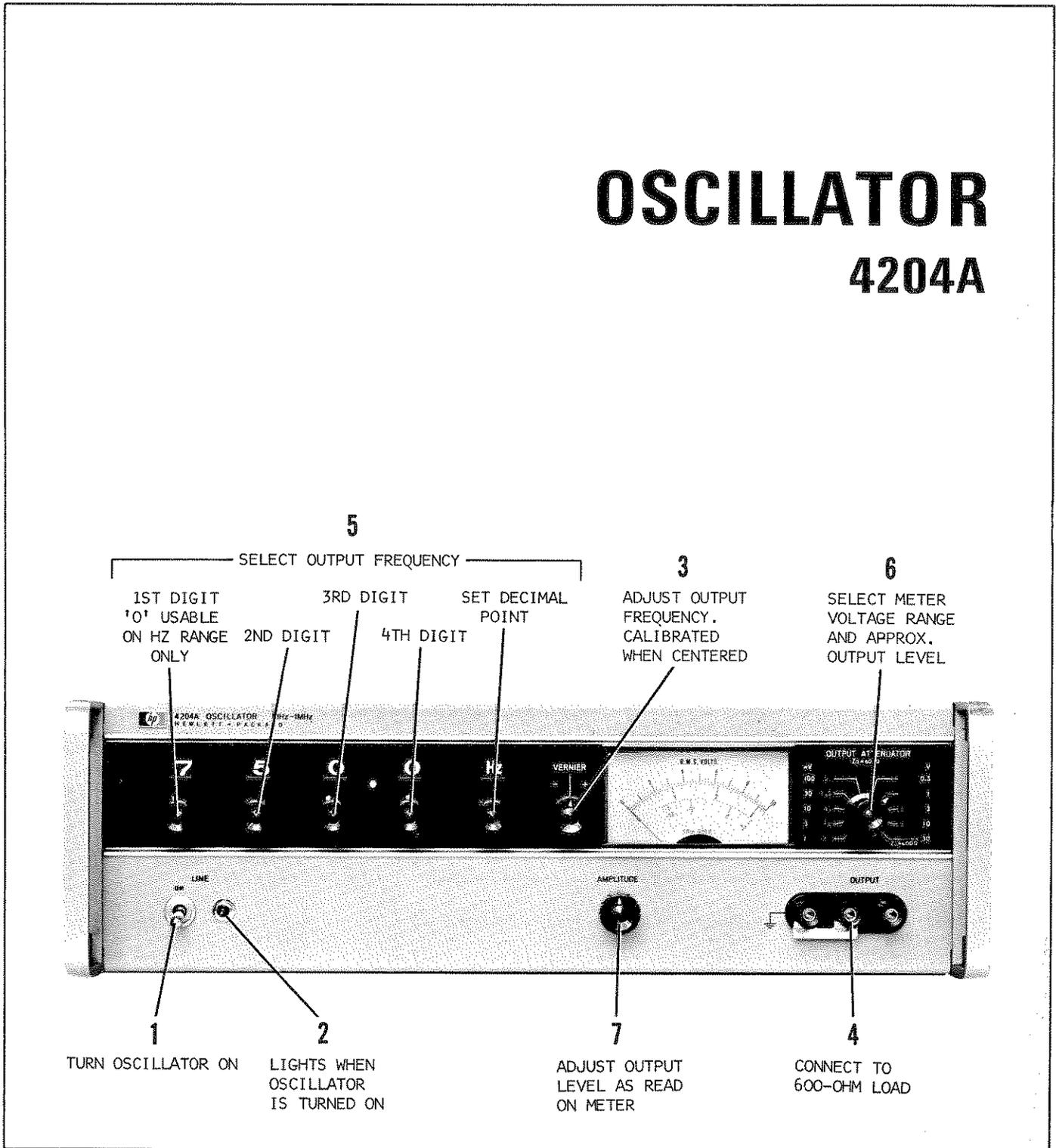


OPERATING INSTRUCTIONS

OSCILLATOR 4204A



PRINTED MARCH 1968

HEWLETT  PACKARD

SPECIFICATIONS

Frequency Range: 10 Hz to 1 MHz, 4 ranges.

Frequency Accuracy: $\pm 0.2\%$ or ± 0.1 Hz (at 25°C).

Frequency Stability

$\pm 10\%$ Line Voltage Variation: Less than $\pm 0.01\%$.

Change of Frequency with Temperature: ± 100 ppm/°C.

Drift: 10 ppm/minute

Frequency Response: Flat within $\pm 3\%$.

Output: 10 V (22 dBm) into 600 ohms (160 mW).
20 V Open Circuit.

Output Attenuator: 80 dB in 10 dB steps; ± 0.5 dB error.

Output Monitor: Voltmeter monitors level at input of attenuator in volts or dB.

Accuracy: $\pm 2\%$ of full scale.

Flatness: $\pm 1\%$ at full scale, 10 Hz to 500 kHz.
 $\pm 2\%$ at full scale, 500 kHz to 1 MHz.

Distortion: Less than 0.3%, 30 Hz to 100 kHz,
Less than 1%, 10 Hz to 1 MHz.

Hum and Noise: Less than 0.05% of output.

Temperature Range: 0°C to + 50°C.

Power: 115 V/230 V switch, $\pm 10\%$, 10 watts,
50 to 60 Hz.

Weight: Net, 19 lbs. (8,5 kg). Shipping, 28 lbs.
(11 kg).

Accessories Available:

HP 11004A Line Matching Transformer has a frequency response of 5 kHz to 600 kHz providing fully balanced outputs for 135 or 600 ohms.

HP 11005A Line Matching Transformer has a frequency response of 20 Hz to 45 kHz providing full balanced output into 600 ohms.

HP 16252A Matching Transformer has a frequency response of 10 kHz to 1 MHz providing unbalanced 75 ohm output, terminated in UG-657/U female BNC connector.

HP 11000A Cable: Dual Banana Plugs.

HP 11001A Cable: Banana Plug to BNC Male Connector.

Option 01: 4204A Output Monitor top scale calibrated in dBm/600Ω. Bottom scale calibrated in volts.

