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HEWLETT PACKARD

SERVICE MANUAL

HP 70205A and HP 70206A GRAPHICS DISPLAYS

SERIAL NUMBERS

This manual applies directly to HP 70205A Graphics Display and HP 70206A System Graphics Display with serial numbers prefixed 2731A and below.

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1212 VALLEY HOUSE DRIVE, ROHNERT PARK, CALIFORNIA 94928-4999, U.S.A.

Manual Part Number: 70206-90025
Microfiche Part Number: 70206-90026

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CERTIFICATION

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

WARRANTY

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

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

HP warrants that its software and firmware designated by HP for use with an instrument will execute its programming instructions when properly installed on that instrument. HP does not warrant that the operation of the instrument, 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 software or interfacing, unauthorized modification or misuse, operation outside of the environmental specifications for the product, or improper site preparation or maintenance.

NO OTHER WARRANTY IS EXPRESSED OR IMPLIED. 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.

ASSISTANCE

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

For any assistance, contact your nearest Hewlett-Packard Sales and Service Office.

SAFETY SYMBOLS

The following safety symbols are used throughout this manual and in the instrument. Familiarize yourself with each of the symbols and its meaning before operating this instrument.



Instruction manual symbol. The instrument will be marked with this symbol when it is necessary for the user to refer to the instruction manual in order to protect the instrument against damage. Location of pertinent information within the manual is indicated by use of this symbol in the table of contents.



Indicates dangerous voltages are present. Be extremely careful.

CAUTION

The CAUTION sign denotes a hazard. It calls attention to a procedure which, if not correctly performed or adhered to, could result in damage to or destruction of the instrument. Do not proceed beyond a CAUTION sign until the indicated conditions are fully understood and met.

WARNING

The WARNING sign denotes a hazard. It calls attention to a procedure which, if not correctly performed or adhered to, could result in injury or loss of life. Do not proceed beyond a WARNING sign until the indicated conditions are fully understood and met.

GENERAL SAFETY CONSIDERATIONS

WARNING

BEFORE THIS INSTRUMENT IS SWITCHED ON, make sure it has been properly grounded through the protective conductor of the ac power cable to a socket outlet provided with protective earth contact. Any interruption of the protective (grounding) conductor, inside or outside the instrument, or disconnection of the protective earth terminal can result in personal injury.

WARNING

There are voltages at many points in the instrument which can, if contacted, cause personal injury. Be extremely careful. Any adjustments or service procedures that require operation of the instrument with protective covers removed should be performed only by trained service personnel.

CAUTION

BEFORE THIS INSTRUMENT IS SWITCHED ON, make sure its primary power circuitry has been adapted to the voltage of the ac power source. Failure to set the ac power input to the correct voltage could cause damage to the instrument when the ac power cable is plugged in.

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HP 70000 MODULAR MEASUREMENT SYSTEM DOCUMENTATION OUTLINE

Instruments and modules of the HP 70000 Modular Measurement System are documented to varying levels of detail. Modules that serve as masters of an instrument require operation information in addition to installation and verification instructions. Modules that function as slaves in a system require only a subset of installation and verification information.

Manuals Supplied with Module

INSTALLATION AND VERIFICATION MANUAL

Topics covered by this manual include installation, specifications, verification of module operation, and some troubleshooting techniques. Manuals for modules that serve as instrument masters will supply information in all these areas; manuals for slave modules will contain only information needed for slave module installation and verification. Master module documentation may also include some system-level information.

OPERATION MANUAL

Operation Manuals usually pertain to multiple- and single-module instrument systems. Topics include preparation for module use, module functions, and softkey definitions.

PROGRAMMING MANUAL

Programming Manuals also pertain to multiple- and single-module instrument systems. Programming Manual topics include programming fundamentals and definitions for remote programming commands.

Service Manual, Available Separately

When available, this manual provides service information for a module, including module verification tests, adjustments, troubleshooting, replaceable parts lists, and replacement procedures. For ordering information, contact an HP Sales and Service Office. (NOTE: Some versions of this manual are titled *Technical Reference*.)

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Chapter 1

GENERAL INFORMATION

Introduction

The HP 70205A and HP 70206A Technical Reference contains the information necessary to service both the HP 70205A Graphics Display and the HP 70206A System Graphics Display. This chapter contains the following information.

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Manual Organization

This manual is organized into the following chapters:

Chapter 1, General Information, contains information on instrument versions covered by this manual, manual updating, safety considerations, and recommended test equipment.

Chapter 2, Verification Tests: Verification tests for the HP 70205A and HP 70206A graphics displays are documented in Chapter 4, "Troubleshooting."

Chapter 3, Adjustments, contains procedures for repairing and adjusting HP 70205A and HP 70206A graphics displays.

Chapter 4, Troubleshooting, contains the block diagram, troubleshooting information, and instrument error-code descriptions for HP 70205A and HP 70206A graphics displays.

Chapter 5, Replacement Procedures, contains instructions for replacing all major assemblies for HP 70205A and HP 70206A graphics displays.

Chapter 6, Replaceable Parts, contains the information necessary to order instrument parts or assemblies for HP 70205A and HP 70206A graphics displays.

Chapter 7, Major Assembly and Cable Locations, contains figures identifying all major assemblies and cable locations for HP 70205A and HP 70206A graphics displays.

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Safety Considerations

Before servicing this instrument, familiarize yourself with both the safety markings on the instrument, and the safety instructions in this manual. Hewlett-Packard manufactures and tests the instrument to international safety standards; however, to prevent damage to the instrument and to ensure personal safety, obey all warnings and cautions and read the safety symbols information summarized at the beginning of this manual.

Instruments/Assemblies Covered by This Manual

SERIAL NUMBERS/BOARD VERSIONS

Tables 1-1 and 1-2 document all assembly versions produced before the print date listed on the title page. Before servicing an assembly, check the assembly part number; instrument serial numbers do not always reflect the assembly versions used in the instrument. A Manual Updating Supplement will document assembly versions produced after the manual print date. Refer to "Manual Updating Supplement" below for more information.

NOTE

It is vital to match the assembly part number with the part number printed on the schematic and the component location diagrams.

Assembly Version Identification

The circuit-board part number identifies the board assembly version. The part number consists of a prefix and a suffix (which changes for each board type and version produced). Recent assembly versions will always have a suffix with a higher numerical value than older versions.

Manual Updating Supplement

A display manufactured after the manual print date may have a different serial-number prefix than the serial-number prefix listed on the title page. If the serial number for your display is not listed on the title page, major changes to the display may have occurred.

The Manual Updating Supplement corrects manual errors and documents manual changes that have occurred since the manual print date. To keep the manual current, periodically request the latest Manual Updating Supplement from your nearest Hewlett-Packard Sales and Service Office listed in Table 1-4.

Table 1-1. HP 70205A Assembly Versions Documented in This Manual

Assembly Name	Assembly Versions (HP Part Numbers)
A1A1 Keyboard	70205-60006
A1A2 RPG	5021-3255
A2 Sweep/Motherboard	70205-60001
A3 Dot Generator	70205-60004 and 70205-60045
A4 Memory	70205-60003 and 70205-60041
A5 Power Supply	70205-60015 and 70205-60040
A6 Host	70205-60002
A7 Interconnect	70205-60007

Table 1-1. HP 70206A Assembly Versions Documented in This Manual

Assembly Name	Assembly Versions (HP Part Numbers)
A1 Filter	70206-60007
A2 Video/Sweep	70206-60005
A3 Dot Generator	70205-60004 and 70205-60045
A4 Memory	70205-60003 and 70205-60041
A6 Host	70205-60002
A7 HP-MSIB	70206-60006 and 70206-60053
A8 Numeric Keyboard	70206-60009
A9 RPG	70206-60040
A10 Bezel Keyboard	70206-60008
A11 Power Supply	0950-1730
A12 Motherboard	70206-60001

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Recommended Test Equipment

Table 1-5 lists the recommended test equipment for the HP 70205A and HP 70206A graphics displays adjustments and troubleshooting. Any equipment that satisfies the critical specifications listed in the table may be substituted for the recommended model(s), unless "No acceptable substitute " is stated in the table.

Electrostatic Discharge

ESD (electrostatic discharge) can damage or destroy electronic components. All work performed on assemblies with electronic components should be done at a static-safe work station. Figure 1-1 shows an example of a static-safe work station with two types of ESD protection:

- conductive table mat and wrist-strap combination
- conductive floor mat and heel-strap combination

Table 1-3 lists static-safe accessories that can be ordered from Hewlett-Packard.

REDUCING ESD DAMAGE

The following suggestions may help reduce ESD damage which can occur during testing and servicing operations.

- Handle PC board assemblies and electronic components at a static-safe work station.
- Store and transport PC board assemblies and electronic components in static-shielding containers.
- To prevent a static-charge buildup, properly earth-ground all instruments.

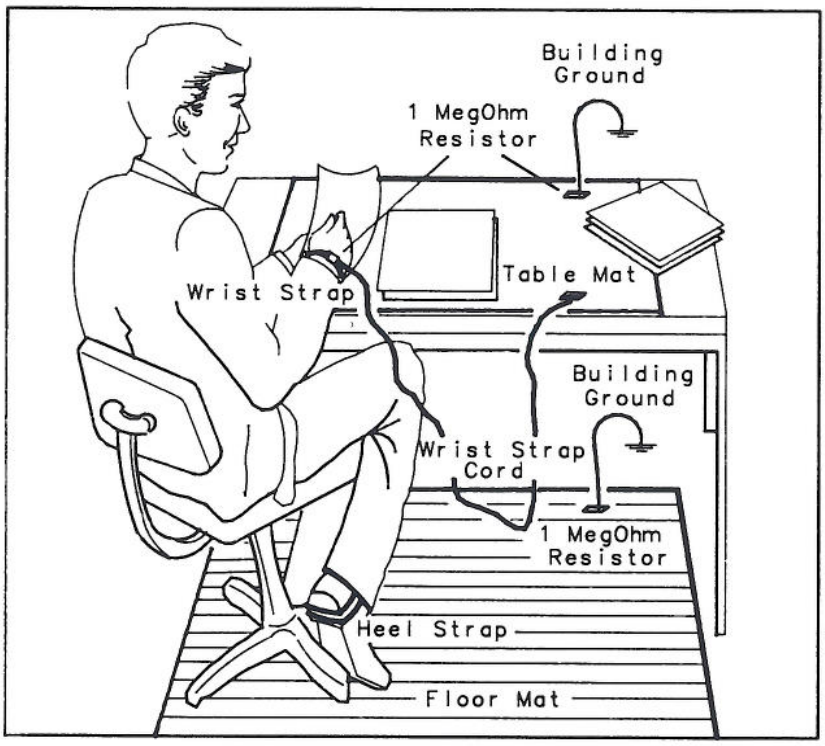


Figure 1-1. Static-Safe Work Station

Sales and Service Offices

Hewlett-Packard's support organization consists of a worldwide sales and service network staffed by highly trained engineers and technicians. They provide complete support for both the HP 70205A and HP 70206A displays. To obtain servicing information, or to order replacement parts, contact the nearest Hewlett-Packard Sales and Service Office listed in Table 1-4. When contacting Hewlett-Packard, refer to the display by its model number and any pertinent assembly version numbers.

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Table 1-3. Static-Safe Accessories

Accessory	Description	HP Part Number
Static-control mat and ground wire	Set includes: 3M static control mat 0.6m × 1.2m (2 ft. × 4 ft.) and 4.6m (15 ft.) ground wire (The wrist strap and wrist strap cord are *not* included. They must be ordered separately.)	9300-0797
Wrist strap cord	1.5m (5 ft.)	9300-0980
Wrist strap	Large Small	9300-0985 9300-0986
ESD heel strap	Reusable 6 to 12 months	9300-1169
Shoe ground strap	One-time use only	9300-0793
Hard-surface static-control mat*	Large, black, 1.2m × 1.5m (4 ft. × 5 ft.) Small, black, 0.9m × 1.2m (3 ft. × 4 ft.)	92175A 92175C
Soft-surface static-control mat*	Brown, 1.2m × 2.4m (4 ft. × 8 ft.)	92175B
Tabletop static control mat*	58 cm × 76 cm (23 in. × 30 in.)	92175T
Anti-static carpet*	Small, 1.2m × 1.8m (4 ft. × 6 ft.) natural color russet color Large, 1.2m × 2.4m (4 ft. × 8 ft.) natural color russet color	 92176A 92176C 92176B 92176D

* These accessories can be ordered from:
Hewlett-Packard Company
Computer Supplies Operations
1320 Kifer Road
Sunnyvale, California 94086
Phone: (408) 738-8858

How to Return the Display for Service

BLUE SERVICE TAG

If either the HP 70205A or HP 70206A display is being returned to Hewlett-Packard for servicing, fill out and attach a blue service tag provided at the end of this manual. Please be as specific as possible about the nature of the problem. Send any information about the display's performance with the returned unit.

PACKAGING

If possible, pack the display in the original factory packaging materials. If the original materials were not retained, identical packaging materials are available through any Hewlett-Packard Sales and Service Office. The tables in Figures 1-2 and 1-3 list the packaging materials available from Hewlett-Packard.

CAUTION

Display damage may result from using packaging materials other than those specified by Hewlett-Packard.

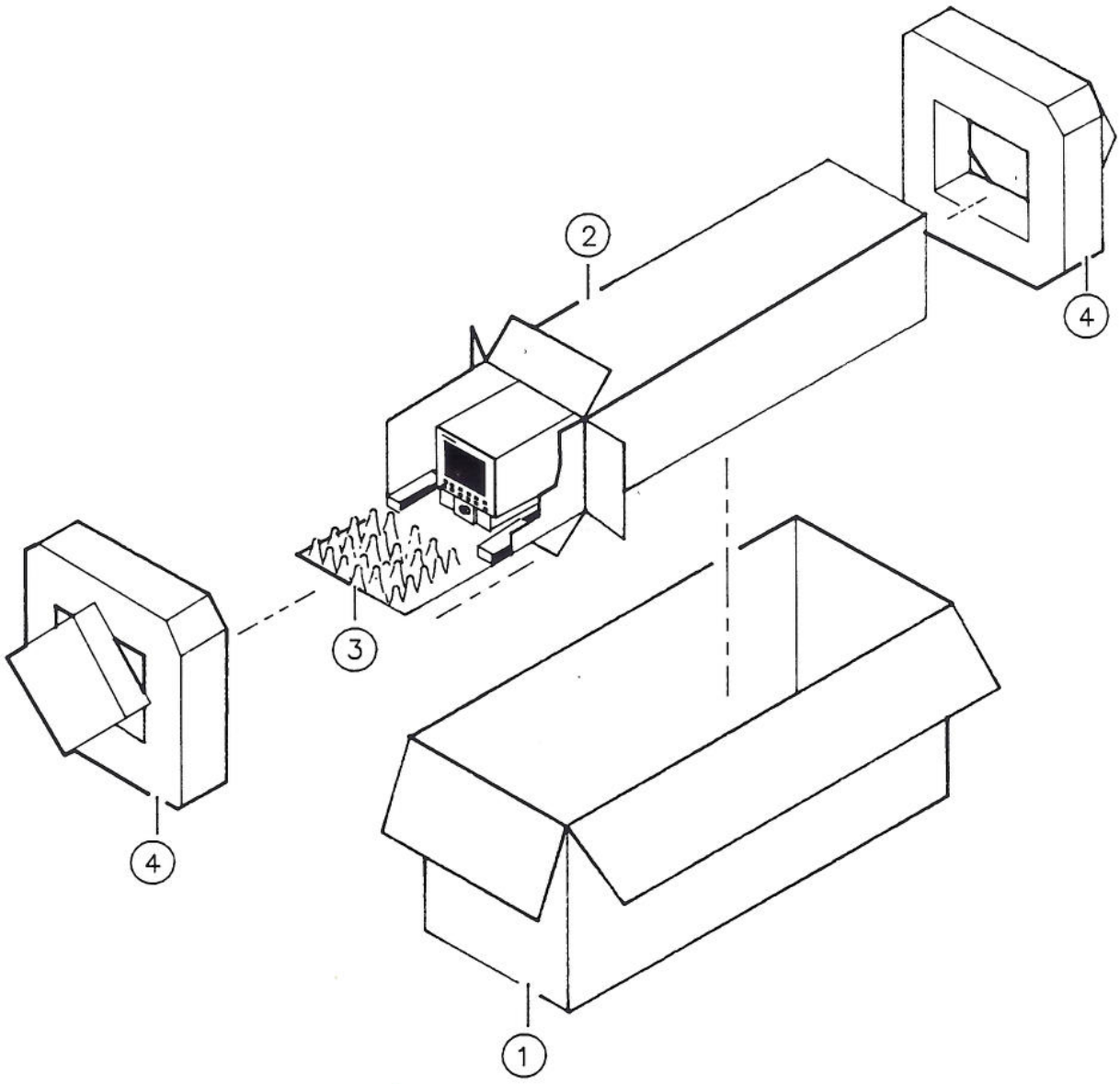
Never use styrene pellets as packaging materials. They generate static electricity, which may damage the instrument.

The display can be repackaged with commercially available materials using the following procedure:

1. Attach a completed service tag to the display.
2. Wrap the display in anti-static plastic to reduce the possibility of damage caused by ESD.
3. Use a strong shipping container. A double-walled, corrugated cardboard carton with 159 kg (350 lb) bursting strength is adequate. The carton must be both large enough and strong enough to accommodate the display.
4. Surround the equipment with three to four inches of packing material and pack tightly enough to prevent the display from moving in the carton. If packing foam is not available, the best alternative is S.D.-240 Air Cap™ from Sealed Air Corporation (Commerce, California, 90001). Air Cap looks like a plastic sheet filled with 1-1/4 inch air bubbles. Use the pink-colored Air Cap to reduce static electricity. Wrapping the display several times in this material should both protect the display and prevent it from moving in the carton.
5. Seal the shipping container securely with strong nylon adhesive tape.
6. Mark the shipping container "FRAGILE, HANDLE WITH CARE" to assure careful handling.
7. Retain copies of all shipping papers.

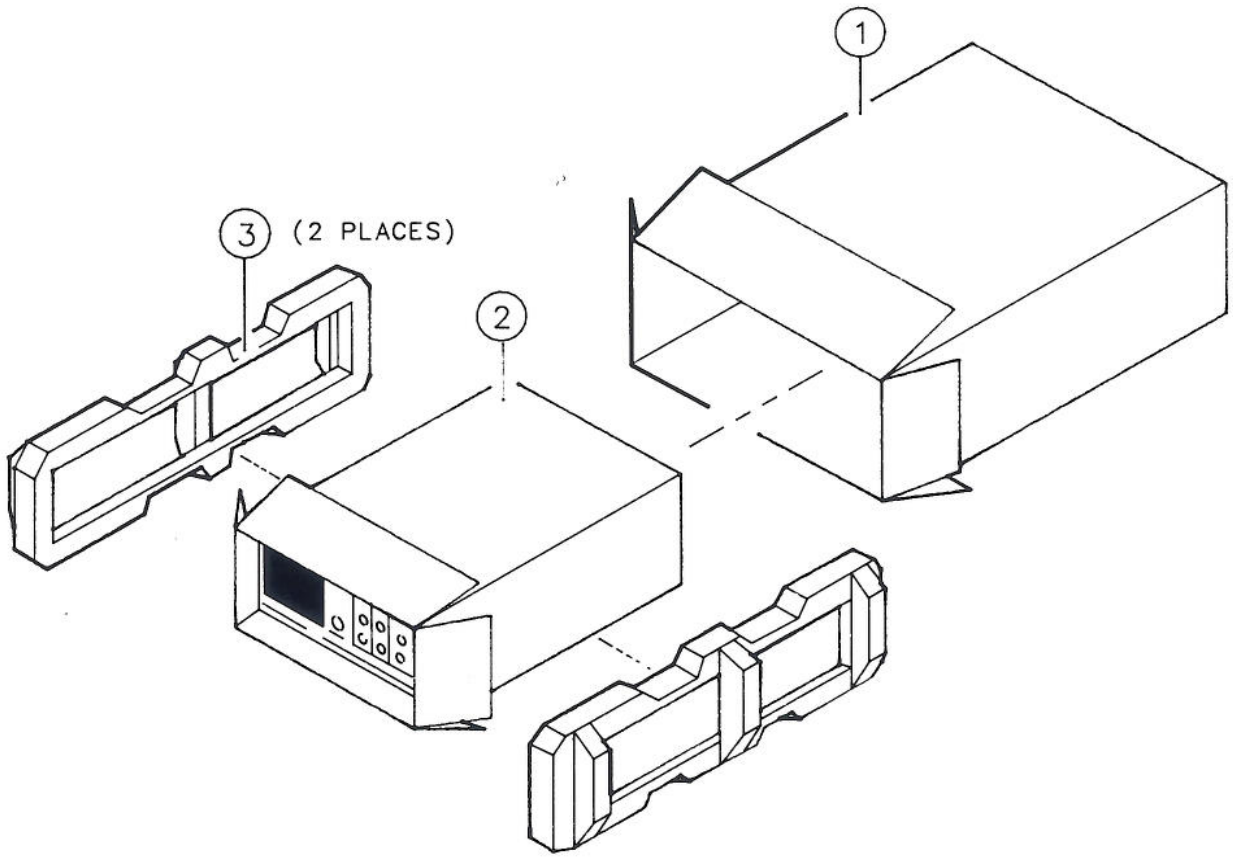
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Item	Qty	HP Part No.	Description
1	1	9211-5118	CARTON-OUTER
2	1	9211-5119	CARTON-INNER
3	1	5180-2369	CARTON-SLIDER
4		4208-0493	FOAM INSERT
5	2	5180-2370	FOAM PADS

Figure 1-2. Packaging Materials for the HP 70205A



Item	Qty	HP Part No.	Description
1	1	9211-4487	CARTON-OUTER
2	1	5180-2321	CARTON-INNER
3	2	5180-7829	FOAM PADS

Figure 1-3. Packaging Materials for the HP 70206A

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Table 1-4. HP Sales and Service Offices

IN THE UNITED STATES

California

Hewlett-Packard Co.
P.O. Box 4230
1421 South Manhattan Ave.
Fullerton, CA 92631
(714) 999-6700
Hewlett-Packard Co.
301 E. Evelyn
Mountain View, CA 94039
(415) 694-2000

Colorado

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

Georgia

Hewlett-Packard Co.
P.O. Box 105005
2000 South Park Place
Atlanta, GA 30339
(404) 955-1500

Illinois

Hewlett-Packard Co.
5201 Tollview Drive
Rolling Meadows, IL 60008
(312) 255-9800

New Jersey

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

Texas

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Table 1-5. Recommended Test Equipment

Equipment	Critical Specifications	Recommended Model	Perf. Test	Adj. Proc.
OSCILLOSCOPE				
Oscilloscope	BW: dc to 100 MHz Sensitivity: 5 mV/div	HP 1740A		√
Oscilloscope Probe	10:1 Division Ratio	HP 10080A, HP 10004D		√ √
METERS				
Digital Mulitmeter	Range: 0 to 1000V Accuracy: 10 mV Digital Readout: 3-1/2 digits	HP 3466A		√
MISCELLANEOUS				
Sweep Extender Board	No acceptable substitute.	HP 70206-60041		√
Module Service Extender	No acceptable substitute.	HP 70001-60013		√

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NOTES

Chapter 2

VERIFICATION TESTS

Introduction

At power-up, the HP 70205A and HP 70206A graphics displays execute a package of self-diagnostic test routines, which verifies the display's electrical performance. For more information about these tests, refer to Chapter 4, "Troubleshooting."

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NOTES

Chapter 3

ADJUSTMENTS

Introduction

Use the adjustment procedures to maximize display performance after a repair. Qualified service personnel should perform the adjustment procedures, since the adjustments require access to the instrument's interior. Perform the adjustments for corrective servicing, not as routine maintenance.

The adjustments for both the HP 70205A Graphics Display and the HP 70206A System Graphics Display are supported in this chapter. These adjustments are not automated; they require that you perform step-by-step manual procedures.

This chapter contains the following information:

Determining Your Display ROM Version 3-1
Adjustable Components 3-3
Recommended Test Equipment 3-4
Adjustment Tool 3-4
Location of Adjustments and Test Points 3-4
Text Conventions 3-4
Electrostatic Discharge 3-4
HP 70205A Graphics Display Adjustments 3-7
HP 70206A System Graphics Display Adjustments 3-25

Determining Your Display ROM Version

The adjustments for display ROM Versions 5.0 and 6.0 are documented in this chapter. Use the following procedure to determine which ROM version of firmware you have.

1. Disconnect the HP-MSIB connectors from the back of the display.
2. Set the LINE switch to the ON position.
3. When the HP-MSIB/HP-IB address screen appears, read the second line on the screen to determine which ROM version you have.

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If the display ROM version cannot be determined because the CRT is blank, remove the A6 Host board assembly (refer to the A6 Host board assembly removal procedure in Chapter 5, "Replacement Procedures"). Refer to Figure 3-1 for the locations of ROMs U39, U40, U47, and U48 on the host board assembly. Refer to Table 3-1 to determine which ROM part numbers correspond to display ROM version 5.0, and which correspond to display ROM version 6.0.

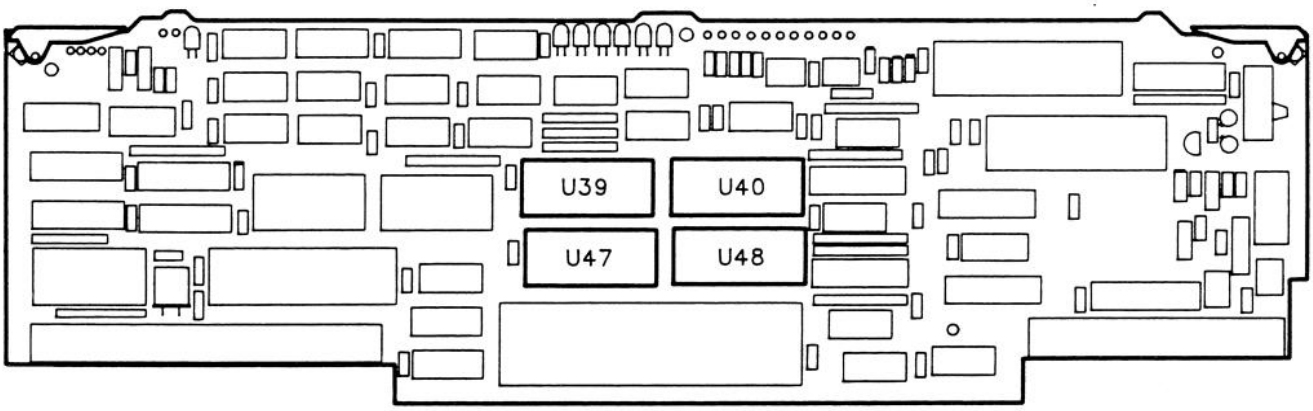


Figure 3-1. A6 Host Board Assembly Display ROM Locations

Table 3-1. ROM Part Numbers and Display ROM Version

Version	Reference Designator	HP Part Number
Display ROM Version 5.0	U39	70205-80004
	U40	70205-80005
	U47	70205-80006
	U48	70205-80007
Display ROM Version 6.0	U39	70205-80037
	U40	70205-80038
	U47	70205-80039
	U48	70205-80040

NOTE

Before performing any adjustments, warm up the instrument for thirty minutes.

Adjustable Components

Table 3-2 lists adjustable components by reference designator, name, and adjustment description.

Table 3-2. HP 70205A and HP 70206A Adjustable Components

HP 70205A Graphics Display		
Reference Designator	**Adjustment Name**	**Adjustment Function**
A2L4	WIDTH	Adjusts horizontal gain of trace.
A2R41	V POS	Adjusts vertical position of trace.
A2R43	HEIGHT	Adjusts vertical gain of trace.
A2R57	V LIN	Adjusts vertical linearity of trace.
A2R87	H POS	Adjusts for horizontal position of trace.
A2R88	FOCUS	Adjusts for optimum focus of CRT display.
A2R94	INTEN	Adjusts range of front-panel intensity control.
A2R95	HV COMP	Adjusts CRT high voltage.

HP 70206A System Graphics Display		
Reference Designator	**Adjustment Name**	**Adjustment Function**
A2L1	WIDTH	Adjusts horizontal gain of trace.
A2R20	HV COMP	Adjusts CRT high voltage.
A2R26	INTEN LIMIT	Adjusts range of front-panel intensity control.
A2R40	FOCUS	Adjusts for optimum focus of CRT display.
A2R47	H POS	Adjusts horizontal position of trace.
A2R68	V POS	Adjusts vertical position of trace.
A2R69	V LIN	Adusts vertical linearity of trace.
A2R84	HEIGHT	Adjusts vertical gain of trace.

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Recommended Test Equipment

Table 1-5, "Recommended Test Equipment," lists the test equipment and accessories required for the adjustment procedures. Test equipment that satisfies the critical specifications may be substituted for the preferred test equipment. Each adjustment procedure also lists the recommended test equipment for that specific adjustment.

Adjustment Tool

For adjustments requiring a non-metallic tuning tool, use Fiber Tuning Tool (HP part number 8170-0033).

Location of Adjustments and Test Points

Each adjustment procedure is illustrated with diagrams showing the location of adjustments and test points. Chapter 7, "Major Assembly and Cable Locations," contains information about assembly and cable locations.

Text Conventions

Softkeys, keys defined by the display, will be represented in the manual by a key name in braces.

Softkey . . . . . {Key Name}

Front-panel keys will be represented in the manual by a bracketed key name.

Front-panel Key . . . . . [Key Name]

Electrostatic Discharge

Electrostatic discharge(ESD) can damage or destroy electronic components. Therefore, all work performed on assemblies containing electronic components should be done at a static-free work station.

PC BOARD ASSEMBLIES AND ELECTRONIC COMPONENTS

- Handle these items at a static-safe work station.
- Store and transport these items in static-shielding containers.

CAUTION

Do not use erasers to clean the pin connector contacts. Erasers generate static electricity and remove the thin gold plating, which degrades the electrical quality of the contacts.

Do not use paper of any kind to clean the pin connector contacts. Paper or lint particles left on the contact surface can cause intermittent electrical connections.

Do not touch the pin connector contacts or trace surfaces with bare hands. Always handle board assemblies by the edges.

The pin connector contacts of PC board assemblies may be cleaned by using a lint-free cloth with a solution of 80% electronics-grade isopropyl alcohol and 20% de-ionized water. Perform this procedure at a static-free work station.

TEST EQUIPMENT

- Personnel should be grounded with a resistor-isolated wrist strap before touching the center pin of any connector and before removing any assembly from the instrument.
- Before connecting any coaxial cable to an instrument connector, momentarily short the center and outer conductors of the cable.
- Be sure that all instruments are properly earth-grounded to prevent buildup of static charge.

Refer to Chapter 1, "General Information," for more detailed information on ESD.

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NOTES

HP 70205A Graphics Display

Adjustments

Introduction

This section contains the following information.

Horizontal Adjustment and Intensity-Limit Adjustment 3-9
Vertical Adjustment 3-15
Focus Adjustment 3-19
High Voltage Compensation Adjustment 3-22

The internal firmware of the display generates the display adjustment test patterns. The test patterns are used to adjust horizontal position and gain, intensity, vertical linearity, vertical position and gain, and focus. A separate test pattern is used to adjust high voltage compensation.

WARNING

DO NOT operate an HP 70001A Option 400 (400 Hz) Mainframe at 400 Hz without the attached in-line isolation transformer. Doing so represents a *SHOCK HAZARD* which may result in personal injury.

NOTE

The 400 Hz option can be operated on a 60 Hz power line if the in-line isolation transformer is detached from the mainframe, and a standard power cord is used. The in-line isolation transformer must be reattached before the mainframe is plugged into a 400 Hz power line source. The in-line isolation transformer protects the user from *SHOCK HAZARD* in the event the power-line source is incorrectly grounded.

Whenever the V1 CRT Assembly, A2 Sweep/Motherboard assembly, or A5 Power Supply board assembly is repaired or replaced, the adjustments in this chapter *must* be performed. These adjustments match the sweep board-assembly video circuits with the characteristics of the CRT tube and yoke. If any of the above assemblies are changed, it is best to preadjust the A2 Sweep/Motherboard assembly trimpots.

NOTE

Center all trimpots before beginning the adjustments.

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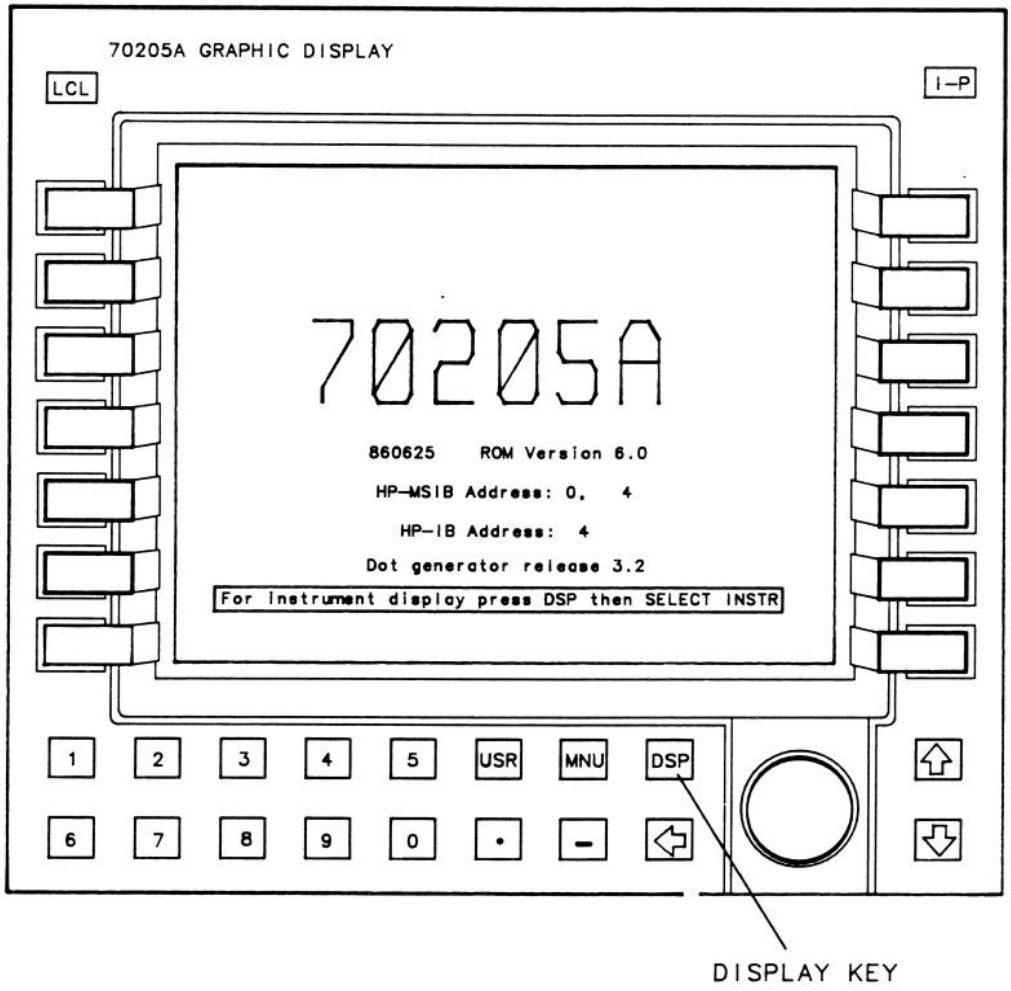


Figure 3-2. HP-IB/HP-MSIB Screen and Location of [DSP] Key

1. Horizontal Adjustment and Intensity-Limit Adjustment

PURPOSE

The Horizontal Adjustment sets the gain (width) and position of the trace. Changing WIDTH directly changes the intensity; therefore, WIDTH should be set first. The Intensity Limit Adjustment sets the maximum output level seen when the display front-panel control is set to its maximum intensity level (19).

EQUIPMENT LIST

Oscilloscope . . . . . HP 1740A

Cable

Probe (10:1) . . . . . HP 10080A

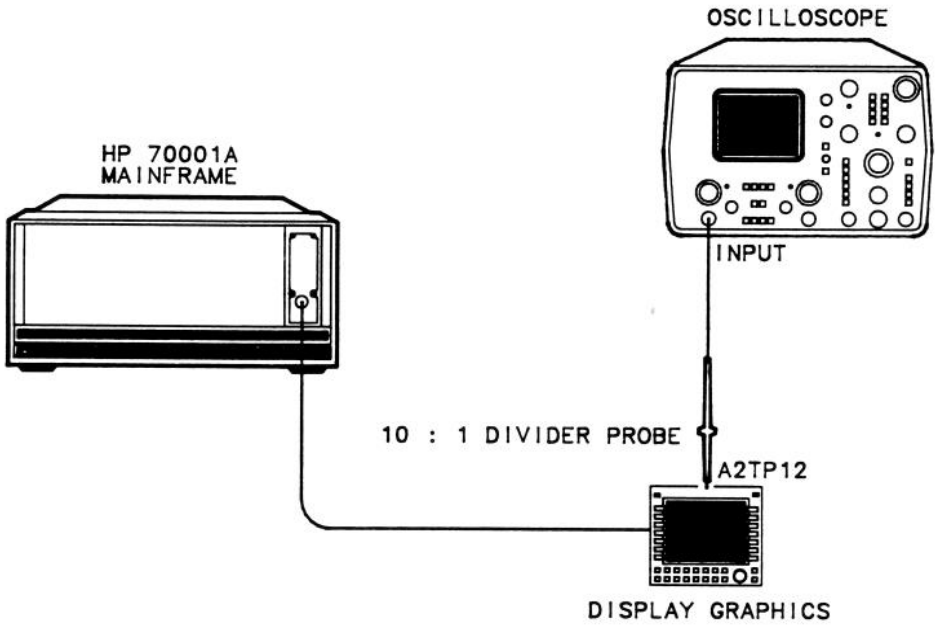


Figure 3-3. HP 70205A Horizontal Adjustment Setup

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PROCEDURE

CAUTION

Use ESD (electrostatic discharge) precautions when working on the A2 Sweep/Motherboard assembly.

1. Set the LINE switch to the OFF position.
2. Remove the top cover. Refer to the top cover removal procedure in Chapter 5, "Replacement Procedures."
3. Place the display module on the module service extender.

Accessing Adjustment Test Patterns

NOTE

If the CRT is not properly adjusted, the softkey labels may not align with the correct keys or they may not appear on-screen. To determine the softkey labels, refer to the illustrations in this chapter.

4. Set the LINE switch to the ON position. If no display appears, rotate A2R94 INTEN clockwise. If there is still no display, refer to Chapter 4, "Troubleshooting."
5. When the HP-IB/HP-MSIB address screen appears, press the [DSP] key (see Figure 3-2).
6. When the DISPLAY screen appears, press {INTEN ADJUST} (see Figure 3-4). Rotate the RPG knob clockwise until the intensity setting reads `INTENSITY:19` in the lower left-hand corner of the screen. (To change the intensity setting without rotating the RPG knob, the up-arrow key [↑] can be used, or the number 19 can be entered directly from the keyboard.)

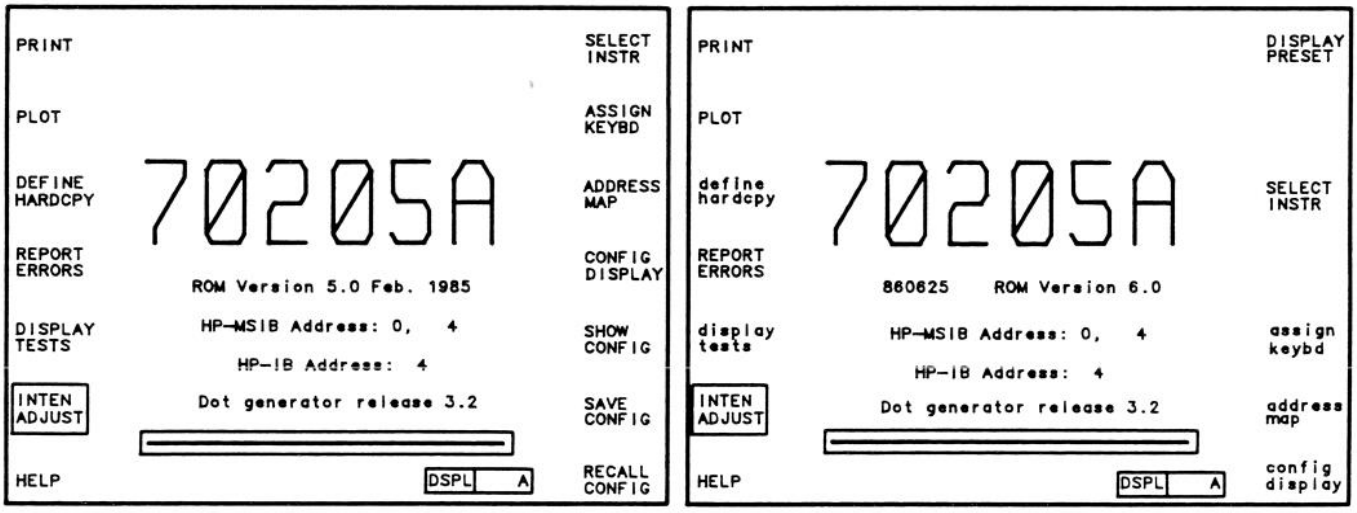


Figure 3-4. Changing Intensity Setting

ROM Version 5.0

7. When the DISPLAY screen appears, press {DISPLAY TESTS}.

ROM Version 6.0

7. When the DISPLAY screen appears, press {display tests}.

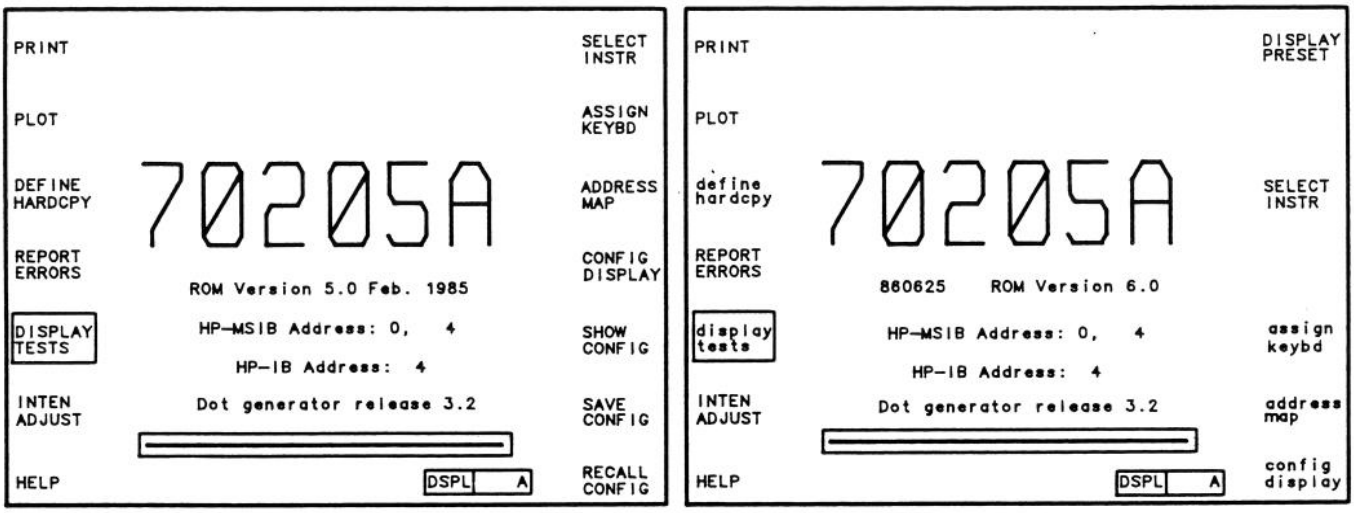


Figure 3-5. Accessing Display Test Menu

8. When the Test Menu appears, press {PATTERN 1}.

8. When the Test Menu appears, press {test pattern}, [1], {ENTER}.

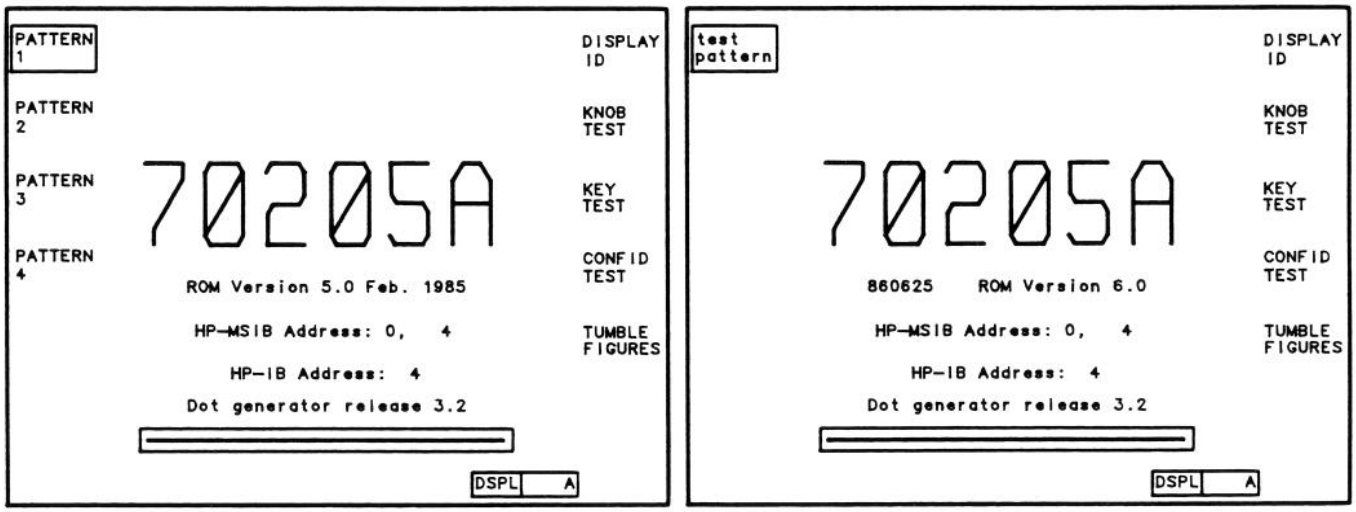


Figure 3-6. Accessing Adjustment Test Patterns

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9. See Figure 3-7 for the Horizontal Adjustment and Intensity Limit Adjustment test pattern.

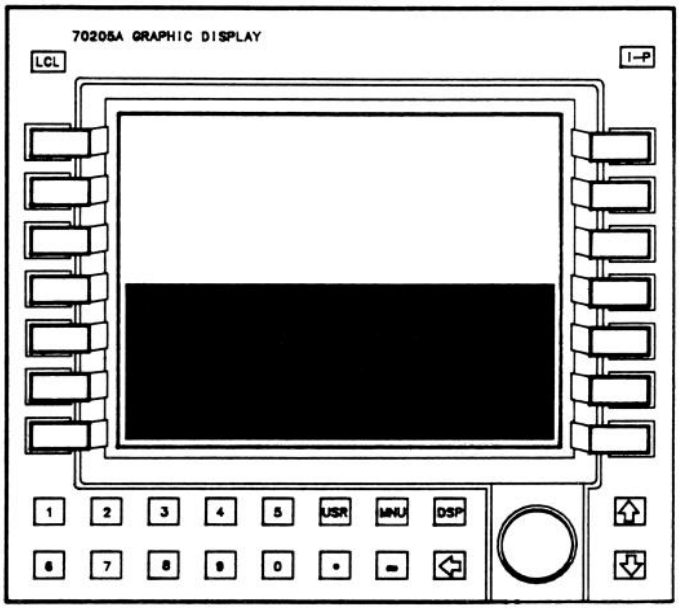


Figure 3-7. Horizontal Width, Horizontal Postion, and Intensity Limit Test Pattern

10. Adjust A2R87 H POS and A2L4 WIDTH (refer to Figure 3-8) until the pattern appears to be centered on-screen, and both sides of the intensified block can be seen from approximately 3 feet away.

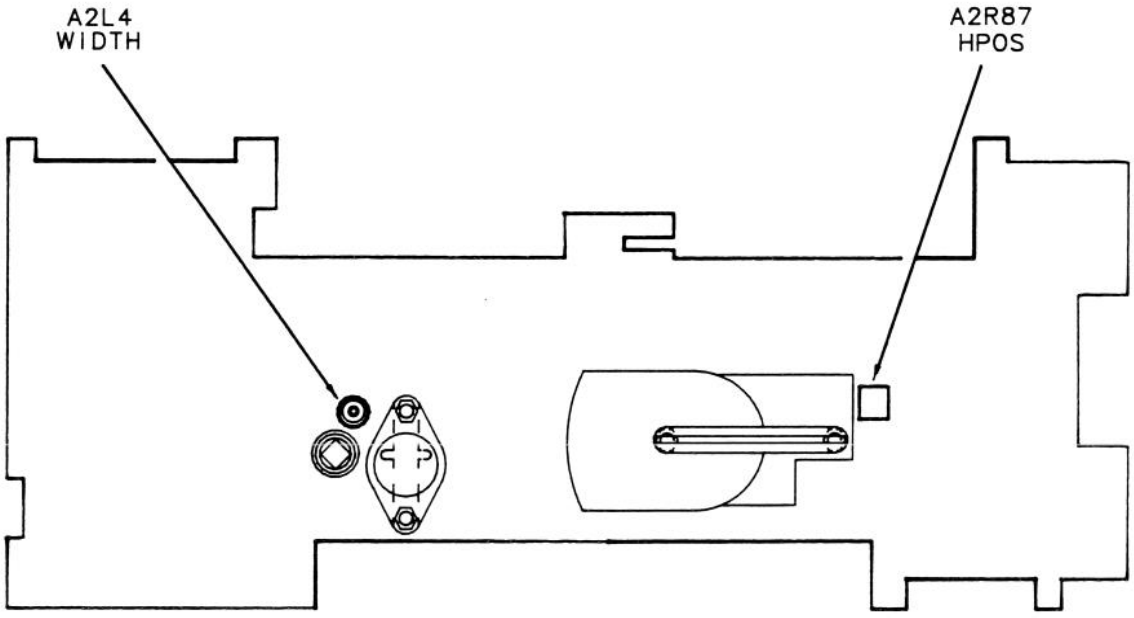


Figure 3-8. Horizontal Width and Horizontal Postion Adjustment Locations

11. Connect the oscilloscope to TP12 on the A2 Sweep/Motherboard assembly (see Figure 3-2).

12. On the oscilloscope, key in the following settings:

[VOLTS/DIV]	10 mV/DIV
[SEC/DIV]	5 ms/DIV
TRIGGER	LINE

13. Rotate A2R95 HV COMP all the way counterclockwise (see Figure 3-19).

14. Adjust A2R94 INTEN (see Figure 3-9) to obtain a square wave of 400 mV peak-to-peak (four divisions on the oscilloscope with a 10X probe). This sets the beam current to 40 μA.

