# 200CD
# WIDE RANGE OSCILLATOR

## OPERATING AND SERVICE MANUAL

HEWLETT hp PACKARD

HP 200CD

HEWLETT hp PACKARD

## CERTIFICATION

*The Hewlett-Packard Company certifies that this instrument was thoroughly tested and inspected and found to meet its published specifications when it was shipped from the factory. The Hewlett-Packard Company further certifies that its calibration measurements are traceable to the U.S. National Bureau of Standards to the extent allowed by the Bureau's calibration facility.*

## WARRANTY AND ASSISTANCE

All Hewlett-Packard products are warranted against defects in materials and workmanship. This warranty applies for one year from the date of delivery, or, in the case of certain major components listed in the operating manual, for the specified period. We will repair or replace products which prove to be defective during the warranty period. No other warranty is expressed or implied. We are not liable for consequential damages.

For any assistance contact your nearest Hewlett-Packard Sales and Service Office. Addresses are provided at the back of this manual.

OPERATING AND SERVICE MANUAL

(HP PART NO. 200CD-903)

# MODEL 200CD/CDR
# WIDE RANGE OSCILLATOR

SERIALS PREFIXED: 605-

Appendix C, Manual Backdating Changes, adapts this manual to serials prefixed: 333-, 229-, 212-, 129-, and 103-, 005- and serials 22549 thru 1.


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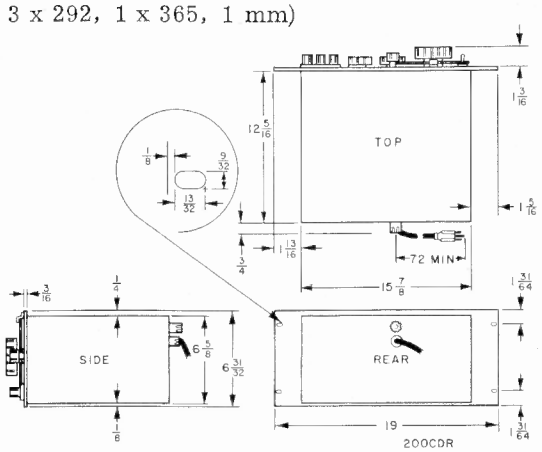
Table 1-1. Specifications

| | |
|---|---|
| FREQUENCY RANGE: | 5 cps to 600 kc covered in five ranges |
| RANGES: | X1 5 cps to 60 cps<br>X10 50 cps to 600 cps<br>X100 500 cps to 6 kc<br>X1000 5 kc to 60 kc<br>X10000 50 kc to 600 kc |
| ACCURACY: | ±2% including calibration error, warmup, changes due to aging of components, tubes, etc |
| DIAL: | 6-inch diameter calibrated over 300° of arc. 85 divisions. Total scale length, 78 inches |
| FREQUENCY RESPONSE: | ±1 db entire frequency range (reference 1 kc) |
| OUTPUT: | 160 milliwatts (10 volts) into 600-ohm rated load, 20 volts open circuit |
| OUTPUT BALANCE: | Better than 0.1% at lower frequencies and approximately 1% at higher frequencies |
| INTERNAL IMPEDANCE: | 600 ohms. Output is balanced to ground for zero attenuation. (May be operated with one side grounded if desired.) |
| DISTORTION: | 0.2% from 20 cps to 200 kc; 0.5% from 5 cps to 20 cps and from 200 kc to 600 kc |
| HUM VOLTAGE: | Less than 0.1% of rated output; decreases as output is attenuated |
| POWER: | 115/230 volts ±10%, 50-1000 cps, 90 watts |
| ACCESSORIES AVAILABLE: | hp 11004A Line Matching Transformer (provides balanced output at any attenuator setting at 135 and 600 ohms)<br>hp 11000A Cable Assembly, 44 in. long, terminated each end with dual banana plugs<br>hp 11001A Cable Assembly, 45 in. long, with one dual banana plug and one BNC male connector |
| DIMENSIONS: | Cabinet Mount: 7-3/8 in. wide, 11-1/2 in. high, 14-3/8 in. deep. (187, 3 x 292, 1 x 365, 1 mm)<br>Rack Mount:  |
| WEIGHT: | Cabinet Mount: Net, 22 lbs. (9,9 kg). Shipping, 27 lbs. (12, 2 Kg).<br>Rack Mount: Net, 27 lbs. (12, 2 kg). Shipping, 37 lbs. (16.7 kg). |

# SECTION I
# GENERAL INFORMATION

## 1-1. DESCRIPTION.

1-2. The Model 200CD Wide Range Oscillator generates frequencies of excellent waveform in the subsonic, audio, and ultrasonic ranges (5 cycles to 600 kc, in five overlapping decade bands). The Model 200CD includes new design features which result in still finer performance than previous Hewlett-Packard instruments. Special circuitry ensures an output voltage of low distortion and high stability with any output load impedance from zero ohms to open circuit. Usefulness of the oscillator has been extended by designing the 200CD output circuit so that the instrument may be operated balanced as well as unbalanced and by providing a 600-ohm impedance match.

1-3. The Model 200CD is easy to operate: frequency and amplitude of the output voltage are set merely by operating dials on the control panel. The easily-read, 6-inch diameter frequency dial is calibrated over 300° of arc, and has an effective scale length of approximately 80 inches.

1-4. The Model 200CD furnishes up to 10 volts into a 600-ohm load (20 volts open circuit) at any frequency from 5 cps to 600 kc. A bridged tee variable attenuator in the output circuit controls the output power.

1-5. The Model 200CD provides an ideal signal source for testing servo and vibrating systems, medical and geophysical equipment, audio amplifier circuits and transducers, sonar and supersonic apparatus, carrier telephone systems, video frequency circuits, and low radio-frequency equipment.

## 1-6. DIFFERENCES BETWEEN INSTRUMENTS.

1-7. Hewlett-Packard uses a two-section eight-digit serial number (000-00000). If the first three digits of the serial number on your instrument do not agree with those on the title page of this manual, change sheets supplied with the manual will define differences between your instrument and the Model 200CD described in this manual.

## 1-8. BACKDATING SHEET.

1-9. A backdating sheet that makes this manual applicable for instruments with serial prefixes to 103, is provided in The Appendix of this manual.


Figure 1-1. Model 200CD Wide Range Oscillator

# NOTES

# SECTION II
# PREPARATION FOR USE

## 2-1. INTRODUCTION.

2-2. This section contains information on unpacking, inspection, repacking, and installation of Model 200CD.

## 2-3. UNPACKING AND INSPECTION.

2-4. Unpack the instrument upon receipt and inspect it for signs of physical damage such as a scratched panel surfaces, broken knobs, etc. If there is any apparent damage, file a claim with the carrier and refer to the warranty page in this manual.

2-5. An electrical inspection should be performed as soon as possible after receipt. To aid in electrical inspection a list of performance checks are given in section V, paragraph 5-39. These procedures make a good test as part of incoming quality-control inspection.

## 2-6. POWER REQUIREMENTS.

2-7. The Model 200CD requires a power source of 115/230 volts +10%, 50/1000 cps, 75 watts.

## 2-8. POWER CABLE.

2-9. This Hewlett-Packard instrument is equipped with a three-conductor power cable which, when plugged into an appropriate receptacle, grounds the instrument. The offset pin on the power cable three-prong connector is the ground pin.

2-10. To preserve the protection feature when operating instrument from a two-contact outlet, use a three-prong to two-prong adapter and connect the pigtail on the adapter to ground.

## 2-11. 230-VOLT OPERATION.

2-12. The Model 200CD is normally wired for operation from a nominal 115-volt supply. Operation from a 230-volt source is easily accomplished by reconnecting the dual 115-volt primary windings of the power transformer from a parallel configuration to a series configuration. (See figure 5-9). At the time of the change, replace the 1.25 amp, slow-blow line fuse with a 0.6 amp, slow-blow line fuse.

## 2-13. REPACKING FOR SHIPMENT.

2-14. The following list is a general guide for repackaging an instrument for shipment. If you have any questions, contact your authorized Hewlett-Packard sales and service office. See map in Appendix.

a. If possible, use the original container designed for the instrument.

b. Wrap the instrument in heavy paper or plastic before placing it in the shipping container.

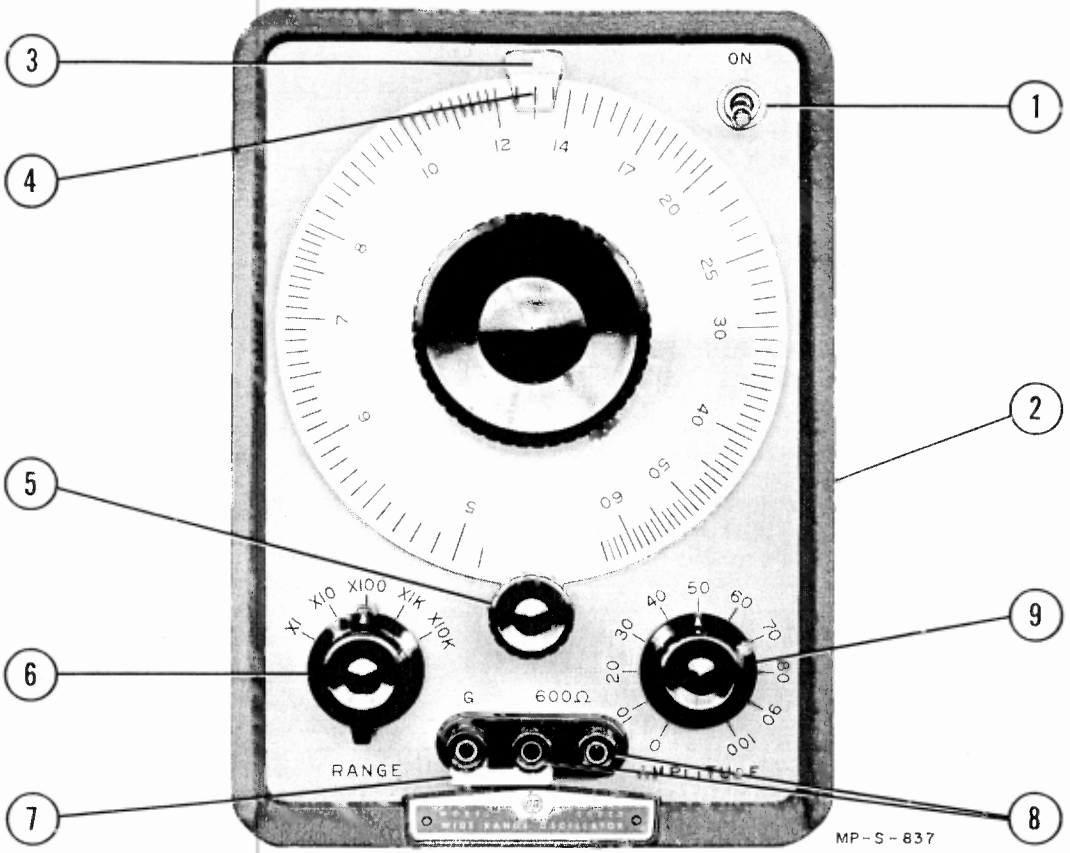
c. Use plenty of packing material around all sides of the instrument and protect the panel with cardboard strips.

d. Use heavy cardboard carton or wooden box to house the instrument and use heavy tape or metal bands to seal the container.

e. Mark the packing box with "Fragile", "Delicate Instrument," etc.

Note

If the instrument is to be shipped to Hewlett-Packard Company for service or repair, attach to the instrument a tag identifying the owner and indicating the service or repair to be accomplished. In any correspondence be sure to identify the instrument by model number, serial prefix, and serial number.




1. Turn on power to instrument.
2. Fuse on rear of instrument.
3. Glows when instrument is energized.
4. Read frequency of operation multiplied by RANGE switch position.
5. Vernier, adjust frequency.
6. Select frequency range of operation.
7. Jumper for 600 ohm unbalanced output.
8. Balanced output terminals internal impedance equals 600 ohms.
9. Adjust output voltage level. Output balanced to ground only with amplitude control in full clockwise position.

Figure 3-1. Controls and Terminals

# SECTION III
# OPERATING INSTRUCTIONS

## 3-1. INTRODUCTION.

3-2. This section contains operating instructions for the Model 200CD Wide Range Oscillator. Figure 3-1 gives basic operating instructions. The remainder of this section supplements these instructions.

## 3-3. OPERATION.

3-4. ON. The oscillator is ready for use as received from the factory and will give specified performance after a short warmup period. Turn oscillator on and allow approximately five minutes to warm up. Where maximum accuracy is desired, this warm-up period should be extended to at least thirty minutes.

3-5. RANGE. The RANGE is selected with the five position RANGE switch. The position of this switch indicates the multiplying factor for the frequency dial calibration.

3-6. FREQUENCY dial. The frequency dial varies the frequency between the RANGE switch steps. The dial is calibrated from 5 to 60 and its indication multiplied by the factor indicated by the RANGE switch will give the actual output frequency of the oscillator. The small knob below the frequency dial is a vernier control for the dial.

3-7. OUTPUT CIRCUIT OPTIONS. The output circuit of the Model 200CD may be arranged for balanced or unbalanced operation. Typical connections for each are indicated in figure 3-2.

a. Unbalanced Operation. To operate with side grounded, a strap is placed between the G terminal, as indicated in figure 3-2A.

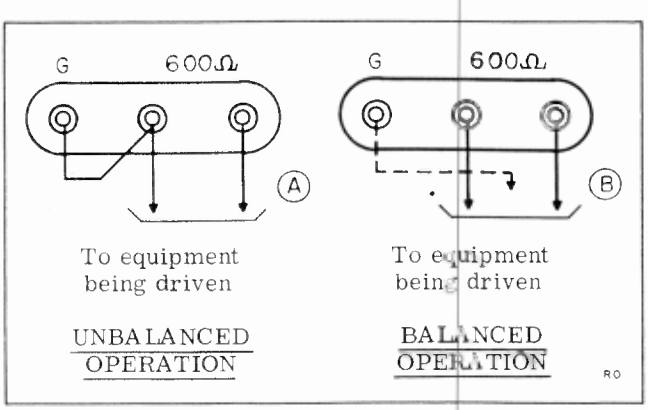



Figure 3-2. Typical Output Connections

b. Balanced Operation. Connections for balanced operation are indicated in figure 3-2B. (The broken line from the ground terminal indicates the output circuit is balanced to ground, within the tolerances given below.)

3-8. The AMPLITUDE control in the output circuit is a bridged-T attenuator and at any setting except minimum attenuation unbalances the circuit. Therefore, for balanced operation the AMPLITUDE control must be set for maximum output (full clockwise). Output balance also is a function of frequency because of capacitive feed-through at higher frequencies. Up to 10 kc, however, unbalance is less than 0.1%, and at 600 kc is approximately 1%. If small outputs are desired, or if balance at higher frequencies is critical, turn the AMPLITUDE control maximum clockwise, and connect an external attenuator, designed for the frequencies involved, between the Model 200CD and the load.

3-9. A balanced output may also be obtained over the full range of the AMPLITUDE control by using an HP AC-60A/B Line Matching Transformer at the output terminals of the oscillator.

3-10. The following chart indicates the area where within 1% of balance may be obtained. This chart indicates balance obtainable at various settings of the AMPLITUDE control when operating into a 600-ohm load. Where other values of load are used, the chart does not apply directly but does apply for settings of the AMPLITUDE control that would produce the indicated voltage across at 600-ohm load.

