

# BENCH BRIEFS

SERVICE INFORMATION FROM HEWLETT-PACKARD

SEPTEMBER-DECEMBER, 1975

SPECIAL  
COMBINED  
ISSUE

## TRAINING SEMINARS OFFERED

Hewlett-Packard is offering a series of seminars for service technicians. Some of these are very general (such as Digital Troubleshooting), while others apply to a specific product. Since this is of such significance to service personnel, the September-October and November-December issue of BENCH BRIEFS has been combined into a special double issue on service training.

A number of locations have been chosen for seminars in January and February, 1976. See the following pages for details of course offerings and locations.

Most seminars include laboratory time to allow hands-on experience with the hardware. To ensure individual attention for the attendees, all seminars are limited in size. We suggest registering early to avoid disappointment. Registration will be handled on a first-come first-served basis.

Many of these seminars are available at your facility at reduced rates for large groups. Please inquire for details.

NOTE: While these seminars are being held only in the U.S. and Canada, readers in other countries will be interested to know that service training seminars are being planned for several additional locations throughout the world. We encourage your comments. Please contact your local HP sales engineer or write directly to the BENCH BRIEFS Editor at the address on the last page.

## DIGITAL TROUBLESHOOTING VIDEOTAPES AVAILABLE

A series of fourteen videotapes is available to help train service personnel on the increasingly encompassing area of digital electronics. Each of the videotapes is less than 30 minutes in length. The tapes were prepared by Dick Gasperini, BENCH BRIEFS Editor, who has repeatedly presented and revised the material in live seminars throughout the world. The information in the videotape series and in the textbook is very similar to the first two days of the Digital Troubleshooting seminar described on the next page.

The individual tapes are:

1. Digital vs Analog (17 min)
2. RTL and DTL (16 min)
3. TTL (21 min)
4. ECL and MOS (25 min)
5. Troubleshooting Techniques (26 min)
6. Logic Symbols (27 min)
7. Number Systems and Decoders (26 min)
8. Flip-flops (29 min)
9. Counters and Shift registers (30 min)
10. Display Technologies (27 min)
11. IC Manufacturing (27 min)
12. Methods of Removing ICs from boards (18 min)
13. Other Symbologies (20 min)
14. Memories (30 min)



The textbook for the series, which is available separately, is DIGITAL TROUBLESHOOTING by Richard E. Gasperini. The text size is 8½x11 inches and it has 180 pages.

The videotape series is available in ½ inch open reel and ¾ inch videocassettes. The part number is 90500C for open reel and 90500D for videocassettes. One copy of the textbook is sent with the set of tapes. Additional copies are available by ordering HP part number 90500E.

As a convenience to BENCH BRIEFS readers, we also might mention that the textbook can also be purchased from the publisher: Movonics Company, 1922 Annette Ln., Los Altos, California 94022. The publisher's price is \$9.95 plus 45¢ shipping and handling. California residents should include sales tax.

## DIGITAL TROUBLESHOOTING

(4-Day Seminar)

### OBJECTIVES:

To present an introduction to digital technology for electronic technicians.

To gain a familiarity with tools and techniques available to troubleshoot digital circuits.

To develop an understanding of current instrument design method (algorithmic or state design) that is very widely used and is sufficiently different from past methods to be a challenge for service personnel.

To present an introduction to microprocessors to prepare for future products.

To develop an appreciation for an international standard for interconnecting instruments to form systems (HP Interface Bus).

PRESTUDY: Application Note 163-1

### COURSE OUTLINE:

#### First Day:

1. Digital vs. Analog
2. Review of transistors and transistor circuits — bipolar, MOS
3. Gate Circuits — AND, NAND, OR, NOR, XOR
4. IC Technologies — RTL, DTL, TTL, Schottky TTL, HTL, ECL, EECL, PMOS, CMOS, IIL
5. Tools and techniques for troubleshooting gates
6. Logical troubleshooting techniques
7. Laboratory — Three hours of hands-on experience experimenting with gates and troubleshooting tools

#### Second Day:

8. Octal and binary number systems



9. Flip flops (D, R-S, J-K) and one shots
10. Counters, dividers, shift registers
11. Decoders and encoders
12. Display technologies
13. Data Transfer techniques
14. Logic Symbols — MIL STD 806, other symbologies, and the new world standard ANSI 432.14 - 1973
15. Demonstration — Methods of removing ICs from boards
16. Laboratory — Three hours of experiments with flip-flops, counters, shifters, and decoders. Students will also be able to try any of the IC removal techniques demonstrated.

#### Third Day:

17. Memories — RAMs, ROMs
18. Understand and troubleshooting Algorithmic State Machines. This technique (ASM) is a new and powerful design method that is being widely used today.
19. Demonstration — Troubleshooting techniques and tools to diagnose failures in ASM instruments
20. Laboratory — Data storage and retrieval on RAMs and ROMs

#### Fourth Day:

21. A brief look at microprocessors
22. Hewlett-Packard Interface Bus

TUITION: \$300 per student

## LOCATION:

Hewlett-Packard Sales Office  
6305 Arizona Place  
Los Angeles, California 90045

DATES: January 6-9, 1976

Hewlett-Packard Sales Office  
W120 Century Road  
Paramus, New Jersey 07652

DATES: January 27-30, 1976

*The instructor for this seminar is:*

*DICK GASPERINI—Dick has been with HP for six years and is currently Service Training Manager for the Instrument section of the company. This job entails coordination of service training for HP personnel and customers.*

*Dick, who received his BSEE in 1969 from Michigan Tech, has presented this material over 20 times in eight countries.*

**1722A OSCILLOSCOPE**

(2-Day Seminar)

## OBJECTIVE:

To give service technicians a detailed circuit description so they may make component level repairs. The microprocessor and related digital oscilloscope circuitry will be discussed at a component level along with the traditional oscilloscope circuitry. The traditional oscilloscope circuitry will also apply directly to the 1710B, 1712A, and 1722A oscilloscopes.

The course describes the microprocessor and the digital circuitry from the viewpoint of how the circuit functions and related troubleshooting. General microprocessor theory is not discussed in detail.

## COURSE OUTLINE:

1. Introduction
  - Features and specifications
  - Front panel controls
  - How to use the microprocessor functions
2. Traditional oscilloscope circuit theory
  - Block diagram
  - Individual circuits
  - Troubleshooting considerations
3. Microprocessor and digital circuit theory
  - Block diagram
  - Individual circuits
  - Troubleshooting considerations
4. Calibration
  - Discussion
  - Demonstration
5. Laboratory
  - Troubleshoot digital and micro-processor problems

TUITION: \$200 per student

## LOCATION:

Hewlett-Packard Sales Office  
450 Interstate North  
Atlanta, Georgia 30339

DATES: January 29 and 30, 1976

Hewlett-Packard Sales Office  
6877 Goreway Drive  
Mississauga, Ontario, Canada

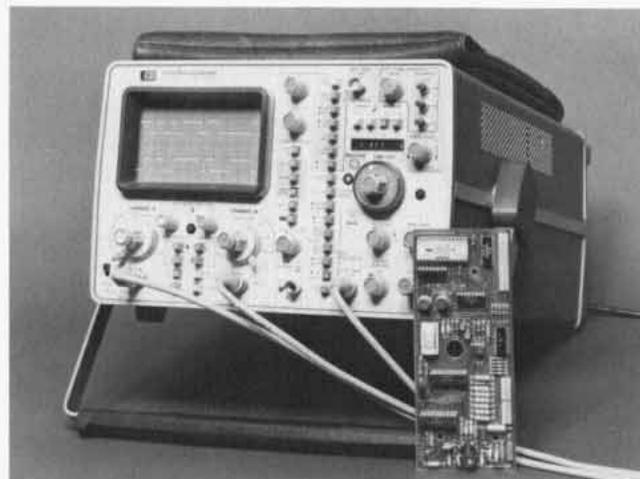
DATES: February 12 and 13, 1976

Hewlett-Packard Sales Office  
W120 Century Road  
Paramus, New Jersey 07652

DATES: February 16 and 17, 1976

*The instructor for this seminar is:*

*GARY ROBERSON—Gary has been with HP for 10 years. He worked in Customer Service for 3 years and 2 years in Plant Computer Maintenance. Gary is a graduate of Central Technician Institute with a 2 year associates degree.*



**3450 A/B MULTI-FUNCTION METER**

(2-Day Seminar)

**OBJECTIVE:**

To teach efficient calibration and troubleshooting techniques needed to repair a 3450 A/B Multi-Function Meter, such that a technician can diagnose failures to the component level.

