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OPERATING AND SERVICE MANUAL

HP PART NO. 00205-90010

AUDIO SIGNAL GENERATOR

MODELS 205A AND 205AG

COVERS ALL SERIALS

HEWLETT hp PACKARD

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COVERS ALL SERIALS

Manual for Serials Prefixed : 953-
Manual Changes for Serials 0953A11577 and above
Manual Backdating Changes (Appendix C)
for
Serials Prefixed: 953-, 246-, 231-, 151-, 024-, 012-
and Serials 8462 and below (205A)

P.O. Box 301, Loveland, Colorado, 80537 U.S.A.

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Table 1-1. Specifications

Frequency Range:
20 Hz to 20 kHz in three decade bands:

X1	20 Hz to 200 Hz
X10	200 Hz to 2 kHz
X100	2 kHz to 20 kHz

Calibration covers approximately 270 degrees on 6 inch diameter main dial.

Dial Accuracy:
Within ± 2% of setting at normal ambient temperatures. (Includes warm-up and changes due to aging of tubes and components.)

Output Flatness:
± 1.5 dB 20 Hz to 20 kHz at output levels ⩾ 30 dBm with output meter reading held at +37 dB (reference = 1000 Hz)
± 1 dB 20 Hz to 20 kHz at output levels < +30 dBm with output meter reading held at +37 dB

Distortion:
Less than 1% at frequencies above 30 Hz.

Hum Level:
More than 60 dB below output levels greater than -30 dBm. For output levels of -30 dBm and below hum level will be ⩽ -90 dBm.

Output Attenuators:
Provide 110 dB attenuation in 10 and 1 dB steps.

Accuracy:
10 dB Attenuator:
1 kHz ± 0.5 dB, 0 dB to 80 dB
± 1.5 dB, 90 dB to 100 dB
20 kHz ± 2.5 dB, 0 dB to 100 dB
1 dB Attenuator:
20 kHz ± 0.25 dB, 0 dB to 10 dB

Input Meter:
Calibrated in dBm (0 dBm = 1 mW into 600 ohms) from -5 to +8 dBm and in volts from 0 to 2 V rms. Voltage accuracy is ± 5% of full scale.

Input Attenuator:
Extends meter range to +48 dBm and to 200 V rms in 5 dB steps. Accuracy is ± 0.1 dB.

Table 1-2. General Information

Output:
Five watts maximum into resistive loads of 50, 200, 600, and 5000 ohms. Output circuit is balanced and center tapped--any terminal may be grounded.

WARNING
Voltages as high as 180 V rms are obtainable at the OUTPUT terminals of the Model 205AG when the output is at maximum on the 5000 ohms impedance setting.

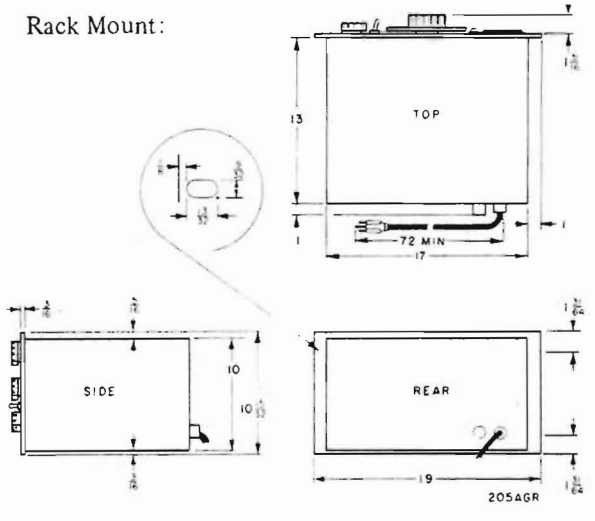
Output Impedance:
Approximately 1/6 load impedance with zero attenuator setting. Approaches load impedance with attenuator settings of 20 dB or more.

Output Meter:
Calibrated in volts and dBm (0 dBm = 1 mW into 600 ohms). Full scale values are 65 V and +37 dBm. Reads on a 600 ohm basis regardless of output impedance selected.

Power Supply:
115 or 230 volts ± 10%, 48 to 440 Hz, 150 watts.

Dimensions:
Cabinet Mount:
20-3/4 in. wide, 12-3/4 in. high, 15-1/2 in. deep.

Rack Mount:



SECTION I
GENERAL INFORMATION

1-1. DESCRIPTION.

1-2. The Model 205AG Audio Signal Generator contains all the necessary instruments for accurate gain or frequency response measurements. The basic audio oscillator uses a Wein Bridge circuit to generate a sine wave. This sine wave is then amplified and provided at the OUTPUT terminals. Any desired frequency in the range of 20 Hz to 20 kHz is obtainable from the instrument. Two voltmeters are provided on the front panel. One voltmeter measures input to the device under test, the second measures output from the device under test. An attenuator is provided to set the output voltage to the desired level. Output impedance can be changed by means of selector switch to 50, 200, 600, or 5000 ohms.

1-3. INSTRUMENT SPECIFICATIONS AND GENERAL INFORMATION.

1-4. Tables 1-1 and 1-2 list Specifications and General Information (respectively) for the Model 205AG. Table 1-2, General Information, is included to provide useful information relating to the instrument. The information it contains should not be considered specifications.

1-5. INSTRUMENT AND MANUAL IDENTIFICATION.

1-6. Hewlett-Packard uses a two-section serial number. The first section (prefix) identifies a series of instruments. The last section (suffix) identifies a particular instrument within the series. If a letter is included with the serial number, it identifies the country in which the instrument was manufactured.

1-7. If the serial prefix of your instrument differs from the one on the title page of this manual, a change sheet will be supplied to make this manual compatable with newer instruments or the backdating information in Appendix C will adapt this manual to earlier instruments. All correspondence with Hewlett-Packard should include the complete serial number.

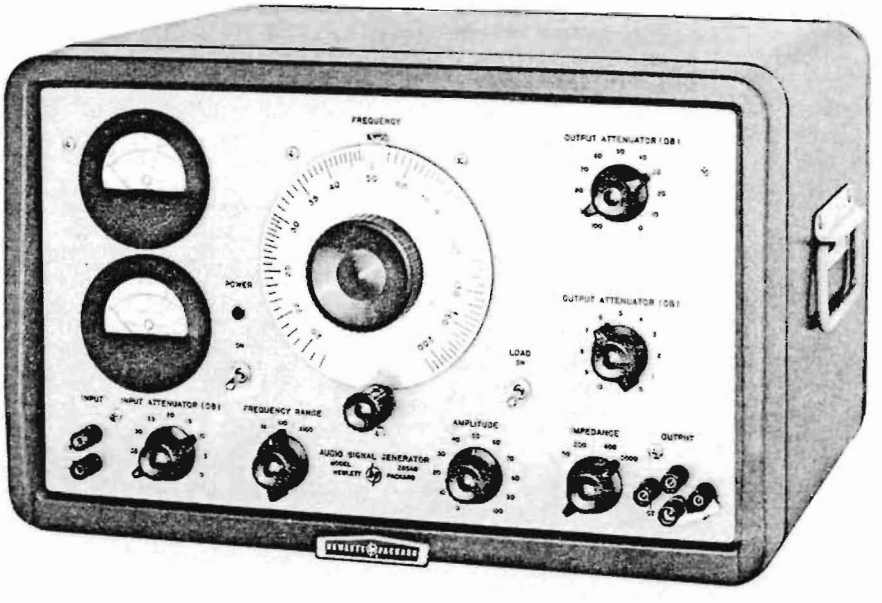


Figure 1-1. Model 205AG Audio Signal Generator

SECTION II
INSTALLATION

2-1. INTRODUCTION.

2-2. This section includes information and instructions necessary for the installation or shipment of this instrument. Included is information pertaining to initial inspection, installation, and repackaging for shipment.

2-3. INSPECTION.

2-4. This instrument was carefully inspected both mechanically and electrically before shipment. It should be physically free of mars or scratches and in perfect electrical order upon receipt. To confirm this, the instrument should be inspected for physical damage. Also, the electrical performance of the instrument should be tested using the procedure outlined in Section V of this manual. If there is damage or deficiency, see the warranty at the front of this manual.

2-5. POWER REQUIREMENTS.

2-6. This instrument will operate from either 115 or 230 Vac, 48 Hz to 440 Hz. The instrument can easily be converted from 115 volt to 230 volt operation by changing the position of the slide switch located on the rear panel, so that the designation appearing on the switch matches the nominal voltage of the power source.

2-7. GROUNDING REQUIREMENTS.

2-8. To protect operating personnel, the National Electrical Manufacturers' Association (NEMA) recommends that the instrument panel and cabinet be grounded. Each Hewlett-Packard instrument is equipped with a three-conductor power cord which, when plugged into an appropriate receptacle grounds the instrument. The offset pin on the power cord three-prong connector is the ground wire.

2-9. To preserve the protection feature when operating the instrument from a two-contact outlet, use a three-prong to two-prong adapter and connect the green pigtail on the adapter to ground.

2-10. RACK/BENCH INSTALLATION.

2-11. This instrument is shipped either as a bench type unit or as a rack mount unit. Four holes, two on each side of the front panel, are provided for rack mounting of the instrument.

2-12. REPACKAGING FOR SHIPMENT.

2-13. The following is a general guide for repackaging for shipment. If you have any question, contact your local -hp- Sales and Service Office. (See Appendix at the back of this manual for office location.)

NOTE

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

2-14. Place the instrument in its original container if available. If the original container is not available a suitable one can be purchased from your nearest -hp- Sales and Service Office.

2-15. If the original container is not used:

a. Wrap the instrument in heavy paper or plastic before placing in an inner container.

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

c. Place the instrument and inner container in a heavy carton or wooden box and seal with strong tape or metal bands.

d. Mark the shipping container with "DELICATE INSTRUMENT," "FRAGILE" etc.

SECTION III
OPERATING INSTRUCTIONS

3-1. INTRODUCTION.

3-2. This section contains information necessary for proper operation of the Model 205AG Audio Signal Generator. Included in this section are identification of controls, indicators and connectors (panel features); preliminary checks; and operating instructions.

3-3. PANEL FEATURES.

3-4. Front and rear panel features are described in Figure 3-1. Each operating control, indicator, and connector is identified by an associated number and described by a paragraph with the corresponding number.

3-5. PRELIMINARY CHECKS.

3-6. Before connecting the 205AG to primary power make the following checks:

a. Ensure that the line voltage selection switch (S6) is correctly positioned for the line voltage to be used.

b. Ensure the proper line fuse (F1) is in place.

3-7. OPERATING INSTRUCTIONS.

3-8. OSCILLATOR OPERATION.

3-9. The procedure for operating the Model 205AG Audio Signal Generator is as follows:

a. Connect the instrument power cable to a 115/230 V alternating current power line and the output terminals to the equipment being tested. Set the IMPEDANCE switch to match the load. When the Signal Generator is operated into a high impedance load, the Load Switch must be turned on, otherwise the Output Level Meter and the Attenuator indications will not be correct. The Load Switch should be off when the instrument is connected to loads within the impedance range of the selected output impedance.

b. Turn the power switch to ON and allow approximately five minutes for the instrument to stabilize. Set the Freq. Range control and the frequency dial so that their indications when multiplied together equal the desired frequency. For example: Frequency dial indication 20, FREQUENCY RANGE X100, 20 x 100 = 2000 Hz.

c. Set the output attenuators and the AMPLITUDE control to obtain the desired output level. Distortion in the output will be minimized by keeping the Output Level meter indication near maximum and reducing the output with the output attenuators.

3-10. OUTPUT LEVEL METER OPERATION.

3-11. The Output Level meter is calibrated directly in output voltage and dB above 1 milliwatt when the instrument is operating into a 600 ohm load and both output attenuators are set at zero.

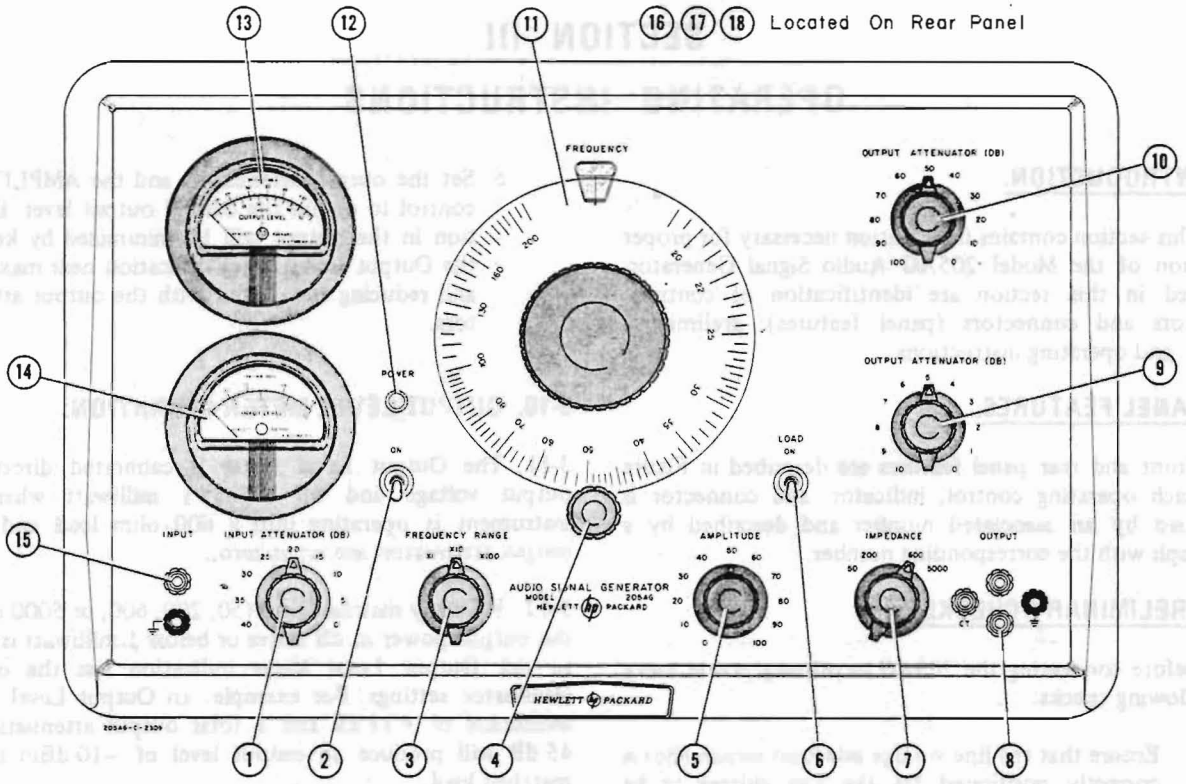
3-12. With any matched load (50, 200, 600, or 5000 ohms) the output power in dB above or below 1 milliwatt is equal to the Output Level Meter indication less the output attenuator settings. For example: an Output Level meter indication of +35 dB and a total output attenuation of 45 dB will produce an output level of −10 dBm into a matched load.

3-13. Figure 3-2 is a chart of meter voltage multiplying factors for any value of output attenuation. With the IMPEDANCE switch set at 600 ohms and an internal or external 600 ohm load, the output voltage will be the Output Level meter voltage indication multiplied by a factor obtained from Figure 3-2 opposite the total output attenuation. For example: with the output attenuators set for 40 dB all Output Level meter indications should be multiplied by .01 to obtain the true output voltage into a 600 ohm load.

3-14. To obtain the true output voltage into a 50, 200 or 5000 ohm load the factors in Table 3-1 must be applied to the true voltage across a 600 ohm matched load. For example: with an Output Level Meter indication of 40 volts and the output attenuators set at 40 dB, we find from Figure 3-2 that the true output voltage into 600 ohms would be 40 volts multiplied by 0.01 or 0.4 volts. To convert this to a voltage across a 200 ohm matched load multiply by 0.577 or 0.4 x 0.577 = 0.2308 volts.

Table 3-1. Output Meter Voltage Multiplying Factor

Load Impedance	600 Ohm Voltage Multiplying Factor
50	0.289
200	0.577
5000	2.89



(1) INPUT ATTENUATOR (DB)
This switch is the range switch for the INPUT LEVEL meter and is calibrated in steps of 5 dB from 0 to 40 dB.

(2) POWER ON
This switch controls the power supplied to the instrument from the power line.

(3) FREQUENCY RANGE
The position of this switch indicates the multiplying factor to be used with the frequency dial indication.

(4) FREQUENCY VERNIER
Permits fine tuning of the FREQUENCY dial.

(5) AMPLITUDE
The control adjusts the amplitude of oscillator voltage applied to the output amplifier. The calibration is in arbitrary units.

(6) LOAD ON
This switch is used to connect an internal 600 ohm load across the OUTPUT terminals.

(7) IMPEDANCE
This switch selects the instrument output impedance. The available impedances are 50, 200, 600, and 5000 ohms.

(8) OUTPUT
The instrument output appears at four terminals. The terminal marked CT is the center tap of the line matching transformer. The ⏚ terminal is connected to the chassis. The two vertically spaced terminals are connected to the line matching transformer through the IMPEDANCE switch. A balanced output is obtained from the vertically spaced terminals and an unbalanced output may be obtained by connecting the ⏚ terminal to one of the output terminals with the captive link provided.

(9) 1 dB ATTENUATOR
Attenuates output in 10 steps of 1 dB each.

(10) 10 dB ATTENUATOR
Attenuates output in 10 steps of 10 dB each.

(11) FREQUENCY Dial
This dial is calibrated in Hz. The output frequency is the frequency dial indication multiplied by the FREQUENCY RANGE switch position.

Figure 3-1. Model 205AG Panel Features

(12) POWER Indicator Light
Illuminates when line switch is ON, indicating primary power has been applied to the instrument.

(13) OUTPUT LEVEL
This meter indicates the voltage at the output terminals when the IMPEDANCE switch is set at 600, output attenuators both at zero, and the instrument is loaded with the internal or an external 600 ohm load. Under other operating conditions the meter may be used as a monitor to insure constant output voltage.

(14) INPUT LEVEL
This meter measures the voltage applied to the input terminals and the range of the meter is controlled by the INPUT ATTENUATOR (DB) range switch.

(15) INPUT
These terminals are the input for the audio frequency INPUT LEVEL vacuum tube voltmeter in the instrument.

(16) FUSE
The fuseholder, located on the back of the chassis, contains the power line fuse. Refer to the Table of Replaceable Parts (6-1) for the correct fuse rating.

(17) PRIMARY POWER RECEPTACLE
Connects primary power to the instrument.

(18) 115 V/230 V Slide Switch
S6 selects nominal operating voltage of the instrument.