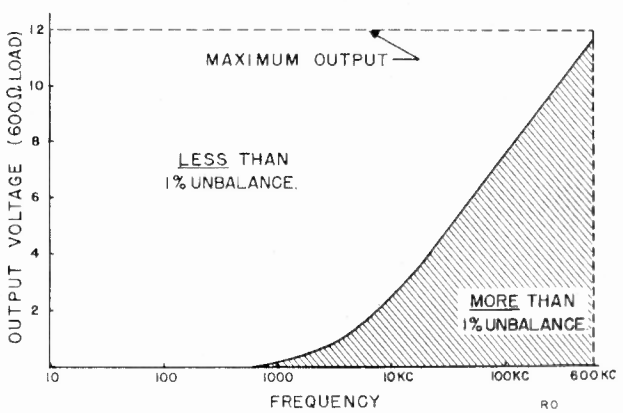



Figure 3-3. Balance Chart Operating into 600-ohm Load

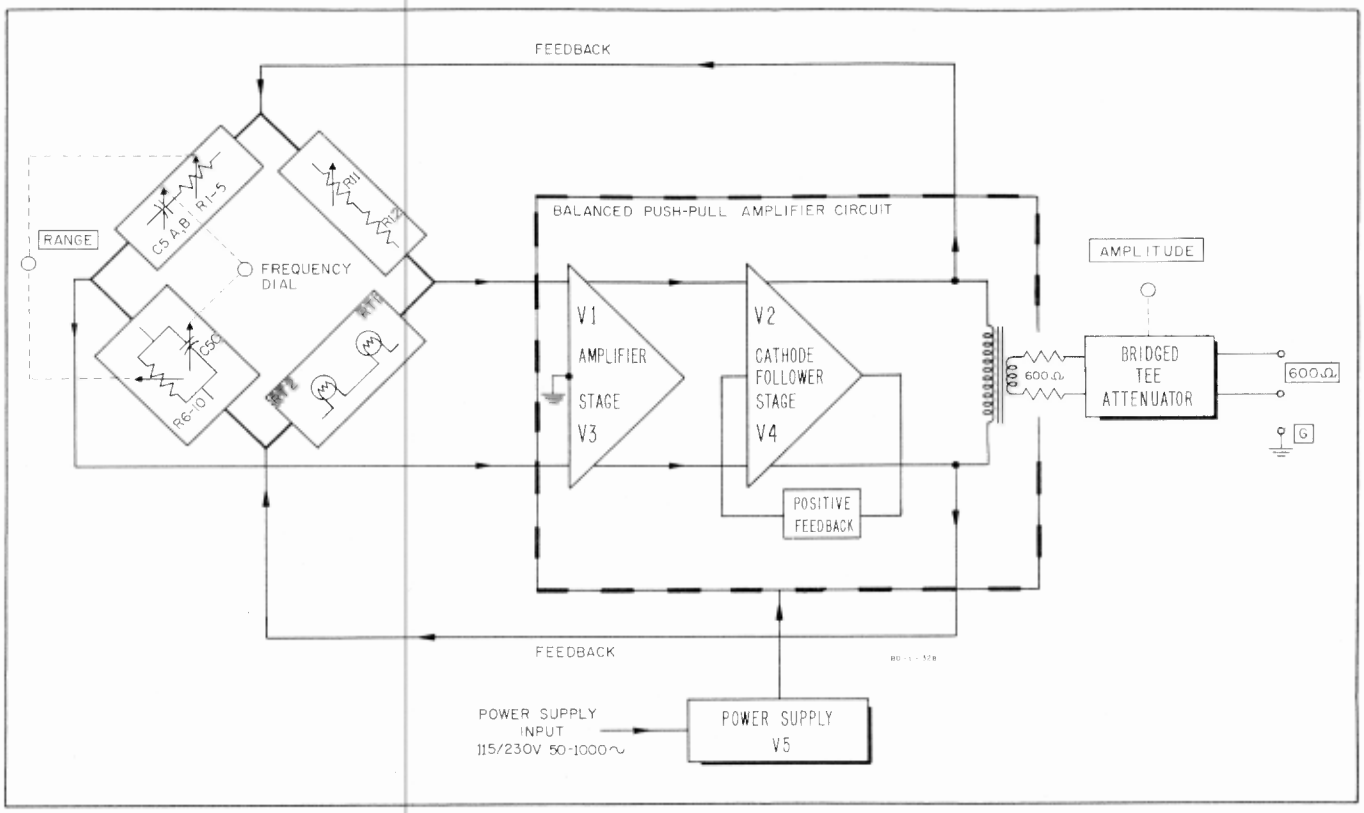



Figure 4-1. Model 200CD Block Diagram

# SECTION IV

# THEORY OF OPERATION

## 4-1. GENERAL.

4-2. The Model 200CD Wide Range Oscillator uses a balanced (push-pull) oscillator circuit from which the output is taken directly, avoiding the complication and possible distortion of an isolating amplifier. Reaction of the load on the oscillator is avoided by the use of a zero source impedance output stage. This arrangement results in a simple, trouble-free circuit having low distortion and high stability over the entire frequency range.

4-3. Functionally, the circuits of the Model 200CD include a frequency-controlling bridge and balanced push-pull amplifier which constitute the oscillator circuit, an output circuit which may be arranged either for balanced or unbalanced operation, and a power-supply circuit. These are shown in block diagram form in figure 4-1 and in detail in the schematic diagram.

## 4-4. FREQUENCY-CONTROLLING BRIDGE.

4-5. The frequency-controlling circuit is arranged as a floating bridge, symmetrical with respect to ground. With no connection to ground on any terminal of the bridge, stability of calibration is assured since any stray capacity or leakage to ground present at the bridge output terminals does not shunt either the frequency-controlling or amplitude-stabilizing arms of the bridge. The frequency-controlling components (RC networks which are varied by operation of the RANGE switch and frequency dial) comprise two arms of the bridge, while the amplitude-stabilizing components (a voltage divider which includes a thermally-sensitive resistance) comprise the other two arms. The amplitude is stabilized at such a level that the amplifier tubes are operated in the substantially linear portion of their characteristics, which, together with the large negative feedback at harmonic frequencies, results in a very pure sine wave oscillation.

4-6. The bridge is fed by the balanced voltage developed at the cathodes of V2 and V4 in the output of the balanced amplifier. The output of the frequency-controlling branch of the bridge is applied to the grid of V3 and the output of the amplitude-stabilizing branch is applied to the grid of V1. The manner in which the voltage-versus-frequency and phase-versus-frequency characteristics of an RC network can be utilized with an amplifier of proper design to achieve an oscillator which delivers a voltage of excellent stability and waveform is well covered in texts such as Terman & Pettit's Electronic Measurements.

4-7. Variable resistor R11 is provided for adjustment of the amplitude-stabilizing branch of the bridge should it be found after replacement of lamp RT1 or RT2 that less or more than rated voltage is being delivered to the output terminals.

4-8. Variable capacitors C3, C6, and C7 are adjusted at the factory for optimum calibration and amplitude constancy with frequency. They should not require adjustment unless the RANGE switch is replaced.

## 4-9. AMPLIFIER.

4-10. The oscillator amplifier is a balanced push-pull circuit including a voltage-amplifier stage (V1, V3) and a special cathode-follower stage (V2, V4). Criss-cross positive feedback is used in the cathode-follower stage to provide an essentially zero output impedance as seen by the cathode-to-cathode load. The feedback paths are from the plate of V2 to the control grid and screen of V4, and from the plate of V4 to the control grid and screen of V2. The degree of the positive feedback is a function of the load and increases as the load impedance decreases, thus tending to maintain the output constant regardless of load. Self-oscillation in the amplifier circuit is prevented by proper choice of resistance in the feedback circuits and by controlling plate and cathode impedances over the entire frequency range of the oscillator. The output stage is protected against a cathode-to-cathode short circuit by the resistors in series with the transformer secondaries. These resistors also make the oscillator present a 600-ohm impedance to the attenuator.

## 4-11. OUTPUT CIRCUIT.

4-12. Transformer coupling provides isolation between the oscillator circuit and the output circuit, and allows the output to be obtained either balanced or unbalanced. Since a single transformer will operate suitably over only a part of the frequency range covered 200CD, two transformers are provided. Connections between cathode-followers V2 and V4 and the proper transformer for the band in use are set up by the RANGE switch. The secondary windings of the coupling transformers supply a conventional bridged tee attenuator, the setting of which is adjusted by operation of the AMPLITUDE control on the front panel. As the control is turned counterclockwise, the loss inserted by the attenuator is increased. The source impedance at the output terminals is 600 ohms.

4-13. With attenuator set for minimum loss, the output circuit is arranged for balanced operation, and is so designed that for frequencies up to 10 kc, stray capacity and leakage resistance will cause less than 0.1% unbalance. Unbalance at 600 kc is approximately 1%.

4-14. When it is desired to operate unbalanced, ground should be connected to the center output terminal, the termination for the connection brought out from terminal 6 of output transformers T1 and T2. Proper operation cannot be obtained if the ground is connected to the side of the circuit which includes the attenuator.

Table 5-1. Test Instruments Required

| Instrument Type | Minimum Required Specifications | Recommended (hp) Instruments |
|---|---|---|
| DC Electronic Voltmeter | Sensitivity: 1 volt full scale minimum<br>Input resistance: 10 megohms or higher | Model 410B or 412A Vacuum Tube Voltmeter |
| AC Transistor Voltmeter | Input impedance: 2 megohms shunted by 40 pf (below the 0.3 volt range)<br>Accuracy: ±3% from 5 cps to 500 kc | Model 403A Transistor Voltmeter |
| AC Electronic Voltmeter | Input impedance: 10 megohms shunted by 25 pf (below the 0.3 volt range)<br>Accuracy: ±2% from 20 cps to 1 mc | Model 400D/H/L Vacuum Tube Voltmeter |
| Distortion Analyzer | Distortion measurement range: 5 cps to 600 kc<br>Sensitivity: 54 db down from rated output | Model 331A or Model 330B (20 kc max range) Distortion Analyzer |
| 600-ohm Resistor | 600 ohms ±1% to 100 kc | Model 470E Shunt Resistor |
| Electronic Counter | Frequency and period readings available. Frequency measuring capabilities to at least 600 kc | Models 523C/CR, D/DR or 524C/D Electronic Counters |
| —or— | | |
| Frequency Standard | Frequencies available:<br>a) 10 cps<br>b) 100 cps<br>c) 1 kc<br>d) 100 kc<br>Output voltage: 5 volts rms minimum<br>Frequency accuracy: ±0.05% | 100ER Precisions Frequency Standard |
| —and— | | |
| (Optional - recommended) Oscilloscope | Frequency range: flat from 5 cps to at least 600 kc | Models 150A, 160B, 170A Oscilloscopes |

# SECTION V
# MAINTENANCE

## 5-1. INTRODUCTION.

5-2. This section contains test and maintenance information for Model 200CD Wide Range Oscillator. A performance check is included (paragraph 5-39) that may be used to verify operation within published specifications. This check should be made with the instrument in its cabinet. This section also includes recommended test equipment, trouble-shooting repair and adjustment procedures.

## 5-3. PERIODIC MAINTENANCE.

5-4. The Model 200CD should require a minimum of maintenance, since there are few moving parts. The following procedure performed once or twice a year should insure smooth operation.

a. Put one drop of oil in each of the three oil holes on the tuning drive mechanism.

b. Place a small amount of high quality contact cleaner on the RANGE switch contacts. Rotate the switch back and forth several times.

c. Using compressed air, gently blow any accumulated dust out of the tuning capacitor plates (C5). See figure 5-1.

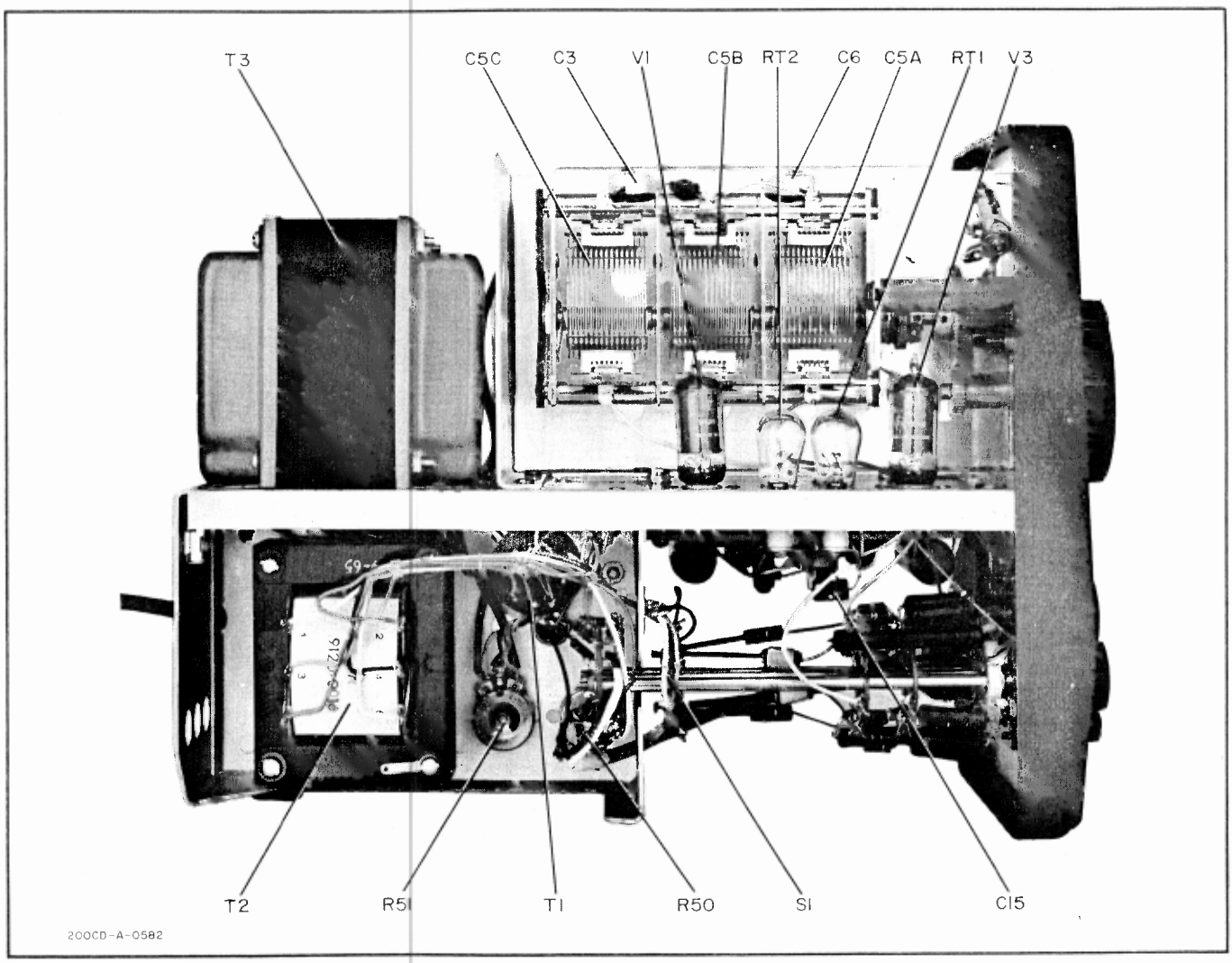



Figure 5-1. Left Side of Model 200CD (as viewed from the front)

## 5-5. TEST EQUIPMENT.

5-6. Table 5-1 lists the test equipment required to accurately check the Model 200CD. Equipment having similar characteristics can be substituted for the equipment listed.

## 5-7. TROUBLESHOOTING.

5-8. The following section gives information to aid in the localizing of troubles in the Model 200CD. In many cases a visual inspection of the instrument will reveal the area of the faulty component if not the component itself. To further assist in troubleshooting, table 5-2 and a voltage-resistance diagram, figure 5-8, have been included in this section. The troubleshooting table (5-2) gives a list of symptoms and their possible causes.

## 5-9. AMPLIFIER POWER SUPPLY.

5-10. Amplifier and power supply operation is best checked by voltage-resistance readings and tube substitution. If tube substitution does not correct the difficulty, return the original tube to the instrument. Voltages and resistances are indicated in figure 5-8; these are typical readings and may vary somewhat from instrument to instrument.

## 5-11. REPAIR AND REPLACEMENT.

5-12. CABINET REMOVAL.

5-13. To remove the Model 200CD proceed as follows:

a. Disconnect the Model 200CD from the power source.

b. Remove the two screws at the rear of the cabinet. The Model 200CDR rack mount unit has two additional screws on the front panel which must be removed.

c. Carefully slide the instrument forward, out of the cabinet.

