HEWLETT-PACKARD COMPANY
Laboratory Instruments for Speed and Accuracy
CUSTOMER SERVICE
395 PAGE MILL ROAD, PALO ALTO, CALIFORNIA 94306
AREA CODE 415 · PHONE 326-3950

July 31, 1964

Mr. R. J. Rockwell
Crosley Broadcasting Corporation
140 W. Ninth Street
Cincinnati 2, Ohio

Reference: Letter dated July 23, 1964

Dear Mr. Rockwell:

You will be happy to know that we here at Hewlett-Packard will be able to provide you with the obsolete tubes that you require for your Hewlett-Packard Model 200CD Oscillators.

As you no doubt know, the Hewlett-Packard Model 200CD has been modified to use later version tubes. Even though it is somewhat difficult to obtain the older version tubes, it is felt here that modification of older units to utilize the new tube lineup would be much too expensive to be practical. Enclosed, Mr. Rockwell, are all available Service Notes covering the Hewlett-Packard 200CD Oscillator. I am sure that you have some or all but just to make sure your files are up to date, a complete set has been enclosed.

In Service Note 200CD-4D, in section 2 paragraph 3, is a discussion of the feedback circuit. In this discussion the compromise that is necessary for the setting of R11 will perhaps best answer the question as to whether any ill effects will be found with your setting.

Located nearby to you, Mr. Rockwell, in Dayton, Ohio, is the Hewlett-Packard Crossley Sales Division. If you will contact Mr. Fred Bliss at the Dayton office, he will be most happy to provide any assistance that you may require on this or any other Hewlett-Packard instrumentation.

Please let us know how we may best be of service to you.

Sincerely,
HEWLETT-PACKARD COMPANY

Paul Gearhart

Paul Gearhart
Customer Service

PG/js
Enclosure

cc: Crossley Sales Division
1250 W. Dorothy Lane
Dayton, Ohio
Phone: 299-3594

SERVICE NOTES

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ⓗp MODEL 200CD WIDE RANGE OSCILLATOR 200CD-1B

RANGE SWITCH REPLACEMENT

Range switches used in the ⓗp Model 200CD Wide Range Oscillator have been of three types. When replacement is necessary, use the same type switch as originally installed in your instrument. You can determine the ⓗp Stock No. for the correct replacement switch by the serial number of the instrument, as listed below.

To replace the range switch in the ⓗp Model 200CD, it is only necessary to disconnect a few wires, remove the switch assembly, and install the replacement switch assembly. No special tools are needed.

Usually no adjustments are required after replacing a range switch.

Instrument Serial No.	Schematic	Range Switch ⓗp Stock No.
1 thru 833	Figure 1	200CD-19W
834 thru 853	Figure 2	200CD-19WA
854 thru 903	Figure 1	200CD-19W
904 thru 3637	Figure 2	200CD-19WA
3638 thru 30635	Figure 3	200CD-19WB
With prefix 103-	Figure 4	200CD-19WB

INSTALLATION PROCEDURE

1) Disconnect power.

2) Remove the two Phillips screws from the rear of the instrument. Turn the instrument face down on a flat surface, taking care not to damage knobs or frequency dial. Slide cabinet up and off. Turn instrument on one side so that range switch is accessible.

3) Disconnect wires from the range switch. Important: Note wire colors and connections.

4) Loosen the two Allen setscrews on the range switch knob. Remove knob from switch.

5) If you are installing an ⓗp Stock No. 200CD-19W Range Switch (instruments with serial numbers 1 through 833 and 854 through 903) and if the output transformer T2 in your instrument is marked "ⓗp Stock No. 912-38", replace the two 100-ohm, 1/2-watt resistors for R37 and R38, on the rear wafer of the replacement range switch, with 200 ohms ±5%, 1/2-watt resistors.

6) Install the replacement range switch with lockwasher behind panel, being careful not to damage any components.

CAUTION: Position switch so that precision resistors will not touch cabinet. Position resistors so they will not touch adjacent mounting lugs on the switch.

7) Install and tighten mounting nut on switch. Connect wires to the same positions disconnected in step 3. This completes the installation.

ADJUSTMENT PROCEDURE

The range switch resistors R1 through R10 and R1A through R10A with the tuning capacitor assembly C3 through C6, and padding capacitors C1, C2, and C7, determine the oscillator frequency and also affect the amplitude. Replacement range switches are factory adjusted, and normally no adjustments are needed when a range switch has been replaced.

If the output frequency is not correct, or if the amplitude varies more than ±1 db from a 1 kc reference, the following adjustment procedure is recommended.

CALIBRATION

Calibration procedure for the 200CD is divided into two basic parts. The first procedure is intended to effect a flat frequency response for the 200CD and is accomplished with the instrument set on the X10 range. The second, accomplished on the X100 range, is given to produce correct frequency dial tracking. Proceed as follows:

A. Frequency Response Adjustments

1) Turn 200CD RANGE to X10, frequency dial to 5.

2) Connect the 200CD to a 400D/H/L AC Voltmeter and a frequency measuring device (counter or frequency standard) as shown in figure 1 or 2.

3) Using 200CD AMPLITUDE, set a reference of 9 volts as read on the 400D/H/L.

4) Turn the frequency dial to 60. The 400D/H/L should read within ±1/4 db of the reference in step 3 and the frequency should be correct within 2%.

5) If 600 cps is off more than 2%, set the frequency on with C6.

Note: Since replacing the cabinet raises the frequency slightly, it is advisable to set the frequency slightly low (e.g., 599 cps) when making this adjustment.

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6) Observe the output voltage and determine how much it differs from the reference.

7) Adjust C3 to correct for half this difference. Then adjust C6 so that the output frequency is again 600 cps.

8) Observe the output voltage. If it is more than ±1/4 db from the reference in step 3 repeat steps 3 through 8 until a flat response is obtained with 600 cps set on frequency (see note above).

B. Frequency Dial Tracking

1) Switch 200CD RANGE to X100. Connect the equipment as shown in figure 1 or 2.

2) Check the frequency at 5. The frequency reading should be 500 cps ±2%. If the frequency is off more than ±2% slip the dial to put it on frequency.

3) If it was necessary to slip the dial, repeat steps A1 through A8.

4) If step B3 was necessary, repeat step B2. It is possible that the entire dial will now track without further adjustment.

5) Check all numbered points on the dial, beginning at the high end. If some points exceed test limits (±2%), try to equalize the error by slipping the dial to get all points within these limits.

a. Remove center knob on frequency dial.

b. Loosen the four screws which secure the dial to the drive shaft.

c. Reset dial to position indicated in the text.

d. Tighten the four securing screws and replace knob.

6) Switch RANGE to X10K, and set the 200CD frequency dial to 60.

7) Adjust C7 to put 600 kc on frequency.

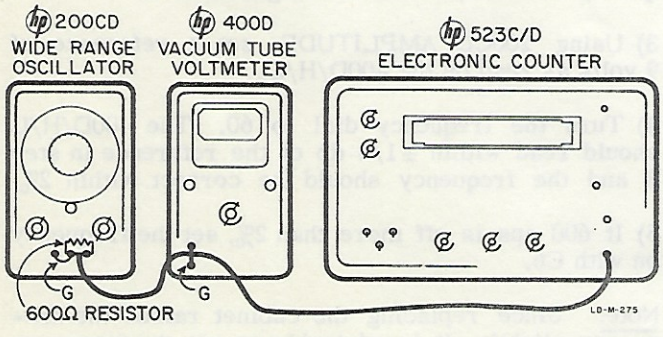


Figure 1. Calibration Test Setup

8) Check calibration on the remaining ranges. Calibration should be correct to ±2%.

Note: It will be advantageous to set the counter FUNCTION SELECTOR to 10 PERIOD AVERAGE when measuring frequency on the X1 range (refer to table 1).

Table 1. Frequency/Period Conversion

Frequency (cps)	Frequency Limits	Period Limits
5	5.1 4.9	196.0 ms 204.0 ms
10	10.2 9.8	098.0 ms 102.0 ms
20	20.4 19.6	049.0 ms 051.0 ms
40	40.8 39.2	024.5 ms 025.5 ms
60	61.2 58.8	016.3 ms 017.0 ms

Finally, if the above procedures do not result in correct calibration, start over by adjusting C3 and/or C6 as in step A1 through A8. Then work toward the low end by setting the dial to the next numbered point and bending one of the outer rotor plates in each section of C5 at the point of mesh. Continue this procedure to the low end of the dial to obtain approximately correct frequencies. Repeat the bending procedure from the high end, this time making fine adjustments of frequency with the other outer rotor plates. In this way, bending of any one plate is minimized.

When bending rotor plates, observe the following precautions: 1) Keep all bends as near the shaft as possible, 2) Keep all segments in line. The rotor plates should taper gradually inward or outward, depending on whether you must compress or expand the frequency range. This gradual taper is essential for linearity, 3) Bending of plates near the high frequency end should be unnecessary.

