HEWLETT PACKARD

TECHNICAL REFERENCE

HP 70700A
DIGITIZER

SERIAL NUMBERS

This manual applies directly to HP 70700A Digitizers with serial numbers prefixed 2709A and below.

FIRMWARE VERSIONS

This manual applies directly to HP 70700A Digitizers with firmware versions of 870501 and below.

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. Addresses are provided at the back of this manual.

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.

CONTENTS

LIST OF ILLUSTRATIONS

LIST OF TABLES

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. Service documentation is available for every module of the HP 70000 Modular Measurement System family.

USER 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

Information in this manual usually pertains to multiple- and single-module instrument systems. The Operation manual describes manual operation of the module, with explanations of softkeys and their use.

Programming Manual

Information in this manual usually pertains to multiple- and single-module instrument systems. The Programming Manual defines commands that enable remote operation of the module, and describes remote command syntax.

SERVICE MANUAL, AVAILABLE SEPARATELY

Technical Reference

This manual provides service information for a module, including performance verification, adjustments, troubleshooting, replaceable parts lists, replacement procedures, schematics, and component location diagrams. For ordering information, contact an HP Sales and Service Office.

Chapter 1
GENERAL INFORMATION

INTRODUCTION

This Technical Reference contains the information required to test, adjust, and service the HP 70700A Digitizer module. It documents support of the module to the subassembly, and includes component-level information.

MANUAL ORGANIZATION

The manual is divided into eight chapters as follows:

Chapter 1, GENERAL INFORMATION, covers manual organization, module versions, and electrostatic discharge.

Chapter 2, PERFORMANCE TESTS, contains the tests necessary to verify the electrical operation of the module.

Chapter 3, ADJUSTMENTS, contains the adjustment procedures necessary to adjust the module properly after a repair.

Chapter 4, TROUBLESHOOTING, contains the module block diagram, error code definitions, and other troubleshooting information.

Chapter 5, REPLACEMENT PROCEDURES, contains instructions for replacing all major assemblies.

Chapter 6, REPLACEABLE PARTS, contains the information necessary to order parts and/or assemblies for the module.

Chapter 7, MAJOR ASSEMBLY AND CABLE LOCATIONS, contains figures identifying all major assemblies and cables.

Chapter 8, SCHEMATICS AND COMPONENT LOCATIONS, contains component location diagrams and schematic diagrams.

SAFETY CONSIDERATIONS

Before servicing this module, you should familiarize yourself with the safety markings on the module and the safety instructions in this manual. This module has been manufactured and tested according to international safety standards. To ensure safe operation of the module and personal safety of the user and service personnel, the cautions and warnings in this manual must be heeded. Refer to the summary of safety considerations at the front of this manual. Also refer to individual chapters of this manual for detailed safety notation concerning the use of the module as described in those individual chapters.

HP 70700A PERFORMANCE TEST SOFTWARE

The HP 70700A Performance Test Software provided with this manual contains the performance tests required to service this module. Refer to Chapter 2, Performance Tests, for information on using the software and running the performance tests. Your software reliability depends on proper handling and storage. Before unpacking the software, refer to the BASIC 3.0 User's Guide for information about disc handling and usage.

SPECTRUM ANALYZER SYSTEM COMPATIBILITY

The HP 70700A Digitizer can be used as a slave in spectrum analyzer systems with the HP 70900A Local Oscillator as the system master. The local oscillator firmware must be revision 870501 or later, to use the digitizer in this manner.

INSTRUMENTS COVERED BY MANUAL

SERIAL NUMBERS/PC BOARD ASSEMBLY VERSIONS

Always check an assembly's version number before servicing it. All assembly versions produced by the print date of the manual will be documented in the manual. The manual print date is listed on the title page. Documentation for assembly versions produced after the manual's print date will be included in a Manual Updating Supplement (see below). A complete list of the assembly versions documented in this manual may be found in Table 1-1.

NOTE

Be sure that you are using the correct schematic or component location diagram for the assembly being worked on. Match the assembly version number printed on the circuit board with the version number printed on the diagrams.

Assembly Version Identification The version of a board assembly is identified by the part number printed on the circuit board. The part number is a ten-digit number consisting of a five-digit prefix and five-digit suffix. Prefix numbers identify the module and will usually be 70700. The suffix varies for each board type and version produced. Later versions of an assembly will always have a suffix with a higher numerical value than the first version.

MANUAL UPDATING SUPPLEMENTS

A module manufactured after the printing of this manual may have assembly versions not listed in this manual. These assembly versions will be documented in a Manual Updating Supplement. These supplements contain information that adapts the manual to the newer versions.

In addition to change information, the supplement may contain information for correcting errors in the manual. To keep this manual as current and accurate as possible, Hewlett-Packard recommends that you request the latest Manual Updating Supplement. Copies of the supplement are available from Hewlett-Packard Sales and Service Offices listed on the inside of the rear cover of this manual.

Table 1-1. Assembly Versions

Assembly	Version Number
A1 Status Board Assembly	70700-60009
A2 Mother Board Assembly	70700-60005
A3 Converter Board Assembly	70700-60003
A4 Address Board Assembly	70700-60002
A5 Processor Board Assembly	70700-60004

ELECTROSTATIC DISCHARGE

Electrostatic discharge (ESD) can damage or destroy electronic components. All work performed on assemblies containing electronic components should be done ONLY at a static-safe work station. See Figure 1-1.

PC BOARD ASSEMBLIES AND ELECTRONIC COMPONENTS

- Handle these items ONLY at a static-safe work station.

- Store or transport these items ONLY in static-shielding containers.

> **CAUTION**
>
> **Do not use erasers to clean the PC board edge 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 edge connector contacts. Paper or lint particles left on the contact surface can cause intermittent electrical connections.**
>
> **Do not touch the edge connector contacts or trace surfaces. Always handle board assemblies by the edges.**

Clean PC board assembly edge connector contacts with a lint-free cloth and a solution of 80% electronics-grade isopropyl alcohol and 20% deionized water. Perform this procedure only at a static-free work station.

TEST EQUIPMENT

- Before connecting a coaxial cable to an instrument connector for the first time each day, momentarily ground the center and outer conductors of the cable.

- 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.

- Be sure that all instruments are properly earth-grounded to prevent buildup of static charge.
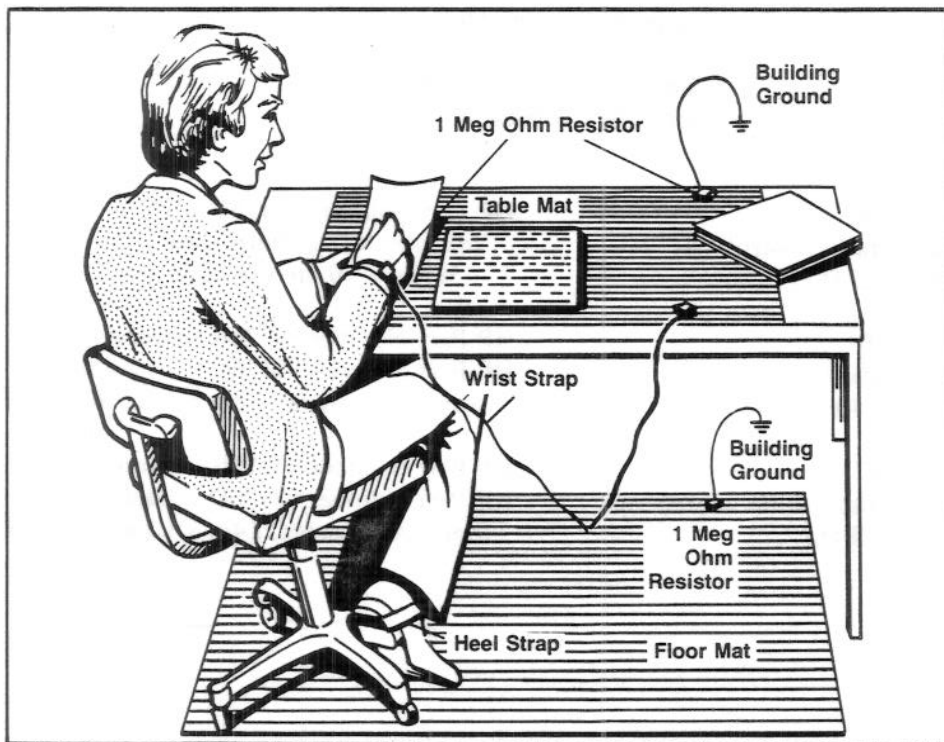
Figure 1-1. Static-Safe Work Station

ESD ACCESSORIES

The following static-safe accessories may be ordered from a Hewlett-Packard sales or service office:

HP Part Number 9300-0797
   3M static control mat .6m x 1.2m (2 ft. x 4 ft.)
   4.6m (15 ft.) ground wire
   wrist strap and attachment cord

HP Part Number 9300-0980
   Wrist strap cord 1.5m (5 ft.)

HP Part Number 9300-0985
   Wrist strap (large)

HP Part Number 9300-0986
   Wrist strap (small)

HP Part Number 9300-1169
   ESD heel strap (reusable 6 to 12 months)

HP Part Number 9300-0793
   Shoe ground strap (one-time use only)

The ESD accessories below may be ordered from:

Hewlett-Packard Company
Computer Supplies Operations
1320 Kifer Road
Sunnyvale, California 94086
Phone: (408) 738-8858

HP Part Number 92175A
    Black, hard-surface, static control mat
        1.2m x 1.5m (4 ft. x 5 ft.)

HP Part Number 92175B
    Brown, soft-surface, static control mat
        2.4m x 1.2m (8 ft. x 4 ft.)

HP Part Number 92175C
    Small, black, hard-surface, static control mat
        1.2m x 0.9m (4 ft. x 3 ft.)

HP Part Number 92175T
    Tabletop static control mat
        58 cm x 76 cm (23 in. x 30 in.)

HP Part Number 92176A (natural color)
HP Part Number 92176C (russet color)
    Anti-static carpet, 1.8m x 1.2m (6 ft. x 4 ft.)

HP Part Number 92176B (natural color)
HP Part Number 92176D (russet color)
    Anti-static carpet, 2.4m x 1.2m (8 ft. x 4 ft.)

SALES AND SERVICE OFFICES

Hewlett-Packard has sales and service offices around the world providing complete support for the HP 70700A Digitizer module. To obtain servicing information or to order replacement parts, contact the nearest Hewlett-Packard Sales and Service Office listed on the inside of the rear cover of this manual. In any correspondence, refer to the module by its model number and any pertinent assembly part numbers.

HOW TO RETURN THE MODULE FOR SERVICE

SERVICE TAG

If you are returning the analyzer to Hewlett-Packard for servicing, fill in and attach a blue service tag. Several service tags are supplied at the end of this chapter.

Please be as specific as possible about the nature of the problem. If you have recorded any error messages that appeared on the screen or have any other specific data on the performance of the module, please send a copy of this information with the unit.

ORIGINAL PACKAGING

Before shipping, pack the unit in the original factory packaging materials. If the original materials were not retained, identical packaging materials are available through any Hewlett-Packard office.

OTHER PACKAGING

> **CAUTION**
>
> **Module damage can result from using packaging materials other than those specified. Never use styrene pellets, in any shape, as packaging materials. They do not adequately cushion the equipment or prevent it from shifting in the carton. They also cause equipment damage by generating static electricity.**

You can repackage the module with commercially available materials as follows:

1. Attach a completed service tag and any other failure information to the instrument.

2. Wrap the module in anti-static plastic to reduce the possibility of ESD damage.

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 module and at least three to four inches of packing material on all sides.

4. Securely pack the module in three to four inches of packing material to prevent it from moving around in the carton. If packing foam is not available, the best alternative is to use S.D.-240 Air Cap TM, from Sealed Air Corporation in Commerce, California, 90001. This material is a plastic sheet of 1-1/4 inch air bubbles. Use the pink-colored Air Cap to reduce static electricity. Wrap the module several times in this material to protect it and to 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 ensure careful handling.

7. Retain copies of all shipping papers.

Chapter 2
PERFORMANCE TESTS

The tests given in this chapter verify the electrical performance of a single channel of the HP 70700A Digitizer module. This is done by using the HP 70700A Digitizer Performance Test Software provided with this manual. If the module passes this verification, its operation is also assured within an HP 70000 Modular Spectrum Analyzer System.

This chapter contains the following information:

- **Required Test Equipment** lists standard and specialized test equipment needed for the performance tests.

- **Performance Test Software** describes how to install, configure, and operate the HP 70700A Digitizer Performance Tests software.

- **Test Descriptions** contains a full list of the tests of specified performance and functional tests. (Tests of specified performance verify that the module meets its specifications; these tests are required for calibration and are all automated. Functional tests are used to check the functionality of the module during troubleshooting or after a repair; these tests are not required for calibration, and several are manual rather than automated.) This section also includes test descriptions, which consist of test setup instructions, a list of equipment for each specific test, and instructions for running the manual tests.

NOTE

Some systems (e.g., multiple-digitizer systems) may have more than one channel available. For information about testing each channel, refer to Testing Multiple Channels in the Operation section of Performance Test Software in this chapter.

REQUIRED TEST EQUIPMENT

STANDARD TEST EQUIPMENT

The equipment and accessories required for the performance tests are listed below in Table 2-1. Other equipment may be substituted if it meets or exceeds the requirements listed in Table 2-2 (however, the user must supply the instrument driver).

Table 2-1. Required Test Equipment and Accessories

Equipment	HP Model Number
Function Generator	HP 8116A
DC Source	HP 8116A
Level Generator	HP 3335A
Pulse Generator	HP 8116A, Opt. 001
Voltmeter	HP 3456A
Mainframe	HP 70001A
Display	HP 70205A or HP 70206A
Technical Computer	See Note, below
Graphics/Non-Graphics Printer (Optional)	Any HP-IB Printer
1 MHz and 10 MHz Low-Pass Filters	See Specialized Test Equipment, below
Accessories	
Cable (4 ft.) BNC (m) to SMB (m)	HP 85680-60093
Cable (122 cm) BNC (m) to BNC (m)	HP 10503A

NOTE

Refer to the Computer Compatibility section of this chapter for the technical computer requirements.

SPECIALIZED TEST EQUIPMENT

Two filters are required for the HP 70700A Digitizer Performance Tests: a 1 MHz low-pass filter, and a 10 MHz low-pass filter. Schematics and parts lists are provided to allow you to build the filters. See Figures 2-1 and 2-2.

A board assembly containing pre-built filters can be purchased through your nearest Hewlett-Packard Sales Office. This assembly also includes a 5 MHz low-pass filter that is not used in the HP 70700A Digitizer Performance Tests, in addition to the 1 MHz and 10 MHz low-pass filters. Refer to Service Accessories in Chapter 4 for information on the filter board assembly part number.

Table 2-2. Critical Specifications for Test Equipment

Equipment	Critical Specifications

Level Generator	Frequency
	    Range: 200 Hz to 50 MHz
	    Stability: ± 1 x 10^{-7}/month
	    Resolution: 0.01 Hz
	Amplitude
	    Range: +12 to −85 dBm
	    Resolution: 0.01 dB
	    Flatness: 200 Hz to 50 MHz, ±0.2 dB
	    Step Attenuator Accuracy:
	        +12 to −26 dBm: ±0.025 dB
	        −26 to −46 dBm: ±0.03 dB
	        −46 to −85 dBm: ±0.09 dB
	Harmonics
	    <−40 dBc

1 MHz Low-Pass Filter	<1 dB Loss at 1 MHz >40 dB Stop Band at 2 MHz
10 MHz Low-Pass Filter	<1 dB Loss at 10 MHz >40 dB Stop Band at 20 MHz
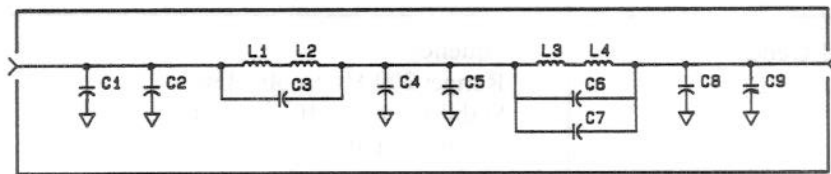
Reference Designator	HP Part Number	CD	Description
C1	0160-2225	5	2000 pF
C2	0160-2226	6	2200 pF
C3	0140-0199	6	240 pF
C4	0140-0170	3	5600 pF
C5	0160-2218	6	1000 pF
C6	0160-2213	1	620 pF
C7	0140-0190	7	39 pF
C8	0160-2225	5	2000 pF
C9	0160-2225	5	2000 pF
L1	9140-0111	1	3.3 uH
L2	9100-1610	3	150 nH
L3	9140-0111	1	3.3 uH
L4	9140-0309	9	1.8 uH

Figure 2-1. 1 MHz Low-Pass Filter, Schematic with Parts Identification
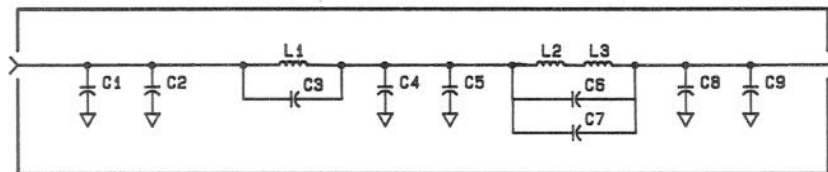
Reference Designator	HP Part Number	CD	Description
C1	0160-0939	4	430 pF
C2	0140-0201	1	12 pF
C3	0140-0145	2	22 pF
C4	0160-2213	1	620 pF
C5	0140-0190	7	39 pF
C6	0140-0214	6	60 pF
C7	0140-0209	9	5 pF
C8	0140-0200	0	390 pF
C9	0140-0202	2	15 pF
L1	9140-0096	1	1 uH
L2	9100-1611	4	220 nH
L3	9140-0094	9	.68 uH

Figure 2-2. 10 MHz Low-Pass Filter, Schematic with Parts Identification

PERFORMANCE TEST SOFTWARE

INTRODUCTION

This section describes how to install, configure, and operate the HP 70700A Digitizer Performance Tests software. The software provides testing for the HP 70700A Digitizer's specifications.

Before running the software, read the rest of this chapter. Then follow the instructions in Installation/Configuration for installing the hardware and software.

Computer Key Names

Computer key names and execution differ depending on the HP Series 200/300 Computer used. The verification instructions in this manual assume the use of an HP Series 200 keyboard. If your key names do not match those found in the text, substitute the alternate key names described below.

Keys Used in Text	Alternate Key
[EXECUTE]	[Return]
[ENTER]	[Return]
[RUN]	press [System], then [Run]
[CONTINUE]	press [System], then [Continue]

Program Versions

The program version number (e.g., Rev. A.01.00) is displayed in the upper right-hand corner of the Main Menu.

Computer Compatibility

The program can be run on the following HP Series 200/300 Computers. (1.5 megabytes of total RAM memory is required):

      HP 9816
      HP 9836
      HP 9920 (with an HP 35721A Monitor)
      HP Series 300 Computer (Refer to Note, below)

NOTE

HP Series 300 Computers should have a standard monitor. This program will not work with a high-resolution monitor.

Computer Language Compatibility

The software runs on HP BASIC 3.0 or later that has the following BIN files loaded:

CLOCK	GRAPH	KBD
CS80	GRAPHX	MAT
DISC	HPIB	MS
ERR	IO	PDEV

If the software will be operating in a shared resource environment, the following BIN files are also required:

DCOM
SRM

Printer Compatibility (Graphics/Non-Graphics)

The program will support any HP-IB printer. However, many of the printed test results require a graphics printer. If a non-graphics printer is used, graphical test results will not be sent to the printer.

OPERATION

This section gives an overview of the menu structure for the HP 70700A Digitizer Performance Tests software. An explanation of how the measurement uncertainty for the program is calculated is also included in this section.

Menu Structure

The first menu displayed by the program is the Main Menu. All other menus are accessed from Main Menu softkeys. The menus are:

First level	Second level
MAIN MENU	MASS STORAGE MENU
	PARAMETER MENU
	EQUIPMENT MENU
	HP-MSIB MAP SCREEN MENU
	TEST MENU

The Mass Storage, Parameter, Equipment, and HP-MSIB Map Screen menus are configuration menus that initialize the software for operation. The Test Menu allows the selection and execution of the desired tests. Detailed information on each menu is provided following Installation/Configuration in this chapter.

NOTE

There are minor differences between the appearance of the menus on the HP 9816/9836 Computers and the HP Series 300 Computers due to the different keyboards.

Main Menu

The Main Menu accesses all other program menus. It is the first menu displayed upon installing the software. A verification of HP 70700A Digitizer operation may be initiated from the Main Menu. Figure 2-3 illustrates the Main Menu's structure and softkeys.

Configuration Menus

Figure 2-4 illustrates the structure and softkeys used for each configuration menu.

Mass Storage Menu: customizes the mass storage environment, if used.

Parameter Menu: controls operating conditions of the program, such as destination of test results and printer lines per page.

Equipment Menu: enters the model numbers and HP-IB address of the external test equipment (ETE) and the device under test. The program needs this information to locate the equipment on the HP-IB successfully.

HP-MSIB Map Screen Menu: indicates the system being tested. This menu is also used to select the channel to be tested, if there is more than one channel available in the system.

Test Menu

The Test Menu allows the user to select and run the tests. Figure 2-5 illustrates the Test Menu's structure and softkeys. For a complete list and description of the performance tests, see the Test Descriptions section of this chapter.

Command/Edit Screens

Two kinds of screens are displayed in the menus: **edit** and **command** screens. An edit screen allows the user to edit or input text on the display. Command screens allow the user to choose menu functions. These functions include storing information changed with the edit screen, test mode selection, access to "Help" displays, and exiting to the Main Menu.

The Main, Test, and HP-MSIB Map Screen menus use command screens only. The Mass Storage, Parameter, and Equipment menus use both edit and command screens. The edit screen always appears first. The command screen is then accessed through the *DONE* softkey.

Menu Cursor: The menu cursor is used to indicate screen selections. To move the cursor, rotate the knob or press the cursor keys on the computer keyboard.

Common Menu Softkeys: The following three softkeys are common to all command screens:

Main Menu returns program operation to the Main Menu.