Table 5-2. Troubleshooting

| Symptom | Probable Cause |
|---|---|
| Resistance to ground less than 100K ohms | C13A, B, C leaky<br>C14 leaky<br>C10, 11 shorted |
| Tubes not glowing, pilot light out | Blown fuse F1<br>S2 defective |
| One or more tubes not glowing, pilot light on | One or more tubes burned out |
| Power supply voltage variation exceeds test limit | C13A, B, C or C14 breaking down under high voltage<br>V5 defective<br>V1-V4 shorted |
| Impossible to set 200CD output to 20 volts (unloaded) | V1-V4 defective<br>RT1, RT2 defective |
| With RANGE set to X1-X100 ranges and output set to 20 volts rms, addition of 600-ohm termination does not lower output to 10 volts ±0.5 v | T2 defective |
| Same as above with RANGE set at X1K or X10K | T1 defective |
| Turning AMPLITUDE control causes jumpy output | R33 (AMPLITUDE control) defective |
| Recovery time exceeds test limit | V1, V3 defective<br>RT1, RT2 defective |
| 200CD obviously microphonic | V1-V4 defective<br>RT1, RT2 defective<br>Tuning capacitor dirty or defective |
| Dial springs back when turned clockwise against the stop | Tuning capacitor closed too far when fully meshed |
| Impossible to set low end on frequency<br>Dial springs back when turned counterclockwise against the stop | Tuning capacitor open too far when fully meshed |
| Calibration bad on one range only | Dirty RANGE switch contacts<br>C1, C2, C7, or C16 need adjusting<br>One RANGE switch resistor has changed resistance |
| Excessive distortion on X1K-X10K ranges | R50 or R51 misadjusted<br>T1 defective |
| Excessive distortion on X1, X10 and X100 ranges | R50 or R51 misadjusted<br>T2 defective |
| Excessive distortion on all ranges | V1-V4 defective<br>RT1-RT2 defective<br>Dust between tuning capacitor plates |
| Impossible to set 11.5 v out with 200CD terminated with 600 ohms (adjustment procedure) | RT1, RT2 defective<br>V1-V4 weak |

5-14. SERVICING ETCHED CIRCUIT BOARDS.

Note

Excessive heat or pressure can lift copper conductors from etched circuit boards.

5-15. To remove components from board, clip leads on component side of board. New components can then be soldered to the leads extending from the board or the leads can be removed. If leads are removed, clean holes with a toothpick or wooden splinter (metal awls or soldering aids may destroy the copper conductor) before inserting leads.

5-16. TUBE REPLACEMENT.

5-17. Tubes used in the Model 200CD are listed in Tube Replacement List (table 5-3). If V2 or V4 are changed, replace the special tube shields in their original positions, (shown in figure 5-2).

Table 5-3. Tube Replacement List

| Tube | Type | Function | Required Checks or Adjustments |
|---|---|---|---|
| V1 | 6AU6 | Voltage Amplifier | Recheck calibration and distortion. |
| V2 | 6CW5/ EL86 | | Reset output voltage (paragraphs 5-24 through 5-38). |
| V3 | 6AU6 | Cathode Followers | Recheck distortion (paragraph 5-37). |
| V4 | 6AU6 | | Reset output voltage (paragraph 5-38). |

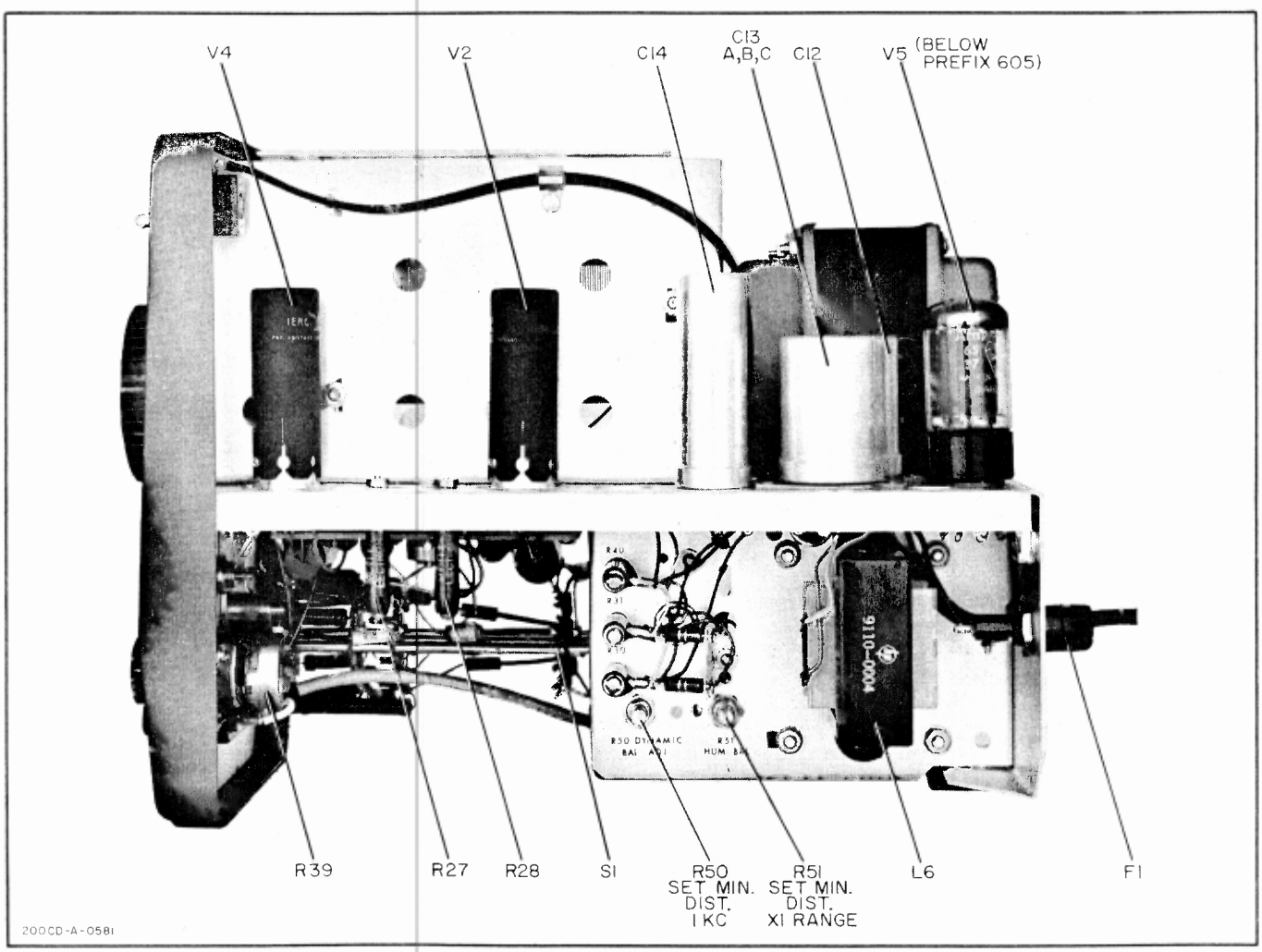



Figure 5-2. Right Side of Model 200CD (as viewed from the front)

5-18. REPLACEMENT OF LAMPS, RT1 and RT2

5-19. The amplitude stablization lamps operate well below their rating and should have a long life, unless they are damaged by severe mechanical vibration. When RT1 or RT2 (see figure 5-1) are replaced, reset output voltage (paragraph 5-38).

5-20. TUNING CAPACITOR REPAIR.

5-21. The tuning capacitor, C5 A, B, C (shown in figure 5-1), should not be loosened unless absolutely necessary, since doing so may cause misalignment of the tuning capacitor shaft with the shaft extension to the gears. If C5 A, B, C has been removed or loosened for any reason, it should be readjusted mechanically before any electrical adjustment is attempted. In some cases, due to slippage, the tuning capacitor will not mesh far enough to allow perfect calibration at the extreme low end of the dial. When correctly set, the edge of the insulation protruding from the rotor plate spacer on C5 should line up with the topmost stator spacer when the dial is set fully clockwise.

5-22. RANGE SWITCH REPAIR.

5-23. Resistor values on S1 have been carefully bridged and adjusted at the factory to the exact value required for proper tracking on all ranges. If one range is found to be badly out of calibration and all other possibilities have been exhausted (especially dirty RANGE switch contacts) try adjusting the value of C1, C2, C7 or C16 (depending on the range affected) slightly. If any part of the RANGE switch is found to be defective, it is recommended that the switch be replaced as an assembly. Figure 5-3 shows all wiring detail for replacement.

## 5-24. ADJUSTMENTS.

5-25. The following section is a complete adjustment procedure and should be made only if it has been definitely determined that the Model 200CD is out of adjustment.

Note

In order to minimize the effects of hand capacity, a "tuning wand" or tuning screwdriver with a plastic shank should be used for all adjustments.

5-26. PRELIMINARY CHECKS.

5-27. The following basic tests are given to avoid possible unnecessary adjustment of the Model 200CD. If the instrument fails any of these tests, some component is probably at fault and should be replaced before attempting any adjustment. Proceed as follows:

5-28. POWER SUPPLY:

a. With the instrument turned off, check the resistance from C13 to ground and the resistance across C13. This resistance is typically many megohms. A very low reading (below 100K) indicates a shorted or leaky capacitor between the B+ line and ground.

b. Turn the instrument on, and allow it to warm up for at least 15 minutes.

c. Check to see that all tubes are glowing.

d. Using an dc electronic voltmeter, measure the positive and negative power supply voltages using ground as a reference. The positive voltage (approximately 225 volts) may be measured between the chassis and C14. The negative voltage (approximately 155 volts) is measured from the chassis to the junction of R30, R31 and R40 (figure 5-2). The difference between the negative and positive voltage should be 380 volts ±75 volts.

5-29. AMPLITUDE CONTROL OPERATION:

a. With a 600-ohm load connected to the OUTPUT terminals, and the Model 200CD output connected to the ac voltmeter, set the Model 200CD RANGE to X100.

b. Turn the Model 200CD AMPLITUDE fully clockwise. If necessary adjust R11 to obtain 12 vac.

c. Now, while observing the voltmeter indication and switching to lower voltmeter ranges as necessary, slowly turn the Model 200CD AMPLITUDE fully counter clockwise. Note the voltmeter reading again. The attenuation should be smooth and the final reading should be at least 46 db below the reference in step b.

5-30. RECOVERY TIME:

a. Switch RANGE to X10 and frequency to 50 kc.

b. Connect the output of the Model 200CD to an oscilloscope.

c. Switch from range to range, observing the oscilloscope pattern after range switching.

d. The oscilloscope presentation should become stable within 5 seconds after switching ranges.

5-31. CALIBRATION.

5-32. The calibration procedure for the Model 200CD is divided into two sections. The first section, paragraph 5-33, is intended to produce a flat frequency response for the Model 200CD, and is accomplished with the instrument set on the X10 range. The second section, paragraph 5-34, is intended to produce correct frequency dial tracking and is accomplished with the instrument set on the X100 range.

5-33. FREQUENCY RESPONSE ADJUSTMENTS:

a. Turn Model 200CD RANGE to X10, frequency dial to 5.

b. Connect the Model 200CD to an ac voltmeter and a frequency measuring device (counter or frequency standard) as shown in figure 5-4.

c. Using Model 200CD AMPLITUDE, set a reference of 9 volts as read on the ac voltmeter.

d. Turn the frequency dial to 60. The ac voltmeter should read within ±1/4 db of the reference in step c and the frequency should be correct within 2%.

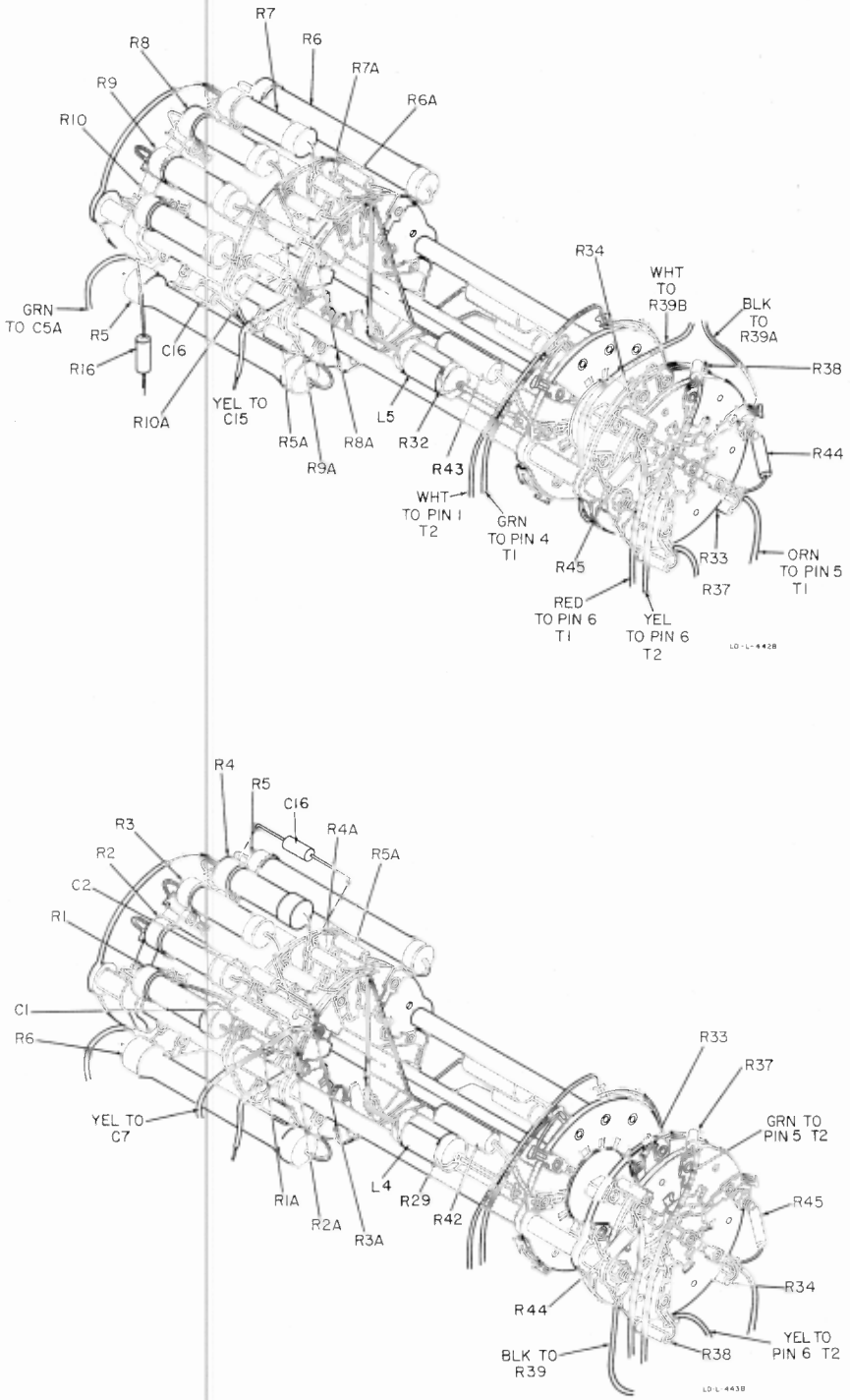



Figure 5-3. Range Switch Detail

e. 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.

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

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

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

5-34. FREQUENCY DIAL TRACKING:

a. Switch Model 200CD RANGE to X100. Connect the equipment as shown in figures 5-4 or 5-5.

b. 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:

1) Remove center knob on frequency dial.

2) Loosen the four screws which secure the dial plate to the drive shaft.

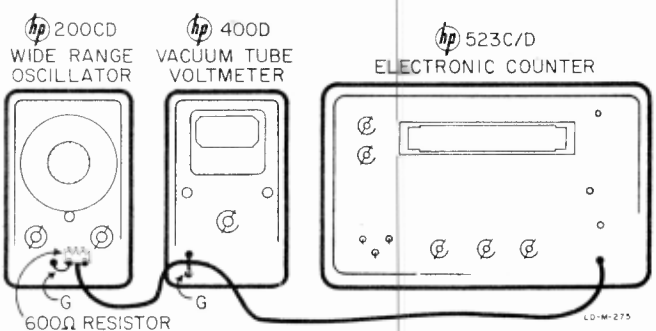



Figure 5-4. Calibration Test Setup

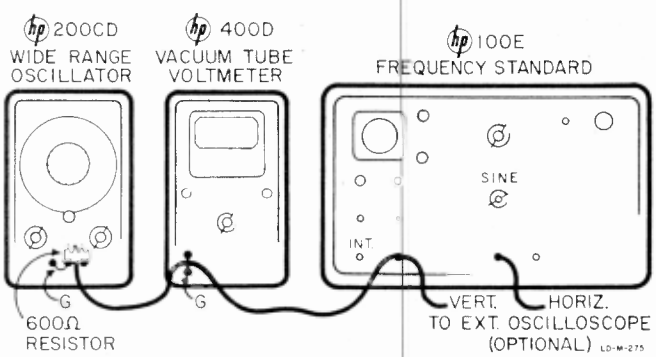



Figure 5-5. Alternate Calibration Setup

3) Reset dial to position indicated in the text.