P/O Figure 3-1. Model 205AG Panel Features

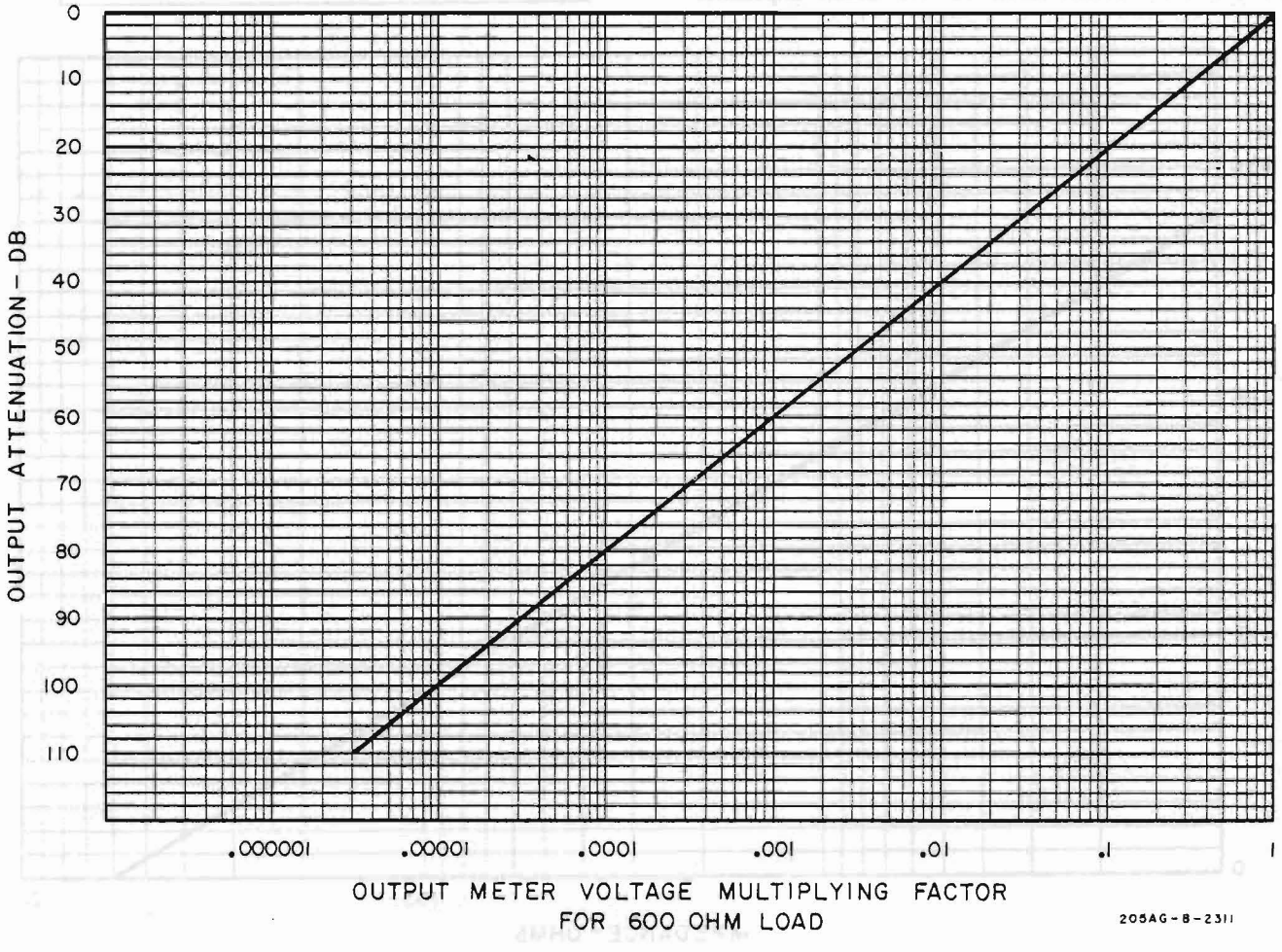


Figure 3-2. Output Voltage Correction Factors When Using Output Attenuators

3-15. INPUT LEVEL METER OPERATION.

3-16. The Input Level meter is an independent audio frequency vacuum tube voltmeter, suitable for monitoring the output voltage of a device under test. The meter is calibrated in volts and dB above 1 milliwatt in 600 ohms when the INPUT ATTENUATOR (DB) switch is on zero.

3-17. When making comparative measurements across a constant impedance the meter and INPUT ATTENUATOR (DB) switch will indicate directly the change in dB in the circuit under test.

3-18. When using the Input Level meter to monitor a 600 ohm circuit, the power level in dB above 1 milliwatt is equal to the meter indication plus the indication of the INPUT ATTENUATOR (DB) switch.

3-19. When making power measurements in circuits with impedances below 600 ohms, the absolute level in dB above or below 1 milliwatt is equal to the level indicated on the meter plus the INPUT ATTENUATOR (DB) switch indication plus a correction factor for the circuit impedance. Figure 3-3 gives correction factors for impedances between 1 and 600 ohms.

3-20. The input voltage level for any range of the INPUT ATTENUATOR (DB) switch is the voltage indicated by the Input Level meter multiplied by the factor indicated in Table 3-2 for the particular range of the INPUT ATTENUATOR (DB) switch in use.

Table 3-2. Input Meter Voltage Multiplying Factor

INPUT ATTENUATOR (DB) Position	Meter Voltage Multiplying Factor
0	1
5	1.78
10	3.16
15	5.62
20	10
25	17.78
30	31.62
35	56.23
40	100

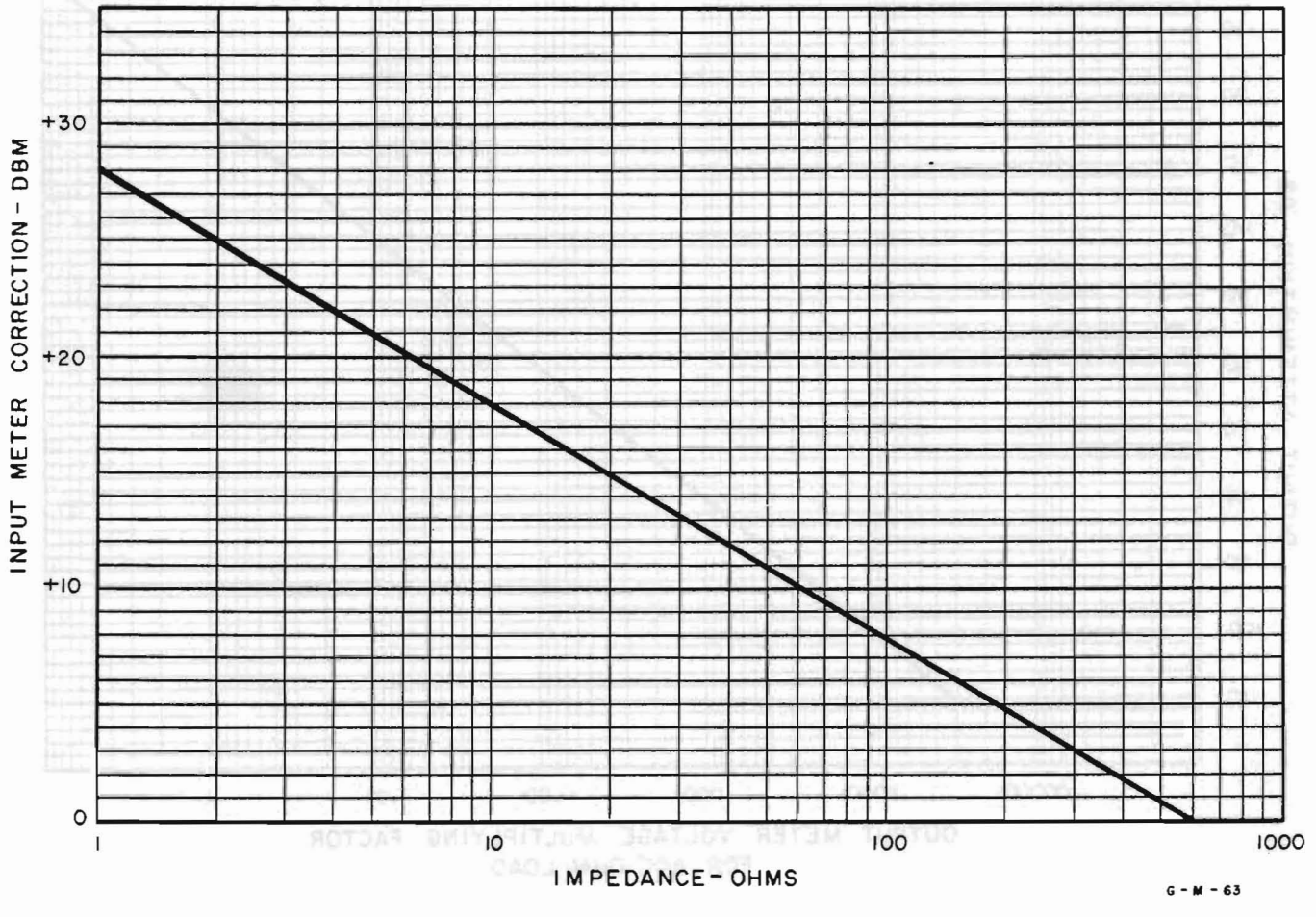


Figure 3-3. Input Level Meter Correction Curve

SECTION IV
THEORY OF OPERATION

4-1. GENERAL.

4-2. The Model 205AG Audio Signal Generator consists of an oscillator, an amplifier, output meter and attenuator, line matching transformer, and a conventional power supply (see Figure 4-1).

4-3. The oscillator section (tubes V1 and V2) is a resistance-tuned type circuit. Basically, this oscillator is a two-stage resistance-coupled amplifier which is caused to oscillate by the use of a positive feedback network. This network is a frequency-selective resistance-capacity combination which controls the frequency of oscillation. By using a variable tuning capacitor for the capacity of the network, it is possible to tune the oscillator over a wide 10:1 range; and by using a switching arrangement to select different values of resistance for the network, several ranges are given to the oscillator.

4-4. Negative feedback is used in the oscillator section in order to minimize distortion and to obtain a very high order of stability. The amount of negative feedback is determined by a resistance network, one element of which is non-linear (the 3-watt lamp in the cathode of V1). This element controls the amount of feedback in accordance with the amplitude of oscillation and consequently maintains the amplitude of oscillation substantially constant over a wide frequency range. The negative feedback also keeps the operation of the system on the linear portion of the tube characteristic.

4-5. The amplifier section consists of a voltage amplifier tube directly coupled to a phase inverter which drives the push-pull output tubes. The tertiary winding on the output transformer provides negative feedback for the amplifier.

4-6. The output meter and attenuator section is made up of an average reading type voltmeter and two bridged T-type attenuators. The attenuators and voltmeter are connected between the output transformer secondary and the primary of the line matching transformer.

4-7. A full-wave rectifier and a dc milliammeter calibrated in volts and decibels make up the Output Level meter. The line matching transformer is used to change the 500 ohms line impedance to 50, 200, 600, or 5,000 ohms output impedance.

4-8. The Model 205AG also includes an Input Level meter which is of the average responding type. The meter consists of a two stage amplifier with negative feedback, a full-wave rectifier and a dc milliammeter calibrated in volts and decibels.

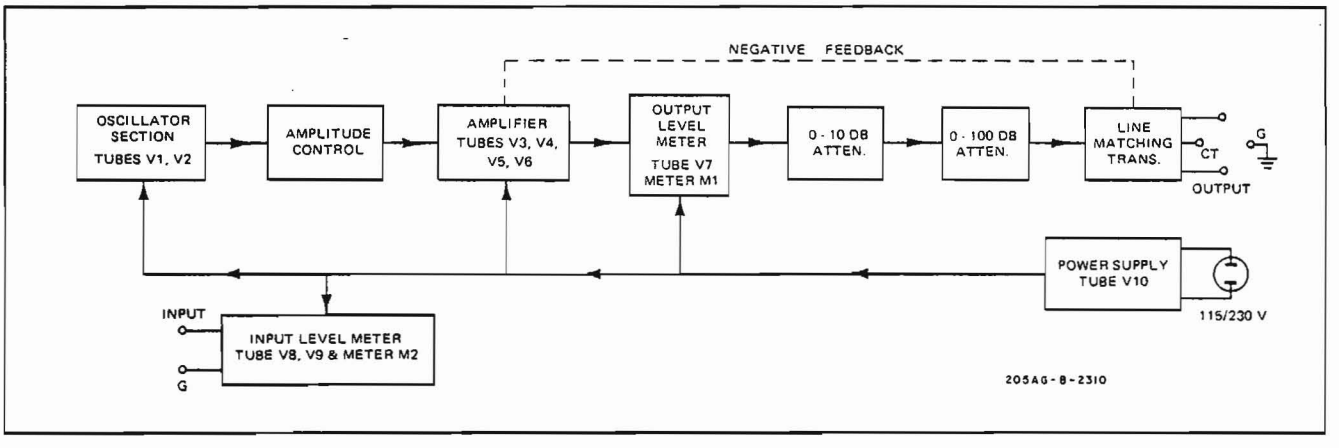


Figure 4-1. Block Diagram Model 205AG

Table 5-1. Required Test Equipment

INSTRUMENT TYPE	REQUIRED CHARACTERISTICS	RECOMMENDED MODEL
Electronic Counter	Frequency Range: < 20 Hz to > 20 kHz	-hp- Model 5245L Electronic Counter
AC Voltmeter	Frequency Range: 20 Hz to > 20 kHz Accuracy: ± 1% of full scale ± 1% of reading.	-hp- Model 400 FL AC Voltmeter
Wave Analyzer	Frequency Range: 20 Hz to > 20 kHz. Dynamic Range: > 75 dB (should be able to measure levels of -90 dBm)	-hp- Model 302A Wave Analyzer
Attenuator	Frequency Range: 0 Hz to > 20 kHz Attenuation Range: > 10 dB in 1 dB steps Overall Accuracy: ± 0.1 dB	-hp- Model 355C Attenuator
Resistor	Approximately 50Ω at 1/4 watt	-hp- Part No. 0698-4110

SECTION V
MAINTENANCE

5-1. INTRODUCTION.

5-2. This section contains maintenance and service information for the -hp- Model 205AG Audio Oscillator. Included are performance checks, adjustment procedures, troubleshooting, and repair procedures.

5-3. REQUIRED TEST EQUIPMENT.

5-4. The equipment needed to properly check and adjust the Model 205AG is listed in Table 5-1. If the recommended model is not available, any instrument that has specifications equal to or better than the required specifications may be used.

5-5. PERFORMANCE CHECKS.

5-6. Performance checks are in-cabinet tests that compare the Model 205AG with its given specifications. These checks may be used for incoming inspection, periodic maintenance, and for specification checks after a repair. A Performance Check Test Card is provided at the end of this section for recording the performance of the instrument during the performance checks. The card may be removed from the manual and used as a permanent record of the incoming inspection or of a routine performance check. If the instrument fails to meet a specification refer to the adjustment and troubleshooting procedures in the last half of this section. Before these checks are attempted the instrument should be turned on according to the procedure outlined in Paragraphs 3-5 thru 3-7 of this manual.

5-7. FREQUENCY RANGE.

Specification

20 Hz to 20 kHz

If instrument does not meet this specification refer to Paragraph 5-74.

5-8. Set power switch to ON.

5-9. Set Model 205AG controls as follows:

10 and 1 dB
OUTPUT ATTENUATORS . . . . . 0 dB
FREQUENCY RANGE X1
LOAD . . . . . ON
IMPEDANCE 600Ω
AMPLITUDE 100
FREQUENCY . . . . . Full CW

5-10. Connect the OUTPUT of the Model 205AG to the input of an electronic counter. The counter should read a frequency of ⩽ 20 Hz.

5-11. Turn the FREQUENCY dial to the full CCW position. A frequency of ⩾ 200 Hz should be read on the counter.

5-12. Repeat steps 5-10 and 5-11 except set FREQUENCY RANGE to X10. The output of the Model 205AG should vary from a frequency ⩽ 200 Hz to a frequency ⩾ 2 kHz.

5-13. Again repeat steps 5-10 and 5-11 except set FREQUENCY RANGE to X100. The output of the Model 205AG should vary from a frequency ⩽ 2 kHz to a frequency ⩾ 20 kHz.

5-14. DIAL ACCURACY.

Specification

± 2% of dial setting

If the instrument does not meet this specification refer to Paragraph 5-74.

5-15. Connect the OUTPUT of the Model 205AG to an electronic counter.

NOTE

Allow at least 5 minutes warmup period before performing the remainder of this check.

5-16. Set the Model 205AG controls as indicated in Paragraph 5-9 except set the FREQUENCY dial to 20.

5-17. Check the dial accuracy at each of the frequencies listed in Table 5-2. The frequency at each setting should lie within the range of frequencies listed in the maximum range column for that particular frequency.

Table 5-2. Dial Accuracy Check

FREQUENCY DIAL SETTING	FREQUENCY RANGE	MAXIMUM RANGE (Hz)
20	X1	19.6 - 20.4
50	X1	49.0 - 51.0
100	X1	98.0 - 102.0
200	X1	196 - 204
20	X10	196 - 204
50	X10	490 - 510
100	X10	980 - 1020
200	X10	1960 - 2040
20	X100	1960 - 2040
50	X100	4900 - 5100
100	X100	9800 - 10200
200	X100	19600 - 20400

5-18. OUTPUT FLATNESS.

Specification

± 1.5 dB, 20 Hz to 20 kHz @ output levels ≥ + 30 dBm
± 1 dB 20 Hz to 20 kHz @ output levels < + 30 dBm
If instrument does not meet this specification refer to Paragraph 5-74.

5-19. Set the Model 205AG controls as follows:

0 and 10 dB
OUTPUT ATTENUATORS . . . . . 0 dB
IMPEDANCE 600Ω
LOAD . . . . . ON
AMPLITUDE . . . . . + 37 dBm as indicated on OUTPUT LEVEL meter

5-20. Connect the OUTPUT to an AC voltmeter.

5-21. Set the output frequency of the Model 205AG to 1 kHz and note the OUTPUT level on the dB scale of the AC voltmeter. This is the reference level. (Ensure OUTPUT LEVEL meter indication remains at + 37 dB.)

5-22. Set the FREQUENCY RANGE to X1, and slowly vary the FREQUENCY dial from 20 to 200 while observing the AC voltmeter.

5-23. The output level should not vary more than ± 1.5 dB from the level observed at the 1 kHz reading (Paragraph 5-21).

5-24. Repeat Paragraphs 5-22 and 5-23 for the X10 and X100 FREQUENCY RANGE.

5-25. Repeat Paragraphs 5-22 thru 5-24 except set the 10 dB OUTPUT ATTENUATOR to 30. The output level should not vary more than ± 1 dB from the 1 kHz reading over the entire frequency range of the Model 205AG.

5-26. DISTORTION.

Specification

Less than 1% at frequencies >30 Hz.
If the instrument can not meet this specification refer to Paragraph 5-90 and Table 5-4 (troubleshooting).

5-27. Set Model 205AG controls as follows:

0 and 10 dB
OUTPUT ATTENUATORS . . . . . 0 dB
FREQUENCY RANGE X10
FREQUENCY 100
LOAD . . . . . ON
AMPLITUDE . . . . . MAXIMUM
IMPEDANCE . . . . . 600 Ω

5-28. Connect the OUTPUT of the Model 205 AG to the input of a distortion analyzer.

5-29. Measure the distortion. It should be less than 1%.

5-30. HUM LEVEL.

Specification

More than 60 dB below output levels > -30 dBm. For output levels ≤ -30 dBm level will be ≤ -90 dBm.
If the instrument cannot meet this specification refer to Table 5-4 (troubleshooting).

5-31. Set Model 205AG controls as follows:

IMPEDANCE 600
LOAD . . . . . ON
FREQUENCY 200
FREQUENCY RANGE X100
10 and 1 dB OUTPUT ATTNEUATORS . . . . 0 dB

5-32. Connect the 205AG OUTPUT to the input of a wave analyzer.

5-33. Adjust the AMPLITUDE control of the Model 205AG to provide an output level of + 30 DBM as observed on the OUTPUT LEVEL meter.

5-34. Using the wave analyzer determine the level of hum at 60 Hz. Record this value.

5-35. Check the hum level at 120 Hz and 180 Hz. Record these values.

NOTE

When making this measurement, be certain you are measuring the 60 Hz hum and not 0 beat which occurs near sixty on the wave analyzer FREQUENCY dial.

5-36. Using the graph of Figure 5-1 determine the number of decibels to add to the largest hum level measured (in this case the level at 60 Hz) for the 120 Hz and 180 Hz harmonies. Add these two values to the level at 60 Hz.

Example: Assume the hum level measured at 60 Hz (largest hum level) is -60 dBm. If the hum level measured at 120 Hz is -70 dBm the difference between the largest measured (i.e., the level at 60 Hz) and the hum level measured at 120 Hz is -10 dBm. Referring to Figure 5-1 the "decibel difference between two values" is, in this case, -10 dBm. The corresponding value to be added to the hum level measured at 60 Hz is approximately 0.50. If this is then

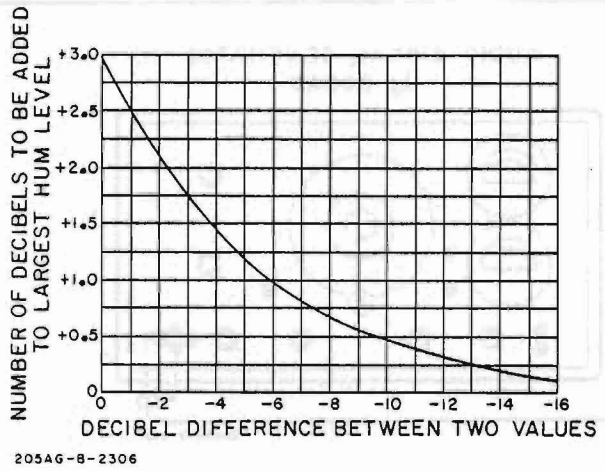


Figure 5-1 Logarithmic Addition of Hum Harmonics

added to the hum level at 60 Hz the overall level is -60 dBm +0.50 = -59.60 dB. The level measured at 180 Hz is obtained in a similar manner, yielding the approximate overall hum level.