BLOCK DIAGRAM

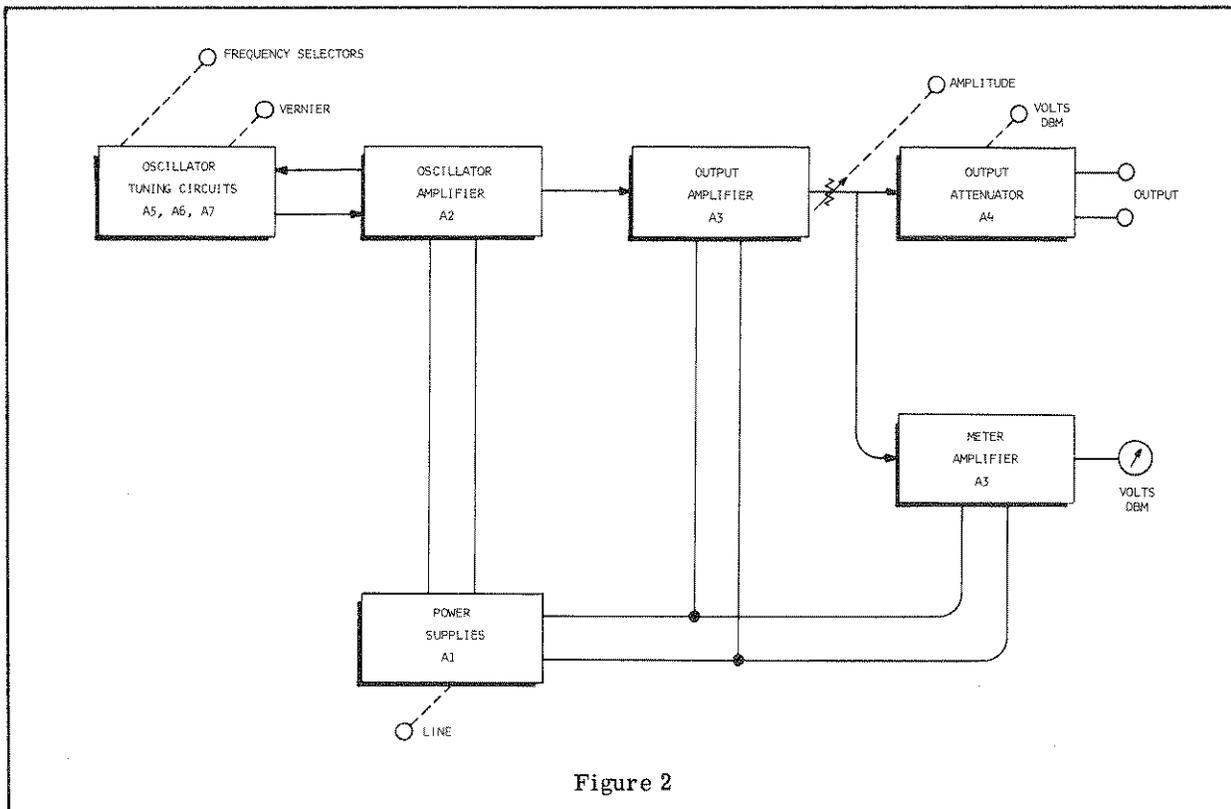


Figure 2

GENERAL DESCRIPTION

DESCRIPTION.

The Hewlett-Packard Model 4204A Oscillator is a general-purpose digital oscillator that produces a sine wave output signal continuously adjustable in frequency from 10 Hz to 1 MHz and in amplitude from 0 to 10 volts rms into a 600-ohm load (-60 to +22 dBm). Frequency selection is by four, in-line, indicating switches, one for each digit and by a frequency control that provides continuous adjustment between digital settings.

An output attenuator provides accurate attenuation in 10-dB steps and an amplitude control provides continuous adjustment between steps. The output signal level is measured by a front-panel meter calibrated in both rms volts and dBm.

The 4204A Oscillator is isolated from power-line ground to permit connecting the output terminals to external circuits above and below ground potential with minimum shunting, and to avoid undesirable ground loops.

The 4204A uses stabilized amplifiers and regulated power supplies to obtain the frequency stability needed for 4-place resetability.

EQUIPMENT SUPPLIED.

4204A	Oscillator	(1)
8120-0078	Power Cord	(1)
5060-3997	Rack mounting adapter kit	(1)

CIRCUIT DESCRIPTION.

The 4204A Oscillator consists of a Wein Bridge oscillator, an output amplifier followed by continuously adjustable amplitude control, a step adjustable attenuator feeding the output terminals, and an electronic voltmeter that measures the signal level applied to the output attenuator. Each step on the attenuator switch indicates the full-scale voltage to be read from the meter.

The output attenuator presents a 600-ohm source resistance to the output terminals. In the 10 and 30-volt positions of the attenuator, the attenuator is out of the circuit, and the amplitude control and amplifier together present a 600-ohm internal impedance to the load.

The output amplifier completely isolates the oscillator tuning circuits from the output terminals. The amplifier maintains good waveform purity with a wide range of load impedances; specified purity is obtained with any load above 600 ohms.

INSTALLATION INSTRUCTIONS

UNPACKING AND INSPECTION.

When receiving a shipment from a carrier, inspect the shipping container with carrier present. If the shipping carton shows evidence of rough handling when received, take exception on the carrier delivery receipt before accepting the shipment.

If no apparent damage is noted, but physical damage is discovered upon opening of the carton, preserve the carton and packing materials intact, notify the carrier immediately, and have them perform a written inspection of the condition of the carton and its contents.

SHIPMENT.

If possible, use original shipping container and cushions for reshipment. Otherwise, wrap instrument in wrapping paper, completely surround it with a 1-1/2 inch thick urethane cushions (or equivalent), and pack firmly in a strong corrugated paper container. Seal with strong tape and mark box "FRAGILE". If loose fill dunnage such as "flakes" or "straws" is used, use at least three inches thickness all around and pack the dunnage very tightly. Loose fill compresses after a short time and allows the load to shift.

