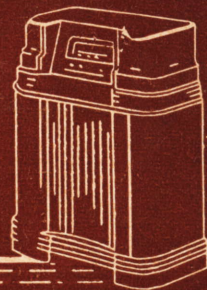


PHILCO SERVICE

HOME RADIO



PHILCO RADIO MODEL 410

Circuit Description

Philco Model 410 is a portable four-tube super-heterodyne providing reception on the standard-broadcast band. A high-impedance loop within the cabinet normally provides adequate signal pickup. However, provisions have been made for connecting an external aerial, if required.

The aerial circuit works directly into a 1R5 converter, where the incoming signal is converted to the 460-kc. intermediate frequency. A 1T4 is used in a single high-gain stage of i-f amplification, which employs neutralization to suppress oscillation. A 3-mmf. condenser, C304, feed parts of the i-f voltage, of the proper phase, back to the 1T4 grid through the tube-socket capacitance.

A 1U5 diode-pentode is used in the detector, a-v-c, and first audio circuits. Then pentode section is resistance-coupled to a 3V4 pentode output amplifier, which works into a p-m speaker.

The operating voltages are obtained from a battery pack, Philco type P-361.

Philco TROUBLE-SHOOTING Procedure

For rapid trouble shooting, the radio circuit is divided into four sections, with test points specified for each section; these sections and test points are indicated in the schematic diagram. The trouble-shooting procedure given for each section includes a simplified test chart and a bottom view of the chassis showing the locations of the test points and the components of that section.

In each chart, the first step is a master check for determining whether trouble exists in that section, without going through the entire chart.

Failure to obtain the "NORMAL INDICATION" in any given step indicates trouble within the circuit under test.

After isolating the trouble to a single stage, the defect is located by: first, testing the tube; second, measuring tube electrode voltages; third, measuring circuit resistances; fourth, substituting condensers. The trouble revealed should be corrected before testing further.

Preliminary Checks

To avoid possible damage to the radio, the following preliminary checks should be made before turning on the power:



MODEL 410

SPECIFICATIONS

CABINET	Molded Polystyrene (maroon, Four-tube superheterodyne)
CIRCUIT	tan, ivory, or green)
FREQUENCY RANGE	540-1600 kc.
AUDIO OUTPUT	160 milliwatts
OPERATING VOLTAGES	"B"; 90 volts; "A", 7.5 volts
POWER CONSUMPTION	"B", 13 ma. at 90 volts; "A", 50 ma. at 7.5 volts.
AERIAL	Built-in high-impedance loop; terminal also provided for external aerial
INTERMEDIATE FREQUENCY	460 kc.
PHILCO TUBES (4)	1R5, 1T4, 1U5, 3V4
BATTERY TYPE	Philco P-361

TP-4523

1. Inspect both the top and the bottom of the chassis. Make sure that all tubes are secure in the proper sockets, and look for any broken or shorted connections, burned resistors, or other obvious sources of trouble.

2. Check the total filament resistance, with the power switch turned on, and the battery plug disconnected from the battery. If the resistance between the A+ and A- pins on the battery plug is higher than 100 ohms, one of the tube filaments is probably open.

Note: If the 3V4 filament is open, check condenser C203B before replacing the tube.

3. Measure the resistance between the B+ and B- pins on the battery plug. If the reading is lower than 5000 ohms, check condenser C203A for leakage or a short.

The resistance value above, which is much lower than normal, does not represent a quality check of this condenser; it is the lowest value which will permit the voltage checks of Section 1 (power supply) to be performed without excessive battery drain.

Section 1—Power Supply

Make the tests for this section with a d-c voltmeter. Connect the negative lead to the chassis, test point C; connect the positive lead to the test points indicated in the chart. The voltage readings given were taken with a 20,000-ohms-per-volt meter, with a new battery pack.

Set the volume control to minimum.

The battery pack should be replaced when the "A" voltage drops below 5 volts, or the "B" voltage drops below 60 volts.

If the "NORMAL INDICATION" is obtained in step 1, proceed with the tests for Section 2 (audio circuits); if not, isolate and correct the trouble in this section.

