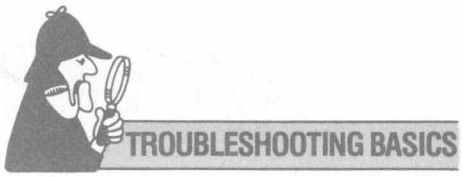
HEWLETT PACKARD

BENCH BRIEFS

SERVICE INFORMATION FROM HEWLETT-PACKARD

JULY–OCTOBER 1986

The Basics of Switching Regulators . . . Cont'd



Barry Halm,
HP New Jersey Division

Flyback Converters

We previously discussed the half-bridge converter and its use in the off-line switching power supply. Remember, off-line is defined as a power supply whose input rectifier circuits operate directly from the ac power line without transformer isolation. This article discusses the flyback converter and its use in off-line autoranging power supplies. We have two new terms, flyback converter and autoranging, to define and relate to each other.

First, let's look at the flyback converter in Figure 1 and describe its operation.

Transistors Q1 and Q2 are power field-effect transistors (FET) that are in series and are switched simultaneously. Both Q1 and Q2 are turned on, initiating current flow in the primary of T1. The primary current (Ipri) is a linear ramp whose rise time is controlled by the magnetizing inductance of the power transformer T1. The output rectifier D3 is reverse biased during this period so that the energy is stored in the magnetic field of T1. When Q1 and Q2 are turned off, the collapsing magnetic field reverses the voltage across the secondary, forcing D3 to conduct and transfer this stored energy to the output filter and load. Both the dynamic voltage range and energy transferred are controlled by the time that Q1 and Q2 are on and Ipri is flowing. Note that the primary and secondary current do not flow at the same time. Thus the input and output are not coupled at the same time so that faults that occur on the secondary are not directly reflected to the primary. Diodes D1 and D2 protect the transistors from inductive surges that occur when the transistors turn off. We can describe this circuit by saying that "The flyback switching converter works by cyclically storing energy in a magnetic field and then transferring this stored energy to a load."

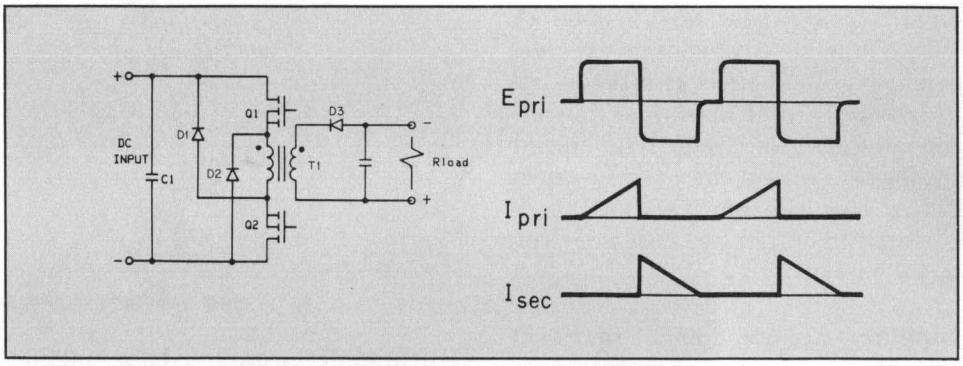


Figure 1. Flyback converter

Now we will define the term autoranging, as it is related to dc power supplies.

Figure 2 shows the output characteristics of three different power supplies. The typical CV/CC power supply, Figure 2A, delivers maximum output power at only one combination of output voltage and current.

The dual-range power supply delivers maximum output power at two points by using switch-selectable voltage/current ranges.

The autoranging power supply delivers maximum output power not only at the points described above, but also over a wide and continuous range

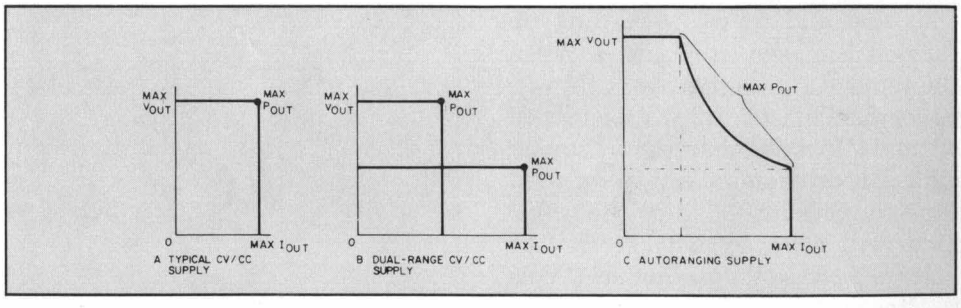


Figure 2. Output characteristics of typical, dual-range, and autoranging power supplies

Pub. No. 5952-0126

of voltage and current combinations as shown in Figure 2C. This autoranging capability is made possible by the flyback converter's ability to provide a greater variation of output voltage with respect to changing duty cycle.

Drive Circuits

The two types of power transistors commonly used in switching regulator circuits are bipolar and field-effect. While bipolar transistors are less expensive, field-effect transistors require a simpler and less power-consuming drive circuit. The bipolar transistor, being a current-dependent device, requires relatively large base currents to obtain the necessary collector current.

Bipolar—Figures 3 and 4 represent simplified base drive circuits used in switching power supplies.

Looking at Figure 3 and waveforms 3a. and 3b., we can see that when the base of Q1 is positive with respect to its emitter, the transistor conducts. When the drive waveform from pulse transformer T1 reverses, the base-emitter voltage of Q1 collector current continues to flow for a short period of time. This time is called storage time and is defined as the interval of time from the moment reverse base drive is applied to when the collector-emitter voltage has reached 10 percent of its off value. To decrease storage time, diodes CR1 and CR2 are added to the drive circuit. CR1 prevents the collector from going more negative than the base, or into "deep" saturation.

A second method of decreasing storage time and thereby speeding up turn-off is shown in Figure 4. When the top of T1 goes positive, CR2 will be forward biased, Q2 will be turned off, and C1 will be charged up through CR3. The drive signal is then removed from the primary of T1 so the waveform will collapse and reverse the voltage across the secondary. This reverse voltage biases CR2 off, which causes Q2 to turn on and discharge

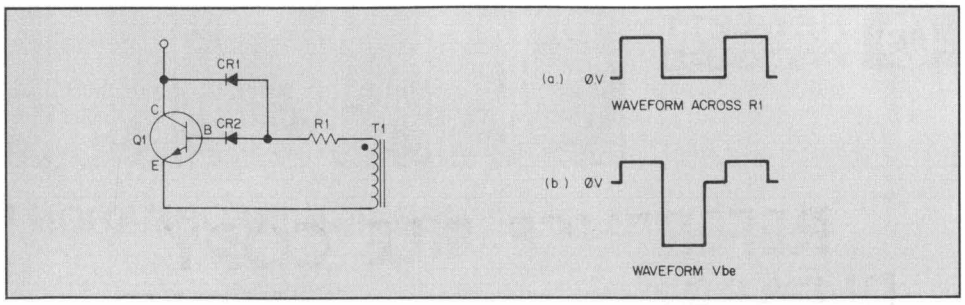


Figure 3. Simple bipolar base drive circuit

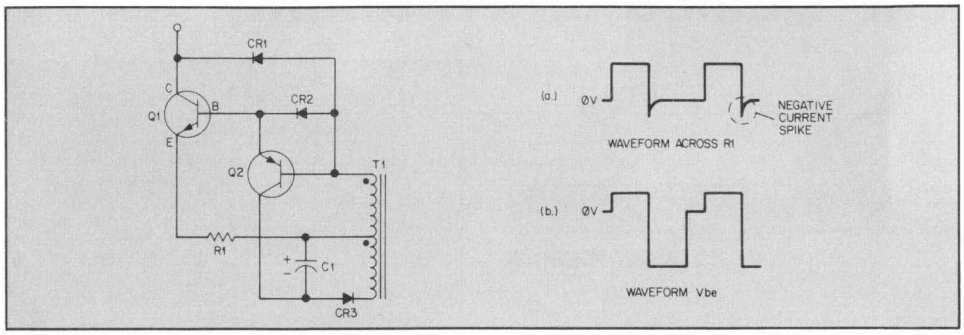


Figure 4. Simple bipolar base drive circuit with turn-off

C1 through the emitter-base junction of Q1 in the reverse direction. The reverse current appears as the negative spike seen in the voltage waveform across R1.

The drive circuit of Figure 4 greatly reduces the turn-off time of the power switches. Because most of the power is dissipated during turn-on and turn-off, the reliability of the power transistors is increased.