**COURSE OUTLINE:**

1. Introduction
2. Theory of Operation
  - Dual Slope Integration
  - Definition of Options
  - Guarding
3. Troubleshooting
  - Power Supplies
  - Half-split method for determining a defective Digital or Analog section
  - Digital section
  - Analog section
    - Input Amplifier
    - Polarity Amplifier
    - % Amplifier
    - Integrator
    - Relay Channel
  - Common failure and their probable causes
4. Calibration
5. Discussion of Options
  - 001 AC
  - 002 ohms
  - 003 Limit Test
  - 004 Digital Output
  - 005 Remote Control
6. Laboratory

TUITION: \$200 per student

**LOCATION:**

Hewlett-Packard Sales Office  
450 Interstate North  
Atlanta, Georgia 30339

DATES: February 2 and 3, 1976

Hewlett-Packard Sales Office  
W120 Century Road  
Paramus, New Jersey 07652

DATES: February 5 and 6, 1976

Hewlett-Packard Sales Office  
5500 Howard Street  
Skokie, Illinois 60076

DATES: February 9 and 10, 1976

Hewlett-Packard Sales Office  
6877 Goreway Drive  
Mississauga, Ontario, Canada

DATES: February 12 and 13, 1976

*The instructors for this seminar are:*

*LES LOTZ*—For the past five years, Les has been a Customer Engineer in DVM Systems Group at the HP factory in Loveland, Colorado. Prior to that, he spent six years in the field as a Service Manager at the HP Service Center in North Hollywood, California. Les has a degree in Computer Science.

*BILL WILLOUGHBY*—Bill is presently a Technician on the 3450 production line in the factory in Loveland, Colorado. He has been working there for 3 years. Prior to joining HP he was an instructor in the air force for 12 years.

**5300 A/B COUNTER**

(2-Day Seminar)

**OBJECTIVE:**

To teach at a technical level the circuit theory and general troubleshooting methods to allow component level repair on the 5300A, 5300B, 5302A, and 5303B.

**PREREQUISITES:**

A basic technician level knowledge of analog and digital electronics.

**PRESTUDY:**

"The Fundamentals of Electronic Frequency Counters", Application Note 172, pages 1-17 and 23-30.

## COURSE OUTLINE:

1. Introduction to 5300 Family
2. 5300A
  - Front and Rear Panel Operation
  - Block Theory
  - Circuit Theory
    - Power Supply
    - Time Base
    - Counter Section
    - Data Control
    - Display Section
  - Troubleshooting Methods
    - Test Cards (10548A)
    - Logic Troubleshooters
  - Troubleshooting Laboratory
3. 5300B
  - Front and Rear Panel Operation
  - Block Theory
  - Circuit Theory
    - Power Supply
    - Time Base
    - Counter Section
    - Data Control
    - Display Section
  - Troubleshooting Methods
    - Test Cards (10548A)
    - Logic Troubleshooters
  - Troubleshooting Laboratory
4. 5302A
  - Front and Rear Panel Operation
  - Block Theory
  - Circuit Theory
    - Totalize Mode
    - Frequency B Mode
    - Auto Gate Selection
    - Frequency A Mode
    - Period B Mode
    - Period Average B Mode
    - Ratio Mode
    - Time Interval Mode
    - Self Check
  - Troubleshooting Methods — Flow Charts
  - Troubleshooting Laboratory

5. 5303B
  - Front and Rear Panel Operation
  - Block Theory
  - Circuit Theory
    - 80 MHz Input
    - 525 MHz Input
  - Counter Section
  - Time Base
  - Data Transfer
  - Troubleshooting Methods
  - Troubleshooting Laboratory

TUITION: \$200 per student

## LOCATION:

Hewlett-Packard Sales Office  
W120 Century Road  
Paramus, New Jersey 07652

DATES: February 2 and 3, 1976

Hewlett-Packard Sales Office  
450 Interstate North  
Atlanta, Georgia 30339

DATES: February 5 and 6, 1976

Hewlett-Packard Sales Office  
6877 Goreway Drive  
Mississauga, Ontario, Canada

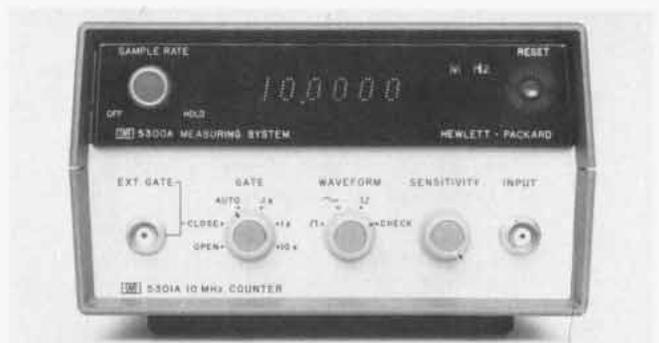
DATES: February 9 and 10, 1976

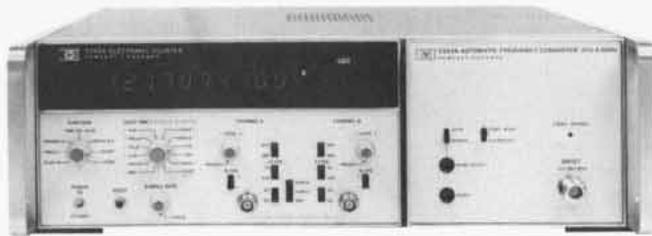
Hewlett-Packard Sales Office  
5500 Howard Street  
Skokie, Illinois 60076

DATES: February 12 and 13, 1976

*The instructor for this seminar is:*

*REX CHAPPELL—Rex joined the Santa Clara, California manufacturing division of HP in August 1973 in International Sales Engineering where he was the factory liaison for International Sales. He then moved into Service Engineering where he now handles the 5300 thru 5312 Economy Counters along with the 5380 series Economy Counters and the HP-IB series.*





### 5345A ELECTRONIC COUNTER

(4-Day Seminar)

#### OBJECTIVE:

To provide technicians with specific methods and procedures for calibration, troubleshooting, and component level repair of the 5345A Electronic Counter.

**PRESTUDY:** Application Note 172 and 5345A Users Handbook

#### COURSE OUTLINE:

1. Introduction to the 5345A
2. Instrument Familiarization
3. Overall Block Diagram Theory (Measurement Phase)
  - Block Diagrams on Assembly A3, A4, A8, A9, A10, A11
  - Board Theory - A9, A10, and A11
4. Laboratory - Overall Troubleshooting

5. Overall Block Diagram Theory (Processor Phase)
  - Block Diagram on Assemblies A13, A14, and A15
  - Board Theory on A13, A14, and A15
6. Processor Troubleshooting Aids (ASM Tester and Scaler Test Board)
7. Laboratory Session - Processor Troubleshooting with the HP1601A and 5345 ASM Tester
8. Processor Flow Chart Theory
9. Laboratory — Troubleshooting the Processor
10. Option 11 General Purpose Interface

**TUITION:** \$300 per student

#### LOCATION:

Hewlett-Packard Sales Office  
6305 Arizona Place  
Los Angeles, California 90045

**DATE:** January 12-15, 1976

*The instructor for this seminar is:*

*DICK HOLMES—A Hewlett-Packard employee for 15 years, Dick is presently a Product Support Engineer at the HP Santa Clara, California manufacturing division. Prior to going to Santa Clara, Dick worked at another HP division for 5 years as a Product Systems Engineer and Systems supervisor, in addition to working in the Product Support Group supporting Systems.*

### 8555A AND 8552 A/B MICROWAVE SPECTRUM ANALYZERS

(2-Day Seminar)

#### OBJECTIVE:

Provide the electronic repair technician with the training needed to:

- Understand all panel control operations as they relate to the functional block diagram.
- Interpret signal waveforms and voltage levels at test points.
- Efficiently perform critical adjustments.
- Isolate troubles to the individual circuits.

