

Repair Manual

HP 3245A
Universal Source

Universal Source HP 3245A

Repair Manual

The information in this manual applies directly to HP 3245A Universal Sources (Standard, Option 001, and Option 002) with serial number prefixes 2831A.



Copyright © Hewlett-Packard Company, 1992

Manual Part Number: 03245-90015
Microfiche Part Number: 03245-99015

Printed: October 1992 Edition 1
Printed in U.S.A. E1092

Notice

Hewlett-Packard to Agilent Technologies Transition

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

Contacting Agilent Sales and Service Offices

The sales and service contact information in this manual may be out of date. The latest service and contact information for your location can be found on the Web at:

<http://www.agilent.com/find/assist>

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

United States

(tel) 1 800 452 4844
(fax) 1 800 829 4433

Canada

(tel) +1 877 894 4414
(fax) +1 888 900 8921

Europe

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

Latin America

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

Japan

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

Australia

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

New Zealand

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

Asia Pacific

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



Agilent Technologies

CERTIFICATION

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

WARRANTY

This Hewlett-Packard product is warranted against defects in materials and workmanship for a period of three years from date of shipment. Duration and conditions of warranty for this product may be superseded when the product is integrated into (becomes a part of) other HP products. During the warranty period, Hewlett-Packard Company will, at its option, either repair or replace products which prove to be defective.

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

HP warrants that its software and firmware designated by HP for use with a product will execute its programming instructions when properly installed on that product. HP does not warrant that the operation of the product, or software, or firmware will be uninterrupted or error free.

LIMITATION OF WARRANTY

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

The design and implementation of any circuit on this product is the sole responsibility of the Buyer. HP does not warrant the Buyer's circuitry or malfunctions of HP products that result from the Buyer's circuitry. In addition, HP does not warrant any damage that occurs as a result of the Buyer's circuit or any defects that result from Buyer-supplied products.

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

EXCLUSIVE REMEDIES

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

NOTICE

The information contained in this document is subject to change without notice. HEWLETT-PACKARD (HP) MAKES NO WARRANTY OF ANY KIND WITH REGARD TO THIS MATERIAL, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. HP shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance or use of this material. This document contains proprietary information which is protected by copyright. All rights are reserved. No part of this document may be photocopied, reproduced, or translated to another language without the prior written consent of Hewlett-Packard Company. HP assumes no responsibility for the use or reliability of its software on equipment that is not furnished by HP.

Restricted Rights Legend

Use, duplication, or disclosure by the Government is subject to restrictions as set forth in subdivision (b)(3)(ii) of the Rights in Technical Data and Computer Software clause at 52.227-7013. Hewlett-Packard Company; 3000 Hanover Street; Palo Alto, California 94304

Declaration of Conformity

According to ISO/IEC Guide 22 and EN 45014

The Hewlett-Packard Company declares that the HP 3245A conforms to the following Product Specifications.

Safety: IEC 1010-1 (1990)
CSA 234
UL 1244

EMC: CISPR 11:1990/EN 55011 (1991): Group 1 Class A
IEC 801-2:1991/EN 50082-1 (1992): 4kVCD, 8kVAD
IEC 801-3:1984/EN 50082-1 (1992): 3 V/m
IEC 801-4:1988/EN 50082-1 (1992): 1kV


Q.A. Manager
October 1992

Hewlett-Packard Company
P.O. Box 301
815 14th Street S.W.
Loveland, Colorado 80539 U.S.A

Printing History

The Printing History shown below lists all Editions and Updates of this manual and the printing date(s). The first printing of the manual is Edition 1. The Edition number increments by 1 whenever the manual is revised. Updates, which are issued between Editions, contain replacement pages to correct the current Edition of the manual. Updates are numbered sequentially starting with Update 1. When a new Edition is created, it contains all the Update information for the previous Edition. Each new Edition or Update also includes a revised copy of this printing history page. Many product updates or revisions do not require manual changes and, conversely, manual corrections may be done without accompanying product changes. Therefore, do not expect a one-to-one correspondence between product updates and manual updates.

Edition 1 (Part Number 03245-90015) October 1992

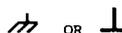
Safety Symbols



Instruction manual symbol affixed to product. Indicates that the user must refer to the manual for specific Warning or Caution information to avoid personal injury or damage to the product.



Indicates the field wiring terminal that must be connected to earth ground before operating the equipment—protects against electrical shock in case of fault.



OR



Frame or chassis ground terminal—typically connects to the equipment's metal frame.



Alternating current (AC).



Direct current (DC).



Indicates hazardous voltages.

WARNING

Calls attention to a procedure, practice, or condition that could cause bodily injury or death.

CAUTION

Calls attention to a procedure, practice, or condition that could possibly cause damage to equipment or permanent loss of data.

WARNINGS

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

Ground the equipment: For Safety Class I equipment (equipment having a protective earth terminal), an uninterruptible safety earth ground must be provided from the mains power source to the product input wiring terminals or supplied power cable.

DO NOT operate the product in an explosive atmosphere or in the presence of flammable gases or fumes.

For continued protection against fire, replace the line fuse(s) only with fuse(s) of the same voltage and current rating and type. DO NOT use repaired fuses or short-circuited fuse holders.

Keep away from live circuits: Operating personnel must not remove equipment covers or shields. Procedures involving the removal of covers or shields are for use by service-trained personnel only. Under certain conditions, dangerous voltages may exist even with the equipment switched off. To avoid dangerous electrical shock, DO NOT perform procedures involving cover or shield removal unless you are qualified to do so.

DO NOT operate damaged equipment: Whenever it is possible that the safety protection features built into this product have been impaired, either through physical damage, excessive moisture, or any other reason, REMOVE POWER and do not use the product until safe operation can be verified by service-trained personnel. If necessary, return the product to a Hewlett-Packard Sales and Service Office for service and repair to ensure that safety features are maintained.

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

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

What's in this Manual

Manual Overview

This manual shows how to service and repair the HP 3245A Universal Source. See the *HP 3245A Universal Source Operating and Programming Manual* (part number 03245-90003) for additional information on operating and programming the HP 3245A. See the *HP 3245A Universal Source Calibration Manual* (03245-90013) for Operation Verification and Performance Tests for the HP 3245A. See the *HP 3245A Universal Source Component Level Information Packet (CLIP)* (03245-90033) for detailed parts lists, component locators, and schematics for the HP 3245A.

Manual Content

Chap	Title	Content
1	General Information	Lists basic HP 3245A description, tools and test equipment required for service, and procedures to inspect and ship the HP 3245A.
2	Replaceable Parts	Lists part numbers for user-replaceable parts in the HP 3245A. Provides information on ordering spare parts and shows component part locators.
3	Service	Procedures to aid in fault isolation and repair of the HP 3245A.

Contents

Chapter 1 - General Information

Introduction	1-1
Safety Considerations	1-1
Description	1-3
Specifications	1-3
Environment	1-4
Serial Numbers	1-4
Configurations and Options	1-4
Recommended Test Equipment	1-5
Inspection/Shipping	1-6
Initial Inspection	1-6
Shipping Guidelines	1-6

Chapter 2 - Replaceable Parts

Introduction	2-1
Replaceable Parts List	2-1
Parts Locators	2-7

Chapter 3 - Service

Introduction	3-1
Equipment Required	3-1
Service Aids	3-1
Troubleshooting Techniques	3-1
Identifying the Problem	3-2
Making Visual Checks	3-2
Turn-on Failures	3-3
Self-test Failures	3-6
TEST	3-6
FTEST	3-7
Performance Failures	3-8
Miscellaneous Failures	3-8
Assembly/Disassembly Procedures	3-9
Covers	3-10
A1/A11 Inguard Source PCA	3-11
A2 Backplane PCA	3-13
A3 High Voltage Amplifier PCA (Option 002 only)	3-14
A5 Outguard Logic PCA	3-15
A6 Outguard Power Supply PCA	3-16
A7 Display Logic PCA	3-17
Repair and Maintenance Guidelines	3-18
ESD Precautions	3-18
Soldering Printed Circuit Boards	3-18

General Information

Introduction

This service manual contains information required to troubleshoot and repair the HP 3245A Universal Source to the assembly level (e.g. circuit card, module, etc).

See the *HP 3245A Calibration Manual* for information on performance verification, and the *HP 3245A Operating and Programming Manual* for additional information on operation.

Figure 1-1 shows a standard single channel HP 3245A Universal Source. Option 001 adds channel B output capability, and Option 002 adds high voltage output capability.

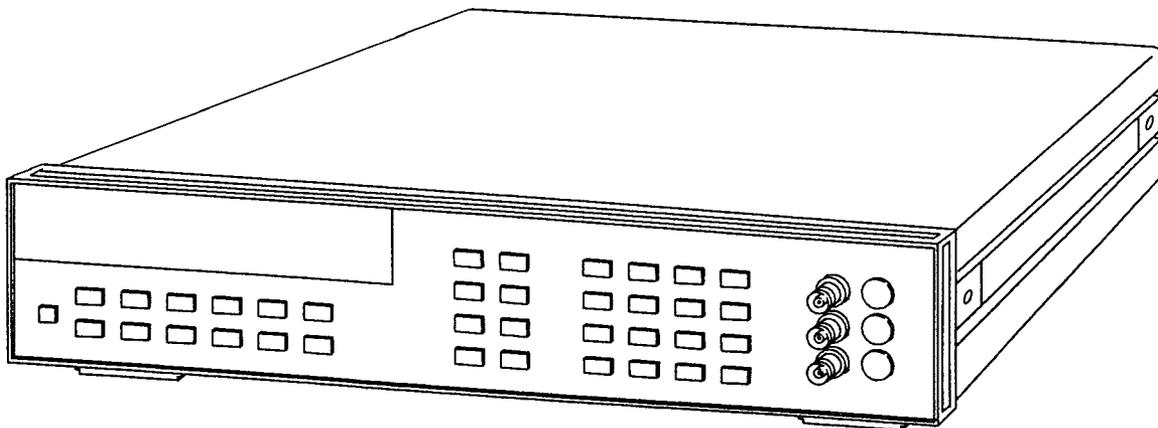


Figure 1-1. HP 3245A Universal Source and Accessories

NOTE

The A1 and A2 assemblies have been changed to accommodate the high voltage option for the HP 3245A Universal Source. Units with serial numbers 2831A01139 and after have REV C A1 and A2 assemblies installed.

Safety Considerations

This product is a Safety Class I instrument that is provided with a protective earth terminal when properly connected to the main power source. Check all related documentation for safety markings and instructions before operation or service.

Refer to the WARNINGS page in this manual for a summary of safety information. Safety information for testing and service follows and is also found throughout this manual.

Warnings

This section contains WARNINGS which must be followed for your protection when performing equipment maintenance or repair.

WARNING

SERVICE-TRAINED PERSONNEL ONLY. The information in this manual is for service-trained personnel who are familiar with electronic circuitry and are aware of the hazards involved. To avoid personal injury or damage to the instrument, do not perform procedures in this manual or do any servicing unless you are qualified to do so.

CHECK POWER SETTINGS. Before applying power, verify that the rear panel line switch setting matches the line voltage and that the correct fuse is installed. An uninterruptible safety earth ground must be provided from the main power source to the supplied power cord set.

GROUNDING REQUIREMENTS. Interruption of the protective (grounding) conductor (inside or outside the instrument) or disconnecting the protective earth terminal will cause a potential shock hazard that could result in personal injury. (Grounding one conductor of a two-conductor outlet is not sufficient protection.)

IMPAIRED PROTECTION. Whenever it is likely that instrument protection has been impaired, the instrument must be made inoperative and be secured against any unintended operation.

REMOVE POWER IF POSSIBLE. Some procedures in this manual may be performed with power supplied to the instrument while protective covers are removed. Energy available at many points may, if contacted, result in personal injury. (If maintenance can be performed without power applied, the power should be removed.)

USING AUTOTRANSFORMERS. If the instrument is to be energized via an autotransformer (for voltage reduction) make sure the common terminal is connected to neutral (that is, the grounded side of the main's supply).

WARNING

CAPACITOR VOLTAGES. Capacitors inside the instrument may remain charged even when the instrument has been disconnected from its source of supply.

USE PROPER FUSES. For continued protection against fire hazard, replace the line fuses only with fuses of the same current rating and type (such as normal blow, time delay, etc.). Do not use repaired fuses or short-circuited fuseholders.

Cautions

This section contains CAUTIONS which must be followed to avoid damage to the equipment when performing instrument maintenance or repair.

CAUTION

Static electricity is a major cause of component failure. To prevent damage to the electrical components in the instrument, observe anti-static techniques whenever working on the HP 3245A.

Description

The HP 3245A Universal Source generates precise DC voltage and current outputs, and AC waveforms. DC voltage outputs from -10.25 Vdc to +10.25 Vdc with 6 digits of resolution (24 bits) in high resolution mode, or 3.5 digits (12 bits) in low resolution mode, are available. DC current outputs are available from -0.1A to +0.1A. AC outputs include sine, square, and arbitrary waveforms up to 1 MHz. Ramp waveforms with variable duty cycles from 5% to 95% are available up to 100 kHz.

Option 001 adds a second channel (B) output, sync out, and trigger I/O capability. Option 002 adds a 10x High Voltage Amplifier to provide 200 V peak-to-peak (AC voltage) and 100 V (DC voltage) output capability.

The HP 3245A also has seven voltage ranges, four current ranges, selectable output impedance, and selectable trigger and timing functions.

See the *HP 3245A Operating and Programming Manual* for additional information.

Specifications

See Appendix A of the *HP 3245A Operating and Programming Manual* for specifications.

Environment

The recommended operating environment for the HP 3245A Universal Source is:

Environment	Temperature	Humidity
Operating	0°C to +55°C	< 95% relative 0°C to +40°C
Storage and shipment	-40°C to +75°C	< 95% relative 0°C to +40°C

Serial Numbers

Instruments covered by this manual are identified by a serial number prefix listed on the title page. Hewlett-Packard uses a two-part serial number in the form XXXXAYYYYY, where XXXX is the serial prefix, A is the country of origin (A = USA), and YYYYY is the serial suffix. The serial number prefix identifies a series of identical instruments. The serial number suffix is assigned sequentially to each instrument.

The serial number plate is located on the rear panel. If the serial number prefix of your instrument is greater than the one listed on the title page, a Manual Update (as required) will explain how to adapt this manual to your instrument.

Configurations and Options

The standard HP 3245A is a single channel universal source with channel A output only. This unit can be field upgraded to a two channel source (Option 001) by adding a second Inguard Source PCA for channel B output capability. There is also a High Voltage Option (Option 002) available. However, this option can only be added to instruments with Inguard Source PCA (A1) and Backplane PCA (A2) of Rev C or higher installed.

NOTE

All instruments with serial numbers prior to 2831A01139 have the Inguard Source PCA (A1) and Backplane PCA (A2) revision B assemblies installed. Instruments with serial numbers greater than 2831A01139 have revision C assemblies installed.

The High Voltage Option (Option 002) can only be installed in units with revision C assemblies.

See *Chapter 2 - Replaceable Parts* for assembly part numbers and locations.

Recommended Test Equipment

Table 1-1 lists the test equipment recommended for troubleshooting the HP 3245A Universal Source. Essential requirements for each piece of test equipment are described in the Requirements column.