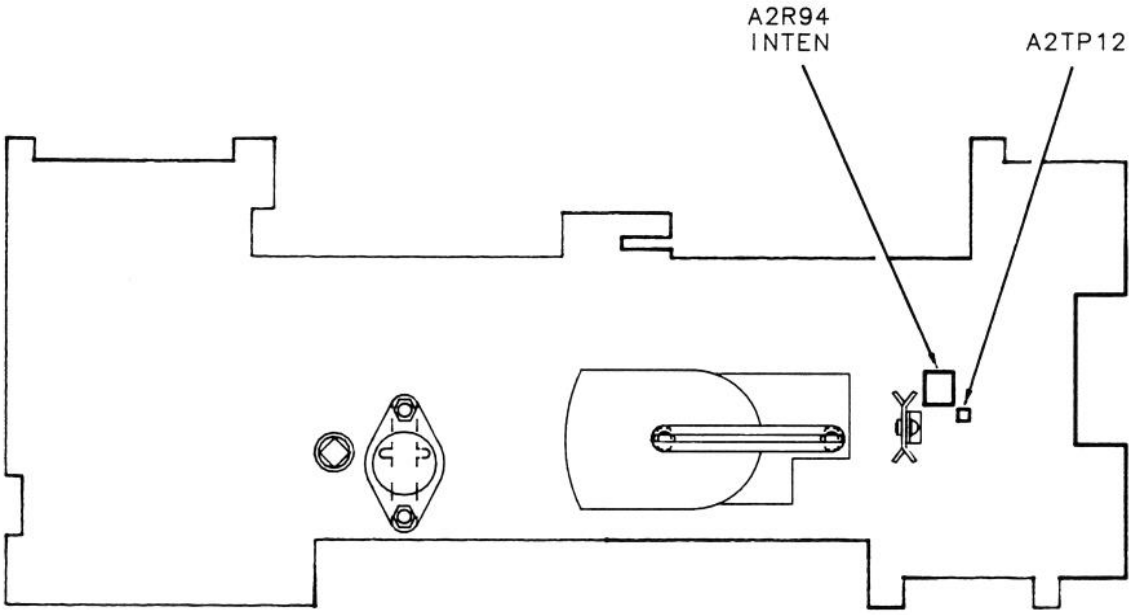


Figure 3-9. Intensity Adjustment Location

15. Adjust A2R94 INTEN up or down until the vertical retrace lines (seen in the top half of the screen) are barely visible. The square wave measurement must fall within the limits in Table 3-3.

16. To verify the settings, press the [DSP] key. The screen characters should not extend off the edge of the screen. Adjustment procedure 2, "Vertical Adjustments," may need to be performed before the screen settings can be visually verified.

17. Press {INTEN ADJUST}, and verify that intensity can be modified by one of these methods: (1) rotate the RPG knob clockwise and counterclockwise, (2) press the [↑] and [↓] keys, or (3) enter a setting on the numeric keypad from 0 to 19 and press {ENTER}. Intensity settings will appear in the lower left-hand corner of the screen.

18. To continue with adjustments, refer to procedure 2, "Vertical Adjustments." If you do not want to continue with adjustments, perform steps 19 through 21 below.

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19. Push the LINE switch to the OFF position.

20. Remove the display module from the module service extender.

21. Remove TP1 from the A3 Dot Generator board assembly (this prevents TP1 from shorting to the cover). Replace the top cover. Refer to the top cover replacement procedure in Chapter 5, "Replacement Procedures."

Table 3-3. Square Wave Measurement Limits

	Minimum	Maximum
Volts peak-to-peak	100 mV	700 mV
Oscilloscope with 10X probe	1 division	7 divisions
Corresponding beam current	10 μA	70 μA

2. Vertical Adjustment

PURPOSE

The Vertical Adjustment adjusts the vertical gain, position, and linearity of the traces.

PROCEDURE

CAUTION

Use ESD (electrostatic discharge) precautions when working on the A2 Sweep/Motherboard assembly.

1. Set the LINE switch to the OFF position.
2. Remove the top cover. Refer to the top cover removal procedure in Chapter 5, "Replacement Procedures."
3. Place the display module on the module service extender.

Accessing Adjustment Test Patterns

NOTE

If the CRT is not properly adjusted, the softkey labels may not align with the correct keys or they may not appear on-screen. To determine the softkey labels, refer to the illustrations in this chapter.

4. Set the LINE switch to the ON position.
5. When the HP-IB/HP-MSIB address screen appears, press the [DSP] key (see Figure 3-2).

NOTE

A2R41, A2R43, and A2R57 are interactive adjustments and require some iteration.

6. Adjust A2R41 V POS and A2R43 HEIGHT until the softkey labels are aligned with each corresponding softkey (see Figure 3-10).

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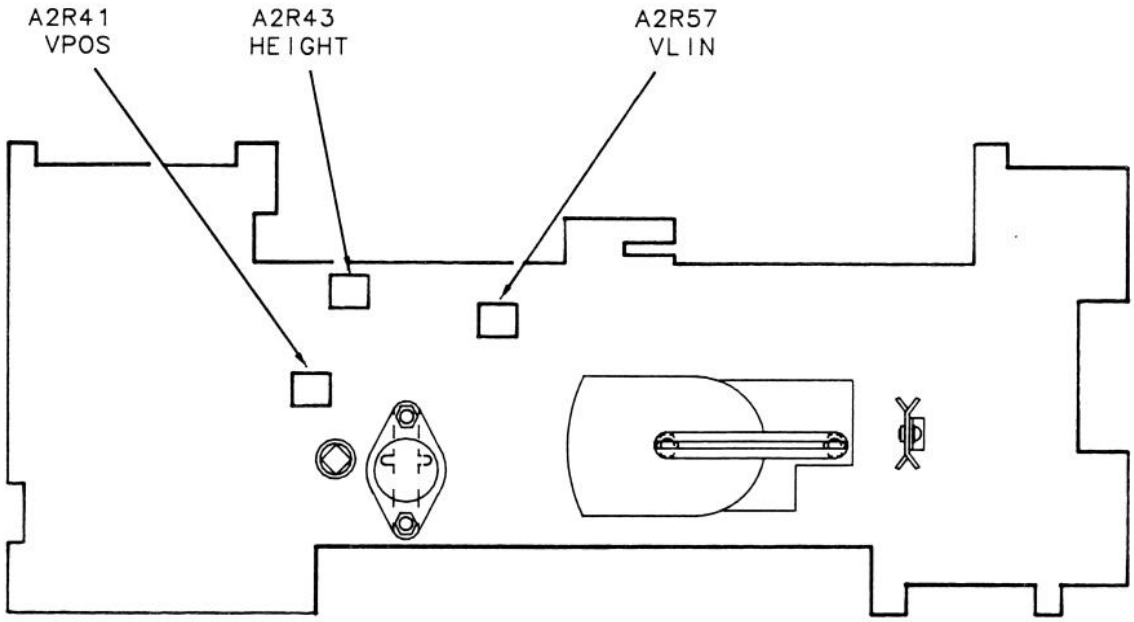


Figure 3-10. Vertical Adjustment Locations

ROM Version 5.0

7. Press {DISPLAY TESTS}, then press {PATTERN 3}.

ROM Version 6.0

7. Press {display tests}, then {test pattern}, [3], {ENTER}.

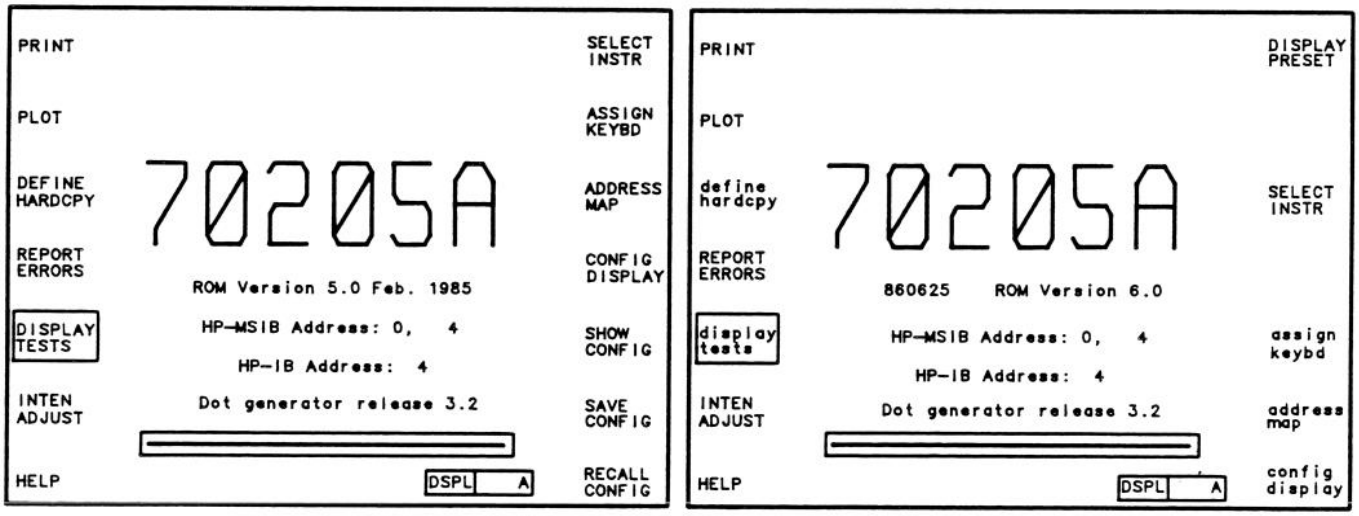


Figure 3-11. Accessing Adjustment Test Patterns

8. Adjust A2R41 V POS to place the entire test pattern on the screen. Adjust A2R43 HEIGHT and A2R41 V POS to place the test pattern's top right-hand corner in line with the top of the highest softkey, and the pattern's lower right-hand corner in line with the lower edge of the bottommost softkey (see Figure 3-12).

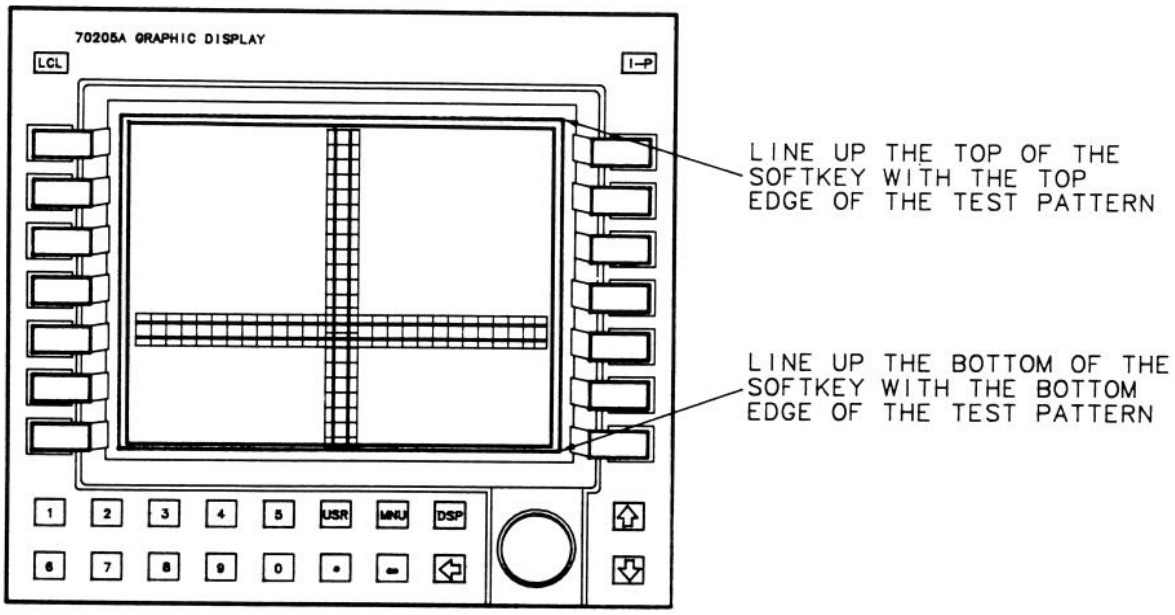


Figure 3-12. Vertical Adjustment Test Pattern

9. Adjust A2R57 V LIN until the middle horizontal crossbars are centered between the top and bottom bars.

10. Readjust A2R41 V POS until the horizontal crossbars in the middle of the screen line up with the central softkeys (see Figure 3-13).

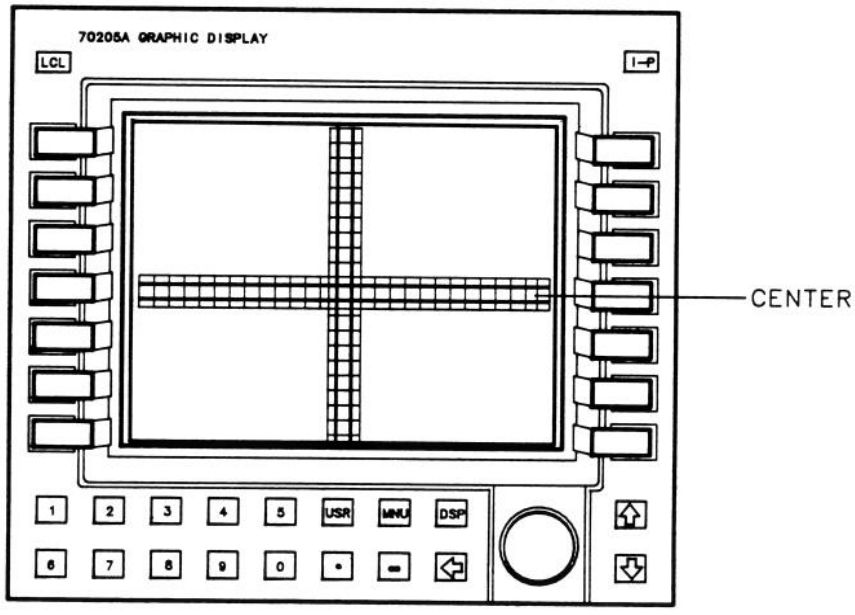


Figure 3-13. Horizontal Crossbar Adjustment Test Pattern

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11. To verify the adjustments, press the [DSP] key. The softkey labels should line up with their corresponding keys. Adjust A2R41 to line up the labels exactly around the softkeys.

12. To continue with adjustments, refer to procedure 3, "Focus Adjustment." If you do not want to continue with adjustments, perform steps 13 through 15 below.

13. Push the LINE switch to the OFF position.

14. Remove the display module from the module service extender.

15. Remove TP1 from the A3 Dot Generator board assembly (this prevents TP1 from shorting to the cover). Replace the top cover. Refer to the top cover replacement procedure in Chapter 5, "Replacement Procedures."

3. Focus Adjustment

PURPOSE

The Focus Adjustment adjusts for optimum focus of the CRT display.

PROCEDURE

CAUTION

Use electrostatic discharge (ESD) precautions when working on the A2 Sweep/Motherboard assembly.

1. Set the LINE switch to the OFF position.
2. Remove the top cover. Refer to the top cover removal procedure in Chapter 5, "Replacement Procedures."
3. Place the display module on the module service extender.

Accessing Adjustment Test Patterns

NOTE

If the CRT is not properly adjusted, the softkey labels may not align with the correct keys or they may not appear on-screen. To determine the softkey labels, refer to the illustrations in this chapter.

4. Set the LINE switch to the ON position.
5. When the HP-IB/HP-MSIB address screen appears, press the [DSP] key (see Figure 3-2).

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ROM Version 5.0

6. When the DISPLAY screen appears, press {DISPLAY TESTS} (see Figure 3-14). Press {DISPLAY ID}.

ROM Version 6.0

6. When the DISPLAY screen appears, press {display tests} (see Figure 3-14). Press {DISPLAY ID}.

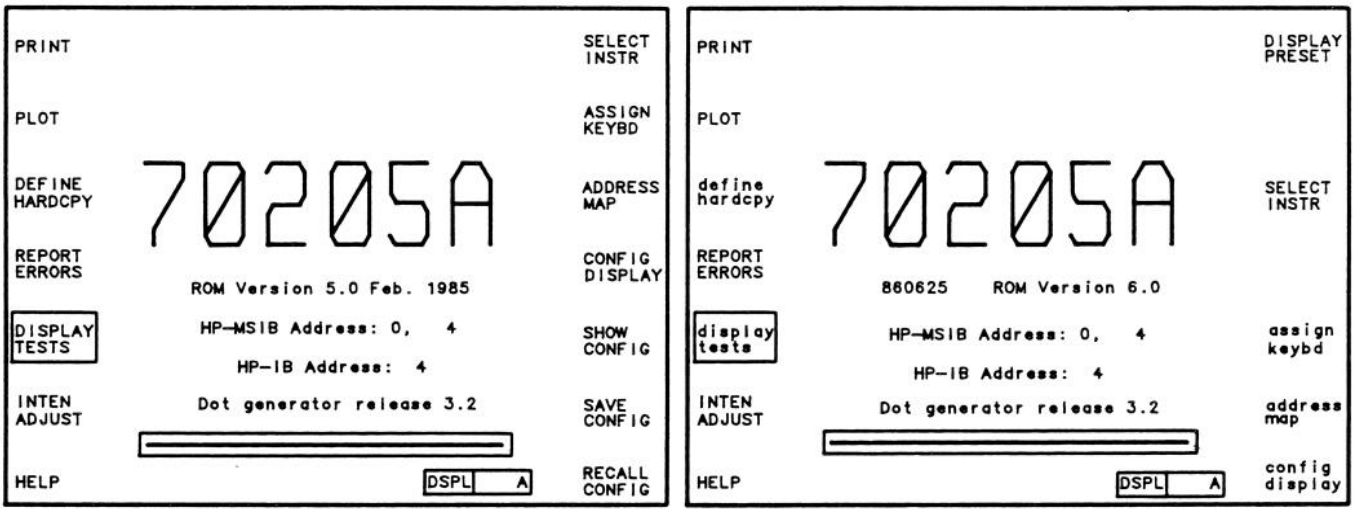


Figure 3-14. Accessing Display Tests

NOTE

Before performing the following steps, set intensity to 15.

7. Adjust A2R88 FOCUS until all characters and figures are focused. Be sure that characters in the left- and right-hand corners, and characters at center screen, are all in focus (see Figure 3-15).

8. If continuing to another adjustment, press the [DSP] key to return to the Display Menu. If you do not want to continue with adjustments, perform steps 9 through 11 below.

9. Push the LINE switch to the OFF position.

10. Remove the display module from the module service extender.

11. Remove TP1 from the A3 Dot Generator board assembly (this prevents TP1 from shorting to the cover). Replace the top cover. Refer to the top cover replacement procedure in Chapter 5, "Replacement Procedures."

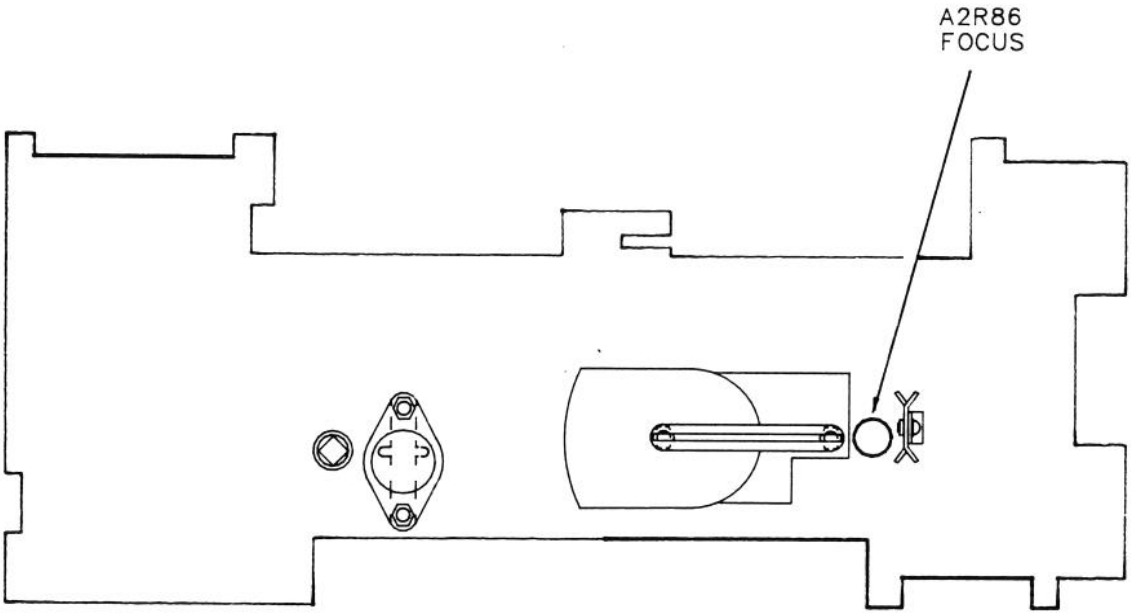


Figure 3-15. Focus Adjustment Location

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4. High Voltage Compensation Adjustment

PURPOSE

The High Voltage Compensation Adjustment sets the gain for a feedback compensation voltage. When the display draws a solid block, beam current flows, causing the CRT 8 kV bias to drop. The screen edges bow outward. To fix this, a voltage proportional to the beam current is added back to the 8 kV bias.

PROCEDURE

CAUTION

Use ESD (electrostatic discharge) precautions when working on the A2 Sweep/Motherboard assembly.

1. Set the LINE switch to the OFF position.
2. Remove the top cover. Refer to the top cover removal procedure in Chapter 5, "Replacement Procedures."
3. Place the display module on the module service extender.

Accessing Adjustment Test Patterns

NOTE

If the CRT is not properly adjusted, the softkey labels may not align with the correct keys or they may not appear on-screen. To determine the softkey labels, refer to the illustrations in this chapter.

4. Set the LINE switch to the ON position.
5. When the HP-MSIB/HP-IB address screen appears, press the [DSP] key (see Figure 3-2). Set display {INTEN ADJUST} to 19.

ROM Version 5.0

6. When the DISPLAY screen appears, press {DISPLAY TESTS}.

ROM Version 6.0

6. When the DISPLAY screen appears, press {display tests}.

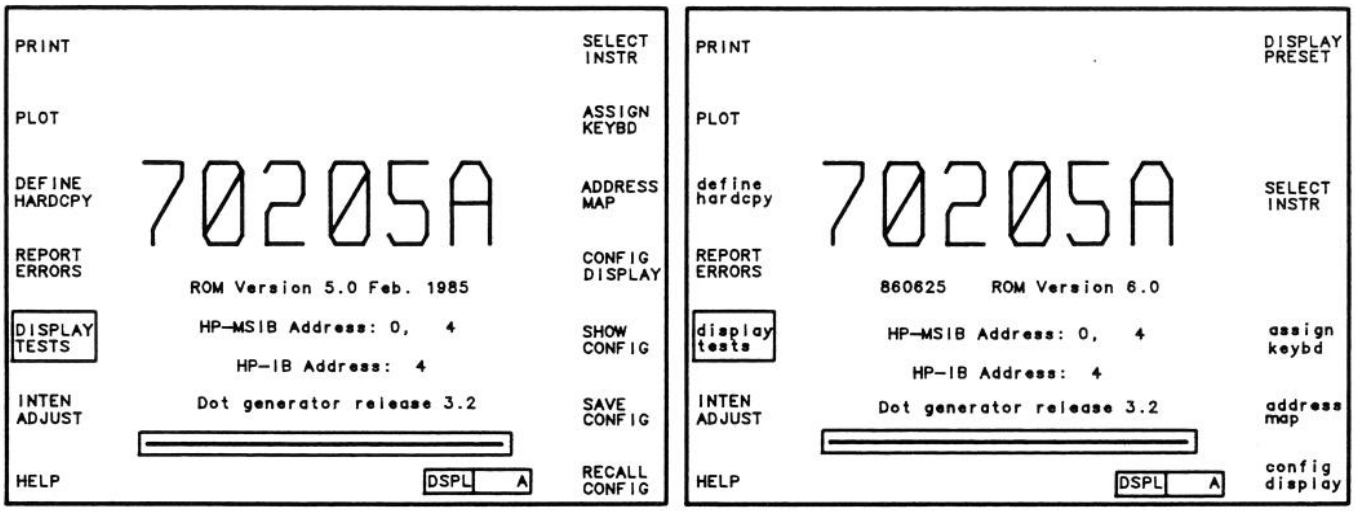


Figure 3-16. Accessing Display Test Menu

7. When the Test Menu appears, press {PATTERN 2}.

7. When the Test Menu appears, press {test pattern}, [2], {ENTER}.

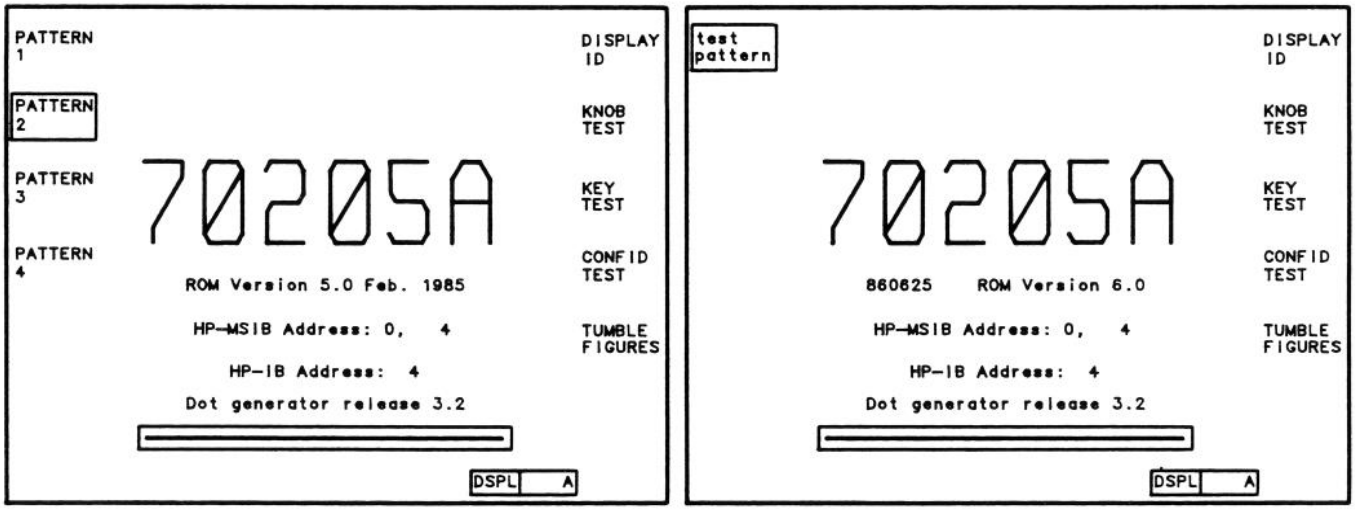


Figure 3-17. Accessing Adjustment Test Patterns

8. Adjust A2R95 HV COMP until the left and right vertical lines of the display border (box) are straight, not bowed (see Figures 3-18 and 3-19).

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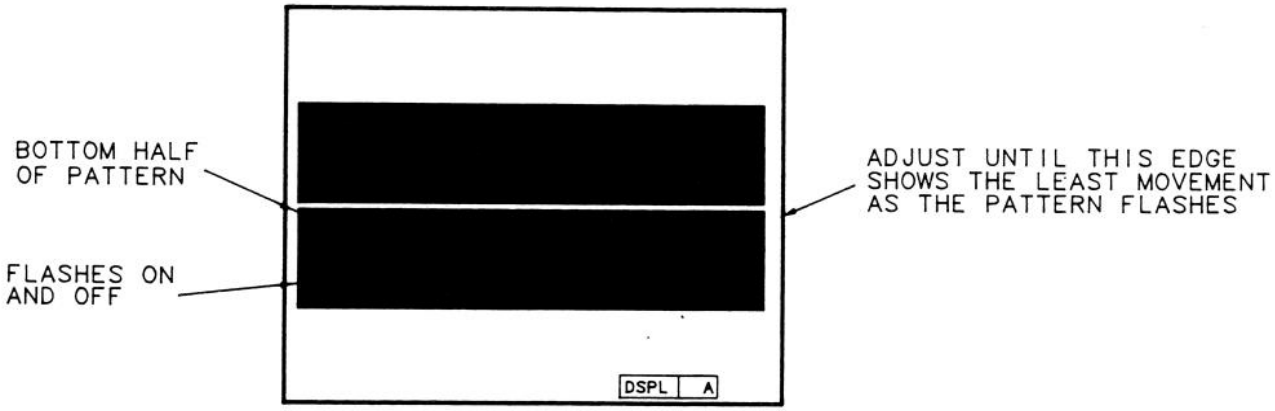


Figure 3-18. High Voltage Compensation Test Pattern

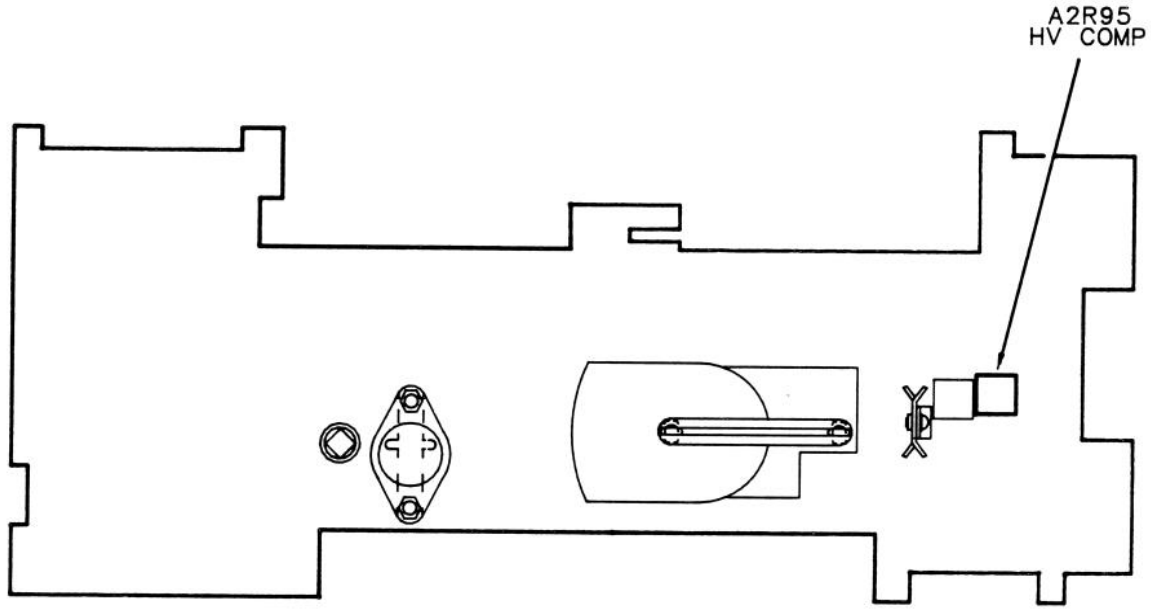


Figure 3-19. High Voltage Compensation Adjustment Location

9. If continuing to another adjustment, press the [DSP] key to return to the Display Menu. If *not* continuing to another adjustment, perform steps 10 through 12 below.

10. Push the LINE switch to the OFF position.

11. Remove the display module from the module service extender.

12. Replace the top cover. Refer to the top cover replacement procedure in Chapter 5, "Replacement Procedures."

HP 70206A System Graphics Display

Adjustments

Introduction

This section contains the following information.

Horizontal Adjustment and Intensity-Limit Adjustment 3-27
Vertical Adjustment 3-33
Focus Adjustment 3-37
High Voltage Compensation Adjustment 3-40

The internal firmware of the display generates the display adjustment test patterns. The test patterns are used to adjust horizontal position and gain, intensity, vertical linearity, vertical position and gain, and focus. A separate test pattern is used to adjust high voltage compensation.

WARNING

DO NOT operate an HP 70206A Option 400 (400 Hz) System Graphics Display at 400 Hz without the attached in-line isolation transformer. Doing so represents a *SHOCK HAZARD* which may result in personal injury.

NOTE

The 400 Hz option can be operated on a 60 Hz power line if the in-line isolation transformer is detached from the display, and a standard power cord is used. The in-line isolation transformer must be re-attached before the display is plugged into a 400 Hz power line source. The in-line isolation transformer protects the user from *SHOCK HAZARD* in the event the power-line source is incorrectly grounded.

Whenever the V1 CRT Assembly, A2 Video/Sweep board assembly, or A11 Power Supply board assembly is repaired or replaced, the adjustments in this chapter *must* be performed. These adjustments match the sweep board-assembly video circuits with the characteristics of the CRT tube and yoke. If any of the above assemblies are changed, it is best to preadjust the A2 Video/Sweep board assembly trimpots.

NOTE

Center all trimpots before beginning the adjustments.

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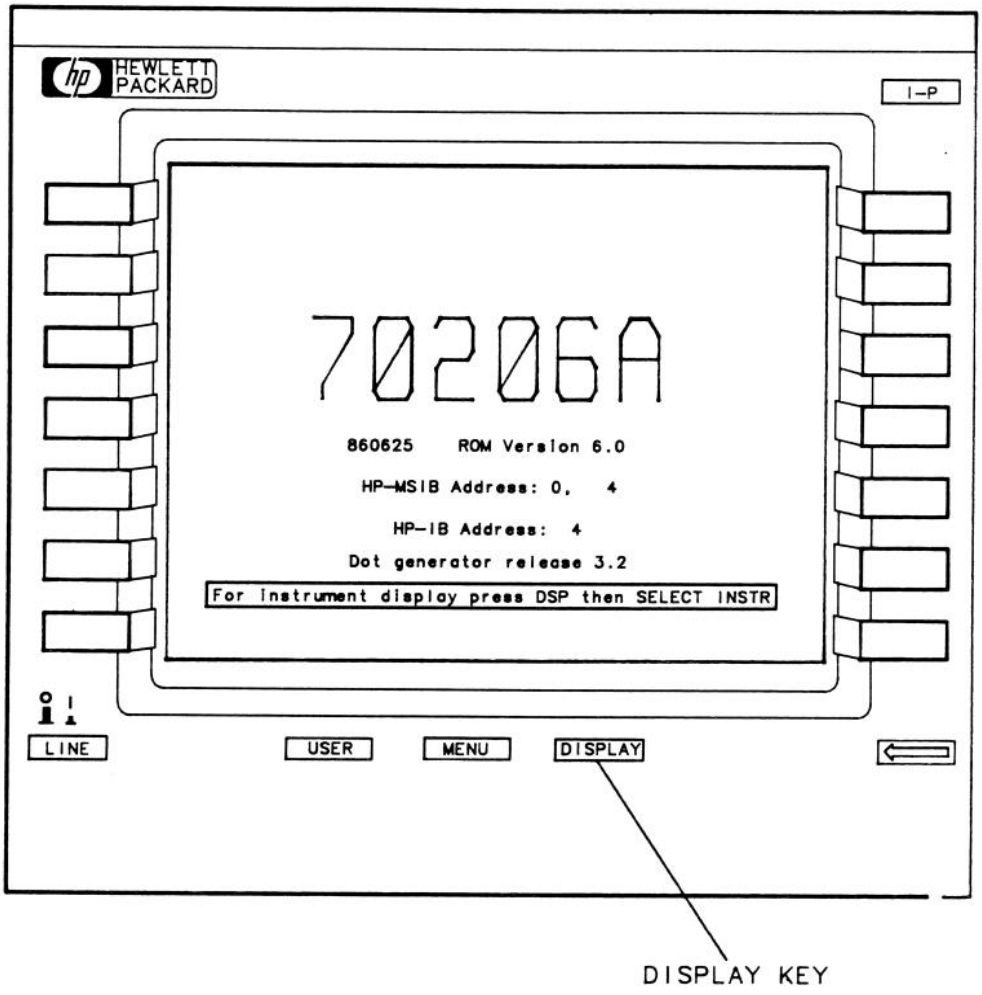


Figure 3-20. HP-IB/HP-MSIB Screen and Location of [DISPLAY] Key

1. Horizontal Adjustment and Intensity-Limit Adjustment

PURPOSE

The Horizontal Adjustment sets the gain (width) and position of the trace. Changing WIDTH directly changes the intensity; therefore, WIDTH should be set first. The Intensity Limit Adjustment sets the maximum output level seen when the display front-panel control is set to its maximum intensity level (19).

EQUIPMENT LIST

Oscilloscope	HP 1740A
Adapter	
Sweep Extender Board	HP 70206-60041
Cable	
Probe (10:1)	HP 10080A

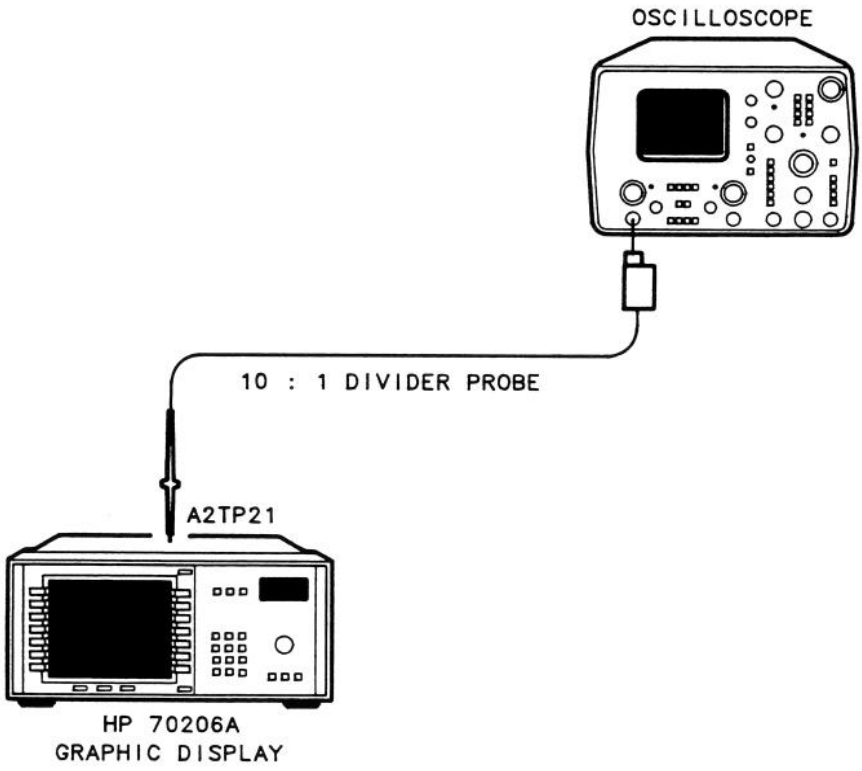


Figure 3-21. Display Adjustment Setup

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PROCEDURE

CAUTION

Use ESD (electrostatic discharge) precautions when working on the A2 Video/Sweep board assembly.

1. Set the LINE switch to the OFF position.
2. Remove the A2 Video/Sweep board assembly. Refer to the A2 Video/Sweep replacement procedure in Chapter 5. Place the A2 Video/Sweep board assembly on the sweep extender board.

Accessing Adjustment Test Patterns

NOTE

If the CRT is not properly adjusted, the softkey labels may not align with the correct keys or they may not appear on-screen. To determine the softkey labels, refer to the illustrations in this chapter.

3. Set the LINE switch to the ON position. If no display appears, rotate A2R26 INTEN LIMIT clockwise. If there is still no display, refer to Chapter 4, "Troubleshooting."
4. When the HP-IB/HP-MSIB address screen appears, press the [DISPLAY] key (see Figure 3-20).
5. When the DISPLAY screen appears, press {INTEN ADJUST} (see Figure 3-22). Rotate the RPG knob clockwise until the intensity setting reads `INTENSITY:19` in the lower left-hand corner of the screen. (To change the intensity setting without rotating the RPG knob, the up-arrow key [↑] can be used, or the number 19 can be entered directly from the keyboard.)

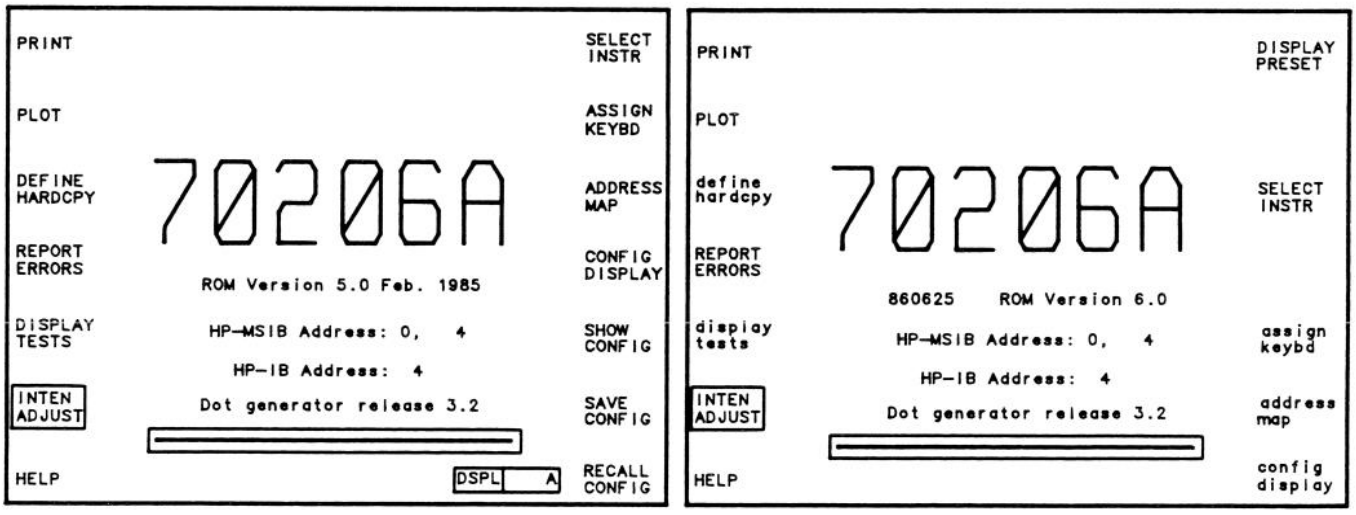


Figure 3-22. Changing Intensity Setting

ROM Version 5.0

6. When the DISPLAY screen appears, press {DISPLAY TESTS}.

ROM Version 6.0

6. When the DISPLAY screen appears, press {display tests}.

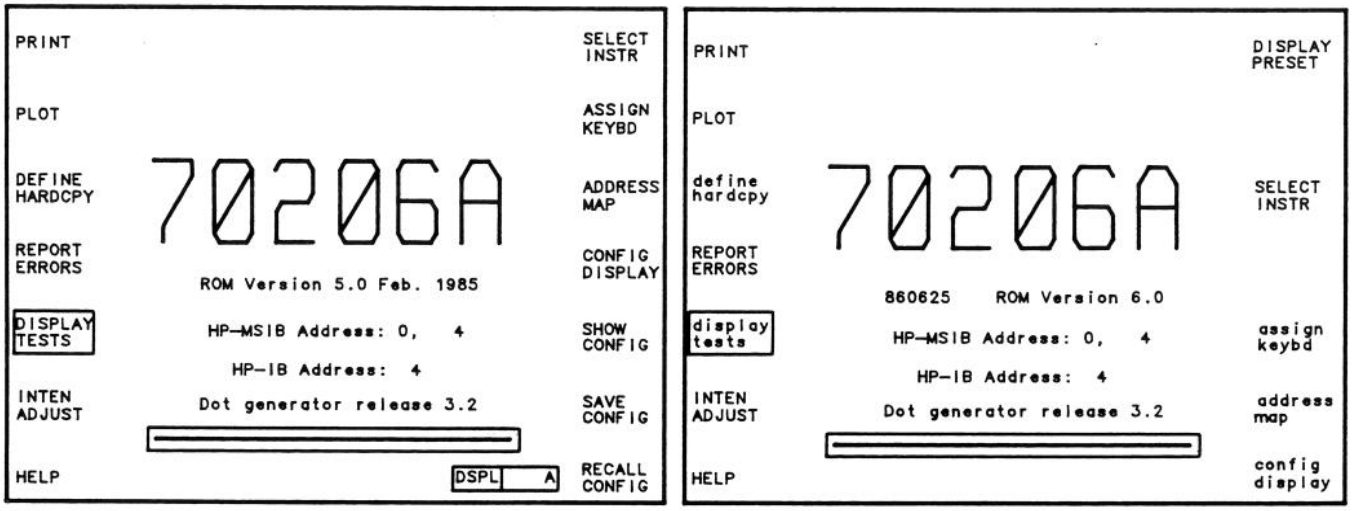


Figure 3-23. Accessing Display Test Menu

7. When the Test Menu appears, press {PATTERN 1}.

7. When the Test Menu appears, press {test pattern}, [1], {ENTER}.

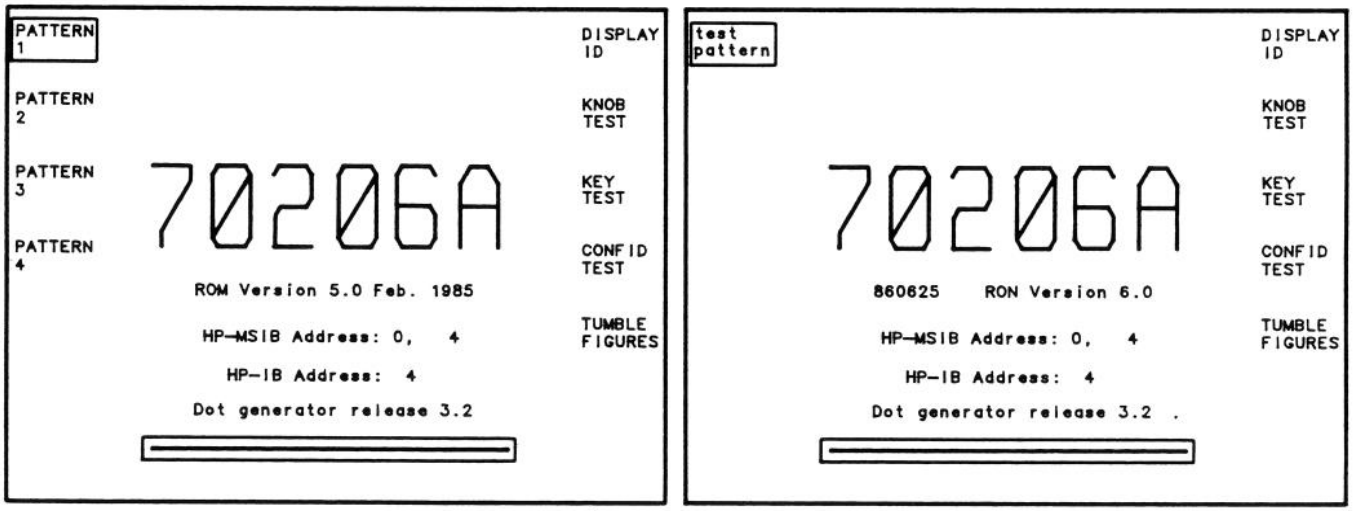


Figure 3-24. Accessing Adjustment Test Patterns

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8. See Figure 3-25 for the Horizontal Adjustment and Intensity Limit Adjustment test pattern.

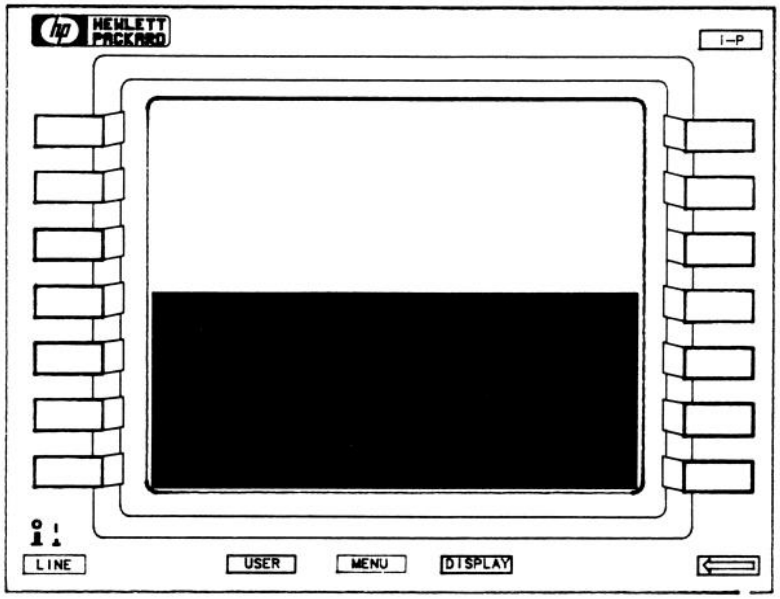


Figure 3-25. Horizontal Width, Horizontal Postion, and Intensity Limit Test Pattern

9. Adjust A2R47 H POS and A2L1 WIDTH (refer to Figure 3-26) until the intensified block appears to be centered on-screen and the sides are still visible from approximately 3 feet away.

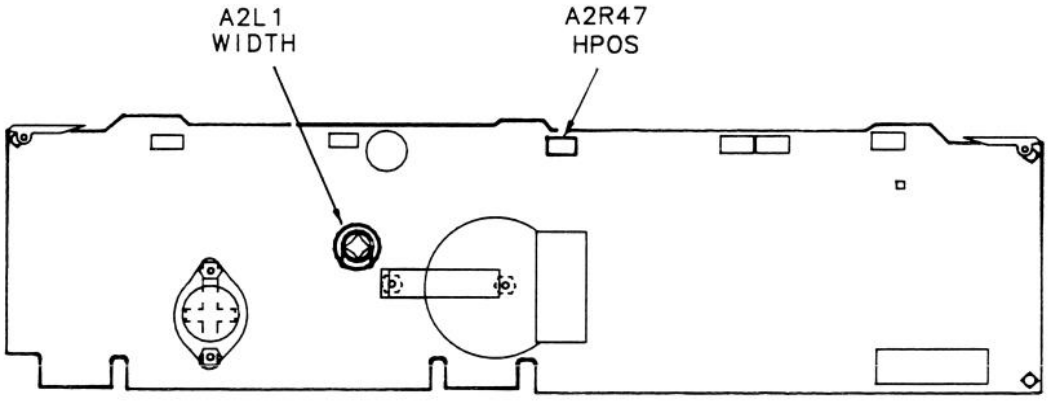


Figure 3-26. Horizontal Width and Horizontal Postion Adjustment Locations

10. Connect the oscilloscope to TP21 on the A2 Video/Sweep board assembly (see Figure 3-21).

11. On the oscilloscope, key in the following settings:

[VOLTS/DIV] . . . . . 10 mV/DIV
[SEC/DIV] . . . . . 5 ms/DIV
TRIGGER . . . . . LINE

12. Rotate A2R20 HV COMP all the way counterclockwise (see Figure 3-34).

13. Adjust A2R26 INTEN LIMIT (see Figure 3-27) to obtain a square wave of 400 mV peak-to-peak (four divisions on the oscilloscope with a 10X probe). This sets the beam current to 40 μA.

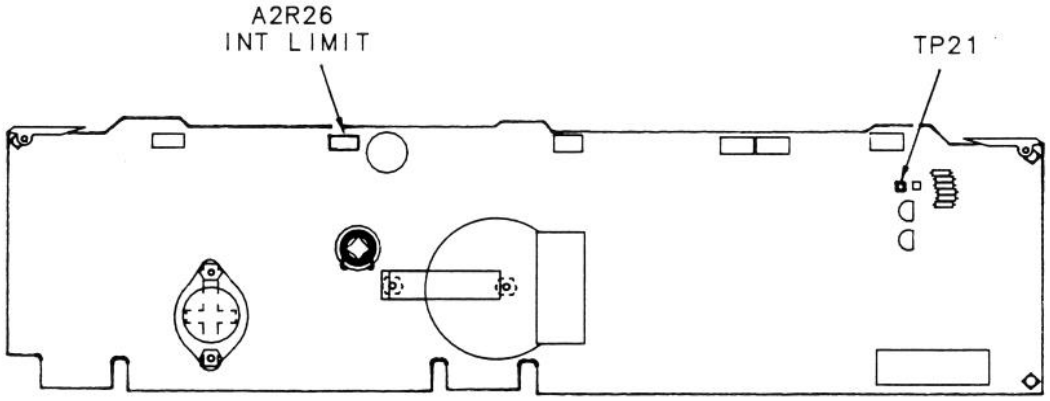


Figure 3-27. Intensity Adjustment Locations

14. Adjust A2R26 INTEN LIMIT up or down until the vertical retrace lines (seen in the top half of the screen) are barely visible. The square wave measurement must fall within the limits in Table 3-4.