STORAGE.

When storing the oscillator, wrap in paper to prevent air circulation and accumulation of dust. Do not subject the oscillator to temperatures below -40°C or above +75°C (-53°F to +167°F).

RACK INSTALLATION.

The Model 4204A is ready for bench operation as shipped from the factory. Additional parts necessary for rack mounting are packaged with the instrument. To convert for rack installation, proceed as follows:

- a. Remove tilt stand from bottom.
- b. Remove feet from bottom. (press the foot -release button, slide foot toward center of instrument, and lift off)
- c. Remove adhesive-backed trim strips near front end of each side panel.
- d. Attach rack filler strip along bottom edge of front panel.
- e. Attach flanges to side panels where trim strips were removed. Instrument is now ready to mount in a standard rack.

OPERATION ON 115 OR 230-VOLT LINES.

The Model 4204A can be operated on either 115 or 230-volt ($\pm 10\%$), 50 to 60 Hz power lines. A slide switch on the rear panel permits quick conversion for operation from either voltage. Insert a narrow blade screwdriver in the switch slot and slide the switch to expose "115" marking for 115-volt operation, or "230" marking for 230-volt operation. A 0.2-ampere, slow-blow fuse (HP part number 2110-0106) is used for either 115 or 230-volt operation.

CAUTION

Do Not change the line voltage selector switch setting during operation.

GROUNDING THE OSCILLATOR CABINET.

The 4202A is equipped with a detachable, 3-wire power cord. (HP part number 8120-0078). The round pin on the plug connects the instrument cabinet (but not the inner chassis) to the power-line ground. When connecting to a 2-blade outlet, use a connector adapter (HP part number 1251-0048), and connect the short lead on the adapter to ground. Do not disconnect this ground wire to obtain "ungrounded" operation; instead, disconnect the captive ground strap between the red and black OUTPUT terminals on the front panel.

OPERATING INSTRUCTIONS

OPERATING PROCEDURE.

The step-by-step procedure for operating the 4204A Oscillator is shown on the Title Page.

FREQUENCY STABILITY AFTER TURN ON.

The 4204A output frequency is within specified accuracy a few seconds after turn on; however, best frequency stability is obtained after a 5-minute warmup. After the warmup, and with a stable ambient temperature, frequency drift is less than 10 PPM/minute.

If the ambient temperature changes, the resulting change in frequency will be less than 100 PPM/ $^{\circ}$ C. If the power-line voltage changes, the resulting change in frequency will be less than 100 PPM/10% line voltage change. Momentary turn-off causes a minor frequency shift and about three minutes are needed to return to original frequency.

FREQUENCY VERNIER.

The 4204A output frequency is calibrated when the VERNIER control is centered. Adjusting the VERNIER clockwise increases frequency; maximum rotation gives about 0.1% frequency change.

OPERATING PRECAUTIONS.

WARNING

When operating the oscillator ungrounded, the inner chassis assumes the electrical potential of the circuit to which the output terminals are connected. This potential exists on the control knob set screws.

Do not connect the OUTPUT terminals to circuits that are more than 600 volts from ground potential.

Do not apply potentials across the OUTPUT terminals. Excessive current applied to the output attenuator can impair its accuracy.

The first (left-hand) frequency selector should be set to "0" only on the Hz frequency range.

When switching to the lowest frequencies, a few seconds are required for oscillation buildup.

On 1v range and below, the OUTPUT terminals must be connected to a 600-ohm load for the meter to be accurate.

OUTPUT TERMINAL ISOLATION FROM GROUND.

The entire oscillator circuit and red OUTPUT terminals are ungrounded; they are isolated from the power-line ground by over 15,000 ohms in parallel with approximately 1,000 picofarads.

The oscillator cabinet is connected through a third wire in the power cord to the power line ground.

The black binding post to the left of the OUTPUT terminals connects directly to the instrument cabinet and power line ground. The captive grounding strap on this binding post can be connected to the adjacent red OUTPUT terminal to ground the low-side of the oscillator output.

If the load connected to the oscillator output is already grounded, it may be desirable to leave the oscillator output ungrounded to avoid having two ground points. This prevents unwanted ground currents from flowing through the signal leads, especially important when generating very low-level signals.

Figure 3 shows an example of using the oscillator output ungrounded and connected to a circuit at high potential.