#### PREREQUISITES:

These seminars are designed for service personnel who will be repairing or calibrating the HP 8555A and HP8-52A/B Spectrum Analyzers. Prerequisite is a two-year degree in electronics or equivalent experience in servicing electronic instrumentation.

**PRESTUDY:** Application Notes AN150, pages 1-34, and AN136, pages 1-24.

#### COURSE OUTLINE:

First Day:

1. Introduction to HP140 Series Displays, HP8552A/B IF Sections, HP8555A RF Sections
  - System block diagram

- Front panel controls related to the instruments detailed block diagrams.
- Laboratory - Front Panel Operation, check-out and calibration.
- Objective - Operate spectrum analyzer in all normal modes and complete the "Front Panel Check" procedure, understanding its relationship to the functional block diagram.

2. 8555A detailed circuit descriptions:

- Input attenuator and driver
- First, second, third mixers and IF
- YIG drivers
- Laboratory - Perform first L.O., 2nd L.O. (1500 MHz), and 3rd L.O. (500 MHz) adjustments.
- Objective - Calibrate the local oscillators in this spectrum analyzers in less than one hour.

3. Continued detailed circuit descriptions: IF Amplifiers, and phase-lock loop.

- Objective - Understanding normal operation of each of these circuits and be able to isolate a trouble to the circuit level in less than one hour.

Second Day:

4. HP8555A and HP8552A/B System Block Diagram and Check-out Review

5. HP8552B detailed circuit descriptions:

- 50 MHz converter
- Automatic phase control and 2 MHz voltage tuned oscillator
- 2 MHz VTO shaping
- Laboratory - Reinforce circuit theory and operation with hands-on measurements of signal waveforms and voltage levels in these converter circuits.
- Objective - Isolate any converter trouble to an individual circuit in less than one hour.

6. Continued detailed circuit descriptions:

- 3 MHz amplifier
- LC bandwidth filters and Crystal bandwidth filters
- Laboratory - Make signal waveform and voltage measurements on the 3 MHz amplifier and perform bandwidth filter adjustments.
- Objective - Properly align the high resolution bandwidth filters & understand how these adjustments affect circuit operation.

7. Continued detailed circuit descriptions:

- Log-linear and deflection amplifiers
- Scan generator and trigger circuit
- Scan driver and penlift driver
- Laboratory - HP8552B and 8555A system troubleshooting - common failures inserted.
- Objective - Isolate these problems to an individual circuit within 30 minutes.

TUITION: \$200 per student

LOCATION:

Hewlett-Packard Sales Office  
6305 Arizona Place  
Los Angeles, California 90045

DATES: January 19 and 20, 1976

Hewlett-Packard Sales Office  
201 East Arapaho Road  
Richardson, Texas 75080

DATES: February 9 and 10, 1976

Hewlett-Packard Sales Office  
W120 Century Road  
Paramus, New Jersey 07652

DATES: February 12 and 13, 1976

Hewlett-Packard Sales Office  
6877 Goreway Drive  
Mississauga, Ontario, Canada

DATES: February 16 and 17, 1976

Hewlett-Packard Sales Office  
5500 Howard Street  
Skokie, Illinois 60076

DATES: February 19 and 20, 1976

*The instructors for this seminar are:*

*JIM BOYER—Jim has been with HP for 5 years at HP Microwave division in Santa Rosa, California working on Spectrum Analyzers. Jim has a BSEE and is continuing his educational program working towards his MBA degree. Prior to joining HP, Jim worked as a Design Engineer at Boeing in Seattle.*

*JIM ARNOLD—Jim joined HP 13 years ago at Microwave division in Santa Rosa, California. Most of his experience lies in Production areas and 4 years in Product Support. He taught several seminars on the 8620/8690 family. Jim is a graduate from Oregon Technical Institute (OTI).*



**8640 A/B AM-FM SIGNAL GENERATOR**

(2-Day Seminar)

**OBJECTIVE:**

To acquaint the technician with front panel operation, theory of operation on block diagram level, instrument layout and disassembly, and some basic troubleshooting and calibration.

**PREREQUISITES:**

This seminar is intended for repair and calibration technicians who have basic knowledge of analog circuits and acquaintance with digital counter circuits.

**PRESTUDY:** Block theory in 8640 manual.

**COURSE OUTLINE:****First Day:**

1. Introduction
  - Description
  - Options
  - New Features
  - Operating and Service Manual
2. Instrument Operation
  - Front Panel
  - Video Tape
  - Specifications
3. Block Diagram Theory
  - RF Generation
  - Leveling, AM, and Pulse Modulation
  - FM
  - Counter and Phase Lock
4. Fault Isolation
  - RF Circuits
  - Leveling Circuits
  - Counter
5. Instrument Repair
  - Oscillator Replacement
  - Divider/Filter Access
  - Counter Access

**Second Day:**

6. Selected Circuit Theory
  - FM
  - Leveling, AM, and Pulse Modulation
  - Counter



7. Troubleshooting Laboratory
  - RF Circuits
  - AM and Leveling Circuits
  - Counter

8. Instrument Calibration
  - AM
  - FM

**TUITION:** \$200 per student

**LOCATION:**

Hewlett-Packard Sales Office  
6305 Arizona Place  
Los Angeles, California 90045

**DATES:** January 26 and 27, 1976

Hewlett-Packard Sales Office  
W120 Century Road  
Paramus, New Jersey 07652

**DATES:** February 9 and 10, 1976

Hewlett-Packard Sales Office  
201 East Arapaho Road  
Richardson, Texas 75080

**DATES:** February 12 and 13, 1976

Hewlett-Packard Sales Office  
5500 Howard Street  
Skokie, Illinois 60076

**DATES:** February 16 and 17, 1976

Hewlett-Packard Sales Office  
6877 Goreway Drive  
Mississauga, Ontario, Canada

**DATES:** February 19 and 20, 1976

*The instructor for this seminar is:*

*JIM HARMON—Jim joined HP 8 years ago at Stanford Park division in Palo Alto, California and has spent 5 years in R & D and 3 years in Product Support. He has presented seminars 20 times in training personnel in five countries. Jim received a BSEE from Utah State in 1967 and an MSEE from Stanford in 1970.*

## 8660 SYNTHESIZED SIGNAL GENERATOR

(3-Day Seminar)

### OBJECTIVE:

To acquaint technicians with front panel operation, block diagram level theory, instrument layout, disassembly, troubleshooting and calibration.

### PREREQUISITES:

This seminar is intended for repair and calibration technicians who have some knowledge of analog circuits, phase lock loops and digital circuitry.

### PRESTUDY:

8660 data sheet, 8660 manual, general theory.

