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HEWLETT PACKARD

OPERATING MANUAL

3335A

SYNTHESIZER/LEVEL GENERATOR

Serial Numbers: 1640A00101 and Greater

IMPORTANT NOTICE

This Operating Manual is a duplication of the first three sections of the Operating and Service Manual. All reference within the text to appendices or "the end of the manual" refer to the end of the Operating and Service Manual. This Operating Manual applies to instruments with serial numbers indicated above.

WARNING

To prevent potential fire or shock hazard, do not expose equipment to rain or moisture.

Manual Part No. 03335-90011

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

Printed: January 1979

Notice

Hewlett-Packard to Agilent Technologies Transition

This manual may contain references to HP or Hewlett-Packard. Please note that Hewlett-Packard's former test and measurement, semiconductor products and chemical analysis businesses are now part of Agilent Technologies. To reduce potential confusion, the only change to product numbers and names has been in the company name prefix: where a product name/number was HP XXXX the current name/number is now Agilent XXXX. For example, model number HP8648 is now model number Agilent 8648.

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`http://www.agilent.com/find/assist`

If you do not have access to the Internet, contact your field engineer or the nearest sales and service office listed below. In any correspondence or telephone conversation, refer to your instrument by its model number and full serial number.

United States
(tel) 1 800 452 4844
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Canada
(tel) +1 877 894 4414
(fax) +1 888 900 8921

Europe
(tel) (31 20) 547 2323
(fax) (31 20) 547 2390

Latin America
(tel) (305) 269 7500
(fax) (305) 269 7599

Japan
(tel) (81) 426 56 7832
(fax) (81) 426 56 7840

Australia
(tel) 1 800 629 485
(fax) (61 3) 9210 5947

New Zealand
(tel) 0 800 738 378
(fax) 64 4 495 8950

Asia Pacific
(tel) (852) 3197 7777
(fax) (852) 2506 9284



Agilent Technologies

Printed in USA July 2004

HEWLETT PACKARD

CERTIFICATION

Hewlett-Packard Company certifies that this product met its published specifications at the time of shipment from the factory. Hewlett-Packard further certifies that its calibration measurements are traceable to the United States National Bureau of Standards, to the extent allowed by the Bureau's calibration facility, and to the calibration facilities of other International Standards Organization members.

WARRANTY

This Hewlett-Packard product is warranted against defects in material and workmanship for a period of one year from date of shipment. During the warranty period, Hewlett-Packard Company will, at its option, either repair or replace products which prove to be defective.

For warranty service or repair, this product must be returned to a service facility designated by -hp-. Buyer shall prepay shipping charges to -hp- and -hp- shall pay shipping charges to return the product to Buyer. However, Buyer shall pay all shipping charges, duties, and taxes for products returned to -hp- from another country.

HP software and firmware products which are designated by HP for use with a hardware product, when properly installed on that hardware product, are warranted not to fail to execute their programming instructions due to defects in materials and workmanship. If HP receives notice of such defects during their warranty period, HP shall repair or replace software media and firmware which do not execute their programming instructions due to such defects. HP does not warrant that the operation of the software, firmware or hardware shall be uninterrupted or error free.

LIMITATION OF WARRANTY

The foregoing warranty shall not apply to defects resulting from improper or inadequate maintenance by Buyer, Buyer-supplied software or interfacing, unauthorized modification or misuse, operation outside of the environmental specifications for the product, or improper site preparation or maintenance.

NO OTHER WARRANTY IS EXPRESSED OR IMPLIED. HEWLETT-PACKARD SPECIFICALLY DISCLAIMS THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

EXCLUSIVE REMEDIES

THE REMEDIES PROVIDED HEREIN ARE BUYER'S SOLE AND EXCLUSIVE REMEDIES. HEWLETT-PACKARD SHALL NOT BE LIABLE FOR ANY DIRECT, INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, WHETHER BASED ON CONTRACT, TORT, OR ANY OTHER LEGAL THEORY.

ASSISTANCE

Product maintenance agreements and other customer assistance agreements are available for Hewlett-Packard products.

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

HEWLETT PACKARD

SAFETY SUMMARY

The following general safety precautions must be observed during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the instrument. Hewlett-Packard Company assumes no liability for the customer's failure to comply with these requirements. This is a Safety Class 1 instrument.

GROUND THE INSTRUMENT

To minimize shock hazard, the instrument chassis and cabinet must be connected to an electrical ground. The instrument is equipped with a three conductor ac power cable. The power cable must either be plugged into an approved three-contact electrical outlet or used with a three-contact to two-contact adapter with the grounding wire (green) firmly connected to an electrical ground (safety ground) at the power outlet. The power jack and mating plug of the power cable meet International Electrotechnical Commission (IEC) safety standards.

DO NOT OPERATE IN AN EXPLOSIVE ATMOSPHERE

Do not operate the instrument in the presence of flammable gases or fumes. Operation of any electrical instrument in such an environment constitutes a definite safety hazard.

KEEP AWAY FROM LIVE CIRCUITS

Operating personnel must not remove instrument covers. Component replacement and internal adjustments must be made by qualified maintenance personnel. Do not replace components with power cable connected. Under certain conditions, dangerous voltages may exist even with the power cable removed. To avoid injuries, always disconnect power and discharge circuits before touching them.

DO NOT SERVICE OR ADJUST ALONE

Do not attempt internal service or adjustment unless another person, capable of rendering first aid and resuscitation, is present.

DO NOT SUBSTITUTE PARTS OR MODIFY INSTRUMENT

Because of the danger of introducing additional hazards, do not install substitute parts or perform any unauthorized modification to the instrument. Return the instrument to a Hewlett-Packard Sales and Service Office for service and repair to ensure that safety features are maintained.

DANGEROUS PROCEDURE WARNINGS

Warnings, such as the example below, precede potentially dangerous procedures throughout this manual. Instructions contained in the warnings must be followed.

WARNING

Dangerous voltages, capable of causing death, are present in this instrument. Use extreme caution when handling, testing, and adjusting.

SAFETY SYMBOLS

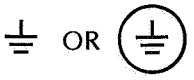
General Definitions of Safety Symbols Used On Equipment or In Manuals.



Instruction manual symbol: the product will be marked with this symbol when it is necessary for the user to refer to the instruction manual in order to protect against damage to the instrument.



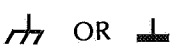
Indicates dangerous voltage (terminals fed from the interior by voltage exceeding 1000 volts must be so marked).



Protective conductor terminal. For protection against electrical shock in case of a fault. Used with field wiring terminals to indicate the terminal which must be connected to ground before operating equipment.



Low-noise or noiseless, clean ground (earth) terminal. Used for a signal common, as well as providing protection against electrical shock in case of a fault. A terminal marked with this symbol must be connected to ground in the manner described in the installation (operating) manual, and before operating the equipment.



Frame or chassis terminal. A connection to the frame (chassis) of the equipment which normally includes all exposed metal structures.



Alternating current (power line).



Direct current (power line).



Alternating or direct current (power line).

WARNING

The WARNING sign denotes a hazard. It calls attention to a procedure, practice, condition or the like, which, if not correctly performed or adhered to, could result in injury or death to personnel.

CAUTION

The CAUTION sign denotes a hazard. It calls attention to an operating procedure, practice, condition or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the product.

N O T E: The NOTE sign denotes important information. It calls attention to procedure, practice, condition or the like, which is essential to highlight.

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SECTION I
GENERAL INFORMATION

1-1. INTRODUCTION.

1-2. This Operating and Service Manual contains information relative to the installation, operation, performance testing, adjustment and maintenance of the Hewlett-Packard Model 3335A Synthesizer/Level Generator. Figure 1-1 shows the Synthesizer/Level Generator and the accessories supplied with the instrument.

1-3. Packaged with this manual is an Operating Information Supplement. This is simply a copy of the first three sections of this manual. This supplement should be kept with the instrument for use by the operator. Additional copies of the Operating Information Supplement or the Operating and Service Manual can be ordered through your nearest Hewlett-Packard Sales and Service Office (a list of these offices is provided at the end of this manual). The part numbers are listed on the title page of this manual.

1-4. Also listed on the title page of this manual following the Operating and Service Manual and Operating Information Supplement part numbers are Microfiche part numbers for these publications. These numbers can be used to order 4 x 6 inch microfilm transparencies of these publications. The Microfiche package includes the latest Manual Changes supplement and all pertinent Service Notes.

1-5. The manual is divided into eight sections, each covering a particular topic for the operating and service of the Synthesizer/Level Generator. The topics by section number are:

Section	Topic
I	General Information
II	Installation
III	Operation
IV	Performance Tests
V	Adjustments
VI	Replacement Parts
VII	Manual Changes
VIII	Service

1-6. This section contains general information about the Model 3335A Synthesizer/Level Generator. The information includes an instrument description, specifications, option and accessory information and instrument and manual identification.

1-7. DESCRIPTION.

1-8. The Model 3335A Synthesizer/Level Generator is a wide range source operating over the range of 200 Hz to 80 MHz with output resolution of .001 Hz. The Synthesizer/Level Generator is capable of making a step frequency sweep both automatically or manually under operator control from the keyboard. Output amplitude is selectable over the range of + 13.01 dBm to - 86.98 dBm for the 50 ohm output and + 11.25 dBm to - 88.74 dBm for the 75 ohm output.

1-9. The 3335A Synthesizer/Level Generator provides three communications-oriented options in addition to the standard 50 ohm and 75 ohm output impedance. Options 002 and 004 provide output impedance of 75 ohms unbalanced, 124 ohms balanced and 135 ohms balanced each terminated in equivalent WECO output connectors (Option 004 contains miniature connectors). Option 003 provides a 75 ohm unbalanced BNC output and a 150 ohm balanced BNC pair output. Refer to Table 1-2, General Information, for the amplitude range of the Options.

1-10. The Synthesizer/Level Generator develops the output signal by an indirect synthesis technique. This technique uses voltage controlled oscillators which are phase-locked to reference signals generated by a 40 MHz master oscillator in the reference section. The master oscillator is phase-locked to an internal temperature-stabilized oscillator or can be phase-locked to an external reference signal. A 10 MHz signal derived from the master oscillator is available at a rear panel connector for use as a reference signal for other equipment.

1-11. Frequency and amplitude can be selected manually from the keyboard or externally when connected to the Hewlett-Packard Interface Bus (HP-IB). A programmable device such as a programmable calculator is capable of remotely controlling the Synthesizer/Level Generator from the HP-IB. When operated in this mode, keyboard inputs are disabled.

1-12. SPECIFICATIONS.

1-13. Table 1-1 is a complete list of the Model 3335A critical specifications that are controlled by tolerances. Any changes in specifications due to manufacturing, design or traceability to the U.S. National Bureau of Standards are included in Table 1-1 of this manual. Specifications listed in this manual supersede all previous specifications for the Model 3335A.

1-14. GENERAL OPERATING INFORMATION.

1-15. Table 1-2 contains general information describing the major operating characteristics of the 3335A. This information does not constitute specifications but is supplemental operating information.

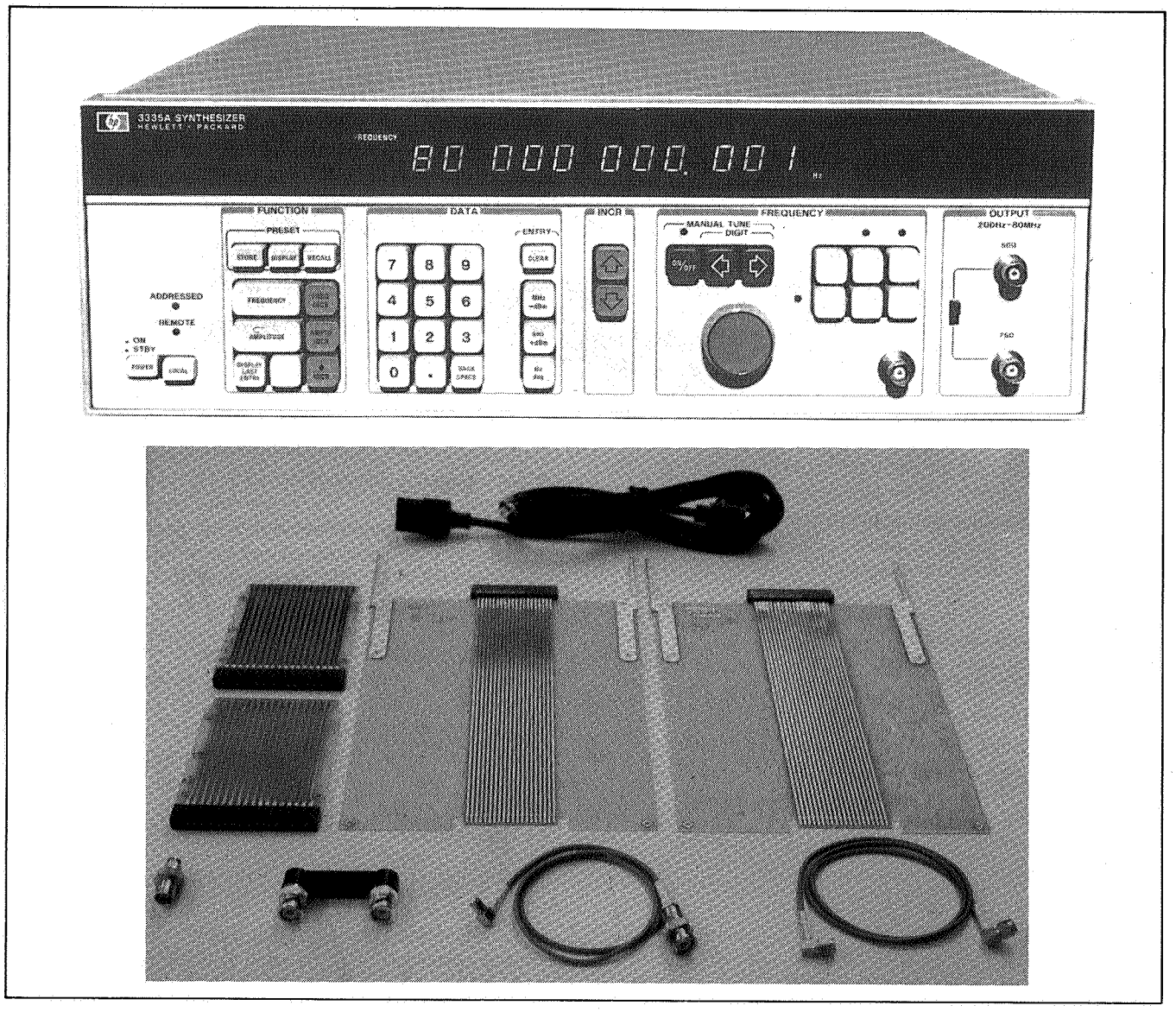


Figure 1-1. -hp- 3335A With Supplied Accessories.

1-16. OPTIONS.

1-17. There are both equipment options and accessory options available with the 3335A Synthesizer/Level Generator. All options are designated by a three digit number. The first digit of the option number identifies the option as either equipment or accessory. For an equipment option, the first digit is a zero and for an accessory option, the first digit is a nine. The following is a list of equipment and accessory options available with the 3335A:

Option	Description
001	High stability crystal oven (10544A)
002	75 Ω Unbalanced Output Connector: Commercial equivalent of WECO type 477B (Accepts WECO plug 358A). 124 Ω Balanced Output Connectors: Commercial equivalent of WECO type 477B (Accepts WECO plug 372A). 135 Ω Balanced Output Connectors: Commercial equivalent of WECO type 223A (Accepts WECO plug 241A).
003	75 Ω Unbalanced Output Connector: BNC 150 Ω Balanced Output Connectors: BNC pair.
004	75 Ω Unbalanced Output Connector: Commercial equivalent of WECO type 560A (Accepts WECO plug 439A or 440A). 124 Ω Balanced Output Connectors: Commercial equivalent of WECO type 562A (Accepts WECO plug 443A). 135 Ω Balanced Output Connectors: Commercial equivalent of WECO type 223A (Accepts WECO plug 241A).
907	Front Handle Assembly
908	Rack Mount Flange Kit
909	Rack Mount Flange Kit/Front Handle Assembly
910	Additional Operating and Service Manual

1-18. For more information concerning these options, refer to Table 1-2, General Information, or contact your local -hp- Sales and Service Office. A list of the -hp- Sales and Service Offices is provided at the end of this manual.

1-19. ACCESSORIES SUPPLIED.

1-20. The following is a list of accessories supplied with the Model 3335A. This list comprises the 3335A service kit, -hp- Part No. 03335-87901.

Accessory	Qty.	-hp- Part No.
Extender Board	2	5061-0775
Extender Board	2	03335-66518
Service Cable	1	03335-61602
Service Cable	1	03335-61627
SMA–to–BNC Adapter	1	1250-1548
BNC-to-BNC Adapter	1	1250-1499

1-21. ACCESSORIES AVAILABLE.

1-22. The following is a list of Hewlett-Packard accessories available for use with the Model 3335A:

Accessory	-hp- Model No.
50 Ω Feedthrough	11048C
75 Ω Feedthrough	11094C

1-23. HP-IB INTERFACING AND PROGRAMMING INFORMATION.

1-24. Section II of this manual contains instructions for interfacing the Model 3335A with the HP-IB. A brief description of the sequence of events comprising the transfer of data by the HP-IB is provided in Section III followed by programming information. Information concerning the design criteria of the bus is available in IEEE Standard 488-1975, titled "IEEE Standard Digital Interface for Programmable Instrumentation".

1-25. INSTRUMENT AND MANUAL IDENTIFICATION.

1-26. The instrument serial number is located on the rear panel. Hewlett-Packard uses a two-section serial number consisting of a four-digit prefix and a five-digit suffix. A letter between the prefix and suffix identifies the country in which the instument was manufactured (A = USA, G = West Germany, J = Japan, U = United Kingdom). All correspondence with Hewlett-Packard concerning this instrument should include the complete serial number.

1-27. If the serial number of your instrument is lower than the serial number on the title page of this manual, you must modify your manual for agreement with your instrument. Refer to Section VII, MANUAL CHANGES, for the information that will adapt this manual to your instrument.

1-28. SAFETY CONSIDERATIONS.

1-29. The Synthesizer/Level Generator is a Safety Class I instrument and has been designed according to international safety standards. To ensure safe operation and to retain the instrument in a safe condition, this Operating Manual contains information, cautions and warnings which must be adhered to by the user.

1-30. The 3335A's front panel contains a ⚠ symbol which is an international symbol meaning "refer to the

Operating Manual." The symbol flags important operating instructions located in Section III required to prevent damage to the instrument. To retain the operating condition of the instrument, these instructions must be adhered to.

1-31. RECOMMENDED TEST EQUIPMENT.

1-32. Equipment required to maintain the Model 3335A is listed in Table 1-3. Other equipment can be substituted if it meets or exceeds the critical specifications listed in the table.

Table 1-1. Specifications.

STANDARD/OPTION 001

FREQUENCY:

Range: 50 Ω, 75 Ω: 200 Hz to 80.999 999 999 MHz

Stability (Standard):

Long Term: ± 1 x 10^{-8} per day
± 1 x 10^{-7} per month

Stability (Option 001):

Long Term: < 5 X 10^{-10}/day after 24-hour warmup and oscillator off time less than 24 hours. < 1 X 10^{-7}/year for continuous operation

Spectral Purity:

Harmonic Distortion:

All harmonically related signals will be less than the following levels (relative to the fundamental) at full output:

Freq Range	Harmonic Level
200 Hz to 10 MHz	–45 dB
10 MHz to 80 MHz	–40 dB

Integrated Phase Noise:

(30 kHz band, excluding ± 1 Hz, centered on the carrier)

9.9 MHz: < –63 dB
20 MHz: < –70 dB
40 MHz: < –64 dB
80 MHz: < –58 dB

Spurious (25°C ± 10°C):

All non-harmonically related signals are > 75 dB below the carrier or –125 dBm whichever is greater.

AMPLITUDE:

Range: 50 Ω: +13.01 dBm to –86.98 dBm
75 Ω: +11.25 dBm to –88.74 dBm

Absolute Level Accuracy:

(Maximum output at 100 kHz, 10°C to 35°C) ± 0.05 dB

Flatness: (Relative to 100 kHz, Full Amplitude)

50 Ω/75 Ω: 1 kHz–25 MHz: ± .07 dB; 200 Hz–80 MHz: ± .15 dB

Attenuator Accuracy: (Relative to Full Output, 100 kHz, In 2 dB Steps)

Impedance*	Attenuation (dB)	Accuracy 200 Hz	25 MHz	80 MHz
50 Ω 75 Ω	0 to 18	± 0.04 dB		± 0.15 dB
50 Ω 75 Ω	20 to 58	± 0.09 dB		± 0.25 dB
50 Ω 75 Ω	60 to 98	± 0.20 dB		± 0.50 dB

Table 1-1. Specifications (Cont'd).

OPTION 002/004

FREQUENCY:

Range: 75 Ω: 200 Hz to 80.999 999 999 MHz
124 Ω: 10 kHz to 10 MHz
135 Ω: 10 kHz to 2 MHz

Stability:

Long Term: ± 1 x 10^{-8} per day
± 1 x 10^{-7} per month

See STANDARD/OPTION 001 table for Option 001 stability.

Spectral Purity:

Harmonic Distortion:

All harmonically related signals will be less than the following levels (relative to the fundamental) at full output:
(75 Ω) 0 dBm (124 Ω, 135 Ω)

Impedance	Freq Range	Harmonic Level
75 Ω	200 Hz to 10 MHz	–45 dB
	10 MHz to 80 MHz	–40 dB
124 Ω	10 kHz to 10 MHz	–45 dB
135 Ω	10 kHz to 2 MHz	–45 dB

Integrated Phase Noise:
(30 kHz band, excluding ± 1 Hz, centered on the carrier)
9.9 MHz: < –63 dB
20 MHz: < –70 dB
40 MHz: < –64 dB
80 MHz: < –58 dB

Spurious (25°C ± 10°C):

Impedance	All non-harmonically related signals (whichever is greater)
75 Ω	–125 dBm or –75 dBc
124 Ω	–97 dBm or –75 dBc (dc to 200 MHz)
135 Ω	–100 dBm or –75 dBc (dc to 10 MHz) –68 dBm or –75 dBc (10 MHz–200 MHz)

AMPLITUDE:

Range: 75 Ω, 124 Ω, 135 Ω: +11.25 dBm to –88.74 dBm

Absolute Level Accuracy: (Maximum output at 100 kHz, 10°C to 35°C)
75 Ω: ± 0.05 dB
124/135 Ω: ± 0.1 dB

Flatness: (Relative to 100 kHz, Full Amplitude)

75 Ω	1 kHz–25 MHz: ± .07 dB
	200 Hz–80 MHz: ± .15 dB
124 Ω	50 kHz–10 MHz: ± .15 dB
	10 kHz–10 MHz: ± .4 dB
135 Ω	10 kHz–2 MHz: ± .18 dB

Amplitude Accuracy (includes effects of flatness and attenuator):

75 Ω:

75 Ω Output Level (dBm)	200 Hz	1 kHz	25 MHz	50 MHz
+11.25	± 0.25 dB	± 0.15 dB	± 0.35 dB	
– 8.74	± 0.30 dB	± 0.20 dB	± 0.45 dB	
–48.74	± 0.40 dB	± 0.30 dB	± 0.70 dB	
–70.0*				

124 Ω:

124 Ω Output Level (dBm)	10 kHz	50 kHz	10 MHz
+11.25	±0.60 dB	± 0.35 dB	
– 8.74	± 0.65 dB	± 0.40 dB	
–48.74	± 1.1 dB	± 0.85 dB	
–70.0*			

135 Ω

135 Ω Output Level (dBm)	10 kHz	2 MHz
+11.25	± 0.35 dB	
– 8.74	± 0.40 dB	
–48.74	± 0.85 dB	
–70.0*		

Output Balance: 124/135 Ω: ≥60 dB

*Levels to –88.74 dBm can be selected but accuracies are unspecified due to the spurious noise floor of –100 dBm.

Table 1-1. Specifications (Cont'd).

OPTION 003

FREQUENCY:

Range: 75 Ω: 200 Hz to 80.999 999 999 MHz
150 Ω: 10 kHz to 2 MHz

Stability:
Long Term: $\pm 1 \times 10^{-8}$ per day
$\pm 1 \times 10^{-7}$ per month
See STANDARD/OPTION 001 table for Option 001 stability.

Spectral Purity:
Harmonic Distortion:
All harmonically related signals will be less than the following levels (relative to the fundamental) at full output:

Freq Range	Harmonic Level
200 Hz to 10 MHz	–45 dB
10 MHz to 80 MHz	–40 dB

Integrated Phase Noise:
(30 kHz Band, excluding ± 1 Hz, centered on the carrier)

9.9 MHz < –63 dB
20 MHz < –70 dB
40 MHz < –64 dB
80 MHz < –58 dB

Spurious (25°C ± 10°C)

Impedance	All non-harmonically related signals (whichever is greater)
75 Ω	–125 dBm or –75 dBc
150 Ω	–100 dBm or –75 dBc

AMPLITUDE:

Range: 75 Ω, 150 Ω: +11.25 dBm to –88.74 dBm

Absolute Level Accuracy (Maximum Output at 100 kHz, 10°C to 35°C)
75 Ω: ± 0.05 dB
150 Ω: ± 0.10 dB

Flatness (relative to 100 kHz, Full Amplitude):
75 Ω: 1 kHz–25 MHz: ± 0.07 dB
200 Hz–80 MHz: ± 0.15 dB
150 Ω: 10 kHz–2 MHz: ± 0.18 dB

Amplitude Accuracy (includes the effects of flatness and attenuator):

75 Ω:

75 Ω Output Level (dBm)

	200 Hz	1 kHz	25 MHz	80 MHz
+11.25	± 0.25 dB	± 0.15 dB	± 0.35 dB	
– 8.74	± 0.30 dB	± 0.20 dB	± 0.45 dB	
–48.74	± 0.40 dB	± 0.30 dB	± 0.70 dB	
–88.74				

150 Ω:

150 Ω Output Level (dBm)

	10 kHz	2 MHz
+11.25	± 0.35 dB	
– 8.74	± 0.40 dB	
–48.74	± 0.85 dB	
–70.0*		

*Levels to –88.74 dBm can be selected but accuracies are unspecified due to the spurious noise floor of –100 dBm.

Table 1-2. General Information.

Output Impedance: (Selected by a front panel switch)
Standard: 50 ohms or 75 ohms
Option 002/004: 75 ohms unbalanced, 124 ohms balanced and 135 ohms balanced
Option 003: 75 ohms unbalanced and 150 ohms balanced

Frequency Range:
Standard:
50 Ω: 200 Hz to 80 099 999.999 Hz
75 Ω: 200 Hz to 80 099 999.999 Hz
Option 002/004:
75 Ω: 200 Hz to 80 099 999.999 Hz
124 Ω: 10 kHz to 10 MHz
135 Ω: 10 kHz to 2 MHz
Option 003
75 Ω: 200 Hz to 80 099 999.999 Hz
150 Ω: 10 kHz to 2 MHz

Frequency Resolution: 0.001 Hz

Frequency Display: 11 digits

Frequency Settling Time: < 20 msec to within 90° of final phase.

Frequency Sweep Mode:
Auto: ≈8 sweeps/sec, 100 steps/sweep
Manual, single 10 sec and 50 sec sweep: 1000 steps/sweep

Amplitude Range:
Standard:
50 ohms: +13.01 dBm to –86.98 dBm
75 ohms: +11.25 dBm to –88.74 dBm
Option 002:
75 ohms unbalanced:
124 ohms balanced: } +11.25 dBm to –88.74 dBm
135 ohms balanced:
Option 003:
75 ohms unbalanced: +11.25 dBm to –88.74 dBm
150 ohms balanced:
Option 004: Same as Option 002

Amplitude Settling Time: < 500 msec to within 0.02 dB of final value.

Internal Frequency Reference:
Frequency stability is obtained by use of a 10 MHz crystal oscillator in a temperature-stabilized oven. A high-stability 10 MHz temperature-stabilized crystal oscillator is provided by Option 001. The master 40 MHz oscillator of the instrument reference section is capable of operating open loop (no oven or external reference) but the frequency stability is not specified.

External Frequency Reference:
The 40 MHz master oscillator of the reference section can be phase-locked to an external reference through a rear panel BNC connector. The amplitude and frequency requirements of the external signal are - 7 dBm to + 7 dBm (+ 0.1 V to + 0.5 V) with frequency being a sub-harmonic of 40 MHz and ⩾1 MHz.

Remote Programming:
The 3335A is a fully programmable instrument designed for systems interfacing with the Hewlett-Packard Interface Bus (HP-IB). It will recognize a preset listen address and accept bit-parallel, word (byte) serial ASCII coded instructions. The address is preset by five rear panel listen address switches. A brief description of the HP-IB with address and programming information is provided in Section III.

Programmability:
All FUNCTION keys except DISPLAY, all DATA keys including the ENTRY keys, all INCR keys and all FREQUENCY keys except the MANUAL TUNE keys and MANUAL SWEEP key are programmable. The POWER key and the impedance selection switch are not programmable.

HP-IB Connector:
The rear panel HP-IB connector provides all lines for remote control and digital output using the HP-IB. The connector is compatible with the -hp- 10631 (A, B or C) HP-IB cables and contains metric threaded cable mounting studs.

Maximum HP-IB Cable Length:
2 meters (6.56 feet) per device; 20 meters (65.6 feet) total accumulation per system.

HP-IB Lines:
The 3335A uses all of the HP-IB lines except EOI (End or Identify), SRQ (Service Request) and the data line DIO 8.

Data Input/Output:
All data is received through the HP-IB Data Input/Output (DIO) lines.

Data Transfer Timing:
Timing of data transfer is controlled by "handshake" lines DAV, NRFD and NDAC.

HP-IB Logic Levels:
TTL compatible low true (true state = digital ground or 0 V to 0.4 V dc; false state = open or + 2.5 V dc to + 5 V dc).

Isolation:
The HP-IB lines and 3335A are optical coupled.

Listen Address Code:
The 3335A is shipped from the factory with an ASCII listen address of $ (octal 044). Instructions for changing the listen address are provided in Section III.

HP-IB Bus Commands:
The 3335A will respond to certain Unaddress, Universal and Addressed Commands (see information on Remote Programming in Section III).

Telecommunications Features:
Amplitude blanking of the output signal at each change of output frequency is obtainable except in the manual tune and manual sweep modes. Special sweep feature allows each frequency step to be held for four seconds and also includes amplitude blanking.

General
Operating Temperature: 0°C to 55°C
Storage Temperature: - 40°C to + 75°C
Power Requirements: 100 V, 120 V, 220 V or 240 V ac, + 5% - 10%, 48 Hz to 66 Hz, 200 VA Maximum

Dimensions:
Dimensions in millimeters and (inches):
Height: 133.4 (5 1/4)
Width: 425.5 (16 3/4)
Depth: 501.7 (19 3/4)

Weight:
Weight in kilograms and (pounds): 19.05 (42)

Table 1-3. Recommended Test Equipment.

Equipment	Required Characteristics	Perf. Tests	Adj.	T.S.	Recommended Model
3335A Service Kit Consists of:	(Supplied with the instrument)		X	X	-hp- 03335-87901
(2) Extender Boards				X	-hp- 5061-0775
(1) Extender Board			X	X	-hp- 03335-66518
(1) Extender Board			X	X	-hp- 03335-66520
(1) Service Cable			X	X	-hp- 03335-61602
(1) Service Cable			X	X	-hp- 03335-61627
(1) SMA-to-BNC			X	X	-hp- 1250-1548
Terminations:					
50 Ω Feedthru		X		X	-hp- 11048C
75 Ω Feedthru		X		X	-hp- 11094B
Adapters:					
BNC "TEE"		X			-hp- 1250-0781
Conn. Adapter		X			-hp- 1250-0591
(2) BNC Male-to-Male		X			-hp- 1250-0216
(2) Type N(f) to BNC (m)		X			-hp- 1250-0077
(2) Type N(m) to BNC (f)		X			-hp- 1250-0780
(2) BNC (f) to dual banana plug		X	X	X	-hp- 1251-2277
Thermal Converter	Impedance: 50 Ω or 75 Ω Frequency Range: 200 Hz – 10 MHz Frequency Response: ± 0.05 dB 200 Hz – 10 MHz Input Voltage: 1 V rms	X			-hp- 11050A (50 Ω) or -hp- 11050A/H01 (75 Ω)
Double Balanced Mixer	Impedance: 50 Ω Frequency Range: 50 kHz to 80 MHz	X			-hp- 10534A
Attenuator	Certified (See Note 1) Range: 0–12 dB Steps: 1 dB	X			-hp- 355C
Attenuator	Certified (See Note 1) Range: 0–120 dB Steps: 10 dB	X			-hp- 355D
Attenuator	Fixed: 3 dB Accuracy: ± 0.3 dB	X			-hp- 8491A Option 003
Attenuator	Fixed: 6 dB Accuracy: ± 0.3 dB	X			-hp- 8491A Option 006
Digital Voltmeter	AC Function: Full Scale Ranges: 1 V, 10 V Freq. Range: 200 Hz–100 kHz Accuracy: ± 0.5% Resolution: 0.1 mV Input Impedance: > 1 mΩ < 90 pF DC Function: Full Scale Ranges: 100 mV–20 V Accuracy: ± 0.15% Resolution: 5 digits Input Resistance: > 1 MΩ	X	X	X	-hp- 3455A
AC Voltmeter	Full Scale Ranges 0.1 – 1 V Frequency Range: 200 Hz to 4 MHz Accuracy: ± 10% Input Impedance: 10 MΩ, < 25 pF	X		X	-hp- 400FL
Oscilloscope	Vertical Sensitivity: 0.005 V/div to 2 V/div Sweep: 0.05 μs/div to 0.1 sec/div Input Impedance: 1 MΩ, < 20 pF Input Coupline: ac/dc	X	X	X	-hp- 180C/D, 1805A, 1825A
Tracking Generator	Freq. Range: 100 kHz to 110 MHz Amplitude Range: 0 to –10 dB		X		-hp- 8443A

Table 1-3. Recommended Test Equipment.

Equipment	Required Characteristics	Perf. Tests	Adj.	T.S.	Recommended Model
Spectrum Analyzer	Frequency Range: 1 kHz–1.25 GHz Amplitude Accuracy: ± .5 dB Response: ± 0.5 dB	X	X	X	-hp- 141T, 8552B, 8553B, 8554B
Spectrum Analyzer	Frequency Range: 5 Hz to 50 kHz Amplitude Accuracy:± 0.5 dB Response: ± 3% Battery operation	X		X	-hp- 3580A Option 001
Wave Analyzer	Frequency Range: 15 Hz–50 kHz Accuracy: ± 3 Hz Amplitude Range: – 150 dBm – +30 dBm Accuracy: ± 0.5 dB Recorder Output: 0–+5 V ± 2.5%	X			-hp- 3581A
Amplifier	Frequency Range: 0.1–80 MHz Gain: 20 dB ± 0.5 dB at 10 MHz Response: ± 0.5 dB Noise Figure: < 5 dB Harmonic Distortion: –32 dB for 0 dBm output Impedance: 50 Ω	X			QB–300 Q-Bit Corp. P.O. Box 2208 Melbourne, FL 32901
Quartz Frequency Standard	Output: 5 MHz, 1 V rms into 50 Ω Short Term Stability: 5 parts in 10^{12} for 1 sec averaging time		X		-hp- 105A/B
Universal Counter	Frequency: 200 Hz–80 MHz Sensitivity: 50 mV rms Impedance: 1 MΩ, < 50 pF	X		X	-hp- 5328A
Power Meter	Power Range: 13.5 dB Frequency Range: 100 kHz to 80 MHz Accuracy: ± 0.05%	X			-hp- 436A
Power Sensor	Power Range: 0.3 μW to 100 mW Impedance: 50 Ω or 75 Ω Freq. Range: 100 kHz–80 MHz	X			-hp- 8482A (50 Ω) or -hp- 8483A (75 Ω)
1 MHz LPF	Cut Off Freq: 1 MHz Stopband Attn: 50 dB by 4 MHz Stopband Freq: 4 MHz–80 MHz	X			J903 TT Electronics,Inc. 2214 S. Barry Ave. Los Angeles, CA 90064
Synthesizer	Frequency Range: 10 MHz–80 MHz Amplitude Range: –10 dBm to +10 dBm Accuracy: ± 0.05 dB Phase Noise (30 kHz Integrated): 9.9 MHz: < –63 dB 20 MHz: < –70 dB 40 MHz: < –64 dB 80 MHz: < –58 dB	X			-hp- 3335A
Power Supply (2) Cables (2) Cables (2) Cables	Output: + 15 V	X X X X			-hp- 6215A -hp- 11170A -hp- 11170B -hp- 11170C
Active Probe	Input Impedance = 100 kΩ shunted by 3 pfds		X		-hp- 1120A

NOTE 1

Attenuators of known accuracy are required. Certification is obtainable from Hewlett-Packard. Contact your nearest Hewlett-Packard Sales and Service Office. A list of offices is provided at the back of this manual.

SECTION II
INSTALLATION

2-1. INTRODUCTION.

2-2. This section contains instructions for installing and interfacing the Model 3335A Synthesizer/Level Generator. Included are initial inspection procedures, power and grounding requirements, line voltage selection, environmental requirements, installation instructions, HP-IB connection procedure and instructions for repackaging for shipment.

2-3. INITIAL INSPECTION.

2-4. Inspect the shipping container for damage. If the shipping container or cushioning material is damaged, it should be kept until the contents of the shipment have been checked for completeness and the instrument has been checked mechanically and electrically. The contents of the shipment should be as shown in Figure 1-1. This instrument was carefully inspected both mechanically and electrically before shipment. It should be free of mars or scratches and in perfect electrical order upon receipt. Procedures for checking electrical performance are given in Section IV. If the contents are incomplete, if there is mechanical damage or defect, or if the instrument does not pass the electrical performance test, notify the nearest Hewlett-Packard Sales and Service Office. If the shipping container is damaged or the cushioning material shows signs of stress, notify the carrier as well as the Hewlett-Packard office. Keep the shipping materials for the carrier's inspection. The warranty statement is located at the front of this manual.

2-5. PREPARATION FOR USE.

2-5(a). Reference Frequency.

2-5(b). A stable frequency reference must be connected to the 40/N MHz REFerence INPUT located on the rear panel. If the internal 10 MHz reference is to be used, the BNC-to-BNC Adapter (see Figure 6-2 Item 25) must be connected from the 10 MHz REFerence OVEN output, also located on the rear panel, to the 40/N M/Hz REFerence INPUT. The BNC-to-BNC Adapter is packed with the accessories.

2-6. Power Requirements.

2-7. The Model 3335A Synthesizer/Level Generator requires a power source of 100, 120, 220 or 240 V ac, + 5%, - 10%, 48 to 66 Hz single phase. Power consumption is 200 VA maximum.

2-8. Line Voltage Selection.

CAUTION

Before switching on this instrument, be sure it is set for the line voltage of the power source. Also ensure the line power cord is connected to a protective earth contact.

2-9. Line voltage and fuse selection instructions are provided on the rear panel above the ac line connector. The line voltage is selected by the position of the two rear panel line voltage selection switches.

NOTE

The correct fuse rating for the line voltage selected is located on the rear panel between the fuse location and line voltage selection switch.

The line voltage and fuse are factory installed for 120 V operation.

WARNING

To maintain operator safety, the following precautions must be followed before the instrument power cable is connected:

a. Before the power cable is connected to a power source, the protective earth terminal of the instrument must be connected to earth ground. This is accomplished by ensuring that the instrument's ac line input connector earth terminal is correctly connected to the instrument's chassis and that the power cord ground conductor has continuity from end to end.

b. Note that the protection provided by grounding the instrument cabinet will be lost if a power cable not containing a ground conductor like the type supplied is used to connect the ac line voltage to the instrument.

c. The power cable plug must be inserted into a socket outlet provided with a protective earth contact. The protection of the grounded instrument cabinet must not be negated by the use of an extension cord without a protective ground conductor.

d. If this instrument is to be energized via an auto-transformer to reduce or increase the line voltage, make sure that the common terminal is connected to the earthed pole of the power source.

2-10. Power Cable.

2-11. In accordance with international safety standards, this instrument is equipped with a three-wire power cable. When connected to an appropriate power line outlet, this cable grounds the instrument cabinet. The type of power cable plug shipped with each instrument depends on the country of destination. Refer to Figure 2-1 for the part numbers of the power cable plugs available.

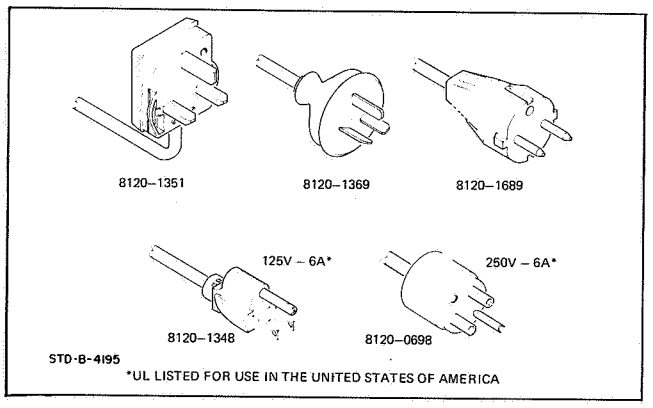


Figure 2-1. Power Cables.

2-12. HP-IB Connections.

2-13. Interconnection data concerning the rear panel HP-IB connector is provided in Figure 2-2. This connector is compatible with the -hp- 10631 (A, B, or C) HP-IB Cables. With the HP-IB system, you can interconnect up to fourteen (including the controller) HP-IB compatible instruments. The HP-IB Cables have identical "piggyback" connectors on both ends so that several cables can be connected to a single source without special adapters or switch boxes. You can interconnect system components and devices in virtually any configuration you desire. There must, of course, be a path from the calculator (or other controller) to every device operating on the bus. As a practical matter, avoid stacking more than three or four cables on any one connector. If the stack gets too large, the force on the stack produces great leverage which can damage the connector mounting. Be sure that each connector is firmly screwed in place to keep it from working loose during use (see CAUTION of Figure 2-2).

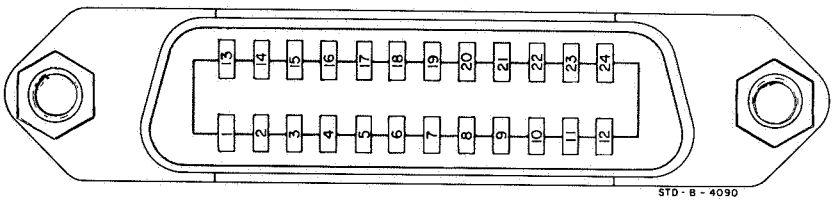
2-14. Cable Length Restrictions. To achieve design performance with the HP-IB, proper voltage levels and timing relationships must be maintained. If the system cable is too long, the lines cannot be driven properly and the system will fail to perform. Therefore, when interconnecting an HP-IB system, it is important to observe the following rules:

a. The total cable length for the system must be less than or equal to 20 meters (65 feet).

b. The total cable length for the system must be less than or equal to 2 meters (6 feet) times the total number of devices connected to the bus.

2-15. 3335A Listen Address.

2-16. The 3335A contains a rear panel HP-IB Instrument listen address selection switch. There are five switches



PIN	LINE
1	DI01
2	DI02
3	DI03
4	DI04
13	DI05
14	DI06
15	DI07
16	DI08
5	EOI
17	REN
6	DAV
7	NRFD
8	NDAC
9	IFC
10	SRQ
11	ATN
12	SHIELD–CHASSIS GROUND
18	P/O TWISTED PAIR WITH PIN 6
19	P/O TWISTED PAIR WITH PIN 7
20	P/O TWISTED PAIR WITH PIN 8
21	P/O TWISTED PAIR WITH PIN 9
22	P/O TWISTED PAIR WITH PIN 10
23	P/O TWISTED PAIR WITH PIN 11
24	ISOLATED DIGITAL GROUND

THESE PINS ARE INTERNALLY GROUNDED

CAUTION

The 3335A contains metric threaded HP–IB cable mounting studs as opposed to English threads. Metric threaded -hp-10631A, B, or C HP–IB cable lockscrews must be used to secure the cable to the instrument. Identification of the two types of mounting studs and lockscrews is made by their color. English threaded fasteners are colored silver and metric threaded fasteners are colored black. DO NOT mate silver and black fasteners to each other or the threads of either or both will be destroyed. Metric threaded HP-IB cable hardware illustrations and part numbers follow.

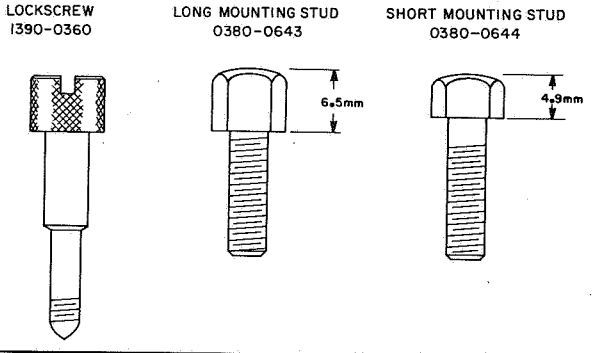


Figure 2-2. HP-IB Connector.

designated (5 . . . 1)which are used to select the listen address. Instructions for changing the listen address are provided in Section III of this manual along with 3335A programming codes.

2-17. HP-IB Descriptions.

2-18. A description of the HP-IB is provided in Section III of this manual. A study of this information is necessary if you are not familiar with the HP-IB concept. Additional information concerning the design criteria and operation of the bus is available in IEEE Standard 488-1975 titled "IEEE Standard Digital Interface for Programmable Instrumentation".

2-19. OPERATING ENVIRONMENT.

WARNING

To prevent potential electrical or fire hazard, do not expose equipment to rain or moisture.

2-20. Operating and Storage Temperature.

2-21. In order for the 3335A to meet the specifications listed in Table 1-1, the operating environment must be within the following limits:

Temperature. . . . . .0 to + 55°C
Humidity. . . . . .< 85% relative
Altitude. . . . . .< 15,000 feet

2-22. Cooling System.

2-23. A forced air cooling system is used to maintain the operating temperature required by the instrument. The cooling fan is located on the right side of the instrument drawing air through the filtered side panel. When operating the instrument, choose a location that provides at least three inches of clearance at the rear and at least one inch for each side. Failure to provide adequate air clearance will result in excessive internal temperature reducing instrument reliability. The clearances provided by the plastic feet in bench stacking and the filler strip in rack mounting allow air passage across the top and bottom cabinet surfaces.

NOTE

Rack Mount side slide assemblies cannot be used with the 3335A. These assemblies block air passage to the fan and will cause overheating.

2-24. Thermal Cutout Switch.