Table 1-1. Recommended Test Equipment

Instrument	Requirements	Recommended Model
Digital Multimeter	General Purpose	HP 3478A

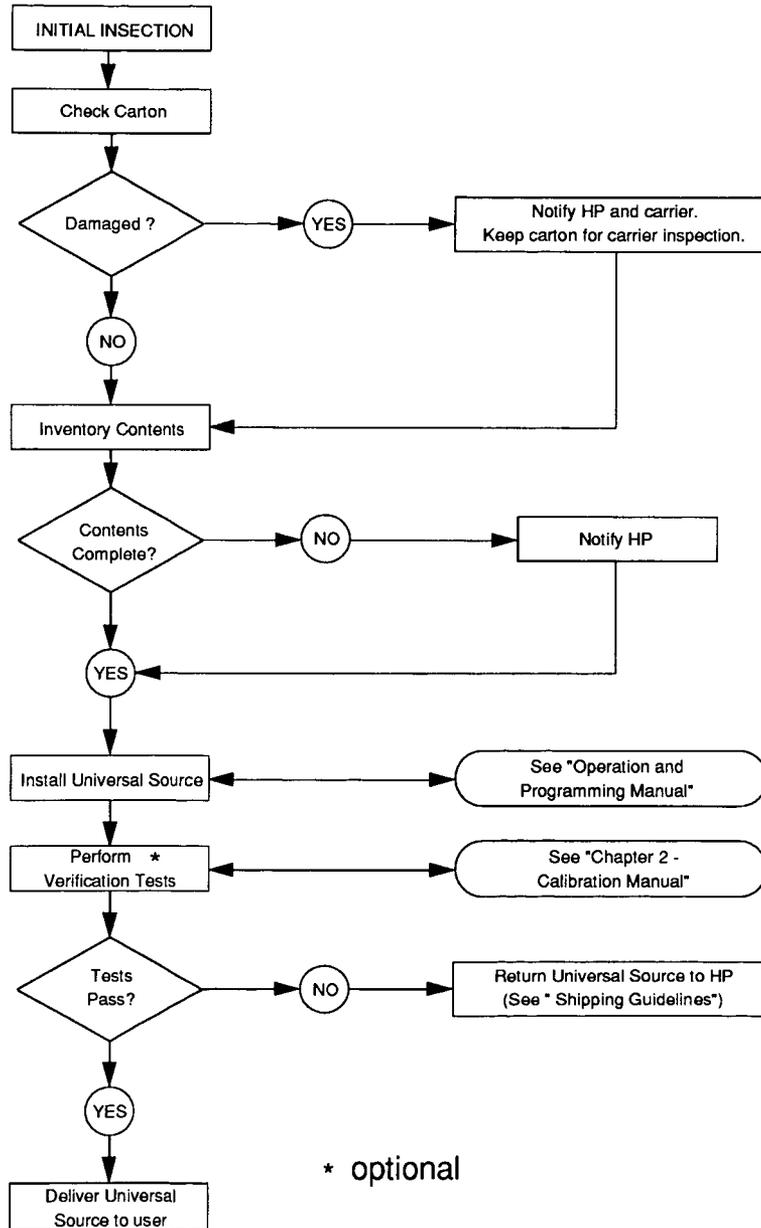


Figure 1-2. Initial (Incoming) Inspection Guidelines

Inspection/ Shipping

This section contains initial (incoming) inspection and shipping guidelines for the HP 3245A Universal Source.

Initial Inspection

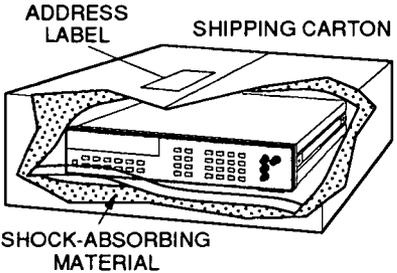
Use the steps in Figure 1-2 as guidelines to perform initial inspection for the HP 3245A Universal Source. Installation Instructions are provided in the HP 3245A Operating and Programming Manual. Performance Verification tests (optional) are provided in the HP 3245A Calibration Manual.

WARNING

To avoid possible hazardous electrical shock, do not perform electrical tests if there are signs of shipping damage to the shipping container or to the instrument.

Shipping Guidelines

Follow the steps in Figure 1-3 to return the HP 3245A Universal Source to a Hewlett-Packard Sales and Support Office or Service Center.



1 Prepare the Universal Source

- Remove user wiring from front panel
- Attach tag to instrument that identifies
 - Owner
 - Model Number/Serial Number
 - Service Required

2 Package the Universal Source

- Place packaged instrument in shipping carton*
- Place 75 to 100 mm (3 to 4 inches) of shock-absorbing material around the instrument .
- Seal the shipping carton securely.
- Mark the shipping carton FRAGILE.

3 Ship the Universal Source to Hewlett-Packard

- Place address label on shipping carton **
- Send carton to Hewlett-Packard

* We recommend that you use the same shipping materials as those used in factory packaging (available from Hewlett-Packard). For other (commercially-available) shipping materials, use a double-wall carton with minimum 2.4 MPa (350 psi) test.

** A list of Sales and Support Offices can be found at the back of this manual.

Figure 1-3. Packaging/Shipping Guidelines

Replaceable Parts

Introduction

This chapter contains information to order replaceable parts for the HP 3245A Universal Source. Table 2-1 lists the assembly part numbers and quantities for all currently available HP 3245A Universal Source configurations. Table 2-2 lists the assembly, electrical part, and mechanical part numbers for the Universal Source. Table 2-3 shows reference designators for parts in Table 2-2, and Table 2-4 shows the manufacturer code list for these parts.

To order a part listed in Table 2-2, specify the Hewlett-Packard part number and the quantity required. Send the order to your nearest Hewlett-Packard Sales and Support Office. A list of Sales and Support Offices is at the back of this manual.

Replaceable Parts List

Table 2-2, HP 3245A Universal Source Replaceable Parts, lists replaceable parts for the Universal Source. See Figure 2-1, Figure 2-2, or Figure 2-3 for locations of selected parts.

Table 2-1. HP 3245A Configurations/Options

HP 3245A Option	Reference Designator and Part Number (prior to serial number 2831A01139)	Reference Designator and Part Number (serial number 2831A01140 to 2831A01562)	Reference Designator and Part Number (serial number 2831A01563 and later)
Standard	A1 03245-66501 REV B [1 ea] A2 03245-66502 REV B [1 ea] A5 03245-66505 [1 ea] A6 03245-66506 [1 ea] A7 03458-66507 [1 ea]	A1 03245-66511 REV C [1 ea] A2 03245-66502 REV C [1 ea] A5 03245-66505 [1 ea] A6 03245-66506 [1 ea] A7 03458-66507 [1 ea]	A1 03245-66511 REV C [1 ea] A2 03245-66502 REV C [1 ea] A5 03245-66505 [1 ea] A6 03245-66506 [1 ea] A7 03458-66507 [1 ea]
Option 001	A1 03245-66501 REV B [1 ea] A2 03245-66502 REV B [1 ea] A5 03245-66505 [1 ea] A6 03245-66506 [1 ea] A7 03458-66507 [1 ea] A11 03245-66501 REV B [1 ea]	A1 03245-66511 REV C [1 ea] A2 03245-66502 REV C [1 ea] A5 03245-66505 [1 ea] A6 03245-66506 [1 ea] A7 03458-66507 [1 ea] A11 03245-66511 REV C [1 ea]	A1 03245-66511 REV C [1 ea] A2 03245-66502 REV C [1 ea] A5 03245-66505 [1 ea] A6 03245-66506 [1 ea] A7 03458-66507 [1 ea] A11 03245-66511 REV C [1 ea]
Option 002	N/A	A1 03245-66511 REV C [1 ea] A2 03245-66502 REV C [1 ea] A3 03245-66503 [1 ea] A5 03245-66505 [1 ea] A6 03245-66506 [1 ea] A7 03458-66507 [1 ea]	A1 03245-66517 [1 ea] A2 03245-66516 [1 ea] A3 03245-66503 [1 ea] A5 03245-66505 [1 ea] A6 03245-66506 [1 ea] A7 03458-66507 [1 ea]

Table 2-2. HP 3245A Universal Source Replaceable Parts

Reference Designator	HP Part Number	Qty	Part Description	Mfr. Code	Mfr. Part Number
			ASSEMBLIES/CABLES/MANUALS ASSEMBLIES (SEE FIGURE 2-1 FOR LOCATION - REFER TO TABLE 2-1 FOR USAGE INFORMATION)		
A1	03245-66511	1	INGUARD SOURCE PCA (STD AND OPTION 001)	28480	03245-66511
A1	03245-66517	1	INGUARD SOURCE PCA (OPTION 002)	28480	03245-66517
A2	03245-66502	1	BACKPLANE PCA (STD AND OPTION 001)	28480	03245-66502
A2	03245-66516	1	BACKPLANE PCA (OPTION 002)	28480	03245-66516
A3	03245-66503	1	HIGH VOLTAGE AMP PCA (OPTION 002)	28480	03245-66503
A5	03245-66505	1	OUTGUARD LOGIC PRINTED CIRCUIT ASSEMBLY	28480	03245-66505
A6	03245-66506	1	OUTGUARD PWR SUPPLY PRINTED CIRCUIT ASSY	28480	03245-66506
A7	03458-66507	1	DISPLAY LOGIC PRINTED CIRCUIT ASSEMBLY	28480	03458-66507
A11	03245-66511	1	INGUARD SOURCE PCA (OPTION 001)	28480	03245-66511
	03245-60201	1	FRONT PANEL ASSEMBLY (STD AND OPTION 001)	28480	03245-60201
	03245-60202	1	FRONT PANEL ASSEMBLY (OPTION 002)	28480	03245-60202
			CABLES (SEE FIGURE 2-1)		
W1	03458-61601	1	20-PIN RIBBON CABLE ASSEMBLY	28480	03458-61601
W2	03245-61604	1	3M RIBBON 40P/20P CABLE ASSEMBLY	28480	03458-61602
W3	03458-61602	1	EXT I/O 4-WIRE CABLE ASSEMBLY	28480	03245-61604
W4	8120-1378	1	CABLE ASSEMBLY 18AWG	16428	CH7081
			MANUALS		
	03245-90001		OPERATING AND PROGRAMMING	28480	03245-90001
	03245-90013		CALIBRATION	28480	03245-90013
			ELECTRICAL PARTS (SEE FIGURE 2-1)		
B1	03458-68501	1	FAN ASSEMBLY	28480	03458-68501
F1M	2110-0202	1	FUSE .5A 250V 1.25X.25 UL	16428	MDL-1/2
FC2	2110-0565	1	FUSEHOLDER CAP 12A MAX FOR UL	28480	2110-0565
J1	1250-0083	1	CONNECTOR-RF BNC FEM SGL-HOLE FR 50-OHM	24931	28JR130-1
J2	1250-0083	1	CONNECTOR-RF BNC FEM SGL-HOLE FR 50-OHM	24931	28JR130-1
T1	9100-4749	1	TRANSFORMER-POWER 100/120/220/240V	05216	PX4881
			MECHANICAL PARTS (SEE FIGURE 2-1) - COMMON HARDWARE NOT ILLUSTRATED		
CVR1	03458-04101	1	COVER, TOP	28480	03458-04101
CVR2	03458-04102	1	COVER, BOTTOM	28480	03458-04102
FRM1	03458-00104	1	GUSSET, CENTER	28480	03458-00104
FRM2	03458-00106	1	CHASSIS, MAINFRAME	28480	03458-00106
FRM3	03458-00105	1	CHASSIS, OUTGUARD	28480	03458-00105
HDW1	1510-0038	1	BINDING POST ASSY SGL THD-STUD	74970	111-2223-001
HDW2	2950-0006	1	NUT-HEX-DBL-CHAM 1/4-32-THD .094-IN-THK	73734	9000
HDW3	2190-0027	1	WASHER-LK INTL T 1/4 IN .256-IN-ID	78189	1914-00
HDW4	2190-0119	2	WASHER-FL 15/32 IN .48-IN-ID .75-IN-OD	73734	1499
HDW5	2190-0577	2	WASHER-LK NO. 10 .194-IN-ID .294-IN-OD	28480	2190-0577
HDW6	2190-0577		WASHER-LK NO. 10 .194-IN-ID .294-IN-OD	28480	2190-0577
HDW7	2190-0432	4	WASHER-LK 5/16 IN .319-IN-ID .575-IN-OD	28480	2190-0432
HDW8	2190-0432		WASHER-LK 5/16 IN .319-IN-ID .575-IN-OD	28480	2190-0432
HDW9	2190-0432		WASHER-LK 5/16 IN .319-IN-ID .575-IN-OD	28460	2190-0432
HDW10	2190-0432		WASHER-LK 5/16 IN .319-IN-ID .575-IN-OD	28480	2190-0432

Table 2-2. HP 3245A Universal Source Replaceable Parts

Reference Designator	HP Part Number	Qty	Part Description	Mfr. Code	Mfr. Part Number
			MECHANICAL PARTS (SEE FIGURE 2-1) - COMMON HARDWARE NOT ILLUSTRATED		
HDW11	2190-0119		WASHER-FL 15/32 IN .48-IN-ID .75-IN-OD	73734	1499
HDW12	2190-0037	1	WASHER-LK 1/2 IN .512-IN-ID .789-IN-OD	78189	1224-08
HDW13	2190-0099	5	WASHER-LK 7/16 IN .472-IN-ID .607-IN-OD	54294	16-886
HDW14	2190-0099		WASHER-LK 7/16 IN .472-IN-ID .607-IN-OD	54294	16-886
HDW15	2190-0099		WASHER-LK 7/16 IN .472-IN-ID .607-IN-OD	54294	16-886
HDW16	2190-0099		WASHER-LK 7/16 IN .472-IN-ID .607-IN-OD	54294	16-886
HDW17	2950-0035	5	NUT-HEX-DBL-CHAM 15/32-32-THD	28480	2950-0035
HDW18	2950-0035		NUT-HEX-DBL-CHAM 15/32-32-THD	28480	2950-0035
HDW19	2950-0035		NUT-HEX-DBL-CHAM 15/32-32-THD	28480	2950-0035
HDW20	2950-0054	1	NUT-HEX-DBL-CHAM 1/2-28-THD .125-IN-THK	28480	2950-0054
HDW21	2950-0001	2	NUT-HEX-DBL-CHAM 3/8-32-THD .094-IN-THK	73734	9002
HDW22	2950-0001		NUT-HEX-DBL-CHAM 3/8-32-THD .094-IN-THK	73734	9002
HDW23	0360-1632	2	TERMINAL-SOLDER LUG LK-MTG FOR-#3/8-SCR	79963	761-3/8
HDW24	0360-1632		TERMINAL-SOLDER LUG LK-MTG FOR-#3/8-SCR	79963	761-3/8
HDW25	2190-0099		WASHER-LK 7/16 IN .472-IN-ID .607-IN-OD	54294	16-886
HDW26	2950-0035		NUT-HEX-DBL-CHAM 15/32-32-THD	28480	2950-0035
HDW27	2950-0035		NUT-HEX-DBL-CHAM 15/32-32-THD	28480	2950-0035
HDW28	3050-0604	2	WASHER-FL 7/16 IN .5-IN-ID .75-IN-OD	86928	5710-94-16
HDW29	3050-0604		WASHER-FL 7/16 IN .5-IN-ID .75-IN-OD	86928	5710-94-16
HDW30	00310-48801	4	INSULATOR	28480	00310-48801
HDW31	00310-48801		INSULATOR	28480	00310-48801
HDW32	00310-48801		INSULATOR	28480	00310-48801
HDW33	00310-48801		INSULATOR	28480	00310-48801
HDW34	3050-0891	1	WASHER-FL 3.0 MM 3.3-MM-ID 6.85-MM-OD	28480	3050-0891
KYC1	5041-0564	1	PB 1/4-COWHT	28480	5041-0564
MP1	03458-01201	1	BRACKET, TRANSFORMER	28480	03458-01201
MP4	03458-24701	4	STANDOFF-HEX, (MALE/FEMALE)	28480	03458-24701
MP5	03458-24701		STANDOFF-HEX, (MALE/FEMALE)	28480	03458-24701
MP6	03458-24701		STANDOFF-HEX, (MALE/FEMALE)	28480	03458-24701
MP7	03458-24701		STANDOFF-HEX, (MALE/FEMALE)	28480	03458-24701
MP8	03458-47901	1	BEZEL OVERLAY, REAR	28480	03458-47901
MP9	03458-84303	1	LABEL, KEYBOARD OVERLAY	28480	03458-84303
MP10	3150-0300	1	FILTER-AIR NYLON 2.3-IN-OD .75-IN-LG	28480	3150-0300
MP11	2190-0586	4	WASHER-LK HLCL 4.0 MM 4.1-MM-ID 7.6-MM-OD	28480	2190-0586
MP12	03458-43701	1	PUSHROD, 186.2 L	28480	03458-43701
MP13	2190-0586		WASHER-LK HLCL 4.0 MM 4.1-MM-ID 7.6-MM-OD	28480	2190-0586
MP14	2190-0586		WASHER-LK HLCL 4.0 MM 4.1-MM-ID 7.6-MM-OD	28480	2190-0586
MP15	2190-0586		WASHER-LK HLCL 4.0 MM 4.1-MM-ID 7.6-MM-OD	28480	2190-0586
MP16	0390-0006	4	INSULATOR-FLANGE-BUSHING NYLON	73734	103304
MP17	0390-0006		INSULATOR-FLANGE-BUSHING NYLON	73734	103304

