the equipment carefully for any possible damage which may have occurred during transit. Should any sign of damage be apparent, file a claim immediately with the carrier stating the extent of damage. Carefully check all shipping labels and tags for any special instructions before removing or destroying them.

2-2. LOCATION.

The Transmitter-Receiver/Transceiver may be placed in any location permitting free air circulation through the ventilation openings on each side of the unit. However, excessively warm locations such as those near radiators or heating units should be avoided. The external speaker may be located in any convenient place. When the auxiliary power supply is used (base installations), place it against the left side of the Transmitter-Receiver/Transceiver, thus allowing both units to be ventilated by the fan within the Transmitter-Receiver/Transceiver.

2-3. ANTENNAS.

In mobile installations, a coaxial antenna connector is provided on the rear of the mounting rack for connecting the antenna.

In base installations, using the auxiliary supply, two coaxial connectors are provided from the power supply power cable. The XMIT connector can be used for both receiving and transmitting when the Model FPM-200 is used as an independent receiving and transmitting unit. If a linear amplifier is used, the XMIT connector is connected to the linear amplifier input and the REC connector is connected to the external antenna changeover relay (see figure 2). If desired, two separate antennas may be used to eliminate the external changeover relay.

Refer to the ARRL handbook or similar publications for the selection and installation of antennas.

2-4. MOBILE INSTALLATION.

The Model FPM-200 may be installed in any vehicle having a 12-volt DC power supply with the negative side grounded. A base bracket and straps

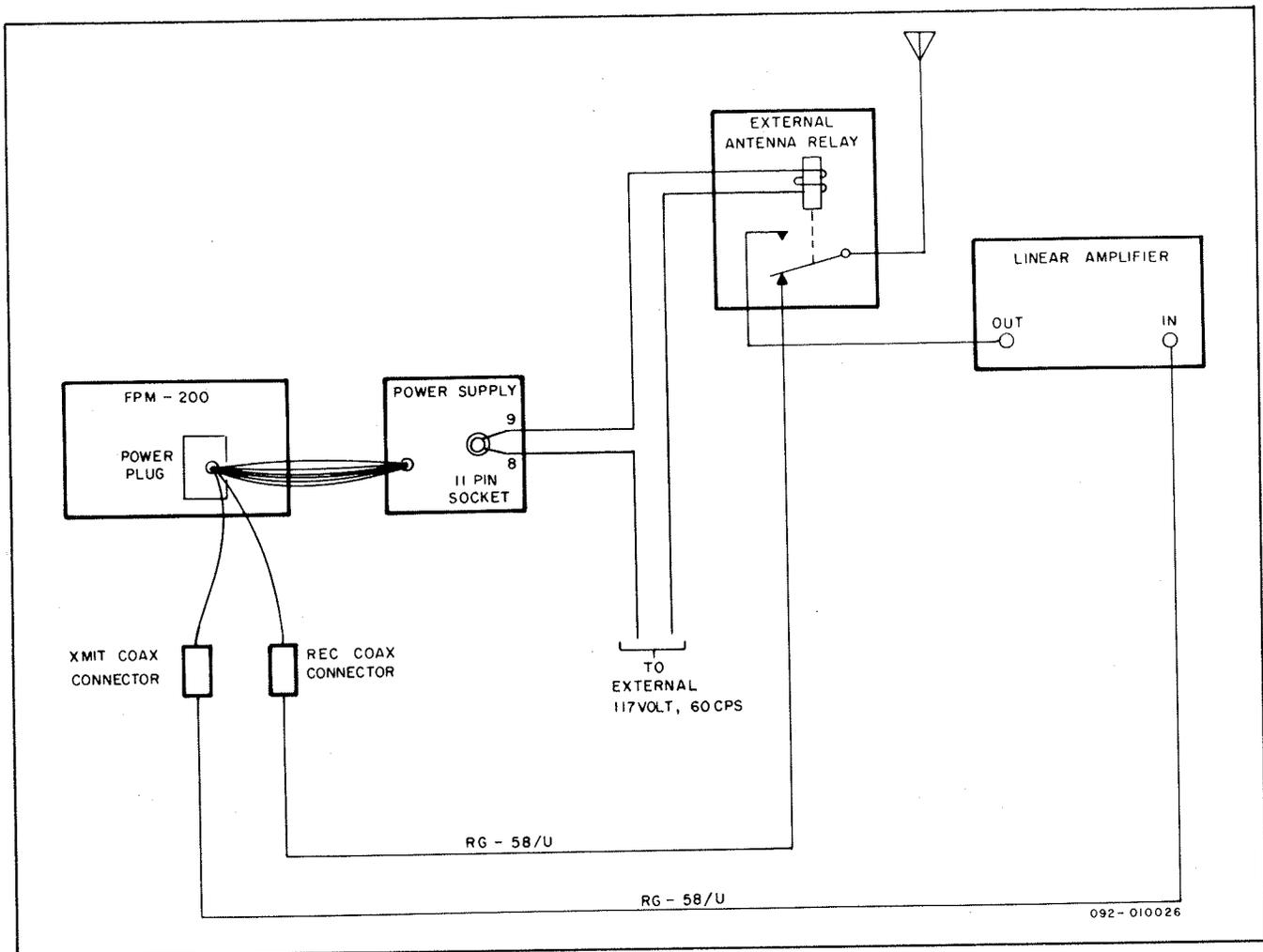


Figure 2. Model FPM-200 Driving a Linear Amplifier.

are provided for installing the Model MR-200 mounting rack (see figure 3). When selecting the installation location of the rack, an open area should be allowed on either side, with the rack sides extended, for ventilation when the Transmitter-Receiver/Transceiver is in place.

The microphone is connected to the front of the Model FPM-200; all other connections are made through the power socket to the mounting rack. The mounting rack provides two phone jacks, a coaxial connector, an 11-pin socket, and a terminal board for external connections. KEY and SPKR jacks are provided on the right side of the mounting rack for connection of a CW key and a 3.2-ohm speaker; headphones may also be connected to the SPKR jack. A 500-ohm speaker may be connected to pins 3 and 2 (ground) of the 11-pin socket. Provision is also made to connect the CW key to pins 6 and 4 (ground) of the 11-pin socket. The 12-volt DC power should be connected directly from the battery to the mounting rack terminal board with a No. 10 or No. 12 AWG shielded power cable. Connect one end of the shielded power cable so that the in-

ner conductor is connected to the positive (+) battery terminal and the cable shield is connected to the negative (-) battery terminal. Connect the other end of the shielded power cable so that the inner conductor is connected to the positive terminal (red wire) of the terminal board on the Model MR-200 Mounting Rack and the cable shield is connected to the negative terminal (yellow wire) of the terminal board. These connections should be made before the mounting rack is installed in the vehicle.

CAUTION

THE UNIT MAY BE USED ONLY ON 12V NEGATIVE GROUND SYSTEMS. DO NOT CONNECT THIS EQUIPMENT IN A VEHICLE WHICH HAS A POSITIVE GROUND ELECTRICAL SYSTEM.

After the mounting rack has been installed and electrical connections made, the Transmitter-Receiver/Transceiver can be put into place (see figure 3). Secure the rack sides to the unit sides with the clamps provided.

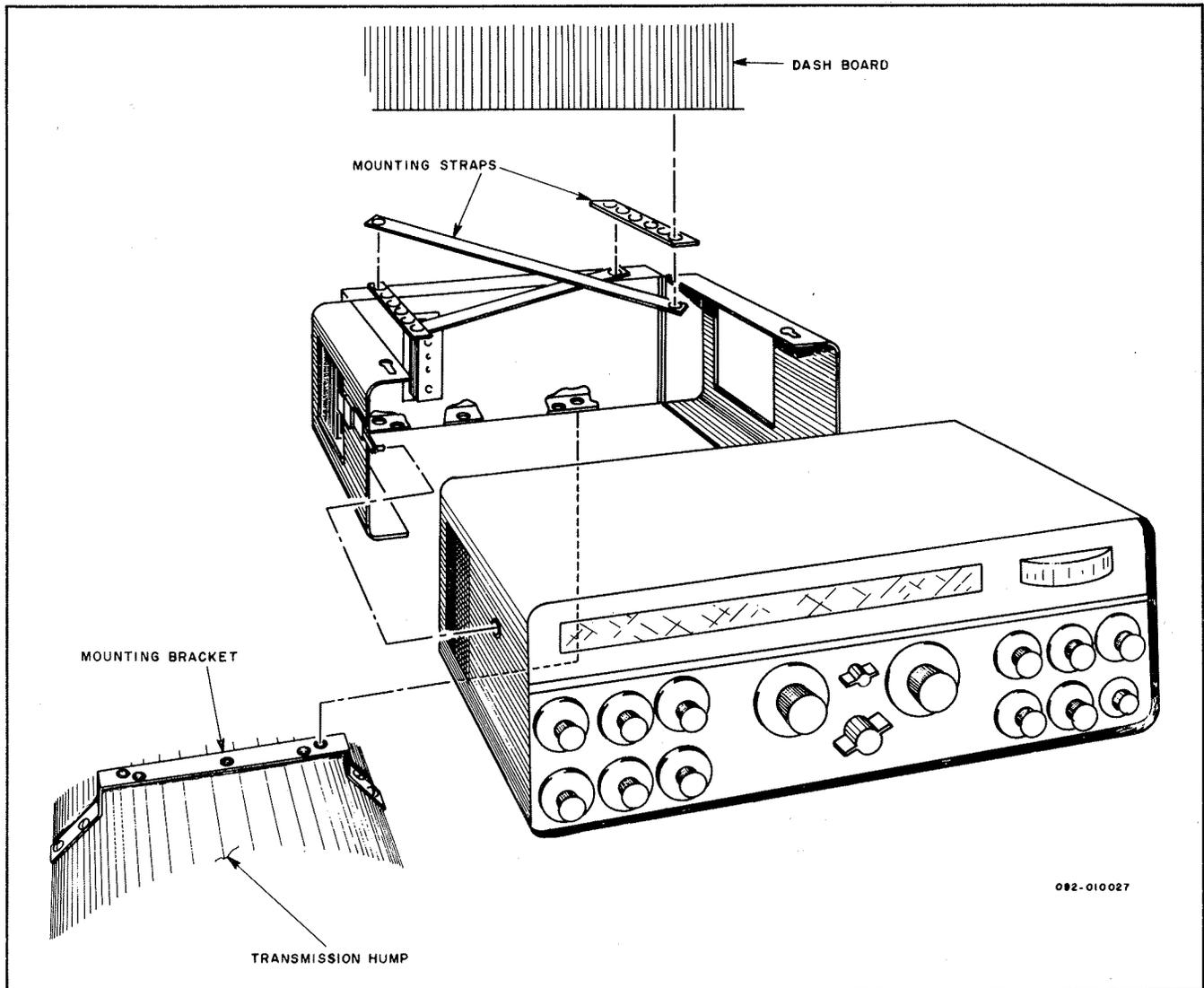


Figure 3. Model FPM-200 Mobile Installation.

2-5. MOBILE NOISE SUPPRESSION.

The following suggestions may be helpful in the suppression of noise encountered in mobile operation. Install resistor-type spark plugs and coaxial bypass capacitors at ignition coil, generator, and voltage regulator leads. Install bracket-mounted, coaxial capacitors in the generator and battery leads to the voltage regulator and a 0.005 mfd. mica or ceramic disc capacitor from the generator lead to ground. Chokes may be used in the generator field and armature leads instead of the bypass capacitors--approximately 12 turns of No. 18 wire on a 1/4-inch powdered iron core for the field lead choke and approximately 12 turns of No. 14 or No. 12 wire on a 1/4-inch powdered iron core for the armature lead choke.

Additional information for the suppression of mobile noise is available in the handbook for

Hallicrafters Model HA-3 or in other current handbooks on the same subject.

2-6. BASE INSTALLATION.

The Model FPM-200 Transmitter-Receiver/Transceiver, as a base station, may be operated with or without a linear amplifier. To operate from 117 volts AC, the Auxiliary Power Supply, Model P-200, is required. The power supply provides 12 volts DC, a speaker, a KEY jack, a PHONE jack, and an 11-pin socket for external connections. As in the case of mobile installation, a 500-ohm speaker and a CW key may be connected to pins 3 and 2 (ground) and pins 6 and 4 (ground) respectively of the 11-pin socket. When a linear amplifier and a changeover relay are used, pins 8 and 9 provide the control circuit for the relay. Refer to figure 2 for connection of the FPM-200 with a linear amplifier, antenna changeover relay, and antenna.

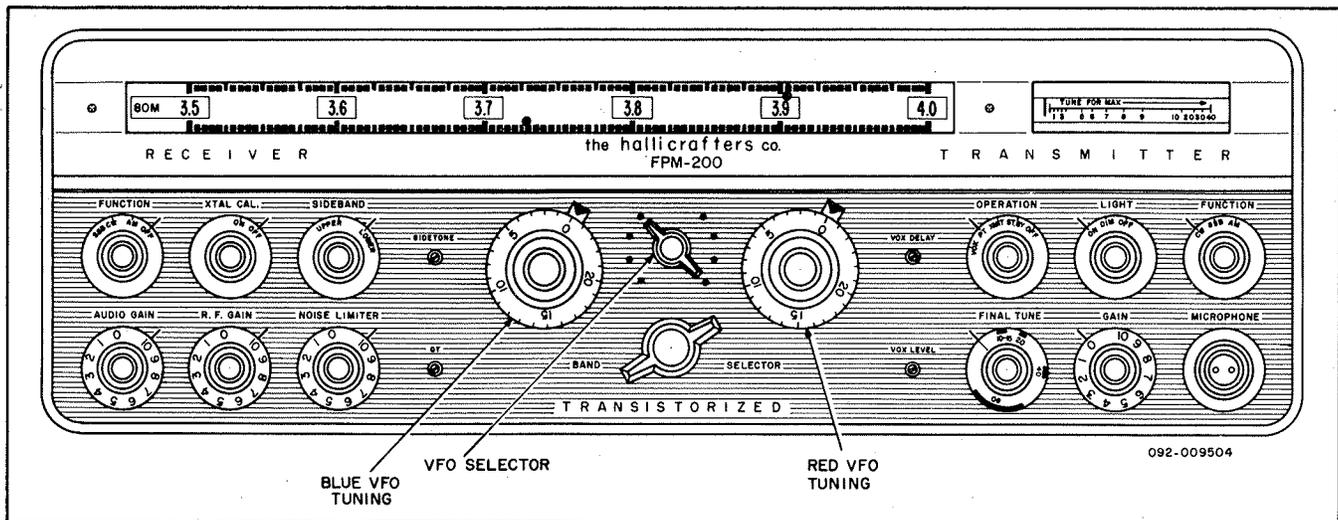


Figure 4. Front Panel View of Equipment.

SECTION III

FUNCTION OF OPERATING CONTROLS

3-1. GENERAL.

The front panel controls (see figure 4) of Model FPM-200 Transmitter-Receiver/Transceiver are grouped according to their functions. The six controls on the left side of the front panel control the calibration and receiving functions. The five controls on the right side of the front panel and the four screwdriver adjustments control the transmitting function. The four controls in the center of the front panel select and tune the VFO's for both the transmit and receive functions of the unit.

3-2. FUNCTION (Receiver).

The FUNCTION control is a three-position rotary switch. In the OFF position, all power is disconnected from the circuitry. In either the AM or SSB/CW positions, power is applied to the receiver section of the equipment. In the AM position, AM signals can be received; in the SSB/CW position, SSB and CW signals can be received.

3-3. AUDIO GAIN (Receiver).

The AUDIO GAIN control is a potentiometer in the first audio amplifier circuit. Clockwise rotation of this control will increase audio output while counterclockwise rotation will decrease audio output.

3-4. RF GAIN (Receiver).

The RF GAIN control is a potentiometer in the AGC amplifier circuit. Clockwise rotation increases the RF gain of the receiver and counterclockwise rotation decreases the RF gain of the receiver.

3-5. SIDEBAND (Common).

The SIDEBAND control is a two-position rotary switch. With this control the operator may select either the UPPER or LOWER sideband for receiving or transmitting SSB/CW signals.

3-6. NOISE LIMITER (Receiver).

The NOISE LIMITER control is a potentiometer in the noise limiter circuit. Counterclockwise rotation decreases the noise limiting effect and clockwise rotation increases the noise limiting effect.

3-7. CRYSTAL CALIBRATOR (Receiver).

The XTAL CAL control is a two-position rotary switch. In the ON position, this switch activates the 100-KC crystal marker, thus providing a known frequency to be used in calibration of the VFO's. In the OFF position, the 100-KC crystal marker is removed from the circuit.

3-8. OPERATION (Transmitter).

The OPERATION control is a five-position rotary switch. This switch is used to select the operating condition of the transmitter portion of the unit. It should be noted that the FUNCTION (receiver) switch on the left of the front panel must be in the AM or SSB/CW position to apply power to the transmitter portion. The five positions of the OPERATION control are: (1) OFF, which turns the transmitter off; (2) STANDBY, which applies power to the transmitter tube heaters; (3) XMIT, which turns transmitter

power on (STANDBY & XMIT are used for manual operation); (4) PT, which allows push-to-talk operation; and (5) VOX, which allows voice controlled operation.

3-9. FINAL TUNE (Transmitter).

The FINAL TUNE control consists of two continuously tunable capacitors. These capacitors tune the final output and driver stages of the transmitter to the operating frequency.

3-10. GAIN (Transmitter).

The GAIN control is a potentiometer in the microphone amplifier circuit. This control sets the modulation level of the signal to be transmitted. It also sets the output level in CW operation.

3-11. FUNCTION (Transmitter).

The FUNCTION control is a three-position rotary switch. This control is used to select the transmitter mode of operation (CW, SSB, or AM).

3-12. LIGHT.

The LIGHT control is a three-position rotary switch for controlling the brightness of the illuminating lamps.

3-13. BAND SELECTOR (Common).

The BAND SELECTOR control is a nine-position rotary switch used to select the desired band for receiving and transmitting. This control is mechanically connected to a cylindrical indicator located behind the dial scale and indicates the band in meters and the frequency in megacycles through windows in the dial scale.

3-14. VFO SELECTOR (Common).

The VFO (variable frequency oscillator) selector is a four-position switch used to select a receiving VFO and a transmitting VFO. The unit has two VFO's identified with the colors blue and red.

The indicators (red and blue dots) on the left of the VFO selector control indicate the VFO used to receive. The indicators on the right of the VFO selector control indicate the VFO used to transmit. Four operating combinations exist, starting counterclockwise:

1. Position 1. - Control set to a blue dot on the left and a red dot on the right--blue VFO receiving, red VFO transmitting.
2. Position 2. - Control set to a blue dot on each side--blue VFO receiving and transmitting (transceiver operation).
3. Position 3. - Control set to a red dot on the left and a blue dot on the right--red VFO receiving, blue VFO transmitting.
4. Position 4. - Control set to a red dot on each side--red VFO receiving and transmitting (transceiver operation).

NOTE

DO NOT use separate VFO's when transmitting and receiving on the same frequency (transceiver operation). Use both VFOs only when transmitting on one frequency and receiving on another frequency within a band. An example of this is communicating with stations outside the U.S. amateur band allocation.

3-15. VFO TUNING.

There are two VFO tuning controls, one for each VFO. Each control has its own indicator on the dial scale. The control on the left controls the blue VFO and bottom indicator. The control on the right controls the red VFO and top indicator.

3-16. SIDETONE (Screwdriver Adjustment).

The SIDETONE control is a potentiometer which is switched into the system by the transmitter FUNCTION control in the CW position. When switched into the circuit, it controls the level of the tone signal from the microphone amplifier stage to the audio amplifier stage of the receiver. The front panel meter provides an indication of the CW signal level being transmitted.

3-17. QT (Screwdriver Adjustment).

The QT (anti-trip) control is a potentiometer in the QT amplifier circuit. This control determines the audio level of a signal which may be received without turning the transmitter on when using VOX.

3-18. VOX DELAY (Screwdriver Adjustment).

The VOX DELAY control is a potentiometer which controls the time the VOX relay remains operated after a transmitted signal has been completed.

3-19. VOX LEVEL (Screwdriver Adjustment).

The VOX LEVEL control is a potentiometer which controls the signal level required to operate the VOX relay.

3-20. SERVICE AND OPERATION QUESTIONS.

For any further information regarding operation or servicing of the equipment, contact the Hallicrafters dealer from whom the Model FPM-200 Transmitter-Receiver/Transceiver was purchased. The Hallicrafters Company maintains an extensive system of authorized service centers where any required service will be performed promptly and efficiently at a nominal charge. All Hallicrafters Authorized Service Centers display the sign shown on the following page. For the location of the dealer nearest you, consult your local telephone directory.

Do not make any service shipments to the factory unless instructed to do so by letter. The Hallicrafters Company will not accept the responsibility for unauthorized shipments.

The Hallicrafters Company reserves the privilege of making revisions in current production of equipment and assumes no obligation to incorporate these revisions in earlier models.



SECTION IV OPERATION

4-1. GENERAL.

The tuning procedure for the Model FPM-200 is not complicated. However, care should be exercised when tuning to insure maximum performance of the equipment. Be sure that the power cord plug is securely inserted into the socket on the rear of the chassis. It is suggested that each time the unit is placed in operation, the settings on the VFO controls be checked with the crystal marker as specified in paragraph 4-2.