2-25. The 3335A is equipped with a thermal cutout switch which automatically removes line voltage when the internal temperature becomes excessive. The switch resets automatically when the instrument cools. If a thermal cutout occurs, check for an inoperative fan, clogged fan parts or filter and other conditions that could obstruct air flow. To clean the fan filter, the side panel/filter assembly must be removed. Flush the filter with soapy water, rinse clean and air dry.

2-26. Bench Operation.

2-27. The instrument has plastic feet attached to the bottom panel. The front feet contain foldaway tilt stands for convenience in bench operation. The tilt stand raises the front of the instrument for easier viewing of the control panel. The plastic feet are shaped to make full-width modular instruments self-align when they are stacked. A front handle kit, -hp- Part No. 5060-9899 (Option 907), can be installed for ease of handling the instrument on the bench (see Figure 2-3). The kit is shipped with the instrument if Option 907 is also ordered. Otherwise, the front handle kit is available separately by its -hp- part number.

2-28. Rack Mounting.

2-29. The 3335A can be rack mounted in a rack having an EIA standard width of 482.6 mm (19 inches). The instru-

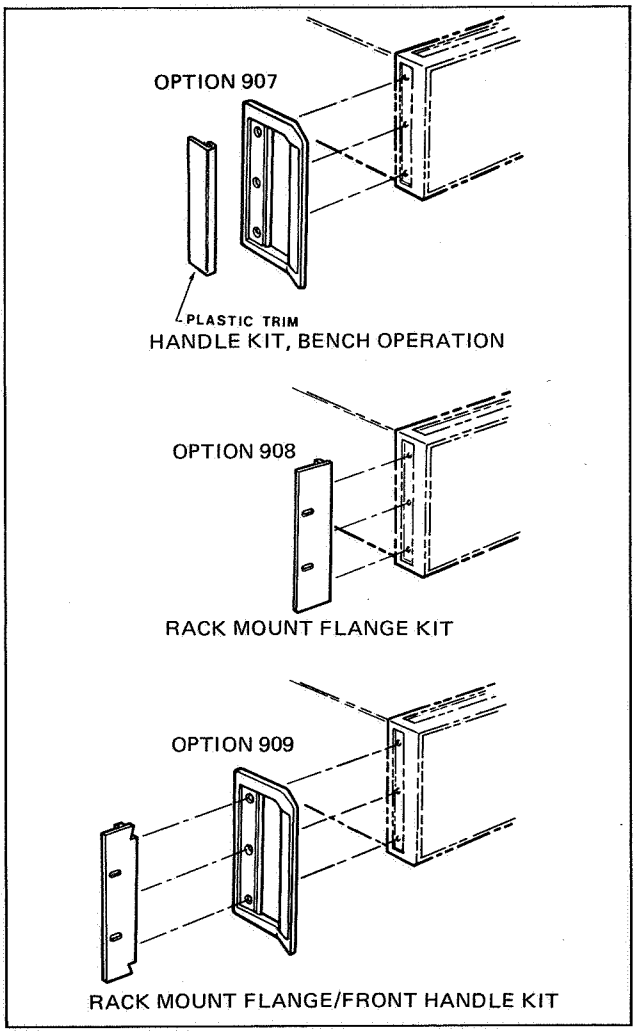


Figure 2-3. Rack Mount and Handle Kits.

ment can be rack mounted with or without a handle kit by use of the following items:

a. Rack mounting without handles: use Rack Mount Flange Kit -hp- Part No. 5061-0077 (Option 908).

b. Rack mounting with handles: use the combination Rack Mount Flange/Front Handle Kit -hp- Part No. 5061-0083 (Option 909).

NOTE

The Rack Mount Flange Kit of item a will not provide the space requirement for rack mounting when used with the bench handle assembly (-hp- Part No. 5060-9899, Option 907). To rack mount with handles, the combination kit of item b (Option 909) must be used (see Figure 2-3). If either Option 908 or 909 is ordered, the corresponding kit is shipped with the instrument. Otherwise, both kits are available separately by their -hp- part numbers.

CAUTION

If instrument is to be rack mounted, do not install standard slide kit. Use of a slide kit blocks air passage to the side mounted fan and will cause excessive heating to occur within the instrument.

2-30. STORAGE AND SHIPMENT.

2-31. Environment.

2-32. The instrument should be stored in a clean, dry environment. The following environmental limitations apply to both storage and shipment:

Temperature. . . . . -40°C to +75°C
Humidity. . . . . <95% relative
Altitude. . . . . <25,000 feet

2-33. Packaging.

2-34. Original Packaging. Containers and materials equivalent to that used in factory packaging are available through Hewlett-Packard offices. If the instrument is being returned to Hewlett-Packard for servicing, attach a tag indicating the type of service required, return address, model number, and full serial number. Also, mark the container FRAGILE to assure careful handling. In any correspondence, refer to the instrument by model number and full serial number.

2-35. Other Packaging. The following general instructions should be used for repackaging with commercially available materials.

a. Wrap the instrument in heavy paper or plastic. (If shipping to a Hewlett-Packard office or service center, attach a tag indicating the type of service required, return address, model number, and full serial number.)

b. Use a strong shipping container. A doublewall carton made of 250-pound test material is adequate.

c. Use enough shock-absorbing material (3-to-4 inch layer) around all sides of the instrument to provide firm cushion and prevent movement inside the container. Protect the control panel with cardboard.

d. Seal the shipping container securely.

e. Mark the shipping container FRAGILE to assure careful handling.

SECTION III
OPERATING INSTRUCTIONS

3-1. INTRODUCTION.

3-2. This section contains operating and programming instructions for the -hp- Model 3335A Synthesizer/Level Generator. Included is a description of controls, connectors and indicators, operating instructions and operator's maintenance. A list of operating features is tabulated in Table 3-1 which can be used as an index to locate operating information.

3-3. PANEL FEATURES.

3-4. Figure 3-2 illustrates and describes the function of all front and rear panel controls, connectors and indicators. Items requiring additional description are referenced to paragraphs in the operating instructions.

3-5. OPERATOR'S MAINTENANCE.

3-6. Operator's maintenance of the -hp- Model 3335A Synthesizer/Level Generator is limited to rear panel power line fuse replacement.

CAUTION

When replacing fuses, always verify the replacement fuse is of the correct amperage and is FAST-BLO.

3-7. POWER/WARM-UP.

3-8. The Model 3335A Synthesizer/Level Generator requires a power source of 100, 120, 220 or 240 V ac, + 5%, - 10%, 48 to 66 Hz single phase. The selection of line voltage and input power fuse is described in Section II, Paragraph 2-5, PREPARATION FOR USE.

3-9. The 3335A has a two-position power switch, STBY and ON. It is important that the instrument remain connected to the power source in the STBY mode when not in use. This supplies power to the crystal oven maintaining a constant oven temperature thus eliminating the need for a long warm-up period. When the STBY mode is not used and power is disconnected from the instrument, allow 30 minutes from the application of external power in the ON mode for the instrument to warm up.

3-10. Modes of Operation.

3-11. There are two manual modes of operation and an automatic sweep mode of operation for the Model 3335A Synthesizer/Level Generator. One manual mode is manual tune operation allowing the user to manually tune any frequency in the 3335A's range. The other manual mode is the manual sweep mode which allows the user to manually sweep the frequency between predetermined end points. The automatic sweep mode allows the user to initiate a single sweep or a continuous sweeping output. The automatic sweep modes are remotely programmable through the HP-IB.

3-12. OPERATING INSTRUCTIONS.

3-13. Operating the Model 3335A Synthesizer/Level Generator requires programming the operating parameters by use of front panel keys. These keys are contained in four major groupings. From left to right across the front panel the groups are:

Table 3-1. Operating Information Index.

Operating Item	Paragraph
Frequency Entry	3-26
Frequency Increment Entry	3-28
Amplitude Entry	3-30
Amplitude Increment Entry	3-33
Phase Increment Entry	3-35
Phase/Phase Increment Displays	3-37
Preset Entries	3-39
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Recalling Data from a Preset Register	3-43
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Front Panel Output Connectors	3-56
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Programming	3-78
Programming the Increment Functions	3-84
Unaddressed or Local Operation when connected to the HP-IB	3-86
Communications Features	3-88

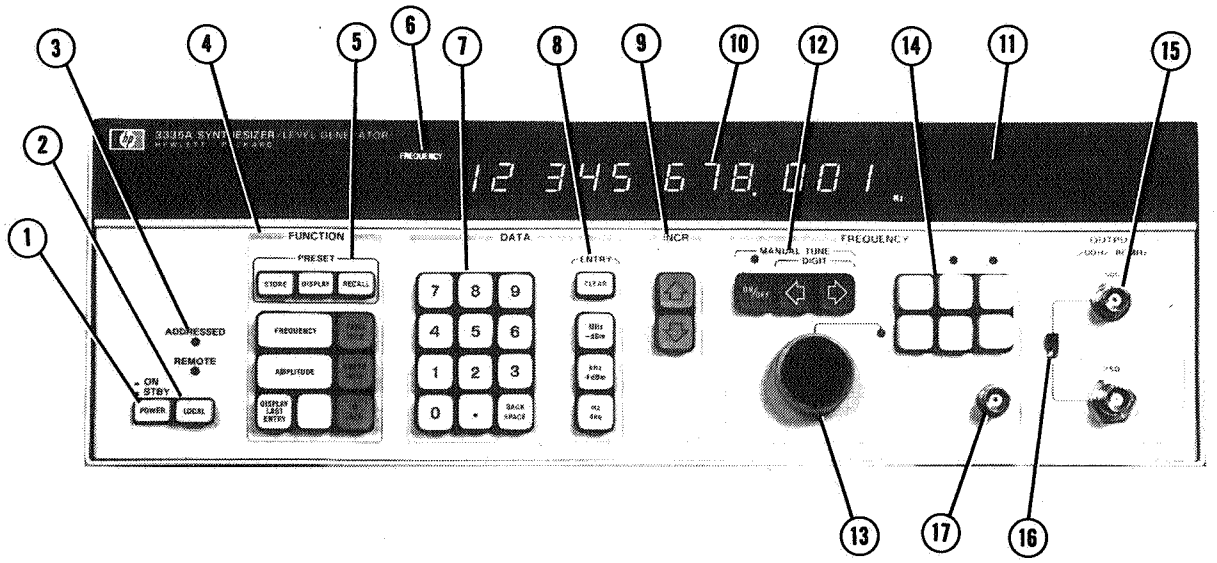
a. FUNCTION
b. DATA
c. INCR
d. FREQUENCY

3-14. FUNCTION Keys.

3-15. The FUNCTION keys control which operating parameter is displayed. Within the FUNCTION group is a subgroup called PRESET. This subgroup controls ten storage registers each capable of storing all of the operating parameters of the FUNCTION group. This is useful for recalling a particular set of operating parameters without having to enter each one.

3-16. DATA Keys.

3-17. The DATA keys are used to enter a new operating parameter which is selected by the FUNCTION keys. This group contains a subgroup called ENTRY. The ENTRY



1. POWER Switch. A two position switch (ON and STBY) for controlling line power. In the STBY position, power is applied to the internal temperature-stabilized crystal oven to maintain the operating temperature. This eliminates the need for long warm-up periods when the instrument is turned on. Additionally, unregulated 8 V is present on the Controller and Attenuator Driver Assemblies in the STBY mode.

2. LOCAL Switch. Returns the instrument to local control when operated remotely and Local Lockout command has not been issued.

3. HP-IB Annunciators. Indicates when the instrument is under remote control and if it is addressed to listen.

4. FUNCTION Keys. Used to display a particular operating parameter or preface a data entry.

5. PRESET Keys. Provide access to ten storage registers each capable of storing all operating parameters of the FUNCTION group.

6. Annunciator Group 1. Indicates the operating parameter being displayed. Annunciators consist of CENTER, FREQUENCY, SWP WIDTH, AMPLITUDE, Ø and INCR.

7. DATA Keys. Used to make data entries.

8. DATA ENTRY Keys. Used to complete a data entry.

9. INCR Keys. Used to initiate a frequency, amplitude or phase increment.

10. Numeric Display. Indicates the magnitude (and polarity if applicable) of the parameter being displayed.

11. Annunciator Group 2. Indicates the units of the operating parameter displayed (MHz, kHz, Hz, dBm or deg). Also contains the annunciators ENTRY, UNLOCKED, SWEEPING and UNLEVELED.

12. Manual Tune Keys. Initiates the manual tune frequency mode and establishes the degree of resolution of the manual tuning.

13. Frequency Tune Knob. Used to manually alter the frequency when in the manual tune or manual sweep mode.

14. Sweep Keys. Initiates and controls the frequency sweep mode of operation.

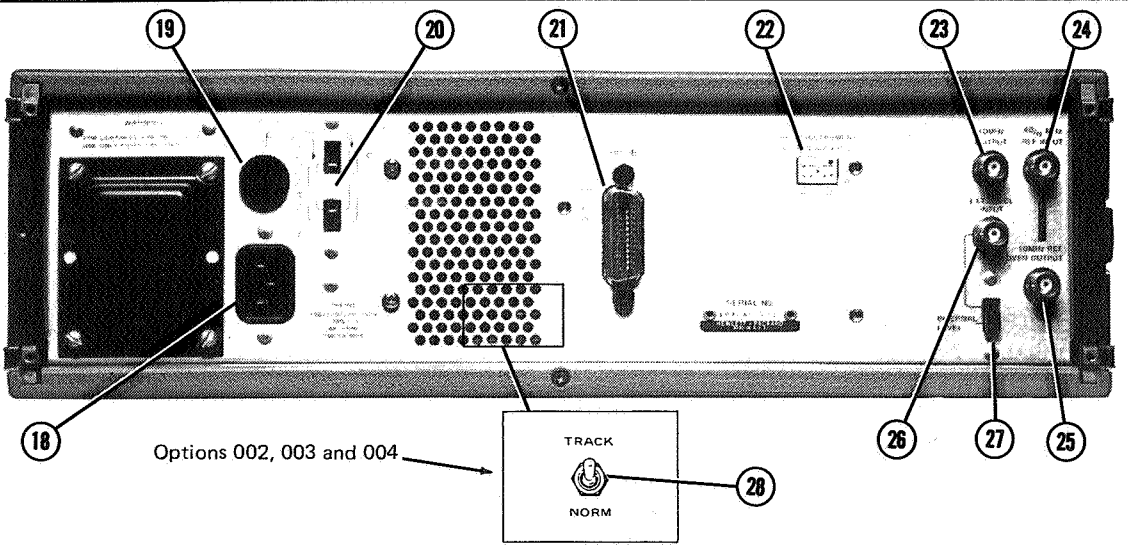
15. Output Connectors. Provides the programmed output at the output impedance selected by the front panel impedance switch.

16. Impedance Switch. Used to select the desired output impedance. This switch determines which output connector (item 15) is active.

17. SWEEP OUTPUT Connector. Provides a 0 to + 2 V dc sweep ramp for use in driving external equipment (oscilloscope, X–Y recorder, etc.) when in the sweep mode.

⚠ Symbol. This symbol is an international symbol meaning "refer to the Operating and Service Manual". This symbol appears in this section of the manual flagging operating instruction information.

Figure 3-1. Front and Rear Panels.



(18) AC Line Input Connector.

(19) AC Line Fuse.

(20) Line Voltage Selection Switches. Used to select the ac line input for the voltage of the power source.

(21) HP-IB Connector. Used to interface the instrument with the HP-IB for remote operation.

(22) HP-IB Listen Address Selection Switches. Used to set the instrument listen address.

(23) 10 MHz OUTPUT Connector. Provides a 10 MHz external reference signal generated by the instrument's reference section.

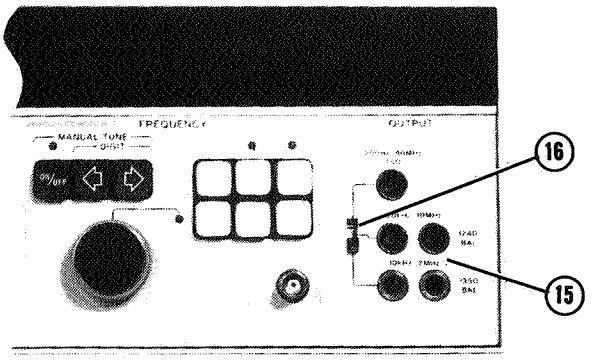
(24) 40/N MHz REF INPUT Connector. Provides the input to the reference section sampling detector to phase-lock the master oscillator. The notation 40/N MHz means this input must be a subharmonic of 40 MHz. The input can be the internal 10 MHz crystal oscillator from the REF OUTPUT (item 25) or an external standard.

(25) 10 MHz REF OVEN OUTPUT Connector. Provides the output from the temperature-stabilized crystal oscillator. It is coupled to the 40/N MHz INPUT connector (item 24) to supply the reference signal when an external standard is not used.

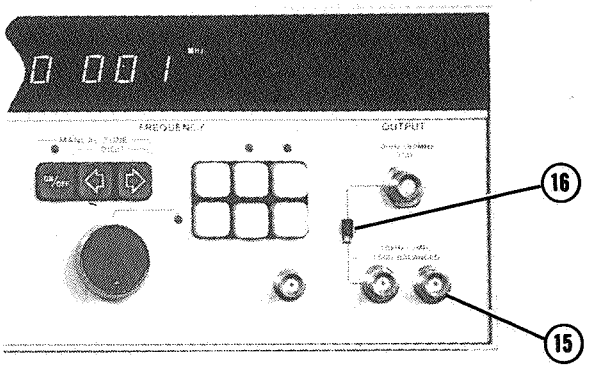
(26) EXT LEVEL INPUT Connector. Provides a means of controlling amplitude by use of an external amplitude reference.

(27) LEVELING Switch. Activates the EXT LEVEL INPUT when in the top position. When in the INTERNAL LEVEL position, leveling is controlled by the instrument.

(28) TELECOMMUNICATIONS SWEEP Switch. In Track position, alters the AUTO sweep by slowing it to ≈ 4 sec per step and blanking the amplitude during frequency changes. (Options 002, 003 and 004 only.)



Option 002/004: Front Panel.



Option 003: Front Panel

Figure 3-1. Front and Rear Panels (Cont'd).

keys are used to complete a data entry or to clear an entry made in error. The FUNCTION and DATA groups together are used to program the operating parameters.

3-18. INCR Keys.

3-19. There are two keys in the INCR group—an arrow up and an arrow down. These keys are used to increment the frequency, amplitude or phase (whichever function is displayed), by the increment parameter programmed from the FUNCTION group. The key pressed determines the direction the increment is made.

3-20. FREQUENCY Keys.

3-21. The FREQUENCY keys are divided into two sub-

groups, MANUAL TUNE and SWEEP. Below the MANUAL TUNE keys is a tuning knob. When the MANUAL TUNE function is selected, a "flashing" digit appears on the display. The left and right arrow digit keys can be used to select any digit to be the "flashing" digit. Turning the knob changes the frequency by the resolution of the "flashing" digit.

3-22. The SWEEP subgroup allows the frequency to automatically sweep a programmed set of frequencies determined by the frequency of operation (center frequency) and the SWEEP WIDTH programmed from the FUNCTION group. A manual sweep mode allows the user to manually sweep the programmed set of frequencies. To return to keyboard operation of the other key groups, the STOP key in the SWEEP subgroup must be pressed.

3-23. Turn-On Operating Parameters.

3-24. When the Model 3335A is turned on, the output parameters of the FUNCTION group initially are:

Frequency	1 000 000. 0 Hz
Amplitude	- 86.98 dBm (50 Ω) - 88.74 dBm (75 Ω)
FREQ INCR	1.0 Hz
AMPTD INCR	1.0 dB (Note: For AMPTD INCR display, the annunciator dBm is used for dB)
Ø INCR	1.0 deg
SWEEP WIDTH	100.0 Hz

3-25. The 3335A turns on with the frequency displayed. To check the initial conditions of the other operating parameters, press the key in the FUNCTION group of the parameter of interest. The display should indicate the initial conditions stated in the preceding paragraph. If the instrument was not previously connected to a power source and in STBY, the out-of-lock annunciator "UNLOCKED" will be displayed until the reference oven temperature stabilizes (< 20 minutes). If "UNLOCKED" is still displayed after twenty minutes, check to be sure the BNC-to-BNC adapter from the 10 MHz REF OVEN OUTPUT connector to the 40/N MHz Ref Input has been installed (see Figure 6-2, Item 25).

3-26. Frequency Entry.

3-27. The 3335A has a frequency range of 200 Hz to 80 099 999. 999 Hz with resolution of 0.001 Hz. The desired output frequency is programmed by activating the FREQUENCY FUNCTION key, DATA keys 0 through 9 and a DATA ENTRY key Hz, kHz or MHz. A description of these keys and the frequency display indicators follows.

NOTE

For the following Operating Instructions, refer to Figure 3-1.

FREQUENCY Key. Preface key for entering frequency. When pressed, the front panel displays the present output frequency and the controller is enabled to accept new frequency data.

DATA Keys. These keys are used to enter the desired frequency. Notice that when data is entered, the digits enter the display from right to left. Holding a digit key down causes that digit to be entered respectively. If a wrong digit is entered, press the BACK SPACE key and the right-most digit of the display (the last digit entered) will be deleted. Continue with the correct entry.

DATA ENTRY Keys. If an entry is completely in error, the CLEAR key can be used to reset the display entry to zero. The correct entry can then be made. An entry is finalized by pressing one of the three range keys. The display changes to indicate the new output frequency. If an illegal entry has been finalized, the output frequency does not change and the display flashes.

DISPLAY INDICATORS:

FREQUENCY Indicator. Indicates the front panel is displaying the output frequency or a frequency entry.

ENTRY Indicator. Indicates the front panel is not displaying the output frequency but holding a frequency entry that has not yet been finalized by a data entry key.

The numeric display indicates the output frequency programmed. The digits are entered from right to left as frequency digits are keyed in. The frequency can be displayed in Hz, kHz or MHz dependent on which range key is pressed. The units of the display can be changed at any time by pressing the desired range key.

Example:

Program a frequency of 12345678.901 Hz

Display Result: 12 345 678.901 Hz

Change units to kHz: Press kHz ENTRY key.

Display Result: 12 345.678 901 kHz

Change units to MHz: Press MHz ENTRY key.

Display Result: 12.345 678 901 MHz

NOTE

If the front panel is displaying frequency, it is not necessary to preface a frequency entry with the FREQUENCY key.

3-28. Frequency Increment Entry.

3-29. Frequency increment is used when it is desired to manually change the frequency by a specified increment. The desired frequency increment is programmed by activating the FREQ INCR FUNCTION key, DATA keys 0 through 9 and a DATA ENTRY key Hz, kHz or MHz just as the frequency was programmed. A frequency increment of zero (no increment) can be programmed while the maxi-

mum increment programmable is the maximum output frequency of 80 099 999. 999 Hz. Trying to program an increment greater than the maximum results in a flashing display indicating an illegal entry. To change the output frequency by the programmed increment, the INCR keys are activated incrementing the frequency either up or down. A description of the keys and frequency step display indicators follows.

KEYS:

FREQ INCR Key. Preface key for entering frequency increment. When pressed, the front panel displays the present frequency increment and the controller is enabled to accept new frequency increment data.

DATA Keys. Used to enter the desired frequency increment.

DATA ENTRY Keys. Used to finalize the frequency increment entry. If an increment is programmed that exceeds the maximum, the display flashes indicating an illegal entry.

INCR Keys. These keys are used to change the output frequency by the programmed increment. The frequency can be incremented either up or down dependent upon the INCR key activated. If an INCR key is held activated, the frequency continues to be incremented providing a step frequency sweep. The magnitude of each step is determined by the frequency increment programmed.

DISPLAY INDICATORS:

FREQUENCY INCR Indicator. Indicates the front panel is displaying the present frequency increment or a frequency increment entry.

ENTRY INDICATOR. Indicates the display holds a frequency increment entry not yet finalized by a data entry key.

The numeric display indicates the frequency increment programmed. Can be displayed in kHz or MHz by pressing the desired range key.

Example:

Program a frequency increment of 12500 Hz.

Display Result: 12 500. 0 Hz

Display present frequency by pressing FREQUENCY FUNCTION key.

Display Result: Present frequency is displayed.

NOTE

This step can be omitted and the frequency incremented by pressing an INCR key even though FREQ INCR is displayed.

Increment the frequency by pressing the INCR down arrow.

Display Result: Present frequency is decreased by 12 500.0 Hz

Return to initial frequency by pressing the INCR up arrow.

Display Result: Initial frequency is displayed.

NOTE

If the front panel is displaying frequency increment, it is not necessary to preface a frequency increment entry with the FREQ INCR key.

3-30. Amplitude Entry.

3-31. The 3335A Amplitude limits are determined by the output impedance selected. In the standard instrument a 50 ohm or 75 ohm output impedance can be chosen. With a 50 ohm output, the amplitude range is - 86.98 dBm to + 13.01 dBm. For a 75 ohm output, the amplitude range is - 88.74 dBm to + 11.25 dBm. Any amplitude within the range can be programmed with 0.01 dBm resolution. For option 002, 003 or 004 instrument amplitude ranges, refer to Table 1-2, General Information.

3-32. The desired output amplitude is programmed by activating the AMPLITUDE FUNCTION key, DATA keys 0 through 9 and a DATA ENTRY key - dBm or + dBm. A description of these keys and the amplitude display indicators follows:

KEYS:

AMPLITUDE Key. Preface key for entering amplitude. When pressed, the display indicates the present output amplitude and the controller is enabled to accept new amplitude data.

DATA Keys. These keys are used to enter the desired amplitude.

DATA ENTRY Keys. Used to finalize the amplitude entry. If an amplitude is programmed which exceeds the range of the instrument, the output amplitude does not change and the display flashes.

DISPLAY INDICATORS:

AMPLITUDE Indicator. Indicates the front panel is displaying the present output amplitude or an amplitude entry.

ENTRY Indicator. Indicates the display holds an amplitude entry not yet finalized by a data entry key.

The numeric display indicates the amplitude programmed.

Example:

Program an amplitude of - 23.45 dBm.

Display Result: - 23.45 dBm

NOTE

1. It is normal to hear relay operation when the attenuator changes attenuator pads.

2. If the front panel is displaying amplitude, it is not necessary to preface and amplitude entry with the AMPLITUDE key.

3. With a negative amplitude displayed, depressing the BACK SPACE key will cause an ENTRY preceded by a negative sign. With this type of amplitude entry displayed, the "–dBm" and "+dBm" entry keys will both finalize a negative amplitude.

3-33. Amplitude Increment Entry.

3-34. Amplitude increment is used when it is desired to manually change the amplitude by specific increments. The desired amplitude increment is programmed by activating the AMPTD INCR FUNCTION key, DATA keys 0 through 9 and a DATA ENTRY key, - dBm or + dBm. If an amplitude increment greater than 99.99 dBm is programmed, the display flashes indicating an illegal entry. A description of the keys and amplitude increment display indicators follows.

KEYS:

AMPTD INCR Key. Preface key for entering amplitude increment. When pressed, the front panel displays the present amplitude increment and the controller is enabled to accept new amplitude increment data.

DATA Keys. These keys are used to enter the desired amplitude increment.

DATA ENTRY Keys. Used to finalize the amplitude increment entry. If an increment is programmed that exceeds the maximum, the display flashes indicating an illegal entry.

INCR Keys. These keys are used to change the output amplitude by the programmed increment. By holding an INCR key activated, the amplitude can be stepped through an amplitude sweep.

DISPLAY INDICATORS:

AMPLITUDE INCR Indicator. Indicates the front panel is displaying the present amplitude increment or an amplitude increment entry.

ENTRY Indicator. Indicates the display holds an amplitude increment entry not yet finalized by a data entry key. The numeric display indicates the amplitude increment programmed.

NOTE

Amplitude increment is actually in dB but the dBm annunciator is used.

Example:

Program an amplitude increment of + 2.75 dBm.

Display Result: 2.75 dBm

Display present amplitude, press AMPLITUDE FUNCTION key.

Display Result: Present Amplitude display

Increment amplitude by pressing the INCR up arrow.

Display Result: Present amplitude is incremented by 2.75 dBm.

3-35. Phase Increment Entry.

3-36. The phase increment can be used to change the output phase relationship with respect to another signal by a fixed phase increment. As an example, the 10 MHz rear panel output and the front panel output signal have a certain phase difference at turn-on. By phase incrementing the output, the output signal will increase or decrease the initial phase difference by the magnitude of the phase increment programmed. An example of using the phase increment function is illustrated in the integrated phase noise test of Section V. The desired phase increment is programmed by activating the Ø INCR FUNCTION key, DATA keys 0 through 9 and the deg DATA ENTRY key. An increment range of 0 degree to 360 degrees is obtainable with a resolution of 0.1 degree. Any increment attempted greater than 360 degrees causes the display to flash indicating an illegal entry. A description of the keys and the Ø and Ø increment displays follows.

KEYS:

Ø INCR Key. Preface key for entering phase increment. When pressed, the front panel displays the present phase increment and the controller is enabled to accept new phase increment data.

DATA Keys. These keys are used to enter the desired phase increment.

DATA ENTRY Key. Used to initialize the phase increment entry. If an increment is entered exceeding 360 degrees, the display flashes when the ENTRY key is pressed.

DISPLAY INDICATORS:

Ø INCR Indicator. Indicates the front panel is displaying the present phase increment or a phase increment entry.

∅ Indicator. Indicates the phase difference introduced with respect to the initial phase of the present frequency. This indicator appears when an INCR key is pressed when ∅ INCR is displayed.

ENTRY Indicator. Indicates the display holds a phase increment entry not yet finalized by a data entry key.

The display indicates the phase increment programmed.

Example:

Program a phase increment of 45.0 degrees.

Display Result: 45.0 deg

Press the INCR up arrow two (2) times.

Display Result: Display annunciator shows ∅ and display shows 90.0 deg.

NOTE

If an INCR key is held, the output is phase incremented continuously.

3-37. Phase/Phase Increment Displays.

3-38. When the display indicates the ∅ difference introduced by the phase increment and a new phase increment entry is made which is not prefaced by the ∅ INCR key, the display automatically reverts to a ∅ INCR display. The entry can be finalized like any other phase increment entry. Therefore, if the display is indicating phase, a phase increment entry need not be prefaced by the ∅ INCR key.

3-39. Preset Entries.

3-40. All operating parameters of the FUNCTION group can be stored in one of ten PRESET registers. The ten registers are numbered 0 through 9 and are capable of storing ten different sets of the operating parameter's frequency, amplitude, frequency increment, amplitude increment, phase increment and sweep width. At turn-on, all registers contain the turn-on operating parameters. The PRESET keys which control the registers are STORE, DISPLAY and RECALL. A description of the PRESET keys follows.

KEYS:

STORE Key. Used to store the operating parameters of the front panel output. The digit key of the register to store the parameters must be pressed following the STORE key. This stores the operating parameters frequency, amplitude, frequency increment, amplitude increment, phase increment, sweep width, and the state of the manual tune control without affecting the output signal.

RECALL Key. Used to recall the operating parameters of a particular register. The digit key of the register containing the operating parameters desired must be pressed following the RECALL key. This changes the amplitude and frequency of the output signal to that stored in the register. It also changes all other FUNCTION parameters to that stored in the register (e.g., AMPTD INCR, FREQ INCR, ∅ INCR and SWEEP WIDTH).

DISPLAY keys. Used to display a particular operating parameter stored in a register. Displaying a parameter does not change the output signal but is displayed as an entry. This entry can be finalized by pressing a DATA ENTRY key.

Example.

Preset the following operating parameters in storage register 2.

FREQUENCY	2 MHz
AMPLITUDE	2 dBm
FREQ INCR	200 Hz
AMPTD INCR	0.2 dBm
∅ INCR	2 degrees
SWEEP WIDTH	2 kHz

Preset the following operating parameters in storage register 3.

FREQUENCY	3 MHz
AMPLITUDE	3 dBm
FREQ INCR	300 Hz
AMPTD INCR	0.3 dBm
∅ INCR	3 deg
SWEEP WIDTH	3 kHz

First program all parameters; then press STORE 2.

NOTE

In the examples for STORE 2 and STORE 3, different parameters are displayed when the STORE key is pressed to preset the register. SWEEP WIDTH is displayed when STORE 2 is pressed. ϕ INCR is displayed when STORE 3 is displayed. In the next two examples, the RECALL function is illustrated. When data is recalled from a preset register, the parameter displayed when that register was preset is the parameter returned to the display. In the case of RECALL 2, SWEEP WIDTH will be returned to the display. All other parameters will be changed to that preset in register 2. For the RECALL 3 case, ϕ INCR will be returned to the display. All other parameters will be changed to that preset in register 3.

Recall parameters of register 2 by pressing RECALL 2.

Result: Display indicates SWEEP WIDTH of 2.0 kHz. When this set of parameters was stored, SWEEP WIDTH was last displayed. When recalled, the parameter last displayed at STORE is returned to the display.

Check the other operating parameters in register 2 by pressing their respective FUNCTION key. The display should indicate the quantities previously programmed.

Recall the operating parameters of register 3 by pressing RECALL 3.

Result: Display indicates ∅ INCR of 3.0 deg (∅ INCR was the parameter displayed when STORE 3 was initiated).

Check other operating parameters in register 3 as previously done for register 2.

Display the frequency of register 2 without changing the output frequency by pressing DISPLAY, FREQUENCY, 2.

Display Result: FREQUENCY 2 000 000. 0 ENTRY (This frequency can be initiated by activating a DATA ENTRY key.)

Initiate by pressing the Hz DATA ENTRY key.

Display result: 2 000 000. 0 Hz

Recall the operating parameters of register 4 by pressing RECALL 4.

Result: FREQUENCY 1 000 000. 0 Hz (This is an initial turn-on condition. The other operating parameters stored in register 4 are also initial conditions. When a register containing initial conditions is recalled, FREQUENCY is displayed.)

3-41. Merging Data Into a Preset Register.

3-42. Any operating parameter stored in a PRESET register can be changed by merging the new parameter into the register without changing the other parameters of the stored sets. This allows the user to change a parameter in a PRESET register and only be concerned with the parameter being changed. Merging a parameter is done much like storing a complete parameter set as described in the preceding paragraph. The difference is the function key, corresponding to the parameter to be merged, is pressed prior to the register number key. Several examples of merging data follow.

EXAMPLE:

Recall from the previous examples that all parameters in PRESET register 2 contain two's and those in PRESET register 3 contain three's.

Change the frequency in PRESET register 2 to 4 MHz and the amplitude increment of register 3 to 0.6 dBm by pressing FREQUENCY, 4 MHz, STORE, FREQUENCY, 2 an and AMPTD INCR, 0.6, + dBm, STORE AMPTD INCR, 3.

Verify these parameters have been merged by displaying each parameter after recalling registers 2 and 3.

3-43. Recalling Data From a Preset Register.

3-44. Any operating parameter stored in a PRESET register can be recalled individually without recalling the entire parameter set. This allows the user to change an output parameter by recalling only that parameter from one of the ten PRESET registers. This is done like the merging of data. The function key, corresponding to the parameter to be recalled, is pressed prior to the register number key. Several examples of recalling a single parameter follow.

EXAMPLE:

Press RECALL 5.

Display Result: Display indicates a frequency of 1 MHz and all operating parameters are initial conditions.

Recall the frequency increment of PRESET register 2 by pressing RECALL, FREQ INCR, 2.

Display Result: Display indicates a frequency increment of 200 Hz. All other parameters are still initial conditions.

Recall the amplitude of PRESET register 3 by pressing RECALL, AMPLITUDE, 3.

Display Result: Display indicates amplitude of + 3 dBm. All other parameters except frequency increment are initial conditions. Frequency increment is 200 Hz.

3-45. Display Last Entry.

3-46. The DISPLAY LAST ENTRY KEY of the FUNCTION group is used to recall to the display the last entry made. It will not recall the function the entry was made in but only the digits. If an operating parameter from one of the ten storage registers is displayed as an entry by activating the DISPLAY key of the PRESET FUNCTION keys, it becomes the last entry. Conversely, when the CLEAR key is pressed, the display shows an entry of zero but this does not constitute a last entry. This is because a display entry cleared in error can be recalled by pressing the DISPLAY LAST ENTRY key.

3-47. Sweep Width Entry.

3-48. In the sweep mode, the 3335A frequency can be swept over a specific range. The operating frequency before the sweep mode is the center frequency of the sweep. The starting point of the sweep is determined by the sweep width programmed. Half the sweep occurs below the center frequency and half above the center frequency. The sweep width is programmed by activating the SWEEP WIDTH FUNCTION key, DATA keys 0 through 9 and a DATA ENTRY key Hz, kHz or MHz. Programming a sweep width greater than the instrument's capability causes the display to flash indicating an illegal sweep. A description of the keys and the sweep width display indicators follows.

KEYS:

SWEEP WIDTH Key. Preface key for entering sweep width. When pressed the front panel displays the present sweep width and the controller is enabled to accept new sweep width data.

DATA Keys. These keys are used to enter the desired sweep width.

DATA ENTRY Keys. Used to finalize the sweep width entry.

DISPLAY INDICATORS:

SWEEP WIDTH Indicator. Indicates the front panel is displaying the present sweep width or a sweep width entry.

ENTRY Indicator. Indicates the display holds a sweep width entry not yet finalized by a data entry key.

The numeric display indicates the sweep width programmed.

Example:

Program a sweep width of 580.34 kHz

Display Result: 580.34 kHz.

3-49. Manual Frequency Tune.

3-50. The frequency can be manually altered in the manual tune mode. The frequency change is controlled by a front panel frequency knob. The 3335A can be put in the manual tune mode by the MANUAL TUNE ON/OFF key. When the manual tune key is activated, an annunciator above the key is illuminated.

3-51. In addition to the ON/OFF key, the MANUAL TUNE controls include two digit keys, a left arrow and a right arrow. These keys are used to select the sensitivity of the manual tune knob. When the manual tune mode is first activated, the fourth digit from the right flashes. The frequency can be changed with the sensitivity of the flashing digit by turning the frequency knob. For more or less sensitivity, the flashing digit can be moved using the left and right digit arrows. Holding an arrow key down causes the flashing digit to step successively to the end digit. When in the MANUAL TUNE mode, the frequency can be incremented by the frequency increment using the INCR keys and all operating parameters can be checked using the FUNCTION keys. A description of the MANUAL TUNE controls follows.

KEYS:

MANUAL TUNE ON/OFF. This key activates the manual tune mode. When on, an annunciator above the key is illuminated.

LEFT ARROW Digit Key. Steps flashing digit to the left.

RIGHT ARROW Digit Key. Steps flashing digit to the right.

Frequency manual tune knob. Used to change the frequency with the sensitivity of the flashing digit.

3-52. Sweep Mode.

3-53. The sweep mode can be used to sweep the output frequency over a specified center frequency. This mode of operation is controlled by the FREQUENCY SWEEP keys which include GO TO START FREQ, START SINGLE 10 SEC, START SINGLE 50 SEC, MANUAL, START AUTO and STOP. A SWEEP OUTPUT connector below the keys provides an output proportional to the sweep frequency for use with a plotter. The frequencies of a frequency sweep are determined by the sweep width and center frequency. The sweep rate in AUTO is approximately 8 sweeps/second, 100 steps/sweep. In MANUAL, 10 SEC and 50 SEC sweeps, the sweep contains 1000 steps.

NOTE

Whenever the -hp- 3335 sweeps through either 20 MHz or 40 MHz, the amplitude of the output will drop severely for approximately 5 msec. Other, much less drastic amplitude discontinuities may be observed. When the instrument sweeps through 10 MHz, 14 MHz, 28 MHz and 56 MHz.

KEYS:

GO TO START FREQ Key. This key is used to display and output the starting frequency of the sweep. The starting frequency is determined by the center frequency and the sweep width. Half the sweep, determined by the sweep width, is below the center frequency establishing the start frequency.

START SINGLE 10 SEC Key. This key is used to initiate a single sweep beginning at the start frequency below the center frequency. The time for the sweep to go from start to finish is approximately 10 seconds and consists of 1000 steps. When the sweep is in this mode, an annunciator above the key is illuminated. The sweep rate can be changed during the sweep by pressing the 50 SEC key or can be stopped by pressing the STOP key. Pressing the AUTO key will put the sweep into auto sweep. During any sweep, depressing a key outside the frequency sweep group has no effect on operation.

START SINGLE 50 SEC Key. This key is used to initiate a single sweep which requires approximately 50 seconds to complete and consists of 1000 steps.

START AUTO Key. This key is used to initiate the sweep which sweeps continuously from the start frequency to the upper limit. The sweep resets to the start frequency when the upper limit is reached and again sweeps up in frequency at a rate of approximately 8 sweeps/second and 100 steps/sweep. The frequency is only swept in the increasing frequency direction in both the single sweep or auto sweep modes. When the instrument is in the auto sweep mode, the display is blank except for the SWEEPING annunciator. The STOP key must be used to exit an auto sweep.

MANUAL key. This key is used to put the sweep into a manual sweep mode. When activated, an annunciator is illuminated to the left of the MANUAL key. The frequency sweep between the start frequency and upper limit can be manually controlled by the frequency knob making 1000 steps between the two limits. When either the upper limit or start frequency is reached, the manual sweep stops. When the frequency knob is rotated changing the frequency, the display segments and annunciators may dim slightly.

STOP Key. This key is used to stop a single sweep before it is complete or to halt an auto sweep and return to keyboard control. When pressed the frequency is returned to the center frequency which was the frequency of operation prior to activating the sweep mode.

SWEEP OUTPUT: The sweep output provides a dc voltage from 0 to + 2 V. 0 V dc corresponds to the start frequency of the sweep and + 2 V the upper limit. During the sweep the output is proportional to the frequency and can be used to drive the horizontal axis of a plotter or an oscilloscope. When the instrument is not in the sweep mode, the SWEEP OUTPUT is + 1 V dc. When GO TO START FREQ is pressed, the instrument displays the start frequency of the sweep and the SWEEP OUTPUT is 0 V. After a single sweep is complete and the upper limit is displayed, the SWEEP OUTPUT is + 2 V dc. These points can be used to adjust the plotter end points.

DISPLAY INDICATORS:

NOTE

In any sweep mode, the frequency display is in hertz.

CENTER FREQUENCY Indicator. Indicates the front panel is displaying the center frequency of the sweep. When the frequency passes through the center frequency during a sweep, the CENTER annunciator flashes.

SWEEPING Indicator. Indicates the instrument is in the SWEEP mode. If the instrument is not in an active single sweep or in auto sweep (i.e., if it is in manual, at start frequency or at the end of a single sweep), pressing any key on the keyboard out of the sweep group will take the instrument out of the sweep mode.

Example:

Program the Synthesizer to sweep a 500 kHz band centered on 12 500 kHz.

Program the center frequency by programming a frequency of 12 500 kHz.

Display Result: 12500.0 kHz

Program the sweep width by pressing SWEEP WIDTH, 500, kHz.

Display Result: 500.0 kHz

Check START FREQ by pressing GO TO START FREQ.

Display Result: 12 250 000.0 Hz SWEEPING annunciator on.

Initiate a single 10 second sweep by pressing START SINGLE 10 SEC key.

Display Result: Annunciator above key illuminates, display shows frequency sweep which stops at 12 750 000.0 Hz. Sweep time is 10 seconds.

Initiate single 50 second sweep by pressing START SINGLE 50 SEC key.

Display Result: Annunciator above key illuminates, display shows frequency sweep which stops at 12 750 000.0 Hz. Sweep time is 50 seconds.

Initiate an Auto Sweep by pressing START AUTO key.

Display Result: Display blanks except for SWEEPING annunciator. (Instrument is continuously sweeping from start frequency to the upper limit.)

Stop Auto Sweep by pressing STOP key.

Display Result: Instrument returns to the center frequency. Display indicates 12 500. 0 kHz, SWEEPING annunciator extinguishes.

Initiate MANUAL Sweep by pressing MANUAL key.

Display Result: SWEEPING annunciator illuminates again. Annunciator next to MANUAL key illuminates.

Manually Sweep Frequency: Rotate frequency knob.

Display Result: Frequency increases and decreases with CW and CCW rotation of knob. CENTER annunciator flashes when sweep passes through 12 500. 0 kHz (the center frequency).

Press GO TO START FREQ key.

Display Result: 12 250. 0 kHz

Press MANUAL key of SWEEP group.

Display Result: No change in display.

Rotate frequency knob CW.

Display Result: Frequency increases.

Rotate frequency knob CCW.

Display Result: Frequency decreases until 12 250. 0 kHz (start frequency) is reached. Further CCW rotation of knob will not lower the frequency.

NOTE

The same result occurs at the upper limit of the sweep.

Return the instrument to full keyboard control by pressing the STOP key. This will result in returning to the center frequency.

NOTE

The single sweep speed of a sweep in progress can be changed by depressing the other single sweep key. To go from the single sweep mode to the auto sweep mode, it is recommended the STOP key be used to terminate the single sweep prior to activating the auto sweep mode.

3-54. HP-IB Indicators and LOCAL key.

3-55. The keyboard contains two HP-IB annunciators—REMOTE and ADDRESSED. One indicates when the 3335A is under remote control; the other indicates when the 3335A is addressed to listen by the HP-IB controller.

If the 3335A is under remote control, it can be returned to local control (control by keyboard inputs) by activating the LOCAL key providing a local lockout command has not been sent by the HP-IB system controller.

3-56. Front Panel Output Connectors.



The output of the -hp- 3335A is directly coupled. Do not allow external dc currents to develop more than 5 volts across the output terminals. For Option 002/004 and Option 003 the dc voltage across the output should not be greater than 10 volts.

3-57. The front panel contains the instrument output connectors located in the right-most group labeled OUTPUT and the SWEEP OUTPUT located in the FREQUENCY group. The output connectors provide the programmed output. The SWEEP OUTPUT provides a dc voltage between 0 and + 2 V proportional to the sweep when the Synthesizer is in the sweep mode. When not in the sweep mode the SWEEP OUTPUT is + 1 V. During the sweep, the SWEEP OUTPUT is proportional to the frequency and can be used to drive the horizontal sweep of a plotter or an oscilloscope.

3-58. Rear Panel BNC Connectors.

3-59. 40/N Input. This is the input for the reference frequency that essentially determines the frequency accuracy and stability of the -hp- 3335A. As the name of the input suggests, the reference frequency must be an integral sub multiple of 40 MHz (i.e., 40, 20, 13.333, 10, etc.). The 40 MHz master oscillator in the -hp- 3335A is phase locked to this signal. Lock will occur with 40/N INPUT levels as low as -7 dBm. When an external frequency reference is not used, the 10 MHz REFerence OVEN OUTPUT is coupled to this input with the BNC-to-BNC adapter.

3-60. 10 MHz REFerence OVEN OUTPUT. This is a reference frequency that is coupled to the 40/N INPUT whenever an external frequency reference is not used. When it is used, its accuracy and stability determine the accuracy and stability of the -hp- 3335A output frequency. The parameters of this output are described in Table 1-1. They depend on the Option selected.

3-61. 10 MHz OUTPUT. This output is used to lock the phase of other synthesizers to the phase of the -hp- 3335A. Its output level and output impedance are typically around 0 dBm and 50 ohms.