Table 2-2. HP 3245A Universal Source Replaceable Parts

Reference Designator	HP Part Number	Qty	Part Description	Mfr. Code	Mfr. Part Number
			MECHANICAL PARTS (SEE FIGURE 2-1) - COMMON HARDWARE NOT ILLUSTRATED		
MP18	0390-0006		INSULATOR-FLANGE-BUSHING NYLON	73734	103304
MP19	0390-0006		INSULATOR-FLANGE-BUSHING NYLON	73734	103304
MP20	3050-0893	4	WASHER-FL 4.0 MM 4.4-MM-ID 8.85-MM-OD	28480	3050-0893
MP21	3050-0893		WASHER-FL 4.0 MM 4.4-MM-ID 8.85-MM-OD	28480	3050-0893
MP22	3050-0893		WASHER-FL 4.0 MM 4.4-MM-ID 8.85-MM-OD	28480	3050-0893
MP23	3050-0893		WASHER-FL 4.0 MM 4.4-MM-ID 8.85-MM-OD	28480	3050-0893
MP24	1250-0161	1	ADAPTER-COAX STRAIGHT F-BNC F-BNC	24931	28AS101-2
MP25	1400-0249	4	CABLE TIE .062- .625-DIA .091-WD NYLON	59730	TY-23M-8
MP26	1400-0249		CABLE TIE .062- .625-DIA .091-WD NYLON	59730	TY-23M-8
MP27	1400-0249		CABLE TIE .062- .625-DIA .091-WD NYLON	59730	TY-23M-8
MP28	1400-0249		CABLE TIE .062- .625-DIA .091-WD NYLON	59730	TY-23M-8
MP34	1460-1311	1	SPRING, GROUND	28480	1460-1311
MP35	1460-1345	2	TILT STAND STAINLESS STEEL	28480	1460-1345
MP36	1460-1345		TILT STAND STAINLESS STEEL	28480	1460-1345
MP41	5001-0538	2	TRIM STRIP SIDE 3 1/2	28480	5001-0538
MP42	5001-0538		TRIM STRIP SIDE 3 1/2	28480	5001-0538
MP43	5041-8801	4	FOOT FULL MOD	28480	5041-8801
MP44	5041-8801		FOOT FULL MOD	28480	5041-8801
MP45	5041-8801		FOOT FULL MOD	28480	5041-8801
MP46	5041-8801		FOOT FULL MOD	28480	5041-8801
MP47	5041-8802	1	TRIM STRIP TOP	28480	5041-8802
MP49	5041-8819	2	HANDLE CAP	28480	5041-8819
MP50	5041-8819		HANDLE CAP	28480	5041-8819
MP51	5041-8820	2	HANDLE CAP	28480	5041-8820
MP52	5041-8820		HANDLE CAP	28480	5041-8820
MP53	5062-3704	2	STRAP HANDLE-18 INCH	28480	5062-3704
MP54	5062-3704		STRAP HANDLE-18 INCH	28480	5062-3704
MP57	5180-6650	2	STANDOFF, HEX	28480	5180-6650
MP58	5180-6650		STANDOFF, HEX	28480	5180-6650
SCW1	0515-1404	4	SCREW-MACHINE M4 X 0.7 55MM-LG PAN-HD	28480	0515-1414
SCW2	0515-1404		SCREW-MACHINE M4 X 0.7 55MM-LG PAN-HD	28480	0515-1414
SCW3	0515-1404		SCREW-MACHINE M4 X 0.7 55MM-LG PAN-HD	28480	0515-1414
SCW4	0515-1404		SCREW-MACHINE M4 X 0.7 55MM-LG PAN-HD	28480	0515-1414
SCW5	0515-0433	4	SCREW-MACHINE ASSY M4 X 0.7 8MM-LG PAN-HD	28480	0515-0433
SCW6	0515-0433		SCREW-MACHINE ASSY M4 X 0.7 8MM-LG PAN-HD	28480	0515-0433
SCW7	0515-0433		SCREW-MACHINE ASSY M4 X 0.7 8MM-LG PAN-HD	28480	0515-0433
SCW8	0515-0433		SCREW-MACHINE ASSY M4 X 0.7 8MM-LG PAN-HD	28480	0515-0433
SCW11	0515-0372	27	SCREW-MACHINE ASSY M3 X 0.5 8MM-LG PAN-HD	28480	0515-0372
SCW12	0515-0372		SCREW-MACHINE ASSY M3 X 0.5 8MM-LG PAN-HD	28480	0515-0372
SCW13	0515-0372		SCREW-MACHINE ASSY M3 X 0.5 8MM-LG PAN-HD	28480	0515-0372

Table 2-2. HP 3245A Universal Source Replaceable Parts

Reference Designator	HP Part Number	Qty	Part Description	Mfr. Code	Mfr. Part Number
			MECHANICAL PARTS (SEE FIGURE 2-1) - COMMON HARDWARE NOT ILLUSTRATED		
SCW14	0515-0372		SCREW-MACHINE ASSY M3 X 0.5 8MM-LG PAN-HD	28480	0515-0372
SCW15	0515-0372		SCREW-MACHINE ASSY M3 X 0.5 8MM-LG PAN-HD	28480	0515-0372
SCW16	0515-0372		SCREW-MACHINE ASSY M3 X 0.5 8MM-LG PAN-HD	28480	0515-0372
SCW17	0515-0367	1	SCREW-MACHINE ASSY M2.5 X 0.45 8MM-LG PAN-HD	28480	0515-0367
SCW21	0515-1132	4	SCREW-MACHINE M3 X 0.8 10MM-LG FLAT-HD	28480	0515-1132
SCW22	0515-1132		SCREW-MACHINE M3 X 0.8 10MM-LG FLAT-HD	28480	0515-1132
SCW23	0515-1132		SCREW-MACHINE M3 X 0.8 10MM-LG FLAT-HD	28480	0515-1132
SCW24	0515-1132		SCREW-MACHINE M3 X 0.8 10MM-LG FLAT-HD	28480	0515-1132
SCW41	0624-0530	2	SCREW-TPG 8-16 .375-IN-LG PAN-HD TORX	28480	0624-0530
SCW42	0624-0530		SCREW-TPG 8-16 .375-IN-LG PAN-HD TORX	28480	0624-0530
	03245-00101	1	DECK-SOURCE BRD	28480	03245-00101
	03245-04101	1	PLATE-BNC TERMINAL	28480	03245-04101
	03245-04701	3	SPACER-BNC MOUNTING (QTY 6 FOR OPTION 001)	28480	03245-04701
	03245-24701	1	SPACER-HEX F/F M3.0X50MM	28480	03245-24701
	03245-69301	1	WINDOW-DISPLAY SS P/O FRONT PANEL ASSY	28480	03245-69301
	03245-81901	1	SW-PADS, RUBBER P/O FRONT PANEL ASSY	28480	03245-81901
	03245-84302	1	LABEL-PANEL, REAR	28480	03245-84302
	0624-0681	1	SCREW-TPG 4-20 .25-IN-LG PAN-HD-TORX	28480	0624-0681
	1250-0781		ADAPTER-COAX TEE F-BNC M-BNC F-BNC	24931	28AT101-2
	1400-0617	3	CLIP-SPRING .375-DIA .375-WD PLASTIC	06915	TC-30-1
	5180-0409	1	SPRING CLIP	28480	5180-0409
	8160-0470	2	RFI STRIP-FINGERS BE-CU SN-PL .38-IN-WD	30817	97-541-02-X
A1	03245-66511		INGUARD SOURCE PCA (STD AND OPTION 001)	28480	03245-66511
A1	03245-66517		INGUARD SOURCE PCA (OPTION 002)	28480	03245-66517
A11	03245-66511		INGUARD SOURCE PCA (OPTION 001)	28480	03245-66511
A1/A11F1	2110-0698	3	FUSE-SUBMINIATURE 2.5A 125V NTD AX	75915	R25102.5T1
A1/A11F2	2110-0698		FUSE-SUBMINIATURE 2.5A 125V NTD AX	75915	R25102.5T1
A1/A11F3	2110-0698		FUSE-SUBMINIATURE 2.5A 125V NTD AX	75915	R25102.5T1
A2	03245-66502		BACKPLANE PCA (STD AND OPTION 001)	28480	03245-66502
A2	03245-66516		BACKPLANE PCA (OPTION 002)	28480	03245-66516
A2K1	0490-1423	1	RELAY-REED 1C 250MA 28VDC 5VDC COIL 3VA	71707	7001-5077
A3	03245-66503	1	HIGH VOLTAGE AMP PCA (OPTION 002)	28480	03245-66503
A3F101	2110-0698	1	FUSE-SUBMINIATURE 2.5A 125V NTD AX	75915	R25102.5T1
A3F201	2110-0757	1	FUSE-SUBMINIATURE 0.63A 125V AX UL CSA	75915	251.062
A3F202	2110-0679	3	FUSE-SUBMINIATURE 1.5A 125V NTD AX UL	75915	R25101.5T1
A3F203	2110-0679		FUSE-SUBMINIATURE 1.5A 125V NTD AX UL	75915	R25101.5T1
A3F204	2110-0679		FUSE-SUBMINIATURE 1.5A 125V NTD AX UL	75915	R25101.5T1
A5	03245-66505	1	OUTGUARD LOGIC PRINTED CIRCUIT ASSY	28480	03245-66505
A5JM600A	1258-0141	1	JUMPER-REMOVABLE FOR .025 IN SQ PINS	18873	65474-004

Table 2-3. HP 3245A Universal Source Reference Designators

HP 3245A Reference Designators	
A..... assembly	JM..... jumper
PCA..... printed circuit assembly	K..... relay
B..... fan	KYC..... keycap
BRK..... bracket	MP..... mechanical part
CS..... case	PNL..... panel
CVR..... cover	SCW..... screw
F..... fuse	SHD..... shield
FC..... fuse cap	T..... transformer
FRM..... frame	W..... cable assembly
J..... electrical connector (jack)	

Table 2-4. HP 3245A Universal Source Code List of Manufacturers

Mfr. Code	Manufacturer's Name	Manufacturer's Address	Zip Code
00779	AMP INC	HARRISBURG PA US	17111
05216	PHOENIX TRANSFORMER CO	PHOENIX AZ US	85040
06915	RICHCO PLASTIC CO	CHICAGO IL US	60646
12014	CHICAGO RIVET & MACHINE CO	NAPERVILLE IL US	60540
16428	COOPER INDUSTRIES INC	HOUSTON TX US	77210
18873	DUPONT E I DE NEMOURS & CO	WILMINGTON DE US	19801
24931	SPECIALTY CONNECTOR CO	FRANKLIN IN US	46131
27264	MOLEX INC	LISLE IL US	60532
28480	HEWLETT-PACKARD COMPANY - CORP	PALO ALTO CA US	94304
30817	INSTRUMENT SPECIALTIES CO INC	DEL WATER GP PA US	07424
46384	PENN ENGINEERING & MFG CORP	DOYLESTOWN PA US	18901
54294	SHALLCROSS INC	NORTHBROOK IL US	60062
57771	STIMPSON EDWIN B CO INC	BROOKLYN NY US	11705
59730	THOMAS & BETTS CORP	RARITAN NJ US	08869
71707	COTO WABASH	PROVIDENCE RI US	02907
71983	DOW CHEMICAL CO	MIDLAND MI US	48674
73734	FEDERAL SCREW PRODUCTS CO	CHICAGO IL US	60618
74970	EF JOHNSON CO	WASECA MN US	56093
75915	LITTELFUSE INC	DES PLAINES IL US	60016
76381	3M CO	ST PAUL MN US	55144
78189	ILLINOIS TOOL WORKS INC SHAKEPROOF	ELGIN IL US	60126
79963	ZIERICK MFG CO	MT KISCO NY US	10549
80509	AVERY LABEL CO	MONROVIA CA US	91016
86928	SEASTROM MFG CO	GLENDALE CA US	91201
90201	EMHART CORP	FARMINGTON CT US	06032

NOTE

Part numbers and reference designators without option designation are used on all configurations.

Parts Locators

Figure 2-1 through 2-3 shows locations of selected assemblies, electrical parts, and mechanical parts for the HP 3245A Universal Source.