### COURSE OUTLINE:

#### First Day:

1. Introduction
  - Description of Products
  - General Specifications
  - Service Accessories
2. Instrument Operation
  - Front Panel Operation
  - Performance Test Methods (General)
3. System Block Diagram
  - Basic Signal Flow in High Frequency Low Frequency Systems



4. Block Diagram Theory
  - Mainframe Sections Basic Understanding
  - Sum Loop, and Divider Phase Lock Loops Service, Calibration Information in Mainframe Sections

#### Second Day:

5. Basic Laboratory
  - Measuring, Analyzing Section Output Signals
  - Troubleshooting to Section and to Assembly
  - Service and Calibration Aids
6. Modulation Plug-Ins
  - General Information & Specifications
  - Basic Block Diagram Understanding
7. High Frequency Circuits
  - 11661A/B Block Diagram Understanding and Servicing
  - 86602/86603 Block Diagram Understanding and Servicing

#### Third Day:

8. Laboratory
  - Troubleshooting - Start with front panel to Assembly level
  - Calibration - Practice calibration in unusual and more complex areas
9. Digital Control Unit
  - Basic Block flow discussion
  - Servicing

TUITION: \$250 per student

### LOCATION:

Hewlett-Packard Sales Office  
6305 Arizona Place  
Los Angeles, California 90045

DATE: January 21-23, 1976

*The instructor for this seminar is:*

*JIM McGRATH—Jim has been with HP a total of 8 years where he has spent 2 years as a Product Support Engineer at Colorado Springs division in Colorado Springs, Colorado. The past 6 years have been spent as a Product Support Engineer at the Stanford Park division in Palo Alto, California where he is involved with the Synthesizers and Signal Generators. Jim has been the instructor for the 8660 for 5 years and has taught it repeatedly in Europe and around the U.S. for HP people and customers.*

## COURSE, DATES AND TUITION

## LOS ANGELES AREA

- Digital Troubleshooting  
Jan. 6-9, 1976 \$300
- 5345A—Electronic Counter  
Jan. 12-15, 1976 \$300
- 8555A/8552A/B—Microwave  
Spectrum Analyzers  
Jan. 19-20, 1976 \$200
- 8660—Synthesized Signal Gen.  
Jan. 21-23, 1976 \$250
- 8640—AM-FM Signal Generator  
Jan. 26-27, 1976 \$200

## Mail registration to:

Mr. Ralph Helper  
Hewlett-Packard Company  
6305 Arizona Place  
Los Angeles, California 90045  
(213) 649-2511

## ATLANTA

- 1700 Family  
Jan. 29-30, 1976 \$200
- 3450A/B—Multi-Function Meter  
Feb. 2-3, 1976 \$200
- 5300 Family  
Feb. 5-6, 1976 \$200

## Mail registration to:

Mr. Don Lutz  
Hewlett-Packard Company  
P.O. Box 28234  
Atlanta, Georgia 30328  
(404) 434-4000

## DALLAS

- 8555A/8552A/B—Microwave  
Spectrum Analyzers  
Feb. 9-10, 1976 \$200
- 8640—AM-FM Signal Gen.  
Feb. 12-13, 1976 \$200

## Mail registration to:

Mr. Harrison Chenault  
Hewlett-Packard Company  
P.O. Box 1270  
Richardson, Texas 75080  
(214) 231-6101

## PARAMUS

- Digital Troubleshooting  
Jan. 27-30, 1976 \$300
- 5300 Family  
Feb. 2-3, 1976 \$200
- 3450A/B—Multi-Function Meter  
Feb. 5-6, 1976 \$200
- 8640—AM-FM Signal Gen.  
Feb. 9-10, 1976 \$200
- 8555A/8552A/B—Microwave  
Spectrum Analyzers  
Feb. 12-13, 1976 \$200
- 1700 Family  
Feb. 16-17, 1976 \$200

## Mail registration to:

Mr. Pete Johnson  
Hewlett-Packard Company  
W120 Century Road  
Paramus, New Jersey 07652  
(201) 265-5000

## SKOKIE

- 3450A/B—Multi-Function Meter  
Feb. 9-10, 1976 \$200
- 5300 Family  
Feb. 12-13, 1976 \$200
- 8640—AM-FM Signal Gen.  
Feb. 16-17, 1976 \$200
- 8555A/8552A/B—Microwave  
Spectrum Analyzers  
Feb. 19-20, 1976 \$200

## Mail registration to:

Mr. Bob Chandler  
Hewlett-Packard Company  
5500 Howard Street  
Skokie, Illinois 60076  
(312) 677-0400

## TORONTO

- 5300 Family  
Feb. 9-10, 1976 \$200
- 1700 Family  
Feb. 12-13, 1976 \$200
- 3450A/B—Multi-Function Meter  
Feb. 12-13, 1976 \$200
- 8555A/8552A/B—Microwave  
Spectrum Analyzers  
Feb. 16-17, 1976 \$200
- 8640—AM-FM Signal Gen.  
Feb. 19-20, 1976 \$200

## Mail registration to:

Mr. Dave Lansley  
Hewlett-Packard Company  
6877 Goreway Drive  
Mississauga, Ontario, Canada

To enroll in any of the above courses, please fill out the registration form and mail it to the location you will be attending. Also enclose a check or purchase order. Please use separate registration forms for each student. Any prestudy literature will be mailed directly to you.

Name		
Title		
Company		
Address		
City	State	Zip
Telephone		

## REPLACEMENT PART CROSS REFERENCE

When selecting replacement parts for your HP products, you may notice that many manuals list only an HP part number for the part, even though it appears that this part is manufactured by one of the large semiconductor manufacturers. Service personnel often ask why only HP part numbers are listed.

It is recommended that HP replacement parts be used to ensure that the original performance of the product will be obtained. While some parts used in HP instruments are identical to

that which can be purchased at a local electronics distributor, many times parts will be selected for certain characteristics, such as gain, bandwidth, capacitance, etc. There may also be slight mechanical differences, such as the shaping or length of leads. In some cases special quality checks are employed to ensure that high reliability parts are used at the factory and at HP field offices.

Therefore, we suggest obtaining replacement parts from HP to maintain

the quality that you have paid for in your instrument. There may be situations however where HP replacement parts are not in stock and substituting parts will allow you to return the product to service immediately. In these cases it may be worthwhile to see if a substitute part will work in the circuit. Perhaps an HP part could be ordered and installed at some later date.

To help you in these situations, here's a cross-reference of HP part numbers to JEDEC numbers for transistors and diodes.

HP P/N	JEDEC NO.	1450-0151	--	2N1309	1453-0086	--	*2N5887	1854-0056	--	2N3119	1454-0370	--	2N5294
0122-0005	--	1N4810		1850-0154	--	2N5084		1854-0057	--	2N3855A	1454-0371	--	*2N3391
0122-0017	--	1N4804		1850-0158	--	2N2635		1854-0060	--	2N3565	1454-0378	--	2N5109
0122-0025	--	1N4811A		1850-0160	--	2N2147		1854-0062	--	2N1701	1454-0379	--	2N6298
0122-0062	--	1N5468A		1450-0170	--	2N1377		1854-0063	--	2N3055	1454-0382	--	2N4348
0122-0070	--	1N5456A		1850-0172	--	2N2990		1854-0064	--	2N3710	1454-0384	--	2N5184
0122-0245	--	1N5139A		1850-0173	--	2N1307		1854-0066	--	2N2925	1454-0386	--	2N5670
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1850-0003	--	2N1516		1850-0418	--	2N400		1854-0216	--	2N3441	1454-0480	--	2N5658
1850-0017	--	2N525		1850-0419	--	2N207		1854-0217	--	2N3442	1454-0513	--	2N5481
1850-0020	--	2N1143		1850-0431	--	2N4277		1854-0218	--	2N3393	1454-0518	--	2N5877
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1850-0051	--	2N1500		1851-0025	--	2N1305		1854-0234	--	2N3440	1454-0557	--	2N4324
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1850-0113	--	2N1997		1453-0057	--	3N41		1854-0315	--	2N3633	1454-0667	--	2N3053
1850-0119	--	2N663		1453-0058	--	*2N3444		1854-0323	--	2N2957	1454-0669	--	2N6057
1850-0124	--	2N666		1453-0059	--	2N1741		1854-0324	--	2N1739	1454-0671	--	2N6262
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								1854-0368	--	2N5191	1855-0001	--	2N1671A
											1855-0005	--	2N3436