3-62. EXTernal LEVEL INPUT. This input is selected using the INTERNAL LEVEL/EXT LEVEL INPUT switch located on the rear panel. When it is selected, the dc level on this input determines the output amplitude. The sensitivity is non-linear, however, it is typically about .5 V rms output per dc volt input. With 0 volts dc on this input, the maximum output amplitude of the -hp- 3335A is nominally .5 volts rms into 50 ohms (or 75 ohms). An "UNLEVELED" annunciator on the front panel will light whenever this input is selected.

3-63. Remote Programming.

3-64. This part of Section III contains a brief description of the HP–IB operation and includes programming information for operating the Model 3335A on the HP–IB. It also includes information on the HP–IB connector, HP–IB logic levels and programming codes.

3-65. The HP–IB. The HP–IB is a carefully defined instrumentation interface which simplifies the integration of instruments, calculators and computers into systems. The 3335A is a fully programmable instrument interfacing with the HP–IB by means of a rear panel HP–IB connector (see Figure 3-1). The HP–IB connector is directly compatible with the mating connectors on the -hp- 10631 (A, B or C) HP–IB Cable Assemblies.

3-66. HP–IB Logic Levels. The 3335A HP–IB lines use standard TTL levels and are low-true. The logic levels are:

Low = digital ground or 0 V to +0.4 V dc
High = open or +2.5 V dc to +5 V dc

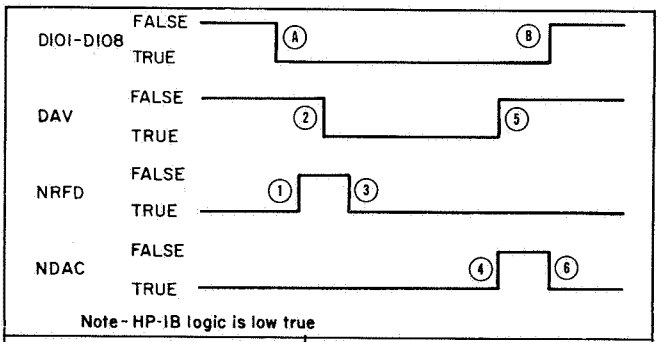
3-67. Isolation. The 3335A is located from the HP–IB by optical couplers. The components located on the HP–IB side of the optical couplers are powered by a separate + 5 V power supply deriving power from an ungrounded secondary transformer winding. This provides isolation of the instrument from the bus.

3-68. Capability. The capability of a device connected to the HP–IB is specified by its interface functions. The interface functions of the 3335A are listed in Table 3-2 and indicate the particular capability of that function as defined in Appendix C of IEEE Std 488-1975. The interface functions indicate what activity a device will respond to or that which it is capable of initiating. Each item indicating a device capability appears on the rear panel next to the HP–IB connector.

3-69. The instrument will recognize a preset "listen" address and accept bit-parallel, word (byte)-serial ASCII-coded data. All data is received through the Data Input/Output (DIO) lines of the HP–IB. The data transfer is controlled by "handshake" lines DAV, NRFD and NDAC. Figure 3-2 illustrates the "handshake" sequence of events and describes each event during the transfer of data. More detailed information is obtainable by ordering a copy of "Condensed Description of the Hewlett-Packard Interface Bus", -hp- Part No. 59401-90030, Microfiche Part No. 59401-90090.

Table 3-2. Interface Functions.

Identification	Description
SH0	No source handshake capability
AH1	Acceptor handshake capability
T0	No talker capability
L2	Basic listener
SR0	No service request capability
RL1	Remote/Local capability
PP0	No parallel poll capability
DC1	Device clear capability
DT0	No device trigger capability
C0	No controller capability



Note - HP-IB logic is low true

Event	Comment
(A) and (B)	The interval between A and B indicates when one byte of information is on the data lines, DIO1 through DIO8. **NOTE** *For the remainder of this explanation,, the term "data" refers to one byte of information (one seven-bit ASCII character).*
(1) NRFD goes false	Listener indicates he is ready to receive data.
(2) DAV goes true	Source recognizes listener is ready for data, places a new character on theDIO lines and indicates to the listener the data on the DIO lines is valid.
(3) NRFD goes true	Listener recognizes the data is valid and indicates to the source he is not ready for any new data. The listener accepts the data on the DIO lines to store internally after NRFD goes true.
(4) NDAC goes false	The listener indicates to the source that he has stored internally the data on the DIO lines. When the data is stored, internal processing begins.
(5) DAV goes false	Source recognizes that the listener has accepted and stored internally the data on the DIO lines. Source removes the data valid indication by setting DAV false in preparation for placing the next byte of information on the DIO lines.
(6) NDAC goes true	Listener recognizes that the source has acknowledged its acceptance of the data and removes the data accepted indication. Listener continues to process the internally stored data.
(1) NRFD goes false	When the listener completes processing the internally stored data, the listener sets NRFD false which indicates he is ready to receive the next byte of information.

NOTE: Events (1) through (6) must occur for each byte of information transferred between devices on the HP-IB.

Figure 3-2. HP-IB "Handshake" Sequence of Events.

Table 3-3. Bus Messages.

Function	Message	Description
Device Communications	Data	Transfers device-dependent information from one device to one or more devices on the Bus.
Device Control	Trigger	Causes a group of selected devices to simultaneously initiate a set of device-dependent actions.
	Clear	Causes an instrument to be set to a predefined state (a certain range, function, etc.).
	Remote	Permits selected devices to be set to remote operation, allowing parameters and device characteristics to be controlled by Bus Messages.
	Local	Causes selected devices to return to local (front panel) operation.
	Local Lockout	Disables local (front panel) controls of selected devices.
	Clear Lockout & Local	Returns all devices to local (front panel) control and simultaneously clears the Local Lockout Message.
Interrupt and Device Status	Require Service	Indicates a device's need for interaction with the controller.
	Status Byte	Presents status information of a particular device; one bit indicates whether or not the device currently requires service, the other 7 bits (optional) are used to indicate the type of service required.
	Status Bit	A single bit of device-dependent status information which may be logically combined with status bit information from other devices by the controller.
Passing Control	Pass Control	Passes bus controller responsibilities from the current controller to a device which can assume the Bus supervisory role.
Bail Out	Abort	Unconditionally terminates Bus communications and returns control to the system controller.

3-70. Messages are the means by which devices communicate on the HP–IB. Table 3-3 lists the Bus Messages by Bus function and provides a description of each.

3-71. HP–IB Remote Operation.

3-72. The HP–IB Remote Enable (REN) line controls the instrument's mode of operation, LOCAL or REMOTE. With no input on the REN line, it is held high by an internal pullup maintaining the 3335A in the LOCAL mode of operation. When the 3335A listen address is transmitted, the REN line is pulled low causing it to go into the remote control mode. The REN lines does not have internal storage and must be held in the low state as long as remote operation is required. Once the 3335A has been put into the

REMOTE mode of operation, it can be unaddressed, and it will remain in REMOTE operation until the REN line is released or the LOCAL key is pressed.

3.73. When the REN line is low and the 3335A is addressed, the instrument goes into the REMOTE mode and the following things take place.

a. The front panel REMOTE annunciator lights.

b. The front panel controls (except POWER and the impedance switch) are disabled. When addressed to listen, the 3335A will accept REMOTE instructions.

c. The output parameters established by keyboard control in the LOCAL mode are retained in the REMOTE mode until remotely changed.

3-74. When the HP-IB system controller releases the REN line, the following things take place:

a. The front panel REMOTE annunciator goes out and the 3335A output parameters remain as last programmed in the REMOTE mode of operation.

b. The 3335A will no longer respond to remote instructions. It will respond to its listen address and the unlisten command.

3-75. Addressing to Listen. All instruments using the HP-IB share a common set of data and control lines because they are connected in parallel. Since the system controller must be able to communicate with individual instruments on the bus, each instrument is given a unique address. The address is a 7-bit ASCII character (byte) which a given instrument recognizes and responds to.

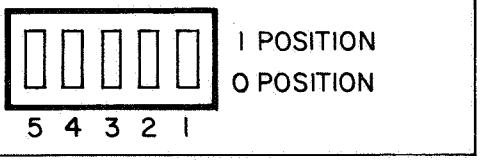
3-76. When addressing instruments, the system controller pulls the ATN line low to get the attention of all instruments on the bus. It then gives the ASCII coded address for one of the instruments on the bus. When the addressed instrument acknowledges receipt of the address by the "handshake" sequence, the controller clears the address code and addresses another instrument if more than one is to receive the same data. When the last addressed instrument acknowledges receipt of its address, the controller releases the ATN line and clears the last address code. With the ATN line released, the HP-IB is in the data mode. The addressed instruments respond by accepting data placed on the bus using the "handshake" sequence. This data programs the functions of the instruments.

3-77. The 3335A functions only as a listener on the HP-IB. It accepts instructions from the controller and responds by establishing the output parameters programmed. The 3335A can be addressed (or unaddressed) in either the LOCAL or REMOTE control mode. Note that the 3335A will not go to Remote unless it is addressed to listen *and* the REN line is low.

3-78. Changing the Listen Address. The 3335A is shipped from the factory with a listen address of ASCII character $ (octal code 044). This address can be changed by changing the positions of the rear panel listen address switches 1 through 5 which control address lines A1 through A5. Table 3-4 lists the listen addresses obtainable and the switch positions required to set each address. The addresses are provided in ASCII, Octal, Decimal and Hexadecimal codes. The upper position of the switch corresponds to "1", the lower position to "0". These positions correspond to the one's and zero's of Table 3-4. When changing the listen address, verify that the new address does not conflict with that of another instrument on the bus.

Table 3-4. Listen Addresses.

HP-IB Instrument Listen Address Switches	Instrument Listen Address			
5 4 3 2 1	ASCII	Octal	Decimal	Hex
0 0 0 0 0	SP	040	32	20
0 0 0 0 1	!	041	33	21
0 0 0 1 0	"	042	34	22
0 0 0 1 1	#	043	35	23
0 0 1 0 0	$	044	36	24
0 0 1 0 1	%	045	37	25
0 0 1 1 0	%	046	38	26
0 0 1 1 1	'	047	39	27
0 1 0 0 0	(	050	40	28
0 1 0 0 1	)	051	41	29
0 1 0 1 0	*	052	42	2A
0 1 0 1 1	+	053	43	2B
0 1 1 0 0	'	054	44	2C
0 1 1 0 1	–	055	45	2D
0 1 1 1 0	.	056	46	2E
0 1 1 1 1	/	057	47	2F
1 0 0 0 0	Ø	060	48	30
1 0 0 0 1	1	061	49	31
1 0 0 1 0	2	062	50	32
1 0 0 1 1	3	063	51	33
1 0 1 0 0	4	064	52	34
1 0 1 0 1	5	065	53	35
1 0 1 1 0	6	066	54	36
1 0 1 1 1	7	067	55	37
1 1 0 0 0	8	070	56	38
1 1 0 0 1	9	071	57	39
1 1 0 1 0	:	072	58	3A
1 1 0 1 1	;	073	59	3B
1 1 1 0 0	<	074	60	3C
1 1 1 0 1	=	075	61	3D
1 1 1 1 0	>	076	62	3E



3-79. Unaddressing. Once the 3335A is addressed to listen, it will remain addressed until it is "unaddressed" or cleared by the system controller. There are several ways to clear an address:

a. By giving the "Unlisten" comand (UNL, 077 Octal, ASCII "?") this command must be given in the HP-IB command mode (ATN line low).

b. By pulling the IFC (Interface Clear) line low. This asynchronously clears all instruments on the bus.

c. By giving the "GO TO LOCAL" command (GTL, 001 Octal, ASCII "SOH").

d. By turning the instrument off.

3-80. HP-IB Bus Commands. The Bus Commands are divided into three categories:

a. Unaddress Commands (UNL and UNT)
b. Universal Commands (LLO, DCL, SPE, etc.)
c. Addressed Commands (SDC, GTL, GET, etc.)

The 3335A will not respond to all of the bus commands. Its operation is unaffected by a command it does not recognize. The commands it will respond to are UNL (Unlisten), LLO (Local Lockout), DCL (Device Clear), SDC (Selective Device Clear) and GTL (Go To Local). Each of these commands is listed above following its respective command category.

3-81. PROGRAMMING.

3-82. Programming of the 3335A functions is by means of data messages sent by the system controller over the HP-IB.

Table 3-5. Programming Codes.

KEY	ASCII Character	Octal Code	Decimal Code	Hexadecimal Code
STORE	S	123	83	53
RECALL	R	122	82	52
FREQUENCY	F	106	70	46
FREQ INCR	I	111	73	49
AMPLITUDE	A	101	65	41
AMPTD INCR	I	111	73	49
Ø INCR	P	120	80	50
SWEEP WIDTH	W	127	87	57
DISPLAY LAST ENTRY	L	114	76	4C
0	0	060	48	30
1	1	061	49	31
2	2	062	50	32
3	3	063	51	33
4	4	064	52	34
5	5	065	53	35
6	6	066	54	36
7	7	067	55	37
8	8	070	56	38
9	9	071	57	39
		056	46	2E
BACK SPACE	B	102	66	42
CLEAR	C	103	67	43
MHz/–dBm	M	115	77	4D
kHz/+dBm	K	113	75	4B
Hz/deg	H	110	72	48
INCR ↑	U	125	85	55
INCR ↓	D	104	68	44
GOTO START FREQ	G	107	71	47
START 10 SEC SINGLE	X	130	88	58
START 50 SEC SINGLE	Y	131	89	59
START AUTO	Z	132	90	5A
STOP	Q	121	81	51
	–	055	45	2D
**See Paragraph 3-81	T	124	84	54

These messages are composed of two parts – the address command and the program information. The address command contains the "talk" and "listen" addresses of the devices involved, here the controller talk address and the 3335A listen address. The program information contains the codes of the 3335A keys to be programmed. Syntax of the address command portion of the data message is dependent on the controller used (see manual of the system controller). Syntax for the program information portion is comprised of the program codes listed in Table 3-5.

3-83. Each programming code is a single 7-bit word or "byte". Table 3-5 lists each front panel key that is programmable and lists the programming code by ASCII character and corresponding octal, decimal and hexidecimal equivalant. The last two entries of the table (– and T) are codes programmable but do not represent front panel keys. The "–" allows for ease in programming amplitudes since negative amplitudes can be preceded by the minus sign and all amplitudes finalized with the + dBm key (K) from the HP–IB. The character T is discussed in the following paragraph.

3-84. A special operating condition is obtainable by using the programming code ASCII character "T". This HP-IB command sets the attenuator to the straight-through position and the impedance to the 50 ohm mode. A change of amplitude cannot be programmed but the digits 1 through 7 will introduce the attenuator pad corresponding to the "AT" line associated with the programmed digit (i.e., programming the digit 4 causes the AT4 line to go low and introduce the 10 dB pad associated with line AT4). Programming a 0 sets the attenuator straight through again once a pad has been introduced. The digit 8 programs the 50 ohm output while the digit 9 programs the 75 ohm output. To return to normal amplitude control, the code C (CLEAR) must be programmed to exit the special operating condition. A summary of the "T" special operating codes and their function is shown in Table 3-6.

3-85. The 3335A will respond to programming codes only when it is addressed to listen in the remote mode. Front panel key instructions can be entered in any order desired by the programmer. The function key instruction must preface a data entry for that function. An entry instruction must follow the data to complete programming of the function changing that particular operating parameter. The key instruction sequence of a program is identical to the key activation sequence when operated manually. Examples of program data messages using a 9830A and 9825A calculator

3-86. Examples illustrating complete programs using a 9830A and 9825A calculator to program various parameters and functions of the 3335A are shown in Figure 3-4.

3-87. Programming the Increment Functions. Special attention to the programming of the amplitude, frequency and phase increment functions is required because the same instruction (ASCII character I) for increment is used. The increment parameter programmed depends on the instrument's operating function prior to the "I" instruction. If

the 3335A is in the frequency mode prior to the "I" instruction, FREQ INCR is programmed; if in the amplitude function prior to the "I" instruction AMPTD INCR is programmed; if in the phase mode, ϕ INCR is programmed. If the instrument is not in the frequency, amplitude or phase mode, an "I" instruction is ignored. To ensure the increment is properly programmed in either frequency or amplitude, it is recommended the increment instruction (I) be preceded by the amplitude or frequency function instruction (A or F).

NOTE

ϕ INCR can be programmed directly by the ASCII character P.

The instruction "PI" is legal but can be performed by just "P" to program ϕ INCR (see Table 3-5). The two left-most 9830A and 9825A examples in Figure 3-3 illustrate frequency programmed immediately preceding the increment instruction "I" and an "FI" instruction is not required.

Table 3-6. Special Attenuator Program Codes.

Code	AT7 40 dB	AT6 20 dB	AT5 20 dB	AT4 10 dB	AT3 4 dB	AT2 2 dB	AT1 2 dB	AT∅ 50 Ω/75 Ω
T	1	1	1	1	1	1	1	1
∅	1	1	1	1	1	1	1	**
1	1	1	1	1	1	1	∅	**
2	1	1	1	1	1	∅	1	**
3	1	1	1	1	∅	1	1	**
4	1	1	1	∅	1	1	1	**
5	1	1	∅	1	1	1	1	**
6	1	∅	1	1	1	1	1	**
7	∅	1	1	1	1	1	1	**
8	**	**	**	**	**	**	**	1
9	**	**	**	**	**	**	**	∅
C	RETURNS TO NORMAL AMPLITUDE OPERATION							

1 = Straight Through
∅ = Pad Introduced
** = Same As Previous State

Table 3-7. Attenuation Actuated, 50 Ohm Output Level.

Output Level (dBm)	Attenuation (dB)	Pads Actuated (dB)	Output Level (dBm)	Attenuation (dB)	Pads Actuated (dB)
+13.01	0	0	–36.99	50	20,20,10
+11.01	2	2	–38.99	52	20,20,10,2
+ 9.01	4	2,2	–40.99	54	20,20,10,2,2
+ 7.01	6	4,2	–42.99	56	20,20,10,4,2
+ 5.01	8	4,2,2	–44.99	58	20,20,10,4,2,2
+ 3.01	10	10	–46.99	60	40,20
+ 1.01	12	10,2	–48.99	62	40,20,2
– .99	14	10,2,2	–50.99	64	40,20,2,2
– 2.99	16	10,4,2	–52.99	66	40,20,4,2
– 4.99	18	10,4,2,2	–54.99	68	40,20,4,2,2
– 6.99	20	20	–56.99	70	40,20,10
– 8.99	22	20,2	–58.99	72	40,20,10,2
–10.99	24	20,2,2	–60.99	74	40,20,10,2,2
–12.99	26	20,4,2	–62.99	76	40,20,10,4,2
–14.99	28	40,4,2,2	–64.99	78	40,20,10,4,2,2
–16.99	30	20,10	–66.99	80	40,20,20
–18.99	32	20,10,2	–68.99	82	40,20,20,2
–20.99	34	20,10,2,2	–70.99	84	40,20,20,2,2
–22.99	36	20,10,4,2	–72.99	86	40,20,20,4,2
–24.99	38	20,10,4,2,2	–74.99	88	40,20,20,4,2,2
–26.99	40	20,20	–76.99	90	40,20,20,10
–28.99	42	20,20,2	–78.99	92	40,20,20,10,2
–30.99	44	20,20,2,2	–80.99	94	40,20,20,10,2,2
–32.99	46	20,20,4,2	–82.99	96	40,20,20,10,4,2
–34.99	48	20,20,4,2,2	–84.99	98	40,20,20,10,4,2,2

3-88. Programming Amplitude to Maximize Attenuator Life. The attenuator assembly of the 3335A introduces an attenuator pad by use of an electro-mechanical mechanism. As with any mechanical system, the more it is used, the greater the wear on the system. A programmer can minimize the mechanical wear on the 3335A attenuator by carefully selecting amplitudes which require minimum operation of the attenuator. Table 3-7 indicates the 50 ohm output level, the attenuation introduced by the attenuator and which pads are actuated to accomplish it. Note that the attenuator attenuates in 2 dB steps while amplitude changes from +.01 dB to +1.99 dB are realized electronically by the leveling loop circuit (A6 Assembly – Section VIII Service Group M). Programming amplitudes within the 1.99 dB capability of the leveling loop and/or selecting amplitudes that minimize pad actuations will increase attenuator life. Table 8-N-1 in Section VIII Service Group N provides a detailed indication of the attenuator pads selected for a particular programmed amplitude for both 50 ohm and 75 ohm output impedances.

3-89. Unaddressed or Local Operation When Connected To the HP-IB.

3-90. If the 3335A is connected to the HP-IB and operated locally or operated in remote but not addressed to listen, interruption of the display/keyboard scan and the sweep mode function can occur. The instrument is controlled by one microprocessor. The processor must service the instrument function and also handle the HP-IB lines. When the ATN line is true or when the 3335A is addressed to listen, microprocessor responds to every DAV handshake. As each data byte is placed on the bus, DAV is pulled true which activates the 3335A HP-IB interrupt request line (IRQ) to the controller section. This causes the controller to interrupt the scan and sweep operation and service the interrupt request before returning to local operation of the 3335A functions. If a long data string is sent on the HP-IB, a data byte rate can be achieved when the 3335A controller has only time to service the interrupt requests. At this point the 3335A controller cannot properly service the basic instrument. The following symptoms can occur; display completely or partially blanks, a keyboard entry is not recognized, sweep output is not linear, and the auto, single 10 or 50 second sweep in the sweep mode exceeds the time interval.

3-91. Telecommunications.

3-92. There is an amplitude blanking feature and a special sweep feature which make the -hp- 3335A especially suitable for applications in the telecommunications industry. These features are standard and appear on all instruments. On instruments equipped with Options 002, 003 or 004, the special sweep is switch selectable. Each feature is described separately in the paragraphs that follow.

NOTE

No instrument with a serial number below 1604A00376 is equipped with a TELECOMMUNICATIONS SWEEP Switch.

3-93. Amplitude Blanking. This feature causes the output amplitude to be blanked for 20 msec whenever a new frequency is entered or whenever the INCREMENT or DECREMENT controls are actuated. Since the amplitude is blanked, no signal will appear at the output during the time that the frequency is changing. This allows the instrument to be stepped from one channel to another without generating spurious signals that might interfere with operating channels. Amplitude Blanking is implemented by modifing the instrument internally. Only *qualified service personnel* can do the modification safely. *Hazardous voltages are exposed when the top cover is removed.* The procedure for implementing this feature is presented on the apron page of Figure 8-D-1 in Service Group D.

WARNING

Since access to the Amplitude Blanking Switch requires removal of the top cover, this feature should be implemented only by qualified service personnel. Hazardous voltage are exposed when the top cover is removed.

3-94. Telecommunications Sweep. This sweep is really a modification of the AUTO sweep. The amplitude is blanked for 20 msec after each step and the duration of each step is extended so that the time duration of the step plus the 20 msecs blanking equals 4 seconds. Since the AUTO sweep consists of 100 steps, the total sweep time is extended to 400 seconds or 6.7 minutes. Blanking the amplitude prevents the -hp- 3335A from outputting spurious signals while it is changing frequencies. The long time duration allows certain Selective Level Measuring Instruments to track the -hp- 3335A output frequency in an open loop test configuration (e.g. – see see Operating Manual for the -hp- 3745A/B Selective Level Measuring Set). If the output is displayed on an oscilloscope, a slight overshoot will be observed at the beginning of each frequency step. This is normal and will cause no problems in the tracking application for which this operating mode was designed. On instruments equipped with Options 002, 003 and 004, the communications sweep is implemented by moving the TRACK/ NORM switch, located on the rear panel, to the TRACK position. On standard instruments, it is implemented by modifying the instrument internally. Only *qualified service personnel* can do the modification safely. *Hazardous voltages are exposed when the top cover is removed.* The procedure for implementing this feature is presented on the apron page of Figure Group D.

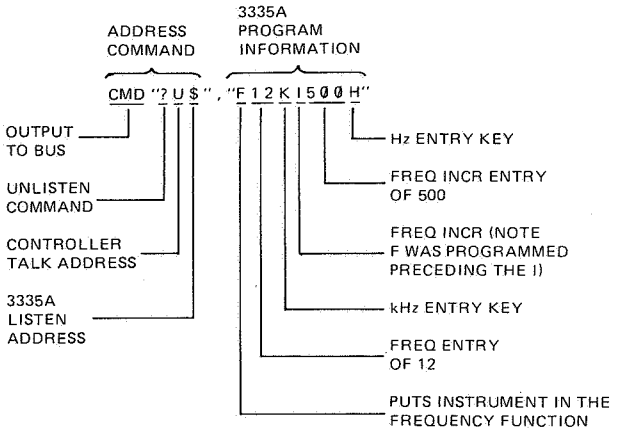
WARNING

Only qualified service personnel should implement the special sweep. Hazardous voltages are exposed when the top cover is removed.

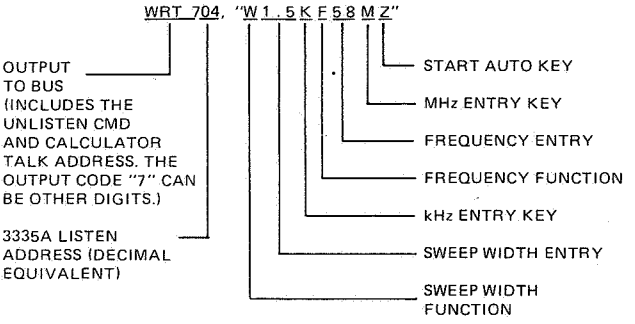
NOTE

The single sweep operating modes should not be used while the telecommunications sweep is implemented. While the frequencies of the single sweeps are correct, the amplitude is higher than the level displayed and somewhat unpredictable.

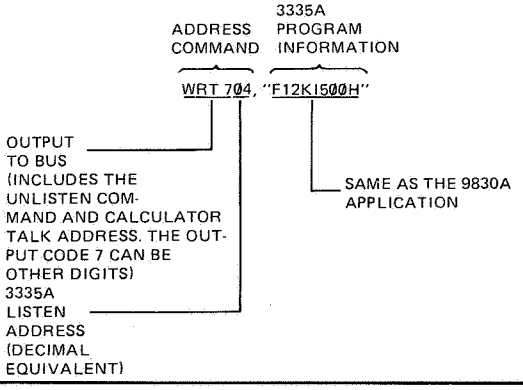
9830A Calculator program data message to establish an output frequency of 12 kHz and frequency increment of 500 Hz.



9825A Calculator program data message to establish an auto sweep with SWEEP WIDTH of 1.5 kHz centered on 58 MHz.



9825A Calculator program data message to establish an output frequency of 12 kHz and frequency increment of 500 Hz.



9825A Calculator program data message to end sweep mode operation and reprogram frequency to 25 kHz, amplitude to +9 dBm.

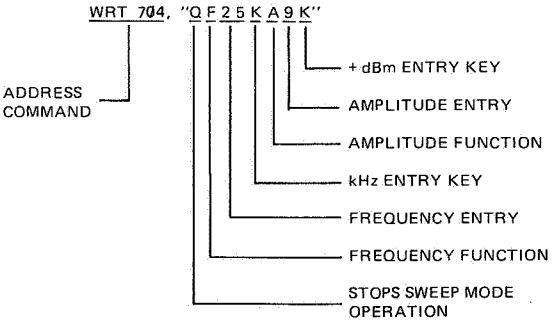


Figure 3-3. 9830A/9825A Program Data Messages.

EXAMPLE 1.

Programming a fixed frequency, e.g., 12.34 MHz:

9830A PROGRAM

```
10 FORMAT B
20 OUTPUT (13,10)768;
30 CMD "?U$","F12.34M"
40 OUTPUT (13,10)1024;
50 END
```

9825A PROGRAM

```
0: rem 7
1: wrt 704,"F12.34M"
2: lcl 7
3: end
*26953
```

EXAMPLE 2.

Programming a fixed amplitude, e.g., –40.01 dBm:

9830A PROGRAM

```
10 FORMAT B
20 OUTPUT (13,10)768;
30 CMD "?U$","A40.01M"
40 OUTPUT (13,10)1024;
50 END
```

9825A PROGRAM

```
0: rem 7
1: wrt 704,"A40.01M"
2: lcl 7
3: end
*28257
```

EXAMPLE 3.

Programming a fixed frequency increment, e.g., 4 kHz:

9830A PROGRAM

```
10 FORMAT B
20 OUTPUT (13,10)768;
30 CMD "?U$","FI4K"
40 OUTPUT (13,10)1024;
50 END
```

9825A PROGRAM

```
0: rem 7
1: wrt 704,"FI4K"
2: lcl 7
3: end
*29653
```

EXAMPLE 4.

Programming a frequency to be entered from the calculator keyboard:

9830A PROGRAM

```
10 FORMAT B
20 OUTPUT (13,10)768;
30 DISP "DESIRED FREQUENCY (IN MHZ)';
40 INPUT F
50 CMD "?U$"
60 FORMAT "F",F13.9,"M"
70 OUTPUT (13;60)F
80 OUTPUT (13,10)1024;
90 END
```

9825A PROGRAM

```
0: rem 7
1: ent "Desired Frequency (in MHz)?",F
2: fmt "F",f13.9,"M"
3: wrt 704,F
4: lcl 7
5: end
*16851
```

Figure 3-4. 9830A/9825A Program Examples.

EXAMPLE 5.

Programming an amplitude to be entered from the calculator keyboard:

9830A PROGRAM

```
10 FORMAT B
20 OUTPUT (13,10)768;
30 DISP "DESIRED AMPLITUDE (IN DBM)";
40 INPUT A
50 CMD "?U$"
60 FORMAT "A",F6.2,"K"
70 OUTPUT (13,60)A
80 OUTPUT (13,10)1024;
90 END
```

9825A PROGRAM

```
0: rem 7
1: ent "Desired Amplitude (in dBm)?",A
2: fmt 1,"A",f6.2,"K"
3: wrt 704.1,A
4: lcl 7
5: end
*12910
```

NOTE

The + dBm programming code is used for both a negative and positive amplitude entry since the 3335A will recognize a negative sign entered by the calculator.

EXAMPLE 6.

Programming a frequency sweep—all parameters entered from the calculator keyboard:

9830A PROGRAM

```
10 FORMAT B
20 OUTPUT (13,10)768;
30 DISP "START FREQ (IN MHZ)";
40 INPUT A
50 DISP "STOP FREQ (IN MHZ)";
60 INPUT B
70 DISP "# OF STEPS";
80 INPUT C
90 DISP "TIME PER STEP (IN MSEC)";
100 INPUT D
110 X=(B-A)/C
120 CMD "?U$"
130 FORMAT "F",F13.9,"M"
140 FOR F=A TO B STEP X
150 OUTPUT (13,130)F
160 WAIT D
170 NEXT F
180 OUTPUT (13,10)1024;
190 END
```

9825A PROGRAM

```
0: rem 7
1: ent "Start Freq (in MHz) ?",A
2: ent "Stop Freq (in MHz) ?",B
3: ent "# of Steps ?",C
4: ent "Time per Step (in msec) ?",D
5: (B-A)/C→X
6: fmt "F",f13.9,"M"
7: for F=A to B by X
8: wrt 704,F
9: wait D
10: next F
11: lcl 7
12: end
*2524
```

NOTE

If you prefer to enter center frequency and sweep width rather than start and stop frequencies, make the following changes to the respective lines of the Example 6 programs:

9830A PROGRAM CHANGES

```
30 DISP "CENTER FREQ (IN MHZ)";
50 DISP "SWEEP WIDTH (IN MHZ)";
110 X=B/C
```

9825A PROGRAM CHANGES

```
1: ent "Center Frequency (in MHz) ?",A
2: ent "Sweep Width (in MHz) ?",B
5: B/C→X
```

Figure 3-4. 9830A/9825A Program Examples (Cont'd).

EXAMPLE 7.

Programming a log sweep—all parameters entered from the calculator keyboard:

9830A PROGRAM

```
10 FORMAT B
20 OUTPUT (13,10)768;
30 DISP "START FREQ (IN MHZ)";
40 INPUT A
50 DISP "STOP FREQ (IN MHZ)";
60 INPUT B
70 DISP "# OF STEPS";
80 INPUT C
90 DISP "TIME PER STEP (IN MSEC)";
100 INPUT D
110 CMD "?U$"
120 FORMAT "F",F13.9,"M"
130 FOR I=0 TO C
140 F=10↑(LGTA+(LGTB-LGTA)*(I/C))
150 OUTPUT (13,120)F
160 WAIT D
170 NEXT I
180 OUTPUT (13,10)1024;
190 END
```

9825A PROGRAM

```
0: rem 7
1: ent "Start Freq (in MHz) ?",A
2: ent "Stop Freq (in MHz) ?",B
3: ent "# of Steps ?",C
4: ent "Time per Step (in msec) ?",D
5: fmt 1,"F",f13.9,"M"
6: for I=0 to C
7: 10↑(log(A)+(log(B)-log(A))(I/C))→F
8: wrt 704.1,F
9: wait D
10: next I
11: lcl 7
12: end
*31968
```

EXAMPLE 8.

Programming an amplitude sweep—all parameters entered from the calculator keyboard:

9830A PROGRAM

```
10 FORMAT B
20 OUTPUT (13,10)768;
30 DISP "START AMPLITUDE (IN DBM)";
40 INPUT A
50 DISP "STOP AMPLITUDE (IN DBM)";
60 INPUT B
70 DISP "# OF STEPS";
80 INPUT C
90 DISP "TIME PER STEP (IN MSEC)";
100 INPUT D
110 X=(B-A)/C
120 CMD "?U$"
130 FORMAT "A",F6.2,"K"
140 FOR I=A TO B STEP X
150 OUTPUT (13,130)I
160 WAIT D
170 NEXT I
180 OUTPUT (13,10)1024;
190 END
```

9825A PROGRAM

```
0: rem 7
1: ent "Start Amplitude (in dBm) ?",A
2: ent "Stop Amplitude (in dBm) ?",B
3: ent "#of Steps ?",C
4: ent "Time per Step (in msec) ?",D
5: (B-A)/C→X
6: fmt 1,"A",f6.2,"K"
7: for I=A to B by X
8: wrt 704.1,I
9: wait D
10: next I
11: lcl 7
12: end
*30595
```

Figure 3-4. 9830A/9825A Program Examples (Cont'd).

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Tel: 16 (59) 80 38 02

Hewlett-Packard France
2 Allée de la Bourgonnette
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Telex: 740912F
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Hewlett-Packard France
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Boite Postale 56
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Telex: 160124F
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Telex: 018 3405 hpbln d
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Geschäftsstelle
Herrenberger Strasse 130
D-7030 **BÖBLINGEN**
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Telex:
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Hewlett-Packard GmbH
Geschäftsstelle
Emanuel-Leutze-Strasse 1
D-4000 **DUSSELDORF**
Tel: (0211) 5971-1
Telex: 085/86 533 hpdd d
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Hewlett-Packard GmbH
Geschäftsstelle
Schleefstr. 28a
D-4600 **DORTMUND**-Aplerbeck
Tel: (0231) 45001

Hewlett-Packard GmbH
Vertriebszentrale Frankfurt
Berner Strasse 117
Postfach 560 140
D-6000 **FRANKFURT** 56
Tel: (0611) 50-04-1
Telex: 04 13249 hpffm d
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Hewlett-Packard GmbH
Geschäftsstelle
Aussenstelle Bad Homburg
Louisenstrasse 115
D-6380 **BAD HOMBURG**
Tel: (06172) 109-0

Hewlett-Packard GmbH
Geschäftsstelle
Kapstadtring 5
D-2000 **HAMBURG** 60
Tel: (040) 63804-1
Telex: 021 63 032 hphh d
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Hewlett-Packard GmbH
Geschäftsstelle
Heidering 37-39
D-3000 **HANNOVER** 61
Tel: (0511) 5706-0
Telex: 092 3259
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Hewlett-Packard GmbH
Geschäftsstelle
Rosslauer Weg 2-4
D-6800 **MANNHEIM**
Tel: (0621) 70050
Telex: 0462105
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Hewlett-Packard GmbH
Geschäftsstelle
Messerschmittstrasse 7
D-7910 **NEU ULM**
Tel: 0731-70241
Telex: 0712816 HP ULM-D
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Hewlett-Packard GmbH
Geschäftsstelle
Ehrichersstr. 13
D-8500 **NÜRNBERG** 10
Tel: (0911) 5205-0
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Hewlett-Packard GmbH
Geschäftsstelle
Eschenstrasse 5
D-8028 **TAUFKIRCHEN**
Tel: (089) 6117-1
Telex: 0524985
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GREAT BRITAIN

See United Kingdom

GREECE

Kostas Karaynnis S.A.
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***ATHENS** 133*
Tel: 32 30 303, 32 37 371
Telex: 215962 RKAR GR
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PLAISIO S.A.
G. Gerardos
24 Stournara Street
ATHENS
Tel: 36-11-160
Telex: 221871
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GUATEMALA

IPESA
Avenida Reforma 3-48, Zona 9
GUATEMALA CITY
Tel: 316627, 314786
Telex: 4192 TELTRO GU
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HONG KONG

Hewlett-Packard Hong Kong, Ltd.
G.P.O. Box 795
5th Floor, Sun Hung Kai Centre
30 Harbour Road
HONG KONG
Tel: 5-8323211
Telex: 66678 HEWPA HX
Cable: HEWPACK HONG KONG
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CET Ltd.
1402 Tung Wah Mansion
199-203 Hennessy Rd.
*Wanchia, **HONG KONG***
Tel: 5-729376
Telex: 85148 CET HX
CM

Schmidt & Co. (Hong Kong) Ltd.
Wing On Centre, 28th Floor
Connaught Road, C.
HONG KONG
Tel: 5-455644
Telex: 74766 SCHMX HX
A,M

ICELAND

Elding Trading Company Inc.
Hafnarnvoli-Tryggvagotu
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IS-REYKJAVIK
Tel: 1-58-20, 1-63-03
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Prabhadevi
***BOMBAY** 400 025*
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Telex: 011-3751
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Sahas
414/2 Vir Savarkar Marg
Prabhadevi
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Cable: BLUESTAR
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***MADRAS** 600 034*
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Telex: 041-379
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91 Nehru Place
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Telex: 031-2463
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Telex: 0155-459
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Maruthankuzhi
***TRIVANDRUM** 695 013*
Tel: 65799
Telex: 0884-259
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Computer Maintenance Corporation Ltd.
115, Sarojini Devi Road
***SECUNDERABAD** 500 003*
Tel: 310-184, 345-774
Telex: 031-2960
*CH***

SALES & SUPPORT OFFICES

Arranged alphabetically by country

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BERCA Indonesia P.T.
P.O.Box 496/Jkt.
Jl. Abdul Muis 62
JAKARTA
Tel: 21-373009
Telex: 46748 BERSAL IA
Cable: BERSAL JAKARTA
P

BERCA Indonesia P.T.
P.O.Box 2497/Jkt
Antara Bldg., 17th Floor
Jl. Medan Merdeka Selatan 17
JAKARTA-PUSAT
Tel: 21-344-181
Telex: BERSAL IA
A,CS,E,M

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P.O. Box 174/SBY.
Jl. Kutei No. 11
SURABAYA
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Telex: 31146 BERSAL SB
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Service Operation
Al Mansoor City 9B/3/7
BAGHDAD
Tel: 551-49-73
Telex: 212-455 HEPAIRAQ IK
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IRELAND

Hewlett-Packard Ireland Ltd.
82/83 Lower Leeson Street
DUBLIN 2
Tel: 0001 608800
Telex: 30439
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Cardiac Services Ltd.
Kilmore Road
Artane
***DUBLIN** 5*
Tel: (01) 351820
Telex: 30439
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ISRAEL

Eldan Electronic Instrument Ltd.
P.O.Box 1270
***JERUSALEM** 91000*
16, Ohaliav St.
***JERUSALEM** 94467*
Tel: 533 221, 553 242
Telex: 25231 AB/PAKRD IL
A

Electronics Engineering Division
Motorola Israel Ltd.
16 Kremenetski Street
P.O. Box 25016
TEL-AVIV 67899
Tel: 3 88 388
Telex: 33569 Motil IL
Cable: BASTEL Tel-Aviv
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ITALY

Hewlett-Packard Italiana S.p.A
Traversa 99C
Via Giulio Petroni, 19
I-70124 **BARI**
Tel: (080) 41-07-44
M

Hewlett-Packard Italiana S.p.A.
Via Martin Luther King, 38/III
I-40132 **BOLOGNA**
Tel: (051) 402394
Telex: 511630
CH,E,MS

Hewlett-Packard Italiana S.p.A.
Via Principe Nicola 43G/C
I-95126 **CATANIA**
Tel: (095) 37-10-87
Telex: 970291
C,P

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Tel: (02) 923691
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Telex: 322116
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Capodimonte, 62/A
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Telex: 215238
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6-11, Hon-dori, Naka-ku
HIROSHIMA, 730
Tel: 82-241-0611

Yokogawa-Hewlett-Packard Ltd.
Towa Building
2-3, Kaigan-dori, 2 Chome Chuo-ku
KOBE, 650
Tel: (078) 392-4791
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Yokogawa-Hewlett-Packard Ltd.
Kumagaya Asahi 82 Bldg
3-4 Tsukuba
KUMAGAYA, Saitama 360
Tel: (0485) 24-6563
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Yokogawa-Hewlett-Packard Ltd.
Asahi Shinbun Daiichi Seimei Bldg.
4-7, Hanabata-cho
KUMAMOTO,860
Tel: (0963) 54-7311
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Yokogawa-Hewlett-Packard Ltd.
Shin-Kyoto Center Bldg.
614, Higashi-Shiokoji-cho
Karasuma-Nishiiru
Shiokoji-dori, Shimogyo-ku
KYOTO, 600
Tel: 075-343-0921
CH,E

Yokogawa-Hewlett-Packard Ltd.
Mito Mitsui Bldg
4-73, Sanno-maru, 1 Chome
MITO, Ibaraki 310
Tel: (0292) 25-7470
CH,CM,E

Yokogawa-Hewlett-Packard Ltd.
Sumitomo Seimei 14-9 Bldg.
Meieki-Minami, 2 Chome
Nakamura-ku
NAGOYA, 450
Tel: (052) 571-5171
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Yokogawa-Hewlett-Packard Ltd.
Chuo Bldg.,
4-20 Nishinakajima, 5 Chome
Yodogawa-ku
OSAKA, 532
Tel: (06) 304-6021
Telex: YHPOSA 523-3624
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Yokogawa-Hewlett-Packard Ltd.
27-15, Yabe, 1 Chome
SAGAMIHARA Kanagawa, 229
Tel: 0427 59-1311

Yokogawa-Hewlett-Packard Ltd.
Daiichi Seimei Bldg.
7-1, Nishi Shinjuku, 2 Chome
Shinjuku-ku,**TOKYO** 160
Tel: 03-348-4611
CH,E

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29-21 Takaido-Higashi, 3 Chome
Suginami-ku **TOKYO** 168
Tel: (03) 331-611
Telex: 232-2024 YHPTOK
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Yokogawa-Hewlett-Packard Ltd.
Daiichi Asano Building
2-8, Odori, 5 Chome
UTSUNOMIYA, Tochigi 320
Tel: (0286) 25-7155
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Yasuda Seimei Nishiguchi Bldg.
30-4 Tsuruya-cho, 3 Chome
YOKOHAMA 221
Tel: (045) 312-1252
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AMMAN
Tel: 24907, 39907
Telex: 21456 SABCO JO
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P.O.Box 30070
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Telex: 22639
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Tel: 42-2846, 42-3801
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P.O. Box 165.167
BEIRUT
Tel: 290293
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P.O. Box 11-6274
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Tel: 89 40 73
Telex: 22259
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Woluwedal
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KUALA LUMPUR 23-03
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Lot 6624, Section 64
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Av. Periferico Sur No. 6501
Tepepan, Xochimilco
16020 **MEXICO D.F.**
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Telex: 17-74-507 HEWPACK MEX
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Hewlett-Packard Mexicana, S.A. de C.V.
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Col. del Valle
Municipio de Garza Garcia
MONTERREY, Nuevo Leon
Tel: 78 42 41
Telex: 038 410
CH

ECISA
José Vasconcelos No. 218
Col. Condesa Deleg. Cuauhtémoc
***MEXICO** D.F. 06140*
Tel: 553-1206
Telex: 17-72755 ECE ME
M

MOROCCO
Dolbeau
81 rue Karatchi
CASABLANCA
Tel: 3041-82, 3068-38
Telex: 23051, 22822
E

Gerep
2 rue d'Agadir
Boite Postale 156
CASABLANCA
Tel: 272093, 272095
Telex: 23 739
P

NETHERLANDS
Hewlett-Packard Nederland B.V.
Van Heuven Goedhartlaan 121
NL 1181KK **AMSTELVEEN**
P.O. Box 667
NL1180 AR **AMSTELVEEN**
Tel: (020) 47-20-21
Telex: 13 216 HEPA NL
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Hewlett-Packard Nederland B.V.
Bongerd 2
NL 2906VK **CAPELLE A/D IJSSEL**
P.O. Box 41
NL 2900AA **CAPELLE A/D IJSSEL**
Tel: (10) 51-64-44
Telex: 21261 HEPAC NL
A,CH,CS,E

Hewlett-Packard Nederland B.V.
Pastoor Petersstraat 134-136
NL 5612 LV **EINDHOVEN**
P.O. Box 2342
NL 5600 CH **EINDHOVEN**
Tel: (040) 326911
Telex: 51484 hepae nl
A,CH**,E,M

NEW ZEALAND
Hewlett-Packard (N.Z.) Ltd.
5 Owens Road
P.O. Box 26-189
Epsom, **AUCKLAND**
Tel: 687-159
Cable: HEWPACK Auckland
CH,CM,E,P*

Hewlett-Packard (N.Z.) Ltd.
4-12 Cruickshank Street
Kilbirnie, **WELLINGTON 3**
P.O. Box 9443
Courtenay Place, **WELLINGTON 3**
Tel: 877-199
Cable: HEWPACK Wellington
CH,CM,E,P

Northrop Instruments & Systems Ltd.
369 Khyber Pass Road
P.O. Box 8602
AUCKLAND
Tel: 794-091
Telex: 60605
A,M

Northrop Instruments & Systems Ltd.
110 Mandeville St.
P.O. Box 8388
CHRISTCHURCH
Tel: 486-928
Telex: 4203
A,M

Northrop Instruments & Systems Ltd.
Sturdee House
85-87 Ghuznee Street
P.O. Box 2406
WELLINGTON
Tel: 850-091
Telex: NZ 3380
A,M

NORTHERN IRELAND
See United Kingdom

NORWAY
Hewlett-Packard Norge A/S
Folke Bernadottes vei 50
P.O. Box 3558
N-5033 **FYLLINGSDALEN** (Bergen)
Tel: 0047/5/16 55 40
Telex: 16621 hpnas n
CH,CS,E,MS

Hewlett-Packard Norge A/S
Österndalen 16-18
P.O. Box 34
N-1345 **ÖSTERÅS**
Tel: 0047/2/17 11 80
Telex: 16621 hpnas n
A,CH,CM,CS,E,M,P