4-2. CALIBRATION OF VFO'S.

The calibration of the VFO's should be made with the BAND SELECTOR control set to the desired band of operation. Disconnect the antenna to eliminate the possibility of tuning the VFO's to an incoming signal.

Calibrate the VFO's as indicated in the following step-by-step procedure:

1. Set the controls as indicated below:

FUNCTION (receiver)	SSB/CW
XTAL CAL	ON
SIDEBAND	Either UPPER or LOWER
AUDIO GAIN	5
RF GAIN	10
NOISE LIMITER	0
OPERATION (transmitter)	OFF
BAND SELECTOR	To desired band
VFO SELECTOR	2nd position (blue/blue)

2. Rotate the blue (left-hand) VFO control until the blue dial indicator is set to a multiple of 100 KC; rock the con-

trol back and forth to obtain a zero beat. Move the black pointer located above the control to the 0 on the control skirt. The skirt provides a fine tuning indicator for the blue VFO; each division is 1 KC.

3. Set the VFO SELECTOR to the 4th position (red/red).
4. Rotate the red (right-hand) VFO control until the red dial indicator is set to a multiple of 100 KC; rock the control back and forth to obtain a zero beat. Move the black pointer located above the control to the 0 on the control skirt. The skirt provides a fine tuning indicator for the red VFO; each division is 1 KC.
5. Both VFO's have now been calibrated for receiving and transmitting on the band indicated on the tuning dial. Turn the XTAL CAL control to the OFF position and connect the antenna.

4-3. RECEIVING.

The receiver section of the equipment will operate with the transmitter section turned off (OPERATION control OFF). The following is the procedure for tuning in a signal.

1. Set the controls as indicated below:

FUNCTION (receiver)	AM for AM reception, SSB/CW for SSB or CW reception.
XTAL CAL	OFF
SIDEBAND	Desired sideband for SSB or CW reception, either position for AM reception.
AUDIO GAIN	5
RF GAIN	10

NOISE LIMITER 0
 OPERATION (transmitter) . . OFF
 BAND SELECTOR Desired band
 VFO SELECTOR Desired VFO
 combination.

2. Tune to the desired frequency by rotating the VFO control corresponding to the VFO selected for receiving.
3. Adjust the volume to a comfortable listening level with the AUDIO GAIN control. Clockwise rotation increases the volume and counterclockwise rotation decreases the volume.
4. The RF GAIN control is normally set for maximum gain (10). However, when receiving extremely strong CW or SSB signals, reducing the RF GAIN control setting will usually improve reception. This adjustment will reduce the undesired background noise that appears between signal pulses. In AM reception, the RF GAIN control should be set for maximum gain (10).
5. Excessive background noise, ignition noise, and other pulse-type noise may be reduced or eliminated by adjusting the NOISE LIMITER control. Clockwise rotation of this control increases the noise limiting capabilities of the circuit. Since limiting the noise also decreases signal strength and introduces some distortion, the NOISE LIMITER control should be advanced only to the point that adequate noise limiting is accomplished.

4-4. TRANSMITTER TUNEUP.

The transmitter should be tuned up each time the equipment is turned on or a different transmitting frequency is selected.

1. Calibrate the VFO's within the desired band of operation (see paragraph 4-2).
2. Set the controls as indicated below:

FUNCTION (receiver) AM, or SSB/CW
 SIDEBAND UPPER
 OPERATION XMIT
 FUNCTION (transmitter) . . AM
 GAIN (transmitter) 0

VFO SELECTOR Desired VFO
 combination
 BAND SELECTOR Desired band
 FINAL TUNE To the segment corresponding to the
 selected band
 SIDETONE Maximum counter-
 clockwise
 QT Maximum counter-
 clockwise
 VOX DELAY Maximum counter-
 clockwise
 VOX LEVEL Maximum counter-
 clockwise
 AUDIO GAIN 0
 RF GAIN 0

3. Tune the VFO control, to be used, to the desired transmitting frequency.
4. Rock the FINAL TUNE control to obtain maximum deflection on the panel meter.

4-5. TRANSMITTING, MANUAL.

Manual transmission may be commenced after the VFO's have been calibrated (see paragraph 4-2) and the transmitter tuned up (see paragraph 4-4). Assuming that the controls are still set to their respective positions for tune-up, rotate the FUNCTION (transmitter) control to the desired mode of operation: AM, SSB, or CW.

In the AM mode of transmission, all the controls remain as set for the tune-up procedure except the GAIN control. Connect the microphone (if it is not already connected) to the MICROPHONE jack on the front panel. Talk into the microphone with a normal voice level, while watching the panel meter, and rotate the GAIN control clockwise until the meter deflects slightly above the carrier level. This is the proper setting for the GAIN control.

For the SSB mode of transmitting, assume all controls are set as at the completion of the tune-up procedure. Rotate the transmitter FUNCTION control to SSB and select the desired sideband with the SIDEBAND control. Advance the GAIN control clockwise until the meter reads between half-scale and full-scale deflection while talking into the microphone.

For the CW mode of transmitting, all controls are to be set as at the completion of the

tune-up procedure. Rotate the transmitter FUNCTION control to CW; with the SIDEBAND control, select the sideband to be used. Connect the CW key through the power socket on the chassis rear (if it has not already been connected). Close the key and advance the GAIN control clockwise until a maximum deflection is indicated on the meter, not necessarily full scale. Do not advance the control beyond this point.

In each of the three modes of manual transmission, the transmitter is controlled by the OPERATION control. During actual transmission, the control is set to XMIT. At other times, the control is set to STBY, thus keeping the transmitter ready for instant use.

A second method of controlling the transmitter, in either the AM or SSB mode of operation, is provided when a microphone with a push-to-talk switch is used. After the transmitter has been tuned up and the GAIN control properly set, rotate the OPERATION control to the PT position. The transmitter is turned on by depressing the push-to-talk switch; when the switch is released, the transmitter is turned off.

4-6. TRANSMITTING, VOX

For VOX (voice controlled operation), the transmitter must first be adjusted for manual operation as described in paragraph 4-5. VOX can be used for AM or SSB transmission. With the transmitter set for manual transmitting, proceed as follows:

1. Rotate the OPERATION control to the VOX position.
2. While talking into the microphone with normal voice level, advance the VOX LEVEL control clockwise until the transmitter turns on.
3. Rotate the VOX DELAY control clockwise until the desired delay time (elapsed time between end of trans-

mission and transmitter cutoff) is reached.

4. Tune-in an average signal to a comfortable listening level (see paragraph 4-3); do not turn the transmitter off.
5. Advance the QT control clockwise until the audio level of signal being received will not turn the transmitter on through the microphone. Slight readjustment of the VOX LEVEL control may be necessary.

NOTE

Never use more VOX LEVEL or QT gain than is required for smooth voice control operation.

4-7. TRANSMITTING, BREAK-IN CW KEYING.

Break-in CW keying is provided in VOX operation. Adjust the transmitter as described in paragraph 4-5 for manual CW operation, then proceed with the following steps:

1. Rotate the OPERATION control to the VOX position.
2. Close the CW key and advance the VOX LEVEL control clockwise until the transmitter turns on.
3. The drop-out delay time is variable with the VOX DELAY control.
4. While operating the CW key, advance the SIDETONE control clockwise to the point where the transmitted signal can be heard in the receiver. This adjustment provides a means of monitoring the transmitted signal and may be used as desired.

SECTION V

THEORY OF OPERATION

5-1. GENERAL.

The Model FPM-200 Transmitter - Receiver/Transceiver consists of a double-conversion receiver and a double-conversion transmitter. The VFO circuitry, the heterodyne crystal oscillator circuitry, and the crystal filter/IF circuitry are common to both the transmitter and receiver. Refer to figure 5 for a block diagram of the equipment and figure 24 for the schematic diagram.

5-2. RECEIVER CIRCUIT.

The antenna is connected to the receiver through the antenna relay located in the transmitter final amplifier section. The input signal is applied through the antenna relay to a high-pass filter that attenuates signals below 3.0 MC. It is then fed through a trap at 4750 KC (the 80-meter first IF frequency). Additional traps are switched into the circuit on the 15-meter band

and on the four segments of the 10-meter band as follows:

<u>Band</u>	<u>Trap Frequency</u>
15 meters	12.750 MC
lowest 10-meter segment . . .	19.450 MC
second 10-meter segment . .	19.950 MC
third 10-meter segment . . .	20.450 MC
highest 10-meter segment . .	20.950 MC

These traps prevent strong signals on these frequencies from entering the first IF stage and causing interference with the desired signal.

The signal is then applied to the proper tuned circuit, as selected by the BAND SELECTOR switch and coupled to the base of the RF amplifier (Q2). The amplified signal is fed to a second tuned circuit and then coupled to the base of the first mixer (Q3). Two semiconductor diodes (voltage-tuned capacitors) are used to track these tuned circuits with the VFO on the 80-meter, 40-meter, 20-meter, and 15-meter bands and on WWV. The DC tuning voltage is derived from the VFO circuitry. The four 10-meter segments are not tracked since the 500-KC bandwidth of each segment is only a small percentage of the input frequency.

The received signal at the base and the VFO injection signal at the emitter of Q3 produce sum and difference products. These products are applied to the proper tuned circuit in the input of the first IF stage and thence through a band-stop filter to reduce the second harmonic of the VFO. This harmonic, if allowed to mix with the crystal oscillator in the second mixer, would produce spurious signals in the receiver. From the band-stop filter, the signal is coupled to the base of the stepping type IF amplifier (Q4) (a different frequency is used for each band). The proper resistance, necessary for the base bias divider of this stage to maintain equal sensitivity on all bands, is selected by the BAND SELECTOR switch.

The BAND SELECTOR also permits the amplified IF signal from Q4 to be fed through the proper tuned circuit and then coupled to the base of the second mixer (Q5). The signal from the crystal oscillator (Q6) is also coupled to the base of Q5. The difference product output (2325 KC) from Q5, which is the output of the receiver board, is fed to the input of the crystal lattice filters. The SIDEBAND switch selects the desired sideband by grounding the output of the filter not in use.

The output from the crystal lattice filter is coupled to the base of the first 2325-KC IF amplifier (Q7). The signal is further amplified by second and third 2325-KC IF stages (Q8 and Q9). The output of the third IF amplifier is coupled to a diode gate (CR5). In the receive condition, CR5 allows the IF signal to be applied to the AM/SSB-CW detector (CR6 and CR7), the AGC detector (CR10), and the noise detector (CR8 and CR9).

The DC voltage output of the AGC detector is applied to the AGC amplifiers (Q20 and Q21). The output from Q20 and Q21 is the AGC voltage applied to the RF amplifier and first mixer. The meter (M1) is electrically located in the emitter of Q22 through the antenna relay contacts and functions as an "S" meter to indicate the relative strength of received signals. The RF GAIN control (R131), located in the collector circuit of Q22, applies a DC voltage to the AGC line, thus reducing the gain of the RF amplifier and first mixer stages of the receiver.

The output of the noise detector (CR8 and CR9) is fed to the base of the audio clamping transistor (Q22). When a negative pulse appears at the base of Q22, the emitter-to-collector impedance drops to a low value. Transistor Q22 is connected across the signal detector output, thus gating the output during noise pulses.

The signal output from the AM/SSB-CW detector is fed through the AUDIO GAIN control (R140) to the base of the first audio amplifier (Q18). The amplified audio signal from Q18 is applied to the base of the audio driver (Q19). The signal from Q19 is fed to the bases of the push-pull output stage (Q33 and Q34) which produces audio power for the speaker, the headphones, or the 500-ohm line.

5-3. TRANSMITTER CIRCUIT.

The signal from the microphone is fed to the base of the microphone preamplifier stage (Q23). Transistor Q23 is an emitter follower used for impedance matching only and provides no voltage gain of the signal. It provides a high-impedance input for the microphone and a low-impedance output for the base of the following stage. The output of Q23 is applied through the transmitter FUNCTION switch (in SSB and AM position) to the microphone GAIN control which controls the signal input to the plate of the microphone amplifier (Q24). In the CW position, the FUNCTION switch disconnects transistor Q23 from the circuit and connects the tone oscillator (Q11) to the microphone GAIN control. The GAIN control, in CW operation, functions as the CW level control.

The output of the microphone amplifier (Q24) is applied to the balanced modulator (CR11 and CR12). A 2325-KC carrier signal is also fed to

the balanced modulator from a crystal controlled oscillator (Q10). The sum and difference products (sidebands) from the balanced modulator are fed to the input of the crystal lattice filters. The upper or lower sideband output of the crystal lattice filter, as selected by the SIDEBAND switch, is coupled to the base of the first 2325-KC IF amplifier (Q7). The IF signal is further amplified by two additional IF stages (Q8 and Q9) and is then coupled to a diode gate (CR4). In transmit condition, CR4 allows the IF signal to be fed to the first transmitter balanced mixer (CR23 and CR24) on the transmitter heterodyning board.

The balanced mixer combines the 2325-KC IF signal with the signal from the crystal oscillator (Q6) to produce the required stepping IF signal for each band. It also cancels out the 2325-KC IF signal. The output of the balanced mixer is applied to the proper tuned circuit for each band and then fed to the base of the stepping IF amplifier (Q25). The BAND SELECTOR switch selects resistors for the base bias divider of this stage to maintain the same overall gain of the transmitter for all bands. The amplified signal from Q25 is fed, via the BAND SELECTOR switch, to the proper tuned circuit for each band and is coupled to the second transmitter balanced mixer (CR26 and CR27). This mixer combines the stepping IF signal with the VFO signal to produce the output signal frequency for each band.

The output of the second transmitter balanced mixer is fed to the proper tuned circuit and is then coupled to the base of the transmitter RF amplifier (Q26). The amplified signal from Q26 is applied, via the proper tuned circuit, to the grid of the transmitter driver (V1). A semiconductor diode (voltage-tuned capacitor) is used to track the tuned circuit on the collector of Q26 with the VFO on the 80, 40, 20, and 15 meter bands. The tuning voltage is derived from the VFO circuitry. The four 10-meter segments are not tracked.

The drive tube (V1) amplifies the signal to provide driving voltage for the grids of the parallel power amplifier stage (V2 and V3). The BAND SELECTOR switch selects the proper tuned circuit for the driver plate and the proper tap on the tank coil of the pi network for the plates of the final amplifier tubes. The driver plate circuit tuning and the final amplifier plate circuit tuning are ganged together to provide single knob tuning (FINAL TUNE control) on each band. The output of the pi network is fixed-tuned and provides for output impedances from 50 ohms to 70 ohms. A small amount of negative RF feedback is provided from the final amplifier plates to the driver cathode to insure linearity. The transmitter meter circuit is also located in the final amplifier compartment. This circuit rectifies a small portion of the RF output voltage which is fed to the meter (M1) through the antenna relay contacts.

The bias voltage and the final amplifier screen voltage are regulated to insure proper operating voltage for the amplifier. This regulation is accomplished by two OA2 type tubes (V4 and V5) and an NE-48 neon, and is necessary because of the wide input voltage variations normally encountered in mobile operation (10.5 volts to 16.0 volts).

5-4. VFO CIRCUITRY.

The Model FPM-200 contains two electrical-ly identical variable frequency oscillators. These VFO's tune from 8.25 MC to 8.75 MC. The RF output of each VFO is fed to a diode gate, through the VFO SELECTOR switch. One diode gate (CR30) couples to the receiver mixer and the other gate (CR31) couples to the transmitter mixer. Both gates are operated by voltages derived from the electronic switch (Q13 and Q14) in the VOX circuit. A potentiometer, geared to the VFO drive mechanism, provides a voltage to tune the voltage-variable capacitors which track the RF stages of the transmitter and receiver.

5-5. VOX AND QT CIRCUITRY.

All transmit-receive switching in the Model FPM-200, with the exception of that switching performed by the antenna relay, is accomplished electronically. The antenna relay controls antenna changeover, meter switching, and changes in the final amplifier-driver bias.

The electronic switching is performed by a high-speed monostable multivibrator (Q13 and Q14). In its normal stable condition (receive), the collector of Q13 (receive switch) has a potential of approximately 12 volts while the collector voltage of Q14 (transmit switch) is about 1 volt. When triggered into its other stable condition (transmit), the collector voltage of Q13 approaches 1 volt and the collector voltage of Q14 becomes 12 volts. After the triggering pulses are removed, the switch will remain in the transmit condition for a period of time as determined by the time constant of the VOX delay circuit (0.2 second to 2 seconds). At the end of this period, which may be varied by the VOX DELAY control, the electronic switch will return to the receive condition.

A portion of the audio voltage from the microphone amplifier (Q24) is fed through the VOX GAIN control to the VOX amplifier (Q16). The amplified signal from the VOX amplifier is rectified by a diode (CR16) and then fed to the base of the VOX DC amplifier (Q17) as a negative DC voltage. The output of the DC amplifier is fed to the base of Q13. This voltage drives the base more positive and flips the electronic switch from receive condition to transmit condition.

The output (collector) voltage of the receive side of the electronic switch is applied to the base of the relay transistor (Q41). When the switch

voltage drops to 1 volt in transmit condition, the relay transistor draws current to close the power relay in its emitter. The power relay then applies voltage to the power supply (DC-to-DC converter, Q37, Q38, Q39, and Q40) and the blower oscillator (Q35 and Q36). It also applies voltage to the antenna relay coil, thus operating the antenna relay. The receive output of the electronic switch controls the receiver first mixer (Q3), the second mixer (Q5), one of the VFO buffers (either Q28 or Q30, depending upon the position of the VFO SELECTOR switch), the VFO output gate, the 2325-KC IF output gate, and the BFO. It also switches the receiver first audio transistor (Q18) through the transmitter FUNCTION switch except in CW operation when the first audio stage is allowed to operate to provide CW sidetone in the receiver output.

The transmit side of the electronic switch controls the transmitter stepping IF amplifier (Q25), the carrier oscillator (Q10), one of the VFO buffers (either Q28 or Q30 depending upon the position of the VFO SELECTOR switch), the VFO output gate, and the 2325-KC IF output gate.

QT or VOX anti-trip is required in VOX operation to prevent speaker audio from tripping the VOX circuit through the microphone. The QT audio voltage is taken from the 500-ohm output of the audio output transformer through R240. It is fed to the base of the QT amplifier (Q15) through the QT level control. The amplified output signal from the QT amplifier is rectified by a diode (CR15) and this negative voltage is applied to the emitter of the VOX amplifier (Q16) reducing its gain by the proper amount to prevent the signal from the speaker to the microphone from tripping the VOX circuit.

In manual transmit, the base of the transistor on the transmit side of the electronic switch (Q14) is grounded through the OPERATION switch, flipping the switch from receive to transmit condition and holding it in this condition. In manual receive, the QT and VOX amplifiers are disabled through the OPERATION switch to prevent the electronic switch from being flipped into transmit condition.

5-6. CW OPERATION.

A phase shift oscillator (Q11), operating at approximately 2000 CPS, is keyed to produce the signal for CW output. When the transmitter FUNCTION switch is in the CW position, the tone oscillator (Q11) output is fed to the base of the microphone amplifier (Q24) through the microphone GAIN control. The microphone GAIN control then becomes the CW level control. The output from the control is fed to the balanced modulator and crystal filters to produce a single signal in the transmitter output. In UPPER sideband, this signal will be 2 KC higher than the indicated dial frequency and in LOWER side-

band, it will be 2 KC below the indicated dial frequency. A portion of the keyed tone signal is taken from the output of Q24 and fed through the sidetone level control and the transmitter FUNCTION switch to the base of the receiver first audio transistor (Q18) to provide CW monitoring in the receiver audio.

5-7. AM OPERATION.

With the FUNCTION switch in the AM position, a DC forward bias is applied to diodes CR11 and CR12 to unbalance the balanced modulator and thus provide for carrier insertion. Resistor R125 is a 5000-ohm thermistor which maintains a constant carrier level over a wide temperature range. This thermistor also controls the percentage of modulation over the temperature range. The resultant double-sideband signal is passed through the sideband filter, resulting in a full-carrier plus one-sideband AM signal. The remaining functions of the unit are the same as in SSB operation.

5-8. POWER SUPPLY CIRCUIT.

The power supply in the Model FPM-200 operates on 10.5 volts to 16.0 volts DC, NEGATIVE GROUND ONLY. The DC-to-DC converter (Q37, Q38, Q39, and Q40) is a square-wave oscillator operating at approximately 1400 CPS. The AC outputs of transformer T7 are rectified and filtered to produce the high voltage, low voltage, and bias voltage required by tubes, V1, V2, and V3 in the transmitter portion of the system. The blower motor is an AC, shaded-pole type and is driven by a square-wave oscillator (Q35 and Q36) operating at approximately 60 CPS. Most of the transistors of the system are operated from a regulated 9.0-volt source. This source is comprised of a series type regulator (Q32), controlled by a feedback amplifier (Q31) and a voltage reference diode (CR32). This arrangement provides a very stable voltage regardless of input voltage variations from 10.5 volts to 16.0 volts.

CAUTION

A thermal switch is attached to the power transistor heat sink and will open the power relay in case of blower failure or any other reason for overheating. The thermal switch will automatically reset (turn on) when the heat sink temperature drops to a predetermined level (155°F, ±5°F). This may occur 5 minutes to 15 minutes after the switch has disabled the power supply, depending on the ambient temperature. If the unit has been removed from the cabinet following a thermal shut-down, care should be exercised to avoid high voltage shock when the thermal switch automatically resets.