Help displays a description of the menu and its softkeys.

Quit allows the user to leave the HP 70700A Digitizer Performance Tests program.

Limited Cal

Limited Cal, a subset of the performance tests, is used to verify the operation of the system. Use Limited Cal whenever system operation needs to be verified, or after any repair. The remaining performance tests are used for troubleshooting or for a full calibration. Limited Cal may be run from either the Main or Test menus.

Printing Test Results

The Performance Test program uses printed test results for permanent test records. The Parameter Menu configures the program to print test results, and also controls their format. If the Parameter Menu is configured to have test results printed, they are automatically printed during testing if an HP-IB printer is on the interface bus.

Output Format: The printed test results contain a **title** page and a **summary** page.

The **title** page lists the following information:

- Test date

- Serial number of the tested instrument

- Firmware versions of the tested instrument

- Test person identification (from the Parameter Menu)

- Power line frequency (from Parameter Menu)

- Model numbers of test equipment with ID, or blanks for identification

The **summary** page lists the following information:

- Tests that passed (Passed)

- Tests that failed (Adjust)

- Tests not run because of unavailable external test equipment (Missing ETE)

- Tests that were aborted (Aborted)

Test Results

For each test, the program indicates whether the instrument passed the test limits. The measurement uncertainty for each test is calculated based on the test equipment. See the Required Test Equipment section in the beginning of this chapter.

Testing Multiple Channels

When there is more than one channel available in a digitizer system, the HP-MSIB Map Screen Menu contains a softkey, Channel, to allow selection of the channel to be tested.

The software will only test one channel of a system at a time. After one channel has been tested, use Channel in the HP-MSIB Map Screen Menu to select the next channel to be tested.

```
┌──────────────┐
│  Main Menu   │
└──────┬───────┘
       │
       ├─── Limited Cal
       │
       ├─── Mass Storage
       │                      ┌──────────────────────────┐
       │                      │    Mass Storage Menu      │
       │                      │       Edit Screen         │
       │                      │      See Figure 2-4       │
       │                      └──────────────────────────┘
       ├─── Parameter Menu
       │                      ┌──────────────────────────┐
       │                      │     Parameter Menu        │
       │                      │       Edit Screen         │
       │                      │      See Figure 2-4       │
       │                      └──────────────────────────┘
       ├─── Equipment Menu
       │                      ┌──────────────────────────┐
       │                      │     Equipment Menu        │
       │                      │       Edit Screen         │
       │                      │      See Figure 2-4       │
       │                      └──────────────────────────┘
       ├─── HP-MSIB Map
       │                      ┌──────────────────────────┐
       │                      │ HP-MSIB Map Screen Menu   │
       │                      │      Command Screen       │
       │                      │      See Figure 2-4       │
       │                      └──────────────────────────┘
       ├─── Test Menu
       │                      ┌──────────────────────────┐
       │                      │        Test Menu          │
       │                      │     Command Screen        │
       │                      │     See Figure 2-5        │
       │                      └──────────────────────────┘
       ├─── Reprint *
       │
       ├─── Restart
       │
       ├─── Help
       │
       └─── Quit
```
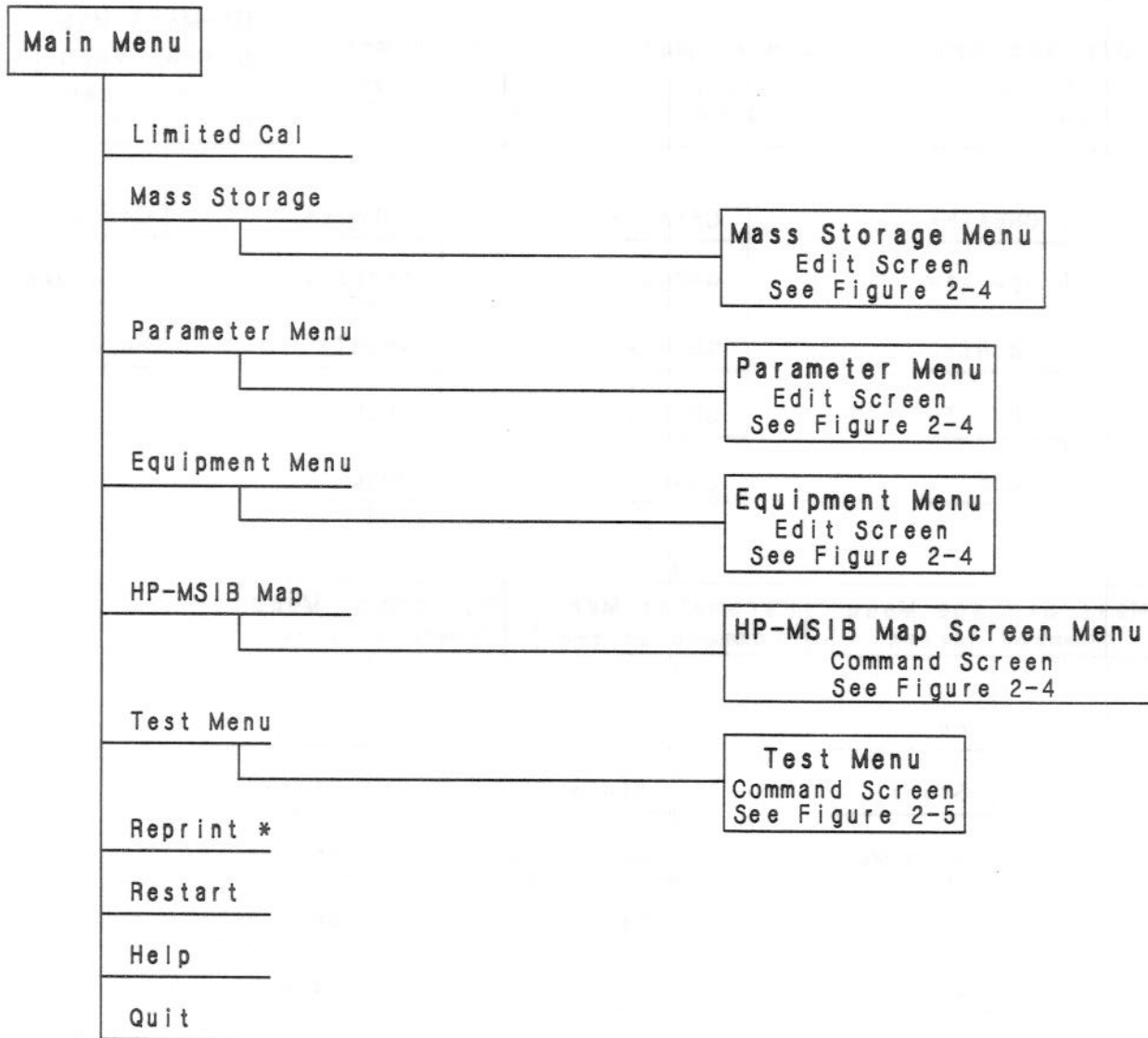
* This softkey is only shown if a printer is available.

Figure 2-3. Main Menu Softkeys

```
┌─────────────────────┐   ┌─────────────────────┐   ┌─────────────────────┐   ┌─────────────────────┐
│  Mass Storage Menu  │   │   Parameter Menu    │   │   Equipment Menu    │   │     HP-MSIB Map     │
│     Edit Screen     │   │     Edit Screen     │   │     Edit Screen     │   │    Screen Menu      │
│   See Figure 2-1    │   │   See Figure 2-1    │   │   See Figure 2-1    │   │   Command Screen    │
│                     │   │                     │   │                     │   │   See Figure 2-1    │
└─────────────────────┘   └─────────────────────┘   └─────────────────────┘   └─────────────────────┘

        CREATE*                    CREATE*                    CREATE*                    Channel

        REPEAT*                    REPEAT*                    REPEAT*                   Main Menu

        ABORT*                     ABORT*                     ABORT*                      Help

        SELECT                     SELECT                     SELECT                      Quit

         DONE                       DONE                       DONE


┌─────────────────────┐   ┌─────────────────────┐   ┌─────────────────────┐
│  Mass Storage Menu  │   │   Parameter Menu    │   │   Equipment Menu    │
│   Command Screen    │   │   Command Screen    │   │   Command Screen    │
└─────────────────────┘   └─────────────────────┘   └─────────────────────┘

          Edit                       Edit                       Edit

         Store                      Store                      Store

       Main Menu                  Main Menu                  No Address

          Help                       Help                    Main Menu

          Quit                       Quit                       Help

                                                                Quit
```

* Softkey that is displayed when the menu
  is entered for the first time.

Figure 2-4. Configuration Menus Softkeys

```
┌─────────────────┐
│   Test Menu     │
│ Command Screen  │
│ See Figure 2-3  │
└─────────────────┘
```

All Tests

Limited Cal

Resume Testing

Single Test

Repeat Test

Mult Tests   Select

                               End List

Repeat Mult   Abort

Summary   Select

                               End List

Select Output   Abort

Main Menu   Return

Help   None

More Keys   Screen

Quit   Printer *

Purge Disc
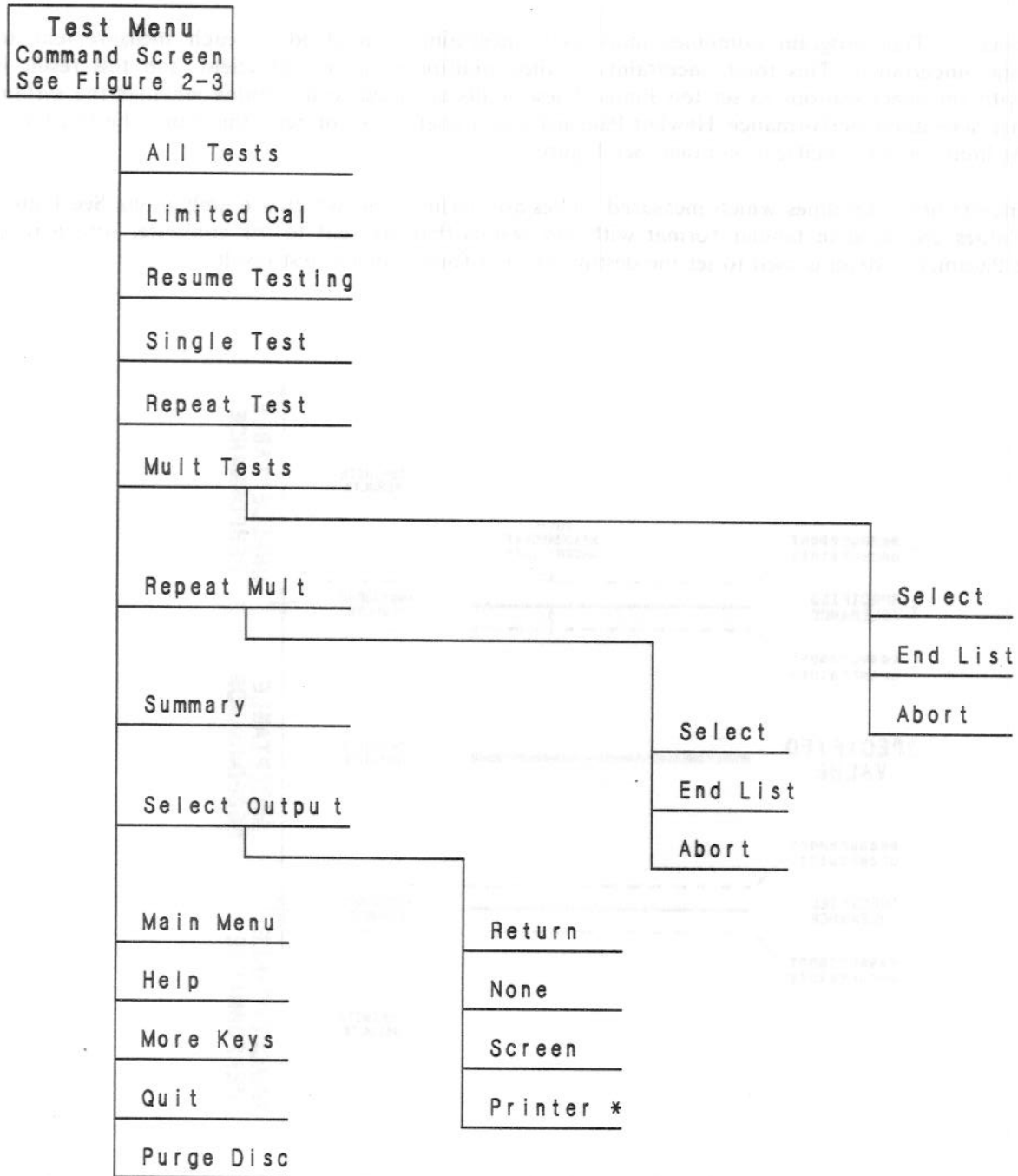
* Softkey is only shown if there is a printer available.

Figure 2-5. Test Menu Softkeys

MEASUREMENT UNCERTAINTY

The Performance Test program combines individual uncertainties involved in each measurement to calculate total uncertainty. This total uncertainty is then multiplied by a coefficient, and this result is combined with the specifications to set test limits. These limits are used to determine whether the system under test has acceptable performance. Hewlett-Packard uses a coefficient of zero; therefore, the test limits are set at the limits of the specification range. See Figure 2-6.

The total uncertainty determines which measured values are definite and which are ambiguous. See Figure 2-6. These values are listed in tabular format with test results that are sent to the computer screen or a printer. The Parameter Menu is used to set the destination and format of the test results.

Figure 2-6. Acceptable Measurement Range
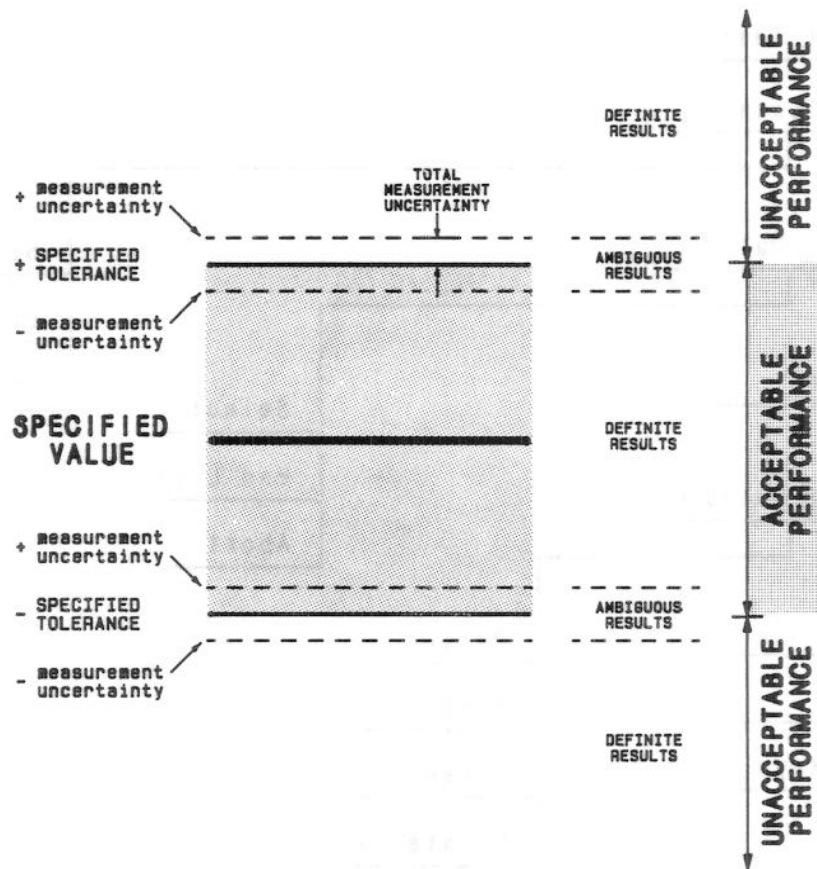
Combining Individual Uncertainties

Individual uncertainties of each measurement are dependent on models of test equipment and measurement technique that the program uses. These uncertainties can be combined to obtain a total measurement uncertainty in two ways: worst case, and root-sum-of-the-squares

Worst Case analysis determines the largest possible value of total measurement uncertainty. This is generated by summing the absolute magnitudes of individual measurement uncertainties as follows:

$$|U_1| + |U_2| + |U_3| + \ldots |U_n|$$

Root-Sum-of-the-Squares (RSS) uncertainty is based on the fact that individual uncertainties are independent of each other. They can, therefore, be combined as random variables as follows:

$$\sqrt{\left(\frac{U_1}{M_1}\right)^2 + \left(\frac{U_2}{M_2}\right)^2 + \left(\frac{U_3}{M_3}\right)^2 \ldots + \left(\frac{U_n}{M_n}\right)^2}$$

where

U_i = uncertainties in the particular measurement (linear)

M_i = expected value of the measurement (in linear)

The RSS is an accurate and statistically significant estimate of the total measurement uncertainty. The Worst Case Sum simply defines the boundaries of the total uncertainty without giving a specific estimate of it. The HP 70700A Digitizer Performance Tests use RSS where appropriate.

Combining Uncertainty and Specification

The way that total measurement uncertainty is combined with the specification is separately controlled for each test. Each test has a measurement uncertainty coefficient that is multiplied by the total measurement uncertainty. This result is then combined with the specification to determine whether it is within specification. The HP 70700A Digitizer Performance Tests program shipped with a modular system has this coefficient set to zero. Figure 2-6 illustrates acceptable performance when the coefficient is set to zero.

The uncertainty coefficient can be changed by modifying the TEST_LIST files. (Since these are ASCII files, the GET and SAVE commands must be used to retrieve and store them.) There is one TEST_LIST file on each Test Disc and on the Operating Disc. This file has a section for each test on that disc. Each section has a line labeled FLAGS. The number after the second comma on a line is the measurement uncertainty coefficient for that test. A negative coefficient tightens the test limit. For example, a coefficient of -1 tightens the test limit by the uncertainty times 1.

NOTE

When the Performance Test program is used to verify warranted performance, the uncertainty coefficient must be zero for all tests. Figure 2-6 illustrates what is acceptable performance (i.e., within specification) when the coefficient is zero.

INSTALLATION/CONFIGURATION

The software must be installed and configured before testing can begin. The installation and configuration procedure given below consists of the following stages:

- Connecting the hardware

- Installing the BASIC language system

- Loading HP 70700A Digitizer Performance Tests software

- Configuring the software

- Loading the test discs

NOTE

Do not use RAM memory volume ":MEMORY, 0, 15". This is used by the program.

Connecting the Hardware

1. Connect the HP 70000 Modular Measurement System to the computer. The computer port used for the connection depends upon the following criteria:

    a. If the computer has an HP 98624A HP-IB Interface, connect the HP 70000 Modular Measurement System HP-IB to the computer port labeled HP-IB SELECT CODE 8. The HP 98624A must be switched to an HP-IB controller device.

    b. If the computer does **not** have an HP 98624A HP-IB Interface, connect the HP 70000 Modular Measurement System HP-IB to the computer port labeled HP-IB SELECT CODE 7.

2. Connect HP-IB cables from the external test equipment to the computer port labeled HP-IB SELECT CODE 7.

3. Connect the HP-IB of the external dual disc drive, if one is used, to the computer HP-IB port labeled HP-IB SELECT CODE 7. Use a 0.5 metre HP-IB cable, such as HP 10833D.

4. Turn on the external test equipment and HP 70000 Modular Measurement System, and allow them to warm up as specified in each respective manual.

5. Turn both the computer and external disc drive on.

Installing the BASIC Language System

6. Refer to the computer manual for instructions on how to load HP BASIC. Due to the variety of computer system configurations possible, it is not appropriate to include detailed language system installation procedures in this manual.

Loading Performance Test Software

7. Insert the disc labeled "Executive Disc #1" into the default drive of the computer. For external disc drives this will be the left-hand drive.

8. Type LOAD "PERF_TST",1.

9. Press [EXECUTE]. After a short time, the computer will beep and instruct you to replace the disc in the default drive (Executive Disc #1) with Executive Disc #2.

10. Press [CONTINUE]. After a short time, the computer will beep and instruct you to replace the disc in the default drive (Executive Disc #2) with the OPERATING disc. After replacing the disc, continue with step 11.

Configuring the Software: Mass Storage Menu

11. Press [CONTINUE]. The computer should display the following message and softkeys:

```
No Mass Storage Parameters were found. Either press Continue to use
defaults, or press EDIT MS to change OPERATING disc.
```

Continue with step 12.

12. Press EDIT MS. The Mass Storage Menu will be displayed.

13. Refer to the Mass Storage Menu section in this chapter. Read the explanation of the Mass Storage Menu. Use the criteria below to determine which parts of the Menu Editing procedure need to be done:

    a. If you intend to use **default** disc drives for software operation and storage, perform only steps 6 and 7 of the Menu Editing procedure in the Mass Storage Menu section. After completing the appropriate portion of the procedure, continue with step 14 below.

    b. If you intend to use memory disc drives other than the default drives, perform steps 1 through 7 of the Menu Editing procedure in the Mass Storage Menu section. After completing the appropriate portion of the procedure, continue with step 14 below.

14. The Main Menu should be displayed on the computer.

Configuring the Software: Parameter Menu

15. Press Parameter Menu. The computer will beep and display an error message with two softkeys. The error message alerts the user that the Parameter Menu needs configuring. Continue with step 16.

16. Press Continue. The Parameter Menu will be displayed.

17. Refer to the Parameter Menu section in this chapter for instructions on setting the value of the program operating parameters. When all the desired parameter values have been entered, and the data is stored, press Main Menu.

18. The Main Menu should be displayed on the computer.

Configuring the Software: Equipment Menu

19. Press *Equipment Menu*. The computer will beep and display an error message with two softkeys. The error message alerts the user that the Equipment Menu needs configuring. Continue with step 20.

20. Press *Continue*. The Equipment Menu will be displayed.

21. Refer to the Equipment Menu section in this chapter for instructions on entering information about the external test equipment. When all data entry is complete, and the data is stored, press *Main Menu*.