TROUBLE SHOOTING

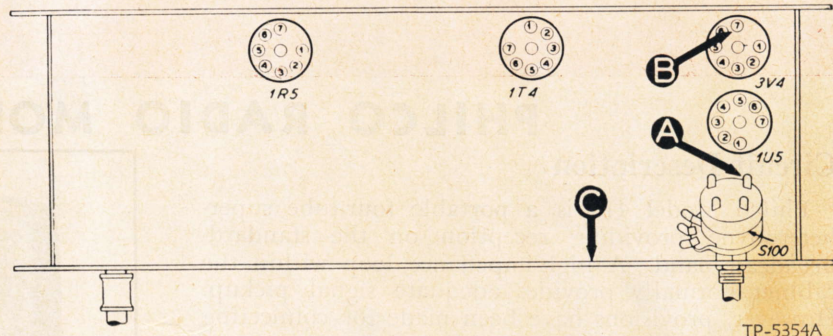


Figure 1. Bottom View, Showing Section 1 Test Points

TP-5354A

STEP	TEST POINT	NORMAL INDICATION	ABNORMAL INDICATION	POSSIBLE CAUSE OF ABNORMAL INDICATION
1 (a) 1 (b)	A B	90v 7.5v		Trouble in this section. Isolate by the following tests.
2	A	90v	Low voltage No voltage	Weak battery. Leaky: C203A*. Defective battery. Open: S100. Shorted: C203A*.
3	B	7.5v	No voltage Low voltage	Weak battery. Leaky: C203B*. Defective battery. Shorted: C203B*. Open: S100.

*This part, located in another section, may cause abnormal indication in this section.

Section 2—Audio Circuits

For the tests in this section, use an audio-frequency signal generator. Connect the generator ground lead to the chassis, test point C; connect the output lead through a .1-mf. condenser to the test points indicated in the chart.

Set the radio volume control to maximum.

If the "NORMAL INDICATION" is obtained in step 1, proceed with the tests for Section 3 (i-f, detector, and a-v-c circuits); if not, isolate and correct the trouble in this section.

TROUBLE SHOOTING

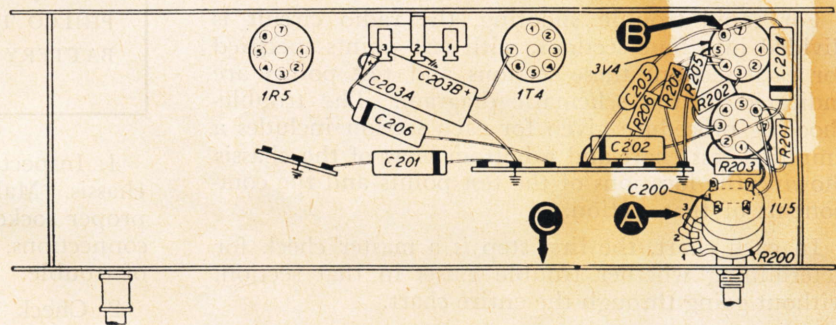


Figure 2. Bottom View, Showing Section 2 Test Points

TP-5354B

STEP	TEST POINT	NORMAL INDICATION	POSSIBLE CAUSE OF ABNORMAL INDICATION
1	A	Loud, clear speaker output with moderate generator input.	Trouble in this section. Isolate by the following tests.
2	B	Clear output with strong input.	Defective: 3V4, LS200. Open: R204, R205, T200. Shorted: C204, C205, C206. Leaky: C204.
3	A	Same as step 1.	Defective: 1U5. Open: R200 (rotate), C200, R201, R202, R203, C204. Shorted: C202, C301C*.

Listening Test: Distortion may be caused by leaky C204 or changed resistance of R202. Distortion on strong signals may be caused by leaky or shorted C200.

*This part, located in another section, may cause abnormal indication in this section.

Section 3—I-F, Detector, and A-V-C Circuits

TRUBLE SHOOTING

For the tests in this section, use an r-f signal generator, with modulated output, set at 460 kc. Connect the generator ground lead to the chassis, test point C; connect the output lead through a .1-mf. condenser to the test points indicated in the chart.

Set the radio volume control to maximum.

If the "NORMAL INDICATION" is obtained in step 1, proceed with the tests for Section 4 (r-f and converter circuits); if not, isolate and correct the trouble in this section.