5-37. The overall level as calculated in Paragraph 5-36 should be < -30 dBm.

5-38. Resetting the Model 205AG ATTENUATORS and AMPLITUDE control as necessary repeat steps 5-34 thru 5-37 for output levels of -20 dBm and -40 dBm. The output hum level under these conditions should be < -80 dBm and ⩽ -90 dBm, respectively.

5-39. OUTPUT ATTENUATOR ACCURACY CHECK.

Specification

Accuracy:

10 dB ATTENUATOR:

1 kHz: ± 0.5 dB, 0 dB to 80 dB
± 1.5 dB, 90 dB to 100 dB

20 kHz: ± 2.5 dB, 0 dB to 100 dB

1 dB ATTENUATOR

20 kHz: ± .25 dB, 0 dB to 10 dB

If the instrument cannot meet this specification refer to Table 5-4 (trouble-shooting).

5-40. 10 dB Check.

5-41. Set the Model 205AG controls as follows:

10 and 1 dB OUTPUT ATTENUATORS	0 dB
LOAD	ON
FREQUENCY RANGE	X10
FREQUENCY	100
IMPEDANCE	600
AMPLITUDE	0

5-42. Connect the OUTPUT of the Model 205AG to the input of an AC voltmeter (600Ω ref.).

5-43. Set the sensitivity of the AC voltmeter to 30 V full scale and adjust the Model 205AG AMPLITUDE to indicate 0 as observed on the dB scale of the AC voltmeter.

5-44. Lower the Model 205AG 10 dB ATTENUATOR one step (10 dB) and increase the AC voltmeter sensitivity one step (10 dB).

5-45. Observe the AC voltmeter. The reading should be within ± 0.5 dB of 0 on the dB scale of the meter.

5-46. Repeat steps 5-44 and 5-45 for the 10 dB thru 100 dB settings of the Model 205AG 10 dB OUTPUT ATTENUATOR. The accuracy tolerance on the 90 and 100 dB settings is ± 1.5 dB.

5-47. Set the Model 205AG controls as indicated in Paragraph 5-41 except set FREQUENCY RANGE to X100 and FREQUENCY to 200.

5-48. Repeat steps 5-43 thru 5-45 except set the AC voltmeter reference (Paragraph 5-43) to -1 dB instead of 0 and check for an indication that is within ±2.5 dB of the -1 dB reference. Repeat this paragraph for the 10 dB thru 100 dB settings of the 10 dB OUTPUT ATTENUATOR.

5-49. 1 dB Check.

5-50. Set the Model 205AG controls as follows:

10 and 1 dB OUTPUT ATTENUATORS	50 and 10 dB, respectively
LOAD	OFF
FREQUENCY RANGE	X100
FREQUENCY	200
IMPEDANCE	50
AMPLITUDE	0

5-51. Connect the equipment as shown in Figure 5-2. The 355C Attenuator should be set to 0.

CAUTION

DO NOT APPLY VOLTAGES IN EXCESS OF 5 V RMS TO THE 355C ATTENUATOR. VOLTAGES IN EXCESS OF THIS MAY DESTROY THE ATTENUATOR.

5-52. Set the AC voltmeter range to -40 dB (10 mV) and adjust the Model 205AG AMPLITUDE control for an indication of 0 on the dB scale of the voltmeter.

5-53. Decrease the Model 205AG attenuation by 1 dB using the 1 dB OUTPUT ATTENUATOR.

5-54. Increase the attenuation of the 355C Attenuator 1 dB and observe the AC voltmeter. The reading should be within ± .25 dB of 0.

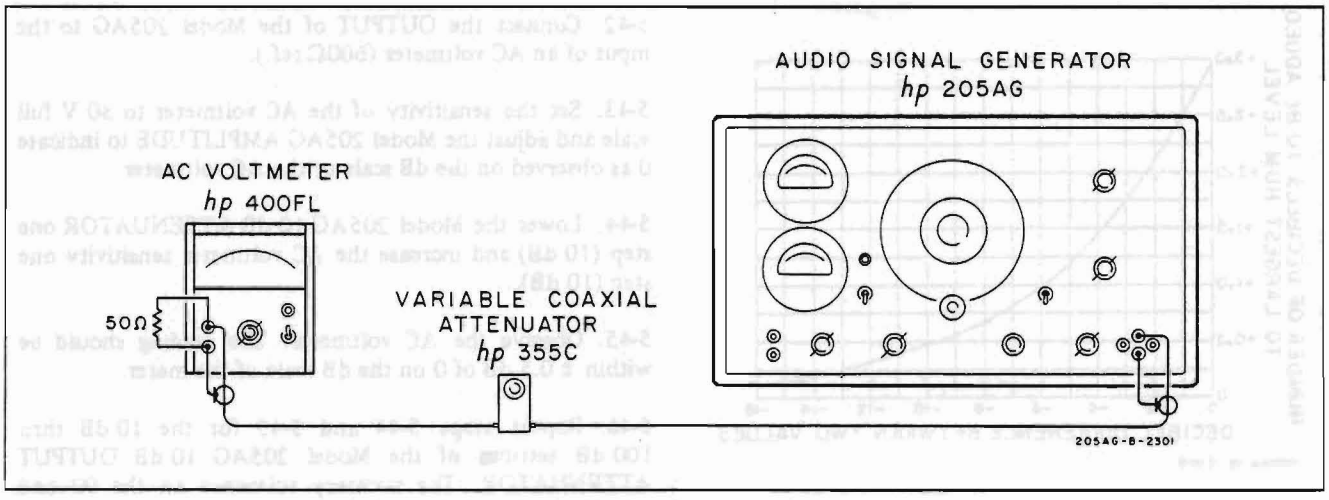


Figure 5-2 1 dB Attenuator Accuracy Check

5-55. Repeat Paragraphs 5-53 and 5-54 for each step of the 1 dB OUTPUT ATTENUATOR.

5-56. INPUT METER CHECK.

Specification

Accuracy is ± 5% of full scale.

If the instrument will not meet this specification refer to Paragraph 5-85 and Table 5-4 (troubleshooting).

5-57. Set the Model 205AG AMPLITUDE to 0 and connect the INPUT to the OUTPUT.

5-58. Set the 205AG controls as follows:

IMPEDANCE 600
LOAD .....ON
FREQUENCY 200
FREQUENCY RANGE X100
10 and 1 dB
OUTPUT ATTENUATORS 0
INPUT ATTENUATOR 20

5-59. Connect an AC voltmeter to the INPUT terminal of the Model 205AG.

5-60. Adjust the AMPLITUDE to 2.0 V as observed on the INPUT METER.

5-61. Observe the AC voltmeter, its reading should be within ± 5% (i.e., ± 1 V) of 20 V. (Input meter reading is attenuated 20 dB).

5-62. Repeat steps 5-59 and 5-60 for INPUT METER settings of 1.5 V, 1.0 V, 0.5 V and 0 V. The AC voltmeter indication should be within ± 1 V of 15 V, 10 V, 5 V, and 0 V, respectively.

NOTE

If this specification cannot be met, refer to Paragraph 5-85 of this manual for the adjustment procedure.

5-63. INPUT ATTENUATOR ACCURACY.

Specification

Accuracy is ± 0.1 dB.

If the instrument cannot meet this specification refer to Table 5-4 (troubleshooting).

5-64. Set the AMPLITUDE control to 0 and connect the OUTPUT of the Model 205AG to the INPUT. Also connect an AC voltmeter to the INPUT.

5-65. Set the Model 205AG controls as follows:

IMPEDANCE 5000
LOAD .....OFF
FREQUENCY 40
FREQUENCY RANGE X10
10 and 1 dB
OUTPUT ATTENUATORS 0
INPUT ATTENUATOR 40

5-66. Adjust the AMPLITUDE control to 0.75 V as observed on the INPUT LEVEL meter.

5-67. Observe and record the meter indication of the reference AC voltmeter.

5-68. Using the Model 205AG 10 dB OUTPUT ATTENUATOR, attenuate the output 10 dB. Decrease the input attenuation by 10 dB using the INPUT ATTENUATOR. Decrease the AC voltmeter sensitivity by 10 dB (one step).

5-69. Observe the AC voltmeter and ascertain that the needle has not moved from its reference position (noted in Paragraph 5-67). If it has, adjust the 205AG AMPLITUDE control to reestablish the reference.

5-70. Observe the INPUT LEVEL meter. It should again read 0.75 V.

5-71. Repeat steps 5-66 thru 5-70 for the 20, 10, and 0 dB steps of the INPUT ATTENUATOR.

5-72. Repeat steps 5-65 thru 5-70 except set the INPUT ATTENUATOR to 35 in step 5-65 and check the 25, 15, and 5 dB steps of the attenuator.

5-73. ADJUSTMENT PROCEDURE.

5-74. FREQUENCY CALIBRATION ADJUSTMENT.

5-75. The range switch resistors R1 to R6 inclusive in conjunction with the tuning capacitor assembly C1 and C2, determine the frequency of the oscillation of the unit and also affect the amplitude. If the output frequency is not within 2% of that indicated by the dial, or if the amplitude varies more than ± 1/2 dB from 200 to 2000 Hz, the following procedure is recommended.

NOTE

For all adjustments the output must be loaded with the internal load. Turn the LOAD switch ON.

The frequency calibration will be correct only when the shields around and above the main tuning capacitor are firmly in place.

Using a gentle airstream, blow out any dust that may be present on the tuning capacitor.

5-76. Check for proper setting of dial on shaft. At one end of the frequency dial will be either a small dot or an extra line. This should be under the indicator hairline when the tuning capacitor is at that end of its travel. This may be adjusted by loosening set screws on one side of the coupler behind the panel, then rotating the dial until correctly lined up. Check and tighten all screws in the dial drive mechanism.

5-77. Turn on the instrument and allow at least 30 minutes for it to warm up.

5-78. Set to X10 range and dial to 20. Set the output meter to 50 volts. Change dial setting to 200. The panel output meter should now read 50 volts ± 2 volts and the frequency should be 2000 Hz ± 2%. If both frequency and amplitude are in error, adjust C1 and C22 for the best compromise between correct frequency and correct amplitude. If C22 has insufficient range, the size of C24 may be changed.

5-79. Check tracking of the rest of the frequency dial. If there is no constant error in tracking, proceed with the next step. If there is a constant error, proceed with one of the following methods, whichever is the easiest.

a. Loosen set screws and reset the dial to take the error into account, then repeat steps 5-77 and 5-78. This method is best if the other ranges also have a constant error in the same direction.

b. Change the small padding resistors in series with the precision resistor on the range switch. Increasing the value of the resistor by 10,000 ohms will lower the frequency of the range approximately 1%; decreasing the value of this resistor will raise the frequency of the range. Recheck steps 5-76 through 5-79.

NOTE

Up to 1% change in frequency on any range may be made by adjusting only one of the two range resistor padders on that range. If a greater frequency change is needed, adjust both padders. If this is not done, the relative amplitude between ranges will be affected.

5-80. When the X10 range has been properly adjusted, the other ranges may be adjusted as follows:

a. X100 range
Change the padding resistor in series with the precision resistor. A change of 1000 ohms will change the frequency approximately 1% at the low end of the dial. Then 20,000 Hz on the dial is corrected by varying C7. A change of 50 to 200 pF is usually adequate.

b. X1 range
An increase of 100 kilohms in the padding resistor will decrease frequency approximately 1% on this range. There may be a small tracking error (less than 2%) at the top or the bottom of the X1 range. This is normal to the instrument and cannot be eliminated.

5-81. If satisfactory calibration cannot be obtained in the above manner, it may be necessary to return the instrument to an authorized repair station or the factory.

5-82. OUTPUT LEVEL METER ADJUSTMENT.

5-83. With the instrument operating and AMPLITUDE control at zero, adjust the meter pointer to zero with zero adjustment screw on the meter.

5-84. Set the Model 205AG IMPEDANCE to 600 and connect an accurate vacuum tube voltmeter across the output terminals with the 600 ohm internal load switched on. Set the instrument for 100 Hz output, zero attenuation, and adjust the AMPLITUDE controls until the external voltmeter indicates 55 volts. Adjust the variable resistor R29 until the Output Level meter indicates exactly 55 volts. The resistor R29, which is reached through a hole in the back of the chassis, can be turned with a screwdriver.

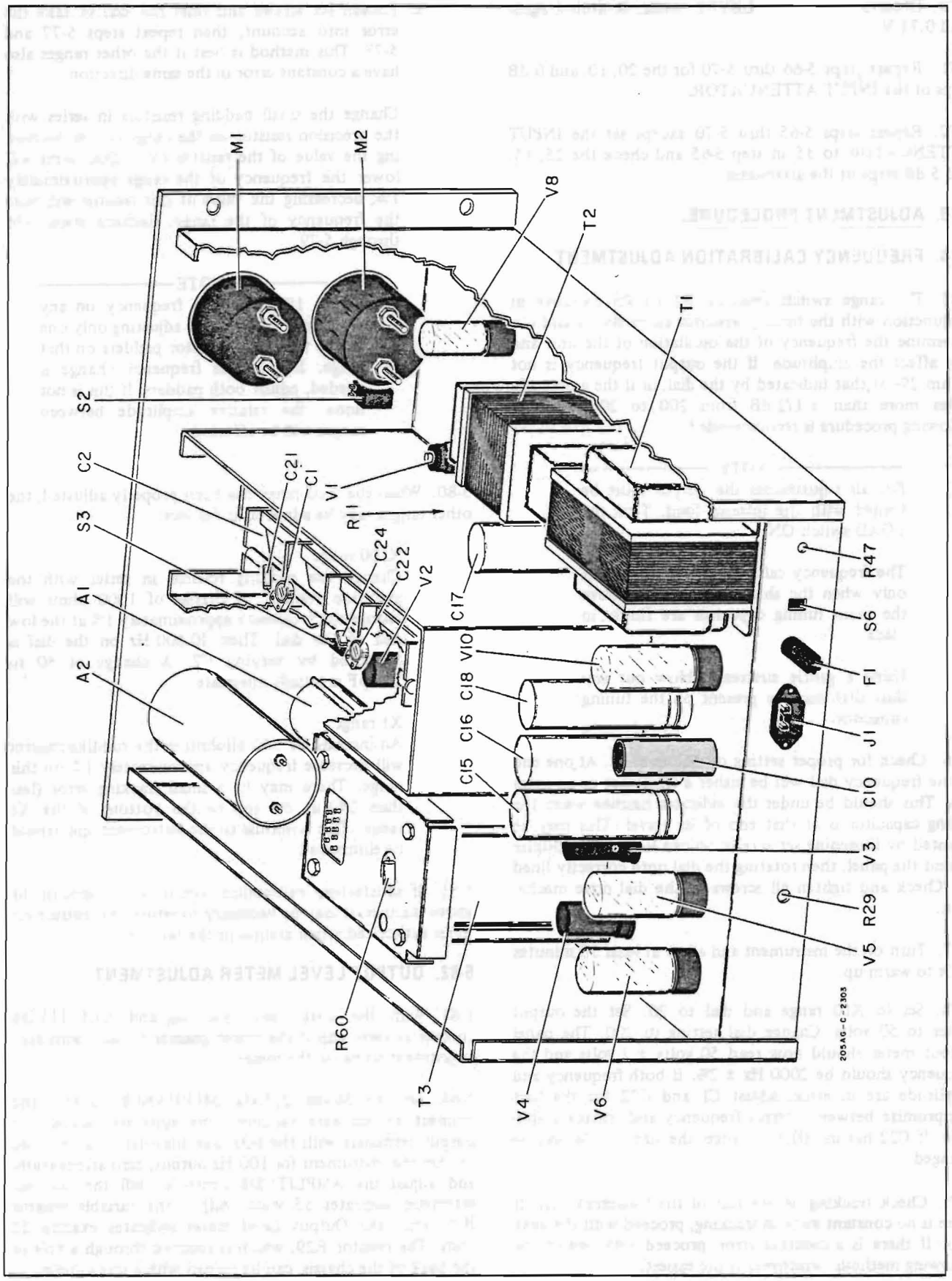


Figure 5-3 Adjustments and Chassis Component Location (Top View)

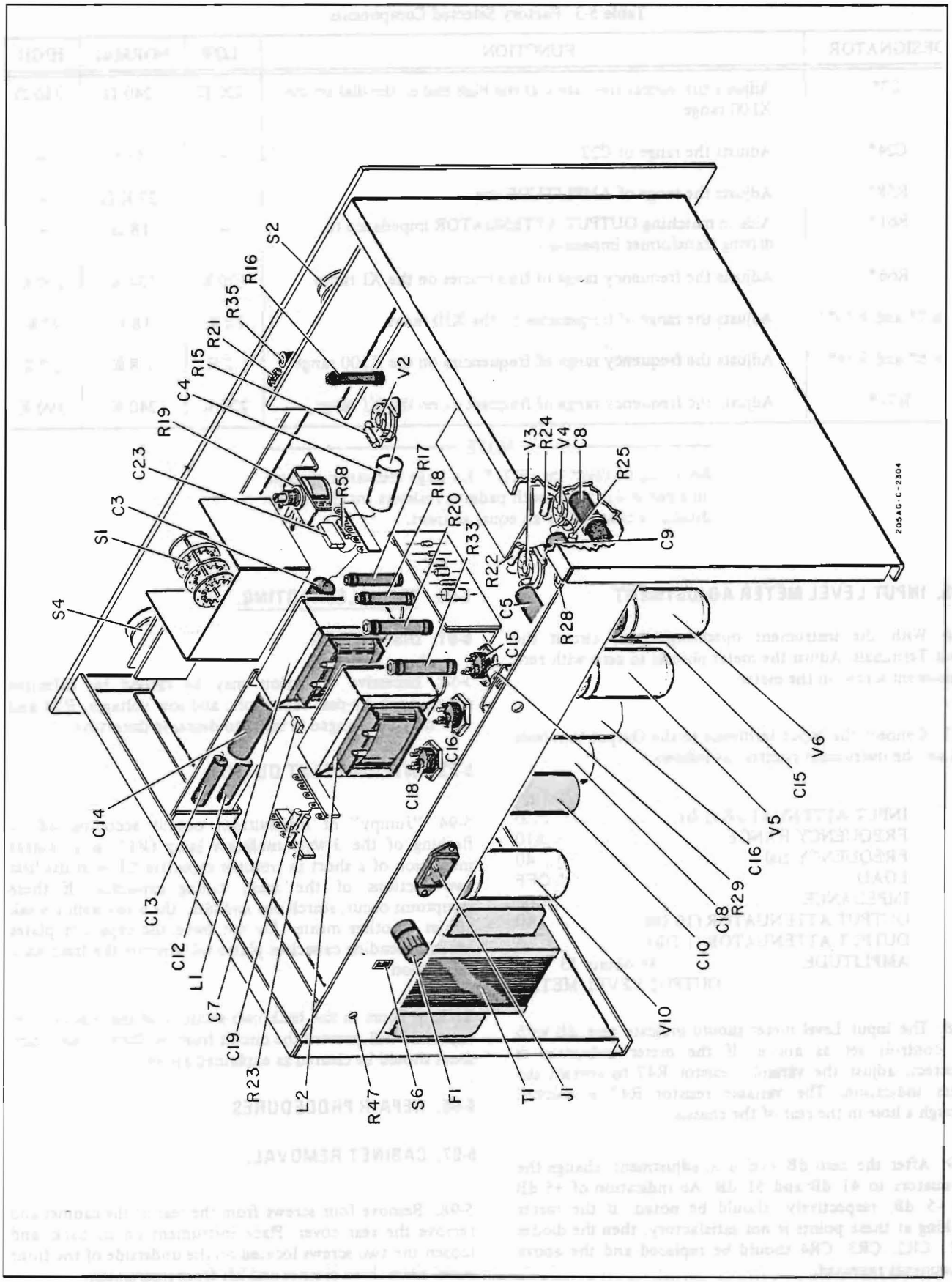


Figure 5-4 Adjustment and Chassis Component Location (Bottom View)

Table 5-3. Factory Selected Components

DESIGNATOR	FUNCTION	LOW	NORMAL	HIGH
C7*	Adjusts the output frequency at the high end of the dial on the X100 range.	220 Ω	240 Ω	330 Ω
C24*	Adjusts the range of C22.	---	5 pf	---
R58*	Adjusts the range of AMPLITUDE control.	---	27 K Ω	---
R61*	Aids in matching OUTPUT ATTENUATOR impedance to driving transformer impedance.	---	18 Ω	---
R66*	Adjusts the frequency range of frequencies on the X1 range.	120 K	134 K	270 K
R67* and R70*	Adjusts the range of frequencies on the X10 range.	12 K	18 K	27 K
R68* and R69*	Adjusts the frequency range of frequencies on the X100 range.	1.2 K	1.8 K	2.7 K
R71*	Adjusts the frequency range of frequencies on the X1 range.	220 K	240 K	390 K

NOTE

Referring to R66* thru R71*, for large resistance changes on a particular range both padding resistors for that range should be changed by an equal amount.