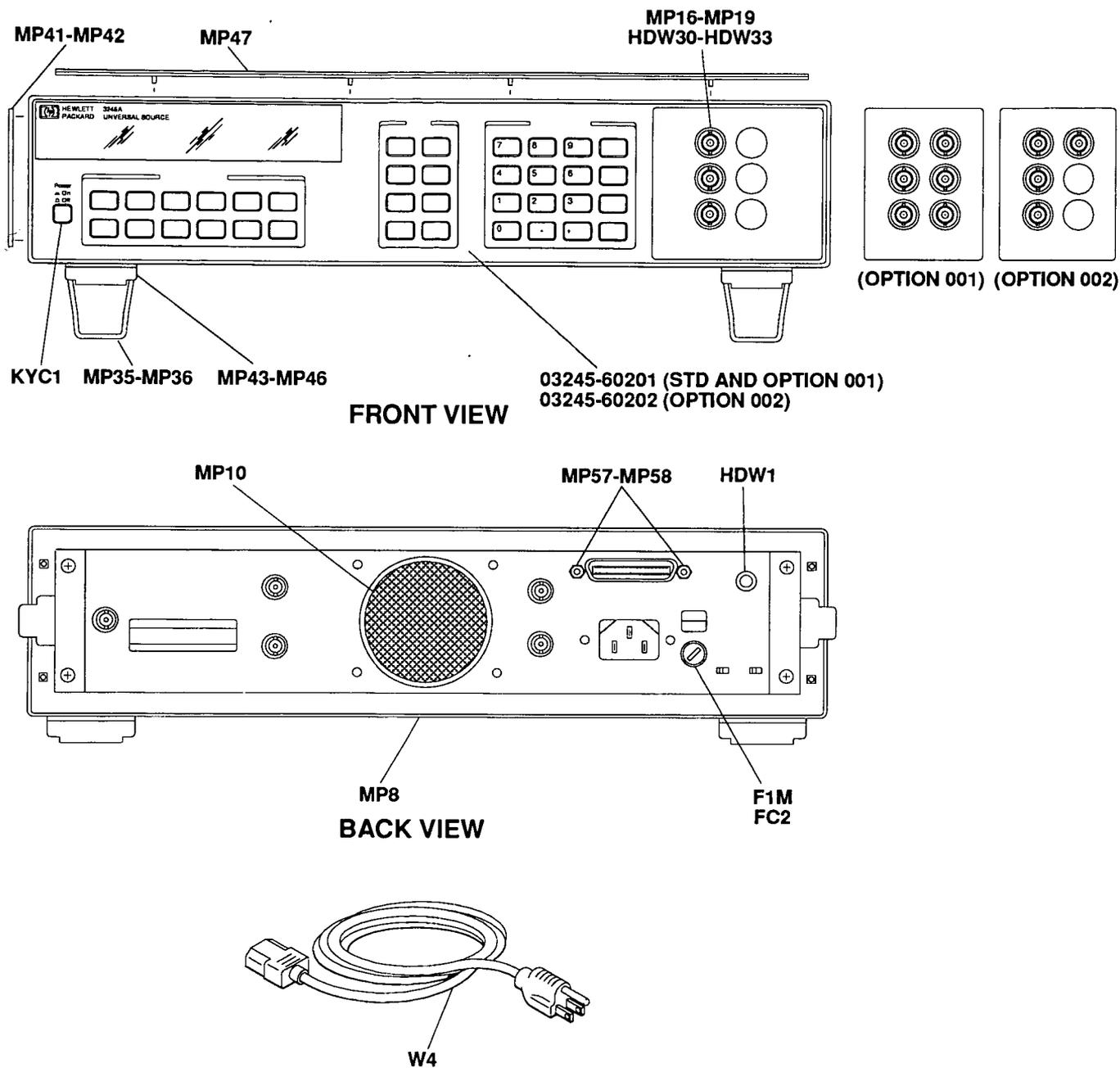


Figure 2-1. Universal Source Parts, Front/Rear View

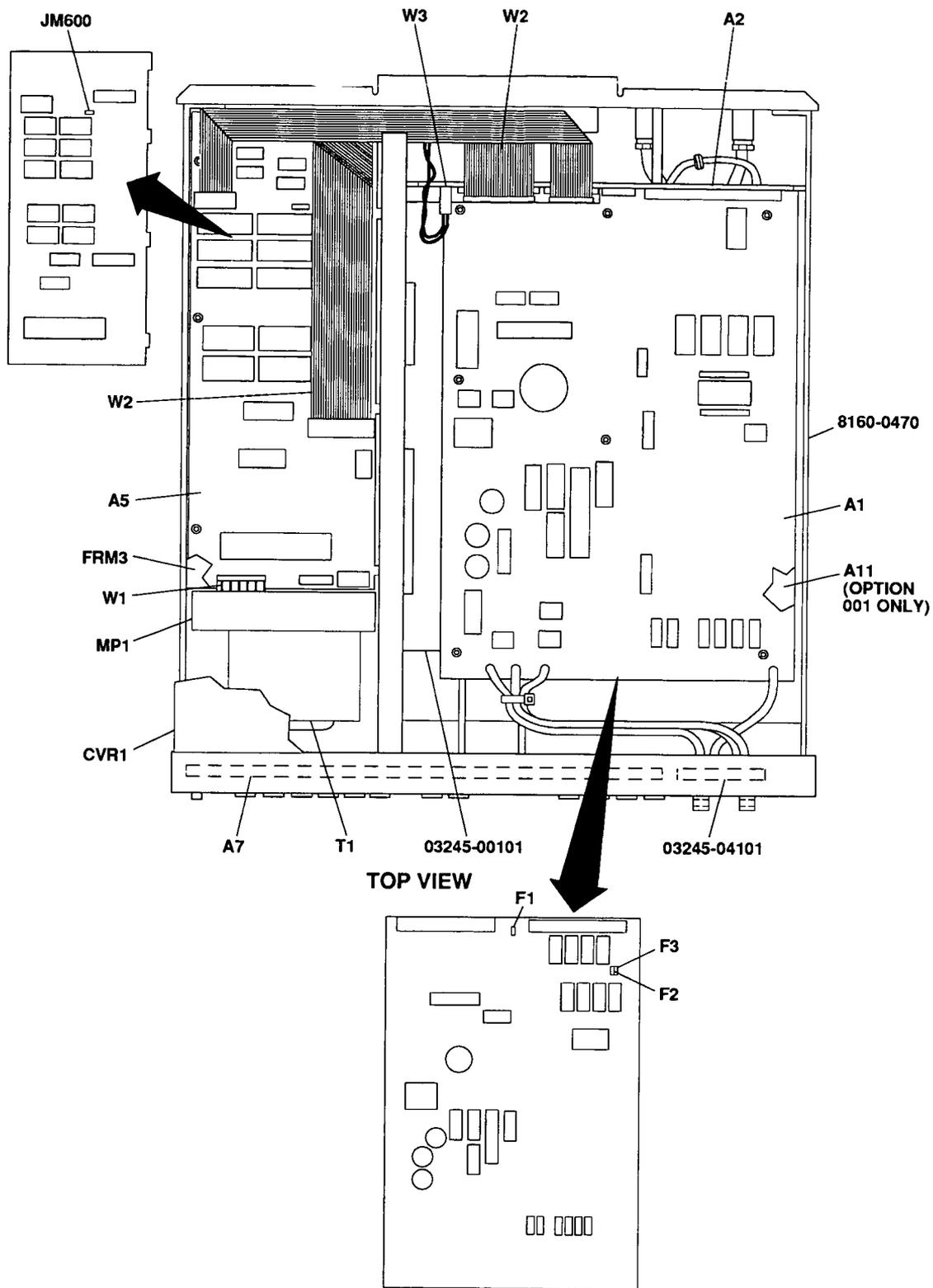


Figure 2-2. Universal Source Parts, Top View

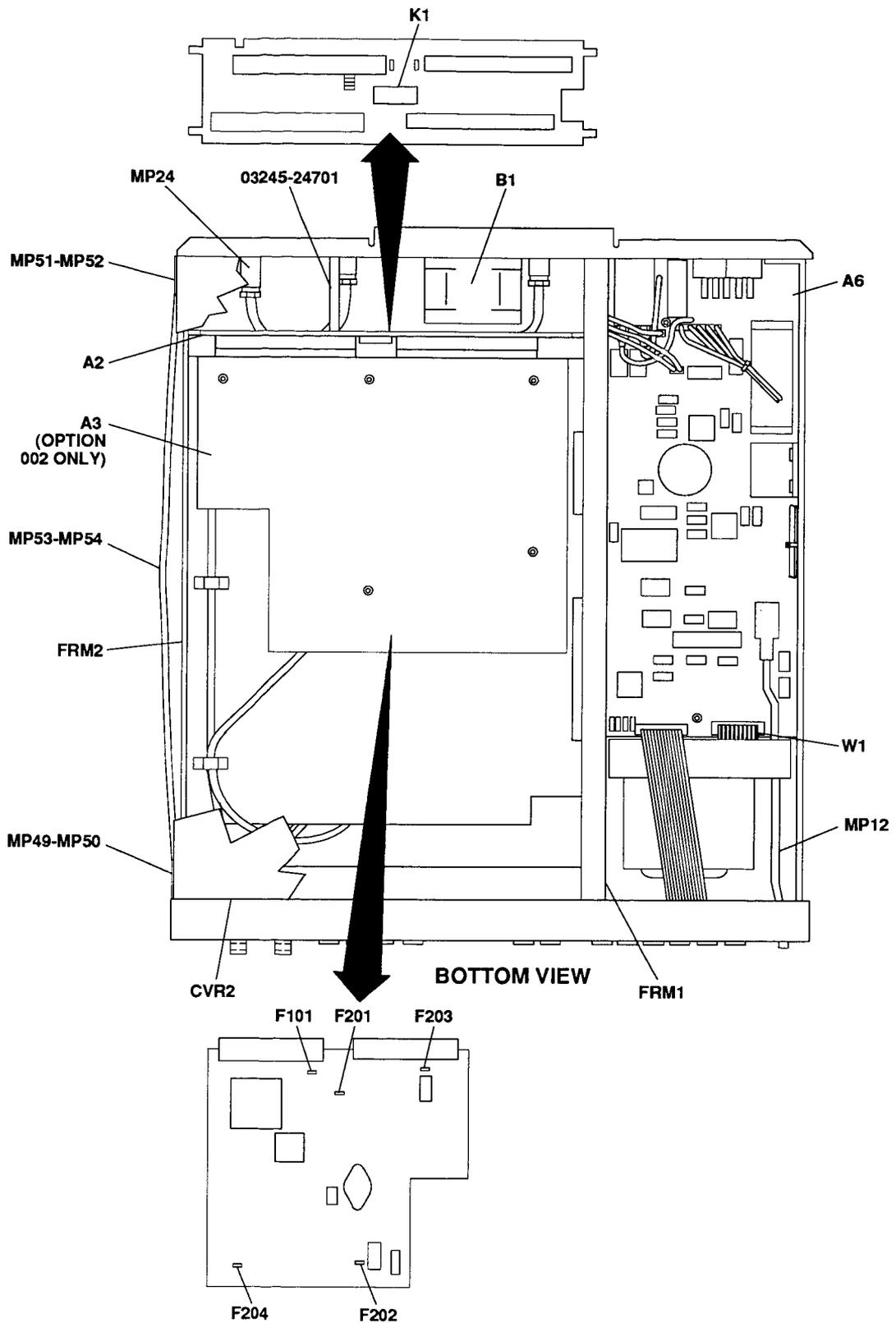


Figure 2-3. Universal Source Parts, Bottom View

Introduction

This chapter contains service information for the HP 3245A Universal Source. Also included are troubleshooting, repair, and maintenance guidelines.

WARNING

Do not perform any of the service procedures shown unless you are a qualified, service-trained technician and have read the WARNINGS and CAUTIONS in Chapter 1.

Equipment Required

Equipment required for universal source troubleshooting and repair is listed in Table 1-1, Recommended Test Equipment. Any equipment that satisfies the requirements given in the table may be substituted.

Service Aids

See Chapter 2 - Replaceable Parts for descriptions and locations of the HP 3245A Universal Source parts. Service notes, manual updates, and service literature for the instrument may be available through Hewlett-Packard. For information, contact your nearest Hewlett-Packard Sales and Service Office.

Troubleshooting Techniques

To troubleshoot an HP 3245A Universal Source problem you must first identify the problem and then isolate the cause of the problem to a replaceable assembly/part. See Chapter 2 - Replaceable Parts for descriptions and locations of HP 3245A Universal Source replaceable parts.

NOTE

If the problem cannot be isolated to a user-replaceable part shown in Table 2-1 and/or Table 2-2 we suggest you return the HP 3245A Universal Source to Hewlett-Packard for repair. See Chapter 2 - Replaceable Parts for procedures to return the HP 3245A Universal Source to Hewlett-Packard.

Identifying the Problem

Table 3-1 lists a variety of problems that can occur in the HP 3245A Universal Source, along with symptoms and recommended troubleshooting procedures. If any of these failure modes match your instrument's problem type, turn to that portion in this chapter and follow the diagnostic steps provided. If the problem cannot be identified using these steps, perform "General Troubleshooting" using the fault location diagram in Figure 3-1.

Table 3-1. HP 3245A Universal Source Typical Problems

Problem Type	Symptom
Turn-on failures	Inoperative with blank display Inoperative with unintelligible message in the display Operative with an ERROR\$ message in the display
Self-test failures	ERROR\$ generated with the execution of FTEST
Performance failures	Instrument that wakes up and passes self-test but fails to meet performance specifications.
Miscellaneous failures	HP-IB problems Fan inoperative

Making Visual Checks

Visual checks for the HP 3245A Universal Source include the following. See Table 3-2 for typical symptoms/actions.

- Check switches/jumpers
- Check for heat damage
- Checking cable connections

Table 3-2. HP 3245A Universal Source Visual Test/Checks

Test/Check	Reference Designator	Check	Action/Notes
Heat Damage	N/A	Discolored PC boards Damaged insulation Evidence of arcing	If there is damage, do not operate the universal source until you have corrected the problem.
Jumper Settings	A5JM132 and A5JM600	A5JM132 no jumper installed A5JM600 jumper	Install/remove jumpers as required.
Component Assembly	Main Fuse (F1M) Fuses A1F1-3 Fuses A3F101, A3F201-A3F204 (option 002) W1-W4 Cable Assemblies	Fuse continuity Fuse continuity Fuse continuity Disconnected, dirty, or bent pins	Check fuses with ohmmeter Straighten/clean pins

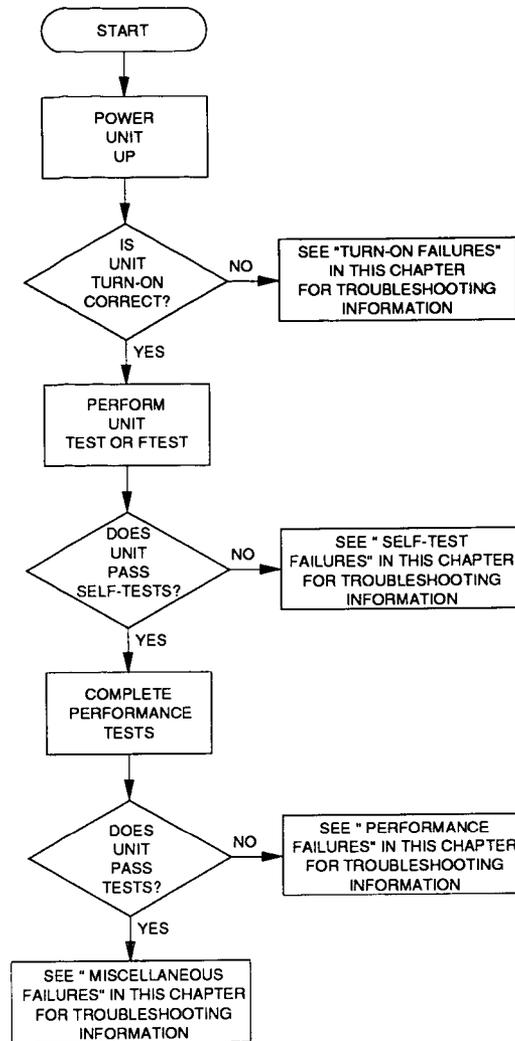


Figure 3-1. General Troubleshooting Diagram

Turn-on Failures

A turn-on self-test is automatically executed upon instrument power up. This test is controlled by firmware residing in ROM on the A5 Outguard Logic PCA. Typical turn-on errors include: inoperative instrument with a blank display, inoperative instrument with unintelligible messages on the display, and operative unit with an error string in the display.

Turn the Universal Source power switch to on and verify that it beeps once, displays "TESTING ROM", displays "TESTING RAM", then relays switch and the display shows "0.000000E + 0DCV".

- If this sequence executes as described, proceed with "Self-test Failures" to continue troubleshooting.
- If this sequence is incorrect, follow the turn-on failure diagnostics tree in Figure 3-2 to isolate these errors to the assembly level.