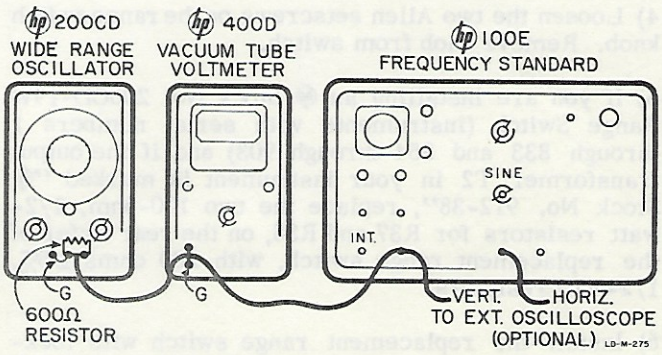


Figure 2. Alternate Calibration Setup

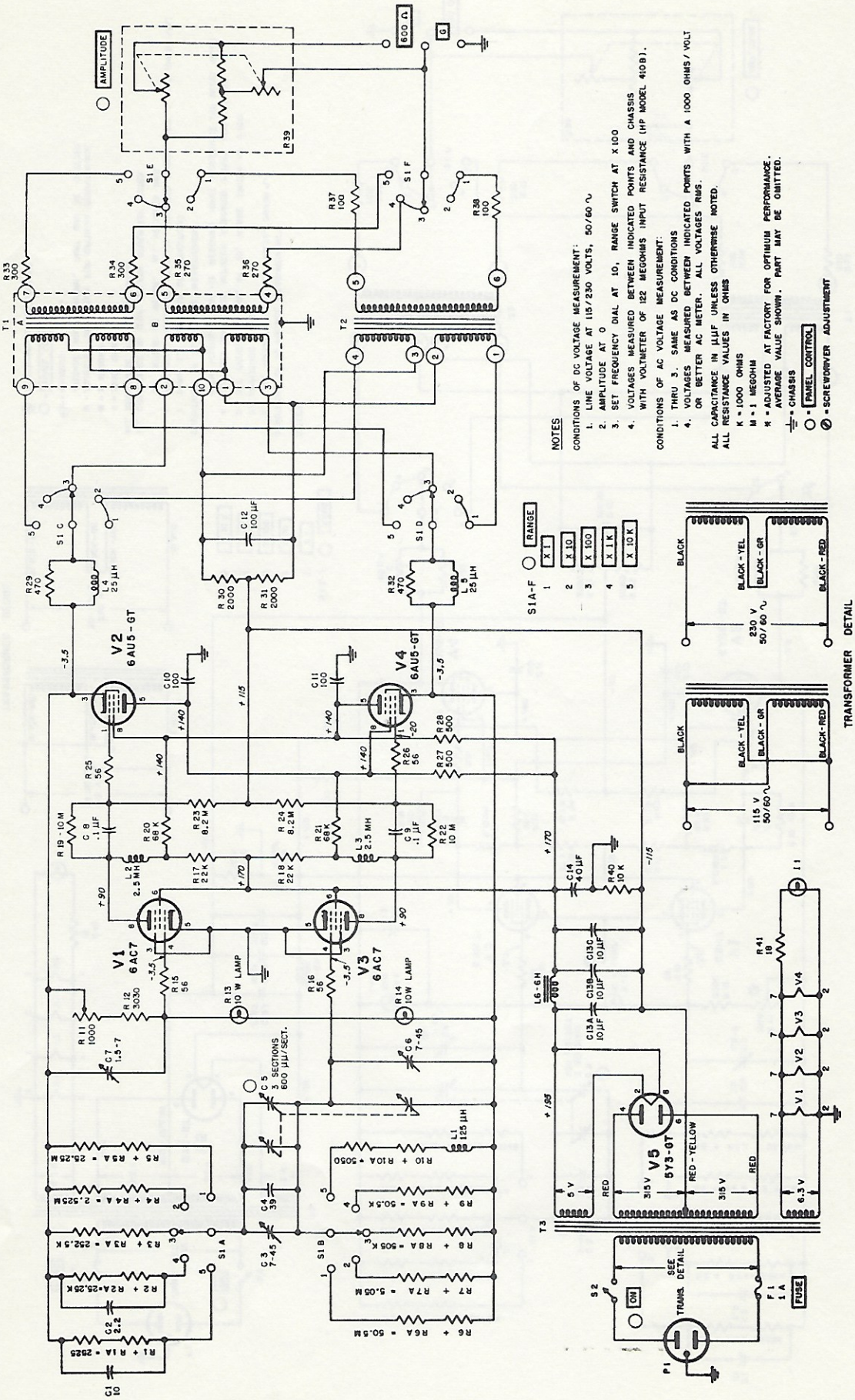
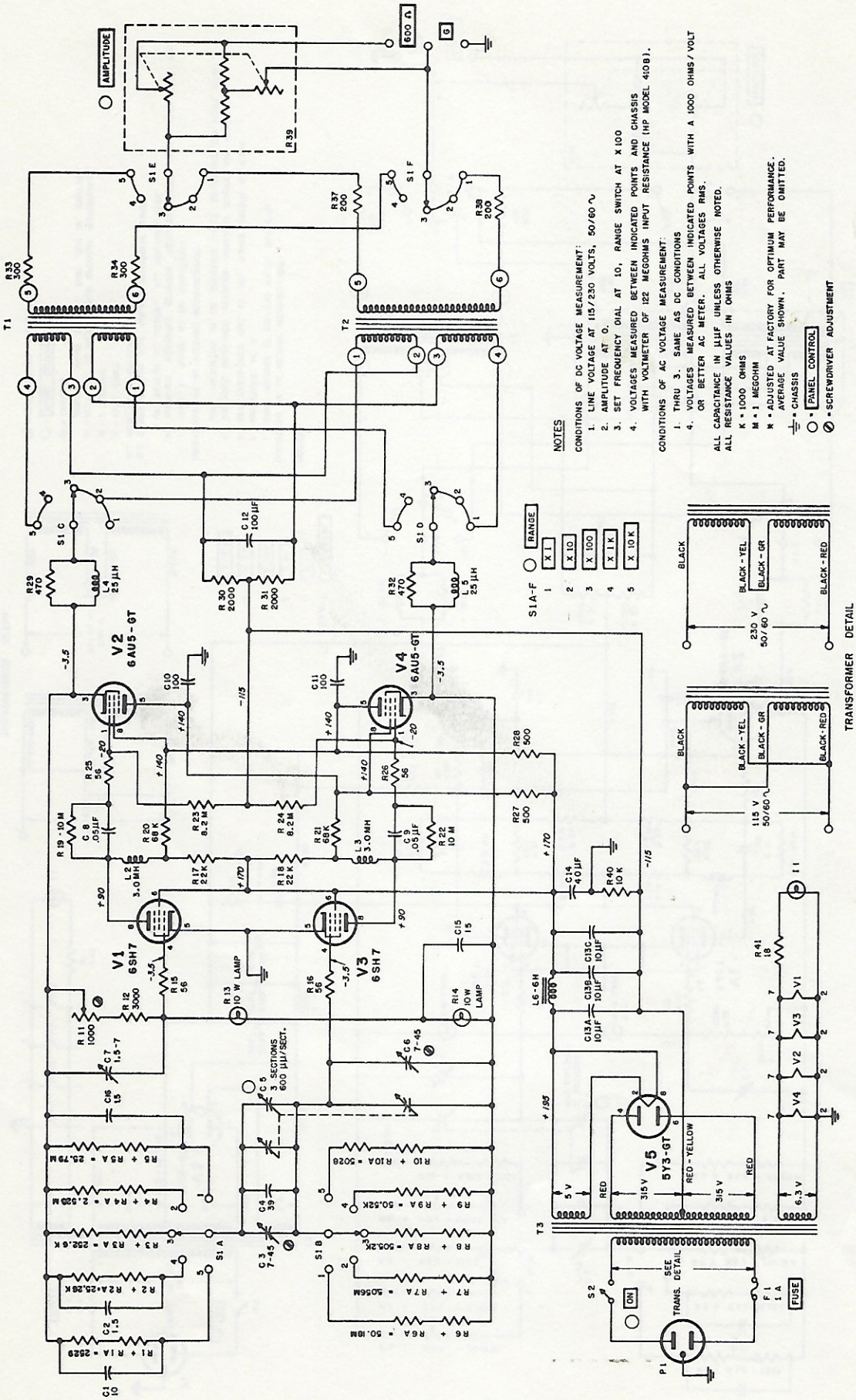


Figure 3. Model 200CD Wide Range Oscillator
Serial 1 through 833 and 854 through 903


AMPLITUDE
600 Ω
G
S1E
S1F
S1C
S1D
S1A-F
RANGE
X 1
X 10
X 100
X 1 K
X 10 K
T1
T2
T3
V1 6SH7
V2 6AU5-GT
V3 6SH7
V4 6AU5-GT
V5 5Y3-GT
NOTES
CONDITIONS OF DC VOLTAGE MEASUREMENT:
1. LINE VOLTAGE AT 115/230 VOLTS, 50/60 ~
2. AMPLITUDE AT 0.
3. SET FREQUENCY DIAL AT 10, RANGE SWITCH AT X 100
4. VOLTAGES MEASURED BETWEEN INDICATED POINTS AND CHASSIS WITH VOLTMETER OF 122 MEGOHMS INPUT RESISTANCE (HP MODEL 410B).
CONDITIONS OF AC VOLTAGE MEASUREMENT:
1. THRU 3. SAME AS DC CONDITIONS
4. VOLTAGES MEASURED BETWEEN INDICATED POINTS WITH A 1000 OHMS/VOLT OR BETTER AC METER. ALL VOLTAGES RMS.
ALL CAPACITANCE IN µµF UNLESS OTHERWISE NOTED.
ALL RESISTANCE VALUES IN OHMS
K = 1000 OHMS
M = 1 MEGOHM
* = ADJUSTED AT FACTORY FOR OPTIMUM PERFORMANCE. AVERAGE VALUE SHOWN. PART MAY BE OMITTED.
⏚ = CHASSIS
○ = PANEL CONTROL
⊘ = SCREWDRIVER ADJUSTMENT
TRANSFORMER DETAIL
BLACK
BLACK - YEL
BLACK - GR
BLACK - RED
230 V 50/60 ~
115 V 50/60 ~
SEE TRANS. DETAIL
ON
FUSE
F1 1A
P1
S2