22. The Main Menu should be displayed on the computer.

Configuring the Software: HP-MSIB Map Screen Menu

23. Press *HP-MSIB Map*. The computer will search for the HP 70700A Digitizer system listed in the Equipment Menu. When found, the HP-MSIB Map Screen Menu will be displayed. If your system has more than one channel, use the *Channel* softkey to select the channel to be tested.

24. Press *Main Menu*.

Loading the Test Discs

NOTE

Step 25 below assumes the use of the default disc drive. If the Mass Storage Menu has been configured to use memory disc drives other than the default drives, make sure that Test Disc # 1 is placed in the appropriate drive.

25. Place Test Disc #1 into the empty drive.

26. Press *TEST MENU*. The computer will load the test disc and then display the Test Menu. Although the Test Menu contains the directory of all available tests, some of the actual tests may be located on the remaining test discs. If a test is selected that is contained on one of these other discs, the display will produce an error message for a missing disc. Take out Test Disc #1, replace it with the Test Disc called out in the error message, and press *REPEAT*.

27. The software is now ready to begin testing. Refer to Test Menu in this chapter for instructions on using the Test Menu.

28. Refer to the Test Descriptions section in this chapter for important information about the test setups used for each test, and test equipment preparation.

MAIN MENU

The Main Menu is the first menu displayed by Performance Test Software. It provides access to all other program menus. The Main Menu does not have an edit screen.

Menu Softkeys

`Limited Cal` places the program in the Limited Cal mode of the Test Menu. If all of the external test equipment is available for performing the tests, then this mode will execute all Limited Cal tests that are listed in the Test Menu.

NOTE

If the Equipment Menu has not been properly configured, the program cannot perform a complete Limited Cal. Instead, it will run only the Limited Cal tests for which the equipment is configured.

`Mass Storage` displays the Mass Storage Menu, which allows control of the mass storage conditions of the program.

`Parameter Menu` displays the Parameter Menu, which allows control of the operating conditions of the program.

`Equipment Menu` displays the Equipment Menu, which enables entry of model numbers and HP-IB addresses of external test equipment.

`HP-MSIB Map` displays the Map Screen Menu, which shows the systems presently on the HP-MSIB and their HP-MSIB addresses. When a system has more than one channel, this menu allows the user to select the channel to be tested.

`Test Menu` displays the Test Menu. When this softkey is pressed, the program searches the HP-IB for an instrument at each address specified in the Equipment Menu. If an invalid address is found, the program defaults to the Equipment Menu and places parentheses around the corresponding instrument.

`Reprint` provides a printout of test data collected if `Save For Reprinting: Yes` was selected in the Parameter Menu.

`Help` displays a description of the Main Menu and its softkeys. The following softkey is also presented:

> `Return` Press this softkey to return to the command screen.

`Quit` displays the Quit Screen. The screen asks if the program is to be terminated and presents two softkeys:

> `Yes` stops the program, leaving the computer in HP BASIC.

> `No` displays the command screen.

Restart provides a means to restart the program. Note that pressing this softkey sets the program to purge stored test data from the disc, and removes test status in the Test Menu, when the Test Menu is next entered.

MASS STORAGE MENU

The Mass Storage Menu allows the operator to customize disc configuration. This configuration information tells the computer where to find the major sections of the program. These sections are called Volumes. For example, the menu may be configured for storing the Volumes in a Shared Resource Management (SRM) environment.

The Volume labels used by the software are:

DATA: a temporary storage area for individual test equipment parameters and limits

ERROR LOG: contains logging errors.

OPERATING: contains all program data storage.

TEST DISCS: contain(s) system tests. The number of test discs varies depending upon the specific software sent with your manual and the revision of that software.

The location of each Volume is set to default values until changed by the operator. The DATA, ERROR LOG, and OPERATING Volumes are accessed often and should be readily available. They may have the same MSUS (Mass Storage Unit Specifier), and be stored on the same disc.

Although the Volume labels cannot be edited, their MSUS and Directory Path data fields may be changed. For the proper command to use when editing the MSUS field, refer to the Language Reference for the language (e.g., BASIC 4.0 or 5.0) being used. The Directory Path should only be used if an SRM system is used, or you are using BASIC 5.0 or later. Otherwise, leave this field blank.

Menu Editing

1. Move the cursor to the desired Volume label. Then, move the cursor to the MSUS field. The Directory Path field is used only in an SRM environment.

2. Press *SELECT* and type in the new location.

3. Press [ENTER] to terminate data entry.

4. Repeat steps 1 through 3 for each Volume label.

5. Press *DONE* when all editing is finished. This will exit you to the command screen.

6. Press *Store Items* to save the edited information.

7. Press *Main Menu* to return to the Main Menu.

Edit Screen Softkeys

SELECT activates the field indicated by the cursor for data entry.

DONE displays the command screen.

Command Screen Softkeys

Edit Items displays the Mass Storage edit screen.

Store Items stores mass storage parameters on disc for future use.

Main Menu returns the program to the Main Menu.

Help displays a description of the Main Menu and its softkeys. The following softkey is also presented:

> *Return* Press this softkey to return to the command screen.

Quit displays the Quit Screen. The screen asks if the program is to be terminated and presents two softkeys:

> *Yes* stops the program, leaving the computer in HP BASIC.

> *No* displays the edit screen.

PARAMETER MENU

The Parameter Menu allows the user to set, or change, the value of program operating parameters.

Operating Parameters (Edit Screen)

Results sent to: flags program to send test result data to the screen or the HP-IB printer.

	Valid Entries:	Screen
		Printer
		None

Output Format: determines if the test result data will be presented in graph or table form. Enter **Graph** and the data will be in tabular or graph form, depending on the test. A graphics printer is required if the output is sent to a printer. Enter **Table** for results that are several pages long.

	Valid Entries:	Graph
		Short Table
		Table

Save For Reprinting: determines whether the test result data will be saved on disc for reprinting. The stored test results may be reprinted with the *Reprint* softkey in the Main Menu.

The stored test results can be purged with the *Purge Disc* softkey in the Test Menu. Test results are automatically purged when the Test Menu is first re-entered after running the program. The program assumes that the existing test results are from a previous instrument, so it purges the disc record to accommodate new test results.

> Valid Entries: Yes
>   No

Printer Lines: sets the number of lines the HP-IB printer can print per page. The program uses this number to make logical page breaks when printing test results.

> Valid Entries: 50 to 70

Line Frequency: enter the power line frequency. The program prints the selected answer with those test results that can be affected by the power line frequency.

> Valid Entries: 50
>   60
>   400

Ambient Temperature: is used to determine if the test limits should reflect temperature-drift guard-bands. Enter the ambient temperature in Celsius.

> Valid Entries: 0 to 55

Equipment Calibration Period: Enter the number of months that have passed since the external test equipment was calibrated. The program uses this number in some of the measurement uncertainty calculations. It prints the number on the header page of the output report.

Test person's ID.: enter the name or ID number of the person running the program. This information is printed on the output report.

Number lines added: this parameter allows a message to be printed with the test results. Use the following steps to enter a message:

1. Place the cursor to the left of the first "User Line" on the screen and type in the desired message. Each line provides for the entry of up to 20 characters. Use additional lines for messages longer than 20 characters.

2. Place the cursor at "Number lines added" on the display and enter the number of "User Lines" used. Up to thirty lines can be created.

Menu Editing

1. Move the cursor to the Operating Parameter that you want to edit.

2. Press *SELECT* to activate the "User Supplied" field for editing.

3. Type in the new parameter value.

4. Press [ENTER] to terminate data entry.

5. Repeat steps 1 through 4 to change any parameter.

6. Press DONE when all editing is finished. This will exit you to the command screen.

7. Press Store to save the parameter values. If the data is being saved for the first time, the computer will beep and an error message will prompt you to create a file. Press CREATE.

8. Press Main Menu to return to the Main Menu.

Edit Screen Softkeys

SELECT activates the field indicated by the cursor for data entry.

DONE displays the command screen.

Command Screen Softkeys

Edit displays the edit screen.

Store Parms stores the parameter on disc for future use.

Main Menu returns program to the Main Menu.

Help displays a description of the Parameter Menu and its softkeys. The following softkey is also presented:

   Return Press this softkey to return to the command screen.

Quit displays the Quit Screen. The screen asks if the program is to be terminated and presents two softkeys:

   Yes stops the program, leaving the computer in HP BASIC.

   No displays the edit screen.

EQUIPMENT MENU

The Equipment Menu allows the user to enter the model numbers, HP-IB addresses, and serial numbers of external test equipment (ETE). This information is necessary for program operation. If this information is missing, the program may indicate "Missing ETE" next to several tests in the Test Menu. For a list of equipment types required for a specific test, refer to the Test Descriptions section of this chapter.

Using the preferred models ensures the most complete testing capability. Using acceptable models may affect measurement uncertainty.

Edit/Command Screens: Use the edit screen to enter device model numbers, addresses, serial numbers, and availability of equipment. Use the command screen to enter calibration data for the power sensor. The power sensor serial number must be entered in the edit screen. All other serial number entries are optional; their only application is that they are printed on the test results.

NOTE

When the Equipment Menu is exited, or the Test Menu is entered, the program searches the HP-IB for an instrument at each address specified in the Equipment Menu. If an address fails to respond, the program defaults to the Equipment Menu's command screen. Press Edit to display the edit screen, and move the cursor to view the ADDRESS column. Each invalid address will be in parentheses. See the description of No Address in this section.

Device Data Entry

The edit screen is divided into four columns: DEVICE TYPE, DEVICE MODEL, ADDRESS, and SERIAL NUMBER. The DEVICE TYPE cannot be edited. Use the following steps to view the DEVICE TYPE, or edit the other selections:

1. Move the cursor to DEVICE TYPE to see which device types are needed for the tests. See the equipment list for test equipment models supported for this software.

2. Move the cursor to the DEVICE MODEL to be edited and press SELECT to activate the field for data entry.

3. Type in the model number of the equipment selected and press [ENTER].

4. Move the cursor to ADDRESS and press SELECT to activate the field for data entry.

NOTE

The address is a three-digit number consisting of the HP-IB SELECT CODE and HP-IB address of the instrument. For example, if an HP 70000 Modular Measurement System has an HP-IB SELECT CODE of 8, and an HP-IB address of 21, the address that would be entered for the system is 821.

5. Type in the address for the equipment selected. The valid address ranges for an HP 70000 Modular Measurement Series master module are 700 to 730 and 800 to 830. The valid address range for any other equipment is 700 to 730. Any device type with "N/A" indicates that the address is not applicable. Editing "N/A" has no affect.

6. Press [ENTER] to terminate the data entry.

NOTE

If a passive device (e.g., filter) is not available, do not enter a serial number for it. Leave its serial number field blank.

7. Move the cursor to the SERIAL NUMBER column, press *SELECT*, and type in the number. A serial number is a five-digit identifier of any equipment. Serial numbers must be five digits or less.

8. Press [ENTER] to terminate data entry.

9. Repeat steps 1 through 8 for all the required device types.

10. Press *DONE* to display the command screen. Press *Store* to save the equipment data just entered. If the data is being saved for the first time, an error message will be displayed, prompting you to create a file. Press *Create*.

11. Press *Main Menu* to return to the Main Menu.

Edit Screen Softkeys

SELECT activates the field indicated by the cursor for data entry.

DONE displays the command screen.

Command Screen Softkeys

Edit Items displays the edit screen.

Store Equip stores the equipment list on disc for future use.

No Address This softkey is presented only when the program cannot find an instrument at a specified HP-IB address and defaults to this menu. Pressing this softkey automatically deletes these addresses from the edit screen.

Main Menu returns the program to the Main Menu.

Help displays a description of the Main Menu and its softkeys. The following softkey is also presented:

> *Return* Press this softkey to return to the command screen.

Quit displays the Quit Screen. The screen asks if the program is to be terminated and presents two softkeys:

> *Yes* stops the program, leaving the computer in HP BASIC.

> *No* displays the edit screen.

HP-MSIB MAP SCREEN MENU

The HP-MSIB Map Screen Menu lists the modules and corresponding HP-MSIB addresses of the HP 70000 Modular Measurement System under test. The HP-MSIB address of the master module is also the system address. Refer to Equipment Menu in this section for instructions on configuring the software for the system under test.

When the system under test has more than one channel available, the *Channel* softkey allows selection of the channel to be tested. Refer to Testing Multiple Channels under Operation in this section for more information.

Command Screen Softkeys

Channel allows selection of the channel that will be tested.

Main Menu returns the program to the Main Menu.

Help displays a description of the Main Menu and its softkeys. The following softkey is also presented:

> *Return* Press this softkey to return to the command screen.

Quit displays the Quit Screen. The screen asks if the program is to be terminated and presents the following two softkeys:

> *Yes* stops the program, leaving the computer in HP BASIC.

> *No* displays the command screen.

TEST MENU

The Test Menu allows selection of the different types of testing available. It also provides a list of all performance tests.

If the external test equipment required to do one of the tests is not present on the HP-IB, the message *Missing ETE* appears onscreen next to the test. The program will not run a test with missing test equipment.

Once testing begins, the program prompts the operator to make any necessary interconnections between the external test equipment and the system under test. Error messages produced by the program are described in Error Messages in this section.

NOTE

If the Equipment Menu is selected anytime after the testing begins, the status (Pass/Fail/Abort) information is lost.

Command Screen Softkeys

All Tests All tests listed in this menu will be run sequentially.

The following softkeys are presented during testing:

> *End Sequence* The program completes the test in progress and then returns program operation to the Test Selection Menu.

> *Abort Tests* The program interrupts the test in progress and then returns program operation to the Test Selection Menu.

Limited Cal Limited Cal tests listed in this menu will be run sequentially.

The following softkeys are presented during testing:

> *End Sequence* The program completes the test in progress and then returns program operation to the Test Selection Menu.

> *Abort Tests* The program interrupts the test in progress and then returns program operation to the Test Selection Menu.

Resume Testing This softkey appears only when Limited Cal or All Tests has been interrupted by the pressing of the *End Sequence* or *Abort Tests* softkeys. Pressing *Resume Testing* causes the program to continue testing.

Single Test The program runs the test indicated by the cursor.

The following softkey is presented during testing:

> *Abort Test* The program interrupts the test in progress and then returns program operation to the Test Selection Menu.

Repeat Test The program runs the test indicated by the cursor repeatedly until interrupted. This mode indicates, next to the listing of the test being run, how many times the test passed versus how many times it was run (e.g., P=3/5).

The following softkeys are presented during testing:

> *End Sequence* The program completes the test in progress and then returns program operation to the Test Selection Menu.

> *Abort Test* The program interrupts the test in progress and then returns program operation to the Test Selection Menu.

Mult. Tests The program allows the user to define a set of tests to be performed in sequence by the program.

The following softkeys are presented for determining tests:

> *Select* Select a test with the cursor and then use this softkey to assign a number to the test. Numbering starts with one. Tests will be run in the order in which they are numbered.

End List Pressing this key terminates test entry and begins testing.

Abort When pressed, the Test Selection Menu is displayed.

The following softkeys are presented during testing:

End Sequence The program completes the test in progress and then returns program operation to the Test Selection Menu.

Abort Tests The program interrupts the test in progress and then returns program operation to the Test Selection Menu.

Repeat Mult. The program allows the user to define a set of tests to be performed in sequence by the program. These tests will be run repeatedly until interrupted.

The following softkeys are presented for determining tests:

Select Select a test with the cursor and then use this softkey to assign a number to the test. Numbering starts with one. Tests will be run in the order in which they are numbered.

End List Pressing this softkey terminates test entry and begins testing.

Abort When this softkey is pressed, the Test Menu is displayed.

The following softkeys are presented during testing:

End Sequence The program completes the test in progress and then returns program operation to the Test Menu.

Abort Tests The program interrupts the test in progress and then returns program operation to the Test Menu.

Summary provides the operator with a printed copy of the current test results.

Select Output The program allows the user to select the output device.

The following softkeys are presented:

Screen Selects the computer screen as the output device for the test results. This softkey is displayed whenever the screen is not the selected destination for test results. Test-result data is formatted according to the "Type of format for test results?" parameter of the Parameter Menu.

Printer Selects the HP-IB printer as the output device for the test results. The softkey is displayed whenever an HP-IB printer is available but not selected as the output device. Test results data is formatted according to the "Type of format for test results?" parameter of the Parameter Menu.

More Keys If a Series 200 Computer is being use, *More Keys* is shown when there is not room for all of the softkeys to be displayed at one time. Pressing *More Keys* displays the remaining Test Menu softkeys. If a Series 300 Computer is being used, the [Next] and [Prev] keys are used to view all of the available softkeys.

Purge Disc purges the current data storage file of all previous test data.

Main Menu returns the program to the Main Menu.

Help displays a description of the Main Menu and its softkeys. The following softkey is also presented:

Return Press this key to return to the command screen.

Quit displays the Quit Screen. The screen asks if the program is to be terminated and presents the following two softkeys:

Yes stops the program, leaving the computer in HP BASIC.

No displays the command screen.

ERROR MESSAGES

Listed below in alphabetical order are the error messages produced by HP 70700A Digitizer Performance Tests software. These messages indicate operator errors and test status or results.

The DUT must have an HP-IB address is displayed when an attempt is made to leave the Equipment Menu, but the program cannot find the HP 70000 system at the HP-IB address specified.

Disc not initialized. This error message indicates a blank disc has not been initialized. After correcting the condition, press [CONTINUE] to return to normal operation.

Enter serial number first. A device serial number must be specified before calibration data can be edited or used.

Equipment list is not acceptable. The equipment selected is not on the HP-IB.

ERROR: Address is HP-IB controller address The HP-IB allows only one instrument per address. The address entered, probably 7, is reserved for the controller. Use another address.

ERROR: Address matches system disc drive The HP-IB allows only one instrument per address. The address entered matches the address of the external disc drive.

ERROR: Address not in acceptable range The HP-IB address entered must be between 700 and 730 or 800 and 830.

ERROR: Duplicate HP-IB address The HP-IB allows only one instrument per address. The same address has been entered for two different instrument model numbers.

ERROR: Non-responding HP-IB address indicates controller cannot locate an instrument at an HP-IB address. Check actual instrument addresses with address values loaded in the Test Equipment Menu.

Error XXX_____encountered This message appears if an abnormal operation of the software has been attempted. If this message appears, contact an HP Sales and Service Office.

Fail This error message indicates that the system failed the test limits.

File already exists This message appears if an attempt is made to store or save a file that already exists on the disc. This error should not occur in normal operation.

File not on disc The file accessed is not on the disc. This error should not occur unless a disc was improperly changed.

Passed This error message indicates that the system passed the test limits.

PRGM ERROR (Program Error) This error message indicates that the program has detected an error in itself. Contact an HP Sales and Service Office for assistance.

Testing_____dd_mmm_yyyy indicates the date that the test (e.g., Calibrator Amplitude) was last modified.

Timed Out indicates that the program aborted the test.

Unable to locate disc or disc changed The appropriate disc is missing. After this condition has been corrected, press [CONTINUE] to return to normal operation.

TEST DESCRIPTIONS

Each test description contains the following information: the specification being tested, whether the test is performed in the Limited Cal mode, a description of the test algorithm, a list of necessary test equipment, and a description of the test equipment setup. Test descriptions list external test equipment by generic type. Refer to the Required Test Equipment section of this chapter for a listing of acceptable model numbers for each type of test equipment.

TEST LIST

Tests of Specified Performance

1. Effective Number of Bits
2. Distortion
3. Gain Accuracy
4. Offset Accuracy
5. Frequency Response
6. Input Isolation
7. Reference Clock Accuracy

Functional Tests

8. Random Event Capture
9. External Trigger
10. High Sweep
11. Input Verification (manual test)
12. Sync Out (manual test)

1. EFFECTIVE NUMBER OF BITS

Purpose

This test verifies the specification EFFECTIVE NUMBER OF BITS. It runs in the Limited Cal mode.

Description

The HP 70700A clock frequency is calculated using an FFT measurement. To improve the measurement uncertainty, test frequencies are selected that are not harmonically related to the digitizer's calculated clock frequency. Reference level measurements are made without the external filter. The filter is then inserted and the signal level is adjusted back up to the reference level. A time domain measurement is then made. An idealized best-fit sine wave for the data is identified. The rms error between the actual data and the best-fit sine wave is found and the effective number of bits is calculated.

Uncertainties

The following characteristic contributes to uncertainties:

- Digitizing uncertainty

Equipment

Level Generator
1 MHz Low-Pass Filter
10 MHz Low-Pass Filter

Equipment Setup

Connect the 50Ω output of the level generator directly to Input 1 of the Digitizer (DUT) for the reference measurement. Then connect the 50Ω output of the level generator to the input of the low-pass filter and connect the output of the low-pass filter to Input 1 of the HP 70700A Digitizer.

2. DISTORTION

Purpose

This test verifies the specification DISTORTION. It runs in the Limited Cal mode.

Description

The HP 70700A clock frequency is calculated using an FFT measurement. To improve the measurement uncertainty, test frequencies are selected that are not harmonically related to the digitizer's calculated clock frequency. Reference level measurements are made without the external filter. The filter is then inserted and the signal level is adjusted back up to the reference level. A frequency domain measurement is then made. The distortion is measured as the difference between the largest response and the next largest response in the frequency domain measurement.

Uncertainties

The following characteristics contribute to uncertainties:

- FFT amplitude interpolation error
- Source harmonics

The RSS total of these uncertainties is calculated for each measurement.

Equipment

Level Generator
1 MHz Low-Pass Filter
10 MHz Low-Pass Filter

Equipment Setup

Connect the 50Ω output of the level generator directly to Input 1 of the Digitizer (DUT) for the reference measurement. Then connect the 50Ω output of the level generator to the input of the low-pass filter and connect the output of the low-pass filter to Input 1 of the HP 70700A Digitizer.

3. GAIN ACCURACY

Purpose

This test verifies the specification INPUT, Voltage Range. It runs in the Limited Cal mode.

Description

The gain accuracy can be checked by comparing the measured value to a known value. The dc source is set to a dc voltage which is 100% of the selected voltage range. (Both positive and negative voltages are checked.) This voltage is measured by the voltmeter. The HP 70700A also measures the voltage, taking the average of a 1024-point trace. The difference between these voltages is used to calculate the percent error. This process is repeated for each voltage range (20V, 6V, 2V, and 0.6V).