SECTION VI

SERVICE INSTRUCTIONS

6-1. CHASSIS REMOVAL.

The chassis is removed from the cabinet by removing the four screws that hold the plastic feet to the bottom of the cabinet. The chassis then slides out the rear of the cabinet.

6-2. TUBE REPLACEMENT.

The tubes, final amplifiers, screen voltage regulators, driver, and also the neon bulb bias regulator may be replaced by removing the final amplifier/power supply top cover.

6-3. RECEIVER SIGNAL TRACING.

An audio signal generator, an RF signal generator, and an audio power output meter are required to make receiver signal tracing measurements.

Set receiver controls as follows:

FUNCTION AM
 XTAL CAL OFF
 SIDEBAND UPPER
 AUDIO GAIN 10 (maximum)
 RF GAIN 10 (maximum)
 NOISE LIMITER . . . 0 (minimum)
 BAND SELECTOR . . . 40-meter band
 VFO TUNING 7.1 MC

Refer to the receiver signal tracing chart (table 1) for measurements.

Table 1. Receiver Signal Tracing Chart.

Band Selector	Signal Generator Input	Connect Signal Generator To:	Generator Frequency	Audio Output
	Audio 7 MV	Pin 11 IF Board	1000 CPS	500 MW
	Audio 1 MV	Pin 1 IF Board	1000 CPS	3 W
WWV	RF 500 μ V 30% 400 CPS MOD.	Pin 8 IF Board	2325 KC	500 MW
	RF 100 μ V 30% 400 CPS MOD.	Point A Receiver Board	1450 KC	500 MW
80M	RF 400 μ V 30% 400 CPS MOD.	Point A Receiver Board	4750 KC	500 MW
40M	RF 100 μ V 30% 400 CPS MOD.	Point A Receiver Board	1450 KC	500 MW
20M	RF 75 μ V 30% 400 CPS MOD.	Point A Receiver Board	5750 KC	500 MW
15M	RF 20 μ V 30% 400 CPS MOD.	Point A Receiver Board	12750 KC	500 MW
1st 10M	RF 30 μ V 30% 400 CPS MOD.	Point A Receiver Board	19450 KC	500 MW
2nd 10M	RF 40 μ V 30% 400 CPS MOD.	Point A Receiver Board	19950 KC	500 MW
3rd 10M	RF 50 μ V 30% 400 CPS MOD.	Point A Receiver Board	20450 KC	500 MW
4th 10M	RF 60 μ V 30% 400 CPS MOD.	Point A Receiver Board	20950 KC	500 MW

6-4. TRANSMITTER SIGNAL TRACING.

An audio signal generator, an RF signal generator, a 50-ohm dummy load, and an RF VTVM are required to make transmitter signal tracing measurements.

Set transmitter controls as follows:

OPERATION XMIT

FUNCTION SSB

FINAL TUNE 40-Meter band

GAIN 0

VFO TUNING 7.1 MC

BAND SELECTOR 40-Meter band

Refer to transmitter signal tracing chart (table 2) for measurements.

Table 2. Transmitter Signal Tracing Chart.

Signal Generator Output	Signal Generator Frequency	Band Selector	Test Point	Output	Note
RF 0.8 volt	3.8 MC	80M	B, Final Amplifier Board	65V	
RF 0.8 volt	7.1 MC	40M	B, Final Amplifier Board	65V	
RF 0.8 volt	14.3 MC	20M	B, Final Amplifier Board	65V	
RF 0.75 volt	21.3 MC	15M	B, Final Amplifier Board	60V	
RF 0.8 volt	28.0 MC	10M	B, Final Amplifier Board	55V	
RF 0.8 volt	28.5 MC	10M	B, Final Amplifier Board	55V	
RF 0.8 volt	29.0 MC	10M	B, Final Amplifier Board	55V	
RF 0.8 volt	29.5 MC	10M	B, Final Amplifier Board	55V	
RF 0.15 volt	2325 KC	80M	Pin 2 IF Board	65V	
RF 0.18 volt	2325 KC	40M	Pin 2 IF Board	65V	
RF 0.2 volt	2325 KC	20M	Pin 2 IF Board	65V	
RF 0.17 volt	2325 KC	15M	Pin 2 IF Board	60V	
RF 0.19 volt	2325 KC	10M	Pin 2 IF Board	55V	
RF 0.2 volt	2325 KC	10M	Pin 2 IF Board	55V	
RF 0.2 volt	2325 KC	10M	Pin 2 IF Board	55V	
RF 0.21 volt	2325 KC	10M	Pin 2 IF Board	55V	
RF 6000 UV	2325 KC	40M	Pin 8 IF Board	65V	
Audio 60 MV	1000 CPS	40M	Pin 26 IF Board	65V	
Audio 6 MV	1000 CPS	40M	Microphone Input	65V	Microphone gain maximum

Table 3. Signal Tracing Chart (General).

Crystal Heterodyne Oscillator Output was Measured With RF VTVM At Pin 10 of Receiver Board					
Band	Output	Frequency	Band	Output	Frequency
WWV	0.3 volt	3775 KC	10	0.2 volt	17125 KC
80	0.3 volt	7075 KC	10	0.2 volt	17625 KC
40	0.2 volt	3775 KC	10	0.2 volt	18125 KC
20	0.25 volt	3425 KC	10	0.18 volt	18625 KC
15	0.3 volt	10425 KC			

VFO RF OUTPUT - 0.3 volts to 0.35 volts.

Sidetone oscillator output 15 MV measured at Pin 25 of IF Board, CW function, key down.

6-5. VOLTAGE MEASUREMENTS.

All significant voltages will be found on the voltage charts (tables 4, 5, and 6). All measurements made with a VTVM between the point indicated on the chart and ground. Controls to be set as follows unless otherwise noted:

Receiver FUNCTION AM
 XTAL CAL OFF

SIDEBAND UPPER
 AUDIO GAIN 10 (maximum)
 RF GAIN 10 (maximum)
 NOISE LIMITER 0 (minimum)
 VFO TUNING See table
 BAND SELECTOR 40-Meter band
 OPERATION XMIT
 Transmitter FUNCTION . . SSB
 Microphone GAIN 0 (minimum)
 FINAL TUNE 40-Meter band

Table 4. Voltage Chart.

DC Voltage to Ground							
	Emitter	Base	Collector		Emitter	Base	Collector
Q1	7.9	8.1	0.03	Q16	6.8 (6.8*)	6.7 (6.7*)	0 (0.5*)
Q2	6.9	6.6	0	Q17	9.0 (9.0*)	9.0 (9.0*)	0 (1.2*)
Q3	7.2 (4.1*)	7.0 (6.5*)	0	Q18	6.3 (4.3*)	6.1 (5.8*)	3.5 (0*)
Q4	7.0	6.8	0	Q19	9.0	8.7	0.43
Q5	7.9 (6.8*)	7.6 (7.3*)	0	Q20	8.9	8.9	0.04
Q6	5.4	5.2	0	Q21	0.12	0.2	7.7 (7.5*)
Q7	6.9	6.7	0	Q22	0	0	0
Q8	8.1	7.9	0	Q23	7.0	6.9	0
Q9	7.1	7.0	0	Q24	7.5	7.4	0.3
Q10	1.2 (2.9*)	4.6 (5.1*)	0	Q25 40M	3.8 (4.5*)	4.1 (4.3*)	0
Q11	5.3	5.2	0.17	Q26	7.9	7.7	0
Q12	5.7 (5.0*)	5.8 (5.3*)	1.5 (0*)				
Q13	0.7 (1.1*)	0.2 (1.2*)	13.0 (1.2*)				
Q14	0.7 (1.1*)	0.9 (0*)	0.8 (12.0*)				
Q15	4.4 (8.6**)	5.4 (7.6**)	0 (0**)				

* This voltage will be correct in transmit position.

** This voltage will be correct when transmitting VOX.

Table 4. Voltage Chart (Cont).

DC Voltage to Ground									
	Emitter			Base			Collector		
Q27	Variable Frequency Oscillator			Q35			0 (13.0*)	0 (15.5*)	0 (0.57*)
Q28	Variable Frequency Oscillator			Q36			0 (13.0*)	0 (15.5*)	0 (0.57*)
Q29	Variable Frequency Oscillator			Q37			0 (13.1*)		0 (0*)
Q30	Variable Frequency Oscillator			Q38			0 (13.1*)		0 (0*)
Q31	3.4	3.5	13.5	Q39			0 (13.1*)		0 (0*)
Q32	13.8	13.5	9.0	Q40			0 (13.1*)		0 (0*)
Q33	13.8	13.5	0.05	Q41			13.5 (1.5*)	13.2 (1.2*)	0 (0*)
Q34	13.8	13.5	0.05						
PIN NUMBER									
	1	2	3	4	5	6	7	8	9
V1	0	3.4	0	0	13.3	6.8	295	202	0
V2	0	13.3	225	0	55	0	6.65	0	--
V3	0	0	225	0	55	0	6.65	0	--
V4	210	--	--	--	--	--	105	105	--
V5	--	--	--	--	105	--	--	--	--

Table 5. Bottom Connector Board Voltage Chart.

Pin	Pot Board	IF Board	Transmitter Board	Receiver Board	Power Supply Front	Power Supply Rear	Final
1	0 (0*)	0	0	0	0	290	290
2	7.8 (7.6*)	0	13.5 (1.2*)	0.8	--	--	--
3	9.0	9.0	0	2 (8*)	--	-95	-95
4	0	0	2 (8*)	--	13.8	13.8	0 (13.8*)
5	0	13.8	13.8	13.8 (1.2*)	0 (13.8*)	13.8	0
6	0	13.8	--	--	13.8	0 (13.8*)	0
7	0	0	0	0	13.8	13.5 (1.2*)	0
8	0	--	0	--	--	--	0 (13.8*)
9	--	13.8	0	0	9.0	--	0
10	--	13.8	0	0	0.95	--	0
11	3.6 (0*)	3.6 (0*)	0	0	0	--	--
12	9.0	9.0	0.8 (12.5*)	9.0	13.8 (1.2*)	--	--
13	0	--	9.0	7.8 (7.6*)	13.8 (1.5*)	--	--
14	9.0	0	0	--	--	0	--
15	6.8	9.0	0	0 (9.0*)	--	0	--
16	0.9 (0*)	6.8	--	--	--	0	--
17	0 (0.5*)	0.9 (0*)	--	--	--	--	--
18	--	--	--	--	--	--	--

Table 5. Bottom Connector Board Voltage Chart (Cont).

Pin	Pot Board	IF Board	Transmitter Board	Receiver Board	Power Supply Front	Power Supply Rear	Final
19	--	0 (0.5*)	--	--	--	--	--
20	--	0	--	--	--	--	--
21	13.8	13.8	--	--	--	--	--
22	0 (13.8*)	0.8 (12.5*)	--	--	--	--	--
23	0 (0.5*)	--	--	--	--	--	--
24	13.5 (1.2*)	13.5 (1.2*)	--	--	--	--	--
25	0	0	--	--	--	--	--
26	0	0	--	--	--	--	--

Table 6. VFO Switch Board Voltage Chart.

CONTACTS										
	1	2	3	4	5	6	7	8	9	10
RED	BLUE 2 to 8	R 1.2	R 13.8	R 0.9	BLUE	RED	R 13.5	R 0.9	0	RED
BLUE	BLUE 2 to 8	T 9.0	T 1.4	T 12.5	2 to 8	2 to 8	T 1.5	T 12.5		2 to 8
BLUE	BLUE 2 to 8	R 1.1	5.4	R 0.8	BLUE	BLUE	R 13.5	0	0	RED
BLUE	BLUE 2 to 8	T 9.0		T 12.5	2 to 8	2 to 8	T 1.2			2 to 8
BLUE	BLUE 2 to 8	0	R 0.9	R 0.9	RED	BLUE	R 13.5	R 13.5	R 1.2	RED
RED	BLUE 2 to 8		T 12.5	T 12.5	2 to 8	2 to 8	T 1.5	T 1.5	T 9.0	2 to 8
RED	BLUE 2 to 8	0	0	R 0.8	RED	RED	R 13.5	5.2	R 1.1	RED
RED				T 12.5	2 to 8	2 to 8	T 1.2		T 9.0	2 to 8

6-6. DIAL CORD RESTRINGING.

1. Remove the chassis from the cabinet.
2. Remove the bottom connector board.
3. Remove the tuning knobs and the band selector knob.
4. Mark the position of the final tuning shaft and coupling. Remove the fiber

shaft from the coupling, noting the position of the stop under the skirt of the knob. (DO NOT REMOVE KNOB FROM SHAFT.)

5. Remove the four screws fastening the front panel and circuit board assemblies to the VFO mounting panel.
6. Restring the bottom pointer dial cord as follows (see figure 7):

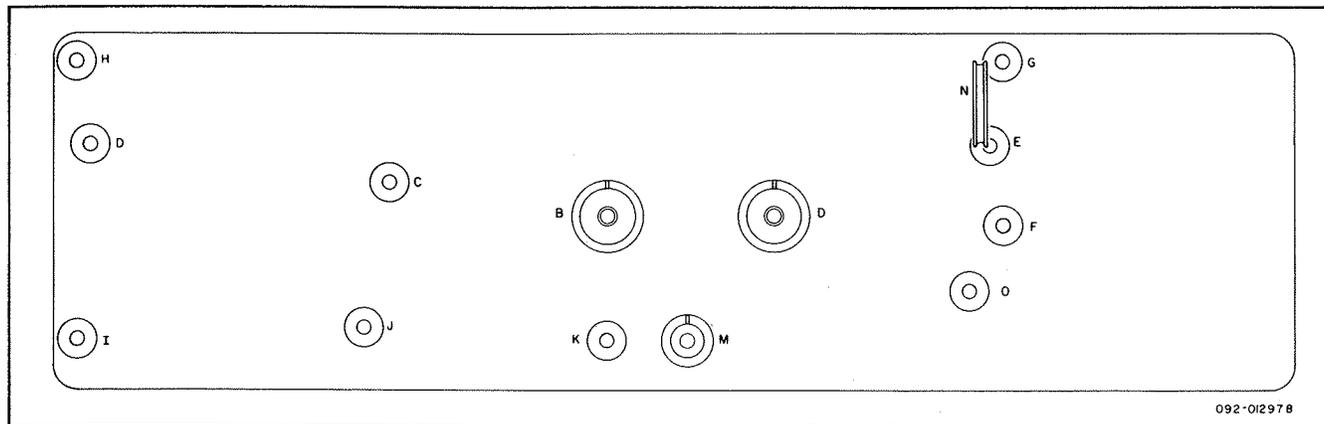


Figure 6. Dial Stringing Pulley Arrangement.

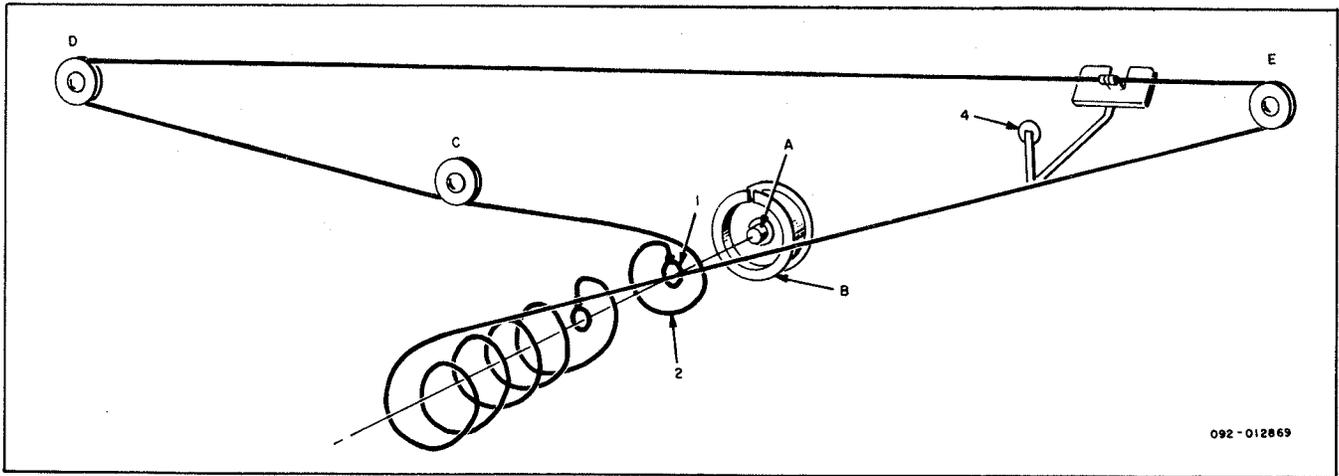


Figure 7. Stringing the Bottom Pointer.

- a. Turn left tuning shaft fully clockwise. Attach the end of the cord (1) to shaft A and place one turn of cord (2) counterclockwise around pulley B, winding the cord toward rear of the pulley.
- b. String the cord over pulleys C, D, and E.
- c. Maintaining tension on the cord, turn the left tuning shaft fully counterclockwise.
- d. Attach the remaining loop (3) to shaft A (see figure 8) and slip one turn of cord clockwise over pulley B. The loops are to be positioned at the bottom of the cord groove so that the cord will take up toward the end of the pulley.
- e. Replace the tuning knob on the left-hand VFO and turn it fully counterclockwise. Turn the knob clockwise fifteen divisions of skirt. Locate pointer (4) at the first calibration mark, crimp tabs, and cement in place. Remove the tuning knob (reverse items 1, 2, 3, 4, and 5).

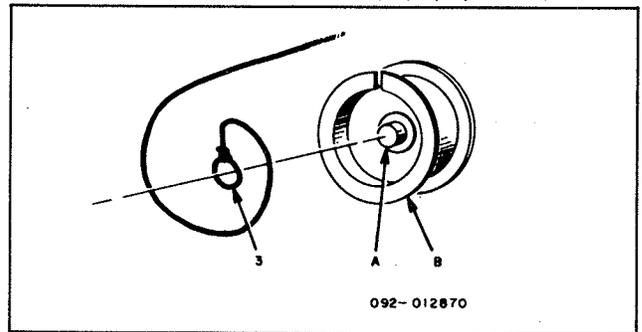


Figure 8. Bottom Pointer Stringing Detail.

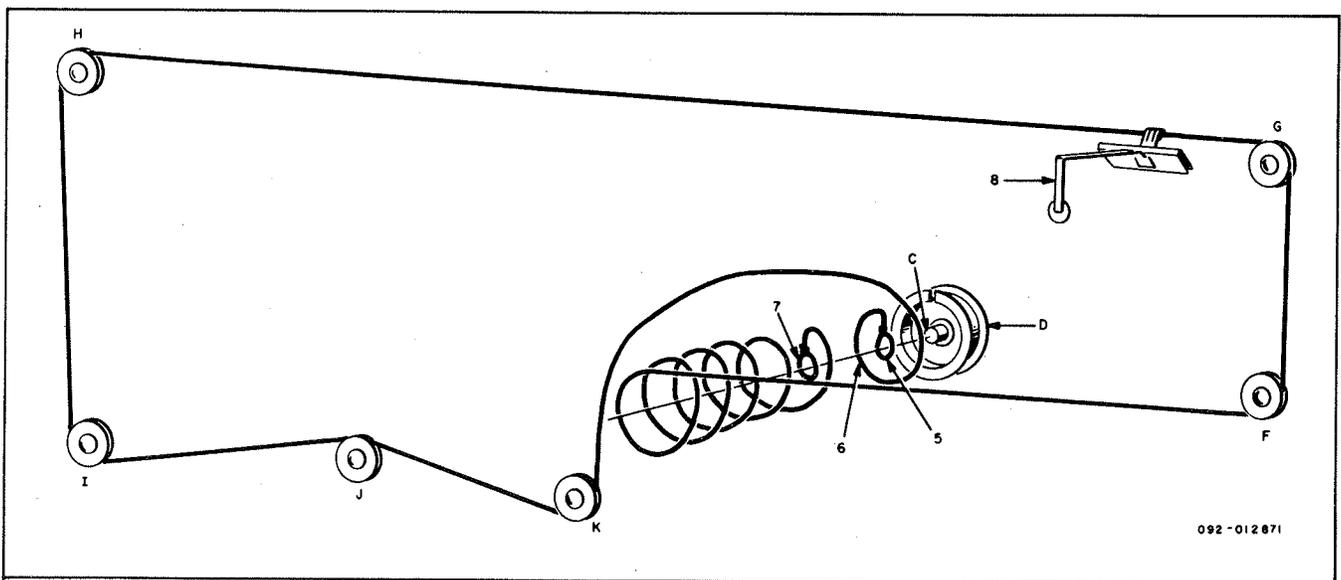


Figure 9. Stringing the Top Pointer.

7. Restring the top pointer dial cord as follows (see figure 9):

- a. Turn the right tuning shaft fully clockwise. Attach the end of the cord (5) to shaft C and place one turn of the cord counterclockwise around pulley D, winding the cord toward the rear of the pulley.
- b. String the cord over pulleys F, G, H, I, J, and K.
- c. Maintaining tension on the cord, turn the right tuning shaft fully counterclockwise.
- d. Attach the remaining loop (7) (see figure 10) to shaft C and slip one turn of the cord clockwise over pulley D. The loops are to be positioned at the bottom of the cord groove so that the cord will take up toward the end of the pulley.
- e. Replace the tuning knob on the right-hand VFO and turn it fully counterclockwise. Turn the knob clockwise fifteen divisions of the skirt. Locate pointer (8) at the first calibration mark, crimp tabs, and cement in place. Remove the tuning knob.