Table 3-4. Square Wave Measurement Limits

	Minimum	Maximum
Volts peak-to-peak	100 mV	650 mV
Oscilloscope with 10X probe	1 division	6.5 divisions
Corresponding beam current	10 μA	65 μA

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15. To verify the settings, press the [DISPLAY] key. The screen characters should not extend off the edges of the screen. Adjustment procedure 2, "Vertical Adjustments," may need to be performed before the screen settings can be visually verified.

16. Press {INTEN ADJUST}, and verify that intensity can be modified by one of these methods: (1) rotate the RPG knob clockwise and counterclockwise, (2) press the [↑] and [↓] keys, or (3) enter a setting on the numeric keypad from 0 to 19 and press {ENTER}. Intensity settings will appear in the lower left-hand corner of the screen.

17. To continue with adjustments, refer to procedure 2, "Vertical Adjustments." If you do not want to continue with adjustments, perform steps 18 through 21 below.

18. Push the LINE switch to the OFF position.

19. Remove the A2 Video/Sweep board assembly.

20. Remove the sweep extender board from the display.

21. Replace the A2 Video/Sweep board assembly. Refer to the A2 Video/Sweep replacement procedure in Chapter 5, "Replacement Procedures."

2. Vertical Adjustment

PURPOSE

The Vertical Adjustment adjusts the vertical gain, position, and linearity of the traces.

EQUIPMENT LIST

Adapter

Sweep Extender Board *(optional)* . . . . . HP 70206-60041

PROCEDURE

CAUTION

Use ESD (electrostatic discharge) precautions when working on the A2 Video/Sweep board assembly.

NOTE

To perform this adjustment, it is not necessary to place the A2 board assembly on the sweep extender board. If the A2 board assembly is already on a sweep extender board, or if you do not wish to put A2 on the sweep extender board, skip to step 4. If you wish to put the A2 board assembly on a sweep extender board, begin this procedure with step 1 below.

1. Set the LINE switch to the OFF position.
2. Remove the A2 Video/Sweep board assembly. Refer to the A2 Video/Sweep replacement procedure in Chapter 5.
3. Place the A2 Video/Sweep board assembly on the sweep extender board.

Accessing Adjustment Test Patterns

NOTE

If the CRT is not properly adjusted, the softkey labels may not align with the correct keys or they may not appear on-screen. To determine the softkey labels, refer to the illustrations in this chapter.

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4. Set the LINE switch to the ON position.

5. When the HP-IB/HP-MSIB address screen appears, press the [DISPLAY] key (see Figure 3-20).

NOTE

A2R68, A2R84, and A2R69 are interactive adjustments and require some iteration.

6. Adjust A2R68 V POS and A2R84 HEIGHT until the softkey labels are aligned with each corresponding softkey.

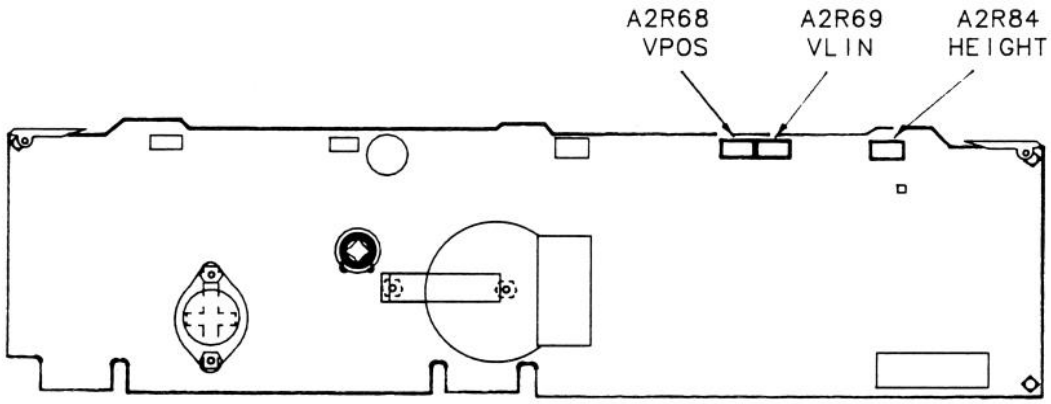


Figure 3-28. Vertical Adjustment Locations

ROM Version 5.0

7. Press {DISPLAY TESTS}, then press {PATTERN 3}.

ROM Version 6.0

7. Press {display tests}, then {test pattern}, [3], {ENTER}.

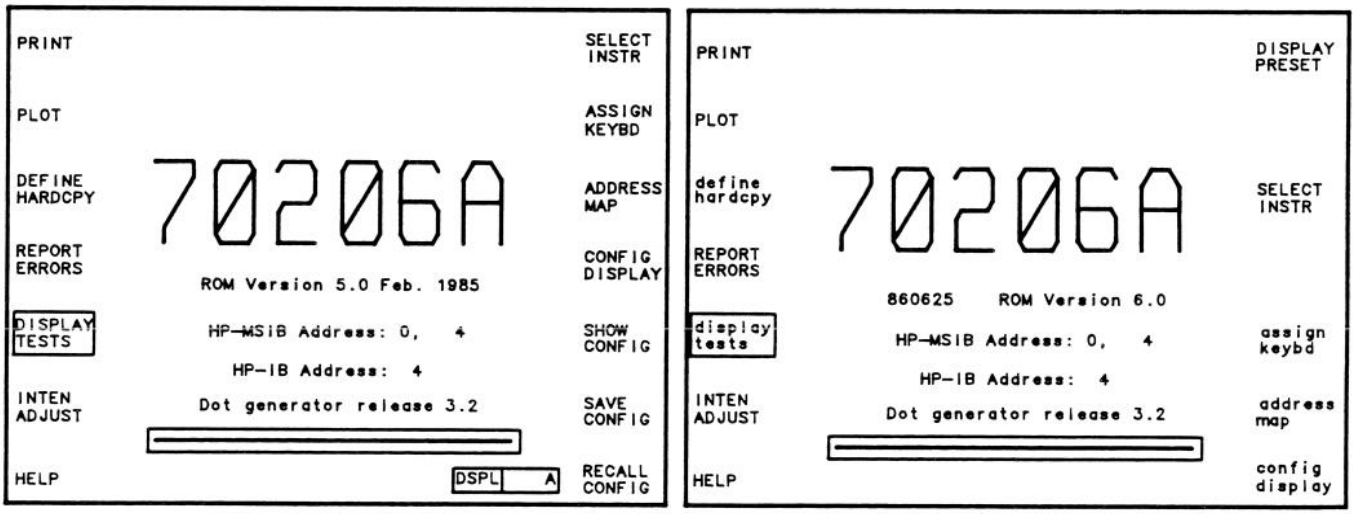


Figure 3-29. Accessing Adjustment Test Patterns

8. Adjust A2R68 V POS to place the entire test pattern on the screen. Adjust A2R84 HEIGHT and A2R68 V POS to place the test pattern's top right corner in line with the top of the highest softkey, and the pattern's lower right corner in line with the lower edge of the bottommost softkey (see Figure 3-30).

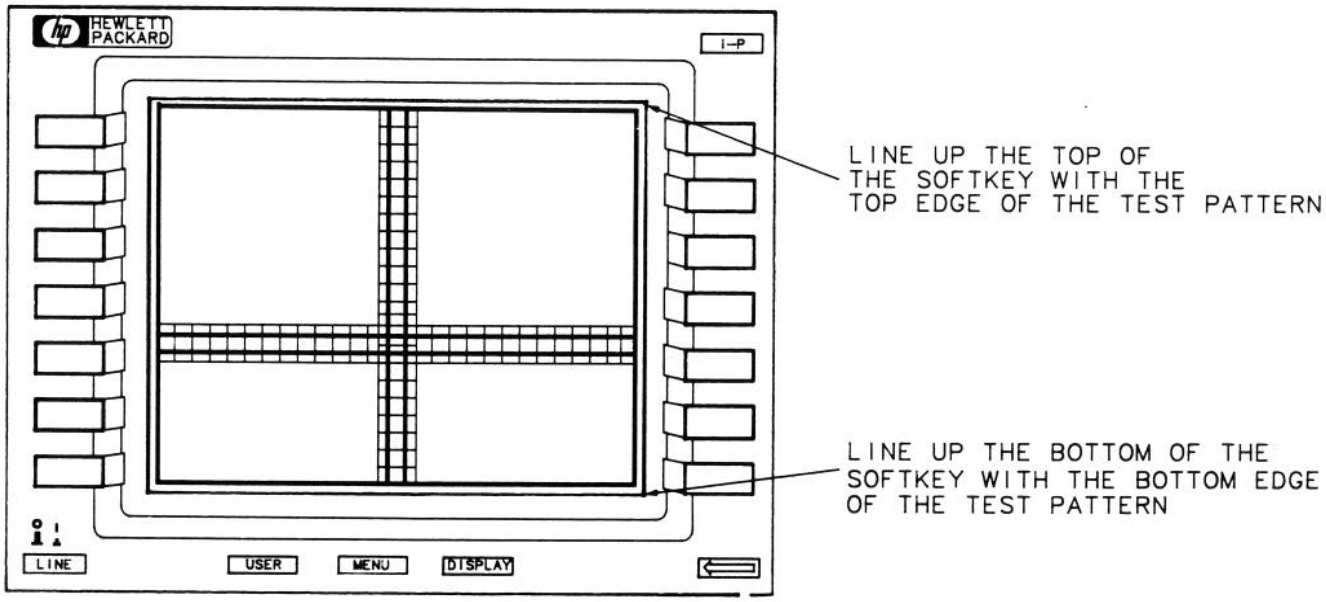


Figure 3-30. Vertical Adjustment Test Pattern

9. Adjust A2R69 V LIN until the middle horizontal crossbars are centered between the top and bottom bars.
10. Readjust A2R68 V POS until the horizontal crossbars in the middle of the screen line up with the central softkeys (see Figure 3-31).

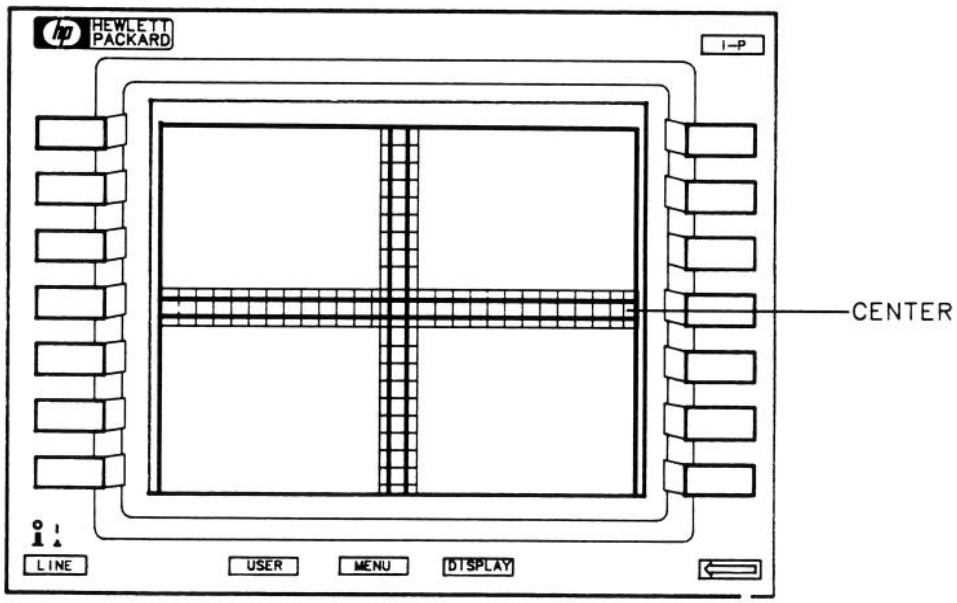


Figure 3-31. Horizontal Crossbar Adjustment Test Pattern

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11. To verify the adjustments, press the [DISPLAY] key. The softkey labels should line up with their corresponding keys. (A2R84 HEIGHT may have to be increased slightly to line up the labels.)

12. To continue with adjustments, refer to procedure 3, "Focus Adjustment." If you do not want to continue with adjustments, perform steps 13 through 16 below.

13. Push the LINE switch to the OFF position.

14. Remove the A2 Video/Sweep board assembly.

15. Remove the sweep board extender from the display.

16. Replace the A2 Video/Sweep board assembly. Refer to the A2 Video/Sweep replacement procedure in Chapter 5, "Replacement Procedures."

3. Focus Adjustment

PURPOSE

The Focus Adjustment adjusts for optimum focus of the CRT display.

EQUIPMENT LIST

Adapter

Sweep Extender Board . . . . . HP 70206-60041

PROCEDURE

CAUTION

Use electrostatic discharge (ESD) precautions when working on the A2 Video/Sweep board assembly.

1. Set the LINE switch to the OFF position.
2. Remove the A2 Video/Sweep board assembly. Refer to the A2 Video/Sweep replacement procedure in Chapter 5.
3. Place the A2 Video/Sweep board assembly on the sweep extender board.

Accessing Adjustment Test Patterns

NOTE

If the CRT is not properly adjusted, the softkey labels may not align with the correct keys or they may not appear on-screen. To determine the softkey labels, refer to the illustrations in this chapter.

4. Set the LINE switch to the ON position.
5. When the HP-IB/HP-MSIB address screen appears, press the [DISPLAY] key (see Figure 3-20).

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ROM Version 5.0

6. When the DISPLAY screen appears, press {DISPLAY TESTS}. See Figure 3-32. Press {DISPLAY ID}.

ROM Version 6.0

6. When the DISPLAY screen appears, press {display tests}. See Figure 3-32. Press {DISPLAY ID}.

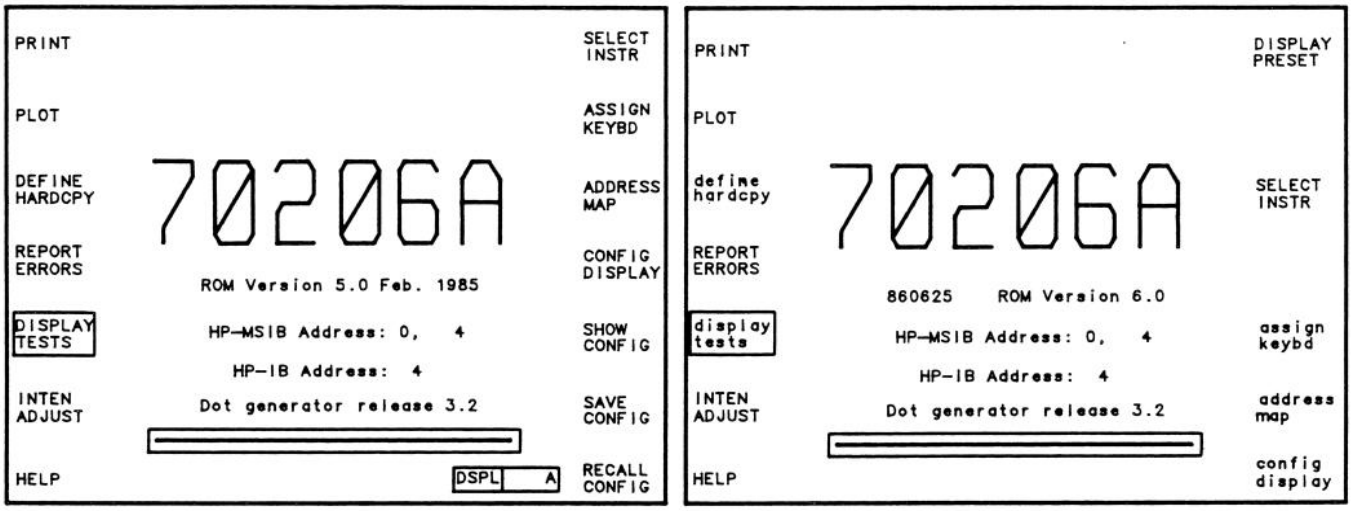


Figure 3-32. Accessing Display Tests

NOTE

Before performing the following steps, set intensity to 15.

7. Adjust A2R40 FOCUS until all characters and figures are focused. Be sure that characters in the left- and right-hand corners, and characters at center screen, are all in focus.

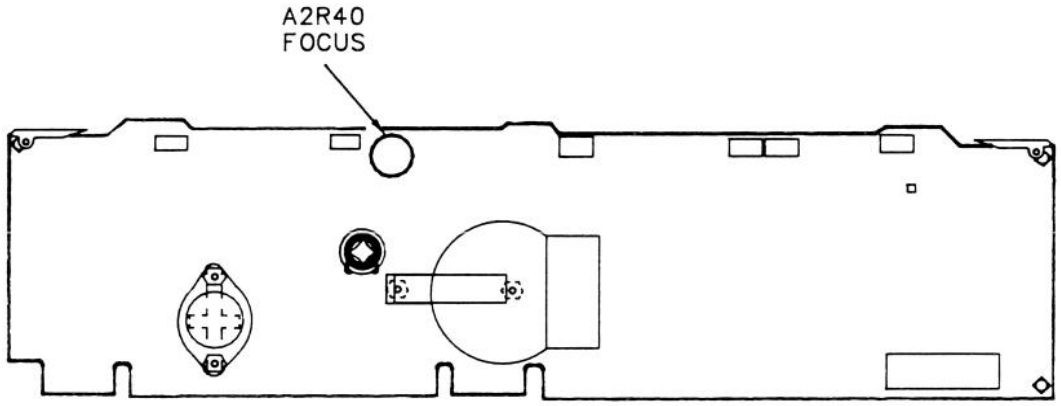


Figure 3-33. Focus Adjustment Location

8. If continuing to another adjustment, press the [DISPLAY] key to return to the Display Menu. If you do not want to continue with adjustments, perform steps 9 through 12 below.

9. Push the LINE switch to the OFF position.

10. Remove the A2 Video/Sweep board assembly.

11. Remove the sweep extender board from the display.

12. Replace the A2 Video/Sweep board assembly. Refer to the A2 Video/Sweep replacement procedure in Chapter 5, "Replacement Procedures."

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4. High Voltage Compensation Adjustment

PURPOSE

The High Voltage Compensation Adjustment sets the gain for a feedback compensation voltage. When the display draws a solid block, beam current flows, causing the CRT 10 kV bias to drop. The screen edges bow outward. To fix this, a voltage proportional to the beam current is added back to the 10 kV bias.

EQUIPMENT

Adapter

Sweep Extender Board *(optional)* . . . . . HP 70206-60041

PROCEDURE

CAUTION

Use ESD (electrostatic discharge) precautions when working on the A2 Video/Sweep board assembly.

NOTE

To perform this adjustment, it is not necessary to place the A2 board assembly on the sweep extender board. If the A2 board assembly is already on a sweep extender board, or if you do not wish to put A2 on the sweep extender board, skip to step 4. If you wish to put the A2 board assembly on a sweep extender board, begin this procedure with step 1 below.

1. Set the LINE switch to the OFF position.
2. Remove the A2 Video/Sweep board assembly. Refer to the A2 Video/Sweep replacement procedure in Chapter 5.
3. Place the A2 Video/Sweep board assembly on the sweep extender board.

Accessing Adjustment Test Patterns

NOTE

If the CRT is not properly adjusted, the softkey labels may not align with the correct keys or they may not appear on-screen. To determine the softkey labels, refer to the illustrations in this chapter.

4. Set the LINE switch to the ON position.
5. When the HP-MSIB/HP-IB address screen appears, press the [DISPLAY] key (see Figure 3-20). Set the display {INTEN ADJUST} to 19.

ROM Version 5.0

6. When the DISPLAY screen appears, press {DISPLAY TESTS}.

ROM Version 6.0

6. When the DISPLAY screen appears, press {display tests}.

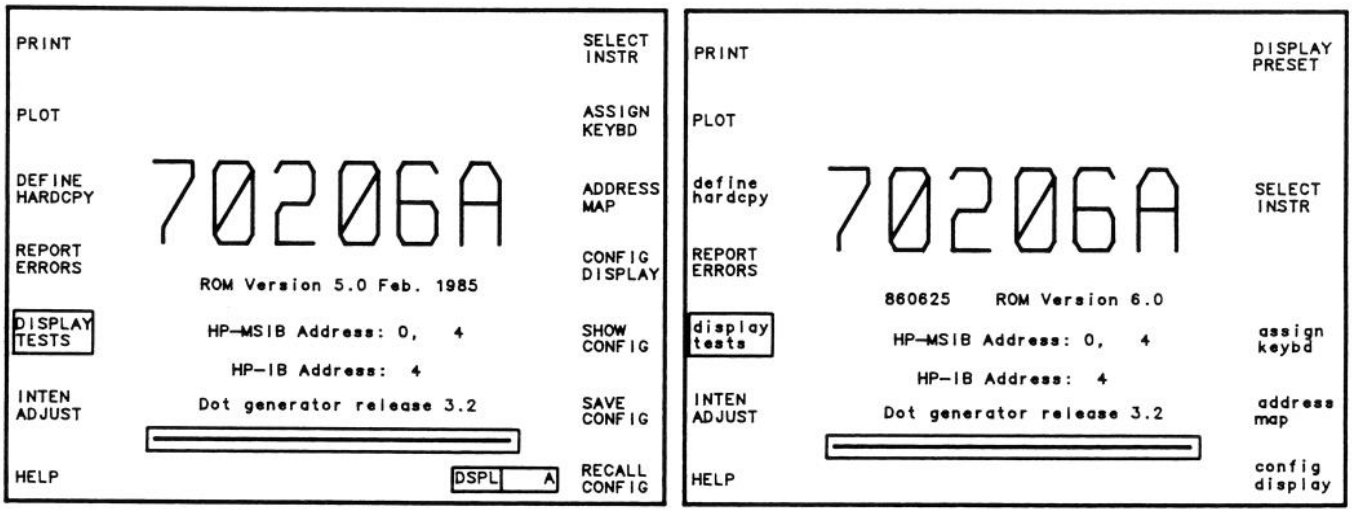


Figure 3-34. Accessing Display Test Menu

7. When the Test Menu appears, press {PATTERN 2}.

7. When the Test Menu appears, press {test pattern}, [2], {ENTER}.

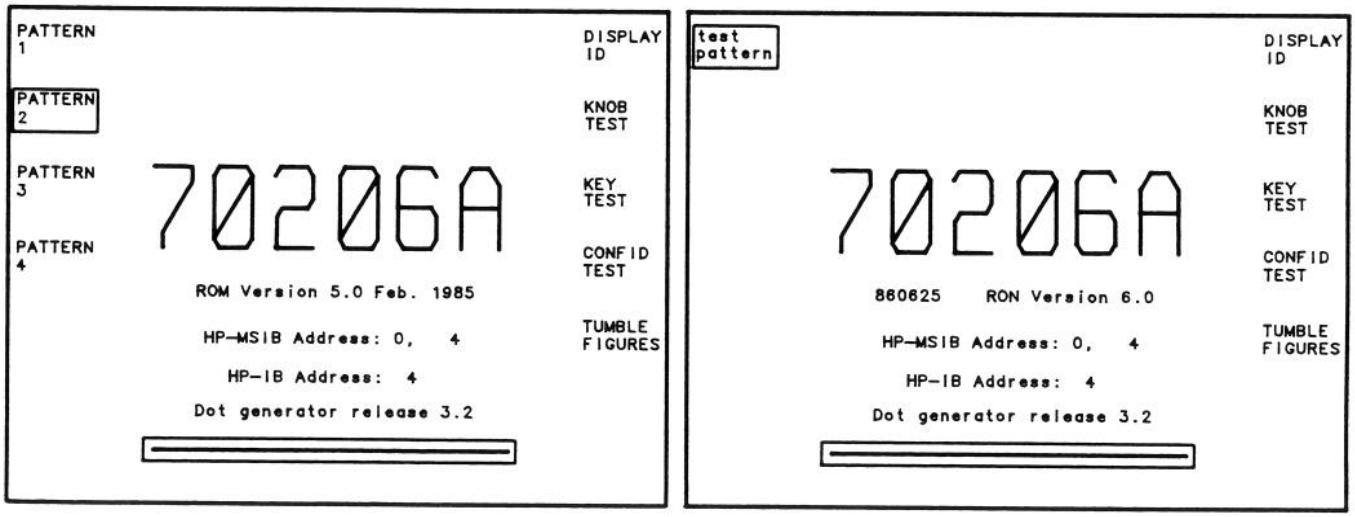


Figure 3-35. Accessing Adjustment Test Patterns

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8. Adjust A2R20 HV COMP until the left and right vertical lines of the display border (box) are straight, not bowed (see Figures 3-36 and 3-37).

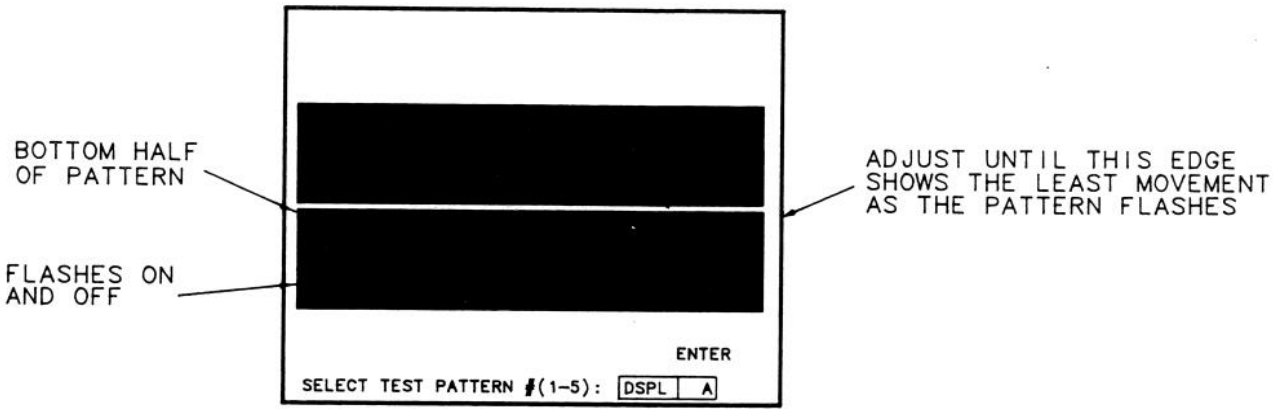


Figure 3-36. High Voltage Compensation Test Pattern

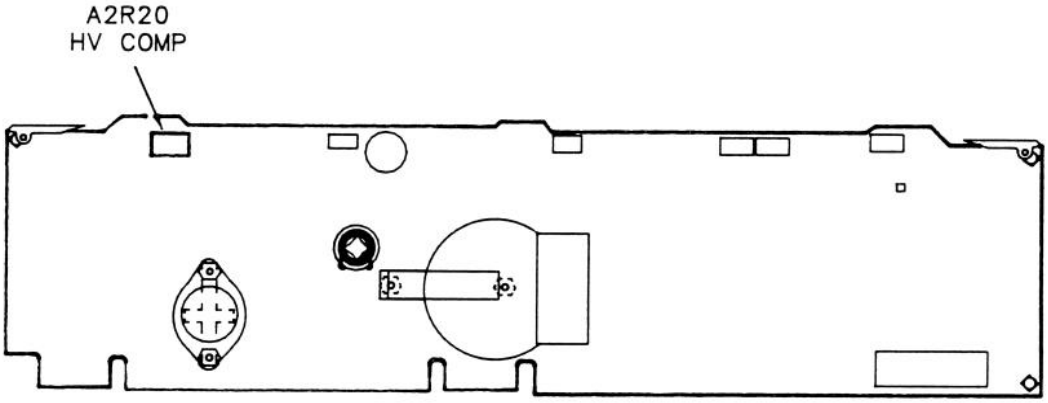


Figure 3-37. High Voltage Compensation Adjustment Location

9. If continuing to another adjustment, press the [DISPLAY] key to return to the Display Menu. If *not* continuing to another adjustment, perform steps 10 and 11 below.

10. Push the LINE switch to the OFF position.

11. If the A2 board assembly was on a sweep extender board, remove the extender and replace the A2 Video/Sweep board assembly. Refer to the A2 Video/Sweep replacement procedure in Chapter 5, "Replacement Procedures."

Chapter 4

TROUBLESHOOTING

Introduction

This chapter contains assembly-level troubleshooting information for both the HP 70205A Graphics Display and the HP 70206A System Graphics Display. This chapter supports ROM Version 5.0 and later.

This chapter contains the following information:

Text Conventions 4-1
Display Firmware Versions 4-2
Procedure for Extending the HP 70205A 4-2
Troubleshooting Procedure 4-3
Distorted Display 4-11
Blinking "E" and other HP-MSIB Problems 4-12
HP 70206A HP-MSIB Troubleshooting 4-13
HP 70205A HP-MSIB Troubleshooting 4-13
Error Codes and Messages 4-13
Display-Disruptive Error Messages 4-14
Exception-Processing Errors 4-17
Hardware-Warning Errors 4-18
Hardware-Broken Errors 4-18
Usage Errors 4-22
Built-In Diagnostics 4-24
Display ROM Version 5.0 4-24
Display ROM Version 6.0 4-28

Text Conventions

Softkeys, keys defined by the display, will be represented in the manual by a key name in braces.

Softkey . . . . . {Key Name}

Front-panel keys will be represented in the manual by a bracketed key name.

Front-panel Key . . . . . [Key Name]

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Display Firmware Versions

To determine which firmware version you have, use the following procedure:

1. Press the LINE switch ON (mainframe for the HP 70205A).
2. Press [DISPLAY] ([DSP] on the HP 70205A Graphics Display).
3. Press the {display tests} softkey (may be labeled {DISPLAY TESTS}).
4. Press the {DISPLAY ID} softkey.

The ROM version is shown on the display screen. Record this information for later use.

Procedure for Extending the HP 70205A Graphics Display

At several points in the following troubleshooting procedure, the procedure for "extending the 70205A display" is referred to. That procedure is as follows:

1. Remove the HP 70205A from the mainframe.
2. Remove the HP 70205A top cover.
3. Remove the A3 Dot Generator board.
4. Unsolder, remove and discard the A3TP1 test point (this test point is never used and has been known to short out against the top cover).
5. Put the A3 Dot Generator board back in the display and replace the top cover.
6. Put the display back in the mainframe and apply power.
7. If the problem you were troubleshooting is now gone, return to the troubleshooting procedure you were following. If not, once again remove the HP 70205A from the mainframe and remove the top cover.
8. In the slot which was the middle of the 3 slots occupied by the HP 70205A, insert a 70001-60013 Extender Module. Connect the cable from that module to the HP-MSIB connector on the rear of the HP 70205A. Make sure the cable is firmly seated on the HP 70205A.

This completes the procedure for extending the HP 70205A. Return to the troubleshooting procedure you were following.

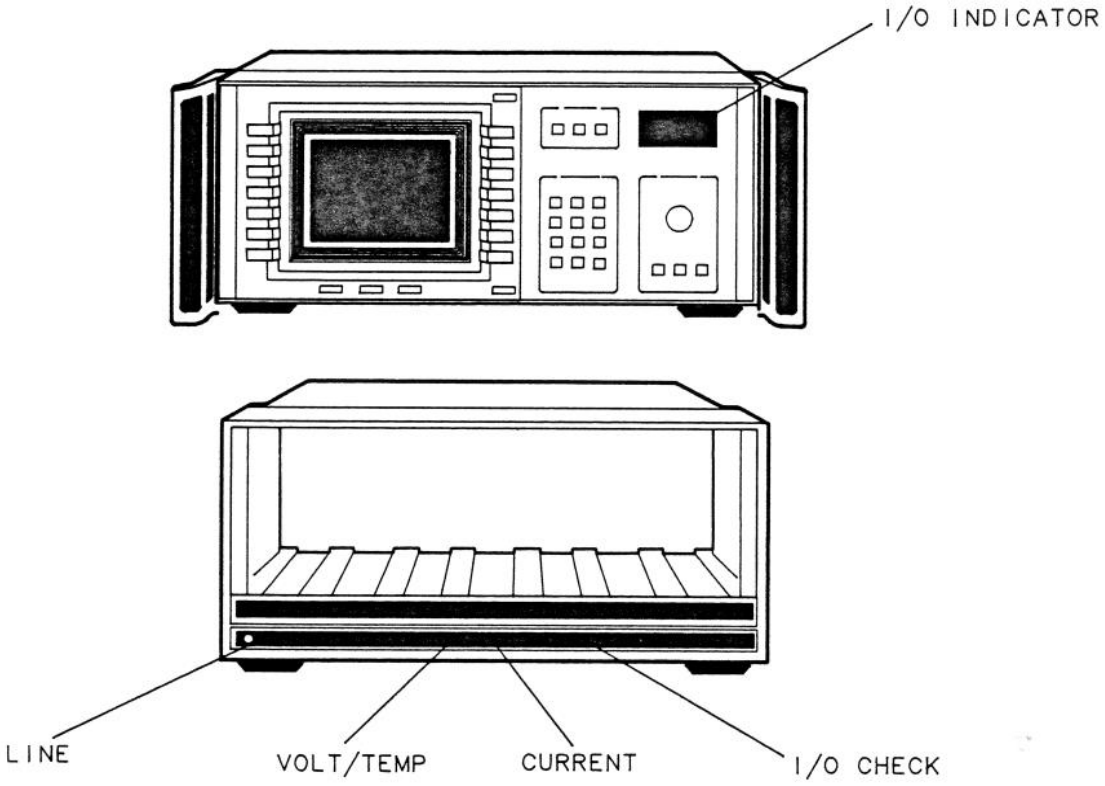


Figure 4-1. HP 70206A and HP 70001A Front Panels

Troubleshooting Procedure

This section describes the procedure for troubleshooting a faulty HP 70205A or HP 70206A display. Follow the steps below *IN THE ORDER SHOWN* to isolate the failure.

STEP 1. HP-MSIB I/O VERIFICATION

The HP 70001A Mainframe's indicator light (I/O CHECK on the front panel) and the HP 70206A Display's I/O indicator light (back-lit light on the front panel) must be OFF for proper display and system operation (See Figure 4-1). Effective troubleshooting can not proceed with any of these indicators on.

If all I/O indicator lights are off, proceed to Step 3. Otherwise, proceed as follows. Turn off all instruments and displays in your HP 70000 system. Remove all HP-MSIB cables from the rear panels of all mainframes and displays. Turn on power to the HP 70206A display you are troubleshooting or to the mainframe containing the HP 70205A you are troubleshooting.

If you are troubleshooting a HP 70205A display and the I/O indicator is still ON, there is a problem in the HP 70001A mainframe. Troubleshoot according to the instructions in the HP 70001A Service

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Manual. For both displays, if the I/O indicator is OFF, the I/O indicator problem is in one of the other displays or mainframes or the HP-MSIB cabling, so proceed to step 2.

If you are troubleshooting a HP 70206A display and the I/O indicator is still ON, verify that the A7 HP-MSIB board and all cables to the A12 Motherboard are properly seated. If the problem persists, replace the A7 HP-MSIB board. If the problem persists, replace cables W8 and W9. If the problem persists, replace the A12 Motherboard. If the problem has been corrected, go on to step 3.

STEP 2: I/O INDICATOR OFF WHEN HP-MSIB CABLES DISCONNECTED

The I/O indicator in a mainframe or HP 70206A display will be on if one but not both of the HP-MSIB cables to that unit are connected, or if that unit is connected over HP-MSIB to another unit whose power is turned off or in which there is an HP-MSIB fault. To isolate which of these is the problem, connect the other instruments in your system to the known good display or mainframe one by one, cycling power each time and watching for the one that makes the I/O light(s) come on. Once isolated, that unit can be troubleshot using the procedure in step 1 (if it is a HP 70206A) or in the HP 70001A Service Manual (if it is a HP 70001A). If after completely reconnecting your system, no I/O indicator is ON, your problem was probably a loose cable and it is now corrected. Proceed to Step 3.

STEP 3: ALL I/O INDICATORS OFF

Check the display screen. If it is blank or if there is a spot flashing periodically on the screen but no picture, proceed as follows: if your display is a HP 70205A, go to step 4, and if your display is a HP 70206A, go to step 13. If the screen is showing a picture, proceed to Step 24.

STEP 4: FLASHING HP 70205A DISPLAY

If your HP 70205A display is flashing, replace the A6 Host board and put the HP 70205A back in the same mainframe slot it was in. If the problem persists, replace the A5 Power Supply Assembly and put the HP 70205A back in the same slot it was in. The display should not be flashing anymore. If the display now shows a picture, proceed to Step 24. If it is blank, proceed to step 5.

STEP 5: BLANK HP 70205A DISPLAY

First remove all modules but the HP 70205A from the mainframe. Then check the HP 70001A for error conditions as follows: if the green "LINE" light (see Figure 4-1) is not on, see the HP 70001A Service Manual to repair this condition before proceeding. If the red VOLT/TEMP light is on (see Figure 4-1), see the HP 70001A Service Manual to repair this condition before proceeding.

If the red "CURRENT" light is on (see Figure 4-1), remove the HP 70205A from the mainframe and cycle power. If the light remains on, see the HP 70001A Service Manual to repair this condition before proceeding. If the light goes out, the problem is in the HP 70205A. Replace the A5 Power Supply Assembly (if you have not already done so) and put the HP 70205A back in the same slot it was in. Apply power. If the "CURRENT" light is still on replace the A7 Interconnect Assembly and put the HP 70205A back in the same slot it was in. Apply power. If the "CURRENT" light is still on, replace the A2 Sweep/Mother board and put the HP 70205A back in the same slot it was in. Apply power. This should fix the problem of the "CURRENT" light being on. Proceed to Step 6.

STEP 6: ALL RED LEDs ON THE MAINFRAME ARE OFF AND THE GREEN "LINE" LED IS ON

If all the red LEDs are off, the green LINE light is on, and the display is no longer blank, proceed to step 24. If the display is still blank, follow the procedure described on Page 4-2 to extend the HP 70205A. If the display is no longer blank after following that procedure, proceed to step 24. If the display is still blank, check the five green LEDs on the A5 Power Supply board. If ALL of these LEDs are on, proceed to Step 10. If ALL of these LEDs are off see the HP 70001A Service Manual for procedures to verify that the HP 70001A is supplying proper power and repair the HP 70001A if it is not. If all of the LIDs are now ON, go to step 10. If some but not all of the LEDs are on, go to step 8. If all the LEDs are off proceed to step 7.

STEP 7: MAINFRAME SUPPLYING PROPER POWER AND ALL GREEN LEDS ARE OFF

If the mainframe is supplying power to the slot in which the display is installed, and ALL of the green LEDs on the A5 Power Supply board are OFF, then replace the A5 Power Supply board if you have not already done so. If the LEDs remain off, replace the A7 Interconnect Assembly if you have not already done so. If the LEDs remain off, replace the A2 Sweep/Mother board if you have not already done so. Some or all of the LEDs should now be on. If the display is no longer blank go to step 24. If all the LEDs are ON proceed to Step 10. If they are not all on go on to step 8.

STEP 8: MAINFRAME SUPPLYING POWER BUT ALL GREEN LEDS ON A5 ARE NOT ON

If one or more but not ALL of the green LEDs on the A5 Power Supply board are off, remove the A3 Dot Generator Board, the A6 Host board, and the A4 Memory board. Remove the A5 Power Supply board. Remove the fuses F1, F2 and F3 on A5 (you MUST remove the A5 fuses to check them). Check each fuses with an ohm meter, they should all measure less than about 10 ohms. In each case if the fuse is good put it back in A5. If ALL of the fuses are good, replace the A5 Power Supply board. If any of the fuses was open, replace the fuse. All of the fuses should now be good. Reinstall A5. If all of the A5 Power Supply green LEDs are now on, and the display is still blank, proceed to step 10. If any of the green LEDs is still off, proceed to step 9.

STEP 9: ALL FUSES GOOD BUT ALL GREEN LEDS ON A5 ARE NOT ON

Replace the A2 Sweep/Motherboard (it may also be necessary to check and replace the fuses again). Do not plug A4 Memory, A6 Host, or A3 Dot Generator back in yet. ALL of the green LEDs on A5 should now be on. Put the A4 Memory board back in the unit. If any of the green LEDs goes off, replace the A4 Memory board (it may also be necessary to check and replace the fuses again). Put the A3 Dot Generator board back in the unit. If any of the green LEDs goes off, replace the A3 Dot Generator board (it may also be necessary to check and replace the fuses again). Put the A6 Host board back in the unit. If any of the green LEDs goes off, replace the A6 Host board (it may also be necessary to check and replace the fuses again). All of the boards should now be installed and all of the green LEDs on. If the display is no longer blank, proceed to step 24. If it is still blank, proceed to step 10.

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STEP 10: ALL GREEN LEDS ON A5 ARE ON

If the display is no longer blank, go to step 24. Otherwise, now that all of the green LEDs are on, measure and verify the power supply voltages on the A5 Power Supply board according to the following table:

Table 4-1. A5 Power Supply Voltages

Testpoint	Minimum Voltage, V	Maximum Voltage, V
+5V	4.94	5.20
+7V	6.2	7.4
+30V	28	33
-7V	-6.2	-7.4
+15V	14	16
-15V	-14	-16

WARNING

Hazardous CRT voltages exist in the display. Serious personnel injury may occur due to the high voltages.

If any of the voltages are outside the proper range, the problem may be a bad A5 Power Supply board, or another board in the display may be loading the supply. Remove the A4 Memory, A3 Dot Generator, and A6 Host boards and put them back in one by one (per step 9), checking the voltages each time, to see if any of them is adversely affecting the power supply voltages (with all boards removed, the +5 volts typically measures 20% higher). If so, replace the board that is doing so. If not, replace the A5 board. If the problem persists, replace the A2 board. The power supplies should now all be in range. If the display is no longer blank, proceed to step 24, otherwise go on to step 11.

STEP 11: POWER SUPPLIES IN RANGE BUT DISPLAY STILL BLANK

If the power supplies are in range, but the display is still blank, check the red LED DS1 on the A6 Host board. If DS1 is off, go on to step 12. If DS1 is flashing, replace the A6 Host board. If it is still flashing, replace the A4 Memory Board. If DS1 is on steadily (not flashing), measure the DC voltage at A6U11 pin 1. If this voltage is between 11 volts and 12.8 volts, replace the A6 Host board. If it is not, replace the A2 Sweep/Motherboard. The DS1 LED should now be off. If the display is no longer blank, proceed to step 24, otherwise go on to step 12.

STEP 12: A6DS1 OFF BUT DISPLAY STILL BLANK

Remove the A3 Dot Generator board and the A6 Host board. The A4 Memory board should now be putting a pattern of dots on the screen. If there is no dot pattern (13 rows by 24 columns of dots), turn off all the lights in the room and see if the CRT filament (heater, near the back of the neck of the CRT) is glowing. If the filament is not glowing, unplug the W4 CRT cable from the CRT and measure the voltage between pins 3 and 4 of this cable. This should measure approximately 12 volts DC. If it does, replace the V1 CRT/Yoke assembly. If it does not, unplug the cable from the A2 board and measure the voltage at pin 8 of the A2J4 connector. If this measures approximately 12 Vdc, replace the W4 cable. If not, replace the A2 Sweep/Mother board. If a dot pattern still does not exist, replace the A4 Memory board. Put the A6 Host and A3 Dot Generator boards back in the display. The display should now be showing a picture. Go on to step 24.

STEP 13: FLASHING HP 70206A DISPLAY

If your HP 70206A display is flashing, replace the A6 Host board. If the problem persists, replace the A11 Power Supply Assembly. If the display stops flashing and shows a picture, proceed to Step 24. Otherwise move on to step 14.

STEP 14: HP 70206A DISPLAY IS NOT FLASHING BUT IS BLANK:

Turn the power off and then, while watching the I/O indicator in the upper-right corner of the front panel (see Figure 4-1), turn the power back on. If this light comes on for about half a second and then turns off, the problem is internal to the HP 70206A. If so, go to step 15. If it does not, it may simply be a bad fuse. Check the fuse in the Input Filter housing (FL1) and replace it with the spare fuse if it is open. Also check the rear panel Voltage Selector switch for the correct setting (refer to the HP 70206A Installation and Verification Procedures) and make sure the line cord is good and is connected to an active source of AC power. If all of these items are verified and the display is still blank, move on to step 15, otherwise proceed to step 24.

STEP 15: FUSES, LINE CORD AND VOLTAGE SELECTOR SWITCH ARE GOOD:

Remove the HP 70206A Top and Inner covers. Refer to the Top and Inner Cover Replacement procedure in the Replacement Procedures, Chapter 5. Remove and reseat all boards (A2, A3, A4, A6, and A7) and be sure all cables are plugged in securely. If the display is no longer blank, install the metal PC board retainer tightly (to prevent the boards from popping up) and go to step 24. Otherwise, turn on the LINE switch. ALL of the green LEDs on the A2 Sweep board should be on steadily. If they are, move on to Step 21. If not, remove the A6 Host board, the A3 Dot Generator board, the A4 Memory board, and the A7 HP-MSIB board. If any of the green LEDs is still not on steadily, see if any of them are flashing. If ANY of the green LEDs are flashing, replace the A2 Sweep board. All of the LEDs should now be steadily on or steadily off. If they are ALL on, move on to Step 20. If they are not ALL on, remove the W3 DC cable from A12J1. Measure and record the voltages on the W3 cable connector as shown in the table below, then plug W3 back in. These voltages can not be exactly predicted at this point because the supply is unloaded; but they should still be close (within about 30%) to the voltages shown below:

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Table 4-2. W3 Cable Connector Voltages

Wire	Approximate Voltage
Red or Black	5V
White/Gray	12V
White/Yellow/Gray	-12V
White/Brown/Gray	24V

If ALL of the voltages described in the above paragraph are close to the desired value, go to step 19. If ALL of the above voltages measure about 0v (that is, not there), move on to step 16. If SOME of the voltages are near 0 and SOME are near the desired value, check the W3 cable connections at the barrier block for tightness. If the cable is OK, replace the A11 Power Supply assembly and the W4 AC Power Cable. Plug the W4 cable back into A1J3. Plug the A2 Sweep board back in and verify that some or all of the green LEDs are on. If they are ALL on go to step 20. If some but not all are on, go to step 19.

STEP 16: ALL OF THE VOLTAGES ON THE W3 CONNECTOR ARE ZERO VOLTS:

If ALL of the above voltages measure about 0v (that is, not there), there may be no AC input power to the A11 power supply. The following procedure tests the AC input voltage distribution to A11.

WARNING

Whenever the AC line cord is plugged in, the input cables and the A1 Filter board described below contain LIVE voltages and are EXTREMELY DANGEROUS, EVEN IF THE LINE SWITCH IS TURNED OFF!!! NEVER touch any wires, test points, or connectors in the power supply or power supply input path without first removing the line cord!

If you have not already done so, check the fuse in the Input Filter housing (FL1) and replace it with the spare fuse if it is open. If the fuse blows again, a possible GND to LINE short may exist. Check the rear panel Voltage Selector switch for the correct setting (refer the HP 70206A Installation and Verification Procedures) and make sure the line cord is good and is connected to an active source of AC power. Remove the A2 Sweep board so that you can make the following measurements. Disconnect the line cord. Unplug the W2 Line Module cable from A1J1. Connect an AC voltmeter probe to W2 between the White/Brown/Gray wire and the White/Gray wire on W2, then WITHOUT TOUCHING ANY OF THESE WIRES plug in the line cord. There will be two possibilities:

1. If the normal AC input voltage is measured, the A1 Filter Board will be known to be receiving the correct input voltage when W2 is plugged in, so plug W2 back in to A1J1 and go to step 17.

2. If no voltage is measured (approximately 0 volts), unplug the line cord and remove and replace the FL1 Filter Module and the W2 Line Module cable. The normal AC line voltage will now appear on W2. Plug W2 back into A1J1. The A1 Filter Board will now be receiving the correct input voltage.

Plug the A2 Sweep board back in and see if any of the green LEDs are on. If they are still all off move on to step 17. If some but not all are on, go to step 19. If all are on go to step 20.

STEP 17: A1 FILTER BOARD RECEIVING CORRECT VOLTAGE BUT ALL A2 GREEN LEDS OFF:

Since the input voltage to A1 from W2 is present, we must check the output from A1. Turn the line switch OFF. Remove the A2 Sweep board. Unplug the W4 AC power cable from A1J3. Connect an AC voltmeter between A1J3 pins 5 and 8. Turn on the line switch. If the normal AC input voltage is measured, go to step 18. If no AC voltage (approximately 0 volts) is measured, first UNPLUG THE LINE CORD then remove the A1 Filter Board assembly. Examine the white plastic end of the W13 Switch Actuator cable while turning the line switch on and off. The brass center tab of W13 should move back and forth while the line switch is cycled. If it does not, replace W13 and reinstall W13 and A1. If it does, replace the A1 Filter Board assembly. Plug W4 back into A1J3. Plug the A2 Sweep board back in and verify that some or all of the green LEDs are on. If all are on go to step 20. If some but not all are on, go to step 19. If ALL of the LEDs are still off go on to step 18.

STEP 18: AC VOLTAGE TO A11 GOOD BUT NONE OF THE A2 SWEEP BOARD GREEN LEDs ARE ON:

Replace the A11 Power Supply assembly and the W4 AC Power Cable. Plug the W4 cable back into A1J3. Plug the A2 Sweep board back in and verify that some or all of the green LEDs are on. If they are ALL on go to step 20. If some but not all are on, go to step 19.

STEP 19: SOME BUT NOT ALL OF THE A2 SWEEP BOARD GREEN LEDs ARE ON (A3,A4,A6,A7 REMOVED)

Disconnect the W7 Keyboard cable from the A12 Motherboard. If ALL of the LEDs are now on, disconnect W7 from the A8 Numeric Keyboard assembly and the A9 Bezel keyboard assembly and plug W7 back into A12. If the LEDs are now NOT all on, replace W7. If they ARE all on, isolate the problem to either A9 or A8 by plugging W7 into one at a time and replace the offending board. If the problem is not W7, A8 or A9, replace the A2 Sweep board. If the green LEDs on A2 are STILL not ALL on, replace the A12 Mother board. All of the LEDs should now be on. Go to step 20.

STEP 20: ALL GREEN A2 LEDS ARE ON (A3,A4,A6,A7 REMOVED)

Put the A4 Memory board back in the unit. If any of the green LEDs goes off, replace the A4 Memory board. Put the A3 Dot Generator board back in the unit. If any of the green LEDs goes off, replace the A3 Dot Generator board. Put the A6 Host board back in the unit. If any of the green LEDs goes off, replace the A6 Host board. Put the A7 HP-MSIB board back in the unit. If any of the green LEDs goes off, replace the A7 HP-MSIB board. All of the boards should now be installed and all of the green LEDs on. If the display is no longer blank, reconnect all cables and move on to step 24, otherwise go on to step 21.

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STEP 21: ALL GREEN LEDS ON A2 ARE ON BUT DISPLAY STILL BLANK

Now that all of the green LEDs are on, measure and verify the power supply voltages on the A2 Sweep Board according to the following table:

If any of the voltages are outside the proper range another board in the display may be loading the supply. Remove the A4 Memory, A3 Dot Generator, A7 HP-MSIB, and A6 Host boards and put them back in one by one, as described in Step 20, checking the voltages each time, to see if any of them is adversely affecting the power supply voltages. If so, replace the board that is doing so. If not, replace the A11 Power Supply and the W4 AC Power Cable. If the problem persists, replace the A12 motherboard. The power supplies should now all be in range. If the display is no longer blank, proceed to step 24, otherwise go on to step 22.