Field-Effect—The FET is a voltage-controlled device. A voltage applied between the gate and source produces a drain current. The gate is electrically isolated from the source so only a small leakage current will flow from the gate when a signal is applied.

Figure 5 is a typical drive circuit used in FET switching. A positive ON pulse is applied to the gate of Q1 through steering diode CR1. Although the ON pulse is of short duration, 1 to 2 microseconds, the input capacitance of the gate-source junction maintains the gate voltage. Q2 is off and CR1 is reverse biased, preventing the gate from discharging. To turn Q1 off, the gate voltage must be reduced below a specific threshold level or to zero.

The OFF pulse from T2 will turn on Q2, pull the gate voltage to zero, and return the drain to a high impedance.

A more detailed description of power FET circuits is described in operating and service manuals for Hewlett-Packard power supplies, such as the HP 6033A. Also, see the August 1981, *Hewlett-Packard Journal.* □

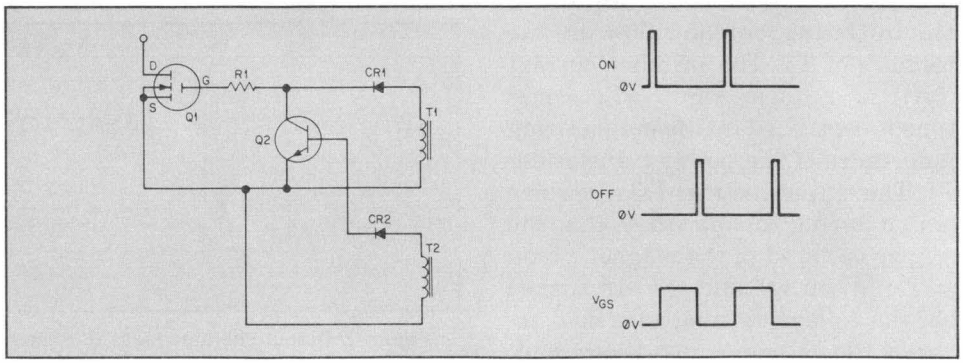


Figure 5. Simplified FET gate drive

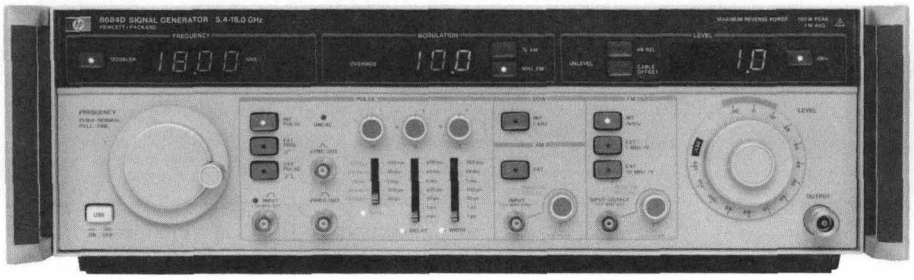
New Adjustment Procedure Improves HP 8684A/B/D Reliability

Eric Jennings,
HP Stanford Park Division

There is a new procedure for adjusting the sloping power supplies in HP 8684A/B/D cavity-tuned Signal Generators that reduces the voltage to the low oscillator circuits while using the high oscillator. This reduced voltage decreases heat dissipation and improves oscillator life.

For current owners of the signal generators the procedure is detailed in Hewlett-Packard service notes 8684A-4, 8684B-4 and 8684D-1. These notes are available from your nearest HP office or from the Literature Distribution Center at 1820 Embarcadero Road, Palo Alto, California, 94303.

The procedure applies to all serial numbers and will be included in the yellow change sheet that accompanies the instrument's operating and service manual for all new 8684s. □



DTS-70 Service Training at Lexico

Lexico Enterprises, Kirkland, Washington, is currently offering a 5-day class that deals with the technical aspects of the HP DTS-70 Circuit Test System.

This course provides background information for the HP 1000 series minicomputer, the TESTAID III/ FASTRACE III software and, in particular, the HP 9571 Digital Test Station. The students learn to perform and evaluate the system's functional tests, performance tests, and to install the test station hardware. Students are also given the opportunity to troubleshoot inserted faults on both the instruments and the circuit boards of the digital test unit.

The cost of this 5-day course is $1,450 per-person, per-session. For additional information in the DTS-70 service course and its 1986/87 training schedule, please contact the registrar's office at Lexico, (206) 828-0555. □

The Bootstrap Circuit

The bootstrap circuit is a circuit in which an increment of the applied signal is partially fed back across the input impedance resulting in a higher effective input impedance.

In the "tube days" a bootstrap circuit was a single-stage electron-tube amplifier circuit in which the output load was connected between cathode and ground or other common return. The signal voltage was applied between the grid and the cathode. The name bootstrap came from the fact that a change in grid voltage changed the potential of the input source with respect to ground by an amount equal to the output signal.

In today's circuits, as then, one of the uses of the bootstrap circuit is to overcome the shunting effect of the input resistance of many kinds of electronic circuits.

Figure 1 shows a standard junction FET amplifier stage. In most applications, the input resistor R1 will display a lower resistance than the input impedance of the FET and, in a way, destroys one advantage of a FET amplifier, which is its high input impedance. There are reasons why R1 cannot be selected with a resistance as high or higher than the FET input impedance, such as thermal noise, stability, etc.

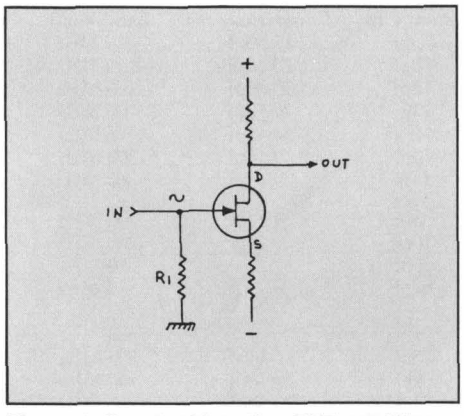


Figure 1. Standard junction FET amplifier stage

The bootstrap principle allows the use of a low value for R1 and still keeps the high input impedance of the FET. Figure 2 shows the principle. The output of the FET amplifier is returned to the bottom of the input resistor R1 with same phase and same amplitude as the input signal. When the input signal is applied to the FET, both ends of R1 are at the same potential at all times, point A and B swing exactly in synchronism.

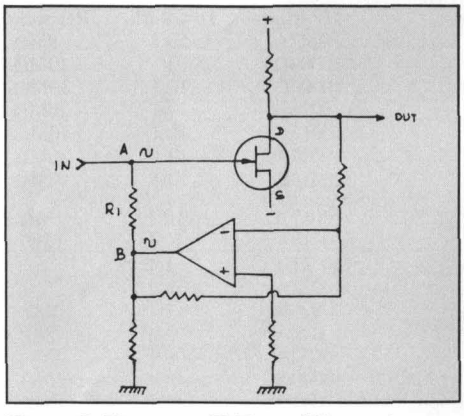


Figure 2. The same FET amplifier as in Figure 1 but with positive feedback to the input that keeps the input impedance high

Therefore, no current can flow through R1, and it becomes virtually an infinite resistance representing no load for the FET input.

Since the signal fed back to point B is in phase with point A, the feedback is positive and the bootstrap circuit has a gain of exactly one. If the gain were above one, the circuit would oscillate. If it were lower than one, the effect of R1 will only be partially eliminated, which for certain applications may be sufficient. For example, if the FET is used as a source follower for the bootstrap, the feedback amplifier can be eliminated. Figure 3 illustrates this solution. At the input, R1 appears 20 to 50 times larger in resistance than the actual resistive value.