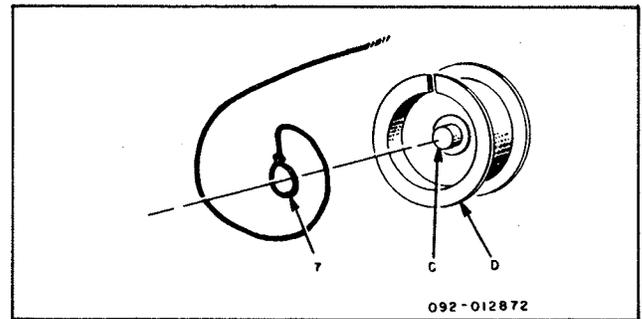


Figure 10. Top Pointer Stringing Detail.

6-7. DIAL DRUM CABLE RESTRINGING.

1. Follow items 1, 2, 3, 4, and 5 of paragraph 6-6.
2. String the dial drum cable as follows (see figure 11):
 - a. Replace the band selector knob and turn it fully counterclockwise.
 - b. Attach end of the cord (8) to shaft L and wind three turns of cord onto pulley M in a clockwise direction.
 - c. Turn the dial drum one complete revolution clockwise and then continue turning until cord loop Q can be slipped over retaining pin P. The cord must pass through the slot in pulley N.

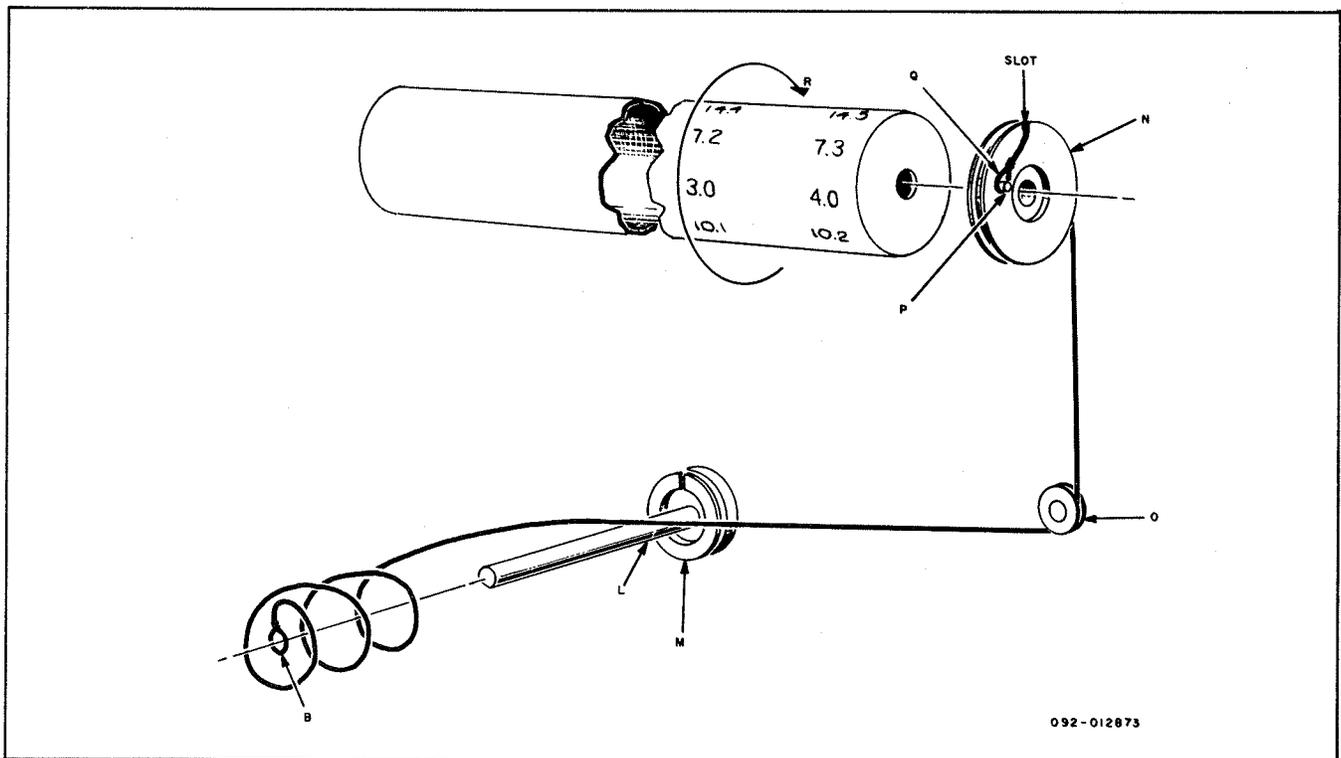


Figure 11. Dial Drum Cable Stringing.

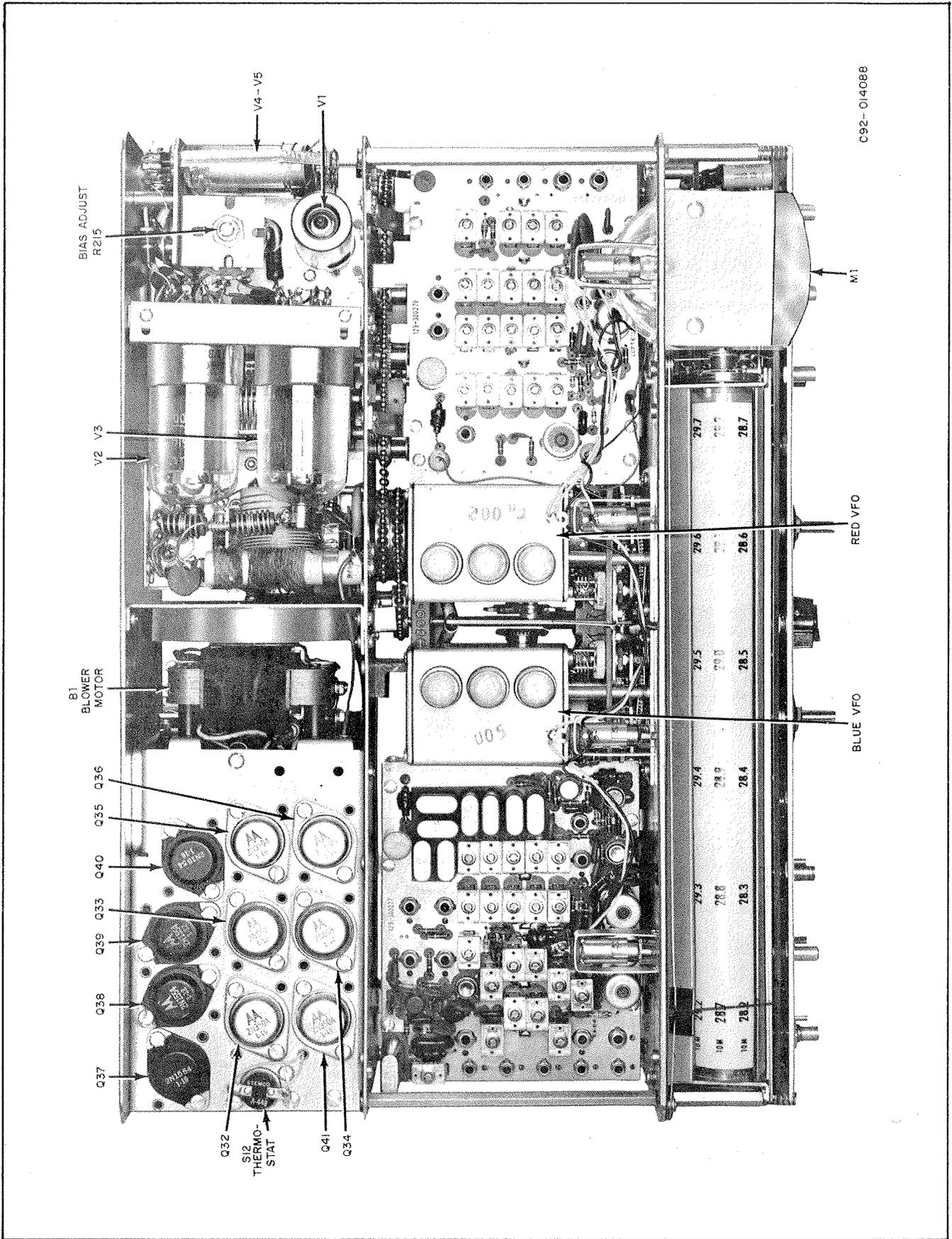


Figure 12. Top View of FPM-200 Chassis.

SECTION VII

ALIGNMENT

7-1. FINAL AMPLIFIER/DRIVER ALIGNMENT.

A 50-ohm, 100-watt, non-inductive dummy load, a VTVM with response to 30 MC, a signal generator with up to 1.0 volt output from 3.5 MC to 30.0 MC, and a radio receiver tuneable from 3.5 MC to 30.0 MC are required to perform final amplifier/driver alignment on the Model FPM-200 equipment.

7-2. FINAL AMPLIFIER BIAS ADJUSTMENT.

If the final amplifier tubes (6146's) have been changed, it may be necessary to readjust the bias level control to insure proper idling current for the tubes. Remove the top cover from the final amplifier/power supply assembly.

Unsolder the high voltage lead (red) from the bypassed end of the final plate choke and insert a DC milliammeter (0-300 MA). With the transmitter OPERATION switch in transmit position and the transmit FUNCTION switch in SSB, and microphone GAIN at "0", adjust the bias control (R215) for 50 MA to 55 MA plate current. The bias voltage at this setting should be -53 volts to -56 volts. This voltage should be measured with a VTVM.

7-3. FINAL AMPLIFIER NEUTRALIZATION.

After the final amplifier bias has been properly set, the amplifier may be neutralized as follows:

1. Connect the 50-ohm dummy load to the transmitter coaxial lead (A2) at the power supply cable.
2. Connect the signal generator to the input of the final amplifier assembly (driver grid input).
3. Connect the RF VTVM at the dummy load to read output voltage (100V range).
4. Set the BAND SELECTOR to the 15-meter band, set the signal generator to 21.3 MC, and set the FINAL TUNE control to the 15-meter segment.
5. Turn the transmitter on and increase the signal generator output until voltage is read at the dummy load.
6. Adjust the FINAL TUNE control for maximum output and set the generator output for about 50 volts at the dummy load.

7. Adjust the 15-meter driver plate coil (L49) while slightly rocking the FINAL TUNE control for maximum output.
8. Reduce the generator output to keep the transmitter output voltage at 50 volts or less to prevent flat-topping.

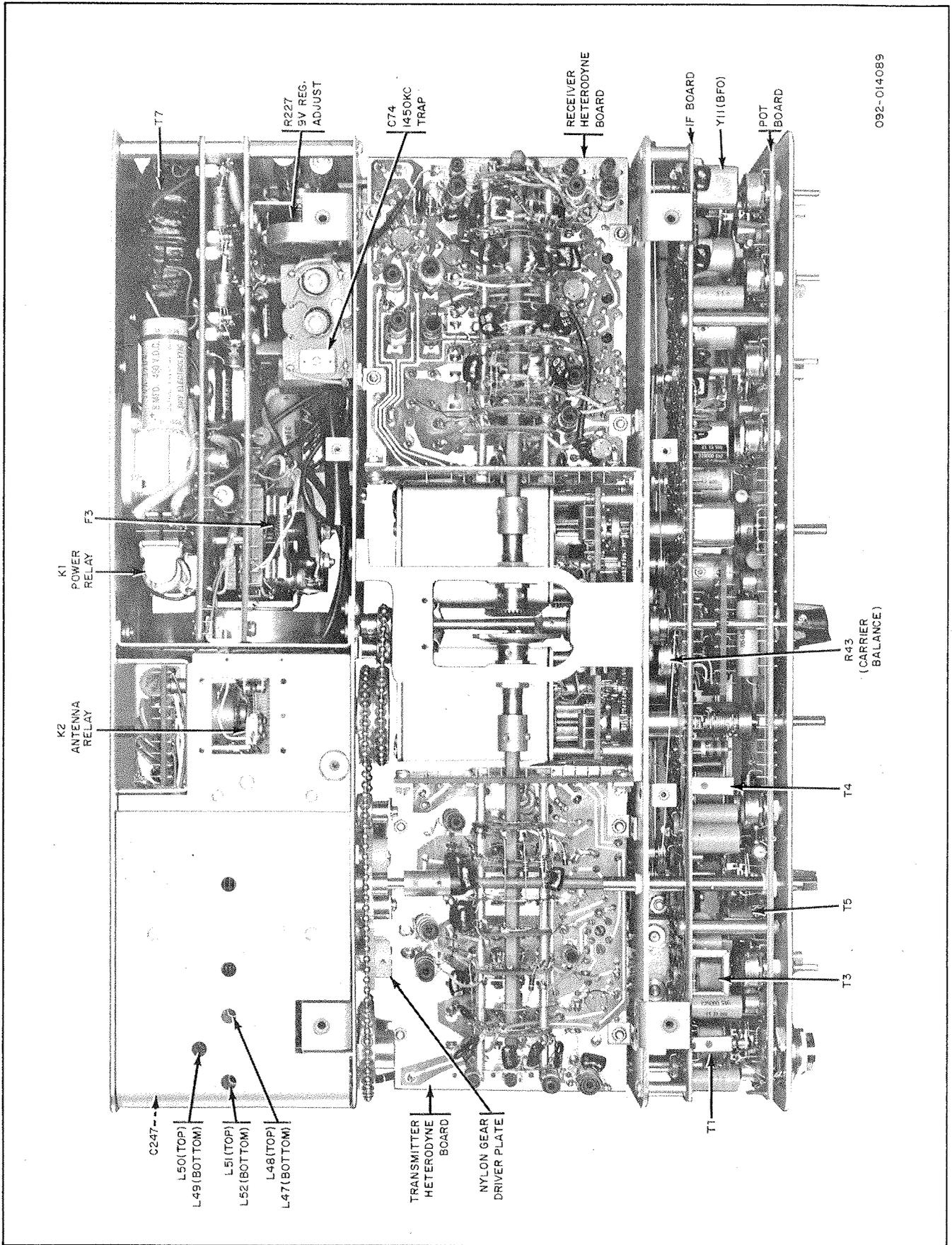
Turn Model FPM-200 off and remove the nylon gear attached to the shaft of the driver plate tuning capacitor (see figure 13). Replace the nylon gear backwards so that it may be used to tune the driver stage separately. Turn the Model FPM-200 on and tune the final amplifier plate capacitor (using the front panel control) and the driver plate capacitor (using the nylon gear as a knob) to resonance. Set the signal generator to 21.3 MC and adjust it to produce approximately 50 volts output at the dummy load. Carefully tune the final amplifier plate capacitor, observing the plate current dip and the output voltage. If both occur at the same time, the amplifier is neutralized. If both DO NOT occur together, adjust the neutralizing capacitor C247 (see figure 13) in small increments (one-quarter to one-half turn) until neutralization is accomplished.

After neutralization is completed, proceed as follows to retrack the final amplifier and the driver plate capacitors:

1. Turn transmitter off.
2. Turn the FINAL TUNE control completely counterclockwise; this should completely mesh the final amplifier plate capacitor.
3. Rotate the driver plate capacitor until it is completely meshed.
4. Replace the driver plate capacitor gear, carefully engage it with the idler gear, and tighten the two set screws.

7-4. ALIGNMENT PROCEDURE.

Remove the plate current meter and replace the final amplifier/power supply top cover. Connect the 50-ohm dummy load to the transmit coaxial lead (A2) at the power supply cable. Connect the signal generator to the input of the final amplifier assembly (driver grid input). Connect the RF VTVM at the dummy load to read output voltage (100V range). Turn the receive on (receiver FUNCTION switch to AM) and the transmitter on (transmitter OPERATION switch to XMIT).



092-014089

Figure 13. Bottom View of FPM-200 Chassis.

Using the final amplifier/driver alignment chart (table 7), proceed as follows:

1. Set BAND SELECTOR to desired band.
2. Set FINAL TUNE control to proper segment.
3. Set signal generator to the proper frequency and increase the generator output until an indication is seen on the RF VTVM at the dummy load.

4. Rock the FINAL TUNE control slightly while tuning the proper coil for maximum output. Keep the output voltage at 50 volts or below to prevent flat-topping in the final amplifier.

NOTE

The 40-meter coil (L51) must be tuned before the 80-meter coil (L52) as the 80-meter band uses the 40-meter coil in series with the 80-meter coil.

Table 7. Final Amplifier/Driver Alignment Chart.

Step	Band	Signal Generator Connection	Signal Generator Frequency	Final Tune Setting	Adjust Coil for Maximum Output
1	10-D	Final Amplifier Assembly Input	29.5 MC	10M	L47
2	10-B	Final Amplifier Assembly Input	28.5 MC	10M	L48
3	15M	Final Amplifier Assembly Input	21.3 MC	15M	L49
4	20M	Final Amplifier Assembly Input	14.3 MC	20M	L50
5	40M	Final Amplifier Assembly Input	7.1 MC	40M	L51
6	80M	Final Amplifier Assembly Input	3.8 MC	80M	L52

If the rest of the system is operating properly, the final amplifier/driver may be aligned as follows:

1. Transmitter on.
2. BAND SELECTOR on desired band.
3. VFO tuned to approximate center of band.
4. Two-tone audio signal, 1 KC and 2 KC, (approximately 4MV) into microphone input in SSB or single audio tone in AM.
5. Set FINAL TUNE control to proper segment.
6. Adjust microphone GAIN control as required for output level.
7. Proceed according to table 7.

7-5. TRANSMITTER HETERODYNING BOARD ALIGNMENT.

Connect the signal generator to Pin No. 8 of the transmitter heterodyning board on the bottom connector board. Connect dummy load and RF VTVM and turn the Model FPM-200 on as in paragraph 7-4.

Using the transmitter heterodyning board alignment chart (table 8) proceed as follows:

1. Set BAND SELECTOR to desired band. (Start with highest 10-meter band, 29.2 MC to 29.7 MC.)
2. Tune VFO to approximate center of dial scale.
3. Set FINAL TUNE control to proper segment.

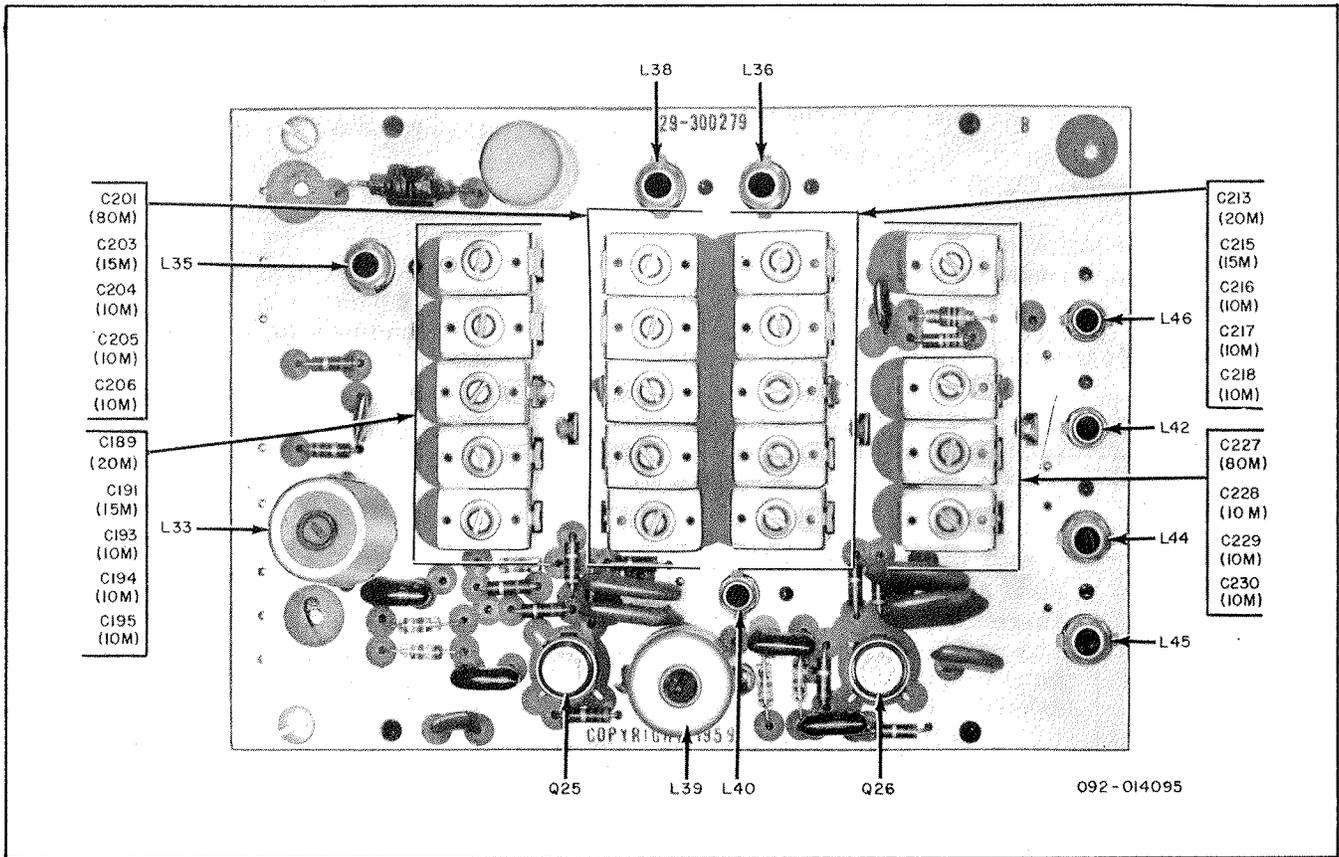


Figure 14. Top View of Transmitter Heterodyne Board.