4) Tighten the four securing screws. (Center knob may be replaced at the end of this procedure.)

c. If it was necessary to slip the dial, repeat steps a through h in paragraph 5-33.

d. If step c was necessary, repeat step b. It is possible that the entire dial will now track without further adjustment.

e. 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.

f. Switch RANGE to X10K, and set the Model 200CD frequency dial to 60.

g. Adjust C7 to put 600 kc on frequency.

h. 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 5-4).

Table 5-4. Frequency/Period Conversion

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

5-35. If the above procedures do not result in correct calibration, start over by adjusting C3 and/or C6 as in step a through h, paragraph 5-33. 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.

5-36. 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.

5-37. DISTORTION.

a. Connect the Model 200CD to the distortion analyzer as shown in figure 5-6.

b. Set the Model 200CD RANGE to X1 and the frequency dial to 20.

c. The distortion analyzer switches should be in the following positions:

| | |
|---|---|
| AF - RF | AF |
| FREQUENCY | 20 |
| Selector switch | SET LEVEL |
| RMS VOLTS-DB switch | ±20 db |

d. Adjust distortion analyzer INPUT control for a zero db reference on the distortion analyzer meter.

e. Switch selector to DISTORTION.

f. Adjust BALANCE and FREQUENCY controls for a dip on the meter.

g. Turn RMS VOLTS-DB switch counterclockwise while continually adjusting distortion analyzer BALANCE and FREQUENCY until the lowest possible dip is obtained.

h. Adjust R50 (dynamic balance) for a dip (minimum distortion; see figure 5-2) on the distortion analyzer meter until the lowest possible dip is obtained.

Note

For optimum results use lowest frequency setting of the 200CD Wide Range Oscillator.

i. Repeat steps a through h, adjusting all distortion analyzer controls for 50 cps (60 cps if 50 cps line frequency is being used) instead of 1000 cps.

j. Adjust R51 (hum balance; see figure 5-2) instead of dynamic balance in step h.

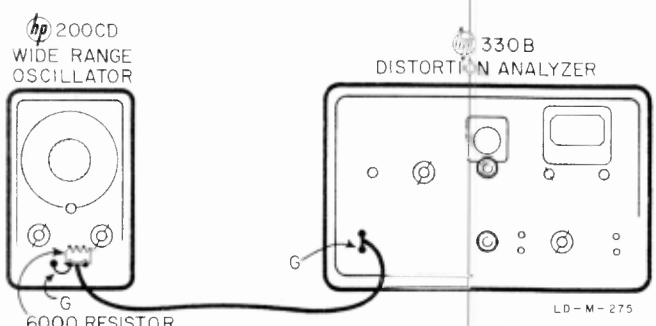



Figure 5-6. Distortion Test Setup

5-38. OUTPUT VOLTAGE

a. Connect the Model 200CD to an ac voltmeter.

b. Load the Model 200CD with a 600-ohm load resistor.

c. Turn Model 200CD AMPLITUDE fully clockwise, and adjust R11 for 11.5 volts on the ac voltmeter (see figure 5-7).

## 5-39. PERFORMANCE CHECK.

5-40. Proper operation of the Model 200CD is verified in the following procedure. A complete adjustment procedure is given in paragraph 5-24.

5-41. OUTPUT IMPEDANCE.

a. Set Model 200CD RANGE to X100, frequency dial to 10.

b. Connect Model 200CD output to an ac transistor voltmeter. Set the voltmeter RANGE to 30 volts.

c. Turn Model 200CD AMPLITUDE fully clockwise. The voltmeter should read at least 20 volts.

d. Set Model 200CD AMPLITUDE for exactly 20 volts as read on the voltmeter.

e. Connect a 600-ohm resistor such as the Model 470E Shunt Resistor across output of Model 200CD.

f. The voltage as read on the voltmeter should drop to 10 volts +0.5 volts.

5-42. FREQUENCY RESPONSE.

a. Connect the Model 200CD to an ac voltmeter and an electronic counter as shown in figure 5-4. Substitute an ac transistor voltmeter for the ac electronic voltmeter in figure 5-4.

b. Set Model 200CD RANGE to X100, frequency dial to 10. Terminate output with 600 ohms.

c. Adjust Model 200CD AMPLITUDE for a convenient reference around 0.9 on the voltmeter scale.

d. Starting with the X1 range, rotate the frequency dial across the band while observing the meter.

e. Repeat this process for each range. The voltmeter indication should not vary more than ±1 db throughout the ranges checked.

5-43. DIAL ACCURACY.

a. Set Model 200CD RANGE to X10K, frequency dial to 60. Observe the frequency reading on the electronic counter.

b. Check frequency at 40, 20, 10 and 5 on the dial.

c. Repeat this procedure for the remaining ranges. The frequency should be correct within ±2%.

Note

For the lower end of the X10 range and the entire X1 range, it will be advantageous to measure the frequency indirectly by switching the electronic counter FUNCTION SELECTOR to 10 PERIOD AVERAGE. Table 5-4 lists the specifications in terms of period readings for each point on the X1 range. To check X10 range, divide the period limit in table 5-4 by 10.

5-44. DISTORTION.

a. Connect the Model 200CD to a distortion analyzer as shown in figure 5-6.

b. Set Model 200CD RANGE switch and frequency dial to one of the frequencies indicated in table 5-5.

c. The distortion analyzer switches should be set to the following positions:
AF-RF . . . . . AF
FREQUENCY. .incoming frequency selected in step b
Selector switch . . . . . SET LEVEL
RMS VOLTS-DB switch . . . . . ±20 db

d. Adjust distortion analyzer INPUT control for a zero db reference on the distortion analyzer meter.

e. Switch selector to DISTORTION.

f. Adjust BALANCE and FREQUENCY controls for a dip on the meter.

g. Turn RMS VOLTS-DB switch counterclockwise while continually adjusting distortion analyzer BALANCE and FREQUENCY until the lowest possible dip is obtained. Specifications are listed in table 5-5.#

Table 5-5. Distortion Test Frequencies

| Range | Frequency | Specifications |
|---|---|---|
| X10 | 100 cps | 54 db |
| X100 | 1000 cps | 54 db |
| X100 | 6 kc | 54 db |
| X1K | 5 kc | 54 db |

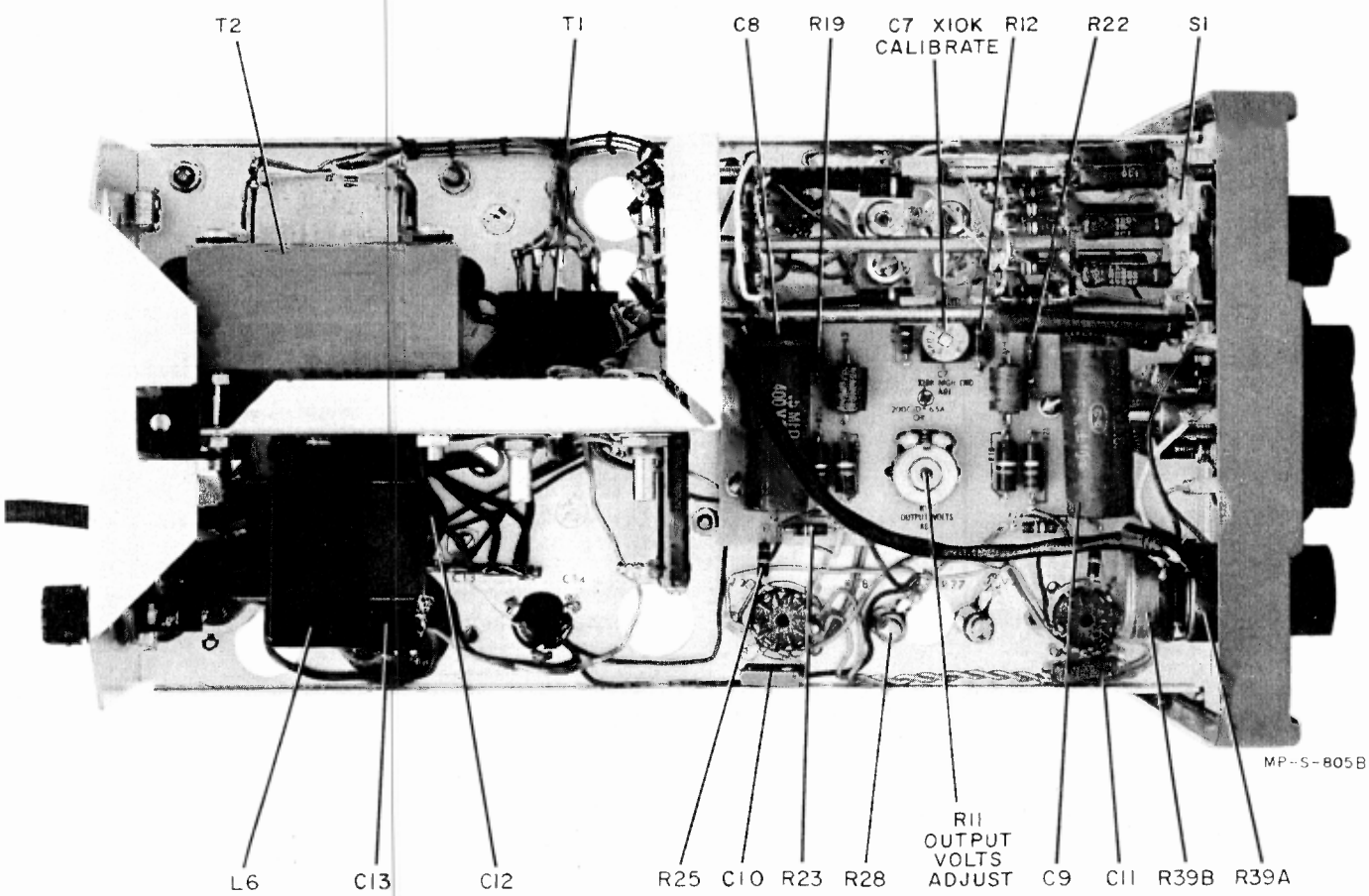



Figure 5-7. Bottom View Model 200CD

# If the measurement of distortion above the frequency of 20 kc is desired, a distortion analyzer which will measure distortion to 600 kc must be used (such as Model 331A). At 500 kc and above, the distortion must be down 46 db from reference 0.5%.

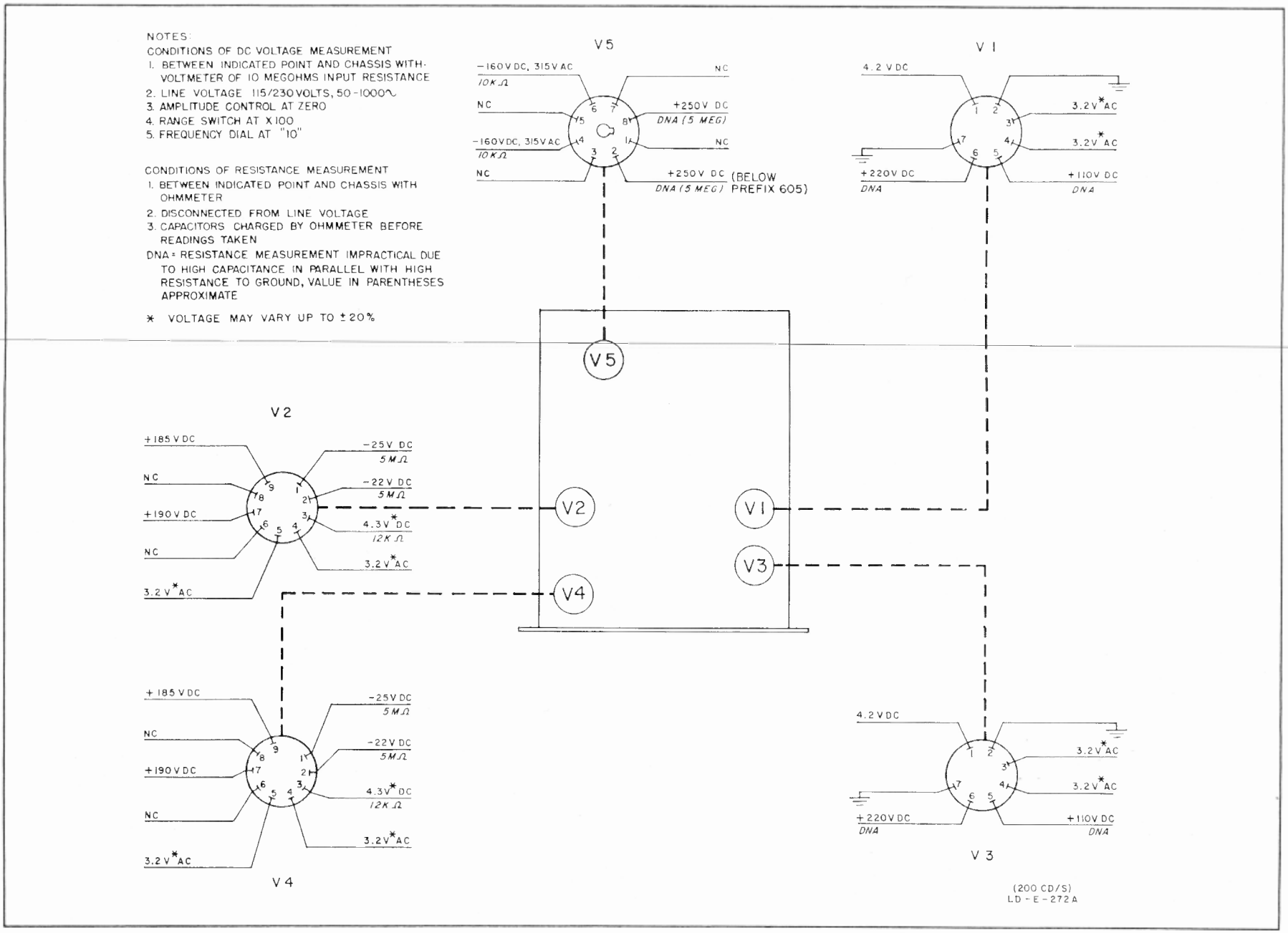



Figure 5-8. Model 200CD Voltage and Resistance Diagram

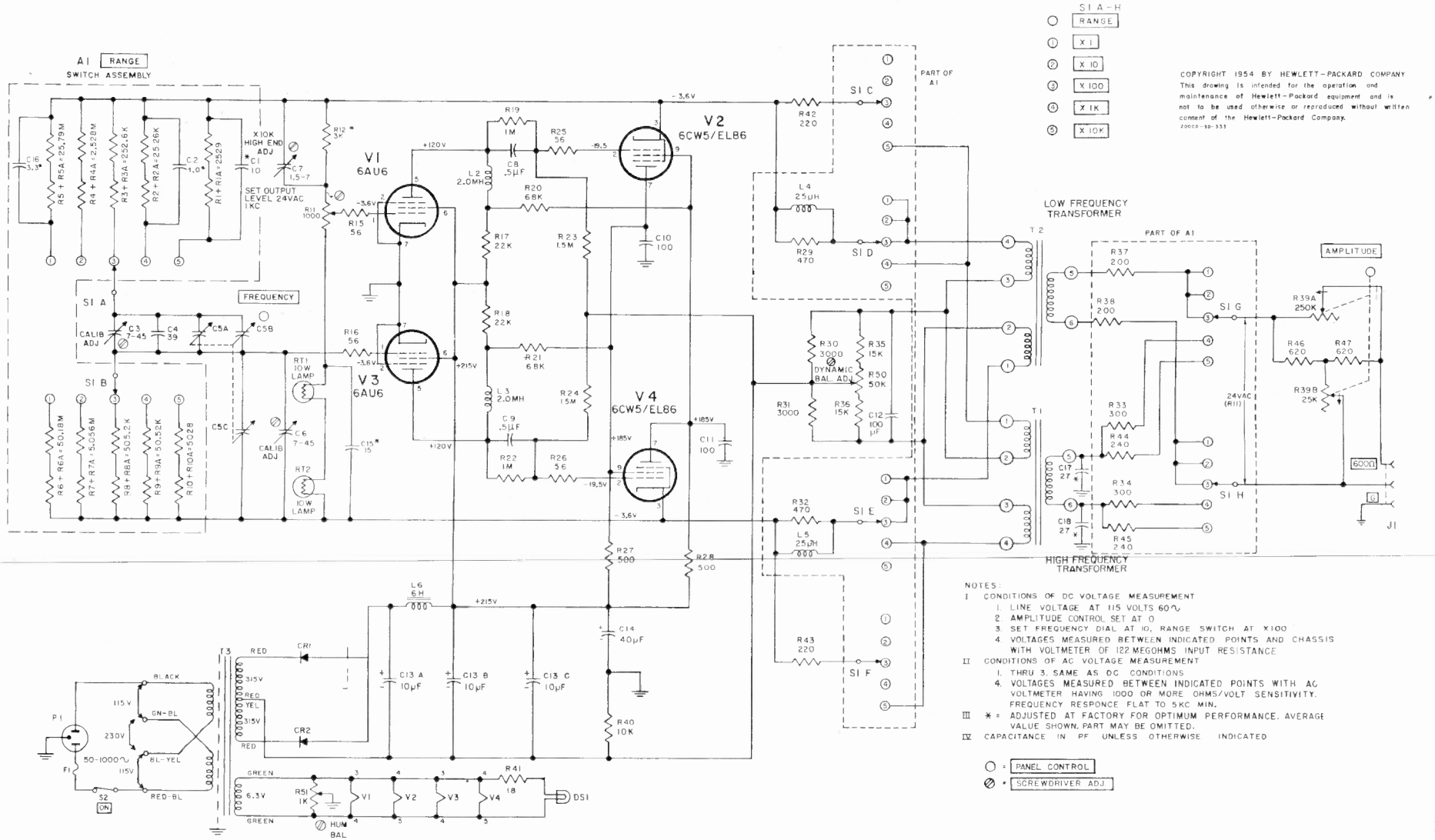



Figure 5-9. Model 200CD Schematic Diagram

# SECTION VI
# REPLACEABLE PARTS

## 6-1. INTRODUCTION.

6-2. This section contains information for ordering replacement parts. Table 6-1 lists parts in alphameric order of their reference designators and indicates the description, -hp- part number of each part, together with any applicable notes, and provides the follows:

a. Total quantity used in the instrument (TQ column).

b. Description of the part. (See list of abbreviations below.)

c. Typical manufacturer of the part in a five-digit code. (See Appendix A for list of manufacturers.)

d. Manufacturer's part number.