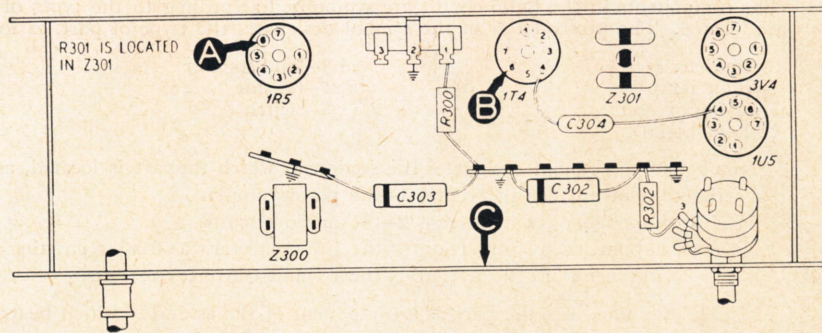


Figure 3. Bottom View, Showing Section 3 Test Points TP-5354C

To provide a complete i-f-amplifier check, test point A for this section is placed at the grid of the mixer in Section 4; therefore, the effectiveness of step 1 as a master check is dependent upon the condition of certain parts in the mixer circuit. These parts are listed below under "POSSIBLE CAUSE OF ABNORMAL INDICATION."

STEP	TEST POINT	NORMAL INDICATION	POSSIBLE CAUSE OF ABNORMAL INDICATION
1	A	Loud, clear speaker output with weak generator input.	Trouble in this section. Isolate by the following tests.
2	B	Loud, clear output with moderate input.	Defective: 1T4, 1U5 (diode section). Misaligned: Z301. Open: R300, C303, L301A, R301, L301B, C301A. Shorted: C300B, C303, L301A, L301B, C301A, C301B.
3	A	Same as step 1.	Defective: 1R5*. Misaligned: Z300. Open: C300A, L300A, L300B, C300B, T400*. Shorted: C400A*, C400B*, C300A, L300A, L300B.

*This part, located in another section, may cause abnormal indication in this section.

Section 4—R-F and Converter Circuits

TRUBLE SHOOTING

For the tests in this section, with the exception of the oscillator test, use an r-f signal generator with modulated output. Connect the generator ground lead to the chassis, test point C; connect the output lead through a .1-mf. condenser to the test points indicated in the chart.

Set the radio volume control to maximum. Set the tuning control and signal-generator frequency as indicated in the chart.

If the "NORMAL INDICATION" is obtained in step 1, further tests should be unnecessary; if not, isolate and correct the trouble in this section. If the trouble is not revealed by the tests for this section, check the alignment.