5-85. INPUT LEVEL METER ADJUSTMENT.

5-86. With the instrument operating, short circuit the Input Terminals. Adjust the meter pointer to zero with zero adjustment screw on the meter.

5-87. Connect the Input terminals to the Output terminals and set the instrument controls as follows:

INPUT ATTENUATOR (DB) 0
FREQUENCY RANGE X10
FREQUENCY dial 40
LOAD . . . . . OFF
IMPEDANCE 5000
OUTPUT ATTENUATOR (10 DB) 40
OUTPUT ATTENUATOR (1 DB) 6
AMPLITUDE . . . . . .to obtain 53 V on OUTPUT LEVEL METER

5-88. The Input Level meter should indicate zero dB with the controls set as above. If the meter indication is incorrect, adjust the variable resistor R47 to correct the meter indication. The variable resistor R47 is reached through a hole in the rear of the chassis.

5-89. After the zero dB level is in adjustment, change the attenuators to 41 dB and 51 dB. An indication of +5 dB and -5 dB, respectively, should be noted. If the meter tracking at these points is not satisfactory, then the diodes CR1, CR2, CR3, CR4 should be replaced and the above adjustments repeated.

5-90. TROUBLESHOOTING.

5-91. DISTORTION.

5-92. Excessive distortion may be caused by defective tubes, open by-pass capacitors, and low voltages. R24 and R57 may be changed in value to decrease distortion.

5-93. INTERMITTENT OUTPUT.

5-94. "Jumpy" or intermittent output accompanied by flashing of the 3-watt oscillator lamp (R11) is a reliable indication of a short in trimmer capacitor C1 or in the first two sections of the main tuning capacitor. If these symptoms occur, search out and clear the short with a weak air jet or other means. Do not bend the capacitor plates because bending capacitor plates will destroy the frequency calibration.

5-95. A short in the back two sections of the main tuning capacitor will prevent the circuit from oscillating. Any such short should be cleared as explained above.

5-96. REPAIR PROCEDURES.

5-97. CABINET REMOVAL.

5-98. Remove four screws from the rear of the cabinet and remove the rear cover. Place instrument on its back, and loosen the two screws located on the underside of the front panel bezel. Free cabinet and lift from instrument.

5-99. TUBE REPLACEMENT.

5-100. The tubes in this instrument may be replaced with any tube having EIA standard characteristics. Whenever a tube is replaced, with the exception of V7 or V8, the distortion should be measured to see that it does not exceed the specifications. When tubes V7 or V8 are replaced it may be necessary to adjust the zero setting of their respective meters.

5-101. CAPACITOR DRIVE LUBRICATION.

5-102. The capacitor drive should be lubricated once a year. Remove the cover plate from the top of the capacitor shield. Put one drop of light oil on each of the bearings on the small gear shaft at the top of the drive. The capacitor ball bearings do not need lubrication.

5-103. REPLACEMENT OF LAMP R11.

5-104. The 3-watt lamp R11 is operated at a very low level and should have an almost infinite life. Therefore, the lamp should not be changed indiscriminately. However, should the lamp require changing, it is necessary to measure the ac voltage from the junction of R58 and C4 to the chassis with the new lamp in the circuit. This voltage should be measured with a high impedance vacuum tube voltmeter such as Hewlett-Packard Models 400D, 403A, or 400FL.

5-105. To make this measurement and adjustment, the instrument must be removed from the cabinet. Set the oscillator frequency to 1000 Hertz and vary the resistor R19 so that 21 to 25 volts is obtained. Resistor R19 is mounted on the underside of the chassis. (See figure 5-4) If the voltage cannot be brought within the 21 to 25 volts range by means of R19, the new lamp should be rejected in favor of another.

Table 5-4 Troubleshooting Chart

SYMPTOMS	CAUSES	REMEDIES
Instrument inoperative (Indicator lamp won't light, no audio output).	Blown fuse.	Clear short circuit and replace fuse.
Instrument inoperative (Indicator lamp lights, no audio output).	Defective tube. Check the 5U4GA/B tube first.	Replace tube.
	Short circuit in DC power circuit capacitor.	Replace capacitor.
	Short circuit in C2 (two rear sections).	Clear the short circuit as outlined in Paragraph 5-93.
Intermittent output.	Capacitors C3, C4, C5, C8 or C9 intermittently open.	Replace capacitor.
	Short circuit in C2 (two front sections) or C1.	Clear the short circuit as outlined in Paragraph 5-93.
Output Level Meter inoperative.	6H6 tube V7 defective.	Replace tube.
Excessive distortion.	Defective tube.	Replace tube.
	Open circuit in capacitor C10 abc, C15, C16, C17, or C18.	Replace capacitor.
	Defective output or line matching transformer.	Replace transformer.

Table 5-4 Troubleshooting Chart (con't)

SYMPTOMS	CAUSES	REMEDIES
Excessive Hum.	Defective power supply filter, R64 or R65 not properly connected or defective.	Check the power supply ripple, it should be about .22 V p-p. If ripple is high replace filter capacitors. Check R64 and R65 for loose, or cold solder connections. Check resistance of R64 and R65. Replace if necessary.
Input or output attenuators do not provide proper attenuation.	Dirty contacts, Poor wiring connections, defective resistor.	If the ATTENUATOR contacts are found to be dirty they can be cleaned using a cleaning spray (V-200 Heavy Duty Flux Remover, -hp- part No. 8500-0735 recommended). They should then be lubricated with Electrolube 2G electrical contact lubricant (Trans-Atlantic Electronics, Inc., 55 Bloomindale Road, Hicksville, New York 11801). CAUTION CARE SHOULD BE EXERCISED WHEN USING THE FLUX REMOVER TO PREVENT CONTACT WITH SURROUNDING COMPONENTS. Beacon grease No. M-325 can be used to lubricate the detent mechanism of the attenuator switch. It should be applied sparingly to prevent splashes and migration onto switch contacts. If wiring connections are bad replace or resolder (using rosin care solder) as necessary. If a resistor on the input attenuator is found to be defective replace the associated resistor block. If a resistor is found to be defective in either of the OUTPUT ATTENUATORS replace that resistor. Pad as necessary.
INPUT METER does not meet accuracy specification.	Improper adjustment. Meter defective.	Recheck Input Meter adjustment (Paragraph 5-85). Replace meter.

PERFORMANCE CHECK TEST CARD

Hewlett-Packard Model 205AG
Audio Oscillator
Serial No. _____

Test Performed by _____

Date _____

CHECK DESCRIPTION	SPECIFICATION	INDICATION
FREQUENCY RANGE	X1 freq., min - ≤ 20 Hz freq., max - ≥ 20 kHz X10 freq., min - ≤ 200 Hz freq., max - ≥ 2 kHz X100 freq., min - ≤ 2 kHz freq., max - ≥ 20 kHz	_____ _____ _____ _____ _____ _____
DIAL ACCURACY	Freq. Dial Setting / Freq. Range / Max. Range (Hz) 20 X1 19.6 - 20.4 50 X1 49.0 - 51.0 100 X1 98.0 - 102.0 200 X1 196.0 - 204.0 20 X10 196.0 - 204.0 50 X10 490.0 - 510.0 100 X10 980.0 - 1020.0 200 X10 1960.0 - 2040.0 20 X100 1960.0 - 2040.0 50 X100 4900.0 - 5100.0 100 X100 9800.0 - 10200.0 200 X100 19600.0 - 20400.0	 _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____
OUTPUT FLATNESS	± 1.5 dB, 20 Hz to 20 kHz at output levels ≥ +30 dBm ± 1 dB, 20 Hz to 20 kHz at output levels < +30 dBm	_____ _____
DISTORTION	Less than 1% (at 1 kHz)	_____
HUM LEVEL	< -30 dBm (output level = +30 dBm) < -80 dBm (output level = -20 dBm) ≤ -90 dBm (output level = -40 dBm)	_____ _____ _____
ATTENUATOR ACCURACY	10 dB ATTENUATOR 1 kHz: ± 0.5 dB, 0 dB to 80 dB ± 1.5 dB, 90 dB to 100 dB 20 kHz: ± 2.5 dB, 0 dB to 100 dB 1 dB ATTENUATOR 20 kHz: ± 0.25 dB, 0 dB to 10 dB	 _____ _____ _____ _____
INPUT METER	± 5% of full scale (± 1 V) for settings of: 20 V 15 V 10 V 5 V 0 V	 _____ _____ _____ _____ _____
INPUT ATTENUATOR ACCURACY	± 0.1 dB (0 to 40 dB)	_____

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 following:

a. Total quantity used in the instrument (TQ column). The total quantity of a part is given the first time the part number appears.

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.

ABBREVIATIONS

Ag	silver	ID	inside diameter	ns	nanosecond(s) = 10^{-9} seconds
Al	aluminum	impg	impregnated	nsr	not separately replaceable
A	ampere(s)	incd	incandescent	Ω	ohm(s)
Au	gold	ins	insulation(ed)	obd	order by description
C	capacitor	kΩ	kilohm(s) = 10^{+3} ohms	OD	outside diameter
cer	ceramic	kHz	kilohertz = 10^{+3} hertz	p	peak
coef	coefficient	L	inductor	pA	picoampere(s)
com	common	lin	linear taper	pc	printed circuit
comp	composition	log	logarithmic taper	pF	picofarad(s) 10^{-12} farads
conn	connection	mA	milliampere(s) = 10^{-3} amperes	piv	peak inverse voltage
dep	deposited	MHz	megahertz = 10^{+6} hertz	p/o	part of
DPDT	double-pole double-throw	MΩ	megohm(s) = 10^{+6} ohms	pos	position(s)
DPST	double-pole single-throw	met film	metal film	poly	polystyrene
elect	electrolytic	mfr	manufacturer	pot	potiometer
encap	encapsulated	ms	millisecond	p-p	peak-to-peak
F	farad(s)	mtg	mounting	ppm	parts per million
FET	field effect transistor	mV	millivolt(s) = 10^{-3} volts	prec	precision (temperature coefficient, long term stability, and/or tolerance)
fxd	fixed	μF	microfarad(s)		
GaAs	gallium arsenide	μs	microsecond(s)	R	resistor
GHz	gigahertz = 10^{+9} hertz	μV	microvolt(s) = 10^{-6} volts	Rh	rhodium
gd	guard(ed)	my	Mylar (R)	rms	root-mean-square
Ge	germanium	nA	nanoampere(s) = 10^{-9} amperes	rot	rotary
grd	ground(ed)	NC	normally closed	Se	selenium
H	henry(ies)	Ne	neon	sect	section(s)
Hg	mercury	NO	normally open	Si	silicon
Hz	hertz (cycle(s) per second)	NPO	negative positive zero (zero temperature coefficient)	sl	slide

SPDT	single-pole double-throw
SPST	single-pole single-throw
Ta	tantalum
TC	temperature coefficient
TiO_2	titanium dioxide
tog	toggle
tol	tolerance
trim	trimmer
TSTR	transistor
V	volt(s)
vacw	alternating current working voltage
var	variable
vdcw	direct current working voltage
W	watt(s)
w/	with
wiv	working inverse voltage
w/o	without
ww	wirewound
•	optimum value selected at factory, average value shown (part may be omitted)
••	no standard type number assigned (selected or special type
(R)	Dupont de Nemours

DECIMAL MULTIPLIERS

Prefix	Symbols	Multiplier	Prefix	Symbols	Multiplier
tera	T	10^{12}	centi	c	10^{-2}
giga	G	10^{9}	milli	m	10^{-3}
mega	M or Meg	10^{6}	micro	μ	10^{-6}
kilo	K or k	10^{3}	nano	n	10^{-9}
hecto	h	10^{2}	pico	p	10^{-12}
deka	da	10	femto	f	10^{-15}
deci	d	10^{-1}	atto	a	10^{-18}

DESIGNATORS

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

Rev I

Table 6-1. Replaceable Parts

REFERENCE DESIGNATOR	-hp- PART NO.		TQ	DESCRIPTION	MFR.	MFR. PART NO.
	2AG-34A		1	Attenuator: output, complete	-hp-	
A1	350C-34A			Ass'y: attenuator, 10 steps, 1 dB/step (includes resistors A1R1 thru A1R12, not shown on schematic)	-hp-	
R1	0766-0018		2	R: fxd met oxide 57.3 ohms 2% 3 W	14674	FP-3 obd
R2	0766-0019		1	R: fxd met oxide 2.15 kilohms 2% 3 W	14674	FP-3 obd
R3	0766-0018			R: fxd met oxide 57.3 ohms 2% 3 W	14674	FP-3 obd
R4	0766-0020		2	R: fxd met oxide 85.5 ohms 2% 3 W	14674	FP-3 obd
R5	0766-0021		1	R: fxd met oxide 1420 ohms 2% 3 W	14674	FP-3 obd
R6	0766-0020			R: fxd met oxide 85.5 ohms 2% 3 W	14674	FP-3 obd
R7	0766-0017		1	R: fxd met oxide 4330 ohms 2% 3 W	14674	FP-3 obd
R8, R9	0766-0016		2	R: fxd met oxide 28.8 ohms 2% 3 W	14674	FP-3 obd
R10	0766-0022		2	R: fxd met oxide 113 ohms 2% 3 W	14674	FP-3 obd
R11	0766-0023		1	R: fxd met oxide 1050 ohms 2% 3 W	14674	FP-3 obd
R12	0766-0022			R: fxd met oxide 113 ohms 2% 3 W	14674	FP-3 obd
S1	00350-61901		1	Switch	-hp-	
A2	350C-34B			Ass'y: attenuator, 10 steps, 10 dB/step (includes resistors A2R1 thru A2R12, not shown on schematic)	-hp-	
R1	0775-0005		1	R: fxd met oxide 469 ohms 2% 7 W	14674	FP-7 obd
R2	0766-0027		1	R: fxd met oxide 31.7 ohms 2% 3 W	14674	FP-3 obd
R3	0766-0028		1	R: fxd met oxide 469 ohms 2% 3 W	14674	FP-3 obd
R4	0772-0003		1	R: fxd met oxide 260 ohms 2% 5 W	14674	FP-5 obd
R5	0772-0004		1	R: fxd met oxide 351 ohms 2% 5 W	14674	FP-5 obd
R6	0766-0024		1	R: fxd met oxide 260 ohms 2% 3 W	14674	FP-3 obd
R7	0775-0004		1	R: fxd met oxide 409 ohms 2% 7 W	14674	FP-7 obd
R8	0766-0025		1	R: fxd met oxide 101 ohms 2% 3 W	14674	FP-3 obd
R9	0766-0026		1	R: fxd met oxide 409 ohms 2% 3 W	14674	FP-3 obd
R10	0775-0006		1	R: fxd met oxide 490 ohms 2% 7 W	14674	FP-7 obd
R11	0766-0029		1	R: fxd met oxide 10 ohms 2% 3 W	14674	FP-3 obd
R12	0766-0030		1	R: fxd met oxide 490 ohms 2% 3 W	14674	FP-3 obd
S1	00350-61902		1	Switch: rotary	-hp-	
C1	0130-0001		1	C: var cer 7 - 45 pF 500 vdcw	72982	503-000-D2P0-33R
C2	0121-0004		1	C: var air 12.5 - 535.1 pF (tuning capacitor)	-hp-	
C3	0160-0024		2	C: fxd paper 0.5 μF 10% 400 vdcw	14655	PKM 4P5
C4	0180-0005		1	C: fxd elect 10 μF 50% 450 vdcw	00853	MT-4510
C5	0160-0018		1	C: fxd paper mylar 0.22 μF 10% 400 vdcw	56289	160P22494 PMD
C6				Not assigned		
C7*	0140-0092		1	C: fxd mica 240 pF 10% 500 vdcw	72136	RCM15E241J
C8, C9	0160-0001		2	C: fxd paper mylar 0.1 μF 10% 600 vdcw	56289	160P10496 PMD
C10ABC	0180-0016		1	C: fxd electrolytic 3 sections 10 μF/sect. -10% +50% 450 vdcw	37942	Type FP 20-21291
C11				Not assigned		
C12, C13	0160-0005		2	C: fxd paper mylar 0.047 μF 10% 600 vdcw	56289	160P47396PMD-Rev. A
C14	0160-0024			C: fxd paper 0.5 μF 10% 400 vdcw	14655	PKM 4P5
C15 thru C18	0160-0077		4	C: fxd paper 4 μF 10% 600 vdcw	14655	CP41B1FF405K
C19	0180-0049		1	C: fxd elect 20 μF +75 -10% 50 vdcw	56289	30D206G050CC2-DSM

Table 6-1. Replaceable Parts (Cont'd)