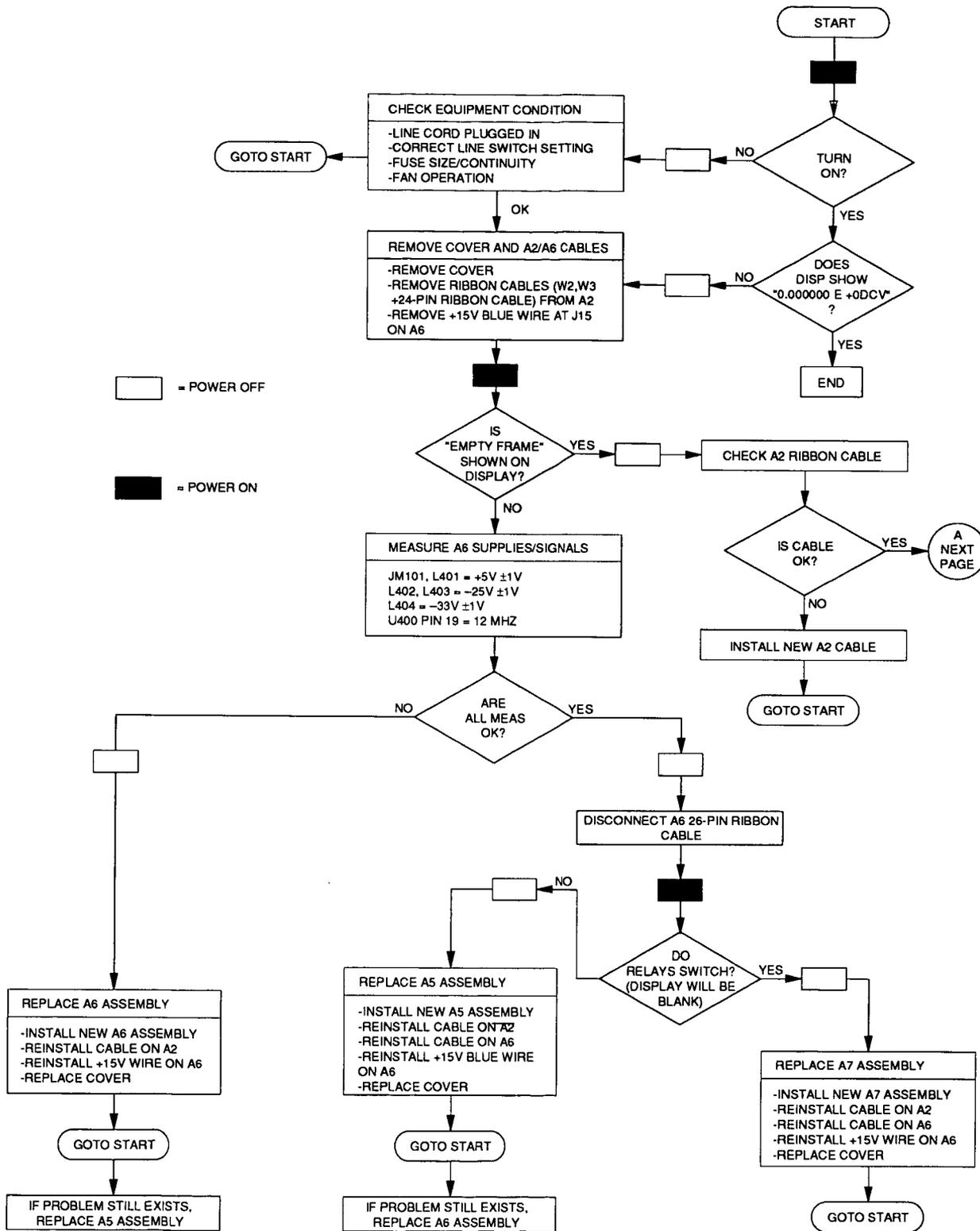


Figure 3-2. Turn-on Failure Troubleshooting Diagram (1 of 2)

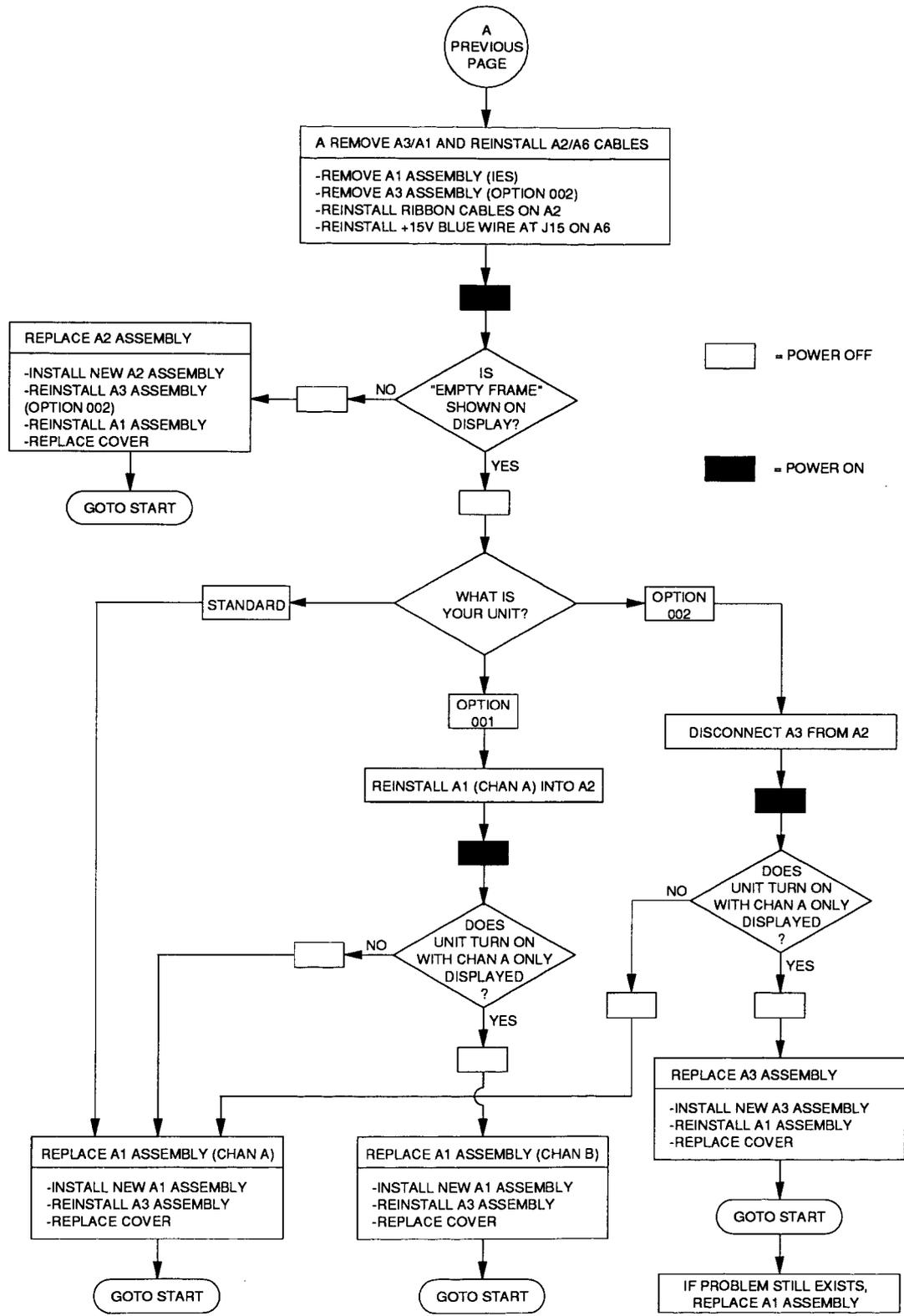


Figure 3-2. Turn-on Failure Troubleshooting Diagram (2 of 2)

Self-test Failures

Two individual self-tests can be executed if the Universal Source performs a successful turn-on: TEST and FTEST.

TEST

TEST is used to provide a basic confidence check of the Universal Source, and does not change the instrument's current state or set-up. Executing TEST from the front panel checks the display panel, then each source module register that can be addressed without affecting the module's I/O state. During the display panel test, all of the normally used display elements are lit (except the shift annunciator). During the source module portion, if any register fails to respond the test fails. The source module busy times are checked and compared to an internal table of limit values, and the contents of the ID registers of the source modules that are stored in the CPU memory at power-on are read and compared. If there are any changes in these read values, the test will fail.

NOTES

TEST performs only a minimum set of routines. If instrument problems are suspected, FTEST should be performed to verify source module functionality. If TEST or FTEST is executed without designating a channel number (using HP-IB only), the first test will be the display panel test. The display panel test is not executed if channel numbers are included with the TEST command. Refer to Chapters 6 and 8 in the HP 3245A Universal Source Operating and Programming Guide for more information on TEST.

TEST is executed (from the front panel) by pressing the shift (blue key), then the TEST key on the front panel. PASS or FAIL is returned to the front panel display at the completion of the tests.

- If PASS is displayed, and there is still uncertainty about instrument functionality, FTEST should be performed.
- If FAIL is displayed, verify that Cable Assembly W2 is not the problem.
- If cable W2 is OK, replace the A5 Outguard Logic PCA (A5).
- If that fails to correct the malfunction, replace the Inguard Source PCA (A1).
- If that fails to correct the malfunction, replace the Backplane PCA (A2).

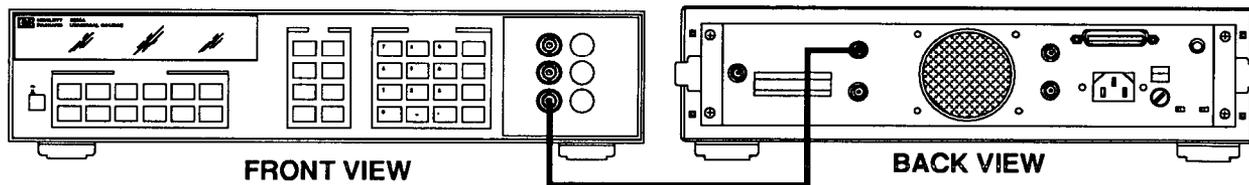
FTEST FTEST (fixtured test) is used to perform a full pass/fail functional test on the Inguard Source PCA specified.

NOTE

FTEST can be performed over the HP-IB interface or the Front Panel. Refer to Chapter 9 in the HP 3245A Universal Source Operating and Programming Guide for more information on the FTEST command.

Connect a BNC cable from the channel under test to the trigger I/O port of the same channel. Execute the FTEST *ch* command, where *ch* is the channel under test (where 0 = front panel A; 1 = rear panel A; 100 = front panel B; 101 = rear panel B). PASS or FAIL is returned to the front panel display at the completion of the test. If fail is returned, the ERR\$ is viewed by pressing the error key (! key) on the front panel.

Example: To test rear panel channel A connect channel A (rear) to the channel A trigger I/O on the front panel (as shown) and execute FTEST 1.



NOTE

Only the first four error messages are returned to the error buffer. Always troubleshoot the errors in the order given, as usually the first problem repaired will eliminate the rest.

- If PASS is displayed, repeat test for all channels.
- If FAIL is displayed after running FTEST 1 or FTEST 101, verify that relay A2K1 is not the problem. If the relay checks good, replace the Inguard Source PCA (A1) under test. If that fails to correct the malfunction, replace the Backplane PCA (A2).*
- If FAIL is displayed after running FTEST 0 or FTEST 100, replace the Inguard Source PCA (A1) under test.

Performance Failures

Performance test failures are problems that may not be detected during the turn-on and self-test procedures, but are detected during the performance tests. Refer to Chapters 2 and 3 in the *HP 3245A Calibration Manual* for Operation verification and performance tests.

NOTE

Before assuming that a performance test has failed, verify that the test equipment and performance test methods have sufficient accuracy to check the instrument. The Universal Source is very accurate and needs appropriately accurate standards to verify specifications. Be sure to check the accuracy requirements before troubleshooting performance test failures.

If a performance test has failed:

- Attempt a recalibration to correct the failed performance specification.
- If recalibration does not correct the problem, replace the Inguard Source PCA (A1) under test.
- Perform the turn-on, self-test, and failed performance test to verify that the performance problem has been corrected.

Miscellaneous Failures

If problems cannot be categorized as Turn-on, Self-test, or Performance Failures, use the following information to troubleshoot the malfunction:

HP-IB PROBLEMS

For HP-IB failures, check/clean all connector and interconnecting cable contacts. If malfunction remains, replace the A5 Outguard Logic PCA (A5).

FAN PROBLEMS

If the fan is not running, check the voltage at A6P3 for +15 Vdc. If +15V is present, replace the Fan (B1), otherwise, replace the Outguard Power Supply PCA (A6).

DISPLAY PROBLEMS

For front panel display problems (e.g., lights, etc.) replace the Display Logic PCA (A7).

Assembly/Disassembly Procedures

Procedures are provided for disassembly and reassembly of the following items:

- Covers
- A1/A11 Inguard Source Printed Circuit Assembly
- A2 Backplane Printed Circuit Assembly
- A3 High Voltage Amplifier Printed Circuit Assembly (Option 002 only)
- A5 Outguard Logic Printed Circuit Assembly
- A6 Outguard Power Supply Printed Circuit Assembly
- A7 Display Logic Printed Circuit Assembly

Reference Designator	Applies to Standard	Applies to Option 001	Applies to Option 002
A1	YES	YES	YES
A2	YES	YES	YES
A3	NO	NO	YES
A5	YES	YES	YES
A6	YES	YES	YES
A7	YES	YES	YES
A11	NO	YES	NO

WARNING

Capacitors inside the instrument may still be charged even if the instrument has been disconnected from its source of supply.

Tools Required

- #2 Pozi Drive
- #T-8 Torx driver
- #T-10 Torx driver
- #T-15 Torx driver
- 3/8 inch spin-tite
- 1/2 inch spin-tite
- 9/16 inch spin-tite
- 7 mm spin-tite
- 5/8 inch open-end wrench

Covers

1. Set power to OFF, and remove the power cable.
2. Remove both screws, then the front cap, rear cap, and strap handle from both sides of the cover (see Figure 3-3).
3. Remove four Torx T15 screws from the rear of the instrument, then remove the rear bezel (screws will remain in bezel).
4. Remove two Torx T10 screws from the side of the instrument.
5. Remove the top and bottom covers.
6. Reverse order to reinstall the cover.

NOTE

When reinstalling the cover, verify the RFI shield fingers are in place and not damaged. These fingers cause the cover to fit snugly, with positive electrical contact. DO NOT FORCE the cover into place.