Figure 4 shows a typical bootstrap circuit that is used in the HP 400E Voltmeter. The input resistor R19 as well as the load resistor R23 are bootstrapped. □

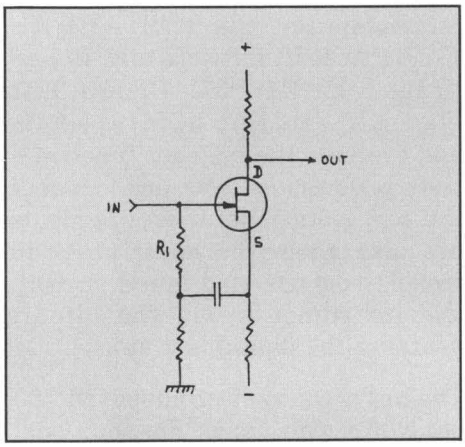


Figure 3. FET used as source follower for the bootstrap

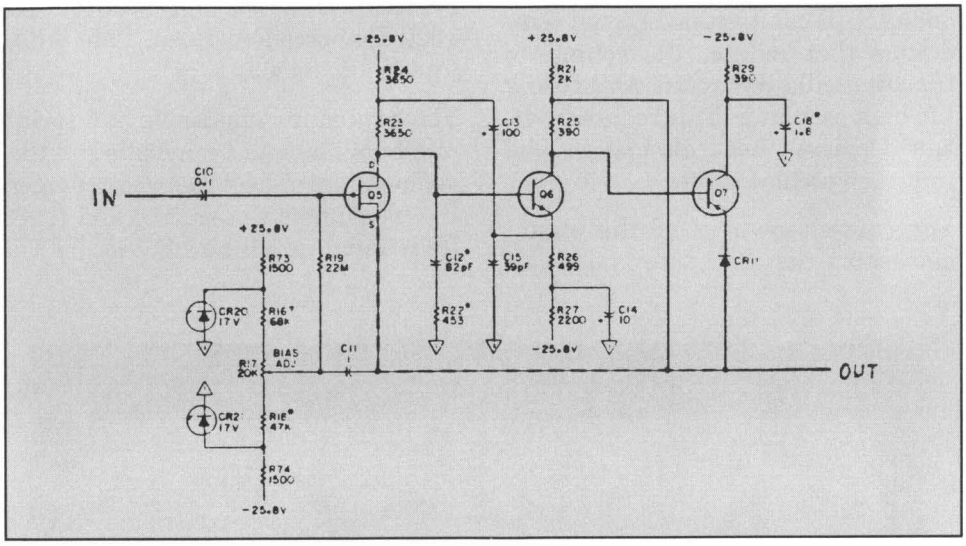


Figure 4. Typical bootstrap circuit example from HP 400E Voltmeter

Taking the Mystery Out of Probe Selection

Ed Mierzejewski,
HP Colorado Springs Division

Hewlett-Packard has been receiving requests for probe information, something to supplement the information in the 1986 instrument catalog.

Table 1 lists HP's current miniature and standard-size resistive divider probes with some key specifications that will help to determine which probe makes the most sense for a given application.

If you need an active probe we recommend the HP 1124A 100 MHz Active Divider Probe that provides high-voltage, general-purpose probing capabilities for scopes having 50-ohm inputs without selectable high impedance inputs. This 10 Megohm, 10 picofarad probe allows direct measurements of 100 volts (dc to 100 MHz) in the 100:1 division ratio mode. In the 10:1 division ratio mode, the input voltage range is ± 10 volts. Power is supplied by instruments with probe power jacks or the HP 1122A Probe Power Supply. □

Table 1. Resistive Divider Probes

HP Model	Div. Ratio	Resistance	Shunt Cap.	Compensates to	Band Width	Max. Voltage	Size	Length
10002A	50:1	9MΩ	2.5pF	15-55pF	40 MHz	1000V	Standard	1.5M (4.9 ft)
10004D	10:1	10MΩ	10pF	20-30pF	100 MHz	500V	Standard	1.1M (3.6 ft)
10005D	10:1	10MΩ	17pF	20-30pF	100 MHz	500V	Standard	3M (9.8 ft)
10006D	10:1	10MΩ	14pF	20-30pF	100 MHz	500V	Standard	1.8M (5.9 ft)
10013A	10:1	10MΩ	13pF	24-45pF	15 MHz	500V	Standard	1.8M (5.9 ft)
10014A	10:1	10MΩ	10pF	9-13pF	300 MHz	500V	Standard	1.1M (3.6 ft)
10016B	10:1	10MΩ	14pF	9-13pF	300 MHz	500V	Standard	1.8M (5.9 ft)
10017A	10:1	1MΩ	8pF	9-14pF	300 MHz	300V	Mini	1M (3.3 ft)
10018A	10:1	1MΩ	10pF	9-14pF	200 MHz	300V	Mini	2M (6.6 ft)
10021A	1:1		36pF		10 MHz	300V	Mini	1M (3.3 ft)
10022A	1:1		62pF		10 MHz	300V	Mini	2M (6.6 ft)
10026A	1:1	50Ω				100V	Mini	1M (3.3 ft)
10027A	1:1	50Ω				100V	Mini	2M (6.6 ft)
10032A	100:1	3MΩ	3pF	9-14pF	300 MHz	300V	Mini	1.1M (3.6 ft)
10040A	10:1	1MΩ	9pF	20-30pF	100 MHz	300V	Mini	1M (3.3 ft)
10041A	10:1	1MΩ	12pF	20-30pF	100 MHz	300V	Mini	2M (6.6 ft)
10042A	10:1	1MΩ	15pF	20-30pF	100 MHz	300V	Mini	3M (9.8 ft)
10081A	10:1	1MΩ	12pF	12-20pF	100 MHz	300V	Mini	2M (6.6 ft)
10084A	1:1		68pF		100 MHz	300V	Mini	2M (6.6 ft)

Recommended Reading

Calibration Services at the U.S. National Bureau of Standards

Editor's Note: In the interest of providing a wider audience for information on their technical services, the U.S. Dept. of Commerce asked for a short presentation in various company publications. Hewlett-Packard is happy to provide this information to our readers because the NBS measurement services and standard reference materials provide the technical references for a wide range of measurements world-wide.

Over 300 different calibration and test services are described in the recently published *NBS Calibration Services Users Guide 1986–88,* edited by G. A. Uriano, and in the supplementary *NBS Calibration Services Fee Schedule.* Services range from dimensional, to ionizing radiation, to highly-specialized microwave parameters.

In addition to measurement services, NBS provides another highly-innovative program that supplies a measurement reference path for quality control of measurements. NBS can supply over 1000 different standard reference materials (SRMs) for use in manufacturing, materials testing, environmental measurements, and clinical testing. By measuring such samples in the actual local situation, a quality-control loop is established around both the equipment and the measuring procedures. The SRMs are described in *NBS Standard Reference Materials Catalog 1986–88,* edited by R. W. Seward, and in the supplementary *NBS Standard Materials Price List.*

A complementary copy of those publications or information about the services can be obtained from:

Ernest L. Garner, Chief
Office of Physical Measurement Services
National Bureau of Standards
B362 Physics Building
Gaithersburg, MD 20899
U.S.A.

Telephone: (301) 921-2805
Telex: TRT 197674NBS UT

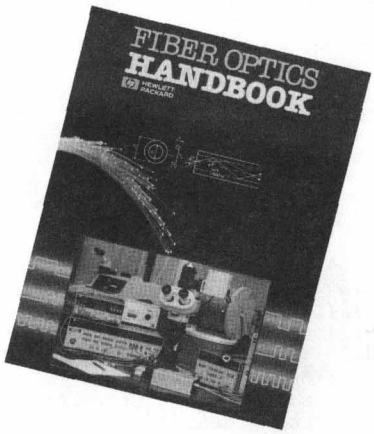
Coaxial Systems

Principles of Microwave Connector Care (For Higher Reliability and Better Measurements)

Recent advances in measurement capabilities have made RF connectors and connection techniques more important than ever before. Damage to the connectors on calibration and verification devices, and on test ports, cables, and other devices also represents an increasing burden in downtime and expense.

The suggestions in *Application Note 326* will help you get the best performance from all coaxial microwave connectors: to know what to look for when cleaning and inspecting them, in order to preserve their precision and extend their life; and to make the best possible microwave connections, improving the accuracy and repeatability of all of your measurements, saving both time and money.

To order the free *Application Note 326* (publication number 5954-1566), contact the HP literature distribution center at the address on the rear page of this issue of *Bench Briefs.*



Fiber Optics Handbook

An Introduction and Reference Guide to Fiber Optic Technology and Measurement Techniques

This handbook provides basic information about fiber optic systems and components, and methods for evaluating their performance. Fibers offer clear advantages over conventional transmission media. These include lower attenuation, larger bandwidth and freedom from electromagnetic interference. Despite these advantages, the underlying basics and the techniques involved in fiber optics are more complicated than, for example, coaxial cables. This book is intended to help answer many questions in a comprehensive and easy-to-read way.

To order the *Fiber Optics Handbook,* contact your nearest HP office and order HP P/N 5952-9554. There is a charge for this book.

Test and Verification Programs

Many Hewlett-Packard instruments and instrument-based systems use ready-made programs, stored in both tape and disc format, that will test, verify and exercise the instrument or system in a variety of ways; all of which are designed to provide the user with a high confidence level that the instrument/system is performing the way it should.