6-3. Miscellaneous parts are listed at the end of Table 6-1.

## 6-4. ORDERING INFORMATION.

6-5. To obtain replacement parts, address order or inquiry to your local Hewlett-Packard Field Office. (See Appendix B for list of office locations.) Identify parts by their Hewlett-Packard part numbers.

## 6-6. NON-LISTED PARTS.

6-7. To obtain a part that is not listed, include:

a. Instrument model number.

b. Instrument serial number.

c. Description of the part.

d. Function and location of the part.

DESIGNATORS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| A | = assembly | F | = fuse | P | = plug | V | = vacuum tube, neon bulb, photocell etc. |
| B | = motor | FL | = filter | Q | = transistor | | |
| BT | = battery | HR | = heater | QCR | = transistor-diode | W | = cable |
| C | = capacitor | J | = jack | R | = resistor | X | = socket |
| CR | = diode | K | = relay | RT | = thermistor | XDS | = lampholder |
| DL | = delay line | L | = inductor | S | = switch | XF | = fuseholder |
| DS | = lamp | M | = meter | T | = transformer | | |
| E | = misc electronic part | MP | = mechanical part | TC | = thermocouple | Z | = network |

ABBREVIATIONS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Ag | = silver | ID | = inside diameter | ns | = nanosecond (s) = $10^{-9}$ | SPDT | = single-pole double-throw |
| Al | = aluminum | impg | = impregnated | nsr | = not separately replaceable | SPST | = single-pole single-throw |
| amp | = ampere (s) | incd | = incandescent | | | | |
| Au | = gold | ins | = insulation (ed) | | | Ta | = tantalum |
| | | | | obd | = order by description | $TiO_2$ | = titanium dioxide |
| C | = capacitor | K | = kilohm (s) = $10^{+3}$ | OD | = outside diameter | | |
| cer | = ceramic | Kc | = kiloycycle (s) = $10^{+3}$ | | | tog | = toggle |
| coef | = coefficient | | | p | = peak | tol | = tolerance |
| com | = common | L | = inductor | pc | = printed circuit | trim | = trimmer |
| comp | = composition | lin | = linear taper | pf | = picofarad (s) = $10^{-12}$ | TSTR | = transistor |
| conn | = connection | log | = logarithmic taper | piv | = peak inverse voltage | | |
| cps | = cycles per second | | | p/o | = part of | v | = volt (s) |
| dep | = deposited | m | = milli = $10^{-3}$ | pos | = position (s) | vacw | = alternating current working volt (s) |
| DPDT | = double-pole double-throw | ma | = milliampere (s) = $10^{-3}$ | poly | = polystyrene | var | = variable |
| DPST | = double-pole single-throw | Mc | = megacycle (s) = $10^{+6}$ | pot | = potentiometer | vdcw | = direct current working volt (s) |
| elect | = electrolytic | meg | = megohm (s) = $10^{+6}$ | p-p | = peak-to-peak | | |
| encap | = encapsulated | met flm | = metal film | prec | = precision (temperature coefficient, long term stability, and/or tolerance) | w | = watt (s) |
| | | mfr | = manufacturer | | | w/ | = with |
| f | = farad (s) | mtg | = mounting | | | wiv | = reverse working voltage |
| FET | = field effect transistor | $\mu$ | = micro = $10^{-6}$ | | | w/o | = without |
| fxd | = fixed | my | = Mylar ® | R | = resistor | ww | = wirewound |
| GaAs | = gallium arsenide | | | Rh | = rhodium | | |
| Gc | = gigacycle (s) = $10^{+9}$ | na | = nanoampere (s) = $10^{-9}$ | rms | = root-mean-square | * | = optimum value selected at factory, average value shown (part may be omitted) |
| gd | = guard (ed) | NC | = normally closed | rot | = rotary | | |
| Ge | = germanium | Ne | = neon | | | | |
| grd | = ground (ed) | NO | = normally open | Se | = selenium | ** | = no standard type number assigned (selected or special type) |
| h | = henry (ies) | NPO | = negative positive zero (zero temperature coefficient) | sect | = section (s) | | |
| Hg | = mercury | | | Si | = silicon | | |
| | | | | sl | = slide | | |

® Dupont de Nemours

Table 6-1. Reference Designation Index

| Circuit Reference | Stock No. | Description | Note |
|---|---|---|---|
| A1 | 200CD-19WB | Assy, range switch includes: C1, C2, C16, L4, L5, R1 thru R10, R33, R34, R37, R38, R42 thru R45, S1 | |
| C1 | | Nsr; part of A1 | |
| C2 | | Nsr; part of A1 | |
| C3 | 0130-0001 | C: var, cer, 7-45 pf, 500 vdcw | |
| C4 | 0140-0116 | C: fxd, mica, 39 pf ±2%, 500 vdcw | |
| C5 | 0121-0018 | C: var, 3 sect, 14-617 pf/sect | |
| C6 | 0130-0001 | C: var, cer, 7-45 pf, 500 vdcw | |
| C7 | 0130-0011 | C: var, cer, 1.5-7 pf, 500 vdcw | |
| C8, C9 | 0160-0024 | C: fxd, my, 0.5 μf ±10%, 400 vdcw | |
| C10, C11 | 0140-0054 | C: fxd, mica, 100 pf ±10%, 500 vdcw | |
| C12 | 0180-0013 | C: fxd, elect, 100 μf, 100 vdcw | |
| C13A, B, C | 0180-0017 | C: fxd, elect, 3 sect, 10 μf/sect, 450 vdcw | |
| C14 | 0180-0024 | C: fxd, aluminum elect, 40 μf, 450 vdcw | |
| C15 | 0140-0004 | C: fxd, mica, 15* pf ±10%, 500 vdcw | |
| C16 | | Nsr; part of A1 | |
| C17, C18 | 0140-0005 | C: fxd, mica, 27* pf ±10%, 500 vdcw | |
| CR1, CR2 | 1901-0037 | Rectifier, silicon | |
| DS1 | 2140-0003 | Lamp, incd: 0.15 amp, 6-8 V | |
| F1 | 2110-0021 | Fuse, 1.25 amp, s-b (for 115 V operation) | |
| | 2110-0016 | Fuse, 0.6 amp, s-b (for 230 V operation) | |
| J1 | | Connector assy, consists of: | |
| | 5060-0625 | Binding post w/ground link | |
| | 5060-0633 | Binding post: red | |
| | 0340-0087 | Insulator: bl, 3 hole (rear) | |
| | 0340-0091 | Insulator: black, 3 hole (front), with locating key | |
| L1 | | Not assigned | |
| L2, L3 | 200CD-60C | Coil, R.F., 2 mh | |
| L4, L5 | | Nsr; part of A1 | |
| L6 | 9110-0001 | Rector, filter choke, 6 h | |
| P1 | 8120-0050 | Assy, power cable: smooth, black, shiny, 7.5 ft, NEMA plug | |
| R1 thru R10 | | Nsr; part of A1 | |
| R11 | 2100-0154 | R: var, comp, lin, 1 K ohms ±30%, 3/10 W | |
| R12 | 0689-3021 | R: fxd, comp, 3 K ohms ±5%, 1 W | |
| R13, R14 | | Not assigned | |
| R15, R16 | 0687-5601 | R: fxd, comp, 56 ohms ±10%, 1/2 W | |
| R17, R18 | 0761-0030 | R: fxd, met flm, 22 K ohms ±5%, 1 W | |
| R19 | 0686-1055 | R: fxd, comp, 1 M ±5%, 1/2 W | |
| R20, R21 | 0761-0083 | R: fxd, met flm, 68 K ohms ±5%, 1 W | |
| R22 | 0686-1055 | R: fxd, comp, 1 M ±5%, 1/2 W | |
| R23, R24 | 0687-1551 | R: fxd, comp, 1.5 M ±10%, 1/2 W | |
| R25, R26 | 0687-5601 | R: fxd, comp, 56 ohms ±10%, 1/2 W | |
| R27, R28 | 0816-0003 | R: fxd, ww, 500 ohms ±10%, 10 W | |
| R29 | | R: 470 ohms, nsr; part of L4 | |
| R30, R31 | 0816-0002 | R: fxd, ww, 3 K ohms ±10%, 10 W | |
| R32 | | R: 470 ohms, nsr; part of L5 | |

# See introduction to this section

Table 6-1. Reference Designation Index (Cont'd)

| Circuit Reference | ℎp Stock No. | Description | Note |
|---|---|---|---|
| R33, R34 | | Nsr; part of A1 | |
| R35, R36 | 0690-1531 | R: fxd, comp, 15 K ohms ±10%, 1 W | |
| R37, R38 | | Nsr; part of A1 | |
| R39A, B | 2100-0113 | R: var, comp, dual tandem, 100 K/sect, 25 K/sect, 2 W | |
| R40 | 0816-0008 | R: fxd, ww, 10 K ohms ±10%, 10 W | |
| R41 | 0690-1801 | R: fxd, comp, 18 ohms ±10%, 1 W | |
| R42 thru R45 | | Nsr; part of A1 | |
| R46, R47 | 0686-6215 | R: fxd, comp, 620 ohms ±5%, 1/2 W | |
| R48, R49 | | Not assigned | |
| R50 | 2100-0013 | R: var, comp, lin, 50 K ohms ±20%, 1/2 W | |
| R51 | 2100-0036 | R: var, comp, lin, 1 K ohms, 0.5 W | |
| RT1, RT2 | 2140-0007 | Lamp, incd: 250 V, 10 W | |
| S1 | | Nsr; part of A1 | |
| S2 | 3101-0001 | Switch, tog: SPST, 3 amp | |
| T1 | 200CD-9 | Transformer, output: high frequency | |
| T2 | 9120-0016 | Transformer, output: low frequency | |
| T3 | 9100-1329 | Transformer: power | |
| V1 | 1923-0021 | Tube, elect: 6AU6, 7 pin minat | |
| V2 | 1923-0044 | Tube, elect: EL 86, 9 pin minat | |
| V3 | 1923-0021 | Tube, elect: 6AU6, 7 pin minat | |
| V4 | 1923-0044 | Tube, elect: EL 86, 9 pin minat | |
| XF1 | 1400-0084 | Fuseholder: extrator post type | |
| XV1 | 1200-0009 | Socket, tube: 7 pin, minat | |
| XV2 | 1200-0072 | Socket, tube: 9 pin | |
| XV3 | 1200-0009 | Socket, tube: 7 pin, minat | |
| XV4 | 1200-0072 | Socket, tube: 9 pin | |

# See introduction to this section

Table 6-1. Reference Designation Index (Cont'd)

| Circuit Reference | ℎp Stock No. | Description | Note |
|---|---|---|---|
| | | MISCELLANEOUS | |
| | 0370-0028 | Knob: frequency dial vernier | |
| | 0370-0032 | Knob: AMPLITUDE | |
| | 0370-0035 | Knob: RANGE | |
| | 0370-0045 | Knob: frequency dial, 2-1/4" | |
| | 1220-0006 | Shield, base: 9 pin | |
| | 1220-0029 | Shield, tube (for V2, V4) | |
| | 1450-0009 | Lampholder, bayonet | |
| | 1450-0013 | Lampholder, candelabra | |
| | 1460-0114 | Spring, gear ass'y | |
| | 1500-0002 | Flexible coupler | |
| | 5000-0637 | Spring, thrust (vernier drive) | |
| | 5020-0600 | Hub, dial -- fits on shaft of 5020-0617 | |
| | 5020-0617 | Gear spur with shaft | |
| | 5020-0618 | Bearing, capacitor drive | |
| | 5040-0212 | Insulator, flex coupling | |
| | 5040-0600 | Window, dial for curved frequency dial | |
| | 5040-0607 | Assy, disc VERNIER DRIVE | |
| | 5060-0020 | Assy, gear with coupling hub | |
| | 5060-0021 | Assy, gear | |
| | 5080-0205 | Coupler, flexible | |
| | 200CD-40A | Dial, frequency calibrated | |
| | 200CD-903 | Manual, operating and service | |