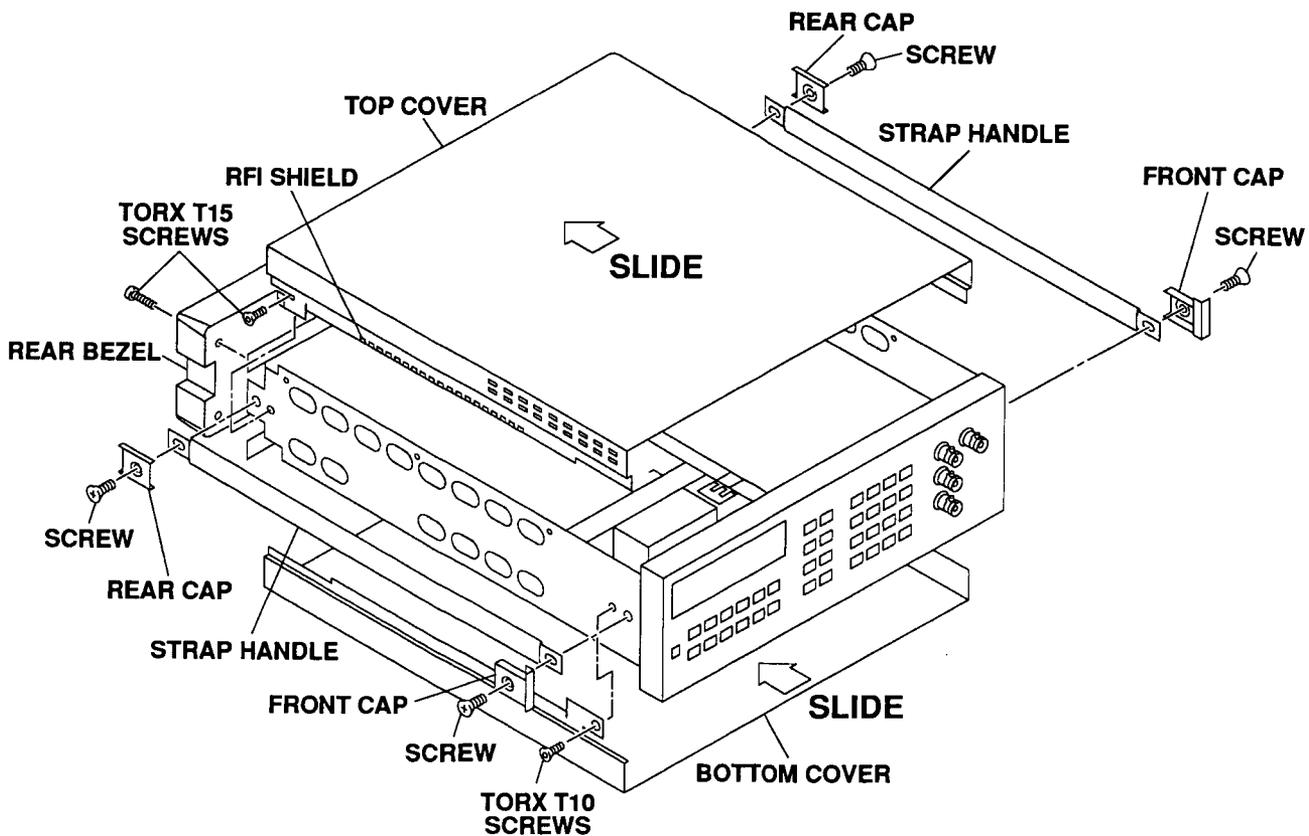


Figure 3-3. Remove and Replace Covers

A1/A11 Inguard Source PCA

1. Remove covers (refer to Figure 3-3).
-

NOTE

There may be 1 (STD) or 2 (Option 001) Inguard Source PCA's installed in the Universal Source. The procedure for each is the same, however, the illustration only shows one installed.

2. Locate the three screws on the side of the instrument that retain the metal deck in place. Remove the outer two screws and loosen the center screw (see Figure 3-4).

3. Slide the metal deck/Inguard Source PCA(s)/optional A3 High Voltage Amplifier PCA (if installed) combination toward the front of the instrument to disengage the PCA(s) from the A2 Backplane PCA connectors.
-

NOTE

The connectors may require some force to disengage. Do not pry on the connectors or the Backplane PCA. If necessary, pry in one of the cutouts between the right side frame and the sheet metal deck.

4. Remove the BNC connectors from the front panel.
5. Remove the seven T10 screws and the A1 Inguard Source PCA(s).
6. Reverse order to reinstall the A1 Inguard Source PCA(s).

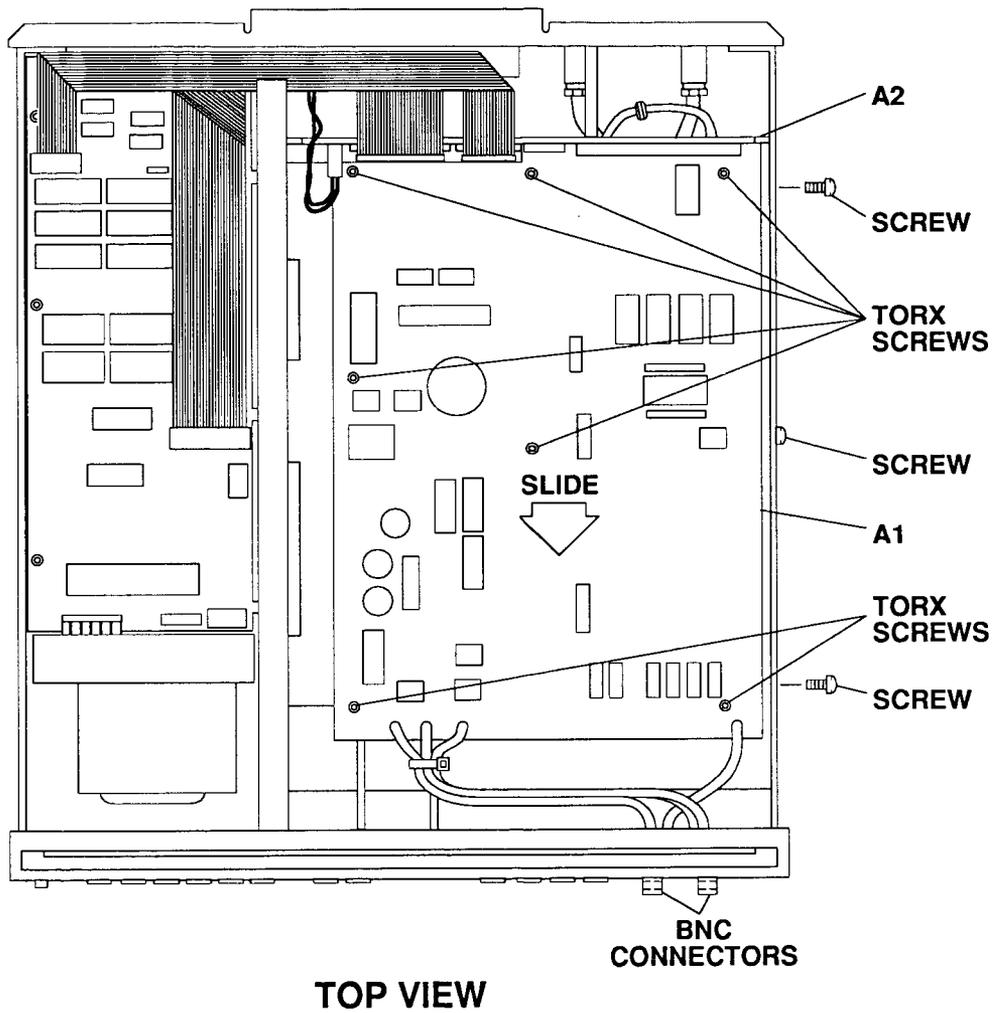


Figure 3-4. Remove and Replace A1/A11 Inguard Source PCA

A2 Backplane PCA

1. Remove covers (refer to Figure 3-3).
2. Disengage the connectors on the A1 Inguard Source PCA, and if installed the optional A3 High Voltage Amplifier PCA (refer to Figure 3-4 steps 2 and 3).
3. Disconnect W2, W3, and 24-pin cable assembly from the A2 Backplane PCA (refer to Figure 3-5).
4. Remove one Torx T10 screw, the two standoffs, and the A2 Backplane PCA.
5. Remove A2 Backplane PCA (standard) or A2 Backplane PCA/A3 High Voltage Amplifier PCA combination (Option 002).
6. Reverse order to reinstall the A2 Backplane PCA.

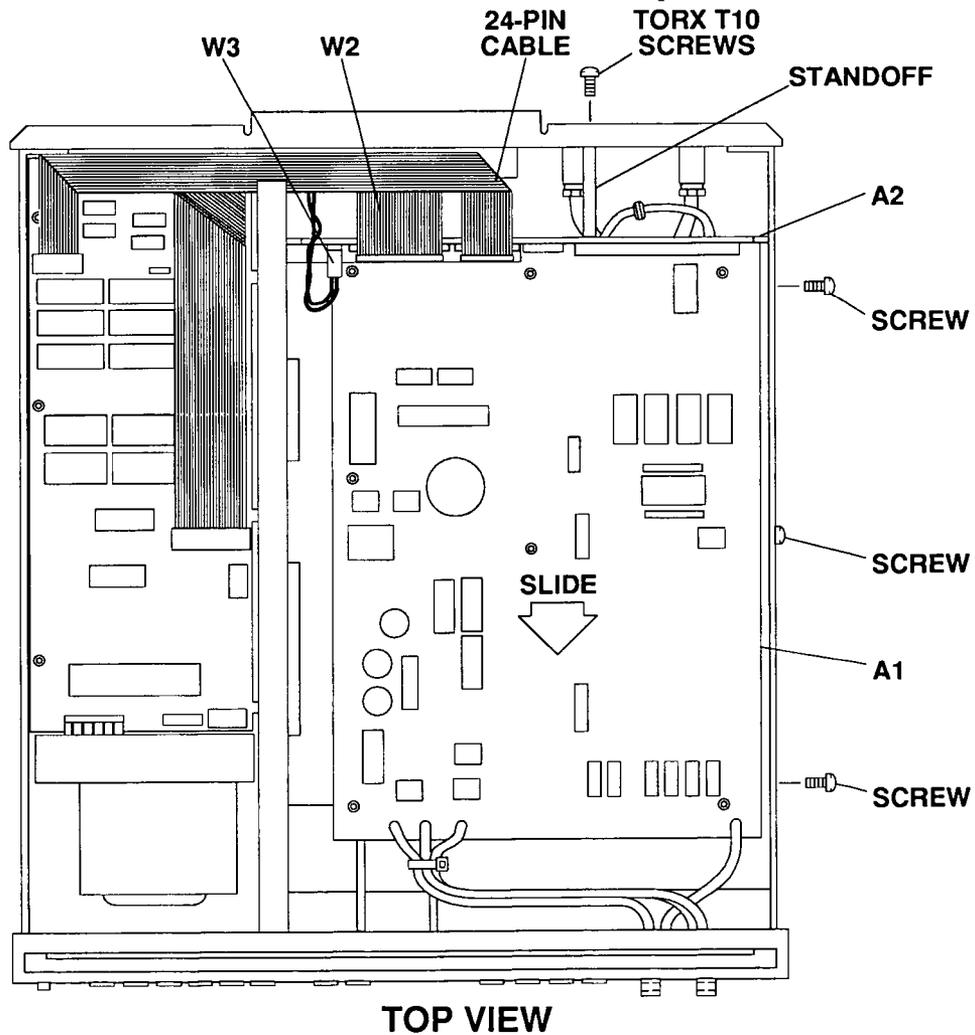


Figure 3-5. Remove and Replace A2 Backplane PCA

A3 High Voltage Amplifier PCA (Option 002 only)

1. Remove covers (refer to Figure 3-3).
2. Disengage the connectors on the A1 Inguard Source PCA/A3 High Voltage Amplifier PCA (refer to Figure 3-4 steps 2 and 3).
3. Disconnect coax cable assembly from A3 (refer to Figure 3-6).
4. Remove five Torx T10 screws and A3 High Voltage Amplifier PCA.
5. Reverse order to reinstall the A3 High Voltage Amplifier PCA.

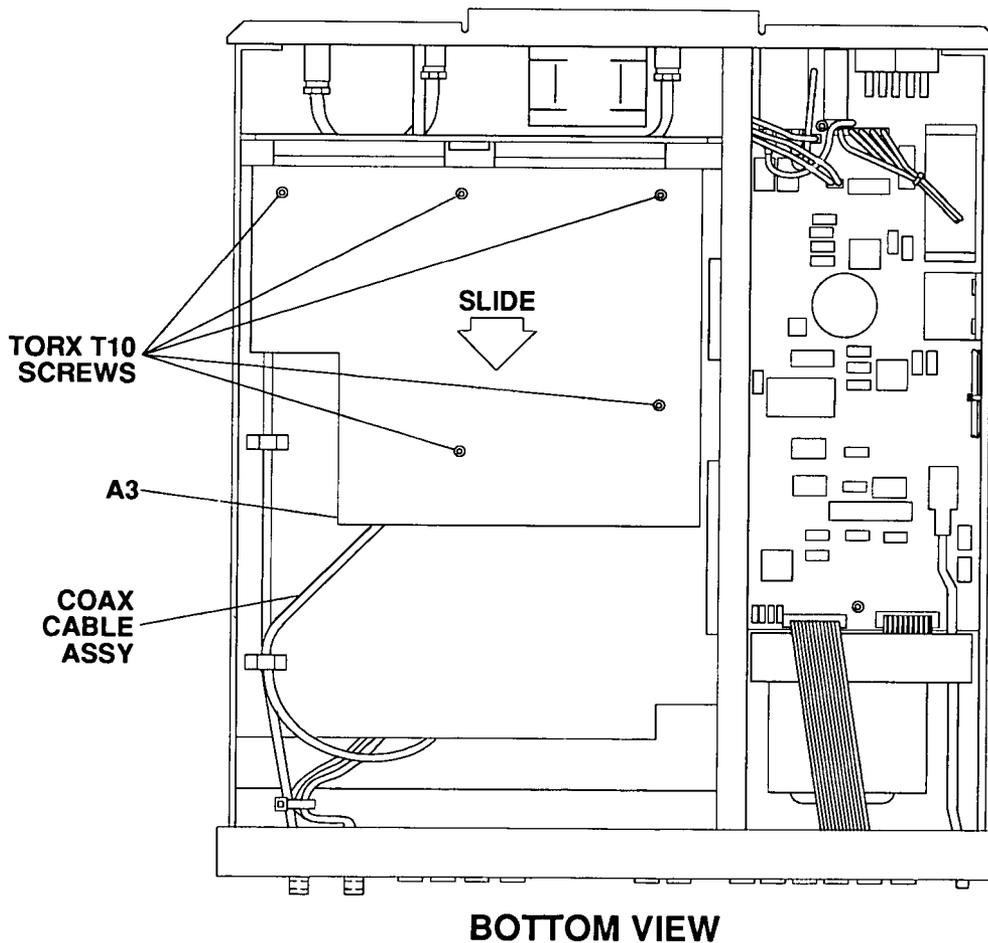


Figure 3-6. Remove and Replace A3 High Voltage Amp PCA

A5 Outguard Logic PCA

1. Remove covers (refer to Figure 3-3).
2. Disconnect W1, W2, and 24-pin cable assembly from A5 Outguard Logic PCA (refer to Figure 3-7).
3. Remove three Torx T10 screws and two rear panel connector standoffs.
4. Slide A5 Outguard Logic PCA forward and lift out.
5. Reverse order to reinstall the A5 Outguard Logic PCA. If installing a new PCA, verify that jumper is not installed at A5JM132, and that jumper is installed at A5JM600 pins 1 - 2.