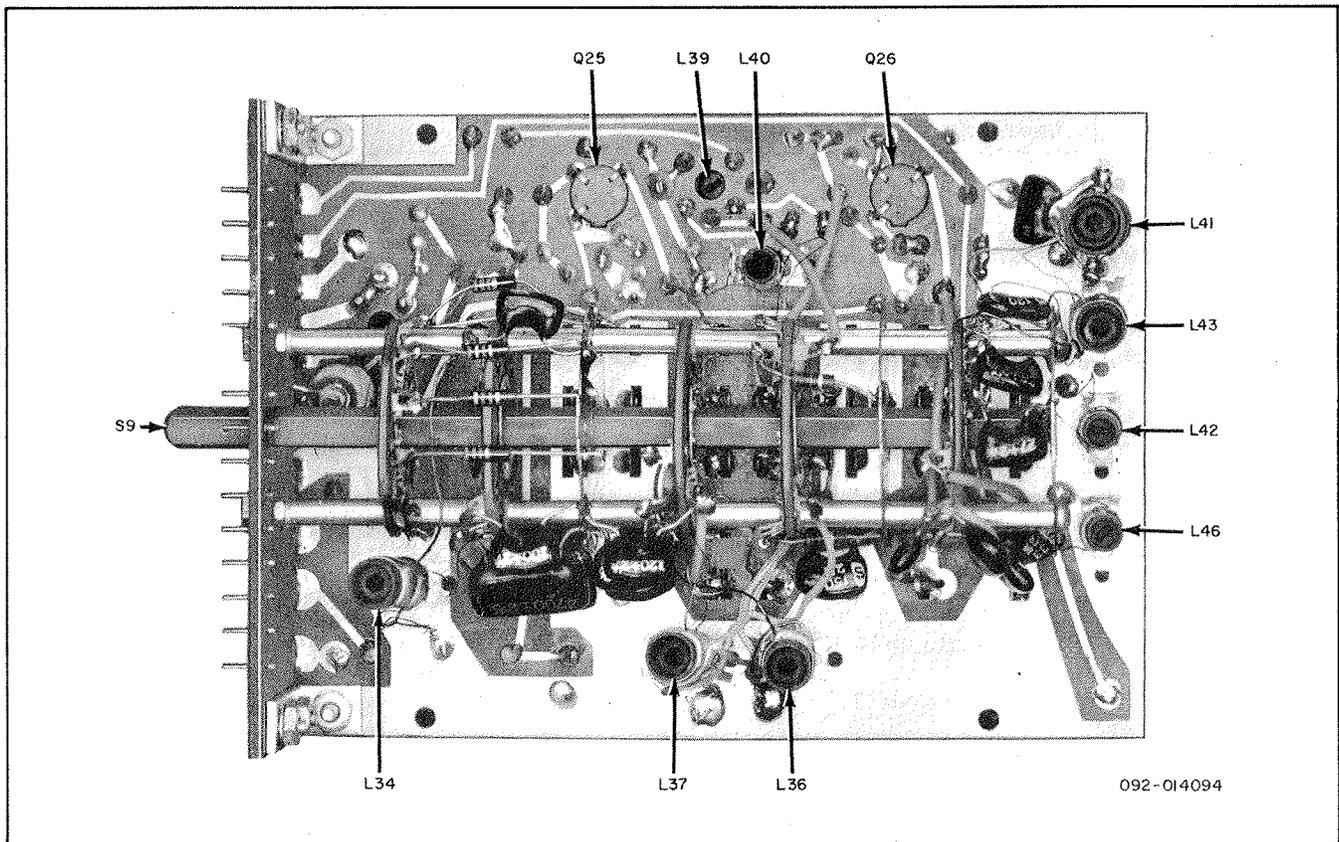


Figure 15. Bottom View of Transmitter Heterodyne Board.

4. Set the signal generator to 2325 KC and adjust the signal generator output level to about 100,000 MV (0.1 volt) or as required to see an indication on an RF VTVM at dummy load.
 5. Adjust FINAL TUNE control for maximum output.
 6. Align proper coils and trimmers according to alignment chart and reduce signal generator output as required to keep RF output at the dummy load at 50 volts or less to prevent flat-topping in final amplifier.
- If the rest of the system is operating properly the transmitter heterodyning board may be aligned using table 8.

Table 8. Transmitter Heterodyning Board Alignment Chart.

NOTE: Connect the signal generator to pin 8 on the heterodyning board, tune generator to 2325 KC, and set generator output to about 0.1 volt. Proceed step by step.				
Step	Band	VFO Frequency	Tune Coil For Maximum	Tune Trimmer For Maximum
1	10-D	29.5 MC	L46, L40, L36, L34, L39, L33	
2	10-C	29.0 MC		C230, C218, C206, C195
3	10-B	28.5 MC		C229, C217, C205, C194
4	10-A	28.0 MC		C228, C216, C204, C193
5	80M	3.6 MC	L45	C201
6	80M	3.9 MC		C227
6A	TRANSMITTER TRAP ALIGNMENT (5750 KC 80-meter band). Connect signal generator at point and tune the 5750 KC. Increase generator output until signal appears at dummy load. Adjust trap (L41) for minimum output. Repeat steps 5 and 6 if a large change is required to properly tune trap.			
7	15M	21.3 MC	L42	C215, C203, C191
8	20M	14.3 MC	L43, L37	C213, C189
9	40M	7.1 MC	L44, L38, L35	
10	80M	3.8 MC		Retune C201

7-6. IF BOARD ALIGNMENT.

The front panel must be removed for the following alignment.

1. 2325-KC IF Alignment.

- a. Connect the dummy load, etc., as in paragraph 7-4.
- b. Connect audio generator to microphone input.
- c. Set bandswitch to 40-meter band.
- d. Tune VFO to 7.1 MC.
- e. Set FINAL TUNE control to the 40-meter segment.
- f. Set audio signal generator to about 1000 CPS with 4 millivolts to 6 millivolts output.
- g. Set transmitter FUNCTION switch to SSB.
- h. Set SIDEBAND switch to UPPER or LOWER.
- i. Increase microphone GAIN control until output is seen at dummy load.

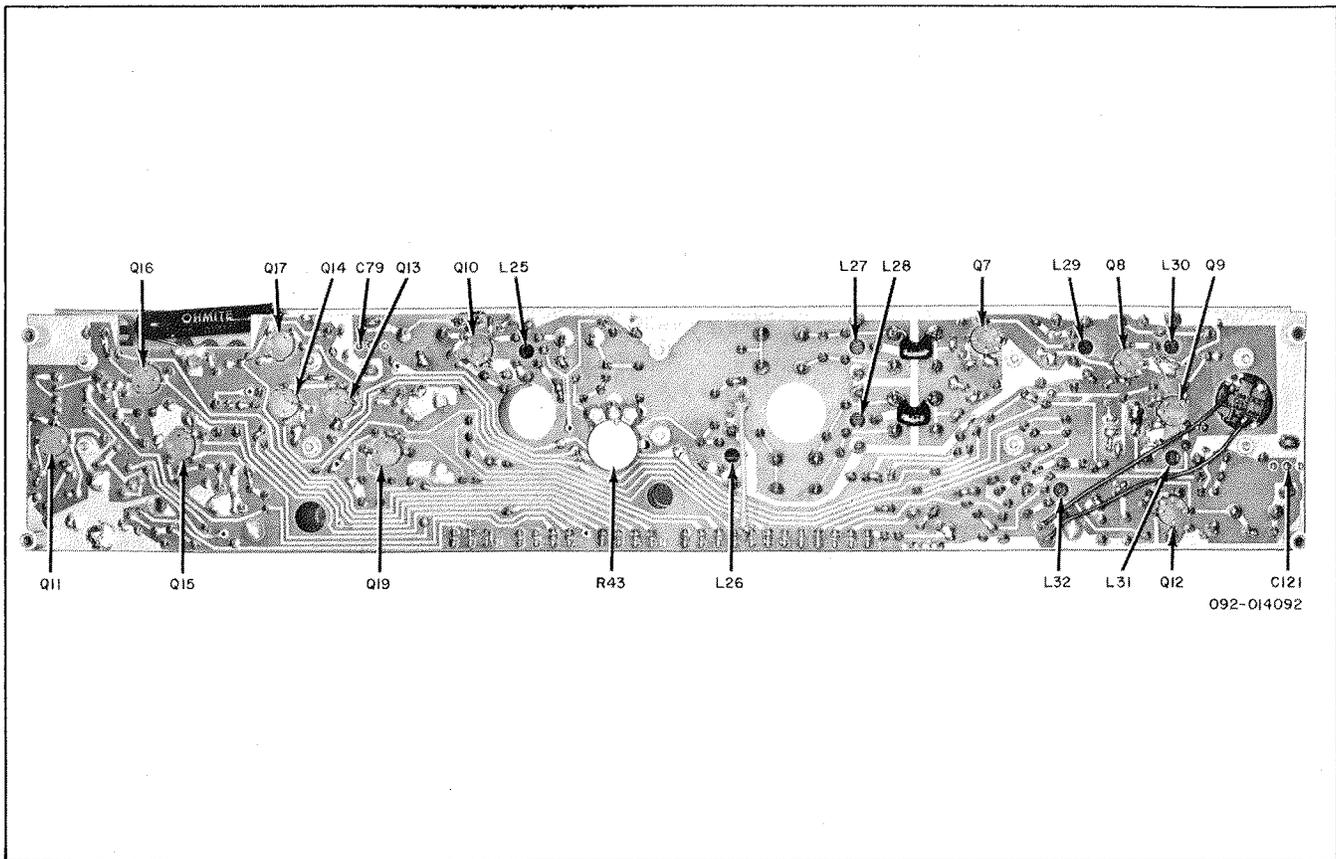


Figure 16. View of IF Board.

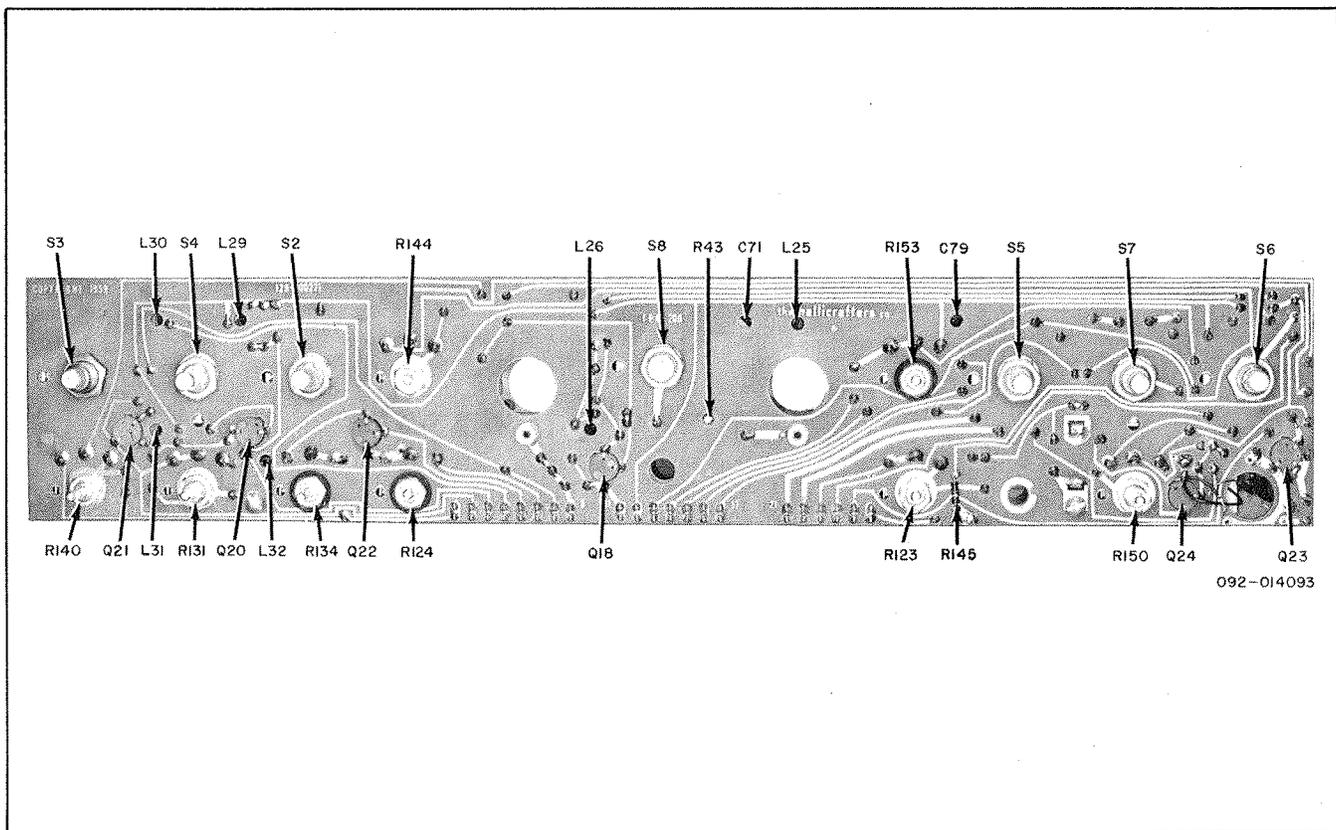


Figure 17. View of Pot Board.

- j. Adjust FINAL TUNE control for maximum output. Reduce GAIN setting as required to keep output at 50 volts or less.
- k. Tune coils L31, L30, L29, L26, and L25 for maximum output, reducing GAIN control as required.

IMPORTANT

Do not attempt to adjust coils L27 and L28 as these are the crystal filter coils and must be aligned at the factory.

If an audio oscillator is not available, the IF may be aligned with the CW sidetone signal as follows:

- a. Set the transmitter FUNCTION switch to CW and close the CW key.
- b. Follow steps a, c, d, e, h, i, j, and k in paragraph 7-6.

7-7. CARRIER BALANCE ALIGNMENT.

- 1. Set transmitter FUNCTION switch to SSB.
- 2. Set microphone GAIN control to "0".
- 3. Set RF VTVM at dummy load to 1 V scale.
- 4. Adjust carrier balance potentiometer (R43) and trimmer (C71) for minimum output. This output should be 0.5 volt or less on the 40-meter band. These two adjustments interact so it may be necessary to repeat the adjustments several times to achieve the minimum output setting.

7-8. CARRIER FREQUENCY ADJUSTMENT.

Normally the carrier frequency will not require adjustment in the field. To determine if the carrier oscillator is off frequency, make the following checks:

- 1. Tune the transmitter on the 40-meter band and set the transmitter FUNCTION switch to SSB.
- 2. Connect an audio generator to the microphone input and use about 4 millivolts input.
- 3. Set the SIDEBAND switch to UPPER sideband.

- 4. Using 1000 CPS as a reference, set the microphone GAIN control for 50 volts RF output.
- 5. Check the low frequency response by lowering the audio generator frequency until the transmitter output drops to 35 volts RMS. This will be the minus 3-DB point. Note this frequency, it should be between 500 CPS and 700 CPS.
- 6. Repeat steps 4 and 5 using the LOWER sideband. The low frequency response (minus 3-DB point) of each sideband should be within 25 CPS of one another. If not, proceed as follows:
 - a. Tune the carrier oscillator frequency adjust trimmer (C79) toward the sideband that has the highest low frequency minus 3-DB point. For example, if the lower sideband minus 3-DB point is at 675 CPS and the upper sideband minus 3-DB point is at 625 CPS, lower the oscillator frequency slightly by tuning the carrier oscillator frequency trimmer (C79) tighter by a small amount. Recheck the low and frequency response of each sideband and repeat the adjustment, if necessary, until the low end response of each sideband is equal or within 25 CPS of one another.

7-9. BFO FREQUENCY ADJUSTMENT.

If the carrier oscillator frequency has been changed, it will be necessary to change the receiver BFO frequency to match it so that, in transceiver operation, the receiver and transmitter will be on the same frequency. To check if the BFO is on the correct frequency, proceed as follows:

- 1. Tune the transmitter on the 40-meter band.
- 2. Set the transmitter FUNCTION switch to SSB.
- 3. Unbalance the balanced modulator a small amount by turning the carrier balance potentiometer about 1/4 turn in either direction.
- 4. Tune-in the resulting signal in another receiver that is set for AM reception.
- 5. Connect a 1000-ohm resistor with a lead between the 9-volt line on the bottom connector board and point on the IF board. (See figure 16.)

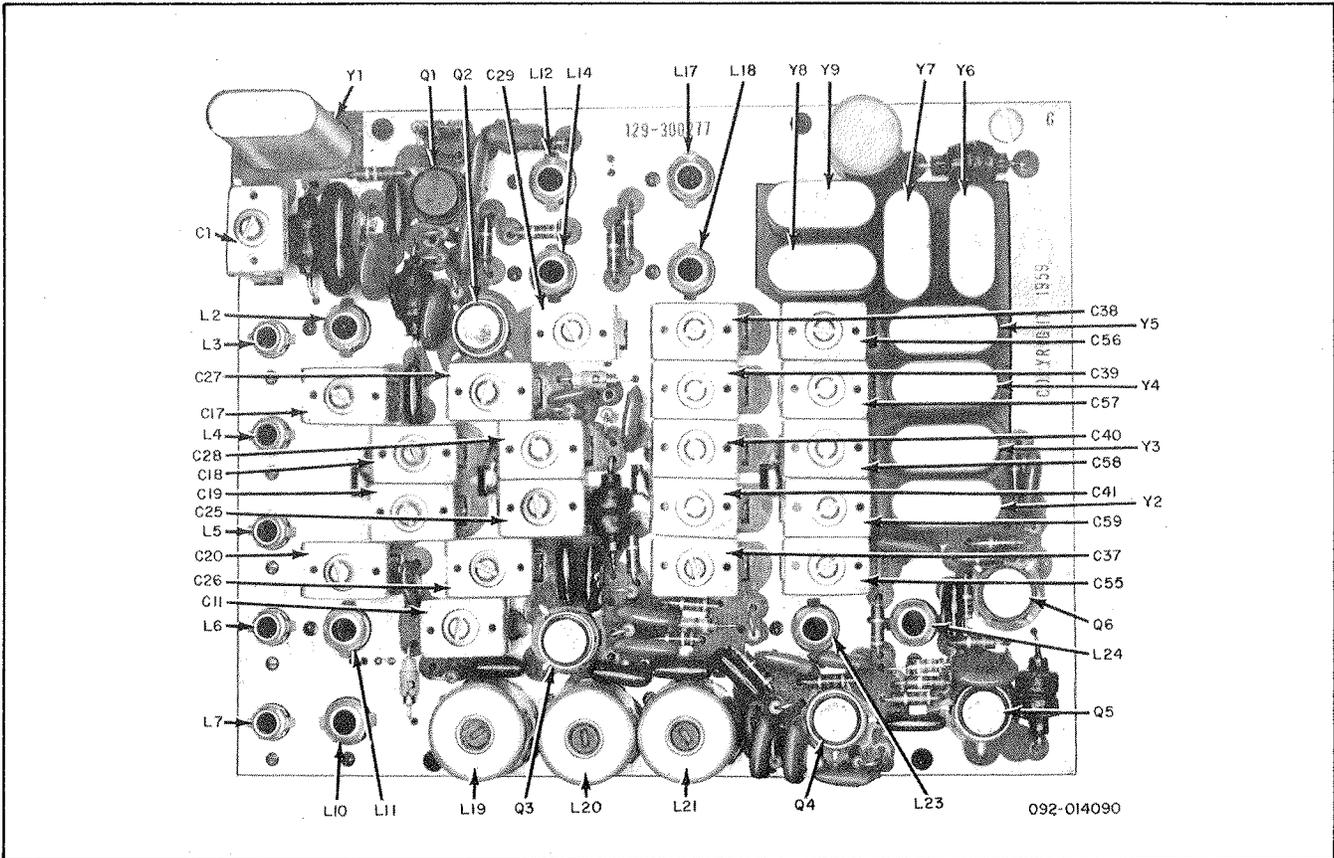


Figure 18. Top View of Receiver Heterodyne Board.