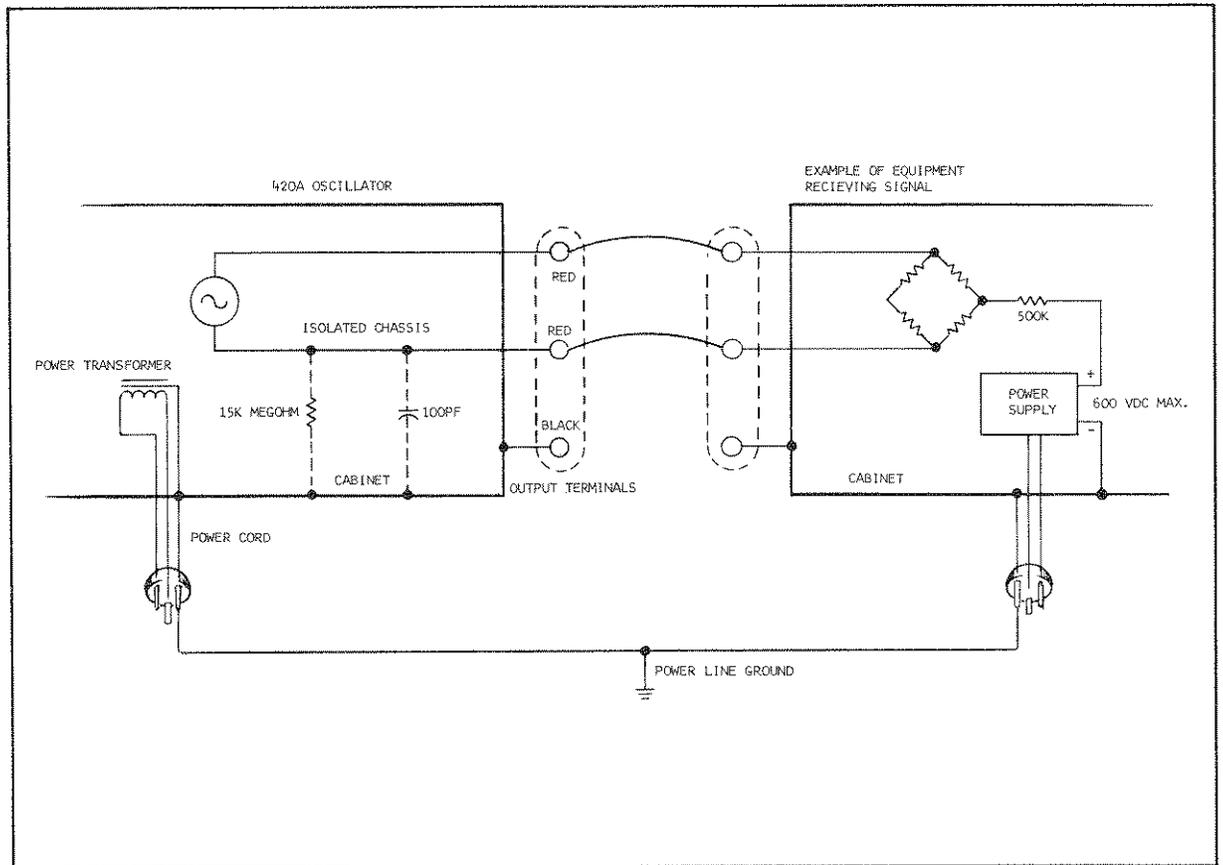


Figure 3

READING THE OUTPUT METER.

The front-panel meter indicates the rms value of the voltage at the OUTPUT terminals, using the full-scale voltage indicated by the setting of the output attenuator. For the meter to be read accurately, the OUTPUT terminals must be connected to a 600-ohm load. Any other value of load resistance changes the actual output voltage from that read on the meter, except on the 10 and 30-volt ranges when all attenuator resistance is out of the circuit. The actual output voltage or dBm for other values of load resistance can be determined from the equations which follow.

Equations for obtaining actual output voltage for external loads other than 600 ohms:

10v and
30v ranges:

$$E_{\text{output}} = E_{\text{meter}}$$

3v range:

$$E_{\text{output}} = \frac{2 \times E_{\text{meter}}}{1 + \frac{600}{R_{\text{load}}} + 0.1 \left(1 - \frac{600}{R_{\text{load}}}\right)}$$

1v to 1 mv ranges:

$$E_{\text{output}} = \frac{2 \times E_{\text{meter}}}{1 + \frac{600}{R_{\text{load}}}}$$

ZERO SETTING THE METER.

Set the meter pointer to the zero calibration mark with the oscillator turned off. Adjust the meter pointer by turning the black disk below the meter face. There is a small recess in the disk to receive a pointed tool.

LOADING THE OUTPUT TERMINALS.

The 4204A output terminals may be connected to any load impedance above 600 ohms without impairing waveform purity. Load impedances very much lower than 600 ohms increase waveform distortion approximately as shown in the graph on the following page.

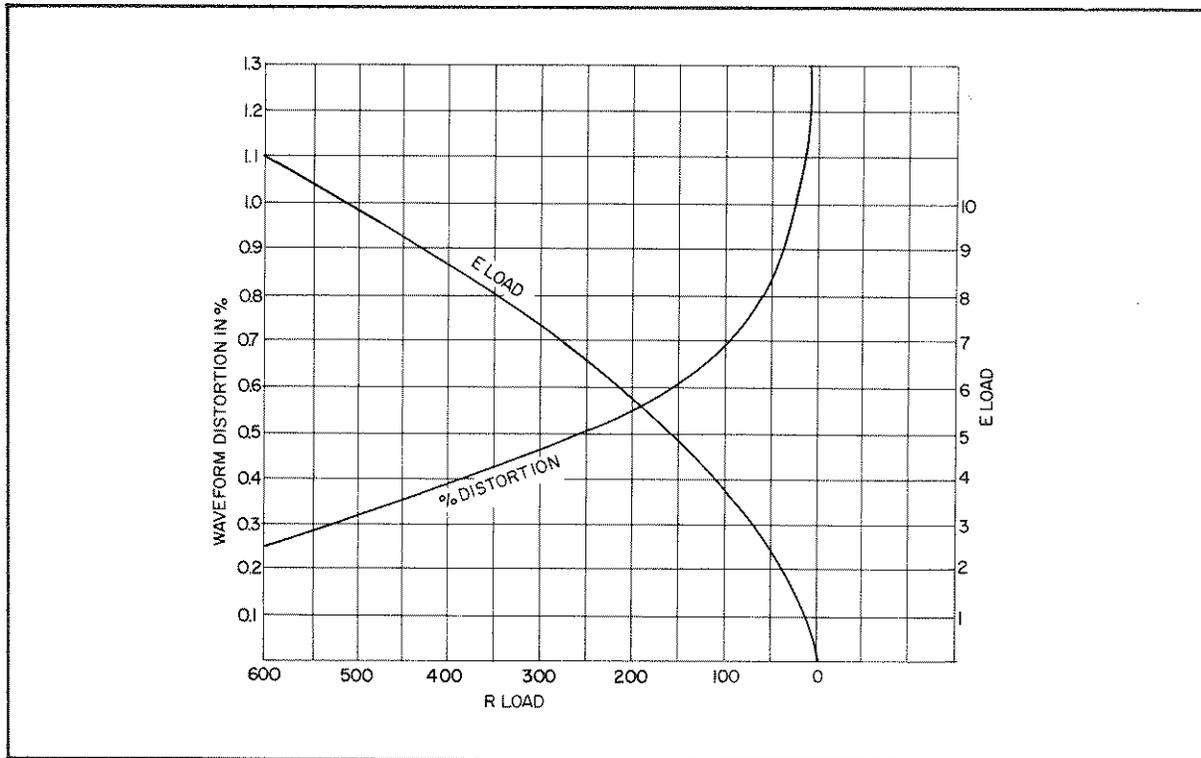


Figure 4

OPERATOR'S MAINTENANCE.