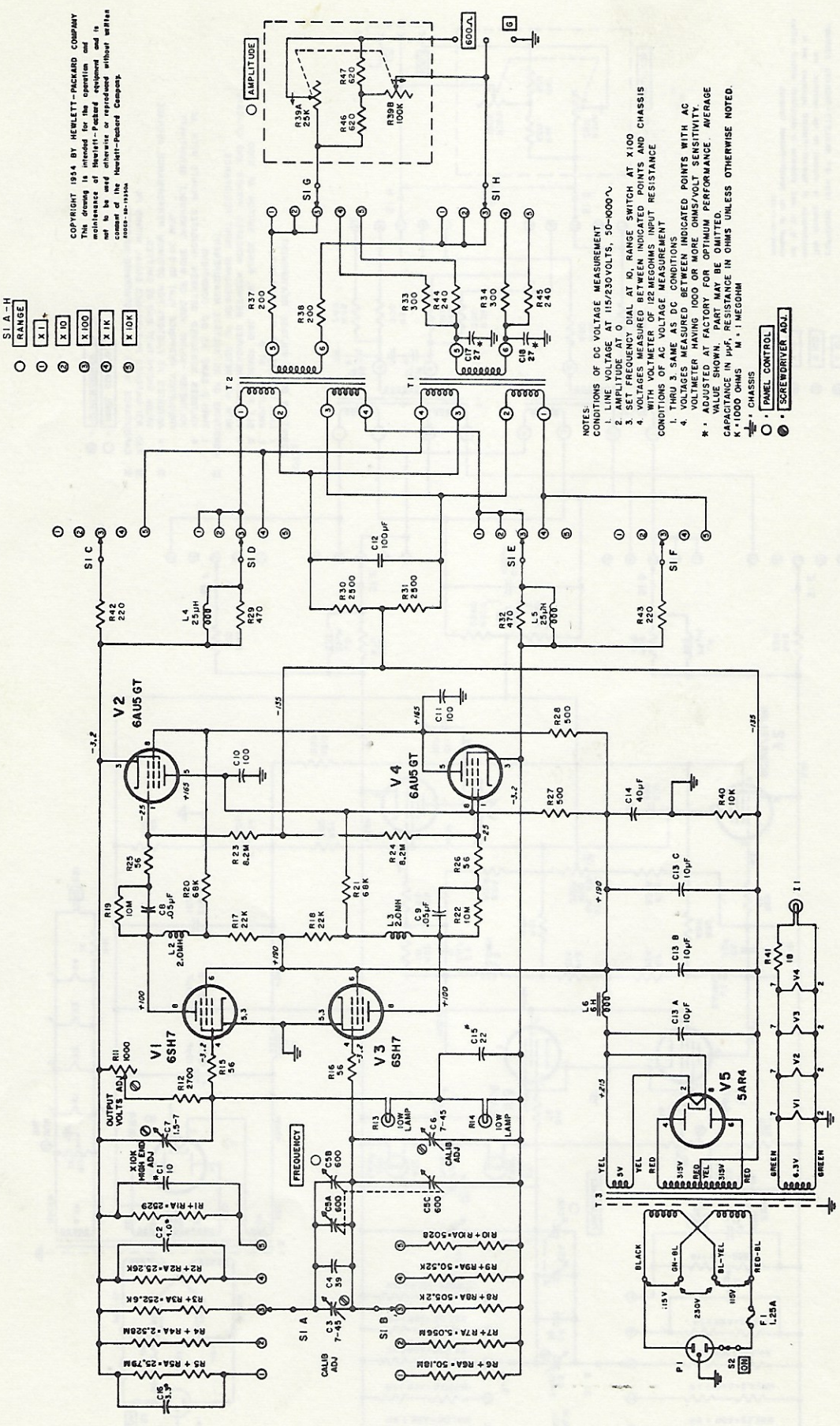


Figure 5. Ⓗ Model 200CD Wide Range Oscillator
Serial 3638 through 30635

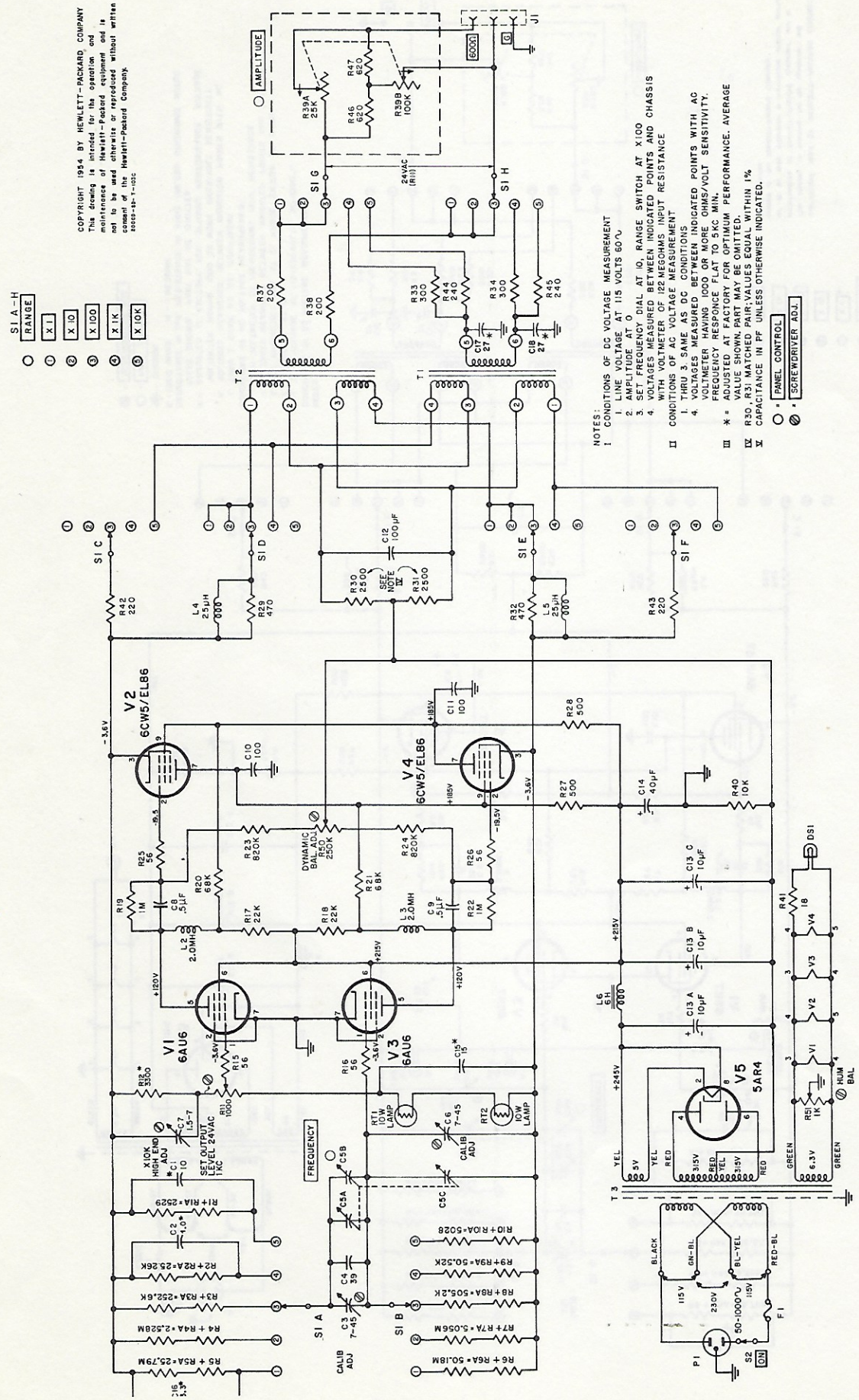


Figure 6. Ⓟ Model 200CD Wide Range Oscillator
Serials Prefixed 103-

SERVICE NOTE

200CD-2

REPLACEMENT OF 6AC7 TUBES IN THE hp MODEL 200CD OSCILLATOR
Serial No. Below 1054

In the Model 200CD with serial numbers below 1054 the 6AC7 tube was used for two positions in the oscillator section. The 6SH7 tube replaces the 6AC7 tube in these two positions because the 6SH7 has a longer useful life, and also generates less distortion.

One of the particular troubles with the 6AC7 was the tendency of this tube to draw grid current and cause oscillation to cease at the lower frequencies. Instruments in which the 6AC7 tubes were used can be modified to use the 6SH7. The actual mechanics of making this change are simple. However, it is necessary to completely test the instrument, recheck the distortion, and realign all frequencies after the change has been made. The procedure follows:

1) Add a 15 $\mu\mu$fd capacitor across the 10-watt lamp R14. This is the lamp connected directly to the cathode of V4.

2) In some instruments using 6AC7's a heater dropping resistor with a value of 0.6 ohm was installed in the filament leads to V1 and V3. This resistor should be removed when 6SH7's are installed, and heater leads run directly to these tubes.*

3) Balance the resistors R30 and R31 to within 1% of each other. The exact value is not important, but they must be balanced to obtain satisfactory distortion. These resistors are the 2000 or 2500 ohm (see Service Note 200CD-3) 10 watt resistors connected in series with the B supply, the output transformer windings, and the cathodes of the 6AU5 or 6AV5GT output tubes.