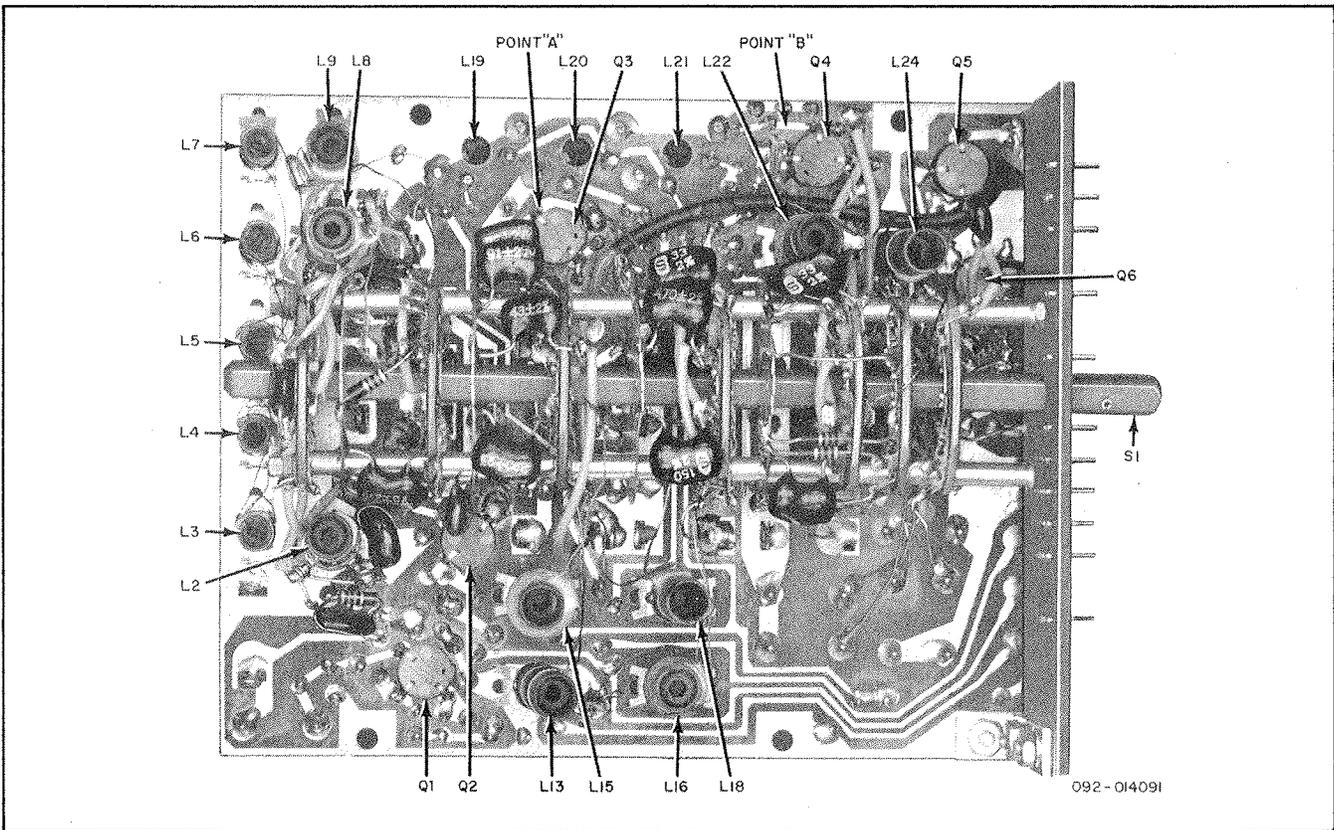


Figure 19. Bottom View of Receiver Heterodyne Board.

6. With the transmitter running, set the receiver FUNCTION switch to CW/SSB.
7. Tune the BFO frequency adjust trimmer (C121) until a beat note is heard in the test receiver. It may be necessary to make a slight adjustment of the carrier balance potentiometer (R43) to obtain a strong beat note.
8. Adjust the BFO trimmer (C121) for zero beat. The BFO is now properly adjusted.
9. Remove the 1000-ohm resistor and restore the balanced modulator adjustment (R43) for minimum carrier output.

7-10. CRYSTAL FILTER RESPONSE.

Do not attempt to align the crystal filters in the field. The unit should be returned to the factory if alignment is necessary. The following check may be made to determine if the crystal filters are aligned correctly:

1. Tune the transmitter on the 40-meter band.
2. Set the transmitter FUNCTION switch to SSB.
3. Connect a signal generator to the microphone input.
4. Using 1000 CPS at about 4 millivolts input, adjust the microphone GAIN control for 50 volts RMS output. This will be the 0-DB reference.
5. Check the transmitter audio response in each sideband using the 1000-CPS, 50-volt output reference. The low frequency minus 3-DB point (35 volts output) should be between 500 CPS and 700 CPS. The high frequency minus 3-DB point should be between 2600 CPS and 3400 CPS. The output should not rise more than +2 DB (to 63 volts RMS) at any point in the audio passband on either sideband.

7-11. RECEIVER ALIGNMENT.

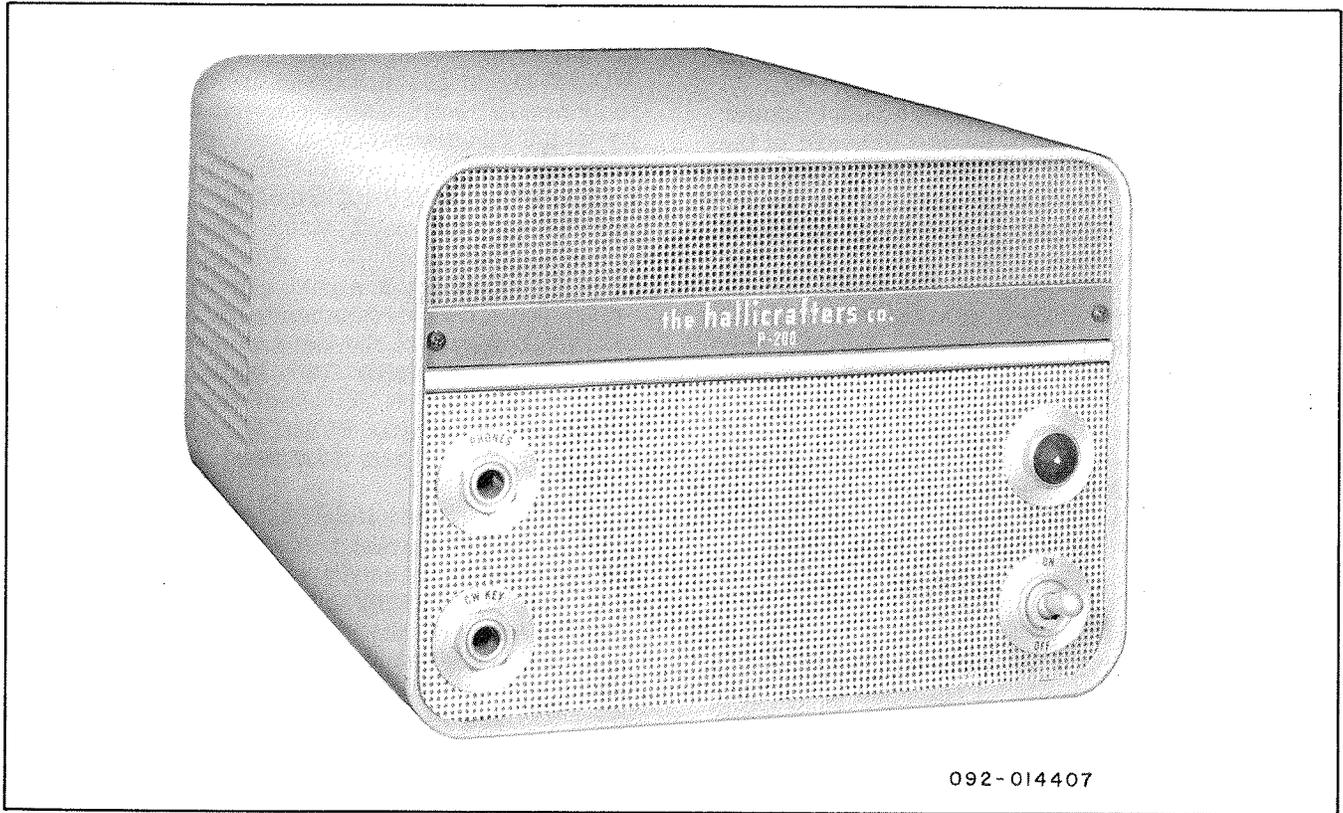
A signal generator and an RF VTVM with a response to 30 MC are required to align the Model FPM-200 receiver section.

7-12. VFO HARMONIC FILTER ALIGNMENT.

1. Connect a signal generator to the receiver first mixer collector and an RF VTVM to the base of receiver stepping IF amplifier. (See figure 18)
2. Set BAND SELECTOR to lowest 10-meter band (27.7 MC to 28.2 MC).
3. Turn receiver FUNCTION switch to AM position.
4. Set RF VTVM to 2.5V range.
5. Tune signal generator to 19.45 MC.
6. Set signal generator output to approximately 2.0V.
7. Tune coil L19 for maximum on meter.
8. Tune signal generator to 17.5 MC.
9. Tune coil L20 for minimum on meter. Increase meter sensitivity to lowest range (25 millivolts) if required.
10. Tune signal generator to 16.5 MC.
11. Tune coil L21 for minimum on meter. Increase meter sensitivity to lowest range (25 millivolts) if required.
12. Repeat steps 4 through 11 and touch up tuning as required as there is some interaction between these coils.
13. Disconnect signal generator and VTVM.

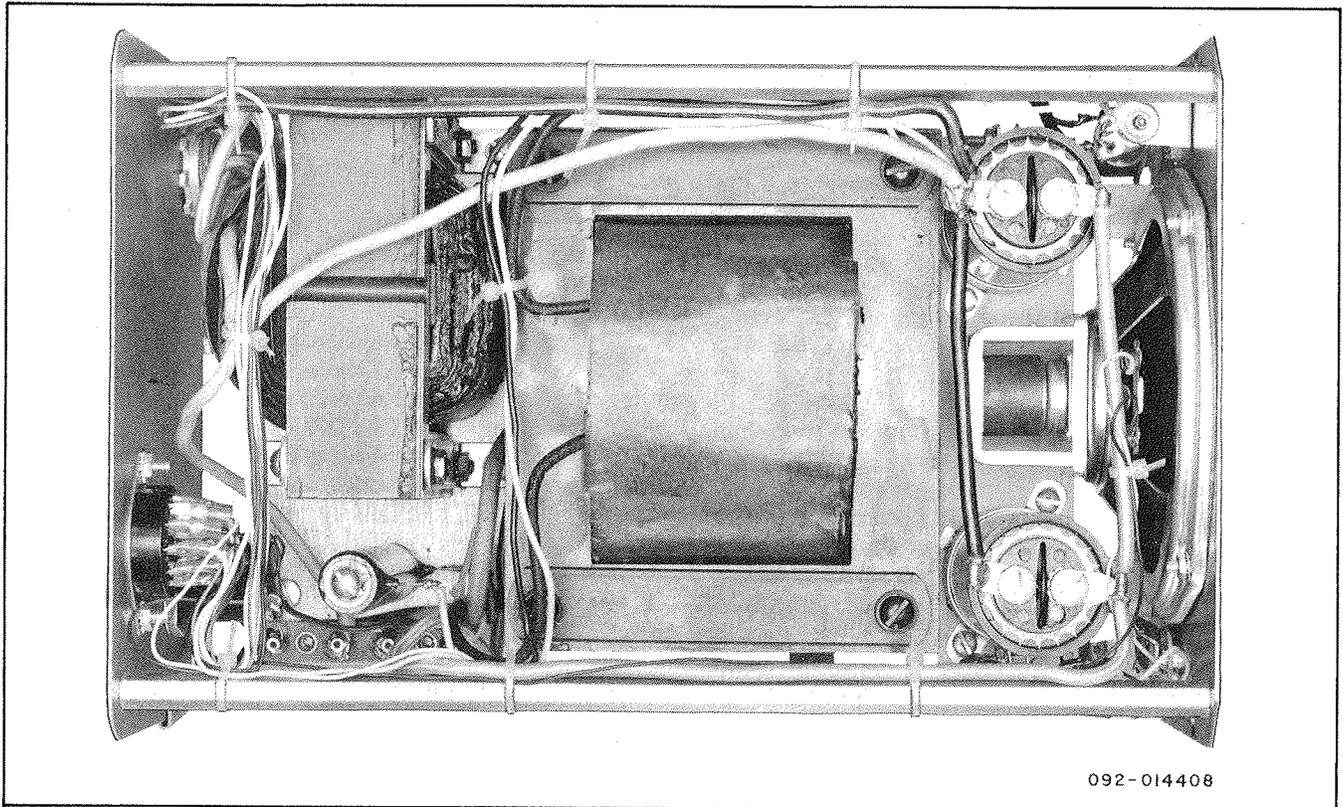
7-13. RF/STEPPING IF ALIGNMENT.

1. Connect signal generator to antenna input cable (A1 or A2).
2. Refer to receiver heterodyning board alignment chart (table 9) and align in sequence indicated on chart.



092-014407

Figure 20. View of P-200 AC Power Supply.



092-014408

Figure 21. Top Chassis View of P-200 AC Power Supply.

Table 9. Receiver Heterodyne Board Alignment Chart.

Step	Band	VFO Frequency	Tune Coil For Maximum	Tune Trimmer For Maximum
1	80M	3.6 MC	L11, L15	C11, C29
2	80M	3.9 MC		C37, C55
3	15M	21.3 MC	L8, L14, L18, L24	
4	10-D	29.5 MC		C17, C27, C38, C56
5	10-C	29.0 MC		C18, C28, C39, C57
6	10-B	28.5 MC		C19, C25, C40, C58
7	10-A	28.0 MC		C20, C26, C41, C59
8	20M	14.3 MC	L9, L13, L16, L22	
9	40M	7.1 MC	L10, L12, L17, L23	
10	80M	3.8 MC		Retune C37, C55
Note	WWV	10.0 MC	No Adjustments	

Table 10. Receiver Trap Alignment Chart.

Step	Band	Generator Frequency	Tune For Minimum
1	10-D	20950 KC	L3
2	10-C	20450 KC	L4
3	10-B	19950 KC	L5
4	10-A	19450 KC	L6
5	15M	12750 KC	L7
6	80M	4750 — 5750 KC	L2
7	40M	1450 KC	C293

SERVICE REPAIR PARTS LIST FPM-200

Schematic Symbol	Description	Hallcrafters Part Number	Schematic Symbol	Description	Hallcrafters Part Number
CAPACITORS			CAPACITORS (CONT)		
C1,17,18,19,20,25,26,27,28,193,194,195,204,205,206,216,217,218,228,229,230	Variable, 1.5 mmf to 20 mmf, Trimmer	044-000526	C239,240,243,245,246,272,291	0.005 mfd, 20%, 500V, Ceramic Disc	047-100442
C2	22 mmf, 2%, 300V, Duramica	481-131220	C241	Variable, 140 mmf, Driver Tuning	048-000442
C3,4,15,22,23,32,33,42,43,50,51,52,64,65,66,77,119,137,141,143,222,287	0.05 mfd, 50V, Ceramic Disc	047-001144	C244	750 mmf, 500V, Silver Mica, Feed-Through	047-001254
C5,196	4700 mmf, 2%, 300V, Duramica	481-361472	C247	Variable, 1 mmf to 10 mmf, Neutralizing	044-000520
C6,9,67,75,98,120,186,188	100 mmf, 2%, 300V, Duramica	481-161101	C248,249,274	0.001 mfd, 20%, 3KV, Ceramic Disc	047-100397
C7,13	75 mmf, 2%, 300V, Duramica	481-161750	C250	Variable, 15 mmf to 325 mmf, FINAL TUNE	048-000487
C8	330 mmf, 2%, 300V, Duramica (Part of L2)	481-161331	C253	5.6 mmf, 10%, 300V, Duramica	481-133056
C10,30,49,74,90,91,92,95,100,102,103,105,109,110,116,123,124,138,148,162,163,164,165,166,167,168,169,170,171,198,210,223,298	0.01 mfd, 50V, Ceramic Disc	047-001140	C254	300 mmf, 2%, 500V, Duramica	482-161301
C11,29,227	Variable, 3 mmf to 35 mmf, Trimmer	044-000518	C255	290 mmf, 2%, 500V, Duramica	482-161291
C12,285	230 mmf, 2%, 300V, Duramica	481-161231	C256,260	39 mmf, 2%, 500V, Duramica	482-161390
C14,106	91 mmf, 2%, 300V, Duramica	481-161910	C257	330 mmf, 2%, 500V, Duramica	482-161331
C16	12 mmf, 2%, 300V, Duramica	481-131120	C258	310 mmf, 2%, 500V, Duramica	482-161311
C21	40 mmf, 2%, 300V, Duramica	481-151400	C259	150 mmf, 2%, 500V, Duramica	482-161151
C24	43 mmf, 2%, 300V, Duramica	481-151430	C261,262,263,264,265,266,267	0.001 mfd, GMV, Feed-Through	047-001308
C31,60,286	15 mmf, 2%, 300V, Duramica	481-131150	C273	0.25 mfd, 1000V, Oil-Filled (Bath Tub Type)	046-000969
C34,36,54,68,94,96,214,232	33 mmf, 2%, 300V, Duramica	481-151330	C275	8 mfd, 450V, Electrolytic	045-100386
C35,53	125 mmf, 2%, 300V, Duramica	047-001286	C276	0.25 mfd, 600V, Metallized Paper	046-000970
C37,38,39,40,41,55,56,57,58,59,79,121,189,191,201,203,213,215,293	Variable, 8 mmf to 60 mmf, Trimmer	044-000519	C277	2 mfd, 150V, Electrolytic	045-000612
C44,61,212	150 mmf, 2%, 300V, Duramica	481-161151	C278	0.2 mfd, 200V, Metallized Paper	046-000968
C45,62,224	470 mmf, 2%, 300V, Duramica	481-161471	C279,280,295	25 mfd, 25V, Electrolytic	045-000643
C46,47	71 mmf, 2%, 300V, Duramica	481-161710	C282,284	400 mfd, 15V, Electrolytic	045-000630
C48	13 mmf, 2%, 300V, Duramica	481-131130	C289	27 mmf, 2%, N80, Ceramic Tubular	491-024270-42
C63,78	10 mmf, 2%, 300V, Duramica	481-131100	C292	0.1 mfd, 10%, 400V, Tubular	499-021104
C69,133,290	100 mfd, 15V, Electrolytic	045-000686	C294	1230 mmf, ±1%, 100V, Duramica	493-221231-414
C70,93,97,101,113,114,118	390 mmf, 2%, 300V, Duramica	481-161391	C296,297	0.1 mfd, 10%, 200V, Molded Paper	499-011104
C71	Variable, 1.5 mmf to 7 mmf, Trimmer	044-000457	Capacitors C1 through C69 and C285 through C287 are located on the Receiver Heterodyning Board 041-950602.		
C72	4.7 mmf, 2%, 300V, Duramica	481-131047	Capacitors C70 through C135 are located on the IF Board 041-950421.		
C73,185	180 mmf, 2%, 300V, Duramica	481-161181	Capacitors C136 through C148 and C188 are located on the Pot Board 041-950420.		
C76,200,233	120 mmf, 2%, 300V, Duramica	481-161121	Capacitors C149 through C165 are located on the Left-Hand VFO (Blue) Board 041-950579.		
C80,111,127,134,135,146	8 mfd, 12V, Electrolytic	045-000610	Capacitors C166 and C167 and C298 are located on the VFO Switch Board 041-950422.		
C81,115,122,125,128,132,147	50 mfd, 12V, Electrolytic	045-000623	Capacitors C168 through C184 and C289 are located on the Right-Hand VFO (Red) Board 041-950578.		
C82,83,84	3900 mmf, 2%, 300V, Duramica	481-361392	Capacitors C185 through C235 and C290 are located on the Transmitter Heterodyning Board 041-950604.		
C85	0.025 mfd, 50V, Ceramic Disc	047-001142	Capacitors C236 through C272 and C291 and C292 are located in the Final Tuning Assembly 041-950587.		
C86,87,187	20 mmf, 2%, 300V, Duramica	481-151200	Capacitors C273 through C283 and C293 through C297 are located in the Power Supply Assembly 041-950596.		
C88,89	2.0 mmf, 2%, 300V, Duramica	481-131020	Capacitor C284 is located on the Bottom Connector Board 041-050606.		
C99,197,199,220,221,251,252,268,269,270,271,281,283	0.1 mfd, 50V, Ceramic Disc	047-001146	RESISTORS*		
C104,108,112,211,219	47 mmf, 2%, 300V, Duramica	481-151470	R1,171	100K ohm	451-152104
C107,126,130	20 mfd, 12V, Electrolytic	045-000620	R2,7,8,25,51,57,59,81,126,130,138,193	10K ohm	451-152103
C117	5.6 mmf, 2%, 300V, Duramica	481-131056	R3,116,206	220 ohm	451-152221
C129,136,142,144,145	10 mfd, 12V, Electrolytic	045-000609	R4,52,93,159,184	100 ohm	451-152101
C131	22 mfd, 12V, Electrolytic	045-000801	R5,34,143	47K ohm	451-152473
C139,288	100 mfd, 12V, Electrolytic	045-000619	R6,13,207	470K ohm	451-152474
C140	50 mfd, 12V, Electrolytic	045-000622	R9,33,47,53,56,60,61,63,64,76,77,78,79,86,88,92,101,148,151,162,182	4700 ohm	451-152472
C149,184	Variable, Butterfly, Cal. Correct	048-000482	R10,15,20,21,27,32,36,49,54,66,71,72,74,75,80,94,120,201,204	1000 ohm	451-152102
C150,183	Variable, Differential, TC Adjust	048-000375	R11,17,26,32,90,104,121,141,154,197	2200 ohm	451-152222
C151,181	15 mmf, 2%, NPO, Ceramic Tubular	491-004150-22	R12,99,129,170,178,202,226	820 ohm	451-152821
C152,182	15 mmf, 5%, N2200, Ceramic Tubular	047-001264	R14,29,135,163,180	5600 ohm	451-152562
C153	56 mmf, 2%, N150, Ceramic Tubular	491-104560-53	R16,112,115	47 ohm	451-152470
C154,179	47 mmf, 2%, N150, Ceramic Tubular	491-104470-53	R18	3900 ohm	451-152392
C155,178	Variable, 15 mmf, Trimmer	048-000376	R19,28,30,31,42,55,62,67,68,69,87,95,97,102,119,133,152,164,181,198,205	470 ohm	451-152471
C156,177	4.7 mmf, ±0.2 mmf, NPO, Ceramic Tubular	491-101047-23	R22,191	39K ohm	451-152393
C157,176,202	82 mmf, 2%, 300V, Duramica	481-161820	R23	68K ohm	451-152683
C158,161,174,175	4700 mmf, 10%, 300V, Duramica	481-363472	R24	120K ohm	451-152124
C159,172	8.2 mmf, 2%, 300V, Duramica	481-131082	R35,48,82,83,84,98,139,147,190,245	33K ohm	451-152333
C160,173,209	700 mmf, 2%, 300V, Duramica	481-161701	R38,46,146	1200 ohm	451-152122
C180	27 mmf, 2%, N150, Ceramic Tubular	491-024270-52	R39	220K ohm	451-152224
C190	620 mmf, 2%, 300V, Duramica	481-361621			
C192	68 mmf, 2%, 300V, Duramica	481-161680			
C207	62 mmf, 2%, 300V, Duramica	481-161620			
C208	360 mmf, 2%, 300V, Duramica	481-161361			
C225	78 mmf, 2%, 300V, Duramica	481-161780			
C231	240 mmf, 2%, 300V, Duramica (Part of L41)	481-161241			
C234	56 mmf, 2%, 300V, Duramica	481-161560			
C235	27 mmf, 2%, 300V, Duramica	481-151270			
C237,238,270	0.001 mfd, 20%, 500V, Ceramic Disc	047-100503			

SERVICE REPAIR PARTS LIST FPM-200 (CONT.)