Table 4-3. A2 Sweep Board Power Supply Voltages

Testpoint	Minimum Voltage, V	Maximum Voltage, V
A2TP10	4.90	5.20
A2TP13	28	32
A2TP4	14	16
A2TP5	-14	-16

STEP 22: POWER SUPPLIES IN RANGE BUT DISPLAY STILL BLANK

If the power supplies are in range but the display is still blank, check the red LED DS1 on the A6 Host board. If DS1 is off, go on to step 23. If DS1 is flashing, replace the A6 Host board. If it is still flashing, replace the A4 Memory Board. If DS1 is on steadily (not flashing), measure the DC voltage at A6U11 pin 1. If this voltage is between 11 volts and 12.8 volts, replace the A6 Host board. If it is not, replace the A2 Sweep board. The DS1 LED should now be off. If the display is no longer blank, proceed to step 24, otherwise go on to step 23.

STEP 23: A6DS1 OFF BUT DISPLAY STILL BLANK

WARNING

Hazardous CRT voltages exist in the display. Serious personnel injury may occur due to the high voltages.

If A6DS1 is off but the display is still blank, remove the A3 Dot Generator board and the A6 Host board. The A4 Memory board should now be putting a pattern of dots on the screen. If there is no dot pattern (13 rows by 24 columns of dots), turn off all the lights in the room and see if the CRT filament (heater, near the back of the neck of the CRT) is glowing. If the filament is not glowing, unplug the W1 CRT cable from the CRT and measure the voltage between pins 3 and 4 of this cable. This should

measure approximately 12 volts DC. If it does, replace the V1 CRT/Yoke assembly. If it does not, unplug the cable from the A2 board and measure the voltage at pin 8 of the A2J3 connector. If this measures 12v DC, replace the W1 cable. If not, replace the A2 Sweep board. If there is still no dot pattern, replace the A4 Memory board. A dot pattern should now be on the CRT. Put the A6 Host, A7 HP-MSIB and A3 Dot Generator boards back in the display. The display should now be showing a picture. Go on to step 24.

STEP 24: DISPLAY NOT BLANK

Now that the display is no longer blank, examine the picture on the screen. There are three possibilities:

1. There is a normal picture on the screen, consisting of the display's ID (HP 70205A or HP 70206A) in large "stick" numbers (See Figure 3-2 in the Adjustments chapter), or data being presented by one of the modules in the system. If this is the case, look in the lower-right corner of the screen. If there is a letter E in the box there, and it is blinking, there is an HP-MSIB problem. See the section titled "BLINKING E OR OTHER HP-MSIB PROBLEMS" to troubleshoot. If there is an E steadily on, press DISPLAY (DSP on the HP 70205A) and the REPORT ERRORS softkey. If an error report is displayed from the display, note the error and look it up in the ERROR CODES AND MESSAGES section and proceed as advised there. If no error report is displayed, then there may be an HP-MSIB problem. See the section titled "BLINKING E OR OTHER HP-MSIB PROBLEMS" to troubleshoot. If there is no E in that box, then the display is working. You are done.

2. If there is a message in large block letters and no graphics on the screen, then a "Display-Disruptive Error" has occurred. If this is the case, turn on the TEST switch and the SYSTEM CONTROLLER switch on the back of the display, and turn off the TALK ONLY switch, then cycle power. The same, or a different, display disruptive message should appear. Go to the section on "Display-Disruptive Error Messages" in the Error Codes and Messages section of this chapter for advice on what to do for the error. After correcting the problem, turn OFF the TEST switch and return the TALK ONLY and SYSTEM CONTROLLER switches to their previous state.

3. If there is a distorted picture on the screen, see the "DISTORTED DISPLAY" troubleshooting section below.

Distorted Display

If the display is distorted, you must decide if the problem is a "Geometric Distortion" problem or a "Catastrophic Distortion" problem. Geometric Distortion problems are characterized by pictures that are stable and visible but that are "out of square", that is, rectangular patterns appear non-rectangular. Catastrophic Distortion problems are characterized by "tearing" of the picture or other distortion so severe that the picture and softkey labels can't be read.

To determine which type of distortion you have, if you have a HP 70206A disconnect all HP-MSIB cables from the rear panel, or if you have a HP 70205A disconnect all HP-MSIB cables from the mainframe containing the HP 70205A and remove all other modules from that mainframe. Then apply power. You should get a picture that looks somewhat like that in Figure 3-2 or Figure 3-20 (Adjustments chapter). If you can't see a stable picture like that you probably have a Catastrophic Distortion problem. If you can see a picture like that, press the DISPLAY key (DSP on the HP 70205A) and the softkey labelled "DISPLAY TESTS" (or "display tests") and then the softkey labelled

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DISPLAY ID. You should see some text on a grid. The grid is made up of nearly-square rectangles. If the grid is visible and stable but distorted, you probably have a Geometric Distortion problem.

CATASTROPHIC DISTORTION

WARNING

Hazardous CRT voltages exist in the display. Serious personnel injury may occur due to the high voltages.

For Catastrophic Distortion problems, first disconnect and reconnect TIGHTLY the W16 High Voltage Anode cable (HP 70206A) or the W3 High Voltage Anode cable (HP 70205A). If the problem persists replace the A2 Sweep board (HP 70206A) or the A2 Sweep/Motherboard (HP 70205A). If the problem persists replace the V1 CRT/Yoke assembly and the W16 High Voltage Anode cable (HP 70206A) or the V1 CRT/Yoke assembly and the W3 High Voltage Anode cable (HP 70205A). If the problem persists replace the A4 Memory board.

GEOMETRIC DISTORTION

For Geometric Distortion replace the V1 CRT/Yoke assembly.

Blinking "E" and Other HP-MSIB Problems

The "E" indicator in the status box in the lower-right corner of the display is the same as the red LED marked "ERR" on other HP 70000 modules. Its purpose is to indicate an error detected in the module or, in the case of the display, in ANY module (on HP-MSIB row 0) in the system. A blinking "E" or "ERR" indicator has a special meaning: it signifies that a problem on the HP-MSIB backplane has been detected during system power-up which may prevent normal communication (and hence, normal error reporting). Such a problem MUST be troubleshot before any predictable system operation can take place.

If the display in your system is a HP 70206A, remove all HP-MSIB cables from its rear panel and cycle power. If the "E" light on the display screen still blinks, then go to the "HP 70206A HP-MSIB Troubleshooting" section, below. If it does not, then connect a known good HP-MSIB cable between the HP-MSIB IN and OUT connectors on the rear panel of the HP 70206A and cycle power. If the "E" light now blinks, go to the "HP 70206A HP-MSIB Troubleshooting" section below. If the "E" light does not blink in either case, other elements of the system are causing the problem. See the "HP-MSIB System Troubleshooting Procedures" in the HP 70001A Service Manual to repair this problem.

If the display in your system is a HP 70205A, remove all other modules from the mainframe containing the HP 70205A. Disconnect all HP-MSIB cables from the rear of the mainframe and cycle power. If the "E" light on the display screen still blinks, then go to the "HP 70205A HP-MSIB Troubleshooting" section, below. If it does not, other elements of the system are causing the problem. See the "HP-MSIB System Troubleshooting Procedures" in the HP 70001A Service Manual to repair this problem.

HP 70206A HP-MSIB TROUBLESHOOTING

1. Remove all HP-MSIB cables from the rear of the HP 70206A. Remove the top and inner covers and the metal PC board retainer from the HP 70206A. Remove and reseat the A7 HP-MSIB board and the A6 Host board. Verify that all three cables to the A12 motherboard which come onto A12 next to the A7 HP-MSIB board are properly seated. Apply power and see if the blinking "E" problem is gone. If so, move on to Step 2. If not, replace the A7 HP-MSIB board. If the trouble persists replace the A6 Host board. If the trouble persists, replace the A12 Motherboard.

2. Connect a known good HP-MSIB cable between the HP-MSIB IN and OUT connectors on the rear panel of the HP 70206A and cycle power. If the "E" light now blinks, replace cables W8 and W9. Apply power and see if the blinking "E" problem is gone. If the "E" still blinks, replace the A7 HP-MSIB board. If it does not blink, you are done.

HP 70205A HP-MSIB TROUBLESHOOTING

A blinking "E" on a HP 70205A with no other modules in the mainframe and no HP-MSIB cables connected to the rear of the mainframe means that there is an HP-MSIB problem in the HP 70205A or there is an HP-MSIB problem in the mainframe. Obtain another HP 70000 module of any kind. Remove the HP 70205A from the mainframe and put the other module in the same slot. Apply power. If the "ERR" indicator on the module blinks, most likely the problem is in the mainframe. See the "HP-MSIB Troubleshooting Procedures" in the HP 70001A Service Manual to repair this problem. If the other module powers up normally, most likely the problem is in the HP 70205A. If so, replace the A6 Host board in the HP 70205A. If the problem persists, replace the A7 Interconnect board in the HP 70205A. If the problem persists, go to the "HP-MSIB Troubleshooting Procedure" in the HP 70001A Service Manual.

Error Codes and Messages

NOTE

Before taking any action based on these error messages, make sure all the boards are firmly seated and all cables are securely fastened.

HP 70205A and HP 70206A Graphics Display error code information is provided in this section. Errors may result when the display module is configured normally or is on the module service extender. Numerical error codes and brief error messages are reported on the display. Error codes fall into four categories:

Display-Disruptive Errors
6000 – 6999 Hardware-Warning Errors
7000 – 7999 Hardware-Broken Errors
2000 – 2999 Usage Errors

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DISPLAY-DISRUPTIVE ERROR MESSAGES

Display-disruptive errors are those that interfere with normal display operation and error reporting. The associated error messages indicate faulty display hardware. The error messages are shown in two ways:

- The error message in large block letters on an otherwise blank display.
- An LED pattern on the A6 Host Board Assembly.

A3 CALL FAILED *(ROM Version 6.0 and later)*

The A3 bit-slice processor failed to call a subroutine after the A6 host processor wrote a special program that tested the ability of the A3 bit-slice processor to call a subroutine. Replace the A3 Dot Generator Board Assembly.

A3 CHAR ROM *(ROM Version 6.0 and later)*

A test of the A3 character ROM failed after the A6 host processor caused the A3 bit-slice processor to read a space character from the character ROM and write it to A4 Pixel RAM. Replace the A3 Dot Generator Board Assembly.

A3 CHAR ROM *(ROM Version 5.0)*

A3 CHAR SET *(ROM Version 6.0 and later)*

A test of the A3 Character set failed. The A6 host processor caused the A3 bit-slice processor to write all the characters in the character ROM to the screen. A signature of the data in screen memory was taken by the host processor and compared to the stored signature for that ROM. Because they disagreed, the test failed. Replace the A3 Dot Generator Board Assembly. If the problem persists, replace the A4 Memory Board Assembly. If the problem still exists, replace the A6 Host Board Assembly.

A3 COND WRITE

The A3 bit-slice processor overwrote data on the screen, indicating a failure of the conditional write circuitry. Replace the A3 Dot Generator Board Assembly.

A3 DOT WRITE

The A3 bit-slice processor failed to do a valid dot-write to A4 Pixel RAM. Replace the A3 Dot Generator Board Assembly. If the problem persists, replace the A4 Memory Board Assembly.

A3 LIMITS ERR

The limit circuitry failed to prevent the A3 bit-slice processor from writing dots to the vector list. Replace the A3 Dot Generator Assembly.

A3 MARK FAILED

The A3 bit-slice processor failed to mark an instruction. The first time any instruction is executed, the A3 processor marks that instruction by setting a specific bit. The A6 Host processor then checks for the unmarked instruction. Replace the A3 Dot Generator Board Assembly. If the problem persists, replace the A6 Host Board Assembly.

A3 MEMORY ADDRESS

The A3 bit-slice processor made an unsuccessful attempt to access A4 RAM. The A6 host processor first caused the A3 bit-slice processor to write data to a RAM location. The A6 host processor then read the RAM location directly and compared this data with the data written. This read/write operation was repeated for each RAM location and failed at some location. Replace the A3 Dot Generator Board Assembly. If the problem persists, replace the A4 Memory Board Assembly.

A3 MEMORY ARB

The A6 host processor and A3 bit-slice processor have failed to share access to A4 Pixel RAM. Replace the A3 Dot Generator Board Assembly. If the problem persists, replace the A4 Memory Board. If the problem still exists, replace the A6 Host Board Assembly.

A3 RETURN FAILED

The A3 bit-slice processor executed a subroutine, but did not return to the mainline program. Replace the A3 Dot Generator Board Assembly.

A3 MEMORY R/W

The A3 bit-slice processor made an unsuccessful attempt to access A4 pixel RAM. The A6 host processor caused the A3 bit-slice processor to perform a write/read to pixel RAM. The A6 host processor then compared the data actually written to RAM with two values: the data written by, and the data read by, the A3 bit-slice processor. Both comparisons failed. Replace the A3 Dot Generator Board Assembly. If the problem persists, replace the A4 Memory Board Assembly.

A3 MEMORY READ

The A3 bit-slice processor made an unsuccessful attempt to access A4 pixel RAM. The A6 host processor first caused the A3 bit-slice to perform a write/read to pixel RAM. The A6 host processor then read pixel RAM directly and compared this data with the data read by the A3 bit-slice processor. The comparison failed. Replace the A3 Dot Generator Board Assembly. If the problem persists, replace the A4 Memory Board Assembly.

A3 MEMORY SYNC

The synchronization between the A3 bit-slice processor and the A6 host processor in accessing the A4 Pixel RAM has failed. Replace the A3 Dot Generator Board Assembly.

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A3 MEMORY WRITE

The A3 bit-slice processor made an unsuccessful attempt to access A4 pixel RAM. The A6 host processor first caused the A3 bit-slice processor to write data to pixel RAM. The A6 host processor then read pixel RAM directly and compared this data with the data written to pixel RAM. The comparison failed. Replace the A3 Dot Generator Board Assembly. If the problem persists, replace the A4 Memory Board Assembly.

A3 SERIAL INTERFACE

A failure occurred with the serial interface between the A6 host processor and the A3 bit-slice processor. The A6 host processor performed a write/read to the A3 bit-slice processor, then attempted unsuccessfully to verify the returned data. Replace the A3 Dot Generator Board Assembly. If the problem persists, replace the A6 Host Board Assembly. If the problem still exists, replace the A2 Sweep/Motherboard Assembly (HP 70205A) or the A2 Video/Sweep Board Assembly (HP 70206A).

A3 START VECTOR

The A3 bit-slice processor failed to read its start vector or jump correctly. Replace the A3 Dot Generator Board Assembly. If the problem persists, replace the A4 Memory Board Assembly.

A3 WORD WRITE

The A3 bit-slice processor failed to do a valid word-write to A4 Pixel RAM. Replace the A3 Dot Generator Board Assembly. If the problem persists, replace the A4 Memory Board.

A3 WRONG DATE CODE

The firmware date code of the A3 bit-slice processor found that its date code does not match that of the A6 host processor. Replace the A3 Dot Generator Board Assembly.

A3 ??? FAILED *(ROM Version 5.0)*

A3 UNKNOWN *(ROM Version 6.0 and later)*

The A6 host processor does not know what failed on the A3 Dot Generator Board. The host processor did not successfully execute the power-up confidence test. Replace the A3 Dot Generator Board Assembly. If the problem persists, replace the A6 Host Board Assembly. If the problem still exists, replace the A4 Memory Board Assembly.

A4 PIXEL RAM

The A6 host processor attempted unsuccessfully to communicate with A4 Pixel RAM. Pixel RAM is tested by writing data to each address location that equals the address of that location. After the data is written, the host reads each address to see if the data equals the location address. *In ROM Version 6.0 a second line is displayed to identify the failed IC.* Replace the A4 Memory Board Assembly. If the problem persists, replace the A6 Host Board Assembly.

A6 RAM ADDR ERROR

A test of CMOS RAM has failed. The data in CMOS RAM is read, saved, and complemented. Every other address is then tested to see if the data is unchanged. The test failed. Replace the A6 Host Board Assembly.

A6 RAM DATA ERROR (LOW) *(ROM Version 5.0)*

A6 RAM DATA ERROR (HIGH) *(ROM Version 5.0)*

A6 RAM DATA ERROR (U37) *(ROM Version 6.0 and later)*

A6 RAM DATA ERROR (U38) *(ROM Version 6.0 and later)*

A test of CMOS RAM has failed. Data is cycled through all the address locations on the data bus. Each time data is written, it is read back and compared with the written data. At least one comparison failed. Replace the A6 Host Board Assembly.

A6 ROM CHECKSUM 3,2,1 and/or 0 *(ROM Version 5.0)*

A6 ROM 39 CHECKSUM *(ROM Version 6.0 and later)*

A6 ROM 40 CHECKSUM *(ROM Version 6.0 and later)*

A6 ROM 47 CHECKSUM *(ROM Version 6.0 and later)*

A6 ROM 48 CHECKSUM *(ROM Version 6.0 and later)*

A checksum was calculated on all ROMs and one or more ROMs failed. Replace the defective ROM. If the problem persists, replace the A6 Host Board Assembly.

A6 8041 INTERFACE

Communications failed between the A6 8041 processor chip and the A6 host processor chip. The 8041 processor chip is instructed to send a data sequence to the host processor chip, which if received correctly should verify the 8041 and the link to it. Replace the A6 Host Board Assembly.

A6 EXCEPTION-PROCESSING ERRORS

These display-disruptive error messages are generated by the A6 host processor for actions that are outside the normal processing associated with the execution of instructions. Exception processing is associated with interrupts, trap instructions, tracing, and other exceptional conditions. Activities that result in these error codes in most cases takes place on the A6 Host Board Assembly. Replace the A6 Host Board Assembly.

The exception-processing error messages appear-on screen as:

EXCEPTION AT XXXXXX (XXXXXX = hex address)
MESSAGE

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6000—6999 HARDWARE-WARNING ERRORS

The following error codes are generated by faults that may impair measurement accuracy. These errors will be noted by the *E* in the lower-right of the CRT. The errors may be viewed by pressing the [DISPLAY] key (HP 70206A) or the [DSP] key (HP 70205A) and then the {REPORT ERRORS} softkey.

6002 A6 RAM checksum *(ROM Version 5.0)*

6002 A6 RAM checksum (battery?) *(ROM Version 6.0 and later)*

A6 RAM memory failed a checksum test. If cycling LINE power does not clear the error, replace the battery in the rear-panel battery compartment. If the problem persists, replace the A6 Host Board Assembly.

6008 Confidence Test Failed

A display self-test has failed. Confidence Test Failed appears on the bottom of the screen at power-up (if an error was detected) or after a confidence test {CONFID TEST}. The {CONFID TEST} softkey invokes a test which is a sequential execution of tests 11, 8, 14, and 12. The same test sequence can be invoked remotely with the *TE* command. If any test fails, the bus which sent the *TE* command will be notified. If this occurs because of a *TE* command, cycle power; a display-disruptive error should be displayed, which will indicate the problem. If this occurs at power-up, press DISPLAY (DSP on the HP 70205A) and REPORT ERRORS will identify the problem.

7000—7999 HARDWARE-BROKEN ERRORS

The following error codes are generated by faults within the instrument. These errors will be noted by the *E* in the lower-right of the CRT. The errors may be viewed by pressing the [DISPLAY] key (HP 70206A) or the [DSP] key (HP 70205A) and then the {REPORT ERRORS} softkey.

7036 HP-MSIB error

The A6 host processor attempted unsuccessfully to communicate over HP-MSIB. The host processor sent data to HP-MSIB address row 0, column 31 and checked for NMAA (No Module at Address), which is the expected response. The host processor also sent data to itself over HP-MSIB and checked the returned data. Possible causes: The A6 Host Board Assembly, or the HP-MSIB. Troubleshoot as in the Blinking E and Other HP-MSIB Problems section of this chapter.

7037 A3 Char ROM *(ROM Version 5.0)*

7037 A3 Character set *(ROM Version 6.0 and later)*

A test of the A3 Character set failed. After the A6 host processor caused the A3 bit-slice processor to write all the characters in the Character ROM to the screen. A signature of the data in screen memory was taken by the host processor and compared to the stored signature for that ROM. Because they

disagreed the test failed. Replace the A3 Dot Generator Board Assembly. If the problem persists, replace the A4 Memory Board Assembly. If the problem still exists, replace the A6 Host Board Assembly.

7038 A6 Error in 8041

Communications failed between the A6 8041 processor and the A6 host processor. The 8041 processor is instructed to send a data sequence to the host processor, which if received correctly should verify the 8041 and the link to it. Replace the A6 Host Board Assembly.

7039 A4 Memory

The A6 host processor attempted unsuccessfully to communicate with A4 Pixel RAM. Pixel RAM is tested by writing data to each address location that equals the address of that location. After the data is written, the host reads each address to see if the data equals the location address. Replace the A4 Memory Board Assembly. If the problem persists, replace the A6 Host Board Assembly.

7040 A3 Dot gen

A test of the A3 Dot Generator Board failed. The A6 host processor caused the A3 bit-slice processor to draw an octagonal test pattern on the display. The host processor then computed a signature on screen memory to see if the bit-slice processor has written the correct data. Replace the A3 Dot Generator Board Assembly. If the problem persists, replace the A4 Memory Board Assembly. If the problem still exists, replace the A6 Host Board Assembly.

7048 A3 Wrong datecode

A check of the A3 bit-slice processor firmware datecode failed. Any datecode less than 3.0 fails. Replace the A3 Dot Generator Board Assembly.

7068 A3 Conditional write

The A3 bit-slice processor overwrote data on the screen, indicating a failure of the conditional write circuitry. Replace the A3 Dot Generator Board Assembly.

7069 A3 Word write

The A3 bit-slice processor failed to do a valid word-write to A4 Pixel RAM. Replace the A3 Dot Generator Board Assembly. If the problem persists, replace the A4 Memory Board Assembly.

7070 A3 Dot write

The A3 bit-slice processor failed to do a valid dot-write to A4 Pixel RAM. Replace the A3 Dot Generator Board Assembly. If the problem persists, replace the A4 Memory Board Assembly.

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7071 A3 Limit error

The limit circuitry failed to prevent the A3 bit-slice processor from writing dots to the vector list. Replace the A3 Dot Generator Board Assembly.

7072 A3 Memory arbitration

The A6 host processor and A3 bit-slice processor have failed to share access to A4 Pixel RAM. Replace the A3 Dot Generator Board Assembly. If the problem persists, replace the A4 Memory Board Assembly. If the problem still exists, replace the A6 Host Board Assembly.

7049 A3 Character ROM *(ROM Version 6.0 and later)*

A test of the A3 character ROM failed. The A6 host processor caused the A3 bit-slice processor to read a space character from the character ROM and write it to A4 pixel RAM. Replace the A3 Dot Generator Board Assembly.

7050 A3 Sub return

The A3 bit-slice processor executed but failed to return from a subroutine. The A6 host processor wrote a special program to test the ability of the bit-slice processor to execute and return from a subroutine. Replace the A3 Dot Generator Board Assembly.

7051 A3 Instruction mark

The A3 bit-slice processor failed to mark an instruction, which indicates the instruction has been executed by the bit-slice processor. The A6 host processor wrote a special program that tests the ability of the bit-slice processor to mark an instruction. The test failed. Replace the A3 Dot Generator Board Assembly. If the problem persists, replace the A6 Host Board Assembly.

7052 A3 Unknown failure

The A6 host processor does not know what failed on the A3 Dot Generator Board. The host processor did not successfully execute the power-up confidence test. Replace the A3 Dot Generator Board Assembly. If the problem persists, replace the A6 Host Board Assembly. If the problem still exists, replace the A4 Memory Board Assembly.

7053 A3 Subroutine call

The A3 bit-slice processor failed to call a subroutine. The A6 host processor wrote a special program to test the ability of the A3 bit-slice processor to call a subroutine. The test failed. Replace the A3 Dot Generator Board Assembly.

7054 A3 Memory sync

The synchronization between the A3 bit-slice processor and the A6 host processor in accessing the A4 pixel RAM has failed. Replace the A3 Dot Generator Board Assembly. If the problem persists, replace the A6 Host Board Assembly. If the problem still exists, replace the A4 Memory Board Assembly.

7055 A3 Serial interface

The serial interface between the A6 host processor and the A3 bit-slice processor has failed. The host processor performed a write/read over the serial interface to the A3 bit-slice processor, then attempted to verify the returned data. Replace the A3 Dot Generator Board Assembly. If the problem persists, first replace the A6 Host Board Assembly. If the problem still exists, replace the A2 Sweep/Motherboard Assembly (HP 70205A) or the A2 Video/Sweep Board Assembly (HP 70206A).

7056 A3 Memory read

The A3 bit-slice processor made an unsuccessful attempt to access A4 Pixel RAM. The A6 host processor first caused the bit-slice processor to perform a write/read to pixel RAM. The host processor then read pixel RAM directly and compared this read data with the data read by the A3 bit-slice processor. The comparison failed. Replace the A3 Dot Generator Board Assembly. If the problem persists, replace the A4 Memory Board Assembly.

7057 A3 Memory write

The A3 bit-slice processor made an unsuccessful attempt to access A4 Pixel RAM. The A6 host processor first caused the bit-slice processor to write data to pixel RAM. The host processor then read pixel RAM directly and compared this read data with the data written to pixel RAM. The comparison failed. Replace the A3 Dot Generator Board Assembly. If the problem persists, replace the A4 Memory Board Assembly.

7058 A3 Memory R/W

The A3 bit-slice processor made an unsuccessful attempt to access A4 Pixel RAM. After the A6 host processor caused the bit-slice processor to perform a write/read to pixel RAM. The host processor compared the data actually written to pixel RAM with two values: the data written by, and the data read by, the A3 bit-slice processor. Both comparisons failed. Replace the A3 Dot Generator Board Assembly. If the problem persists, replace the A4 Memory Board Assembly.

7059 A3 Memory address

The A3 bit-slice processor made an unsuccessful attempt to access A4 Pixel RAM. After the A6 host processor first caused the bit-slice processor to write data to a pixel RAM location. The host processor then read the pixel RAM location directly and compared this read data with the data written. This write/read operation was repeated for each pixel RAM location. At least one of the comparisons failed. Replace the A3 Dot Generator Board Assembly. If the problem persists, replace the A4 Memory Board Assembly.

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7060 A6 RAM Data (U37)

7061 A6 RAM Data (U38)

A test of CMOS RAM has failed. Data is cycled through all the address locations on the data bus. Each time data is written, it is read back and compared with the written data. At least one test failed. Replace the A6 Host Board Assembly.

7062 A6 RAM Address

A test of CMOS RAM has failed. The data in CMOS RAM is read, saved, and complemented. Every other address is then tested to see if the data is unchanged. Replace the A6 Host Board Assembly.

7063 A6 ROM U39 Checksum

7064 A6 ROM U40 Checksum

7065 A6 ROM U47 Checksum

7066 A6 ROM U48 Checksum

A checksum is calculated on all ROMs. Replace the defective ROM. If the problem persists, replace the A6 Host Board Assembly.

7067 A3 Start vector

The A3 bit-slice processor failed to read its start vector or jump correctly. Replace the A3 Dot Generator Board Assembly.

2000—2999 Usage Errors

Usage errors are those that occur during normal display operation and usually indicate an error elsewhere in the system.

2001 Illegal Command

The Display has been sent a command it does not recognize (for example in HP BASIC the command `OUTPUT @Display;"XX"` would generate this error.

2002 Illegal Parameter

An item has been sent a command that does not match (for example, sending **LB** to a **PA** type item), a CL command has been sent in GP0, or a bad learnstring has been sent.

2005 Illegal character set

An attempt has been made to specify a character set (using CA or CS) that is not available in the display.

2006 Parm out to Range

A parameter that violates the range specification for a given command has been sent.

2007 Missing terminator

A command has been sent to the display without a valid terminator.

2009 Protocol error

A command has been sent to the display that requires a link type that is not currently established between the sender and the display.

2011 Memory overflow

An attempt has been made to allocate more vector list memory than the display contains. Usually this means that the user is trying to display more traces than the display's memory can support, or that to many strokes have been sent in non-referenced graphics.

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Built-In Diagnostics

There are diagnostics built into the display for a more in-depth troubleshooting of the processor/graphics system.

Display ROM Version 5.0

The display implements a package of self-diagnostic routines at power up. A self-test mode can be invoked with the {CONFID TEST} softkey.

Internal Diagnostics Interpretation

The LEDs on the A6 Host Board Assembly (inside the instrument) are used in two test modes: normal and test (also called error mode). In normal mode the LEDs indicate which board has failed, in test mode the LEDs indicate which test has failed. Refer to Figure 4-2 for the correct rear-panel switch setting for each case. It is necessary to reset the display each time the test mode switch is changed. When the display indicates a display-disruptive error (refer to the error messages section of this chapter), the error LEDs will light. The error messages indicated by these LED patterns are a duplication of the error messages displayed on the CRT. Refer to Figures 4-3 and 4-4 for the location of the error LEDs and the LED error patterns. This may be the only way to tell what error is indicated, because the screen may be blank.

To repair the problems indicated in Table 4-4, look-up the corresponding error in the Display-Disruptive Error section of this manual and follow the directions.

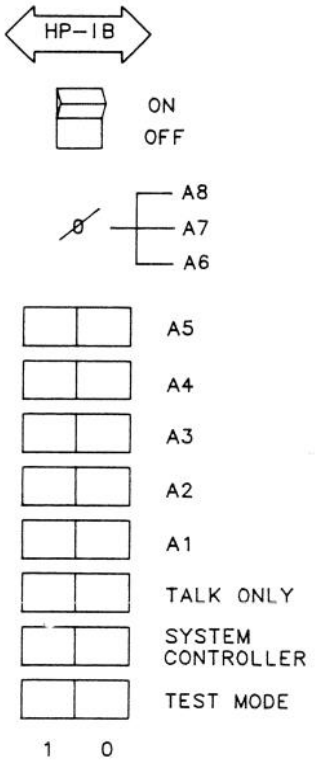


Figure 4-2. Rear-Panel Test Switch

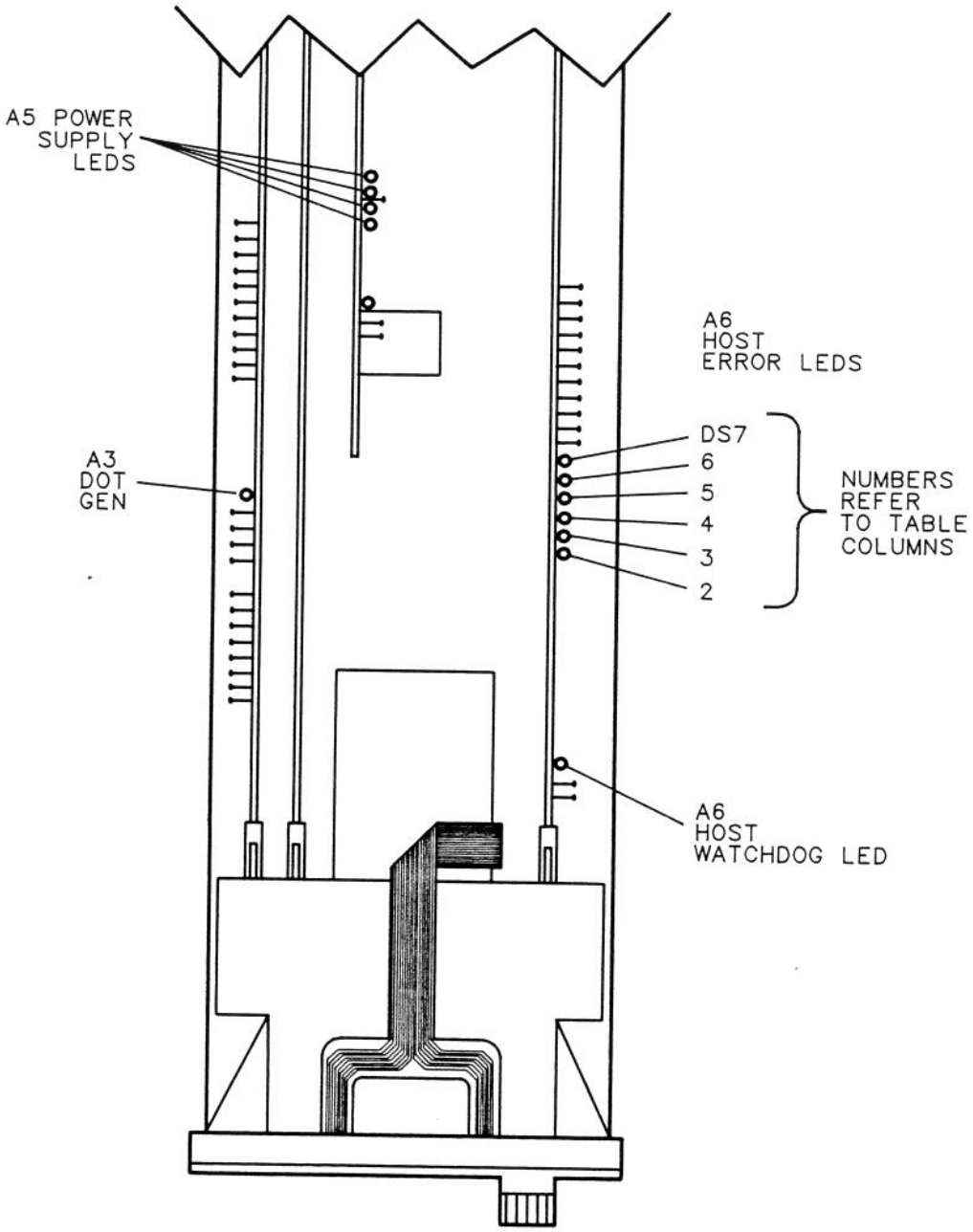


Figure 4-3. HP 70205A Error LEDs

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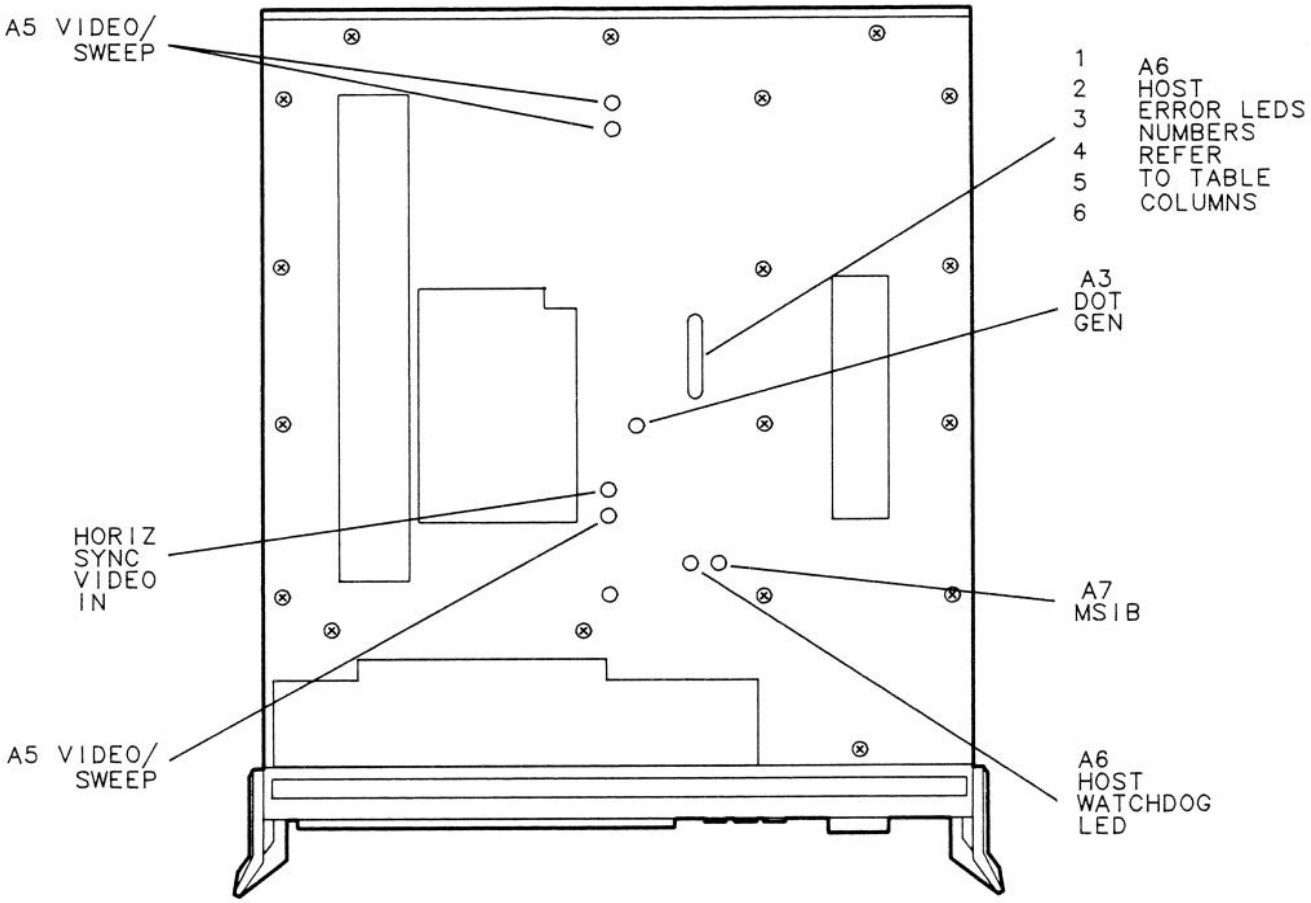


Figure 4-4. HP 70206A Error LEDs

Table 4-4. LED Error Patterns (ROM Version 5.0)

LED INDICATORS

REAR PANEL
TEST SWITCH IN
NORMAL POSITION

1	2	3	4	5	6	
			X			A3 DOT GENERATOR
		X				A4 MEMORY
	X					A6 HOST

IF ANY OF THE ABOVE LEDS ARE LIT,
SET THE 'TEST' SWITCH ON THE REAR
PANEL AND CYCLE POWER.

REAR PANEL
TEST SWITCH
IN ERROR POSITION

1	2	3	4	5	6	
X					X	A3 SERIAL INTERFACE
X				X		A3 MEMORY READ
X				X	X	A3 MEMORY WRITE
X			X			A3 MEMORY R/W
X			X		X	A3 MEMORY ADDRESS
X			X	X		A3 CHAR ROM
X			X	X	X	A3 RETURN FAILED
X		X				A3 MARK FAILED
X		X			X	A3 ??? FAILED
X		X		X		A3 WRONG DATECODE
X	X					A6 8041 INTERFACE
X	X		X			A4 PIXEL RAM
X	X		X		X	A3 CHAR ROM

X: LED LIT

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Display ROM Version 6.0

NOTE

The built-in diagnostics implemented in ROM Version 6.0 are more extensive than those implemented in ROM Version 5.0. If you have ROM Version 5.0 installed and want Version 6.0, contact one of the Hewlett-Packard Service offices listed in Chapter 1, General Information.

The power-up tests are controlled by the address switch on the display rear-panel. See Figure 4-2.

In NORMAL mode (the test mode switch in the 0 position), the display runs a basic power-up test sequence. If any test fails, the sequence terminates and an error is displayed on the screen in large block letters. The board failure is also indicated on the A6 Host board LEDs (A6DS4 symbolizes the A6 Host Board, A6DS5 the A4 Memory Board, and A6DS6 the A3 Dot Generator Board).

In TEST mode (the test mode switch is in the 1 position), the position of the next two switches (SYSTEM CONTROLLER and TALK ONLY) determines which one of three possible test modes is implemented. Refer to Table 4-1 for a description of the three test modes.

In STOP mode, the normal Power-up tests are run but some extra tests are also run. Any failure results in a Display-Disruptive error. This is the recommended mode for assembly-level troubleshooting.

CONTINUE mode can be used if the problem cannot be found in STOP mode, but it may not yield better results.

SELECT mode is for component-level troubleshooting.

Table 4-5. Test Modes

TALK ONLY Switch	SYSTEM CONTROLLER Switch	Mode of Testing
0	0	*CONTINUE* mode. Normal power-up test sequence, but will continue even if a test fails. Report test results using the REPORT ERRORS function after normal operation begins (which may not be possible, depending on the failure).
0	1	*STOP* mode. Normal power-up test sequence, stop on any error. This is like NORMAL mode, except the LEDs on the A6 Host board (which normally read out the board number in the event of a failure) will instead indicate the error number. Refer to figure 5-2 and Table 5-3.
1	0	*SELECT* mode. In this mode, the test selected with switches A5—A1 repeats continuously. LED DS2 on the A6 Host board blinks each time around. If the test fails, LED DS3 blinks at the same time. Refer to Table 5-2.

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Test Descriptions

The following is a summary of the tests which can be selected in SELECT mode.

Table 4-6. Test Descriptions (1 of 3)

A5...A1	Test Number	Name	Description
00000	0	CMOS RAM read	Memory location $0FFF000^H$ is read. This occurs so rapidly that A6DS2 does not appear to blink. No check is made for bad data.
00001	1	CMOS RAM write	Data $0\text{-}0FFFF^H$ is written to location $0FFF000^H$. No check is made for any error.
00010	2	CMOS RAM R/W	Data $0\text{-}0FFFF^H$ is continuously written to location $0FFF000^H$, then read back.
00011	3	CMOS RAM data	For each location in CMOS RAM (with the exception of the non-volatile variable area), a 1 is cycled through all 16 locations on the data bus. Each time a word is written, it is read back and checked. The test should find any shorted or open data lines. Each word is saved before testing, so the test is non-destructive.
00100	4	CMOS RAM address	For 16 locations, each corresponding to only one address bit set, the data in RAM is read, saved, and complemented. Then every other address is tested to see if any are the same as what we just wrote. If so, we save and complement the data at the new location. If it changes, OK. If not, one or more address lines are probably open or shorted. If all is well, we restore data and go to the next address bit, so the test is non-destructive.
00101	5	PIXEL RAM read	Memory location $0F00000^H$ is read continuously to exercise hardware. No check is made for any error. The test is so fast that A6DS2 appears to stay on and not blink.

Table 4-6. Test Descriptions (2 of 3)

A5...A1	Test Number	Name	Description
00110	6	PIXEL RAM write	Data 0-0FFFF^{H} is written to location 0F00000^{H}. No check is made for any error.
00111	7	PIXEL RAM R/W	Data 0-0FFFF^{H} is continuously written to location 0F00000^{H}, then read back.
01000	8	PIXEL RAM	Performs a (destructive) test on PIXEL RAM. Writes a pattern to each location which equals that location number. After the patterns are written, each location is read to see if it equals its address. The same test is then repeated with complementary data.
01001	9	ROM checksum	A checksum is calculated on all ROMs. Any bad ROM causes A6DS3 to blink.
01010	10	HP-MSIB	The functions performed are: send a NULL to Address 31 and check for NMAA (No Module At Address), which is the expected response. Send 0, 1, 2, 4, 8, 16, 64, 128 to self and check the data after each is sent. Failure of this test most likely means that the HP-MSIB itself is hung, that some line is short or open, that the display's HP-MSIB chip is bad or that the host's interface to HP-MSIB chip is bad.
01011	11	8041	This test tells the 8041 processor to send a count sequence to the host processor, which if received correctly should verify the 8041 processor and the link to it.
01100	12	Character ROM Checksum	The bit-slice processor is told to write all characters in the Character ROM to the screen. A signature of the data in screen memory is then taken by the host processor and compared to the signature for the ROM. If they disagree, the test fails.

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Table 4-6. Test Descriptions (3 of 3)

A5...A1	Test Number	Name	Description
01101	13	Dot Generator Datecode	The datecode (e.g., 3.1) of the bit-slice processor firmware is checked to make sure that the first number (e.g., 3) agrees with what the host processor expects.
01110	14	Dot Generator Signature	The host processor writes a program into the vector list, then activates it. This will cause the bit-slice processor to draw a test pattern (an octagon on a grid with a jagged line through it). The host processor then computes a signature on screen memory to see if the dot generator has written the correct data.
01111	15	Dot Generator Confidence	See flowchart, Figure 5-3 (3 of 3)
10000	16	Serial Interface Function	See flowchart, Figure 5-5 (1 of 3)
10001	17	Serial Interface Read/Write	See flowchart, Figure 5-5 (2 of 3)
10010	18	Serial Interface Address	See flowchart, Figure 5-5 (3 of 3)
10011	19	Memory arbitration test	For this test the bit-slice processor fills half of screen memory with dots, then the host processor and the bit-slice processor simultaneously try to access it. Failure of the test (if the rest of the bit-slice processor tests pass) indicates a failure in the circuitry which allows the host processor and bit-slice processor to share access to pixel RAM.

Display Confidence Test

The {CONFID TEST} softkey invokes a test which is a sequential execution of tests 11, 8, 14, and 12. If the test fails, the Message **6008 Confidence Test Failed** is printed on the display's title line. If it passes, **6001 Confidence Test Passed** is displayed. The same test sequence can be invoked remotely with the "TE" command. If any test fails, the bus which sent the "TE" command will be notified.

Error Descriptions

The LED patterns represented in Tables 4-3 and 4-4 are on the top edge of the A6 host board, component side up. Note that some tests only operate in SELECT mode; these tests have no LED pattern or error code associated with NORMAL, TEST, or CONTINUE mode. To view the LEDs on the printed circuit board assemblies, proceed as follows:

1. Remove the top cover from the display. Refer to the Top Cover Replacement Procedure in Chapter 5.

2. Turn the display ON.

Two of the tests have an extra line on the readout of the "disruptive" message. This extra line consists of a 16-bit word displayed as 16 1's and 0's (for example, 0000101001100110). For the PIXEL RAM test (test 8), each 1 bit corresponds to one bad bit found during the test (with D15 corresponding to the left-most bit). This can help identify the failed RAM chip(s). For the bit-slice Confidence Test (Test 15), the pattern tells which of the several tests performed has passed or failed for use in factory diagnostics.

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Table 4-7. Error Indications (1 of 3)

Test Number	LED lit on failure NORMAL mode	LED pattern on failure TEST mode A6DS7..DS2	Possible errors, disruptive	Possible errors in REPORT ERRORS
0	–	–	–	–
1	–	–	–	–
2	–	–	–	–
3	A6DS4	110110	A6 RAM DATA ERROR (U37)	7060 A6 RAM Data (U37)
	A6DS4	110110	A6 RAM DATA ERROR (U38)	7061 A6 RAM Data (U38)
4	A6DS4	110011	A6 RAM ADDR ERROR	7062 A6 RAM Address
5	–	–	–	–
6	–	–	–	–
7	–	–	–	–
8	A6DS5	110100	A4 PIXEL RAM	7039 A4 Memory
9	A6DS4	111000	A6 ROM 39 CHECKSUM	7063 A6 ROM U39 checksum
	A6DS4	111001	A6 ROM 40 CHECKSUM	7064 A6 ROM U40 checksum
	A6DS4	111010	A6 ROM 47 CHECKSUM	7065 A6 ROM U47 checksum
	A6DS4	111011	A6 ROM 48 CHECKSUM	7066 A6 ROM U48 checksum

Table 4-7. Error Indications (2 of 3)

Test Number	LED lit on failure NORMAL mode	LED pattern on failure TEST mode A6DS7..DS2	Possible errors, disruptive	Possible errors in REPORT ERRORS
10	–	–	–	7036 HP-MSIB error
11	A6DS4	110000	A6 8041 INTERFACE	7038 A6 Error in 8041
12	A6DS6	110101	A3 CHAR SET	7037 A3 Character set
13	A6DS6	101010	A3 WRONG DATECODE	7048 A3 Wrong datecode
14	–	–	–	7040 A3 Dot Gen
15	A6DS6	100110	A3 CHAR ROM	7049 A3 Character ROM
	A6DS6	100111	A3 RETURN FAILED	7050 A3 Sub return
	A6DS6	101000	A3 MARK FAILED	7051 A3 Instruction mark
	A6DS6	101001	A3 ??? FAILED	7052 A3 Unknown failure
	A6DS6	110001	A3 CALL FAILED	7053 A3 Subroutine call
	A6DS6	101110	A3 MEMORY SYNC	7054 A3 Memory Sync
	A6DS6	101011	A3 START VECTOR	7067 A3 Start vector
	A6DS6	101111	A3 COND WRITE	7068 A3 Conditional write
	A6DS6	111101	A3 WORD WRITE	7069 A3 Word write
	A6DS6	111100	A3 DOT WRITE	7070 A2 Dot write

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Table 4-7. Error Indications (3 of 3)

Test Number	LED lit on failure NORMAL mode	LED pattern on failure TEST mode A6DS7..DS2	Possible errors, disruptive	Possible errors in REPORT ERRORS
	A6DS6	101101	A3 LIMITS ERR	7071 A3 Limit error
16	A6DS6	100001	A3 SERIAL INTERFACE	7055 A3 Serial interface
17	A6DS6	100010	A3 MEMORY READ	7056 A3 Memory read
	A6DS6	100011	A3 MEMORY WRITE	7057 Memory write
	A6DS6	100100	A3 MEMORY R/W	7058 A3 Memory R/W
18	A6DS6	100101	A3 MEMORY ADDRESS	7059 A3 Memory address
19	A6DS6	101100	A3 MEMORY ARB	7072 A3 Memory arbitration

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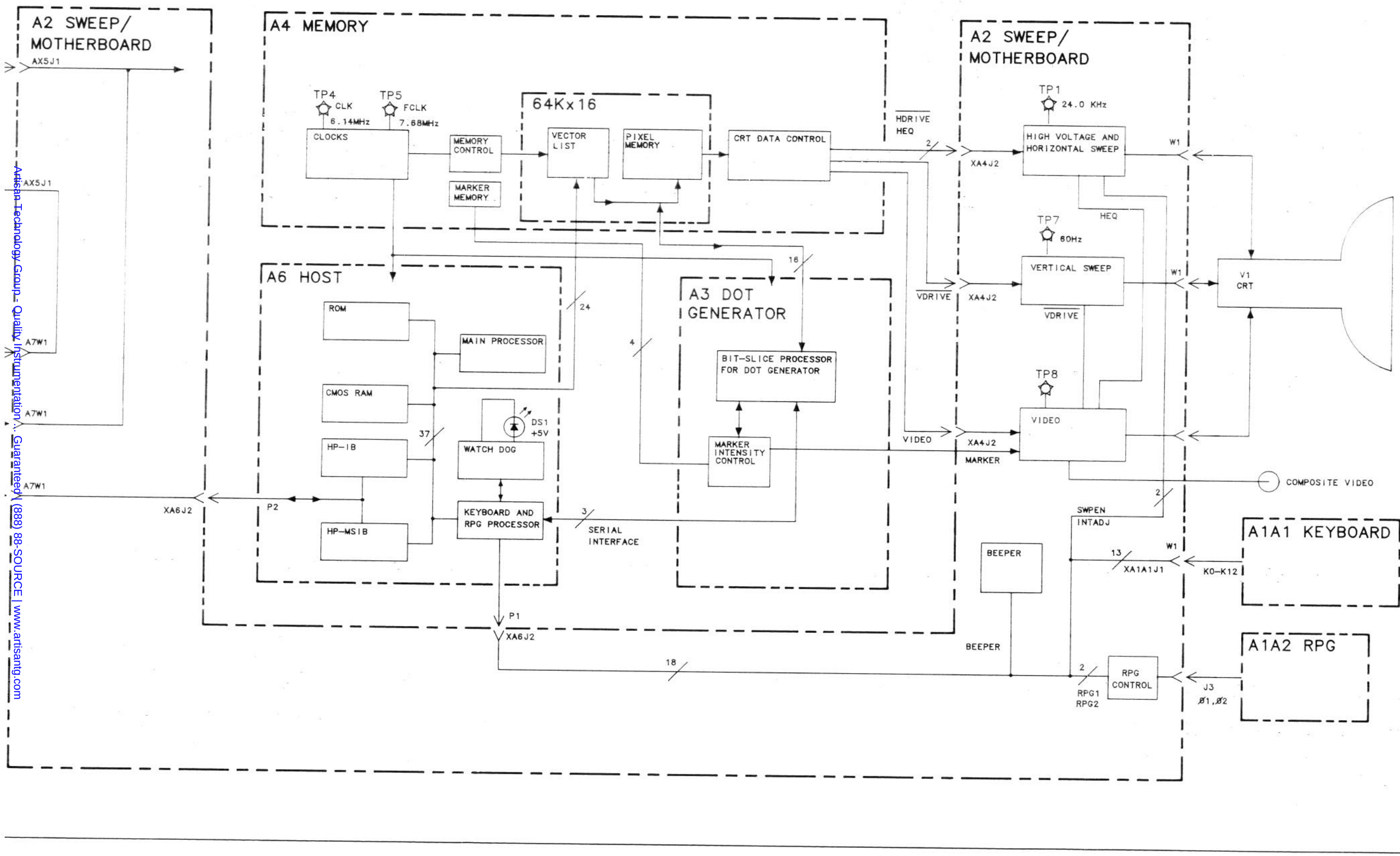


FIGURE 4-5. HP70205A GRAPHICS DISPLAY, BLOCK DIAGRAM

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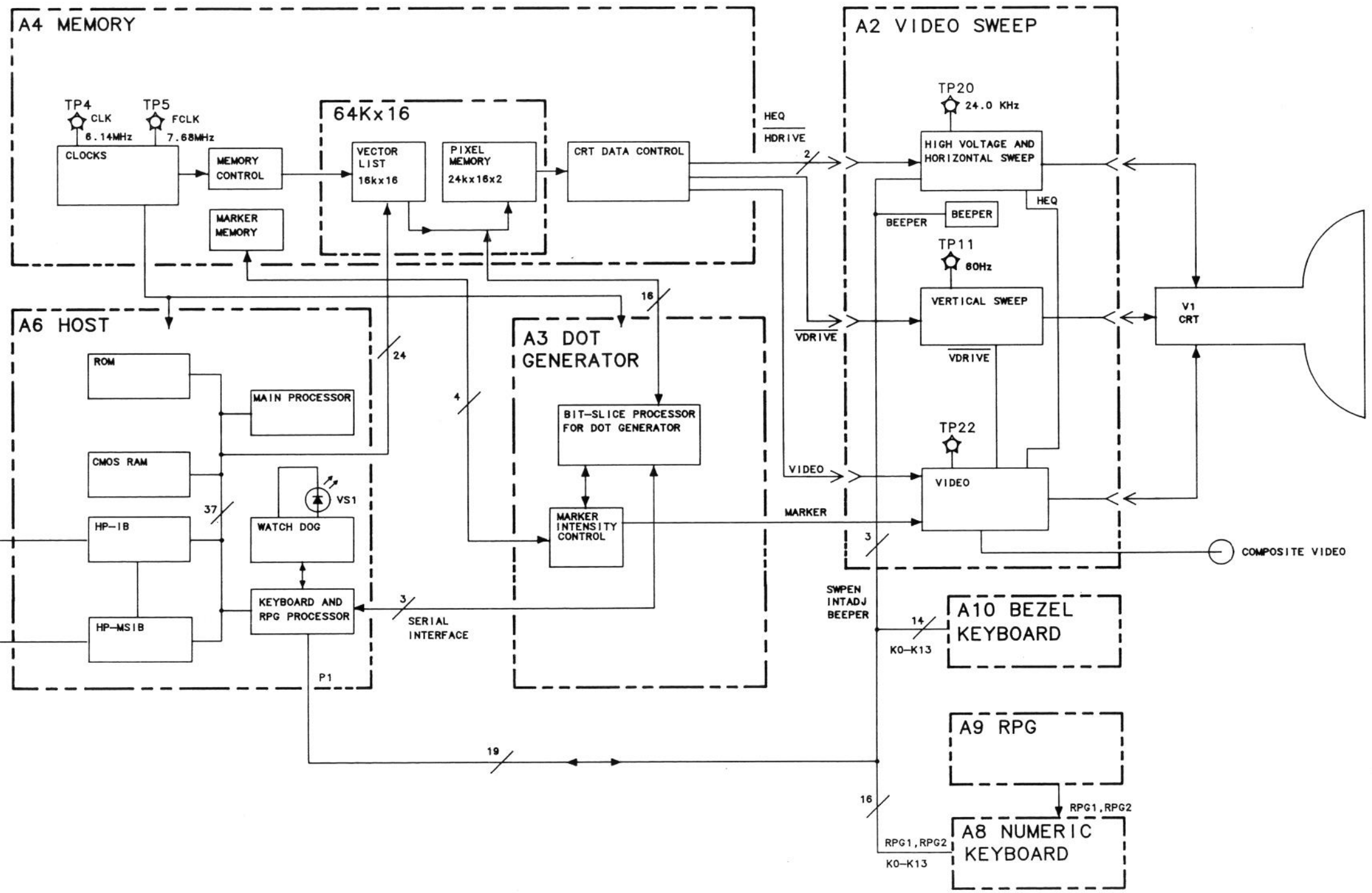


FIGURE 4-6. HP SYSTEM GRAPHICS DISPLAY, BLOCK DIAGRAM

Chapter 5

REPLACEMENT PROCEDURES

Introduction

The procedures in this chapter describe the removal and replacement of HP 70205A Graphics Display and HP 70206A System Graphics Display major assemblies. Refer to Table 5-1 for a complete listing of all tools and materials required in the procedures.