\*=ELECTRICALLY EQUIVALENT TO JEDEC NO. (LEAD FORMED ONLY)

1855-0010	--	2N2646	1901-0057	--	1N2525	1902-0156	--	1N2486B	1902-1313	--	1N2988A	1N1597A	--	1902-0039
1855-0021	--	2N1671B	1901-0058	--	1N629	1902-0157	--	1N2620	1910-0002	--	1N388	1N1604A	--	1902-1199
1855-0027	--	2N2647	1901-0059	--	1N629	1902-0166	--	1N2486B	1910-0003	--	1N55A	1N2148	--	1901-0398
1855-0040	--	2N3819	1901-0060	--	1N1116	1902-0178	--	1N3004RA	1910-0014	--	1N277	1N2158	--	1901-0305
1855-0055	--	2N4339	1901-0061	--	1N416	1902-0183	--	1N2495B	1910-0023	--	1N270	1N2158R	--	1901-0306
1855-0056	--	*2N4342	1901-0062	--	1N1563A	1902-0191	--	1N2471MB	1910-0024	--	1N191	1N2163A	--	1902-0763
1855-0065	--	2N4891	1901-0071	--	1N625	1902-0245	--	1N4099	1910-0025	--	1N995	1N2242	--	1901-0151
1855-0077	--	2N1671C	1901-0129	--	1N647	1902-0246	--	1N4105	1910-0031	--	1N344	1N2326	--	1910-0041
1855-0081	--	2N5245	1901-0132	--	1N640	1902-0509	--	1N823	1910-0033	--	1N279	1N2525	--	1901-0057
1855-0099	--	2N4853	1901-0151	--	1N2242	1902-0522	--	1N5340B	1910-0039	--	1N55A	1N2565	--	1901-0383
1855-0204	--	2N4852	1901-0164	--	1N4721	1902-0526	--	1N5305	1910-0041	--	1N2326	1N2620	--	1902-0157
1855-0207	--	2N3955	1901-0169	--	1N3404	1902-0528	--	1N5524U	1911-0001	--	1N91	1N2809B	--	1902-1276
1855-0208	--	2N4117	1901-0305	--	1N158	1902-0549	--	1N5365A	1912-0002	--	1N3716	1N2820	--	1902-1298
1855-0213	--	2N5912	1901-0306	--	1N2158B	1902-0569	--	1N941	1912-0005	--	1N3718	1N2971RA	--	1902-1225
1855-0224	--	2N3824	1901-0307	--	1N1289	1902-0581	--	1N944	1912-0007	--	1N3714	1N2971RH	--	1902-0191
1855-0226	--	2N5460	1901-0308	--	1N289H	1902-0625	--	1N829	1912-0009	--	1N3712	1N2973H	--	1902-1198
1855-0229	--	2N4119	1901-0309	--	1N1347A	1902-0627	--	1N5312	1912-0014	--	1N3720	1N2974RA	--	1902-1203
1855-0232	--	2N5565	1901-0310	--	1N250C	1902-0630	--	1N5236B	1912-0015	--	1N3717	1N2976H	--	1902-1194
1855-0301	--	2N5198	1901-0311	--	1N3260H	1902-0631	--	1N5351B	1912-0016	--	1N3713	1N2979	--	1902-1229
1855-0305	--	2N4117A	1901-0312	--	1N3262	1902-0632	--	1N5754B	1912-0017	--	1N3719	1N2979R	--	1902-0643
1855-0306	--	3N128	1901-0313	--	1N3262R	1902-0640	--	1N5476A	1912-0019	--	1N3721	1N2979RH	--	1902-1205
1855-0307	--	3N153	1901-0314	--	1N1206A	1902-0641	--	1N5456A				1N2980B	--	1902-1200
1855-0309	--	2N4352	1901-0315	--	1N1183A	1902-0643	--	1N2979B				1N2982RH	--	1902-1223
1855-0314	--	2N6027	1901-0316	--	1N1183AR	1902-0644	--	1N5363H				1N2983B	--	1902-0759
1855-0322	--	2N5105	1901-0317	--	1N1184A	1902-0645	--	1N2997RH				1N2984B	--	1902-1204
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1855-0341	--	2N4338	1901-0320	--	1N1187A	1902-0686	--	1N425				1N2988A	--	1902-1313
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1855-0371	--	2N4042	1901-0323	--	1N3736	1902-0759	--	1N2983H				1N2995B	--	1902-0183
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1855-0380	--	2N4351	1901-0325	--	1N3736	1902-0763	--	1N2163A				1N2999B	--	1902-0028
1855-0386	--	2N4392	1901-0327	--	1N3261R	1902-0772	--	1N975				1N3003B	--	1902-0088
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1855-0390	--	2N3382	1901-0343	--	1N3491R	1902-0785	--	1N376				1N3008R	--	1902-0178
1855-0393	--	2N3330	1901-0346	--	1N3209H	1902-0786	--	1N377				1N3034B	--	1902-0035
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1855-0421	--	2N5114	1901-0410	--	1N4720	1902-0792	--	1N443				1N279	--	1910-0033
1884-0002	--	2N6844A	1901-0412	--	1N4722	1902-0793	--	1N444				1N415B	--	1900-0009
1884-0003	--	3N58	1901-0414	--	1N4723	1902-1169	--	1N4100				1N415C	--	1900-0015
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1884-0010	--	2N4170	1901-0422	--	1N3210	1902-1171	--	1N4102				1N416HM	--	1900-0011
1884-0012	--	2N3528	1901-0423	--	1N3212	1902-1172	--	1N4103				1N468	--	1902-0105
1884-0015	--	2N685	1901-0424	--	1N3492	1902-1173	--	1N4104				1N603A	--	1901-0005
1884-0016	--	2N688	1901-0425	--	1N3493	1902-1174	--	1N4106				1N625	--	1901-0071
1884-0018	--	2N4186	1901-0426	--	1N3494	1902-1175	--	1N4107				1N628	--	1901-0058
1884-0019	--	2N3669	1901-0427	--	1N3495	1902-1176	--	1N4108				1N629	--	1901-0059
1884-0021	--	3N83	1901-0428	--	1N3650	1902-1177	--	1N4109				1N647	--	1901-0129
1884-0022	--	2N4172	1901-0429	--	1N3660	1902-1178	--	1N4110				1N660	--	1901-0132
1884-0023	--	2N4190	1901-0430	--	1N3661	1902-1179	--	1N4111				1N705A	--	1902-0094
1884-0025	--	2N4186	1901-0431	--	1N3662	1902-1180	--	1N4112				1N746	--	1902-0095
1884-0026	--	2N2322	1901-0432	--	1N3663	1902-1181	--	1N4113				*1N750A	--	1902-0697
1884-0027	--	2N1771A	1901-0478	--	1N3958	1902-1182	--	1N4114				1N751A	--	1902-1255
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1884-0044	--	2N4102	1901-0493	--	1N4725	1902-1185	--	1N4117				1N759	--	1902-1246
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1884-0065	--	2N3670	1901-0511	--	1N3889R	1902-1195	--	1N1362				1N821	--	1902-0761
1884-0066	--	2N4443	1901-0536	--	1N3289R	1902-1198	--	1N2073H				1N823	--	1902-0033
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1884-0071	--	2N4188	1901-0655	--	1N3290H	1902-1200	--	1N2980H				1N825	--	1902-0686
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1884-0204	--	2N5168H	1901-0717	--	1N3891	1902-1218	--	1N2992				1N935	--	1902-0772
1884-0209	--	2N5645	1901-0726	--	1N5823	1902-1219	--	1N2980RH				1N936	--	1902-0785
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1884-0219	--	2N3999	1901-0735	--	*1N3899H	1902-1228	--	1N2988RH				1N941	--	1902-0018
1884-0236	--	2N4156	1901-0742	--	1N3563	1902-1229	--	1N2979				1N941	--	1902-0569
1884-0237	--	2N4162	1901-0743	--	1N4004	1902-1232	--	1N3997AP				1N941A	--	1902-0698
1884-0238	--	2N4071H	1901-0750	--	1N5553	1902-1234	--	1N4000A				1N942	--	1902-0791
1884-0245	--	*2N4644	1901-0751	--	1N5554	1902-1244	--	1N3034B				1N943	--	1902-0792
1884-0247	--	2N2323	1901-0752	--	1N3644	1902-1245	--	1N752A				1N944	--	1902-0581
1884-0249	--	*2N4198	1901-1015	--	1N4531	1902-1246	--	1N759				1N944	--	1902-0793
1900-0001	--	1N218	1901-1029	--	1N914	1902-1255	--	1N751A				1N961H	--	1902-1303
1900-0004	--	1N74	1901-1030	--	1N3644	1902-1259	--	1N5357B				1N965H	--	1902-1304
1900-0006														