Schematic Symbol	Description	Hallcrafters Part Number	Schematic Symbol	Description	Hallcrafters Part Number
RESISTORS* (CONT)			SEMICONDUCTOR DIODES		
R40,50,192	56K ohm	451-152563	CR1	1N295, 100-KC Marker Clipper	019-002834
R41	18K ohm	451-152183	CR2	1N295, First Mixer Switch Isolation	019-002834
R43	Variable, 250 ohm, CARRIER BALANCE	025-001692	CR3	1N295, Second Mixer Switch Isolation	019-002834
R44,45,228	390 ohm	451-152391	CR4	1N295, Transmit Gate IF Output	019-002834
R58,244	15K ohm	451-152153	CR5	1N295, Receiver Gate IF Output	019-002834
R65,70,142,155	6800 ohm	451-152682	CR6,7	1N295 SSB/AM Detector	019-002834
R73,107	3300 ohm	451-152332	CR8	1N295, Negative Pulse Detector (Noise Limiter)	019-002834
R85,91,106,109,110,145	22K ohm	451-152223	CR9	1N295, Positive Pulse Detector (Level Setting)	019-002834
R89,113,137,160,185,189	2700 ohm	451-152272	CR10	1N295, AGC Detector	019-002834
R96	56 ohm	451-152560	CR11,12	1N295, Balanced Modulator	019-002834
R100,188,208	330 ohm	451-152331	CR13	1N295, Carrier Oscillator Switch Isolation	019-002834
R103,195,199	1800 ohm	451-152182	CR14	1N295, BFO Switch Isolation	019-002834
R105,114,125,187,225	5000 ohm, 10%, Thermistor	023-000240	CR15	1N295, QT Amplifier	019-002834
R108,165,179	1500 ohm	451-152152	CR16	1N295, VOX Amplifier	019-002834
R111	82K ohm	451-152823	CR17	1N295, Temperature Compensator	019-002834
R117	3.3 ohm, 5%, 1/2 watt	451-251033	CR18	1N295, VOX DC Amplifier Bias	019-002834
R118	180 ohm, 2 watt	451-652181	CR19	1N295, Temperature Compensator	019-002834
R122,172,173,196,203,229	8200 ohm	451-152822	CR20	1N295, First AGC Amplifier Bias	019-002834
R123	Variable, 15K ohm, VOX LEVEL	025-001831	CR21	1N295, Temperature Compensator	019-002834
R124	Variable, 50K ohm, QT	025-001690	CR22	1N295, First Audio Switch Isolation	019-002834
R127	120 ohm	451-152121	CR23,24	1N295, Transmitter First Mixer	019-002834
R128	1.5K ohm, Thermistor	023-000239	CR25	1N295, Transmitter IF Amplifier Switch Isolation	019-002834
R131	Variable, 5K ohm, RF GAIN	025-001686	CR26,27	1N295, Transmitter Second Mixer	019-002834
R132	10 ohm, 1/2 watt	451-252100	CR28	HD6225, VFO Buffer Switch Isolation (Blue)	019-002354
R134	Variable, 100K ohm, NOISE LIMITER	025-001687	CR29	HD6225, VFO Buffer Switch Isolation (Red)	019-002354
R136,200,230	680 ohm	451-152681	CR30	1N295, Receiver VFO Output	019-002834
R140	Variable, 10K ohm, AUDIO GAIN	025-001685	CR31	1N295, VFO Output Gate	019-002834
R144	Variable, 100K ohm, SIDETONE	025-001689	CR32	1N469, 9-Volt Regulator (6-volt Zener type)	019-002355
R149	20 ohm, 5%, 10 watt, Wire Wound	448-031021	CR33,34,35,36,37,38,39,40	1N3195, High Voltage Bridge	019-002770
R150	Variable, 5K ohm, Microphone GAIN	025-001688	CR41,42,43,44	1N3194, Low Voltage Bridge	019-002769
R153	Variable, 25K ohm, VOX DELAY	025-001691	CR45,46	1N3194, Bias Rectifier	019-002769
R156	270K ohm	451-152274	CR47	1N295, Metering Diode	019-002834
R157	1 Megohm	451-152105	CR48,50	Type V47, Vari-Cap	048-000459
R158,186	150 ohm	451-152151	CR49	1N295	019-002834
R161,183	82 ohm	451-152820	CR51	Type V100, Vari-Cap	048-000464
R166,174	8200 ohm, 1%, Precision	452-004822	CR52	HD6225	019-002354
R167,175	Variable, 10K ohm (Ganged)	025-001665			
R168,176	220 ohm, 1%, Precision	452-004221			
R169,177	4300 ohm, 1%, Precision	452-004432			
R194	27K ohm	451-152273			
R209	100K ohm, 1/2 watt	451-252104			
R210,218	12K ohm, 1/2 watt	451-252123			
R211	220K ohm, 1/2 watt	451-252224			
R212	39K ohm, 2 watt	451-652393			
R213	8200 ohm, 1 watt	451-352822			
R214,222	10K ohm, 1/2 watt	451-252103			
R215	Variable, 10K ohm, Bias Adjust	025-001833			
R216,239	3900 ohm, 1/2 watt	451-252392			
R217	2200 ohm, 1/2 watt	451-252222			
R219	4700 ohm, 1/2 watt	451-252472			
R220	2200 ohm, 5%, 5 watt, Wire Wound	448-021222			
R221	470 ohm, 1 watt	451-352471			
R223,232	6800 ohm, 2 watt	451-652682			
R224	1200 ohm, 1 watt	451-352122			
R227	Variable, 5K ohm, 9-Volt Adjust	025-001832			
R231	500 ohm, 5%, 5 watt, Wire Wound	448-021501			
R233,234	6 ohm, 5%, 5 watt, Wire Wound	453-041060			
R235,236	200 ohm, 5%, 20 watt, Wire Wound	453-071201			
R237	2 ohm, 5%, 5 watt, Wire Wound	453-041020			
R238	100 ohm, 5%, 5 watt, Wire Wound	453-041101			
R240	47K ohm, 1/2 watt	451-252473			
R241	1500 ohm, 2 watt	451-652152			
R242,243	0.47 ohm, 1 watt, Wire Wound	453-022000-47			
<p>*All RESISTORS are carbon type, 1/4 watt, 10%, unless otherwise specified.</p> <p>Resistors R1 through R42 and R193 are located on the Receiver Heterodyne Board 041-950602.</p> <p>Resistors R43 through R89 and R91 through R122 are located on the IF Board 041-950421.</p> <p>Resistors R123 through R157 and R244 are located on the Pot Board 041-950420.</p> <p>Resistors R158 through R170 are located on the Left-Hand VFO (Blue) Board 041-950579.</p> <p>Resistors R171 through R173 are located on the VFO Switch Board 041-950422.</p> <p>Resistors R174 through R186 are located on the Right-Hand VFO (Red) Board 041-950478.</p> <p>Resistors R90 and R187 through R208 are located on the Transmitter Heterodyne Board 041-950604.</p> <p>Resistors R209 through R224 are located in the Final Tuning Assembly 041-950587.</p> <p>Resistors R225 through R243 are located in the Power Supply Assembly 041-950596.</p>			<p>Diodes CR1 through CR3 and CR48 through CR50 are located on the Receiver Heterodyning Board 041-950602.</p> <p>Diodes CR4 through CR18 are located on the IF Board 041-950421.</p> <p>Diodes CR19 through CR22 and CR52 are located on the Pot Board 041-950420.</p> <p>Diodes CR23 through CR27 and CR51 are located on the Transmitter Heterodyning Board 041-950604.</p> <p>Diode CR28 is located on the Left-Hand (Blue) VFO Board 041-950579.</p> <p>Diode CR29 is located on the Right-Hand (Red) VFO Board 041-950578.</p> <p>Diodes CR30 and CR31 are located on the VFO Switch Board 041-950422.</p> <p>Diodes CR32 through CR46 are located in the Power Supply Assembly 041-950596.</p> <p>Diode CR47 is located in the Final Tuning Assembly 041-950587.</p>		
			TRANSISTORS		
			Q1	2N324, 100-KC Marker	112-100073
			Q2	2N1742, Receiver RF Amplifier	112-000085
			Q3	2N1744, Receiver First Mixer	112-000097
			Q4	2N1743, Receiver Stepping IF Amplifier	112-000086
			Q5	2N1744, Receiver Second Mixer	112-000097
			Q6	2N371, Heterodyne Crystal Oscillator	112-000070
			Q7	2N1224, First 2325-KC IF Amplifier	112-000122
			Q8	2N1224, Second 2325-KC IF Amplifier	112-000122
			Q9	2N1224, Third 2325-KC IF Amplifier	112-000122
			Q10	2N1224, Carrier Oscillator	112-000122
			Q11	2N1193, Sidetone Oscillator	112-000120
			Q12	2N1224, BFO	112-000122
			Q13	2N214, Electronic Switch (Receive)	112-000069
			Q14	2N214, Electronic Switch (Transmit)	112-000069
			Q15	2N1193, QT Amplifier	112-000120
			Q16	2N1193, VOX Amplifier	112-000120
			Q17	2N1193, VOX DC Amplifier	112-000120
			Q18	2N1193, Receiver First Audio	112-000120
			Q19	2N1193, Audio Driver	112-000120
			Q20	2N1193, First AGC Amplifier	112-000120
			Q21	2N214, Second AGC Amplifier	112-000069
			Q22	2N1193, Noise Clamper	112-000120
			Q23	2N1193, Microphone Pre-Amplifier	112-000120
			Q24	2N1193, Microphone Amplifier	112-000120
			Q25	2N1743, Transmitter Stepping IF Amplifier	112-000086
			Q26	2N1742, Transmit RF Amplifier	112-000085
			Q27	2N1745, VFO Oscillator (Blue)	112-000079

SERVICE REPAIR PARTS LIST FPM-200 (CONT.)

Schematic Symbol	Description	Hallicrafters Part Number	Schematic Symbol	Description	Hallicrafters Part Number
TRANSISTORS (CONT)			COILS AND TRANSFORMERS (CONT)		
Q28	2N1745, VFO Buffer (Blue)	112-000079	Coils L1 and L59 and transformers T6 and T7 are located in the Power Supply Assembly 041-950596.		
Q29	2N1745, VFO Oscillator (Red)	112-000079	Coils L2 through L24 and RFC1 through RFC5 are located on the Receiver Heterodyning Board 041-950602.		
Q30	2N1745, VFO Buffer (Red)	112-000079	Coils L25 through L32, RFC6 through 8, and transformers T1 through T4 are located on the IF Board 041-950421.		
Q31	2N214, Regulator Feedback Amplifier	112-000069	Coils L33 through L46 and RFC9 are located on the Transmitter Heterodyning Board 041-950604.		
Q32	2N350A, 9-volt Regulator	112-000071	Coils L47 through L53 and L58 and RFC11 through RFC18 are located in the Final Tuning Assembly 041-950587.		
Q33,34	2N669, Audio Output	112-000072	Coils L54, L55, RFC21, and RFC22 are located on the Left-Hand (Blue) VFO Board 041-950579.		
Q35,36	2N350A, Blower Oscillator	112-000071	Coils L56, L57, RFC23, and RFC24 are located on the Right-Hand (Red) VFO Board 041-950578.		
Q37,38,39,40	2N1554, DC-to-DC Converters	112-000107	Coils RFC19 and RFC20 are located on the VFO Switch Assembly 041-950422.		
Q41	2N350A, Relay Amplifier	112-000071	Transformer T5 is located on the Pot Board 041-950420.		
Transistors Q1 through Q6 are located on the Receiver Heterodyning Board 041-950602.			SWITCHES		
Transistors Q7 through Q17 and Q19 are located on the IF Board 041-950421.			S1	Rotary, Receiver BAND SELECTOR	060-002203
Transistors Q18 and Q20 through Q24 are located on the Pot Board 041-950420.			S2	Rotary, Receiver SIDE BAND	060-002042
Transistors Q25 and Q26 are located on the Transmitter Heterodyning Board 041-950604.			S3	Rotary, Receiver FUNCTION (Inc. ON-OFF)	060-002040
Transistors Q27 and Q28 are located on the Left-Hand (Blue) VFO Board 041-950579.			S4	Rotary, XTAL CAL	060-002039
Transistors Q29 and Q30 are located on the Right-Hand (Red) VFO Board 041-950578.			S5	Rotary, Transmitter OPERATION	060-002043
Transistors Q31 through Q41 are located in the Power Supply Assembly 041-950596.			S6	Rotary, Transmitter FUNCTION	060-002038
ELECTRON TUBES			S7	Rotary, LIGHTS (Dial)	060-002111
V1	12BY7A, Transmitter Driver	090-901192	S8	Rotary, VFO	060-002041
V2,3	6146, Power Amplifiers	090-900756	S9	Rotary, Transmitter BAND SELECTOR	060-002061
V4,5	OB2, Voltage Regulator	090-900005	S10	Switch Wafer (Driver Plate)	062-000157
All of the electron tubes are located in the Final Amplifier Assembly 041-950587.			S11	Switch Wafer (Final Tuning)	062-000158
COILS AND TRANSFORMERS			S12	Thermostat, Heat Sink (N.C., Opens at 175°F)	060-002353
L1	Coil, Filter, 9.7 UH	051-003305	Switch S1 is located on the Receiver Heterodyning Board 041-950602.		
L2	Coil, 4750-KC Trap	051-002900	Switches S2 and S3 are located on the IF Board 041-950421.		
L3,4,5,6,40,42,46	Coil, RF (10,15, and 20 meters)	051-002797	Switches S4 through S7 are located on the Pot Board 041-950420.		
L7	Coil, 15-meter Trap	053-000571	Switch S8 is located on the VFO Switch Board 041-950422.		
L8&11	Coil, Antenna (80 and 10 meters)	051-002563	Switch S9 is located on the Transmitter Heterodyning Board 041-950604.		
L9&10,L34&35	Coil, Antenna and RF (10, 20, and 40 meters)	051-002562	Switches S10 and S11 are located in the Final Tuning Assembly 041-950587.		
L43&44			Switch S12 is located in the Power Supply Assembly 041-950596.		
L12&13	Coil, RF (40 and 20 meters)	051-002560	CRYSTALS		
L14&15	Coil, RF (80 and 10 meters)	051-002561	Y1	100 KC (Marker)	019-002272
L16&17,L22&23	Coil, Stepping IF (80, 20, and 40 meters)	051-002564	Y2	7.075 MC (80 meters)	019-002276
L18,24	Coil, Stepping IF (10 meters)	051-002565	Y3	3.775 MC (40 meters)	019-002275
L19,21	Coil, Band-Stop Filter	051-002898	Y4	3.425 MC (20 meters)	019-002274
L20	Coil, Band-Stop Filter	051-002899	Y5	10.425 MC (15 meters)	019-002277
L25,33	Transformer, Balanced Modulator (2325 KC)	050-000739	Y6	17.125 MC (10 meters)	019-002278
L26,31	Transformer, IF (w/o tap)	050-000744	Y7	17.625 MC (10 meters)	019-002279
L27,28	Coil, Crystal Filter	050-000741	Y8	18.125 MC (10 meters)	019-002280
L29,30	Transformer, IF (w/tap)	050-000743	Y9	18.625 MC (10 meters)	019-002281
L32	Transformer, IF (Detector)	050-000745	Y10,11	2325 KC, Carrier Oscillator and BFO	019-002273
L36	Coil, Transmitter Second Stepping IF (10 and 15 meters)	051-002795	Y12,13	Lower Sideband	019-002282
L37&38	Coil, Transmitter Second Stepping IF (20, 40, and 80 meters)	051-002796	Y14,15	Lower Sideband	019-002283
L39	Transformer, Balanced Mixer (8.5 MC)	050-000736	Y16,17	Upper Sideband	019-002284
L41&45	Coil, RF (80 meters) (Inc. 4750-KC Trap)	051-002798	Y18,19	Upper Sideband	019-002285
L47&48	Coil, RF, Driver Stage (10 meters)	051-002523	Crystals Y1 through Y9 are located on the Receiver Heterodyning Board 041-950602.		
L49&50	Coil, RF, Driver Stage (15 and 20 meters)	051-002525	Crystals Y10 through Y19 are located on the IF Board 041-950421.		
L51&52	Coil, RF, Driver Stage (80 and 40 meters)	051-002524	KNOBS		
L53	Coil, Final Tuning Tank	051-002786	VFO SELECTOR		015-001407
L54,56	Coil, Shunt	051-002527	BAND SELECTOR		015-001408
L55	Coil, VFO Tuning (Left)	051-002502	XTAL CAL		015-001657
L57	Coil, VFO Tuning (Right)	051-002784	LIGHT		015-001658
L58	Parasitic Choke Assembly	053-000557	Transmitter FUNCTION		015-001659
L59	Coil, Filter, 3.2 UH	051-003304	FINAL TUNE		015-001660
RFC1,2,3,4,5,6,7,8,9,14,15,16,17,18,19,20,21,22,23,24	Choke, RF, 0.7 MH	053-000530	SIDE BAND		015-001661
RFC11,12	Choke, RF, 2.5 MH	053-000335	Receiver FUNCTION		015-001662
RFC13	Choke, RF, Final Plate	053-000426	OPERATION		015-001663
T1	Transformer, Tone Oscillator	055-000402	AUDIO GAIN		015-001664
T2	Transformer, VOX Amplifier	055-000403	RF GAIN		015-001664
T3	Transformer, Anti-Trip Amplifier	055-000400	NOISE LIMITER		015-001664
T4	Transformer, Audio Driver	055-000410	Microphone GAIN		015-001664
T5	Transformer, Microphone Pre-amplifier	055-000401	VFO TUNING (2)		015-001665
T6	Transformer, Audio Output	055-000394			
T7	Transformer, Power Supply (Toroid)	052-000711			

SERVICE REPAIR PARTS LIST FPM-200 (CONT).