4) Adjust the frequency at 600 kc for correct dial reading by adjusting C7, the 1.5 to 7 $\mu\mu$fd variable capacitor between the grid of V1 and the cathode of V2.

5) Check the dial calibration on each range. Normally it will remain within specifications but if not, instructions for recalibrating are in the instruction manual on this instrument.

6) Measure the output distortion with 10 volts output in the 600 ohms. Replace tubes or make other repairs as necessary if the distortion is greater than 1%.

7) The frequency response should be checked, but normally it will not be affected by this change.

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*When trouble occurs with the 6AC7 tubes, and it is not practical to replace them with the 6SH7, insert a 0.6 ohm 2 watt resistor so it will be in series with the heaters of both V1 and V3, the 6AC7's. This lower heater voltage reduces the possibility of the tube drawing grid current. This resistor should be used only with 6AC7 tubes and not with 6SH7 tubes.

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SERVICE NOTE

200CD-3A

MODEL 200CD, 200J, AND 202C OSCILLATORS

200CD . . . . SERIAL NO. 8691 AND BELOW
200J . . . . SERIAL NO. 54 AND BELOW
202C . . . . SERIAL NO. 92 AND BELOW

INCREASED RECTIFIER TUBE LIFE

Increased 5Y3GT rectifier tube life can be obtained in the above instrument by changing two resistor values.

The following modification reduces total B+ current through the 5Y3GT rectifier tube without affecting instrument calibration or performance.

Change cathode resistors (R30 and R31 in most instruments) for V2 and V4 type 6AU5GT or 6AV5GT output tubes from 2000 to 2500 ohms, ±7 1/2%. The replacement 10 watt, wirewound resistors must be matched to within 1.0% of each other.

A matched pair of resistors meeting these requirements is available from Hewlett-Packard under Stock No. 200J-26.

In Model 200CD Wide Range Oscillators only, this resistor change must be accompanied by a modification of coils L2 and L3 in the plate circuits of 6SH7 oscillator tubes V1 and V3 respectively. Loosen plastic coil clamp, disconnect coil leads, and remove coil from instrument. Locate outer end of coil, disconnect lead, unwind 108 inches of wire from the coil winding, and resolder coil lead. Replace both coils in plastic clamps and reconnect coil leads to the same terminals. This wire removal changes the coil inductance from 3 to 2.0 millihenrys. Replacement Stock No. 200CD-60C coils will have an inductance of 2.0 mh.

No adjustments are necessary after changing resistors. Modification of coils in the 200CD Oscillator will necessitate adjusting C7 to recalibrate the high end of the X10K range at 600 KC. This ceramic trimmer is the only variable capacitor on the underside of the chassis. Increasing the setting of this capacitor will decrease the output frequency with a given dial setting.

If replacement of the line fuse becomes necessary in any of above instruments, a "slo-blo" type fuse should be used. Install a 1.25 ampere fuse, Stock No. 2110-0021, for operation from 115 volts. Install a 0.6 ampere fuse, Stock No. 2110-0016, for operation from 230 volts.

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SERVICE NOTE

200CD-4D

ℎ MODEL 200CD AUDIO OSCILLATOR
TEST AND ADJUSTMENT PROCEDURES

Here are the procedures for testing and adjusting your ℎ Model 200CD Audio Oscillator should the original adjustments become altered or when there is reason to believe that the performance has been changed.

These procedures are divided into three Sections. Section I describes tests for checking instrument Specifications:

Calibration Accuracy	Distortion
Frequency Response	Power Output
Output Balance	Hum Voltage

Section II describes tests for locating causes of distortion.

Section III describes how to recalibrate the 200CD.

A ten to fifteen minute warmup at normal line voltage and measurement of the power supply voltages are always recommended before testing or adjusting.

Schematic diagrams are included in these Service Notes to help you identify internal adjustments and test points. Parts values in any particular instrument may differ from these diagrams and should not be changed unless the change is a part of an adjustment procedure.

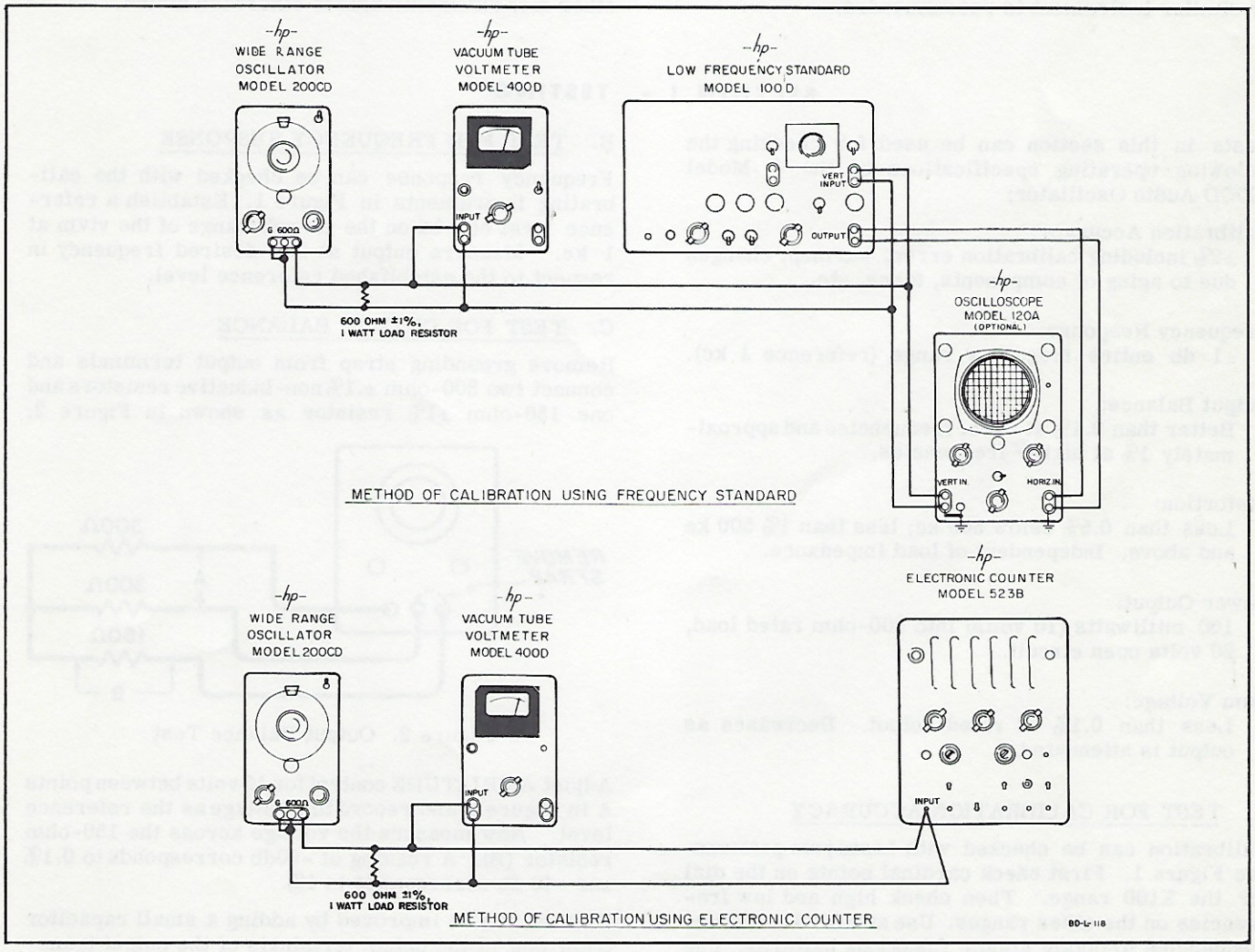

Figure 1. Frequency Calibration Equipment

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Figure 1 shows test equipment and interconnections for frequency calibration. The electronic counter is shown as an optional method of measuring frequency. However, the procedures are based on the use of an oscilloscope and a standard frequency source so Lissajous patterns may be obtained.

The 600-ohm load shown in Figure 1 is essential when making distortion and frequency response tests, and may be left in place for other tests unless otherwise indicated.

TEST EQUIPMENT FOR TESTING AND ADJUSTING ℗ MODEL 200CD OSCILLATOR

The ℗ Model 200CD Audio Oscillator can be completely tested and adjusted to specifications with instrument which accurately measure frequency, distortion and voltage.

Frequency measurement with Lissajous patterns is recommended. This method is fast, convenient and accurate. Any oscilloscope such as ℗ Model 120, 130, 150, or equivalent, and a source of standard frequencies can be used. The ℗ Model 100D Frequency Standard or similar instrument is recommended.

Frequency can also be measured with an electronic counter such as ℗ Model 521, 522, 523, or 524. Frequencies below 100 cps should be read in terms of period measurements.

Distortion can be measured with ℗ Models 330B/C/D (20 kc), ℗ Model H01 330B/BR (60 kc), or ℗ Model H02-330B/BR (100 kc) Distortion Analyzer. A Wave Analyzer such as ℗ Model 300A or 302A can be used to evaluate individual distortion components within the ranges of these two instruments.

A method for measuring distortion beyond the ranges of the above instruments using a filter and a vtvm is given in Section I.

Voltage can be measured with the built-in vtvm in the above Distortion Analyzers or with a vtvm such as ℗ Model 400D/H/L, 410B, or equivalent instruments.

Figure 1 shows test equipment and interconnections for frequency calibration. Note that a 600-ohm ±1% load resistor is connected to the 200CD. This load resistor is essential for frequency response and distortion measurements and may be left in place for all other measurements unless otherwise stated.