Most of the programs are HP-IB based and test the interface capability of the instrument through a particular controller. There are programs used for troubleshooting the instrument and programs that are almost complete application tools. Some programs are not stored on a disc or tape but are printed in the operating and service manual and need to be manually entered into the controller line-by-line.

In some cases the controller is listed as HP Series 200. This means that the software may run on one or more of the following technical workstations; Models 216, 217, 220, 226, 236, and 237 (ordered as 9816, 9817, 9920, 9826, 9836, 9837). This does not imply that the software will run on all of the workstations.

In some instances, the software is part of a maintenance kit and cannot be purchased separately.

Please note that we have made every attempt to make sure this list is complete and accurate. However, since this list was compiled by human hand there will no doubt be human errors. We have done our best. If you have any questions about this list, please contact your local HP office.

HP Model/Description	Tape/Disc P/N	Format	Controller	Documentation
10871A Service Kit	05180-13301		9825A	5180A Manual
11664E Detector	in manual		Ser. 200	11664E Manual
11740A MW Phase Noise Meas. Sys.	03047-10015	5 1/4" disc	9836A	3047A Manual
11740A MW Phase Noise Meas. Sys.	35601-10011	5 1/4" disc	9836A	35601A Manual
1630/31 Logic Analyzer	01630-68705	test kit	Ser. 200	1630/31 Manual
1630/31 Logic Analyzer	01630-90049	5 1/4" disc #1	Ser. 200	01630-68705 Prod. Supt. Pkg.
1630/31 Logic Analyzer	01630-90050	5 1/4" disc #2	Ser. 200	01630-68705 Prod. Supt. Pkg
1630/31 ET 19776	01630-90051	5 1/4" disc	Ser. 200	01630-68705 Prod. Supt. Pkg.
1630/31 66505 State Board	01630-90039	5 1/4" disc	Ser. 200	1630/31 Manual
1630/31 66509 State Board	01630-90040	5 1/4" disc	Ser. 200	1630/31 Manual
1630/31 66506 Timing Mstr. Board	01630-90041	5 1/4" disc	Ser. 200	1630/31 Manual
1630/31 66510-66524 Tmg.Mstr.Bds.	01630-90042	5 1/4" disc	Ser. 200	1630/31 Manual
1630/31 66508 Timing Slave Board	01630-90043	5 1/4" disc	Ser. 200	1630/31 Manual
1631 Logic Analyzer	01631-90007	5 1/4" disc	Ser. 200	01630-68705 Prod. Supt. Pkg.
1631 Log. Analy. Analog Board	manual test	----------	---------	New - Manual Update
18198A X.21 State Simul. Intf. Pod	18198-16001	service kit	--	Supplied w/kit
2250 Meas. Cont. Processor	25582-13301	tape	9835/9845	25582-90001 Manual
2250 Meas. Cont. Processor	25582-13401	5 1/4" disc	9825/9836	25582-90001 Manual
2250 Meas. Cont. Processor	25595-13301	tape #1	264x	25595-90001 Manual
2250 Meas. Cont. Processor	25595-13302	tape #2	264x	25595-90001 Manual
2250 Meas. Cont. Processor	25595-13303	tape #3	264x	25595-90001 Manual
2250 Meas. Cont. Processor	25595-13305	tape #1	85A/B	25595-90001 Manual
2250 Meas. Cont. Processor	25595-13306	tape #2	85A/B	25595-90001 Manual
2250 Meas. Cont. Processor	25595-13307	tape #3	85A/B	25595-90001 Manual
3042A Network Analyzer	03042-90211	tape	9825A	3042A Manual
3045A Spectrum Analyzer	03045-10001	tape	9825A	3045A Manual
3046A Sel. Lev. Meas. System	03046-10001	tape	85A/B	3046A Manual
3046B Sel. Lev. Meas. System	03046-10002	tape	85A/B	3046B Manual
3047A Spectrum Analyzer w/35601	35601-10001	tape	9845B	35601A Manual
3047A Spectrum Analyzer w/35601	35601-10011	tape	9836A	35601A Manual
3052A Voltmeter System	03052-90011	tape	9825A	3052A Manual
3052A Voltmeter System	03052-10002	tape	9835A	3052A Manual
3052A Voltmeter System	03052-10004	tape	9835B	3052A Manual
3052A Voltmeter System	03052-10006	tape	9845A	3052A Manual
3052A Voltmeter System	03052-10008	tape	9845B	3052A Manual
3052A Note 1: The 3052 system				
3052A tapes verify units				
3052A 3455, 3437, 3495, 59309,				
3052A 9871, and the HP-IB card.				
3054A Data Acq. System	03054-10002	tape	9835A	3054 Manual
3054A Data Acq. System	03054-10005	tape	9845B	3054 Manual
3054A Data Acq. System	03054-10008	tape	9825B/T	3054 Manual
3054A Data Acq. System	03054-10028	tape	9826 HPL	3054 Manual
3054A Data Acq. System	03054-10043	3 1/2" disc #2	Ser. 200	3054 Manual
3054A Data Acq. System	03054-10045	5 " disc #2	Ser. 200	3054 Manual
3054A Data Acq. System	03054-10049	disc	Ser. 200	Contact HP
3054A/DL Data Acq. System	03054-10011	tape	85A/B	3054 Manual
3054A/DL Note 2: The 3054A/DL				
3054A/DL tapes verify 3497,				
3054A/DL 3456, 3437, 3325, HP-IB				
3054A/DL interface & card ver.				