Uncertainties

The following characteristic contributes to uncertainties:

- Voltmeter measurement uncertainty

Equipment

DC Source
Voltmeter

Equipment Setup

Connect the dc source output to Input 1 of the HP 70700A Digitizer. Also connect Input 1 to the input of the 1 MHz low-pass filter. Then connect the output of the filter to the voltmeter's volts input. (Refer to Specialized Test Equipment in the Required Test Equipment section of this chapter for more information about the 1 MHz filter.)

4. OFFSET ACCURACY

Purpose

This test verifies the specification INPUT, Offset Voltage. It runs in the Limited Cal mode.

Description

The dc source is set to dc volts with 0 volts of offset. The voltage is measured by the voltmeter to establish a reference for measuring the offset accuracy of the HP 70700A Digitizer. The digitizer is then set to an offset voltage and a time domain measurement is made. The average of this 1024-point trace is compared to the reference voltage to calculate the percent error for the offset voltage being tested. The process is repeated at several positive and negative offset increments for each voltage range (20V, 6V, 2V, and 0.6V).

Uncertainties

The following characteristic contributes to uncertainties:

• Voltmeter measurement uncertainty

Equipment

DC Source
Voltmeter

Equipment Setup

Connect the dc source output to Input 1 of the HP 70700A Digitizer. Also connect Input 1 to the input of the 1 MHz low-pass filter. Then connect the output of the filter to the voltmeter's volts input. (Refer to Specialized Test Equipment in the Required Test Equipment section of this chapter for more information about the 1 MHz low-pass filter.)

5. FREQUENCY RESPONSE

Purpose

This test verifies the specification INPUT, Bandwidth, and checks the input impedance. It runs in the Limited Cal mode.

Description

The HP 70700A input is set to dc, at 50Ω. The level generator frequency is set to 1 kHz. A frequency domain measurement is made to obtain a reference level. The input signal frequency is stepped from 1 kHz to 50 MHz, and the peak amplitude is measured at each frequency. The process is repeated for each voltage range (20V, 6V, 2V, and 0.6V) to verify the bandwidth.

The 1 kHz reference level, measured with the level generator, is used as a reference for low frequency testing. The level generator is replaced by the function generator and its amplitude is adjusted to the reference level. The input signal is stepped from 1 Hz to 1 kHz, and the peak amplitude is measured at each frequency. Only the 2V range is tested.

Finally, the input is changed to ac at 1 MΩ, and the 2V range is tested over the 1 Hz to 1 kHz frequency range.

When the test is run in the Limited Cal mode, only the high frequency response is measured.

Uncertainties

The following characteristics contribute to uncertainties:

- Source amplitude accuracy
- FFT amplitude interpolation error

The RSS total of these uncertainties is calculated for each measurement.

Equipment

Function Generator
Level Generator

Equipment Setup

Connect the level generator output to Input 1 of the HP 70700A Digitizer for the high (>1 kHz) frequency part of the test. Then connect the function generator output to Input 1 of the HP 70700A Digitizer for the low (<1 kHz) frequency part of the test.

6. INPUT ISOLATION

Purpose

This test verifies the specification INPUT, Isolation. It should be run after repairs to inputs, the cabling, or the A4 Converter board assembly.

Description

A 2V, 9.5 MHz signal from the level generator is sent to Input 1 of the HP 70700A Digitizer. The amplitudes at Input 1 and Input 2 are measured by the digitizer. The difference between the amplitudes is a measure of the isolation between the two channels.

Uncertainties

The following characteristic contributes to uncertainties:

- FFT amplitude interpolation error

Equipment

Level Generator

Equipment Setup

Connect the level generator output to the HP 70700A Digitizer's rear-panel Input 1.

7. REFERENCE CLOCK ACCURACY

Purpose

This test verifies the accuracy of the internal clock. It runs in the Limited Cal mode.

Description

The level generator signal is set to 5 MHz and then is input to the digitizer (DUT). A frequency domain sweep, in a 10 MHz span, is taken. The trace location of the peak signal is determined. This information is used to narrow the span to 8 kHz, and another measurement is made. The actual trace location of the signal is compared to the expected location to calculate the error in the clock frequency.

Uncertainties

The following characteristics contribute to uncertainties:

- Source frequency error
- FFT frequency interpolation error

The RSS total of these uncertainties is calculated for each measurement.

Equipment

Level Generator

Equipment Setup

Connect the output of the level generator to Input 1 of the HP 70700A Digitizer.

8. RANDOM-EVENT CAPTURE

Purpose

This test verifies the operation of the random-event capture feature.

Description

The function generator is set to "burst" three cycles of a 95 kHz sine wave every 5 ms. The HP 70700A is put in the random-event capture mode and set to trigger on either edge at a level of 0.5V. One hundred and fifty trigger events are stored, and the timing is compared to the known values. If they are all correct, the operation of the random-event capture mode is verified.

Uncertainties

None (functional check only)

Equipment

Function Generator

Equipment Setup

Connect the function generator output to the Input 1 of the HP 70700A Digitizer.

9. EXTERNAL TRIGGER

Purpose

This test verifies the operation of the External Trigger input.

Description

The pulse generator trigger output is set to output a trigger pulse to the Digitizer's External Trigger input. The program loops ten times, each time deciding whether or not to send out a trigger. Each time the program loops, the digitizer's Operation Complete status is checked to see if it corresponds to the trigger/no-trigger condition. In this way the functional operation of the external trigger input is verified.

Uncertainties

None (functional check only)

Equipment

Pulse Generator

Equipment Setup

Connect the pulse generator trigger output to the External Trigger input on the HP 70700A Digitizer.

10. HIGH SWEEP

Purpose

This test verifies the operation of the High Sweep input. It should be run after a repair to the connector or the A5 Processor board assembly.

Description

The pulse generator is set to send a 0 to 5 V, 3 Hz pulse to the HI SWP port of the HP 70700A Digitizer. The pulse generator's trigger output is connected to the digitizer's External Trigger input. The digitizer is set for single sweep at one second and the pulse generator sends a trigger to the digitizer. Since data is only taken when High Sweep is high, the resulting trace length should be high for 1/3 of the sweep. The number of trace points is counted and compared to the number of points in a full trace divided by three (±10%).

Then the HI SWP port of the HP 70700A is connected to the voltmeter. The voltage level out of the HI SWP port is measured with the high sweep drive enabled and disabled. These two values are compared to acceptable TTL levels to determine the port's functionality.

Uncertainties

None (functional check only)

Equipment

Pulse Generator
Voltmeter

Equipment Setup

1. Connect the output of the pulse generator to the HI SWP port on the HP 70700A Digitizer. Connect the trigger out of the pulse generator to the external trigger input of the digitizer.

2. Disconnect the pulse generator output from the HI SWP port and connect the HI SWP port to the input of the voltmeter.

11. INPUT VERIFICATION

Purpose

This is a manual test to verify the functionality of the front- and rear-panel Input 1 and Input 2 ports.

Description

A 2V, 2.5 kHz signal from the pulse generator is sent to the rear-panel Input 1 of the HP 70700A Digitizer. The amplitude is measured. The signal is then input to the front-panel Input 1 and measured to see if the amplitude is within ±1% of the rear-panel Input 1.

The signal is then input to the rear-panel Input 2 and the amplitude is measured. The values of the front-panel Input 1 and rear-panel Input 2 measurements are compared to verify the operation of the second input.

Uncertainties

None (functional check only)

Equipment

Function Generator

Equipment Setup

Connect the output of the function generator to the HP 70700A Digitizer rear-panel Input 1.

Procedure

1. Set the function generator output to 2.5 kHz at 2V.

2. Execute an instrument preset on the HP 70700A Digitizer by pressing the green [I-P] key on the display.

3. Set the digitizer as follows:

chan 1 50 Ω	enabled
chan 1 VOLTS/DIV	250 mV
timebase SEC/DIV	100 µs
markers AUTO PITPEAK	enabled

4. Note the "pitpeak" amplitude of the signal in the lower right-hand corner of the display screen.

5. Disconnect the function generator output from the digitizer's rear-panel Input 1 and connect it to the front-panel Input 1 port.

6. Measure the amplitude by pressing *AUTO PITPEAK* again. The difference between the front-panel and rear-panel Input 1 amplitudes should be less than 1% of full scale, 20 mV.

7. Disconnect the function generator output from the front-panel Input 1 port and connect it to the rear-panel Input 2 port. Press *chan 1* and then *INPUT 2* to select the digitizer's second input.

8. Press *markers* and *AUTO PITPEAK* to make a measurement. The difference between the front-panel Input 1 and the rear-panel Input 2 amplitudes should be less than 1% of full scale, 20 mV.

12. SYNC OUT

Purpose

This is a manual test that verifies that the Sync Out port on the HP 70700A is functional.

Description

A signal from the function generator is sent to the external trigger input of the digitizer (DUT). When this trigger is received by the digitizer, it should send out a sync pulse. The sync pulse is then input to the digitizer so it can be measured. The displayed sync pulse should be a TTL ouput.

Uncertainties

None (functional check only)

Equipment

Function Generator

Equipment Setup

Connect the function generator output to the HP 70700A Digitizer's External Trigger Input. Connect the digitizer's Sync Out to its rear-panel Input 1.

Procedure

1. Set the function generator to 2.5 kHz with a peak-to-peak amplitude of 4V and an offset of 2V.

2. Execute an instrument preset on the HP 70700A Digitizer by pressing the green [I-P] key on the display.

3. Set the digitizer as follows:

chan 1 DC	enabled
chan 1 TTL	enabled
trigger EXTERNL	enabled
trigger AUTO	enabled
display TRACE LENGTH	20 points
display GRID	enabled

4. The displayed pulse should originate near the center graticule. See Figure 2-7. Verify that the "high" and "low" voltages meet the standard TTL requirements; that is, the high should be $\geq 2.4V$ and the low should be $\leq 0.4V$. (Note that this is a functional check only.)
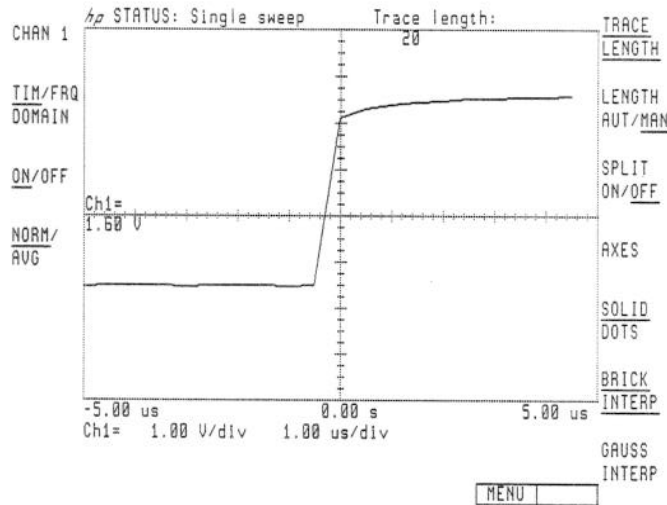
Figure 2-7. Sync Output

Chapter 3
ADJUSTMENTS

INTRODUCTION

There are no performance adjustments for the HP 70700A Digitizer. There is one factory-selected component, and a procedure for its selection is included in this chapter.

SAFETY CONSIDERATIONS

This module has been designed in accordance with international safety standards. This manual contains information, cautions, and warnings which must be followed to ensure safe operation and to retain the module in a safe condition. Service and adjustments should be performed only by qualified service personnel.

> **CAUTION**
>
> To avoid blowing the mainframe line fuse or any module fuse, the mainframe line power must be set to OFF before connecting or disconnecting the module service extender cable.

FACTORY-SELECTED COMPONENTS

The following procedure affects the module's electrical performance. It should only be performed by qualified service personnel. This procedure should not be performed as routine maintenance, but only when A4U68 or A4R63 is replaced.

A4R63 is a factory selectable component. Its value is determined by the manufacturer's part number on A4U68. The list below indicates the preferred value for each manufacturer's part number:

A4U68 Manufacturer Part Number	A4R63 Value (HP Part Number)
CX20220	11Ω (0698-7189)
CX20220A	23.7Ω (0698-7197)

Chapter 4
TROUBLESHOOTING

INTRODUCTION

This chapter provides assembly-level troubleshooting information for the HP 70700A Digitizer module. It includes information on the module's internal self-test routine. It also includes a module block diagram and detailed descriptions of the error codes and messages that are generated during normal operation.

Once the assembly to be replaced has been identified, refer to the Verification information below for the necessary performance tests required to verify the repair. If a component on an assembly is changed, test as if the entire assembly were changed.

DIGITIZER SELF TEST

The digitizer will perform a self-test routine at power-on. To run the self-test routine again, press *utility* and *SELF TEST* on the system display. Refer to the information on self-test and the error code descriptions if any errors result.

DIGITIZER CALIBRATION

The digitizer will perform a calibration routine at power-on if it does not find any calibration data in memory. If the data is already in memory, the calibration routine is not run. The calibration routine can be executed at any time by pressing *utility* and *INVOKE CALIB* on the system display.

DOWNLOADING RAM

The HP 70700A Digitizer has firmware in ROM and in battery-backed-up RAM. The RAM may have its data erased under certain conditions (e.g., the A5 Processor board assembly battery's being shorted or failing). Error message 6385 is an indication of this. A service accessory is available to allow reloading of the data in RAM using HP Series 200 or Series 300 computers. The kit number is indicated under Service Accessories, below.

VERIFICATION

Verification of the module's performance is required after any repair. The assemblies being repaired or replaced require different tests to verify their operation. A list of the verification that should be performed after repairing each assembly is indicated below:

Assembly Repaired	Verification
A1 Status board	Self-Test (verify that the LEDs light)
A2 Mother board	Self-Test (verify that the LEDs light)

Assembly Repaired (Continued)   **Verification**

A3 Address board . . . . Self-Test
Random Event Capture test
A4 Converter board . . . . Self-Test
Calibration
all of the Performance Tests (except High Sweep)
A5 Processor board . . . . Self-Test
High Sweep test
W1 Fr. Panel Input Cable . . . . Input 2 Verification
W2 HP-MSIB Cable Assembly . . . . Self-Test
access the address map and select the digitizer

SERVICE ACCESSORIES

HP Part Number 70001-60013: Module Service Extender
HP Part Number 70900-60058: Board Extender
HP Part Number 5021-7445:   Connector Pin Straightener
HP Part Number 10871-60002: 1, 5, 10 MHz Low-Pass Filter Assembly
HP Part Number 70700-60011: Downloading RAM Kit

POWER-ON

At power-on one or more Error LED may be flashing at a 1 Hz rate. This is an indication of an HP-MSIB error and may be caused by any module. The faulty module must be identified before continuing. Refer to the HP 70700A Digitizer Installation and Verification Manual for more information on identifying the faulty module.

If the HP 70700A cannot complete its power-on sequence (e.g., cannot establish a link with the display and/or the front-panel LEDs remain lit), check the power supplies. Remove the module from the HP 70001A Mainframe, install it on the module service extender, and remove the module's top cover. Verify that the four green LEDs on the A5 Processor board assembly are lit. The module can be powered on with the A5 Processor board assembly on extenders. Refer to Chapter 5, Replacement Procedures, for detailed information on removal of the A5 Processor board assembly.

+5 volts (TP16)	DS12 (near bottom of board)
−5.2 volts (TP17)	DS11 (near bottom of board)
+12 volts (TP18)	DS9 (near top of board)
−12 volts (TP19)	DS10 (near top of board)

SELF-TEST AND CALIBRATION

The HP 70700A Digitizer performs calibration and self-test routines at power-on, though the calibration is only executed if there is no calibration data stored in memory. The self-test and calibration routines can be executed separately at any time using the softkeys on the display or through remote commands. The internal calibration routine provides sufficient compensation for about ±10°C variation in room temperature. If the instrument is being used at a temperature of more than 10°C away from the temperature at which it was calibrated, the calibration routine should be run again.

The LEDs indicate which part of the power-on routine is in progress. The front-panel LEDs are a coarse indication, and the LEDs on the processor board assembly are a fine indication, of the routine in progress. The front-panel LEDs are indicated by the first letter of their name. An upper-case letter indicates that the LED is on. When the letter is lower-case it indicates that the LED is turned off.

> A Active (ACT)
> E Error (ERR)
> R Remote (RMT)
> L Listen (LSN)
> T Talk (TLK)
> S Service Request (SRQ)
> M Measure

There are eight LEDs on the processor board which indicate what part of the test is in progress. They light in the binary representation of a hexadecimal number. The hexadecimal numbers are indicated below along with the part of the test that they represent.

A E R L T S M The processor self-test is located in ROM. The processor has been reset and is beginning its self-test program. The U21 versatile interface adapter (VIA) and the HP-IB and HP-MSIB circuitry are being initialized. The processor board assembly LEDs are off.

A E R L T S m The processor is performing the HP-MSIB power-on check. The processor board assembly LEDs are off.

A E R L T s m The processor is performing its test. The LEDs on the processor board assembly indicate:

> **05** ROM checksum
> **04** RAM data test
> **03** RAM address test
> **02** VIA test
> **01** Wait state test

The rest of the self-test program is stored in RAM. If it cannot be located, the test will stop here.

A E R L t s m If the clock is present, the processor performs a synchronous write to the address board. If this operation is not successful, the test will stop here. The processor board assembly LEDs are off.

A E R l t s m The address board test is in progress. The LEDs on the processor board assembly indicate:

01 Microprocessor bus and write address test
02 Read address test
03 Shield address test
04 Segment size too short test
05 Segment size too long test
06 Inhibit read reset test
07 Inhibit write reset test
08 Write address counter test
09 Clocks-per-sample too early test
10 Clocks-per-sample too late test
11 Trigger reset test
12 Trigger set test
13 Writes-after-trigger timer too early test
14 Writes-after-trigger timer too late test
15 Writes address counter stopped
16 Writes-after-trigger counter stopped
17 Clocks-per-sample counter stopped
18 Clocks-per-sample counter stuck
19 Writes-after-trigger waiting for trigger test
20 Writes-after-trigger started by trigger test
21 Writes-after-trigger reload test
22 Write address and writes-after-trigger test of least significant bits
23 Trace starting before the trigger test
24 Trace not started by the trigger test
25 Timebase switched too early test
26 Timebase switched too late test
27 Time RAM "ones" test
28 Time RAM "zeros" test
29 Time counter/RAM test
30 Starting address test
31 Time RAM delay test
32 Time RAM post trigger test
33 Time RAM time between triggers test
34 Too many triggers test

A E R l t s m The converter board test is in progress. The LEDs on the processor board assembly indicate:

50 ADC stuck low test
51 ADC stuck high test
52 ADC codes test
53 Trace memory test
54 Positive peak detector test
55 Negative peak detector test
56 Positive peak detector reset test
57 Negative peak detector reset test
58 Positive and negative peak detector comparison test
59 Gain is X3 test
60 Gain is X1 test
61 Gain is X.3 test

62 Gain is X.1 test
63 Positive slope hysteresis test
64 Positive slope trigger test
65 Negative slope hysteresis test
66 Negative slope trigger test
67 Above the level trigger reset test
68 Above the level trigger set test
70 Below the level trigger reset test
71 Below the level trigger set test
73 Random Event Capture trigger reset test

A e r l t s m The gain and offset calibration is in progress. The LEDs on the processor board assembly indicate:

17 Gain Calib: measuring Vref for X0.1 gain
16 Offset Calib: measuring GND for X0.1 gain
15 Gain Calib: measuring Vref for X0.3 gain
14 Offset Calib: measuring GND for X0.3 gain
13 Gain Calib: measuring Vref for X1 gain
12 Offset Calib: measuring GND for X1 gain
11 Gain Calib: measuring Vref for X3 gain
10 Offset Calib: measuring GND for X3 gain

ERROR CODES

The error codes generated by the HP 70700A Digitizer are listed below in numerical order. A description of the error meaning is given. Some errors are generated while operating, and others will only occur during the self-test routine. It can be helpful to know where in the self-test sequence the failure occurred. This provides information on which areas of the module have already been tested, and which have yet to be tested, when the error occurs. The Self-test description in this chapter includes this information.

HP 70700A Digitizer error codes with negative numbers have HP-SL (Hewlett-Packard Systems Language) defined categories and descriptions. Error codes with positive numbers are device-dependent.

Descriptions of the error codes are given below. All errors reported on the display screen indicate the model number and HP-MSIB address along with the error message. Errors reported remotely do not. For some of the hardware errors described below, the reference designator and board assembly name (e.g., A3 Address board assembly) are given in square brackets for the assembly most likely to have caused the error.

Both the negative and positive error codes are separated into functional types which are indicated below:

Negative Error Codes

Types	Numbers
Command	−100 to −199
Execution	−200 to −299
Internal/Hardware	−300 to −399
Query	−400 to −499

Positive Error Codes

Types	Numbers
No Errors	0000
Usage/Operating	2000 to 2999
Hardware Warning	6000 to 6999
Hardware Broken	7000 to 7999

NEGATIVE ERROR CODES

Command Errors

These errors are generated when the module cannot understand a remote programming message.

−**100 unrec cmd** (unrecognized command) A command not in the device command table was received.

−**101 inval chr** (invalid character) A non-numerical parameter is unrecognized or not valid.

−**110 cmd hdr** (command header) There was an error in a command header.

−**111 hdr delim** (header delimiter) The wrong header delimiter was received. The module expected ":".

−**120 num arg** (numerical argument) There is a problem with a numerical argument.

−**121 exp num** (expected numeric) The device expected a numerical argument instead of what it received.

−**123 num ovrflw** (number overflow) The number received exceeds the internal representation format of the device.

−**129 miss num** (missing numeric) A numerical argument was required, but not received.

−**130 non-num arg** (non-numeric argument) There is a problem with a non-numerical argument.

−**131 exp chr** (expected character) The device expected a single character.

−**132 exp str** (expected string) The device expected a string (i.e., "text" or 'text').

−**133 exp bin** (expected binary) The device expected a binary parameter (i.e., #x...).