SECTION I - TESTING

Tests in this section can be used for checking the following operating specifications of the ℗ Model 200CD Audio Oscillator:

Calibration Accuracy:
±2% including calibration error, warmup, changes due to aging of components, tubes, etc.

Frequency Response:
±1 db entire frequency range (reference 1 kc).

Output Balance:
Better than 0.1% at lower frequencies and approximately 1% at higher frequencies.

Distortion:
Less than 0.5% below 500 kc; less than 1% 500 kc and above. Independent of load impedance.

Power Output:
160 milliwatts (10 volts) into 600-ohm rated load, 20 volts open circuit.

Hum Voltage:
Less than 0.1% of rated output. Decreases as output is attenuated.

A. TEST FOR CALIBRATION ACCURACY

Calibration can be checked with Lissajous patterns. See Figure 1. First check cardinal points on the dial for the X100 range. Then check high and low frequencies on the other ranges. Use standard reference frequencies to obtain simple Lissajous patterns. The 100 cps, 1 kc, 10 kc, and 100 kc frequencies obtainable from the ℗ Model 100D Frequency Standard are excellent choices.

B. TEST FOR FREQUENCY RESPONSE

Frequency response can be checked with the calibrating instruments in Figure 1. Establish a reference level of 0 bd on the 10-volt range of the vtvm at 1 kc. Measure output at any desired frequency in respect to the established reference level.

C. TEST FOR OUTPUT BALANCE

Remove grounding strap from output terminals and connect two 300-ohm ±.1% non-inductive resistors and one 150-ohm ±1% resistor as shown in Figure 2.

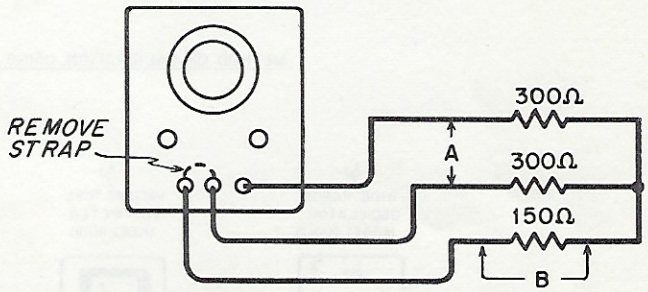


Figure 2. Output Balance Test

Adjust AMPLITUDE control for 10 volts between points A in Figure 2 and record this voltage as the reference level. Now measure the voltage across the 150-ohm resistor (B). A reading of -60db corresponds to 0.1% and -40 db corresponds to 1%.

Balance can be improved by adding a small capacitor from one of the output terminals of the output transformer being used, to ground. Connect to the terminal which reduces the voltage across the 150-ohm resistor. Ground the capacitor to the spade lug provided on one

of the output transformers. If a capacitor is added for either transformer, balance at the highest frequency: 5 kc for T2; 600 kc for T1.

D. TEST FOR DISTORTION

Connect the 600-ohm resistor and a Distortion Analyzer to the output terminals. Measure distortion at rated 10 volts output. Measurements within the fundamental ranges of the distortion analyzers listed in these Service Notes are usually sufficient. However, if measurements at the extreme frequencies of the 200CD are desired, apply the output of the 200CD to a Rejection Filter as shown in Figure 3 and measure the output from the filter with a vtvm. A reading of -40 db below input level corresponds to a 1% distortion; a reading of -46 db corresponds to 0.5%.

E. TEST FOR POWER OUTPUT

Connect the 600-ohm load to the output terminals and measure voltage across load.

F. TEST FOR HUM VOLTAGE

Hum voltage can be measured through a 600-ohm low-pass filter having at least 70 db rejection at 1 kc. Use a 1 kc signal at rated 10 volts output as the reference level. A -60 db hum level corresponds to 0.1%.

This completes testing. If corrective adjustments are needed, refer to Sections II and III of these Service Notes.

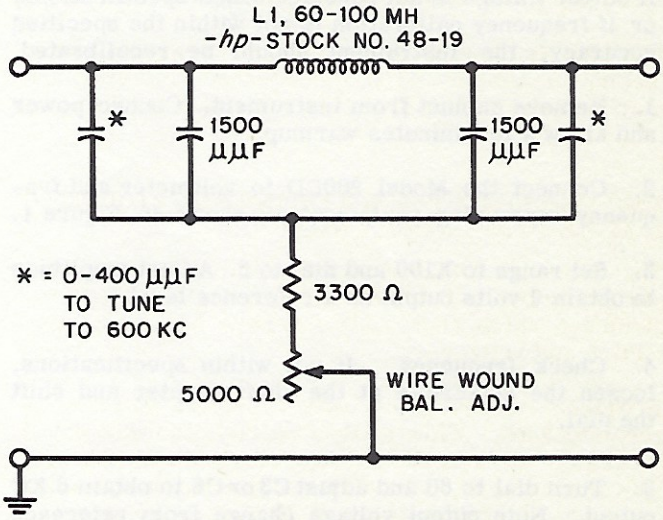


Figure 3. Typical Rejection Filter (600 kc)

SECTION II - TESTING

Tests in this section are useful for localizing causes of distortion. Data given here are not instrument specifications and are intended only as an aid to servicing.

TESTS FOR LOCATING DISTORTION

Distortion includes an unwanted signals which cause the output voltages to differ from pure sine waves. Possible sources of excessive distortion are heater to cathode leakage in tubes, power supply hum or ripple, maladjustment of feedback circuit, defective ballast lamps R13, R14 (RT1 and RT2) or amplifier unbalance. The circuits can be checked for these possibilities individually:

1. Amplifier Balance.

Instruments with serials prefixed 103- have a DYNAMIC BALANCE ADJ., R50, which should be adjusted for minimum distortion at 1 kc.

In all instruments distortion at very low frequencies may be caused by aging of components or tubes in the output circuit. Resistors R30 or R31 may be adjusted for minimum distortion (best amplifier balance) at 5 cycles.

2. Hum.

Heater to cathode leakage in the tubes causes a certain amount of "beat" in the vicinity of 60 cycles output. This is normally in the order of 3% of the signal voltage. If desired it may be measured exactly by using a battery operated voltmeter or may be observed on an oscilloscope. An excessive amount can be cured by tube replacement; it is also necessary to keep the 60 cycle bearing wires away from other portions of the circuit, and this precaution should be observed if any work is done in the instrument. Excessive 120-cycle beat can also be caused by a defective tube, but is more often the fault of a defective electrolytic capacitor in the power supply filtering network.

Instruments with serials prefixed 103- have a HUM BALANCE control, R51, which should be adjusted for minimum distortion at 50 cycles.

3. Feedback Circuit.

Connect a VTVM to the output terminals. Set dial to low end for X10 range and adjust AMPLITUDE to about 8 volts. Switch to X1 range; the voltage reading should stabilize in 5 seconds or less. Stabilizing time can be compromised with distortion by adjusting R11 which establishes the oscillator voltage:

If you decrease the oscillator voltage, distortion will decrease. If you increase the oscillator voltage, recovery time will decrease.

Your adjustment of R11 should be optimum for satisfactory recovery time, distortion, and power output.

Try new lamps for R13 and R14 (RT1 and RT2) if satisfactory adjustment is not possible.

4. Miscellaneous.

Examine output frequency with oscilloscope. Check AMPLITUDE control for "noisy" operation. Check for spurious oscillations at or near 600 kc. Check tubes by replacement; return good tubes to original positions. A "notch" in the output wave indicates a defective lamp for R13 or R14 (RT1 and RT2).

SECTION III - CALIBRATION

Calibration of the 200CD consists of adjusting for constant output voltage and correct frequency.

If output voltage is not constant within specifications, or if frequency calibration is not within the specified accuracy, the instrument should be recalibrated.

1. Remove cabinet from instrument. Connect power and allow a few minutes warmup.

2. Connect the Model 200CD to voltmeter and frequency measuring equipment as shown in Figure 1.

3. Set range to X100 and dial to 5. Adjust amplitude to obtain 9 volts output as a reference level.

4. Check frequency. If not within specifications, loosen the setscrews at the shaft coupler and shift the dial.

5. Turn dial to 60 and adjust C3 or C6 to obtain 6 KC output. Note output voltage change from reference level and correct for half the difference with trimmer C3. Reset frequency to 6 KC with trimmer C6.

6. Turn dial to 5 and check voltage and frequency. If not within specifications, repeat steps 3 through 5.

7. Check frequency at numbered points on dial, beginning at high end. If any points are outside specifications, try to slip dial for best overall calibration. Then repeat step 5.

8. If calibration is still not satisfactory, repeat steps 3 through 5, then follow dial tracking procedure in step 9.

9. Dial tracing is accomplished by bending the segmented outer rotor plates of each tuning capacitor section. These plates were carefully adjusted during manufacture and should not need readjustment. However, should it become necessary, the following precautions should be observed when bending rotor plates:

a. Keep all bends as near the shaft as possible.

b. Keep all segments in line. The rotor plates should taper gradually inward or outward, depending on whether you must compress or expand the frequency range. This gradual taper is essential for linearity.

c. Bending of plates near the high frequency end should be unnecessary.

NOTE

When starting the procedure, begin at the high end of the dial. Work toward the low end by setting the dial to the next numbered point and bending one of the outer rotor plates in each section of C5 at the point of mesh. Continue this procedure to the low end of the dial to obtain approximately correct frequencies. Repeat the bending procedure from the high end, this time making fine adjustments of frequency with the other outer rotor plates. In this way, bending of any one plate is minimized.