# See introduction to this section

Table 6-2. Replaceable Parts

| ℘ Stock No. | Description | Mfr. | Mfr. Part No. | TQ | | |
|---|---|---|---|---|---|---|
| 200CD-9 | Transformer, high frequency | 28480 | 200CD-9 | 1 | | |
| 200CD-19WB | Assy, range switches includes:<br>C1, C2, C16 R33, R34, R37, R38<br>L4, L5 R42 thru R45<br>R1 thru R10 S1 | 28480 | 200CD-19WB | 1 | | |
| 200CD-40A | Dial, frequency, calibrated | 28480 | 200CD-40A | 1 | | |
| 200CD-60C | Coil, RF | 28480 | 200CD-60C | 2 | | |
| 0121-0018 | C: var, 3 sect, 14-617pf/sect | 28480 | 0121-0018 | 1 | | |
| 0130-0001 | C: var, cer, 7-45 pf, 500 vdcw | 72982 | 503-000D2PO-33R | 2 | | |
| 0130-0011 | C: var, cer, 1.5-7 pf, 500 vdcw | 72982 | 557-023-COPO-10R | 1 | | |
| 0140-0004 | C: fxd, mica, 15 pf ±10%, 500 vdcw | 72136 | CM15B150K | 1 | | |
| 0140-0005 | C: fxd, mica, 27 pf ±10%, 500 vdcw | 14655 | CM15B270K | 2 | | |
| 0140-0054 | C: fxd, mica, 100 pf ±10%, 500 vdcw | 14655 | CM20B101K | 2 | | |
| 0140-0116 | C: fxd, mica, 39 pf ±2%, 500 vdcw | 14655 | CM15E390G | 1 | | |
| 0160-0024 | C: fxd, my, 0.5 μf ±10%, 400 vdcw | 14655 | PKM4P5 | 2 | | |
| 0180-0013 | C: fxd, elect, 100 μf, 100 vdcw | 56289 | D33067 | 1 | | |
| 0180-0017 | C: fxd, elect, 3 sect/10 μf, 450 vdcw | 56289 | D32631 | 1 | | |
| 0180-0024 | C: fxd, aluminum elect, 40 μf, 450 vdcw | 56289 | D32441 | 1 | | |
| 0340-0087 | Insulator: binding post, black, 3 hole | 28480 | 0340-0087 | 1 | | |
| 0340-0091 | Insulator: binding post, black, 3 hole, with locating key | 28480 | 0340-0091 | 1 | | |
| 0370-0028 | Knob: frequency dial vernier | 28480 | 0370-0028 | 1 | | |
| 0370-0032 | Knob: AMPLITUDE | 28480 | 0370-0032 | 1 | | |
| 0370-0035 | Knob: RANGE | 28480 | 0370-0035 | 1 | | |
| 0370-0045 | Knob: frequency dial | 28480 | 0370-0045 | 1 | | |
| 0686-1055 | R: fxd, comp, 1 M ±5%, 1/2 W | 01121 | EB 1055 | 2 | | |
| 0686-6215 | R: fxd, comp, 620 ohms ±5%, 1/2 W | 01121 | EB 6215 | 2 | | |
| 0687-1551 | R: fxd, comp, 1.5 M ±10%, 1/2 W | 01121 | EB 1551 | 1 | | |
| 0687-5601 | R: fxd, comp, 56 ohms ±10%, 1/2 W | 01121 | EB 5601 | 4 | | |
| 0689-3025 | R: fxd, comp, 3 K ohms ±5%, 1 W | 01121 | GB 3025 | 1 | | |
| 0690-1531 | R: fxd, comp, 15 K ohms ±10%, 1 W | 01121 | GB 1531 | 2 | | |
| 0690-1801 | R: fxd, comp, 18 ohms ±10%, 1 W | 01121 | GB 1801 | 1 | | |
| 0761-0030 | R: fxd, met flm 22 K ohms ±5%, 1 W | 07115 | C32 obd | 2 | | |
| 0761-0083 | R: fxd, met flm 68 K ohms ±5%, 1 W | 07115 | C32 obd | 4 | | |
| 0816-0002 | R: fxd, ww, 3 K ohms ±10%, 10 W | 35434 | Type GC10-3KA | 2 | | |
| 0816-0003 | R: fxd, ww, 5000 ohms ±10%, 10 W | 35434 | G-10, obd# | 2 | | |
| 0816-0008 | R: fxd, ww, 10 K ohms ±10%, 10 W | 35434 | Type C-10, obd# | 1 | | |
| 1200-0009 | Socket, tube: 7 pin, minat | 91662 | 316PH-3702 | 2 | | |
| 1200-0072 | Socket, tube: 9 pin | 91662 | 988PHTDX103 | 2 | | |
| 1220-0006 | Shield, base: 9 pin | 71785 | 441-43-11-215/202 | 2 | | |
| 1220-0029 | Shield, tube (for V , V ) | 98978 | TRTg-6027B | 2 | | |
| 1400-0084 | Fuseholder: extractor post type | 75915 | 342014 | 1 | | |
| 1450-0009 | Lampholder, bayonet | 72765 | 223G-CE | 1 | | |
| 1450-0013 | Lampholder, candelabra | 72765 | 169B | 1 | | |
| 1460-0114 | Spring, gear assy | 91260 | obd# | 1 | | |
| 1500-0002 | Flexible coupler | 76487 | obd# | 1 | | |
| 1901-0037 | Rectifier, silicon | 83701 | IN2359 | 2 | | |
| 1923-0021 | Tube, elect: 6AU6, 7 pin minat | 33173 | 6AU6 | 2 | | |
| 1923-0044 | Tube, elect: EL86, 9 pin minat | 73445 | EL 86/6CW5 | 2 | | |

# See introduction to this section

Table 6-2. Replaceable Parts (Cont'd)

| ℎ Stock No. | Description | Mfr. | Mfr. Part No. | TQ | | |
|---|---|---|---|---|---|---|
| 2100-0013 | R: var, comp, lin, 50 K ohms ±20%, 1/2 W | 71590 | Model 2 | 1 | | |
| 2100-0036 | R: var, comp, lin, 1 K ohms, 0.5 W | 01121 | JA1L0405502UC | 1 | | |
| 2100-0113 | R: var, comp, dual tandem, 2 W | 01121 | JJ59160 | 1 | | |
| 2100-0154 | R: var, comp, lin, 1 K ohms ±30%, 3/10 W | 11237 | UPE-70 | 1 | | |
| 2110-0016 | Fuse, 0.6 amp, s-b (for 230 v operation) | 75915 | 313.600 | 1 | | |
| 2110-0021 | Fuse, 1.25 amp, s-b (for 115 v operation) | 71400 | MDL 1.25 | 1 | | |
| 2140-0007 | Lamp, incd: 250 v, 10 W | 24455 | 8A/S6-12V | 2 | | |
| 2140-0009 | Lamp, incd: 0.15 amp, 6-8 v | 24455 | 47 | 1 | | |
| 3101-0001 | Switch, tog: SPST, 3 amp | 04009 | 80994-11 | 1 | | |
| 5000-0637 | Spring, thrust (vernier drive) | 28480 | 5000-0637 | 1 | | |
| 5020-0600 | Hub, dial: fits on shaft of 5020-0617 | 28480 | 5020-0600 | 1 | | |
| 5020-0618 | Bearing, capacitor drive | 28480 | 5020-0618 | 1 | | |
| 5040-0212 | Insulator, flex coupling | 28480 | 5040-0212 | 1 | | |
| 5040-0600 | Window, dial for curved frequency dial | 28480 | 5040-0600 | 1 | | |
| 5040-0607 | Assy, disc vernier drive | 28480 | 5040-0607 | 1 | | |
| 5060-0020 | Assy, Gear with coupling hub | 28480 | | 1 | | |
| 5060-0021 | Assy, Gear | 28480 | | 1 | | |
| 5060-0625 | Assy, binding post, ground w/link | 28480 | 5060-0625 | 1 | | |
| 5060-0633 | Binding post, red | 28480 | 5060-0633 | 2 | | |
| 5080-0205 | Coupler, flexible | 28480 | 5080-0205 | 1 | | |
| 8120-0050 | Assy, power cable: Smooth, black, shiny, 7.5 ft. NEMA plug | 70903 | KH-4096/PH-151/ 7.5 ft. | 1 | | |
| 9100-1329 | Transformer, power | 28480 | 9100-1329 | 1 | | |
| 9110-0004 | Rector, filter choke | 72964 | 8168-D | 1 | | |
| 9120-0016 | Transformer, low freq. output | 98734 | 2005 | 1 | | |

# See introduction to this section

# APPENDIX
# CODE LIST OF MANUFACTURERS (Sheet 1 of 2)

The following code numbers are from the Federal Supply Code for Manufacturers Cataloging Handbooks H4-1 (Name to Code) and H4-2 (Code to Name) and their latest supplements. The date of revision and the date of the supplements used appear at the bottom of each page. Alphabetical codes have been arbitrarily assigned to suppliers not appearing in the H4 handbooks.