HP Model/Description	Tape/Disc P/N	Format	Controller	Documentation
3054C Data Acq. System				
3054C Option 851/871	all system tapes req'd:			
3054C Option 851/871	03054-10032	tape #1	HP 1000	3054 Manual
3054C Option 851/871	03054-10033	tape #2	HP 1000	3054 Manual
3054C Option 851/871	03054-10034	tape #3	HP 1000	3054 Manual
3054C Option 851/871	03054-10035	tape #4	HP 1000	3054 Manual
3054C Option 851/871	03054-10036	tape #5	HP 1000	3054 Manual
3054C Option 851/871	03054-10037	tape #6	HP 1000	3054 Manual
3054C Option 851/871	03054-10038	tape #7	HP 1000	3054 Manual
3054C Option 852/872	03054-10039	8" disc	HP 1000	3054 Manual
3054C Option 853/873	03054-10040	5 " disc #1	HP 1000	3054 Manual
3054C Option 853/873	03054-10041	5 " disc #2	HP 1000	3054 Manual
3054C Option 854/874	03054-10031	CS 80 tape	HP 1000	3054 Manual
3054C Option 855/875	03054-10046	3 1/2" disc #1	HP 1000	3054 Manual
3054C Option 855/875	03054-10047	3 1/2" disc #2	HP 1000	3054 Manual
3054C Note 3: The 30C system				
3054C tapes verify uts				
3054C 3497, 3456, ancard				
3054C verification.				
3056DL Data Logger	03056-10001	tape	85A/B	3056DL Manual
3056DL Note 4: The 3056DL system	03056-10002	tape (data)	85A/B	3056DL Manual
3056DL tape verifies the 3421 &				
3056DL the multiplexer options.				
3065CL/CX Board Test System	03065-10102	tape	loads utilities, offline	
3235A Switch/Test Unit	03235-69900	test kit	Ser.200/300	Supplied w/kit
3253A Analog Stimulus Resp. Unit	03253-10002	tape	9825A/B	3253A Manual
3253A Analog Stimulus Resp. Unit	44587-89400	3 1/2" disc	Ser. 200	3253A Manual
3253A Analog Stimulus Resp. Unit	44587-89410	5 1/4" X disc	Ser. 200	3253A Manual
3253A Analog Stimulus Resp. Unit	44587-89420	5 1/4" I disc	Ser. 200	3253A Manual
3335A Frequency Synthesizer	03335-10001	tape	9825A	3335A Manual
3421A Data Acquis. System	03421-67901	test kit	85A/B	3421A-1C S/N
3421A Data Acquis. System		(incl-10001 tape & cal pcb)		3421A-5 S/N
3421A Data Acquis. System	03421-10001	tape	85A/B	3421A-1C S/N
3437A System DVM	03437-10001	tape, verif.	9825A	3052A Manual/3437A-8 S/N
3455A System DVM	03455-10001	tape, verif.	9830A	3052A Manual
3455A System DVM	03455-10002	tape, verif.	9825A	3052A Manual
3456A Digital Voltmeter	03456-10001	tape, verif.	9825A/B	3456A Manual
3456A Digital Voltmeter	03456-10002	tape, verif.	9835A/45B	3456A Manual
3456A Digital Voltmeter	03456-10003	tape, verif.	85A/B	3456A Manual
3457A Multimeter	03457-10085	tape	85	Supplied w/tape
3457A Multimeter	03457-10200	disc	Ser. 200	Supplied w/disc
3457A Multimeter	03457-10085	tape	85B	3457 Manual
3457A Multimeter	03457-10200	5 1/4" disc	Ser. 200	3457 Manual
3457A Multimeter	03457-10203	3 1/2" disc	Ser. 300	3457 Manual
3468A/B Digital Voltmeter	03468-10001	tape, verif.	85A/B	3468A/B-4 S/N
3468A/B Digital Voltmeter	03468-10002	tape, cal	85A/B	Supplied w/tape
3478A Digital Multimeter	03478-10001	tape, verif.	85A/B	3478A-1 S/N
3478A Digital Multimeter	03478-10002	tape, cal	85A/B	Supplied w/tape
3478A Digital Voltmeter	03478-10085	tape, test/cal.	85B	03478-90020 & 3478A-6 S/N
3488A Switch Cont.Unit	03488-10001	tape, verif.	85A/B	Supplied w/tape
3495A Scanner	03495-10001	tape	9830A	3495A Manual/3495A-9 S/N
3495A Scanner	03495-10002	tape	9825A	3495A Manual/3495A-9 S/N
3497A Data Acquis./Cont.Unit	03497-10001	tape	9825A	3497A-12 S/N
3565 Dynamic Signal Anal. System	35651-19404	disc	Ser. 300	35600-90000 Manual
3582A Spectrum Analyzer	03582-10001	tape	9825A	3582 Manual
3585A Spectrum Analyzer	03585-10001	tape	9825A	3585 Manual
3585A Selective Level Meter	03046-10001	tape	85A/B	3046A Manual
3586B Selective Level Meter	03046-10002	tape	85A/B	3046B Manual
37201A HP-IB Extender	37201-18100	tape	9825A	37201A Manual
37203A HP-IB Extender	37203-12101	tape	9825A	37203A Manual
37203A HP-IB Extender	37203-12105	disc	Ser. 200	37203A Manual
37204A/B Extender	37203-12101	tape	9825A	37204A/B Manual
37204A/B Extender	37203-12105	disc	Ser. 200	37204A/B Manual
3745A/B Sel. Level Meas. Set	03745-18003	tape	9825A	3745A/B-52 S/N
3746A Sel. Level Meas. Set	in manual		85A	3746A Manual
3747A/B Sel. Level Meas. Set	03745-18003	tape	9825A	3747A/B-23 S/N
3755A Switch controller	in manual		9830A	3755A Manual
3771A/B Data Line Analyzer	in manual		9825A	3771A/B Manual
3776A/B PCM Terminal Test Set	03776-10001	tape	85B	3776A/B Manual
3777A Channel Selector	in manual		9815/25/30	3777A Manual
3779A/B Pri. Multiplex Analyzer	in manual		9825A	3779A/B Manual
3779C/D Pri. Multiplex Analyzer	in manual		9825A	3779C/D Manual
3785A/B Jitter Gen. & Rec.	03785 10004	tape	85A	3785A/B Manual
3852A Data Acq./Cntrl. Unit	44743F	disc	Ser.200/300	Supplied w/disc
4061A Test System	16290A	service kit	Ser. 300	4061A Manual
4062A/B Test System	04062-65101	5 1/4" disc(2)	9836S	4062A Manual
4062B Test System	04062-65301	3 1/2" disc	Ser. 300	4062B Manual
4085M Switching Matrix	04085-90501	tape	85F	04085-90100 Note
4085M Switching Matrix	16290A	service kit	Ser. 300	4085M Manual
4191A Impedance Analyzer	16342A kit	5 1/4" disc	Ser. 200	Supplied w/kit

04194-65005

HP Model/Description	Tape/Disc P/N	Format	Controller	Documentation
4192A LF Impedance Analyzer	04192-90501	tape	9825B	04192-90100
4192A LF Impedance Analyzer	04192-90503	tape	85F	04192-90200
4194A Impedance Analyzer	04194-5605	disc	Ser. 200	Supplied w/disc
4194A Impedance Analyzaer	16349A	test kit	9826/36	16349 Operating Note
4276A LCZ Meter	04276-90501	tape	85F	04276-90100
4277A LCZ Meter	04277-90501	tape	85F	04277-90100
4278A Capacitance Meter	not rels'd	disc	Ser. 200	not yet rels'd
4280A 1 MHz C Meter	04280-90501	tape	85F	not yet rels'd
436A Power Meter	00436-10047	5 1/4" disc	9836A	436A-9 S/N
436A Power Meter	00436-10006	tape	9830A	436A Manual
436A Power Meter	00436-10007	tape	9825A	436A-2 S/N
4951C Protocol Analyzer	5060-7183	service kit	--	4951C Manual
4953A Prot. Ana. w/18198A X.21 Pod	18198-16001	service kit	--	Supplied w/kit
5005B Signature Multimeter	59300-10002	tape	85A	5005B Manual
5006A Signature Analyzer	59300-10002	tape	85A	5006A Manual
5150A Thermal Printer	59300-10001	tape	9825A	5050A-4 S/N
5180/82 Waveform Recorder	05180-13401	disc	Ser. 200	5180/82 Manual
5180/82 Waveform Recorder	05180-13302	tape	9825T	5180/82 Manual
5312A ASCII Interface 5300B	59300-10001	tape	9825A	5312A-2 S/N
5312A HP-IB Interface Module	59300-10002	tape	85A	5312A-4A S/N
5316A Universal Cntr.	59300-10002	tape	85A	5316A-3A S/N
5328A Universal Cntr. Opt.011, 020,021,030,031,040,041	59300-10001	tape	9825A	5328A-17 S/N
5328A Universal Cntr. Opt.H99	59300-10001	tape	9825A	5328A/H99 Manual
5328A Universal Cntr. Opt.096/H42	59300-10001	tape	9825A	5328A/H42 Manual
5328A Universal Cntr. Opt.011, 020,021,030,031,040,041	59300-10002	tape	85A	5328A-33B S/N
5328A Universal Cntr. military	59300-10002	tape	85A	5328A-34B S/N
5334A Universal Cntr.	59300-10002	tape	85	5334A Manual
5335A Universal Cntr.	59300-10001	tape	9825A	5335A Manual
5335A Universal Cntr.	59300-10002	tape	85A	5335A-7B S/N
5340A Frequency Cntr. Opt.011	59300-10001	tape	9825A	5340A-11 S/N
5341A Frequency Cntr. Opt.011	59300-10001	tape	9825A	5341A Manual
5342A Microwave Cntr. Opt.011	59300-10001	tape	9825A	5342A Manual
5342A Microwave Cntr. Opt.002,011	59300-10002	tape	85A	5342A-32A S/N
5343A Microwave Cntr. Opt.011	59300-10001	tape	9825A	5343A Manual
5343A Microwave Cntr. Opt.004,011	59300-10002	tape	85A	5343A-11A S/N
5344S Microwave Source Synchro.	59300-10002	tape	85A	5344S Manual
5345A Electronic Cntr. Opt.011	59300-10001	tape	9825A	5345A-9A S/N
5345A Electronic Cntr. Opt.012	59300-10001	tape	9825A	5345A-12A S/N
5345A Electronic Cntr. Opt.011	59300-10002	tape	85A	5345A 19A S/N
5345A Electronic Cntr. Opt.012	59300-10002	tape	85A	5345A-20A S/N
5350A Microwave Cntr.	59300-10002	tape	85	5350A Manual
5351A Microwave Cntr.	59300-10002	tape	85	5351A Manual
5353A Channel C Plug-In	59300-10001	tape	9825A	5353A-1 S/N
5354A 4 GHz Frequency Cntr.	59300-10001	tape	9825A	5354A-6 S/N
5355A Automatic Frequency Cnvtr	59300-10001	tape	9825A	5355A Manual
5358A Measurement Stor. Plug-in	59300-10001	tape	9825A	5358A Manual
5359A Time Synthesizer	59300-10001	tape	9825A	5359A Manual
5363A Time Interval Probes	59300-10001	tape	9825A	5363A-2 S/N
5363B Time Interval Probes	59300-10001	tape	9825A	5363B Manual
5370A/B Univ. Time Intv. Cntr.	59300-10001	tape	9825A	5370A-1A S/N
5386A Frequency Cntr.	59300-10002	tape	85	5386A Manual
54200A/D Digitizing Oscilloscope	54200-12001	disc	Ser. 200	54200A/D Manual
54200A/D Digitizing Oscilloscope	54200-69501	support kit	Ser. 200	54200A/D Manual
5420A/B Digital Signal Analyzer	05420-69002	tape	9825A/B	Supplied w/tape
5423A Structural Dynamics Ana.	05420-69002	tape	9825A/B	Supplied w/tape
59301A ASCII/Parallel Cnvtr.	59300-10001	tape	9825A	59301-2 S/N
59303A Digital-to-Analog Cnvtr.	59300-10001	tape	9825A	59303A-1 S/N
59304A Numeric Display	59300-10001	tape	9825A	59304A-1 S/N
59306A Relay Actuator	59300-10001	tape	9825A	59306A-4 S/N
59307A VHF Switch	59300-10001	tape	9825A	59307A-3 S/N
59308A Timing Generator	59300-10001	tape	9825A	59308A-1 S/N
59309A Digital Clock	59300-10001	tape	9825A	59309A-3 S/N
59313A Analog-to-Digital Cnvtr.	59300-10001	tape	9825A	59313A Manual
59500A Multiprogmr. Interface	14551-13001	tape	9825A	Supplied w/tape
6030A Power Supply	5010-1703	disc	Ser. 200	Supplied w/disc
6030A Power Supply	5010-1704	tape	85	Supplied w/tape
6031A Power Supply	5010-1703	disc	Ser. 200	Supplied w/disc
6031A Power Supply	5010-1704	tape	85	Supplied w/tape
6032A Power Supply	5010-1703	disc	Ser. 200	Supplied w/disc
6032A Power Supply	5010-1704	tape	85	Supplied w/tape
6033A Power Supply	5010-1703	disc	Ser. 200	Supplied w/disc
6033A Power Supply	5010-1704	tape	85	Supplied w/tape
6034A Power Supply	06034-10001	tape	85	Supplied w/tape
6034A Power Supply	06034-10002	tape	9825	Supplied w/tape
6034A Power Supply	06034-10003	disc	9826A/36A	Supplied w/disc
6038A Power Supply	5010-1703	disc	Ser. 200	Supplied w/disc
6038A Power Supply	5010-1704	tape	85	Supplied w/tape
6940B Multiprogmr.	14551-13001	tape	9825A	Supplied w/tape
6940B Multiprogmr. Plug-In Cds	14551-13001	tape	9825A	Supplied w/tape