The following information is included in this chapter:

Electrostatic Discharge 5-1
Reducing ESD Damage 5-1
HP 70205A Replacement Procedures 5-3
HP 70206A Replacement Procedures 5-25

Electrostatic Discharge

Electrostatic discharge (ESD) can damage or destroy electronic components. All work performed on assemblies with electronic components should be done at a static-safe work station. Figure 5-1 is an example of a static-safe work station with two types of ESD protection.

- conductive table mat and wrist-strap combination.
- conductive floor mat and heel-strap combination.

Table 1-3 in Chapter 1 lists static-safe accessories that can be ordered from Hewlett-Packard.

REDUCING ESD DAMAGE

The following suggestions may help reduce ESD damage which can occur during testing and servicing operations.

- Handle PC board assemblies and electronic components at a static-safe work station.
- Store and transport PC board assemblies and electronic components in static-shielding containers.
- To prevent a static-charge buildup, properly earth-ground all instruments.

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For further information on ESD, refer to "Electrostatic Discharge" in Chapter 1.

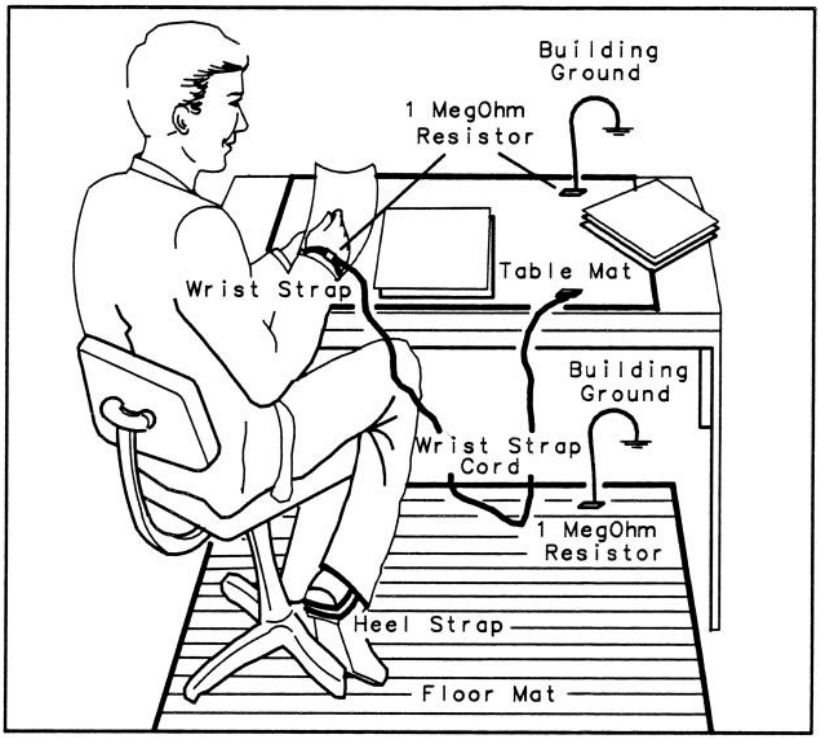


Figure 5-1. Static-Safe Work Station

Table 5-1. Tools and Materials Required for Replacement Procedures

Description	HP Part Number	CD
Phillips Screwdriver #0	8710-0978	6
Pozi-drive Screwdriver (small)	8710-0899	0
Pozi-drive Screwdriver (large)	8710-0900	4
3 mm Hex (Allen) Wrench	8710-1366	8
5/16-inch Open-end Wrench	8720-0015	3
1/4-inch Nut Driver	8720-0002	8
9/16-inch Nut Driver (drilled out, end covered with heatsink tubing)	8720-0008	4
Long-nosed Pliers	8710-0030	1
Wire Cutters	8710-0012	9

HP 70205A Graphics Display

REPLACEMENT PROCEDURES

The procedures in this section describe the removal and replacement of all the HP 70205A Graphics Display's major assemblies. Numbers in parentheses are used throughout the replacement procedures to indicate numerical callouts on the figures.

The following replacement procedures are included in this section.

Top Cover 5-4
Bottom Cover 5-6
Rear Cover 5-8
A1A1 Bezel/Keyboard 5-10
A1A2 RPG 5-12
A2 Sweep/Motherboard 5-14
A3 Dot Generator, A4 Memory, A5 Power Supply, A6 Host 5-16
BT1 Battery 5-19
V1 CRT Assembly 5-21

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Top Cover

REMOVAL

1. Remove the six screws (**1**) and (**2**) securing the top cover. See Figure 5-2.

CAUTION

When prying the top cover loose, insert a screwdriver blade into the pry slots and push the screwdriver handle down. If the screwdriver is inserted too far, or if the handle is lifted , internal damage may occur.

2. Using the slots (**3**) at the top of the rear panel, pry the top cover up and lift it off the display module.

REPLACEMENT

3. Replace the top cover, aligning the cover with the front of the display module.
4. Insert the front top-cover screws (**1**) and tighten until they make contact. See Figure 5-2.
5. Press the rear of the cover down firmly until the screw holes are aligned. The metal RFI gasket will make a scraping sound, which is normal.
6. Align the PC board tabs in the top cover slots (**4**), then fully seat the cover by pressing firmly.
7. Insert the two rear-top screws (**2**) and the two rear-side screws (**2**), one located on each side.
8. Tighten all the screws to six inch-pounds.

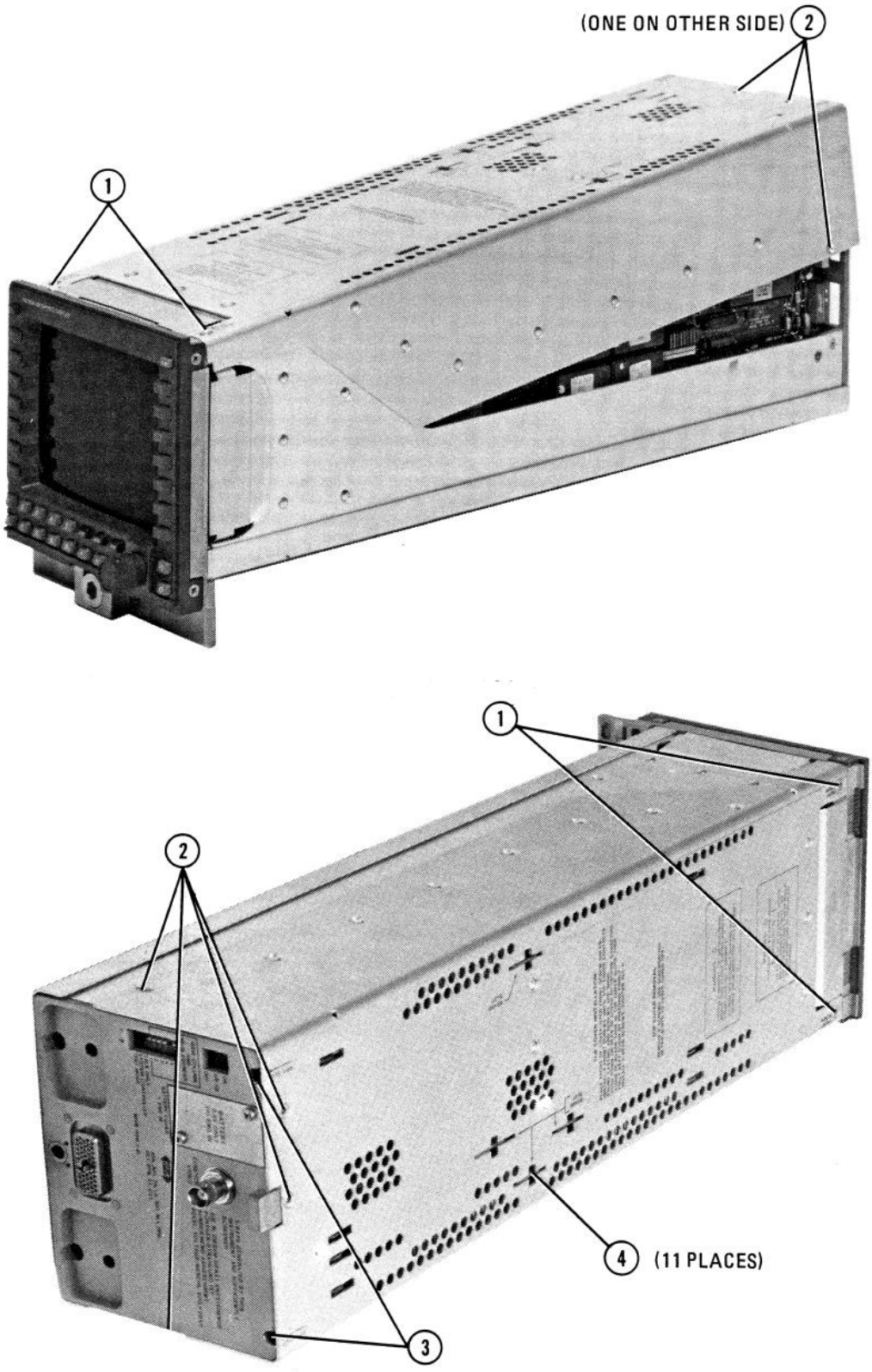


Figure 5-2. Top Cover Replacement

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Bottom Cover

REMOVAL

1. Remove the nine bottom-cover screws (**1**) and lift the bottom cover from the display module. See Figure 5-3.

REPLACEMENT

2. Align the bottom cover with the bottom of the display module. Reinsert the nine bottom-cover screws (**1**). See Figure 5-3.

3. Tighten all the screws to six inch-pounds.

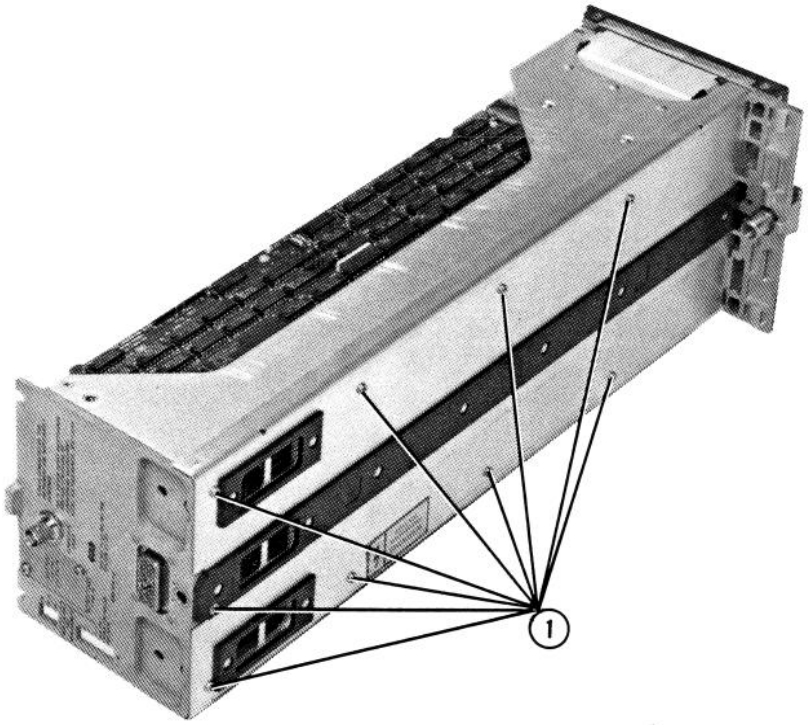


Figure 5-3. Bottom Cover Replacement

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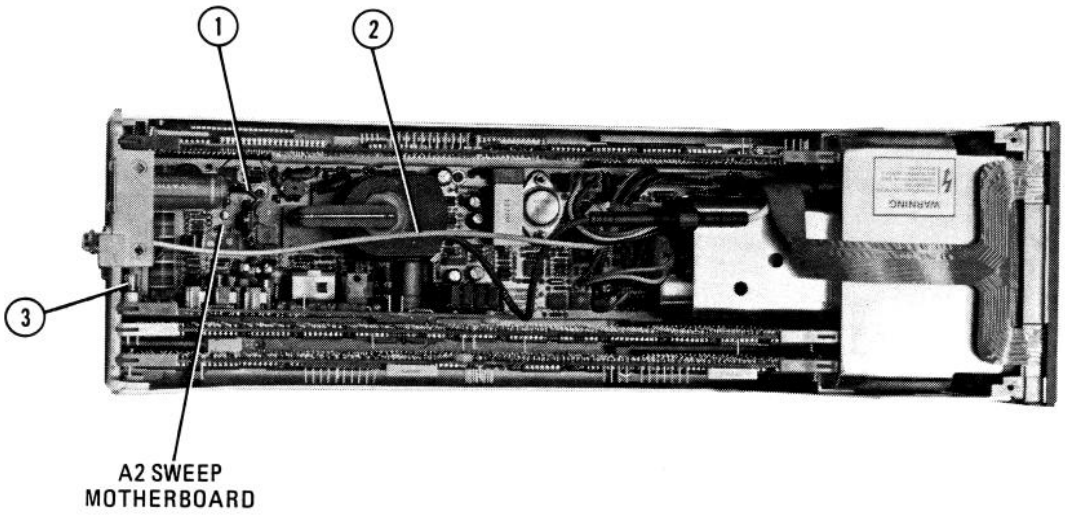
Rear Panel

REMOVAL

1. Remove top cover, bottom cover, A3 Dot Generator, A4 Memory, A5 Power Supply, and A6 Host board assemblies. Refer to the top cover, bottom cover, and respective board assembly replacement procedures.
2. Disconnect the following cables from the A2 Sweep/Motherboard assembly. See Figure 5-4.
   - W1 Battery (**1**)
   - W2 Video (**2**) Clip the tie wrap.
   - W8 Interconnect (**3**)
3. Remove the four screws (**4**) (two on each side) securing the rear panel to the display.
4. Remove the two screws (**5**) securing the A2 Sweep/Motherboard to the rear panel.
5. Remove the rear panel from the display.

REPLACEMENT

6. Attach the rear panel to the A2 Sweep/Motherboard assembly using two screws (**5**).
7. Replace the four screws (**4**) securing the rear panel to the display. See Figure 5-4.
8. Reconnect the following cables to the A2 Sweep/Motherboard assembly.
   - W1 Battery (**1**)
   - W2 Video (**2**)
   - W8 Interconnect (**3**)
9. Replace the top cover, bottom cover, A3 Dot Generator, A4 Memory, A5 Power Supply, and A6 Host board assemblies. Refer to the top cover, bottom cover, and respective board assembly replacement procedures.



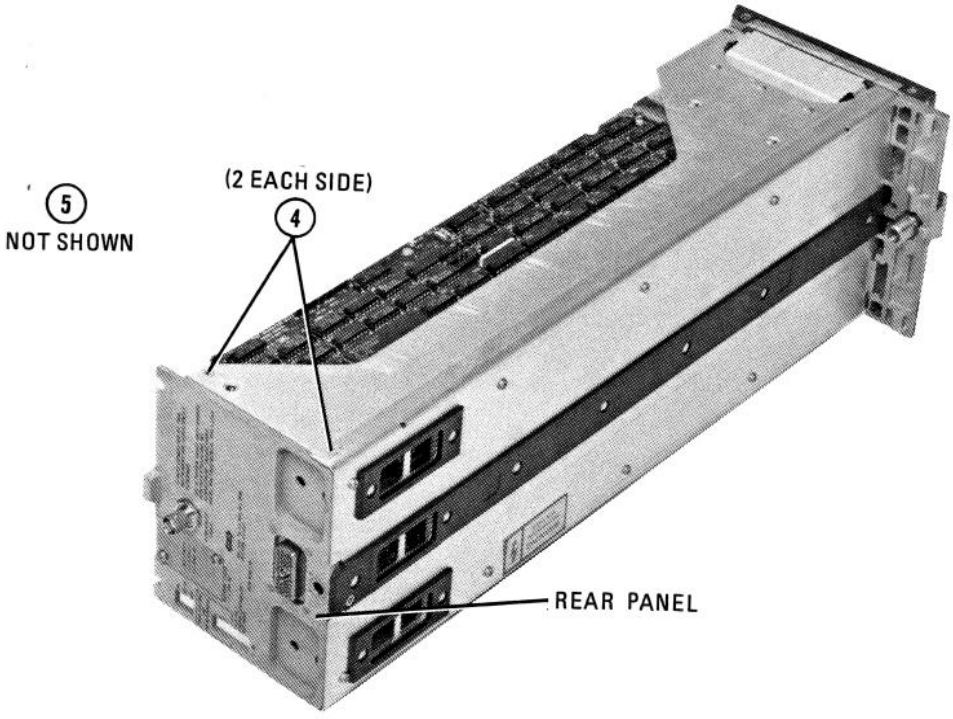


Figure 5-4. A2 Sweep/Motherboard and Rear Panel Replacement

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A1A1 Bezel/Keyboard Assembly

REMOVAL

1. Remove the top cover. Refer to the top cover replacement procedure.
2. Disconnect the W7 keyboard cable (**1**) from the A2 Sweep/Motherboard assembly. See Figure 5-5.
3. Remove the two set-screws that secure the RPG knob (**2**), and remove the knob (**3**).
4. Remove the four screws (**4**) that secure the keyboard to the front frame.
5. Remove the A1A1 Bezel/Keyboard Assembly. Take care to not lose the three small grounding springs in the casting; they ground the bezel to the front frame.

REPLACEMENT

6. Replace the three small grounding springs in the bezel.
7. Replace the A1A1 Bezel/Keyboard Assembly, carefully guiding the W5 RPG cable (**5**) through the frame. See Figure 5-5.
8. Replace the four screws (**4**) and tighten to six inch-pounds, securing the keyboard to the front frame.
9. Replace the RPG knob (**3**) and tighten the two set-screws (**2**) to six inch-pounds.
10. Reconnect the W7 keyboard cable (**1**) to the A2 Sweep/Motherboard assembly.
11. Replace the top cover. Refer to the top cover replacement procedure.

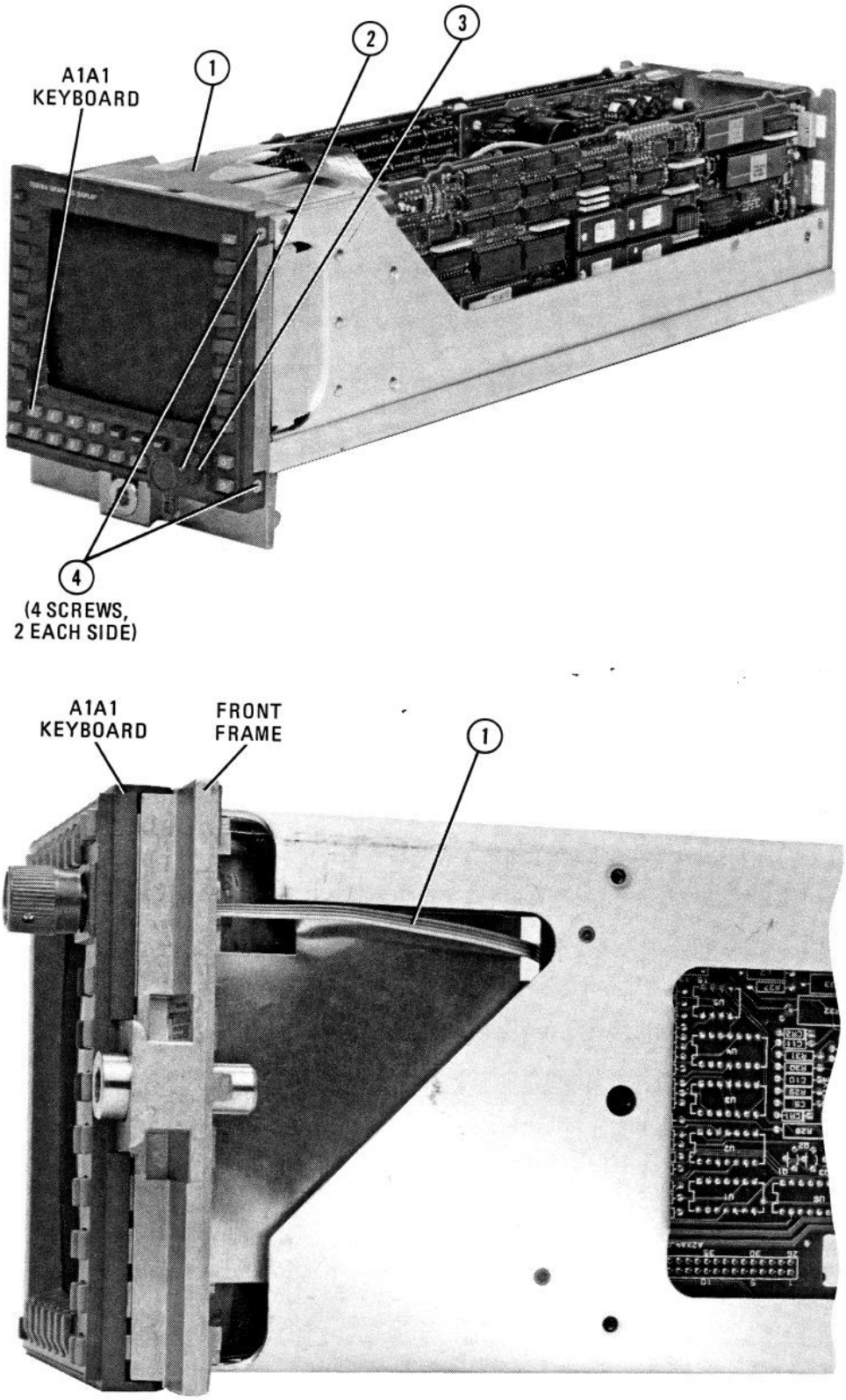


Figure 5-5. A1A1 Bezel/Keyboard Assembly Replacement

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A1A2 RPG

REMOVAL

1. Remove the top cover. Refer to the top cover replacement procedure.
2. Remove the bottom cover. Refer to the bottom cover replacement procedure.
3. Remove the bezel/keyboard. Refer to the A1A1 Bezel/Keyboard replacement procedure.
4. Disconnect the W5 RPG cable (**1**) from the A2 Sweep/Motherboard assembly. See Figure 5-6.
5. Remove the two screws (**2**) that secure the A1A2 RPG board assembly to the front frame (**3**).
6. Remove the A1A2 RPG board assembly (**4**), carefully guiding the W5 RPG cable (**1**) through the frame.

REPLACEMENT

7. Replace the A1A2 RPG board assembly (**4**), carefully guiding the W5 RPG cable (**1**) through the front frame (**3**). See Figure 5-6.
8. Replace the two screws (**2**) that secure the front frame (**3**) to the A1A2 RPG board assembly. Tighten the screws to six inch-pounds.
9. Reconnect the W5 RPG cable (**1**) to the A2 Sweep/Motherboard assembly.
10. Replace the bezel/keyboard assembly. Refer to the A1A1 Bezel/Keyboard Assembly replacement procedure.
11. Replace the bottom cover. Refer to the bottom cover replacement procedure.
12. Replace the top cover. Refer to the top cover replacement procedure.

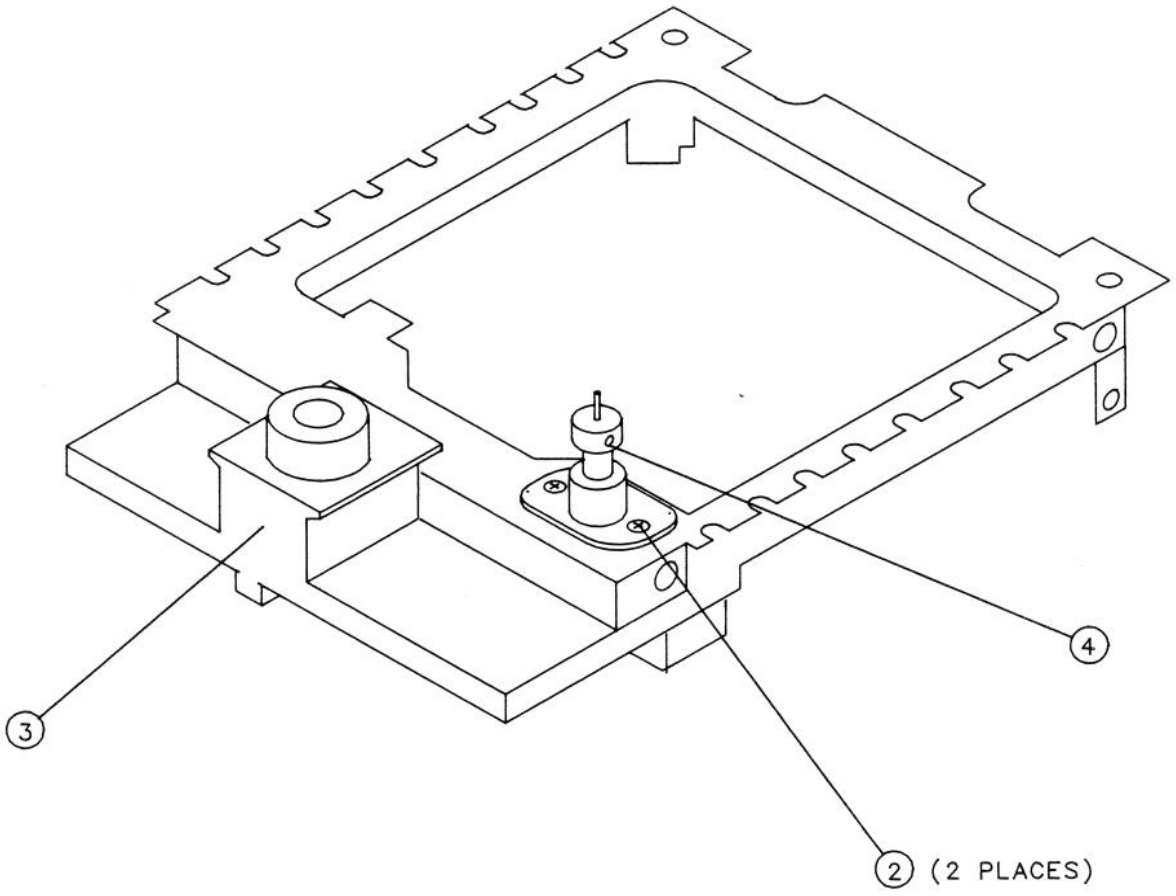


Figure 5-6. A1A2 RPG Replacement

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A2 Sweep/Motherboard

REMOVAL

1. Remove rear cover. Refer to the rear cover replacement procedure.

WARNING

Serious personal injury may occur if electrostatic discharge (ESD) precautions are used while discharging the CRT Anode cable.

2. Disconnect the following cables from the A2 Sweep/Motherboard assembly. See Figure 5-7.

   - W3 Anode (**1**)
   - W4 CRT (**2**)
   - W5 RPG (**3**)
   - W6 Yoke (**4**)
   - W7 Keyboard (**5**)

3. Remove the seven screws (**6**) securing the sweep/motherboard to the chassis.
4. Slide the A2 Sweep/Motherboard assembly out of the rear of the display module.

REPLACEMENT

5. Slide the A2 Sweep/Motherboard assembly into the display module.

WARNING

Serious personal injury may occur if electrostatic discharge (ESD) precautions are used while discharging the CRT Anode cable.

6. Replace the seven screws (**5**) that secure the sweep/motherboard to the chassis. Tighten the screws to 20 inch-pounds. See Figure 5-7.

7. Reconnect the following cables to the A2 Sweep/Motherboard assembly.

   - W3 Anode (**1**)
   - W4 CRT (**2**)
   - W5 RPG (**3**)
   - W6 Yoke (**4**)
   - W7 Keyboard (**5**)

8. Replace the rear panel. Refer to the rear panel replacement procedures.

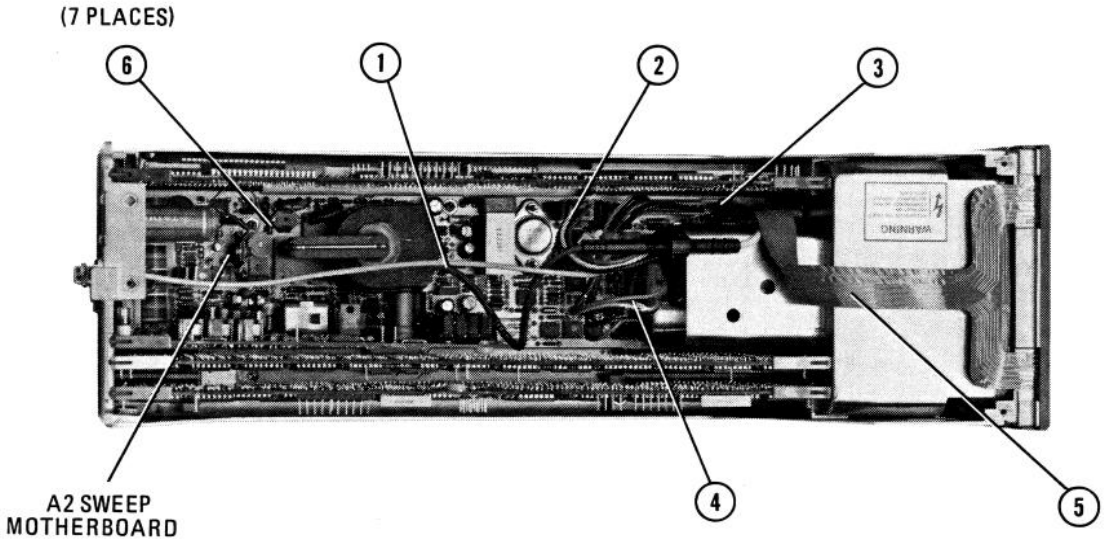


Figure 5-7. A2 Sweep/Motherboard Replacement

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A3 Dot Generator, A4 Memory, A5 Power Supply, and A6 Host

CAUTION

Use electrostatic discharge (ESD) precautions when working on the A3 Dot Generator, A4 Memory, A5 Power Supply, and A6 Host board assemblies.

REMOVAL

1. Remove the top cover. Refer to the top cover replacement procedure.
2. Using the colored tabs, remove the A3 Dot Generator (**1**), A4 Memory (**2**), A5 Power Supply (**3**), and A6 Host (**4**), board assemblies. See Figure 5-8.

REPLACEMENT

3. Replace the A3 Dot Generator Board Assembly (**1**), A4 Memory (**2**), A5 Power Supply (**3**), and A6 Host (**4**) board assemblies. Use the colored tabs as a guide. See Figure 5-8.
4. Replace the top cover. Refer to the top cover replacement procedure.

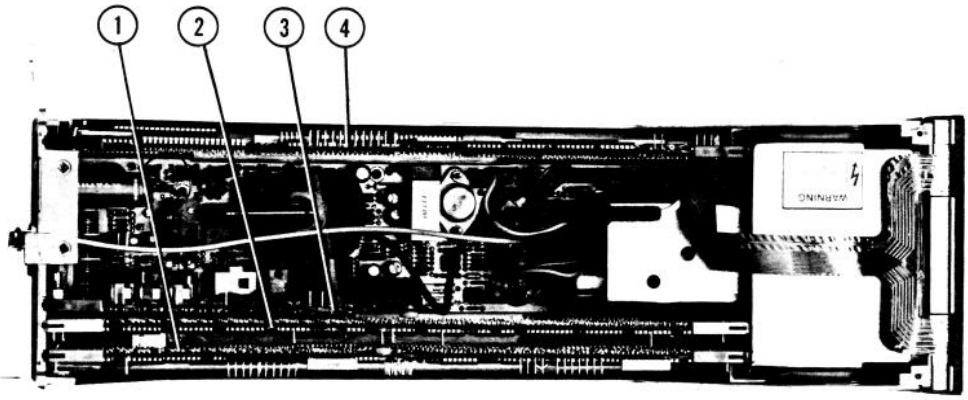


Figure 5-8. A3 Dot Generator, A4 Memory, A5 Power Supply, and A6 Host Replacement

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BT1 Battery

WARNING

The BT1 Battery must not be recharged, forced open, or disposed of in fire. If abused, this battery represents a fire, explosion, and severe burn hazard. Dispose of the battery in accordance with local hazardous-material-disposal regulations.

REMOVAL

1. Remove the two screws (**1**) securing the battery cover and remove the cover (**2**). See Figure 5-9.
2. Remove the battery.

REPLACEMENT

3. Replace the battery, (+) end in.
4. Replace the battery cover (**2**) and the two screws (**1**) that secure it. See Figure 5-9.

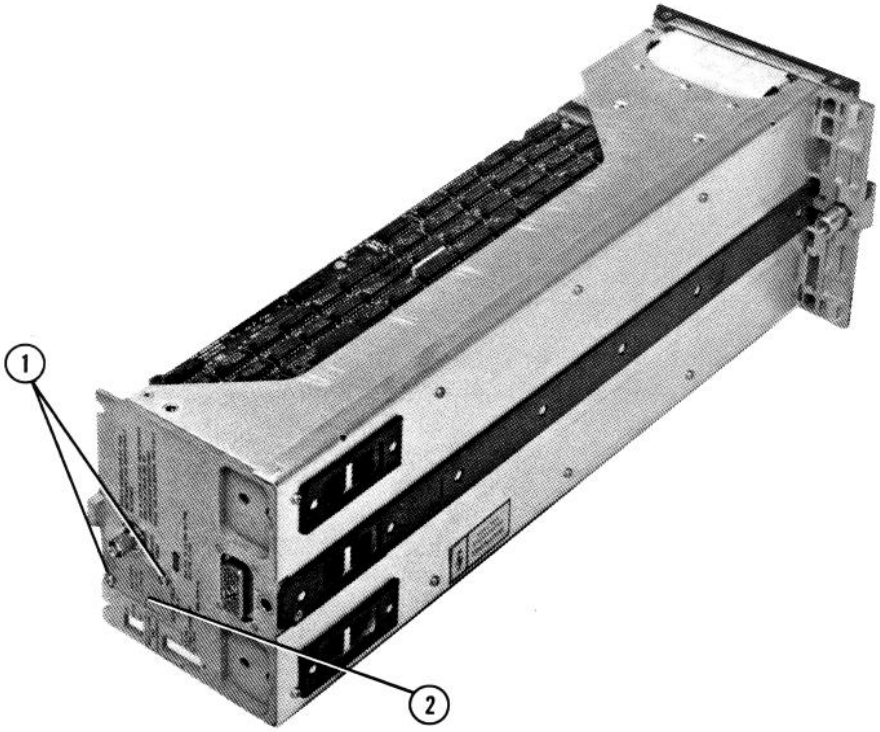


Figure 5-9. BT1 Battery Replacement

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V1 CRT Assembly

REMOVAL

1. Remove the top cover, bottom cover, A3 Dot Generator, A4 Memory, A5 Power Supply, and A6 Host board assemblies. Refer to their respective replacement procedures.

WARNING

Serious personal injury may occur if electrostatic discharge (ESD) precautions are used while discharging the CRT Anode cable.

2. Disconnect the following cables from the A2 Sweep/Motherboard assembly. See Figure 5-10.

- W2 Video (**2**)
- W3 Anode (**3**) (ground the CRT side of W3)
- W4 CRT (**4**)
- W5 RPG (**5**)
- W6 Yoke (**6**)
- W7 Keyboard (**7**)

WARNING

Since the CRT is mounted under pressure, the 5 mm spring-compression screws must be installed prior to removing the front frame or the CRT. Removal of the front frame without installing the 5 mm spring-compression screws can result in bodily injury, or damage to the CRT and the pressure plate, or both.

3. Install the 5 mm spring-compression screws (**1**) (located inside the top cover) to compress the CRT springs. Use a 8 mm hex balldriver (HP part number 8710-1307) to tighten. Tighten each screw (**8**) alternately five turns, until tight.

4. Remove the A1A1 Bezel/Keyboard. Refer to the A1A1 Bezel/Keyboard replacement procedure.

5. Remove the RPG board assembly. Refer to the A1A2 RPG replacement procedure.

6. Remove the four Torx bolts (**9**) securing the front frame to the display module frame. Use a Torx handle (HP part number 8710-1413) and a T9 bit (HP part number 8710-1521).

7. Place the display module on its side and remove the front frame.(**10**)

8. Remove the CRT (**11**) and the RFI gasket (**12**). Save the front gasket for reinstallation.

REPLACEMENT

NOTE

HP 70205A Graphics Displays with serial prefix 2607A and below use CRTs with a bonded faceplate. Displays with serial prefix 2607A and above use CRTs with a separate faceplate. When a display with a bonded faceplate requires a CRT replacement, four parts must be installed:

CRT/Yoke Assembly
CRT Faceplate
Gasket/Shockmount

Refer to Service Note 70205A-2 for more information about installing CRTs with unbonded faceplates.

9. Place the front casting on a protective mat with a lint-free cloth.

10. Insert the conductive gasket into the front frame.

11. Clean both sides of the tinted glass shield with a lint-free cloth and thin-film cleaner.

12. Place the glass over the conductive gasket.

13. Place the non-conductive (shockmount) gasket on top of the tinted glass shield.

14. Supporting the display module on the rear panel, place the CRT (**11**) into the instrument housing. Guide the anode cable through the hole provided in the CRT chassis. Make sure the spring (**13**) does not get caught on the yoke. See Figure 5-10.

15. Align the front frame and install the four Torx bolts (**9**). Tighten the Torx bolts to six inch-pounds.

16. Install the RPG board assembly. Refer to the A1A2 RPG replacement procedure.

17. Install the keyboard assembly. Refer to the A1A1 Keyboard replacement procedure.

WARNING

Serious personal injury may occur if electrostatic discharge (ESD) precautions are used while discharging the CRT Anode cable.

18. Reconnect the following cables on the A2 Sweep/Motherboard assembly. See Figure 5-10.

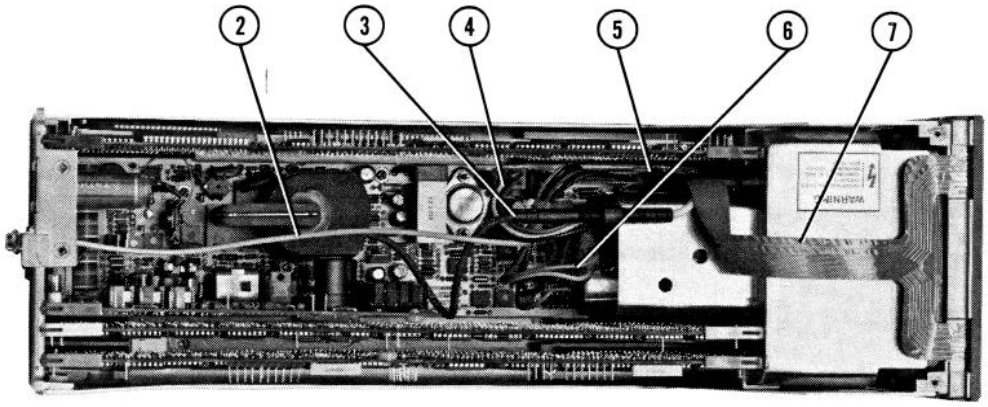
- W2 Video (**2**)
- W3 Anode (**3**)
- W4 CRT (**4**)
- W5 RPG (**5**)
- W6 Yoke (**6**)
- W7 Keyboard (**7**)

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19. Remove the 5 mm spring-compression screws (**8**), alternating five turns each.

20. Replace the top cover, bottom cover, A3 Dot Generator, A4 Memory, A5 Power Supply and A6 Host board assemblies. Refer to their respective replacement procedures.



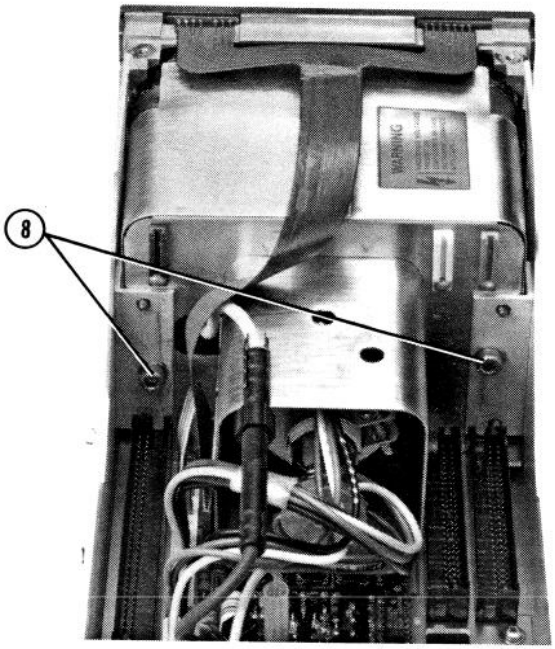


Figure 5-10. V1 CRT Replacement (1 of 2)

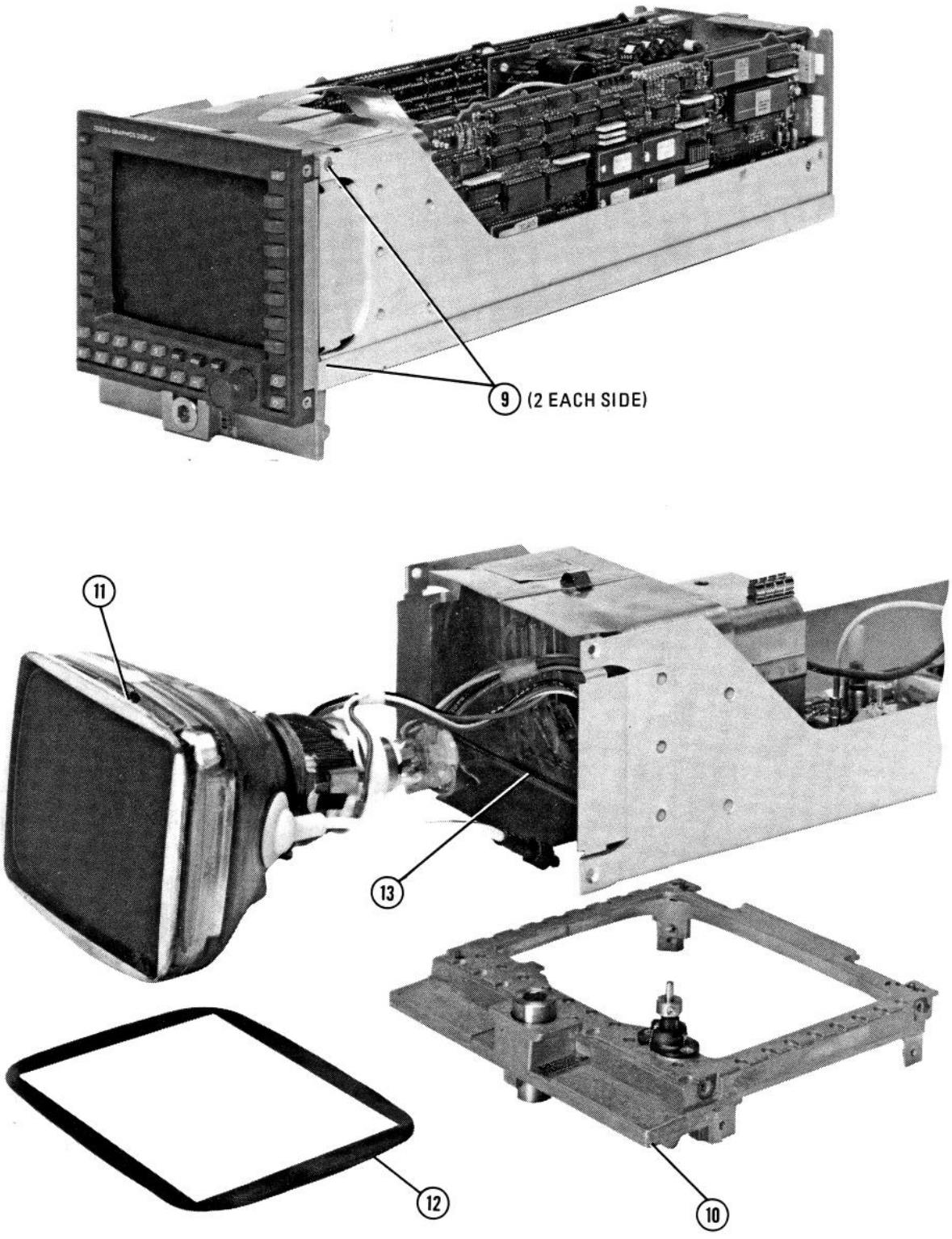


Figure 5-10. V1 CRT Replacement (2 of 2)

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NOTES

HP 70206A System Graphics Display

REPLACEMENT PROCEDURES

Introduction

The procedures in this section describe the removal and replacement of all the HP 70206A System Graphics Display's major assemblies. Numbers in parentheses are used throughout the replacement procedures to indicate numerical callouts on the figures.

The following replacement procedures are included in this section.

Top and Inner Covers 5-26
Front Panel 5-28
A1 Filter 5-30
A2 Video/Sweep 5-32
A3 Dot Generator 5-34
A4 Memory 5-36
A6 Host 5-38
A7 HP-MSIB 5-40
A8 Numeric Keyboard Assembly 5-42
A9 RPG 5-44
A10 Bezel Keyboard Assembly 5-46
A11 Power Supply 5-47
BT1 Battery 5-53
V1 CRT Assembly 5-54

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Top and Inner Covers

CAUTION

Some versions of the inner cover require one full counterclockwise turn to remove the inner-cover screws, other versions require only one-quarter turn to remove the screws. Take care not to over-torque the one-quarter turn screws.

REMOVAL

1. Remove the two top-rear feet (**1**) from the display. See Figure 5-11.
2. Loosen the screw (**2**) on the rear edge of the top cover. As this screw is backed out, the top cover (**3**) will slide to the rear. Remove the cover.
3. Remove the inner cover (**4**) by twisting the inner-cover screws (**5**) one full turn counterclockwise.

REPLACEMENT

4. Replace the inner cover (**4**).
5. To secure the inner cover, press and twist the inner-cover screws (**5**) one full turn clockwise.
6. Replace the top cover (**3**). Leave a cover overhang of 2.0 cm (1/2 inch) at the rear of the instrument.
7. Push the top cover towards the front of the instrument.
8. When the top-cover screw (**2**) makes contact with the frame, tighten the screw to six inch-pounds.
9. Replace the two top-rear feet (**1**) and tighten to 20 inch-pounds.