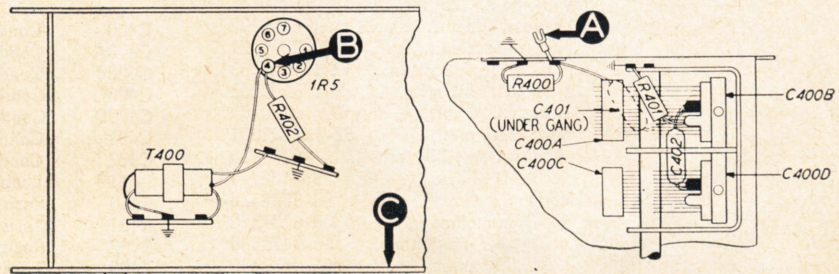


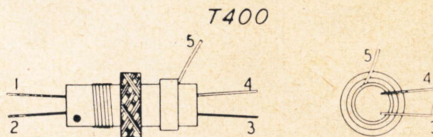
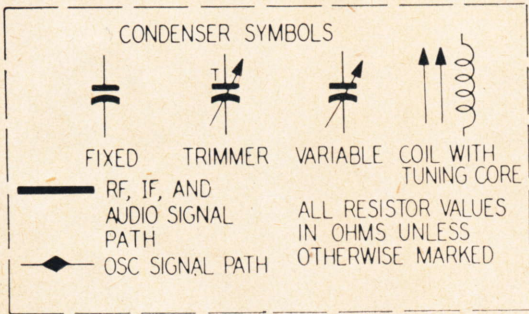
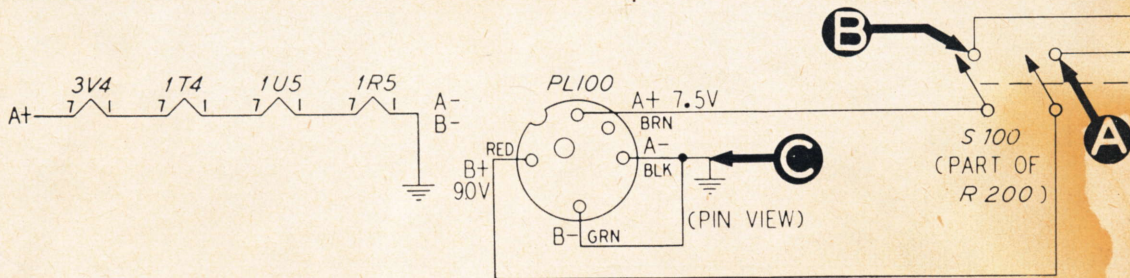
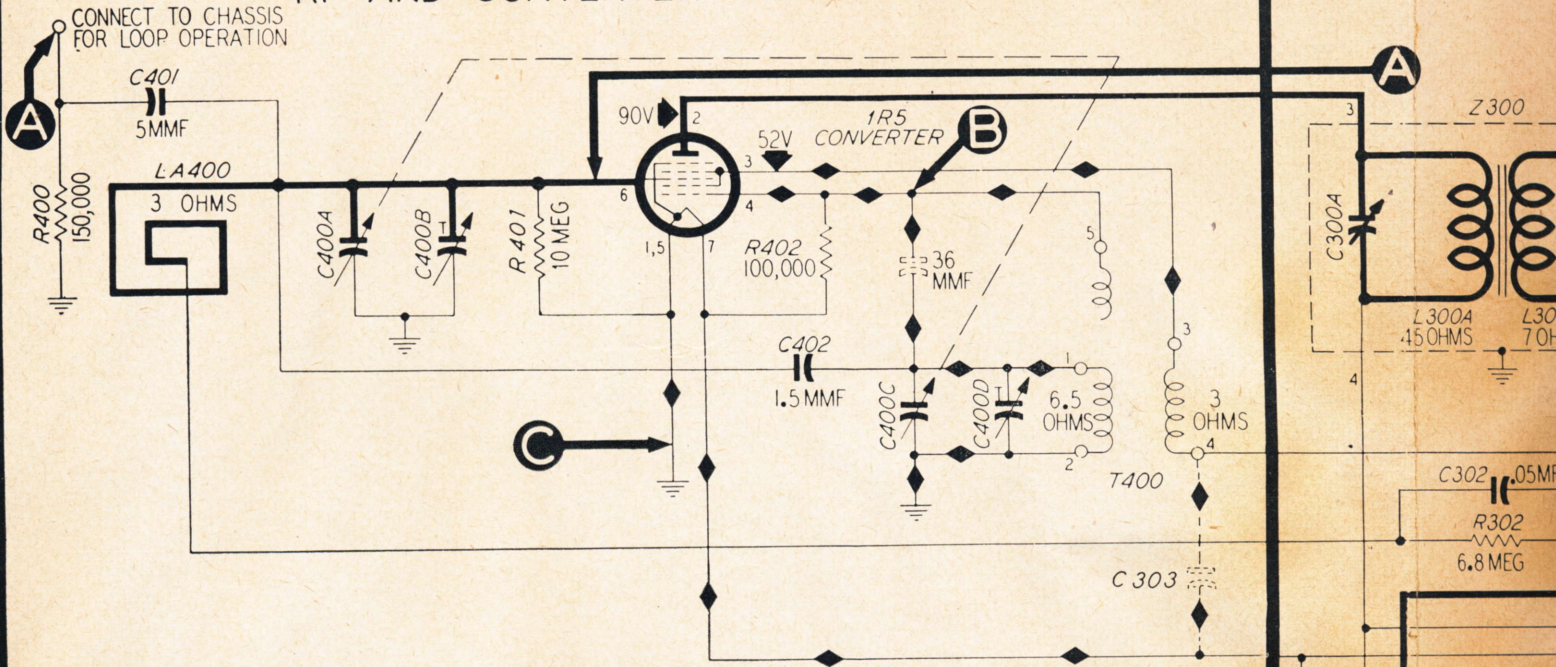
Figure 4. Bottom View, Showing Section 4 Test Points TP-5354D

STEP	TEST POINT	SIGNAL GEN. FREQUENCY	RADIO TUNING	NORMAL INDICATION	POSSIBLE CAUSE OF ABNORMAL INDICATION
1	A	1000 kc.	Tune to signal.	Loud, clear speaker output with weak generator input.	Trouble in this section. Isolate by the following tests.
2	B (Osc. test; see note below.)		Rotate through range.	Negative 5 to 10 volts.	Defective: 1R5. Open: R402, T400. Leaky: C303*. Shorted: C400C, C400D.
3	A	1000 kc.	Tune to signal.	Same as step 1.	Open: C401, R401, LA400.