OMAN
Khimjil Ramdas
P.O. Box 19
MUSCAT
Tel: 722225, 745601
Telex: 3289 BROKER MB MUSCAT
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P.O.Box 169
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Telex: 3274 BAHWAN MB

PAKISTAN
Mushko & Company Ltd.
1-B, Street 43
Sector F-8/1
ISLAMABAD
Tel: 51071
Cable: FEMUS Rawalpindi
A,E,M

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Abdullah Haroon Road
***KARACHI** 0302*
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Calle Samuel Lewis, Ed. Alfa
Apartado 4929
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Tel: 63-6613, 63-6748
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Casilla 1030
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Tel: 41-4325, 41-3703
Telex: Pub. Booth 25306
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Legaspi Village, Makati
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Telex: 3274 ONLINE
A,CH,CS,E,M

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690-B Epifanio de los Santos Avenue
Cubao, ***QUEZON CITY***
P.O. Box 2649 Manila
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Telex: 40018, 42000 ITT GLOBE MACKAY BOOTH
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Intercambio Mundial de Comércio S.A.R.L.
P.O. Box 2761
Av. Antonio Augusto de Aguiar 138
P-LISBON
Tel: (19) 53-21-31, 53-21-37
Telex: 16691 munter p
M

Soquimica
Av. da Liberdade, 220-2
1298 ***LISBOA** Codex*
Tel: 56 21 81/2/3
Telex: 13316 SABASA
P

Telectra-Empresa Técnica de Equipmentos Eléctricos S.A.R.L.
Rua Rodrigo da Fonseca 103
P.O. Box 2531
***P-LISBON** 1*
Tel: (19) 68-60-72
Telex: 12598
CH,CS,E,P

PUERTO RICO
Hewlett-Packard Puerto Rico
Ave. Munoz Rivera #101
Esq. Calle Ochoa
HATO REY, Puerto Rico 00918
Tel: (809) 754-7800

Hewlett-Packard Puerto Rico
Calle 272 Edificio 203
Urb. Country Club
RIO PIEDRAS, Puerto Rico
P.O. Box 4407
CAROLINA, Puerto Rico 00628
Tel: (809) 762-7255
A,CH,CS

QATAR
Computearbia
P.O. Box 2750
DOHA
Tel: 883555
Telex: 4806 CHPARB
P

Eastern Technical Services
P.O.Box 4747
DOHA
Tel: 329 993
Telex: 4156 EASTEC DH

Nasser Trading & Contracting
P.O.Box 1563
DOHA
Tel: 22170, 23539
Telex: 4439 NASSER DH
M

SAUDI ARABIA
Modern Electronic Establishment
Hewlett-Packard Division
P.O. Box 22015
Thuobah
AL-KHOBAR
Tel: 895-1760, 895-1764
Telex: 671 106 HPMEEK SJ
Cable: ELECTA AL-KHOBAR
CH,CS,E,M

Modern Electronic Establishment
Hewlett-Packard Division
P.O. Box 1228
Redec Plaza, 6th Floor
JEDDAH
Tel: 644 38 48
Telex: 4027 12 FARNAS SJ
Cable: ELECTA JEDDAH
CH,CS,E,M

Modern Electronic Establishment
Hewlett-Packard Division
P.O.Box 22015
RIYADH
Tel: 491-97 15, 491-63 87
Telex: 202049 MEERYD SJ
CH,CS,E,M

Abdul Ghani El Ajou
P.O. Box 78
RIYADH
Tel: 40 41 717
Telex: 200 932 EL AJOU
P

SCOTLAND
See United Kingdom

SINGAPORE
Hewlett-Packard Singapore (Sales)
Pte. Ltd.
#08-00 Inchcape House
450-2 Alexandra Road
P.O. Box 58 Alexandra Rd. Post Office
SINGAPORE, 9115
Tel: 631788
Telex: HPSGSO RS 34209
Cable: HEWPACK, Singapore
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SALES & SUPPORT OFFICES

Arranged alphabetically by country

SINGAPORE (Cont'd)

Dynamar International Ltd.
Unit 05-11 Block 6
Kolam Ayer Industrial Estate
SINGAPORE 1334
Tel: 747-6188
Telex: RS 26283
CM

SOUTH AFRICA

Hewlett-Packard So Africa (Pty.) Ltd.
P.O. Box 120
Howard Place **CAPE PROVINCE** 7450
Pine Park Center, Forest Drive,
Pinelands
CAPE PROVINCE 7405
Tel: 53-7954
Telex: 57-20006
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Hewlett-Packard So Africa (Pty.) Ltd.
P.O. Box 37099
92 Overport Drive
DURBAN 4067
Tel: 28-4178, 28-4179, 28-4110
Telex: 6-22954
CH,CM

Hewlett-Packard So Africa (Pty.) Ltd.
6 Linton Arcade
511 Cape Road
Linton Grange
PORT ELIZABETH 6000
Tel: 041-302148
CH

Hewlett-Packard So Africa (Pty.) Ltd.
P.O.Box 33345
Glenstantia 0010 **TRANSVAAL**
1st Floor East
Constantia Park Ridge Shopping
Centre
Constantia Park
PRETORIA
Tel: 982043
Telex: 32163
CH,E

Hewlett-Packard So Africa (Pty.) Ltd.
Private Bag Wendywood
SANDTON 2144
Tel: 802-5111, 802-5125
Telex: 4-20877
Cable: HEWPACK Johannesburg
A,CH,CM,CS,E,MS,P

SPAIN

Hewlett-Packard Española S.A.
Calle Entenza, 321
E-BARCELONA 29
Tel: 322.24.51, 321.73.54
Telex: 52603 hpbee
A,CH,CS,E,MS,P

Hewlett-Packard Española S.A.
Calle San Vicente S/No
Edificio Albia II
E-BILBAO 1
Tel: 423.83.06
A,CH,E,MS

Hewlett-Packard Espanola S.A.
Crta. de la Coruña, Km. 16, 400
Las Rozas
E-MADRID
Tel: (1) 637.00.11
CH,CS,M

Hewlett-Packard Española S.A.
Avda. S. Francisco Javier, S/no
Planta 10. Edificio Sevilla 2,
E-SEVILLA 5
Tel: 64.44.54
Telex: 72933
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Hewlett-Packard Española S.A.
Calle Ramon Gordillo, 1 (Entlo.3)
E-VALENCIA 10
Tel: 361-1354
CH,P

SWEDEN

Hewlett-Packard Sverige AB
Sunnanvagen 14K
S-22226 **LUND**
Tel: (046) 13-69-79
Telex: (854) 17886 (via Spånga
office)
CH

Hewlett-Packard Sverige AB
Östra Tullgatan 3
S-21128 **MALMÖ**
Tel: (040) 70270
Telex: (854) 17886 (via Spånga
office)

Hewlett-Packard Sverige AB
Västra Vintergatan 9
S-70344 **ÖREBRO**
Tel: (19) 10-48-80
Telex: (854) 17886 (via Spånga
office)
CH

Hewlett-Packard Sverige AB
Skalholtsgatan 9, Kista
Box 19
S-16393 **SPÅNGA**
Tel: (08) 750-2000
Telex: (854) 17886
Telefax: (08) 7527781
A,CH,CM,CS,E,MS,P

Hewlett-Packard Sverige AB
Frötallisgatan 30
S-42132 **VÄSTRA-FRÖLUNDA**
Tel: (031) 49-09-50
Telex: (854) 17886 (via Spånga
office)
CH,E,P

SWITZERLAND

Hewlett-Packard (Schweiz) AG
Clarastrasse 12
CH-4058 **BASEL**
Tel: (61) 33-59-20
A

Hewlett-Packard (Schweiz) AG
7, rue du Bois-du-Lan
Case Postale 365
CH-1217 **MEYRIN** 2
Tel: (0041) 22-83-11-11
Telex:27333 HPAG CH
CH,CM,CS

Hewlett-Packard (Schweiz) AG
Allmend 2
CH-8967 **WIDEN**
Tel: (0041) 57 31 21 11
Telex: 53933 hpag ch
Cable: HPAG CH
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SYRIA

General Electronic Inc.
Nuri Basha Ahnaf Ebn Kays Street
P.O. Box 5781
DAMASCUS
Tel: 33-24-87
Telex: 411 215
Cable: ELECTROBOR DAMASCUS
E

Middle East Electronics
P.O.Box 2308
Abu Rumnaneh
DAMASCUS
Tel: 33 4 5 92
Telex: 411 304
M

TAIWAN

Hewlett-Packard Far East Ltd.
Kaohsiung Office
2/F 68-2, Chung Cheng 3rd Road
KAOHSIUNG
Tel: (07) 241-2318
CH,CS,E

Hewlett-Packard Far East Ltd.
Taiwan Branch
8th Floor
337 Fu Hsing North Road
TAIPEI
Tel: (02) 712-0404
Telex: 24439 HEWPACK
Cable:HEWPACK Taipei
A,CH,CM,CS,E,M,P

Ing Lih Trading Co.
3rd Floor, 7 Jen-Ai Road, Sec. 2
TAIPEI 100
Tel: (02) 3948191
Cable: INGLIH TAIPEI
A

THAILAND

Unimesa
30 Patpong Ave., Suriwong
BANGKOK 5
Tel: 235-5727
Telex: 84439 Simonco TH
Cable: UNIMESA Bangkok
A,CH,CS,E,M

Bangkok Business Equipment Ltd.
5/5-6 Dejo Road
BANGKOK
Tel: 234-8670, 234-8671
Telex: 87669-BEQUIPT TH
Cable: BUSIQUIPT Bangkok
P

TRINIDAD & TOBAGO

Caribbean Telecoms Ltd.
50/A Jerningham Avenue
P.O. Box 732
PORT-OF-SPAIN
Tel: 62-44213, 62-44214
Telex: 235,272 HUGCO WG
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TUNISIA

Tunisie Electronique
31 Avenue de la Liberte
TUNIS
Tel: 280-144
E,P

Corema
1 ter. Av. de Carthage
TUNIS
Tel: 253-821
Telex: 12319 CABAM TN
M

TURKEY

Teknim Company Ltd.
Iran Caddesi No. 7
*Kavaklidere, **ANKARA***
Tel: 275800
Telex: 42155 TKNM TR
E

E.M.A.
Medina Eldem Sokak No.41/6
Yuksel Caddesi
ANKARA
Tel: 175 622
Telex: 42 591
M

UNITED ARAB EMIRATES

Emitac Ltd.
P.O. Box 2711
ABU DHABI
Tel: 82 04 19-20
Cable: EMITAC ABUDHABI

Emitac Ltd.
P.O. Box 1641
SHARJAH
Tel: 591 181
Telex: 68136 Emitac Sh
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UNITED KINGDOM

GREAT BRITAIN

Hewlett-Packard Ltd.
Trafalgar House
Navigation Road
ALTRINCHAM
Cheshire WA14 1NU
Tel: 061 928 6422
Telex: 668068
A,CH,CS,E,M,MS,P

Hewlett-Packard Ltd.
Elstree House, Elstree Way
BOREHAMWOOD, Herts WD6 1SG
Tel: 01 207 5000
Telex: 8952716
E,CH,CS,P

Hewlett-Packard Ltd.
Oakfield House, Oakfield Grove
Clifton **BRISTOL,** Avon BS8 2BN
Tel: 0272 736806
Telex: 444302
CH,CS,E,P

Hewlett-Packard Ltd.
Bridewell House
Bridewell Place
LONDON EC4V 6BS
Tel: 01 583 6565
Telex: 298163
CH,CS,P

Hewlett-Packard Ltd.
Fourier House
257-263 High Street
LONDON COLNEY
Herts. AL2 1HA, St. Albans
Tel: 0727 24400
Telex: 1-8952716
CH,CS

Hewlett-Packard Ltd.
Pontefract Road
NORMANTON, West Yorkshire WF6 1RN
Tel: 0924 895566
Telex: 557355
CH,CS,P

Hewlett-Packard Ltd.
The Quadrangle
106-118 Station Road
REDHILL, Surrey RH1 1PS
Tel: 0737 68655
Telex: 947234
CH,CS,E,P

GREAT BRITAIN (Cont'd)
Hewlett-Packard Ltd.
Avon House
435 Stratford Road
Shirley, **SOLIHULL**, West Midlands
B90 4BL
Tel: 021 745 8800
Telex: 339105
CH,CS,E,P

Hewlett-Packard Ltd.
West End House
41 High Street, West End
SOUTHAMPTON
Hampshire S03 3DQ
Tel: 04218 6767
Telex: 477138
CH,CS,P

Hewlett-Packard Ltd.
Eskdale Rd.
Winnersh, **WOKINGHAM**
Berkshire RG11 5DZ
Tel: 0734 696622
Telex: 848884
E

Hewlett-Packard Ltd.
King Street Lane
Winnersh, **WOKINGHAM**
Berkshire RG11 5AR
Tel: 0734 784774
Telex: 847178
A,CH,CS,E,M,MP,P

Hewlett-Packard Ltd.
Nine Mile Ride
Easthampstead, **WOKINGHAM**
Berkshire, 3RG11 3LL
Tel: 0344 773100
Telex: 848805
CH,CS,E,P

IRELAND

NORTHERN IRELAND
Hewlett-Packard Ltd.
Cardiac Services Building
95A Finaghy Road South
BELFAST BT10 0BY
Tel: 0232 625-566
Telex: 747626
CH,CS

SCOTLAND
Hewlett-Packard Ltd.
SOUTH QUEENSFERRY
West Lothian, EH30 9TG
Tel: 031 331 1188
Telex: 72682
CH,CM,CS,E,M,P

UNITED STATES

Alabama
Hewlett-Packard Co.
700 Century Park South, Suite 128
BIRMINGHAM, AL 35226
Tel: (205) 822-6802
A,CH,M

Hewlett-Packard Co.
420 Wynn Drive
HUNTSVILLE, AL 35805
P.O. Box 7700
HUNTSVILLE, AL 35807
Tel: (205) 830-2000
CH,CM,CS,E,M*

Arizona
Hewlett-Packard Co.
8080 Pointe Parkway West
PHOENIX, AZ 85044
Tel: (602) 273-8000
A,CH,CM,CS,E,MS

Hewlett-Packard Co.
2424 East Aragon Road
TUCSON, AZ 85706
Tel: (602) 889-4631
CH,E,MS**

California
Hewlett-Packard Co.
99 South Hill Dr.
BRISBANE, CA 94005
Tel: (415) 330-2500
CH,CS

Hewlett-Packard Co.
P.O. Box 7830 (93747)
5060 E. Clinton Avenue, Suite 102
FRESNO, CA 93727
Tel: (209) 252-9652
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Hewlett-Packard Co.
P.O. Box 4230
1430 East Orangethorpe
FULLERTON, CA 92631
Tel: (714) 870-1000
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Hewlett-Packard Co.
320 S. Kellogg, Suite B
GOLETA, CA 93117
Tel: (805) 967-3405
CH

Hewlett-Packard Co.
5400 W. Rosecrans Boulevard
LAWNDALE, CA 90260
P.O. Box 92105
LOS ANGELES, CA 90009
Tel: (213) 970-7500
Telex: 910-325-6608
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Hewlett-Packard Co.
3155 Porter Oaks Drive
PALO ALTO, CA 94304
Tel: (415) 857-8000
CH,CS,E

Hewlett-Packard Co.
4244 So. Market Court, Suite A
P.O. Box 15976
SACRAMENTO, CA 95852
Tel: (916) 929-7222
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Hewlett-Packard Co.
9606 Aero Drive
P.O. Box 23333
SAN DIEGO, CA 92139
Tel: (619) 279-3200
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Hewlett-Packard Co.
2305 Camino Ramon "C"
SAN RAMON, CA 94583
Tel: (415) 838-5900
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Hewlett-Packard Co.
3005 Scott Boulevard
SANTA CLARA, CA 95050
Tel: (408) 988-7000
Telex: 910-338-0586
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Hewlett-Packard Co.
5703 Corsa Avenue
WESTLAKE VILLAGE, CA 91362
Tel: (213) 706-6800
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Hewlett-Packard Co.
24 Inverness Place, East
ENGLEWOOD, CO 80112
Tel: (303) 649-5000
A,CH,CM,CS,E,MS

Connecticut
Hewlett-Packard Co.
47 Barnes Industrial Road South
P.O. Box 5007
WALLINGFORD, CT 06492
Tel: (203) 265-7801
A,CH,CM,CS,E,MS

Florida
Hewlett-Packard Co.
2901 N.W. 62nd Street
P.O. Box 24210
FORT LAUDERDALE, FL 33307
Tel: (305) 973-2600
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Hewlett-Packard Co.
6177 Lake Ellenor Drive
P.O. Box 13910
ORLANDO, FL 32859
Tel: (305) 859-2900
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Hewlett-Packard Co.
5750B N. Hoover Blvd., Suite 123
P.O. Box 15200
TAMPA, FL 33614
Tel: (813) 884-3282
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Georgia
Hewlett-Packard Co.
2000 South Park Place
P.O. Box 105005
ATLANTA, GA 30348
Tel: (404) 955-1500
Telex: 810-766-4890
A,CH,CM,CS,E,MP

Hawaii
Hewlett-Packard Co.
Kawaiahao Plaza, Suite 190
567 South King Street
HONOLULU, HI 96813
Tel: (808) 526-1555
A,CH,E,MS

Illinois
Hewlett-Packard Co.
304 Eldorado Road
P.O. Box 1607
BLOOMINGTON, IL 61701
Tel: (309) 662-9411
CH,MS**

Hewlett-Packard Co.
1100 31st Street, Suite 100
DOWNERS GROVE, IL 60515
Tel: (312) 960-5760
CH,CS

Hewlett-Packard Co.
5201 Tollview Drive
ROLLING MEADOWS, IL 60008
Tel: (312) 255-9800
Telex: 910-687-1066
A,CH,CM,CS,E,MP

Indiana
Hewlett-Packard Co.
7301 No. Shadeland Avenue
P.O. Box 50807
INDIANAPOLIS, IN 46250
Tel: (317) 842-1000
A,CH,CM,CS,E,MS

Iowa
Hewlett-Packard Co.
1776 22nd Street, Suite 1
WEST DES MOINES, IA 50265
Tel: (515) 224-1435
CH,MS**

Kansas
Hewlett-Packard Co.
7804 East Funston Road, #203
WICHITA, KS 67207
Tel: (316) 684-8491
CH

Kentucky
Hewlett-Packard Co.
10300 Linn Station Road, #100
LOUISVILLE, KY 40223
Tel: (502) 426-0100
A,CH,CS,MS

Louisiana
Hewlett-Packard Co.
160 James Drive East
ST. ROSE, LA 70087
P.O. Box 1449
KENNER, LA 70063
Tel: (504) 467-4100
A,CH,CS,E,MS

Maryland
Hewlett-Packard Co.
3701 Koppers Street
BALTIMORE, MD 21227
Tel: (301) 644-5800
Telex: 710-862-1943
A,CH,CM,CS,E,MS

Hewlett-Packard Co.
2 Choke Cherry Road
ROCKVILLE, MD 20850
Tel: (301) 948-6370
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Massachusetts
Hewlett-Packard Co.
1775 Minuteman Road
ANDOVER, MA 01810
Tel: (617) 682-1500
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Hewlett-Packard Co.
32 Hartwell Avenue
LEXINGTON, MA 02173
Tel: (617) 861-8960
CH,CS,E

Michigan
Hewlett-Packard Co.
4326 Cascade Road S.E.
GRAND RAPIDS, MI 49506
Tel: (616) 957-1970
CH,CS,MS

Hewlett-Packard Co.
1771 W. Big Beaver Road
TROY, MI 48084
Tel: (313) 643-6474
CH,CS

Minnesota
Hewlett-Packard Co.
2025 W. Larpenteur Ave.
ST. PAUL, MN 55113
Tel: (612) 644-1100
A,CH,CM,CS,E,MP

Missouri
Hewlett-Packard Co.
11131 Colorado Avenue
KANSAS CITY, MO 64137
Tel: (816) 763-8000
A,CH,CM,CS,E,MS

Hewlett-Packard Co.
13001 Hollenberg Drive
BRIDGETON, MO 63044
Tel: (314) 344-5100
A,CH,CS,E,MP

SALES & SUPPORT OFFICES

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UNITED STATES (Cont'd)

Nebraska
Hewlett-Packard
10824 Old Mill Rd., Suite 3
OMAHA, NE 68154
Tel: (402) 334-1813
CM,MS

New Jersey
Hewlett-Packard Co.
120 W. Century Road
PARAMUS, NJ 07652
Tel: (201) 265-5000
A,CH,CM,CS,E,MP

Hewlett-Packard Co.
60 New England Av. West
PISCATAWAY, NJ 08854
Tel: (201) 981-1199
A,CH,CM,CS,E

New Mexico
Hewlett-Packard Co.
11300 Lomas Blvd.,N.E.
P.O. Box 11634
ALBUQUERQUE, NM 87112
Tel: (505) 292-1330
CH,CS,E,MS

New York
Hewlett-Packard Co.
5 Computer Drive South
ALBANY, NY 12205
Tel: (518) 458-1550
A,CH,E,MS

Hewlett-Packard Co.
9600 Main Street
P.O. Box AC
CLARENCE, NY 14031
Tel: (716) 759-8621
CH

Hewlett-Packard Co.
200 Cross Keys Office Park
FAIRPORT, NY 14450
Tel: (716) 223-9950
CH,CM,CS,E,MS

Hewlett-Packard Co.
7641 Henry Clay Blvd.
LIVERPOOL, NY 13088
Tel: (315) 451-1820
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Hewlett-Packard Co.
No. 1 Pennsylvania Plaza
55th Floor
34th Street & 8th Avenue
MANHATTAN NY 10119
Tel: (212) 971-0800
CH,CS,E*,M*

Hewlett-Packard Co.
250 Westchester Avenue
WHITE PLAINS, NY 10604
Tel: (914) 684-6100
CM,CH,CS,E

Hewlett-Packard Co.
3 Crossways Park West
WOODBURY, NY 11797
Tel: (516) 921-0300
A,CH,CM,CS,E,MS

North Carolina
Hewlett-Packard Co.
5605 Roanne Way
P.O. Box 26500
GREENSBORO, NC 27420
Tel: (919) 852-1800
A,CH,CM,CS,E,MS

Ohio
Hewlett-Packard Co.
9920 Carver Road
CINCINNATI, OH 45242
Tel: (513) 891-9870
CH,CS,MS

Hewlett-Packard Co.
16500 Sprague Road
CLEVELAND, OH 44130
Tel: (216) 243-7300
A,CH,CM,CS,E,MS

Hewlett-Packard Co.
962 Crupper Ave.
COLUMBUS, OH 43229
Tel: (614) 436-1041
Eff: Nov. 25, 1983
675 Brooksedge Blvd.
WESTERVILLE, OH 43081
CH,CM,CS,E*

Hewlett-Packard Co.
330 Progress Rd.
DAYTON, OH 45449
Tel: (513) 859-8202
A,CH,CM,E*,MS

Oklahoma
Hewlett-Packard Co.
304 N. Meridian, Suite A
P.O. Box 75609
OKLAHOMA CITY, OK 73147
Tel: (405) 946-9499
A*,CH,E*,MS

Hewlett-Packard Co.
3840 S. 103rd E. Avenue, #100
P.O. Box 35747
TULSA, OK 74153
Tel: (918) 665-3300
A**,CH,CS,M*

Oregon
Hewlett-Packard Co.
9255 S. W. Pioneer Court
P.O. Box 328
WILSONVILLE, OR 97070
Tel: (503) 682-8000
A,CH,CS,E*,MS

Pennsylvania
Hewlett-Packard Co.
111 Zeta Drive
PITTSBURGH, PA 15238
Tel: (412) 782-0400
A,CH,CS,E,MP

Hewlett-Packard Co.
2750 Monroe Boulevard
P.O. Box 713
VALLEY FORGE, PA 19482
Tel: (215) 666-9000
A,CH,CM,E,M

South Carolina
Hewlett-Packard Co.
Brookside Park, Suite 122
1 Harbison Way
P.O. Box 21708
COLUMBIA, SC 29221
Tel: (803) 732-0400
CH,E,MS

Hewlett-Packard Co.
Koger Executive Center
Chesterfield Bldg., Suite 124
GREENVILLE, SC 29615
Tel: (803) 297-4120

Tennessee
Hewlett-Packard Co.
224 Peters Road, Suite 102
P.O. Box 22490
KNOXVILLE, TN 37922
Tel: (615) 691-2371
A*,CH,MS

Hewlett-Packard Co.
3070 Directors Row
MEMPHIS, TN 38131
Tel: (901) 346-8370
A,CH,MS

Texas
Hewlett-Packard Co.
4171 North Mesa
Suite C-110
EL PASO, TX 79902
Tel: (915) 533-3555
CH,E*,MS**

Hewlett-Packard Co.
10535 Harwin Drive
P.O. Box 42816
HOUSTON, TX 77042
Tel: (713) 776-6400
A,CH,CM,CS,E,MP

Hewlett-Packard Co.
930 E. Campbell Rd.
P.O. Box 1270
RICHARDSON, TX 75080
Tel: (214) 231-6101
A,CH,CM,CS,E,MP

Hewlett-Packard Co.
1020 Central Parkway South
P.O. Box 32993
SAN ANTONIO, TX 78216
Tel: (512) 494-9336
CH,CS,E,MS

Utah
Hewlett-Packard Co.
3530 W. 2100 South
SALT LAKE CITY, UT 84119
Tel: (801) 974-1700
A,CH,CS,E,MS

Virginia
Hewlett-Packard Co.
4305 Cox Road
GLEN ALLEN, VA 23060
P.O. Box 9669
RICHMOND, VA 23228
Tel: (804) 747-7750
A,CH,CS,E,MS

Washington
Hewlett-Packard Co.
15815 S.E. 37th Street
BELLEVUE, WA 98006
Tel: (206) 643-4000
A,CH,CM,CS,E,MP

Hewlett-Packard Co.
Suite A
708 North Argonne Road
SPOKANE, WA 99212
Tel: (509) 922-7000
CH,CS

West Virginia
Hewlett-Packard Co.
4604 MacCorkle Ave.
P.O. Box 4297
CHARLESTON, WV 25304
Tel: (304) 925-0492
A,MS

Wisconsin
Hewlett-Packard Co.
150 S. Sunny Slope Road
BROOKFIELD, WI 53005
Tel: (414) 784-8800
A,CH,CS,E*,MP

URUGUAY

Pablo Ferrando S.A.C. e I.
Avenida Italia 2877
Casilla de Correo 370
MONTEVIDEO
Tel: 80-2586
Telex: Public Booth 901
A,CM,E,M

VENEZUELA

Hewlett-Packard de Venezuela C.A.
3RA Transversal Los Ruices Norte
Edificio Segre 1, 2 & 3
Apartado 50933
CARACAS 1071
Tel: 239-4133
Telex: 251046 HEWPACK
A,CH,CS,E,MS,P

Hewlett-Packard de Venezuela C.A.
Calle-72-Entre 3H y 3Y, No. 3H-40
Edificio Ada-Evelyn, Local B
Apartado 2646
4001, **MARACAIBO**, Estado Zulia
Tel: (061) 80.304
C,E*

Hewlett-Packard de Venezuela C.A.
Calle Vargas Rondon
Edificio Seguros Carabobo, Piso 10
VALENCIA
Tel: (041) 51 385
CH,CS,P

Bioelectronica Medica C.A.
Calle Buen Pastor
Edif. Cota Mil-Piso 2 y Semi Sotano 1
Boleita Norte
Apartado 50710 ***CARACAS*** *1050A*
Tel: 239 84 41
Telex: 26518

ZIMBABWE

Field Technical Sales
45 Kelvin Road, North
P.B. 3458
SALISBURY
Tel: 705 231
Telex: 4-122 RH
C,E,M,P

July 1983 5952-6900

Indicates main office

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03335-90011



Printed in U.S.A.

HEWLETT PACKARD

SAFETY SUMMARY

The following general safety precautions must be observed during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the instrument. Hewlett-Packard Company assumes no liability for the customer's failure to comply with these requirements. This is a Safety Class 1 instrument.

GROUND THE INSTRUMENT

To minimize shock hazard, the instrument chassis and cabinet must be connected to an electrical ground. The instrument is equipped with a three-conductor ac power cable. The power cable must either be plugged into an approved three-contact electrical outlet or used with a three-contact to two-contact adapter with the grounding wire (green) firmly connected to an electrical ground (safety ground) at the power outlet. The power jack and mating plug of the power cable meet International Electrotechnical Commission (IEC) safety standards.

DO NOT OPERATE IN AN EXPLOSIVE ATMOSPHERE

Do not operate the instrument in the presence of flammable gases or fumes. Operation of any electrical instrument in such an environment constitutes a definite safety hazard.

KEEP AWAY FROM LIVE CIRCUITS

Operating personnel must not remove instrument covers. Component replacement and internal adjustments must be made by qualified maintenance personnel. Do not replace components with power cable connected. Under certain conditions, dangerous voltages may exist even with the power cable removed. To avoid injuries, always disconnect power and discharge circuits before touching them.

DO NOT SERVICE OR ADJUST ALONE

Do not attempt internal service or adjustment unless another person, capable of rendering first aid and resuscitation, is present.

DO NOT SUBSTITUTE PARTS OR MODIFY INSTRUMENT

Because of the danger of introducing additional hazards, do not install substitute parts or perform any unauthorized modification to the instrument. Return the instrument to a Hewlett-Packard Sales and Service Office for service and repair to ensure that safety features are maintained.

DANGEROUS PROCEDURE WARNINGS

Warnings, such as the example below, precede potentially dangerous procedures throughout this manual. Instructions contained in the warnings must be followed.

WARNING

Dangerous voltages, capable of causing death, are present in this instrument. Use extreme caution when handling, testing, and adjusting.

SAFETY SUMMARY.

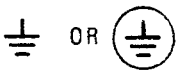
General Definitions of Safety Symbols Used On Equipment or In Manuals.



Instruction manual symbol: the product will be marked with this symbol when it is necessary for the user to refer to the instruction manual in order to protect against damage to the instrument.



Indicates dangerous voltage (terminals fed from the interior by voltage exceeding 1000 volts must be so marked).



Protective conductor terminal. For protection against electrical shock in case of a fault. Used with field wiring terminals to indicate the terminal which must be connected to ground before operating equipment.



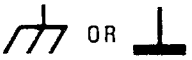
Low-noise or noiseless, clean ground (earth) terminal. Used for a signal common, as well as providing protection against electrical shock in case of a fault. A terminal marked with this symbol must be connected to ground in the manner described in the installation (operating) manual, and before operating the equipment.



Logic return connected to chassis (outguard) ground.



Logic return isolated (inguarded) from chassis ground.



Frame or chassis terminal. A connection to the frame (chassis) of the equipment which normally includes all exposed metal structures.



Alternating current (power line).



Direct current (power line).



Alternating or direct current (power line).

DANGER

The DANGER sign denotes a hazard. It calls attention to an operating procedure, practice, condition or the like, which could result in injury or death to personnel even during normal operation.

WARNING

The WARNING sign denotes a hazard. It calls attention to a procedure, practice, condition or the like, which, if not correctly performed or adhered to, could result in injury or death to personnel.

CAUTION

The CAUTION sign denotes a hazard. It calls attention to an operating procedure, practice, condition or the like, which,if not correctly performed or adhered to, could result in damage to or destruction of part or all of the product.

NOTE:

The NOTE sign denotes important information. It calls attention to procedure, practice, condition or the like, which is essential to highlight.

SECTION I
GENERAL INFORMATION

1-1. INTRODUCTION.

1-2. This Operating and Service Manual contains information relative to the installation, operation, performance testing, adjustment and maintenance of the Hewlett-Packard Model 3335A Synthesizer/Level Generator. Figure 1-1 shows the Synthesizer/Level Generator and the accessories supplied with the instrument.

1-3. Packaged with this manual is an Operating Information Supplement. This is simply a copy of the first three sections of this manual. This supplement should be kept with the instrument for use by the operator. Additional copies of the Operating Information Supplement or the Operating and Service Manual can be ordered through your nearest Hewlett-Packard Sales and Service Office (a list of these offices is provided at the end of this manual). The part numbers are listed on the title page of this manual.

1-4. Also listed on the title page of this manual following the Operating and Service Manual and Operating Information Supplement part numbers are Microfiche part numbers for these publications. These numbers can be used to order 4 x 6 inch microfilm transparencies of these publications. The Microfiche package includes the latest Manual Changes supplement and all pertinent Service Notes.

1-5. The manual is divided into eight sections, each covering a particular topic for the operating and service of the Synthesizer/Level Generator. The topics by section number are:

Section	Topic
I	General Information
II	Installation
III	Operation
IV	Performance Tests
V	Adjustments
VI	Replacement Parts
VII	Manual Changes
VIII	Service

1-6. This section contains general information about the Model 3335A Synthesizer/Level Generator. The information includes an instrument description, specifications, option and accessory information and instrument and manual identification.

1-7. DESCRIPTION.

1-8. The Model 3335A Synthesizer/Level Generator is a wide range source operating over the range of 200 Hz to 80 MHz with output resolution of .001 Hz. The Synthesizer/Level Generator is capable of making a step frequency sweep both automatically or manually under operator control from the keyboard. Output amplitude is selectable over the range of + 13.01 dBm to - 86.98 dBm for the 50 ohm output and + 11.25 dBm to - 88.74 dBm for the 75 ohm output.

1-9. The 3335A Synthesizer/Level Generator provides three communications-oriented options in addition to the standard 50 ohm and 75 ohm output impedance. Options 002 and 004 provide output impedance of 75 ohms unbalanced, 124 ohms balanced and 135 ohms balanced each terminated in equivalent WECO output connectors (Option 004 contains miniature connectors). Option 003 provides a 75 ohm unbalanced BNC output and a 150 ohm balanced BNC pair output. Refer to Table 1-2, General Information, for the amplitude range of the Options.

1-10. The Synthesizer/Level Generator develops the output signal by an indirect synthesis technique. This technique uses voltage controlled oscillators which are phase-locked to reference signals generated by a 40 MHz master oscillator in the reference section. The master oscillator is phase-locked to an internal temperature-stabilized oscillator or can be phase-locked to an external reference signal. A 10 MHz signal derived from the master oscillator is available at a rear panel connector for use as a reference signal for other equipment.

1-11. Frequency and amplitude can be selected manually from the keyboard or externally when connected to the Hewlett-Packard Interface Bus (HP-IB). A programmable device such as a programmable calculator is capable of remotely controlling the Synthesizer/Level Generator from the HP-IB. When operated in this mode, keyboard inputs are disabled.

1-12. SPECIFICATIONS.

1-13. Table 1-1 is a complete list of the Model 3335A critical specifications that are controlled by tolerances. Any changes in specifications due to manufacturing, design or traceability to the U.S. National Bureau of Standards are included in Table 1-1 of this manual. Specifications listed in this manual supersede all previous specifications for the Model 3335A.

1-14. GENERAL OPERATING INFORMATION.

1-15. Table 1-2 contains general information describing the major operating characteristics of the 3335A. This information does not constitute specifications but is supplemental operating information.

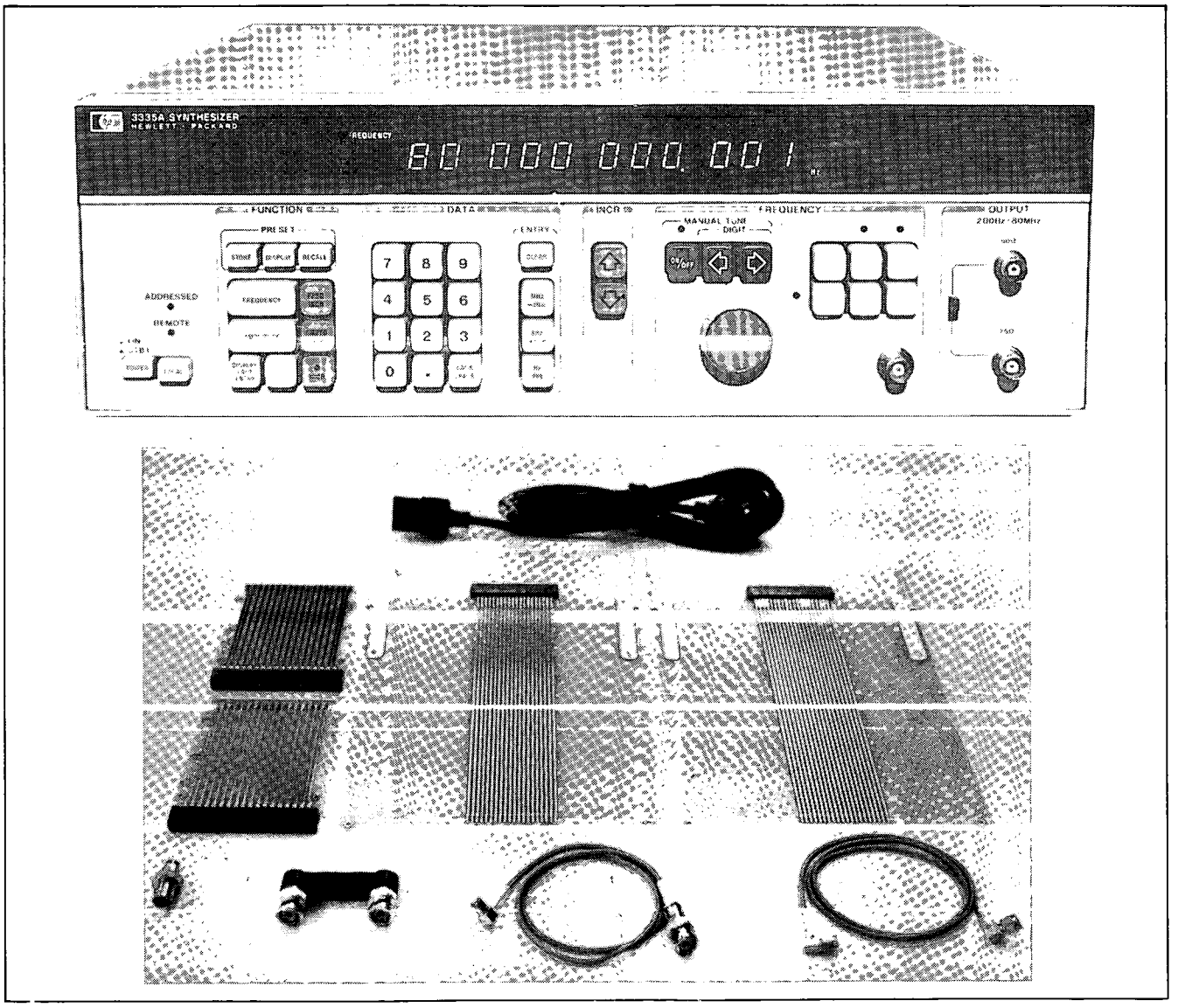


Figure 1-1. -hp- 3335A With Supplied Accessories.

1-16. OPTIONS.

1-17. There are both equipment options and accessory options available with the 3335A Synthesizer/Level Generator. All options are designated by a three digit number. The first digit of the option number identifies the option as either equipment or accessory. For an equipment option, the first digit is a zero and for an accessory option, the first digit is a nine. The following is a list of equipment and accessory options available with the 3335A:

Option	Description
001	High stability crystal oven (10544A)
002	75 Ω Unbalanced Output Connector: Commercial equivalent of WECO type 477B (Accepts WECO plug 358A). 124 Ω Balanced Output Connectors: Commercial equivalent of WECO type 477B (Accepts WECO plug 372A). 135 Ω Balanced Output Connectors: Commercial equivalent of WECO type 223A (Accepts WECO plug 241A).
003	75 Ω Unbalanced Output Connector: BNC 150 Ω Balanced Output Connectors: BNC pair.
004	75 Ω Unbalanced Output Connector: Commercial equivalent of WECO type 560A (Accepts WECO plug 439A or 440A). 124 Ω Balanced Output Connectors: Commercial equivalent of WECO type 562A (Accepts WECO plug 443A). 135 Ω Balanced Output Connectors: Commercial equivalent of WECO type 223A (Accepts WECO plug 241A).
907	Front Handle Assembly
908	Rack Mount Flange Kit
909	Rack Mount Flange Kit/Front Handle Assembly
910	Additional Operating and Service Manual

1-18. For more information concerning these options, refer to Table 1-2, General Information, or contact your local -hp- Sales and Service Office. A list of the -hp- Sales and Service Offices is provided at the end of this manual.

1-19. ACCESSORIES SUPPLIED.

1-20. The following is a list of accessories supplied with the Model 3335A. This list comprises the 3335A service kit, -hp- Part No. 03335-87901.

Accessory	Qty.	-hp- Part No.
Extender Board	2	5061-0775
Extender Board	2	03335-66518
Service Cable	1	03335-61602
Service Cable	1	03335-61627
SMA–to–BNC Adapter	1	1250-1548
BNC-to-BNC Adapter	1	1250-1499

1-21. ACCESSORIES AVAILABLE.

1-22. The following is a list of Hewlett-Packard accessories available for use with the Model 3335A:

Accessory	-hp- Model No.
50 Ω Feedthrough	11048C
75 Ω Feedthrough	11094C

1-23. HP-IB INTERFACING AND PROGRAMMING INFORMATION.

1-24. Section II of this manual contains instructions for interfacing the Model 3335A with the HP-IB. A brief description of the sequence of events comprising the transfer of data by the HP-IB is provided in Section III followed by programming information. Information concerning the design criteria of the bus is available in IEEE Standard 488-1975, titled "IEEE Standard Digital Interface for Programmable Instrumentation".

1-25. INSTRUMENT AND MANUAL IDENTIFICATION.

1-26. The instrument serial number is located on the rear panel. Hewlett-Packard uses a two-section serial number consisting of a four-digit prefix and a five-digit suffix. A letter between the prefix and suffix identifies the country in which the instument was manufactured (A = USA, G = West Germany, J = Japan, U = United Kingdom). All correspondence with Hewlett-Packard concerning this instrument should include the complete serial number.

1-27. If the serial number of your instrument is lower than the serial number on the title page of this manual, you must modify your manual for agreement with your instrument. Refer to Section VII, MANUAL CHANGES, for the information that will adapt this manual to your instrument.

1-28. SAFETY CONSIDERATIONS.

1-29. The Synthesizer/Level Generator is a Safety Class I instrument and has been designed according to international safety standards. To ensure safe operation and to retain the instrument in a safe condition, this Operating Manual contains information, cautions and warnings which must be adhered to by the user.

1-30. The 3335A's front panel contains a ⚠ symbol which is an international symbol meaning "refer to the

Operating Manual." The symbol flags important operating instructions located in Section III required to prevent damage to the instrument. To retain the operating condition of the instrument, these instructions must be adhered to.

1-31. RECOMMENDED TEST EQUIPMENT.

1-32. Equipment required to maintain the Model 3335A is listed in Table 1-3. Other equipment can be substituted if it meets or exceeds the critical specifications listed in the table.

Table 1-1. Specifications.

STANDARD/OPTION 001

FREQUENCY:

Range: 50 Ω, 75 Ω: 200 Hz to 80.999 999 999 MHz

Stability (Standard):

Long Term: ± 1 x 10^{-8} per day
± 1 x 10^{-7} per month

Stability (Option 001):

Long Term: < 5 X 10^{-10}/day after 24-hour warmup and oscillator off time less than 24 hours. < 1 X 10^{-7}/year for continuous operation

Spectral Purity:

Harmonic Distortion:

All harmonically related signals will be less than the following levels (relative to the fundamental) at full output:

Freq Range	Harmonic Level
200 Hz to 10 MHz	–45 dB
10 MHz to 80 MHz	–40 dB

Integrated Phase Noise:

(30 kHz band, excluding ± 1 Hz, centered on the carrier)

9.9 MHz: < –63 dB
20 MHz: < –70 dB
40 MHz: < –64 dB
80 MHz: < –58 dB

Spurious (25°C ± 10°C):

All non-harmonically related signals are > 75 dB below the carrier or –125 dBm whichever is greater.

AMPLITUDE:

Range: 50 Ω: +13.01 dBm to –86.98 dBm
75 Ω: +11.25 dBm to –88.74 dBm

Absolute Level Accuracy:

(Maximum output at 100 kHz, 10°C to 35°C) ± 0.05 dB

Flatness: (Relative to 100 kHz, Full Amplitude)

50 Ω/75 Ω: 1 kHz–25 MHz: ± .07 dB; 200 Hz–80 MHz: ± .15 dB

Attenuator Accuracy: (Relative to Full Output, 100 kHz, In 2 dB Steps)

Impedance*	Attenuation (dB)	Accuracy 200 Hz	Accuracy 25 MHz	Accuracy 80 MHz
50 Ω	0 to 18	± 0.04 dB		
75 Ω				± 0.15 dB
50 Ω	20 to 58	± 0.09 dB		
75 Ω				± 0.25 dB
50 Ω	60 to 98	± 0.20 dB		
75 Ω				± 0.50 dB

Table 1-1. Specifications (Cont'd).

OPTION 002/004

FREQUENCY:

Range: 75 Ω: 200 Hz to 80.999 999 999 MHz
124 Ω: 10 kHz to 10 MHz
135 Ω: 10 kHz to 2 MHz

Stability:

Long Term: ± 1 x 10^{-8} per day
± 1 x 10^{-7} per month

See STANDARD/OPTION 001 table for Option 001 stability.

Spectral Purity:

Harmonic Distortion:

All harmonically related signals will be less than the following levels (relative to the fundamental) at full output:
(75 Ω) 0 dBm (124 Ω, 135 Ω)

Impedance	Freq Range	Harmonic Level
75 Ω	200 Hz to 10 MHz	–45 dB
	10 MHz to 80 MHz	–40 dB
124 Ω	10 kHz to 10 MHz	–45 dB
135 Ω	10 kHz to 2 MHz	–45 dB

Integrated Phase Noise:
(30 kHz band, excluding ± 1 Hz, centered on the carrier)
9.9 MHz: < –63 dB
20 MHz: < –70 dB
40 MHz: < –64 dB
80 MHz: < –58 dB

Spurious (25°C ± 10°C):

Impedance	All non-harmonically related signals (whichever is greater)
75 Ω	–125 dBm or –75 dBc
124 Ω	–97 dBm or –75 dBc (dc to 200 MHz)
135 Ω	–100 dBm or –75 dBc (dc to 10 MHz) –68 dBm or –75 dBc (10 MHz–200 MHz)

AMPLITUDE:

Range: 75 Ω, 124 Ω, 135 Ω: +11.25 dBm to –88.74 dBm

Absolute Level Accuracy: (Maximum output at 100 kHz, 10°C to 35°C)
75 Ω: ± 0.05 dB
124/135 Ω: ± 0.1 dB

Flatness: (Relative to 100 kHz, Full Amplitude)

75 Ω	1 kHz–25 MHz: ± .07 dB
	200 Hz–80 MHz: ± .15 dB
124 Ω	50 kHz–10 MHz: ± .15 dB
	10 kHz–10 MHz: ± .4 dB
135 Ω	10 kHz–2 MHz: ± .18 dB

Amplitude Accuracy (includes effects of flatness and attenuator):

75 Ω:

75 Ω Output Level (dBm)	200 Hz	1 kHz	25 MHz	50 MHz
+11.25	± 0.25 dB	± 0.15 dB	± 0.35 dB	
– 8.74	± 0.30 dB	± 0.20 dB	± 0.45 dB	
–48.74	± 0.40 dB	± 0.30 dB	± 0.70 dB	
–70.0*				

124 Ω:

124 Ω Output Level (dBm)	10 kHz	50 kHz	10 MHz
+11.25	±0.60 dB	± 0.35 dB	
– 8.74	± 0.65 dB	± 0.40 dB	
–48.74	± 1.1 dB	± 0.85 dB	
–70.0*			

135 Ω

135 Ω Output Level (dBm)	10 kHz	2 MHz
+11.25	± 0.35 dB	
– 8.74	± 0.40 dB	
–48.74	± 0.85 dB	
–70.0*		

Output Balance: 124/135 Ω: >60 dB

*Levels to –88.74 dBm can be selected but accuracies are unspecified due to the spurious noise floor of –100 dBm.