1N4101	--	1902-1170	2N519A	--	1850-0127	2N2556	--	1850-0076	2N3766	--	1854-0259	2V5115	--	1855-0402
1N4102	--	1902-1171	2N525	--	1850-0017	2N2635	--	1850-0158	2N3771	--	1854-0313	2V5168H	--	1884-0204
1N4103	--	1902-1172	2V526	--	1850-0031	2N2646	--	1855-0010	2N3772	--	1854-0519	2V5171	--	1884-0211
1N4104	--	1902-1173	2V597	--	1850-0417	2N2647	--	1855-0027	2N3789	--	1853-0031	2V5179	--	1854-0345
1N4105	--	1902-0246	2N600	--	1850-0418	2N2664	--	1850-0409	2N3791	--	1853-0059	2V5179	--	1854-0431
1N4106	--	1902-1174	2N604	--	1850-0110	2N2712	--	1854-0029	2N3792	--	1853-0111	2V5181	--	1854-0390
1N4107	--	1902-1175	2N650	--	1850-0048	*2N2714	--	1854-0027	2N3799A	--	1853-0360	2V5184	--	1854-0384
1N4108	--	1902-1176	2N652A	--	1850-0054	2N2832	--	1850-0437	2N3809	--	1853-0269	2V5189	--	1854-0570
1N4109	--	1902-1177	2N685A	--	1884-0002	2N2857	--	1854-0048	2N3814	--	1855-0040	2V5191	--	1854-0368
1N4110	--	1902-1178	2N685	--	1884-0015	2N2857	--	1854-0323	2N3824	--	1855-0224	2V5192	--	1854-0453
1N4111	--	1902-1179	2N688	--	1884-0016	2N2869	--	1850-0126	2N3855A	--	1854-0057	*2V5192	--	1854-0654
1N4112	--	1902-1180	2N700	--	1850-0066	2N2904	--	1853-0013	2N3866	--	1854-0233	2V5193	--	1853-0236
1N4113	--	1902-1181	2N708	--	1854-0005	2N2904	--	1853-0012	2N3879	--	1854-0476	2V5194	--	1853-0212
1N4114	--	1902-1182	2N709	--	1854-0009	2N2905	--	1853-0282	2N3894	--	1884-0219	2V5195	--	1851-0280
1N4115	--	1902-1183	2N743	--	1854-0004	2N2905A	--	1853-0314	*2N3904	--	1854-0215	*2V5195	--	1853-0372
1N4116	--	1902-1184	2N779A	--	1850-0075	2N2907	--	1853-0205	*2N3904	--	1854-0651	2V5198	--	1855-0301
1N4117	--	1902-1185	2N834	--	1854-0010	2N2907A	--	1853-0281	*2N3906	--	1853-0036	2V5210	--	1854-0409
1N4150	--	1901-1098	2N835	--	1854-0011	2N2913	--	1854-0349	2N3933	--	1854-0238	2V5217	--	1854-0286
1N4154	--	1901-1052	2N910	--	1854-0209	2N2925	--	1854-0066	2N3955	--	1855-0207	2V5245	--	1855-0081
1N4530	--	1901-0370	2N915	--	1854-0287	2N2944A	--	1853-0327	2N3959	--	1854-0220	2V5262	--	1854-0363
1N4531	--	1901-1015	2N916	--	1854-0050	2N2946A	--	1853-0322	2N3993	--	1853-0387	2V5294	--	1854-0370
1N4561	--	1902-1297	2N918	--	1854-0021	2N2958	--	1854-0036	2N4028	--	1853-0206	2V5301	--	1854-0398
1N4567	--	1902-0649	2N963	--	1850-0119	2N2972	--	1854-0411	2N4032	--	1853-0320	2V5333	--	1853-0349
1N4603	--	1900-0016	2N964	--	1850-0099	2N2996	--	1850-0172	2N4034	--	1853-0072	*2V5340	--	1853-0264
1N4719	--	1901-0409	2N976	--	1850-0137	2N3019	--	1854-0263	2N4035	--	1853-0258	2V5416	--	1851-0221
1N4720	--	1901-0410	2N1008H	--	1850-0049	2N3053	--	1854-0039	2N4036	--	1853-0045	2V5427	--	1854-0596
1N4721	--	1901-0164	2N1038	--	1850-0178	2N3053	--	1854-0667	2N4036	--	1853-0301	2V5442	--	1884-0586
1N4722	--	1901-0412	2N1121	--	1851-0038	*2N3054	--	1854-0703	2N4037	--	1853-0051	2V5445	--	1884-0080
1N4723	--	1901-0414	2N1131	--	1851-0019	2N3054	--	1854-0072	2N4044	--	1854-0248	2V5445	--	1884-0209
1N4724	--	1901-0491	2N1143	--	1850-0020	2N3054	--	1854-0590	2N4046	--	1854-0478	*2V5446	--	1884-0218
1N4725	--	1901-0493	2N1183	--	1850-0064	2N3055	--	1854-0063	*2N4062	--	1853-0076	2V5460	--	1855-0226
1N4732	--	1902-1300	2N1204	--	1850-0073	2N3119	--	1854-0056	2N4092	--	1853-0311	2V5474	--	1855-0379
1N4734A	--	1902-1308	2N1304	--	1851-0017	2N3134	--	1853-0006	2N4102	--	1884-0044	2V5496	--	1854-0454
1N4804	--	0122-0107	2N1305	--	1850-0404	2N3215	--	1850-0405	2N4117	--	1855-0208	2V5519	--	1855-0398
1N4810	--	0122-0005	2N1306	--	1851-0025	2N3227	--	1854-0260	2N4117A	--	1855-0305	*2V5551	--	1854-0474
1N4811A	--	0122-0025	2N1307	--	1850-0173	2N3228	--	1884-0088	2N4119	--	1855-0229	2V5565	--	1855-0232
1N4934	--	1901-0693	2N1309	--	1850-0151	2N3244	--	1853-0384	*2N4122	--	1853-0069	2V5575	--	1854-0709
1N4936	--	1901-1065	2N1358	--	1850-0150	2N3250	--	1851-0008	2N4170	--	1884-0010	2V5578	--	1854-0708
1N5002	--	1901-0492	2N1360	--	1850-0094	2N3250	--	1851-0287	2N4172	--	1884-0022	2V5583	--	1853-0293
1N5003	--	1901-0494	2N1363	--	1850-0082	2N3251	--	1853-0007	2N4186	--	1884-0018	2V5607	--	1853-0302
1N5139	--	0122-0245	2N1370	--	1850-0065	2N3261	--	1854-0301	2N4186	--	1884-0028	2V5681	--	1854-0513
1N5139A	--	0122-0246	2N1373	--	1850-0070	2N3262	--	1854-0242	2N4188	--	1884-0071	2V5762	--	1853-0370
1N5140	--	0122-0247	2N1374	--	1850-0180	2N3302	--	1854-0278	2N4190	--	1884-0023	2N5805	--	1854-0572
1N5140A	--	0122-0248	2N1377	--	1850-0170	2N3304	--	1853-0014	2N4233	--	1854-0600	2N5838	--	1854-0534
1N5141	--	0122-0249	2N1378	--	1850-0182	2N3318	--	1853-0033	2N4236	--	1853-0213	2N5845A	--	1854-0568
1N5141A	--	0122-0250	2N1379	--	1850-0139	2N3325	--	1850-0199	2N4237	--	1854-0566	2N5875	--	1853-0305
1N5142	--	0122-0251	2N1414	--	1850-0200	2N3330	--	1850-0393	2N4239	--	1854-0361	2N5876	--	1853-0344
1N5142A	--	0122-0252	2N1482	--	1854-0214	2N3382	--	1850-0390	2N4240	--	1854-0311	2N5877	--	1854-0518
1N5143	--	0122-0253	2N1484	--	1854-0235	*2N3390	--	1854-0202	*2N4249	--	1853-0081	2N5884	--	1853-0340
1N5143A	--	0122-0254	2N1495	--	1850-0067	2N3391	--	1854-0033	*2N4250	--	1853-0066	2N5885	--	1854-0679
1N5144	--	0122-0255	2N1499A	--	1850-0093	*2N3391	--	1854-0371	*2N4258	--	1853-0081	2N5886	--	1854-0697
1N5144A	--	0122-0256	2N1500	--	1850-0051	*2N3391A	--	1854-0201	*2N4265	--	1854-0271	2N5905	--	1855-0400
1N5145	--	0122-0257	2N1516	--	1850-0003	2N3393	--	1854-0218	2N4277	--	1850-0430	2V5912	--	1855-0213
1N5145A	--	0122-0258	2N1523	--	1850-0194	*2N3393	--	1854-0099	2N4298	--	1854-0379	2V5943	--	1854-0597
1N5146	--	0122-0259	2N1533	--	1850-0140	*2N3405	--	1854-0302	2N4338	--	1855-0341	2N5954	--	1853-0277
1N5146A	--	0122-0260	2N1540	--	1850-0132	2N3414	--	1854-0656	2N4339	--	1855-0055	2N5956	--	1853-0303
1N5147	--	0122-0261	2N1541	--	1850-0129	2N3415	--	1854-0093	*2N4342	--	1855-0056	*2N5956	--	1853-0342
1N5147A	--	0122-0262	2N1544	--	1850-0087	*2N3416	--	1854-0327	2N4348	--	1854-0322	2N5963	--	1854-0548
1N5148	--	0122-0263	2N1545	--	1850-0185	*2N3417	--	1854-0087	2N4351	--	1855-0380	2N5987	--	1853-0378
1N5148A	--	0122-0264	2N1558	--	1850-0403	2N3426	--	1854-0416	2N4352	--	1855-0309	2N6027	--	1855-0314
1N5236E	--	1902-0630	2N1595	--	1884-0004	2N3436	--	1855-0005	*2N4355	--	1853-0100	2N6028	--	1855-0346
1N5237B	--	1902-1305	2N1605	--	1851-0031	2N3439	--	1854-0079	2N4384	--	1854-0226	2N6051	--	1853-0391
1N5270B	--	1902-1306	2N1605A	--	1851-0034	2N3440	--	1854-0234	2N4391	--	1855-0420	2N6053	--	1853-0351
1N5305	--	1902-0526	2N1671A	--	1855-0001	2N3441	--	1854-0216	2N4392	--	1855-0386	2N6055	--	1854-0611
1N5312	--	1902-0627	2N1671B	--	1855-0021	2N3442	--	1854-0217	2N4393	--	1855-0414	2N6057	--	1854-0669
1N5338H	--	1902-1291	2N1671C	--	1855-0027	2N3467	--	1853-0399	2N4398	--	1853-0310	2N6067	--	1853-0390
1N5340B	--	1902-0522	2N1700	--	1854-0007	2N3478	--	1854-0325	2N4401	--	1854-0467	2N6071B	--	1884-0238
1N5342B	--	1902-1286	2N1701	--	1854-0062	2N3494	--	1853-0071	2N4403	--	1853-0271	2N6078	--	1854-0599
1N5348H	--	1902-1278	2N1701	--	1854-0613	2N3528	--	1884-0012	*2N4410	--	1854-0365	2N6107	--	1853-0371
1N5351H	--	1902-0631	2N1760	--	1850-0406	2N3553	--	1854-0308	2N4416	--	1855-0327	2N6156	--	1884-0236
1N5354B	--	1902-0632	2N1771A	--	1884-0027	*2N3564	--	1854-0092	2N4441	--	1884-0082	2N6162	--	1884-0237
1N5357B	--	1902-1259	2N1774	--	1884-0028	2N3565	--	1854-0060	*2N4441	--	1884-0213	2N6178	--	1854-0639
1N5358H	--	1902-1288	2N1846	--	1884-0051	2N3585	--	1854-0643	2N4443	--	1884-0066	2N6211	--	1853-0328
1N5363B	--	1902-0644	2N1926	--	1850-0145	2N3614	--	1850-0192	*2N4444	--	1884-0245	2N6249	--	1854-0598
1N5365A	--	1902-0549	2N1970	--	1850-0195	2N3634	--	1854-0315	2N4452	--	1855-0204	2N6258	--	1854-0576
1N5372B	--	1902-1292	2N1973	--	1854-0076	2N3634	--	1853-0028	2N4853	--	1855-0099	2N6259	--	1854-0577
1N5384A	--	1902-1290	2N1997	--	1850-0113	*2N3638	--	1851-0016	*2N4888	--	1853-0080	2N6282	--	1854-0671
1N5456A	--	0122-0070	2N2001	--	1850-0112	*2N3638								