10. Set RANGE switch to X10K, and frequency dial to 60. Adjust C7 to put 600 KC on frequency.

11. Check dial calibration on remaining ranges. Change or adjust values of C16 (X1 range), C2 (X1K range), or C1 (X10K range) if necessary for best overall calibration. In some instruments, C16 may not be present. If needed, install across resistor R5 on range switch.

NOTE

It will be advantageous to set the counter FUNCTION SELECTOR to 10 PERIOD AVERAGE when measuring frequency on the X1 range (refer to Table 1).

Table 1. Frequency/Period Conversion

Frequency (cps)	Frequency Limits	Period Limits
5	5.1	196.0 ms
	4.9	204.0 ms
10	10.2	098.0 ms
	9.8	102.0 ms
20	20.4	049.0 ms
	19.6	051.0 ms
40	40.8	024.5 ms
	39.2	025.5 ms
60	61.2	016.3 ms
	58.8	017.0 ms

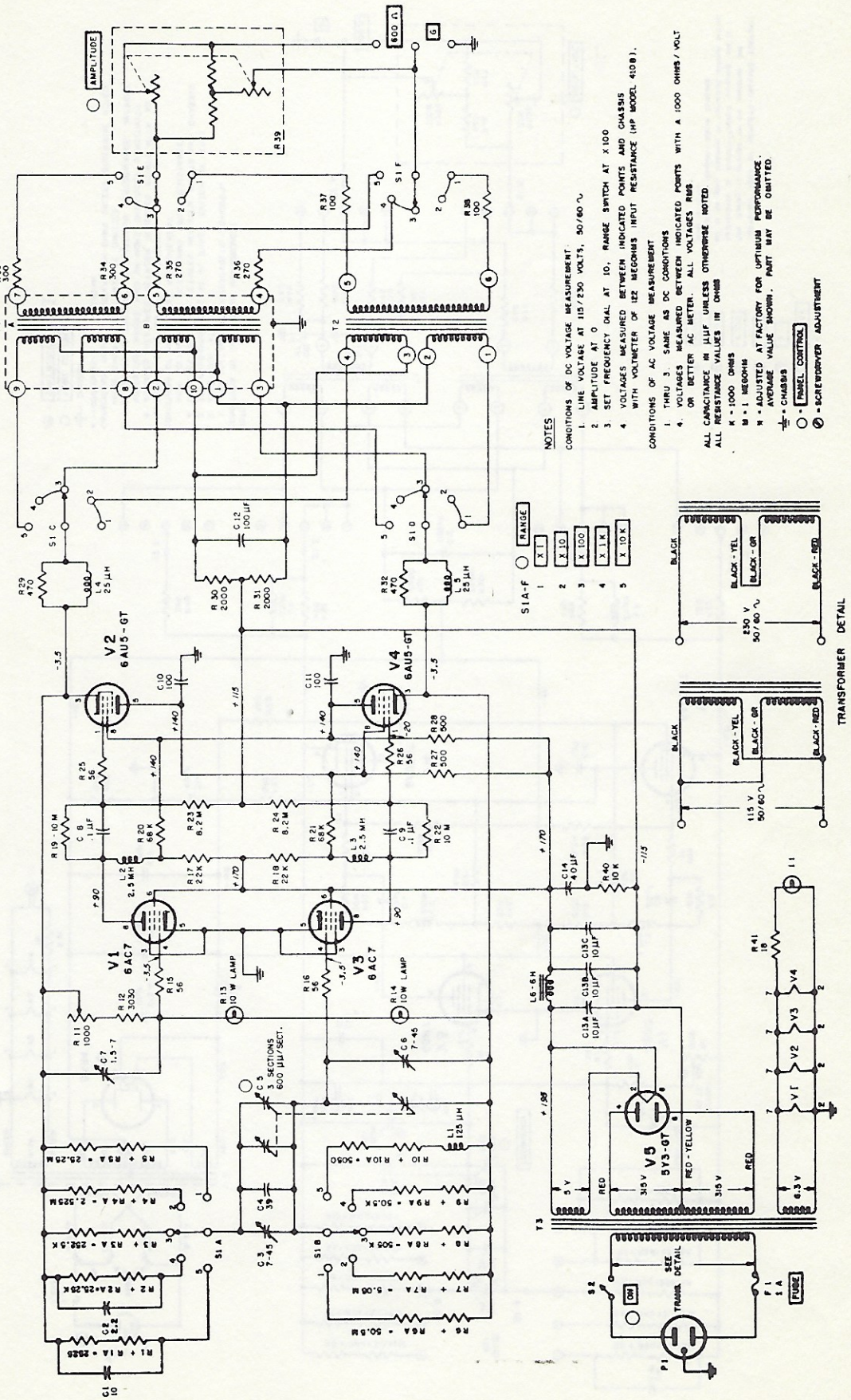


Figure 4. Model 200CD Wide Range Oscillator Serial 1 through 903

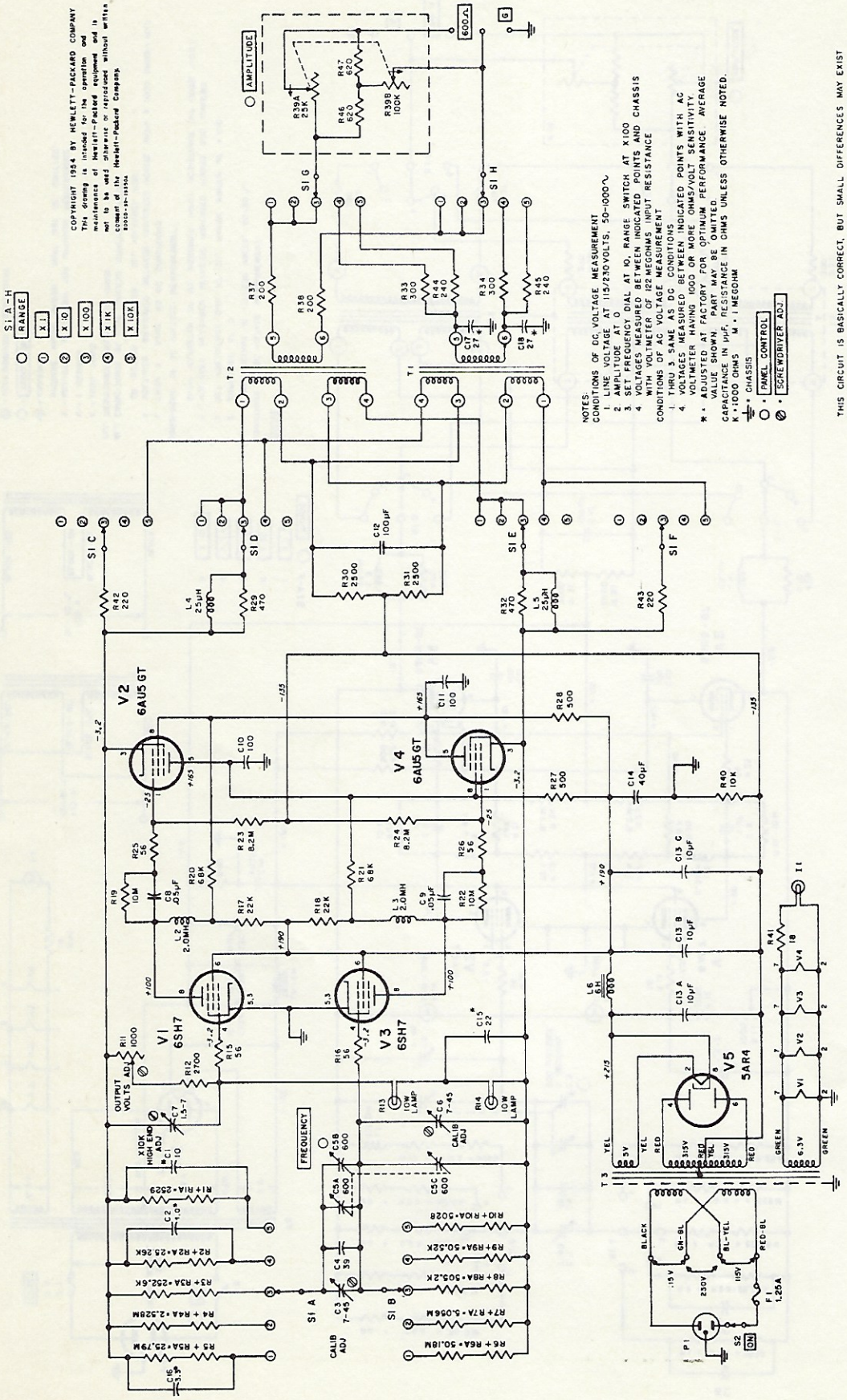


Figure 5. Typical Schematic for Instruments with Serials 904 through 22550

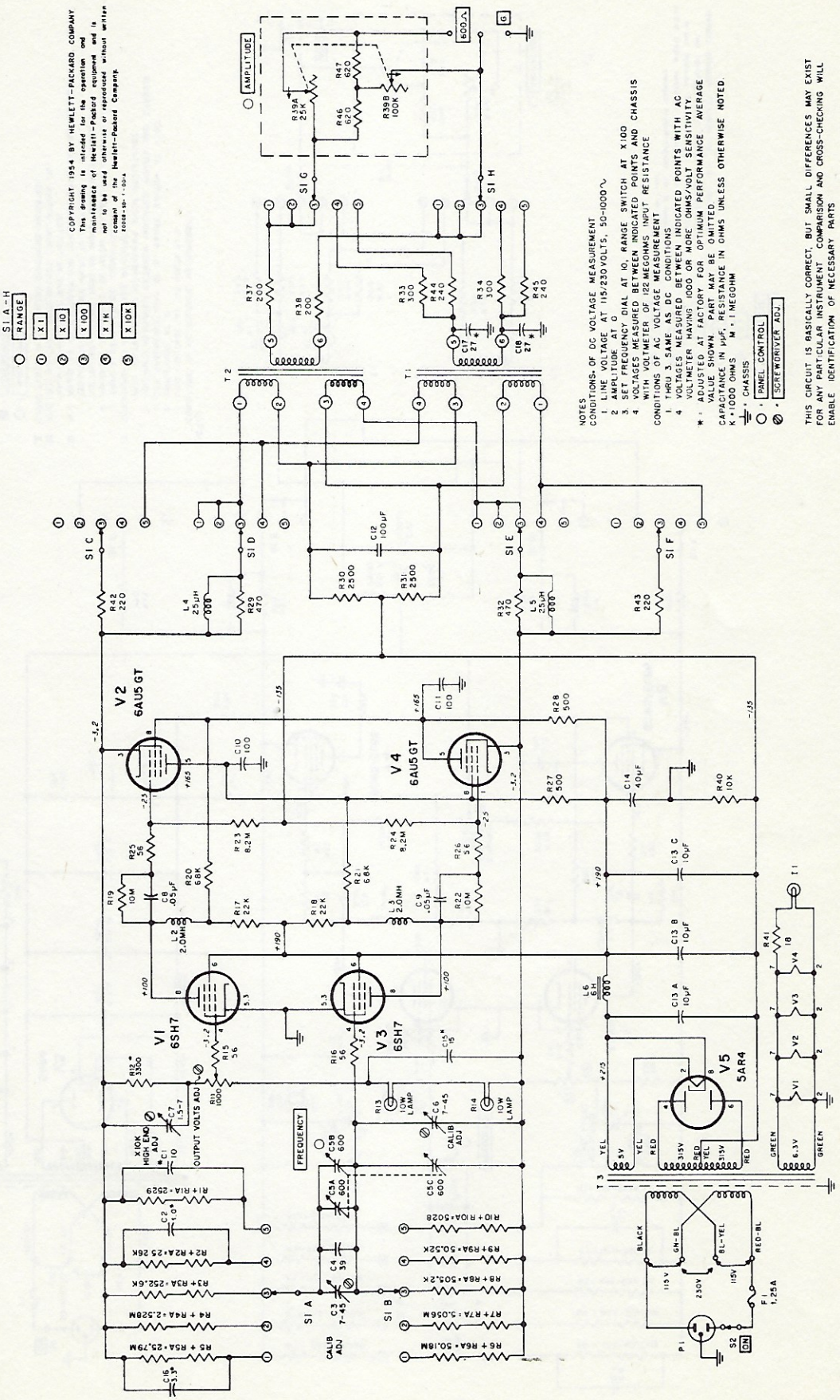


Figure 6. Typical Schematic for Instrument with Serials 22551 through 30635

SERVICE NOTE

200CD-5

MODEL 200CD WIDE RANGE OSCILLATORS
SERIAL NO. 22550 AND BELOW
REDUCTION OF LOW FREQUENCY DISTORTION

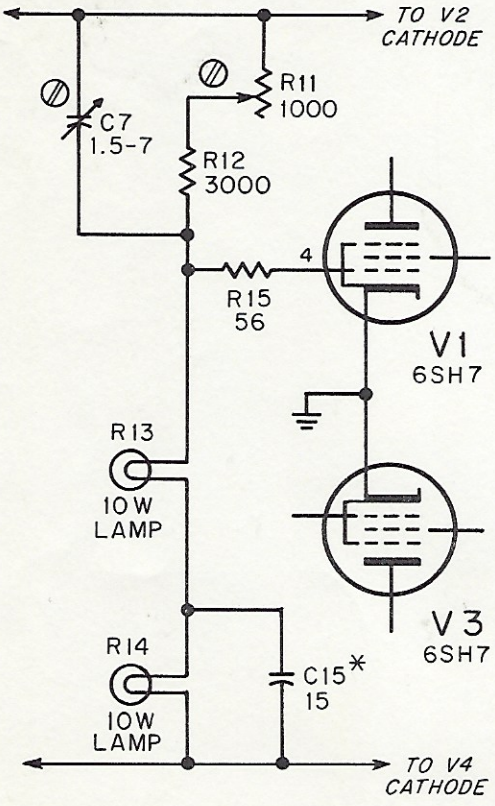
A simple wiring change in the lamp circuit and connections to the grid of V1 will reduce low frequency distortion in the above oscillators.

The wiring changes provide a circuit which stabilizes the current through the lamps to prevent the lamps from attempting to regulate the level of each cycle. In addition, the revised circuit permits feedback level adjustment without affecting frequency response or calibration.

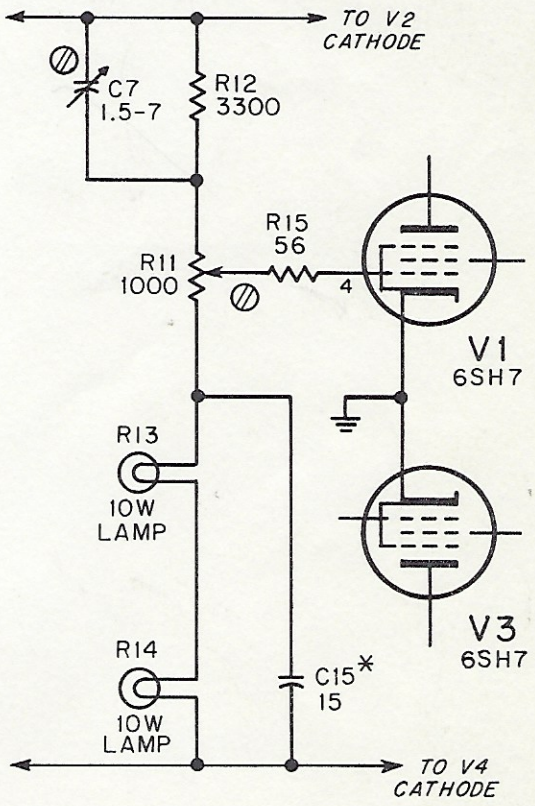
One 3300 ohm ± 10%, 1 watt, fixed, composition resistor and a dual tie lug strip will be required.

Mount the tie lug strip between the lamp insulated mounting posts and feedback level control R11. Be careful to keep the metal chips out of the instrument and tuning capacitor when drilling the required mounting hole. Rewire the circuit as shown in the partial schematic diagrams below.

After completing the wiring changes, set maximum output level control, R11, and adjust instrument calibration. These changes affect calibration more at the high frequencies than at the low frequencies. The value of C15 can be changed to center the adjustment range of C7.



Original Circuit



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Modified Circuit