HP Model/Description	Tape/Disc P/N	Format	Controller	Documentation
6941B Multiprogmr. Extndr.	14551-13001	tape	9825A	Supplied w/tape
6942A Multiprogrammer	06942-90031	tapes #1,#2,#3	85A	Operating Note
6942A Multiprogrammer	14752-69003	5 1/4" disc	Ser. 200	14752-90001
6942A Multiprogrammer	14752-69004	3 1/2" disc	Ser. 200	14752-90001
6942A Multiprogmr. Plug-In Cds	06942-90031	tapes #1,#2,#3	85A	Operating Note
6942A Multiprogmr. Plug-In Cds	06942-60003	tape #3	85A	Operating Note
6944A Multiprogrammer	14752-69003	5 1/4" disc	Ser. 200	14752-90001
6944A Multiprogrammer	14752-69004	3 1/2" disc	Ser. 200	14752-90001
6944S Multiprogrammer	14752-69003	5 1/4" disc	Ser. 200	14752-90001
6944S Multiprogrammer	14752-69004	3 1/2" disc	Ser. 200	14752-90001
69790A/B 4K Memory Cards	06942-90031	test kit	85	Supplied w/kit
7090A Meas. Graphics System	07090-18030	tape	85A/B	Supplied w/tape
71000 Spectrum Analyzer System				
71000 70300A Tracking Gen.	5010-1536/37	3" & 5" discs	Ser.200/300	5958-6459 Manual
71000 71100A RF Spect. Analy.	5010-1536/37	3" & 5" discs	Ser.200/300	5958-6459 Manual
71000 71200A MW Spect. Analy.	5010-1536/37	3" & 5" discs	Ser.200/300	5958-6459
71000 71210A Preslt. MW Sp. An.	5010-1536/37	3" & 5" discs	Ser.200/300	5958-6459
71000 71300A Millimeter Sp. An.	5010-1536/37	3" & 5" discs	Ser.200/300	5958-6459
71000 70900A Local Osc. Mem. +	5010-1535/34	3" & 5" discs	Ser.200/300	5958-6459
71000 70900A Local Osc. nonMem+	5010-1508/07	3" & 5" discs	Ser.200/300	5958-6459
7220 Graphics Plotter (RS-232)	5010-2585/2410	tape	85A	auto st. w/menu
7221 Graphics Plotter (RS-232)	5010-2585/2410	tape	85A	auto st. w/menu
7225 Graphics Plotter w/17601	5010-2585/2410	tape	85A	auto st. w/menu
7225 Graphics Plotter w/17603	5010-2585/2410	tape	85A	auto st. w/menu
7225 Graphics Plotter w/17604	5010-2585/2410	tape	85A	auto st. w/menu
7240A Printer/Plotter (RS-232)	5010-2585/2410	tape	85A	auto st. w/menu
7245A/B Printer/Plotter (RS-232)	5010-2585/2410	tape	85A	auto st. w/menu
7470A Graphic Plotter				
7470A Option 001 (RS-232)	5010-2585/2410	tape	85A	auto st. w/menu
7470A Option 002 (HP-IB)	5010-2585/2410	tape	85A	auto st. w/menu
7470A Option 003 (HP-IL)	5010-2585/2410	tape	85A	auto st. w/menu
7475A Graphic Plotter				
7475A Option 001 (RS-232)	5010-2585/2410	tape	85A	auto st. w/menu
7475A Option 002 (HP-IB)	5010-2585/2410	tape	85A	auto st. w/menu
7550A Graphic Plotter (both)	5010-2585/2410	tape	85A	auto st. w/menu
7580A/B Drafting Plotter (both)	5010-2585/2410	tape	85A	auto st. w/menu
7585A/B Drafting Plotter (both)	5010-2585/2410	tape	85A	auto st. w/menu
7586B Drafting Plotter (both)	5010-2585/2410	tape	85A	auto st. w/menu
8160A Programmable Pulse Gen.	08160-39910	test kit (tape)	9825A	Supplied w/kit
8160A Programmable Pulse Gen.	08160-39911	tape	9825A	8160A Manual
8340A/B Synthesized Sweeper	08340-60270	disc	Ser. 200	08340-90291 Manual
8341A/B Synthesized Sweeper	08340-60270	disc	Ser. 200	08340-90291 Manual
8409B Network Analyzer	11863-10004	tape	9835/45	8409B Manual
8409C Network Analyzer	11863-10006	tape	9845B	8409C Manual
8409D Network Analyzer	11863-10005	5 1/4" disc	9826B	8409C Manual
85013 BASIC Appl. Pak for 8510				
85013 Option 630	85013-10001	3 1/2" disc		85013A Manual
85013 Option 655	85013-10002	5 1/4" disc		85013A Manual
8501A Storage Normalizer	Contact HP	tape		8501A Manual
85050A 7mm Calibration Kit	08510-10007	tape	8510	85050A Manual
85051A 7mm Verification Kit	Contact HP	tape	8510	85051A Manual
85052A 3.5mm Calibration Kit	08510-10007	tape	8510	85052A Manual
85053A 3.5mm Verification Kit	Contact HP	tape	8510	85053A Manual
85054A Type-N Calibration Kit	08510-10007	tape	8510	85054A Manual
8507A Network Analyzer	85030-10002	tape	9830A	8507A Manual
8507B Network Analyzer	85030-10007	tape	9825A	8507B Manual
8507C Network Analyzer	85030-10013	tape	9845B	8507C Manual
8507D Network Analyzer	85011A Op 630	3 1/2" disc	Ser. 200	8507D Manual
8507D Network Analyzer	85011A Op 655	5 1/4" disc	Ser. 200	8507D Manual
8510A Network Analyzer System	08510-10001	adjustments	8510	8510A Manual
8510A Network Analyzer System	85101-10003	troubleshooting	8510	8510A Manual
8510A Network Analyzer System	08510-10008	time dom. tst.	8510	Supplied w/tape
8510A Circuit Model Progs.				
8510A BOOT (Pascal 2.0)	85101-10004	5" & 3" discs	Ser. 200	8510A Manual
8510A BOOT (Pascal 3.0)	85101-10006	5" & 3" discs	Ser. 200	8510A Manual
8510A PROG (Pascal 2.0)	85101-10005	5" & 3" discs	Ser. 200	8510A Manual
8510A PROG (Pascal 3.0)	85101-10007	5" & 3" discs	Ser. 200	8510A Manual
8510A Sys. Performance Tests				
8510A 8510/8512 Combo.	08510-80002	5" & 3" discs	Ser. 200	8510A Manual
8510A 8510/8513 Combo.	08510-80003	5" & 3" discs	Ser. 200	8510A Manual
8510A 8510/8514 Combo.	08510-80004	5" & 3" discs	Ser. 200	8510A Manual
8510A 8510/8515 Combo.	08510-80005	5" & 3" discs	Ser. 200	8510A Manual
8510A 8510/8511 Combo.	08510-80006	5" & 3" discs	Ser. 200	8510A Manual
8510A 8510/8350 Combo.	08510-90043	Update packet	Ser. 200	Supplied w/packet
8510A 8510/8511 Combo.	08511-60002	test kit	Ser.200/300	Supplied w/kit
8512A 8512A/8513A Test Set	08510-10002	performance tests method 2 NBS traceability		
8513 Test Set	08510-10003	performance tests		
8514A 8514A/8515A Test Set	08510-10004	performance tests method 2 NBS traceability		
8515A Test Set	08510-10005	performance tests		