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 SERVICE NOTE INDEX

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### 410C ELECTRONIC VOLTMETER

410C-14. Revisions to minimize shock potentials.

### 414A AUTOVOLTMETER

414A-7. Revisions to minimize shock potential.

### 435A POWER METER

435A-2. Serial prefix 1527A and below. Range switch selection knob.

### 463A PRECISION AC AMPLIFIER

463A-7A. Revisions to minimize shock potentials.

### 606A SIGNAL GENERATORS

606A-11. Serial numbers 1352A13896 through 1433A13910. Elimination of potential shock hazard.

### 618C SHF SIGNAL GENERATOR

618C-9. Serial numbers 1311A02341 through 1518A02657. Elimination of potential shock hazard.

618C-10. Serial numbers 1441A02411 through 1518A02616. Regulator transistor substitution for improved reliability.

### 620B SHF SIGNAL GENERATOR

620B-12. Serial numbers 1312A02131 through 1517A02425. Elimination of potential shock hazards.

620B-13. Serial numbers 1443A02191 through 1517A02401. Regular transistor substitution for improved reliability.

### 651B/652A TEST OSCILLATOR

651B-7A. 651B serials 1230A07800 and below. 652A serials 1226A03820 and below. Replacement part numbers for A2Q11 and A2Q12.

### 653A AND 654A TEST OSCILLATORS

653A-3. Serial numbers 0960A00586 through 0960A00589, 0960A00576 and below. Improved oscillator and output assembly.