Operator's preventive maintenance consists of observing and reporting any sign of deterioration to repair facilities. Examples of deterioration are inaccurate frequency or amplitude indication, inadequate output level, difficult operation of controls or physical damage.

Lubrication is used only on a sliding bar that carries the decimal point across the frequency indicators. A small amount of grease can be applied when needed, after wiping off old lubricant.

The following check-out procedure is provided for an operator's quick test of oscillator performance. Perform this test after every shipment or prolonged storage, and after rough handling or use in severe climatic conditions.

OSCILLATOR PERFORMANCE CHECK.

The following test procedure is a quick check of oscillator performance. The procedure checks frequency response, signal level adjustment and amplitude, and internal impedance. Frequency and waveform are then checked on an oscilloscope. More accurate frequency tests require an electronic counter; more accurate waveform tests require a distortion analyzer.

a. Connect the oscillator to the power source and turn on.

b. Set the frequency switches to 1.000 kHz; set the AMPLITUDE control and OUTPUT ATTENUATOR maximum clockwise. The output meter must read at least 20v.

c. Connect a 600-ohm load to the OUTPUT terminals, and set the OUTPUT ATTENUATOR to the 10v range. The output meter must read at least 10v.

d. Set the AMPLITUDE control for a meter reading of 9. Switch the frequency range switch to each other range. The meter must read between 8.6 and 9.4 on each other range.

e. Set the frequency switches to 9.999 kHz. Turn the frequency range switch to each other range. The output meter must read between 8.6 and 9.4 on each range except the top range where it may read between 8.5 and 9.5.

f. Observe the oscillator output on an oscilloscope at the following frequencies, at maximum output level into the 600-ohm load. Use the sweep speeds listed; with the slow sweep speeds, the display must be one sine wave per centimeter.

010.0 Hz	100 and 10 msec/cm
999.9 Hz	1 and 0.1 msec/cm
1.000 kHz	1 and 0.1 msec/cm
9.999 kHz	100 and 10 usec/cm
10.00 kHz	100 and 10 usec/cm
99.99 kHz	10 and 1 usec/cm
100.0 kHz	10 and 1 usec/cm
999.9 kHz	1 and 0.1 usec/cm

HEWLETT · PACKARD

ELECTRONIC INSTRUMENTATION SALES AND SERVICE

UNITED STATES, CENTRAL AND SOUTH AMERICA, CANADA

UNITED STATES

ALABAMA

P.O. Box 4207
2003 Bird Spring Road S.W.
Huntsville 35802
Tel: (205) 881-4591
TWX: 810-726-2204

ARIZONA

3009 North Scottsdale Road
Scottsdale 85251
Tel: (602) 845-7601
TWX: 910-950-1282

5737 East Broadway
Tucson 85716
Tel: (602) 298-2313
TWX: 910-952-1162

CALIFORNIA

3939 Lankershim Boulevard
North Hollywood 91604
Tel: (213) 877-1282
TWX: 910-499-2170

1101 Embarcadero Road
Palo Alto 94303
Tel: (415) 327-6500
TWX: 910-373-1280

2591 Carlsbad Avenue
Sacramento 95821
Tel: (916) 482-1463
TWX: 910-367-2092

1055 Shafter Street
San Diego 92106
Tel: (714) 223-8103
TWX: 910-335-2000

COLORADO

7965 East Prentice
Englewood 80110
Tel: (303) 771-3455
TWX: 910-935-0705

CONNECTICUT

508 Tolland Street
East Hartford 06108
Tel: (203) 289-9394
TWX: 710-425-3416

111 East Avenue
Norwalk 06851
Tel: (203) 853-1251
TWX: 710-468-3750

DELAWARE

3941 Kennett Pike
Wilmington 19807
Tel: (302) 655-6161
TWX: 510-666-2214

FLORIDA

P.O. Box 545
Suite 106
9999 N.E. 2nd Avenue
Miami Shores 33153
Tel: (305) 759-3626
TWX: 810-848-7262

P.O. Box 20007
Herndon Station 32814
621 Commonwealth Avenue
Orlando
Tel: (305) 841-3970
TWX: 810-850-0113

P.O. Box 8128
Madera Beach 33708
419 150th Avenue
St. Petersburg
Tel: (813) 391-0211
TWX: 810-863-0366

GEORGIA

P.O. Box 28234
2340 Interstate Parkway
Atlanta 30328
Tel: (404) 436-6181
TWX: 810-766-4890

ILLINOIS

5500 Howard Street
Skokie 60076
Tel: (312) 677-0400
TWX: 910-223-3613

INDIANA

4002 Meadows Drive
Indianapolis 46205
Tel: (317) 546-4891
TWX: 810-341-3263

LOUISIANA

P.O. Box 856
1942 Williams Boulevard
Kenner 70062
Tel: (504) 721-6201
TWX: 810-955-5524

MARYLAND

6707 Whitestone Road
Baltimore 21207
Tel: (301) 944-5400
TWX: 710-862-0850

MASSACHUSETTS

P.O. Box 727
Twinbrook Station 20851
12303 Twinbrook Parkway
Rockville
Tel: (301) 427-7560
TWX: 710-828-9684

MINNESOTA

2459 University Avenue
St. Paul 55114
Tel: (612) 845-9461
TWX: 910-563-3734

MICHIGAN

24315 Northwestern Highway
Southfield 48075
Tel: (313) 353-9100
TWX: 810-232-1532

MISSOURI

9208 Wyoming Place
Kansas City 64114
Tel: (816) 333-2445
TWX: 910-771-2087

MISSOURI

2812 South Brentwood Blvd.
St. Louis 63144
Tel: (314) 644-0220
TWX: 910-760-1670

NEW JERSEY

W. 120 Century Road
Paramus 07652
Tel: (201) 265-5000
TWX: 710-990-4951

NEW MEXICO

P.O. Box 8366
Station C
6501 Lomas Boulevard N.E.
Albuquerque 87108
Tel: (505) 255-5586
TWX: 910-989-1665