HP Model/Description		Tape/Disc P/N	Format	Controller	Documentation
8566A	Spectrum Analyzer	08566-60002	tape	9825B	08566-90005 Manual
8566A/B	Spectrum Analyzer	08566-60008	disc	Ser. 200	08566-90076 Manual
8568A	Spectrum Analyzer	08568-60002	tape	9825B	08568-90028 Manual
8568B	Spectrum Analyzer	08568-60008	disc	Ser. 200	08568-90042 Manual
8620C	Sweeper Mainframe	Contact HP	for tape	9825A/B	Supplied w/tape
86210	Sweeper Plug-in	Contact HP	for tape	9825A/B	Supplied w/tape
86220	Sweeper Plug-in	Contact HP	for tape	9825A/B	Supplied w/tape
86222	Sweeper Plug-in	Contact HP	for tape	9825A/B	Supplied w/tape
86230	Sweeper Plug-in	Contact HP	for tape	9825A/B	Supplied w/tape
86235	Sweeper Plug-in	Contact HP	for tape	9825A/B	Supplied w/tape
86241	Sweeper Plug-in	Contact HP	for tape	9825A/B	Supplied w/tape
86242	Sweeper Plug-in	Contact HP	for tape	9825A/B	Supplied w/tape
86245	Sweeper Plug-in	Contact HP	for tape	9825A/B	Supplied w/tape
86250	Sweeper Plug-in	Contact HP	for tape	9825A/B	Supplied w/tape
86260	Sweeper Plug-in	Contact HP	for tape	9825A/B	Supplied w/tape
86290	Sweeper Plug-in	Contact HP	for tape	9825A/B	Supplied w/tape
86320	Sweeper Plug-in	Contact HP	for tape	9825A/B	Supplied w/tape
86330	Sweeper Plug-in	Contact HP	for tape	9825A/B	Supplied w/tape
86331	Sweeper Plug-in	Contact HP	for tape	9825A/B	Supplied w/tape
86341	Sweeper Plug-in	Contact HP	for tape	9825A/B	Supplied w/tape
86342	Sweeper Plug-in	Contact HP	for tape	9825A/B	Supplied w/tape
86350	Sweeper Plug-in	Contact HP	for tape	9825A/B	Supplied w/tape
86351	Sweeper Plug-in	Contact HP	for tape	9825A/B	Supplied w/tape
86352	Sweeper Plug-in	Contact HP	for tape	9825A/B	Supplied w/tape
8640B	Signal Generator	11795A Op 204	Perf. Verif	Ser. 200	Supplied w/disc
8642A/B	Synthesized Sig. Gen	11795A Op 205	Perf. Verif	Ser. 200	supplied w/disc
8656A	Signal Generator	11795A Op 208	Perf. Verif	Ser. 200	Supplied w/disc
8656B	Signal Generator	11795A Op 209	Perf. Verif	Ser. 200	Supplied w/disc
8660A/C	Synthesized Sig. Gen.	08660-10001	tape	9825A	8660A-29 S/N
8662A	Signal Generator	11795A Op 214	Perf. Verif	Ser. 200	Supplied w/disc
8662A	Synthesized Sig. Gen.	08662-60310	tape	9825A	08662-60057 Note
8663A	Signal Generator	11795A Op 216	Perf. Verif	Ser. 200	Supplied w/disc
8672A	Signal Generator	11795A Op 317	Perf. Verif	Ser. 200	Supplied w/disc
8672A	Synthesized Sig. Gen.	11712-10001	tape	9830A	11712-90001 Man.
8672A	Synthesized Sig. Gen.	11712-10002	tape	9825A	11712-90001 Man.
8673A/B	Synthesized Sig. Gen.	11726-10002	tape	85	Supplied w/tape
8673C/D	Synthesized Sig. Gen.	11726-10004	tape	85	Supplied w/tape
8753A	Network Analyzer	85029A	verif. kit	Ser. 200	Supplied w/kit
8756A	Scalar Network Analyzer	08756-10003	5 1/4" disc	Ser. 200	Supplied w/disc
8756A	Scalar Network Analyzer	08756-10004	3 1/2" disc	Ser. 200	Supplied w/disc
8757A	Scalar Network Analyzer	11613-10001	adjustment & calibration - requires 11613A calibrator		
8757A	Scalar Network Analyzer	11613A calib.	disc	Ser.200/300	11613A Manual
8970A	Noise Figure Meter	08970-10001	tape	85F	08970-90017
8970A	Noise Figure Meter	08970-10002	disc	Ser. 200	08970-90020 Manual
9872	Graphics Plotter (HP-IB)	5010-2585/2410	tape	85A	auto st. w/menu

Complete Repair Kits for HELI-COIL Repair of Stripped Threads

The last issue of Bench Briefs contained a story on using HELI-COILS to repair stripped threads in HP cabinet frames. Unfortunately, the HP part numbers listed were not for the HELI-COIL kits, but for the individual inserts. The HELI-COIL kit part numbers were correct. The following is the correct HP part numbers.

Size	HP P/N	HELI-COIL P/N
6-32	1535-4941	5401-6
M3.5	1535-4940	5403-3.5

We are sorry for any inconvenience this may have caused. □

supplement to
BENCH BRIEFS
SERVICE NOTE INDEX

Need Any Service Notes?

They're free!

Here's the latest listing of service notes. They recommend modifications to Hewlett-Packard instruments to increase reliability, improve performance, or extend their usefulness.

Use the form at the rear of *Bench Briefs* to order, free of charge, service notes for several instruments.

If you would like to purchase large quantities of service notes covering a wide range of instruments, or if you desire a complete history of all service notes documenting all changes to your instruments, Hewlett-Packard offers a microfiche library for a one time charge. There is also a microfiche subscription service available that automatically updates the library on a quarterly schedule.

The part numbers for the service note microfiche library and subscription service are:

Library—	5951-6511
Subscription service—	5951-6517

Contact your local HP Sales Office for ordering information. □

HP 355E/F PROGRAMMABLE ATTENUATOR

355E-1. Serials 1205A01710 and below. New foam tape for attenuator cover eliminates the possibility of the plunger hitting and/or sticking to the cover.
355F-1. Serials 1203A02410 and below. New foam tape for attenuator cover eliminates the possibility of the plunger hitting and/or sticking to the cover.

HP 432C POWER METER

432C-3B. Serials 1906A and below. Preferred digital panel meter replacement.

HP 1349A/D DIGITAL DISPLAY

1349A/D-3. Serials 2611A and below on Model 1349A; Serials 2613A and below on Model 1349D. New and improved MP1 mainframe replacement.

HP 3065 BOARD TEST SYSTEM

3065-42. Serials 2541A00129 and below for the HP 3065HL; 2543A00149 and below for the HP3065HX. Upgrading scanner power supplies to improve performance.
3065-43. HP11345A Diagnostic test fixture obsolescence.

HP 3455 DIGITAL VOLTMETER

3455A-20D. All Serials. Service kit (HP P/N 03455-69801) for 3455A digital voltmeter.

HP 3456A DIGITAL VOLTMETER

3456A-4B. All Serials. Spare parts kit for service (HP P/N 03456-69802).
3456A-17B. All Serials. Customer service kit for component level repair.

HP 3457A DIGITAL MULTIMETER

3457A-2A. Serials 2538A01301 and below. Modification to the digital board to improve performance.

HP 3708A NOISE AND INTERFERENCE TEST SET

3708A-9. Serials 2515U00330 and below. Preferred replacement for A201 U5, U6, U7, and U8.
3708A-10. All Serials. Correction to the noise source soft constants adjustment procedure.
3708A-11. All Serials. Indicates soft constant corruption.