653A-4/654A-2. 653A serials 0960A00650 and below. 654A serials 0951A02355 and below. Recommended replacement for A2C42.

### 735A DC TRANSFER STANDARD

735A-3. Revisions to minimize shock potentials.

### 741A/B AC-DC DIFFERENTIAL VOLTMETER DC STANDARD

741B-2C. 741B serial numbers 634-00514 and below. Modification to increase reliability of Q1-Q2 (Power Switch).

### 745A AC CALIBRATOR

745A-12. Serial numbers 1319A01250 and below. Revisions to minimize shock potentials.

745A-13. Serial numbers 1319A01251 to 1319A-01670. Elimination of counter output connector incompatibility.

745A-14A. All serials. Long lead transistor replacement.

745A-15. All serials. Overloads when 746A turned on.

### 746A HIGH-VOLTAGE AMPLIFIER

746A-8. Serials 0990A01225 and below. Modifications to eliminate turn-on oscillation.

### 1220A/1221A OSCILLOSCOPES

1220A-3/1221A-1. All serials. Service procedures for removal and replacement of A1, A2, A3 and A4 assemblies.

### 1310A, 1311A, 1317A, 1321A DISPLAYS

1310A-15/1311A-15/1317A-3/1321A-4. All serials. Noise bar in display.

### H06-1330A DISPLAY

H06-1330A-1. Serial number 1340A01260 and below. Preferred components for improved reliability.

### HP MODEL 1331A/C DISPLAY

1331A/C-16. 1331A serial prefix 1319A and below. 1331C serial prefix 1318A and below. Preferred components for improved reliability.

1331A/C-17. 1331A serial number 1424A thru 1513A; 1331C serial number 1426A thru 1520A. Preferred components for improved reliability.

### 1645A DIGITAL ERROR ANALYZER

1645A-2. Serial prefix 1506A and below. Modification to add power connector for 10235A.

### 3304A SWEEP/OFFSET PLUG-IN

3304A-1A. All serials. Long lead transistor replacement (A1Q1 and A1Q2).

### 3420A/B DC DIFFERENTIAL VOLTMETER/RATIOMETER

3420A/B-6. Serial numbers 09502A00980 and below. Reduction of noise at recorder output especially for 50 Hz, 230 V AC operation.

3420A/B-7. Serials 1524A00995 and below. Recommended replacements for insulators on decade switch A1S6-A1S11.

### 3450B DIGITAL MULTIMETER

3450B-3. Intermittent ohms converter failures.

### 3460A/B DIGITAL VOLTMETER

3460A-16/3460B-6. Revisions to minimize shock potentials.

### 3465A MULTIMETER

3465A-1. Serial numbers 1521A00100 to 1521A-00200. Modifications to reduce temperature sensitivity.

3465A-2. Serial numbers 1521A00100 and above. Precautionary procedures.

### 3485A SCANNING UNIT

3485A-2. Serials 1119A00599 and below. Modification for proper scanning under remote control.

3485A-3. All serials. Optional modification to disable monitor function when in remote mode.

### 3551 AND 3552A TRANSMISSION TEST SET

3551A-2/3552A-2. 3551A serial number 1425A-00355 and below; 3552A serial numbers 1435A00140 and below. Modification to reduce susceptibility to RFI.

### 5308A 75 MHz TIMER/COUNTER

5308A-1. Serial prefix 1440A and below. Modifications to reduce crosstalk between input A and B. Also recommended replacement for the High Speed Decade Counter.

5308A-2. Serial prefix 1524A and below. Modifications for improved attenuator accuracy.

### 7035B X-Y RECORDER

7035B-2. All serials. A change in common mode rejection test procedure.

### 8403A MODULATOR

8403A-8. Serial prefix 1413A and below. Modification for improved external pulse operation and suppression of double triggering.

### 8558B SPECTRUM ANALYZER

8558B-9. All serials. Intensity control of HP 8558B spectrum analyzer and 180-series oscilloscope mainframe with an external horizontal input.

### 8620A SWEEP OSCILLATOR

8620A-6B. Serial prefix 1332A and below. Modification required for compatibility with 86290A, 2.0-18.0 GHz RF plug-in or 8410B network analyzer.

### 8660A SYNTHESIZED SIGNAL GENERATOR

8660A-22C. Serials 1445A00691 and below. Recommended changes on power supply fuses.

### 8660B SYTHESIZED SIGNAL GENERATOR

8660B-20C. Serials 1439A00950 and below. Recommended changes on power supply fuses.

### 8690A/B SWEEP OSCILLATORS

8690A-14/8690B-10. All serials on 8690A. 8690B serial prefix 1349A and below. Recommended modification to install thermal protection in case of a fan failure.

### 11661A FREQUENCY EXTENSION MODULE

11661A-9B. Serial prefixes 1426A and below. Modification to improve lock stability.

### 11661B FREQUENCY EXTENSION MODULE

11661B-3. Serial prefix 1533A and below. Modification to increase YIG loop pretune adjustment range.

### 34703A DCV/DCA/OHM METER

34703A-11. All serials. Comments on apparent erratic behavior in DCV and ohms, manual ranging mode when input terminals open.

### 59306 RELAY ACTUATOR

59306A-1. Serial number 1332A00200 and below. Modification to prevent loss of remote control when subjected to mechanical shock.

### 59307A VHF SWITCH

59307A-1. Serials 1332A00180 and below. Modification to prevent loss of remote control when subjected to mechanical shock.

### 62605J MODULAR SWITCHING DC POWER SUPPLY

62605J-1. Serial numbers below 1523A01314. Modification to reduce repair cost.

### 86603A RF SECTION

86603A-3. Serials 1505A00146 and below. Eliminations of short in the attenuator 80 dB step.

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# READERS CORNER

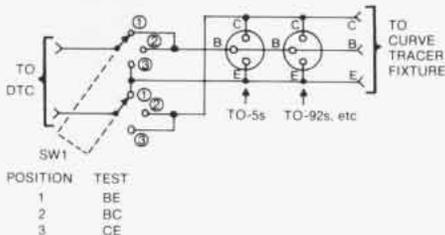
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If there is something you have to share with other *Bench Briefs* readers, let us hear from you.

Dear Editor:

The diode/transistor checker (DTC) shown in the Sept.-Oct. 1974 issue of *Bench Briefs* can be made more useful with a simple accessory. We often service old equipment for which no schematics are available. When the active devices (transistors or diodes) are socketed a rapid check of their condition can be made with the switcher test box and DTC.

Fig. 1 Switcher Test Box



The switcher test box is simple in design and operation. (see schematic Fig. 1). The test leads from the DTC are alternately switched between base emitter, base collector, and collector emitter junctions of the device under test (DUT).

SW1 can be a wafer switch or a DPDT center off toggle switch. In our tester we wired two sockets in parallel one for TO-5 and one for TO-92 and other small cased transistors. Also, included were three banana jacks spaced in line on 0.75 inch centers so standard curve tracer fixtures can be utilized for TO-3 and TO-220 testing.

Neil B. McCleery  
MAC-LAB  
Santa Clara, CA

## 7402A RECORDER HANDLE MODIFICATION

There is the possibility of the handle assembly of the 7402A becoming loose if it is not properly installed. On all units up through serial number 01760 the handle assembly was fastened with two 6-32x $\frac{1}{2}$  inch posi-driv screws which fit into two 6-32 fasteners located in the top rail assembly. Because there was a chance of either stripping the threads or not having enough threads in the fastener, the present screws should be replaced with 6-32x.625 screws, HP P/N 2360-0203, and a 6-32 lock nut, HP P/N 0590-0381, should be tightened onto the end of the screw protruding through the top rail.

This modification takes less than thirty minutes to perform and service note 7402 A-5 gives step by step instructions. If for any reason it is inconvenient to perform this modification, the instrument may be returned to your nearest HP office where it will be done at no cost.

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