Table 1-1. Specifications (Cont'd).

OPTION 003

FREQUENCY:

Range: 75 Ω: 200 Hz to 80.999 999 999 MHz
150 Ω: 10 kHz to 2 MHz

Stability:

Long Term: $\pm 1 \times 10^{-8}$ per day
$\pm 1 \times 10^{-7}$ per month

See STANDARD/OPTION 001 table for Option 001 stability.

Spectral Purity:

Harmonic Distortion:

All harmonically related signals will be less than the following levels (relative to the fundamental) at full output:

Freq Range	Harmonic Level
200 Hz to 10 MHz	–45 dB
10 MHz to 80 MHz	–40 dB

Integrated Phase Noise:
(30 kHz Band, excluding ± 1 Hz, centered on the carrier)

9.9 MHz < –63 dB
20 MHz < –70 dB
40 MHz < –64 dB
80 MHz < –58 dB

Spurious (25°C ± 10°C)

Impedance	All non-harmonically related signals (whichever is greater)
75 Ω	–125 dBm or –75 dBc
150 Ω	–100 dBm or –75 dBc

AMPLITUDE:

Range: 75 Ω, 150 Ω: +11.25 dBm to –88.74 dBm

Absolute Level Accuracy (Maximum Output at 100 kHz, 10°C to 35°C)

75 Ω: ± 0.05 dB
150 Ω: ± 0.10 dB

Flatness (relative to 100 kHz, Full Amplitude):

75 Ω: 1 kHz–25 MHz: ± 0.07 dB
200 Hz–80 MHz: ± 0.15 dB
150 Ω: 10 kHz–2 MHz: ± 0.18 dB

Amplitude Accuracy (includes the effects of flatness and attenuator):

75 Ω:

75 Ω Output Level (dBm)

	200 Hz	1 kHz	25 MHz	80 MHz
+11.25	± 0.25 dB	± 0.15 dB	± 0.35 dB	
– 8.74	± 0.30 dB	± 0.20 dB	± 0.45 dB	
–48.74	± 0.40 dB	± 0.30 dB	± 0.70 dB	
–88.74				

150 Ω:

150 Ω Output Level (dBm)

	10 kHz	2 MHz
+11.25	± 0.35 dB	
– 8.74	± 0.40 dB	
–48.74	± 0.85 dB	
–70.0*		

*Levels to –88.74 dBm can be selected but accuracies are unspecified due to the spurious noise floor of –100 dBm.

Table 1-2. General Information.

Output Impedance: (Selected by a front panel switch)
Standard: 50 ohms or 75 ohms
Option 002/004: 75 ohms unbalanced, 124 ohms balanced and 135 ohms balanced
Option 003: 75 ohms unbalanced and 150 ohms balanced

Frequency Range:
Standard:
50 Ω: 200 Hz to 80 099 999.999 Hz
75 Ω: 200 Hz to 80 099 999.999 Hz
Option 002/004:
75 Ω: 200 Hz to 80 099 999.999 Hz
124 Ω: 10 kHz to 10 MHz
135 Ω: 10 kHz to 2 MHz
Option 003
75 Ω: 200 Hz to 80 099 999.999 Hz
150 Ω: 10 kHz to 2 MHz

Frequency Resolution: 0.001 Hz

Frequency Display: 11 digits

Frequency Settling Time: < 20 msec to within 90° of final phase.

Frequency Sweep Mode:
Auto: ≈8 sweeps/sec, 100 steps/sweep
Manual, single 10 sec and 50 sec sweep: 1000 steps/sweep

Amplitude Range:
Standard:
50 ohms: +13.01 dBm to –86.98 dBm
75 ohms: +11.25 dBm to –88.74 dBm
Option 002:
75 ohms unbalanced:
124 ohms balanced: } +11.25 dBm to –88.74 dBm
135 ohms balanced: }
Option 003:
75 ohms unbalanced: +11.25 dBm to –88.74 dBm
150 ohms balanced:
Option 004: Same as Option 002

Amplitude Settling Time: < 500 msec to within 0.02 dB of final value.

Internal Frequency Reference:
Frequency stability is obtained by use of a 10 MHz crystal oscillator in a temperature-stabilized oven. A high-stability 10 MHz temperature-stabilized crystal oscillator is provided by Option 001. The master 40 MHz oscillator of the instrument reference section is capable of operating open loop (no oven or external reference) but the frequency stability is not specified.

External Frequency Reference:
The 40 MHz master oscillator of the reference section can be phase-locked to an external reference through a rear panel BNC connector. The amplitude and frequency requirements of the external signal are - 7 dBm to + 7 dBm (+ 0.1 V to + 0.5 V) with frequency being a sub-harmonic of 40 MHz and ⩾1 MHz.

Remote Programming:
The 3335A is a fully programmable instrument designed for systems interfacing with the Hewlett-Packard Interface Bus (HP-IB). It will recognize a preset listen address and accept bit-parallel, word (byte) serial ASCII coded instructions. The address is preset by five rear panel listen address switches. A brief description of the HP-IB with address and programming information is provided in Section III.

Programmability:
All FUNCTION keys except DISPLAY, all DATA keys including the ENTRY keys, all INCR keys and all FREQUENCY keys except the MANUAL TUNE keys and MANUAL SWEEP key are programmable. The POWER key and the impedance selection switch are not programmable.

HP-IB Connector:
The rear panel HP-IB connector provides all lines for remote control and digital output using the HP-IB. The connector is compatible with the -hp- 10631 (A, B or C) HP-IB cables and contains metric threaded cable mounting studs.

Maximum HP-IB Cable Length:
2 meters (6.56 feet) per device; 20 meters (65.6 feet) total accumulation per system.

HP-IB Lines:
The 3335A uses all of the HP-IB lines except EOI (End or Identify), SRQ (Service Request) and the data line DIO 8.

Data Input/Output:
All data is received through the HP-IB Data Input/Output (DIO) lines.

Data Transfer Timing:
Timing of data transfer is controlled by "handshake" lines DAV, NRFD and NDAC.

HP-IB Logic Levels:
TTL compatible low true (true state = digital ground or 0 V to 0.4 V dc; false state = open or + 2.5 V dc to + 5 V dc).

Isolation:
The HP-IB lines and 3335A are optical coupled.

Listen Address Code:
The 3335A is shipped from the factory with an ASCII listen address of $ (octal 044). Instructions for changing the listen address are provided in Section III.

HP-IB Bus Commands:
The 3335A will respond to certain Unaddress, Universal and Addressed Commands (see information on Remote Programming in Section III).

Telecommunications Features:
Amplitude blanking of the output signal at each change of output frequency is obtainable except in the manual tune and manual sweep modes. Special sweep feature allows each frequency step to be held for four seconds and also includes amplitude blanking.

General
Operating Temperature: 0°C to 55°C
Storage Temperature: - 40°C to + 75°C
Power Requirements: 100 V, 120 V, 220 V or 240 V ac, + 5% - 10%, 48 Hz to 66 Hz, 200 VA Maximum

Dimensions:
Dimensions in millimeters and (inches):
Height: 133.4 (5 1/4)
Width: 425.5 (16 3/4)
Depth: 501.7 (19 3/4)

Weight:
Weight in kilograms and (pounds): 19.05 (42)

Table 1-3. Recommended Test Equipment.

Equipment	Required Characteristics	Perf. Tests	Adj.	T.S.	Recommended Model
3335A Service Kit Consists of:	(Supplied with the instrument)		X	X	-hp- 03335-87901
(2) Extender Boards				X	-hp- 5061-0775
(1) Extender Board			X	X	-hp- 03335-66518
(1) Extender Board			X	X	-hp- 03335-66520
(1) Service Cable			X	X	-hp- 03335-61602
(1) Service Cable			X	X	-hp- 03335-61627
(1) SMA-to-BNC			X	X	-hp- 1250-1548
Terminations:					
50 Ω Feedthru		X		X	-hp- 11048C
75 Ω Feedthru		X		X	-hp- 11094B
Adapters:					
BNC "TEE"		X			-hp- 1250-0781
Conn. Adapter		X			-hp- 1250-0591
(2) BNC Male-to-Male		X			-hp- 1250-0216
(2) Type N(f) to BNC (m)		X			-hp- 1250-0077
(2) Type N(m) to BNC (f)		X			-hp- 1250-0780
(2) BNC (f) to dual banana plug		X	X	X	-hp- 1251-2277
Thermal Converter	Impedance: 50 Ω or 75 Ω Frequency Range: 200 Hz – 10 MHz Frequency Response: ± 0.05 dB 200 Hz – 10 MHz Input Voltage: 1 V rms	X			-hp- 11050A (50 Ω) or -hp- 11050A/H01 (75 Ω)
Double Balanced Mixer	Impedance: 50 Ω Frequency Range: 50 kHz to 80 MHz	X			-hp- 10534A
Attenuator	Certified (See Note 1) Range: 0–12 dB Steps: 1 dB	X			-hp- 355C
Attenuator	Certified (See Note 1) Range: 0–120 dB Steps: 10 dB	X			-hp- 355D
Attenuator	Fixed: 3 dB Accuracy: ± 0.3 dB	X			-hp- 8491A Option 003
Attenuator	Fixed: 6 dB Accuracy: ± 0.3 dB	X			-hp- 8491A Option 006
Digital Voltmeter	AC Function: Full Scale Ranges: 1 V, 10 V Freq. Range: 200 Hz–100 kHz Accuracy: ± 0.5% Resolution: 0.1 mV Input Impedance: > 1 mΩ < 90 pF DC Function: Full Scale Ranges: 100 mV–20 V Accuracy: ± 0.15% Resolution: 5 digits Input Resistance: > 1 MΩ	X	X	X	-hp- 3455A
AC Voltmeter	Full Scale Ranges 0.1 – 1 V Frequency Range: 200 Hz to 4 MHz Accuracy: ± 10% Input Impedance: 10 MΩ, < 25 pF	X		X	-hp- 400FL
Oscilloscope	Vertical Sensitivity: 0.005 V/div to 2 V/div Sweep: 0.05 μs/div to 0.1 sec/div Input Impedance: 1 MΩ, < 20 pF Input Coupline: ac/dc	X	X	X	-hp- 180C/D, 1805A, 1825A
Tracking Generator	Freq. Range: 100 kHz to 110 MHz Amplitude Range: 0 to –10 dB		X		-hp- 8443A

Table 1-3. Recommended Test Equipment.

Equipment	Required Characteristics	Perf. Tests	Adj.	T.S.	Recommended Model
Spectrum Analyzer	Frequency Range: 1 kHz–1.25 GHz Amplitude Accuracy: ± .5 dB Response: ± 0.5 dB	X	X	X	-hp- 141T, 8552B, 8553B, 8554B
Spectrum Analyzer	Frequency Range: 5 Hz to 50 kHz Amplitude Accuracy:± 0.5 dB Response: ± 3% Battery operation	X		X	-hp- 3580A Option 001
Wave Analyzer	Frequency Range: 15 Hz–50 kHz Accuracy: ± 3 Hz Amplitude Range: – 150 dBm – +30 dBm Accuracy: ± 0.5 dB Recorder Output: 0–+5 V ± 2.5%	X			-hp- 3581A
Amplifier	Frequency Range: 0.1–80 MHz Gain: 20 dB ± 0.5 dB at 10 MHz Response: ± 0.5 dB Noise Figure: < 5 dB Harmonic Distortion: –32 dB for 0 dBm output Impedance: 50 Ω	X			QB–300 Q-Bit Corp. P.O. Box 2208 Melbourne, FL 32901
Quartz Frequency Standard	Output: 5 MHz, 1 V rms into 50 Ω Short Term Stability: 5 parts in 10^{12} for 1 sec averaging time		X		-hp- 105A/B
Universal Counter	Frequency: 200 Hz–80 MHz Sensitivity: 50 mV rms Impedance: 1 MΩ, < 50 pF	X		X	-hp- 5328A
Power Meter	Power Range: 13.5 dB Frequency Range: 100 kHz to 80 MHz Accuracy: ± 0.05%	X			-hp- 436A
Power Sensor	Power Range: 0.3 μW to 100 mW Impedance: 50 Ω or 75 Ω Freq. Range: 100 kHz–80 MHz	X			-hp- 8482A (50 Ω) or -hp- 8483A (75 Ω)
1 MHz LPF	Cut Off Freq: 1 MHz Stopband Attn: 50 dB by 4 MHz Stopband Freq: 4 MHz–80 MHz	X			J903 TT Electronics,Inc. 2214 S. Barry Ave. Los Angeles, CA 90064
Synthesizer	Frequency Range: 10 MHz–80 MHz Amplitude Range: –10 dBm to +10 dBm Accuracy: ± 0.05 dB Phase Noise (30 kHz Integrated): 9.9 MHz: < –63 dB 20 MHz: < –70 dB 40 MHz: < –64 dB 80 MHz: < –58 dB	X			-hp- 3335A
Power Supply	Output: + 15 V	X			-hp- 6215A
(2) Cables		X			-hp- 11170A
(2) Cables		X			-hp- 11170B
(2) Cables		X			-hp- 11170C
Active Probe	Input Impedance = 100 kΩ shunted by 3 pfds		X		-hp- 1120A

NOTE 1

Attenuators of known accuracy are required. Certification is obtainable from Hewlett-Packard. Contact your nearest Hewlett-Packard Sales and Service Office. A list of offices is provided at the back of this manual.

SECTION II
INSTALLATION

2-1. INTRODUCTION.

2-2. This section contains instructions for installing and interfacing the Model 3335A Synthesizer/Level Generator. Included are initial inspection procedures, power and grounding requirements, line voltage selection, environmental requirements, installation instructions, HP-IB connection procedure and instructions for repackaging for shipment.

2-3. INITIAL INSPECTION.

2-4. Inspect the shipping container for damage. If the shipping container or cushioning material is damaged, it should be kept until the contents of the shipment have been checked for completeness and the instrument has been checked mechanically and electrically. The contents of the shipment should be as shown in Figure 1-1. This instrument was carefully inspected both mechanically and electrically before shipment. It should be free of mars or scratches and in perfect electrical order upon receipt. Procedures for checking electrical performance are given in Section IV. If the contents are incomplete, if there is mechanical damage or defect, or if the instrument does not pass the electrical performance test, notify the nearest Hewlett-Packard Sales and Service Office. If the shipping container is damaged or the cushioning material shows signs of stress, notify the carrier as well as the Hewlett-Packard office. Keep the shipping materials for the carrier's inspection. The warranty statement is located at the front of this manual.

2-5. PREPARATION FOR USE.

2-5(a). Reference Frequency.

2-5(b). A stable frequency reference must be connected to the 40/N MHz REFerence INPUT located on the rear panel. If the internal 10 MHz reference is to be used, the BNC-to-BNC Adapter (see Figure 6-2 Item 25) must be connected from the 10 MHz REFerence OVEN output, also located on the rear panel, to the 40/N M/Hz REFerence INPUT. The BNC-to-BNC Adapter is packed with the accessories.

2-6. Power Requirements.

2-7. The Model 3335A Synthesizer/Level Generator requires a power source of 100, 120, 220 or 240 V ac, + 5%, - 10%, 48 to 66 Hz single phase. Power consumption is 200 VA maximum.

2-8. Line Voltage Selection.

CAUTION

Before switching on this instrument, be sure it is set for the line voltage of the power source. Also ensure the line power cord is connected to a protective earth contact.

2-9. Line voltage and fuse selection instructions are provided on the rear panel above the ac line connector. The line voltage is selected by the position of the two rear panel line voltage selection switches.

NOTE

The correct fuse rating for the line voltage selected is located on the rear panel between the fuse location and line voltage selection switch.

The line voltage and fuse are factory installed for 120 V operation.

WARNING

To maintain operator safety, the following precautions must be followed before the instrument power cable is connected:

a. Before the power cable is connected to a power source, the protective earth terminal of the instrument must be connected to earth ground. This is accomplished by ensuring that the instrument's ac line input connector earth terminal is correctly connected to the instrument's chassis and that the power cord ground conductor has continuity from end to end.

b. Note that the protection provided by grounding the instrument cabinet will be lost if a power cable not containing a ground conductor like the type supplied is used to connect the ac line voltage to the instrument.

c. The power cable plug must be inserted into a socket outlet provided with a protective earth contact. The protection of the grounded instrument cabinet must not be negated by the use of an extension cord without a protective ground conductor.

d. If this instrument is to be energized via an auto-transformer to reduce or increase the line voltage, make sure that the common terminal is connected to the earthed pole of the power source.

2-10. Power Cable.

2-11. In accordance with international safety standards, this instrument is equipped with a three-wire power cable. When connected to an appropriate power line outlet, this cable grounds the instrument cabinet. The type of power cable plug shipped with each instrument depends on the country of destination. Refer to Figure 2-1 for the part numbers of the power cable plugs available.

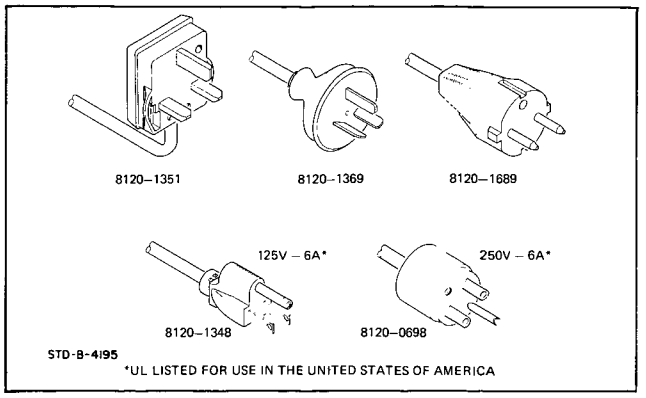


Figure 2-1. Power Cables.

2-12. HP-IB Connections.

2-13. Interconnection data concerning the rear panel HP-IB connector is provided in Figure 2-2. This connector is compatible with the -hp- 10631 (A, B, or C) HP-IB Cables. With the HP-IB system, you can interconnect up to fourteen (including the controller) HP-IB compatible instruments. The HP-IB Cables have identical "piggyback" connectors on both ends so that several cables can be connected to a single source without special adapters or switch boxes. You can interconnect system components and devices in virtually any configuration you desire. There must, of course, be a path from the calculator (or other controller) to every device operating on the bus. As a practical matter, avoid stacking more than three or four cables on any one connector. If the stack gets too large, the force on the stack produces great leverage which can damage the connector mounting. Be sure that each connector is firmly screwed in place to keep it from working loose during use (see CAUTION of Figure 2-2).

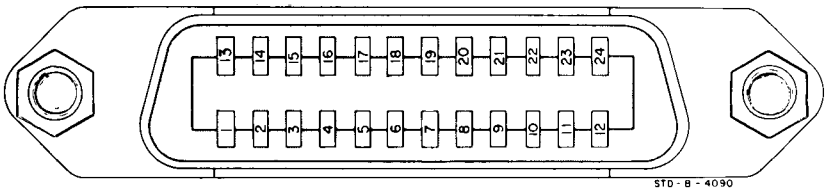
2-14. Cable Length Restrictions. To achieve design performance with the HP-IB, proper voltage levels and timing relationships must be maintained. If the system cable is too long, the lines cannot be driven properly and the system will fail to perform. Therefore, when interconnecting an HP-IB system, it is important to observe the following rules:

a. The total cable length for the system must be less than or equal to 20 meters (65 feet).

b. The total cable length for the system must be less than or equal to 2 meters (6 feet) times the total number of devices connected to the bus.

2-15. 3335A Listen Address.

2-16. The 3335A contains a rear panel HP-IB Instrument listen address selection switch. There are five switches



PIN	LINE	
1	DI01	
2	DI02	
3	DI03	
4	DI04	
13	DI05	
14	DI06	
15	DI07	
16	DI08	
5	EOI	
17	REN	
6	DAV	
7	NRFD	
8	NDAC	
9	IFC	
10	SRQ	
11	ATN	
12	SHIELD–CHASSIS GROUND	
18	P/O TWISTED PAIR WITH PIN 6	THESE PINS ARE INTERNALLY GROUNDED
19	P/O TWISTED PAIR WITH PIN 7	
20	P/O TWISTED PAIR WITH PIN 8	
21	P/O TWISTED PAIR WITH PIN 9	
22	P/O TWISTED PAIR WITH PIN 10	
23	P/O TWISTED PAIR WITH PIN 11	
24	ISOLATED DIGITAL GROUND	

CAUTION

The 3335A contains metric threaded HP–IB cable mounting studs as opposed to English threads. Metric threaded -hp-10631A, B, or C HP–IB cable lockscrews must be used to secure the cable to the instrument. Identification of the two types of mounting studs and lockscrews is made by their color. English threaded fasteners are colored silver and metric threaded fasteners are colored black. DO NOT mate silver and black fasteners to each other or the threads of either or both will be destroyed. Metric threaded HP-IB cable hardware illustrations and part numbers follow.

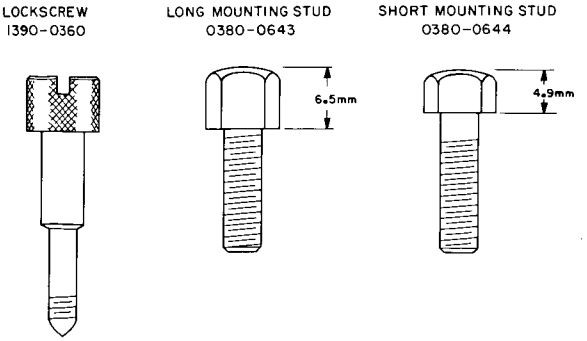


Figure 2-2. HP-IB Connector.

designated (5 . . . 1)which are used to select the listen address. Instructions for changing the listen address are provided in Section III of this manual along with 3335A programming codes.

2-17. HP-IB Descriptions.

2-18. A description of the HP-IB is provided in Section III of this manual. A study of this information is necessary if you are not familiar with the HP-IB concept. Additional information concerning the design criteria and operation of the bus is available in IEEE Standard 488-1975 titled "IEEE Standard Digital Interface for Programmable Instrumentation".

2-19. OPERATING ENVIRONMENT.

WARNING

To prevent potential electrical or fire hazard, do not expose equipment to rain or moisture.

2-20. Operating and Storage Temperature.

2-21. In order for the 3335A to meet the specifications listed in Table 1-1, the operating environment must be within the following limits:

Temperature. . . . . .0 to + 55°C
Humidity. . . . . .< 85% relative
Altitude. . . . . < 15,000 feet

2-22. Cooling System.

2-23. A forced air cooling system is used to maintain the operating temperature required by the instrument. The cooling fan is located on the right side of the instrument drawing air through the filtered side panel. When operating the instrument, choose a location that provides at least three inches of clearance at the rear and at least one inch for each side. Failure to provide adequate air clearance will result in excessive internal temperature reducing instrument reliability. The clearances provided by the plastic feet in bench stacking and the filler strip in rack mounting allow air passage across the top and bottom cabinet surfaces.

NOTE

Rack Mount side slide assemblies cannot be used with the 3335A. These assemblies block air passage to the fan and will cause overheating.

2-24. Thermal Cutout Switch.

2-25. The 3335A is equipped with a thermal cutout switch which automatically removes line voltage when the internal temperature becomes excessive. The switch resets automatically when the instrument cools. If a thermal cutout occurs, check for an inoperative fan, clogged fan parts or filter and other conditions that could obstruct air flow. To clean the fan filter, the side panel/filter assembly must be removed. Flush the filter with soapy water, rinse clean and air dry.

2-26. Bench Operation.

2-27. The instrument has plastic feet attached to the bottom panel. The front feet contain foldaway tilt stands for convenience in bench operation. The tilt stand raises the front of the instrument for easier viewing of the control panel. The plastic feet are shaped to make full-width modular instruments self-align when they are stacked. A front handle kit, -hp- Part No. 5060-9899 (Option 907), can be installed for ease of handling the instrument on the bench (see Figure 2-3). The kit is shipped with the instrument if Option 907 is also ordered. Otherwise, the front handle kit is available separately by its -hp- part number.

2-28. Rack Mounting.

2-29. The 3335A can be rack mounted in a rack having an EIA standard width of 482.6 mm (19 inches). The instru-

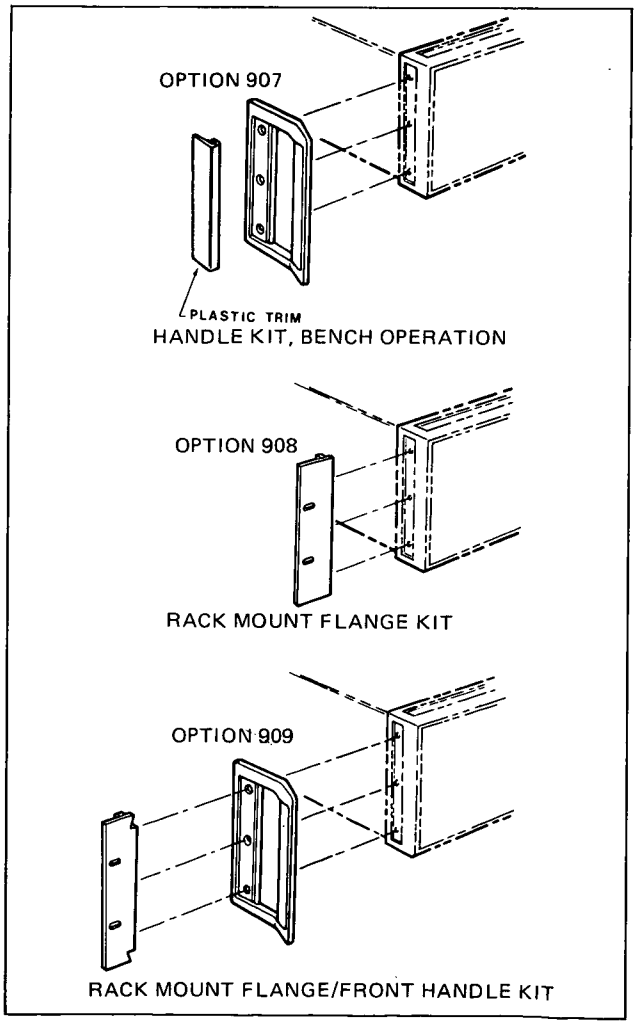


Figure 2-3. Rack Mount and Handle Kits.

ment can be rack mounted with or without a handle kit by use of the following items:

a. Rack mounting without handles: use Rack Mount Flange Kit -hp- Part No. 5061-0077 (Option 908).

b. Rack mounting with handles: use the combination Rack Mount Flange/Front Handle Kit -hp- Part No. 5061-0083 (Option 909).

NOTE

The Rack Mount Flange Kit of item a will not provide the space requirement for rack mounting when used with the bench handle assembly (-hp- Part No. 5060-9899, Option 907). To rack mount with handles, the combination kit of item b (Option 909) must be used (see Figure 2-3). If either Option 908 or 909 is ordered, the corresponding kit is shipped with the instrument. Otherwise, both kits are available separately by their -hp- part numbers.

CAUTION

If instrument is to be rack mounted, do not install standard slide kit. Use of a slide kit blocks air passage to the side mounted fan and will cause excessive heating to occur within the instrument.

2-30. STORAGE AND SHIPMENT.

2-31. Environment.

2-32. The instrument should be stored in a clean, dry environment. The following environmental limitations apply to both storage and shipment:

Temperature. . . . . -40°C to +75°C
Humidity. . . . . <95% relative
Altitude. . . . . <25,000 feet

2-33. Packaging.

2-34. Original Packaging. Containers and materials equivalent to that used in factory packaging are available through Hewlett-Packard offices. If the instrument is being returned to Hewlett-Packard for servicing, attach a tag indicating the type of service required, return address, model number, and full serial number. Also, mark the container FRAGILE to assure careful handling. In any correspondence, refer to the instrument by model number and full serial number.

2-35. Other Packaging. The following general instructions should be used for repackaging with commercially available materials.

a. Wrap the instrument in heavy paper or plastic. (If shipping to a Hewlett-Packard office or service center, attach a tag indicating the type of service required, return address, model number, and full serial number.)

b. Use a strong shipping container. A doublewall carton made of 250-pound test material is adequate.

c. Use enough shock-absorbing material (3-to-4 inch layer) around all sides of the instrument to provide firm cushion and prevent movement inside the container. Protect the control panel with cardboard.

d. Seal the shipping container securely.

e. Mark the shipping container FRAGILE to assure careful handling.

SECTION III
OPERATING INSTRUCTIONS

3-1. INTRODUCTION.

3-2. This section contains operating and programming instructions for the -hp- Model 3335A Synthesizer/Level Generator. Included is a description of controls, connectors and indicators, operating instructions and operator's maintenance. A list of operating features is tabulated in Table 3-1 which can be used as an index to locate operating information.

3-3. PANEL FEATURES.

3-4. Figure 3-2 illustrates and describes the function of all front and rear panel controls, connectors and indicators. Items requiring additional description are referenced to paragraphs in the operating instructions.

3-5. OPERATOR'S MAINTENANCE.

3-6. Operator's maintenance of the -hp- Model 3335A Synthesizer/Level Generator is limited to rear panel power line fuse replacement.

CAUTION

When replacing fuses, always verify the replacement fuse is of the correct amperage and is FAST-BLO.

3-7. POWER/WARM-UP.

3-8. The Model 3335A Synthesizer/Level Generator requires a power source of 100, 120, 220 or 240 V ac, + 5%, - 10%, 48 to 66 Hz single phase. The selection of line voltage and input power fuse is described in Section II, Paragraph 2-5, PREPARATION FOR USE.

3-9. The 3335A has a two-position power switch, STBY and ON. It is important that the instrument remain connected to the power source in the STBY mode when not in use. This supplies power to the crystal oven maintaining a constant oven temperature thus eliminating the need for a long warm-up period. When the STBY mode is not used and power is disconnected from the instrument, allow 30 minutes from the application of external power in the ON mode for the instrument to warm up.

3-10. Modes of Operation.

3-11. There are two manual modes of operation and an automatic sweep mode of operation for the Model 3335A Synthesizer/Level Generator. One manual mode is manual tune operation allowing the user to manually tune any frequency in the 3335A's range. The other manual mode is the manual sweep mode which allows the user to manually sweep the frequency between predetermined end points. The automatic sweep mode allows the user to initiate a single sweep or a continuous sweeping output. The automatic sweep modes are remotely programmable through the HP-IB.

3-12. OPERATING INSTRUCTIONS.

3-13. Operating the Model 3335A Synthesizer/Level Generator requires programming the operating parameters by use of front panel keys. These keys are contained in four major groupings. From left to right across the front panel the groups are:

Table 3-1. Operating Information Index.

Operating Item	Paragraph
Frequency Entry	3-26
Frequency Increment Entry	3-28
Amplitude Entry	3-30
Amplitude Increment Entry	3-33
Phase Increment Entry	3-35
Phase/Phase Increment Displays	3-37
Preset Entries	3-39
Merging Data into a Preset Register	3-41
Recalling Data from a Preset Register	3-43
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Sweep Mode	3-52
HP-IB Indicators and LOCAL Key	3-54
Front Panel Output Connectors	3-56
Rear Panel BNC Connectors	3-58
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HP-IB Bus Commands	3-77
Programming	3-78
Programming the Increment Functions	3-84
Unaddressed or Local Operation when connected to the HP-IB	3-86
Communications Features	3-88

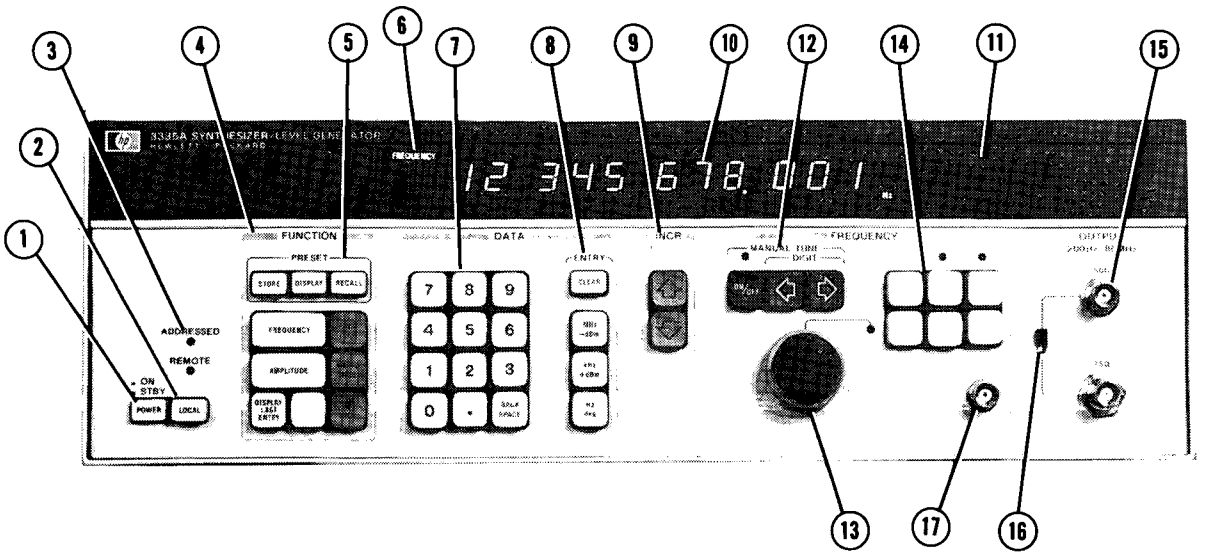
a. FUNCTION
b. DATA
c. INCR
d. FREQUENCY

3-14. FUNCTION Keys.

3-15. The FUNCTION keys control which operating parameter is displayed. Within the FUNCTION group is a subgroup called PRESET. This subgroup controls ten storage registers each capable of storing all of the operating parameters of the FUNCTION group. This is useful for recalling a particular set of operating parameters without having to enter each one.

3-16. DATA Keys.

3-17. The DATA keys are used to enter a new operating parameter which is selected by the FUNCTION keys. This group contains a subgroup called ENTRY. The ENTRY



(1) POWER Switch. A two position switch (ON and STBY) for controlling line power. In the STBY position, power is applied to the internal temperature-stabilized crystal oven to maintain the operating temperature. This eliminates the need for long warm-up periods when the instrument is turned on. Additionally, unregulated 8 V is present on the Controller and Attenuator Driver Assemblies in the STBY mode.

(2) LOCAL Switch. Returns the instrument to local control when operated remotely and Local Lockout command has not been issued.

(3) HP-IB Annunciators. Indicates when the instrument is under remote control and if it is addressed to listen.

(4) FUNCTION Keys. Used to display a particular operating parameter or preface a data entry.

(5) PRESET Keys. Provide access to ten storage registers each capable of storing all operating parameters of the FUNCTION group.

(6) Annunciator Group 1. Indicates the operating parameter being displayed. Annunciators consist of CENTER, FREQUENCY, SWP WIDTH, AMPLITUDE, Ø and INCR.

(7) DATA Keys. Used to make data entries.

(8) DATA ENTRY Keys. Used to complete a data entry.

(9) INCR Keys. Used to initiate a frequency, amplitude or phase increment.

(10) Numeric Display. Indicates the magnitude (and polarity if applicable) of the parameter being displayed.

(11) Annunciator Group 2. Indicates the units of the operating parameter displayed (MHz, kHz, Hz, dBm or deg). Also contains the annunciators ENTRY, UNLOCKED, SWEEPING and UNLEVELED.

(12) Manual Tune Keys. Initiates the manual tune frequency mode and establishes the degree of resolution of the manual tuning.

(13) Frequency Tune Knob. Used to manually alter the frequency when in the manual tune or manual sweep mode.

(14) Sweep Keys. Initiates and controls the frequency sweep mode of operation.

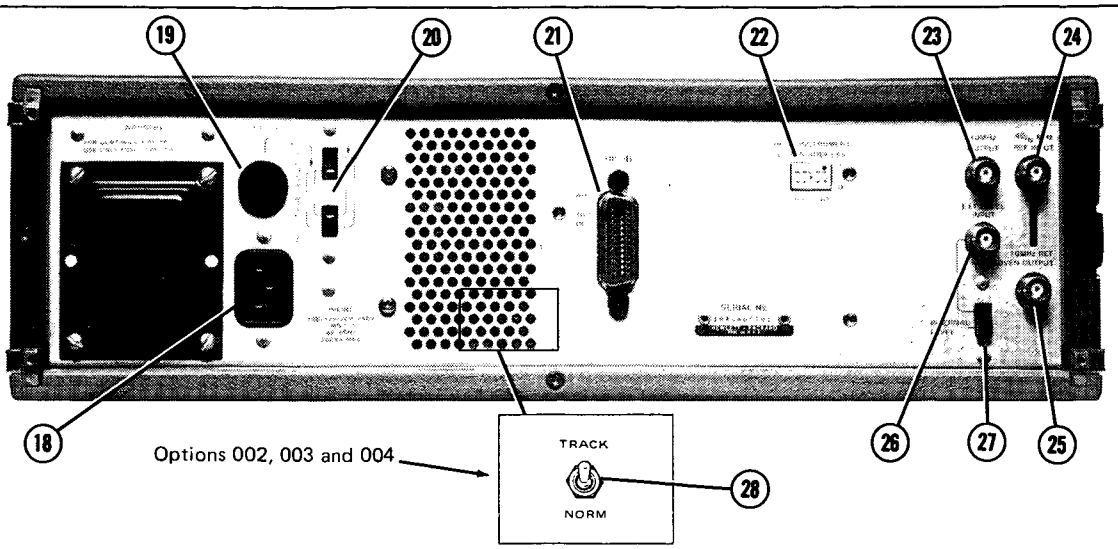
(15) Output Connectors. Provides the programmed output at the output impedance selected by the front panel impedance switch.

(16) Impedance Switch. Used to select the desired output impedance. This switch determines which output connector (item 15) is active.

(17) SWEEP OUTPUT Connector. Provides a 0 to + 2 V dc sweep ramp for use in driving external equipment (oscilloscope, X–Y recorder, etc.) when in the sweep mode.

⚠ Symbol. This symbol is an international symbol meaning "refer to the Operating and Service Manual". This symbol appears in this section of the manual flagging operating instruction information.

Figure 3-1. Front and Rear Panels.



(18) AC Line Input Connector.

(19) AC Line Fuse.

(20) Line Voltage Selection Switches. Used to select the ac line input for the voltage of the power source.

(21) HP-IB Connector. Used to interface the instrument with the HP-IB for remote operation.

(22) HP-IB Listen Address Selection Switches. Used to set the instrument listen address.

(23) 10 MHz OUTPUT Connector. Provides a 10 MHz external reference signal generated by the instrument's reference section.

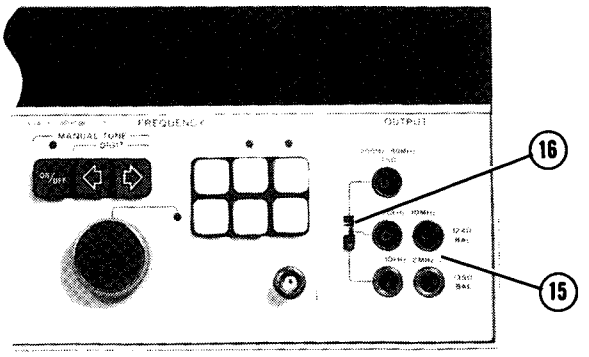
(24) 40/N MHz REF INPUT Connector. Provides the input to the reference section sampling detector to phase-lock the master oscillator. The notation 40/N MHz means this input must be a subharmonic of 40 MHz. The input can be the internal 10 MHz crystal oscillator from the REF OUTPUT (item 25) or an external standard.

(25) 10 MHz REF OVEN OUTPUT Connector. Provides the output from the temperature-stabilized crystal oscillator. It is coupled to the 40/N MHz INPUT connector (item 24) to supply the reference signal when an external standard is not used.

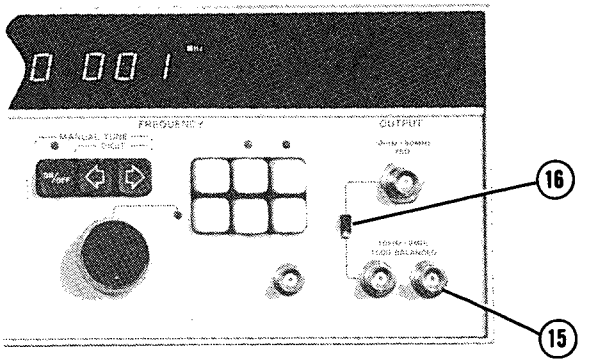
(26) EXT LEVEL INPUT Connector. Provides a means of controlling amplitude by use of an external amplitude reference.

(27) LEVELING Switch. Activates the EXT LEVEL INPUT when in the top position. When in the INTERNAL LEVEL position, leveling is controlled by the instrument.

(28) TELECOMMUNICATIONS SWEEP Switch. In Track position, alters the AUTO sweep by slowing it to ≈ 4 sec per step and blanking the amplitude during frequency changes. (Options 002, 003 and 004 only.)



Option 002/004: Front Panel.



Option 003: Front Panel

Figure 3-1. Front and Rear Panels (Cont'd).

keys are used to complete a data entry or to clear an entry made in error. The FUNCTION and DATA groups together are used to program the operating parameters.

3-18. INCR Keys.

3-19. There are two keys in the INCR group—an arrow up and an arrow down. These keys are used to increment the frequency, amplitude or phase (whichever function is displayed), by the increment parameter programmed from the FUNCTION group. The key pressed determines the direction the increment is made.

3-20. FREQUENCY Keys.

3-21. The FREQUENCY keys are divided into two sub-

groups, MANUAL TUNE and SWEEP. Below the MANUAL TUNE keys is a tuning knob. When the MANUAL TUNE function is selected, a "flashing" digit appears on the display. The left and right arrow digit keys can be used to select any digit to be the "flashing" digit. Turning the knob changes the frequency by the resolution of the "flashing" digit.

3-22. The SWEEP subgroup allows the frequency to automatically sweep a programmed set of frequencies determined by the frequency of operation (center frequency) and the SWEEP WIDTH programmed from the FUNCTION group. A manual sweep mode allows the user to manually sweep the programmed set of frequencies. To return to keyboard operation of the other key groups, the STOP key in the SWEEP subgroup must be pressed.

3-23. Turn-On Operating Parameters.

3-24. When the Model 3335A is turned on, the output parameters of the FUNCTION group initially are:

Frequency	1 000 000. 0 Hz
Amplitude	- 86.98 dBm (50 Ω) - 88.74 dBm (75 Ω)
FREQ INCR	1.0 Hz
AMPTD INCR	1.0 dB (Note: For AMPTD INCR display, the annunciator dBm is used for dB)
Ø INCR	1.0 deg
SWEEP WIDTH	100.0 Hz

3-25. The 3335A turns on with the frequency displayed. To check the initial conditions of the other operating parameters, press the key in the FUNCTION group of the parameter of interest. The display should indicate the initial conditions stated in the preceding paragraph. If the instrument was not previously connected to a power source and in STBY, the out-of-lock annunciator "UNLOCKED" will be displayed until the reference oven temperature stabilizes (< 20 minutes). If "UNLOCKED" is still displayed after twenty minutes, check to be sure the BNC-to-BNC adapter from the 10 MHz REF OVEN OUTPUT connector to the 40/N MHz Ref Input has been installed (see Figure 6-2, Item 25).

3-26. Frequency Entry.

3-27. The 3335A has a frequency range of 200 Hz to 80 099 999. 999 Hz with resolution of 0.001 Hz. The desired output frequency is programmed by activating the FREQUENCY FUNCTION key, DATA keys 0 through 9 and a DATA ENTRY key Hz, kHz or MHz. A description of these keys and the frequency display indicators follows.

NOTE

For the following Operating Instructions, refer to Figure 3-1.

FREQUENCY Key. Preface key for entering frequency. When pressed, the front panel displays the present output frequency and the controller is enabled to accept new frequency data.

DATA Keys. These keys are used to enter the desired frequency. Notice that when data is entered, the digits enter the display from right to left. Holding a digit key down causes that digit to be entered respectively. If a wrong digit is entered, press the BACK SPACE key and the right-most digit of the display (the last digit entered) will be deleted. Continue with the correct entry.

DATA ENTRY Keys. If an entry is completely in error, the CLEAR key can be used to reset the display entry to zero. The correct entry can then be made. An entry is finalized by pressing one of the three range keys. The display changes to indicate the new output frequency. If an illegal entry has been finalized, the output frequency does not change and the display flashes.

DISPLAY INDICATORS:

FREQUENCY Indicator. Indicates the front panel is displaying the output frequency or a frequency entry.

ENTRY Indicator. Indicates the front panel is not displaying the output frequency but holding a frequency entry that has not yet been finalized by a data entry key.

The numeric display indicates the output frequency programmed. The digits are entered from right to left as frequency digits are keyed in. The frequency can be displayed in Hz, kHz or MHz dependent on which range key is pressed. The units of the display can be changed at any time by pressing the desired range key.

Example:

Program a frequency of 12345678.901 Hz

Display Result: 12 345 678.901 Hz

Change units to kHz: Press kHz ENTRY key.

Display Result: 12 345.678 901 kHz

Change units to MHz: Press MHz ENTRY key.

Display Result: 12.345 678 901 MHz

NOTE

If the front panel is displaying frequency, it is not necessary to preface a frequency entry with the FREQUENCY key.

3-28. Frequency Increment Entry.

3-29. Frequency increment is used when it is desired to manually change the frequency by a specified increment. The desired frequency increment is programmed by activating the FREQ INCR FUNCTION key, DATA keys 0 through 9 and a DATA ENTRY key Hz, kHz or MHz just as the frequency was programmed. A frequency increment of zero (no increment) can be programmed while the maxi-

mum increment programmable is the maximum output frequency of 80 099 999. 999 Hz. Trying to program an increment greater than the maximum results in a flashing display indicating an illegal entry. To change the output frequency by the programmed increment, the INCR keys are activated incrementing the frequency either up or down. A description of the keys and frequency step display indicators follows.