| Code No. | Manufacturer | Address |
|---|---|---|
| 00000 | U.S.A. Common | Any supplier of U.S. |
| 00136 | McCoy Electronics | Mount Holly Springs, Pa. |
| 00213 | Sage Electronics Corp. | Rochester, N. Y. |
| 00334 | Humidail Co. | Colton, Calif. |
| 00335 | Westrex Corp. | New York, N.Y. |
| 00373 | Garlock Packing Co., Electronic Products Div. | Camden, N. J. |
| 00656 | Aerovox Corp. | New Bedford, Mass. |
| 00779 | Amp, Inc. | Harrisburg, Pa. |
| 00781 | Aircraft Radio Corp. | Boonton, N. J. |
| 00815 | Northern Engineering Laboratories, Inc. | Burlington, Wis. |
| 00853 | Sangamo Electric Company, Ordill Division (Capacitors) | Marion, Ill. |
| 00866 | Goe Engineering Co. | Los Angeles, Calif. |
| 00891 | Carl E. Holmes Corp. | Los Angeles, Calif. |
| 01121 | Allen Bradley Co. | Milwaukee, Wis. |
| 01255 | Litton Industries, Inc. | Beverly Hills, Calif. |
| 01281 | TRW Semiconductors Inc. | Lawndale, Calif. |
| 01295 | Texas Instruments, Inc. Transistor Products Div. | Dallas, Texas |
| 01349 | The Alliance Mfg. Co. | Alliance, Ohio |
| 01561 | Chassi-Trak Corp. | Indianapolis, Ind. |
| 01589 | Pacific Relays, Inc. | Van Nuys, Calif. |
| 01930 | Amerock Corp | Rockford, Ill. |
| 01961 | Pulse Engineering Co. | Santa Clara, Calif. |
| 02114 | Ferroxcube Corp. of America | Saugerties, N.Y. |
| 02286 | Cole Mfg. Co. | Palo Alto, Calif. |
| 02660 | Amphenol-Borg Electronics Corp. | Chicago, Ill. |
| 02735 | Radio Corp. of America, Semiconductor and Materials Div. | Somerville, N.J. |
| 02771 | Vocaline Co. of America, Inc. | Old Saybrook, Conn. |
| 02777 | Hopkins Engineering Co. | San Fernando, Calif. |
| 03508 | G.E. Semiconductor Products Dept. | Syracuse, N.Y. |
| 03705 | Apex Machine & Tool Co. | Dayton, Ohio |
| 03797 | Eldema Corp. | El Monte, Calif. |
| 03877 | Transitron Electronic Corp. | Wakefield, Mass. |
| 03888 | Pyrofilm Resistor Co. | Morristown, N.J. |
| 03954 | Air Marine Motors, Inc. | Los Angeles, Calif. |
| 04009 | Arrow, Hart and Hegeman Elect. Co. | Hartford, Conn. |
| 04013 | Taurus Corp. | Lambertville, N. J. |
| 04062 | Elmenco Products Co. | New York, N.Y. |
| 04222 | Hi-Q Division of Aerovox | Myrtle Beach, S.C. |
| 04298 | Elgin National Watch Co., Electronics Division | Burbank, Calif. |
| 04354 | Precision Paper Tube Co. | Chicago, Ill. |
| 04404 | Dymec Division of Hewlett-Packard Co. | Palo Alto, Calif. |
| 04651 | Sylvania Electric Prods., Inc. Electronic Tube Div. | Mountain View, Calif. |
| 04713 | Motorola, Inc., Semiconductor Prod. Div. | Phoenix, Arizona |
| 04732 | Filtron Co., Inc., Western Div. | Culver City, Calif. |
| 04773 | Automatic Electric Co. | Northlake, Ill. |
| 04777 | Automatic Electric Sales Corp. | Northlake, Ill. |
| 04796 | Sequoia Wire & Cable Co. | Redwood City, Calif. |
| 04811 | Precision Coil Spring Co. | El Monte, Calif. |
| 04870 | P. M. Motor Company | Chicago 44, Ill. |
| 05006 | Twentieth Century Plastics, Inc. | Los Angeles, Calif. |
| 05277 | Westinghouse Electric Corp., Semi-Conductor Dept. | Youngwood, Pa. |
| 05347 | Ultronix, Inc. | San Mateo, Calif. |
| 05593 | Illumitronic Engineering Co. | Sunnyvale, Calif. |
| 05616 | Cosmo Plastic (c/o Electrical Spec. Co.) | Cleveland, Ohio |
| 05624 | Barber Colman Co. | Rockford, Ill. |
| 05728 | Tiffen Optical Co. | Roslyn Heights, Long Island, N.Y. |
| 05729 | Metropolitan Telecommunications Corp. Metro Cap. Division | Brooklyn, N.Y. |
| 05783 | Stewart Engineering Co. | Santa Cruz, Calif. |
| 05820 | Wakefield Engineering Inc. | Wakefield, Mass. |
| 06004 | The Bassick Co. | Bridgeport, Conn. |
| 06175 | Bausch and Lomb Optical Co. | Rochester, N.Y. |
| 06402 | E.T.A. Products Co. of America | Chicago, Ill. |
| 06475 | Western Devices, Inc. | Inglewood, Calif. |
| 06540 | Amatom Electronic Hardware Co. Inc. | New Rochelle, N. Y. |
| 06555 | Beede Electrical Instrument Co., Inc. | Penacook, N.H. |
| 06751 | U. S. Semcor Division of Nuclear Corp. of America | Phoenix, Arizona |
| 06812 | Torrington Mfg. Co., West Div. | Van Nuys, Calif. |
| 07088 | Kelvin Electric Co. | Van Nuys. Calif. |
| 07115 | Corning Glass Works Electronic Components Dept. | Bradford, Pa. |
| 07126 | Digitran Co. | Pasadena, Calif. |
| 07137 | Transistor Electronics Corp. | Minneapolis, Minn. |
| 07138 | Westinghouse Electric Corp. Electronic Tube Div. | Elmira, N.Y. |
| 07149 | Filmohm Corp. | New York, N. Y. |
| 07233 | Cinch-Graphik Co. | City of Industry, Calif. |
| 07261 | Avnet Corp. | Los Angeles, Calif. |
| 07263 | Fairchild Semiconductor Corp. | Mountain View, Calif. |
| 07322 | Minnesota Rubber Co. | Minneapolis, Minn. |
| 07387 | The Birtcher Corp. | Los Angeles, Calif. |
| 07700 | Technical Wire Products | Springfield, N.J. |
| 07910 | Continental Device Corp. | Hawthorne, Calif. |
| 07933 | Rheem Semiconductor Corp. | Mountain View, Calif. |
| 07966 | Shockley Semi-Conductor Laboratories | Palo Alto, Calif. |
| 07980 | Boonton Radio Corp. | Boonton, N.J. |
| 08145 | U.S. Engineering Co. | Los Angeles, Calif. |
| 08289 | Blinn, Delbert, Co. | Pomona, Calif. |
| 08358 | Burgess Battery Co. | Niagara Falls, Ontario, Canada. |
| 08717 | Sloan Company | Burbank, Calif. |
| 08718 | Cannon Electric Co., Phoenix Div. | Phoenix, Ariz. |
| 08792 | CBS Electronics Semiconductor Operations, Div. of C.B.S., Inc. | Lowell, Mass. |
| 08984 | Mel-Rain | Indianapolis, Ind. |
| 09026 | Babcock Relays, Inc. | Costa Mesa, Calif. |
| 09134 | Texas Capacitor Co. | Houston, Texas |
| 09145 | Atohm Electronics | Sun Valley, Calif. |
| 09250 | Electro Assemblies, Inc. | Chicago, Ill. |
| 09569 | Mallory Battery Co. of Canada, Ltd. | Toronto, Ontario, Canada |
| 09664 | The Bristol Co. | Waterbury, Conn. |
| 10214 | General Transistor Western Corp. | Los Angeles, Calif. |
| 10411 | Ti-Tal, Inc. | Berkeley, Calif. |
| 10646 | Carborundum Co. | Niagara Falls, N.Y. |
| 11236 | CTS of Berne, Inc. | Berne, Ind. |
| 11237 | Chicago Telephone of California, Inc. | So. Pasadena, Calif. |
| 11312 | Microwave Electronics Corp. | Palo Alto, Calif. |
| 11534 | Duncan Electronic, Inc. | Santa Ana, Calif. |
| 11711 | General Instrument Corporation Semiconductor Division | Newark, N.J. |
| 11717 | Imperial Electronic, Inc. | Buena Park, Calif. |
| 11870 | Melabs, Inc. | Palo Alto, Calif. |
| 12136 | Philadelphia Handle Co. | Camden, N. J. |
| 12697 | Clarostat Mfg. Co. | Dover, N.H. |
| 12859 | Nippon Electric Co., Ltd. | Tokyo, Japan |
| 12930 | Delta Semiconductor Inc. | Newport Beach, Calif. |
| 13103 | Thermolloy | Dallas, Texas |
| 13396 | Telefunken (G.M.B.H.) | Hannover, Germany |
| 13835 | Midland Mfg. Co. | Kansas City, Kansas |
| 14099 | Sem-Tech | Newbury Park, Calif. |
| 14153 | Calif. Resistor Corp. | Santa Monica, Calif. |
| 14298 | American Components, Inc. | Conshohocken, Pa. |
| 14655 | Cornell Dubilier Elec. Corp. | So. Plainfield, N.J. |
| 14960 | Williams Mfg. Co. | San Jose, Calif. |
| 15203 | Webster Electronics Co. Inc. | Brooklyn, N.Y. |
| 15291 | Adjustable Bushing Co. | N. Hollywood, Calif. |
| 15772 | Twentieth Century Coil Spring Co. | Santa Clara, Calif. |
| 15909 | The Daven Co. | Livingston, N.J. |
| 16037 | Spruce Pine Mica Co. | Spruce Pine, N. C. |
| 16352 | Computer Diode Corp. | Lodi, N. J. |
| 16688 | De Jur-Amsco Corporation | Long Island City 1, N.Y. |
| 16758 | Delco Radio Div. of G.M. Corp. | Kokomo, Ind. |
| 17109 | Thermonetics Inc. | Canoga Park, Calif. |
| 17474 | Tranex Company | Mountain View, Calif. |
| 18486 | Radio Industries | Des Plaines, Ill. |
| 18583 | Curtis Instrument Inc. | Mt. Kisco, N.Y. |
| 18873 | E. I. DuPont and Co., Inc. | Wilmington, Del. |
| 19315 | Eclipse Pioneer, Div. of Bendix Aviation Corp. | Teterboro, N.J. |
| 19500 | Thomas A. Edison Industries, Div. of McGraw-Edison Co. | West Orange, N.J. |
| 19701 | Electra Manufacturing Co. | Kansas City, Mo. |
| 20183 | Electronic Tube Corp. | Philadelphia, Pa. |
| 21226 | Executive, Inc. | New York, N.Y. |
| 21520 | Fansteel Metallurgical Corp. | No. Chicago, Ill. |
| 21335 | The Fafnir Bearing Co. | New Britain, Conn. |
| 21964 | Fed. Telephone and Radio Corp. | Clifton, N.J. |
| 24446 | General Electric Co. | Schenectady, N.Y. |
| 24455 | G.E., Lamp Division | Nela Park, Cleveland, Ohio |
| 24655 | General Radio Co. | West Concord, Mass. |
| 26365 | Gries Reproducer Corp. | New Rochelle, N.Y. |
| 26462 | Grobet File Co. of America, Inc. | Carlstadt, N.J. |
| 26992 | Hamilton Watch Co. | Lancaster, Pa. |
| 28480 | Hewlett-Packard Co. | Palo Alto, Calif. |
| 33173 | G.E. Receiving Tube Dept. | Owensboro, Ky. |
| 35434 | Lectrohm Inc. | Chicago, Ill. |
| 36196 | Sanwyck Corp. | Hawkesbury, Ontario, Canada |
| 37942 | P.R. Mallory & Co., Inc. | Indianapolis, Ind. |
| 39543 | Mechanical Industries Prod. Co. | Akron, Ohio |
| 40920 | Miniature Precision Bearings, Inc. | Keene, N.H. |
| 42190 | Muter Co. | Chicago, Ill. |
| 43990 | C.A. Norgren Co. | Englewood, Colo. |
| 44655 | Ohmite Mfg. Co. | Skokie, Ill. |
| 47904 | Polaroid Corp. | Cambridge, Mass. |
| 48620 | Precision Thermometer and Inst. Co. | Philadelphia, Pa. |
| 49956 | Raytheon Company | Lexington, Mass. |
| 52090 | Rowan Controller Co. | Baltimore, Md. |
| 53743 | Ward Leonard Electric | Mt. Vernon, N.Y. |
| 54294 | Shallcross Mfg. Co. | Selma, N.C. |
| 55026 | Simpson Electric Co. | Chicago, Ill. |
| 55933 | Sonotone Corp. | Elmsford, N.Y. |
| 55938 | Sorenson & Co., Inc. | So. Norwalk, Conn. |
| 56137 | Spaulding Fibre Co., Inc. | Tonawanda, N.Y. |
| 56289 | Sprague Electric Co. | North Adams, Mass. |
| 59446 | Telex, Inc. | St. Paul, Minn. |
| 59730 | Thomas & Betts Co. | Elizabeth 1, N. J. |
| 60741 | Tripplett Electrical Inc. | Bluffton, Ohio |
| 61775 | Union Switch and Signal, Div. of Westinghouse Air Brake Co. | Swissvale, Pa. |
| 62119 | Universal Electric Co. | Owosso, Mich. |
| 63743 | Ward-Leonard Electric Co. | Mt. Vernon, N.Y. |
| 64959 | Western Electric Co., Inc. | New York, N.Y. |
| 65092 | Weston Inst. Div. of Daystrom, Inc. | Newark, N.J. |
| 66295 | Wittek Manufacturing Co. | Chicago 23, Ill. |
| 66346 | Wollensak Optical Co. | Rochester, N.Y. |
| 70276 | Allen Mfg. Co. | Hartford, Conn. |
| 70309 | Allied Control Co., Inc. | New York, N.Y. |
| 70319 | Alimetal Screw Prod. Co., Inc. | Garden City, N.Y. |
| 70485 | Atlantic India Rubber Works, Inc. | Chicago, Ill. |
| 70563 | Amperite Co., Inc. | New York, N.Y. |
| 70903 | Belden Mfg. Co. | Chicago, Ill. |
| 70998 | Bird Electronic Corp. | Cleveland, Ohio |
| 71002 | Birnbach Radio Co. | New York, N.Y. |
| 71041 | Boston Gear Works Div. of Murray Co. of Texas | Quincy, Mass. |
| 71218 | Bud Radio Inc. | Cleveland, Ohio |
| 71286 | Camloc Fastener Corp. | Paramus, N.J. |
| 71313 | Allen D. Cardwell Electronic Prod. Corp. | Plainville, Conn. |
| 71400 | Bussmann Fuse Div. of McGraw-Edison Co. | St. Louis, Mo. |
| 71436 | Chicago Condenser Corp. | Chicago, Ill. |
| 71450 | CTS Corp. | Elkhart, Ind. |
| 71468 | Cannon Electric Co. | Los Angeles, Calif. |
| 71471 | Cinema Engineering Co. | Burbank, Calif. |
| 71482 | C.P. Clare & Co. | Chicago, Ill. |
| 71590 | Centralab Div. of Globe Union Inc. | Milwaukee, Wis. |
| 71616 | Commercial Plastics Co. | Chicago, Ill. |
| 71700 | The Cornish Wire Co. | New York, N.Y. |
| 71744 | Chicago Miniature Lamp Works | Chicago, Ill. |
| 71753 | A.O. Smith Corp., Crowley Div. | West Orange, N.J. |
| 71785 | Cinch Mfg. Corp. | Chicago, Ill. |
| 71984 | Dow Corning Corp. | Midland, Mich. |
| 72092 | Eitel-McCullough, Inc. | San Bruno, Calif. |
| 72136 | Electro Motive Mfg. Co., Inc. | Willimantic, Conn. |
| 71707 | Coto Coil Co., Inc. | Providence, R.I. |
| 72354 | John E. Fast & Co. | Chicago, Ill. |
| 72619 | Dialight Corp. | Brooklyn, N.Y. |
| 72656 | General Ceramics Corp. | Keasbey, N.J. |
| 72699 | General Instrument Corp., Semiconductor Div. | Newark, N.J. |
| 72758 | Girard-Hopkins | Oakland, Calif. |
| 72765 | Drake Mfg. Co. | Chicago, Ill. |
| 72825 | Hugh H. Eby Inc. | Philadelphia, Pa. |
| 72928 | Gudeman Co. | Chicago, Ill. |
| 72964 | Robert M. Hadley Co. | Los Angeles, Calif. |
| 72982 | Erie Resistor Corp. | Erie, Pa. |
| 73061 | Hansen Mfg. Co., Inc. | Princeton, Ind. |
| 73076 | H.M. Harper Co. | Chicago, Ill. |
| 73138 | Helipot Div. of Beckman Instruments, Inc. | Fullerton, Calif. |
| 73293 | Hughes Products Division of Hughes Aircraft Co. | Newport Beach, Calif. |
| 73445 | Amperex Electronic Co., Div. of North American Phillips Co, Inc. | Hicksville, N.Y. |
| 73490 | Beckman Helipot Corp. | So. Pasadena, Calif. |
| 73506 | Bradley Semiconductor Corp. | Hamden, Conn. |
| 73559 | Carling Electric, Inc. | Hartford, Conn. |
| 73682 | George K. Garrett Co., Inc. | Philadelphia, Pa. |
| 73734 | Federal Screw Prod. Co. | Chicago, Ill. |
| 73743 | Fischer Special Mfg. Co. | Cincinnati, Ohio |
| 73793 | The General Industries Co. | Elyria, Ohio |
| 73846 | Goshen Stamping & Tool Co. | Goshen, Ind. |
| 73899 | JFD Electronics Corp. | Brooklyn, N. Y. |
| 73905 | Jennings Radio Mfg. Co. | San Jose, Calif. |
| 74276 | Signalite Inc. | Neptune, N.J. |
| 74455 | J.H. Winns, and Sons | Winchester, Mass. |
| 74861 | Industrial Condenser Corp. | Chicago, Ill. |
| 74868 | R.F. Products Division of Amphenol-Borg Electronics Corp. | Danbury, Conn. |
| 74970 | E.F. Johnson Co. | Waseca, Minn. |
| 75042 | International Resistance Co. | Philadelphia, Pa. |
| 75173 | Jones, Howard B., Division of Cinch Mfg. Corp. | Chicago, Ill. |
| 75378 | James Knights Co. | Sandwich, Ill. |
| 75382 | Kulka Electric Corporation | Mt. Vernon, N.Y. |
| 75818 | Lenz Electric Mfg. Co. | Chicago, Ill. |
| 75915 | Littlefuse Inc. | Des Plaines, Ill. |
| 76005 | Lord Mfg. Co. | Erie, Pa. |
| 76210 | C.W. Marwedel | San Francisco, Calif. |
| 76433 | Micamold Electronic Mfg. Corp. | Brooklyn, N.Y. |
| 76487 | James Millen Mfg. Co., Inc. | Malden, Mass. |
| 76493 | J.W. Miller Co. | Los Angeles, Calif. |
| 76530 | Monadnock Mills | San Leandro, Calif. |
| 76545 | Mueller Electric Co. | Cleveland, Ohio. |
| 76854 | Oak Manufacturing Co. | Crystal Lake, Ill. |
| 77068 | Bendix Pacific Division of Bendix Corp. | No. Hollywood, Calif. |
| 77075 | Pacific Metals Co. | San Francisco, Calif. |
| 77221 | Phaostron Instrument and Electronic Co. | South Pasadena, Calif. |
| 77250 | Phoell Mfg. Co. | Chicago, Ill. |
| 77252 | Philadelphia Steel and Wire Corp. | Philadelphia, Pa. |
| 77342 | Potter and Brumfield, Div. of American Machine and Foundry | Princeton, Ind. |
| 77630 | Radio Condenser Co. | Camden, N.J. |
| 77638 | Radio Receptor Co., Inc. | Brooklyn, N.Y. |
| 77764 | Resistance Products Co. | Harrisburg, Pa. |
| 77969 | Rubbercraft Corp. of Calif. | Torrance, Calif. |
| 78189 | Shakeproof Division of Illinois Tool Works | Elgin, Ill. |
| 78283 | Signal Indicator Corp. | New York, N.Y. |
| 78290 | Struthers-Dunn Inc. | Pitman, N.J. |
| 78452 | Thompson-Bremer & Co. | Chicago, Ill. |
| 78471 | Tilley Mfg. Co. | San Francisco, Calif. |
| 78488 | Stackpole Carbon Co. | St. Marys, Pa. |
| 78493 | Standard Thomson Corp. | Waltham, Mass. |
| 78553 | Tinnerman Products, Inc. | Cleveland, Ohio |
| 78790 | Transformer Engineers | Pasadena, Calif. |
| 78947 | Ucinite Co. | Newtonville, Mass. |
| 79142 | Veeder Root, Inc. | Hartford, Conn. |
| 79251 | Wenco Mfg. Co. | Chicago, Ill. |
| 79727 | Continental-Wirt Electronics Corp. | Philadelphia, Pa. |
| 79963 | Zierick Mfg. Corp. | New Rochelle, N.Y. |
| 80031 | Mepco Division of Sessions Clock Co. | Morristown, N.J. |
| 80120 | Schnitzer Alloy Products | Elizabeth, N.J. |
| 80130 | Times Facsimile Corp. | New York, N.Y. |
| 80131 | Electronic Industries Association. Any brand tube meeting EIA standards | Washington, D.C. |
| 80207 | Unimax Switch, Div. of W.L. Maxson Corp. | Wallingford, Conn. |
| 80223 | United Transformer Corp. | New York, N.Y. |
| 80248 | Oxford Electric Corp. | Chicago, Ill. |
| 80294 | Bourns Laboratories, Inc. | Riverside, Calif. |
| 80411 | Acro Div. of Robertshaw Fulton Controls Co. | Columbus 16, Ohio |
| 80486 | All Star Products Inc. | Defiance, Ohio |
| 80509 | Avery Adhesive Label Corp. | Monrovia, Calif. |
| 80583 | Hammerlund Co., Inc. | New York, N.Y. |
| 80640 | Stevens, Arnold, Co., Inc. | Boston, Mass. |
| 81030 | International Instruments, Inc. | New Haven, Conn. |
| 81073 | Grayhill Co. | LaGrange, Ill. |
| 81095 | Triad Transformer Corp. | Venice, Calif. |
| 81312 | Winchester Electronics Co., Inc. | Norwalk, Conn. |



From: FSC. Handbook Supplements
H4-1 Dated DECEMBER 1964
H4-2 Dated MARCH 1962

# APPENDIX
# CODE LIST OF MANUFACTURERS (Sheet 2 of 2)

| Code No. | Manufacturer | Address |
|---|---|---|
| 81349 | Military Specification | ..... |
| 81415 | Wilkor Products, Inc. | Cleveland, Ohio |
| 81453 | Raytheon Mfg. Co., Industrial Components Div., Industr. Tube Operations | Newton, Mass. |
| 81483 | International Rectifier Corp. | El Segundo, Calif. |
| 81541 | The Airpax Products Co. | Cambridge, Mass. |
| 81860 | Barry Controls, Inc. | Watertown, Mass. |
| 82042 | Carter Parts Co. | Skokie, Ill. |
| 82142 | Jeffers Electronics Division of Speer Carbon Co. | Du Bois, Pa. |
| 82170 | Allen B. DuMont Labs, Inc. | Clifton, N.J. |
| 82209 | Maguire Industries, Inc. | Greenwich, Conn. |
| 82219 | Sylvania Electric Prod, Inc. Electronic Tube Div. | Emporium, Pa. |
| 82376 | Astron Co. | East Newark, N.J. |
| 82389 | Switchcraft, Inc. | Chicago, Ill. |
| 82647 | Metals and Controls, Inc., Div. of Texas Instruments, Inc., Spencer Prods. | Attleboro, Mass. |
| 82866 | Research Products Corp. | Madison, Wis. |
| 82877 | Rotron Manufacturing Co., Inc. | Woodstock, N.Y. |
| 82893 | Vector Electronic Co. | Glendale, Calif. |
| 83053 | Western Washer Mfr. Co. | Los Angeles, Calif. |
| 83058 | Carr Fastener Co. | Cambridge, Mass. |
| 83086 | New Hampshire Ball Bearing, Inc. | Peterborough, N.H. |
| 83125 | Pyramid Electric Co. | Darlington, S.C. |
| 83148 | Electro Cords Co. | Los Angeles, Calif. |
| 83186 | Victory Engineering Corp. | Springfield, N.J. |
| 83298 | Bendix Corp., Red Bank Div. | Red Bank, N.J. |
| 83315 | Hubbell Corp. | Mundelein, Ill. |
| 83330 | Smith, Herman H., Inc. | Brooklyn, N.Y. |
| 83385 | Central Screw Co. | Chicago, Ill. |
| 83501 | Gavitt Wire and Cable Co., Div. of Amerace Corp. | Brookfield, Mass. |
| 83594 | Burroughs Corp., Electronic Tube Div. | Plainfield, N.J. |
| 83740 | Eveready Battery | New York, N.Y. |
| 83777 | Model Eng. and Mfg., Inc. | Huntington, Ind. |
| 83821 | Loyd Scruggs Co. | Festus, Mo. |
| 84171 | Arco Electronis, Inc. | New York, N.Y. |
| 84396 | A.J. Glesener Co., Inc. | San Francisco, Calif. |
| 84411 | Good All Electric Mfg. Co. | Ogallala, Neb. |
| 84970 | Sarkes Tarzian, Inc. | Bloomington, Ind. |
| 85454 | Boonton Molding Company | Boonton, N.J. |
| 85471 | A.B. Boyd Co. | San Francisco, Calif. |
| 85474 | R.M. Bracamonte & Co. | San Francisco, Calif. |
| 85660 | Koiled Kords, Inc. | New Haven, Conn. |
| 85911 | Seamless Rubber Co. | Chicago, Ill. |
| 86197 | Clifton Precision Products | Clifton Heights, Pa. |
| 86579 | Precision Rubber Products Corp. | Dayton, Ohio |
| 86684 | Radio Corp. of America, RCA Electron Tube Div. | Harrison, N.J. |
| 87216 | Philco Corporation (Lansdale Division) | Lansdale, Pa. |
| 87473 | Western Fibrous Glass Products Co. | San Francisco, Calif. |
| 87664 | Van Waters & Rogers Inc. | Seattle, Wash. |
| 87930 | Tower Mfg. Corp | Providence, R. I. |
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| 89462 | Waldes Kohinoor, Inc. | Cambridge, Mass. |
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| 89636 | Carter Parts Div. of Economy Baler Co. | Chicago, Ill. |
| 89665 | United Transformer Co. | Chicago, Ill. |
| 90179 | U.S. Rubber Co., Mechanical Goods Div. | Passaic, N.J. |
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| 91260 | Conner Spring Mfg. Co. | San Francisco, Calif. |
| 91345 | Miller Dial & Nameplate Co. | El Monte, Calif. |
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| 91637 | Dale Electronics, Inc. | Columbus, Nebr. |
| 91662 | Elco Corp. | Philadelphia, Pa. |
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| 91929 | Minneapolis-Honeywell Regulator Co., Microswitch Div. | Freeport, Ill. |
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| 92607 | Tinsolite Insulated Wire Co. | Tarrytown, N.Y. |
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| 94148 | Scientific Radio Products, Inc. | Loveland, Colo. |
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| 94682 | Worcester Pressed Aluminum Corp. | Worcester, Mass. |
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| 98220 | Francis L. Mosley | Pasadena, Calif. |
| 98278 | Microdot, Inc. | So. Pasadena, Calif. |
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| 98405 | Carad Corp. | Redwood City, Calif. |
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| 99109 | Columbia Technical Corp. | New York, N.Y. |
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| 000AA | British Radio Electronics Ltd. | Washington, D.C. |
| 000AB | ETA | England |
| 000AC | Indiana General Corp., Elect. Div. | Indiana |
| 000BB | Precision Instrument Components Co. | Van Nuys, Calif. |
| 000MM | Rubber Eng. & Development | Hayward, Calif. |
| 000NN | A "N" D Manufacturing Co. | San Jose 27, Calif. |
| 000QQ | Cooltron | Oakland, Calif. |
| 000SS | Control of Elgin Watch Co. | Burbank, Calif. |
| 000WW | California Eastern Lab. | Burlingame, Calif. |
| 000YY | S.K. Smith Co. | Los Angeles 45, Calif. |