Listening Test: Distortion may be caused by open R401. Instability may be caused by open C302* or C303*.

*This part, located in another section, may cause abnormal indication in this section.

SECTION 4 RF AND CONVERTER CIRCUITS



SECTION 1 POWER SUPPLY

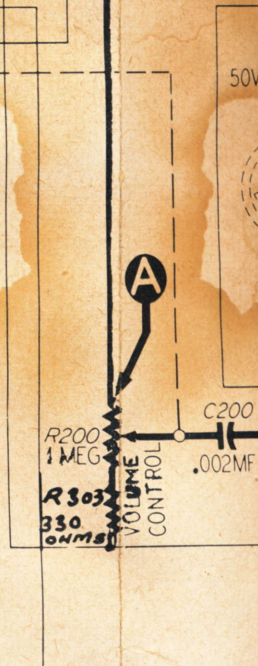
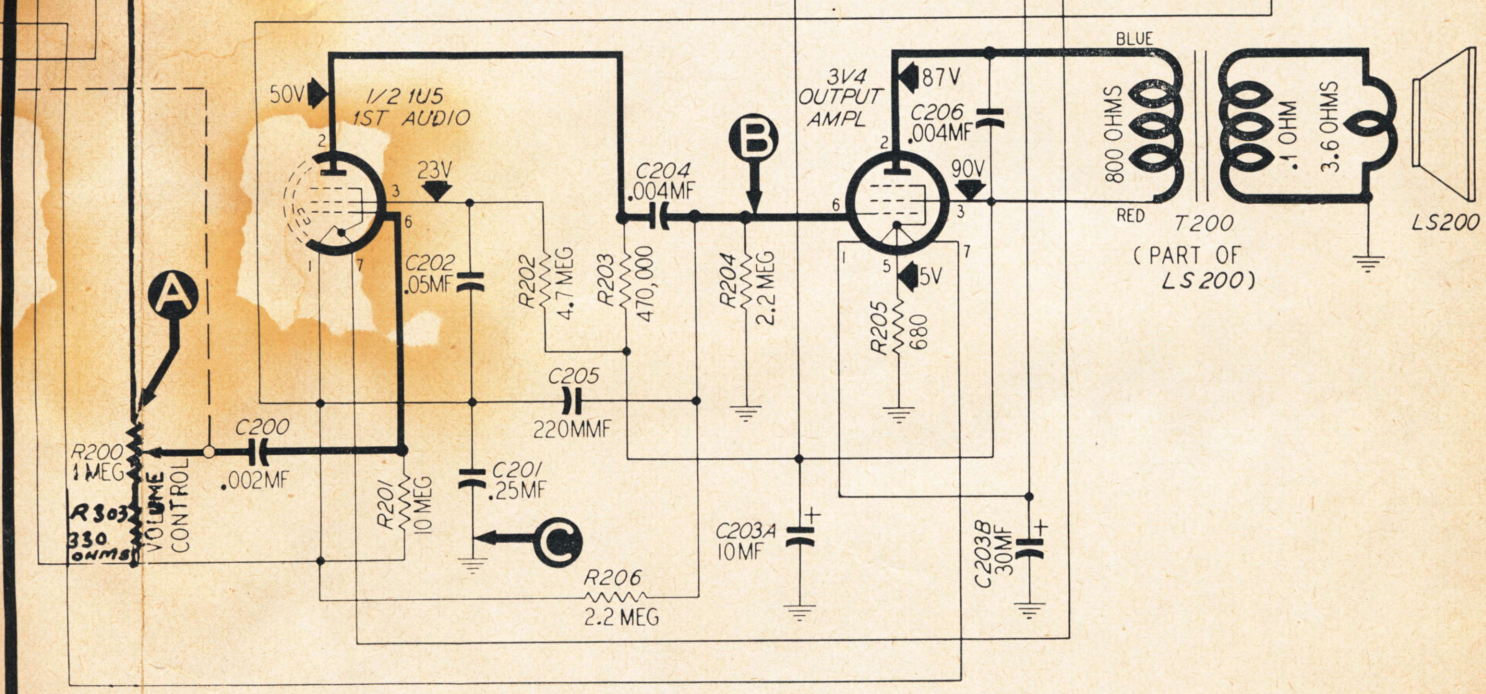
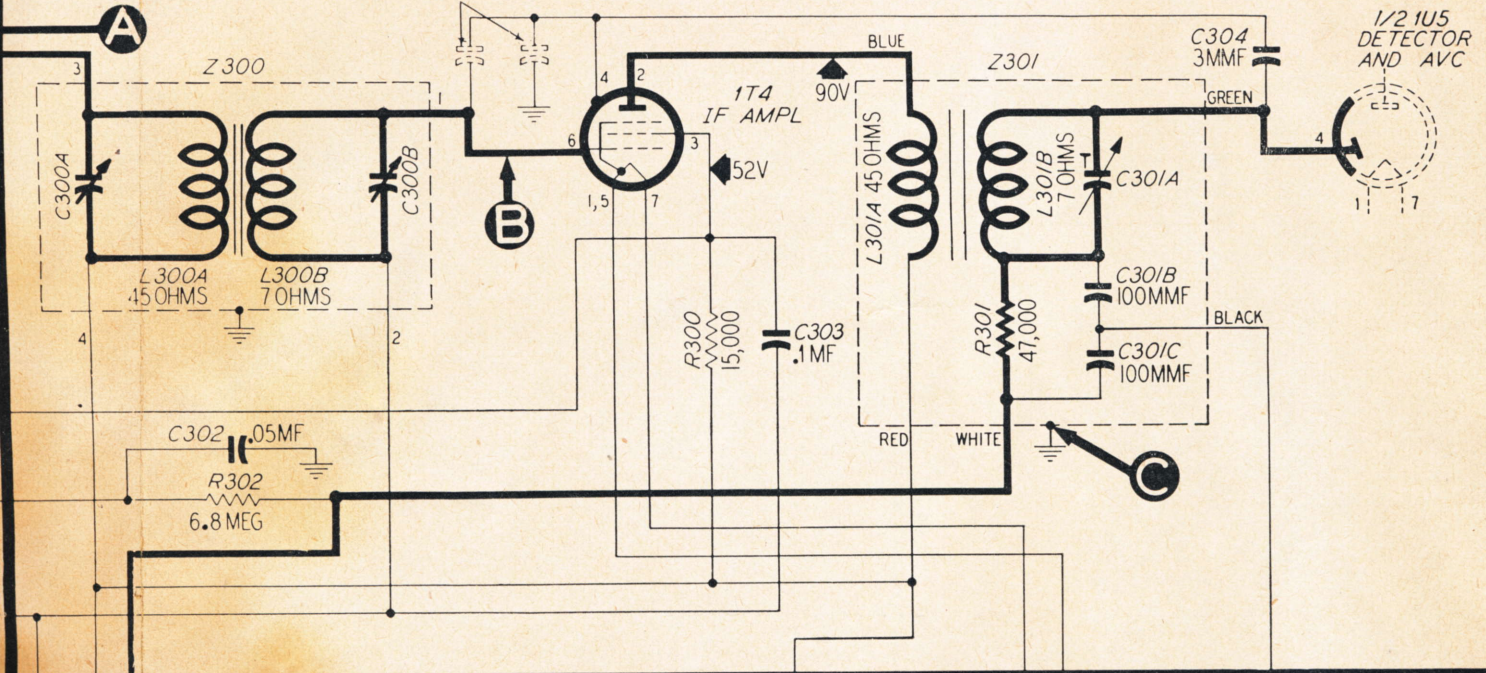