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SERVICE NOTE

200CD-6A

℗ MODEL 200CD WIDE RANGE OSCILLATOR
ALL SERIAL NUMBERS
REPLACEMENT OUTPUT TRANSFORMERS AND RANGE SWITCHES

Here is a convenient list of correct replacements for output transformers and range switch assembly in ℗ Model 200CD Wide Range Oscillators. Ordering by stock number from this list makes it unnecessary to include instrument serial number with your order.

SERIAL NO. 1 THROUGH 833 (except Nos. 14, 47, 54, 171, 221, 234, 374 and 384)

Component		℗ Stock No.
Output transformer T1	(*912-31)	9120-0011
Output transformer T2	(*912-30 or *912-38	9120-0010 or 9120-0016

NOTE: Use 100 ohm resistors for R37 and R38 on range switch with 9120-0010; 200 ohms with 9120-0016.

Range switch S1 . . . . . 200CD-19W

SERIAL NO. 834 THROUGH 853 (and 14, 47, 54, 171, 221, 234, 374 and 384)

Output transformer T1	(*912-37)	9120-0015
Output transformer T2	(*912-38)	9120-0016
Range switch S1		200CD-19WA

SERIAL NO. 854 THROUGH 871

Output transformer T1	(*912-31)	9120-0011
Output transformer T2	(*912-30 or *912-38)	9120-0010 or 9120-0016

NOTE: Use 100 ohm resistors for R37 and R38 on range switch with 9120-0010; 200 ohms with 9120-0016.

Range switch S1 . . . . . 200CD-19W

SERIAL NO. 872 THROUGH 903

Output transformer T1	(*912-31)	9120-0011
Output transformer T2	(*912-38)	9120-0016
Range switch S1		200CD-19W

NOTE: Use 200 ohm resistors for R37 and R38 on range switch with 9120-0016.

SERIAL NO. 904 THROUGH 3637

Output transformer T1	(*912-37)	9120-0015
Output transformer T2	(*912-38)	9120-0016
Range switch S1		200CD-19WA

SERIAL NO. 3638 THROUGH 24149 and ALL SERIALS WITH PREFIXES OF 005- and 103-.

Output transformer T1		200CD-9
Output transformer T2	(*912-38)	9120-0016
Range switch S1		200CD-19WB

* Old ℗ Stock Numbers.

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00400-4

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SERVICE NOTE

200CD-7A

- MODEL 200AB AUDIO OSCILLATOR
- MODEL 200CD WIDE RANGE OSCILLATOR
- MODEL 200J INTERPOLATION OSCILLATOR
- MODEL 200S SPECIAL WIDE RANGE OSCILLATOR
- MODEL 201C AUDIO OSCILLATOR
- MODEL 202C LOW FREQUENCY OSCILLATOR
- MODEL 205AG AUDIO SIGNAL GENERATOR

TUNING CAPACITOR REPLACEMENT PROCEDURE

When replacement of the tuning capacitor is required in any model of the above oscillators and audio signal generators, an improved assembly is available for installation.