KEYS:

FREQ INCR Key. Preface key for entering frequency increment. When pressed, the front panel displays the present frequency increment and the controller is enabled to accept new frequency increment data.

DATA Keys. Used to enter the desired frequency increment.

DATA ENTRY Keys. Used to finalize the frequency increment entry. If an increment is programmed that exceeds the maximum, the display flashes indicating an illegal entry.

INCR Keys. These keys are used to change the output frequency by the programmed increment. The frequency can be incremented either up or down dependent upon the INCR key activated. If an INCR key is held activated, the frequency continues to be incremented providing a step frequency sweep. The magnitude of each step is determined by the frequency increment programmed.

DISPLAY INDICATORS:

FREQUENCY INCR Indicator. Indicates the front panel is displaying the present frequency increment or a frequency increment entry.

ENTRY INDICATOR. Indicates the display holds a frequency increment entry not yet finalized by a data entry key.

The numeric display indicates the frequency increment programmed. Can be displayed in kHz or MHz by pressing the desired range key.

Example:

Program a frequency increment of 12500 Hz.

Display Result: 12 500. 0 Hz

Display present frequency by pressing FREQUENCY FUNCTION key.

Display Result: Present frequency is displayed.

NOTE

This step can be omitted and the frequency incremented by pressing an INCR key even though FREQ INCR is displayed.

Increment the frequency by pressing the INCR down arrow.

Display Result: Present frequency is decreased by 12 500.0 Hz

Return to initial frequency by pressing the INCR up arrow.

Display Result: Initial frequency is displayed.

NOTE

If the front panel is displaying frequency increment, it is not necessary to preface a frequency increment entry with the FREQ INCR key.

3-30. Amplitude Entry.

3-31. The 3335A Amplitude limits are determined by the output impedance selected. In the standard instrument a 50 ohm or 75 ohm output impedance can be chosen. With a 50 ohm output, the amplitude range is - 86.98 dBm to + 13.01 dBm. For a 75 ohm output, the amplitude range is - 88.74 dBm to + 11.25 dBm. Any amplitude within the range can be programmed with 0.01 dBm resolution. For option 002, 003 or 004 instrument amplitude ranges, refer to Table 1-2, General Information.

3-32. The desired output amplitude is programmed by activating the AMPLITUDE FUNCTION key, DATA keys 0 through 9 and a DATA ENTRY key - dBm or + dBm. A description of these keys and the amplitude display indicators follows:

KEYS:

AMPLITUDE Key. Preface key for entering amplitude. When pressed, the display indicates the present output amplitude and the controller is enabled to accept new amplitude data.

DATA Keys. These keys are used to enter the desired amplitude.

DATA ENTRY Keys. Used to finalize the amplitude entry. If an amplitude is programmed which exceeds the range of the instrument, the output amplitude does not change and the display flashes.

DISPLAY INDICATORS:

AMPLITUDE Indicator. Indicates the front panel is displaying the present output amplitude or an amplitude entry.

ENTRY Indicator. Indicates the display holds an amplitude entry not yet finalized by a data entry key.

The numeric display indicates the amplitude programmed.

Example:

Program an amplitude of - 23.45 dBm.

Display Result: - 23.45 dBm

NOTE

1. It is normal to hear relay operation when the attenuator changes attenuator pads.

2. If the front panel is displaying amplitude, it is not necessary to preface and amplitude entry with the AMPLITUDE key.

3. With a negative amplitude displayed, depressing the BACK SPACE key will cause an ENTRY preceded by a negative sign. With this type of amplitude entry displayed, the "–dBm" and "+dBm" entry keys will both finalize a negative amplitude.

3-33. Amplitude Increment Entry.

3-34. Amplitude increment is used when it is desired to manually change the amplitude by specific increments. The desired amplitude increment is programmed by activating the AMPTD INCR FUNCTION key, DATA keys 0 through 9 and a DATA ENTRY key, - dBm or + dBm. If an amplitude increment greater than 99.99 dBm is programmed, the display flashes indicating an illegal entry. A description of the keys and amplitude increment display indicators follows.

KEYS:

AMPTD INCR Key. Preface key for entering amplitude increment. When pressed, the front panel displays the present amplitude increment and the controller is enabled to accept new amplitude increment data.

DATA Keys. These keys are used to enter the desired amplitude increment.

DATA ENTRY Keys. Used to finalize the amplitude increment entry. If an increment is programmed that exceeds the maximum, the display flashes indicating an illegal entry.

INCR Keys. These keys are used to change the output amplitude by the programmed increment. By holding an INCR key activated, the amplitude can be stepped through an amplitude sweep.

DISPLAY INDICATORS:

AMPLITUDE INCR Indicator. Indicates the front panel is displaying the present amplitude increment or an amplitude increment entry.

ENTRY Indicator. Indicates the display holds an amplitude increment entry not yet finalized by a data entry key. The numeric display indicates the amplitude increment programmed.

NOTE

Amplitude increment is actually in dB but the dBm annunciator is used.

Example:

Program an amplitude increment of + 2.75 dBm.

Display Result: 2.75 dBm

Display present amplitude, press AMPLITUDE FUNCTION key.

Display Result: Present Amplitude display

Increment amplitude by pressing the INCR up arrow.

Display Result: Present amplitude is incremented by 2.75 dBm.

3-35. Phase Increment Entry.

3-36. The phase increment can be used to change the output phase relationship with respect to another signal by a fixed phase increment. As an example, the 10 MHz rear panel output and the front panel output signal have a certain phase difference at turn-on. By phase incrementing the output, the output signal will increase or decrease the initial phase difference by the magnitude of the phase increment programmed. An example of using the phase increment function is illustrated in the integrated phase noise test of Section V. The desired phase increment is programmed by activating the Ø INCR FUNCTION key, DATA keys 0 through 9 and the deg DATA ENTRY key. An increment range of 0 degree to 360 degrees is obtainable with a resolution of 0.1 degree. Any increment attempted greater than 360 degrees causes the display to flash indicating an illegal entry. A description of the keys and the Ø and Ø increment displays follows.

KEYS:

Ø INCR Key. Preface key for entering phase increment. When pressed, the front panel displays the present phase increment and the controller is enabled to accept new phase increment data.

DATA Keys. These keys are used to enter the desired phase increment.

DATA ENTRY Key. Used to initialize the phase increment entry. If an increment is entered exceeding 360 degrees, the display flashes when the ENTRY key is pressed.

DISPLAY INDICATORS:

Ø INCR Indicator. Indicates the front panel is displaying the present phase increment or a phase increment entry.

∅ Indicator. Indicates the phase difference introduced with respect to the initial phase of the present frequency. This indicator appears when an INCR key is pressed when ∅ INCR is displayed.

ENTRY Indicator. Indicates the display holds a phase increment entry not yet finalized by a data entry key.

The display indicates the phase increment programmed.

Example:

Program a phase increment of 45.0 degrees.

Display Result: 45.0 deg

Press the INCR up arrow two (2) times.

Display Result: Display annunciator shows ∅ and display shows 90.0 deg.

NOTE

If an INCR key is held, the output is phase incremented continuously.

3-37. Phase/Phase Increment Displays.

3-38. When the display indicates the ∅ difference introduced by the phase increment and a new phase increment entry is made which is not prefaced by the ∅ INCR key, the display automatically reverts to a ∅ INCR display. The entry can be finalized like any other phase increment entry. Therefore, if the display is indicating phase, a phase increment entry need not be prefaced by the ∅ INCR key.

3-39. Preset Entries.

3-40. All operating parameters of the FUNCTION group can be stored in one of ten PRESET registers. The ten registers are numbered 0 through 9 and are capable of storing ten different sets of the operating parameter's frequency, amplitude, frequency increment, amplitude increment, phase increment and sweep width. At turn-on, all registers contain the turn-on operating parameters. The PRESET keys which control the registers are STORE, DISPLAY and RECALL. A description of the PRESET keys follows.

KEYS:

STORE Key. Used to store the operating parameters of the front panel output. The digit key of the register to store the parameters must be pressed following the STORE key. This stores the operating parameters frequency, amplitude, frequency increment, amplitude increment, phase increment, sweep width, and the state of the manual tune control without affecting the output signal.

RECALL Key. Used to recall the operating parameters of a particular register. The digit key of the register containing the operating parameters desired must be pressed following the RECALL key. This changes the amplitude and frequency of the output signal to that stored in the register. It also changes all other FUNCTION parameters to that stored in the register (e.g., AMPTD INCR, FREQ INCR, ∅ INCR and SWEEP WIDTH).

DISPLAY keys. Used to display a particular operating parameter stored in a register. Displaying a parameter does not change the output signal but is displayed as an entry. This entry can be finalized by pressing a DATA ENTRY key.

Example.

Preset the following operating parameters in storage register 2.

FREQUENCY	2 MHz
AMPLITUDE	2 dBm
FREQ INCR	200 Hz
AMPTD INCR	0.2 dBm
∅ INCR	2 degrees
SWEEP WIDTH	2 kHz

Preset the following operating parameters in storage register 3.

FREQUENCY	3 MHz
AMPLITUDE	3 dBm
FREQ INCR	300 Hz
AMPTD INCR	0.3 dBm
∅ INCR	3 deg
SWEEP WIDTH	3 kHz

First program all parameters; then press STORE 2.

NOTE

In the examples for STORE 2 and STORE 3, different parameters are displayed when the STORE key is pressed to preset the register. SWEEP WIDTH is displayed when STORE 2 is pressed. ϕ INCR is displayed when STORE 3 is displayed. In the next two examples, the RECALL function is illustrated. When data is recalled from a preset register, the parameter displayed when that register was preset is the parameter returned to the display. In the case of RECALL 2, SWEEP WIDTH will be returned to the display. All other parameters will be changed to that preset in register 2. For the RECALL 3 case, ϕ INCR will be returned to the display. All other parameters will be changed to that preset in register 3.

Recall parameters of register 2 by pressing RECALL 2.

Result: Display indicates SWEEP WIDTH of 2.0 kHz. When this set of parameters was stored, SWEEP WIDTH was last displayed. When recalled, the parameter last displayed at STORE is returned to the display.

Check the other operating parameters in register 2 by pressing their respective FUNCTION key. The display should indicate the quantities previously programmed.

Recall the operating parameters of register 3 by pressing RECALL 3.

Result: Display indicates ∅ INCR of 3.0 deg (∅ INCR was the parameter displayed when STORE 3 was initiated).

Check other operating parameters in register 3 as previously done for register 2.

Display the frequency of register 2 without changing the output frequency by pressing DISPLAY, FREQUENCY, 2.

Display Result: FREQUENCY 2 000 000. 0 ENTRY (This frequency can be initiated by activating a DATA ENTRY key.)

Initiate by pressing the Hz DATA ENTRY key.

Display result: 2 000 000. 0 Hz

Recall the operating parameters of register 4 by pressing RECALL 4.

Result: FREQUENCY 1 000 000. 0 Hz (This is an initial turn-on condition. The other operating parameters stored in register 4 are also initial conditions. When a register containing initial conditions is recalled, FREQUENCY is displayed.)

3-41. Merging Data Into a Preset Register.

3-42. Any operating parameter stored in a PRESET register can be changed by merging the new parameter into the register without changing the other parameters of the stored sets. This allows the user to change a parameter in a PRESET register and only be concerned with the parameter being changed. Merging a parameter is done much like storing a complete parameter set as described in the preceding paragraph. The difference is the function key, corresponding to the parameter to be merged, is pressed prior to the register number key. Several examples of merging data follow.

EXAMPLE:

Recall from the previous examples that all parameters in PRESET register 2 contain two's and those in PRESET register 3 contain three's.

Change the frequency in PRESET register 2 to 4 MHz and the amplitude increment of register 3 to 0.6 dBm by pressing FREQUENCY, 4 MHz, STORE, FREQUENCY, 2 an and AMPTD INCR, 0.6, + dBm, STORE AMPTD INCR, 3.

Verify these parameters have been merged by displaying each parameter after recalling registers 2 and 3.

3-43. Recalling Data From a Preset Register.

3-44. Any operating parameter stored in a PRESET register can be recalled individually without recalling the entire parameter set. This allows the user to change an output parameter by recalling only that parameter from one of the ten PRESET registers. This is done like the merging of data. The function key, corresponding to the parameter to be recalled, is pressed prior to the register number key. Several examples of recalling a single parameter follow.

EXAMPLE:

Press RECALL 5.

Display Result: Display indicates a frequency of 1 MHz and all operating parameters are initial conditions.

Recall the frequency increment of PRESET register 2 by pressing RECALL, FREQ INCR, 2.

Display Result: Display indicates a frequency increment of 200 Hz. All other parameters are still initial conditions.

Recall the amplitude of PRESET register 3 by pressing RECALL, AMPLITUDE, 3.

Display Result: Display indicates amplitude of + 3 dBm. All other parameters except frequency increment are initial conditions. Frequency increment is 200 Hz.

3-45. Display Last Entry.

3-46. The DISPLAY LAST ENTRY KEY of the FUNCTION group is used to recall to the display the last entry made. It will not recall the function the entry was made in but only the digits. If an operating parameter from one of the ten storage registers is displayed as an entry by activating the DISPLAY key of the PRESET FUNCTION keys, it becomes the last entry. Conversely, when the CLEAR key is pressed, the display shows an entry of zero but this does not constitute a last entry. This is because a display entry cleared in error can be recalled by pressing the DISPLAY LAST ENTRY key.

3-47. Sweep Width Entry.

3-48. In the sweep mode, the 3335A frequency can be swept over a specific range. The operating frequency before the sweep mode is the center frequency of the sweep. The starting point of the sweep is determined by the sweep width programmed. Half the sweep occurs below the center frequency and half above the center frequency. The sweep width is programmed by activating the SWEEP WIDTH FUNCTION key, DATA keys 0 through 9 and a DATA ENTRY key Hz, kHz or MHz. Programming a sweep width greater than the instrument's capability causes the display to flash indicating an illegal sweep. A description of the keys and the sweep width display indicators follows.

KEYS:

SWEEP WIDTH Key. Preface key for entering sweep width. When pressed the front panel displays the present sweep width and the controller is enabled to accept new sweep width data.

DATA Keys. These keys are used to enter the desired sweep width.

DATA ENTRY Keys. Used to finalize the sweep width entry.

DISPLAY INDICATORS:

SWEEP WIDTH Indicator. Indicates the front panel is displaying the present sweep width or a sweep width entry.

ENTRY Indicator. Indicates the display holds a sweep width entry not yet finalized by a data entry key.

The numeric display indicates the sweep width programmed.

Example:

Program a sweep width of 580.34 kHz

Display Result: 580.34 kHz.

3-49. Manual Frequency Tune.

3-50. The frequency can be manually altered in the manual tune mode. The frequency change is controlled by a front panel frequency knob. The 3335A can be put in the manual tune mode by the MANUAL TUNE ON/OFF key. When the manual tune key is activated, an annunciator above the key is illuminated.

3-51. In addition to the ON/OFF key, the MANUAL TUNE controls include two digit keys, a left arrow and a right arrow. These keys are used to select the sensitivity of the manual tune knob. When the manual tune mode is first activated, the fourth digit from the right flashes. The frequency can be changed with the sensitivity of the flashing digit by turning the frequency knob. For more or less sensitivity, the flashing digit can be moved using the left and right digit arrows. Holding an arrow key down causes the flashing digit to step successively to the end digit. When in the MANUAL TUNE mode, the frequency can be incremented by the frequency increment using the INCR keys and all operating parameters can be checked using the FUNCTION keys. A description of the MANUAL TUNE controls follows.

KEYS:

MANUAL TUNE ON/OFF. This key activates the manual tune mode. When on, an annunciator above the key is illuminated.

LEFT ARROW Digit Key. Steps flashing digit to the left.

RIGHT ARROW Digit Key. Steps flashing digit to the right.

Frequency manual tune knob. Used to change the frequency with the sensitivity of the flashing digit.

3-52. Sweep Mode.

3-53. The sweep mode can be used to sweep the output frequency over a specified center frequency. This mode of operation is controlled by the FREQUENCY SWEEP keys which include GO TO START FREQ, START SINGLE 10 SEC, START SINGLE 50 SEC, MANUAL, START AUTO and STOP. A SWEEP OUTPUT connector below the keys provides an output proportional to the sweep frequency for use with a plotter. The frequencies of a frequency sweep are determined by the sweep width and center frequency. The sweep rate in AUTO is approximately 8 sweeps/second, 100 steps/sweep. In MANUAL, 10 SEC and 50 SEC sweeps, the sweep contains 1000 steps.

NOTE

Whenever the -hp- 3335 sweeps through either 20 MHz or 40 MHz, the amplitude of the output will drop severely for approximately 5 msec. Other, much less drastic amplitude discontinuities may be observed. When the instrument sweeps through 10 MHz, 14 MHz, 28 MHz and 56 MHz.

KEYS:

GO TO START FREQ Key. This key is used to display and output the starting frequency of the sweep. The starting frequency is determined by the center frequency and the sweep width. Half the sweep, determined by the sweep width, is below the center frequency establishing the start frequency.

START SINGLE 10 SEC Key. This key is used to initiate a single sweep beginning at the start frequency below the center frequency. The time for the sweep to go from start to finish is approximately 10 seconds and consists of 1000 steps. When the sweep is in this mode, an annunciator above the key is illuminated. The sweep rate can be changed during the sweep by pressing the 50 SEC key or can be stopped by pressing the STOP key. Pressing the AUTO key will put the sweep into auto sweep. During any sweep, depressing a key outside the frequency sweep group has no effect on operation.

START SINGLE 50 SEC Key. This key is used to initiate a single sweep which requires approximately 50 seconds to complete and consists of 1000 steps.

START AUTO Key. This key is used to initiate the sweep which sweeps continuously from the start frequency to the upper limit. The sweep resets to the start frequency when the upper limit is reached and again sweeps up in frequency at a rate of approximately 8 sweeps/second and 100 steps/sweep. The frequency is only swept in the increasing frequency direction in both the single sweep or auto sweep modes. When the instrument is in the auto sweep mode, the display is blank except for the SWEEPING annunciator. The STOP key must be used to exit an auto sweep.

MANUAL key. This key is used to put the sweep into a manual sweep mode. When activated, an annunciator is illuminated to the left of the MANUAL key. The frequency sweep between the start frequency and upper limit can be manually controlled by the frequency knob making 1000 steps between the two limits. When either the upper limit or start frequency is reached, the manual sweep stops. When the frequency knob is rotated changing the frequency, the display segments and annunciators may dim slightly.

STOP Key. This key is used to stop a single sweep before it is complete or to halt an auto sweep and return to keyboard control. When pressed the frequency is returned to the center frequency which was the frequency of operation prior to activating the sweep mode.

SWEEP OUTPUT: The sweep output provides a dc voltage from 0 to + 2 V. 0 V dc corresponds to the start frequency of the sweep and + 2 V the upper limit. During the sweep the output is proportional to the frequency and can be used to drive the horizontal axis of a plotter or an oscilloscope. When the instrument is not in the sweep mode, the SWEEP OUTPUT is + 1 V dc. When GO TO START FREQ is pressed, the instrument displays the start frequency of the sweep and the SWEEP OUTPUT is 0 V. After a single sweep is complete and the upper limit is displayed, the SWEEP OUTPUT is + 2 V dc. These points can be used to adjust the plotter end points.

DISPLAY INDICATORS:

NOTE

In any sweep mode, the frequency display is in hertz.

CENTER FREQUENCY Indicator. Indicates the front panel is displaying the center frequency of the sweep. When the frequency passes through the center frequency during a sweep, the CENTER annunciator flashes.

SWEEPING Indicator. Indicates the instrument is in the SWEEP mode. If the instrument is not in an active single sweep or in auto sweep (i.e., if it is in manual, at start frequency or at the end of a single sweep), pressing any key on the keyboard out of the sweep group will take the instrument out of the sweep mode.

Example:

Program the Synthesizer to sweep a 500 kHz band centered on 12 500 kHz.

Program the center frequency by programming a frequency of 12 500 kHz.

Display Result: 12500.0 kHz

Program the sweep width by pressing SWEEP WIDTH, 500, kHz.

Display Result: 500.0 kHz

Check START FREQ by pressing GO TO START FREQ.

Display Result: 12 250 000.0 Hz SWEEPING annunciator on.

Initiate a single 10 second sweep by pressing START SINGLE 10 SEC key.

Display Result: Annunciator above key illuminates, display shows frequency sweep which stops at 12 750 000.0 Hz. Sweep time is 10 seconds.

Initiate single 50 second sweep by pressing START SINGLE 50 SEC key.

Display Result: Annunciator above key illuminates, display shows frequency sweep which stops at 12 750 000.0 Hz. Sweep time is 50 seconds.

Initiate an Auto Sweep by pressing START AUTO key.

Display Result: Display blanks except for SWEEPING annunciator. (Instrument is continuously sweeping from start frequency to the upper limit.)

Stop Auto Sweep by pressing STOP key.

Display Result: Instrument returns to the center frequency. Display indicates 12 500. 0 kHz, SWEEPING annunciator extinguishes.

Initiate MANUAL Sweep by pressing MANUAL key.

Display Result: SWEEPING annunciator illuminates again. Annunciator next to MANUAL key illuminates.

Manually Sweep Frequency: Rotate frequency knob.

Display Result: Frequency increases and decreases with CW and CCW rotation of knob. CENTER annunciator flashes when sweep passes through 12 500. 0 kHz (the center frequency).

Press GO TO START FREQ key.

Display Result: 12 250. 0 kHz

Press MANUAL key of SWEEP group.

Display Result: No change in display.

Rotate frequency knob CW.

Display Result: Frequency increases.

Rotate frequency knob CCW.

Display Result: Frequency decreases until 12 250. 0 kHz (start frequency) is reached. Further CCW rotation of knob will not lower the frequency.

NOTE

The same result occurs at the upper limit of the sweep.

Return the instrument to full keyboard control by pressing the STOP key. This will result in returning to the center frequency.

NOTE

The single sweep speed of a sweep in progress can be changed by depressing the other single sweep key. To go from the single sweep mode to the auto sweep mode, it is recommended the STOP key be used to terminate the single sweep prior to activating the auto sweep mode.

3-54. HP-IB Indicators and LOCAL key.

3-55. The keyboard contains two HP-IB annunciators—REMOTE and ADDRESSED. One indicates when the 3335A is under remote control; the other indicates when the 3335A is addressed to listen by the HP-IB controller.

If the 3335A is under remote control, it can be returned to local control (control by keyboard inputs) by activating the LOCAL key providing a local lockout command has not been sent by the HP-IB system controller.

3-56. Front Panel Output Connectors.



The output of the -hp- 3335A is directly coupled. Do not allow external dc currents to develop more than 5 volts across the output terminals. For Option 002/004 and Option 003 the dc voltage across the output should not be greater than 10 volts.

3-57. The front panel contains the instrument output connectors located in the right-most group labeled OUTPUT and the SWEEP OUTPUT located in the FREQUENCY group. The output connectors provide the programmed output. The SWEEP OUTPUT provides a dc voltage between 0 and + 2 V proportional to the sweep when the Synthesizer is in the sweep mode. When not in the sweep mode the SWEEP OUTPUT is + 1 V. During the sweep, the SWEEP OUTPUT is proportional to the frequency and can be used to drive the horizontal sweep of a plotter or an oscilloscope.

3-58. Rear Panel BNC Connectors.

3-59. 40/N Input. This is the input for the reference frequency that essentially determines the frequency accuracy and stability of the -hp- 3335A. As the name of the input suggests, the reference frequency must be an integral sub multiple of 40 MHz (i.e., 40, 20, 13.333, 10, etc.). The 40 MHz master oscillator in the -hp- 3335A is phase locked to this signal. Lock will occur with 40/N INPUT levels as low as -7 dBm. When an external frequency reference is not used, the 10 MHz REFerence OVEN OUTPUT is coupled to this input with the BNC-to-BNC adapter.

3-60. 10 MHz REFerence OVEN OUTPUT. This is a reference frequency that is coupled to the 40/N INPUT whenever an external frequency reference is not used. When it is used, its accuracy and stability determine the accuracy and stability of the -hp- 3335A output frequency. The parameters of this output are described in Table 1-1. They depend on the Option selected.

3-61. 10 MHz OUTPUT. This output is used to lock the phase of other synthesizers to the phase of the -hp- 3335A. Its output level and output impedance are typically around 0 dBm and 50 ohms.

3-62. EXTernal LEVEL INPUT. This input is selected using the INTERNAL LEVEL/EXT LEVEL INPUT switch located on the rear panel. When it is selected, the dc level on this input determines the output amplitude. The sensitivity is non-linear, however, it is typically about .5 V rms output per dc volt input. With 0 volts dc on this input, the maximum output amplitude of the -hp- 3335A is nominally .5 volts rms into 50 ohms (or 75 ohms). An "UNLEVELED" annunciator on the front panel will light whenever this input is selected.

3-63. Remote Programming.

3-64. This part of Section III contains a brief description of the HP–IB operation and includes programming information for operating the Model 3335A on the HP–IB. It also includes information on the HP–IB connector, HP–IB logic levels and programming codes.

3-65. The HP–IB. The HP–IB is a carefully defined instrumentation interface which simplifies the integration of instruments, calculators and computers into systems. The 3335A is a fully programmable instrument interfacing with the HP–IB by means of a rear panel HP–IB connector (see Figure 3-1). The HP–IB connector is directly compatible with the mating connectors on the -hp- 10631 (A, B or C) HP–IB Cable Assemblies.

3-66. HP–IB Logic Levels. The 3335A HP–IB lines use standard TTL levels and are low-true. The logic levels are:

Low = digital ground or 0 V to +0.4 V dc
High = open or +2.5 V dc to +5 V dc

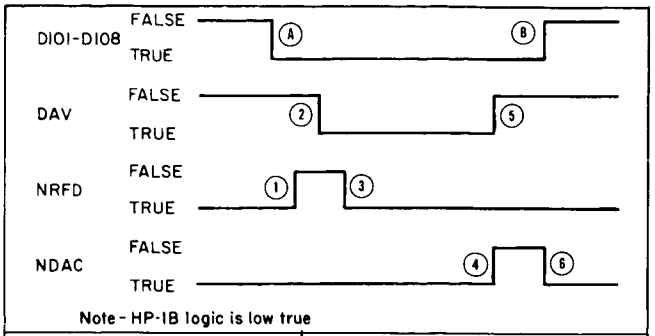
3-67. Isolation. The 3335A is located from the HP–IB by optical couplers. The components located on the HP–IB side of the optical couplers are powered by a separate + 5 V power supply deriving power from an ungrounded secondary transformer winding. This provides isolation of the instrument from the bus.

3-68. Capability. The capability of a device connected to the HP–IB is specified by its interface functions. The interface functions of the 3335A are listed in Table 3-2 and indicate the particular capability of that function as defined in Appendix C of IEEE Std 488-1975. The interface functions indicate what activity a device will respond to or that which it is capable of initiating. Each item indicating a device capability appears on the rear panel next to the HP–IB connector.

3-69. The instrument will recognize a preset "listen" address and accept bit-parallel, word (byte)-serial ASCII-coded data. All data is received through the Data Input/Output (DIO) lines of the HP–IB. The data transfer is controlled by "handshake" lines DAV, NRFD and NDAC. Figure 3-2 illustrates the "handshake" sequence of events and describes each event during the transfer of data. More detailed information is obtainable by ordering a copy of "Condensed Description of the Hewlett-Packard Interface Bus", -hp- Part No. 59401-90030, Microfiche Part No. 59401-90090.

Table 3-2. Interface Functions.

Identification	Description
SH0	No source handshake capability
AH1	Acceptor handshake capability
T0	No talker capability
L2	Basic listener
SR0	No service request capability
RL1	Remote/Local capability
PP0	No parallel poll capability
DC1	Device clear capability
DT0	No device trigger capability
C0	No controller capability



Note - HP-IB logic is low true

Event	Comment
(A) and (B)	The interval between A and B indicates when one byte of information is on the data lines, DIO1 through DIO8. **NOTE** *For the remainder of this explanation,, the term "data" refers to one byte of information (one seven-bit ASCII character).*
(1) NRFD goes false	Listener indicates he is ready to receive data.
(2) DAV goes true	Source recognizes listener is ready for data, places a new character on theDIO lines and indicates to the listener the data on the DIO lines is valid.
(3) NRFD goes true	Listener recognizes the data is valid and indicates to the source he is not ready for any new data. The listener accepts the data on the DIO lines to store internally after NRFD goes true.
(4) NDAC goes false	The listener indicates to the source that he has stored internally the data on the DIO lines. When the data is stored, internal processing begins.
(5) DAV goes false	Source recognizes that the listener has accepted and stored internally the data on the DIO lines. Source removes the data valid indication by setting DAV false in preparation for placing the next byte of information on the DIO lines.
(6) NDAC goes true	Listener recognizes that the source has acknowledged its acceptance of the data and removes the data accepted indication. Listener continues to process the internally stored data.
(1) NRFD goes false	When the listener completes processing the internally stored data, the. listener sets NRFD false which indicates he is ready to receive the next byte of information.

NOTE: Events (1) through (6) must occur for each byte of information transferred between devices on the HP-IB.

Figure 3-2. HP-IB "Handshake" Sequence of Events.

Table 3-3. Bus Messages.

Function	Message	Description
Device Communications	Data	Transfers device-dependent information from one device to one or more devices on the Bus.
Device Control	Trigger	Causes a group of selected devices to simultaneously initiate a set of device-dependent actions.
	Clear	Causes an instrument to be set to a predefined state (a certain range, function, etc.).
	Remote	Permits selected devices to be set to remote operation, allowing parameters and device characteristics to be controlled by Bus Messages.
	Local	Causes selected devices to return to local (front panel) operation.
	Local Lockout	Disables local (front panel) controls of selected devices.
	Clear Lockout & Local	Returns all devices to local (front panel) control and simultaneously clears the Local Lockout Message.
Interrupt and Device Status	Require Service	Indicates a device's need for interaction with the controller.
	Status Byte	Presents status information of a particular device; one bit indicates whether or not the device currently requires service, the other 7 bits (optional) are used to indicate the type of service required.
	Status Bit	A single bit of device-dependent status information which may be logically combined with status bit information from other devices by the controller.
Passing Control	Pass Control	Passes bus controller responsibilities from the current controller to a device which can assume the Bus supervisory role.
Bail Out	Abort	Unconditionally terminates Bus communications and returns control to the system controller.

3-70. Messages are the means by which devices communicate on the HP–IB. Table 3-3 lists the Bus Messages by Bus function and provides a description of each.

3-71. HP–IB Remote Operation.

3-72. The HP–IB Remote Enable (REN) line controls the instrument's mode of operation, LOCAL or REMOTE. With no input on the REN line, it is held high by an internal pullup maintaining the 3335A in the LOCAL mode of operation. When the 3335A listen address is transmitted, the REN line is pulled low causing it to go into the remote control mode. The REN lines does not have internal storage and must be held in the low state as long as remote operation is required. Once the 3335A has been put into the

REMOTE mode of operation, it can be unaddressed, and it will remain in REMOTE operation until the REN line is released or the LOCAL key is pressed.

3.73. When the REN line is low and the 3335A is addressed, the instrument goes into the REMOTE mode and the following things take place.

a. The front panel REMOTE annunciator lights.

b. The front panel controls (except POWER and the impedance switch) are disabled. When addressed to listen, the 3335A will accept REMOTE instructions.

c. The output parameters established by keyboard control in the LOCAL mode are retained in the REMOTE mode until remotely changed.

3-74. When the HP-IB system controller releases the REN line, the following things take place:

a. The front panel REMOTE annunciator goes out and the 3335A output parameters remain as last programmed in the REMOTE mode of operation.

b. The 3335A will no longer respond to remote instructions. It will respond to its listen address and the unlisten command.

3-75. Addressing to Listen. All instruments using the HP-IB share a common set of data and control lines because they are connected in parallel. Since the system controller must be able to communicate with individual instruments on the bus, each instrument is given a unique address. The address is a 7-bit ASCII character (byte) which a given instrument recognizes and responds to.

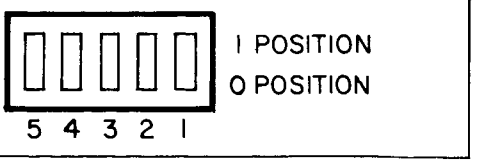
3-76. When addressing instruments, the system controller pulls the ATN line low to get the attention of all instruments on the bus. It then gives the ASCII coded address for one of the instruments on the bus. When the addressed instrument acknowledges receipt of the address by the "handshake" sequence, the controller clears the address code and addresses another instrument if more than one is to receive the same data. When the last addressed instrument acknowledges receipt of its address, the controller releases the ATN line and clears the last address code. With the ATN line released, the HP-IB is in the data mode. The addressed instruments respond by accepting data placed on the bus using the "handshake" sequence. This data programs the functions of the instruments.

3-77. The 3335A functions only as a listener on the HP-IB. It accepts instructions from the controller and responds by establishing the output parameters programmed. The 3335A can be addressed (or unaddressed) in either the LOCAL or REMOTE control mode. Note that the 3335A will not go to Remote unless it is addressed to listen *and* the REN line is low.

3-78. Changing the Listen Address. The 3335A is shipped from the factory with a listen address of ASCII character $ (octal code 044). This address can be changed by changing the positions of the rear panel listen address switches 1 through 5 which control address lines A1 through A5. Table 3-4 lists the listen addresses obtainable and the switch positions required to set each address. The addresses are provided in ASCII, Octal, Decimal and Hexadecimal codes. The upper position of the switch corresponds to "1", the lower position to "0". These positions correspond to the one's and zero's of Table 3-4. When changing the listen address, verify that the new address does not conflict with that of another instrument on the bus.

Table 3-4. Listen Addresses.

HP-IB Instrument Listen Address Switches					Instrument Listen Address			
5	4	3	2	1	ASCII	Octal	Decimal	Hex
0	0	0	0	0	SP	040	32	20
0	0	0	0	1	!	041	33	21
0	0	0	1	0	"	042	34	22
0	0	0	1	1	#	043	35	23
0	0	1	0	0	$	044	36	24
0	0	1	0	1	%	045	37	25
0	0	1	1	0	%	046	38	26
0	0	1	1	1	'	047	39	27
0	1	0	0	0	(	050	40	28
0	1	0	0	1	)	051	41	29
0	1	0	1	0	*	052	42	2A
0	1	0	1	1	+	053	43	2B
0	1	1	0	0	'	054	44	2C
0	1	1	0	1	–	055	45	2D
0	1	1	1	0	.	056	46	2E
0	1	1	1	1	/	057	47	2F
1	0	0	0	0	Ø	060	48	30
1	0	0	0	1	1	061	49	31
1	0	0	1	0	2	062	50	32
1	0	0	1	1	3	063	51	33
1	0	1	0	0	4	064	52	34
1	0	1	0	1	5	065	53	35
1	0	1	1	0	6	066	54	36
1	0	1	1	1	7	067	55	37
1	1	0	0	0	8	070	56	38
1	1	0	0	1	9	071	57	39
1	1	0	1	0	:	072	58	3A
1	1	0	1	1	;	073	59	3B
1	1	1	0	0	<	074	60	3C
1	1	1	0	1	=	075	61	3D
1	1	1	1	0	>	076	62	3E



3-79. Unaddressing. Once the 3335A is addressed to listen, it will remain addressed until it is "unaddressed" or cleared by the system controller. There are several ways to clear an address:

a. By giving the "Unlisten" comand (UNL, 077 Octal, ASCII "?") this command must be given in the HP-IB command mode (ATN line low).

b. By pulling the IFC (Interface Clear) line low. This asynchronously clears all instruments on the bus.

c. By giving the "GO TO LOCAL" command (GTL, 001 Octal, ASCII "SOH").

d. By turning the instrument off.

3-80. HP-IB Bus Commands. The Bus Commands are divided into three categories:

a. Unaddress Commands (UNL and UNT)
b. Universal Commands (LLO, DCL, SPE, etc.)
c. Addressed Commands (SDC, GTL, GET, etc.)

The 3335A will not respond to all of the bus commands. Its operation is unaffected by a command it does not recognize. The commands it will respond to are UNL (Unlisten), LLO (Local Lockout), DCL (Device Clear), SDC (Selective Device Clear) and GTL (Go To Local). Each of these commands is listed above following its respective command category.

3-81. PROGRAMMING.

3-82. Programming of the 3335A functions is by means of data messages sent by the system controller over the HP-IB.

Table 3-5. Programming Codes.

KEY	ASCII Character	Octal Code	Decimal Code	Hexadecimal Code
STORE	S	123	83	53
RECALL	R	122	82	52
FREQUENCY	F	106	70	46
FREQ INCR	I	111	73	49
AMPLITUDE	A	101	65	41
AMPTD INCR	I	111	73	49
Ø INCR	P	120	80	50
SWEEP WIDTH	W	127	87	57
DISPLAY LAST ENTRY	L	114	76	4C
0	0	060	48	30
1	1	061	49	31
2	2	062	50	32
3	3	063	51	33
4	4	064	52	34
5	5	065	53	35
6	6	066	54	36
7	7	067	55	37
8	8	070	56	38
9	9	071	57	39
		056	46	2E
BACK SPACE	B	102	66	42
CLEAR	C	103	67	43
MHz/–dBm	M	115	77	4D
kHz/+dBm	K	113	75	4B
Hz/deg	H	110	72	48
INCR ↑	U	125	85	55
INCR ↓	D	104	68	44
GOTO START FREQ	G	107	71	47
START 10 SEC SINGLE	X	130	88	58
START 50 SEC SINGLE	Y	131	89	59
START AUTO	Z	132	90	5A
STOP	Q	121	81	51
	–	055	45	2D
**See Paragraph 3-81	T	124	84	54

These messages are composed of two parts – the address command and the program information. The address command contains the "talk" and "listen" addresses of the devices involved, here the controller talk address and the 3335A listen address. The program information contains the codes of the 3335A keys to be programmed. Syntax of the address command portion of the data message is dependent on the controller used (see manual of the system controller). Syntax for the program information portion is comprised of the program codes listed in Table 3-5.

3-83. Each programming code is a single 7-bit word or "byte". Table 3-5 lists each front panel key that is programmable and lists the programming code by ASCII character and corresponding octal, decimal and hexidecimal equivalant. The last two entries of the table (– and T) are codes programmable but do not represent front panel keys. The "–" allows for ease in programming amplitudes since negative amplitudes can be preceded by the minus sign and all amplitudes finalized with the + dBm key (K) from the HP–IB. The character T is discussed in the following paragraph.

3-84. A special operating condition is obtainable by using the programming code ASCII character "T". This HP-IB command sets the attenuator to the straight-through position and the impedance to the 50 ohm mode. A change of amplitude cannot be programmed but the digits 1 through 7 will introduce the attenuator pad corresponding to the "AT" line associated with the programmed digit (i.e., programming the digit 4 causes the AT4 line to go low and introduce the 10 dB pad associated with line AT4). Programming a 0 sets the attenuator straight through again once a pad has been introduced. The digit 8 programs the 50 ohm output while the digit 9 programs the 75 ohm output. To return to normal amplitude control, the code C (CLEAR) must be programmed to exit the special operating condition. A summary of the "T" special operating codes and their function is shown in Table 3-6.

3-85. The 3335A will respond to programming codes only when it is addressed to listen in the remote mode. Front panel key instructions can be entered in any order desired by the programmer. The function key instruction must preface a data entry for that function. An entry instruction must follow the data to complete programming of the function changing that particular operating parameter. The key instruction sequence of a program is identical to the key activation sequence when operated manually. Examples of program data messages using a 9830A and 9825A calculator

3-86. Examples illustrating complete programs using a 9830A and 9825A calculator to program various parameters and functions of the 3335A are shown in Figure 3-4.

3-87. Programming the Increment Functions. Special attention to the programming of the amplitude, frequency and phase increment functions is required because the same instruction (ASCII character I) for increment is used. The increment parameter programmed depends on the instrument's operating function prior to the "I" instruction. If

the 3335A is in the frequency mode prior to the "I" instruction, FREQ INCR is programmed; if in the amplitude function prior to the "I" instruction AMPTD INCR is programmed; if in the phase mode, ϕ INCR is programmed. If the instrument is not in the frequency, amplitude or phase mode, an "I" instruction is ignored. To ensure the increment is properly programmed in either frequency or amplitude, it is recommended the increment instruction (I) be preceded by the amplitude or frequency function instruction (A or F).

NOTE

ϕ INCR can be programmed directly by the ASCII character P.

The instruction "PI" is legal but can be performed by just "P" to program ϕ INCR (see Table 3-5). The two left-most 9830A and 9825A examples in Figure 3-3 illustrate frequency programmed immediately preceding the increment instruction "I" and an "FI" instruction is not required.

Table 3-6. Special Attenuator Program Codes.

Code	AT7 40 dB	AT6 20 dB	AT5 20 dB	AT4 10 dB	AT3 4 dB	AT2 2 dB	AT1 2 dB	AT∅ 50 Ω/75 Ω
T	1	1	1	1	1	1	1	1
∅	1	1	1	1	1	1	1	**
1	1	1	1	1	1	1	∅	**
2	1	1	1	1	1	∅	1	**
3	1	1	1	1	∅	1	1	**
4	1	1	1	∅	1	1	1	**
5	1	1	∅	1	1	1	1	**
6	1	∅	1	1	1	1	1	**
7	∅	1	1	1	1	1	1	**
8	**	**	**	**	**	**	**	1
9	**	**	**	**	**	**	**	∅
C	RETURNS TO NORMAL AMPLITUDE OPERATION							

1 = Straight Through
∅ = Pad Introduced
** = Same As Previous State

Table 3-7. Attenuation Actuated, 50 Ohm Output Level.

Output Level (dBm)	Attenuation (dB)	Pads Actuated (dB)	Output Level (dBm)	Attenuation (dB)	Pads Actuated (dB)
+13.01	0	0	−36.99	50	20,20,10
+11.01	2	2	−38.99	52	20,20,10,2
+ 9.01	4	2,2	−40.99	54	20,20,10,2,2
+ 7.01	6	4,2	−42.99	56	20,20,10,4,2
+ 5.01	8	4,2,2	−44.99	58	20,20,10,4,2,2
+ 3.01	10	10	−46.99	60	40,20
+ 1.01	12	10,2	−48.99	62	40,20,2
− .99	14	10,2,2	−50.99	64	40,20,2,2
− 2.99	16	10,4,2	−52.99	66	40,20,4,2
− 4.99	18	10,4,2,2	−54.99	68	40,20,4,2,2
− 6.99	20	20	−56.99	70	40,20,10
− 8.99	22	20,2	−58.99	72	40,20,10,2
−10.99	24	20,2,2	−60.99	74	40,20,10,2,2
−12.99	26	20,4,2	−62.99	76	40,20,10,4,2
−14.99	28	40,4,2,2	−64.99	78	40,20,10,4,2,2
−16.99	30	20,10	−66.99	80	40,20,20
−18.99	32	20,10,2	−68.99	82	40,20,20,2
−20.99	34	20,10,2,2	−70.99	84	40,20,20,2,2
−22.99	36	20,10,4,2	−72.99	86	40,20,20,4,2
−24.99	38	20,10,4,2,2	−74.99	88	40,20,20,4,2,2
−26.99	40	20,20	−76.99	90	40,20,20,10
−28.99	42	20,20,2	−78.99	92	40,20,20,10,2
−30.99	44	20,20,2,2	−80.99	94	40,20,20,10,2,2
−32.99	46	20,20,4,2	−82.99	96	40,20,20,10,4,2
−34.99	48	20,20,4,2,2	−84.99	98	40,20,20,10,4,2,2

3-88. Programming Amplitude to Maximize Attenuator Life. The attenuator assembly of the 3335A introduces an attenuator pad by use of an electro-mechanical mechanism. As with any mechanical system, the more it is used, the greater the wear on the system. A programmer can minimize the mechanical wear on the 3335A attenuator by carefully selecting amplitudes which require minimum operation of the attenuator. Table 3-7 indicates the 50 ohm output level, the attenuation introduced by the attenuator and which pads are actuated to accomplish it. Note that the attenuator attenuates in 2 dB steps while amplitude changes from +.01 dB to +1.99 dB are realized electronically by the leveling loop circuit (A6 Assembly – Section VIII Service Group M). Programming amplitudes within the 1.99 dB capability of the leveling loop and/or selecting amplitudes that minimize pad actuations will increase attenuator life. Table 8-N-1 in Section VIII Service Group N provides a detailed indication of the attenuator pads selected for a particular programmed amplitude for both 50 ohm and 75 ohm output impedances.

3-89. Unaddressed or Local Operation When Connected To the HP-IB.

3-90. If the 3335A is connected to the HP-IB and operated locally or operated in remote but not addressed to listen, interruption of the display/keyboard scan and the sweep mode function can occur. The instrument is controlled by one microprocessor. The processor must service the instrument function and also handle the HP-IB lines. When the ATN line is true or when the 3335A is addressed to listen, microprocessor responds to every DAV handshake. As each data byte is placed on the bus, DAV is pulled true which activates the 3335A HP-IB interrupt request line (IRQ) to the controller section. This causes the controller to interrupt the scan and sweep operation and service the interrupt request before returning to local operation of the 3335A functions. If a long data string is sent on the HP-IB, a data byte rate can be achieved when the 3335A controller has only time to service the interrupt requests. At this point the 3335A controller cannot properly service the basic instrument. The following symptoms can occur; display completely or partially blanks, a keyboard entry is not recognized, sweep output is not linear, and the auto, single 10 or 50 second sweep in the sweep mode exceeds the time interval.

3-91. Telecommunications.

3-92. There is an amplitude blanking feature and a special sweep feature which make the -hp- 3335A especially suitable for applications in the telecommunications industry. These features are standard and appear on all instruments. On instruments equipped with Options 002, 003 or 004, the special sweep is switch selectable. Each feature is described separately in the paragraphs that follow.

NOTE

No instrument with a serial number below 1604A00376 is equipped with a TELECOMMUNICATIONS SWEEP Switch.

3-93. Amplitude Blanking. This feature causes the output amplitude to be blanked for 20 msec whenever a new frequency is entered or whenever the INCREMENT or DECREMENT controls are actuated. Since the amplitude is blanked, no signal will appear at the output during the time that the frequency is changing. This allows the instrument to be stepped from one channel to another without generating spurious signals that might interfere with operating channels. Amplitude Blanking is implemented by modifing the instrument internally. Only *qualified service personnel* can do the modification safely. *Hazardous voltages are exposed when the top cover is removed.* The procedure for implementing this feature is presented on the apron page of Figure 8-D-1 in Service Group D.

WARNING

Since access to the Amplitude Blanking Switch requires removal of the top cover, this feature should be implemented only by qualified service personnel. Hazardous voltage are exposed when the top cover is removed.