156 Wyatt Drive
Las Cruces 89001
Tel: (505) 525-2485
TWX: 910-983-0550

NEW YORK

1792 Central Avenue
Albany 12205
Tel: (518) 869-8462
TWX: 710-441-8270

1219 Campville Road
Endicott 13764
Tel: (607) 754-0050
TWX: 510-252-0890

82 Washington Street
Poughkeepsie 12601
Tel: (914) 454-7330
TWX: 510-248-0012

39 Saginaw Drive
Rochester 14623
Tel: (716) 473-9500
TWX: 510-253-5981

1025 Northern Boulevard
Roslyn, Long Island 11576
Tel: (516) 869-8400
TWX: 510-223-0811

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

NORTH CAROLINA

P.O. Box 5188
1923 North Main Street
High Point 27262
Tel: (919) 882-6873
TWX: 510-926-1516

OHIO

5579 Pearl Road
Cleveland 44129
Tel: (216) 884-9209
TWX: 810-421-8500

3460 South Dixie Drive
Dayton 45439
Tel: (613) 298-0351
TWX: 810-459-1925

OKLAHOMA

2919 United Founders Boulevard
Oklahoma City 73112
Tel: (405) 848-2801
TWX: 910-830-6862

OREGON

Westhill Mall, Suite 158
4475 S.W. Scholls Ferry Road
Portland 97225
Tel: (503) 292-9171
TWX: 910-464-6103

PENNSYLVANIA

2500 Moss Side Boulevard
Monroeville 15146
Tel: (412) 273-0724
TWX: 710-797-3650

144 Elizabeth Street
West Conshohocken 19428
Tel: (215) 248-1600, 828-6200
TWX: 510-660-8715

TEXAS

P.O. Box 7166
3605 Inwood Road
Dallas 75209
Tel: (214) 357-1881
TWX: 910-861-4081

P.O. Box 22813
4242 Richmond Avenue
Houston 77027
Tel: (713) 667-2407
TWX: 910-881-2645

GOVERNMENT CONTRACT OFFICE

225 Billy Mitchell Road
San Antonio 78226
Tel: (512) 434-4171
TWX: 910-871-1170

UTAH

2890 South Main Street
Salt Lake City 84115
Tel: (801) 486-8166
TWX: 910-925-5681

VIRGINIA

P.O. Box 6514
2111 Spencer Road
Richmond 23230
Tel: (703) 282-5451
TWX: 710-956-0157

WASHINGTON

433-108th N.E.
Bellevue 98004
Tel: (206) 454-3971
TWX: 910-443-2303

FOR U.S. AREAS NOT LISTED:
Contact the regional office nearest you:
Atlanta, Georgia . . . North Hollywood, California . . . Paramus, New Jersey . . . Skokie, Illinois. Their complete addresses are listed above.

CENTRAL AND SOUTH AMERICA

ARGENTINA

Hewlett-Packard Argentina
S.A.C.e.I.
Lavalle 1171 - 3°
Buenos Aires

Lutz, Ferrando y Cia. S. A.
Florida 240 (R.5)
Buenos Aires
Tel: 46-7241, 46-1635
Cable: OPTICA Buenos Aires

BRAZIL

Hewlett-Packard Do Brasil
I.e.C. Ltda.
Rua Cel. Oscar Porto, 691
Sao Paulo - 8, SP
Tel: 71-1503
Cable: HEWPAK Sao Paulo

Hewlett-Packard Do Brasil
I.e.C. Ltda.
Avenida Franklin Roosevelt 84-
grupo 203
Rio de Janeiro, ZC-39, 68
Tel: 32-9733
Cable: HEWPAK Rio de Janeiro

CHILE

Hector Calcagni P.
Casilla 13942
Estado 215 - Oficina 1016
Santiago
Tel: 31-890, 490-505

COLOMBIA

Instrumentacion
Henrik A. Langbaek & Cia. Ltda.
Carrera 7 # 48-59
Apartado Aéreo 8287
Bogota, I. D.E.
Tel: 45-78-06, 45-55-46
Cable: AARIS Bogota

COSTA RICA

Lic. Alfredo Gallegos Gurdian
Apartado 3243
San José
Tel: 21-86-13
Cable: CALGUR San José

ECUADOR

Laboratorios de Radio-Ingenieria
Calle Guayaquil 1246
Post Office Box 3199
Quito
Tel: 12496
Cable: HORVATH Quito

EL SALVADOR

Electrónica
Apartado Postal 1589
27 Avenida Norte 1133
San Salvador
Tel: 25 74 50
Cable: ELECTRONICA San Salvador

GUATEMALA

Olander Associates Latin America
Apartado 1226
7a. Calle, 0-22, Zona 1
Guatemala City
Tel: 22812
Cable: OLALA Guatemala City

MEXICO

Hewlett-Packard Mexicana, S.A.
de C.V.
Apartado Postal 12-832
Eugenia 408, Dept. 1
Mexico 12, D.F.
Tel: 43-03-79, 36-08-78

NICARAGUA

Roberto Terán G.
Apartado Postal 689
Edificio Terán
Managua
Tel: 3451, 3452
Cable: ROTERAN Managua

PANAMA

Electronica Balboa, S.A.
P.O. Box 4929
Ave. Manuel Espinosa No. 13-50
Bldg. Atina
Panama City
Tel: 30833
Cable: ELECTRON Panama City

PERU

Fernando Ezeta B.
Avenida Petit Thouars 4719
Miraflores
Casilla 3061
Lima
Tel: 50346
Cable: FEPERU Lima

PUERTO RICO

San Juan Electronics, Inc.
P.O. Box 5167
Ponce de Leon 154
Pda. 3-Pta. de Tierra
San Juan, P.R. 00906
Tel: (174) 725-3342
Cable: SATRONICS San Juan

URUGUAY

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

VENEZUELA

Hewlett-Packard de Venezuela C.A.
Edificio Arisán-Of. 4
Avda. Francisco de Miranda
Chacabito
Caracas
Tel: 71.88.05
Cable: HEWPAK Caracas
Mailing Address: Apartado del
Este 10934 Caracas