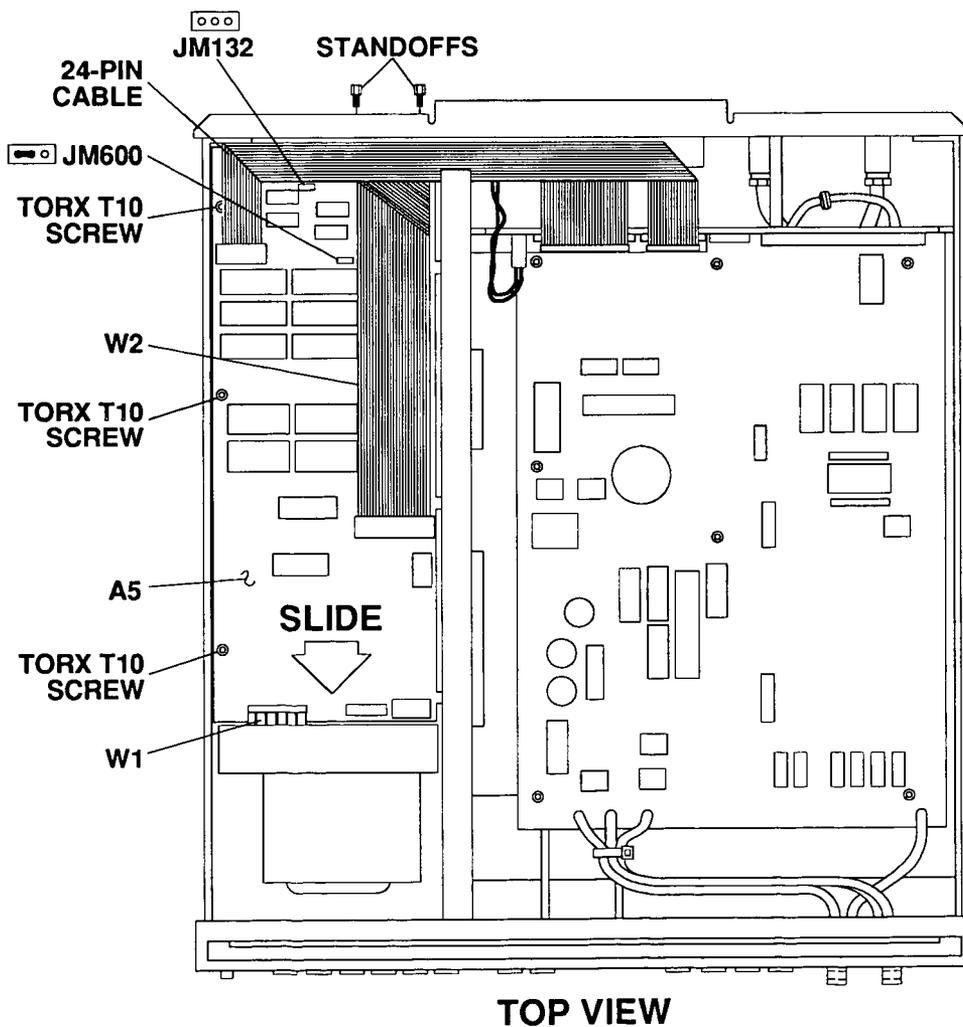


Figure 3-7. Remove and Replace A5 Outguard Logic PCA

A6 Outguard Power Supply PCA

1. Remove covers (refer to Figure 3-3).
2. Remove the power switch actuator (refer to Figure 3-8).
3. Disconnect W1, 26-pin cable assembly, 8-pin cable assembly, 2-pin cable assembly, blue wire, and line filter wires (W3 and W4) from A6 Outguard Power Supply PCA.
4. Cut cable ties next to heatsink.
5. Remove two screws holding heatsink to side panel, and two Torx T15 screws retaining the A6 Outguard Power Supply PCA.
6. Slide and lift A6 Outguard Power Supply PCA out of the frame.
7. Reverse order to reinstall the A6 Outguard Power Supply PCA.

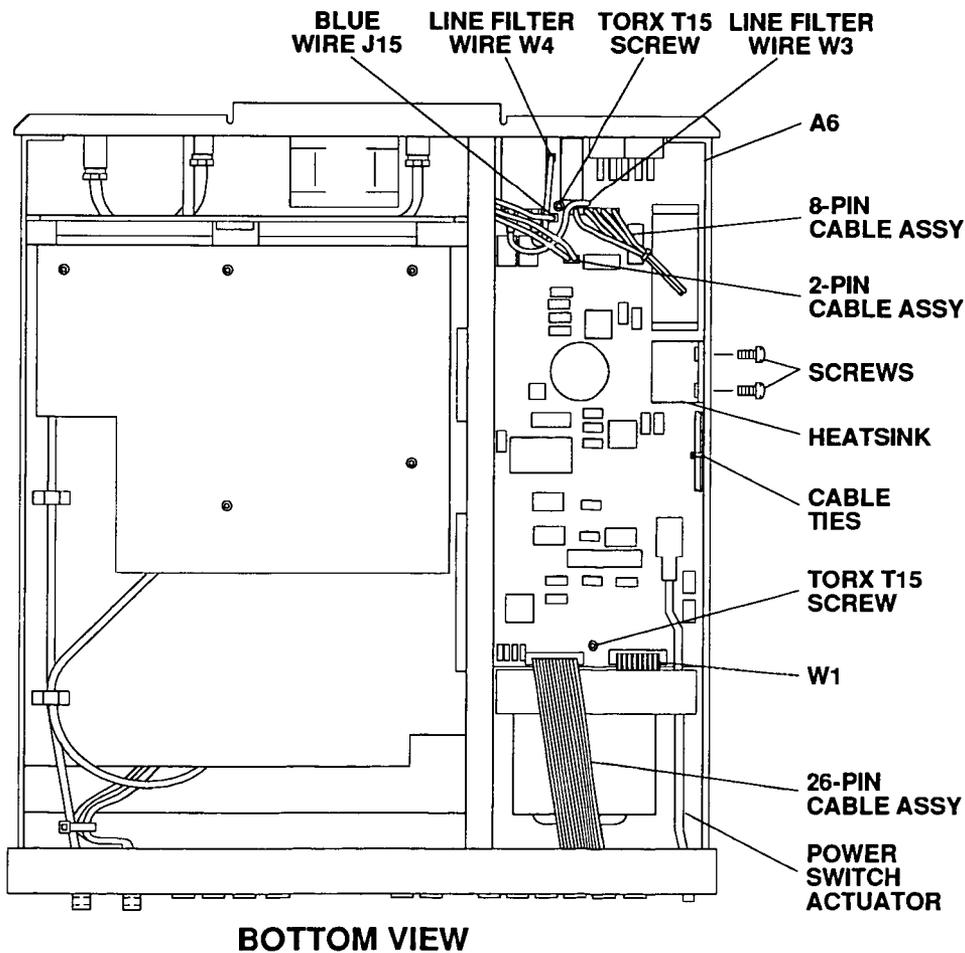


Figure 3-8. Remove and Replace A6 Outguard Power Supply PCA

A7 Display Logic PCA

1. Remove covers (refer to Figure 3-3).
2. Remove A1/A11 Inguard Source PCA(s) (refer to Figure 3-4).
3. Remove the screw (located behind the front panel BLUE key) that holds the front panel to the center frame (refer to Figure 3-9).
4. Remove the power switch actuator.
5. Push the side frame in toward the center of the instrument until frame disengages from the front panel.
6. The center frame has a small metal tab that holds the front panel to the center frame. Lift the front panel away from the center frame small metal tab and move the front panel away from the center frame.
7. Remove the front panel from the other side frame.
8. Remove one screw and slide the A7 Display Logic PCA out of the retaining tabs.
9. Reverse order to reinstall the A7 Display Logic PCA. When reinstalling, verify that rubber switch pad is in place prior to replacing the PCA.

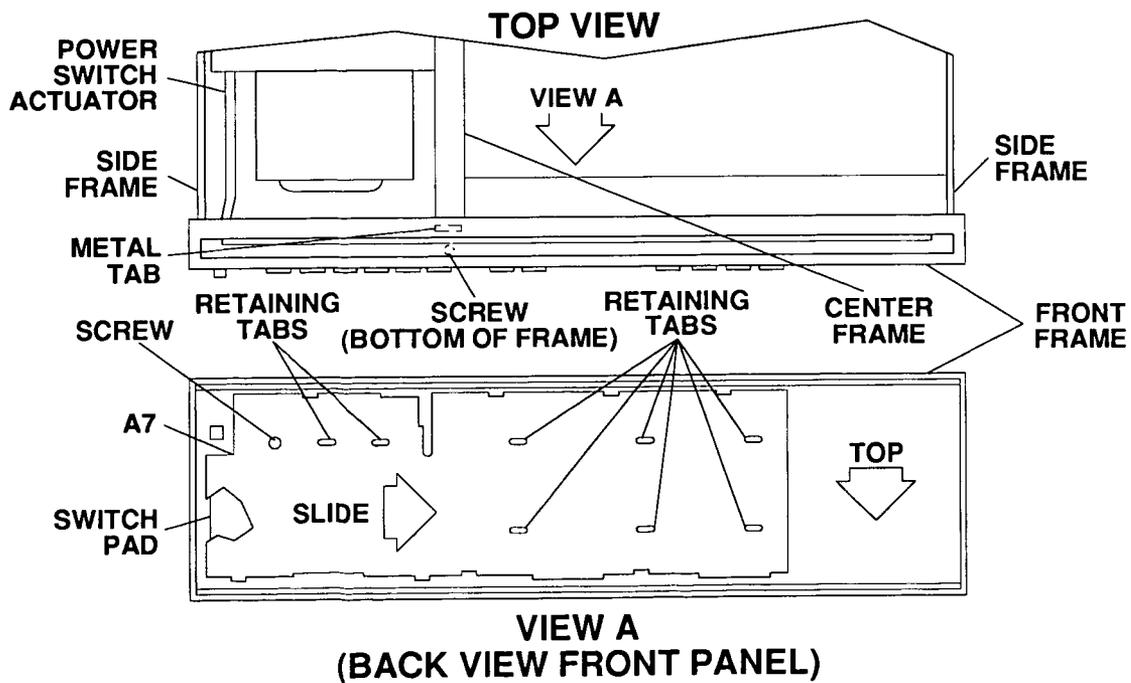


Figure 3-9. Remove and Replace A7 Display Logic PCA

Repair and Maintenance Guidelines

This section provides guidelines for repairing and maintaining the HP 3245A Universal Source including:

- ESD precautions
- Soldering printed circuit boards
- Post-repair safety checks

ESD Precautions

Electrostatic discharge (ESD) may damage static sensitive devices in the Universal Source . This damage can range from slight parameter degradation to catastrophic failure. When handling Universal Source assemblies, observe the following guidelines to avoid damaging the assemblies:

- Always use a static-free work station with a pad of conductive rubber or similar material when handling assemblies.
- If a device requires soldering, be sure the assembly is placed on a pad of conductive material. Also, be sure that you, the pad, and the soldering iron tip are grounded to the assembly.

Soldering Printed Circuit Boards

The etched circuit boards of the Universal Source assemblies have plated-through holes that provide a solder path to both sides of the insulating material. Soldering can be done from either side of the board with equally good results. When soldering to any circuit board:

- Avoid unnecessary component unsoldering and soldering. Excessive replacement can result in damage to the circuit board, adjacent components, or both.
- Do not use a high-power soldering iron on etched circuit boards, as excessive heat may lift a conductor or damage the board.
- Use a suction device or wooden toothpick to remove solder from component mounting holes. When using a suction device, be sure that the equipment is properly grounded.

Post-Repair Safety Checks

After making repairs to the Universal Source, inspect the instrument for any signs of abnormal internally generated heat, such as discolored printed circuit boards or components, damaged insulation, or evidence of arcing. Determine and correct the cause of the condition. Then perform the functional tests as described in Chapter 2 and 3 of the Calibration Manual to verify that the instrument is functional.

SALES & SUPPORT OFFICES

Arranged alphabetically by country



HEADQUARTERS OFFICES

If there is no sales office listed for your area, contact one of these headquarters offices.

NORTH/CENTRAL AFRICA

Hewlett-Packard S.A.
7, rue du Bois-du-Lan
CH-1217 MEYRIN 1, Switzerland
Tel: (022) 83 12 12
Telex: 27835 hmea
Cable: HEWPACKSA Geneve

ASIA

Hewlett-Packard Asia Ltd.
47/F, 26 Harbour Rd.,
Wanchai, HONG KONG
G.P.O. Box 863, Hong Kong
Tel: 5-8330833
Telex: 76793 HPA HX
Cable: HPASIAL TD

EASTERN EUROPE

Hewlett-Packard Ges.m.b.h.
Lieblgasse 1
P.O.Box 72
A-1222 VIENNA, Austria
Tel: (222) 2500-0
Telex: 1 3 4425 HEPA A

NORTHERN EUROPE

Hewlett-Packard S.A.
V. D. Hooplaan 241
P.O.Box 999
NL-1183 AG AMSTELVEEN
The Netherlands
Tel: 20 547999
Telex: 18 919 hpner

SOUTH EAST EUROPE

Hewlett-Packard S.A.
World Trade Center
110 Avenue Louis Casai
1215 Cointrin, GENEVA, Switzerland
Tel: (022) 98 96 51
Telex: 27225 hpser

EASTERN USA

Hewlett-Packard Co.
4 Choke Cherry Road
ROCKVILLE, MD 20850
Tel: (301) 948-6370

MIDWESTERN USA

Hewlett-Packard Co.
5201 Tollview Drive
ROLLING MEADOWS, IL 60008
Tel: (312) 255-9800

SOUTHERN USA

Hewlett-Packard Co.
2000 South Park Place
ATLANTA, GA 30339
Tel: (404) 955-1500

WESTERN USA

Hewlett-Packard Co.
5161 Lankershim Blvd.
NORTH HOLLYWOOD, CA 91601
Tel: (818) 505-5600

MEDITERRANEAN AND MIDDLE EAST

Hewlett-Packard S.A.
Mediterranean and Middle East
Operations
Atrina Centre
32 Kifissias Ave.
Paradissos-Amarousion, ATHENS
Greece
Tel: 682 88 11
Telex: 21-6588 HPAT GR
Cable: HEWPACKSA Athens

OTHER INTERNATIONAL AREAS

Hewlett-Packard Co.
Intercontinental Headquarters
3495 Deer Creek Road
PALO ALTO, CA 94304
Tel: (415) 857-1501
Telex: 034-8300
Cable: HEWPACK

ARGENTINA

Hewlett-Packard Argentina S.A.
Montaneses 2140/50
1428 BUENOS AIRES
Tel: 781-4059/69
Cable: HEWPACKARG

AUSTRALIA

Hewlett-Packard Australia Ltd.
31-41 Joseph Street
P.O. Box 221
BLACKBURN, Victoria 3130
Tel: 895-2895
Telex: 31-024
Cable: HEWPARD Melbourne

Hewlett-Packard Australia Ltd.
17-23 Talavera Road
P.O. Box 308
NORTH RYDE, N.S.W. 2113
Tel: 888-4444
Telex: 21561
Cable: HEWPARD Sydney

AUSTRIA

Hewlett-Packard Ges.m.b.h.
Lieblgasse 1
P.O. Box 72
A-1222 VIENNA
Tel: (0222) 2500-0
Telex: 134425 HEPA A

BELGIUM

Hewlett-Packard Belgium S.A./N.V.
Blvd de la Woluwe, 100
Woluwedal
B-1200 BRUSSELS
Tel: (02) 762-32-00
Telex: 23-494 paloben bru

BRAZIL

Hewlett-Packard do Brasil
I.e.C. Ltda.
Alameda Rio Negro, 750
ALPHAVILLE
06400 Barueri SP
Tel: (011) 421.1311
Telex: (011) 33872 HPBR-BR
Cable: HEWPACK Sao Paulo

Hewlett-Packard do Brasil
I.e.C. Ltda.
Praia de Botafogo 228
6° Andar-conj 614
Edificio Argentina - Ala A
22250 RIO DE JANEIRO, RJ
Tel: (021) 552-6422
Telex: 21905 HPBR-BR
Cable: HEWPACK Rio de Janeiro