3-94. Telecommunications Sweep. This sweep is really a modification of the AUTO sweep. The amplitude is blanked for 20 msec after each step and the duration of each step is extended so that the time duration of the step plus the 20 msecs blanking equals 4 seconds. Since the AUTO sweep consists of 100 steps, the total sweep time is extended to 400 seconds or 6.7 minutes. Blanking the amplitude prevents the -hp- 3335A from outputting spurious signals while it is changing frequencies. The long time duration allows certain Selective Level Measuring Instruments to track the -hp- 3335A output frequency in an open loop test configuration (e.g. – see see Operating Manual for the -hp- 3745A/B Selective Level Measuring Set). If the output is displayed on an oscilloscope, a slight overshoot will be observed at the beginning of each frequency step. This is normal and will cause no problems in the tracking application for which this operating mode was designed. On instruments equipped with Options 002, 003 and 004, the communications sweep is implemented by moving the TRACK/ NORM switch, located on the rear panel, to the TRACK position. On standard instruments, it is implemented by modifying the instrument internally. Only *qualified service personnel* can do the modification safely. *Hazardous voltages are exposed when the top cover is removed.* The procedure for implementing this feature is presented on the apron page of Figure Group D.

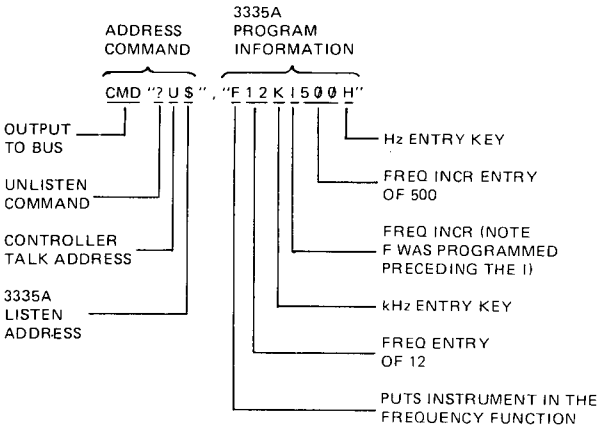
WARNING

Only qualified service personnel should implement the special sweep. Hazardous voltages are exposed when the top cover is removed.

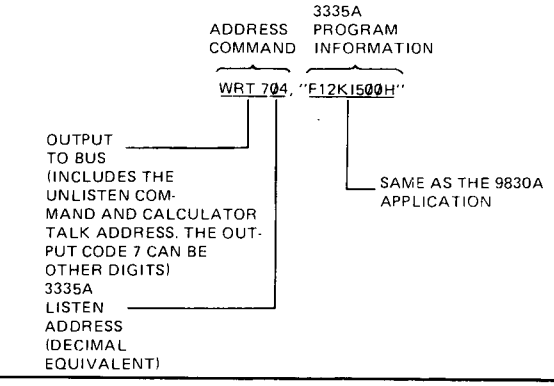
NOTE

The single sweep operating modes should not be used while the telecommunications sweep is implemented. While the frequencies of the single sweeps are correct, the amplitude is higher than the level displayed and somewhat unpredictable.

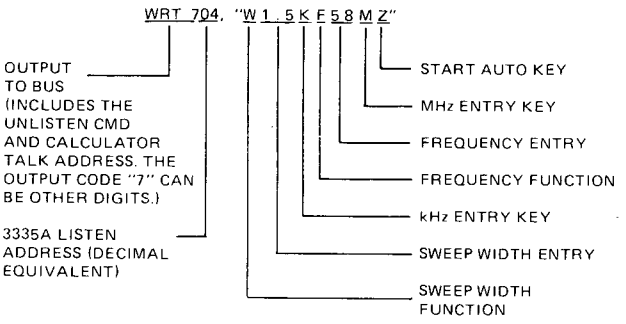
9830A Calculator program data message to establish an output frequency of 12 kHz and frequency increment of 500 Hz.



9825A Calculator program data message to establish an output frequency of 12 kHz and frequency increment of 500 Hz.



9825A Calculator program data message to establish an auto sweep with SWEEP WIDTH of 1.5 kHz centered on 58 MHz.



9825A Calculator program data message to end sweep mode operation and reprogram frequency to 25 kHz, amplitude to +9 dBm.

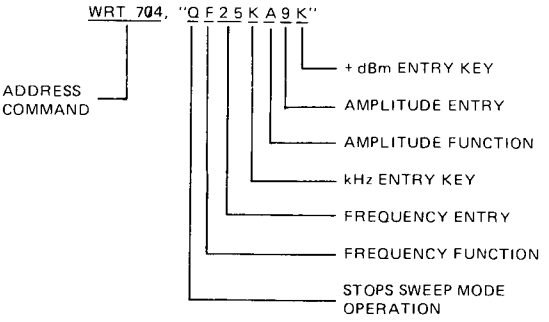


Figure 3-3. 9830A/9825A Program Data Messages.

EXAMPLE 1.

Programming a fixed frequency, e.g., 12.34 MHz:

9830A PROGRAM

```
10 FORMAT B
20 OUTPUT (13,10)768;
30 CMD "?U$","F12.34M"
40 OUTPUT (13,10)1024;
50 END
```

9825A PROGRAM

```
0: rem 7
1: wrt 704,"F12.34M"
2: lcl 7
3: end
*26953
```

EXAMPLE 2.

Programming a fixed amplitude, e.g., –40.01 dBm:

9830A PROGRAM

```
10 FORMAT B
20 OUTPUT (13,10)768;
30 CMD "?U$","A40.01M"
40 OUTPUT (13,10)1024;
50 END
```

9825A PROGRAM

```
0: rem 7
1: wrt 704,"A40.01M"
2: lcl 7
3: end
*28257
```

EXAMPLE 3.

Programming a fixed frequency increment, e.g., 4 kHz:

9830A PROGRAM

```
10 FORMAT B
20 OUTPUT (13,10)768;
30 CMD "?U$","FI4K"
40 OUTPUT (13,10)1024;
50 END
```

9825A PROGRAM

```
0: rem 7
1: wrt 704,"FI4K"
2: lcl 7
3: end
*29653
```

EXAMPLE 4.

Programming a frequency to be entered from the calculator keyboard:

9830A PROGRAM

```
10 FORMAT B
20 OUTPUT (13,10)768;
30 DISP "DESIRED FREQUENCY (IN MHZ)";
40 INPUT F
50 CMD "?U$"
60 FORMAT "F",F13.9,"M"
70 OUTPUT (13,60)F
80 OUTPUT (13,10)1024;
90 END
```

9825A PROGRAM

```
0: rem 7
1: ent "Desired Frequency (in MHz)?",F
2: fmt "F",f13.9,"M"
3: wrt 704,F
4: lcl 7
5: end
*16851
```

Figure 3-4. 9830A/9825A Program Examples.

EXAMPLE 5.

Programming an amplitude to be entered from the calculator keyboard:

9830A PROGRAM

```
10 FORMAT B
20 OUTPUT (13,10)768;
30 DISP "DESIRED AMPLITUDE (IN DBM)";
40 INPUT A
50 CMD "?U$"
60 FORMAT "A",F6.2,"K"
70 OUTPUT (13,60)A
80 OUTPUT (13,10)1024;
90 END
```

9825A PROGRAM

```
0: rem 7
1: ent "Desired Amplitude (in dBm)?",A
2: fmt 1,"A",f6.2,"K"
3: wrt 704.1,A
4: lcl 7
5: end
*12910
```

NOTE

The + dBm programming code is used for both a negative and positive amplitude entry since the 3335A will recognize a negative sign entered by the calculator.

EXAMPLE 6.

Programming a frequency sweep—all parameters entered from the calculator keyboard:

9830A PROGRAM

```
10 FORMAT B
20 OUTPUT (13,10)768;
30 DISP "START FREQ (IN MHZ)";
40 INPUT A
50 DISP "STOP FREQ (IN MHZ)";
60 INPUT B
70 DISP "# OF STEPS";
80 INPUT C
90 DISP "TIME PER STEP (IN MSEC)";
100 INPUT D
110 X=(B-A)/C
120 CMD "?U$"
130 FORMAT "F",F13.9,"M"
140 FOR F=A TO B STEP X
150 OUTPUT (13,130)F
160 WAIT D
170 NEXT F
180 OUTPUT (13,10)1024;
190 END
```

9825A PROGRAM

```
0: rem 7
1: ent "Start Freq (in MHz) ?",A
2: ent "Stop Freq (in MHz) ?",B
3: ent "# of Steps ?",C
4: ent "Time per Step (in msec) ?",D
5: (B-A)/C→X
6: fmt "F",f13.9,"M"
7: for F=A to B by X
8: wrt 704,F
9: wait D
10: next F
11: lcl 7
12: end
*2524
```

NOTE

If you prefer to enter center frequency and sweep width rather than start and stop frequencies, make the following changes to the respective lines of the Example 6 programs:

9830A PROGRAM CHANGES

```
30 DISP "CENTER FREQ (IN MHZ)";
50 DISP "SWEEP WIDTH (IN MHZ)";
110 X=B/C
```

9825A PROGRAM CHANGES

```
1: ent "Center Frequency (in MHz) ?",A
2: ent "Sweep Width (in MHz) ?",B
5: B/C→X
```

Figure 3-4. 9830A/9825A Program Examples (Cont'd).

EXAMPLE 7.

Programming a log sweep—all parameters entered from the calculator keyboard:

9830A PROGRAM

```
10 FORMAT B
20 OUTPUT (13,10)768;
30 DISP "START FREQ (IN MHZ)";
40 INPUT A
50 DISP "STOP FREQ (IN MHZ)";
60 INPUT B
70 DISP "# OF STEPS";
80 INPUT C
90 DISP "TIME PER STEP (IN MSEC)";
100 INPUT D
110 CMD "?U$"
120 FORMAT "F",F13.9,"M"
130 FOR I=0 TO C
140 F=10↑(LGTA+(LGTB-LGTA)*(I/C))
150 OUTPUT (13,120)F
160 WAIT D
170 NEXT I
180 OUTPUT (13,10)1024;
190 END
```

9825A PROGRAM

```
0: rem 7
1: ent "Start Freq (in MHz) ?",A
2: ent "Stop Freq (in MHz) ?",B
3: ent "# of Steps ?",C
4: ent "Time per Step (in msec) ?",D
5: fmt 1,"F",f13.9,"M"
6: for I=0 to C
7: 10↑(log(A)+(log(B)-log(A))(I/C))→F
8: wrt 704.1,F
9: wait D
10: next I
11: lcl 7
12: end
*31968
```

EXAMPLE 8.

Programming an amplitude sweep—all parameters entered from the calculator keyboard:

9830A PROGRAM

```
10 FORMAT B
20 OUTPUT (13,10)768;
30 DISP "START AMPLITUDE (IN DBM)";
40 INPUT A
50 DISP "STOP AMPLITUDE (IN DBM)";
60 INPUT B
70 DISP "# OF STEPS";
80 INPUT C
90 DISP "TIME PER STEP (IN MSEC)";
100 INPUT D
110 X=(B-A)/C
120 CMD "?U$"
130 FORMAT "A",F6.2,"K"
140 FOR I=A TO B STEP X
150 OUTPUT (13,130)I
160 WAIT D
170 NEXT I
180 OUTPUT (13,10)1024;
190 END
```

9825A PROGRAM

```
0: rem 7
1: ent "Start Amplitude (in dBm) ?",A
2: ent "Stop Amplitude (in dBm) ?",B
3: ent "#of Steps ?",C
4: ent "Time per Step (in msec) ?",D
5: (B-A)/C→X
6: fmt 1,"A",f6.2
7: for I=A to B by X
8: wrt 704.1,I
9: wait D
10: next I
11: lcl 7
12: end
*30595
```

Figure 3-4. 9830A/9825A Program Examples (Cont'd).

SECTION IV
PERFORMANCE TESTS

4-1. INTRODUCTION.

4-2. This section contains performance tests which are in-cabinet procedures designed to verify that the instrument meets the specifications listed in Table 1-1. They can be used for incoming quality control inspection, specification verification after a repair or for routine maintenance. The performance tests contained in this section are:

a. Frequency Accuracy Test
b. Harmonic Distortion Test
c. Integrated Phase Noise Test
d. Spurious Response Test
e. Maximum Output Level Accuracy Test
f. Flatness Test (Attenuator Straight Through)
g. Attenuator Verification Test

4-3. EQUIPMENT REQUIRED.

4-4. The test equipment required for the performance tests and for maintaining the Model 3335A Synthesizer/Level Generator is listed in Table 1-3. Any equipment that satisfies the required specifications given in the table can be substituted for the recommended model(s).

4-5. PERFORMANCE TEST RECORD.

4-6. Results of the performance tests can be tabulated on the Performance Test Record located at the end of the procedures. The Test Record lists all of the tested specifications and their acceptable limits. The results recorded at incoming inspection can be used for comparison in periodic maintenance, troubleshooting, after repairs or adjustments.

4-7. For ease of recording measured specifications at periodic intervals, additional copies of the performance test record are helpful. Prior to first use of the Test Record, copies should be made. The Performance Test Record may be reproduced without written permission from Hewlett-Packard.

4-8. PERFORMANCE TESTS.

4-9. Frequency Accuracy Test.

4-10. This test verifies that the -hp- 3335A is multipling the reference frequency by the correct factor.

Equipment Required:

Universal Counter -hp- 5328A

a. Connect the 10 MHz Output on the rear panel of the -hp- 3335A to the External Frequency Standard Input on the rear panel of the -hp- 5328A. Switch the INT/EXT Frequency Standard Switch on the rear panel of the -hp-5328A to EXTernal.

b. Connect the Universal Counter to the 3335A output.

c. Set the 3335A parameters as follows:

AMPLITUDE . . . . . +13.01 dBm (50 Ω)
+11.25 dBm (75 Ω)
FREQUENCY . . . . . .200 Hz

d. Counter should indicate 200 Hz ± 1 Hz.

e. Change the 3335A frequency to that stated in Table 4-1 and check for the Counter reading stated in Table 4-1.

Table 4-1. Frequency Accuracy Test.

Frequency (MHz)	Counter Reading (MHz)
10.999 999	10.999 999 ± 1 Hz
14.5	14.5 ± 1 Hz
20	20 ± 1 Hz
28.123 456	28.123 456 ± 1 Hz
40	40 ± 1 Hz
60	60 ± 1 Hz
80	80 ± 1 Hz

4-11. Harmonic Distortion.

4-12. This test verifies that the 3335A meets the harmonic distortion specification of Table 1-1.

Equipment Required:

50 ohm Feedthrough Termination, -hp- Model 11048C
Spectrum Analyzer (high frequency), -hp- Model 141T/8552B/8553B/8554B
Spectrum Analyzer (low frequency), -hp- Model 3580A
50 ohm-to-75 ohm Minimum Loss Pad, -hp- Model 85428B (Required for Options 002, 003 and 004 only)

a. Connect the test set up as shown in Figure 4-1. Note the use of the 50 ohm-to-75 ohm Minimum Loss Pad for the 75 ohm output of the option instruments.

b. Set the 3335A amplitude to:

AMPLITUDE . . . . . + 13.01 dBm (50 Ω)
+ 11.25 dBm (75 Ω)

c. Set the 3335A frequency to those indicated in Table 4-2 and at each frequency check that all harmonic level meet the specification.

NOTE

The 3580A Spectrum Analyzer is used to measure harmonics of fundamental frequencies from 200 Hz to 15 kHz. The 3580A has a frequency range of 5 Hz to 50 kHz allowing the

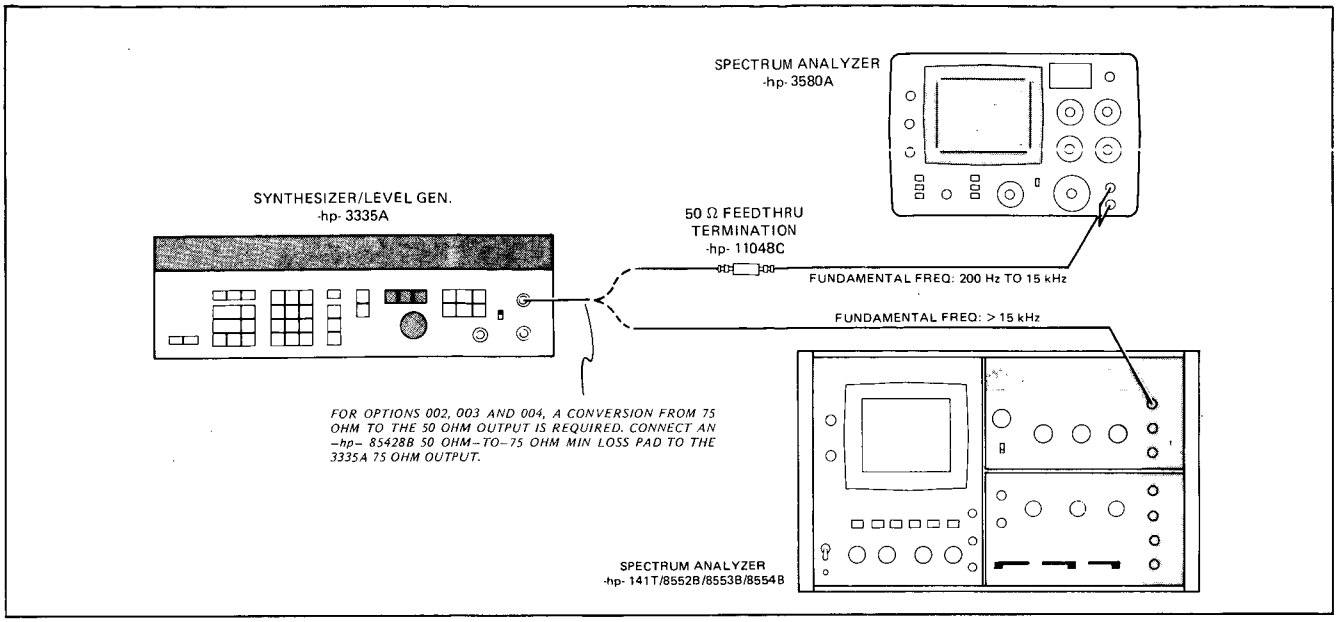


Figure 4-1. Harmonic Distortion Test.

measurement of the third harmonic with a 15 kHz fundamental. The 141T/8552B/8553B/8554B Spectrum Analyzer is used to measure harmonics of fundamental frequencies from 15 kHz to 80 MHz. The maximum frequency of this analyzer is 1250 MHz allowing adequate harmonic measurement.

Table 4-2. Harmonic Level Specification.

3335A Frequency	Harmonic Level Specification
200 Hz 1 kHz 1 MHz 9.9 MHz 10 MHz	< −45 dB
> 10 MHz 80 MHz	< −40 dB

4-13. Integrated Phase Noise Test.

4-14. This performance test ensures the 3335A meets the integrated phase noise specifications of Table 1-1. The specifications are for a 30 kHz band, excluding ± 1 Hz, centered on the carrier. The test set-up uses another 3335A in addition to the one under test as a reference. Any synthesizer with a noise floor equivalent to the 3335A can be used as a reference. (See required characteristics, Table 1-3). The reference and the tested signal are mixed and the difference signal is applied to a wideband ac voltmeter and a dc digital voltmeter through two filters (see Figure 4-2). The 1 MHz filter used in the test is available commercially (see Table 1-3). The 15 kHz filter must be constructed.

Equipment Required:

Synthesizer, -hp- Model 3335A or equivalent
Digital Voltmeter, -hp- Model 3455A
1 MHz LPF, TT Electronics Model J903
AC Voltmeter, -hp- Model 400FL
Mixer, -hp- Model 10514A
50 ohm Feedthrough Termination, -hp- Model 11048C
BNC TEE, -hp- Part No. 1250-0781
50 ohm-to-75 ohm Minimum Loss Pad, -hp- Model 85428B (Required for Options 002, 003 and 004 only)

a. Connect the test set-up shown in Figure 4-2.

b. Set the 3335A under test as follows:

AMPLITUDE . . . . . 0 dBm (50 Ω)
+ 5 dBm (75 Ω)
FREQUENCY . . . . . 9.901 MHz

c. Set the Reference Synthesizer as follows:

AMPLITUDE . . . . . + 13.01 dBm (50 Ω)
+ 11.25 dBm (75 Ω)
FREQUENCY . . . . . 9.9 MHz

d. Record the AC Voltmeter reading.

e. Change the frequency of the 3335A under test to 9.9 MHz.

f. Adjust the phase of the 3335A under test using Ø INCR for a minimum dc reading on the DVM.

g. Disconnect the DVM from the test set-up.

h. Record the AC Voltmeter reading and subtract it from the reading recorded in Step d. Enter this quantity on the performance test card.

i. The difference calculated in the previous step should satisfy the specification of Table 1-1 +6 dB (i.e., if spec is

–63 dB, the difference must be 57 or greater). This is a correction factor compensating for the folding action of the mixer.

j. Reconnect the DVM to the test set-up.

k. Change the frequency of both the 3335A under test and the Reference Synthesizer to the set of frequencies stated in Table 4-3. At each frequency set, record the AC Voltmeter reading.

l. Change the frequency of the 3335A under test to equal that of the Reference. At each new frequency step repeat Steps f through j.

Table 4-3. Phase Noise Test.

Set	Frequency	
	3335A Under Test	Reference
1.	20.001 MHz	20 MHz
2.	40.001 MHz	40 MHz
3.	80.001 MHz	80 MHz

4-15. Spurious Response Test.

4-16. This performance test verifies the spurious specification of Table 1-1. The test is in two parts – first checking for spurious signals within 1 kHz of the fundamental and secondly checking for known spurious signals.

Equipment Required:
Digital Voltmeter, -hp- Model 3455A
Synthesizer, -hp- Model 3335A or equivalent
Mixer, -hp- Model 10514A
1 MHz LPF, TT Electronics Model J903
Spectrum Analyzer, -hp- Model 3580A Option 001
Spectrum Analyzer -hp- Model 141T/8552B/8553B/8554B
50 ohm Feedthrough Termination, -hp- Model 11048C

NOTE

Use the internal battery to power the -hp- 3580A during this test.

a. Close-In Spurious Response Test.

1. Connect the test set-up as shown in Figure 4-3.

2. Set the parameters of the 3335A under test as follows:

AMPLITUDE . . . . . 0.0 dBm
FREQUENCY . . . . . 80.001 MHz

3. Set the parameters of the Reference Synthesizer in the test set-up as follows:

AMPLITUDE . . . . . + 13.01 dBm (50 Ω)
+ 11.25 dBm (75 Ω)
FREQUENCY . . . . . 80 MHz

4. Adjust the Spectrum Analyzer for full scale.

5. Change the frequency of the Reference Synthesizer to 80.001 MHz.

6. Change the phase of the -hp- 3335A under test using the ∅ INCR parameter to obtain a minimum DVM dc voltage reading. After completing this step, disconnect the DVM.

7. With the Spectrum Analyzer adjust for a 1 kHz span (100 Hz/Div) and tune up to 50 kHz searching for spurious signals greater than –69 dB. All spurious signals less than –69 dB verify the spur-

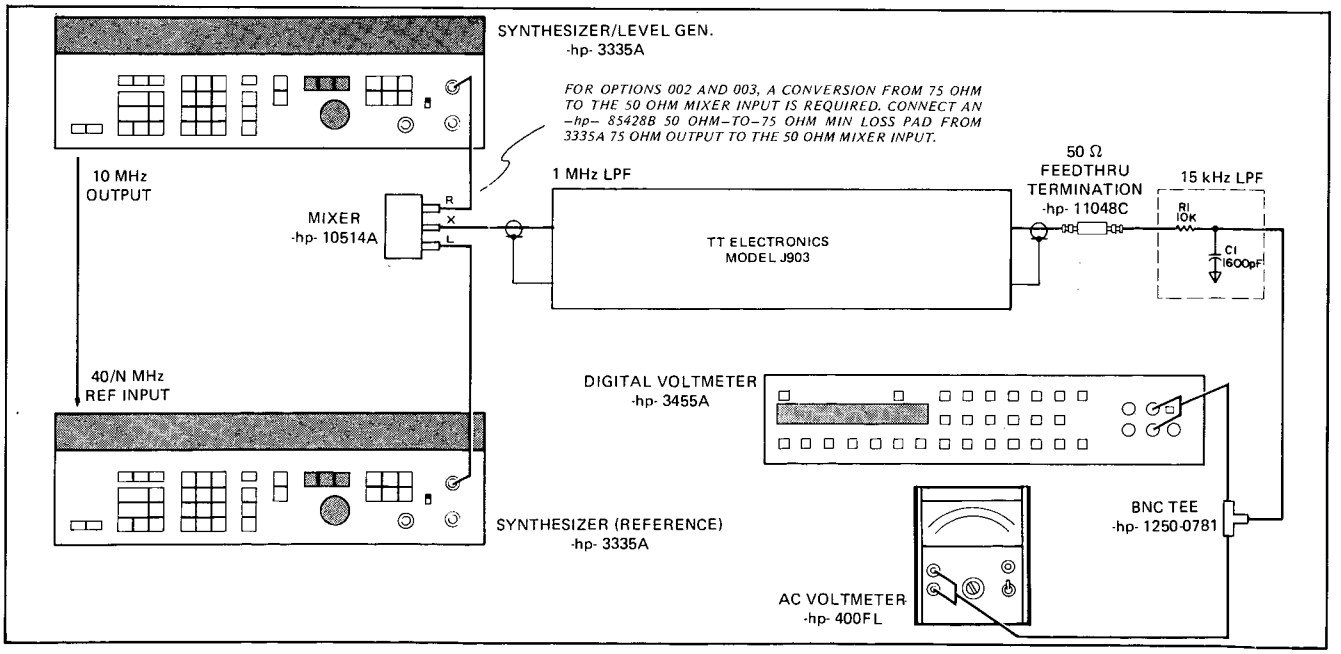


Figure 4-2. Integrated Phase Noise.

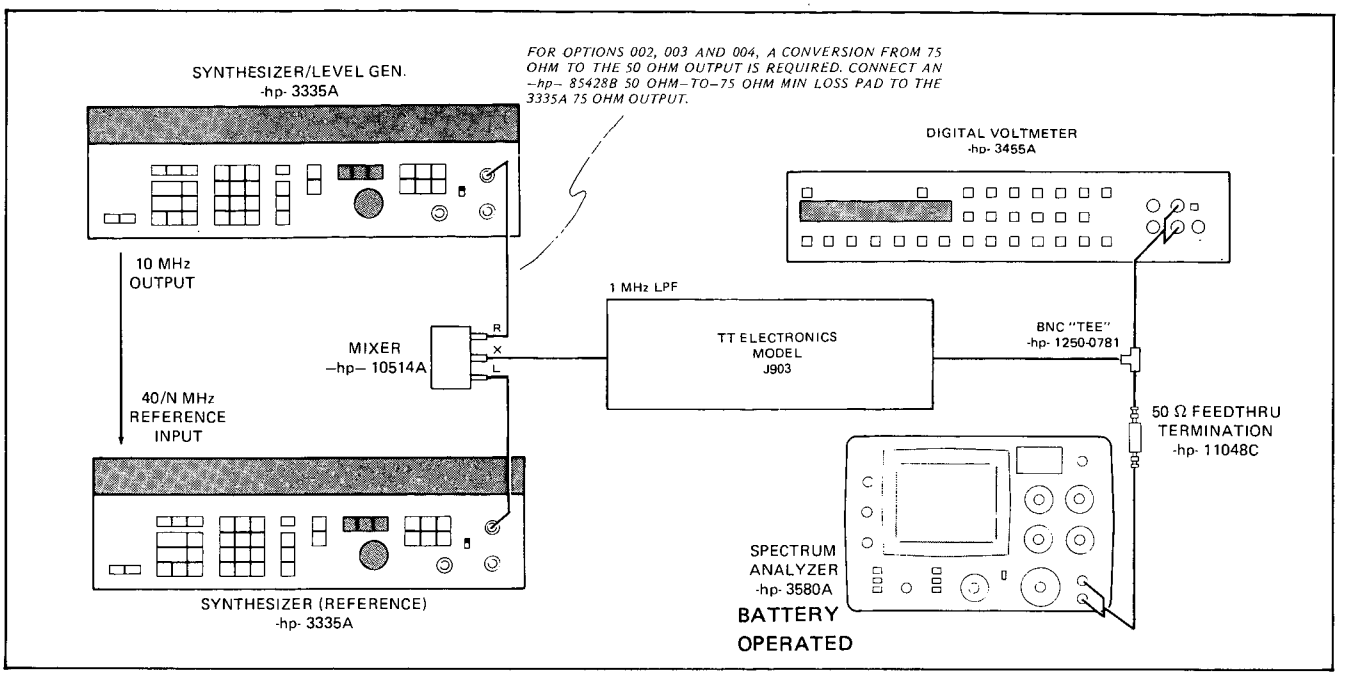


Figure 4-3. Spurious Response Test (Close-In).

ious specification. This incorporates a 6 dB correction factor due to the folding of coherent source sidebands as a result of mixing.

b. Known Spurious Response Test. This test checks for the presence of known worst case spurious signals that may exist. In some cases, this known spurious signal may not be present or detectable.

1. Connect the test set-up as shown in Figure 4-4 using the 3580A Spectrum Analyzer first.

2. Set the 3335A parameters as follows:

AMPLITUDE . . . . . +13.01 dBm (50 Ω)
+11.25 dBm (75 Ω)
FREQUENCY . . . . . 16.5 kHz

3. Check for a 46.5 kHz spurious signal greater than −75 dB.

4. Set the 3335A to the frequencies in Table 4-4 and check for the corresponding spurious signal also stated in Table 4-4. All spurious signals less than −75 dB verify the spurious specification.

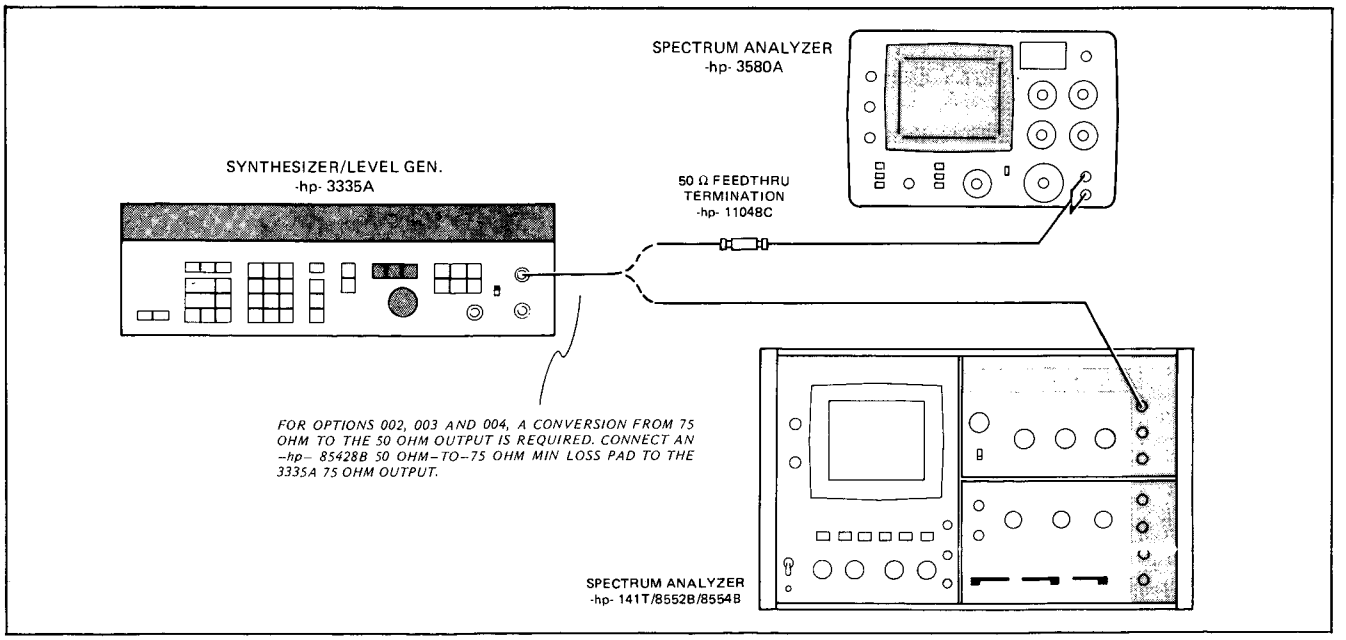


Figure 4-4. Spurious Response Test (Known).

5. Replace the -hp- 3580A Spectrum Analyzer with the 141T/8552B/8553B (see Figure 4-4) Spectrum Analyzer. Set the 141T/8552B/8553B for a normal display with the input attenuator set to 40 dB.

6. Overdrive the 141T/8552B/8553B input by setting the attenuator to 20 dBs. This effectively subtracts 20 dB from all vertical calibrating legends on the CRT face shield.

7. Set the 3335A to the frequencies in Table 4-5 and check for the corresponding spurious signal also stated in Table 4-5. All spurious signals less than −75 dB verify the spurious specification.

Table 4-4. Spurious Test (1).

3335A Frequency	Spurious Frequency
15.5 kHz	25.5 kHz
10.5 kHz	20.5 kHz
10.05 kHz	20.15 kHz
10.005 kHz	20.005 kHz

Table 4-5. Spurious Test (2).

3335A Frequency	Spurious Frequency
7.5 MHz	10.0 MHz
9.0 MHz	40.0 MHz
9.0 MHz	49.0 MHz
9.90 MHz	0.40 MHz
9.90 MHz	10.3 MHz
9.999 MHz	15.0 MHz

4-17. Maximum Output Level Accuracy Test.

4-18. This performance test verifies the 3335A meets the maximum output level accuracy specification.

Equipment Required:
- 50 ohm Feedthrough Termination, -hp- Model 11048C (For Options 002, 003 and 004 a 75 ohm Feedthrough Termination, -hp- Model 11094B, is required in place of the 11048C)
- Digital Voltmeter, -hp- Model 3455A

a. Connect a Digital Voltmeter (DVM) in the ACV mode to the 3335A output (50 ohm for Standard; 75 ohm for Options 002, 003 and 004) through the appropriate feedthrough termination.

b. Set the 3335A as follows:

AMPLITUDE . . . . . + 13.01 dBm (50 Ω)
+ 11.25 dBm (75 Ω)
(Includes the 75 Ω output for Options 002, 003 and 004)

c. The DVM reading should be as follows for either 50 ohm or 75 ohm output:

0.99423 V to 1.00577 V

This verifies the maximum output level accuracy test.

4-19. Flatness Test (Attenuator Straight Through).

4-20. This performance test verifies that the 3335A meets the flatness specification of Table 1-1 with no attenuation introduced.

Equipment Required:
- Thermal Converter, -hp- Model 11050A (50 Ω) or -hp- Model 11050A/H01 (75 Ω)
- Digital Voltmeter, -hp- Model 3455A
- Power Meter, -hp- Model 436A
- Power Sensor, -hp- Model 8482A (50 Ω) and/or -hp- Model 8483A (75 Ω)

a. Connect the test set-up as shown in Figure 4-5.

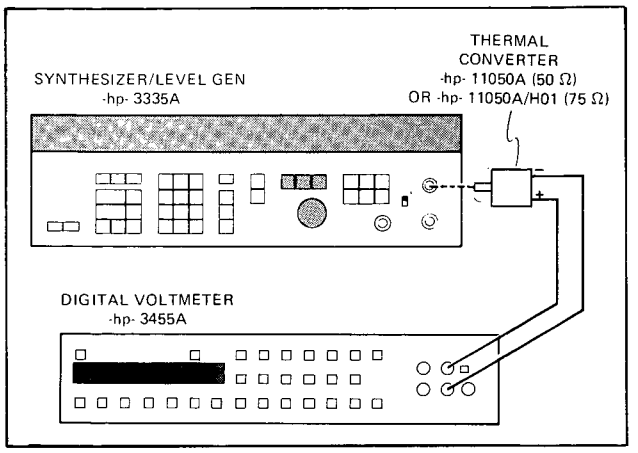


Figure 4-5. Flatness Test (200 Hz to 10 MHz).

b. The purpose of steps b through f is to find the change in the DC output voltage of the thermal convertor that occurs when the input changes 0.1 dB. Set the 3335A as follows:

AMPLITUDE . . . . . + 13.01 dBm (50 Ω)
+ 11.25 dBm (75 Ω)
FREQUENCY . . . . . 100 kHz

c. Record the DVM reading.

d. Change AMPLITUDE to + 12.91 dBm (50 Ω) or + 11.15 dBm (75 Ω).

e. Record the DVM reading.

f. Calculate the allowable tolerance by subtracting the reading of Step e from the reading of Step c and record the tolerance.

g. Set AMPLITUDE to that stated in Step b.

h. Set FREQUENCY to the following frequencies, allow the 3455A reading to settle and record the reading:

200 Hz
50 kHz
500 kHz
1 MHz
5 MHz
10 MHz

i. Add the thermal converter's correctional data for each frequency to the readings of the previous step.

j. The result should indicate the reading of Step c ± the tolerance calculated in Step f for each frequency set in Step h verifying the flatness between 200 Hz and 10 MHz.

k. Disconnect the test set-up of Figure 4-5 and connect the test set-up shown in Figure 4-6.

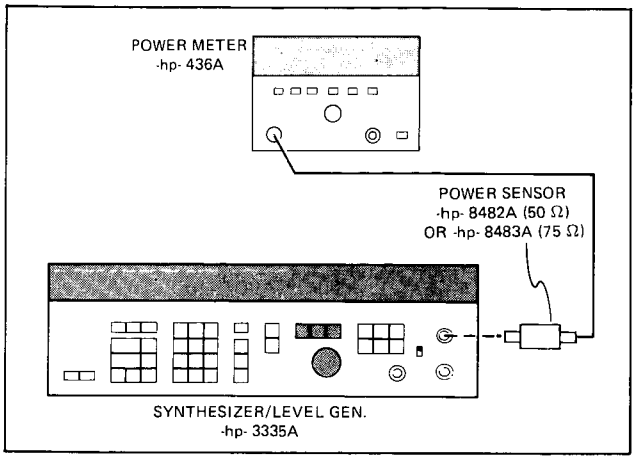


Figure 4-6. Flatness Test (10 MHz to 80 MHz).

l. Set the 3335A FREQUENCY to 10 MHz and AMPLITUDE to that stated in Step b.

m. With the Power Meter "CAL FACTOR %" set for the Power Sensor used, set the dB (REF) to the power level of the output from the previous step.

NOTE

The Power Meter readings will now indicate the deviation from the 10 MHz full output reference. The deviation with the 10 MHz tolerance from Step f incorporated should be within the specified tolerance.

n. Set the 3335A FREQUENCY to the following frequencies and record the Power Meter relative reading:

20 MHz	60 MHz
30 MHz	70 MHz
40 MHz	80 MHz
50 MHz	

o. The Power Meter readings incorporating the 10 MHz tolerance calculated in Step f, should be within the limits stated in Table 1-1 verifying the flatness from 10 MHz to 80 MHz.

4-21. Attenuator Verification Test.

NOTE

This test is not required unless the attenuator has been repaired.

4-22. This performance test verifies the attenuator accuracy of Table 1-1 for three attenuation levels at three different test frequencies. The test set-up is very critical to the results of the test. It is preferred that this test be performed in a screen room. If one is not available, an electrically "clean" environment is a must. It is important that the specified cables be used and that the test equipment be arranged as illustrated. Failure to follow test set-up instructions can result in erroneous data.

NOTE

A recertification program is available to verify the attenuator accuracy specifications. To recertify, the attenuator must be returned to Hewlett-Packard. The recertified attenuator will be returned with a computer printout containing the results of each attenuation test. Contact your nearest Hewlett-Packard Sales and Service Office for further details. A list of these offices is provided in the back of this manual.

Equipment Required:

Step Attenuator with certification chart, -hp- Model 355C
Step Attenuator with certification chart, -hp- Model 355D
6 dB Pad, -hp- Model 8491A Option 006
3 dB Pad, -hp- Model 8491A Option 003
50 ohm to 75 ohm Pad, -hp- Model 85428B
Amplifier, Q-Bit Corp. Model QB-300
Mixer, -hp- Model 10514A
50 ohm Feedthrough Termination, -hp- Model 11048C
Synthesizer, -hp- Model 3335A or equivalent
Wave Analyzer, -hp- Model 3581A
Digital Voltmeter, -hp- Model 3455A
Power Supply, -hp- Model 6215A
(3) BNC Male-to-Male Adapter, -hp- 1250-0216
(1) BNC Female-to-Female Adaptor, -hp- 1250-0080
(2) Type N(f) to BNC(m) Adaptor, -hp- 1250-0077
(2) Type N(m) to BNC(f) Adaptor, -hp- 1250-0780
(2) BNC(f) to dual Banana Plug, -hp- 1251-2277
Cables: (2) 11170A
(2) 11170B
(2) 11170C

a. Connect the test set-up as shown schematically in Figure 4-7 and by physical location as shown in Figure 4-8. If the 75 ohm output of the 3335A is being tested, an -hp- 85428B 50 ohm to 75 ohm minimum loss pad must be inserted between the 3335A under test and the connecting cable. Do not connect the amplifier into the test set-up at this time but connect the amplifier to the power supply and allow it to warm up prior to its use in Step q.

NOTE

The test set-up is very critical to the test results. It is important that the specified cables be used and the equipment arranged as shown in Figure 4-8. Do not crossover cables of the test set-up. Failure to use the specified test set-up can result in erroneous data.

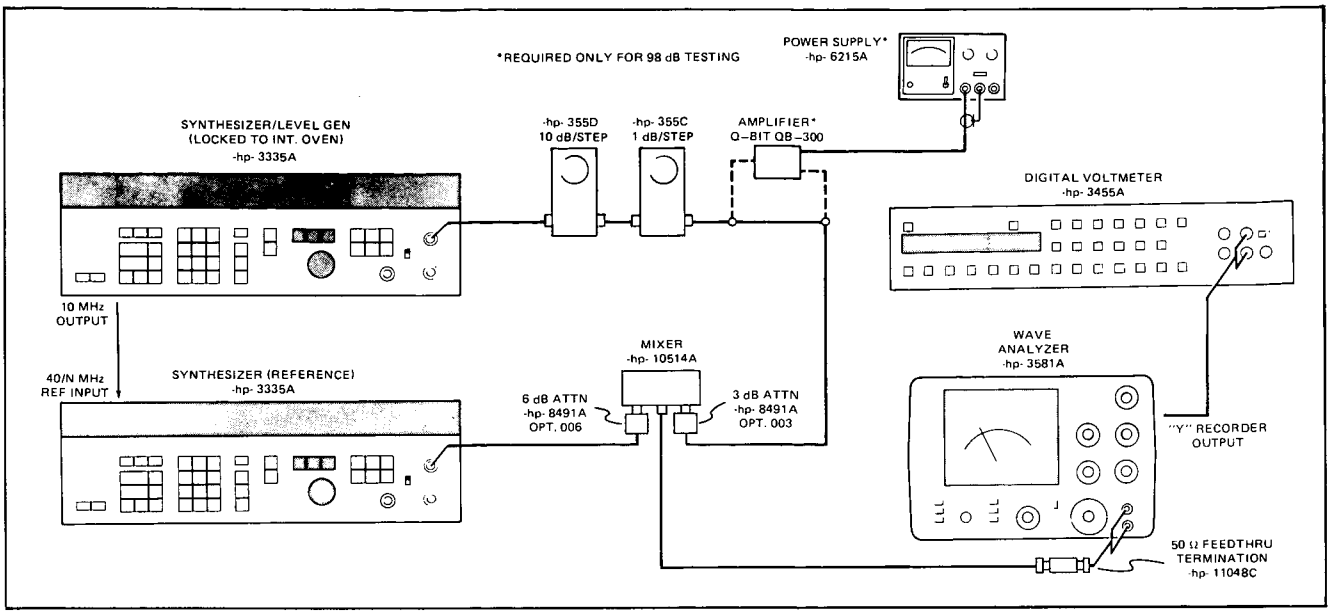


Figure 4-7. Attenuator Verification Test.

b. Set the 3335A under test as follows:

AMPLITUDE . . . . . +13.01 dBm (50 Ω)
+ 11.25 dBm (75 Ω)
FREQUENCY . . . . . 2 MHz

c. Set the Reference Synthesizer as follows:

AMPLITUDE . . . . . +13.01 dBm (50 Ω)
+11.25 dBm (75 Ω)
FREQUENCY . . . . . 2.008 MHz

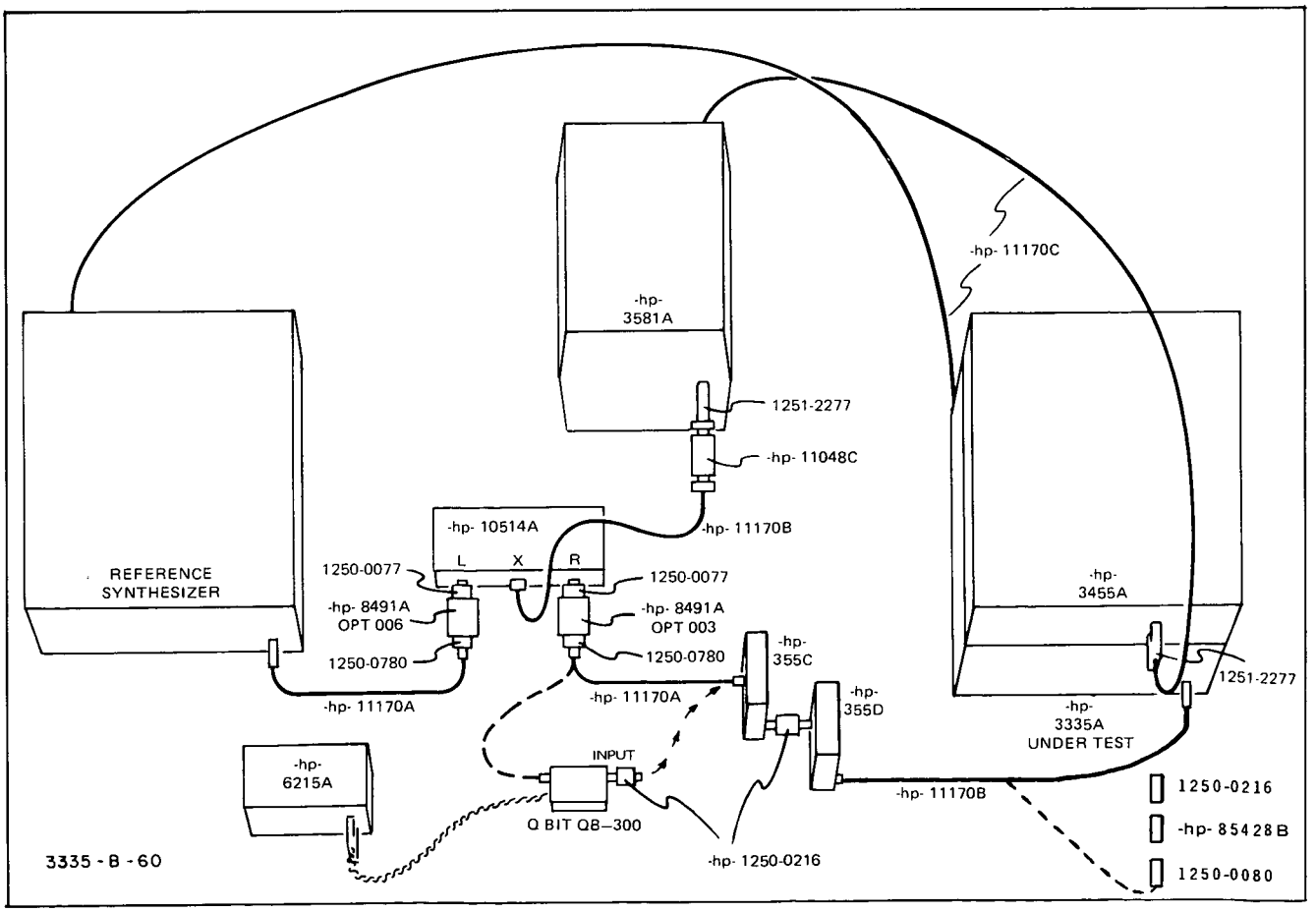


Figure 4-8. Attenuator Verification Test Equipment Layout (Top View).

d. Set the attenuation of the two standard attenuators to 18 dB.

e. Set the 3581A Wave Analyzer as follows:

SCALE . . . . . VOLTS
RESOLUTION BANDWIDTH . . . . . 30 Hz
SWEEP TIME . . . . . 1 sec
SWEEP MODE . . . . . OFF
AMPLITUDE REF LEVEL . . . . . .NORMAL
AFC . . . . .OUT; Tune FREQUENCY to 8 kHz
AFC . . . . . After tuning to 8 kHz, push in to lock to 8 kHz

f. Adjust the 3581A INPUT SENSITIVITY for a DVM reading of approximately 4.6 V.

g. Observe the 3455A reading for several seconds. By observation, determine the average reading and record this average on the performance test record.

h. Program an AMPTD INCR of 18 dB and use this parameter to decrease the amplitude by 18 dB from maximum output then set the standard attenuators to zero.