Figure 5. Philco Model 410, Sectionalized Schematic Diagram. OSCILLATOR TEST: Connect the positive lead of a high-resistance voltmeter to the chassis, test point C; connect the prod end of the negative lead to the antenna coil, such as 0-10 volts. Proper operation of the oscillator is indicated by negative voltage within the range given in the chart (measured with a 20,000-ohms-impedance voltmeter).

SECTION 3 IF, DETECTOR, AND AVC CIRCUITS

SOCKET CAPACITANCE



SECTION 2-AUDIO CIRCUITS

Sectionalized Schematic Diagram, Showing Test Points
 od end of the negative lead through a 100,000-ohm isolating resistor to the oscillat or grid (pin 4 of the 1R5), test point B. Use a suitable meter range, (measured with a 20,000-ohms-per-volt meter) throughout the tuning range.

DIAL—Calibration and pointer-index measurements are shown in figure 7. With tuning condenser fully meshed, set pointer to index mark.

RADIO CONTROLS—Set volume control to maximum.

OUTPUT METER—Connect across voice-coil terminals.

SIGNAL GENERATOR—Use modulated output.

STEP	SIGNAL GENERATOR		RADIO		ADJUST
	CONNECTION TO RADIO	DIAL SETTING	DIAL SETTING	SPECIAL INSTRUCTIONS	
1	Ground lead to chassis. Positive lead through .05-mf. condenser to external-aerial lead. Make sure that radio loop aerial is connected to radio.	460 kc.	Tuning condenser fully meshed.	Adjust, in order given, for maximum output.	C301A—2nd i-f sec. _____ C300B—1st i-f sec. _____ C300A—1st i-f pri. _____
2	Radiating loop (see note below).	1600 kc.	1600 kc.	Adjust for maximum output.	C400D—osc. _____
3	Same as step 2.	1500 kc.	1500 kc.	Adjust for maximum output while rocking tuning condenser.	C400B—aerial _____

RADIATING LOOP: Make up a 6—8 turn, 6-inch-diameter loop, using insulated wire; connect to signal-generator leads and place near radio loop aerial. Make sure that radio loop aerial is connected to radio.

CALIBRATING DIAL BACKPLATE

When the radio chassis has been removed from the cabinet, dial calibration and alignment points may be marked on the dial (chassis) backplate at the end of the pointer with a pencil. The method of measuring for these points is illustrated in figure 7.

With the tuning gang fully meshed, the pointer should be adjusted on the dial-drive cord to coincide with the index mark.

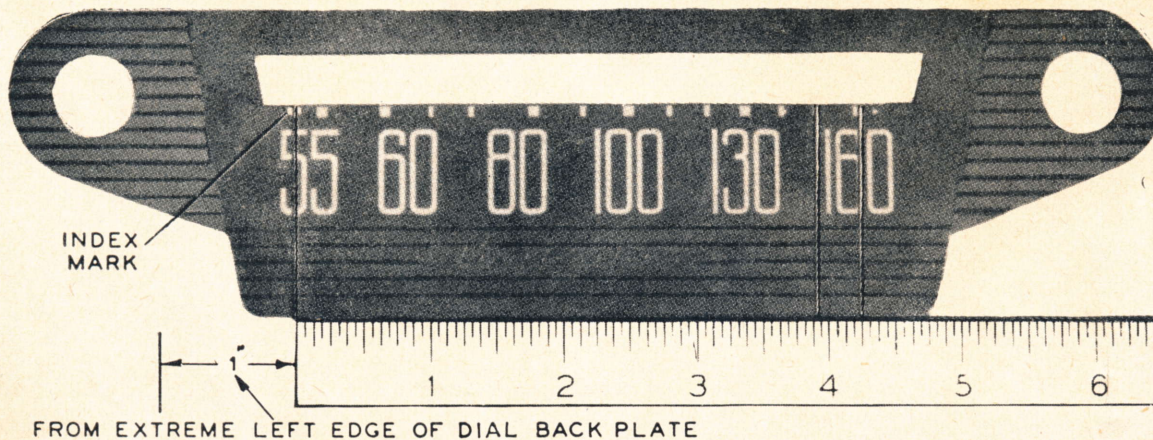


Figure 7. Dial-Backplate Calibration Measurements

1P 5776

SYMBOLIZATION

The components in the radio circuit are symbolized according to the types of parts and the section of the radio in which the parts are located. The prefix letter of the symbol designates the type of part, as follows:

- | | | |
|-----------------|-----------------|-----------------------|
| C—condenser | LS—loud-speaker | T—transformer |
| I—pilot lamp | R—resistor | W—line cord |
| L—choke or coil | S—switch | Z—electrical assembly |
| LA—loop aerial | | |

The number of the symbol designates the section in which the part is located, as follows:

- 100-series components are in Section 1—the power supply.
- 200-series components are in Section 2—the audio circuits.
- 300-series components are in Section 3—the i-f, detector, and a-v-c circuits.
- 400-series components are in Section 4—the r-f and converter circuits.

A suffix letter identifies the part as a component of the assembly which bears an identical number without a suffix letter, and with perhaps a different prefix letter.

REPLACEMENT PARTS LIST

NOTE: Part numbers identified by an asterisk(*) are general replacement items. These numbers may not be identical with those on factory assemblies; also, the electrical values of some replacement items may differ from the values indicated in the schematic diagram and parts list. The values substituted in any case are so chosen that the operation of the radio will be either unchanged or improved. When ordering replacements, use only the "Service Part No."