CANADA

Hewlett-Packard (Canada) Ltd.
11120-178th Street
EDMONTON, Alberta T5S 1P2
Tel: (403) 486-6666

Hewlett-Packard (Canada) Ltd.
17500 Trans Canada Highway
South Service Road
KIRKLAND, Quebec H9J 2X8
Tel: (514) 697-4232
Telex: 058-21521

Hewlett-Packard (Canada) Ltd.
6877 Goreway Drive
MISSISSAUGA, Ontario L4V 1M8
Tel: (416) 678-9430
Telex: 069-8644

Hewlett-Packard (Canada) Ltd.
2670 Queensview Dr.
OTTAWA, Ontario K2B 8K1
Tel: (613) 820-6483

CHINA, People's Republic of

China Hewlett-Packard Co., Ltd.
P.O. Box 9610, Beijing
4th Floor, 2nd Watch Factory Main
Bldg.
Shuang Yu Shou, Bei San Huan Road
Hai Dian District
BEIJING
Tel: 28-0567
Telex: 22601 CTSHP CN
Cable: 1920 Beijing

DENMARK

Hewlett-Packard A/S
Kongevejen 25
DK-3460 BIRKERØD
Tel: (02) 81-66-40
Telex: 37409 hpas dk

FINLAND

Hewlett-Packard Oy
Piispankalliontie 17
02200 ESPOO
Tel: 00358-0-88721
Telex: 121563 HEWPA SF

FRANCE

Hewlett-Packard France
Chemin des Mouilles
Boite Postale 162
69131 ECULLY Cedex (Lyon)
Tel: (78) 133-81-25
Telex: 310617F

Hewlett-Packard France
Parc d'activités du Bois Briard
Avenue du Lac
91040 EVRY Cedex
Tel: (60) 77-83-83
Telex: 692315F

Hewlett-Packard France
Zone Industrielle de Courtabœuf
Avenue des Tropiques
91947 LES ULIS Cedex (Orsay)
Tel: (69) 07-78-25
Telex: 600048F

GERMAN FEDERAL REPUBLIC

Hewlett-Packard GmbH
Vertriebszentrum Mitte
Hewlett-Packard-Strasse
D-6380 BAD HOMBURG
Tel: (06172) 16-0
Fax: (06172) 16-1309

Hewlett-Packard GmbH
Vertriebszentrum Südwest
Schickardstrasse 2
D-7030 BÖBLINGEN
Tel: (07031) 14-0
Fax: (07031) 14-6429

Hewlett-Packard GmbH
Vertriebszentrum Süd
Eschenstrasse 5
D-8028 TAUFKIRCHEN
Tel: (089) 61207-0
Fax: (089) 61207-300

GREECE

Hewlett-Packard A.E.
178, Kifissias Avenue
6th Floor
Halandri-ATHENS
Greece
Tel: 6471543, 6471673, 6472971
Telex: 221 286 HPHLGR

HONG KONG

Hewlett-Packard Hong Kong, Ltd.
G.P.O. Box 795
5th Floor, Sun Hung Kai Centre
30 Harbour Road
HONG KONG
Tel: 5-8323211
Telex: 66678 HEWPA HX
Cable: HEWPACK HONG KONG

ICELAND

Hewlett-Packard Iceland
Hoefdabakka 9
110 REYKJAVIK
Tel: (1) 67 1000

INDIA

Blue Star Ltd.
13 Community Center
New Friends Colony
NEW DELHI 110 065
Tel: 633182, 636674
Telex: 031-61120
Cable: BLUEFROST

INDONESIA

BERCA Indonesia P.T.
P.O.Box 2497/Jk1
Antara Bldg., 11th Floor
Jl. Medan Merdeka Selatan 17
JAKARTA-PUSAT
Tel: 343989
Telex: 46748 BERSAL IA

IRELAND

Hewlett-Packard Ireland Ltd.
82/83 Lower Leeson Street
DUBLIN 2
Tel: 001 608800
Telex: 30439

ISRAEL

Computation and Measurement
Systems (CMS) Ltd.
11 Masad Street
67060
TEL-AVIV
Tel: 388 388
Telex: 33569 Motil IL

ITALY

Hewlett-Packard Italiana S.p.A.
Via G. di Vittorio 9
I-20063 CERNUSCO SUL
NAVIGLIO
(Milano)
Tel: (02) 923691
Telex: 334632

Hewlett-Packard Italiana S.p.A.
Viale C. Pavese 340
I-00144 ROMA EUR
Tel: (06) 54831
Telex: 610514

JAPAN

Yokogawa-Hewlett-Packard Ltd.
Chuo Bldg.,
4-20 Nishinakajima, 5 Chome
Yodogawa-ku
OSAKA, 532
Tel: (06) 304-6021
Telex: YHPOSA 523-3624

Yokogawa-Hewlett-Packard Ltd.
29-21 Takaido-Higashi, 3 Chome
Suginami-ku TOKYO 168
Tel: (03) 331-6111
Telex: 232-2024 YHPTOK

Yokogawa-Hewlett-Packard Ltd.
Yasuda Seimei Nishiguchi Bldg.
30-4 Tsuruya-cho, 3 Chome
Kanagawa-ku, YOKOHAMA 221
Tel: (045) 312-1252

SALES & SUPPORT OFFICES

Arranged alphabetically by country

**KOREA**

Samsung Hewlett-Packard Co. Ltd.
Dongbang Yeoeuido Building
12-16th Floors
36-1 Yeoeuido-Dong
Youngdeungpo-Ku
SEOUL
Tel: 784-4666, 784-2666
Telex: 25166 SAMSAN K

MALAYSIA

Hewlett-Packard Sales (Malaysia)
Sdn. Bhd.
9th Floor
Chung Khaiw Bank Building
46, Jalan Raja Laut
50350 **KUALA LUMPUR**
Tel: 2986555
Telex: 31011 HPSM MA

MEXICO

Hewlett-Packard de Mexico,
S.A. de C.V.
Monte Pelvoux No. 111
Lomas de Chapultepec
11000 **MEXICO, D.F.**
Tel: 5-40-62-28, 72-66, 50-25
Telex: 17-74-507 HEWPACK MEX

NETHERLANDS

Hewlett-Packard Nederland B.V.
Startbaan 16
NL-1187 XR **AMSTELVEEN**
P.O. Box 667
NL-1180 AR **AMSTELVEEN**
Tel: (020) 547-6911
Telex: 13 216 HEPA NL

NORWAY

Hewlett-Packard Norge A/S
Osterndalen 16-18
P.O. Box 34
N-1345 **OEESTERAA**
Tel: 0047/2/24 60 90
Telex: 76621 hpnas n

PUERTO RICO

Hewlett-Packard Puerto Rico
101 Muñoz Rivera Av
Esu. Calle Ochoa
HATO REY, Puerto Rico 00918
Tel: (809) 754-7800

SAUDI ARABIA

Modern Electronics Establishment
Hewlett-Packard Division
P.O. Box 1228
Redec Plaza, 6th Floor
JEDDAH
Tel: 644 96 28
Telex: 4027 12 FARNAS SJ
Cable: ELECTA JEDDAH

SINGAPORE

Hewlett-Packard Singapore (Sales)
Pte. Ltd.
#08-00 Inchcape House
450-2 Alexandra Road
Alexandra P.O. Box 58
SINGAPORE, 9115
Tel: 4731788
Telex: 34209 HPSGSO RS
Cable: HEWPACK, Singapore

SOUTH AFRICA

Hewlett-Packard So Africa (Pty.) Ltd.
9 Eastern Service Road
Eastgate Ext. 3
SANDTON 2144
Tel: 802-5111, 802-5125
Telex: 4-20877 SA
Cable: HEWPACK Johannesburg

SPAIN

Hewlett-Packard Española, S.A.
Ctra. de la Coruña, Km. 16, 400
Las Rozas
E-MADRID
Tel: (1) 637.00.11
Telex: 23515 HPE

SWEDEN

Hewlett-Packard Sverige AB
Skalhottsgatan 9, Kista
Box 19
S-16393 **SPÅNGA**
Tel: (08) 750-2000
Telex: (854) 17886
Telefax: (08) 7527781

SWITZERLAND

Hewlett-Packard (Schweiz) AG
7, rue du Bois-du-Lan
Case postale 365
CH-1217 **MEYRIN 1**
Tel: (0041) 22-83-11-11
Telex: 27333 HPAG CH

TAIWAN

Hewlett-Packard Taiwan Ltd.
8th Floor, Hewlett-Packard Building
337 Fu Hsing North Road
TAIPEI

Tel: (02) 712-0404
Telex: 24439 HEWPACK
Cable: HEWPACK Taipei

TURKEY

Teknim Company Ltd.
Iran Caddesi No. 7
Karaklidere

ANKARA

Tel: 275800
Telex: 42155 TKNM TR

UNITED KINGDOM**ENGLAND**

Hewlett-Packard Ltd.
Heathside Park Road
Cheadle Heath
STOCKPORT
Cheshire
SK3 ORB
Tel: 061-428-0828
Telex: 668068

Hewlett-Packard Ltd.
King Street Lane
Winnersh, **WOKINGHAM**
Berkshire RG11 5AR
Tel: 0734 784774
Telex: 847178

SCOTLAND

Hewlett-Packard Ltd.
SOUTH QUEENSFERRY
West Lothian, EH30 9TG
Tel: 031 331 1188
Telex: 72682

UNITED STATES**Alabama**

Hewlett-Packard Co.
420 Wynn Drive
HUNTSVILLE, AL 35805
Tel: (205) 830-2000

Arizona

Hewlett-Packard Co.
8080 Pointe Parkway West
PHOENIX, AZ 85044
Tel: (602) 273-8000

California

Hewlett-Packard Co.
1421 S. Manhattan Av.
FULLERTON, CA 92831
Tel: (714) 999-6700

Hewlett-Packard Co.
5651 West Manchester Ave.
LOS ANGELES, CA 90045
Tel: (213) 337-8000
Telex: 910-325-6608

Hewlett-Packard Co.
9606 Aero Drive
SAN DIEGO, CA 92123
Tel: (619) 279-3200

Hewlett-Packard Co.
3003 Scott Boulevard
SANTA CLARA, CA 95054
Tel: (408) 988-7000
Telex: 910-338-0586

Colorado

Hewlett-Packard Co.
24 Inverness Place, East
ENGLEWOOD, CO 80112
Tel: (303) 649-5000

Connecticut

Hewlett-Packard Co.
47 Barnes Industrial Road South
WALLINGFORD, CT 06492
Tel: (203) 265-7801

Florida

Hewlett-Packard Co.
2901 N.W. 62nd Street
FORT LAUDERDALE, FL 33309
Tel: (305) 973-2600

Hewlett-Packard Co.
6177 Lake Ellenor Drive
ORLANDO, FL 32809
Tel: (305) 859-2900

Georgia

Hewlett-Packard Co.
2000 South Park Place
ATLANTA, GA 30339
Tel: (404) 955-1500
Telex: 810-766-4890

Illinois

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

Indiana

Hewlett-Packard Co.
11911 N. Meridian St.
CARMEL, IN 46032
Tel: (317) 844-4100

Louisiana

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

Maryland

Hewlett-Packard Co.
3701 Koppers Street
BALTIMORE, MD 21227
Tel: (301) 644-5800
Telex: 710-862-1943

Hewlett-Packard Co.
2 Choke Cherry Road
ROCKVILLE, MD 20850
Tel: (301) 948-6370

Massachusetts

Hewlett-Packard Co.
1775 Minuteman Road
ANDOVER, MA 01810
Tel: (617) 682-1500

Michigan

Hewlett-Packard Co.
39550 Orchard Hill Place Drive
NOVI, MI 48050
Tel: (313) 349-9200

Minnesota

Hewlett-Packard Co.
2025 W. Larpenteur Ave.
ST. PAUL, MN 55113
Tel: (612) 644-1100

Missouri

Hewlett-Packard Co.
1001 E. 101st Terrace Suite 120
KANSAS CITY, MO 64131-3368
Tel: (816) 941-0411

Hewlett-Packard Co.
13001 Hollenberg Drive
BRIDGETON, MO 63044
Tel: (314) 344-5100

New Jersey

Hewlett-Packard Co.
120 W. Century Road
PARAMUS, NJ 07653
Tel: (201) 265-5000

New Mexico

Hewlett-Packard Co.
7801 Jefferson N.E.
ALBUQUERQUE, NM 87109
Tel: (505) 823-6100

New York

Hewlett-Packard Co.
9600 Main Street
CLARENCE, NY 14031
Tel: (716) 759-8621

Hewlett-Packard Co.
7641 Henry Clay Blvd.
LIVERPOOL, NY 13088
Tel: (315) 451-1820

Hewlett-Packard Co.
3 Crossways Park West
WOODBURY, NY 11797
Tel: (516) 682-7800

North Carolina

Hewlett-Packard Co.
5605 Roanne Way
GREENSBORO, NC 27420
Tel: (919) 852-1800

Ohio

Hewlett-Packard Co.
15885 Sprague Road
CLEVELAND, OH 44136
Tel: (216) 243-7300

Hewlett-Packard Co.
9080 Springboro Pike
MIAMISBURG, OH 45342
Tel: (513) 433-2223

Hewlett-Packard Co.
675 Brooksedge Blvd.
WESTERVILLE, OH 43081
Tel: (614) 891-3344

Oklahoma

Hewlett-Packard Co.
3525 N.W. 56th St.
Suite C-100
OKLAHOMA CITY, OK 73112
Tel: (405) 946-9499

Oregon

Hewlett-Packard Co.
9255 S. W. Pioneer Court
WILSONVILLE, OR 97070
Tel: (503) 682-8000

Pennsylvania

Hewlett-Packard Co.
111 Zeta Drive
PITTSBURGH, PA 15238
Tel: (412) 782-0400

Hewlett-Packard Co.
2750 Monroe Boulevard
VALLEY FORGE, PA 19482
Tel: (215) 666-9000

Texas

Hewlett-Packard Co.
1826-P Kramer Lane
AUSTIN, TX 78758
Tel: (512) 835-6771

Hewlett-Packard Co.
10535 Harwin Drive
HOUSTON, TX 77038
Tel: (713) 776-6400

Hewlett-Packard Co.
930 E. Campbell Rd.
RICHARDSON, TX 75081
Tel: (214) 231-6101

Hewlett-Packard Co.
1020 Central Parkway South
SAN ANTONIO, TX 78232
Tel: (512) 494-9336

Utah

Hewlett-Packard Co.
3530 W. 2100 South St.
SALT LAKE CITY, UT 84119
Tel: (801) 974-1700

Virginia

Hewlett-Packard Co.
4305 Cox Road
GLEN ALLEN, VA 23060
Tel: (804) 747-7750

Washington

Hewlett-Packard Co.
15815 S.E. 37th Street
BELLEVEUE, WA 98006
Tel: (206) 643-4000

Wisconsin

Hewlett-Packard Co.
275 N. Corporate Dr.
BROOKFIELD, WI 53005
Tel: (414) 794-8800

VENEZUELA

Hewlett-Packard de Venezuela C.A.
3A Transversal Los Ruices Norte
Edificio Segre 2 & 3
Apartado 50933
CARACAS 1050
Tel: (582) 239-4133
Telex: 251046 HEWPACK

YUGOSLAVIA

Do Hermes
General Zdanova 4
YU-11000 **BEOGRAD**
Tel: (011) 342 641
Telex: 11433

Copyright © 1992
Hewlett-Packard Company
Printed in U.S.A.
October 1992
E1092



03245-90015