FOR AREAS NOT LISTED,

CONTACT:
Hewlett-Packard Inter-Americas
1501 Page Mill Road
Palo Alto, California 94304
Tel: (415) 326-7000
TWX: 910-373-1267
Telex: 034-8461
Cable: HEWPAK Palo Alto

CANADA

ALBERTA

Hewlett-Packard (Canada) Ltd.
11745 Jasper Avenue
Edmonton
Tel: (403) 482-5561
TWX: 610-831-2431

BRITISH COLUMBIA

Hewlett-Packard (Canada) Ltd.
304-1037 West Broadway
Vancouver 9
Tel: (604) 731-5301
TWX: 610-922-5059

NOVA SCOTIA

Hewlett-Packard (Canada) Ltd.
7001 Mumford Road
Suite 356
Halifax
Tel: (902) 455-0511
TWX: 610-271-4482

ONTARIO

Hewlett-Packard (Canada) Ltd.
880 Lady Ellen Place
Ottawa 3
Tel: (613) 722-4223
TWX: 610-562-1952

Hewlett-Packard (Canada) Ltd.
1415 Lawrence Avenue West
Toronto
Tel: (416) 249-9196
TWX: 610-492-2382

QUEBEC

Hewlett-Packard (Canada) Ltd.
275 Hymus Boulevard
Pointe Claire
Tel: (514) 697-4232
TWX: 610-422-3022
Telex: 01-20607

FOR CANADIAN AREAS NOT LISTED:
Contact Hewlett-Packard (Canada) Ltd. in
Pointe Claire, at the complete address
listed above.

HEWLETT · PACKARD

ELECTRONIC INSTRUMENTATION SALES AND SERVICE

EUROPE, AFRICA, ASIA, AUSTRALIA

EUROPE

AUSTRIA

Unitlabor H.m.B.H.
Wissenschaftliche Instrumente
Rummelhardtgasse 6/3
P.O. Box 33
Vienna IX/71
Tel: 426 181
Cable: LABORINSTRUMENT
Vienna

BELGIUM

Hewlett-Packard Benelux S.A.
20-24 rue de l'Hôpital
Brussels
Tel: 11 22 20
Tel: 29 48 00
Cable: PALOBEN Brussels

DENMARK

Tage Olsen A/S
Ronnegade 1
Copenhagen O
Tel: 29 48 00
Cable: TOCOPEN Copenhagen

FINLAND

INTO O/Y
Meritullinkatu 11
P.O. Box 10153
Helsinki 10
Tel: 61 133
Cable: INTO Helsinki

FRANCE

Hewlett-Packard France
2 rue Tête d'Or
Lyon, 6 - Rhône
Tel: 52 35 66
Hewlett-Packard France
150 Boulevard Massena
Paris 13e
Tel: 707 97 19
Cable: HEWPACK Paris

GERMANY

Hewlett-Packard Vertriebs-GmbH
Lietzenburger Strasse 30
1 Berlin W 30
Tel: 24 86 36

Hewlett-Packard Vertriebs-GmbH

Herrnberger Strasse 110
703 Böblingen, Württemberg
Tel: 07031-6971
Cable: HEFAG Böblingen

Hewlett-Packard Vertriebs-GmbH

Achenbachstrasse 15
4 Düsseldorf 1
Tel: 68 52 58/59

Hewlett-Packard Vertriebs-GmbH

Kurhessenstrasse 95
6 Frankfurt 50
Tel: 52 00 36
Cable: HEWPACKSA Frankfurt

Hewlett-Packard Vertriebs-GmbH

Beim Strohhaue 26
2 Hamburg 1
Tel: 24 05 51/52
Cable: HEWPACKSA Hamburg

Hewlett-Packard Vertriebs-GmbH

Reginfriedstrasse 13
8 Munich 9
Tel: 59 51 21/22
Cable: HEWPACKSA Munich

GREECE

Kostas Karavannis
18, Ermou Street
Athens 126
Tel: 230 301
Cable: RAKAR Athens

IRELAND

Hewlett-Packard Ltd.
224 Bath Road
Slough, Bucks, England
Tel: Slough 28406-9, 29486-9
Cable: HEWPIE Slough

ITALY

Hewlett-Packard Italiana S.p.A.
Viale Lunigiana 46
Milan
Tel: 69 15 84
Cable: HEWPACIT Milan

Hewlett-Packard Italiana S.p.A.

Palazzo Italia
Piazza Marconi 25
Rome - Eu
Tel: 59 2544
Cable: HEWPACIT Rome

NETHERLANDS

Hewlett-Packard Benelux, N.V.
de Boelelaan 1043
Amsterdam, Z.2
Tel: 42 77 77
Cable: PALOBEN Amsterdam

NORWAY

Morgenstjerne & Co. A/S
Ingenjorfirma
6 Wessels Gate
Oslo
Tel: 20 16 35
Cable: MOROF Oslo

PORTUGAL

Telectra
Rua Rodrigo da Fonseca 103
P.O. Box 2531
Lisbon 1
Tel: 68 60 72
Cable: TELECTRA Lisbon

SPAIN

Ataio Ingerieros
Urgel, 259
Barcelona, 11
Tel: 230-69-88
Ataio Ingenieros
Enrique Larreta 12
Madrid, 16
Tel: 235 43 44
Cable: TELEATAIO Madrid

SWEDEN

HP Instrument AB
Hagakergatan 7
Malmö
Tel: 031 - 27 68 00

HP Instrument AB

Centraltvågen 28
Sätra
Tel: 08 - 83 08 30
Cable: MEASUREMENTS
Stockholm

SWITZERLAND

HEWPAK AG
Zürcherstrasse
8952 Schlieren
Zürich
Tel: (051) 88 18 21
Cable: HEWPACKAG Zurich

TURKEY

Telekom Engineering Bureau
P.O. Box 376 - Galata
Istanbul
Tel: 49 40 40
Cable: TELEMATION Istanbul