These assemblies are completely prefabricated with all tuning capacitor mounted components installed. Mounting boards are riveted to the assembly for ease of installation. Mounting hardware is supplied with each assembly.

In some instruments the rear mounting board of the tuning capacitor assembly has two spade lugs. In other instruments the rear mounting board has only one lug. All replacement tuning capacitor assemblies have only one spade lug on the rear mounting board. This improvement allows the tuning capacitor to absorb greater shocks.

To replace the tuning capacitor in your instrument, select the required capacitor assembly, perform the installation procedure, and adjust your oscillator or audio signal generator for proper performance.

STOCK NUMBERS FOR TUNING CAPACITOR ASSEMBLIES

Instrument	Stock No.
200AB	200AB-95B
201C	200 AB-95B
205AG	200AB-95B
200CD	200CD-95A
202C	200CD-95A
200S	200CD-95A
200J	200J-95A

Each assembly includes basic tuner, all capacitor mounted components (such as trimmers, etc.) installed mounting board riveted to assembly, and the following mounting hardware:

Quantity	Description	Stock No.
6	Washer, Flat, #6 x 7/16 in. O.D. brass-nickel finish	3050-0100
3	Hex nuts, w/lockwasher, 6-32 x 5/16 in., steel-nickel finish	2420-0001
3	Hex nuts, 6-32 x 1/4 in., stainless steel.	2420-0003

REPLACEMENT PROCEDURE

1) Disconnect power. Remove cabinet.

REMOVAL OF TUNING CAPACITOR TO BE REPLACED

2) Loosen setscrews and remove FREQUENCY dial knob. Remove the four retaining screws and lift off FREQUENCY dial.

3) Loosen the three pairs of setscrews on the drive coupling assembly. Two pair are on the flexible coupler and one pair is on the large driving gear. See figure 1 for typical arrangement.

4) Slide drive shaft toward front of instrument. Remove flexible coupler.

CAUTION

BE SURE THAT DRIVING GEARS REMAIN ENGAGED.

5) Unsolder wires connected to tuning capacitor assembly. Remove mounting nuts and washers. Lift out assembly.

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01041-3

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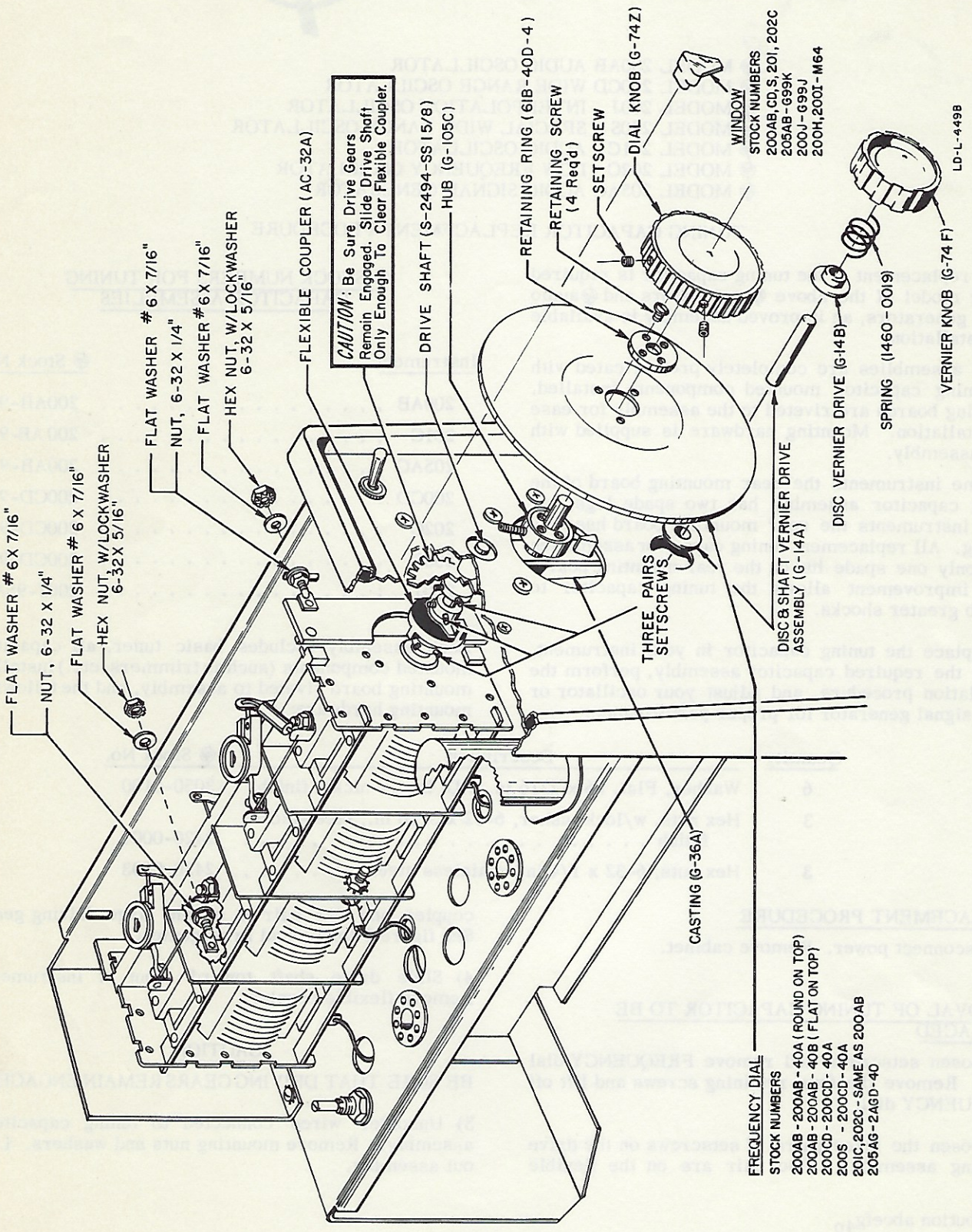

Figure 1. Typical Tuning Capacitor Installation

INSTALLATION OF REPLACEMENT TUNING CAPACITOR ASSEMBLY

Note: To mount replacement tuner assembly in instruments which had two lug rear mounting boards, a 5/16 in. hole must be drilled to accommodate the single lug assembly. Figure 2 is a template for locating the required hole.

6) Mount replacement tuning capacitor assembly. Install mounting hardware but do not tighten nuts. Assembly must be free to move for final placement.

7) Slide drive shaft towards rear of instrument until it butts against tuner shaft. Note: This is a good time to file off setscrew burrs on drive shaft.

8) Position the tuning capacitor assembly so that tuner shaft is exactly in line with drive shaft. Tighten tuner mounting nuts.

9) Solder wires to tuning capacitor that were disconnected in step 5.

10) Slide drive shaft towards front of instrument. Install flexible coupler. Butt drive shaft and tuner shaft against flexible coupler. Tighten setscrews.

11) Butt large pair of driving gears snugly against iron casting. Tighten the pair of setscrews on large driving gears.

12) Mount FREQUENCY dial.

CALIBRATION

13) Calibrate the instrument. Adjustment procedures for your oscillator can be found in either the Operating and Servicing Manual or Service Notes as indicated in the table below:

Instrument	For Calibration Procedures Refer to
Model 200AB . .	Service Notes 200AB-2A
Model 200CD . .	Manual or Service Notes 200CD-4
Model 200J . . .	Manual
Model 200S . . .	Manual
Model 201C . .	Manual
Model 202C . .	Manual
Model 205AG . .	Manual or Service Notes 205AG-1A

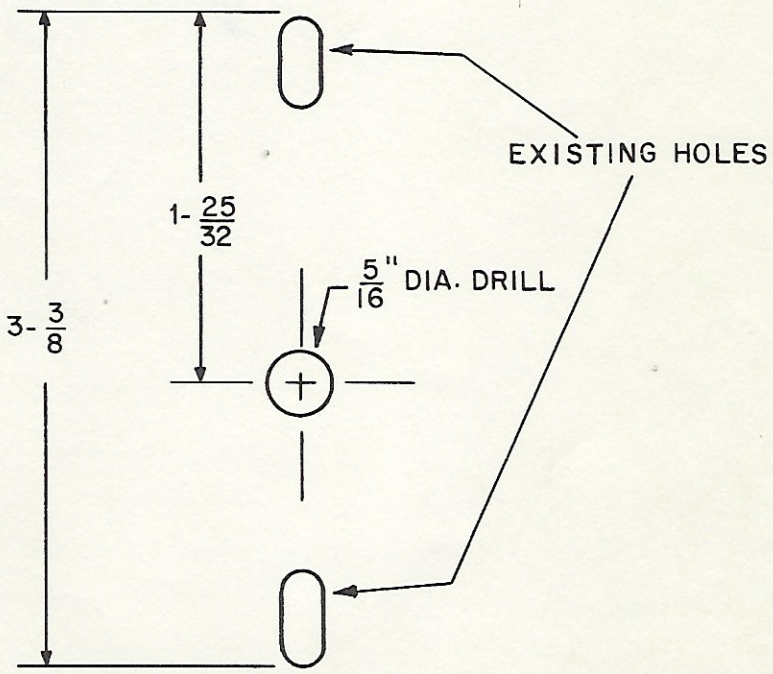

Figure 2. Template