REFERENCE DESIGNATOR	-hp- PART NO.		TQ	DESCRIPTION	MFR.	MFR. PART NO.	
C20	0150-0011		1	C: fxd TiO_2 1.5 pF 20% 500 vdcw (Part of S1)	78488	Type GA	
C21	0150-0002		1	C: fxd cer 39 pF 5% 500 vdcw	00656	CI-2	
C22	0130-0003		1	C: fxd cer 1.5 - 7 pF 500 vdcw	71590	DA-825-040	
C23	0140-0023		1	C: fxd mica 180 pF 500 vdcw	72136	RCM20E181K	
C24*	0140-0001		1	C: fxd cer 22 pF 5% 500 vdcw	00656	Type CI-2	
CR1 thru CR6	1910-0016		6	Diode: Ge 60 wiv 1 μs	03877	S3185G	
DS1	2140-0012		1	Lamp, incandescent: 6 - 8 V, 2 pin base	01002	#12	
F1	2110-0338		1	Fuse, cartridge: 1.6 A (115 V operation)	71400	MDX 1-6/10	
F1	2110-0336		1	Fuse, cartridge: 0.8 A (230 V operation)	71400	MDL 8/10	
J1	1251-2357		1	Connector: power	82389	EAC-301	
L1, L2	9110-0004		2	Reactor: 6 H at 125 mA, 240 ohms	-hp-		
M1	1120-0003		1	Meter: OUTPUT LEVEL	-hp-		
M2	1120-0002		1	Meter: INPUT LEVEL	-hp-		
R1	0730-0136		2	R: fxd carbon 8.3 megonms 1% 1 W (Part of S1)	91637	DC-1	obd
R2	0730-0102		2	R: fxd carbon 830 kilohms 1% 1 W	91637	DC-1	obd
R3, R4	0730-0063		2	R: fxd carbon 83 kilohms 1% 1 W (Part of S1)	91637	DC-1	obd
R5	0730-0102			R: fxd carbon 830 kilohms 1% 1 W (Part of S1)	91637	DC-1	obd
R6	0730-0136			R: fxd carbon 8.3 megohms 1% 1 W (Part of S1)	91637	DC-1	obd
R7 thru R9				Not assigned			
R10	0812-0010		1	R: fxd ww 3000 ohms 5% 3 W	91637	CW2B-1	
R11	2140-0001		1	Lamp: incandescent 120 V 3 W candelabra screw base	01002	3S6/5	
R12	0690-3331		2	R: fxd comp 33 kilohms 10% 1 W	01121	GB 3331	
R13, R14	0690-1041		2	R: fxd comp 100 kilohms 10% 1 W	01121	GB 1041	
R15	0690-5641		3	R: fxd comp 560 kilohms 10% 1 W	01121	GB 5641	
R16	0816-0004		1	R: fxd ww 800 ohms 5% 10 W	91637	HL12-02Z-5	
R17	0816-0009		1	R: fxd ww 25 kilohms 5% 12 W	91637	HL12-02Z-5	
R18	0816-0008		1	R: fxd ww 10 kilohms 5% 10 W	91637	HL12-02Z-5	
R19	2100-0004		1	R: var ww lin taper 1000 ohms 10% 2 W	71450	252	
R20	0819-0027		1	R: fxd ww 10 kilohms 5% 20 W	91637	HL20-02Z-5	
R21	2100-0009		1	R: var comp 25 kilohms 20% 1/3 W	71590	Model 2	
R22	0690-1051		1	R: fxd comp 1 megohm 10% 1 W	01121	GB 1051	
R23	0690-8221		1	R: fxd comp 8200 ohms 10% 1 W	01121	GB 8221	
R24*	0690-1251		1	R: fxd comp 1.2 megohms 10% 1 W	01121	GB 1251	
R25	0689-2235		2	R: fxd comp 22 kilohms 5% 1 W	01121	GB 2235	
R26, R27	0690-5641			R: fxd comp 560 kilohms 10% 1 W	01121	GB 5641	
R28	0819-0035		1	R: fxd ww 500 ohms 10% 20 W	91637	HL20-02Z-9	
R29	2100-0161		1	R: var comp lin taper 20 kilohms 1/3 W	-hp-		
R30	0727-0170		1	R: fxd carbon 18 kilohms 1% 1/2 W	91637	DCS-1/2-15	obd

Table 6-1. Replaceable Parts (Cont'd)

REFERENCE DESIGNATOR	-hp- PART NO.		TQ	DESCRIPTION	MFR.	MFR. PART NO.
R31, R32	0690-1031		2	R: fxd comp 10 kilohms 10% 1 W	01121	GB 1031
R33	0819-0002		1	R: fxd ww 2500 ohms 5% 20 W	91637	HL20-02Z-5
R34				Not assigned		
R35	0817-0001		1	R: fxd ww 600 ohms 1% 20 W	91637	HL20-02Z-5
R36 thru R44				Resistors: part of Input Attenuator Ass'y (See S4)		
R45	0687-1051		2	R: fxd comp 1 megohm 10% 1/2 W	01121	EB 1051
R46	0813-0001		1	R: fxd ww 1000 ohms 5% 3 W	91637	CW2B-1
R47	2100-0022		1	R: var ww 500 ohms 20% 2 W	11236	112
R48	0690-1021		1	R: fxd comp 1000 ohms 10% 1 W	01121	GB 1021
R49	0687-1051			R: fxd comp 1 megohm 10% 1/2 W	01121	EB 1051
R50	0690-1541		1	R: fxd comp 150 kilohms 10% 1 W	01121	GB 1541
R51	0690-2741		1	R: fxd comp 270 kilohms 10% 1 W	01121	GB 2741
R52	0690-3331			R: fxd comp 33 kilohms 10% 1 W	01121	GB 3331
R53	0690-1831		1	R: fxd comp 18 kilohms 10% 1 W	01121	GB 1831
R54				Not assigned		
R55	0689-2235			R: fxd comp 22 kilohms 5% 1 W	01121	GB 2235
R56, R57				Not assigned		
R58*	0690-3931		1	R: fxd comp 39 kilohms 10% 1 W	01121	GB 3931
R59				Not assigned		
R60	0693-4721		1	R: fxd comp 4700 ohms 10% 2 W	01121	HB 4721
R61*	0693-1801		1	R: fxd comp 18 ohms 10% 2 W	01121	HB 1801
R62, R63	0687-6811		2	R: fxd comp 680 ohms 10% 1/2 W	01121	EB 6811
R64, R65	0690-4711		2	R: fxd comp 470 ohms 10% 1 W	01121	GB 4711
R66*	0686-1345		1	R: fxd comp 130 kilohms 5% 1/2 W (Part of S1)	01121	EB 1345
R67*	0686-1635		1	R: fxd comp 16 kilohms 5% 1/2 W	01121	EB 1635
R68*	0687-1821		2	R: fxd comp 1.8 kilohms 10% 1/2 W	01121	EB 1821
R69*	0686-1625		1	R: fxd comp 1.6 kilohms 5% 1/2 W	01121	EB 1625
R70*	0687-1831			R: fxd comp 18 kilohms 10% 1/2 W	01121	EB 1831
R71*	0686-2445		1	R: fxd comp 240 kilohms 5% 1/2 W	01121	EB 2445
S1	2AG-19WB		1	Range switch ass'y: includes C20, R1 thru R6, R66* thru R71*, and rotary switch, -hp- part no. 3100-0017)	-hp-	
S2	2G-39		1	Impedance switch ass'y	-hp-	
S3	3101-0001		2	Switch: toggle SPST	04009	80994-HB
S4	2G-53		1	Input Attenuator ass'y: (includes R36 thru R44, ww resistors mounted on two resistor blocks, and a rotary switch, -hp- part no. 3130-0150)	-hp-	
S4RB1				Resistor block: Resistors R36 thru R39 are mounted on this block. -hp- part no. 2AG-26A, (nearest attenuator switch)		
S4RB2				Resistor block: Resistors R40 thru R44 are mounted on this block. -hp- part no. 2AG-26B (farthest from attenuator switch)		
S5	3101-0001			Switch: toggle SPST	04009	80994-HB
S6	3101-1234		1	Switch: slide DPST	82389	11A-1242A
T1	9100-0041		1	Transformer: power	-hp-	
T2	9120-0009		1	Transformer: audio output	-hp-	
T3	9120-0020		1	Transformer: impedance matching	-hp-	

Table 6-1. Replaceable Parts (Cont'd)

REFERENCE DESIGNATOR	-hp- PART NO.		TQ	DESCRIPTION	MFR.	MFR. PART NO.
V1	1923-0032		1	Tube: electron 6J7	86684	6J7
V2	1923-0031		1	Tube: electron 6F6	86684	6F6
V3	1939-0005		1	Tube: electron 6SQ7	86684	6SQ7
V4	1921-0008		1	Tube: electron 6J5	01002	6J5
V5, V6	1923-0035		2	Tube: electron 6L6GB	01002	6L6GC
V7				Not assigned		
V8	1932-0025		1	Tube: electron 6SN7GT	01002	6SN7GTB
V9				Not assigned		
V10	1930-0008		1	Tube: electron 5U4GA/B	86684	5U4GB
W1	8120-1348			Cable: power (black)	70903	KHS-7041
				MISCELLANEOUS		
	5020-0618		1	Bearing: capacitor drive	-hp-	
	1510-0006		1	Binding post ass'y: black	-hp-	
	1510-0007		4	Binding post ass'y: red	-hp-	
	5060-0626		1	Binding post ass'y: w/ground strap	-hp-	
	2G-75C		1	Board Ass'y: input amplifier (includes C12 thru C14, CR1 thru CR4, R45, R48 thru R53)	-hp-	
	2G-75D		1	Board Ass'y: output meter circuit (includes CR5, CR6, R30, R61 thru R63)	-hp-	
	5060-0077		1	Cabinet ass'y	-hp-	
	35F-95A		1	Conversion kit: conversion of cabinet mount to rack mount in the field)	-hp-	
	5000-9506		1	Cover: rack mount only	-hp-	
	5000-0104		1	Cover: rear (slotted)	-hp-	
	200AB-40B		1	Dial: frequency w/o knob	-hp-	
	5040-0607		1	Disc ass'y: vernier drive	-hp-	
	1400-0084		1	Fuseholder	75915	342014
	5060-0020		1	Gear ass'y	-hp-	
	5060-0021		1	Gear ass'y	-hp-	
	1450-0413		1	Jewel: pilot light	72765	14L-113-WHITE
	1450-0013		1	Lampholder: candelabra (for R11)	72765	4309-016
	1450-0022		1	Lampholder: 2 pin base	72765	2020E-AE
	350C-55A		1	Shield: output attenuator (10 dB)	-hp-	
	350C-55B		1	Shield: output attenuator (100 dB)	-hp-	
	1200-0020		8	Socket: tube	76530	101-12-11-046
	5000-0637		1	Spring: thrust	-hp-	
	0370-0032		1	Knob: AMPL.	-hp-	
	0370-0045		1	Knob: FREQ	-hp-	
	0370-0035		5	Knob: INPUT DB, FREQ. RANGE, IMPEDANCE, 0 - 10 DB (lower attenuator) 0 - 100 DB (upper attenuator)	-hp-	
	0370-0028		1	Knob: VERNIER	-hp-	
	1460-0114		1	Spring: torsion (on tuning gear ass'y)	-hp-	
	5040-0665		1	Window: dial	-hp-	

SECTION VII
CIRCUIT DIAGRAMS

7-1 INTRODUCTION.

7-2. This section contains the circuit schematic necessary for maintenance of the Model 205AG.

7-3. The schematic notes (Page 7-2) should be referred to before making voltage checks. This will ensure proper voltage indications will be obtained. These notes also contain information necessary for proper interpretation of schematic symbols and values.

7-4. An explanation of terms and symbols used on schematic diagrams is given below.

SCHEMATIC NOTES

1. REFER TO REFERENCE DESIGNATOR DRAWING (PAGE 7-1) FOR INFORMATION REGARDING COMPONENT DESIGNATORS.
2. COMPONENT VALUES ARE SHOWN AS FOLLOWS UNLESS OTHERWISE NOTED.
   RESISTANCE IN OHMS
   CAPACITANCE IN MICROFARADS
3. ⊥ DENOTES CHASSIS GROUND.
4. ⏚ DENOTES EARTH GROUND.
5. ▭ DENOTES FRONT PANEL MARKING.
6. ▭ DENOTES REAR PANEL MARKING.
7. DENOTES SCREWDRIVER ADJUST.
8. CONDITIONS OF D.C. VOLTAGE MEASUREMENT.
   a. 115/230 V, 48-440 Hz POWER SUPPLY.
   b. MEASUREMENT TAKEN BETWEEN THE INDICATED POINTS AND CHASSIS WITH A VOLTMETER OF 10 MEGOHMS INPUT RESISTANCE
   c. SET FREQUENCY RANGE AT X10, FREQUENCY DIAL AT 100, AMPL AT ZERO, IMPEDANCE AT 600 Ω, DB AT ZERO, LOAD ON, INPUT DB AT 40

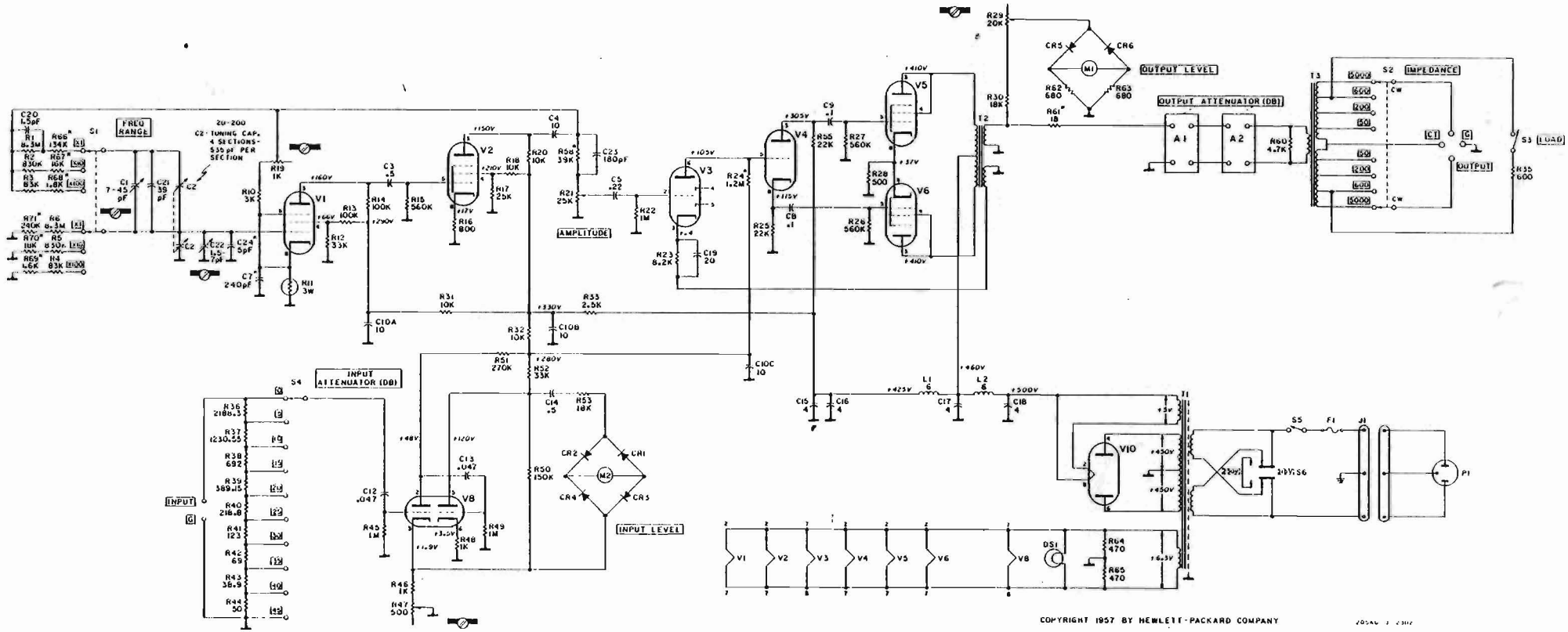


Figure 7-1. Model 205AG Audio Signal Generator Circuit and A1/A2 Component Locator.

CODE LIST OF MANUFACTURERS (Continued)