−**134 too long** (too long) The parameter(s) are too long (e.g., a string longer than 31 characters).

−**139 miss non-num** (missing non-numeric) A non-numerical parameter was required, but not received.

−**142 too many arg** (too many arguments) More arguments were received than were expected.

−**143 arg delim** (argument delimiter) The wrong argument delimiter was received. (Generally, "," is expected.)

−**144 mess delim** (message delimiter) The wrong message delimiter was received. (**<LF>** or **<END>** is expected.)

Execution Errors

These errors occur when the device cannot successfully perform an operation requested from the remote interface.

–200 ex err (execution error) There is an execution error.

–201 not ex in lcl (not executable in local) This command is not executable when the device is in local.

–202 set lost (settings lost) Due to the execution of this command, some settings were lost.

–203 trig ign (trigger ignored) The trigger condition was ignored.

–211 set confl (setting conflict) This command is in conflict with other device settings.

–212 arg rng (argument range) The numerical argument(s) are outside the acceptable range of settings for this command.

–221 busy (busy) The device is too busy to execute the command (e.g., requesting that the module save two waveforms at the same time).

–222 insuf capab (insufficient capability) The device does not have enough capability or the correct configuration to execute this command.

–232 out buf full (output buffer full) The output buffer (I/O) is full.

Internal/Hardware Errors

These error messages indicate that there is a hardware problem that prevents operation. Unless otherwise noted, these error conditions are checked for at power-on and self-test only.

–300 hrdwr (hardware) There is a problem with the hardware that cannot be identified more specifically.

–301 intr (interrupt) There is a failure of the interrupt system. This is checked continuously, rather than during self-test only.

–302 sys err (system error) There is a problem with the system rather than with the module itself.

–303 time out (time out) The instrument has timed out waiting for the trace to complete. This error occurs if trace information has been requested and it is not available in time.

–310 RAM addr (RAM address) The address bus on the A5 Processor board assembly is of questionable integrity.

–311 ___ data (U31 data) or (U32 data) The U31 or U32 RAM failed a data read/write test.

–312 data (batt?) (data [battery?]) Some or all of the data in the battery-backed-up RAM has been lost. (This is checked at power-on only, not during self-test.)

−321 ___ chksm (U43 checksum) or (U44 checksum) The U43 or U44 ROM failed its checksum test.

−322 incompatible (incompatible) The hardware in the device is not 100% compatible with the firmware.

−330 PON test (power-on test) The self-test executed at power-on failed.

−340 self test (self test) The self-test failed.

−350 too many err (too many errors) There are too many errors to fit into the error buffer. All subsequent errors are lost.

Query Errors

These errors occur when the instrument receives an incorrect query or one that it cannot understand.

−400 qry (query) The query is incorrect or incomplete.

−410 qry intr (query interrupted) The query was interrupted.

−420 qry unt (query unterminated) The query is unterminated.

−421 in prog (in progress) The query is in progress.

−422 empty (empty) The device was addressed to talk, but it has nothing to say.

−430 deadlock (deadlock) The I/O buffers are full, and the device cannot do anything without destroying commands or data.

POSITIVE ERROR CODES

0000 No errors (no errors) There are no errors.

Usage/Operating Errors

These errors occur when the instrument is used incorrectly.

2100 unsupported (unsupported) The command received is executable, but not guaranteed to work with all revisions of firmware.

Hardware Warning Errors

These error messages report the status of the HP 70700A Digitizer hardware or indicate that some hardware of the HP 70700A Digitizer may be broken. Measurement validity may be impaired. Unless otherwise noted, these errors are checked for during power-on and self-test only.

6200 discont time (discontinuity timing) During a random-event capture (REC) measurement, the time between two triggers exceeded the hardware's ability to record the data. (This may be a measurement error, rather than a hardware failure.)

6327 time ram: 1 (time RAM: 1) The time RAM did not pass the "ones" test. The time RAM is filled with "ones" and then read. The error occurs if the values read are not ones. [A3 Address board assembly]

6328 time ram: 0 (time RAM: 0) The time RAM did not pass the "zeros" test. The time RAM is filled with "zeros" and then read. The error occurs if the values read are not zeros. [A3 Address board assembly]

6329 time cntr, ram (time counter, RAM) The time counter or RAM is not working properly. The time RAM counters were reset and then allowed to run for one second. The time is read and compared to the expected value. [A3 Address board assembly]

6330 add1 (add1) The add1 line is not working. After a random event capture measurement, the start address should not be zero. It is checked by setting the read address to zero and then checking the inhibit read (−INHRD) line. If −INHRD is set, then the address was zero and the error is generated. Check the ADD1 line on the A3 Address board assembly.

6331 1st time ram # (first time RAM number) The delay time of the time RAM is in error. In the random event capture mode, a series of software triggers are generated and approximately one hundred trigger times are written to the time RAM. The first trigger time written should approximate the circuit delay. If this time does not correspond to the expected value, an error is generated. [A3 Address board assembly]

6332 tm rm post trig n 0 (time RAM post trigger not zero) The test expected to see zeros in the time RAM at this point in the test. In the random-event capture mode, a series of software triggers are generated and approximately one hundred trigger times are written to the time RAM. The second trigger time read should be zero, or an error is generated. [A3 Address board assembly]

6333 tm rm time bet trigs wrng (time RAM time between triggers wrong) The time RAM sequence is not as was expected. In the random-event capture mode, a series of software triggers are generated and approximately one hundred trigger times are written to the time RAM. The last trigger time should be a large number followed by a zero, or an error is generated. [A3 Address board assembly]

6334 too many trigs (too many triggers) The hardware received too many triggers. In the random-event capture mode, a series of software triggers are generated and approximately one hundred trigger times are written to the time RAM. This process should not have caused the inhibit write (−INHWR) to go low. The error was generated because it did go low. This could be caused by glitches in the converter triggering circuitry, or trigger reset (−TRESET) might be stuck high. [A3 Address board assembly]

6350 adc bit stuck low: _____ (adc bit stuck low:) Behind the error message is the number of the suspected bit, from 0 to 9. This error is caused by bits in the data path from U68 to the RAM being stuck low. [A4 Converter board assembly]

6351 adc bit stuck high: _____ (adc bit stuck high:) Behind the error message is the number of the suspected bit, from 0 to 9. This error is caused by bits in the data path from U68 to the RAM being stuck high. [A4 Converter board assembly]

6352 adc missing code # (adc missing code number) This error occurs when the self-test fails to generate an ADC code. A long trace is made ramping through every ADC code. The missing code number (from 0 to 1023) is indicated after the error. [A4 Converter board assembly]

6353 mem addr low bits (memory address low bits) This error means that memory addressing error(s) exist. A long ramping trace is made, filling all of the trace memory. The data is then read and compared to an expected value. The error is generated when the two values are not close enough. [A4 Converter board assembly]

6354 +pk det (positive peak detector) The positive peak detector is not working. A high frequency triangle wave is created by the DAC and then detected using the alternate mode. The positive peak value should be 1023; if it is not, an error is generated. The positive peak data lines may be short or open, or the offset DAC may not be operating over its full range (0 to 5 volts). [A4 Converter board assembly]

6355 −pk det (negative peak detector) The negative peak detector is not working. A high frequency triangle wave is created by the DAC and then detected using the alternate mode. The negative peak value should be 0; if it is not, an error is generated. The negative peak data lines may be short or open, or the offset DAC may not be operating over its full range (0 to 5 volts). [A4 Converter board assembly]

6356 +pk det n reset (positive peak detector not reset) The positive peak detector did not reset when it should have. A high frequency triangle wave, followed by a mid-scale value is created by the DAC and then detected using the alternate mode. The detector should keep the positive peak during the triangle wave and then hold the mid-scale value, or the error is generated. [A4 Converter board assembly]

6357 −pk det n reset (negative peak detector not reset) The negative peak detector did not reset when it should have. A high frequency triangle wave, followed by a mid-scale value is created by the DAC and then detected using the alternate mode. The detector should keep the negative peak during the triangle wave and then hold the mid-scale value, or the error is generated. [A4 Converter board assembly]

6358 dets n equal (detectors not equal) The positive peak and negative peak detectors are not clocking the same value. With the alternate mode selected, the outputs of positive and negative peak detectors are compared. An error is generated if the difference is too large. [A4 Converter board assembly]

6359 gain< >3 (gain is less than or greater than 3) "Gain=3" has an error. Sets the offset DAC so that ground is near the bottom of the screen. The internal reference voltage is then measured and averaged. If the value is outside the expected range (approximately +5% to −25% of the range), an error is generated. Check K4, K6, R38, R39, R43, and R44 on the converter board assembly. [A4 Converter board assembly]

6360 gain< >1 (gain is less than or greater than 1) "Gain=1" has an error. Sets the offset DAC so that ground is near the bottom of the screen. The internal reference voltage is then measured and averaged. If the reading is outside the expected range (approximately +5% to −25% of the range), an error is generated. Check K4, K6, R38, R39, R43, and R44 on the converter board assembly. [A4 Converter board assembly]

6361 gain< >.1 (gain is less than or greater than .1) "Gain=.1" has an error. Sets the offset DAC so that ground is near the bottom of the screen. The internal reference voltage is then measured and averaged. If the reading is outside the expected range (approximately +30 to −40% of the range), an error is generated. Check K4, K6, R38, R39, R43, and R44 on the converter board assembly. [A4 Converter board assembly]

6362 gain < >.3 (gain is less than or greater than .3) "Gain=.3" has an error. Sets the offset DAC so that ground is near the bottom of the screen. The internal reference voltage is then measured and averaged. If the reading is outside the expected range (approximately +10% to =25% of the range), an error is generated. Check K4, K6, R38, R39, R43, and R44 on the converter board assembly. [A4 Converter board assembly]

6363 pos slope hyst (positive slope hysteresis) There is a problem with positive slope hysteresis. The offset DAC is used as a signal source. The trigger DACs are then moved to a position so that when the offset DAC is moved past the trigger or reset point, the trigger operation can be verified. [A4 Converter board assembly]

6364 pos slope trig (positive slope trigger) There is a problem with the positive slope trigger. The offset DAC is used as a signal source. The trigger DACs are then moved to a position so that when the offset DAC is moved past the trigger or reset point, the trigger operation can be verified. [A4 Converter board assembly]

6365 neg slope hyst (negative slope hysteresis) There is a problem with the negative slope hysteresis. The offset DAC is used as a signal source. The trigger DACs are then moved to a position so that when the offset DAC is moved past the trigger or reset point, the trigger operation can be verified. [A4 Converter board assembly]

6366 neg slope trig (negative slope trigger) There is a problem with the negative slope trigger. The offset DAC is used as a signal source. The trigger DACs are then moved to a position so that when the offset DAC is moved past the trigger or reset point, the trigger operation can be verified. [A4 Converter board assembly]

6367 abv lvl trig n reset (above level trigger not reset) The above-level triggering is not resetting. The offset DAC is used as a signal source. The trigger DACs are then moved to a position so that when the offset DAC is moved past the trigger or reset point, the trigger operation can be verified. [A4 Converter board assembly]

6368 abv lvl trig (above level trigger) The above-level triggering is not setting. The offset DAC is used as a signal source. The trigger DACs are then moved to a position so that when the offset DAC is moved past the trigger or reset point, the trigger operation can be verified. [A4 Converter board assembly]

6370 bel lvl trig n reset (below level trigger not reset) The below-level trigger is not resetting. The offset DAC is used as a signal source. The trigger DACs are then moved to a position so that when the offset DAC is moved past the trigger or reset point, the trigger operation can be verified. [A4 Converter board assembly]

6371 bel lvl trig (below level trigger) The below-level trigger is not setting. The offset DAC is used as a signal source. The trigger DACs are then moved to a position so that when the offset DAC is moved past the trigger or reset point, the trigger operation can be verified. [A4 Converter board assembly]

6373 REC trig reset (random-event-capture trigger reset) The REC trigger is not resetting. While in the random-event capture mode, several triggers are forced. Trigger reset (−TRESET) is set when the triggers stop, which means the memory should only be partly filled. If inhibit write (−INHWR) is set (i.e., the memory is full), the error will be generated. [A4 Converter board assembly]

6382 clk >.1 uS (clock greater than .1 μs) The measured period of the clock into the HP 70700A Digitizer is too slow. This is checked at power-on or during calibration only.

6384 gain cal (gain calibration) The gain calibration failed. Check the gain circuitry and the voltage reference on the converter board assembly. This error only occurs during power-on. Use the self-test routine to further identify the fault. [A4 Converter board assembly]

6385 pgm lost (program lost) Some or all of the self-test program contained in the HP 70700A Digitizer's RAM has been lost. The contents of the RAM has been lost or damaged. This is only checked during power-on. [Possible failure of the battery on the A5 Processor board assembly]

6386 pgm inval (program invalid) The HP 70700A Digitizer ROM and RAM code are not compatible. This is only tested at power-on and when the digitizer firmware is being downloaded to RAM. [A5 Processor board assembly]

6387 prg ovrlp (program overlap) The last attempt to load RAM tried to overwrite an existing program. This may be a user error rather than a hardware failure. This error only occurs when the user is accessing memory. [A5 Processor board assembly]

6388 prg gone (program gone) An attempt has been made to access a program that is not loaded in RAM. This may be a user error rather than a hardware failure. It only occurs when the user is accessing memory. [A5 Processor board assembly]

6391 wait state (wait state) The wait state generator on the A5 Processor board assembly is generating an incorrect number of wait states.

Hardware Broken Errors

These error messages indicate that the HP 70700A Digitizer has faulty software, firmware, or hardware. Unless otherwise noted, these errors are checked during power-on and self-test only.

7301 uP bus, wr addr: _____ (microprocessor bus, write address:) This error occurs when there is a microprocessor-bus or write-address problem. The microprocessor tried to load the write-address counter and then read it back. The number behind the error code is the bit which failed (0 to 19). [A3 Address board assembly]

7302 rd addr, inh rd: _____ (read address, inhibit read:) This error occurs when there is a microprocessor-bus or read-address problem. The microprocessor tried to set the read and write addresses the same, which sets inhibit read (−INHRD). The number behind the error code is the read address bit which failed (0 to 19). [A3 Address board assembly]

7303 shld addr, inh wr: _____ (shield address, inhibit write:) Behind the error message is the number of the suspected bit (from 0 to 19). This error occurs if inhibit write (−INHWR) is not set when the shield address and the write address are set the same.

7304 seg size short: _____ (segment size short) Behind the error message is the number of the suspected bit (from 0 to 19). The segment size is too short or the wrap address is wrong. The microprocessor tried to set the segment size and then verify it. The error occurred when the write address was earlier in memory than expected. [A3 Address board assembly]

7305 seg size long: _____ (segment size long) Behind the error message is the number of the suspected bit (from 0 to 19). The segment size is too long or the wrap address is wrong. The microprocessor tried to set the segment size and then verify it. The error occurred when the write address was further in memory than expected. [A3 Address board assembly]

7306 inh rd n reset (inhibit read not reset) The microprocessor tried to reset inhibit read (−INHRD), and could not. A write address is loaded. If this does not reset inhibit read (−INHRD), the error occurs. [A3 Address board assembly]

7307 inh wr n reset (inhibit write not reset) The microprocessor tried to reset inhibit write (−INHWR), and could not. [A3 Address board assembly]

7308 wr addr n count (write address not counting) The write address counters are not working. They are not counting or they did not reach their maximum count value in the time allowed. [A3 Address board assembly]

7309 cps cntr early (clocks-per-sample counter early) The clocks-per-sample counter found the expected number of clocks too quickly. They counted to their maximum value faster than was expected. [A3 Address board assembly]

7310 cps cntr late (clocks-per-sample counter late) The clocks-per-sample counter found the expected number of clocks too late. They counted to their maximum value slower than was expected, or they were not counting at all. [A3 Address board assembly]

7311 trig n reset @ uP (trigger not resetting at microprocessor) The trigger is not resetting at the microprocessor. Running the clocks-per-sample counter should force the trigger to be reset. It could be the trigger circuitry itself or the microprocessor read circuitry. [A3 Address board assembly]

7312 trig n set @ uP (trigger not setting at microprocessor) The trigger is not setting at the microprocessor. Internal triggers are forced, which should set the trigger. [A3 Address board assembly]

7313 WAT timout early (writes-after-trigger timeout early) The WAT (writes-after-trigger) timeout is early. The writes-after-trigger counters counted to their maximum value faster than expected. [A3 Address board assembly]

7314 WAT timeout late (writes-after-trigger timeout late) The WAT (writes-after-trigger) timeout is late or absent. The writes-after-trigger counters counted to their maximum value slower than expected. [A3 Address board assembly]

7315 wr addr n stop @ EOS (write address not stop at end-of-segment) The write address did not stop incrementing at EOS (end-of-segment) boundary. [A3 Address board assembly]

7316 WAT cntr n stop @ EOS (writes-after-trigger counter not stop at end-of-segment) The WAT (writes-after-trigger) counters did not stop incrementing at EOS (end-of-segment) boundary. [A3 Address board assembly]

7317 cps stuck @ 1 (clocks-per-sample stuck at 1) The clocks-per-sample counter is stuck at 1. The CPS counter is started. The time it takes the writes-after-trigger counter to overflow with a CPS number of 2 is checked. The error is generated if it takes too long. Check the low bits into the CPS counter. [A3 Address board assembly]

7318 cps bad load (clocks-per-sample bad load) The clocks-per-sample counter is not loading properly. When the CPS counter is started it is initialized. The error occurs if the CPS number is not 1. [A3 Address board assembly]

7319 WAT n wait for trig (writes-after-trigger not wait for trigger) The WAT (writes-after-trigger) counter did not wait for the trigger. The WAT is enabled and a trigger is sent. If the end of segment (EOS) is found too early, the WAT did not wait for the trigger to start counting, and the error is generated. [A3 Address board assembly]

7320 WAT n strt by trig (writes-after-trigger not started by trigger) The WAT (writes-after-trigger) counter was not enabled by the trigger. The WAT is enabled and a trigger is sent. If an end of segment (EOS) is not found after the expected delay, then the WAT counter never started counting and the error is generated. [A3 Address board assembly]

7321 WAT n reload (writes-after-trigger not reload) The WAT (writes-after-trigger) counter did not reload. With the WAT enabled, the end of segment (EOS) is set and then cleared. This reloads the WAT counter, which sets EOS. The error occurs if EOS is not set. [A3 Address board assembly]

7322 wr addr, WAT lsbs (write address, writes-after-trigger least significant bits) There is a problem with the write address or WAT (writes-after-trigger) counter least significant bits. The write address is read to check the least significant bits of the WAT. The WAT is counting slowly while the processor reads the bits to make sure that they count from zero to seven. [A3 Address board assembly]

7323 trace n wait for trig (trace not wait for trigger) The trace is starting before the trigger is received. Operation is enabled but the trigger is held. The write address should remain at zero. If it increments, the error is generated. [A3 Address board assembly]

7324 trace n strt by trig (trace not start by trigger) The trace did not start when the trigger was received. Operation is enabled and the trigger is forced. This should cause the write address to increment. If it remains at zero, the error is generated. [A3 Address board assembly]

7325 timebase switch-early (timebase switch — early) The sample clock was disabled and the write address frozen before they should have been. The clocks-per-sample counter was loaded with the alternate value earlier than expected, so inhibit write is set. [A3 Address board assembly]

7326 timebase switch-late (timebase switch — late) The sample clock was not disabled when it should have been. The clocks-per-sample counter was loaded with the alternate value later than expected, and inhibit write is not set. [A3 Address board assembly]

7389 HP-MSIB err (HP-MSIB error) The HP 70700A Digitizer is having problems communicating over HP-MSIB. [A5 Processor board assembly, system cabling, or system mainframe]

7390 U21 via (U21 via) The test of the U21 VIA (versatile interface adapter) chip failed. [A5 Processor board assembly]

7392 miss clk (missing clock) No clock on the HP 70700A Digitizer was found. The internal clock is not functioning or is not reaching the processor, or the rear-panel cabling for the clock input is faulty.

Chapter 5
REPLACEMENT PROCEDURES

INTRODUCTION

The procedures in this chapter describe the removal and replacement of the major assemblies. The assemblies included in this chapter are listed below:

Top Cover
A3 Address Board Assembly
A4 Converter Board Assembly
A5 Processor Board Assembly
A1 Status Board Assembly

NOTE

Incorrect insertion of the PC board assemblies may result in bent connector pins. Never use pliers to straighten pins. This damages the pins and will decrease reliability. A pin-straightening tool is available (see Service Accessories in Chapter 4, Troubleshooting).

ELECTROSTATIC DISCHARGE

Electrostatic discharge (ESD) can damage or destroy electronic components. Therefore, all work performed on assemblies consisting of electronic components in this module 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 or transport these items in static-shielding containers.

CAUTION

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

Test Equipment

- Before connecting any coaxial cable to an instrument connector for the first time each day, ground the center and outer conductors of the cable together.

- Personnel must be grounded with a resistor-isolated wrist strap before touching the center pin of any connector and before removing any assembly from the instrument.

- Be sure that line power to all instruments is properly earth-grounded to prevent buildup of static charge.

HP 70700A DIGITIZER TOP COVER

┊ CAUTION ┊

Use ESD precautions when performing the HP 70700A Digitizer Top Cover Replacement Procedure.

REMOVAL

1. Remove two screws **(1)** from the top of the cover (one near the front of the module, and the other near the back). See Figure 5-1.

2. Remove eight screws **(2)** from the sides of the cover, four on each side along the bottom edge of the module.

3. Remove the top cover **(3)** from the module by grasping it and lifting the entire top cover upwards.

REPLACEMENT

4. Reposition the top cover **(3)** on the module frame by carefully sliding it over the board assemblies and properly positioning it into the groove on the base frame.