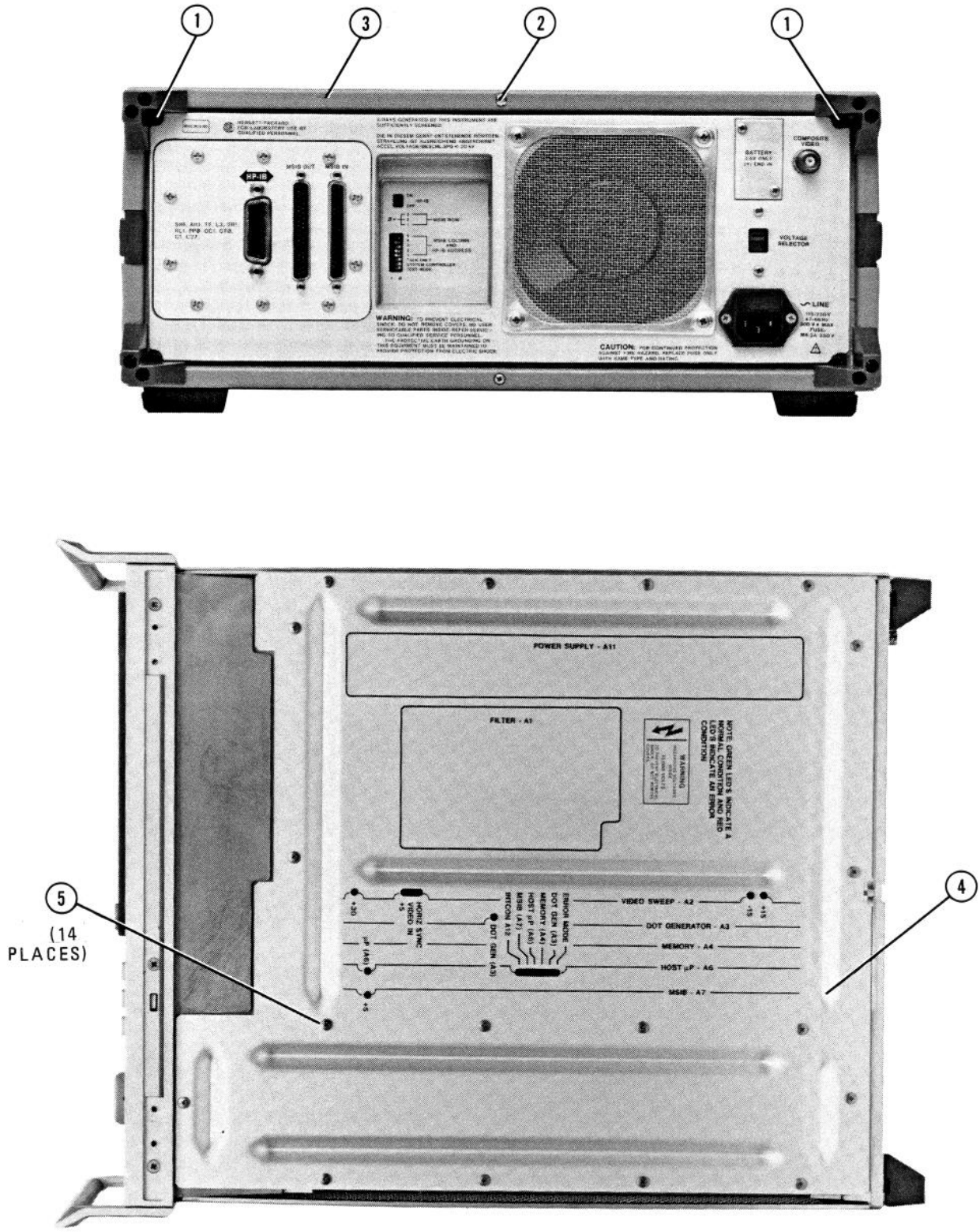


Figure 5-11. Top and Inner Covers Replacement

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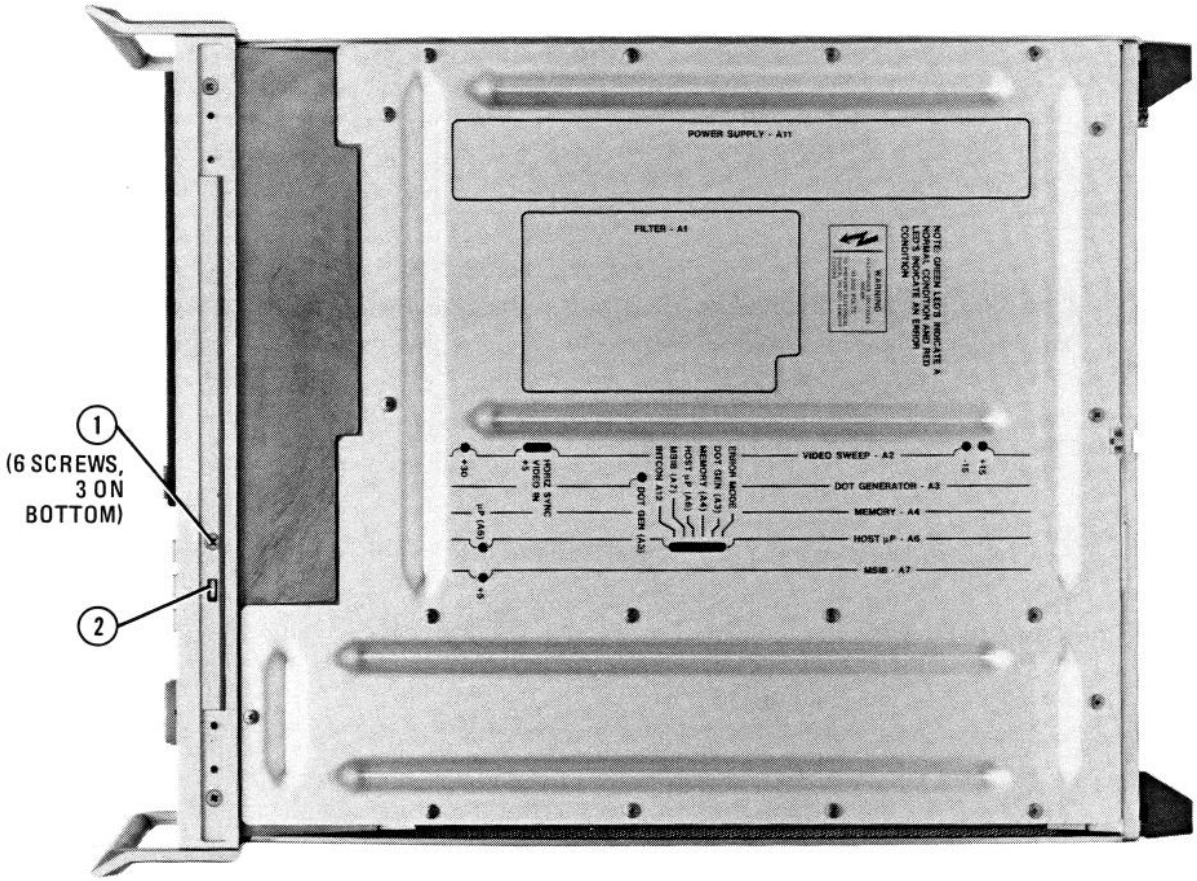
Front Panel

REMOVAL

1. Remove the top trim strip exposing the front-frame screws (**1**). See Figure 5-12.
2. Remove the six screws (**1**), three top and three bottom.
3. Using the pry slot (**2**), pry the front panel from the instrument housing.
4. Disconnect the ribbon cable (**3**) from the front panel.

REPLACEMENT

5. Reconnect the ribbon cable (**3**) to the front panel.
6. Replace the front panel.
7. Replace the six screws (**1**) (three top and three bottom) and tighten to 12 inch-pounds. See Figure 5-12.
8. Replace the top trim strip.



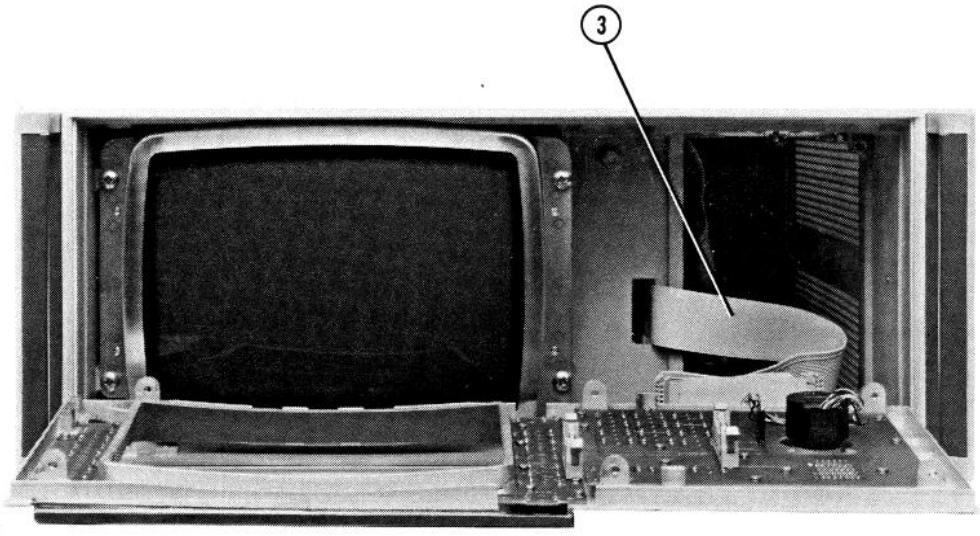


Figure 5-12. Front Panel Replacement

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A1 Filter

CAUTION

Use electrostatic discharge (ESD) precautions when working on the A2 Video/Sweep board assembly.

REMOVAL

1. Remove the A2 Video/Sweep board assembly. Refer to the A2 Video/Sweep board assembly replacement procedure.

2. Disconnect the cables from the following connectors on the A1 Filter board assembly. See Figure 5-13.

   - J1 (**1**)
   - J2 (**2**)
   - J3 (**3**)

3. Remove the five screws (**4**) securing the A1 filter board assembly, then remove the board.

4. Disconnect the front-panel switch cable (**5**) from the A1 filter board assembly. Tilt the cable at a 45-degree angle to remove it.

REPLACEMENT

5. Reconnect the front-panel switch cable (**5**) to the A1 Filter board assembly. Tilt the cable at a 45-degree angle to insert it into the connector, then press down to snap the cable into place. See Figure 5-13.

NOTE

Check the action of the front-panel switch to make sure it is switching on the A1 Filter board assembly. The switch on the A1 Filter board assembly must be in the same position as it was before disassembly. If the switch does not work, remove the cable and reposition the switch.

6. Replace the A1 Filter board assembly and secure it with five screws (**4**) tightened to 20 inch-pounds.

- J1 (1)
- J2 (2)
- J3 (3)

8. Replace the A2 Video/Sweep board assembly. Refer to the A2 Video/Sweep board assembly replacement procedure.

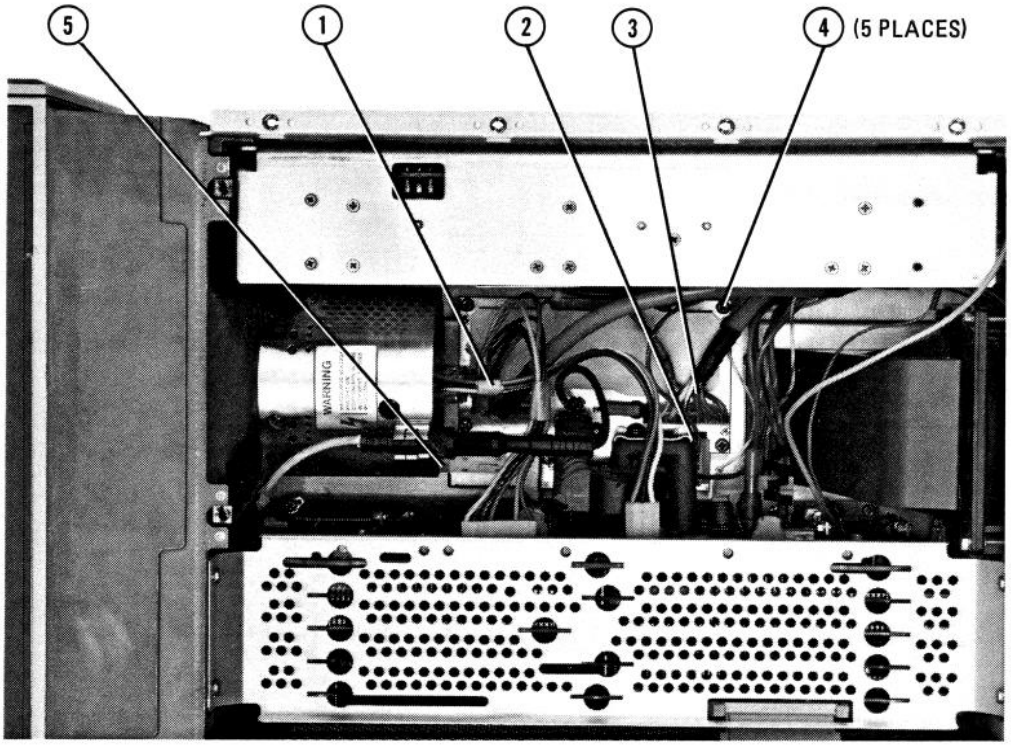


Figure 5-13. A1 Filter Replacement

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A2 Video/Sweep

CAUTION

Use electrostatic discharge (ESD) precautions when working on the A2 Video/Sweep board assembly.

REMOVAL

1. Remove the top and inner covers. Refer to the top and inner covers replacement procedure.
2. Remove the four screws (**1**) securing the PC board retainer (**2**) to the instrument frame. See Figure 5-14.
3. Remove the board retainer (**2**).

WARNING

Serious personal injury may occur if electrostatic discharge (ESD) precautions are used while discharging the CRT Anode cable.

4. Disconnect the following cables from the A2 Video/Sweep board assembly (**5**):
   - W1 CRT (**4**)
   - W17 Yoke (**3**)
   - W16 Anode (**6**)
5. Using the colored tabs, remove the A2 Video/Sweep board assembly (**3**).

REPLACEMENT

6. Replace the A2 Video/Sweep board assembly (**5**). See Figure 5-14.

WARNING

Serious personal injury may occur if electrostatic discharge (ESD) precautions are used while discharging the CRT Anode cable.

7. Reconnect the following cables on the A2 Video/Sweep board assembly.
   - W1 CRT (**4**)
   - W17 Yoke (**3**)
   - W16 Anode (**6**)
8. Replace the board retainer (**2**), making sure the PC boards fit into the slots on the board retainer.
9. Replace the four screws (**1**) that secure the PC board retainer to the instrument frame and tighten them to 20 inch-pounds.
10. Replace the top and inner covers. Refer to the top and inner covers replacement procedure.

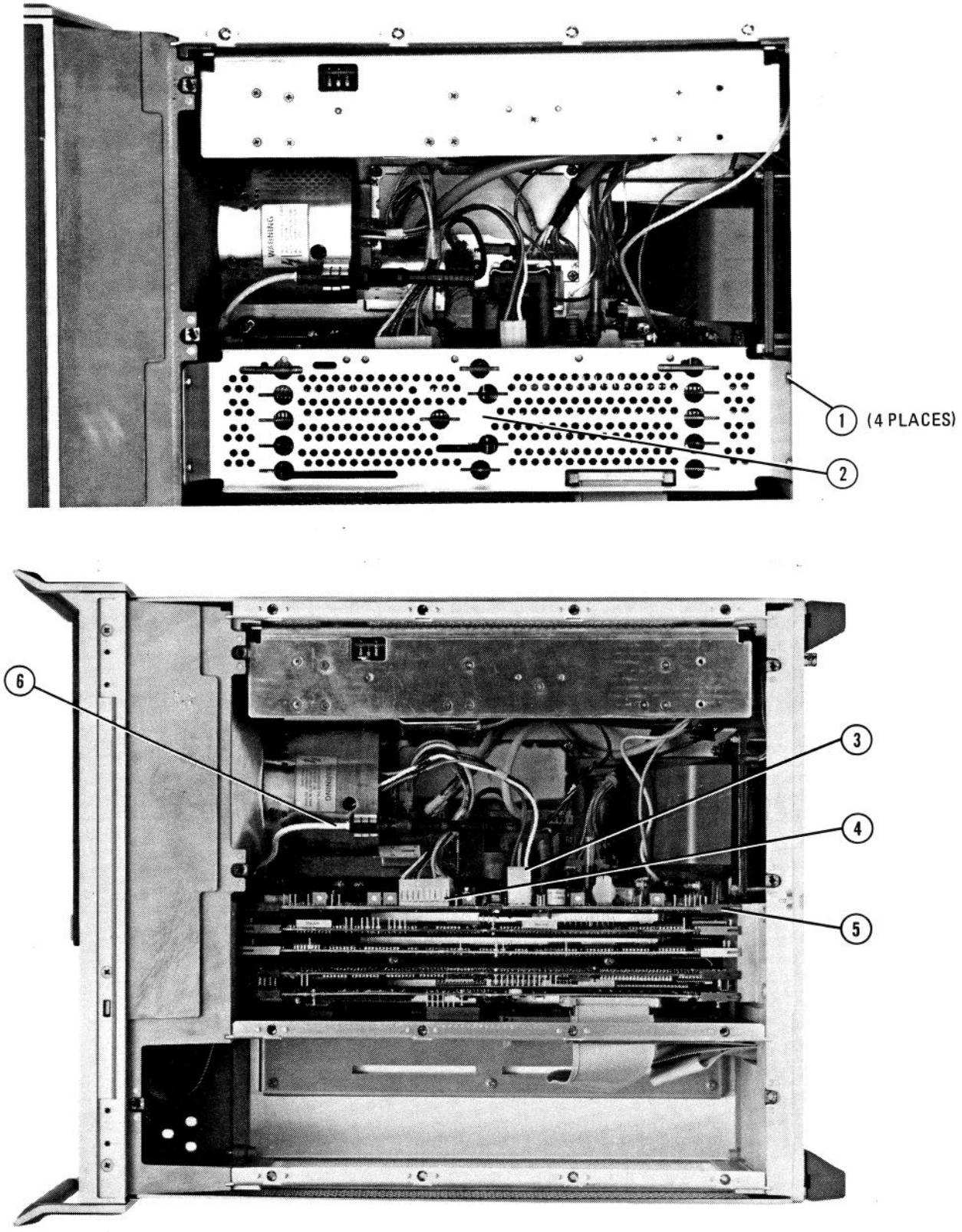


Figure 5-14. A2 Video/Sweep Replacement

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A3 Dot Generator

CAUTION

Use electrostatic discharge (ESD) precautions when working on the A3 Dot Generator board assembly.

REMOVAL

1. Remove the top and inner covers. Refer to the top and inner covers replacement procedure.
2. Remove the four screws (**1**) securing the PC board retainer (**2**). See Figure 5-15.
3. Remove the board retainer.
4. Using the colored tabs remove the A3 Dot Generator board assembly (**3**).

REPLACEMENT

5. Replace the A3 Dot Generator board assembly (**3**). Use the colored tabs as a guide. See Figure 5-15.
6. Replace the board retainer (**2**), making sure the PC boards fit into the slot on the retainer.
7. Replace the four screws (**1**) that secure the PC board retainer to the instrument frame and tighten them to 20 inch-pounds.
8. Replace the top and inner covers. Refer to the top and inner covers replacement procedure.

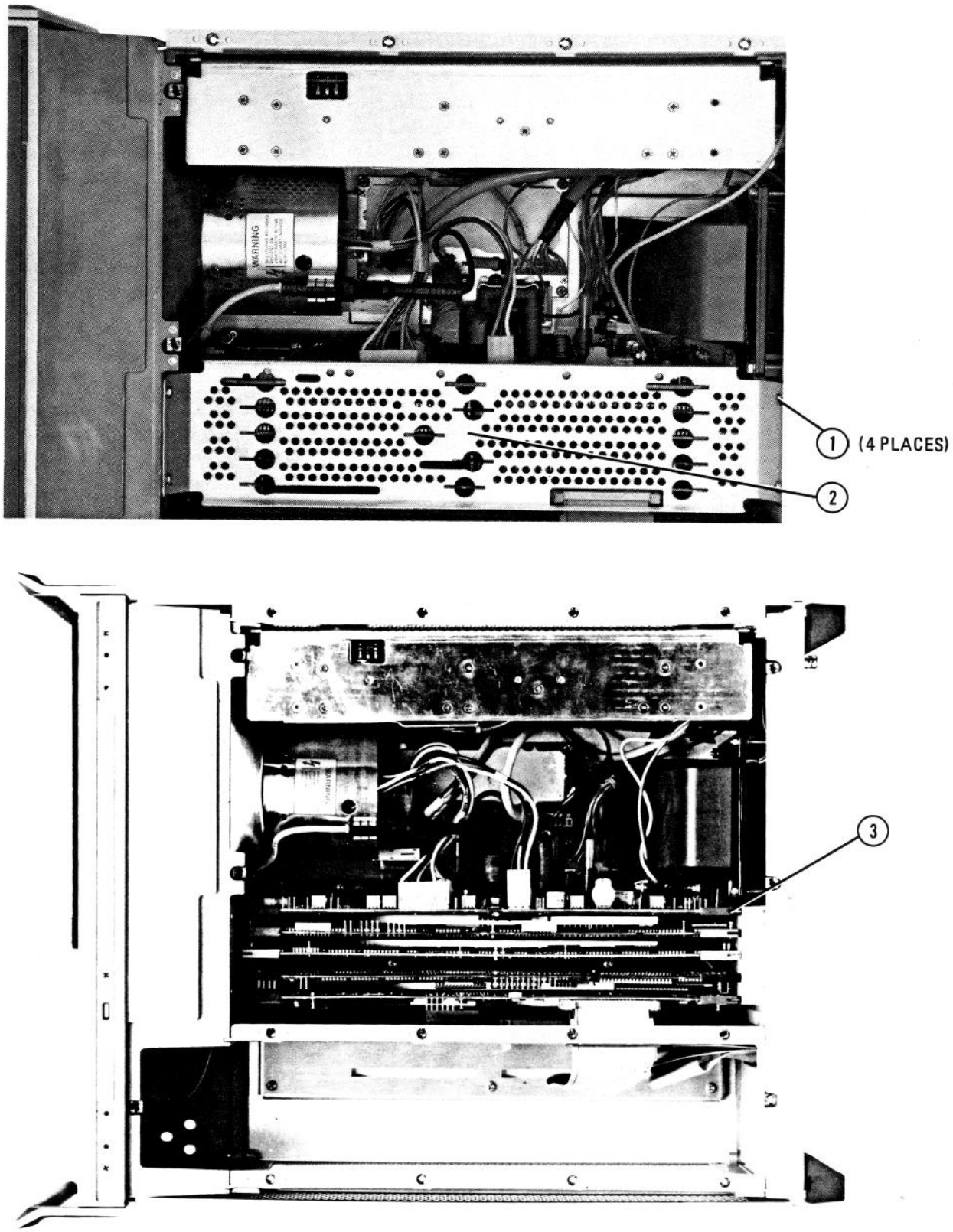


Figure 5-15. A3 Dot Generator Replacement

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A4 Memory

CAUTION

Use electrostatic discharge (ESD) precautions when working on the A4 Memory board assembly.

REMOVAL

1. Remove the top and inner covers. Refer to the top and inner covers replacement procedure.
2. Remove the four screws (**1**) securing the PC board retainer (**2**). See Figure 5-16.
3. Remove the board retainer.
4. Using the colored tabs, remove A4 Memory board assembly (**3**).

REPLACEMENT

5. Replace the A4 Memory board assembly (**3**). Use the colored tabs as a guide. See Figure 5-16.
6. Replace the board retainer (**2**).
7. Replace the four screws (**1**) that secure the PC board retainer to the instrument frame.
8. Replace the top and inner covers. Refer to the top and inner covers replacement procedure.

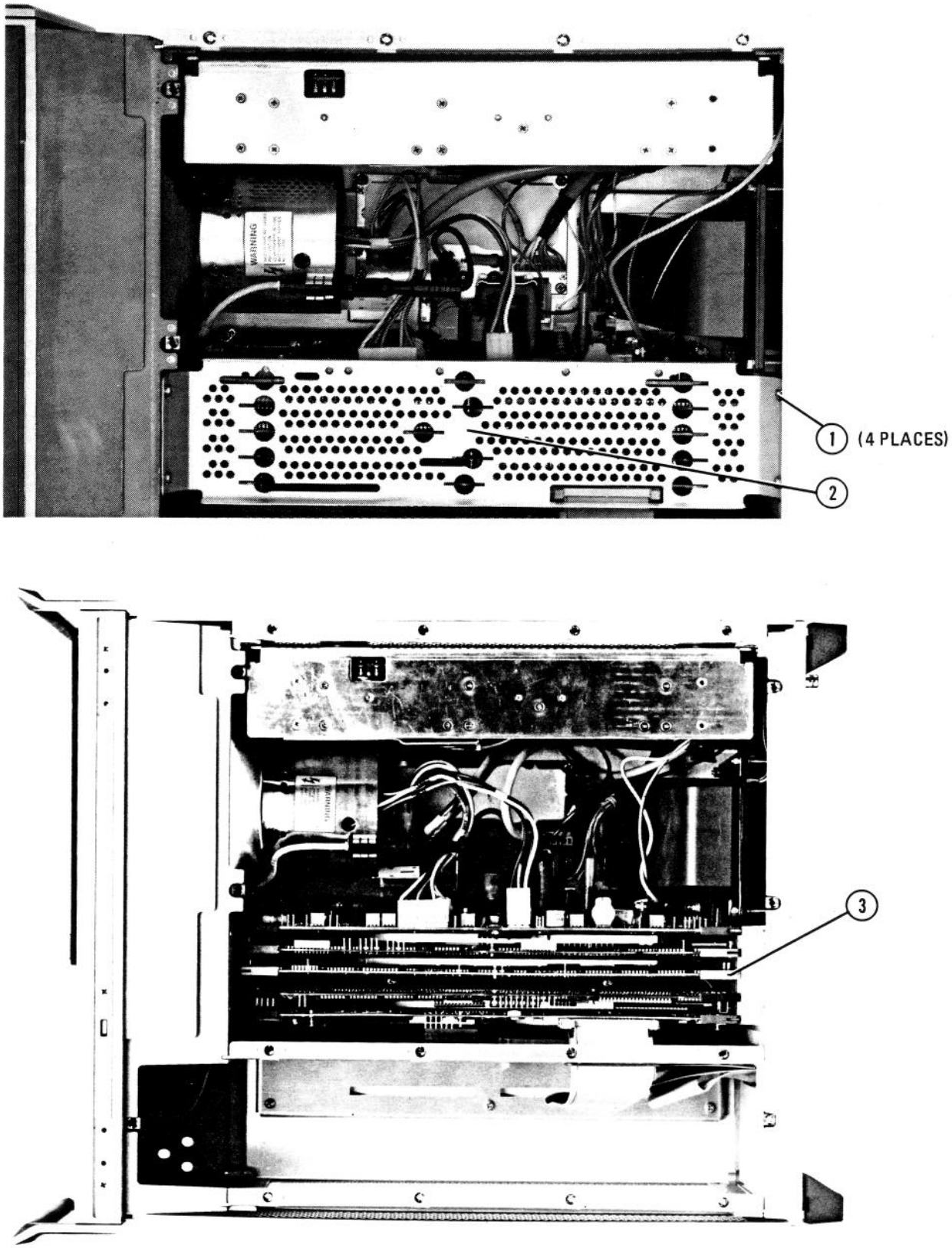


Figure 5-16. A4 Memory Replacement

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A6 Host

CAUTION

Use electrostatic discharge (ESD) precautions when working on the A6 Host board assembly.

REMOVAL

1. Remove the top and inner covers. Refer to the top and inner covers replacement procedure.
2. Remove the four screws (**1**) securing the PC board retainer (**2**). See Figure 5-17.
3. Remove the board retainer.
4. Using the colored tabs, remove the A6 Host board assembly (**3**).

REPLACEMENT

5. Replace A6 Host (**3**) board assembly. Use the colored tabs as a guide. See Figure 5-17.
6. Replace the PC board retainer (**2**), making sure the PC board fits into the slots on the retainer.
7. Replace the four screws (**1**) that secure the board retainer to the instrument frame and tighten the screws to 20 inch-pounds.
8. Replace the top and inner covers. Refer to the top and inner covers replacement procedure.

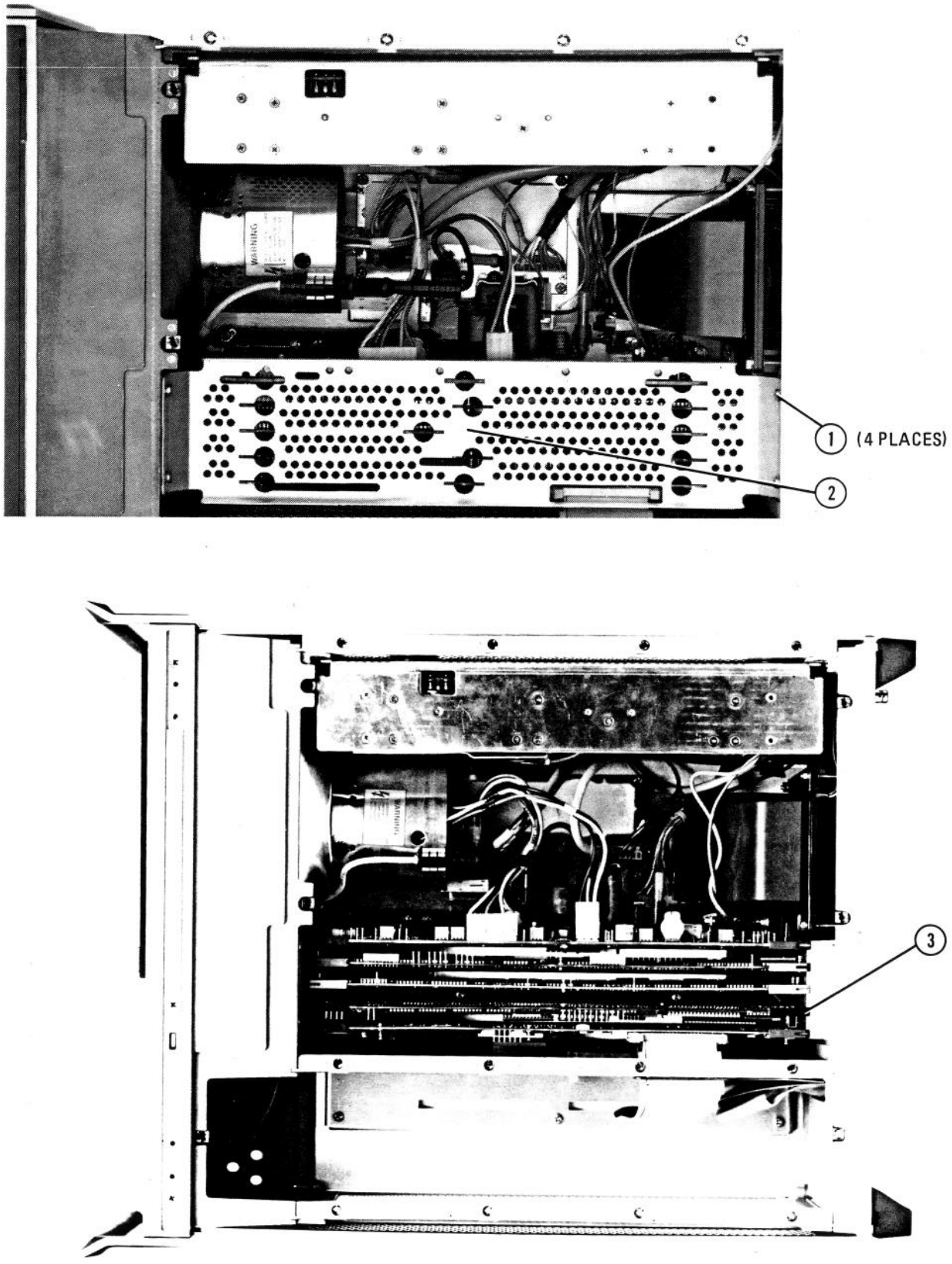


Figure 5-17. A6 Host Replacement

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A7 HP-MSIB

CAUTION

Use electrostatic discharge (ESD) precautions when working on the A7 HP-MSIB board assembly.

REMOVAL

1. Remove the top and inner covers. Refer to the top and inner covers replacement procedure.
2. Remove the four screws (**1**) securing the PC board retainer (**2**). See Figure 5-18.
3. Remove the board retainer.
4. Disconnect the HP-MSIB IN and OUT cables (**4**) from the A7 HP-MSIB board assembly (**3**).
5. Using the colored tabs, remove the A7 HP-MSIB board assembly (**3**).

REPLACEMENT

6. Replace the A7 HP-MSIB board assembly (**3**). Use the colored tabs as a guide. See Figure 5-18.
7. Reconnect the HP-MSIB IN and OUT cables (**4**) to the A7 HP-MSIB board assembly (**3**).
8. Replace the PC board retainer (**2**), making sure the PC boards fit into the slots on the retainer.
9. Replace the four screws (**1**) that secure the board retainer to the instrument frame and tighten the screws to 20 inch-pounds.
10. Replace the top and inner covers. Refer to the top and inner covers replacement procedure.

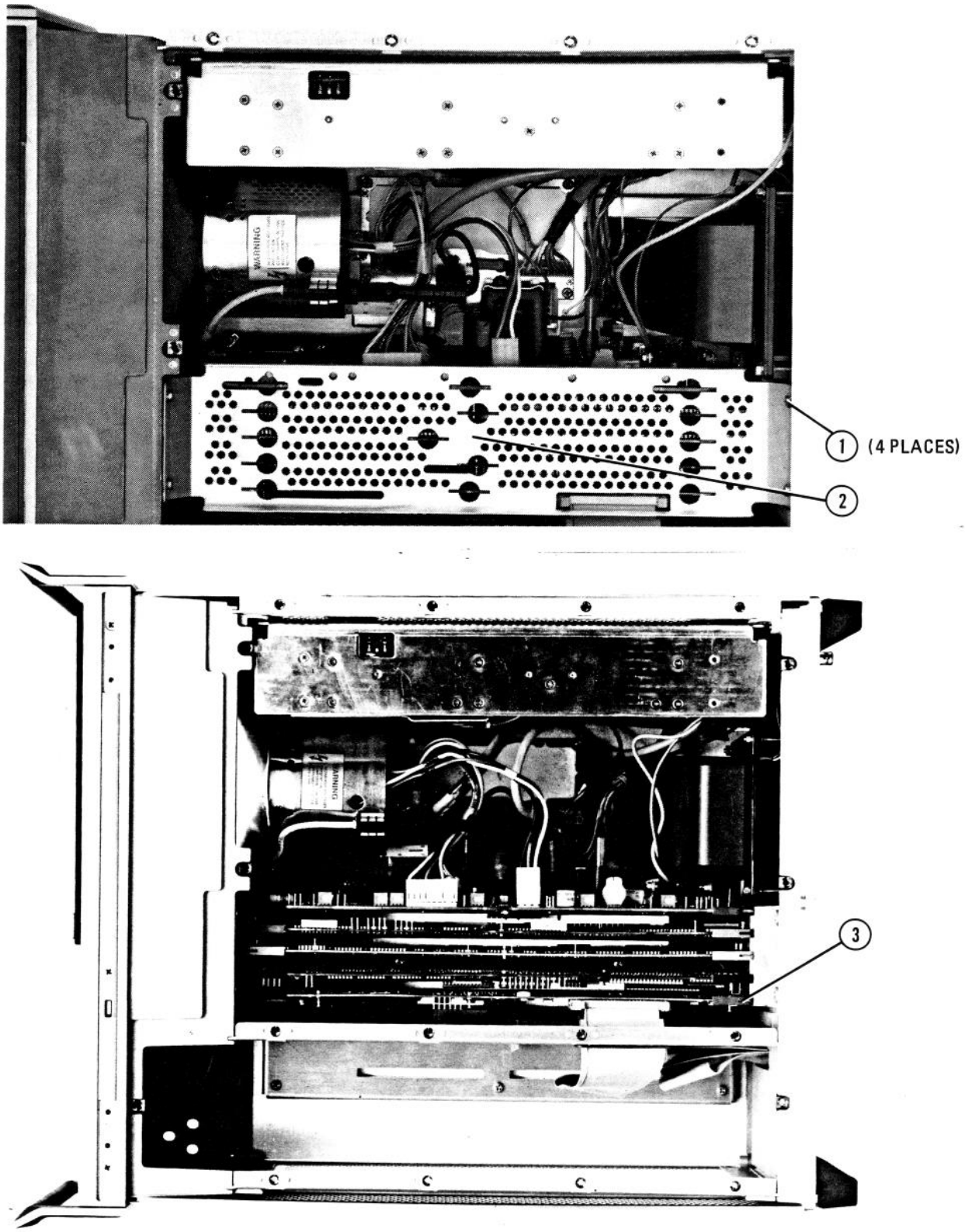


Figure 5-18. A7 HP-MSIB Replacement

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A8 Numeric Keyboard Assembly

REMOVAL

1. Remove the front panel. Refer the front panel replacement procedure.
2. Disconnect the RPG cable (**1**) from the connector on the A8 Numeric Keyboard Assembly (**2**). See Figure 5-19.
3. Remove the 17 screws (**3**) securing the A8 numeric keyboard assembly to the front-panel frame. Remove the keyboard.

REPLACEMENT

4. Replace the A8 Numeric Keyboard Assembly, securing it to the front panel frame with 17 screws (**3**). Tighten the screws to six inch-pounds. See Figure 5-19.
5. Reconnect the RPG cable (**1**) to the connector on the A8 Numeric Keyboard Assembly.
6. Replace the front panel. Refer to the front panel replacement procedure.

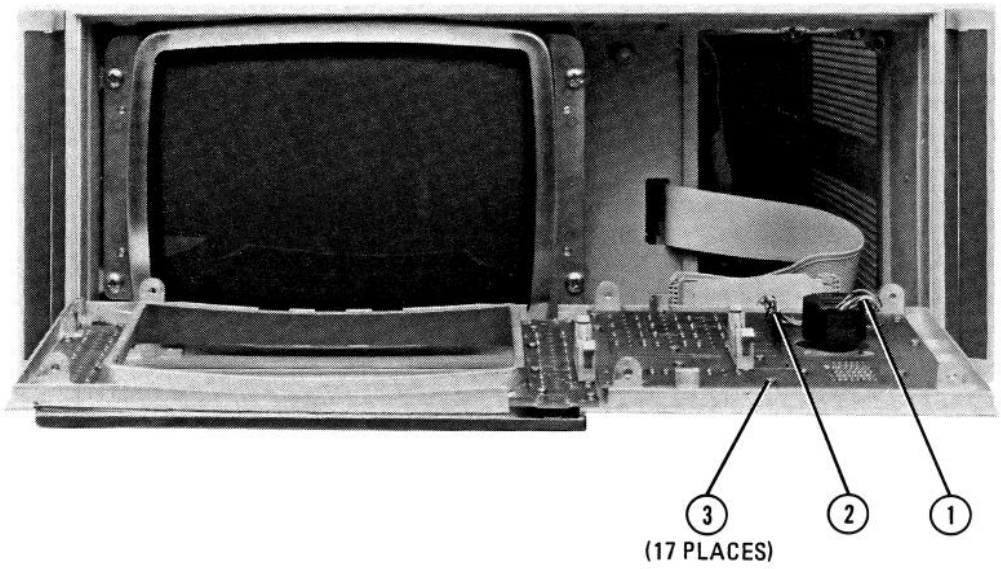


Figure 5-19. A8 Numeric Keyboard Assembly Replacement

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A9 RPG

REMOVAL

1. Remove the front panel. Refer to the front panel replacement procedure.
2. Remove the two set-screws (**1**) that secure the A9 RPG board assembly and knob, and remove both the RPG (**2**) and knob. See Figure 5-20.
3. Remove the nut and star washer (**3**) that hold the RPG to the front panel.
4. Disconnect the RPG cable (**4**) from the A8 Numeric Keyboard (**5**).
5. Remove the A9 RPG board assembly (**6**).

REPLACEMENT

6. Replace the A9 RPG board assembly (**6**). See Figure 5-20.
7. Secure the A9 RPG board assembly to the front panel with the star washer and nut (**3**), and tighten the nut to 20 inch-pounds.
8. Reconnect the RPG cable (**4**) to the connector on the A8 Numeric Keyboard Assembly (**5**).
9. Replace the front panel. Refer to the front panel Assembly replacement procedure.
10. Replace the A9 RPG Assembly (**2**) and knob, and the two set-screws (**1**) that secure it. Tighten the set-screw to three inch-pounds.

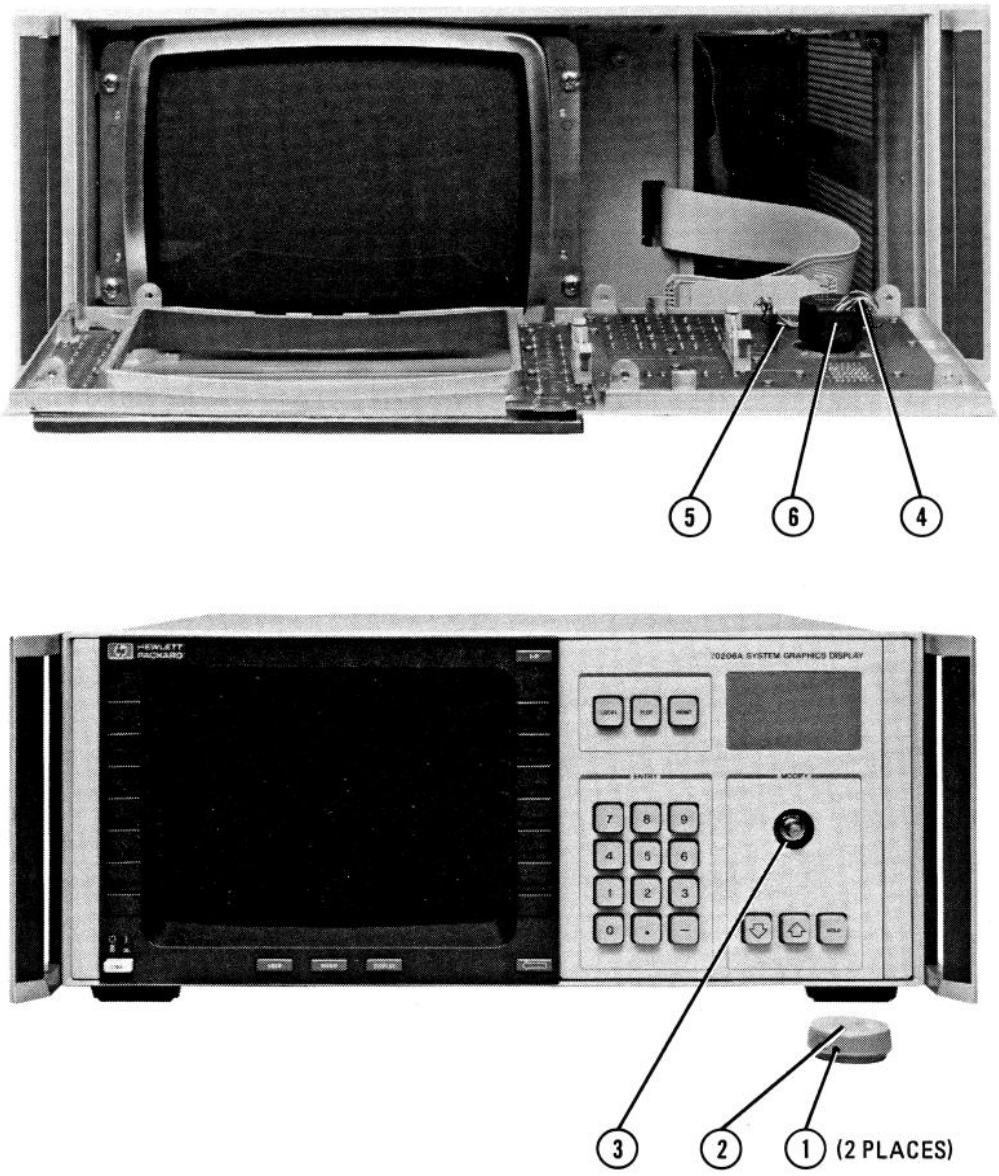


Figure 5-20. A9 RPG Replacement

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A10 Bezel Keyboard Assembly

REMOVAL

1. Remove the front panel. Refer to the front panel Assembly replacement procedure.
2. Remove the 14 softkey pads from the front panel by gently prying them off. See Figure 5-21.
3. Remove the 10 screws and washers (**1**) securing the outer edge of the A10 Bezel Keyboard Assembly to the front-panel frame.
4. Remove the remaining 16 screws (**2**). Remove the A10 Bezel Keyboard Assembly.

REPLACEMENT

5. Replace the A10 Bezel Keyboard Assembly, securing it to the front-panel frame with 16 screws (**2**) and 10 screws with washers (**1**). Tighten all the screws to six inch-pounds. See Figure 5-21.
6. Replace the 14 softkey pads by gently pressing them onto the key switches.
7. Replace the front panel. Refer to the front panel replacement procedure.

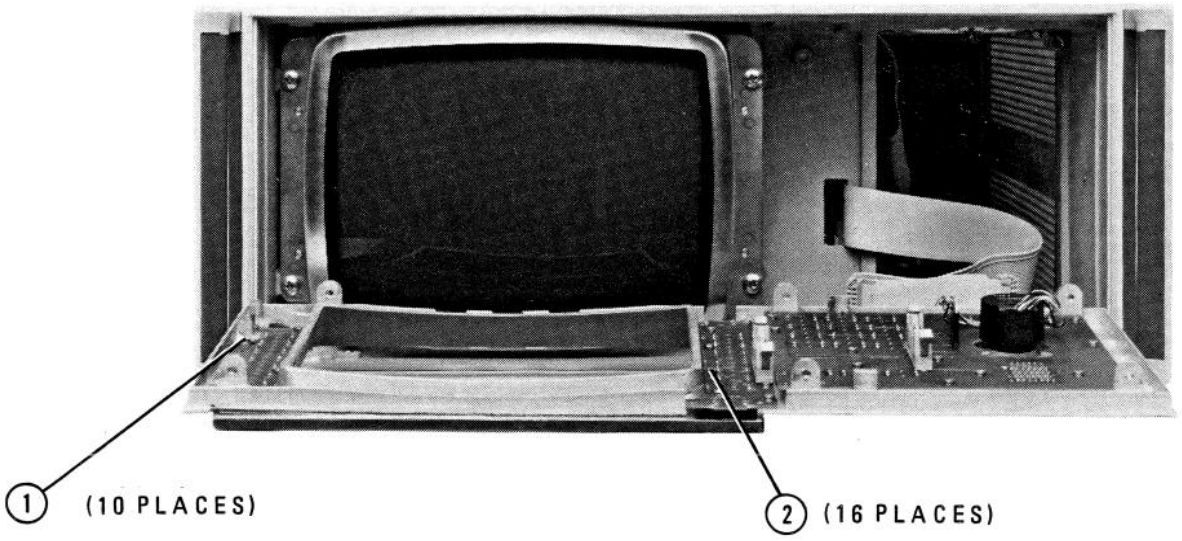


Figure 5-21. A10 Bezel Keyboard Assembly Replacement

A11 Power Supply

CAUTION

Use ESD electrostatic discharge precautions when working on the A11 Power Supply.

REMOVAL

1. Remove the top and inner covers. Refer to the top and inner covers replacement procedure.
2. Turn the instrument over so the bottom faces up.
3. Remove the two bottom-front (**1**) and the two lower-rear feet (**2**). See Figure 5-22.
4. Remove the bottom cover by loosening the screw on the rear edge of the cover. As this screw is backed out, the bottom cover will slide to the rear. Remove the cover by sliding it to the rear of the instrument.
5. Turn the instrument over so the top faces up.
6. Remove the two screws (**3**) securing the right strap handle and remove the handle (**4**).
7. Remove the side cover (**5**) by sliding it to the rear of the instrument.
8. Disconnect the W5 Battery Cable (**6**) from the A12 Motherboard Assembly.
9. Remove the two screws (**7**) securing the battery cover and remove the cover (**8**).
10. Remove the battery (**9**).
11. Remove the two screws securing the battery holder (located under the battery cover) and remove the holder.
12. Remove the four screws (**10**) securing the A11 Power Supply board assembly to the side frame.
13. Disconnect the following A11 Power Supply board assembly cables from the A1 Filter board assembly and the A12 Motherboard:
    - A1J2 (**11**)
    - A1J3 (**12**)
    - A12J1 (**13**)
14. Lift the A11 Power Supply board assembly (**14**) partially out of the instrument.
15. Disconnect the COM1 Ground Cable (**15**) from the line module.

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16. Lift the A11 Power Supply board assembly out of the instrument.

17. Remove the three screws (**16**) securing the A11 Power Supply board assembly shield to the power supply and remove the shield (**17**). Unsolder the A11W1 Power Supply cable from the A11 Power Supply board assembly.

REPLACEMENT

18. Resolder the A11W1 Power Supply cable to the A11 Power Supply board assembly.

19. Replace the A11 Power Supply board assembly shield (**17**) to the side of the power supply and secure it with three screws (**16**) tightened to six inch-pounds. See Figure 5-22.

20. Replace the A11 Power Supply board assembly (**14**), leaving it partially out of the instrument.

21. Reconnect the COM1 Ground Cable (**15**) to the line module and tighten the cable to six inch-pounds.

22. Carefully push the A11 Power Supply board assembly into the instrument.

23. Reconnect the following power supply cables to the A1 Filter board assembly and the A12 Motherboard assembly:

    - A1J2 (**11**)
    - A1J3 (**12**)
    - A12J1 (**13**)

24. Replace the four screws (**10**) securing the A11 Power Supply board assembly to the side frame and tighten the screws to 12 inch-pounds.

25. Replace the battery holder and the two screws securing the holder, and tighten the screws to six inch-pounds.

26. Replace the battery (**9**), (+) end in.

27. Replace the battery cover (**8**) and the two screws (**7**) that secure it, and tighten the screws to six inch-pounds.

28. Reconnect the W5 Battery Cable (**6**) to the A12 Motherboard assembly.

29. Replace the side cover (**5**).

30. Replace the strap handle (**4**) and the two screws (**3**) securing the strap handle to the side cover and tighten the screws to 20 inch-pounds.

31. Replace the top and inner covers. Refer to the top and inner covers replacement procedure.

32. Turn the instrument over so the bottom faces up.

33. Place the bottom cover on the instrument with the cover screw at the back. Leave a cover overhang of 2.0 cm (1/2 inch) at the rear of the instrument.