SECTION 1
POWER SUPPLY

Reference Symbol	Description	Service Part No.
PL100	Battery-cable-and-plug assembly	41-3712-3
S100	Switch, on-off	Part of 33-5538-28

SECTION II
AUDIO CIRCUITS

C200	Condenser, d-c blocking, .002 mf.	61-0162*
C201	Condenser, filament by-pass, .25 mf.	61-0125*
C202	Condenser, screen by-pass, .05 mf.	61-0122*
C203	Condenser, electrolytic, 2-section	30-2575-21
C203A	Condenser, by-pass, 10 mf.	Part of C203
C203B	Condenser, filament by-pass, 30 mf.	Part of C203
C204	Condenser, d-c blocking, .004 mf.	61-0179*
C205	Condenser, r-f by-pass, 220 mmf.	62-122001001*
C206	Condenser, tone compensation, .004 mf.	61-0179*
LS200	Loud-speaker, p-m	36-1627-1
R200	Volume control, 1 megohm	33-5538-28
R201	Resistor, grid return, 10 megohms	66-6103340*
R202	Resistor, screen dropping, 4.7 megohms	66-5473340*
R203	Resistor, plate load, 470,000 ohms	66-4473340*
R204	Resistor, grid return, 2.2 megohms	66-5223340
R205	Resistor, bias, 680 ohms.	66-1683340*
R206	Resistor, bias voltage divider, 2.2 megohms	66-5223340
T200	Transformer, output	Part of LS200

SECTION III
I-F, DETECTOR, AND A-V-C CIRCUITS

C300A	Condenser, shunt	Part of Z300
C300B	Condenser, shunt	Part of Z300
C301A	Condenser, trimmer	Part of Z301
C301B	Condenser, filter	Part of Z301
C301C	Condenser, filter	Part of Z301
C302	Condenser, a-v-c filter, .05 mf.	61-0122*
C303	Condenser, screen by-pass, .1 mf.	61-0113*
C304	Condenser, neutralizing, 3 mmf	30-1221
L300A	Transformer primary, 1st i-f	Part of Z300
L300B	Transformer secondary, 1st i-f	Part of Z300
L301A	Transformer primary, 2nd i-f	Part of Z301
L301B	Transformer secondary, 2nd i-f	Part of Z301
R300	Resistor, screen dropping, 15,000 ohms	66-3153340*

SECTION III (Continued)
I-F, DETECTOR, AND A-V-C CIRCUITS

Reference Symbol	Description	Service Part No.
Z301	Resistor, filter, 470,000 ohms (Part of Z301)	66-3473340*
R302	Resistor, a-v-c filter, 6.8 megohms	66-5103340*
R303	Resistor, 330 ohms	66-1333340*
Z300	Transformer, 1st i-f	32-3968-5
Z301	Transformer, 2nd i-f	32-3987-2

SECTION IV
R-F AND CONVERTER CIRCUITS

C400	Condenser, tuning gang	31-2727-2
C400A	Condenser, tuning, aerial section	Part of C400
C400B	Condenser, trimmer, aerial	Part of C400
C400C	Condenser, tuning, oscillator section	Part of C400
C400D	Condenser, trimmer, oscillator	Part of C400
C401	Condenser, isolating, 5 mmf.	30-1224-5*
C402	Condenser, neutralizing, 1.5 mmf.	30-1221-3
LA400	Loop aerial	32-4274
R400	Resistor, leakage, 150,000 ohms	66-4153340*
R401	Resistor, grid return, 10 megohms	66-3103340*
R402	Resistor, oscillator bias, 100,000 ohms	66-4103340*
T400	Transformer, oscillator	32-4282

MISCELLANEOUS

Description	Service Part No.
Cabinet and Cabinet Parts	
Cabinet (M), maroon	10703
Cabinet (T), tan	10703A
Cabinet (I), ivory	10703B
Cabinet (G), green	10703C
Handle	76-3742
Terminal, aerial strip	76-3674
Dial-Scale Hardware	
Dial-backplate assembly	56-5425FCP
Drive cord, 25-foot spool	45-8750*
Pointer	56-4362-2FCP
Spring, drive-cord	56-2617
Knob (M)	54-4557
Knob (T)	54-4557-1
Knob (I)	54-4557-2
Knob (G)	54-4557-3
Socket, tube, miniature	27-6203