5. Replace the two screws **(1)** to the top of the cover.

6. Replace the eight screws **(2)** to the sides of the cover, four on each side.
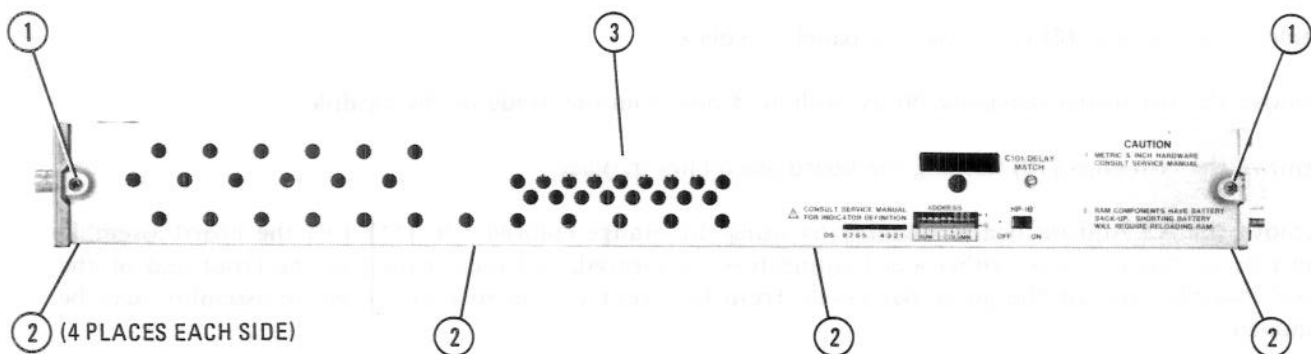
Figure 5-1. Top Cover Replacement

A3 ADDRESS

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CAUTION
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Use ESD precautions when performing the A3 Address Replacement Procedure.

REMOVAL

1. Remove the top cover from the module. Refer to the HP 70700A Digitizer Top Cover Replacement Procedure.

2. Remove the gray coaxial cable from the A5J2 CLK OUT and A4J3 CLK IN connectors on the rear panel.

3. Remove the lock-nuts and washers from the following rear-panel SMB connectors (see Figure 5-2):

   - A5J3 HI SWP **(1)**

   - A5J2 CLK OUT **(2)**

   - A4J3 CLK IN **(3)**

   - A4J4 INPUT 1 **(4)**

   - A4J5 INPUT 2 **(5)**

   - A4J6 EXT TRIG **(6)**

   - A4J7 SYNC OUT **(7)**

4. Remove four screws **(8)** from the rear-panel faceplate.

5. Remove the rear-panel faceplate **(9)** by pushing it out from the inside of the module.

6. Remove the two clips **(10)** holding the board assemblies in place.

7. Remove the A3 Address board assembly by using the orange colored tabs **(11)**. Lift the board assembly upwards so that the two motherboard connectors are cleared, and then maneuver the front end of the board assembly out of the guide bar (away from the front frame) so that the entire assembly may be removed.

REPLACEMENT

8. Replace the A3 Address board assembly by sliding the notch in the top rear of the board assembly into the rear-frame guide bar using the orange colored tabs **(11)**. Carefully maneuver the front of the board assembly into the front guide bar and align A3P1 over A2J2 and A3P2 over A2J3, and then press the board assembly firmly into place.

9. Replace the two clips **(10)** that hold the board assemblies in place.

10. Replace the rear-panel faceplate **(9)** by aligning the rear-panel SMB connectors with the holes of the faceplate.

11. Replace the four screws **(8)** to the rear-panel faceplate and tighten.

12. Replace the lock-nuts and washers on the following rear-panel SMB connectors:

    - A5J3 HI SWP **(1)**

    - A5J2 CLK OUT **(2)**

    - A4J3 CLK IN **(3)**

    - A4J4 INPUT 1 **(4)**

    - A4J5 INPUT 2 **(5)**

    - A4J6 EXT TRIG **(6)**

    - A4J7 SYNC OUT **(7)**

13. Replace the gray coaxial cable to the A5J2 CLK OUT and A4J3 CLK IN SMB connectors on the rear panel.

14. Replace the top cover to the module. Refer to the HP 70700A Digitizer Top Cover Replacement Procedure.
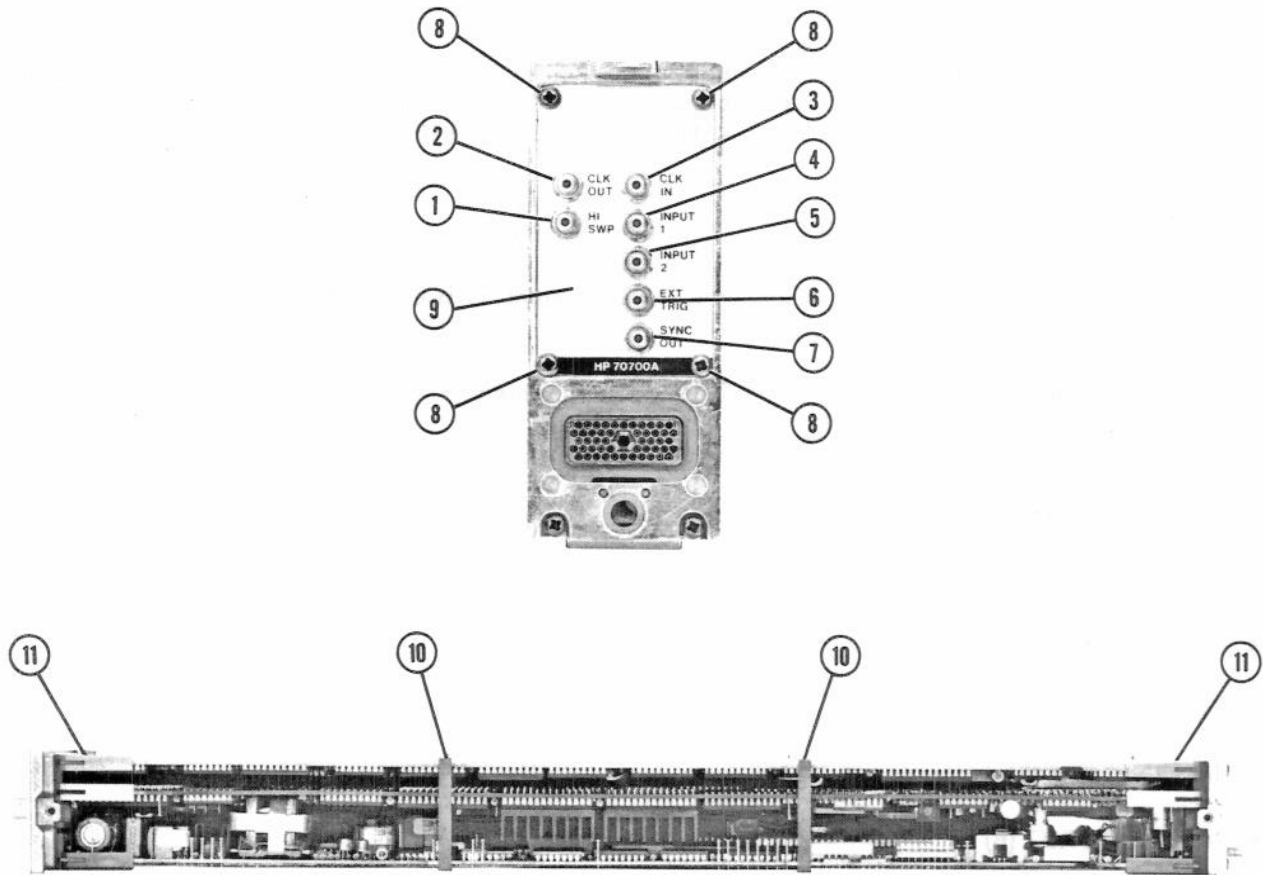
Figure 5-2. A3 Address Replacement

A4 CONVERTER

CAUTION

Use ESD precautions when performing the A4 Converter Replacement Procedure.

REMOVAL

1. Remove the top cover from the module. Refer to the HP 70700A Digitizer Top Cover Replacement Procedure.

2. Remove the A3 Address (1) and the A5 Processor (2) board assemblies from the module so that the A4 Converter board assembly is exposed. Refer to the A3 Address and the A5 Processor Replacement Procedures for disassembly. See Figure 5-3.

3. Remove the front-panel gray coaxial cable W2 (3) from A4J2.

4. Remove the A4 Converter board assembly by using the yellow colored tabs (4). Lift the board assembly upwards so that the two motherboard connectors are cleared, and then maneuver the front end of the board assembly out of the guide bar (away from the front frame) so that the entire assembly may be removed.

REPLACEMENT

NOTE

Position the end of the A4 Converter board assembly with the SMB connectors in the rear frame of the module.

5. Replace the A4 Converter board assembly by sliding the rear of the board assembly into the second groove of the rear-frame guide bar using the yellow colored tabs (4). Carefully maneuver the front of the board assembly into the second groove of the front guide bar and align A4P1 over A2J4 and A4P2 over A2J5, and then press the board assembly firmly into place.

6. Replace the front-panel gray coaxial cable W2 (3) to A4J2.

7. Replace the A3 Address (1) and the A5 Processor (2) board assemblies. Refer to the A3 Address and the A5 Processor Replacement Procedures.

8. Replace the top cover to the module. Refer to the HP 70700A Digitizer Top Cover Replacement Procedure.

Figure 5-3. A4 Converter Replacement

A5 PROCESSOR

CAUTION

Use ESD precautions when performing the A5 Processor Replacement Procedure.

REMOVAL

1. Remove the top cover from the module. Refer to the HP 70700A Digitizer Top Cover Replacement Procedure.

2. Remove the gray coaxial cable from the A5J2 CLK OUT and A4J3 CLK IN connectors on the rear panel.

3. Remove the lock-nuts and washers from the following rear-panel SMB connectors. See Figure 5-4.

   - A5J3 HI SWP **(1)**

   - A5J2 CLK OUT **(2)**

   - A4J3 CLK IN **(3)**

   - A4J4 INPUT 1 **(4)**

   - A4J5 INPUT 2 **(5)**

   - A4J6 EXT TRIG **(6)**

   - A4J7 SYNC OUT **(7)**

4. Remove four screws **(8)** from the rear-panel faceplate.

5. Remove the rear-panel faceplate **(9)** by pushing it out from the inside of the module.

6. Remove the two clips **(10)** holding the board assemblies in place.

7. Remove two screws and four washers **(11)** that mount the ferrite bracket to the A5 Processor board assembly.

8. Remove the A5 Processor board assembly by using the green colored tabs **(12)**. Lift the board assembly upwards so that the two motherboard connectors are cleared, and then maneuver the front end of the board assembly out of the guide bar (away from the front frame) so that the entire assembly may be removed.

9. Remove the W1 flex cable assembly by disconnecting the 50-pin connector **(13)** from A5J1 and the gray 5-pin connector **(14)** from A5J4.

REPLACEMENT

NOTE

Position the end of the A5 Processor board assembly with the SMB connectors in the rear frame of the module.

10. Replace the W1 flex cable assembly by reconnecting the gray 5-pin connector (14) to A5J4 first and then the 50-pin connector (13) to A5J1.

11. Replace the A5 Processor board assembly by sliding the notch in the top rear of the board assembly into the rear-frame guide bar using the green colored tabs (12). Carefully maneuver the front the board assembly into the front guide bar and align A5P2 over A2J6 and A5P1 over A2J7, and then press the board assembly firmly into place.

NOTE

Check the gray cable portion of the W1 flex cable assembly so that it does not protrude through the base of the module frame.

Check the fuse to make sure that it is secure in the fuse clip on the A5 Processor board assembly.

12. Replace two screws and four washers (11) to mount the ferrite bracket to the A5 Processor board assembly.

13. Replace the two clips (10) holding the board assemblies in place.

14. Replace the rear-panel faceplate (9) by aligning the rear-panel SMB connectors with the holes of the faceplate.

15. Replace the four screws (8) to the rear-panel faceplate and tighten.

16. Replace the lock-nuts and washers on the following rear-panel SMB connectors:

- A5J3 HI SWP (1)

- A5J2 CLK OUT (2)

- A4J3 CLK IN (3)

- A4J4 INPUT 1 (4)

- A4J5 INPUT 2 (5)

- A4J6 EXT TRIG (6)

- A4J7 SYNC OUT (7)

17. Replace the gray coaxial cable to the A5J2 CLK OUT and A4J3 CLK IN SMB connectors on the rear panel.

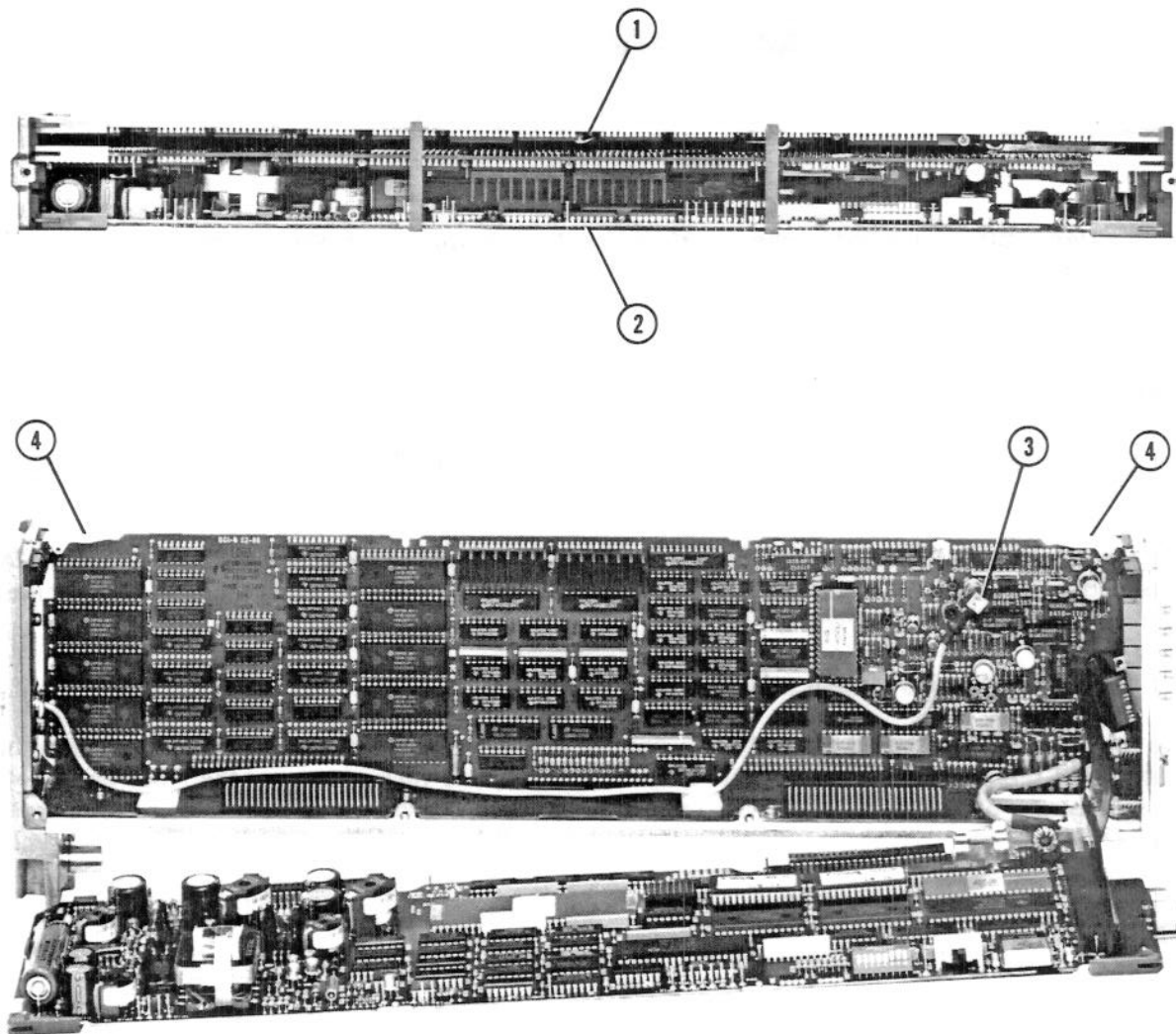18. Replace the top cover to the module. Refer to the HP 70700A Digitizer Top Cover Replacement Procedure.
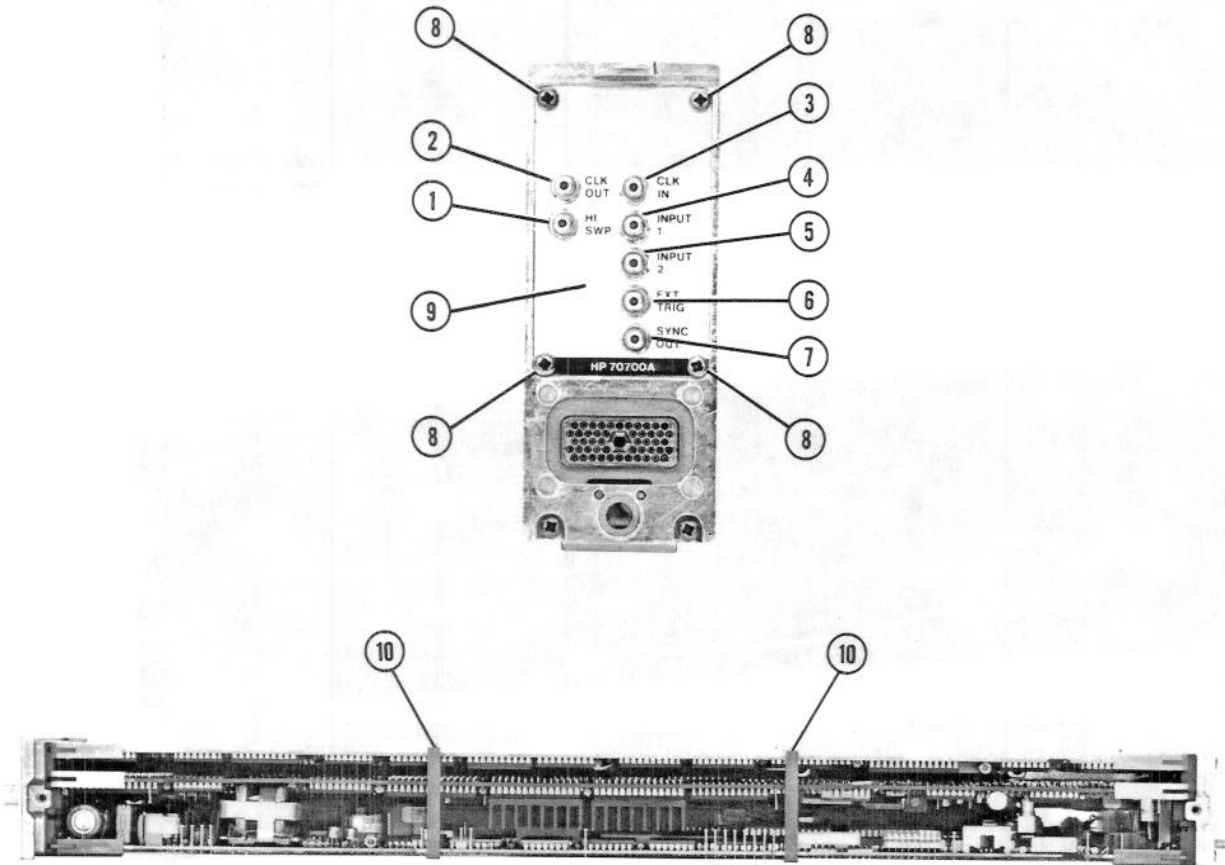
Figure 5-4. A5 Processor Replacement (1 of 2)
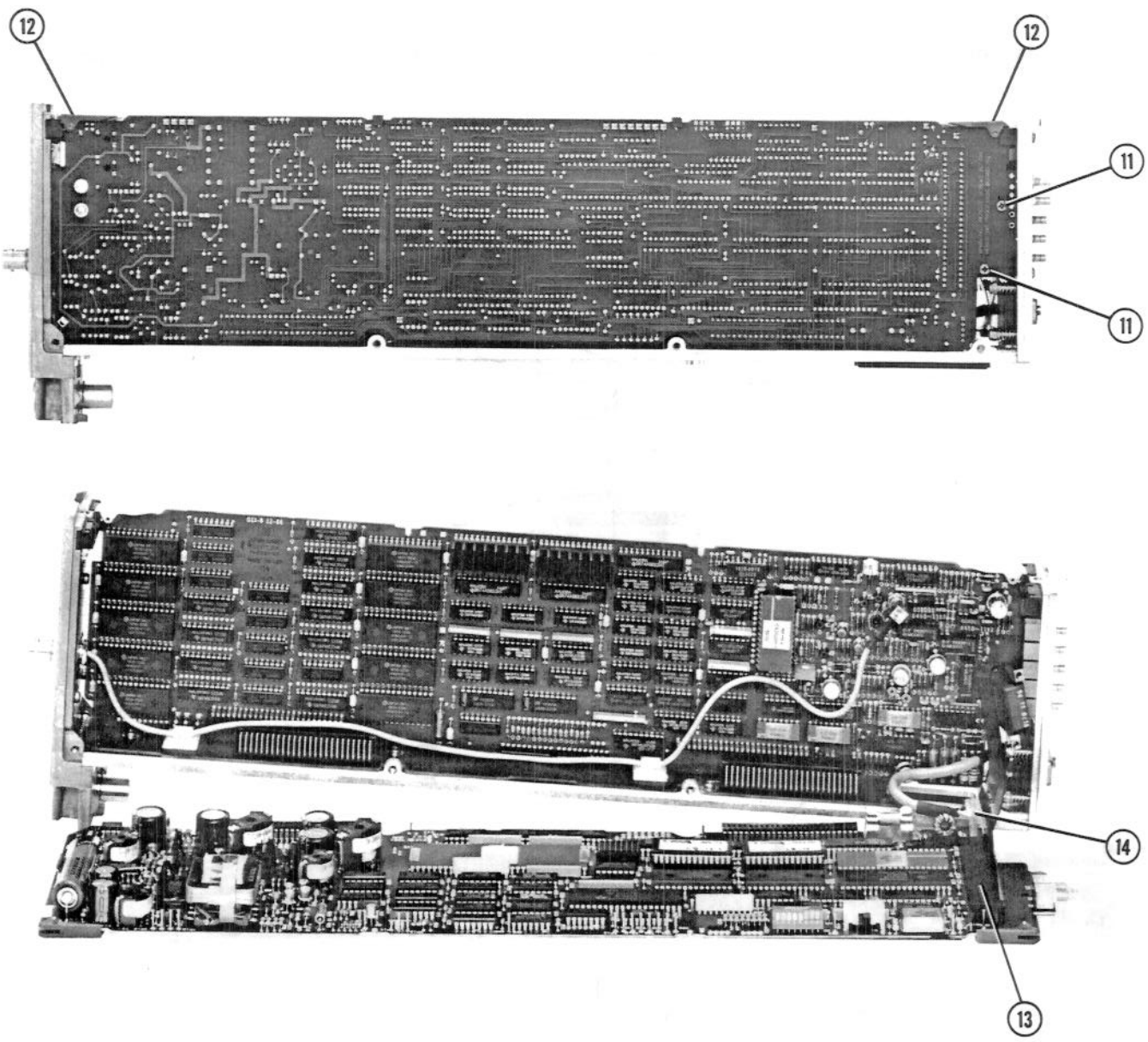
Figure 5-4. A5 Processor Replacement (2 of 2)

A1 STATUS

CAUTION

Use ESD precautions when performing the A1 Status Replacement Procedure.