Code No.	Manufacturer	Address
19644	LRC Electronics	Horseheads, N. Y.
19701	Electra Mfg. Co.	Independence, Kansas
20183	General Atronics Corp.	Philadelphia, Pa.
21226	Executone, Inc.	Long Island City, N. Y.
21355	Fafnir Bearing Co., The	New Britian, Conn.
21520	Fansteel Metallurgical Corp.	N. Chicago, Ill.
23020	General Reed Co.	Metuchen, N. J.
23042	Texscan Corp.	Indianapolis, Ind.
23783	British Radio Electronics Ltd.	Washington, D.C.
24455	G. E. Lamp Division, Nela Park,	Cleveland, Ohio
24655	General Radio Co.	West Concord, Mass.
24681	Memcor Inc., Comp. Div.	Huntington, Ind.
26365	Gries Reproducer Corp.	New Rochelle, N. Y.
26462	Grobert File Co. of America, Inc.	Carlstadt, N. J.
26851	Compac Hollister Co.	Hollister, Cal.
26992	Hamilton Watch Co.	Lancaster, Pa.
28480	Hewlett-Packard Co.	Palo Alto, Cal.
28520	Heyman Mfg. Co.	Kenilworth, N. J.
30817	Instrument Specialties Co., Inc.	Little Falls, N. J.
33173	G. E. Receiving Tube Dept.	Owensboro, Ky.
35434	Lectrohm Inc.	Chicago, Ill.
36196	Stanwyck Coil Products, Ltd.	Hawkesbury, Ontario, Canada
36287	Cunningham, W. H. & Hill, Ltd.	Toronto, 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.
40931	Honeywell Inc.	Minneapolis, Minn.
42190	Muter Co.	Chicago, Ill.
43990	C. A. Norgren Co.	Englewood, Colo.
44655	Ohmite Mfg. Co.	Skokie, Ill.
46384	Penn Eng. & Mfg. Corp.	Doylestown, Pa.
47904	Polaroid Corp.	Cambridge, Mass.
48620	Precision Thermometer & Inst. Co.	Southampton, Pa.
49956	Microwave & Power Tube Div.	Waltham, Mass.
52090	Rowan Controller Co.	Westminster, Md.
52983	HP Co., Med. Elec. Div.	Waltham, Mass.
54294	Shallcross Mfg. Co.	Selma, N. C.
55026	Simpson Electric Co.	Chicago, Ill.
55933	Sonotone Corp.	Elmsford, N. Y.
55938	Raytheon Co. Commercial Apparatus & System Div.	So. Norwalk, Conn.
56137	Spaulding Fibre Co., Inc.	Tonawanda, N. Y.
56289	Sprague Electric Co.	North Adams, Mass.
58474	Superior Elect. Co.	Bristol, Conn.
59446	Telex Corp.	Tulsa, Okla.
59730	Thomas & Betts Co.	Elizabeth, N. J.
60741	Triplett Electrical Inst. Co.	Bluffton, Ohio
61775	Union Switch and Signal Div. of Westinghouse Air Brake Co.	Pittsburgh, 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. Inc. Weston-Newark	Newark, N. J.
66295	Wittek Mfg. Co.	Chicago, Ill.
66346	Minnesota Mining & Mfg. Co. Revere Mincom Div.	St. Paul, Minn.
70276	Allen Mfg. Co.	Hartford, Conn.
70309	Allied Control	New York, N. Y.
70318	Allmetal Screw Product Co., Inc.	Garden City, N. Y.
70417	Amplex, Div. of Chrysler Corp.	Detroit, Mich.
70485	Atlantic India Rubber Works, Inc.	Chicago, Ill.
70563	Amperite Co., Inc.	Union City, N. J.
70674	ADC Products Inc.	Minneapolis, Minn.
70903	Belden Mfg. Co.	Chicago, Ill.
70998	Bird Electric Corp.	Cleveland, Ohio
71002	Birnbach Radio Co.	New York, N. Y.
71034	Bliley Electric Co., Inc.	Erie, Pa.
71041	Boston Gear Works Div. of Murray Co. of Texas	Quincey, Mass.
71218	Bud Radio, Inc.	Willoughby, Ohio
71279	Cambridge Thermionics Corp.	Cambridge, Mass.
71286	Camloc Fastener Corp.	Paramus, N. J.
71313	Cardwell Condenser Corp.	Lindenhurst, L. I., N. Y.
71400	Bussmann Mfg. Div. of McGraw-Edison Co.	St. Louis, Mo.
71436	Chicago Condenser Corp.	Chicago, Ill.
71447	Calif. Spring Co., Inc.	Pico-Rivera, Cal.
71450	CTS Corp.	Elkhart, Ind.
71468	ITT Cannon Electric Inc.	Los Angeles, Cal.
71471	Cinema, Div. Aerovox Corp.	Burbank, Cal.
71482	C. P. Clare & Co.	Chicago, Ill.
71590	Centralab Div. of Globe Union Inc.	Milwaukee, Wis.
71616	Commercial Plastics Co.	Chicago, Ill.
71700	Cornish Wire Co., The	New York, N. Y.
71707	Coto Coil Co., Inc.	Providence, R. I.
71744	Chicago Miniature Lamp Works	Chicago, Ill.
71785	Cinch Mfg. Co., Howard B. Jones Div.	Chicago, Ill.
71984	Dow Corning Corp.	Midland, Mich.
72136	Electro Motive Mfg. Co., Inc.	Willimantic, Conn.
72619	Dialight Corp.	Brooklyn, N. Y.
72656	Indiana General Corp., Electronics Div.	Keasby, N. J.
72699	General Instrument Corp., Cap Division	Newark, N. J.
72765	Drake Mfg. Co.	Harwood Heights, Ill.
72825	Hugh H. Eby Inc.	Philadelphia, Pa.
72928	Gudeman Co.	Chicago, Ill.
72962	Elastic Stop Nut Corp.	Union, N. J.
72964	Robert M. Hadley Co.	Los Angeles, Cal.
72982	Erie Technological Products, Inc.	Erie, Pa.
73061	Hansen Mfg. Co., Inc.	Princeton, Ind.
73076	H. M. Harper Co.	Chicago, Ill.
73138	Helipot Div. of Beckman Inst., Inc.	Fullerton, Cal.
73293	Hughes Products Division of Hughes Aircraft Co.	Newport Beach, Cal.
73445	Amperex Elect. Co.	Hicksville, L. I., N. Y.
73506	Bradley Semiconductor Corp.	New Haven, Conn.
73559	Carling Electric, Inc.	Hartford, Conn.
73586	Circle F Mfg. Co.	Trenton, N. J.
73682	George K. Garrett Co., Div. MSL Industries, Inc.	Philadelphia, Pa.
73734	Federal Screw Products, Inc.	Chicago, Ill.
73743	Fischer Special Mfg. Co.	Cincinnati, Ohio
73793	General Industries Co., The	Elyria, Ohio
73846	Goshen Stamping & Tool Co.	Goshen, Ind.
73899	JFD Electronics Corp.	Brooklyn, N. Y.
73905	Jennings Radio Mfg. Corp.	San Jose, Cal.
73957	Groove-Pin Corp.	Ridgefield, N. J.
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 Electronic Corp.	Danbury, Conn.
74970	E. F. Johnson Co.	Waseca, Minn.
75042	International Resistance Co.	Philadelphia, Pa.
75263	Keystone Carbon Co., Inc.	St. Marys, Pa.
75378	CTS Knights, Inc.	Sandwich, Ill.
75382	Kulka Electric Corp.	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, Cal.
76433	General Instrument Corp., Micamold Division	Newark, N. J.
76487	James Millen Mfg. Co., Inc.	Malden, Mass.
76493	J. W. Miller Co.	Los Angeles, Cal.
76530	Cinch-Monadnock, Div. of United Carr Fastener Corp.	San Leandro, Cal.
76545	Mueller Electric Co.	Cleveland, Ohio
76703	National Union	Newark, N. J.
76854	Oak Manufacturing Co.	Crystal Lake, Ill.
77068	The Bendix Corp., Electrodynamics Div.	N. Hollywood, Cal.
77075	Pacific Metals Co.	San Francisco, Cal.
77221	Phaostran Instrument and Electronic Co.	So. Pasadena, Cal.
77252	Philadelphia Steel and Wire Corp.	Philadelphia, Pa.
77342	American Machine & Foundry Co. Potter & Brumfield Div.	Princeton, Ind.
77630	TRW Electronic Components Div.	Camden, N. J.
77638	General Instrument Corp., Rectifier Division	Brooklyn, N. Y.
77764	Resistance Products Co.	Harrisburg, Pa.
77969	Rubbercraft Corp. of Calif.	Torrance, Cal.
78189	Shakeproof Division of Illinois Tool Works	Elgin, Ill.
78277	Sigma	So. Braintree, Mass.
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, Cal.
78488	Stackpole Carbon Co.	St. Marys, Pa.
78493	Standard Thomson Corp.	Waltham, Mass.
78553	Tinnerman Products, Inc.	Cleveland, Ohio
78790	Transformer Engineers	San Gabriel, Cal.
78947	Ucinite Co.	Newtonville, Mass.
79136	Waldes Kohinoor Inc.	Long Island City, N. Y.
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.
80033	Prestole Corp.	Toledo, Ohio
80120	Schnitzer Alloy Products Co.	Elizabeth, N. J.
80131	Electronic Industries Association. Standard tube or semi-conductor device, any manufacturer.	
80207	Unimax Switch, Div. Maxon Electronics Corp.	Wallingford, Conn.
80223	United Transformer Corp.	New York, N. Y.
80248	Oxford Electric Corp.	Chicago, Ill.
80294	Bourns Inc.	Riverside, Cal.
80411	Arco Div. of Robertshaw Controls Co.	Columbus, Ohio
80486	All Star Products Inc.	Defiance, Ohio
80509	Avery Label Co.	Monrovia, Cal.
80583	Hammarlund Co., Inc.	Mars Hill, N. C.
80640	Stevens, Arnold, Co., Inc.	Boston, Mass.
80813	Dimco Gray Co.	Dayton, Ohio
81030	International Inst. Inc.	Orange, Conn.
81073	Grayhill Co.	LaGrange, Ill.
81095	Triad Transformer Corp.	Venice, Cal.
81312	Winchester Elec. Div. Litton Ind., Inc.	Oakville, Conn.
81349	Military Specification	
81483	International Rectifier Corp.	El Segundo, Cal.
81541	Airpax Electronics, Inc.	Cambridge, Maryland
81860	Barry Controls, Div. Barry Wright Corp.	Watertown, Mass.
82042	Carter Precision Electric Co.	Skokie, Ill.
82047	Sperti Faraday Inc., Copper Hewitt Electric Div.	Hoboken, N. J.
82116	Electric Regulator Corp.	Norwalk, Conn.
82142	Jeffers Electronics Division of Speer Carbon Co.	Du Bois, Pa.
82170	Fairchild Camera & Inst. Corp., Space & Defense Systems Div.	Paramus, N. J.
82209	Magurie Industries, Inc.	Greenwich, Conn.
82219	Sylvania Electric Prod., Inc. Electronic Tube Division	Emporium, Pa.
82376	Astron Corp.	East Newark, Harrison, N. J.
82389	Switchcraft, Inc.	Chicago, Ill.
82647	Metals & Controls Inc., Spencer Products	Attleboro, Mass.
82768	Phillips-Advance Control Co.	Joliet, Ill.
82866	Research Products Corp.	Madison, Wis.
82877	Rolton Mfg. Co., Inc.	Woodstock, N. Y.
82893	Vector Electronic Co.	Glendale, Cal.
83058	Carr Fastener Co.	Cambridge, Mass.
83086	New Hampshire Ball Bearing, Inc.	Peterborough, N. H.
83125	General Instrument Corp., Capacitor Div.	Darlington, S. C.
83148	ITT Wire and Cable Div.	Los Angeles, Cal.
83186	Victory Eng. Corp.	Springfield, N. J.
83298	Bendix Corp., Red Bank Div.	Red Bank, N. J.
83315	Hubbell Corp.	Mundelein, Ill.
83324	Rosan Inc.	Newport Beach, Cal.
83330	Smith, Herman H., Inc.	Brooklyn, N. Y.
83332	Tech Labs	Palisades Park, N. J.
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	Union Carbide Corp., Consumer Prod. Div.	New York, N. Y.
83777	Model Eng. and Mfg., Inc.	Huntington, Ind.
83821	Loyd Scruggs Co.	Festus, Mo.
83942	Aeronautical Inst. & Radio Co.	Lodi, N. J.
84171	Arco Electronics Inc.	Great Neck, N. Y.
84396	A. J. Glesener Co., Inc.	San Francisco, Cal.
84411	TRW Capacitor Div.	Ogallala, Neb.

CODE LIST OF MANUFACTURERS (Continued)

Code No.	Manufacturer	Address
94870	Sarkes Tarzian, Inc.	Bloomington, Ind.
85454	Boonton Molding Company	Boonton, N.J.
85471	A.B. Boyd Co.	San Francisco, Cal.
85474	R.M. Bracamonte & Co.	San Francisco, Cal.
85660	Koiled Kords, Inc.	Hamden, Conn.
85911	Seamless Rubber Co.	Chicago, Ill.
86174	Fafnir Bearing Co.	Los Angeles, Calif.
86197	Clifton Precision Products Co., Inc.	Clifton Heights, Pa.
86579	Precision Rubber Products Corp.	Dayton, Ohio
86684	Radio Corp. of America, Electronic Comp. & Devices Division	Harrison, N.J.
86928	Seastrom Mfg. Co.	Glendale, Cal.
87034	Marco Industries	Anaheim, Cal.
87216	Philco Corporation (Lansdale Division)	Lansdale, Pa.
87473	Western Fibrous Glass Products Co.	San Francisco, Cal.
87664	Van Waters & Rogers Inc.	San Francisco, Cal.
87930	Tower Mfg. Corp.	Providence, R.I.
88140	Cutler-Hammer, Inc.	Lincoln, Ill.
88220	Gould-National Batteries, Inc.	St. Paul, Minn.
88698	General Mills, Inc.	Buffalo, N.Y.
89231	Graybar Electric Co.	Oakland, Cal.
89473	G.E. Distributing Corp.	Schenectady, N.Y.
89479	Security Co.	Detroit, Mich.
89665	United Transformer Co.	Chicago, Ill.
90030	United Shoe Machinery Corp.	Beverly, Mass.
90179	U.S. Rubber Co., Consumer Ind. & Plastics Prod. Div.	Passaic, N.J.
90365	Belleville Speciality Tool Mfg., Inc.	Belleville, Ill.
90763	United Carr Fastener Corp.	Chicago, Ill.
90970	Bearing Engineering Co.	San Francisco, Cal.
91146	ITT Cannon Elect. Inc., Salem Div.	Salem, Mass.
91260	Connor Spring Mfg. Co.	San Francisco, Cal.
91345	Miller Dial & Nameplate Co.	El Monte, Cal.
91418	Radio Materials Co.	Chicago, Ill.
91506	Augat Inc.	Attleboro, Mass.
91637	Dale Electronics, Inc.	Columbus, Nebr.
91662	Elco Corp.	Willow Grove, Pa.
91673	Epiphone Inc.	New York, N.Y.
91737	Gremar Mfg. Co., Inc.	Wakefield, Mass.
91827	K F Development Co.	Redwood City, Cal.
91886	Malco Mfg., Inc.	Chicago, Ill.
91929	Honeywell Inc., Micro Switch Division	Freeport, Ill.
91961	Nahm-Bros. Spring Co.	Oakland, Cal.
92180	Tru-Connector Corp.	Peabody, Mass.
92367	Elgeet Optical Co., Inc.	Rochester, N.Y.
92607	Tensolite Insulated Wire Co., Inc.	Tarrytown, N.Y.
92702	IMC Magnetics Corp.	Westbury, L.I., N.Y.
92966	Hudson Lamp Co.	Kearney, N.J.
93332	Sylvania Electric Prod. Inc., Semiconductor Div.	Woburn, Mass.
93369	Robbins & Myers Inc.	Pallisades Park, N.J.
93410	Stemco Controls, Div. of Essex Wire Corp.	Mansfield, Ohio
93632	Waters Mfg. Co.	Culver City, Cal.
93929	G.V. Controls	Livingston, N.J.
94137	General Cable Corp.	Bayonne, N.J.
94144	Raytheon Co., Comp. Div., Ind. Comp. Operations	Quincy, Mass.
94148	Scientific Electronics Products, Inc.	Loveland, Colo.
94154	Wagner Elect. Corp., Tung-Sol Div.	Newark, N.J.
94197	Curtiss-Wright Corp., Electronics Div.	East Patterson, N.J.
94222	South Chester Corp.	Chester, Pa.
94330	Wire Cloth Products, Inc.	Bellwood, Ill.
94375	Automatic Metal Products Co.	Brooklyn, N.Y.
94682	Worcester Pressed Aluminum Corp.	Worcester, Mass.
94696	Magnecraft Electric Co.	Chicago, Ill.
95023	George A. Philbrick Researchers, Inc.	Boston, Mass.
95146	Alco Elect. Mfg. Co.	Lawrence, Mass.
95236	Allies Products Corp.	Diania, Fla.
95238	Continental Connector Corp.	Woodside, N.Y.
95263	Leecraft Mfg. Co., Inc.	Long Island, N.Y.
95265	National Coil Co.	Sheridan, Wyo.
95275	Vitramon, Inc.	Bridgeport, Conn.
95348	Gordos Corp.	Bloomfield, N.J.
95354	Methode Mfg. Co.	Rolling Meadows, Ill.
95566	Arnold Engineering Co.	Marengo, Ill.
95712	Dage Electric Co., Inc.	Franklin, Ind.
95984	Siemon Mfg. Co.	Wayne, Ill.
95987	Weckesser Co.	Chicago, Ill.
96067	Microwave Assoc., West, Inc.	Sunnyvale, Cal.
96095	Hi-Q Div. of Aerovox Corp.	Olean, N.Y.
96256	Thordarson-Meissner Inc.	Mt. Carmel, Ill.
96296	Solar Mfg. Co.	Los Angeles, Cal.
96396	Microswitch, Div. of Minn.-Honeywell	Freeport, Ill.
96330	Carlton Screw Co.	Chicago, Ill.
96341	Microwave Associates, Inc.	Burlington, Mass.
96501	Excel Transformer Co.	Oakland, Cal.
96508	Xcelite, Inc.	Orchard Park, N.Y.
96733	San Fernando Elec. Mfg. Co.	San Fernando, Cal.
96881	Thomson Ind. Inc.	Long Island, N.Y.
97464	Industrial Retaining Ring Co.	Irvington, N.J.
97539	Automatic & Precision Mfg.	Englewood, N.J.
97979	Reon Resistor Corp.	Yonkers, N.Y.
97983	Litton System Inc., Adler-Westrex Commun. Div.	New Rochelle, N.Y.
98141	R-Tronics, Inc.	Jamaica, N.Y.
98159	Rubber Teck, Inc.	Gardena, Cal.
98220	Hewlett-Packard Co., Medical Elec. Div.	Pasadena, Cal.
98278	Microdot, Inc.	So. Pasadena, Cal.
98291	Sealectro Corp.	Mamaronech, N.Y.
98376	Zero Mfg. Co.	Burbank, Cal.
98410	Etc Inc.	Cleveland, Ohio
98731	General Mills Inc., Electronics Div.	Minneapolis, Minn.
98734	Paeco Division of Hewlett-Packard Co.	Palo Alto, Cal.
98821	North Hills Electronics, Inc.	Glen Cove, N.Y.
98978	International Electronic Research Corp.	Burbank, Cal.
99109	Columbia Technical Corp.	New York, N.Y.
99313	Varian Associates	Palo Alto, Cal.
99378	Atlee Corp.	Winchester, Mass.
99515	Marshall Ind., Capacitor Div.	Monrovia, Cal.
99707	Control Switch Division, Controls Co. of America	El Segundo, Cal.
99800	Delevan Electronics Corp.	East Aurora, N.Y.
99848	Wilco Corporation	Indianapolis, Ind.
99928	Branson Corp.	Whippany, N.J.
99934	Rembrandt, Inc.	Boston, Mass.
99942	Hoffman Electronics Corp., Semiconductor Division	El Monte, Cal.
99957	Technology-Instrument Corp. of California	Newbury Park, Cal.

The following HP Vendors have no number assigned in the latest supplement to the Federal Supply Code for Manufacturers Handbook.

0000F	Malco Tool and Die	Los Angeles, Calif.
0000Z	Willow Leather Products Corp.	Newark, N.J.
000AB	ETA	England
000BB	Precision Instrument Comp. Co.	Van Nuys, Cal.
000CS	Hewlett-Packard Co., Colorado Springs Div.	Colorado Springs, Colorado
000MM	Rubber Eng. & Development	Hayward, Cal.
000NN	A "N" D Mfg. Co.	San Jose, Cal.
000QQ	Cooltron	Oakland, Cal.
000WW	California Eastern Lab	Burlington, Cal.
000YY	S.K. Smith Co.	Los Angeles, Cal.

MANUAL BACKDATING CHANGES

MODEL 205AG

AUDIO SIGNAL GENERATOR

Manual Serial Prefixed: 953 and above

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
Below 4683	1, 3 thru 10
4683 - 4687	2 thru 10
4688 to 5666	3 thru 10
5667 to 6236	4 thru 10
6237 to 7611	5 thru 10
7612 to 7711	6 thru 10

Instrument Serial Prefix	Make Manual Changes
7712 to 8311	7 thru 10
8312 to 8462	8 thru 10
024-, 012-	9, 10
246, 231, 151	10
953 - 11427 and below	11

CHANGE NO. 1

For instruments having serials below 4683, refer to schematic diagrams A and B for additional changes, such as the values of frequency range resistors, phase inverter circuit of V3 and V4, and input voltmeter circuit.

CHANGE NO. 2

T1: Change -hp- Part No. to 9100-0041.
Power filter capacitor is 10 x 20 μF 450 V, -hp- Part No. 0180-0017.
Voltage output to T2 is +300 V.
V3 is 6J5 tube, -hp- Part No. 1921-0008.
R24 res. 100 kilohms replaces C5.
R22 and C19 are deleted.
R23 is 5600 ohms, -hp- Part No. 0690-5621.

CHANGE NO. 3

C20, 21, 22: Delete.

CHANGE NO. 4

R30: Change value to 25.2 kilohms.
R4: Change to 82,500 ohms.
R5: Change to 825 kilohms.
R6: Change to 8.35 megohms.
Add R7: 5000 ohms potentiometer between R4 and ground.
Add R8: 50 kilohms potentiometer between R5 and ground.
Add R9: 500 kilohms potentiometer between R6 and ground.
R24: Change to 1.2 megohms.
R58: Change to 39 kilohms.
R61: Delete.
S1: Change -hp- Part No. 2AG-19W.
On page 4-1, Paragraph 4-5,

First sentence:

Insert "and the individual range adjustment potentiometers R7, R8, and R9" between "inclusive" and "in".

Step c:

Insert between 1st and 2nd sentence: "Set the X10 adjustment potentiometer, R8, so that the frequency is exactly 200 Hz."

Step d, 2:

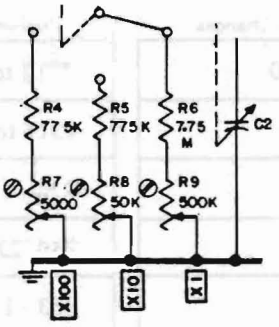
Add: "Precede paragraph in manual with "Change the setting of range switch adjustment R8; if a greater change is necessary,".

Step e, 1:

Add: "Adjust potentiometer R7 to make 2000 Hz (20 on dial) read correctly. If a greater change is necessary, it may be necessary to change the padding resistors etc."

Step e, 2:

Add: "Adjust potentiometer R9 to make the dial read correctly at 100 Hz. If a greater change is necessary, change the padding resistors etc."



CHANGE NO. 5

C19: Change to 1000 pF.

R61: Change to 100 ohms.

CHANGE NO. 6

DS1: Change to GE-47 lamp, -hp- Part No. 2140-0009.

Add R56: 33 ohms resistors in series with DS1.

Lens: Change -hp- Part No. to 1450-0003.

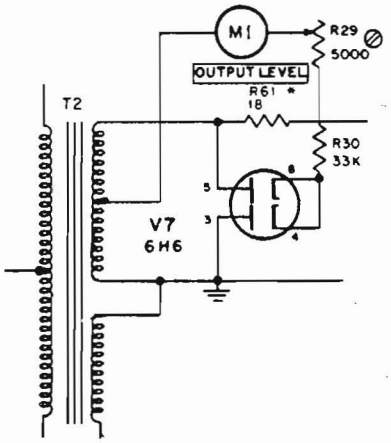
Lampholder: Change -ho- Part No. 1450-0027.

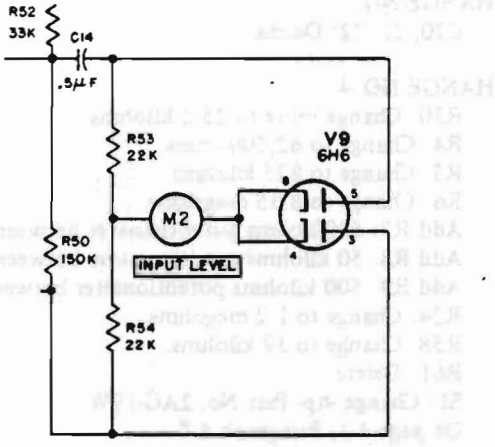
CHANGE NO. 7

R30: Change to 27.5 kilohms, -hp- Part No. 0730-0048.

CHANGE NO. 8

Change circuits of M1 and M2 as shown:





R29: Change to 500 ohms, -hp- Part No. 2100-0011.
R53: Change to 22 kilohms, -hp- Part No. 0690-2231.
Add R54: 22 kilohms, -hp- Part No. 0690-2231.
R62, 63: Delete.
CR1 to CR6: Delete.
Add V7, 9: Type 6H6 tubes.
Add R59: 7 ohm resistor, connected in series with V9, heater pin 7.