From: FSC. Handbook Supplements
H4-1 Dated DECEMBER 1964
H4-2 Dated MARCH 1962

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# MANUAL BACKDATING CHANGES

Model 200CD

WIDE RANGE OSCILLATOR

Manual Serial Prefixed: 605-

-hp- Part No. 200CD-903

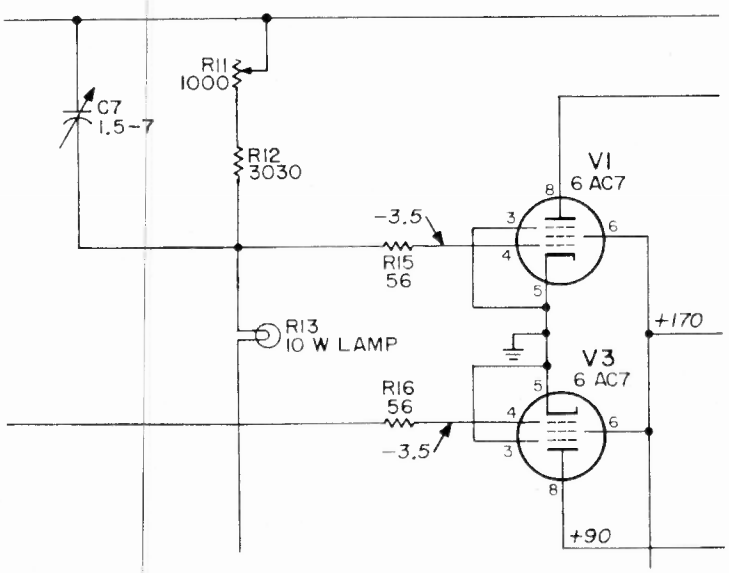
This manual backdating sheet makes this manual applicable to earlier instruments. Instrument-component values that differ from those in the manual, yet are not listed in the backdating sheet, should be replaced using the part number given in the manual.

| Instrument Serial Prefix | Make Manual Changes |
|---|---|
| Serials 1 thru 903 | 1, 2, 3, 4, 5, 6, 7, 8 |
| Serials 904 thru 22549 | 2, 3, 4, 5, 6, 7, 8 |
| 005- | 3, 4, 5, 6, 7, 8 |
| 103- | 4, 5, 6, 7, 8 |

| Instrument Serial Prefix | Make Manual Changes |
|---|---|
| 129- | 5, 6, 7, 8 |
| 212- | 6, 7, 8 |
| 229- | 7, 8 |
| 333- | 8 |

CHANGE #1

Change V1 and V3 to 6AC7 tubes, -hp- Part No. 1923-0014. The following partial schematic shows these tubes and their connections.

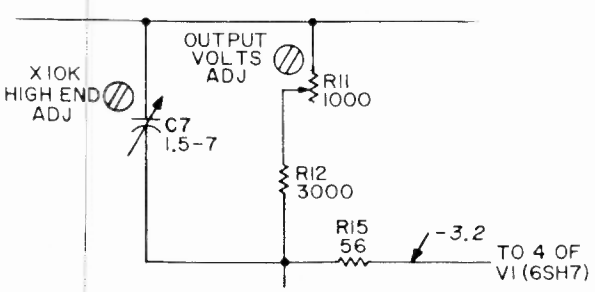



CHANGE #2

Delete C17 and C18 below serial 3637.

Change R11 to 1000 ohm rheostat, -hp- Part No. 2100-0036 and R12 to 3000 ohms, -hp- Part No. 0689-3025.

The following partial schematic shows the electrical connections.



Manual Changes Model 200CD Page 2

| Instrument Serial Prefix | Make Manual Changes |
|---|---|
| Serials 1 thru 903 | 1, 2, 3, 4, 5, 6, 7, 8 |
| Serials 904 thru 22529 | 2, 3, 4, 5, 6, 7, 8 |
| 005- | 3, 4, 5, 6, 7, 8 |
| 103- | 4, 5, 6, 7, 8 |

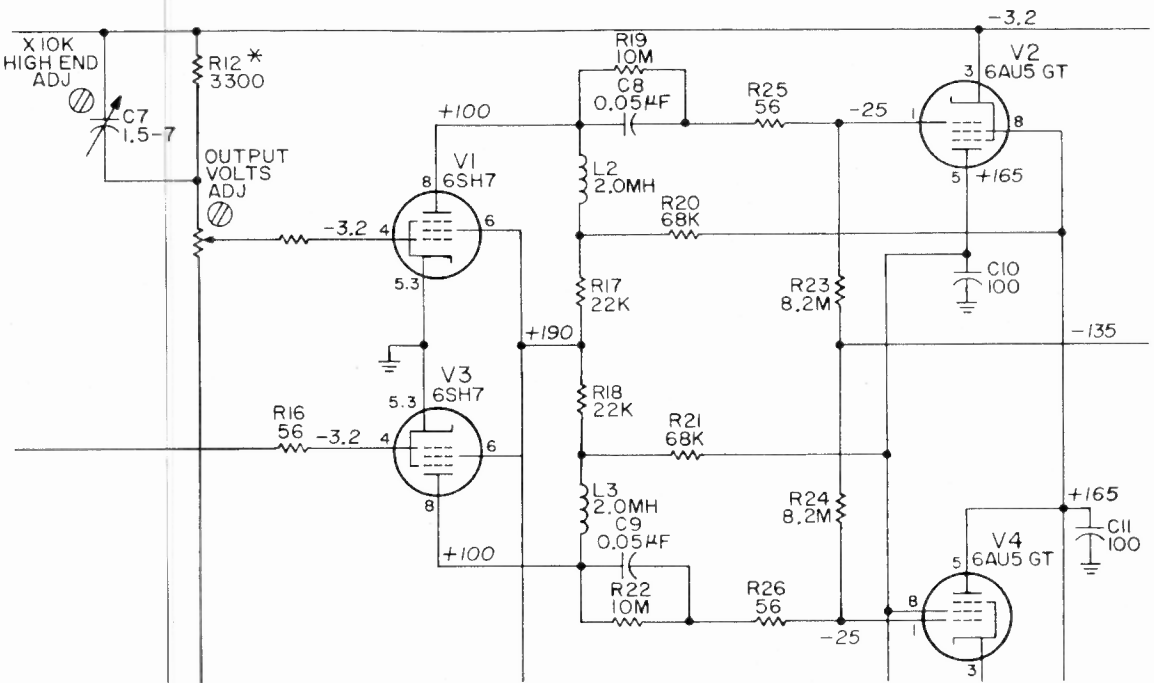
| Instrument Serial Prefix | Make Manual Changes |
|---|---|
| 129- | 5, 6, 7, 8 |
| 212- | 6, 7, 8 |
| 229- | 7, 8 |
| 333- | 8 |

CHANGE #3

Change V1 and V3 to 6SH7 tubes, -hp- Part No. 1923-0036.

Change V2 and V4 to 6AU5 tubes, -hp- Part No. 1923-0020.

The following schematic shows electrical connections.




5AR4 tube is interchangeable with 5Y3 in the power supply.

Delete R51, hum adjust and R50, Dynamic Bal. Adj.

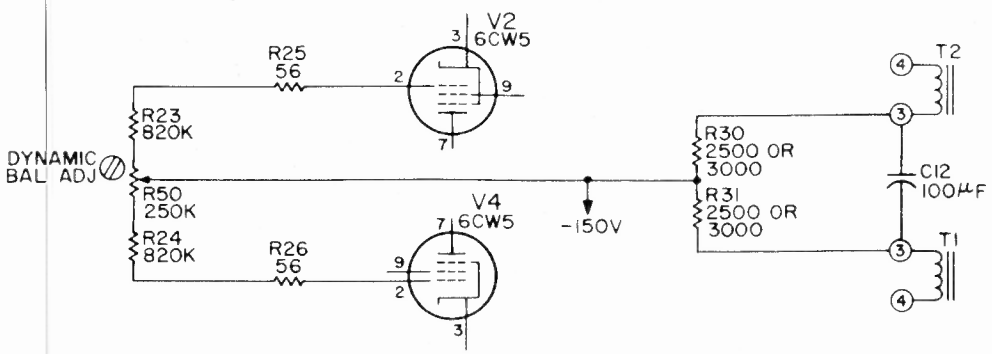
CHANGE #4

Change R50 to 250 K ohms, -hp- Part No. 2100-0175, connected between R23 and R24.

Change R30, 31 to resistors, matched pair, 2500 ohms each matched to within 1%, -hp- Part No. 200J-26.

Delete R35 and 36.

Partial schematic shows change in this circuit.



Manual Changes Model 200CD Page 3

| Instrument Serial Prefix | Make Manual Changes |
|---|---|
| Serials 1 thru 903 | 1, 2, 3, 4, 5, 6, 7, 8 |
| Serials 904 thru 22549 | 2, 3, 4, 5, 6, 7, 8 |
| 005- | 3, 4, 5, 6, 7, 8 |
| 103- | 4, 5, 6, 7, 8 |

| Instrument Serial Prefix | Make Manual Changes |
|---|---|
| 129- | 5, 6, 7, 8 |
| 212- | 6, 7, 8 |
| 229- | 7, 8 |
| 333- | 8 |

CHANGE #5

Change R23, 24 to resistor: fixed, composition, 820,000 ohms ±10%, 1/2 w, -hp- Part No. 0687-8241. (If amplitude oscillations occur expecially at high frequencies, use current value of resistors.)

CHANGE #6

Section VI Table 6-1, under Miscellaneous, and Table 6-2
Delete the following:

Disc Ass'y Vernier Drive, -hp- Part No. 5040-0607; Mfr. 28480; TQ, 1
Bearing Capacitor Drive, -hp- Part No. 5020-0618; Mfr. 28480; TQ, 1
Spring Thrust, -hp- Part No. 5000-0637; Mfr. 28480; TQ, 1

Add the following:

| | |
|---|---|
| Disc, vernier drive | 5020-0236 |
| Disc, vernier drive | 5040-0211 |
| Spring, compression | 1460-0019 |

Spring only for replacement. For replacement of vernier drive, use current part numbers.

CHANGE #7

Section VI Table 6-1, under Miscellaneous, and Table 6-2
Delete the following:

Assembly, Gear, -hp- Part No. 5060-0020
Assembly, Gear, -hp- Part No. 5060-0021
Spring, -hp- Part No. 1460-0114

Add the following:

Gear Spur, -hp- Part No. 5020-0011
Assembly, Gear, -hp- Part No. 5020-0602
Spring, -hp- Part No. 624A-36B-5

Spring only for replacement. For replacement of gears, use current gear assembly.

ALL

Proper Range Switches for All Serials

| Instrument Serial No. | Range Switch (-hp- Part No.) |
|---|---|
| 1 thru 833 | 200CD-19W |
| 834 thru 853 | 200CD-19WA |
| 854 thru 903 | 200CD-19W |
| 904 thru 3637 | 200CD-19WA |
| 3638 and above | 200CD-19WB |

Proper Output Transformers for All Serials

| Instrument Serial No. | Output Transformer (-hp- Part No.) |
|---|---|
| 1 thru 833 | $T_1$ is 9120-0011, $T_2$ is 9120-0010# |
| 834 thru 853 | $T_1$ is 9120-0015, $T_2$ is 9120-0016# |
| 854 thru 903 | $T_1$ is 9120-0011, $T_2$ is 9120-0010# |
| 904 thru 3637 | $T_1$ is 9120-0015, $T_2$ is 9120-0016# |
| 3638 and above | $T_1$ is 200CD-9, $T_2$ is 9120-0016 |

# There are some exceptions. If R37 and R38, on the range switch, are 100 ohms, use 9120-0010; if R37 and R38 are 200 ohms, use 9120-0016.

Manual Changes Model 200CD Page 4

| Instrum Serial Prefix | Make Manual Changes | Instrument Serial Prefix | Make Manual Changes |
|---|---|---|---|
| Serials 1 thru 903 | 1, 2, 3, 4, 5, 6, 7, 8 | 129- | 5, 6, 7, 8 |
| Serials 904 thru 22549 | 2, 3, 4, 5, 6, 7, 8 | 212-212- | 6, 7, 8 |
| 005- | 3, 4, 5, 6, 7, 8 | 229- | 7, 8 |
| 103- | 4, 5, 6, 7, 8 | 333- | 8 |

CHANGE #8

Section VI and Figure 5-9
Delete CR1 and CR2.

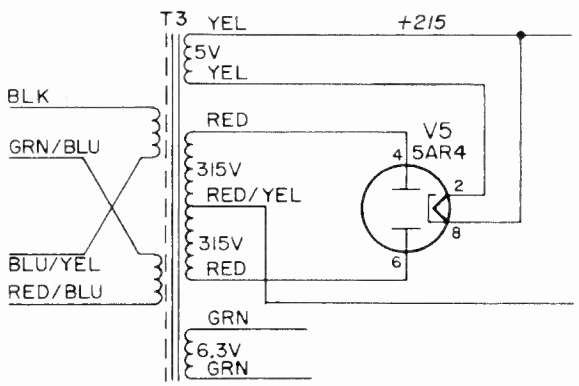
Change T3 power transformer to -hp- Part No. 9100-0036.

Add the following:

V5, Tube, elect, 5AR4, -hp- Part No. 1930-0003.
XV5, Socket, tube, octal, -hp- Part No. 1200-0020.

Change Table 1-1, Specifications, to the following:
DISTORTION: Less than 0.5% below 500 kc; less than 1%, 500 kc and above. Independent of load impedance.

The following partial schematic shows Power Supply changes



200CD-903

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