HP 3709A CONSTELLATION DISPLAY

3709A-1. Serials 2544U00140 and below. Preferred replacement for A3U7, U12 and U13.
3709A-2. Serials 2544U00159 and below, excluding 2544U00141 to 146. Mechanical attachment check on transformer T1.

HP 3711A IF/BB TRANSMITTER

3711A-6. Serials 2620U00779 and below. Preferred replacement for A9 mixer and A9 assembly.

HP 3712A IF/BB RECEIVER

3712A-14A. All Serials. AM to PM conversion adjustment.

HP 3746A SELECTIVE LEVEL MEASURING SET

3746A-21. All option 013 instruments. Preferred replacement for A41 Assembly.

HP 3793B DIFFERENTIAL PHASE DETECTOR

3793B-7. All Serials. Preferred replacement for high tone crystals.

HP 4271B 1MHz DIGITAL LCR METER

4271B-6. All Serials. Mounting procedure for replacement diode.

HP 4936A TRANSMISSION IMPAIRMENT MEASURING SET

4936A-4. Preferred replacement for HP P/N 1826-0735.

HP 4951A/B PROTOCOL ANALYZER

4951A-13A. Serials 2508A and below. Modification to prevent BERT ERRORS.
4951B-1. Serials 2612A and 2612F and below. Modification to prevent external video jitter.
4951B-2. Serials 2612A01876 and 2612F51001 and below. Modification to improve servo motor speed control.
4951B-3. Serials 2612A02076 and 2612F51001 and below. Improved read/write multiplexer.

HP 5335A UNIVERSAL FREQUENCY COUNTER

5335A-19. Serials 2610A08981 through 2610A0980. Simple modification to avoid permanent damage to 0533560031 power supply assembly.
5335A-20. All Serials. Rear Panel—external arm switch test.

HP 5342A MICROWAVE FREQUENCY COUNTER

5342A-47. Series Prefix 2542. Modification to prevent A3 board miscount.

HP 5343A MICROWAVE FREQUENCY COUNTER

5343A-25. Series Prefix 2542. Modification to prevent A3 board miscount.

HP 5350A MICROWAVE FREQUENCY COUNTER

5350A-2. Serials 2510A00548 and below. Modification to eliminate LO VCO problems.

HP 5351A MICROWAVE FREQUENCY COUNTER

5351A-2. Serials 2510A00228 and below. Modification to eliminate LO VCO problems.

HP 5352A MICROWAVE FREQUENCY COUNTER

5352A-1. Serials 2508A00140 and below. Modification to eliminate LO VCO problems.

HP 5355A AUTOMATIC FREQUENCY CONVERTER

5355A-2. Serials 2620A and above. Modification to make 5355A compatible with 5356A/B/C.

HP 5356A/B/C FREQUENCY CONVERTER HEAD

5356A-2. Serials 2118A01555 or lower. Interconnect cable modification for compatibility with HP 5355A automatic frequency converter.
5356B-2. Serials 2118A00420 or lower. Interconnect cable modification for compatibility with HP 5355A automatic frequency converter.
5356C-1. Serials 2118A00470 or lower. Interconnect cable modification for compatibility with HP 5355A automatic frequency converter.

HP 5383A520 MHz FREQUENCY COUNTER

5383A-4. Serials 2552A07086 through 2552A07120. Incorrect insertion of capacitor A1C14 can cause self check problems.

HP 5501A LASER HEAD

5501A-10 All Serials. Modification to the A5 lock reference board to prevent "Retune Error."

HP 5507A LASER POSITION TRANSDUCER ELECTRONICS

5507A/10932A/10946A-1. All serial prefixes 2604 except serials 5507A serial numbers 2604A00115, 117,118–122; 10932A serial numbers 2604A00101–109; 10946A serial numbers 2604A00101–105. Modification to eliminate math problem in EPROM.

HP 6012B SYSTEM POWER SUPPLY

6012B-1. All Serials. Modification to enhance A2 control board interchangeability.

HP 8483A POWER SENSOR

8483A-3. All Serials. New label for HP 1250-0597 adapter.

HP 8510A NETWORK ANALYZER

8510A-7. English to metric chassis parts. Serial prefix breaks are referenced in the text of the note.

HP 8554B SPECTRUM ANALYZER

8554B-12. All serials. Preferred replacement of A4 phase lock assembly.

HP 8566A SPECTRUM ANALYZER

8566A-20A. All serials. HP model 8566A+01K retrofit kit.

HP 8568A SPECTRUM ANALYZER

8568A-44A. All serials. HP model 8568A+01K retrofit kit.

HP 8660C SYNTHESIZED SIGNAL GENERATOR

8660C-12. Serials 2602A and below. Modification necessary to replace A1A12 readout board.

HP 11592A SERVICE KIT

11592A-2. Service kit modification.

HP 11729C CARRIER NOISE TEST SET

11729C-2. All serials. AM detector (option 130) retrofit.

HP 33311B MICROWAVE SWITCH

33311B-3. Serials 2235A and below. New rocker arm and spring for the switch.

HP 33311C MICROWAVE SWITCH

33311C-2. Serials 2235A and below. New rocker arm and spring for the switch.

HP 33312B MICROWAVE SWITCH

33312B-1. Serial prefix 2603A and below. New rocker arm and spring for the switch.

HP 54201A/D DIGITIZING OSCILLOSCOPES

54201A/D-2. 54201A serials 2625A; 54201D serials 2625A.

HP 64243AA 68000 EMULATOR

64243AA-2. All repair numbers. Single-stepping with user interrupts pending causes failure.

HP 64243AB 68000 EMULATOR

64243AB-2. All repair numbers. Single-stepping with user interrupts pending causes failure.

HP 64244AA 68008 EMULATOR

64244AA-2. All repair numbers. Single-stepping with user interrupts pending causes failure.

HP 64245AB 68010 EMULATOR

64245AB-2. All repair numbers. Single-stepping with user interrupts pending causes failure.

HP 70206A SYSTEM GRAPHICS DISPLAY

70206A-2-S. Serials 2529A00415 and below. A possible shock hazard may exist if a resistor in the primary circuits shorts to the internal ground plane AND safety earth ground has been defeated.

HP 85685A RF PRESELECTOR

85685A-2. All serials. Proper line voltage selection and fuse removal.

Service Note Order Form

If you want service notes, please check the appropriate boxes below and return this form separately to one of the following addresses.

Hewlett-Packard
1820 Embarcadero Road
Palo Alto, California 94303

For European customers (ONLY)

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AMSTELVEEN—1134
Netherlands

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Firm _____

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State _____ **Zip** _____

- ☐ 355E-1
- ☐ 355F-1
- ☐ 432C-3B
- ☐ 1349A/D-3
- ☐ 3065-42
- ☐ 3065-43
- ☐ 3455A-20D
- ☐ 3456A-4B
- ☐ 3456A-17B
- ☐ 3457A-2A
- ☐ 3708A-9
- ☐ 3708A-10
- ☐ 3708A-11
- ☐ 3709A-1
- ☐ 3709A-2
- ☐ 3711A-6
- ☐ 3712A-14A
- ☐ 3746A-21
- ☐ 3793B-7
- ☐ 4271B-6
- ☐ 4936A-4
- ☐ 4951A-13A
- ☐ 4951B-1
- ☐ 4951B-2
- ☐ 4951B-3
- ☐ 5335A-19
- ☐ 5335A-20
- ☐ 5342A-47
- ☐ 5343A-25
- ☐ 5350A-2
- ☐ 5351A-2
- ☐ 5352A-1
- ☐ 5355A-2
- ☐ 5356A-2
- ☐ 5356B-2
- ☐ 5356C-1
- ☐ 5383A-4
- ☐ 5501A-10
- ☐ 5507A/10932A/10946A-1
- ☐ 6012B-1
- ☐ 8483A-3
- ☐ 8510A-7
- ☐ 8554B-12
- ☐ 8566A-20A
- ☐ 8568A-44A
- ☐ 8660C-12
- ☐ 11592A-2
- ☐ 11729C-2
- ☐ 33311B-3
- ☐ 33311C-2
- ☐ 33312B-1
- ☐ 33313B-1
- ☐ 54201A/D-2
- ☐ 64243AA-2
- ☐ 64243AB-2
- ☐ 64244AA-2
- ☐ 64245AA-2
- ☐ 64245AB-2
- ☐ 70206A-2-S
- ☐ 85685A-2

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HEWLETT-PACKARD COMPANY
1820 Embarcadero Road
Palo Alto, California 94303

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