CHANGE NO. 9

The 205AG contains two terminal boards on which are mounted a variety of small parts. The boards used in earlier instruments (24-terminal board, -hp- Part No. 2G-75A; 14-terminal board Part No. 2G-75B) utilized solder lugs to mount parts. The boards used in later issue instruments, having serial prefix number 151- (large board Part No. 2G-75C; small board Part No. 2G-75D) are directly interchangeable, and the etched-circuit board will be supplied as a replacement part for both types.

CHANGE NO. 10

Attenuator Sets and Vernier Drive Assemblies have been changed, but the new part numbers are preferred for replacement in older instruments.

For replacement of a portion of the old gear assembly or vernier drive, use the following part numbers:

Spring: gear -hp- Part No. 624A-36B-5.
Spring: compression vernier drive -hp- Part No. 1460-0019.

CHANGE NO. 11

Figure 5-3:

Delete the power transformer (T1) primary detail as shown and add the following drawing:

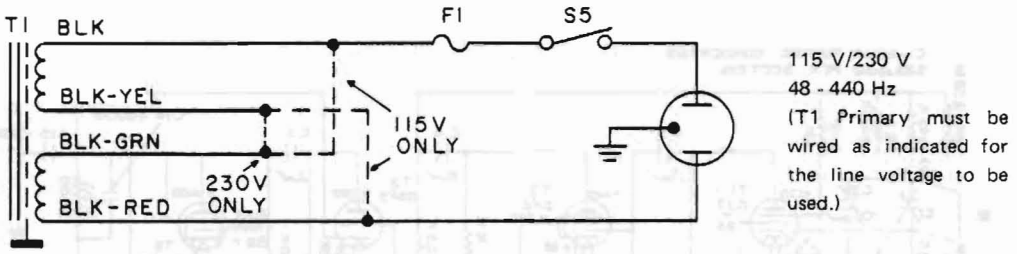
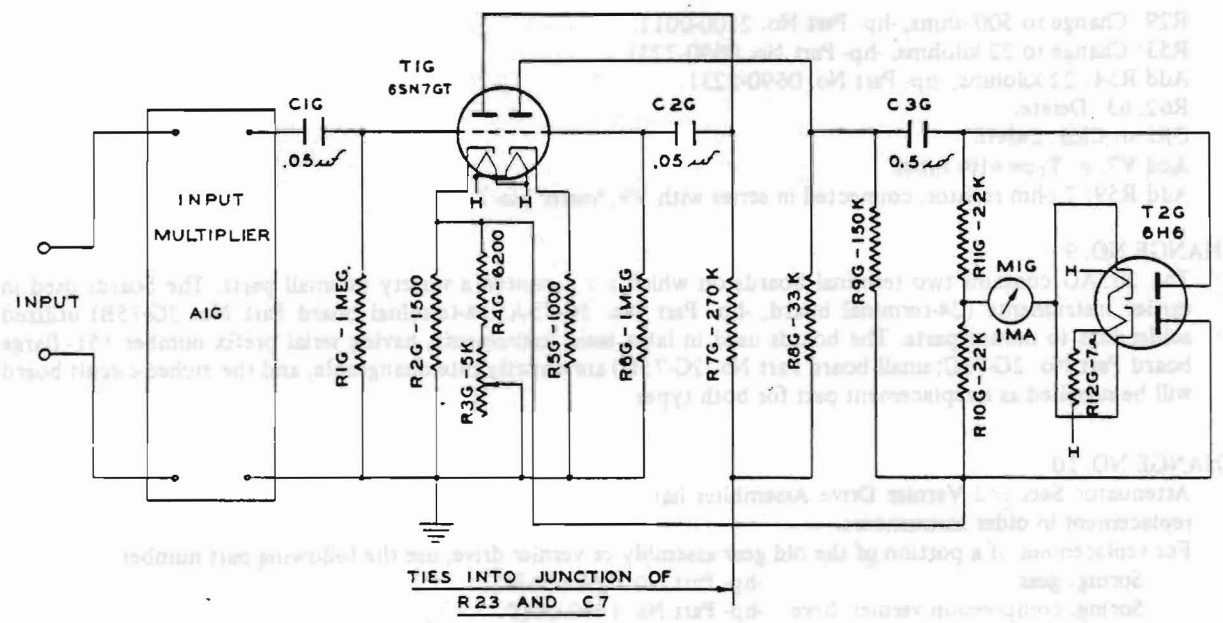
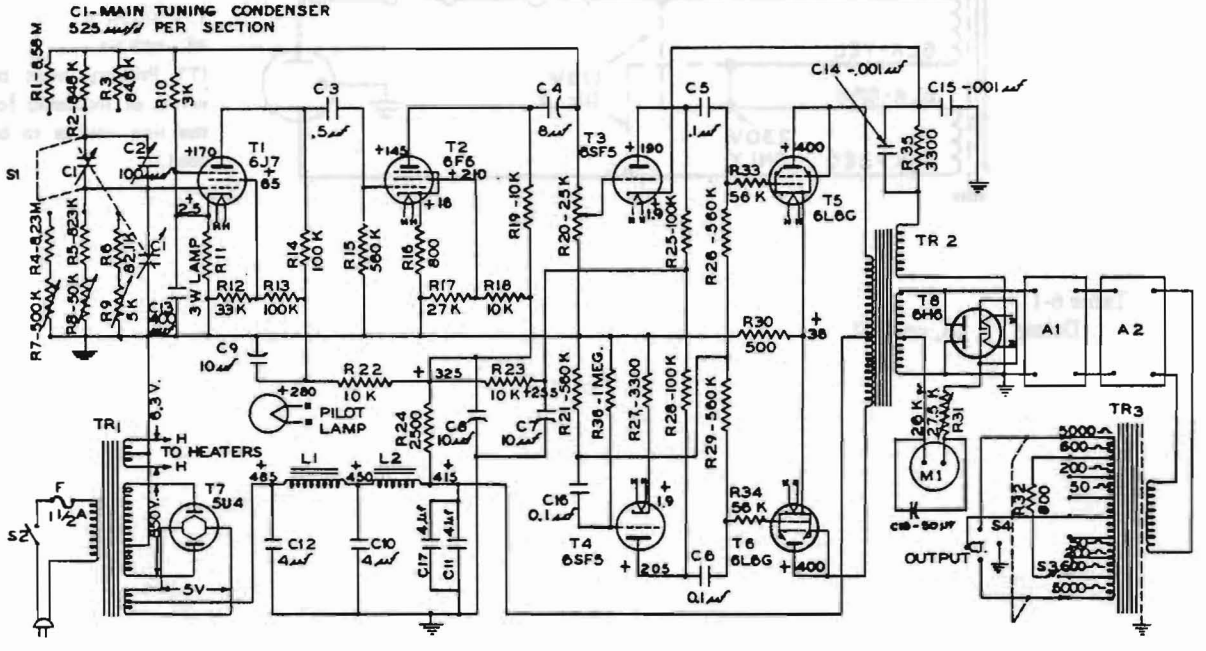


Table 6-1:

Delete J1, S6, and W1.



A



SCHEMATIC DIAGRAM OF -HP- MODELS 205A AND 205AG AUDIO SIGNAL GENERATOR
SERIALS BELOW 4683

B

MANUAL CHANGES

205AG

AUDIO SIGNAL GENERATOR

For Manual Part No. 00205-90010

Manual Serials Prefixed 953-

Instrument Serial Number	Make Manual Changes	Instrument Serial Number	Make Manual Changes
All Instruments	ERRATA		
Approximately** 0953A11577 and above	No. 1		

ERRATA

Page 7-3, Figure 7-1 Schematic
Place asteric at C23.

Page 6-3, Change C24*, -hp- Part No. 0140-0001 to mica 5 pF #20%.

CHANGE No. 1

Table 6-1, Miscellaneous:

Change -hp- Part No. of Cabinet Assembly to 5060-8774. 1 each.
Change -hp- Part No. of Cover: rear (slotted) to 5000-8760. 1 each.
Add the following:

Panel: Control, -hp- Part No. 00205-00201. 1 each.
†Panel: Control, -hp- Part No. 2G-2 (Opt. A85). 1 each.
†Cabinet Assembly, -hp- Part No. 5060-0077 (Opt Y98). 1 each.
†Cover: rear (slotted), -hp- Part No. 5000-0104 (Opt. A85). 1 each.

NOTES:

† These parts are painted with the original 205AG colors (i.e. light gray/blue gray combination). If so desired the entire instrument may be purchased in old color under Opt. X95.

**No definite serial no. break was set up for this color change.

MANUAL CHANGES

205AG

AUDIO SIGNAL GENERATOR

For Manual Part No. 00205-90004
Manual Serials Prefixed 953-

Instrument Serial Number	Make Manual Changes	Instrument Serial Number	Make Manual Changes
Approximately* 0953A11577 and above	No. 1		

CHANGE NO. 1

Table 6-1, Miscellaneous:

Change -hp- part no. of Cabinet Assembly to 5060-8774. 1 each.
Change -hp- part no. of Cover: rear (slotted) to 5000-8760. 1 each.
Add the following:

Panel: Control, -hp- part no. 00205-00201. 1 each.
† Panel: Control, -hp- part no. 2G-2 (Opt. A85). 1 each.
† Cabinet Assembly, -hp- part no. 5060-0077 (Opt Y98). 1 each.
† Cover: rear (slotted), -hp- part no. 5000-0104 (Opt. A85) 1 each.

NOTES:

† These parts are painted with the original 205AG colors (i.e. light gray/blue gray combination). If so desired the entire instrument may be purchased in old color under Opt. X95.

* No definite serial no. break was set up for this color change.

HEWLETT hp PACKARD

SALES & SERVICE OFFICES

AFRICA, ASIA, AUSTRALIA

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Caixa Postal, 6487
Luanda
Tel 35515,6
Cable TELECTRA Luanda

AUSTRALIA
Hewlett-Packard Australia Pty Ltd.
31-41 Joseph Street
Blackburn, Victoria 3130
P O Box 36
Doncaster East, Victoria 3109
Tel 89-6351
Telex 31-024
Cable HEWPARD Melbourne

Hewlett-Packard Australia Pty Ltd.
31 Bridge Street
Pymble
New South Wales, 2073
Tel 449-6566
Telex 21561
Cable HEWPARD Sydney

Hewlett-Packard Australia Pty Ltd
153 Greenhill Road
Parkside, S A 5063
Tel 272-5911
Telex 82536 ADEL
Cable HEWPARD ADELAID

Hewlett-Packard Australia Pty Ltd
141 Stirling Highway
Nedlands, W A 6009
Tel 86-5455
Telex 93859 PERTH
Cable HEWPARD PERTH

Hewlett-Packard Australia Pty Ltd
121 Wollongong Street
Fyshwick, A C T 2609
Tel 95-2733
Telex 62650 Canberra
Cable HEWPARD CANBERRA

Hewlett Packard Australia Pty Ltd
5th Floor
Teachers Union Building
495-499 Boundary Street
Spring Hill, 4000 Queensland
Tel 229-1544
Cable HEWPARD Brisbane

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P O Box 297
Connaught Centre
39th Floor
Connaught Road, Central
Hong Kong
Tel H-255291-5
Telex 74766 SCHMC HX
Cable SCHMIDTCO Hong Kong

INDIA
Blue Star Ltd
Kasturi Buildings
Jamshedji Tata Rd
Bombay 400 020
Tel 29 50 21
Telex 001-2156
Cable BLUEFROST

Blue Star Ltd
Sahas
414-2 Vir Savarkar Marg
Prabhadevi
Bombay 400 025
Tel 45 78 87
Telex 011-4093
Cable FROSTBLUE

Blue Star Ltd
Band Box House
Prabhadevi
Bombay 400 025
Tel 45 73 01
Telex 011-3751
Cable BLUESTAR

Blue Star Ltd
7 Hare Street
P O Box 506
Calcutta 700 001
Tel 23-0131
Telex 021-7655
Cable BLUESTAR

Blue Star Ltd
7th & 8th Floor
Bhandari House
91 Nehru Place
New Delhi 110024
Tel 634770 & 635166
Telex 031-2463
Cable BLUESTAR

Blue Star Ltd.
Blue Star House
11-11A Magarath Road
Bangalore 560 025
Tel 55668
Telex 043-430
Cable BLUESTAR

Blue Star Ltd.
Meeaksni Mandiran
xxx/1678 Mahatma Gandhi Rd.
Cochin 682 016
Tel 32069,32161,32282
Telex 0885-514
Cable BLUESTAR

Blue Star Ltd
1-1-117, 1
Sarojini Devi Road
Secunderabad 500 003
Tel 70126, 70127
Cable: BLUEFROST
Telex 015-459

Blue Star Ltd
2,34 Kodambakkam High Road
Madras 600034
Tel 82056
Telex 041-379
Cable BLUESTAR

INDONESIA
BERCA Indonesia P T
P O Box 496 Jkt
JLNoAbdul Muis 62
Jakarta
Tel 40369, 49886,49255,356038
JKT 42895
Cable BERCACON

BERCA Indonesia P t
63 JL. Raya Gubeng
Surabaya
Tel 44309

ISRAEL
Electronics & Engineering Div
of Motorola Israel Ltd
17 Kremenetski Street
P O Box 25016
Tel-Aviv
Tel 38973
Telex 33569
Cable BASTEL Tel-Aviv

JAPAN
Yokogawa-Hewlett-Packard Ltd
Ohashi Building
59-1 Yoyogi 1-Chome
Shibuya-ku, **Tokyo** 151
Tel 03-370-2281,92
Telex 232-2024YHP MARKET
TOK 23-724
Cable YHPMARKET

Yokogawa-Hewlett-Packard Ltd
Chuo Bldg., 4th Floor
4-20 Nishinakajima 5-chome
Yodogawa-ku, Osaka-shi
Osaka,532
Tel 06-304-6021

Yokogawa-Hewlett-Packard Ltd
Nakamo Building
24 Kami Sasajima-cho
Nakamura-ku, **Nagoya**, 450
Tel (052) 571-5171

Yokogawa-Hewlett-Packard Ltd
Taniqawa Building
2-24-1 Tsuruya-cho
Kanagawa-ku
Yokohama, 221
Tel 045-312-1252
Telex 382-3204 YHP YOK

Yokogawa-Hewlett-Packard Ltd.
Mito Mitsu Building
105, Chome-1 San-no-maru
Mito, Ibaragi 310
Tel 0292-25-7470

Yokogawa-Hewlett-Packard Ltd
Inoue Building
1348-3 Asahi-cho, 1-chome
Atsugi, Kanagawa 243
Tel 0462-24-0452

Yokogawa-Hewlett-Packard Ltd
Kumagaya Asahi
Hacknumi Building
4th Floor
3-4 Tsukuba
Kumagaya, Saitama 360
Tel 0485-24-6563

KENYA
Technical Engineering Services(E A)Ltd.
P O Box 18311
Nairobi
Tel 557726/556762
Cable PROTON

Medical Only
International Aeradio(E A)Ltd.,
P O Box 19012
Nairobi Airport
Nairobi
Tel 336055-56
Telex 22201 22301
Cable INTAERIO Nairobi

KOREA
Samsung Electronics Co., Ltd.
20th Fl Dongpang Bldg. 250, 2-KA
C P O Box 2775
Taeqvung-Ro, Chung-Ku
Seoul
Tel (23) 5811
Telex 22575
Cable ELEKSTAR Seoul

MALAYSIA
Tekmik Mutu Sdn Bhd
2 Lorong 13 6A
Section 13
Petaling Jaya,**Selangor**
Tel 54994,54946
Telex MA 37605

Protel Engineering
P O Box 1917
Lot 259, Satok Road
Kuching, **Sarawak**
Tel 2400
Cable PROTEL ENG

MOZAMBIQUE
A N Goncalves, Lta
162, 1 Apt 14 Av. D Luis
Caixa Postal 107
Lourenco Marques
Tel 27091, 27114
Telex 6-203 NEGON Mo
Cable NEGON

NEW ZEALAND
Hewlett-Packard (N Z) Ltd
P O Box 9443
Courtenay Place
Wellington
Tel 877-199
Cable HEWPACK Wellington

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Wellington
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Telex 3858
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Medical Supplies N Z Ltd
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239 Stanmore Road
Christchurch
Tel 892-019
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Medical Supplies N Z Ltd
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P O Box 233
Dunedin
Tel 88-817
Cable DENTAL, Dunedin

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P M B 5402
Ibadan
Tel 61577
Telex 31231 TEIL Nigeria
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Lagos
Cable THETEIL Lagos

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Oosman Chambers
Abdullah Haroon Road
Karachi-3
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Telex 2894
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Legaspi Village, Makati
Metro **Manila**
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RHODESIA
Field Technical Sales
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P O Box 3458
Salisbury
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Telex RH 4122

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Hewlett-Packard Singapore (Pte.) Ltd
1150 Depot Road
Alexandra P O Box 58
Singapore 4
Tel 270-2355
Telex HPSG RS 21486
Cable HEWPACK, Singapore

SOUTH AFRICA
Hewlett-Packard South Africa (Pty.) Ltd.
Private Bag Wendywood
Sandton, Transvaal 2144
Hewlett-Packard Centre
Daphne Street, Wendywood,
Sandton, Transvaal 2144
Tel 802-10408
Telex 8-4782
Cable HEWPACK JOHANNESBURG

Service Department
Hewlett-Packard South Africa (Pty.) Ltd
P O Box 39325
Gramley, Sandton 2018
451 Wynberg Extension 3,
Sandton, 2001
Tel 536-8188/9
Telex 8-2391

Hewlett-Packard South Africa (Pty.) Ltd
P O Box 120
Howard Place, Cape Province, 7450
Pine Park Centre, Forest Drive
Pinelands, Cape Province, 7405
Tel 53-7955 thru 9
Telex 57-0006

Service Department
Hewlett-Packard South Africa (Pty.) Ltd
P O Box 37099
Overport, Durban 4067
Brady House,
641 Ridge Road
Durban 4001
Tel 88-7478
Telex 6-7954

TAIWAN
Hewlett-Packard Far East Ltd
Taiwan Branch
39 Chung Hsiao West Road
Sec 1 7th Floor
Taipei
Tel 3819160-4
Cable HEWPACK TAIPEI

Hewlett-Packard Far East Ltd
Taiwan Branch
68-2, Chung Cheng 3rd Road
Kaohsiung
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Dar es Salaam
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2538 Sukumvit Ave
Bangkok
Tel 3932387, 3930338
Cable UNIMESA Bangkok

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Medical Only
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Kampala
Tel 54388
Cable INTAERIO Kampala

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P O Box 2792
Lusaka
Tel 73793
Cable ARJAYTEE, Lusaka

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Hewlett-Packard Intercontinental
3200 Hillview Ave
Palo Alto, California 94304
Tel (415) 493-1501
TWX 910-373-1267
Cable HEWPACK Palo Alto

CANADA

ALBERTA
Hewlett-Packard (Canada) Ltd
11620A - 168th Street
EdmontonT5M 3T9
Tel (403) 452-3670
TWX 610-831-2431

Hewlett-Packard (Canada) Ltd
210 7220 Fisher St. S.E.
Calgary T2H 2H8
Tel (403) 253-2713
Twx 610-821-6141

BRITISH COLUMBIA
Hewlett-Packard (Canada) Ltd
837 E. Cordova Street
Vancouver V6A 3R2
Tel (604) 254-0531
TWX 610-922-5059

MANITOBA
Hewlett-Packard (Canada) Ltd
513 Century St
St. James
Winnipeg R3H 0L8
Tel (204) 786-7581
TWX 610-671-3531

NOVA SCOTIA
Hewlett-Packard (Canada) Ltd
800 Windmill Road
Dartmouth B3B 1L1
Tel (902) 469-7820
TWX 610-271-4482 HFX

ONTARIO
Hewlett-Packard (Canada) Ltd
1020 Morrison Dr
Ottawa K2H 8K7
Tel (613) 820-6483
TWX 610-563-1636