REMOVAL

1. Remove the top cover from the module. Refer to the HP 70700A Digitizer Top Cover Replacement Procedure.

2. Remove the nut and washer from the front-panel BNC connector **(1)** by using a 9/16-inch torque driver. See Figure 5-5.

3. Remove two screws **(2)** from the front-panel assembly to disconnect it from the module frame.

4. Remove the entire front-panel assembly from the module frame by disconnecting A1P1 from A2J1 **(3)** and pulling the front-panel assembly away from the module frame. The front-panel BNC connector will also slip out of the front-panel assembly.

5. Remove three screws **(4)** from the A1 Status board assembly to remove it from the front frame.

REPLACEMENT

6. Reposition the A1 Status board assembly in the front frame and replace the three screws **(4)**.

7. Realign the entire front-panel assembly with the module frame by aligning A1P1 with A2J1 **(3)** and repositioning the front-panel BNC connector so that the flat side of the connector matches the flat side of the hole in the front-panel faceplate. Carefully press the front-panel assembly into place.

8. Replace two screws **(2)** to the front-panel assembly to attach it to the module frame.

9. Replace the nut and washer to the front-panel BNC connector **(1)** by using a 9/16-inch torque driver and torque the nut to 20 inch-pounds.

10. Replace the top cover to the module. Refer to the HP 70700A Digitizer Top Cover Replacement Procedure.
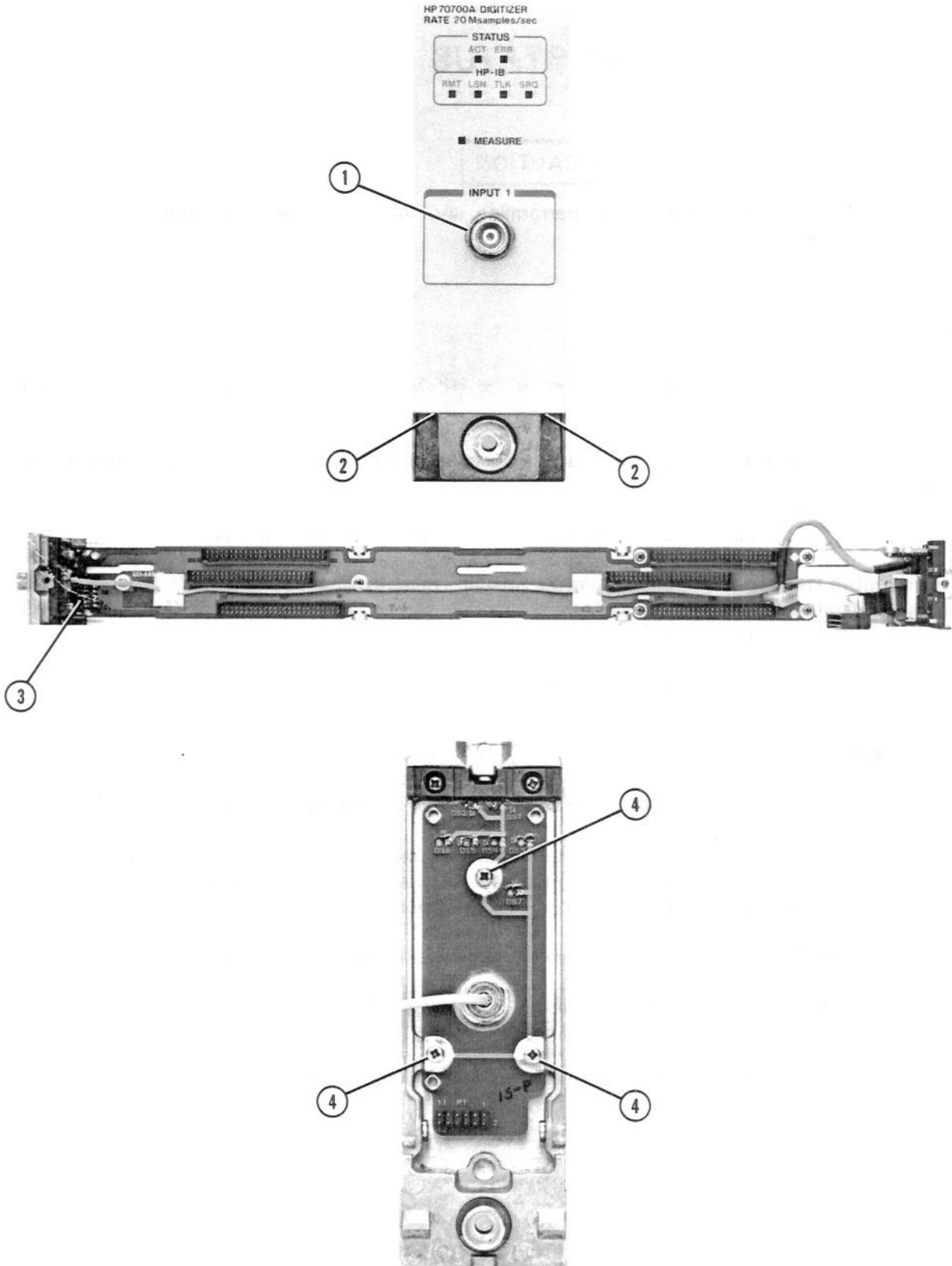
Figure 5-5. A1 Status Replacement

Chapter 6
REPLACEABLE PARTS

INTRODUCTION

This chapter contains information for ordering replacement parts. Table 6-1 includes a list of reference designations and a list of abbreviations used in the parts list. Table 6-2 lists names and addresses that correspond to the manufacturer code numbers in the parts list. Table 6-3 lists all replaceable parts in alpha-numerical order by reference designation. Module parts are listed first, followed by each of the electrical assemblies. The parts lists document all assembly versions produced up to the time of this manual's printing.

REPLACEABLE PARTS LIST FORMAT

The following information is listed for each part:

1. Hewlett-Packard part number

2. Part number's check digit (CD)

3. Total quantity (Qty) in the assembly. This quantity is given only once, at the first appearance of the part in the list.

4. Description of the part

5. A five-digit code indicating a typical manufacturer of the part

6. Manufacturer's part number

ORDERING INFORMATION

To order a part listed in the replaceable parts table, quote the Hewlett-Packard part number (with check digit), indicate the quantity required, and address your order to the nearest Hewlett-Packard office. The check digit will ensure accurate and timely processing of the order.

To order a part that is not listed in the replaceable parts table, include the module model number, the description and function of the part, and the number of parts required. Address your 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 listed below:

- 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 (a check or money order must accompany each order)

Mail-order forms and specific ordering information are available through your local HP Sales or Service 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

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}			

Table 6-2. Manufacturer's Code List

MFR. NO.	MANUFACTURER NAME	ADDRESS		ZIP CODE
S0562	TOSHIBA CORP	TOKYO	JP	
S4013	HITACHI AMERICA LTD	SUNNYVALE	CA US	94086
00000	ANY SATISFACTORY SUPPLIER			
00779	AMP INC	HARRISBURG	PA US	17111
01121	ALLEN-BRADLEY CO INC	EL PASO	TX US	79935
01295	TEXAS INSTRUMENTS INC	DALLAS	TX US	75265
03051	MULTICORE SOLDERS	WESTBURY	NY	11590
03888	K D I PYROFILM CORP	WHIPPANY	NJ	07981
04713	MOTOROLA INC SEMI-COND PROD	PHOENIX	AZ US	85008
07263	FAIRCHILD CORP	MOUNTAIN VIEW	CA US	94042
08452	WESTINGHOUSE ELEC CORP WELDING EQPT	SYKESVILLE	MD	21784
1B546	VARO SEMICONDUCTOR INC	GARLAND	TX US	75046
10411	TI-TAL INC	SANTA MONICA	CA	90405
11236	CTS CORP BERNE DIV	BERNE	IN US	46711
13103	THERMALLOY INC	DALLAS	TX US	75234
16299	CORNING ELECTRONICS	RALEIGH	NC US	27604
2M627	ROHM CORP	IRVINE	CA US	92716
24355	ANALOG DEVICES INC	NORWOOD	MA US	02062
24546	CORNING ELECTRONICS	SANTA CLARA	CA US	95050
27014	NATIONAL SEMICONDUCTOR CORP	SANTA CLARA	CA US	95052
28480	HEWLETT-PACKARD CO CORPORATE HQ	PALO ALTO	CA	94304
30161	AAVID ENGINEERING INC	LACONIA	NH US	03247
34335	ADVANCED MICRO DEVICES INC	SUNNYVALE	CA US	94086
34344	MOTOROLA INC	FRANKLIN PARK	IL US	60131
51633	FLUOROCARBON CO THE	SUNNYVALE	CA	94088
56289	SPRAGUE ELECTRIC CO	NORTH ADAMS	MA	01247
9M011	INTL RECTIFIER CORP	EL SEGUNDO	CA US	90245
9N171	UNITRODE CORP	LEXINGTON	MA US	02173
91506	AUGAT INC	MANSFIELD	MA US	02048
91637	DALE ELECTRONICS INC	EL PASO	TX US	79936

Table 6-3. HP 70700A Module Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
				M A J O R A S S E M B L I E S		
A1	70700-60009	5	1	STATUS BOARD ASSEMBLY	28480	70700-60009
A2	70700-60005	1	1	MOTHERBOARD ASSEMBLY	28480	70700-60005
A3	70700-60002	8	1	ADDRESS BOARD ASSEMBLY	28480	70700-60002
A4	70700-60003	9	1	CONVERTER BOARD ASSEMBLY	28480	70700-60003
A5	70700-60004	0	1	PROCESSOR BOARD ASSEMBLY	28480	70700-60004
				M E C H A N I C A L P A R T S		
	0510-1244	9	1	RETAINER-PUSH ON CIRCULAR-EXT	28480	0510-1244
	0515-0886	3		SCREW-MACH M3 X 0.5 6MM-LG PAN-HD	28480	0515-0886
	0590-1251	6	1	NUT-SPCLY 15/32-32-THD .1-IN-THK .562-WD	00000	ORDER BY DESCRIP.
	0900-0012	4	1	O-RING .364-IN-ID .07-IN-XSECT-DIA NTRL	51633	AS568-012 A-700
	2190-0068	5	1	WASHER-LOCK .505ID	28480	2190-0068
	5021-3290	7	1	LATCH-MOD TH REC	28480	5021-3290
W1	5062-1902	0	1	CBL AY-INPUT	28480	5062-1902
	70700-00002	2	1	PNL-FRONT	28480	70700-00002
	70700-20006	8	1	FRAME-FRONT	28480	70700-20006
	70700-40002	6		GUIDE-PC BD	28480	70700-40002
	08753-60061	1	1	CABLE ASSY-PH LK IN CA	28480	08753-60061
	5001-5840	5	1	SPRING-GROUNDING	28480	5001-5840
	70700-00001	1	1	COVER-TOP	28480	70700-00001
	70700-00003	3	1	PNL-REAR	28480	70700-00003
	70700-00004	4	1	BRKT-FERRITE	28480	70700-00004
	70700-20007	9	1	FRAME-REAR	28480	70700-20007
	70700-20008	0	1	MOUNTING-BASE	28480	70700-20008
	70700-20010	4	1	INSULATOR-LEFT	28480	70700-20010
	70700-20011	5	1	INSULATOR-RIGHT	28480	70700-20011
	70700-40001	5	2	CLIP-PC BD	28480	70700-40001
	70700-40002	6	2	GUIDE-PC BD	28480	70700-40002
W2	70700-60001	7	1	AY-WIRING-FLEX CABLE	28480	70700-60001
	0515-0886	3	31	SCREW-MACH M3 X 0.5 6MM-LG PAN-HD	28480	0515-0886
	0515-0894	3	2	SCREW-MACH M2.5 X 0.45 6MM-LG PAN-HD	28480	0515-0894
	0535-0042	5	4	NUT-HEX PLSTC-LKG M3 X 0.5 4MM-THK	28480	0535-0042
	1460-2095	4	4	SPRING-CPRSN 5.49-MM-OD 16.8-MM-OA-LG	28480	1460-2095
	2190-0124	4	7	WASHER-LK INTL T NO. 10 .195-IN-ID	28480	2190-0124
	2950-0078	9	7	NUT-HEX-DBL-CHAM 10-32-THD .067-IN-THK	28480	2950-0078
	5001-5835	8	2	BAR-CONNECTOR	28480	5001-5835

REPLACEABLE PARTS

Table 6-4. A1 Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A1	70700-60009	5	1	STATUS BOARD ASSEMBLY	28480	70700-60009
A1DS1	1990-1131	0	2	LED-LAMP LUM-INT=560UCD IF=20MA-MAX	2M627	LD-101MG
A1DS2	1990-1129	6	1	LED-LAMP LUM-INT=900UCD BVR=3V	2M627	LD-101UR
A1DS3	1990-1130	9	4	LED-LAMP LUM-INT=1.4MCD IF=25MA-MAX	2M627	LD-101YY
A1DS4	1990-1130	9		LED-LAMP LUM-INT=1.4MCD IF=25MA-MAX	2M627	LD-101YY
A1DS5	1990-1130	9		LED-LAMP LUM-INT=1.4MCD IF=25MA-MAX	2M627	LD-101YY
A1DS6	1990-1130	9		LED-LAMP LUM-INT=1.4MCD IF=25MA-MAX	2M627	LD-101YY
A1DS7	1990-1131	0		LED-LAMP LUM-INT=560UCD IF=20MA-MAX	2M627	LD-101MG
A1P1	1252-1818	6	1	CONN HDR 12 M2R	28480	1252-1818

6-8

Table 6-5. A2 Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A2	70700-60005	1	1	MOTHERBOARD ASSEMBLY	28480	70700-60005
A2J1	1252-1819	7	1	CONN MODII 12F2R	28480	1252-1819
A2J2	1252-1417	1	6	CONN-POST TYPE .100-PIN-SPCG 50-CONT	00779	2-102318-5
A2J3	1252-1417	1		CONN-POST TYPE .100-PIN-SPCG 50-CONT	00779	2-102318-5
A2J4	1252-1417	1		CONN-POST TYPE .100-PIN-SPCG 50-CONT	00779	2-102318-5
A2J5	1252-1417	1		CONN-POST TYPE .100-PIN-SPCG 50-CONT	00779	2-102318-5
A2J6	1252-1417	1		CONN-POST TYPE .100-PIN-SPCG 50-CONT	00779	2-102318-5
A2J7	1252-1417	1		CONN-POST TYPE .100-PIN-SPCG 50-CONT	00779	2-102318-5
	1400-0510	8	1	CLIP-CABLE .15DI .62W	28480	1400-0510

Table 6-6. A3 Replaceable Parts (1 of 4)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A3	70700-60002	8	1	ADDRESS BOARD ASSEMBLY	28480	70700-60002
A3C1	0160-4554	7	51	CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A3C2	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A3C3	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A3C4	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A3C5	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A3C6	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A3C7	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A3C8	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A3C9	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A3C10	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A3C11	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A3C12	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A3C13	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A3C14	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A3C15	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A3C16	0160-4812	0	1	CAPACITOR-FXD 220PF +-5% 100VDC CER	28480	0160-4812
A3C17	0160-4557	0	3	CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC04X7R104M050A
A3C18	0160-4557	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC04X7R104M050A
A3C19	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A3C20	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A3C21	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A3C22	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A3C23	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A3C24	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A3C25	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A3C26	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A3C27	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A3C28	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A3C29	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A3C30	0160-4801	7	1	CAPACITOR-FXD 100PF +-5% 100VDC CER	28480	0160-4801
A3C31	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A3C32	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A3C33	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A3C34	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A3C35	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A3C36	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A3C37	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A3C38	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A3C39	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A3C40	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A3C41	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A3C42	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A3C43	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A3C44	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A3C45	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A3C46	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A3C47	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A3C48	0160-4557	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC04X7R104M050A
A3C49	0180-0229	7	1	CAPACITOR-FXD 33UF+-10% 10VDC TA	56289	150D336X9010B2

Table 6-6. A3 Replaceable Parts (2 of 4)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A3C50	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A3C51	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A3C52	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A3C53	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A3C54	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A3C55	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A3C56	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A3C57	0160-4821	1	1	CAPACITOR-FXD 1200PF +-5% 100VDC CER	28480	0160-4821
A3C58	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A3P1	1251-8767	6	2	CONN-POST TYPE .100-PIN-SPCG 50-CONT	28480	1251-8767
A3P2	1251-8767	6		CONN-POST TYPE .100-PIN-SPCG 50-CONT	28480	1251-8767
A3R1	0698-7252	7	14	RESISTOR 4.64K 1% .05W F TC=0+-100	24546	C3-1/8-T0-4641-F
A3R2	0698-7252	7		RESISTOR 4.64K 1% .05W F TC=0+-100	24546	C3-1/8-T0-4641-F
A3R3	0698-7252	7		RESISTOR 4.64K 1% .05W F TC=0+-100	24546	C3-1/8-T0-4641-F
A3R4	0698-7252	7		RESISTOR 4.64K 1% .05W F TC=0+-100	24546	C3-1/8-T0-4641-F
A3R5	0698-7236	7	10	RESISTOR 1K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1001-F
A3R6	0698-7212	9	3	RESISTOR 100 1% .05W F TC=0+-100	24546	C3-1/8-T0-100R-F
A3R7	0698-7252	7		RESISTOR 4.64K 1% .05W F TC=0+-100	24546	C3-1/8-T0-4641-F
A3R8	0698-7236	7		RESISTOR 1K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1001-F
A3R9	0698-7236	7		RESISTOR 1K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1001-F
A3R10	0698-7236	7		RESISTOR 1K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1001-F
A3R11	0698-7212	9		RESISTOR 100 1% .05W F TC=0+-100	24546	C3-1/8-T0-100R-F
A3R12	0698-7252	7		RESISTOR 4.64K 1% .05W F TC=0+-100	24546	C3-1/8-T0-4641-F
A3R13	0698-7252	7		RESISTOR 4.64K 1% .05W F TC=0+-100	24546	C3-1/8-T0-4641-F
A3R14	0698-7252	7		RESISTOR 4.64K 1% .05W F TC=0+-100	24546	C3-1/8-T0-4641-F
A3R15	0698-7252	7		RESISTOR 4.64K 1% .05W F TC=0+-100	24546	C3-1/8-T0-4641-F
A3R16	0698-7252	7		RESISTOR 4.64K 1% .05W F TC=0+-100	24546	C3-1/8-T0-4641-F
A3R17	0698-7252	7		RESISTOR 4.64K 1% .05W F TC=0+-100	24546	C3-1/8-T0-4641-F
A3R18	0698-7212	9		RESISTOR 100 1% .05W F TC=0+-100	24546	C3-1/8-T0-100R-F
A3R19	0698-7236	7		RESISTOR 1K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1001-F
A3R20-R35				NOT ASSIGNED		
A3R36	0698-7252	7		RESISTOR 4.64K 1% .05W F TC=0+-100	24546	C3-1/8-T0-4641-F
A3R37	0698-7252	7		RESISTOR 4.64K 1% .05W F TC=0+-100	24546	C3-1/8-T0-4641-F
A3R38	0698-7236	7		RESISTOR 1K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1001-F
A3R39	0698-7236	7		RESISTOR 1K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1001-F
A3R40	0698-7236	7		RESISTOR 1K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1001-F
A3U1	1820-3789	9	16	IC FF CMOS/74HC D-TYPE POS-EDGE-TRIG COM	27014	MM74HC574N
A3U2	1820-3789	9		IC FF CMOS/74HC D-TYPE POS-EDGE-TRIG COM	27014	MM74HC574N
A3U3	1820-3789	9		IC FF CMOS/74HC D-TYPE POS-EDGE-TRIG COM	27014	MM74HC574N
A3U4	1820-3789	9		IC FF CMOS/74HC D-TYPE POS-EDGE-TRIG COM	27014	MM74HC574N
A3U5	1820-3789	9		IC FF CMOS/74HC D-TYPE POS-EDGE-TRIG COM	27014	MM74HC574N
A3U6	1820-3789	9		IC FF CMOS/74HC D-TYPE POS-EDGE-TRIG COM	27014	MM74HC574N
A3U7	1820-4392	2	4	IC ADDR CMOS/74HC BIN FULL ADDR 4-BIT	27014	MM74HC283N
A3U8	1820-4392	2		IC ADDR CMOS/74HC BIN FULL ADDR 4-BIT	27014	MM74HC283N
A3U9	1820-4392	2		IC ADDR CMOS/74HC BIN FULL ADDR 4-BIT	27014	MM74HC283N
A3U10	1820-4392	2		IC ADDR CMOS/74HC BIN FULL ADDR 4-BIT	27014	MM74HC283N
A3U11	1820-3790	2	7	IC LCH CMOS/74HC D-TYPE OCTL	27014	MM74HC573N
A3U12	1820-3790	2		IC LCH CMOS/74HC D-TYPE OCTL	27014	MM74HC573N