34. Push the cover towards the front of the instrument.

35. When the screw makes contact with the frame, tighten the screw.

36. Replace the two bottom-front feet (**1**).

37. Replace all four rear feet.

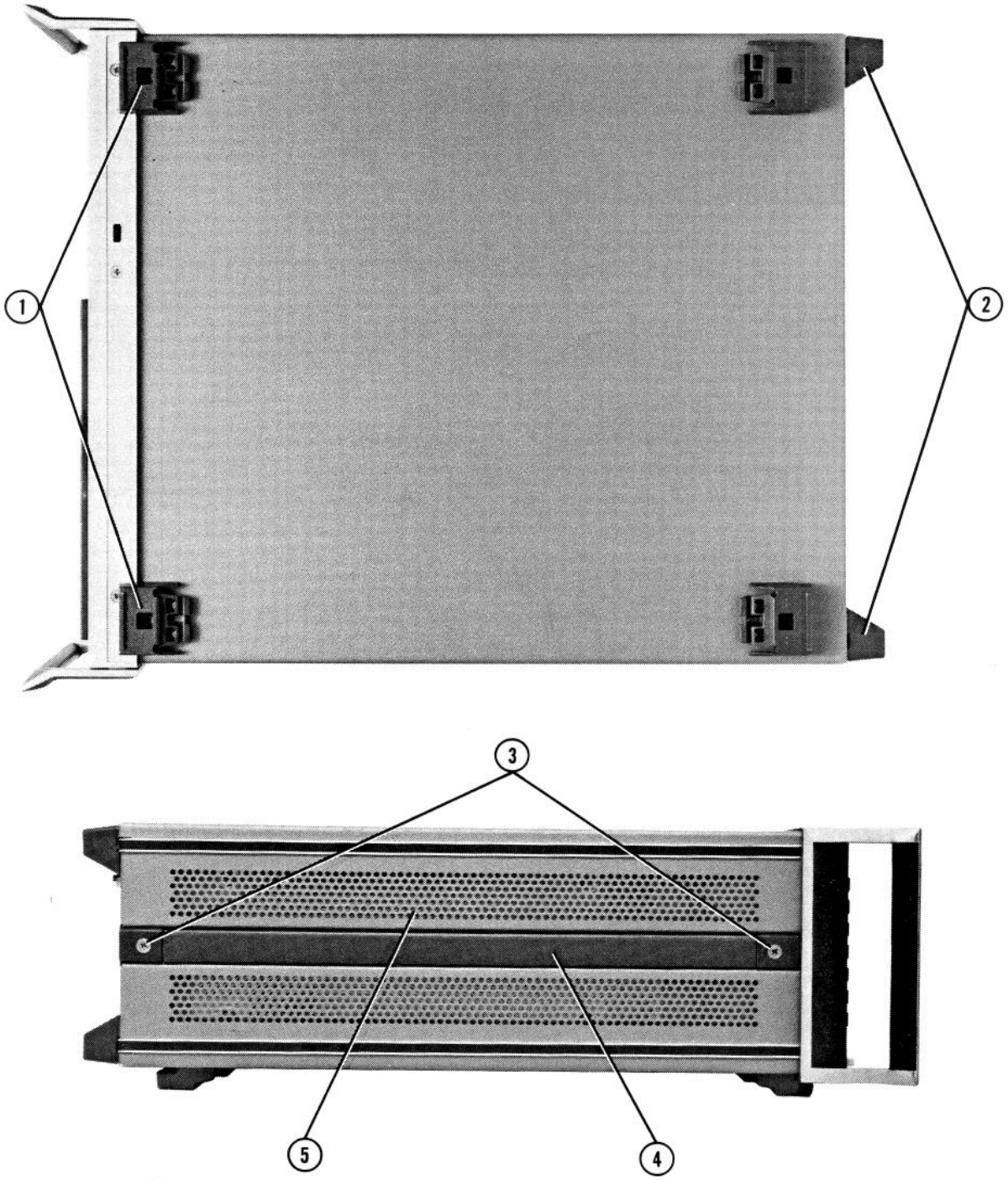
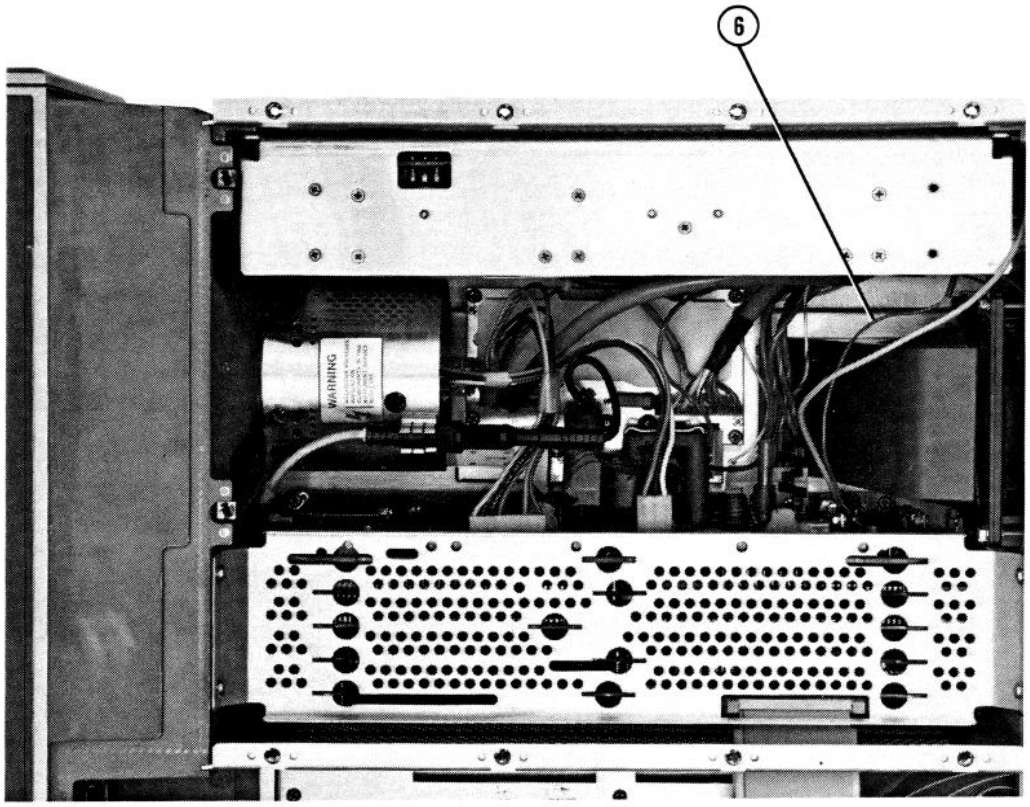


Figure 5-22. A11 Power Supply Replacement (1 of 4)

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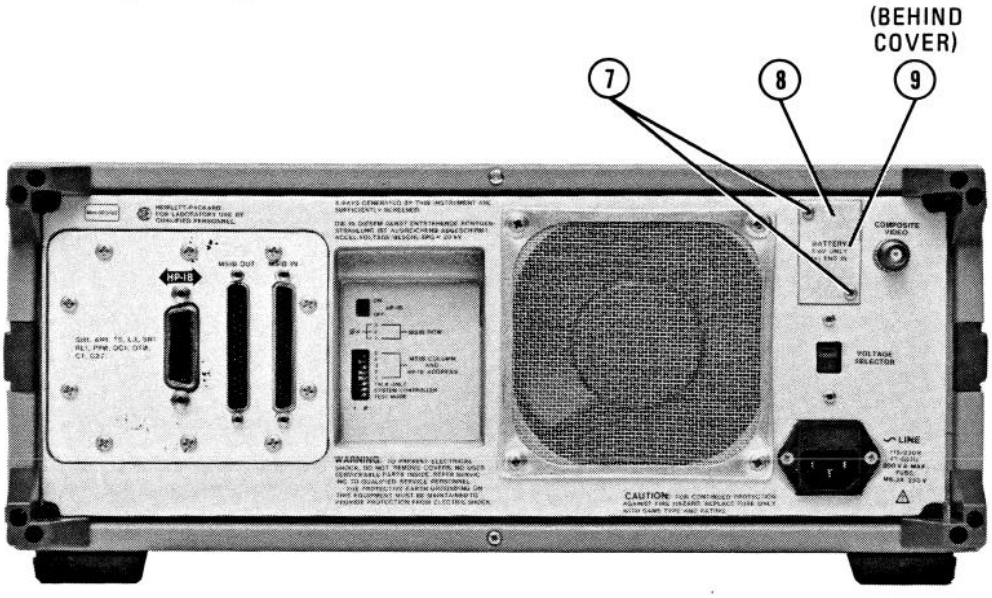


Figure 5-22. A11 Power Supply Replacement (2 of 4)

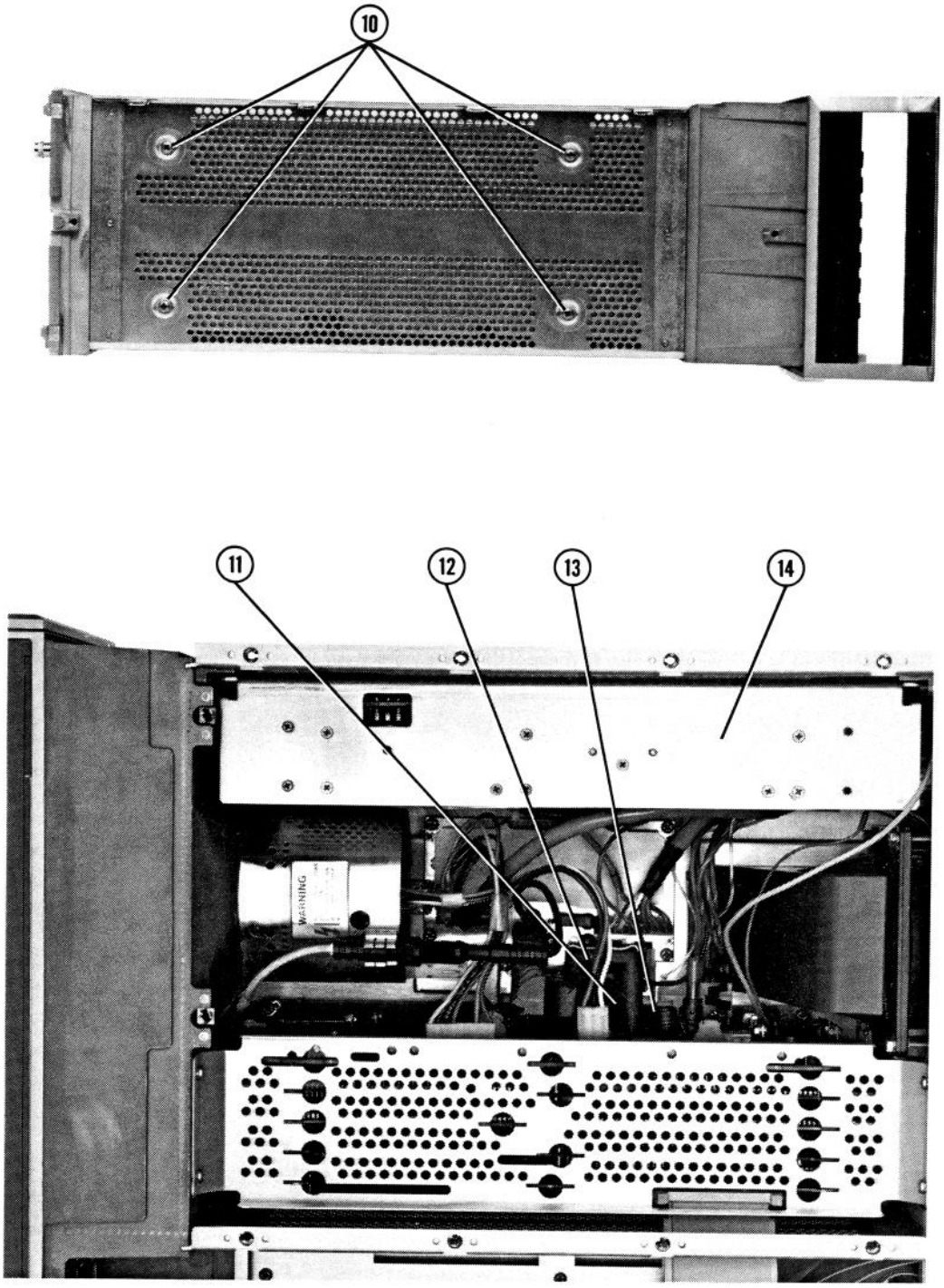


Figure 5-22. A11 Power Supply Replacement (3 of 4)

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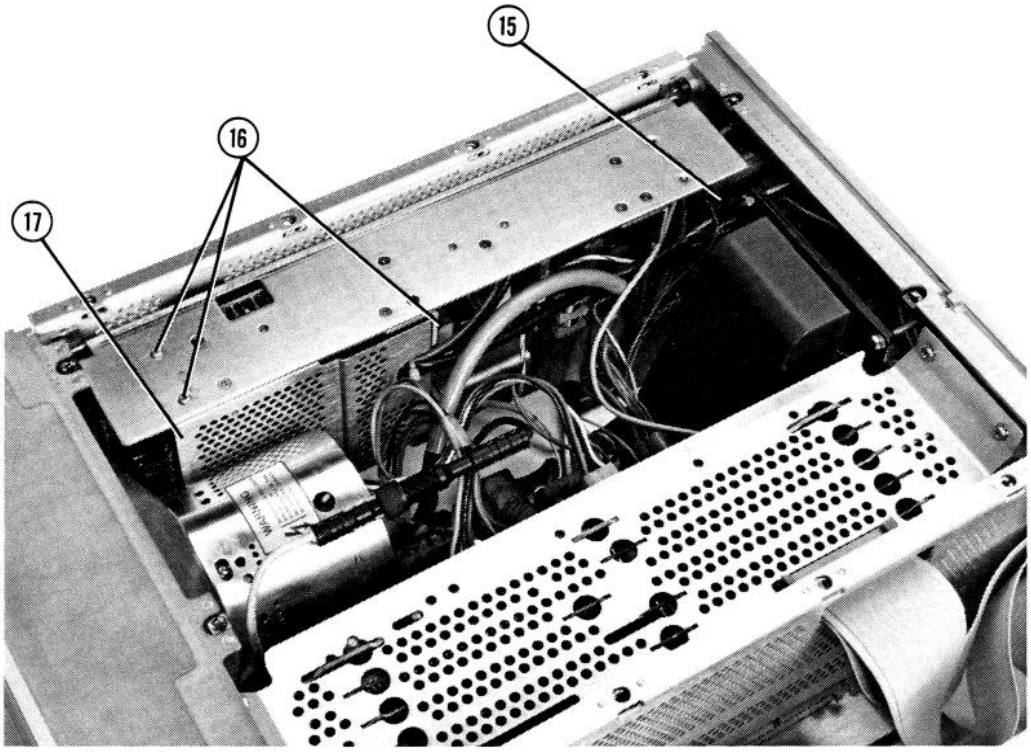


Figure 5-22. A11 Power Supply Replacement (4 of 4)

BT1 Battery

WARNING

The BT1 Battery must not be recharged, forced open, or disposed of in fire. If abused, this battery represents a fire, explosion, and/or severe burn hazard. Dispose of the battery in accordance with local hazardous material disposal regulations.

REMOVAL

1. Remove the two screws (**1**) securing the battery cover and remove the cover (**2**). See Figure 5-23.
2. Remove the battery.

REPLACEMENT

3. Replace the battery, (+) end in.
4. Replace the battery cover (**2**). See Figure 5-23.
5. Replace the two battery cover screws (**1**) and tighten them to six inch-pounds.

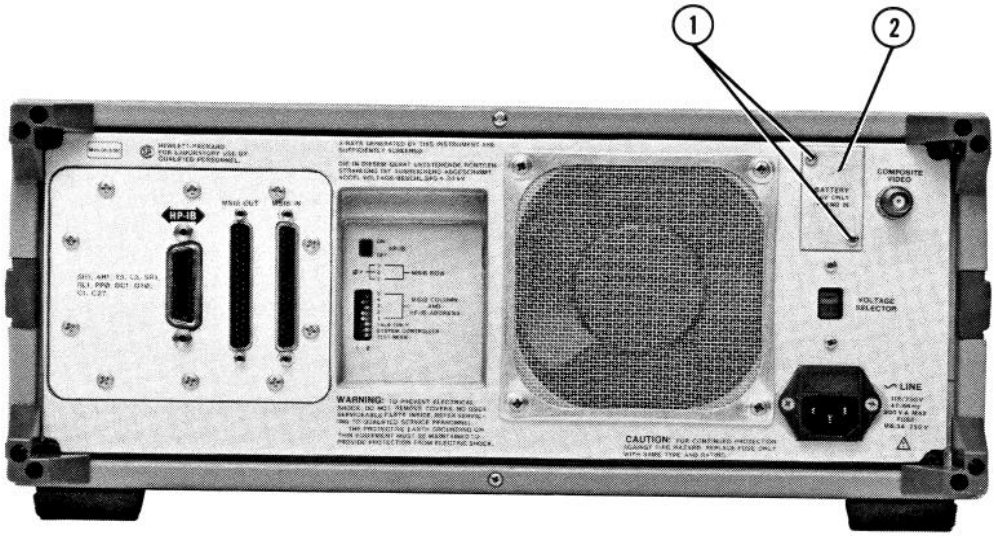


Figure 5-23. BT1 Battery Replacement

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V1 CRT Assembly

REMOVAL

1. Remove the top and the inner covers. Refer to the top and inner covers replacement procedure.

WARNING

Serious personal injury may occur if electrostatic discharge (ESD) precautions are used while discharging the CRT Anode cable.

2. Remove the front panel. Refer to the front panel Assembly replacement procedure.
3. Disconnect the following cables from the V1 CRT Assembly (See Figure 5-24):
   - W1 CRT (**1**)
   - W17 Yoke (**2**)
   - W16 Anode (**3**) (ground the CRT side)
4. Remove the four screws (**4**) securing the CRT to the front frame.
5. Slide the CRT assembly (**5**) out of the instrument.
6. Remove the four CRT shield screws (**6**) from each side of the CRT assembly.
7. Remove the CRT shield (**7**).
8. Remove the four CRT screws (**8**) and separate the CRT frame (**9**) from the CRT retainer (**10**).
9. Remove the RFI gasket (**11**) and save the RFI gasket for reinstallation.

REPLACEMENT

NOTE

HP 70206A System Graphics Displays with serial numbers 2529A00432 and below use CRTs with a bonded faceplate. Displays with serial numbers 2529A00433 and above use CRTs with a separate faceplate. When a display with a bonded faceplate requires a CRT replacement, four parts must be installed.

CRT/Yoke Assembly
CRT Faceplate
Gasket (2 each)

Refer to Service Note 70206A-5 for more information about installing the CRTs with unbonded faceplates.

10. Clean the inside edge of the CRT retainer (**10**). See Figure 5-24.

NOTE

The RFI gasket needs to be stretched slightly for it to fit inside the CRT retainer ring. The gasket must not be visible when viewed from the front of the display.

11. Deposit a dot of Super Glue #496 on each corner and two dots of glue on each side.
12. Clean both sides of the faceplate with thin film cleaner and a lint-free cloth.
13. Place the faceplate over the RFI gasket.
14. Place the anti-bonding gaskets over the faceplate (one on the left side, the other on the right).
15. Clean the CRT glass with thin film cleaner and a lint-free cloth.
16. Place the cleaned CRT on top of the anti-bonding gaskets.
17. Insert the CRT rear frame (**9**) into the CRT retainer (**10**).

CAUTION

Watch orientation of the springs on the rear frame. Springs crossing the CRT should be touching the copper tape. Check the rubber pads for binding when tightening the screws. Make sure the yoke cable is not caught between the rear frame and front frame.

18. Replace the four CRT screws (**8**). Torque each screw a little at a time, until they seat properly. Torque is 20 inch-pounds.
19. Replace the CRT shield (**7**) and the four CRT shield screws (**6**). Tighten the CRT shield screws to six inch-pounds.
20. Slide the CRT assembly (**5**) into the instrument.
21. Replace the four screws (**4**) to secure the V1 CRT Assembly to the front frame. Tighten the four screws to six inch-pounds.

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WARNING

Serious personal injury may occur if electrostatic discharge (ESD) precautions are used while discharging the CRT Anode cable.

22. Reconnect the following CRT cables:

- W1 CRT (**1**)
- W17 Yoke (**2**)
- W16 Anode (**3**)

23. Replace the front panel. Refer to the front panel replacement procedure.

24. Replace the top and the inner covers. Refer to the top and inner covers replacement procedure.

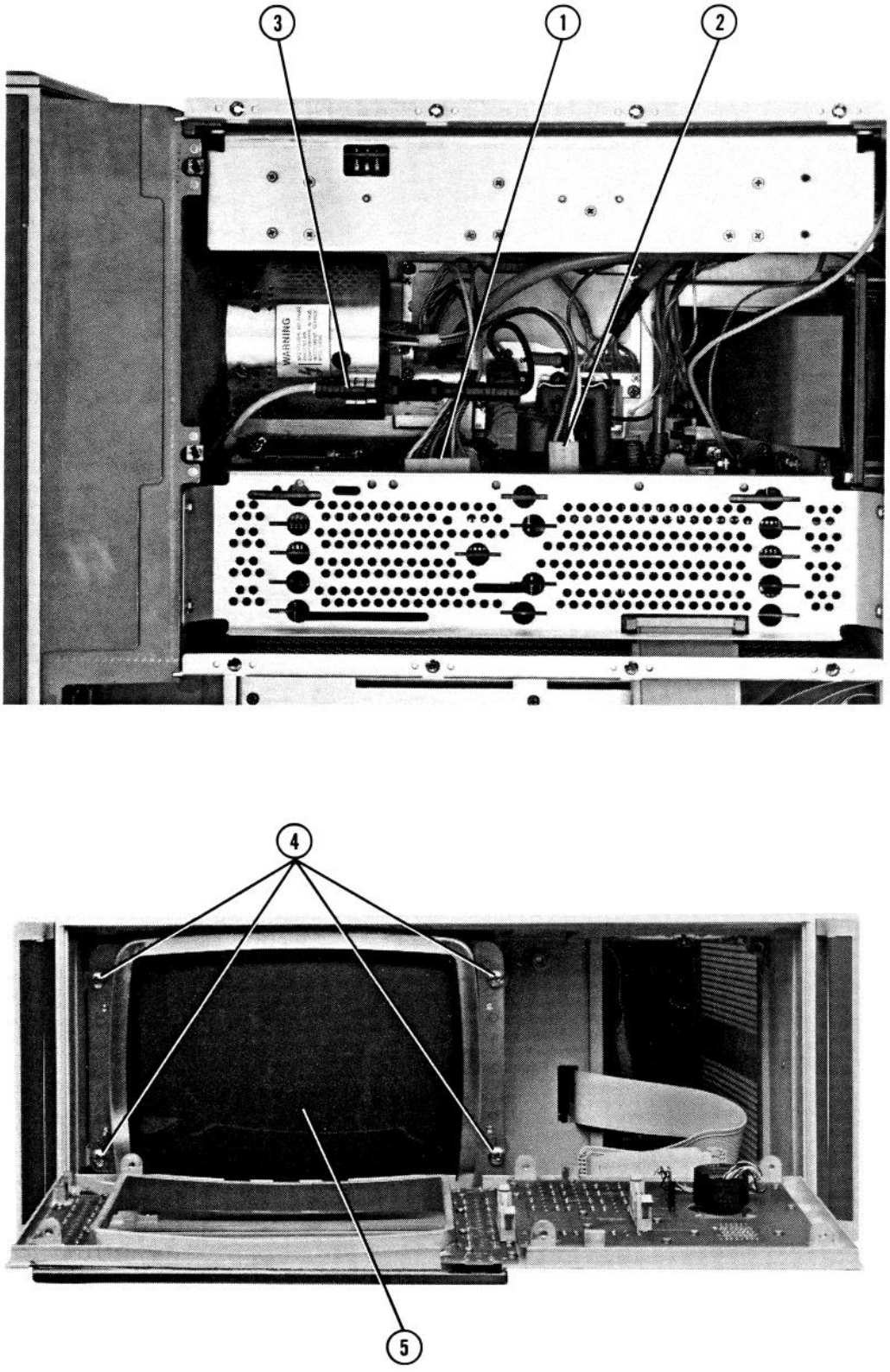


Figure 5-24. V1 CRT Assembly Replacement (1 of 2)

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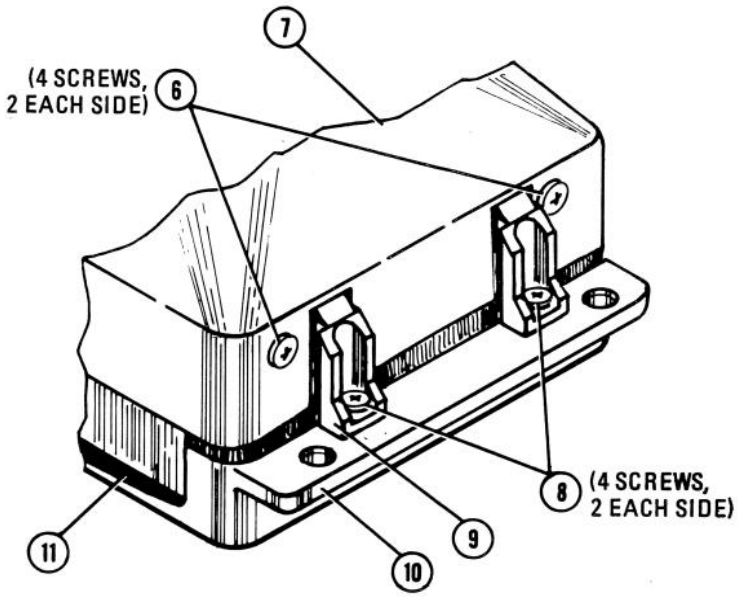


Figure 5-24. V1 CRT Assembly Replacement (2 of 2)

Chapter 6

REPLACEABLE PARTS

Introduction

This chapter contains the information necessary to order all hardware replacement parts. This chapter contains the following information:

Ordering Information 6-2
Direct Mail Order System 6-2
HP 70205A Graphics Display Replaceable Parts 6-7
HP 70206A Overall Instrument Parts Identification 6-15

Table 6-1 lists reference designations, abbreviations, and value multipliers used in the parts lists.

Table 6-2 lists the names and addresses that correspond to the manufacturer code numbers in the parts list.

Table 6-3 lists all major assemblies for the HP 70205A Graphics Display.

Table 6-4 lists all major assemblies for the HP 70206A System Graphics Display.

Figures 6-1 to 6-9 illustrate the locations of module assemblies and hardware, with part numbers.

NOTE

The component-level parts for all versions of board assemblies are listed in the HP 70205A and HP 70206A Component Level Information manual.

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Ordering Information

To order a part from the replaceable parts list, quote the Hewlett-Packard part number, include the check digit, and indicate the quantity required. Address and mail the order to the nearest Hewlett-Packard office. Including the check digit will ensure accurate and timely processing of your order.

To order a part that is not listed in the replaceable parts list, include the module model number, the function and description of the part, and the number of parts required. Address and mail the order to the nearest Hewlett-Packard office.

Direct Mail Order System

Within the USA, Hewlett-Packard can supply parts through a direct mail order system. Advantages of using the system are as follows:

- Direct ordering and shipment from the HP Parts Center in Mountain View, California.
- No maximum or minimum on any mail order (there is a minimum order amount for parts ordered through a local HP office when the orders require billing and invoicing).
- Prepaid transportation (there is a small handling charge for each order).
- No invoices

To take advantage of direct mail ordering, a check or money order must accompany each order. Mail order forms and specific ordering information are available through your local HP office.

Table 6-1. Reference Designations and Abbreviations (1 of 3)

REFERENCE DESIGNATIONS

A ..... Assembly
AT ..... Attenuator, Isolator, Limiter, Termination
B ..... Fan, Motor
BT ..... Battery
C ..... Capacitor
CP ..... Coupler
CR ..... Diode, Diode Thyristor, Step Recovery Diode, Varactor
DC ..... Directional Coupler
DL ..... Delay Line
DS ..... Annunciator, Lamp, Light Emitting Diode (LED), Signaling Device (Visible)
E ..... Miscellaneous Electrical Part
F ..... Fuse
FL ..... Filter
HY ..... Circulator
J ..... Electrical Connector (Stationary Portion), Jack
K ..... Relay
L ..... Coil, Inductor
M ..... Meter
MP ..... Miscellaneous Mechanical Part
P ..... Electrical Connector (Movable Portion), Plug
Q ..... Silicon Controlled Rectifier (SCR), Transistor, Triode Thyristor
R ..... Resistor
RT ..... Thermistor
S ..... Switch
T ..... Transformer
TB ..... Terminal Board
TC ..... Thermocouple
TP ..... Test Point
U ..... Integrated Circuit, Microcircuit
V ..... Electron Tube
VR ..... Breakdown Diode (Zener), Voltage Regulator
W ..... Cable, Wire, Jumper
X ..... Socket
Y ..... Crystal Unit (Piezoelectric, Quartz)
Z ..... Tuned Cavity, Tuned Circuit

ABBREVIATIONS

A

A ..... Across Flats, Acrylic, Air (Dry Method), Ampere
ADJ ..... Adjust, Adjustment
ANSI ..... American National Standards Institute (formerly USASI-ASA)
ASSY ..... Assembly
AWG ..... American Wire Gage

B

BCD ..... Binary Coded Decimal
BD ..... Board, Bundle
BE-CU ..... Beryllium Copper
BNC ..... Type of Connector
BRG ..... Bearing, Boring
BRS ..... Brass
BSC ..... Basic
BTN ..... Button

C

C ..... Capacitance, Capacitor, Center Tapped, Cermet, Cold, Compression
CCP ..... Carbon Composition Plastic
CD ..... Cadmium, Card, Cord
CER ..... Ceramic
CHAM ..... Chamfer
CHAR ..... Character, Characteristic, Charcoal
CMOS ..... Complementary Metal Oxide Semiconductor
CNDCT ..... Conducting, Conductive, Conductivity, Conductor
CONT ..... Contact, Continuous, Control, Controller
CONV ..... Converter
CPRSN ..... Compression
CUP-PT ..... Cup Point
CW ..... Clockwise, Continuous Wave

D

D ..... Deep, Depletion, Depth, Diameter, Direct Current
DA ..... Darlington
DAP-GL ..... Diallyl Phthalate Glass
DBL ..... Double
DCDR ..... Decoder
DEG ..... Degree
D-HOLE ..... D-Shaped Hole
DIA ..... Diameter
DIP ..... Dual In-Line Package
DIP-SLDR ..... Dip Solder
D-MODE ..... Depletion Mode
DO ..... Package Type Designation
DP ..... Deep, Depth, Diametric Pitch, Dip
DP3T ..... Double Pole Three Throw
DPDT ..... Double Pole Double Throw
DWL ..... Dowel

E

E-R ..... E-Ring
EXT ..... Extended, Extension, External, Extinguish

F

F ..... Fahrenheit, Farad, Female, Film (Resistor), Fixed, Flange, Frequency
FC ..... Carbon Film/Composition, Edge of Cutoff Frequency, Face
FDTHRU ..... Feed Through
FEM ..... Female
FIL-HD ..... Fillister Head
FL ..... Flash, Flat, Fluid
FLAT-PT ..... Flat Point
FR ..... Front
FREQ ..... Frequency
FT ..... Current Gain Bandwidth Product (Transition Frequency), Feet, Foot
FXD ..... Fixed

G

GEN ..... General, Generator
GND ..... Ground
GP ..... General Purpose, Group

H

H ..... Henry, High
HDW ..... Hardware
HEX ..... Hexadecimal, Hexagon, Hexagonal
HLCL ..... Helical
HP ..... Hewlett-Packard Company, High Pass

I

IC ..... Collector Current, Integrated Circuit
ID ..... Identification, Inside Diameter
IF ..... Forward Current, Intermediate Frequency
IN ..... Inch
INCL ..... Including
INT ..... Integral, Intensity, Internal

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Table 6-1. Reference Designations and Abbreviations (2 of 3)

J

J-FET ..... Junction Field Effect Transistor
JFET ..... Junction Field Effect Transistor

K

K ..... Kelvin, Key, Kilo, Potassium
KNRLD ..... Knurled
KVDC ..... Kilovolts Direct Current

L

LED ..... Light Emitting Diode
LG ..... Length, Long
LIN ..... Linear, Linearity
LK ..... Link, Lock
LKG ..... Leakage, Locking
LUM ..... Luminous

M

M ..... Male, Maximum, Mega, Mil, Milli, Mode
MA ..... Milliampere
MACH ..... Machined
MAX ..... Maximum
MC ..... Molded Carbon Composition
MET ..... Metal, Metallized
MHZ ..... Megahertz
MINTR ..... Miniature
MIT ..... Miter
MLD ..... Mold, Molded
MM ..... Magnetized Material, Millimeter
MOM ..... Momentary
MTG ..... Mounting
MTLC ..... Metallic
MW ..... Milliwatt

N

N ..... Nano, None
N-CHAN ..... N-Channel
NH ..... Nanohenry
NM ..... Nanometer, Nonmetallic
NO ..... Normally Open, Number
NOM ..... Nominal
NPN ..... Negative Positive Negative (Transistor)
NS ..... Nanosecond, Non-Shorting, Nose
NUM ..... Numeric
NYL ..... Nylon (Polyamide)

O

OA ..... Over-All
OD ..... Outside Diameter
OP AMP ..... Operational Amplifier
OPT ..... Optical, Option, Optional

P

PA ..... Picoampere, Power Amplifier
PAN-HD ..... Pan Head
PAR ..... Parallel, Parity
PB ..... Lead (Metal), Pushbutton
PC ..... Printed Circuit
PCB ..... Printed Circuit Board
P-CHAN ..... P-Channel
PD ..... Pad, Power Dissipation
PF ..... Picofarad, Power Factor
PKG ..... Package
PLSTC ..... Plastic
PNL ..... Panel
PNP ..... Positive Negative Positive (Transistor)
POLYC ..... Polycarbonate
POLYE ..... Polyester
POT ..... Potentiometer
POZI ..... Pozidriv Recess
PREC ..... Precision
PRP ..... Purple, Purpose
PSTN ..... Piston
PT ..... Part, Point, Pulse Time
PW ..... Pulse Width

Q

Q ..... Figure of Merit

R

R ..... Range, Red, Resistance, Resistor, Right, Ring
REF ..... Reference
RES ..... Resistance, Resistor
RF ..... Radio Frequency
RGD ..... Rigid
RND ..... Round
RR ..... Rear
RVT ..... Rivet, Riveted

S

SAWR ..... Surface Acoustic Wave Resonator
SEG ..... Segment
SGL ..... Single
SI ..... Silicon, Square Inch
SL ..... Slide, Slow
SLT ..... Slot, Slotted
SMA ..... Subminiature, A Type (Threaded Connector)
SMB ..... Subminiature, B Type (Slip-On Connector
SMC ..... Subminiature, C Type (Threaded Connector)
SPCG ..... Spacing
SPDT ..... Single Pole Double Throw
SPST ..... Single Pole Single Throw
SQ ..... Square
SST ..... Stainless Steel
STL ..... Steel
SUBMIN ..... Subminiature
SZ ..... Size

T

T ..... Teeth, Temperature, Thickness, Time, Timed, Tooth, Typical
TA ..... Ambient Temperature, Tantalum
TC ..... Temperature Coefficient
THD ..... Thread, Threaded
THK ..... Thick
TO ..... Package Type Designation
TPG ..... Tapping
TR-HD ..... Truss Head
TRMR ..... Trimmer
TRN ..... Turn, Turns
TRSN ..... Torsion

U

UCD ..... Microcandela
UF ..... Microfarad
UH ..... Microhenry
UL ..... Microliter, Underwriters' Laboratories, Inc.
UNHDND ..... Unhardened

V

V ..... Variable, Violet, Volt, Voltage
VAC ..... Vacuum, Volts, Alternating Current
VAR ..... Variable
VDC ..... Volts, Direct Current

W

W ..... Watt, Wattage, White, Wide, Width
W/SW ..... With Switch
WW ..... Wire Wound

X

X ..... By (Used With Dimensions), Reactance

Y

YIG ..... Yttrium-Iron-Garnet

Z

ZNR ..... Zener

Table 6-1. Reference Designations and Abbreviations (3 of 3)

MULTIPLIERS					
Abbreviation	**Prefix**	**Multiple**	**Abbreviation**	**Prefix**	**Multiple**
T	tera	10^{12}	m	milli	10^{-3}
G	giga	10^{9}	μ	micro	10^{-6}
M	mega	10^{6}	n	nano	10^{-9}
k	kilo	10^{3}	p	pico	10^{-12}
da	deka	10	f	femto	10^{-15}
d	deci	10^{-1}	a	atto	10^{-18}
c	centi	10^{-2}			

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Table 6-2. Manufacturer's Code List

Mfr Code	Manufacturer Name	Address	ZIP Code
00000	ANY SATISFACTORY SUPPLIER		
00779	AMP INC	HARRISBURG, PA	17111
01121	ALLEN-BRADLEY CO	MILWAUKEE, WI	53204
01295	TEXAS INSTR SEMICOND CMPNT DIV	DALLAS, TX	75222
02768	ITW FASTEX	DES PLAINES, ILL	60016
03888	KDI PYROFILM CORP	WHIPPANY, NJ	07981
04713	MOTOROLA SEMICONDUCTOR PRODUCTS	PHOENIX, AZ	85008
06132	COMPUTER TERMINAL CORP	SAN ANTONIO, TX	78784
07263	FAIRCHILD CORP	MOUNTAIN VIEW, CA	94042
08806	GE CO MINIATURE LAMP PROD DEPT	CLEVELAND, OH	44112
1B546	VARO SEMICONDUCTOR INC	GARLAND, TX	75046
10411	TI-TAL INC	SANTA MONICA, CA	90405
11236	CTS CORP BERNE DIV	BERNE, IN	46711
14936	GENERAL INSTRUMENT CORP (DIODE)	HICKSVILLE, NY	11802
18873	DUPONT E I DE NEMOURS & CO	WILMINGTON, DE	19801
19701	MEPCO/ELECTRA CORP	MINERAL WELLS, TX	76067
24546	CORNING GLASS WORKS (BRADFORD)	BRADFORD, PA	16701
27014	NATIONAL SEMICONDUCTOR CORP	SANTA CLARA, CA	95051
28480	HEWLETT-PACKARD CO CORPORATE-HQ	PALO ALTO, CA	94304
3L585	RCA CORP SOLID STATE DIV	SOMERVILLE, NJ	
32997	BOURNS INC TRIMPOT PROD DIV	RIVERSIDE, CA	92507
34335	ADVANCED MICRO DEVICES INC	SUNNYVALE, CA	94086
34344	MOTOROLA INC	FRANKLIN PARK, ILL	60131
34649	INTEL CORP	SANTA CLARA, CA	95054
83360	MARKEM CORP	KEENE, NH	03431
52063	EXAR INTERGRATED SYSTEMS INC	SUNNYVALE, CA	94086
56289	SPRAGUE ELECTRIC CO	NORTH ADAMS, MA	01247
75042	TRW INC PHILADELPHIA DIV	PILADELPHIA, PA	19108
75915	LITTLEFUSE INC	DES PLAINES, IL	60016
9N171	UNITRODE CORP	LEXINGTON, MA	02173
91506	AUGAT INC	MANSFIELD, MA	02048
91637	DALE ELECTRONICS INC	EL PASO, TX	79936

HP 70205A Graphics Display

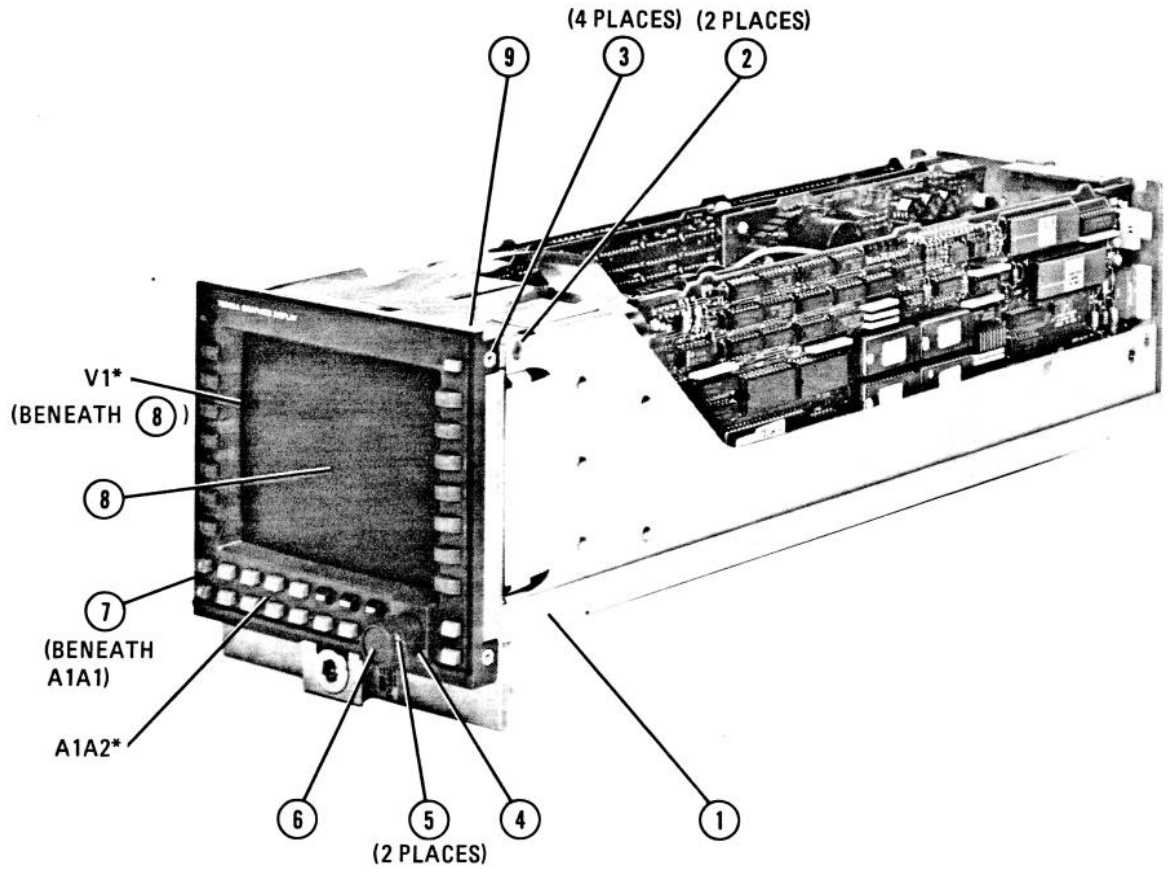
REPLACEABLE PARTS

This section contains the following information:

Figure 6-1. Overall Module Parts Identification, Front View 6-8
Figure 6-2. Overall Module Parts Identification, Rear View 6-9
Figure 6-3. Overall Module Parts Identification, Top View 6-10
Figure 6-4. Overall Module Parts Identification, Bottom View 6-11
Figure 6-5. Overall Module Parts Identification, V1 CRT Assembly 6-12
Table 6-3. HP 70205A Major Assemblies 6-14

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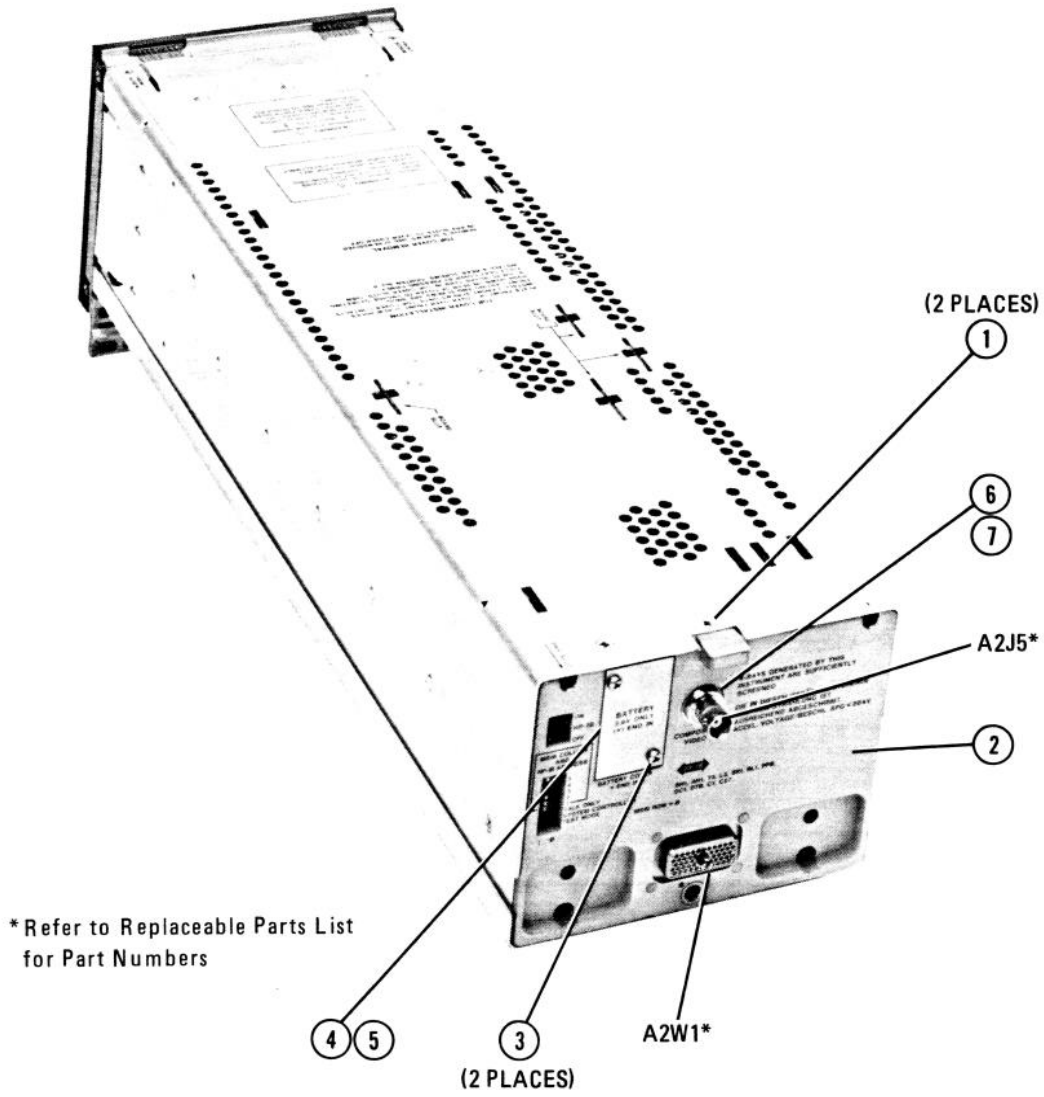
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*Refer to Replaceable Parts List for Part Numbers

Item	HP Part Number	CD	Description	Mfr Code	Mfr Part Number
1	70205-00001	1	Cover, Bottom	28480	70205-00001
2	0515-1063	0	Screw-Mach M3X0.5 6MM LG	28480	0515-1063
3	0515-0890	9	Screw-Mach M3X0.5 6MM 90 deg	28480	0515-0890
4	70205-40006	0	Knob, RPG order -40054	28480	70205-40006
5	3030-0007	5	Screw, Set 4-40 .125 In	28480	3030-0007
6	70205-80016	6	Decal, RPG Knob	28480	70205-80016
7	1460-1917	7	Spring, CPRSN 0.088 In-Dia	28480	1460-1917
8	70205-00011	3	Plate, CRT Plastic	28480	70205-00011
9	0515-0570	2	Screw, Mach M3X0.5 8MM LG 90 deg	28480	0515-0570

Figure 6-1. Overall Module Parts Identification, Front View

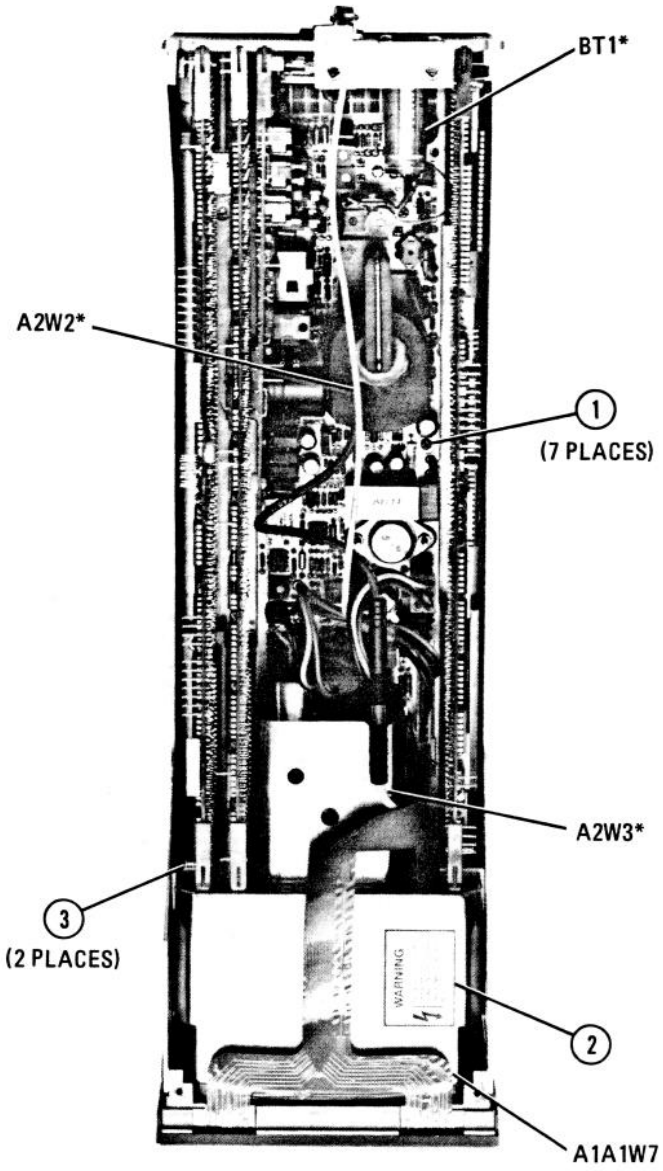


Item	HP Part Number	CD	Description	Mfr Code	Mfr Part Number
1	0515-0890	9	Screw, Mach 3MX0.5 6MM LG 90 deg	28480	0515-0890
2	70205-20017	1	Casting, Rear	28480	70205-20017
3	0515-0897	6	Screw, Mach 3MX0.5 8MM LG-Pan Hd	28480	0515-0897
4	70205-00006	6	Cover, Battery	28480	70205-00006
5	1420-0315	3	Battery, 3.60V 1.7 AH	28480	1420-0315
6	0590-1251	6	Nut, SPCLY 15/32 32 THD 0.1 IN THK	28480	0590-1251
7	2190-0102	8	Washer, I.K INTL T 15/32 IN	28480	2190-0102