Hewlett-Packard (Canada) Ltd
6877 Goreway Drive
Mississauga L4V 1M8
Tel (416) 678-9430
TWX 610-492-4246

QUEBEC
Hewlett-Packard (Canada) Ltd
275 Hymus Blvd
Pointe Claire H9R 1G7
Tel (514) 697-4232
TWX 610-422-3022
TLX 05-821521 HPCL

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CENTRAL AND SOUTH AMERICA

ARGENTINA
Hewlett-Packard Argentina S.A.
Av. Leandro N. Alem 822 - 12
1001**Buenos Aires**
Tel 31-6063 4 5,6 and 7
Telex 122443 AR CIGY
Cable HEWPACK ARG

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Casa Kavlin S.A.
Calle Potosi 1130
P O Box 500
La Paz
Tel 41530,53221
Telex CWC BX 5298,ITT 3560082
Cable KAVLIN

BRAZIL
Hewlett-Packard do Brasil I e C Ltda
Avenida Rio Negro, 980
Alphaville
06400**Barueri** SP
Tel 429-3222

Hewlett-Packard do Brasil I e C Ltda.
Rua Padre Chagas, 32
90000-**Porto Alegre**-RS
Tel (0512) 22-2998, 22-5621
Cable HEWPACK Porto Alegre

Hewlett-Packard do Brasil I e C Ltda
Rua Siqueira Campos, 53
Copacabana
20000-**Rio de Janeiro**
Tel 257-80-94-DDD (021)
Telex 391-212-1905 HEWP-BR
Cable, HEWPACK
Rio de Janeiro

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Calcagni y Metcalfe Ltda.
Alameda 580-01 807
Casilla 2118
Santiago, 1
Tel 398613
Telex 3520001 CALMET
Cable: CALMET Santiago

COLOMBIA
Instrumentacion
Henrik A. Langebaek & Kier S.A.
Carrera 7 No. 48-75
Apartado Aereo 6287
Bogota, D.E.
Tel 69-88-77
Cable AARIS Bogota
Telex 044-400

COSTA RICA
Cientifica Costarricense S.A.
Avenida 2, Calle 5
San Pedro de Montes de Oca
Apartado 10159
San Jose
Tel 24-38-20, 24-08-19
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Cable GALGUR

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Eloy Alfaro #1824 3 Piso
Quito
Tel 453482
Telex 02-2113 Sagita Ed
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EL SALVADOR
Instrumentacion y Procesamiento Electronico de el Salvador
Boulevar de los Heroes 11-48
San Salvador
Tel 252787

GUATEMALA
IPESA
Avenida La Reforma 3-48,
Zona 9
Guatemala City
Tel 63627, 64796
Telex 4192 Teletro Gu

MEXICO
Hewlett-Packard Mexicana, S.A. de C.V.
Av. Periferico Sur No. 6501
Tepepan, Xochimilco
Mexico 23, D.F.
Tel 905-676-4600

Hewlett-Packard Mexicana, S.A. de C.V.
Ave. Constitución No. 2184
Monterrey, N.L.
Tel 48-71-32, 48-71-84
Telex 038-410

NICARAGUA
Roberto Teran G.
Apartado Postal 689
Edificio Teran
Managua
Tel 25114, 23412,23454
Cable ROTERAN Managua

PANAMA
Electronico Balboa, S.A.
P O Box 4929
Calle Samuel Lewis
Ciudad de Panama
Tel 64-2700
Telex 3483103 Curunda, Canal Zone
Cable ELECTRON Panama

PERU
Compañia Electro Medica S.A.
Los Flamencos 145
San Isidro Casilla 1030
Lima 1
Tel 41-4325
Cable ELMED Lima

PUERTO RICO
Hewlett-Packard Inter-Americas
Puerto Rico Branch Office
Calle 272,
No 203 Urb. Country Club
Carolina 00924
Tel (809) 762-7255
Telex 345 0514

URUGUAY
Pablo Ferrando S.A.
Comercial e Industrial
Avenida Italia 2877
Casilla de Correo 370
Montevideo
Tel 40-3102
Cable RADIUM Montevideo

VENEZUELA
Hewlett-Packard de Venezuela C.A.
P O Box 50933
Caracas 105
Los Ruices Norte
3a Transversal
Edificio Segre
Caracas 107
Tel 35-00-11 (20 lines)
Telex 25146 HEWPACK
Cable HEWPACK Caracas

FOR AREAS NOT LISTED, CONTACT:
Hewlett-Packard
Inter-Americas
3200 Hillview Ave
Palo Alto, California 94304
Tel (415) 493-1501
TWX 910-373-1260
Cable HEWPACK Palo Alto
Telex 034-8300, 034-8493

EUROPE, NORTH AFRICA AND MIDDLE EAST

AUSTRIA
Hewlett-Packard Ges m b H
Handelskai 52
P O box 7
A-1205 **Vienna**
Tel (0222) 351521 to 27
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Telex 75923 hewpak a

BELGIUM
Hewlett-Packard Benelux
S A N V
Avenue de Col-Vert, 1,
(Groenkraaglaan)
B-1170 **Brussels**
Tel (02) 672 22 40
Cable PALOBEN Brussels
Telex 23 494 paloben bru

CYPRUS
Kypronics
19, Gregorios & Xenopoulos Rd.
P O. Box 1152
CY-**Nicosia**
Tel: 45628/29
Cable KYPRONICS PANDEHIS
Telex 3018

CZECHOSLOVAKIA
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Telex 121333

Institute of Medical Bionics
Vyskumny Ustav Lekarskej Bioniky
Jedlova 6
CS-88346 **Bratislava-Kramare**
Tel 44-551/45-541

DDR
Entwicklungslabor der TU Dresden
Forschungsinstitut Meinsoerg
DDR-7305
Waldheim/Meinsberg
Tel 37 667
Telex 112145

Export Contact AG Zuench
Guentner Forgber
Schiegelstrasse 15
1040 **Berlin**
Tel 42-74-12
Telex 111889

DENMARK
Hewlett-packard A/S
Datavej 52
DK-3460 **Birkerod**
Tel (02) 81 66 40
Cable HEWPACK AS
Telex 37409 hpas dk

Hewlett-Packard A/S
Navervej 1
DK-8600 **Silkeborg**
Tel (06) 82 71 66
Telex 37409 hpas dk
Cable HEWPACK AS

FINLAND
Hewlett-Packard OY
Nahkahousuntie 5
P O Box 6
SF-00211 **Helsinki** 21
Tel (90) 6923031
Cable HEWPACKOY Helsinki
Telex 12-1563 HEWPA SF

FRANCE
Hewlett-Packard France
Quartier de Courtaboeuf
Boite Postale No 6
F-91401 **Orsay** Cédex
Tel (1) 907 78 25
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Telex 600048

Hewlett-Packard France
Agency Régionale
Le Saquin
Chemin des Mouilles
B P 162
F-69130 **Ecully**
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Cable HEWPACK Eculy
Telex 31 06 17

Hewlett-Packard France
Agence Régionale
Péricentre de la Cépière
Chemin de la Cépière 20
F-31300 **Toulouse-Le Mirail**
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Telex 510957

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Cable HEWPACK MARGN
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B P 1124
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Entrée A2
F-59000 **Lille**
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Telex: 820744

Hewlett-Packard France
Centre d' Affaires Paris-Nord
Bâtiment Ampère
Rue de La Commune de Paris
B P 300
F-93153 **Le Blanc Mesnil Cédex**
Tel (01) 931 88 50

GERMAN FEDERAL REPUBLIC
Hewlett-Packard GmbH
Vertriebszentrale Frankfurt
Bernerstrasse 117
Posttach 560 140
D-6000 **Frankfurt** 56
Tel (0611) 50 04-1
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Tel (0611) 50 04-1
Cable: HEWPACKSA Frankfurt
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Hewlett-Packard GmbH
Technisches Buero Boblingen
Herrenbergerstrasse 110
D-7030 **Boblingen**, Württemberg
Tel (07031) 667-1
Cable: HEPAK Böblingen
Telex: 07265739 bbn

Hewlett-Packard GmbH
Technisches Buero Dusseldorf
Emanuel-Leutze-Str 1 (Seesterni)
D-4000 **Dusseldorf** 11
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Telex: 085/86 533 hpdd d

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D-2000 **Hamburg** 1
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Neumeyer Str 90
D-8500 **Nuremberg**
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ISAR Center
D-8012 **Ottobrunn**
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GR - **Athens** 135
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Miremad Avenue
P O Box 41/2419
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Telex: 21 25 74 khrm ir

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King Street Lane
GB-**Winnersh**, Wokingham
Berks. RG11 5AR
Tel (0734) 78 47 74
Telex: 847178/848179

ITALY
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I-40137 **Bologna**
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Hewlett-Packard Benelux
S.A.-N.V.
Avenue du Col-Vert, 1,
(Groenkraaglaan)
B-1170 **Brussels**
Tel (02) 672 22 40
Cable: PALOBEN Brussels
Telex: 23 494

MOROCCO
Gerep
190, Blvd. Brahim Roudani
Casablanca
Tel: 25-16-76/25-90-99
Cable: Gerep-Casa
Telex: 23739

NETHERLANDS
Hewlett-Packard Benelux N.V.
Van Heuven Goedhartlaan 121
P.O. Box 667
NL-1134 **Amstelveen**
Tel: (020) 47 20 21
Cable: PALOBEN Amsterdam
Telex: 13 216 hepa nl

NORWAY
Hewlett-Packard Norge A/S
Nesveien 13
Box 149
N-1344 **Haslum**
Tel. (02) 53 83 60
Telex: 16621 hpnas n

POLAND
Biuro Informacji Technicznej
Hewlett-Packard
Ul. Stawki 2, 6P
00-950 **Warszawa**
Tel. 395962 395187
Telex: 81 24 53 hepa pl

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Zaklad Doswiadczalny
Budowy Aparatury Naukowej
Ul. Krolowej Rady Narodowej 51/55
00-800 **Warszawa**
Tel. 36190
Telex: 81 46 48

Zaklady Naprawcze Sprzetu
Medycznego
Plac Komuny Paryskiej 6
90-007 **Lodz**
Tel. 334-41, 337-83

PORTUGAL
Telectra-Empresa Técnica de
Equipamentos Eléctricos S.a.r.l.
Rua Rodrigo da Fonseca 103
P.O. Box 2531
P-**Lisbon** 1
Tel. (19) 68 60 72
Cable: TELECTRA Lisbon
Telex: 12598

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Intercambio Mundial de Comércio
S.a.r.l.
Av. A.A. de Aguiar 138
P.O. Box 2761
P - **Lisbon**
Tel. (19) 53 21 31/7
Cable: INTERCAMBIO Lisbon

RUMANIA
Hewlett-Packard Reprezentanta
Bd. N. Balcescu 16
Bucharest
Tel. 158023/138885
Telex: 10440

I.P.R.U.C.
Intreprinderea Pentru
Intretinerea
Si Repararea Utilajelor de Calcul
B-dul prof. Dimitrie Pompei 6
Bucharest-Sectorul 2
Tel. 12 54 30
Telex: 11716

SAUDI ARABIA
Modern Electronic Establishment
King Abdul Aziz str. (Head office)
P.O. Box 1228
Jeddah
Tel. 31173-332201
Cable: ELECTRA

P.O. Box 2728 (Service center)
Riyadh
Tel. 62596-66232
Cable: RAOUFCO

SPAIN
Hewlett-Packard Española, S.A.
Jerez, Calle 3
E-**Madrid** 16
Tel. (1) 458 26 00 (10 lines)
Telex: 23515 hpe

Hewlett-Packard Española, S.A.
Milanesado 21-23
E-**Barcelona** 17
Tel. (3) 203 6200 (5 lines)
Telex: 52603 hpbe e

Hewlett-Packard Española, S.A.
Av. Ramón y Cajal, 1
Edificio Sevilla, planta 9.
E-**Sevilla** 5
Tel. 64 44 54/58

Hewlett-Packard Española S.A.
Edificio Albia II 7° 8
E-**Bilbao** 1
Tel. 23 83 06/23 82 06

Calculators Only
Hewlett-Packard Española S.A.
Gran Via Fernando El Católico, 67
E-**Valencia-8**
Tel. 326 67 28/326 85 55

SWEDEN
Hewlett-Packard Sverige AB
Enighetsvagen 1-3
Fack
S-161 20 **Bromma** 20
Tel. (08) 730 05 50
Cable: MEASUREMENTS
Stockholm
Telex: 10721

Hewlett-Packard Sverige AB
Ostra Vintergatan 22
S-702 40 **Orebro**
Tel. (019) 14 07 20

Hewlett-Packard Sverige AB
Frotalisgatan 30
S-421 32 **Vastra Frolunda**
Tel. (031) 49 09 50
Telex: 10721 via Bromma Office

SWITZERLAND
Hewlett-Packard (Schweiz) AG
Zurcherstrasse 20
P.O. Box 307
CH-8952 **Schlieren-Zurich**
Tel. (01) 730 52 40 730 18 21
Cable: HPAG CH
Telex: 53933 hpag ch

Hewlett-Packard (schweiz) AG
Chateau Bloc 19
CH-1219 **Le Lignon-Geneva**
Tel. (022) 96 03 22
Cable: HEWPACKAG Geneva
Telex: 27 333 hpag ch

SYRIA
Medical/Calculator only
Sawah & Co
Place Azmé
B.P. 2308
SYR-**Damascus**
Tel. 16367, 19697, 14268
Cable: SAWAH, Damascus

TURKEY
Telekom Engineering Bureau
P.O. Box 437
Beyoglu
TR-**Istanbul**
Tel. 49 40 40
Cable: TELEMATION Istanbul
Telex: 23609

Medical only
E.M.A.
Muhendislik Kollektif Sirketi
Adakale Sokak 41/6
TR-**Ankara**
Tel. 175622

Analytical only
Yilmaz Ozyurek
Milk Mudafaa Cad. No. 16/6
Kizilay
TR-**Ankara**
Tel. 25 03 09
Telex: 42576 ozek tr

UNITED KINGDOM
Hewlett-Packard Ltd.
King Street Lane
GB-**Winnersh**, Wokingham
Berks. RG11 5AR
Tel. (0734) 78 47 74
Cable: Hewpie London
Telex 847178/9

Hewlett-Packard Ltd
Trafalgar House,
Navigation Road
Altrincham
Cheshire WA14 1NU
Tel. (061) 928 6422
Telex: 668068

Hewlett-Packard Ltd
Lygon Court
Hereward Rise
Dudley Road
Halesowen
West Midlands B62 8SO
Tel. (021) 550 9911
Telex: 339105

Hewlett-Packard Ltd
Wedge House
799, London Road
GB-**Thornton Heath**
Surrey CR4 6XL
Tel. (01) 684 0103 8
Telex: 946825

Hewlett-Packard Ltd
c/o Makro
South Service wholesale Centre
Wear Industrial Estate
Washington
GB-**New Town**, County Durham
Tel. Washington 464001 ext. 57 58

Hewlett-Packard Ltd
10, Wesley St.
GB-**Castleford**
West Yorkshire WF10 1AE
Tel. (09775) 50402
Telex: 557355

Hewlett-Packard Ltd
1, Wallace Way
GB-**Hitchin**
Herts
Tel. (0462) 52824/56704
Telex: 825981

Hewlett-Packard Ltd
2C, Avonbeg Industrial Estate
Long Mile Road
Dublin 12
Tel. Dublin 509458
Telex: 30439

USSR
Hewlett-Packard
Representative Office USSR
Pokrovsky Boulevard 4-17-KW 12
Moscow 101000
Tel. 294-2024
Telex: 7825 hewpak su

YUGOSLAVIA
Iskra-standard/Hewlett-Packard
Miklosiceva 38/VII
61000 **Ljubljana**
Telb. 31 58 79/32 16 74
Telex: 31583

SOCIALIST COUNTRIES NOT SHOWN PLEASE CONTACT:
Hewlett-Packard Ges m b.H
P.O. Box 7
A-1205 **Vienna**, Austria
Tel. (0222) 35 16 21 to 27
Cable: HEWPAK Vienna
Telex: 75923 hewpak a

MEDITERRANEAN AND MIDDLE EAST COUNTRIES NOT SHOWN PLEASE CONTACT:
Hewlett-Packard S.A.
Mediterranean and Middle
East Operations
35, Kolokotroni Street
Plaka Kefallariou
GR-Kifissia-**Athens**, Greece
Tel. 8080337/359/429
Telex: 21-6588
Cable: HEWPACKSA Athens

FOR OTHER AREAS NOT LISTED CONTACT
Hewlett-Packard S.A.
7, rue du Bois-du-Lan
P.O. Box
CH-1217 Meyrin 2 --**Geneva**
Switzerland
Tel. (022) 82 70 00
Cable HEWPACKSA Geneva
Telex: 2 24 86

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Huntsville 35802
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Tel. (312) 255-9800
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Louisville 40218
Tel. (502) 456-1573

LOUISIANA
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Kenner 70063
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Baltimore 21207
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TWX 710-862-9157

2 Choke Cherry Road
Rockville 20850
Tel. (301) 948-6370
TWX 710-828-9684

MASSACHUSETTS
32 Hartwell Ave.
Lexington 02173
Tel. (617) 861-8960
TWX 710-326-6904

MICHIGAN
23855 Research Drive
Farmington Hills 48024
Tel. (313) 476-6400

724 West Centre Ave.
Kalamazoo 49002
Tel. (606) 323-8362

MINNESOTA
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TWX 910-771-2087

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St. Louis 63141
Tel. (314) 878-0200

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Suite 110
Omaha 68106
Tel. (402) 392-0948

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Paramus 07652
Tel. (201) 265-5000
TWX 710-990-4951

Crystal Brook Professional
Building
Eatontown 07724
Tel (201) 542-1384

NEW MEXICO
P.O. Box 11634
Station E
11300 Lomas Blvd., N.E.
Albuquerque 87123
Tel. (505) 292-1330
TWX 910-989-1185

156 Wyatt Drive
Las Cruces 88001
Tel. (505) 526-2484
TWX 910-9983-0550

NEW YORK
6 Automation Lane
Computer Park
Albany 12205
Tel. (518) 458-1550

201 South Avenue
Poughkeepsie 12601
Tel. (914) 454-7330
TWX 510-253-5981

650 Perinton Hill Office Park
Fairport 14450
Tel. (716) 223-9950

5858 East Molloy Road
Syracuse 13211
Tel. (315) 454-2486
TWX 710-541-0482

1 Crossways Park West
Woodbury 11797
Tel. (516) 921-0300
TWX 710-990-4951

NORTH CAROLINA
P.O. Box 5188
1923 North Main Street
High Point 27262
Tel. (919) 885-8101

OHIO
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Cleveland 44130
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TWX 810-423-9430

330 Progress Rd.
Dayton 45449
Tel. (513) 859-8202

1041 Kingsmill Parkway
Columbus 43229
Tel. (614) 436-1041

OKLAHOMA
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Oklahoma City 73132
Tel. (405) 721-0200

OREGON
17890 SW Lower Boones
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Tualatin 97062
Tel. (503) 620-3350

PENNSYLVANIA
111 Zeta Drive
Pittsburgh 15238
Tel. (412) 782-0400

1021 8th Avenue
King of Prussia Industrial Park
King of Prussia 19406
Tel. (215) 265-7000
TWX 510-660-2670

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Columbia 29260
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TEXAS
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Richardson 75080
Tel. (214) 231-6101

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Houston 77036
Tel. (713) 776-6400

205 Billy Mitchell Road
San Antonio 78226
Tel. (512) 434-8241

UTAH
2160 South 3270 West Street
Salt Lake City 84119
Tel. (801) 972-4711

VIRGINIA
P.O. Box 12778
No. 7 Koger Exec. Center
Suite 212
Norfolk 23502
Tel. (804) 461-4025/6

P.O. Box 9669
2914 Hungary Springs Road
Richmond 23228
Tel. (804) 285-3431

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Bellefield Office Pk.
1203-114th Ave. S.E.
Bellevue 98004
Tel. (206) 454-3971
TWX 910-443-2446

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Charleston
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West Allis 53227
Tel. (414) 541-0550

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nearest you: Atlanta, Georgia
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