NOTE

The amplitude of the 3335A is decreased before setting the standard attenuators to zero to eliminate saturating the mixer and introducing measurement errors.

i. Observe the 3455A reading for several seconds (do not readjust the 3581A INPUT SENSITIVITY). By observation, determine the average reading and record this average on the performance test record under the previously recorded reading.

j. Set the standard attenuator to 18 dB then change the frequency of the 3335A under test to 40 MHz and amplitude back to full output.

k. Change the frequency of the Reference Synthesizer to 40.008 MHz.

l. Repeat Steps f through i.

m. Set the standard attenuator to 18 dB then change the frequency of the 3335A under test to 80 MHz and amplitude to full output.

n. Change the frequency of the Reference Synthesizer to 80.008 MHz.

o. Repeat Steps f through i.

p. Repeat Steps b through o using attenuation of 58 dB in Step d and an AMPTD INCR of 58 dB in Step h.

q. Connect the amplifier into the test set-up.

r. Repeat Steps b through o using attenuation of 98 dB in Step d and an AMPTD INCR of 98 dB in Step h.

NOTE

For Steps s, t and u, an example illustrating the procedure is shown following Step u.

s. For each set of measurements (V_{std} and V_{3335}), calculate Δ dB from the equation

$$\Delta \text{ dB} = 20 \log_{10} \left(\frac{V_{std}}{V_{3335}}\right)$$

and record on the performance test record.

t. Determine the attenuation error of the two standard attenuators for each measurement frequency (including the algebraic sign) and record the STD ERROR on the performance test record.

u. Total the quantities Δ dB and STD ERROR on the performance test record. Compare this total to the test limits to determine if the attenuator is within specification.

EXAMPLE:

Measurements obtained for 18 dB attenuation at 2 MHz from the 3455A:

$V_{std} = 4.6005$ V
$V_{3335} = 4.5924$ V

Calcuation of Δ dB:

$$\Delta \text{ dB} = 20 \log \left(\frac{4.6005}{4.5924}\right) = 0.0153 \text{ dB}$$

From the certification record of the 355C and 355D attenuators, actual standard attenuation for 18 dB is:

Model	Setting	Actual Attn	Std Error
355D	10 dB	9.990 dB	–0.010 dB
355C	8 dB	7.995 dB	–0.005 dB

Total STD ERROR for 18 dB at 2 MHz is –0.015 dB.

Calculation of measured accuracy:

Δ dB	0.0153 dB
+STD ERROR	–0.0150 dB
Measured Accuracy	0.0003 dB

Since the 18 dB, 2 MHz specification is ± 0.04 dB, the 18 dB, 2 MHz level is within the specification.

PERFORMANCE TEST RECORD

HEWLETT–PACKARD MODEL 3335A

SYNTHESIZER/LEVEL GENERATOR

SERIAL NO. _____

Tests Performed By _____

Date _____

FREQUENCY ACCURACY TEST:

Frequency	Test Limits	Counter Reading
200 Hz	± 1 Hz	_____
10.999 999 MHz	± 1 Hz	_____
14.5 MHz	± 1 Hz	_____
20 MHz	± 1 Hz	_____
28.123 456 MHz	± 1 Hz	_____
40 MHz	± 1 Hz	_____
60 MHz	± 1 Hz	_____
80 MHz	± 1 Hz	_____

HARMONIC DISTORTION:

Frequency	Test Limits	Test Measurement
200 Hz	< - 45 dB	_____
1 kHz	< - 45 dB	_____
10 kHz	< - 45 dB	_____
1 MHz	< - 45 dB	_____
9.9 MHz	< - 45 dB	_____
40 MHz	< - 45 dB	_____
41 MHz	< - 40 dB	_____
80 MHz	< - 40 dB	_____

INTEGRATED PHASE NOISE:

Frequency	Test Limits	Test Measurement (Calculated Difference)
9.9 MHz	> 57 dB	_____
20.0 MHz	> 64 dB	_____
40.0 MHz	> 58 dB	_____
80.0 MHz	> 52 dB	_____

SPURIOUS RESPONSES:

Close–In Spurs

Frequency	Test Limits	Test Measurement
79.9999 MHz	<–69 dB or –110 dB whichever is greater	_____

Known Spurs

Frequency	Test Limits	Test Measurement
25 kHz	⩽–75 dB	_____
10 MHz	⩽–75 dB	_____
45 MHz	⩽–75 dB	_____
80 MHz	⩽–75 dB	_____

MAXIMUM OUTPUT LEVEL ACCURACY TEST:

Frequency	Amplitude	Test Limits	Test Measurement
100 kHz	+13.01 dBm (50 Ω)	0.99423–1.00577 V	_____
	+11.25 dBm (75 Ω)	0.99423–1.00577 V	_____

FLATNESS TEST:

Frequency	Test Limits (Calculated Unless Stated)	Test Measurement
200 Hz	_____	_____
50 kHz	_____	_____
500 kHz	_____	_____
1 MHz	_____	_____
5 MHz	_____	_____
10 MHz	_____	_____
20 MHz	± 0.07 dB	_____
30 MHz	± 0.15 dB	_____
40 MHz	± 0.15 dB	_____
50 MHz	± 0.15 dB	_____
60 MHz	P 0.15 dB	_____
70 MHz	± 0.15 dB	_____
80 MHz	± 0.15 dB	_____

ATTENUATOR ACCURACY TEST:

Impedance: 50 Ω

Attenuation	Measurements/ Calculations	Test Frequency 2 MHz	40 MHz	80 MHz
18 dB	$V_{Std\ Attn}$	_____	_____	_____
	V_{3335A}	_____	_____	_____
	Δ_{dB}	_____	_____	_____
	Std Error	_____	_____	_____
	Total	_____	_____	_____
	Test Limit	± 0.04 dB	± 0.04 dB	± 0.04 dB
58 dB	$V_{Std\ Attn}$	_____	_____	_____
	V_{3335A}	_____	_____	_____
	Δ dB	_____	_____	_____
	Std Error	_____	_____	_____
	Total	_____	_____	_____
	Test Limit	± 0.09 dB	± 0.09 dB	± 0.09 dB
98 dB	$V_{Std\ Attn}$	_____	_____	_____
	V_{3335A}	_____	_____	_____
	Δ dB	_____	_____	_____
	Std Error	_____	_____	_____
	Total	_____	_____	_____
	Test Limit	± 0.2 dB	± 0.2 dB	± 0.2 dB

Impedance: 75 Ω		Test Frequency		
Attenuation	Measurements/ Calculations	2 MHz	40 MHz	80 MHz
18 dB	$V_{Std\ Attn}$	_____	_____	_____
	V_{3335A}	_____	_____	_____
	Δ dB	_____	_____	_____
	Std Error	_____	_____	_____
	Total	_____	_____	_____
	Test Limit	± 0.04 dB	± 0.15 dB	± 0.15 dB
58 dB	$V_{Std\ Attn}$	_____	_____	_____
	V_{3335A}	_____	_____	_____
	Δ dB	_____	_____	_____
	Std Error	_____	_____	_____
	Total	_____	_____	_____
	Test Limit	± 0.09 dB	± 0.25 dB	± 0.25 dB
98 dB	$V_{Std\ Attn}$	_____	_____	_____
	V_{3335A}	_____	_____	_____
	Δ dB	_____	_____	_____
	Std Error	_____	_____	_____
	Total	_____	_____	_____
	Test Limit	± 0.2 dB	± 0.25 dB	± 0.50 dB

WARNING

Maintenance described herein is performed with power supplied to the instrument, and protective covers removed. Such maintenance should be performed only by service-trained personnel who are aware of the hazards involved (for example, fire and electrical shock). Where maintenance can be performed without power applied, the power should be removed.

SECTION V
ADJUSTMENTS

5-1. INTRODUCTION.

5-2. This section contains the adjustment procedures required to return the instrument to its peak operating capability when repairs have been made. The adjustment procedures contained in this section are:

a. Power Supply Adjustment (Para. 5-9).

b. Temperature-Stabilized Oscillator Adjustments Paragraph 5-11).

c. Reference Oscillator Adjustments (Para. 5-14).

d. N Step Loop VCO Adjustments (Para. 5-16).

e. Fractional N (N.F) Loop Analog Adjustments (Para. 5-18).

f. Summation Loop VCO Adjustments (Para. 5-20).

g. Divider–Filter Low-Pass Filter Bank Adjustments (Para. 5-22 and 5-23).

h. Mixer 40 MHz Bandpass Filter Adjustment (Para. 5-24).

i. Mixer 10 MHz LPF Adjustment (Para. 5-26).

j. Output Amplifier Adjustments (Para. 5-28).

k. Level Control Loop Adjustments (Para. 5-30).

5-3. The adjustment procedures are arranged in the sequence the adjustments are to be made. Interaction of the Output Amplifier and Level Control Loop Adjustments require that these adjustments be performed if an adjustment in one or the other is affected. Adjustments in the phase-locked loops do not affect the filter, output amplifier or level control loop adjustments.

5-4. EQUIPMENT REQUIRED.

5-5. Each adjustment procedure in this section contains a list of test equipment and accessories required to perform the adjustment. All test equipment required for adjustments is itemized in Table 1-3, Test Equipment Required. Any equipment that satisfies the required specifications given in the table can be substituted for the recommended model(s).

5-6. FACTORY SELECTED COMPONENTS.

5-7. Some component values of certain circuits are selected at the factory. These components are identifiable by an asterisk next to the designation on the schematic. The nominal values of the factory selected components found in the standard -hp- 3335A are listed on the schematic and in the replaceable parts list. The range of values for these components is presented in Table 5-1.

5-7(a). The factory selected components used in Option 002/004 (75 ohm unbal/124 ohm bal/135 ohm bal outputs) and Option 003 (75 ohm unbal and 150 ohm bal outputs) are not to be replaced using the procedure described in Paragraph 5-8. The procedure for selecting these resistors is so intricate that it is impractical to include it in the manual (in fact it is computorized at the factory). Information presented in the Replaceable Parts list for these assemblies describes the proper replacement of these resistors.

Table 5-1. Factory Selected Components.

Reference Designation	Assembly Title	Component Values	-hp- Part No.
A14R5*, R17*, R33*, R44*	Power Supply	10 Ω	0757-0346
		No Nominal	
		51 Ω	0757-0394
A14R40*	Power Supply	10 Ω	0757-0346
		20 Ω	0757-0384
		30.1 Ω Nominal	0757-0388
		40.2 Ω	0698-3262
		51.1 Ω	0757-0394
		60.4 Ω	0698-4387
A14R49*	Power Supply	10 Ω	0757-0346
		34.8 Ω	0698-3434
		60.4 Ω	0698-4387
		84.5 Ω	0698-4397
		110 Ω	0757-0402
		133 Ω Nominal	0698-3437
		162 Ω	0757-0405
		187 Ω	0698-6324
		210 Ω	0698-4419
		261 Ω	0698-3132
		387 Ω	0698-3442

5-8. The procedure for replacing standard factory selected components is as follows:

a. Install a replacement of the original value installed and perform the adjustment procedure for the section repaired as specified in this section.

b. If the adjustment cannot be made as specified, replace the selected component with the nominal value stated in Table 5-1.

c. If the adjustment cannot be made with the nominal value, substitute a value from the range stated in Table 5-1 until the adjustment is obtainable.

5-9. Power Supply Adjustment.

5-10. Voltage. There is one voltage power supply adjustment (A14R10) which sets the level of the +15 V dc regulated output.

Equipment Required:
Digital Voltmeter, -hp- Model 3455A

a. Set the Digital Voltmeter (DVM) to the dc FUNCTION, auto range.

b. Connect the DVM to the + 15 V test point located on Mother Board A1 between the halves of the module (see Figure 5-5). Assemblies A2 through A9 must be installed in the module for this adjustment.

c. Adjust A14R10 (+ 15 V adj) for a DVM reading of + 15 V ± .01 V.

d. One at a time, connect DVM to the remaining three test points (+ 5, - 15 and - 5.2) and verify their outputs are within the following range.

TP + 5: + 5.049 V to + 5.151 V
TP - 15: - 15.15 V to - 14.85 V
TP - 5.2: - 5.353 V to - 5.247 V

If one of the regulated outputs is out of range, troubleshoot the regulator associated with that output. *Each of these supplies are referenced to the + 15 V output. If the + 15 V supply is not within the specified value, the + 5 V, - 15 V and - 5.2 V supplies will be out of range. Note that the + 5 V and - 5.2 V outputs are actually + 5.1 V and - 5.3 V respecitvely at the Mother Board (A1) test points. This compensates for losses from this point to the assemblies of application.*

5-10A. Current.

NOTE

Current limit adjustments are not found on instruments with serial number 1640A00215 or lower.

There are four current limit adjustments corresponding to the four regulated power supplies located on board A14. The recommended method of implementing their adjustment is to use the test fixture diagramed in Figure 5-1.

The parts for the test fixture along with their Manufacturing Source are listed in Table 5-2. Construct the test fixture such that pins 1 and 2 are in the same position as the two black wires on W8's connector.

Table 5-2. Test Fixture Parts List.

Qty.	Description	-hp- Part No.	Manufacturing Source
10	Clips	1251-3073	-hp-
1	Connector	1251-3750	Molex Products (09-65-1101)
1	1 Ω Resistor 5 W 1% Alligator Clip No. 22 Wire	0811-0040	-hp-

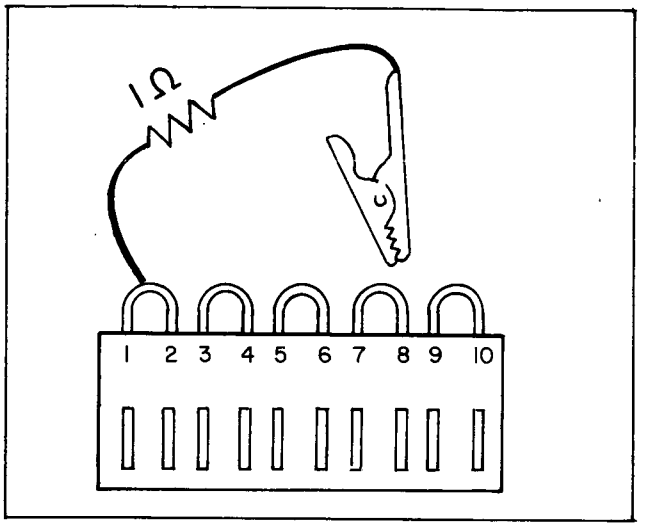


Figure 5-1. Current Limit Test Fixture.

5-10B. After the test fixture has been built, use the following procedure to adjust the current limit of the supplies.

CAUTION

The resistor used in this procedure gets HOT! Apply power only during the actual adjustment in order to reduce heating.

a. Complete the voltage adjustment procedure (Paragraph 5-10) before attempting to adjust any current limit.

b. With the instrument turned off, replace the connection of cable W8 to J2 with the test fixture.

c. Measure and note the line voltage.

d. Determine the specific adjustment and test fixture connection from Table 5-3.

Table 5-3. Current Limit Connections/Adjustments.

Power Supply	Connect Alligator Clip To	Adjust
−15	Jumper 3, 4	R27
+15	Jumper 5, 6	R25
−5.2	Jumper 7, 8	R54
+5.0	Jumper 9, 10	R29

e. Connect the voltmeter directly to the leads of the resistor. The ground of the voltmeter should go to the side of the resistor connected to jumper 1, 2.

f. Select the voltmeter readings column in Table 5-4 according to the line voltage noted in Step c. If the measured line voltage does not correspond to one of the columns, either use a variac to adjust it to 115 V ac or interpolate the voltmeter readings.

Table 5-4. Current Limit Voltmeter Readings.

Power Supply	105 V AC	Line Voltage 115 V AC	127 V AC
−15 V	−1.30 V	−1.47 V	−1.60 V
+15 V	1.27 V	1.33 V	1.43 V
−5.2 V	−2.22 V	−2.45 V	−2.62 V
+5.0 V	2.51 V	2.73 V	2.96 V

g. Adjust the appropriate potentiometer for the voltage indicated in Table 5-4. See Figure 5-6 for the locations of the current adjustments. If adjustment is impossible see Paragraph 5-6.

5-11. Temperature–Stabilized Oscillator Adjustments.

5-12. This adjustment procedure sets the 10 MHz temperature–stabilized oscillator frequency.

NOTE

This adjustment is required only if:

1. the 10 MHz REF OUTPUT does not meet the frequency specification;

2. the temperature-stabilized oscillator has been replaced;

3. a circuit repair was made to the oscillator interface assembly.

Equipment Required:
Oscilloscope, -hp- Model 180C/D/1805A/1824A
Quartz Oscillator, -hp- Model 105A/B

a. If the instrument contains Option 001 (high-stability crystal oscillator, A18 Assembly, 03335-66517) adjust the instrument as described in Paragraph 5-13.

b. The following steps apply only to the standard temperature-stabilized oscillator contained on the A17 Assembly (03335-66522).

c. The 3335A must be connected to ac power either in the ON or STBY power mode for at least 30 minutes prior to this adjustment.

NOTE

If adjustment for high frequency stability is required, warm-up time must be adjusted as described in Table 1-2, General Information.

d. Connect the Quartz Oscillator 5 MHz OUTPUT to an ac coupled input of one channel of the oscilloscope and trigger the display from this channel.

e. Connect the 3335A output to the second oscilloscope channel.

f. Program a 3335A frequency of 5 MHz and amplitude of + 13.01 dBm.

g. Set A17R11 (FINE FREQ ADJ) to mid-range.

h. Remove the bottom cover and through the rectangular hole beneath the oven in the floor panel assembly, remove the side FREQ ADJ screw from the A17A1 Assembly (oscillator can) to provide access to the adjustment.

i. With a non-metallic adjustment tool, adjust the A17A1 FREQ ADJ to stabilize the 3335A output trace on the oscilloscope (both signal traces should be stationary).

j. Expand the display to sweep one cycle or less.

k. If drift in the 3335A trace is detected, adjust A17R11 (FINE FREQ ADJ) to stabilize the oscilloscope trace.

l. This completes the adjustment. Disconnect the 3335A from the adjustment setup.

5-13. This procedure is for instruments containing Option 001. It sets the 10 MHz temperature-stabilized oscillator frequency.

a. The 3335A must be connected to ac power either in the ON or STBY power mode for at least 30 minutes prior to this adjustment.

NOTE

If adjustment for high frequency stability is required, warm-up time must be adjusted as described in Table 1-2, General Information.

b. Connect the Quartz Oscillator 5 MHz output to one channel of the oscilloscope and trigger the display from this channel.

c. Connect the 3335A output to the second oscilloscope channel.

d. Program a 3335A frequency of 5 MHz and amplitude of + 13.01 dBm.

e. With a non-metallic adjustment tool, adjust the A18A1 FREQ ADJ (oscillator can adjustment) to stabilize the 3335A output trace on the oscilloscope (both signal traces should be stationary).

f. Expand the display to sweep one cycle or less.

g. If drift in the 3335A trace is detected, adjust the A18A1 FREQ ADJ to stabilize (or nearly stabilize) the 3335A trace.

h. This completes the adjustment. Disconnect the 3335A from the adjustment setup.

NOTE

For all adjustments that follow, first perform the module troubleshooting/adjustment set-up procedure located in Service Group 0. Second, fold out Figure 5-6 for a reference to all adjustment locations.

5-14. Reference VCXO Adjustments.

NOTE

See Note preceding Paragraph 5-14.

5-15. These adjustments center the automatic frequency control characteristic on 40 MHz and establish 40 MHz operation for a 0 V dc tune voltage.

Equipment Required:
Digital Voltmeter, -hp- Model 3455A
Spectrum Analyzer, -hp- Model 141T/8552B/8553B

a. Remove the A3 assembly and install it on an extender. Remove the BNC Jumper between the 10 MHz REF OVEN OUTPUT and the 40/N MHz REF INPUT rear panel connectors.

b. Connect the Spectrum Analyzer to the rear panel 10 MHz REF OVEN OUTPUT connector. Verify the signal is 10 MHz and all harmonics are $\leq$ - 40 dB.

c. Reconnect the BNC jumper between the 10 MHz REF OVEN OUTPUT connector and the 40/N MHz REF INPUT connector.

d. Set the Digital Voltmeter (DVM) to the dc volts function and connect it to A3TP1.

e. Set A3C21 (VCXO FREQ ADJ) to the full clockwise position.

f. Adjust A3C31 (GAIN ADJ) to obtain a minimum dc V reading at TP1. The minimum dc V should be approximately + 14.7 V.

g. Disconnect DVM and connect it to junction of A3R66 and A3U4 Pin 6.

h. Adjust A3C21 (VCXO FREQ ADJ) for a DVM reading of 0 V ± 0.3 V at A3U4 Pin 6.

i. Remove the DVM and install the A3 assembly in the module.

5-16. N Step Loop VCO Adjustments.

NOTE

See Note preceding Paragraph 5-14.

5-17. These adjustments establish the frequency tune voltage characteristic and the flatness response of the N Step Loop VCO.

Equipment Required:
Digital Voltmeter, -hp- Model 3455A
Spectrum Analyzer, -hp- Model 141T/3552B/3553B

a. Remove the A8 assembly (Summation Loop) from the module and install the A9 assembly on an extender.

b. Remove the VCO shield (both component and circuit side) on the A9 assembly and set A9L7 and A9R66 (FLATNESS ADJ) to the center of their adjustment range.

c. Connect the Digital Voltmeter (DVM) to A9TP3.

d. Set the 3335A frequency to 80 MHz and adjust A9L8 for a DVM reading as close to - 8.7 dc as can be adjusted. The voltage must be between 0 V and - 8.7 V dc.

e. Set the 3335A frequency to 40 MHz and check that the voltage at A9TP3 is $\leq$ + 8.7 V dc. If the voltage is $>$ + 8.7 V dc, adjust A9L8 for + 8.7 V dc, set the frequency to 80 MHz and check that A9TP3 is $\geq$ - 8.7 V dc. It may be necessary to iterate the A9L8 adjustment at 40 MHz and 80 MHz until both limits are met. At 40 MHz, TP3 must be $\leq$ + 8.7 V dc and at 80 MHz it must be $\geq$ - 8.7 V dc. Adjust both end limits to be symmetrical about 0 V.

NOTE

If this adjustment cannot be made, replace varicaps A9CR3 and A9CR4.

f. Disconnect the DVM and connect the Spectrum Analyzer to the 39–79 MHz test point on Mother Board A1 of the module using service cable W1 (see Figure 8-49).

g. Set the Spectrum Analyzer to the linear mode.

h. Set the 3335A frequency to 40 MHz.

i. Adjust A9L7 for a peak reading on the Spectrum Analyzer.

j. Set the 3335A frequency to 60 MHz and program a SWEEP WIDTH of 40 MHz.

k. Press the START AUTO key in the FREQUENCY SWEEP key group.

l. With the 3335A now in the auto sweep mode sweeping from 40 MHz to 80 MHz (the N Step Loop VCO sweeps from 39 MHz to 79 MHz in 1 MHz steps), adjust A9R66 (FLATNESS ADJ) for flatness of ⩽ 2 dB with the 39 MHz and 79 MHz end points of equal amplitude.

m. This completes the N Step Loop VCO adjustments. Disconnect the Spectrum Analyzer and install the VCO shield. Insert the Summation Loop Assembly (A8) and the N Step Loop (A9) into the module.

5-18. Fractional N (N.F) Loop Analog Adjustments.

NOTE

See Note preceding Paragraph 5-14.

5-19. The purpose of these adjustments is to tune the N.F Loop VCO frequency, adjust the tune voltage in the Sample/Hold section and calibrate the proportionality of the current sources in the API section.

Equipment Required:
Oscilloscope, -hp- Model 180C/D/1805A/1824A
Spectrum Analyzer, -hp- Model 141T/8552B/8553B

a. Place the A5 assembly on an extender and connect the Oscilloscope to the dotted end of A5C26 (Integrator capacitor)

b. Set the 3335A frequency to 1 MHz and adjust A5L7 of the VCO tank circuit for the waveform of Figure 5-2.

c. Disconnect the oscilloscope, remove extender board and place the A5 assembly into the module. Replace the screws before continuing.

d. Set the 3335A FREQUENCY to 20.5 kHz, AMPLITUDE to + 13.01 dBm and FREQ INCR to 10 kHz.

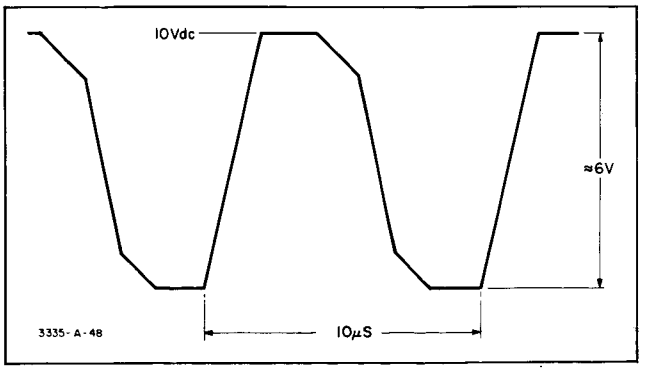


Figure 5-2. A5L7 Adjustment Waveform.

e. Connect the Spectrum Analyzer to the A6, OUTPUT AMPLIFIER's output connector located on the A6 assembly front extrusion (MP1).

f. Set the Spectrum Analyzer to 20.5 kHz MANUAL SWEEP MODE, 3 Hz BW and tune in the signal (obtain maximum amplitude display).

g. Press the INCR down key to set the frequency at 10.5 kHz.

h. Adjust A5R45 (API 1 ADJ) for a null of the Spectrum Analyzer display (< - 80 dB).

i. Set the 3335A FREQUENCY to 20.05 kHz.

j. Set the Spectrum Analyzer to 20.05 kHz and tune in the signal.

k. Press the INCR down key to set the FREQUENCY at 10.05 kHz.

l. Adjust A5R43 (API 2 ADJ) for a null of the Spectrum Analyzer display (< - 80 dB).

5-20. Summation Loop VCO Adjustments.

NOTE

See Note preceding Paragraph 5-14.

5-21. These adjustments establish the frequency tune voltage characteristic and the flatness response of the VCO. The adjustments procedure is identical to that for the N Step Loop VCO.

Equipment Required:
Digital Voltmeter, -hp- Model 3455A
Spectrum Analyzer, -hp- Model 141T/3552B/3553B

a. Remove the A2 assembly (Divider-Filter) from the module. This assembly is to be set aside while Summation Loop adjustments are made.

b. Remove the VCO Phase Detector shields on the A8 assembly and set A8L15 and A8R76 (FLATNESS ADJ) to the center of their adjustment range.

c. Connect the Digital Voltmeter (DVM) to A8TP3.

d. Set the 3335A frequency to 80 MHz and adjust A8L16 for a DVM reading as close to - 8.7 V dc as can be adjusted. The voltage must be between 0 V and - 8.7 V dc.

e. Set the 3335A frequency to 40 MHz and check that the voltage at A8TP3 is ⩽ + 8.7 V dc. If the voltage is > + 8.7 V dc, adjust A8L16 for + 8.7 V dc, set the frequency to 80 MHz and check that A8TP3 is ⩾ - 8.7 V dc. It may be necessary to iterate the A8L16 adjustment at 40 MHz and 80 MHz until both limits are met. At 40 MHz, TP3 must be ⩽ 8.7 V dc and at 80 MHz it must be

$\geq$ - 8.7 V dc. Adjust both end limits to be symmetrical about 0 V.

NOTE

If this adjustment cannot be made, replace varicaps A8CR9 and A8CR10.

f. Disconnect the DVM and connect the Spectrum Analyzer to the 40–80 MHz test point on Mother Board A1 or the module (see Figure 5-6).

g. Set the Spectrum Analyzer to the linear mode.

h. Set the 3335A frequency to 40 MHz.

i. Adjust A8L15 for a peak reading on the Spectrum Analyzer.

j. Set the 3335A frequency to 60 MHz and program a SWEEP WIDTH of 40 MHz.

k. Press the START AUTO key in the FREQUENCY SWEEP key group.

l. With the 3335A now in the AUTO SWEEP mode sweeping from 40 MHz to 80 MHz (the Summation Loop VCO sweeps from 40 MHz to 80 MHz), adjust A8R76 (FLATNESS ADJ) for a serial response of < 2 dB with the 40 MHz and 80 MHz end points of equal amplitude.

m. This completes the Summation Loop VCO Adjustments. Disconnect the Spectrum Analyzer and install the VCO and Phase Detector shields. Insert the Divider-Filter Assembly (A2) and the Summation Loop (A8) into the module.

5-22. Filter Adjustments.

NOTE

The Divider-Filter Low-Pass Filter Bank adjustments normally will not be required. Do not perform a filter adjustment unless the following test (Steps a through f) indicates it is required. Refer to Note preceding Paragraph 5-14.

a. Disconnect the Divider-Filter cable at the A6 assembly and remove the A6 assembly from the module.

b. Place the Divider-Filter assembly, A2, on an extender.

c. Short TP LC to TP LCT.

d. Program a FREQUENCY of 10 MHz and a FREQ INCR of 1 MHz.

e. Monitor the output of the Divider-Filter assembly at the disconnected cable with a 50 ohm input impedance oscilloscope. The output level should be 0 dBm ± 3 dB.

f. Increment the frequency. The output level should be 0 dBm ± 3 dB for all frequencies from 10 MHz to 80 MHz. If the output from the Divider-Filter is within ± 3 dB, filter adjustments are not required. If certain frequencies are out of range, determine the filter activated and adjust it by the following procedure.

5-23. Divider-Filter Low-Pass Filter Bank Adjustments. These adjustments align the band edge and flatness of the low-pass filters on the Divider-Filter assembly, A2.

Equipment Required:
Tracking Generator -hp- Model 8443A
Spectrum Analyzer -hp- Model 141T/3552B/3553B

a. Remove the Divider-Filter assembly, A2, from the module. All filter adjustments are made while the assembly is disconnected from the module.

b. Connect the Spectrum Analyzer with a 50 ohm input impedance to the output connector of the filter to be adjusted. The location of each filter, adjustment location and filter input and output is shown in Figure 5-3. Adjust only those filters requiring alignment. The following Steps c through i apply to each filter listed in Table 5-5.

NOTE

Keep cable lengths between filter pins and instrumentation as short as possible.

c. Connect a Tracking Generator to the input connector of the filter. Set the output level to - 10 dBm.

d. Set the marker frequency to f1 shown in Table 5-5.

e. Adjust the left-most adjustment (see Table 5-5) for a minimum reading on the spectrum analyzer.

Table 5-5. Filter Adjustment Data.

fØ Low Pass Filter	f1 (MHz)	f2 (MHz)	Filter Adjustment		
			Left-Most	Middle	Right-Most
14 MHz	19.6	22.7	L28	L29	L30
20 MHz	28.0	32.4	L24	L25	L26
28 MHz	39.1	45.3	L20	L21	L22
40 MHz	55.9	64.7	L16	L17	L18
56 MHz	78.3	90.6	L12	L13	L14
80 MHz	112	130	L37	L38	L39

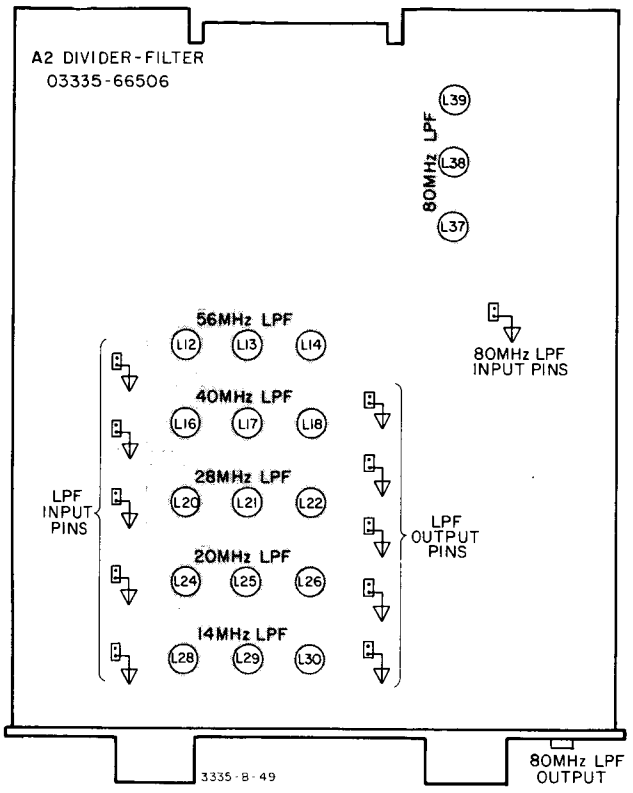


Figure 5-3. Filter Adjustment Location.

f. Set the marker frequency to f2 shown in Table 5-5.

g. Adjust the middle filter adjustment (see Table 5-5) for a minimum reading on the spectrum analyzer.

h. With the Tracking Generator, sweep the filter across the band edge (roll off) and adjust the right-most adjustment (see Table 5-5) for the best approximation of an ideal band edge as shown in Figure 5-4. Two examples of an improperly adjusted filter are shown in Figure 5-5.

i. Repeat Steps d to h once to compensate for adjustment interaction.

j. Install the A6 assembly in the module.

5-24. Mixer 40 MHz Bandpass Filter Adjustments.

5-25. This adjustment reduces the harmonic components of the 40 MHz reference signal to prevent undesired products from occurring in the mixer.

Equipment Required:
Spectrum Analyzer, -hp- Model 141T/8552B/8553B
Active Probe, -hp- Model 1120A

a. Remove the A6 assembly from the module and place the A7 assembly on an extender.

b. Remove shield MP3 covering the connection of cable W2 to L15.

c. Connect the Spectrum Analyzer, through the -hp- 1120A Active Probe, to the connection of cable W2 and L15.

d. Set the -hp- 3335A frequency to 1 MHz.

e. Short test point LC to test point LCT. This connection will turn the modulator on.

f. Adjust A7L9 and A7L10 for maximum signal indication on the spectrum analyzer. It will be necessary to work back and forth between these two adjustments because of their interaction.

g. Set the Spectrum Analyzer to the 2 dB log mode. Adjust R24 for 0 dBm indication on the Spectrum Analyzer. This is a cursory adjustment that makes subsequent adjustments easier.

h. Remove the short between test point LC and test point LCT. Replace shield MP3.

5-26. Mixer 10 MHz LPF Adjustment.

5-27. This adjustment establishes the amplitude flatness of the 10 MHz LPF located on the Mixer assembly, A7. All module assemblies must be installed and working properly before making this adjustment.

Equipment Required:
Spectrum Analyzer, -hp- Model 141T/3552B/3553B

a. Remove the A6 assembly from the module and place the A7 assembly on an extender. Connect a short between test points LC and LCT. (This fixes the dc control voltage applied to the modulator.)

b. Connect a spectrum analyzer to the module Mother Board 0–10 MHz test point.

c. Set the 3335A output parameters as follows:

FREQUENCY . . . . . 5 000 099.999 Hz
SWEEP WIDTH. . . . . 9 999 799.000 Hz
AMPLITUDE . . . . . + 13.01 dBm

d. Press the AUTO SWEEP key.

e. Adjust A7C38, C39 and R90 for best flatness.

f. Remove short from test points and install the A6 and A7 assemblies.

5-28. Output Amplifier Adjustments.

NOTE

See Note preceding Paragraph 5-14.

5-29. The purpose of these adjustments is to ensure that the output signal from the output amplifier does not contain a dc component.

Equipment Required:
Digital Voltmeter, -hp- Model 3455A

a. Install the A7 Assembly (Mixer) and the A6 Assembly (Output Amplifier and Level Control) on extenders.

b. Set the 3335A FREQUENCY to 10 kHz.

c. Set A6R85 (BIAS ADJ) to the midrange position.

d. Connect the Digital Voltmeter (DVM) to A6TP6.

e. Ground A6TP5.

f. Adjust A6R85 (BIAS ADJ) for 0 V ± .01 V dc at A6TP6.

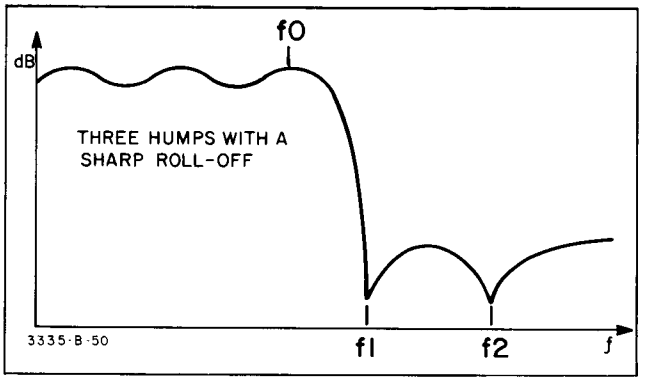


Figure 5-4. Ideal Filter Characteristics.

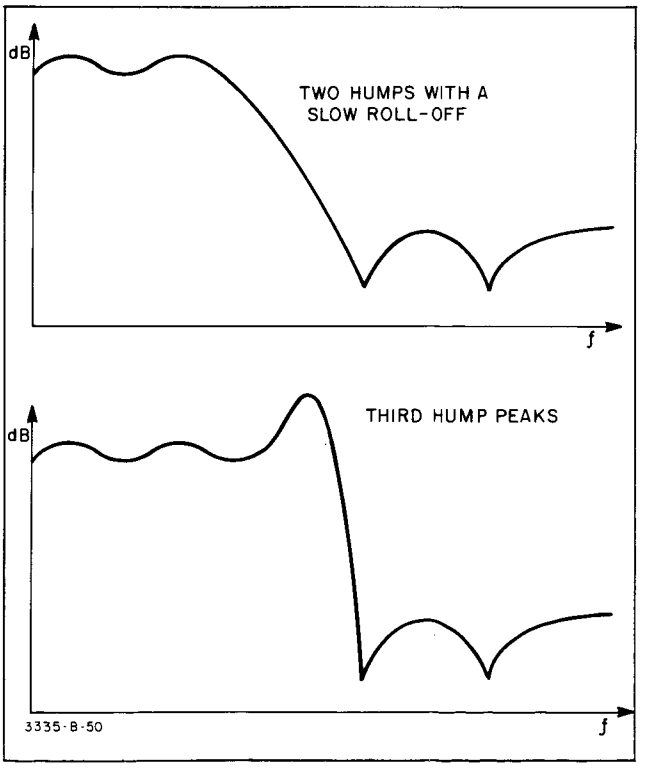


Figure 5-5. Improperly Adjusted Filter Characteristics.

g. Remove ground from A6TP5.

h. Adjust A7R92 (DC NULL ADJ) for 0 V ± .01 V dc at A6TP6.

5-30. Level Control Loop Adjustments.

NOTE

See Note preceding Paragraph 5-14.

5-31. The purpose of these adjustments is to set the - 10 V reference, establish the operation of the ac-to-dc converter, establish the 1.99 dB attenuation range of the loop and set the operation of the external leveling amplifier.

Equipment Required:
Digital Voltmeter, -hp- Model 3455A
Oscilloscope, -hp- Model 180C/D/1805A/1824A
50 Ω Feedthru Termination, -hp- Model 11048C
For Options 002 & 003 the following is also required:
75 Ω Feedthru Termination, -hp- Model 11094B
(2) Connector Adapter, -hp- Part No. 1250-0591

a. Verify that the + 15 V jumper between + 15 V and the LEVELING switch connector of the A1 Mother Board is properly installed. (This puts the instrument in the INTERNAL LEVEL mode of operation).

b. Set the Digital Voltmeter (DVM) to the dc FUNCTION, auto range and connect it to A6TP3.

c. Adjust A6R144 (−10 V ADJ) for a DVM reading of −10 V ± .01 V.

d. Set the 3335A frequency to 10 kHz.

e. Connect an alligator clip across the two pins of A6TP1.

f. Connect the Oscilloscope to A6TP2. Set the Oscilloscope to the dc coupled mode.

g. Adjust A6R122 (THERM CONV. BAL ADJ) for + 1.4 V ± 0.1 V at TP2.

h. Slowly adjust A6R122 in the CCW direction until the integrator (U4) begins to integrate in the negative direction. This is detected by the Oscilloscope at TP2 showing a decreasing dc voltage from that of the previous step. Verify that the rate of change of the decreasing voltage is $\leqslant$ 1 V per second.

NOTE

If uncertain of the rate of change, adjust A6R122 slowly in the CW direction causing the voltage at TP2 to change in a positive direction. Check that the rate of change is $\leqslant$ 1 V per second.

i. Remove short from TP1 and remove oscilloscope from TP2.

j. Insert the A6 assembly in the module.

k. Set amplitude to +13.01 dBm and frequency to 100 kHz.

l. Connect the DVM to the output connector of the A6 assembly through a 50 ohm feedthrough termination.

m. Adjust A6R147 (+ 13.01 dBm ADJ) for a voltmeter reading of 1 V ± .005 V. Note and record the difference from 1 V.

n. Set the 3335A amplitude to + 11.02 dBm.

o. Adjust A6R150 (+11.02 dBm ADJ) for the DVM reading stated in Table 5-6 corresponding to the difference recorded in Step m.

p. Install the A2 and A7 assemblies on extenders.

q. Set amplitude to + 13.01 dBm and frequency to 10 kHz.

Table 5-6. +11.02 dBm ADJ Specifications.

A6R147 + 13.01 dBm ADJ Difference	A6R150, + 11.02 dBm ADJ Adjustment Specification*
+ .005 V	+ .799 ± .001
+ .004 V	+ .798 ± .001
+ .003 V	+ .797 ± .001
+ .002 V	+ .797 ± .001
+ .001 V	+ .796 ± .001
± .000 V	+ .795 ± .001
- .001 V	+ .794 ± .001
- .002 V	+ .793 ± .001
- .003 V	+ .793 ± .001
- .004 V	+ .792 ± .001
- .005 V	+ .791 ± .001

*Adjustment specification is derived from the following formula:

Spec. = + 0.795 + [(0.79) x (Difference recorded in step M)] ± .001 V

r. Connect the DVM set to the dc FUNCTION, auto range, to test point LC (Level Control) on the module Mother Board, A1 (see Figure 5-6)

s. Adjust A7R24 (MOD LEVEL ADJ on Mixer Assy) for a DVM reading of + 1.75 V ± .05 V at TP LC.

t. Remove the A7 assembly from the extender and install in the module.

u. Set the 3335A frequency to 9.999 MHz, the amplitude to 13.01 dBm and record the DVM reading of TP LC.

v. Set the 3335A frequency to 10 MHz and amplitude to + 13.01 dBm.

w. Adjust A2R37 (MOD LEVEL ADJ on Divider-Filter Assembly) for the same DVM reading as noted in Step u for a frequency of 9.999 MHz.

x. Install the A2 assembly in the module.

y. Install the A6 assembly on an extender, set the 3335A frequency to 10 kHz and remove the jumper between LEVEL SW. pin and + 15 pin on A1 Mother Board.

z. Connect the DVM to the A6 assembly output through a 50 ohm feedthrough termination and adjust A6R164 for a DVM reading of +0.5 V ± 0.1 VAC.

aa. Install the A6 assembly into the module and install the module in the chassis. Connect the semi-rigid coaxial cable from A6 assembly to attenuator. Install the top cover.

bb. Allow the 3335A to operate for 30 minutes undesturbed.

cc. After 30 minutes, connect the Oscilloscope to the 3335A output and verify a frequency of 10 kHz.

dd. Disconnect the oscilloscope and connect the DVM to the 3335A output. (STD: 50 ohm output through 50 ohm termination, Option 002 and 003: 75 ohm output through 75 ohm termination).

ee. If the DVM does not read 1 V ± .005 V (+13.01 dBm = 1 V rms into 50 ohms, +11.25 dBm = 1 V rms into 75 ohms), use a short screwdriver to readjust A6R147 (+13.01 dBm ADJ) for a DVM reading of 1 V ± .005 V and record the difference from 1 V.

NOTE

DO NOT remove the A6 assembly from the module for this adjustment.

ff. For a 50 ohm output, program an amplitude of +11.02 dBm (for 75 ohm output, program +9.26 dBm), readjust A6R150 (+11.02 dBm ADJ) for a DVM reading as specified in Table 5-6.

gg. This completes the Level Control Loop Adjustments. Remove the DVM.

5-32. Carrier Balance Adjustment.

NOTE

See Note preceding Paragraph 5-14.

5-33. This adjustment provides a smooth transition from frequencies below 10 MHz to frequencies above 10 MHz.

Equipment Required:
Oscilloscope, -hp- 180C/D, 1805A, 1825A

a. Place the A6 and A7 assemblies on extender boards.

b. Connect the Oscilloscope to the output of the A6 board.

c. Terminate the output of the A6 assembly with a 50 ohm resistor or, if available, use the 50 ohm Oscilloscope Input impedance.

d. Set the -hp- 3335A output parameters as follows:

FREQUENCY . . . . . 10 MHz
SWEEP WIDTH. . . . . .10 Hz
AMPLITUDE . . . . . +13.01 dBm

e. Press the Auto Sweep key.

f. Adjust A7R68 for a smooth transition through 10 MHz.

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