Figure 6-2. Overall Module Parts Identification, Rear View

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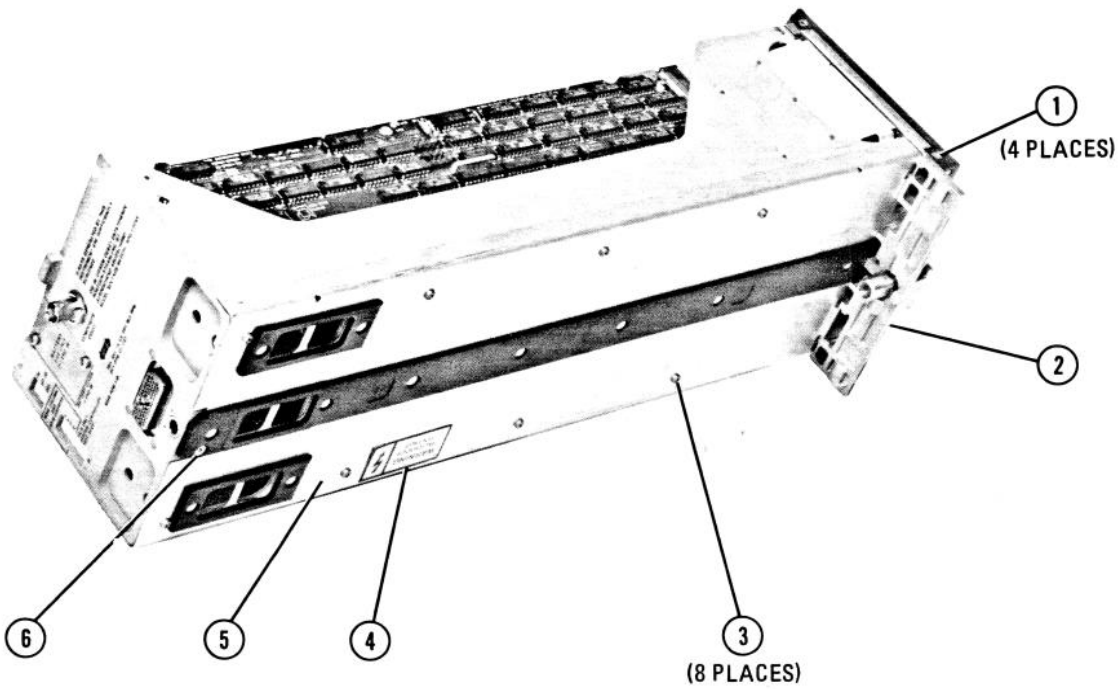
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*Refer to Replaceable Parts List for Part Numbers

Item	HP Part Number	CD	Description	Mfr Code	Mfr Part Number
1	0515-0886	3	Screw, Mach M3X0.5 6MM LG Pan Hd	28480	0515-0886
2	70205-80029	1	Label, Warning	28480	70205-80029
3	0515-1041	4	Screw, SKT HD CAP M5X0.8 6MM	28480	0515-1041

Figure 6-3. Overall Module Parts Identification, Top View



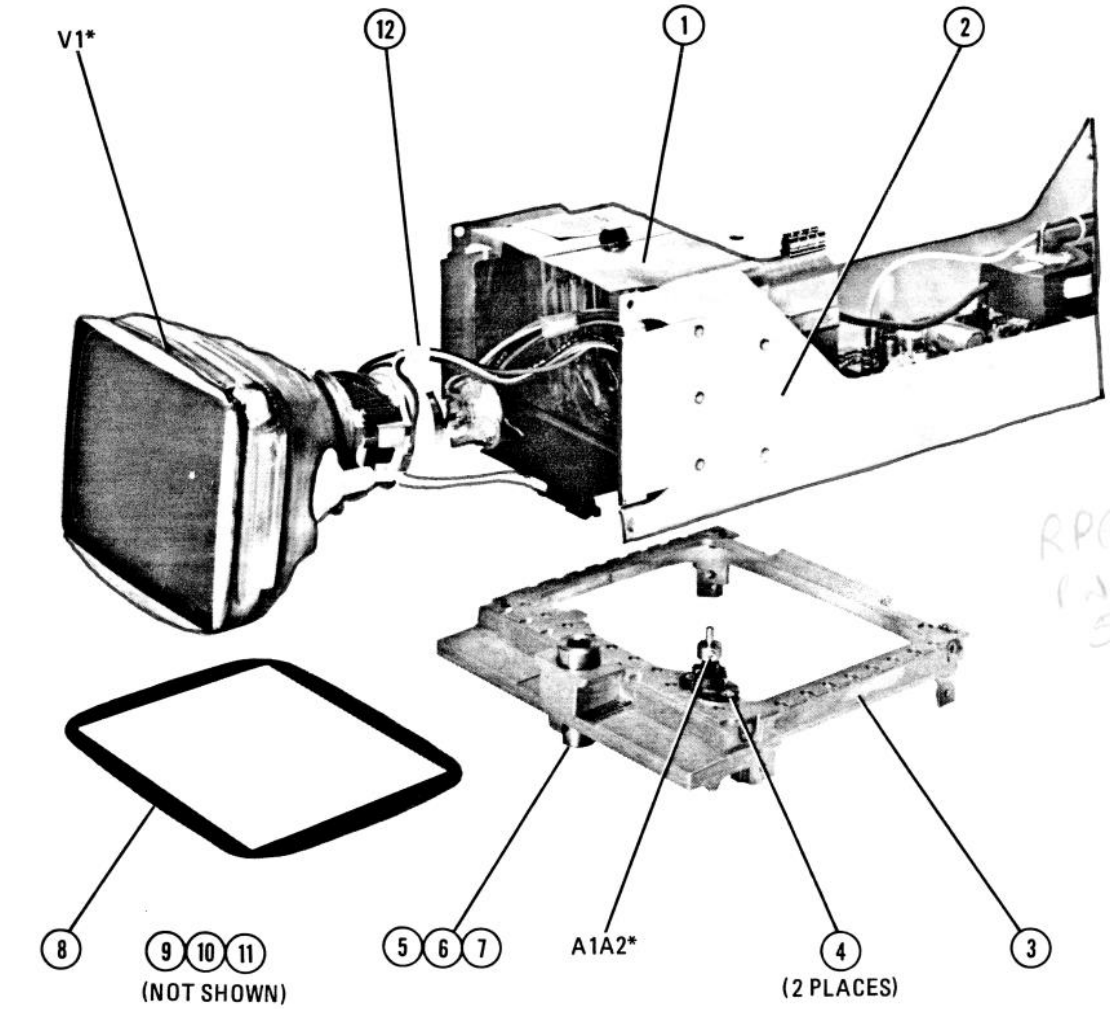
Item	HP Part Number	CD	Description	Mfr Code	Mfr Part Number
1	0515-0890	9	Screw, Mach M3X0.5 6MM LG	28480	0515-0890
2	70205-20016	0	Casting, Front	28480	70205-20016
3	0515-1146	3	Screw, Mach M3X0.5 6MM LG Pan Hd	28480	0515-0886
4	7120-4162	6	Label, Hazardous Warning	28480	7120-4162
5	70205-00001	1	Cover, Bottom	28480	70205-00001
6	0515-0570	2	Screw, Mach M3X0.5 8MM 90 deg	28480	0515-0570

Figure 6-4. Overall Module Parts Identification, Bottom View

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P/N FOR CRT WITH YOKE INSTALLED 70205-60042



* Refer to Replaceable Parts List for Part Numbers

Figure 6-5. Overall Module Parts Identification, V1 CRT Assembly (1 of 2)

Item	HP Part Number	CD	Description	Mfr Code	Mfr Part Number
1	70205-00004	4	Shield, CRT	28480	70205-00004
2	70205-00003	3	Strut, Frame	28480	70205-00003
3	70205-20016	0	Casting, Front	28480	70205-20016
4	0515-0566	6	Screw, Mach M2.5X0.45 6MM 90 deg	28480	0515-0566
5	5021-3290	7	Latch, MOD-TH-REC 0.625 IN DIA	28480	5021-3290
6	0900-0012	4	Ring, O Ext MVW	28480	0900-0012
7	0510-1244	4	Ring, Retaining	28480	0460-0142
8	70205-80015	5	Gasket, CRT RFI	28480	70205-80015
9	70205-00011	3	Faceplate, CRT	28480	70205-80015
10	8500-2163	4	Cleaner, OCLI TRC	28480	8500-2163
11	70205-00016	8	Gasket, CRT	28480	70205-00016
12	0460-0142	7	Tape, Friction 0.5 IN-W	28480	0460-0142

Figure 6-5. Overall Instrument Parts Identification, V1 CRT Assembly (2 of 2)

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Table 6-3. HP 70205A Major Assemblies

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
				HP 70205A MAJOR ASSEMBLIES		
A1A1	70205-60006	2	1	KEYBOARD ASSEMBLY	28480	70205-60006
A1A2	5021-3255	4	1	ROTARY PULSE GENERATOR (RPG)	28480	5021-3255
A2	70205-60001	7	1	SWEEP/MOTHERBOARD ASSEMBLY	28480	70205-60001
	70205-69001	2	1	RESTORED 70205-60001, EXCHANGE REQUIRED	28480	70205-69001
A3	70205-60045	9	1	DOT GENERATOR BOARD ASSEMBLY	28480	70205-60045
	70205-69045	8	1	RESTORED 70205-60045, EXCHANGE REQUIRED	28480	70205-69045
A3	70205-60004	0	1	DOT GENERATOR BOARD ASSEMBLY	28480	70205-60004
	70205-60044	8	1	REPLACEMENT FOR 70205-60004, EXCH. REQ.	28480	70205-60044
A4	70205-60041	5	1	MEMORY BOARD ASSEMBLY	28480	70205-60041
	70205-69041	3	1	RESTORED 70205-60041, EXCHANGE REQUIRED	28480	70205-69041
A4	70205-60003	9	1	MEMORY BOARD ASSEMBLY	28480	70205-60003
	70205-69041	3	1	RESTORED 70205-60041, EXCHANGE REQUIRED	28480	70205-69041
A5	70205-60040	4	1	POWER SUPPLY ASSEMBLY	28480	70205-60040
	70205-69040	2	1	RESTORED 70205-60040, EXCHANGE REQUIRED	28480	70205-69040
A5	70205-60015	3	1	POWER SUPPLY ASSEMBLY	28480	70205-60015
	70205-69040	2	1	RESTORED 70205-60040, EXCHANGE REQUIRED	28480	70205-69040
A6	70205-60002	8	1	HOST BOARD ASSEMBLY	28480	70205-60002
	70205-69002	7	1	RESTORED 70205-60002, EXCHANGE REQUIRED	28480	70205-69002
A7	70205-60007	3	1	INTERCONNECT BOARD ASSEMBLY	28480	70205-60007

HP 70206A System Graphics Display

REPLACEABLE PARTS

This section contains the following information:

Figure 6-6. Overall Instrument Parts Identification, Front View 6-16
Figure 6-7. Overall Instrument Parts Identification, Front Cover Removed 6-18
Figure 6-8. Overall Instrument Parts Identification, Rear View 6-20
Figure 6-9. Overall Instrument Parts Identification, Top View 6-22
Table 6-4. HP 70206A Major Assemblies 6-24

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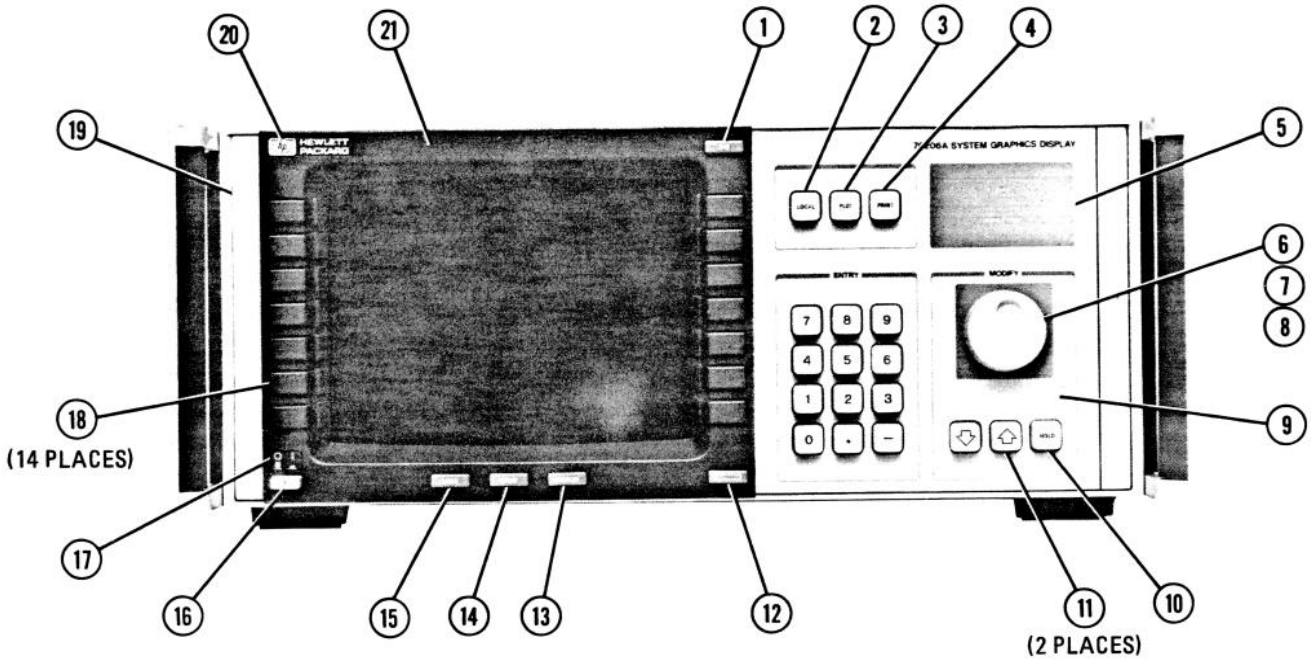


Figure 6-6. Overall Instrument Parts Identification, Front View (1 of 2)

Item	HP Part Number	CD	Description	Mfr Code	Mfr Part Number
1	70206-40027	6	"IP" Key	28480	70206-40027
2	70206-40021	0	"Local" Key	28480	70206-40021
3	70206-40022	1	"Plot" Key	28480	70206-40022
4	70206-40023	2	"Print" Key	28480	70206-40023
5	70206-00023	8	Window, Backlit	28480	70206-00023
6	0310-3033	4	Knob-RPG 1 1/2 JGK .25 IN-ID	28480	0310-3033
7	2950-0001	8	Nut-Hex DBL-Cham 3/8-32 THD	00000	By Description
8	2190-0016	3	Washer-LK INTL T 3/8 IN .377 IN-ID	28480	2190-0016
9	70206-00010	3	Panel, Front Dress → 00039 NEW COLOR	28480	70206-00010
10	70206-40024	3	"Hold" Key	28480	70206-40024
11	70206-40025	4	"Up/Down" Key	28480	70206-40025
12	70206-40005	0	"Back Arrow" Key	28480	70206-40005
13	70206-40007	2	"Display" Key	28480	70206-40007
14	70206-40006	1	"Menu" Key	28480	70206-40006
15	70206-40008	3	"User" Key	28480	70206-40008
16	70206-40026	5	Button, Line Switch (see page 7-8 FOR switch P/N)	28480	70206-40026
17	70206-80002	1	Label, ON/OFF	28480	70206-80002
18	70206-40004	9	Key, Soft New Color 70206-40038	28480	70206-40004
19	70206-00011	4	Spacer, Left Front Panel → 00010 NEW color	28480	70206-00011
20	70206-80001	0	Logo, HP	28480	70206-80001
21	70206-20014	9	Casting, Bezel	28480	70206-20014

Figure 6-6. Overall Instrument Parts Identification, Front View (2 of 2)

KEYCAPS

KEY 2 70206-40010

4 70206-40012

8 70206-40016

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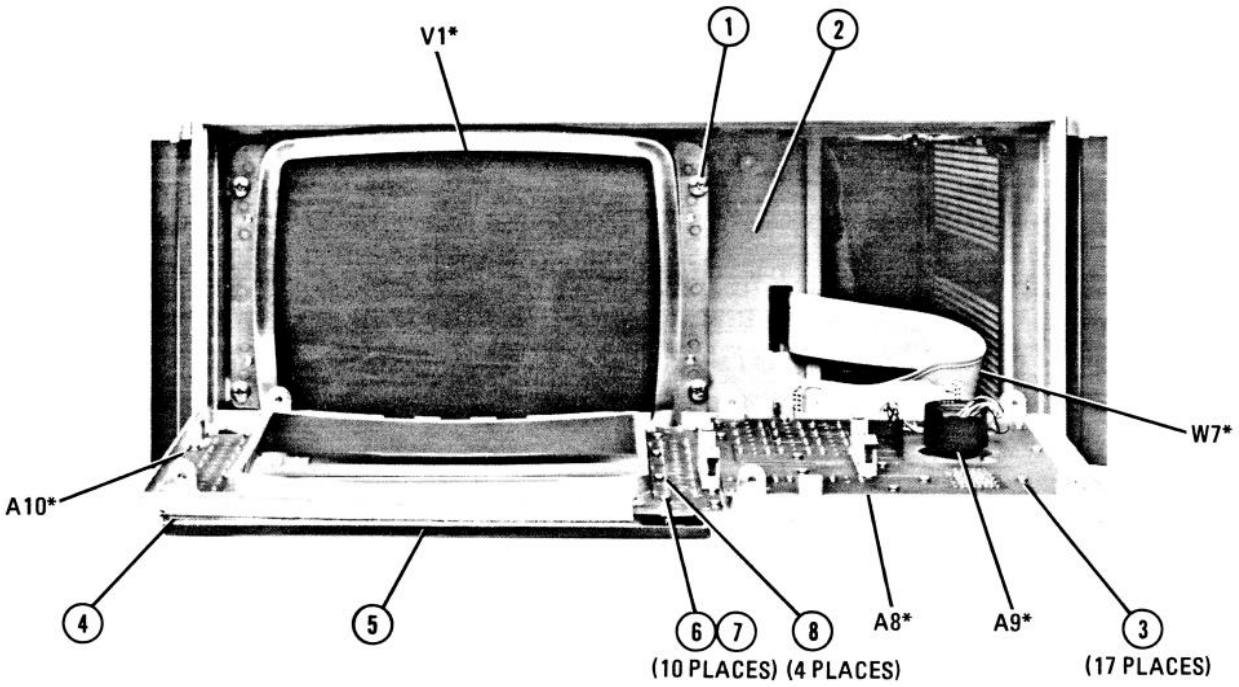


Figure 6-7. Overall Instrument Parts Identification, Front Cover Removed (1 of 2)

Item	HP Part Number	CD	Description	Mfr Code	Mfr Part Number
1	0515-1241	6	Screw-Mach M5X0.8 12MM LG PAN-HD	28480	0515-1241
2	70206-20030	9	Casting, Front Frame	28480	70206-20013
3	0515-1243	8	Screw THD-RLG M2.5X0.45 5MM LG PAN-HD	28480	0515-1243
4	8160-0500	3	RFI Strip Fingers BE-CU SN-PL 7.54 MM-WD	28480	8160-0500
5	70206-20014	9	Casting, Bezel → Doesn't New color	28480	70206-20014
6	0515-0972	8	Screw, SMM2.5 4PNPDS	28480	0515-0972
7	3050-0980	5	Washer, LK INTL T	28480	3050-0980

Figure 6-7. Overall Instrument Parts Identification, Front Cover Removed (2 of 2)

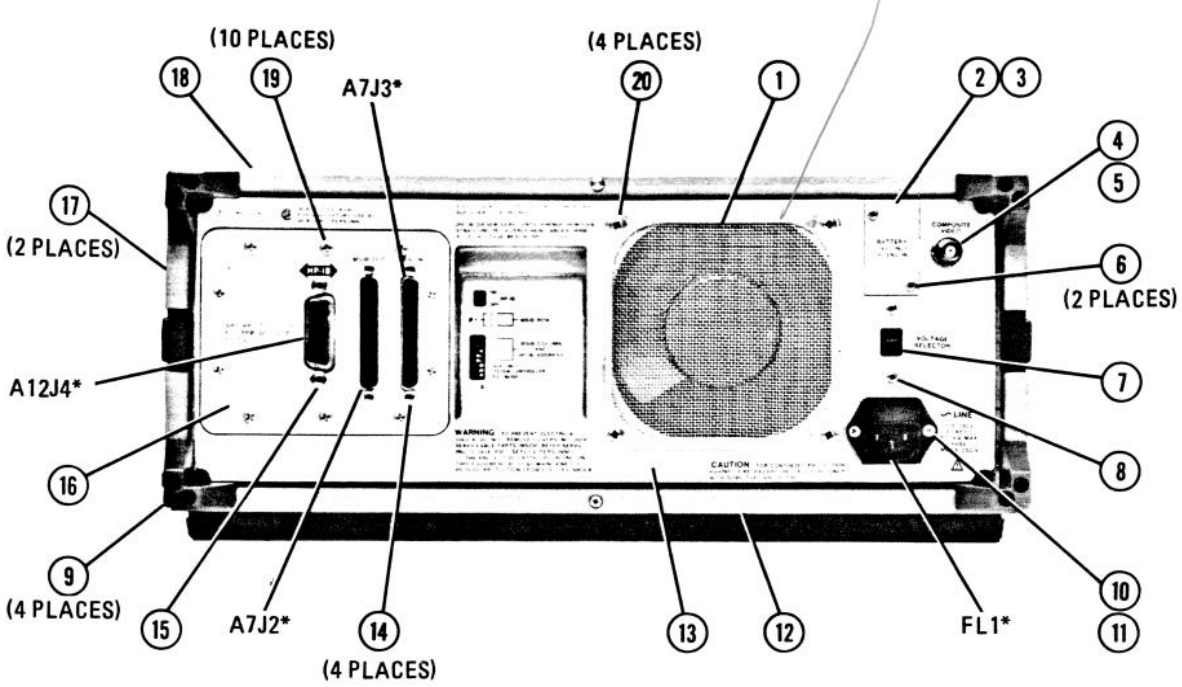
SHIELD FOR CRT 70206-00009

FILTER FOR CRT 70206-00019

S17 → S21 & S25 → S32 SOFTKEY SWITCHES
3101-2772

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*Refer to Replaceable Parts List for Part Numbers

Figure 6-8. Overall Instrument Parts Identification, Rear View (1 of 2)

60Hz FAN ASSY 70206-60003
FAN 3160-0467

400 Hz FAN ASSY 70206-60002
ACTUAL FAN 3160-0087 (400 Hz)

Item	HP Part Number	CD	Description	Mfr Code	Mfr Part Number
1	3150-0490	4	Filter Screen Guard, Alum	28480	3150-0490
2	70205-00006	6	Cover, Battery	28480	70205-00006
3	1430-0315	3	Battery 34V 1.7A-hr Lithium Thionyl	28480	1430-0315
4	2190-0102	8	Washer LK INTL T 15/32 IN .472 IN-ID	28480	2190-0102
5	0590-1251	6	Nut-SPCLY 15/32-32 THD .1 IN-THK	28480	0590-1251
6	0515-0897	6	Screw-Mach M3X0.5 8MM LG PAN-HD	28480	0515-0897
7	3101-2299	2	Switch-SL DPDT STD 5A 250VAC	28480	3101-2299
8	0515-0911	5	Screw-Mach M3X0.5 12MM LG-PAN HD	28480	0515-0911
9	5040-7221	2	Foot, Rear	28480	5040-7221
10	0515-1006	1	Screw-Mach M3X0.5 12MM LG-PAN HD	28480	0515-1006
11	0515-0042	3	Screw-Mach M6X1.0 30MM LG-HEX HD	28480	0515-0042
12	5061-9447	2	Cover, Bottom	28480	5061-9447
13	70206-20015	0	Panel, Rear	28480	70206-20015
14	5021-6390	2	Screw 5MM A/F HEX AISI 304/UNS	28480	5021-6390
15	5021-6391	3	Screw 7MM A/F HEX AISI 304/UNS	28480	5021-6391
16	70206-00031	5	Cover, HP-IB/HP-MSIB	28480	70206-00031
17	5061-2006	5	Cover, Side Sys II	28480	5061-2006
18	5061-9435	8	Cover, Top	28480	5061-9435
19	0535-0885	2	Screw-Mach M4X0.7 8MM LG PAN-HD	28480	0535-0885
20	0535-0088	9	Screw-TRQ M4X0.7 2.9MM-THK	28480	0535-0088

Figure 6-8. Overall Instrument Parts Identification, Rear View (2 of 2)

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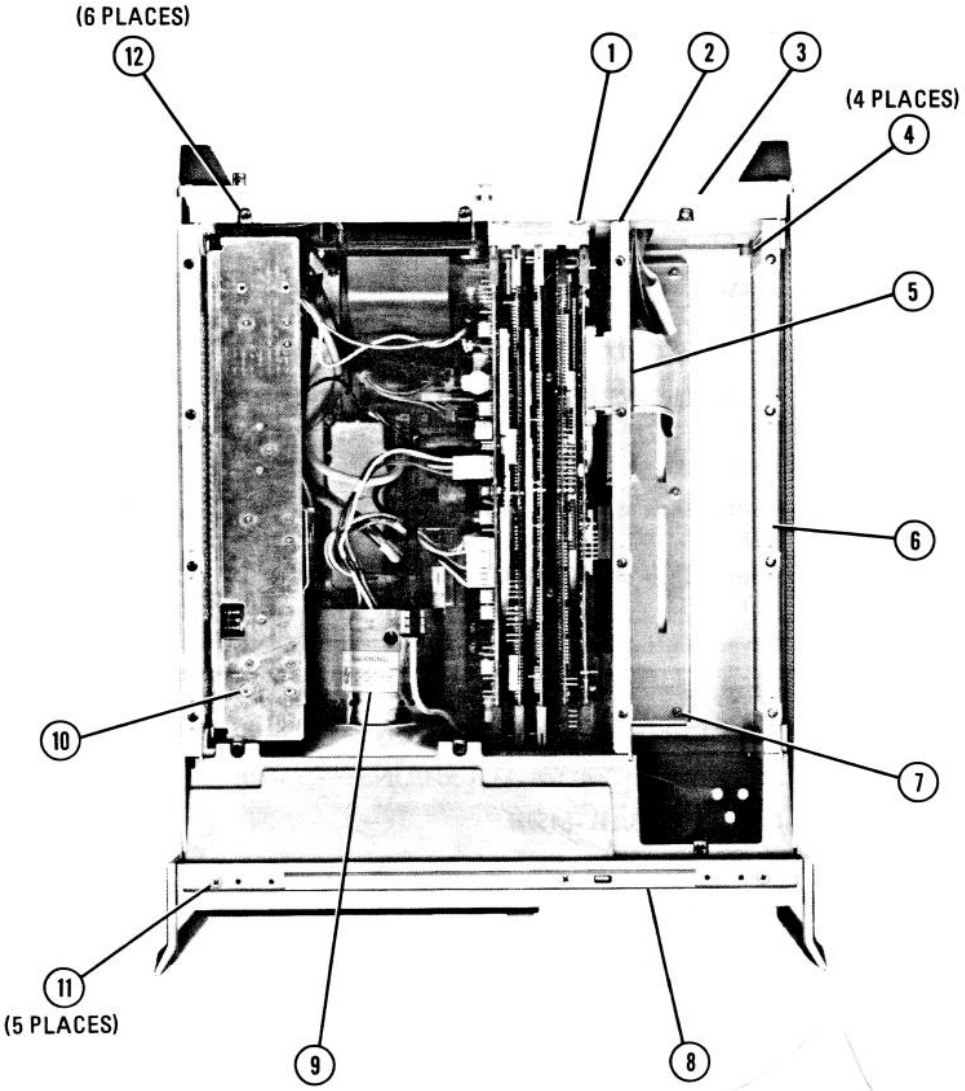


Figure 6-9. Overall Instrument Parts Identification, Top View (1 of 2)

See P 7-8
Switch P/N

Item	HP Part Number	CD	Description	Mfr Code	Mfr Part Number
1	0515-0898	7	Screw-Mach M4X0.7 6MM-LG PAN HD	28480	0515-0898
2	70206-00003	2	Divider, Chassis	28480	70206-00003
3	70206-20015	0	Casting, Rear Frame	28480	70206-20015
4	0515-1240	5	Screw-SKT-HD M5X0.8 20MM LG PAN-HD	28480	0515-1240
5	70206-40032	3	Gasket, Rubber	28480	70206-40032
6	70206-00001	2	Chassis, Main	28480	70206-00001
7	0515-0885	2	Screw-Mach M4X0.7 8MM LG PAN-HD	28480	0515-0085
8	70206-20030	9	Casting, Front Frame	28480	70206-20030
9	70206-80029	2	Label, Warning	28480	70206-80029
10	0515-1079	8	Screw-Mach M4X0.7 8MM LG PAN-HD	28480	0515-1079
11	0515-1474	7	Screw-Mach M4.0 PCFLPDS	28480	0515-1474
12	0515-1240	5	Screw-S M4.0.5 8MM LG PAN-HD	28480	0515-1240

Figure 6-9. Overall Instrument Parts Identification, Top View (2 of 2)

TO: Hong ZHAO / HPF400/00

CC: Clay BILBY / HP5300/M0
Tom ENNIS / HP5300/M0
Scott REESER / HP5300/M0

Part 2.

Greetings Hong,

Here is the part number information you requested. The part number for the cable that is connected to the front panel line switch is 3131-0492. The inner switch part number is 3131-0493. If the cable is bent it could create problems in turning on your instrument. I hope this information will help you repair your HP 70206A. If you need more information, please let me know.

Regards,

Sue Tatton

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Table 6-4. HP 70206A Major Assemblies

Reference Designation	HP Part Number	CD	Qty	Description	Mfr Code	Mfr Part Number
				HP 70206A MAJOR ASSEMBLIES		
A1	70206-60007	4	1	FILTER BOARD ASSEMBLY	28480	70206-60007
A2	70206-60005	2	1	VIDEO/SWEEP BOARD ASSEMBLY	28480	70206-60005
	70206-69005	0	1	RESTORED 70206-60005, EXCHANGE REQUIRED	28480	70206-69005
A3	70205-60045	9	1	DOT GENERATOR BOARD ASSEMBLY	28480	70205-60045
	70205-69045	8	1	RESTORED 70206-60045, EXCHANGE REQUIRED	28480	70206-69045
A3	70205-60004	0	1	DOT GENERATOR BOARD ASSEMBLY	28480	70205-60004
	70205-60044	8	1	REPLACEMENT FOR 70205-60004, EXCH. REQ.	28480	70205-60044
A4	70205-60041	5	1	MEMORY BOARD ASSEMBLY	28480	70205-60041
	70205-69041	3	1	RESTORED 70205-60041, EXCHANGE REQUIRED	28480	70205-69041
A4 →	70205-60003	9	1	MEMORY BOARD ASSEMBLY PCO 3808	28480	70205-60003 → order 69003 + order 69041
	70205-69041	3	1	RESTORED 70205-60041, EXCHANGE REQUIRED	28480	70205-69041
A6	70205-60002	8	1	HOST BOARD ASSEMBLY	28480	70205-60002
	70205-69002	7	1	RESTORED 70205-60002, EXCHANGE REQUIRED	28480	70205-69002
A7 obsolete PCO 3309	70206-60053	0	1	HP-MSIB BOARD ASSEMBLY	28480	70206-60053
	70206-69053	8	1	RESTORED 70206-60053, EXCHANGE REQUIRED	28480	70206-69053
A7 OBSOLETE PCO 6659 →	70206-60006	3	1	HP-MSIB BOARD ASSEMBLY	28480	70206-60006
	70206-~~69053~~ 69053	8	1	RESTORED 70206-60053, EXCHANGE REQUIRED	28480	70206-69053
A8	70206-60009	6	1	NUMERIC KEYBOARD ASSEMBLY	28480	70206-60009
A9	70206-60040	5	1	ROTARY PULSE GENERATOR (RPG) ASSEMBLY	28480	70206-60040
A10	70206-60008	5	1	BEZEL KEYBOARD ASSEMBLY	28480	70206-60008
A11				NOT ASSIGNED		
A11A1	0950-1730	0	1	POWER SUPPLY ASSEMBLY $350	28480	0950-1730
A11W1	70206-60039	2	1	POWER SUPPLY CABLE ASSEMBLY	28480	70206-60039
A12	70206-60001	8	1	MOTHERBOARD ASSEMBLY	28480	70206-60001
A7 V1	70206-60021			ASSY-CRT		
~~A9~~ W8 W9	70206-60016			MSIB CABLE INPUT		
	70206-60017			MSIB CABLE OUTPUT		
W13	3131-0492			Switch actuator cable		
	3131-0493			Switch push button		
	3101-2799			Switch on A1 Filter Bd Assy		
	70206-40026			Power button		

Chapter 7

MAJOR ASSEMBLY and CABLE LOCATIONS

Introduction

This chapter contains the HP 70205A Graphics Display and HP 70206A System Graphics Display major assembly and cable locations; each is listed by reference designator.

HP 70205A Major Assembly and Cable Locations 7-3
HP 70206A Major Assembly and Cable Locations 7-7

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NOTES

HP 70205A Graphics Display

MAJOR ASSEMBLY and CABLE LOCATIONS

The illustrations in this section show the locations of the following assemblies and cables.

Major Assemblies

A1A1 . . . . . Keyboard Assembly
A1A2 . . . . . RPG Assembly
A2 . . . . . Sweep/Motherboard Assembly
A3 . . . . . Dot Generator Board Assembly
A4 . . . . . Memory Board Assembly
A5 . . . . . Power Supply Assembly
A6 . . . . . Host Board Assembly
A7 . . . . . Interconnect Assembly

Cables

W1 . . . . . Battery cable
W2 . . . . . Video cable
W3 . . . . . Anode cable
W4 . . . . . CRT cable
W5 . . . . . RPG cable
W6 . . . . . Yoke cable
W7 . . . . . Keyboard cable

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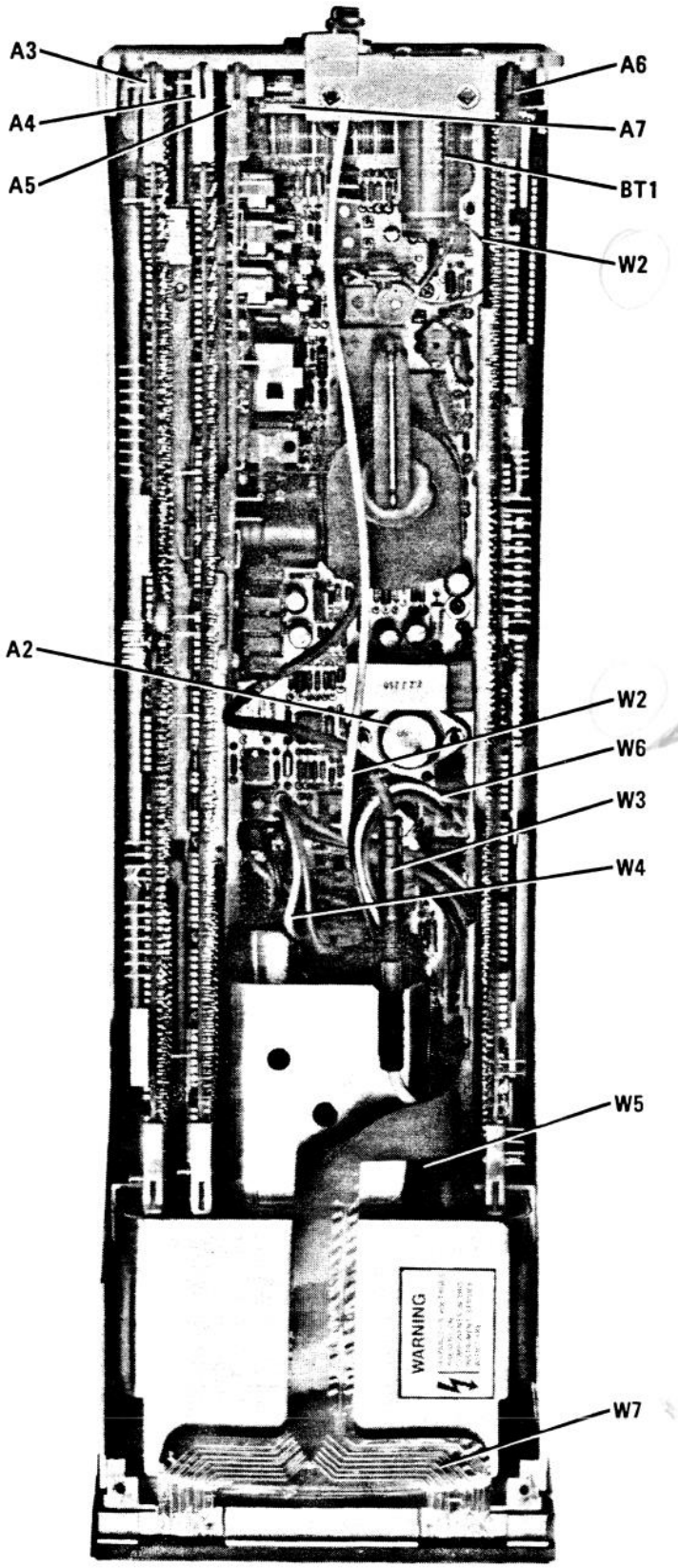


Figure 7-1. HP 70205A Major Assembly and Cable Locations (1 of 2)

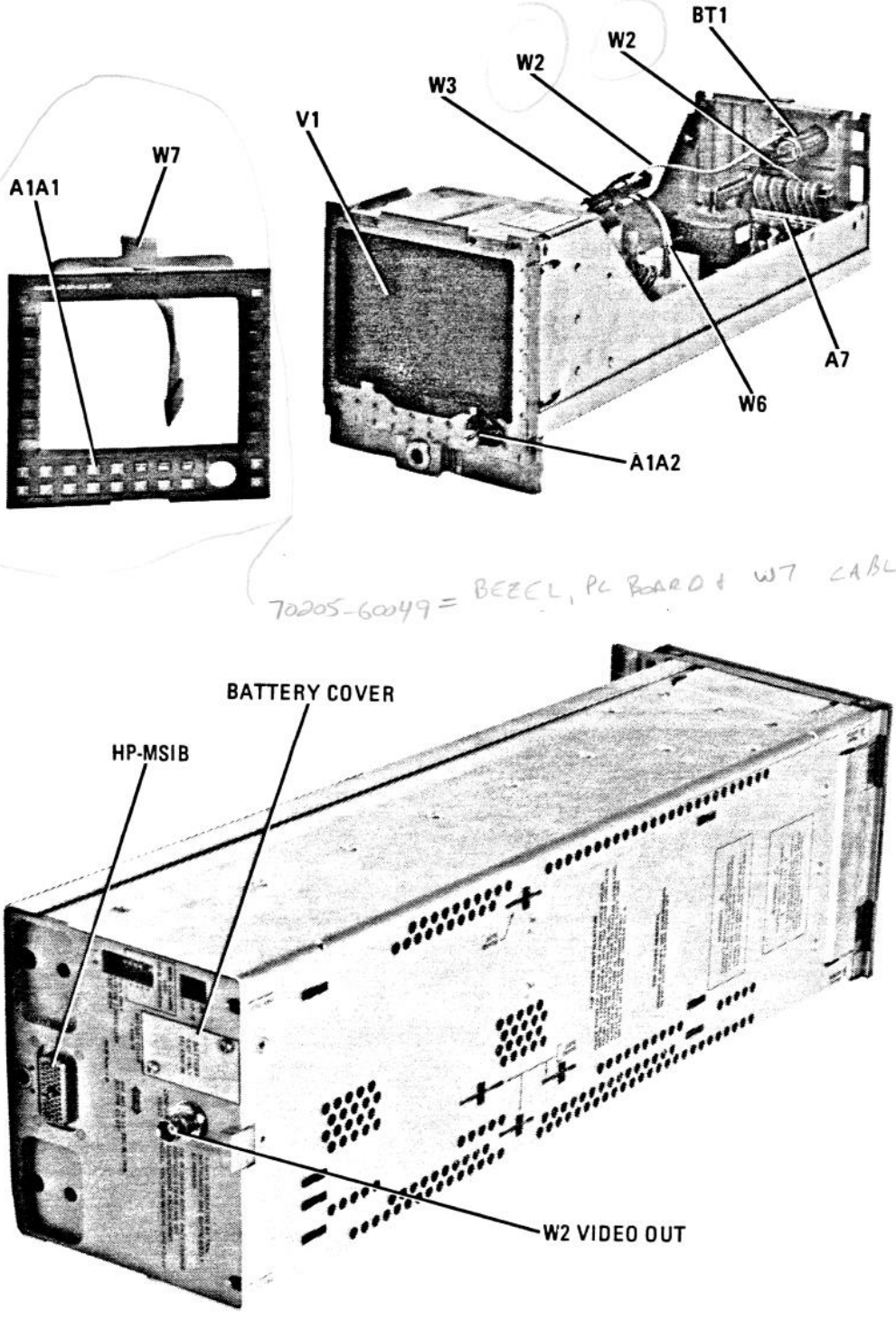


Figure 7-1. HP 70205A Major Assembly and Cable Locations (2 of 2)

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HP 70206A System Graphics Display

MAJOR ASSEMBLY and CABLE LOCATIONS

This illustrations in this section show the locations of the following assemblies and cables.

Major Assemblies

A1 . . . . . Filter Assembly
A2 . . . . . Video/Sweep Board Assembly
A3 . . . . . Dot Generator Board Assembly
A4 . . . . . Memory Board Assembly
A6 . . . . . Host Board Assembly
A7 . . . . . HP-MSIB Board Assembly
A8 . . . . . Numeric Board Assembly
A9 . . . . . RPG Assembly
A10 . . . . . Bezel Assembly
A11A1 . . . . . Power Supply Assembly
A11W1 . . . . . Power Supply cable assembly
A12 . . . . . Interconnect Board Assembly

Cables

W1 . . . . . CRT cable
W2 . . . . . Line Module cable
W3 . . . . . DC Power cable
W4 . . . . . AC Power cable
W5 . . . . . Battery cable
W6 . . . . . HP-IB cable
W7 . . . . . Front Panel cable
W8 . . . . . HP-MSIB (in) cable
W9 . . . . . HP-MSIB (out) cable
W10 . . . . . Voltage Select cable
W11 . . . . . Module Ground cable
W13 . . . . . Switch Actr cable
W15 . . . . . Video cable
W16 . . . . . Anode cable
W17 . . . . . Yoke cable

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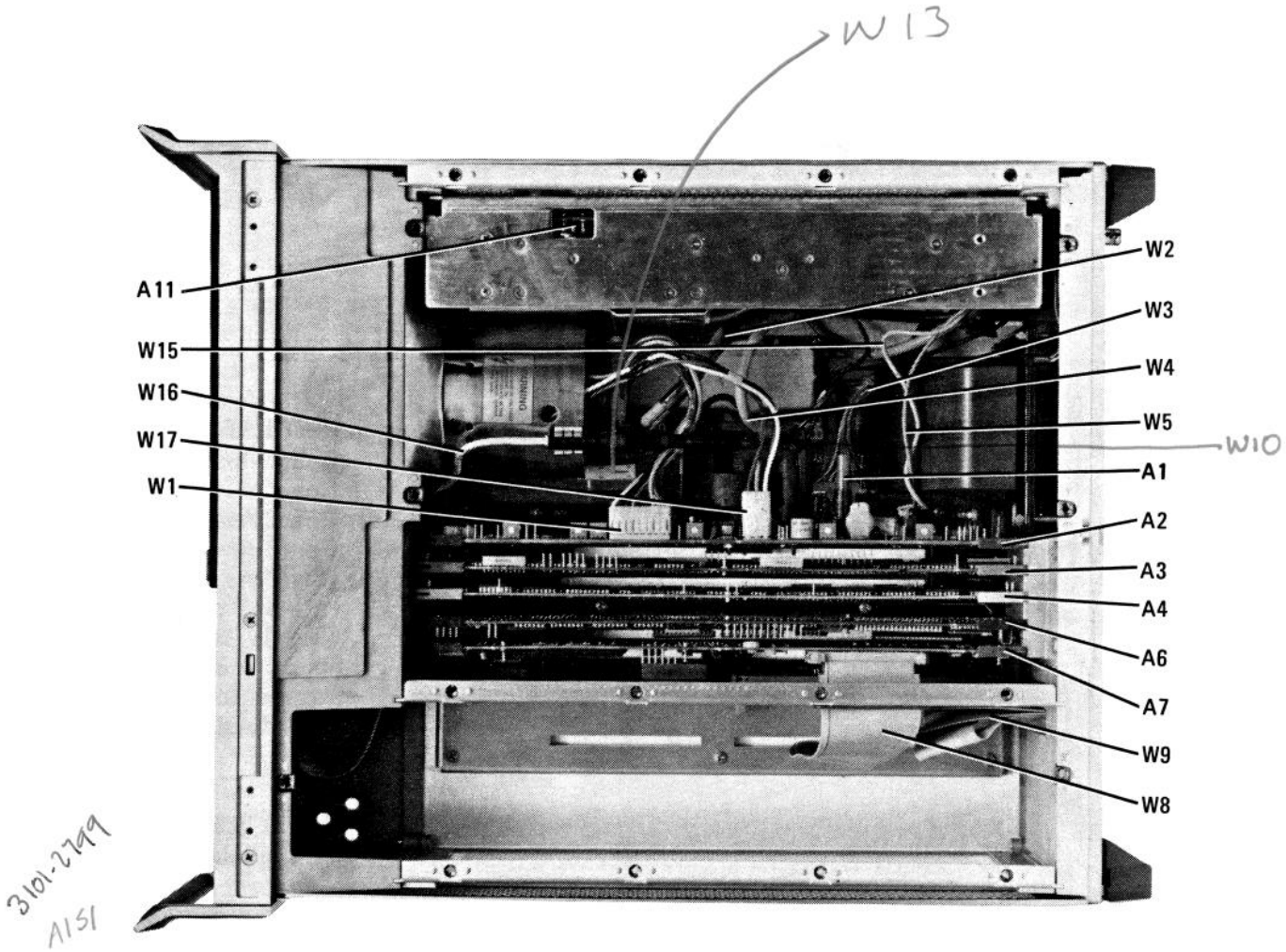
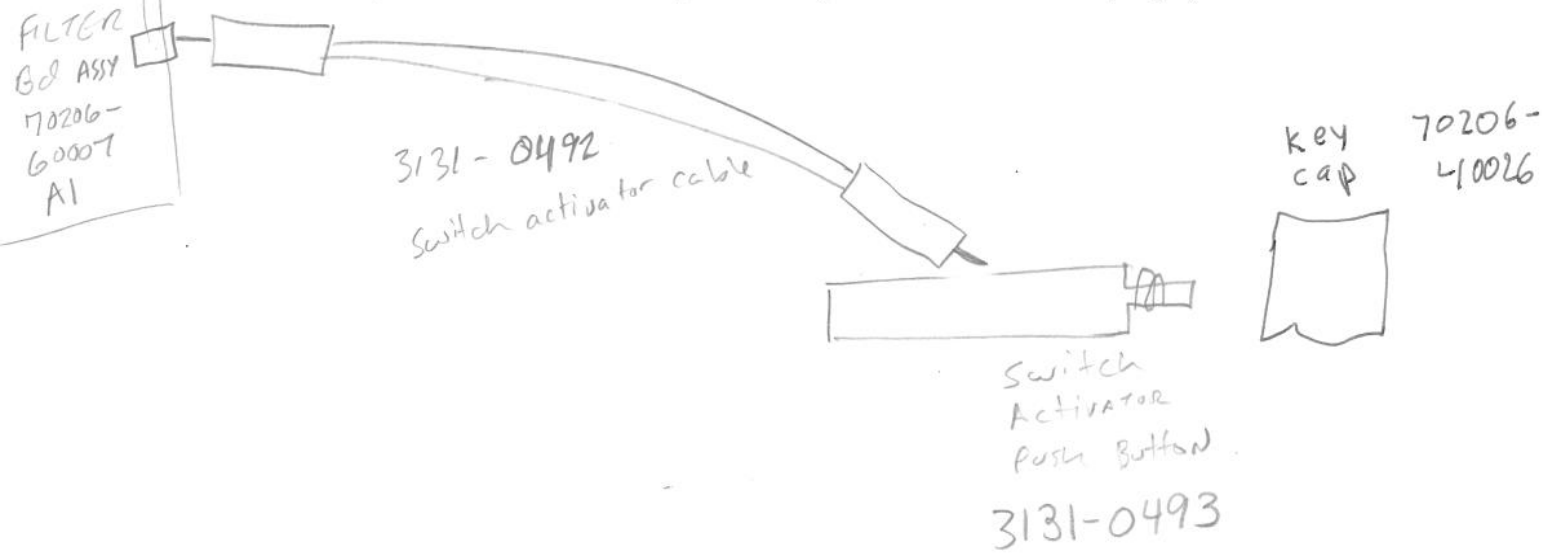


Figure 7-2. HP 70206A Major Assembly and Cable Locations (1 of 2)



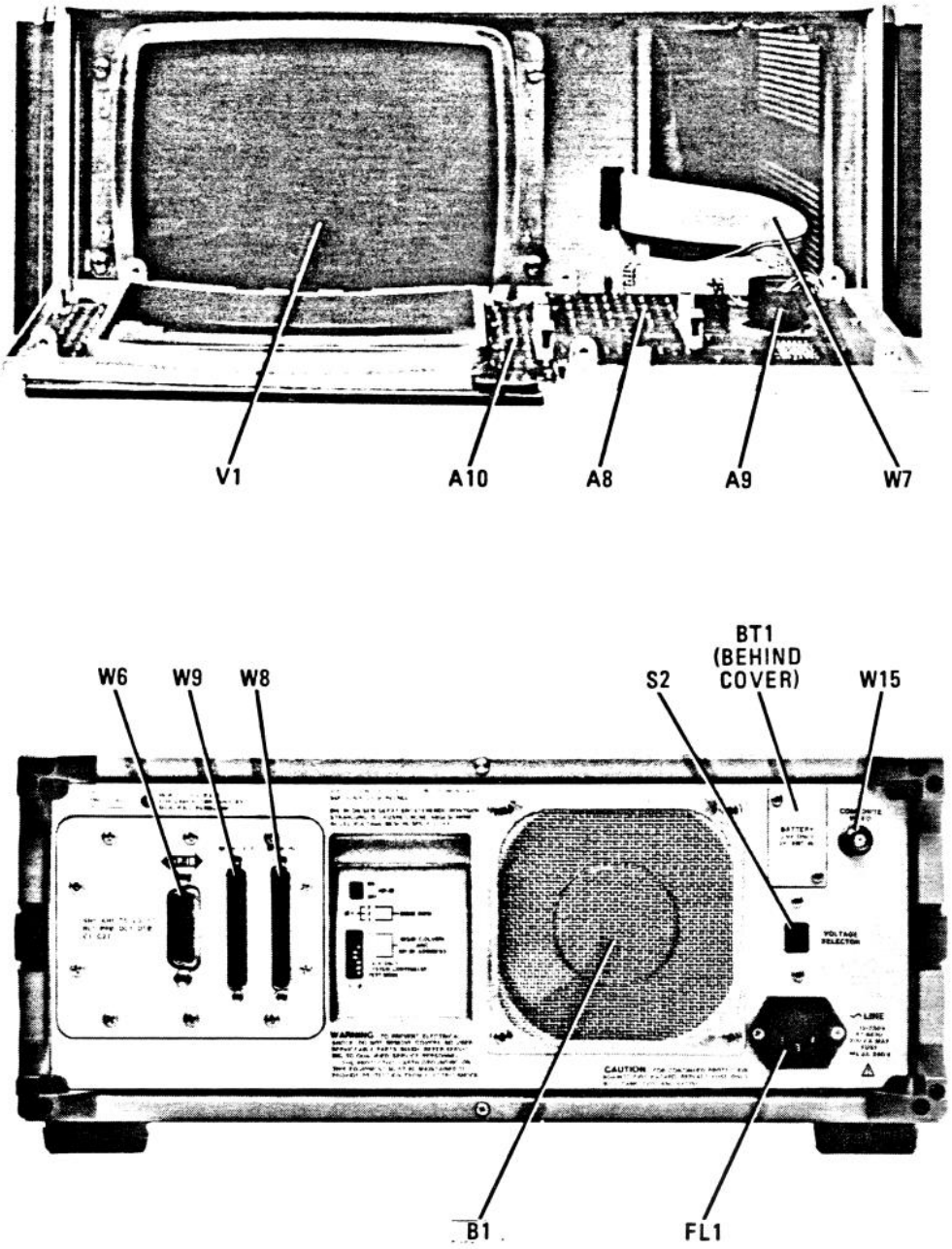


Figure 7-2. HP 70206A Major Assembly and Cable Locations (2 of 2)

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