Schematic Symbol	Description	Hallicrafters Part Number	Schematic Symbol	Description	Hallicrafters Part Number
	MISCELLANEOUS			MISCELLANEOUS (CONT)	
	Blade, Fan	080-000852	Final Tuning Mechanical Assembly (Cont)		
	Bracket, Drum Shield	067-007939	Pinion, Spur (24-Teeth)		026-000864
	Bracket, Meter Mounting (Left-Hand)	067-007136	Retainer, Bearing		076-002782
	Bracket, Meter Mounting (Right-Hand)	067-007137	Ring, Retaining		076-002947
	Bracket, RF Connector	067-007069	Ring, Retaining		076-002948
	Bracket, Shield Mounting (Left-Hand)	067-006885	Shaft, Driver		074-002084
	Bracket, Shield Mounting (Right-Hand)	067-006883	Shaft, Final		074-002068
	Bracket, Tube Clamp	067-007174	Shaft, Idler Gear		074-002104
	Bracket, VFO Panel	067-007742	Shaft, Idler Sprocket		074-002110
	Bracket, Window Retainer (Left-Hand)	067-007710	Sprocket, Idler		026-000876
	Bracket, Window Retainer (Right-Hand)	067-008777	Sprocket		041-035898
	Bumper, Plastic (Foot)	016-001469	Sprocket		041-035951
	Bushing, Bearing (Nylon)	008-205643	Sprocket		041-036122
	Bushing, Pointer	077-002335	Sprocket		041-050444
	Cabinet	066-002329	Sprocket		041-050613
	Cable, Coaxial, RG-174/U	087-104723			
	Clip, Coil	076-101005	VFO Mechanical Assembly		
	Connector, Feed-Through	010-000447	Coupling, Driving		029-000492
	Connector, Jack (Coaxial)	010-001751	Coupling, Driven		029-000491
	Connector, Microphone	010-001569	Follower, Cam		018-000621
	Connector, Plug (Coaxial)	010-001752	Gasket, Cover		016-001408
	Cover, Power Supply and Final Tuning Assemblies	066-002407	Gear, Spur (VFO)		026-000874
	Cover, Shield (Final Tuning)	066-002718	Gear, Spur (VFO Staking)		026-000873
	Dial Cord	087-006011	Gear, Spur (63 Teeth)		026-000943
	Dial Scale	083-000741	Pinion, Spur (12 Teeth)		026-000869
	Drum, Rotary Assembly (Dial Scale)	028-000378	Pinion, Spur (Pot Driver)		026-000870
	Escutcheon, Dial Scale	007-000744	Seal, "O" Ring		016-001457
	Final Tuning Shaft Assembly (Front and Middle)	041-050546	Spring, Anti-Backlash		075-000708
	Front Panel	068-000822	Spring, Cam Follower (Right) Red VFO		075-000731
F1	Fuse, 25 Amperes, 32 volts, 3AG (Slo-Blo)	039-000652	Spring, Cam Follower (Left) Blue VFO		075-000732
F2	Fuse, 4 Amperes, 3AG	039-100490			
F3	Fuse, 2 Amperes, 3AG	039-100428	Band Selector Drive Assembly		
	Fuseholder, Double (F1 and F2)	006-000906	Bushing, Gang Switch		077-002221
	Fuseholder, Single (F3)	006-000969	Chain, Index Sprocket		029-000624
DS1	Lamp, Neon, Type NE48	039-100023	Gear, Switch Drive		026-000862
DS2,3,4,5	Lamp, Pilot, Type 47	039-100019	Pinion, Switch Drive		026-000863
	Lampholder Assembly (DS1)	086-000513	Ring, Retaining		076-001385
M1	Meter	082-000456	Shaft, Band Selector		074-002101
B1	Motor, Fan	020-000239	Shaft, Coupling		074-002106
	Pin, Spring Retaining	074-002118	Shaft, Index Arm		074-002252
	Plate, Cover (Final Tune Bracket)	063-004635	Spring, Index Arm		075-000693
	Plate, Fuse Cover	063-004342	Sprocket		041-035897
	Pointer, Indicator (Bottom)	082-000454			
	Pointer, Indicator (Top)	082-000455	Sub-Assemblies (Including components)		
	Pointer, Tuning (Bottom)	082-000438	Printed Circuit Pot Board Assembly		041-950420
	Pointer, Tuning (Top)	082-000439	Printed Circuit IF Board Assembly		041-950421
	Pointer, VFO	082-000422	Printed Circuit VFO Switch Board Assembly		041-950422
	Pulley, Dial Drum	028-000332	Printed Circuit Right-Hand VFO (Red) Assembly		041-950578
	Pulley, Dial Drum Drive	028-000331	Printed Circuit Left-Hand VFO (Blue) Assembly		041-950579
	Pulley, Dial Pointer	028-000350	Final Tuning Assembly		041-950587
	Pulley, Idler	028-000357	Power Supply Assembly		041-950596
	Rail, Indicator	067-006915	Printed Circuit Receiver Heterodyning Board Assembly		041-950602
K1	Relay, Power	021-000462	Printed Circuit Transmitter Heterodyning Board Assembly		041-950604
K2	Relay, Antenna	021-000459			
	Retainer, Tube	076-002277	Printed Circuit Bottom Connector Board Assembly		041-050606
	Ring, Retaining	076-002949			
	Ring, Retaining	076-002990			
	Shaft, Receiver Band Selector	008-005569			
	Shaft, Transmitter Band Selector	008-006229			
	Shield, Heat Insert	069-001020			
	Shield, Tube (J-Lock)	069-201189			
	Spring, Dial Drum	075-000689			
	Spring, Idler Pulley Arm	075-000692			
	Spring	075-000690			
	Socket, Electron Tube, 9-pin w/base (V1)	006-200672			
	Socket, Electron Tube, 8-pin (V2 and V3)	006-100760			
	Socket, Electron Tube, 7-pin (V4 and V5)	006-000886			
	Socket, Pilot Lamp (DS2, 3, 4, and 5)	006-000847			
	Socket, Transistor (Q32, 33, 34, 35, 36, 37, 38, 39, 40, and 41)	006-000879			
	Socket, Transistor (Q13, 14, 21, 31)	006-000896			
	Socket, Transistor (Q1, 2, 3, 4, 5, 11, 15, 16, 17, 18, 19, 20, 22, 23, 24, 25, and 26)	006-000897			
	Socket, Transistor (Q7, 8, 9, 10, and 12)	006-000900			
	Socket, Transistor (Q6)	006-001002			
	Stud, Pulley Arm Mounting	073-002854			
	Window, Panel	022-000601			
	<u>Final Tuning Mechanical Assembly</u>				
	Bearing	077-002233			
	Bushing, Spacer	077-002216			
	Chain, Switch Sprocket	029-000625			
	Coupling, Shaft	029-000573			
	Gear, Spur	026-000866			
	Gear, Spur Idler	026-000867			

SERVICE REPAIR PARTS LIST P-200 POWER SUPPLY

Schematic Symbol	Description	Hallicrafters Part Number	Schematic Symbol	Description	Hallicrafters Part Number
C501,502	Capacitor, Fixed, Electrolytic, 2000 mfd, 25V	045-000628	T501	Transformer, AC Power	052-000707
C503,504	Capacitor, Fixed, Ceramic Disc, 0.01 mfd, 1400V	047-001309		Bumper, Plastic (Foot)	016-001469
CR501,502	Rectifier, Silicon, Type MR212R	027-000293		Cabinet Assembly	066-002529
DS501	Pilot Light, 25 volts, 0.25 Amperes	039-000686		Connector, Jack, Amphenol 31-005	010-100334
F501	Fuse, 5 Amperes, 125 volts, 3AG (Slo-Blo)	039-000457		Escutcheon	007-000810
J501	Connector, Jack, CW KEY	036-000225		Front Panel (Bottom Half)	068-000916
J502	Socket, 11-pin	006-000911		Front Panel (Top Half)	068-000917
J503	Connector, Jack, PHONES	036-000226		Fuseholder	006-000837
J504	Socket, Connector	006-000841		Line Cord	087-000078
L501	Choke, AC Power Supply	056-000363		Lock, Line Cord	076-100974
R501	Resistor, Fixed, Wire Wound, 7 ohm, 5%, 50 watt	024-001316		Pilot Lamp Socket Assembly (w/jewel)	086-000489
R502	Resistor, Fixed, Wire Wound, 3.2 ohm, 5 watt	453-042032		Speaker	085-000205
S501	Switch, Toggle, POWER	060-000378		Terminal Board	088-002186

SERVICE REPAIR PARTS LIST MR-200 MOUNTING RACK

Schematic Symbol	Description	Hallicrafters Part Number	Schematic Symbol	Description	Hallicrafters Part Number
J601	Connector, Jack, CW KEY	036-000225	R601	Resistor, Fixed, Wire Wound, 3 ohm, 5%, 5 watt	453-041030
J602	Socket, 11-pin (w/retainer)	006-000894		Bracket, Mounting Rack	087-007460
J603	Connector, Jack, PHONES	036-000226		Cable, Coaxial, RG-58A/U	087-104994
J604	Socket, Connector	006-000841		Mobile Mount Assembly	066-002873

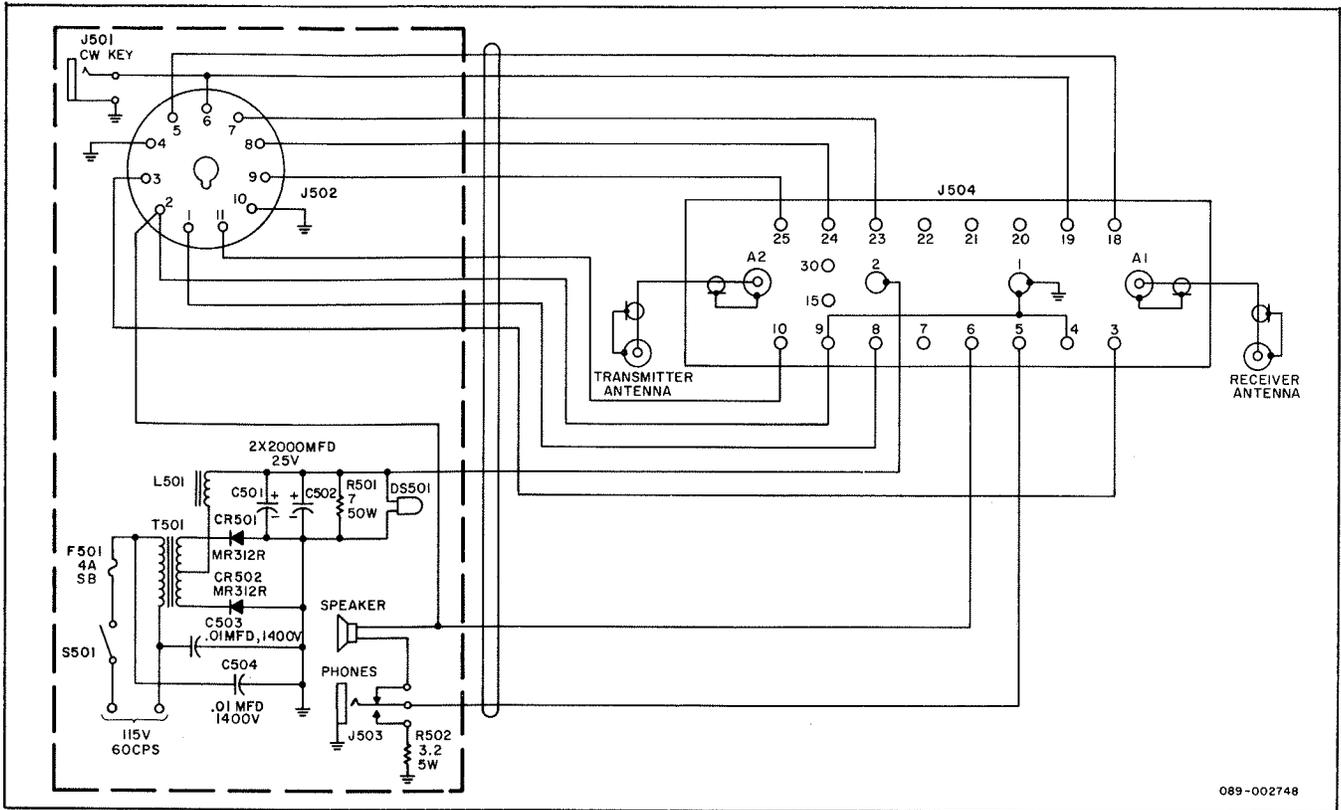


Figure 22. Schematic Diagram of P-200 Power Supply.

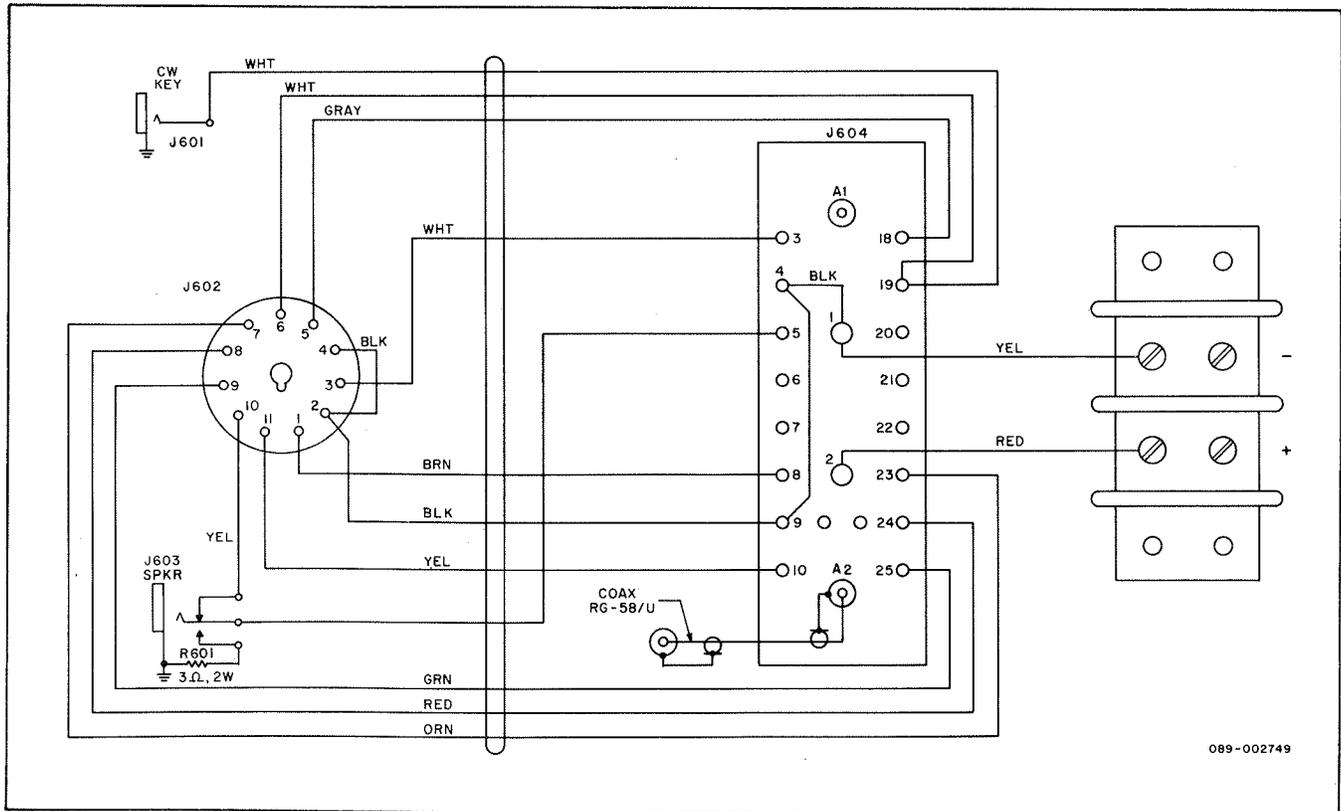


Figure 23. Schematic Diagram of MR-200 Mounting Rack.

NOTES:

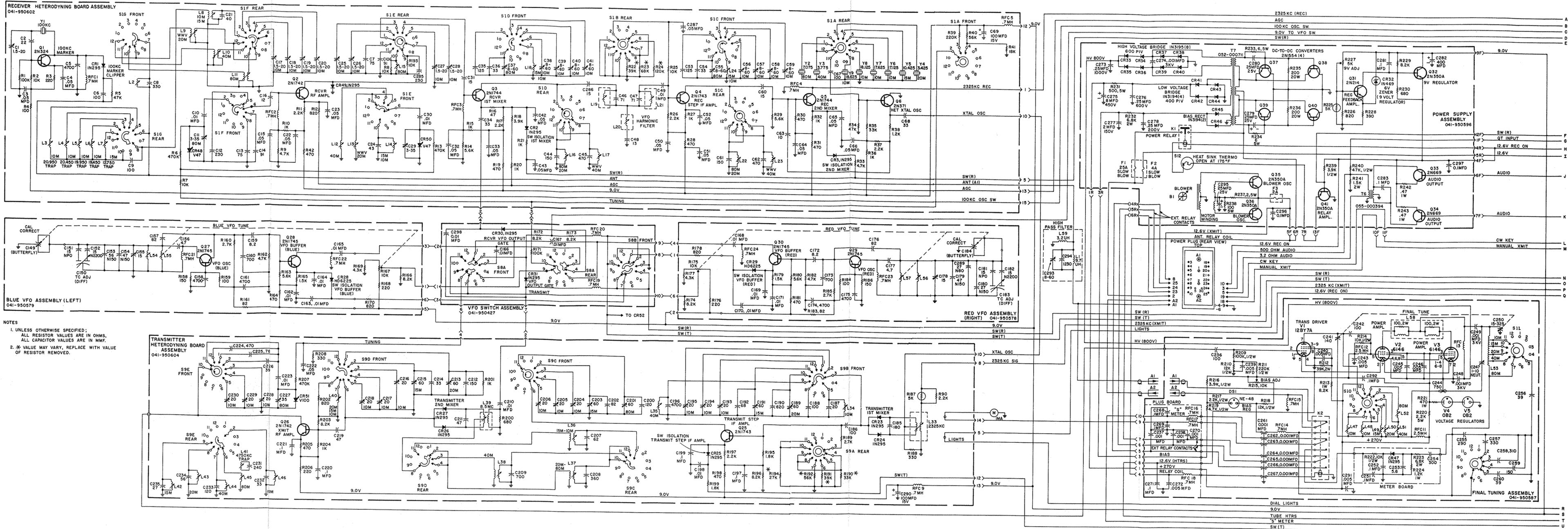


Figure 24A. Schematic Diagram of the FPM-200 (Sheet 1 of 2).

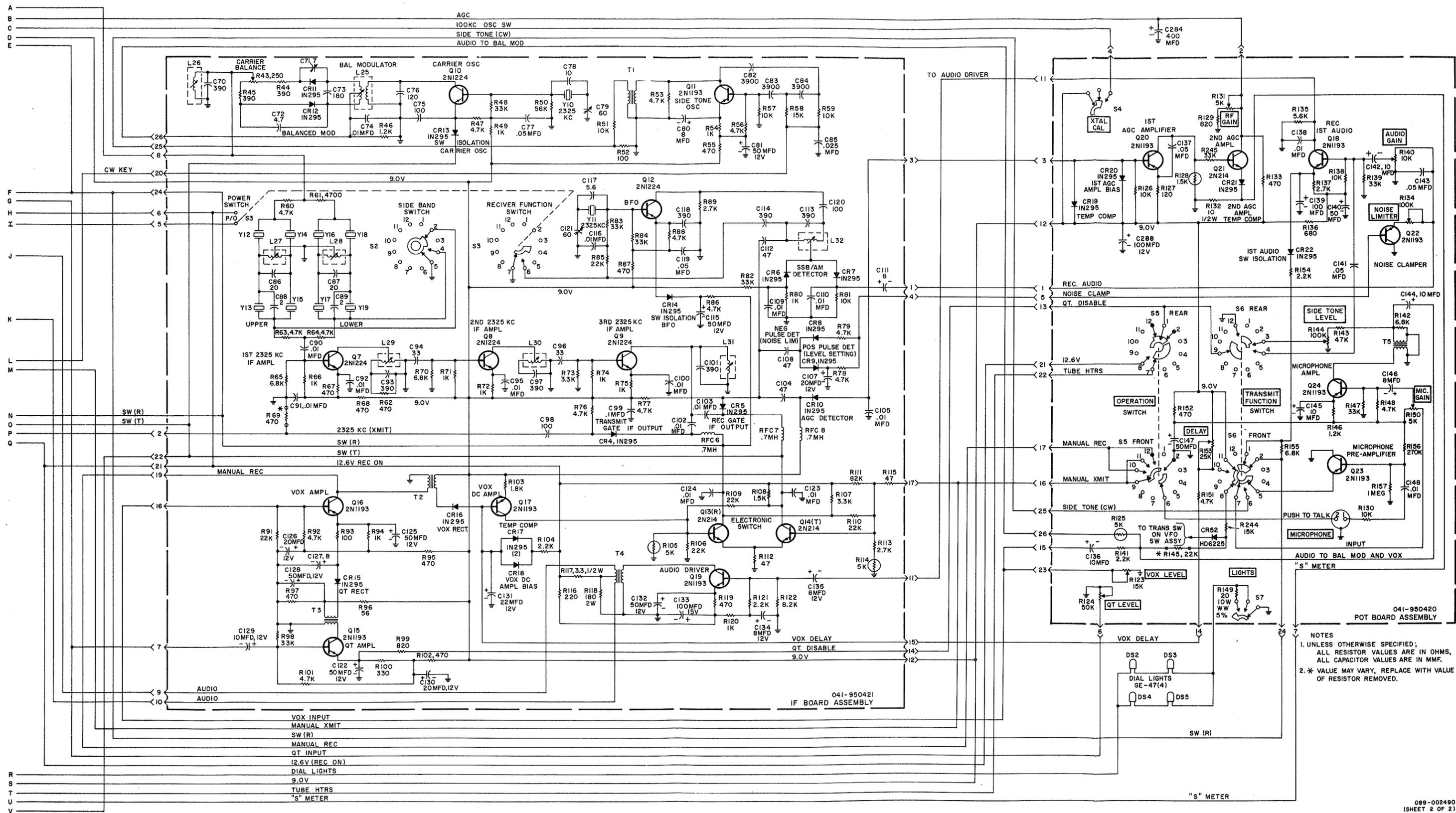


Figure 24B. Schematic Diagram of the FPM-200 (Sheet 2 of 2).