UNITED KINGDOM

Hewlett-Packard Ltd.
224 Bath Road
Slough, Bucks
Tel: Slough 28406-9, 29486-9
Cable: HEWPIE Slough

YUGOSLAVIA

Bilam S.A.
83 avenue des Mimosas
Brussels 15, Belgium
Cable: BELRAMEL Brussels

FOR AREAS NOT LISTED, CONTACT: Hewlett-Packard S.A.; 54 Route des Acacias; Geneva, Switzerland; Tel: (022) 42 81 50; Telex: 2.24.86; Cable: HEWPACKSA Geneva

AFRICA, ASIA, AUSTRALIA

AUSTRALIA

Hewlett-Packard Australia
Pty. Ltd.
22-26 Weir Street
Glen Iris, S. E. 6
Victoria
Tel: 20-1371 (4 lines)
Cable: HEWPAK Melbourne
Hewlett-Packard Australia
Pty. Ltd.
4 Grose Street
Glebe, New South Wales
Tel: 211-2235, 211-2888
Cable: HEWPAK Sydney

CEYLON

United Electricals Ltd.
P.O. Box 681
Yahala Building
Staples Street
Colombo 2
Tel: 5496
Cable: HOTPOINT Colombo

ETHIOPIA

African Salespower & Agency
Private Ltd., Co.
P. O. Box 718
Addis Ababa
Tel: 44090
Cable: ASACO Addisababa

HONG KONG

Schmidt & Co. (Hong Kong) Ltd.
P.O. Box 297
1511, Prince's Building
10, Chater Road
Hong Kong
Tel: 240168, 232735
Cable: SCHMIDTCO Hong Kong

INDIA

The Scientific Instrument
Co., Ltd.
6, Tej Bahadur Sapru Road
Allahabad 1
Tel: 2451
Cable: SICO Allahabad
The Scientific Instrument
Co., Ltd.
240, Dr. Dadabhai Naoroji Road
Bombay 1
Tel: 26-2642
Cable: SICO Bombay
The Scientific Instrument
Co., Ltd.
11, Esplanade East
Calcutta 1
Tel: 23-4129
Cable: SICO Calcutta
The Scientific Instrument Co., Ltd.
30, Mount Road
Madras 2
Tel: 86339
Cable: SICO Madras

The Scientific Instrument Co., Ltd.

B-7, Ajmeri Gate Extn.
New Delhi 1
Tel: 27-1053
Cable: SICO New Delhi

IRAN

Telecom, Ltd.
P. O. Box 1812
Teheran
Tel: 43850, 48111
Cable: BASCOM Teheran

ISRAEL

Electronics & Engineering
Div. of Motorola Israel Ltd.
16, Kromenetski Street
Tel-Aviv
Tel: 35021/2/3
Cable: BASTEL Tel-Aviv

JAPAN

Yokogawa-Hewlett-Packard Ltd.
Shinbanyu Building
No. 8, Umeda
Kita-ku, Osaka City
Tel: 0726-23-1641
Yokogawa-Hewlett-Packard Ltd.
Ito Building
No. 59, Kotori-cho
Nakamura-ku, Nagoya City
Tel: 551-0215

Yokogawa-Hewlett-Packard Ltd.

Chashi Building
No. 59, I-chome, Yoyogi
Shibuya-ku, Tokyo
Tel: 370-2281
Cable: YOKOHEWPAK Tokyo
Telex: 232-2034

KENYA

R. J. Tilbury Ltd.
P. O. Box 2754
Suite 517/518
Hotel Ambassador
Nairobi
Tel: 25670, 26803, 68206
Cable: ARJAYTEE Nairobi

KOREA

American Trading Co., Korea, Ltd.
Seoul P. O. Box 1103
112-35 Sokong-Dong
Jung-ku, Seoul
Tel: 3,7049, 3,7613
Cable: AMTRACO Seoul

LEBANON

Constantin E. Macridis
Clemenceau Street
Clemenceau Center
Beirut
Tel: 220846
Cable: ELECTRONUCLEAR Beirut

MALAYSIA

MECOMB Malaysia Ltd.
2 Lorong 13/6A
Section 13
Petaling Jaya, Selangor
Tel: MEACOMB Kuala Lumpur

NEW ZEALAND

Sample Electronics (N.Z.) Ltd.
8 Matipo Street
Onehunga S.E. 5
Auckland
Tel: 667-356
Cable: ELPMAS Auckland

PAKISTAN (EAST)

Mushko & Company, Ltd.
31, Jinnah Avenue
Dacca
Tel: 80058
Cable: COOPERATOR Dacca

PAKISTAN (WEST)

Mushko & Company, Ltd.
Oosman Chambers
Victoria Road
Karachi 3
Tel: 51027, 52927
Cable: COOPERATOR Karachi

SINGAPORE

Mechanical and Combustion
Engineering Company Ltd.
9, Jalan Kilang
Singapore, 3
Tel: 642361-3
Cable: MECOMB Singapore

SOUTH AFRICA

F. H. Flanter & Co. (Pty.), Ltd.
Rosella House
Buitencensing Street
Cape Town
Tel: 3-3817
Cable: AUTOPHONE Cape Town

F. H. Flanter & Co. (Pty.), Ltd.

104 Pharmacy House
80 Jorissen Street
Braamfontein, Johannesburg
Tel: 724-4172

TAIWAN

Hwa Sheng Electronic Co., Ltd.
P. O. Box 1558
21 Nanking West Road
Taipei
Tel: 46075, 45936
Cable: VICTRONIX Taipei

THAILAND

The International
Engineering Co., Ltd.
P. O. Box 39
614 Sukhumvit Road
Bangkok
Tel: 913460-1-2
Cable: GYSOM Bangkok

VIETNAM

Landis Brothers and Company,
Inc.
P.O. Box H-3
216 Hien-Vuong
Saigon
Tel: 20.805
Cable: LANBROCOMP Saigon

FOR AREAS NOT LISTED, CONTACT: Hewlett-Packard Export Marketing; 1501 Page Mill Road; Palo Alto, California 94304; Tel: (415) 326-7000; Telex: 034-8461; Cable: HEWPAK Palo Alto