Table 6-6. A3 Replaceable Parts (3 of 4)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A3U13	1820-3785	5	10	IC CNTR CMOS/74HC BIN SYNCHRO	04713	MC74HC163N
A3U14	1820-3785	5		IC CNTR CMOS/74HC BIN SYNCHRO	04713	MC74HC163N
A3U15	1820-3785	5		IC CNTR CMOS/74HC BIN SYNCHRO	04713	MC74HC163N
A3U16	1820-3785	5		IC CNTR CMOS/74HC BIN SYNCHRO	04713	MC74HC163N
A3U17	1820-3209	8	6	IC COMPTR CMOS/74HC MAGTD 8-BIT	27014	MM74HC688N
A3U18	1820-3209	8		IC COMPTR CMOS/74HC MAGTD 8-BIT	27014	MM74HC688N
A3U19	1820-3209	8		IC COMPTR CMOS/74HC MAGTD 8-BIT	27014	MM74HC688N
A3U20	1820-3209	8		IC COMPTR CMOS/74HC MAGTD 8-BIT	27014	MM74HC688N
A3U21	1820-3790	2		IC LCH CMOS/74HC D-TYPE OCTL	27014	MM74HC573N
A3U22	1820-3748	0	4	IC MUXR/DATA-SEL TTL AS 2-TO-1-LINE QUAD	01295	SN74AS257N
A3U23	1820-3748	0		IC MUXR/DATA-SEL TTL AS 2-TO-1-LINE QUAD	01295	SN74AS257N
A3U24	1820-3748	0		IC MUXR/DATA-SEL TTL AS 2-TO-1-LINE QUAD	01295	SN74AS257N
A3U25	1820-3748	0		IC MUXR/DATA-SEL TTL AS 2-TO-1-LINE QUAD	01295	SN74AS257N
A3U26	1820-3790	2		IC LCH CMOS/74HC D-TYPE OCTL	27014	MM74HC573N
A3U27	1820-3785	5		IC CNTR CMOS/74HC BIN SYNCHRO	04713	MC74HC163N
A3U28	1820-3785	5		IC CNTR CMOS/74HC BIN SYNCHRO	04713	MC74HC163N
A3U29	1820-3785	5		IC CNTR CMOS/74HC BIN SYNCHRO	04713	MC74HC163N
A3U30	1820-3785	5		IC CNTR CMOS/74HC BIN SYNCHRO	04713	MC74HC163N
A3U31	1820-3789	9		IC FF CMOS/74HC D-TYPE POS-EDGE-TRIG COM	27014	MM74HC574N
A3U32	1820-3789	9		IC FF CMOS/74HC D-TYPE POS-EDGE-TRIG COM	27014	MM74HC574N
A3U33	1820-3209	8		IC COMPTR CMOS/74HC MAGTD 8-BIT	27014	MM74HC688N
A3U34	1820-3209	8		IC COMPTR CMOS/74HC MAGTD 8-BIT	27014	MM74HC688N
A3U35	1820-3081	4	4	IC FF CMOS/74HC D-TYPE POS-EDGE-TRIG	04713	MC74HC74N
A3U36	1820-3081	4		IC FF CMOS/74HC D-TYPE POS-EDGE-TRIG	04713	MC74HC74N
A3U37	1820-2922	0	1	IC GATE CMOS/74HC NAND QUAD 2-INP	04713	MC74HC00N
A3U38	1820-3097	2	1	IC GATE CMOS/74HC AND QUAD 2-INP	27014	MM74HC08N
A3U39	1820-3353	3	9	IC CNTR TTL ALS BIN UP/DOWN SYNCHRO	01295	SN74ALS169BN
A3U40	1820-3353	3		IC CNTR TTL ALS BIN UP/DOWN SYNCHRO	01295	SN74ALS169BN
A3U41	1820-3353	3		IC CNTR TTL ALS BIN UP/DOWN SYNCHRO	01295	SN74ALS169BN
A3U42	1820-3353	3		IC CNTR TTL ALS BIN UP/DOWN SYNCHRO	01295	SN74ALS169BN
A3U43	1820-3742	4	2	IC CNTR TTL AS BIN SYNCHRO POS-EDGE-TRIG	01295	SN74AS163N
A3U44	1820-3493	2	2	IC FF TTL AS D-TYPE POS-EDGE-TRIG	01295	SN74AS74N
A3U45	1820-3790	2		IC LCH CMOS/74HC D-TYPE OCTL	27014	MM74HC573N
A3U46	1820-3790	2		IC LCH CMOS/74HC D-TYPE OCTL	27014	MM74HC573N
A3U47	1820-3790	2		IC LCH CMOS/74HC D-TYPE OCTL	27014	MM74HC573N
A3U48	1820-3591	1	2	IC GATE TTL AS NAND QUAD 2-INP	01295	SN74AS00N
A3U49	1820-3991	5	4	IC GATE TTL AS AND DUAL 4-INP	01295	SN74AS21N
A3U50	1820-3991	5		IC GATE TTL AS AND DUAL 4-INP	01295	SN74AS21N
A3U51	1820-2693	2	1	IC FF TTL F J-K BAR POS-EDGE-TRIG	07263	74F109PC
A3U52	1820-3734	4	2	IC GATE TTL AS NAND 8-INP	01295	SN74AS30N
A3U53	1820-2488	3	1	IC FF TTL ALS D-TYPE POS-EDGE-TRIG	01295	SN74ALS74AN
A3U54	1820-3731	1	2	IC GATE TTL AS NAND TPL 3-INP	01295	SN74AS10N
A3U55	1820-3733	3	1	IC GATE TTL AS NAND DUAL 4-INP	01295	SN74AS20N
A3U56	1820-2739	7	1	IC GATE TTL ALS NOR QUAD 2-INP	01295	SN74ALS02N
A3U57	1820-3608	1	1	IC INV TTL AS HEX	01295	SN74AS04N
A3U58	1820-3591	1		IC GATE TTL AS NAND QUAD 2-INP	01295	SN74AS00N
A3U59	1820-2777	3	1	IC CNTR TTL ALS BIN SYNCHRO	01295	SN74ALS161BN
A3U60	1820-2724	0	6	IC LCH TTL ALS TRANSPARENT OCTL	01295	SN74ALS573BN
A3U61	1820-2724	0		IC LCH TTL ALS TRANSPARENT OCTL	01295	SN74ALS573BN
A3U62	1820-2724	0		IC LCH TTL ALS TRANSPARENT OCTL	01295	SN74ALS573BN

Table 6-6. A3 Replaceable Parts (4 of 4)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A3U63	1820-2724	0		IC LCH TTL ALS TRANSPARENT OCTL	01295	SN74ALS573BN
A3U64	1820-3731	1		IC GATE TTL AS NAND TPL 3-INP	01295	SN74AS10N
A3U65	1820-3493	2		IC FF TTL AS D-TYPE POS-EDGE-TRIG	01295	SN74AS74N
A3U66	1820-3353	3		IC CNTR TTL ALS BIN UP/DOWN SYNCHRO	01295	SN74ALS169BN
A3U67	1820-3353	3		IC CNTR TTL ALS BIN UP/DOWN SYNCHRO	01295	SN74ALS169BN
A3U68	1820-3353	3		IC CNTR TTL ALS BIN UP/DOWN SYNCHRO	01295	SN74ALS169BN
A3U69	1820-3353	3		IC CNTR TTL ALS BIN UP/DOWN SYNCHRO	01295	SN74ALS169BN
A3U70	1820-3734	4		IC GATE TTL AS NAND 8-INP	01295	SN74AS30N
A3U71	1820-3991	5		IC GATE TTL AS AND DUAL 4-INP	01295	SN74AS21N
A3U72	1820-2921	9	2	IC INV CMOS/74HC HEX	27014	MM74HC04N
A3U73	1820-3991	5		IC GATE TTL AS AND DUAL 4-INP	01295	SN74AS21N
A3U74	1820-3353	3		IC CNTR TTL ALS BIN UP/DOWN SYNCHRO	01295	SN74ALS169BN
A3U75	1820-3742	4		IC CNTR TTL AS BIN SYNCHRO POS-EDGE-TRIG	01295	SN74AS163N
A3U76	1820-2724	0		IC LCH TTL ALS TRANSPARENT OCTL	01295	SN74ALS573BN
A3U77	1820-2724	0		IC LCH TTL ALS TRANSPARENT OCTL	01295	SN74ALS573BN
A3U78	1820-3789	9		IC FF CMOS/74HC D-TYPE POS-EDGE-TRIG COM	27014	MM74HC574N
A3U79	1820-3789	9		IC FF CMOS/74HC D-TYPE POS-EDGE-TRIG COM	27014	MM74HC574N
A3U80	1820-3789	9		IC FF CMOS/74HC D-TYPE POS-EDGE-TRIG COM	27014	MM74HC574N
A3U81	1820-3789	9		IC FF CMOS/74HC D-TYPE POS-EDGE-TRIG COM	27014	MM74HC574N
A3U82	1820-3789	9		IC FF CMOS/74HC D-TYPE POS-EDGE-TRIG COM	27014	MM74HC574N
A3U83	1820-3789	9		IC FF CMOS/74HC D-TYPE POS-EDGE-TRIG COM	27014	MM74HC574N
A3U84	1820-3789	9		IC FF CMOS/74HC D-TYPE POS-EDGE-TRIG COM	27014	MM74HC574N
A3U85	1820-3789	9		IC FF CMOS/74HC D-TYPE POS-EDGE-TRIG COM	27014	MM74HC574N
A3U86	1818-3330	1	1	IC CMOS 65536 (64K) STAT RAM 120-NS 3-S	S4013	HM6264P-12
A3U87	1820-3177	9	3	IC MUXR/DATA-SEL CMOS/74HC 2-TO-1-LINE	04713	MC74HC157N
A3U88	1820-3177	9		IC MUXR/DATA-SEL CMOS/74HC 2-TO-1-LINE	04713	MC74HC157N
A3U89	1820-3177	9		IC MUXR/DATA-SEL CMOS/74HC 2-TO-1-LINE	04713	MC74HC157N
A3U90	1820-3199	5	5	IC CNTR CMOS/74HC BIN ASYNCHRO	04713	MC74HC4040N
A3U91	1820-3199	5		IC CNTR CMOS/74HC BIN ASYNCHRO	04713	MC74HC4040N
A3U92	1820-3199	5		IC CNTR CMOS/74HC BIN ASYNCHRO	04713	MC74HC4040N
A3U93	1820-3081	4		IC FF CMOS/74HC D-TYPE POS-EDGE-TRIG	04713	MC74HC74N
A3U94	1820-2924	2	1	IC GATE CMOS/74HC NOR QUAD 2-INP	04713	MC74HC02N
A3U95	1820-2921	9		IC INV CMOS/74HC HEX	27014	MM74HC04N
A3U96	1820-3014	3	1	IC DCDR CMOS/74HC 2-TO-4-LINE DUAL	27014	MM74HC139N
A3U97	1820-2923	1	1	IC GATE CMOS/74HC NAND TPL 3-INP	04713	MC74HC10N
A3U98	1820-3201	0	1	IC GATE CMOS/74HC OR TPL 3-INP	04713	MC74HC4075N
A3U99	1820-3199	5		IC CNTR CMOS/74HC BIN ASYNCHRO	04713	MC74HC4040N
A3U100	1820-3199	5		IC CNTR CMOS/74HC BIN ASYNCHRO	04713	MC74HC4040N
A3U101	1820-3081	4		IC FF CMOS/74HC D-TYPE POS-EDGE-TRIG	04713	MC74HC74N
A3U102	1820-3785	5		IC CNTR CMOS/74HC BIN SYNCHRO	04713	MC74HC163N
A3U103	1820-3785	5		IC CNTR CMOS/74HC BIN SYNCHRO	04713	MC74HC163N
A3U104	1810-0279	5	2	NETWORK-RES 10-SIP 4.7K OHM X 9	91637	CSC10A01-472G/MSP
A3U105	1810-0279	5		NETWORK-RES 10-SIP 4.7K OHM X 9	91637	CSC10A01-472G/MSP
A3W1	8159-0005	0	8	JUMPER-22 AWG LEAD DIA	28480	8159-0005
A3W2	8159-0005	0		JUMPER-22 AWG LEAD DIA	28480	8159-0005
A3W3	8159-0005	0		JUMPER-22 AWG LEAD DIA	28480	8159-0005
A3W4	8159-0005	0		JUMPER-22 AWG LEAD DIA	28480	8159-0005
A3W5	8159-0005	0		JUMPER-22 AWG LEAD DIA	28480	8159-0005
A3W6	8159-0005	0		JUMPER-22 AWG LEAD DIA	28480	8159-0005
A3W7	8159-0005	0		JUMPER-22 AWG LEAD DIA	28480	8159-0005
A3W8	8159-0005	0		JUMPER-22 AWG LEAD DIA	28480	8159-0005
	1480-0059	8	2	PIN-ROLL .062-IN-DIA .25-IN-LG STL	28480	1480-0059
	4040-0751	8	2	EXTR-PC BD ORN POLYC .062-IN-BD-THKNS	28480	4040-0751

Table 6-7. A4 Replaceable Parts (1 of 8)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A4	70700-60003	9	1	CONVERTER BOARD ASSEMBLY	28480	70700-60003
A4C1	0160-4557	0	18	CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC04X7R104M050A
A4C2	0160-4557	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC04X7R104M050A
A4C3	0160-4557	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC04X7R104M050A
A4C4	0160-4557	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC04X7R104M050A
A4C5	0160-4557	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC04X7R104M050A
A4C6	0160-4554	7	15	CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A4C7	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A4C8	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A4C9	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A4C10	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A4C11	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A4C12	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A4C13	0160-4557	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC04X7R104M050A
A4C14	0160-4557	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC04X7R104M050A
A4C15	0160-4557	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC04X7R104M050A
A4C16	0160-4557	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC04X7R104M050A
A4C17	0160-4557	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC04X7R104M050A
A4C18	0160-4557	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC04X7R104M050A
A4C19	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A4C20	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A4C21	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A4C22	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A4C23	0180-0229	7	2	CAPACITOR-FXD 33UF+-10% 10VDC TA	56289	150D336X9010B2
A4C24	0160-4557	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC04X7R104M050A
A4C25	0160-4557	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC04X7R104M050A
A4C26	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A4C27	0160-4557	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC04X7R104M050A
A4C28	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A4C29	0160-4557	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC04X7R104M050A
A4C30	0160-4812	0	15	CAPACITOR-FXD 220PF +-5% 100VDC CER	28480	0160-4812
A4C31	0160-4812	0		CAPACITOR-FXD 220PF +-5% 100VDC CER	28480	0160-4812
A4C32	0160-4812	0		CAPACITOR-FXD 220PF +-5% 100VDC CER	28480	0160-4812
A4C33	0160-4812	0		CAPACITOR-FXD 220PF +-5% 100VDC CER	28480	0160-4812
A4C34	0160-4812	0		CAPACITOR-FXD 220PF +-5% 100VDC CER	28480	0160-4812
A4C35	0160-4812	0		CAPACITOR-FXD 220PF +-5% 100VDC CER	28480	0160-4812
A4C36	0160-4812	0		CAPACITOR-FXD 220PF +-5% 100VDC CER	28480	0160-4812
A4C37	0160-4812	0		CAPACITOR-FXD 220PF +-5% 100VDC CER	28480	0160-4812
A4C38	0160-4812	0		CAPACITOR-FXD 220PF +-5% 100VDC CER	28480	0160-4812
A4C39	0160-4812	0		CAPACITOR-FXD 220PF +-5% 100VDC CER	28480	0160-4812
A4C40	0160-4812	0		CAPACITOR-FXD 220PF +-5% 100VDC CER	28480	0160-4812
A4C41	0160-4812	0		CAPACITOR-FXD 220PF +-5% 100VDC CER	28480	0160-4812
A4C42	0160-4812	0		CAPACITOR-FXD 220PF +-5% 100VDC CER	28480	0160-4812
A4C43	0160-4812	0		CAPACITOR-FXD 220PF +-5% 100VDC CER	28480	0160-4812
A4C44	0160-4812	0		CAPACITOR-FXD 220PF +-5% 100VDC CER	28480	0160-4812
A4C48	0160-4557	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC04X7R104M050A
A4C49	0160-4557	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC04X7R104M050A
A4C50	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A4C51	0160-0575	4	40	CAPACITOR-FXD .047UF +-20% 50VDC CER	28480	0160-0575
A4C52	0160-0575	4		CAPACITOR-FXD .047UF +-20% 50VDC CER	28480	0160-0575

Table 6-7. A4 Replaceable Parts (2 of 8)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A4C53-C54				NOT ASSIGNED		
A4C55	0160-0575	4		CAPACITOR-FXD .047UF +-20% 50VDC CER	28480	0160-0575
A4C56				NOT ASSIGNED		
A4C57	0160-4389	6	2	CAPACITOR-FXD 100PF +-5% 200VDC CER	28480	0160-4389
A4C58	0160-4527	4	1	CAPACITOR-FXD 56PF +-5% 200VDC CER	28480	0160-4527
A4C59	0160-4389	6		CAPACITOR-FXD 100PF +-5% 200VDC CER	28480	0160-4389
A4C60-C65				NOT ASSIGNED		
A4C66	0160-4619	5	2	CAPACITOR-FXD 2.7PF +-.25PF 200VDC CER	28480	0160-4619
A4C67	0160-4619	5		CAPACITOR-FXD 2.7PF +-.25PF 200VDC CER	28480	0160-4619
A4C68	0160-4492	2	2	CAPACITOR-FXD 18PF +-.25PF 200VDC CER	28480	0160-4492
A4C70	0160-4808	4	1	CAPACITOR-FXD 470PF +-5% 100VDC CER	28480	0160-4808
A4C73	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A4C74	0180-0229	7		CAPACITOR-FXD 33UF+-10% 10VDC TA	56289	150D336X9010B2
A4C75	0180-1746	5	2	CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A4C77	0180-1746	5		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A4C78	0160-0575	4		CAPACITOR-FXD .047UF +-20% 50VDC CER	28480	0160-0575
A4C81	0160-0575	4		CAPACITOR-FXD .047UF +-20% 50VDC CER	28480	0160-0575
A4C82	0160-4557	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC04X7R104M050A
A4C83	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A4C99	0160-0575	4		CAPACITOR-FXD .047UF +-20% 50VDC CER	28480	0160-0575
A4C100	0160-3873	1		CAPACITOR-FXD 4.7PF +-.5PF 200VDC CER	28480	0160-3873
A4C101	0121-0444	4	1	CAPACITOR-V TRMR-CER 3-9PF 160V PC-MTG	28480	0121-0444
A4C102	0160-4791	4	1	CAPACITOR-FXD 10PF +-5% 100VDC CER 0+-30	28480	0160-4791
A4C103	0160-0575	4		CAPACITOR-FXD .047UF +-20% 50VDC CER	28480	0160-0575
A4C104	0160-0575	4		CAPACITOR-FXD .047UF +-20% 50VDC CER	28480	0160-0575
A4C105	0160-0575	4		CAPACITOR-FXD .047UF +-20% 50VDC CER	28480	0160-0575
A4C106	0160-0575	4		CAPACITOR-FXD .047UF +-20% 50VDC CER	28480	0160-0575
A4C107	0160-0575	4		CAPACITOR-FXD .047UF +-20% 50VDC CER	28480	0160-0575
A4C108	0160-0575	4		CAPACITOR-FXD .047UF +-20% 50VDC CER	28480	0160-0575
A4C109	0160-0575	4		CAPACITOR-FXD .047UF +-20% 50VDC CER	28480	0160-0575
A4C110	0160-0575	4		CAPACITOR-FXD .047UF +-20% 50VDC CER	28480	0160-0575
A4C111	0160-0575	4		CAPACITOR-FXD .047UF +-20% 50VDC CER	28480	0160-0575
A4C112	0160-4492	2		CAPACITOR-FXD 18PF 200VDC CER	28480	0160-4492
A4C113	0160-0575	4		CAPACITOR-FXD .047UF +-20% 50VDC CER	28480	0160-0575
A4C114	0160-0575	4		CAPACITOR-FXD .047UF +-20% 50VDC CER	28480	0160-0575
A4C115	0160-0575	4		CAPACITOR-FXD .047UF +-20% 50VDC CER	28480	0160-0575
A4C116	0160-0575	4		CAPACITOR-FXD .047UF +-20% 50VDC CER	28480	0160-0575
A4C117	0160-4535	4	2	CAPACITOR-FXD 1UF +-10% 50VDC CER	28480	0160-4535
A4C118	0160-4381	8	1	CAPACITOR-FXD 1.5PF +-.25PF 200VDC CER	28480	0160-4381
A4C119	0160-0575	4		CAPACITOR-FXD .047UF +-20% 50VDC CER	28480	0160-0575
A4C120	0160-0575	4		CAPACITOR-FXD .047UF +-20% 50VDC CER	28480	0160-0575
A4C121	0160-0575	4		CAPACITOR-FXD .047UF +-20% 50VDC CER	28480	0160-0575
A4C122	0160-0575	4		CAPACITOR-FXD .047UF +-20% 50VDC CER	28480	0160-0575
A4C123	0160-0575	4		CAPACITOR-FXD .047UF +-20% 50VDC CER	28480	0160-0575
A4C124	0160-0575	4		CAPACITOR-FXD .047UF +-20% 50VDC CER	28480	0160-0575
A4C125	0160-0575	4		CAPACITOR-FXD .047UF +-20% 50VDC CER	28480	0160-0575
A4C126	0160-0575	4		CAPACITOR-FXD .047UF +-20% 50VDC CER	28480	0160-0575
A4C127	0160-0575	4		CAPACITOR-FXD .047UF +-20% 50VDC CER	28480	0160-0575
A4C128	0160-0575	4		CAPACITOR-FXD .047UF +-20% 50VDC CER	28480	0160-0575
A4C129	0160-0575	4		CAPACITOR-FXD .047UF +-20% 50VDC CER	28480	0160-0575
A4C130	0160-0575	4		CAPACITOR-FXD .047UF +-20% 50VDC CER	28480	0160-0575

Table 6-7. A4 Replaceable Parts (3 of 8)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A4C131	0160-0575	4		CAPACITOR-FXD .047UF +-20% 50VDC CER	28480	0160-0575
A4C132	0160-0575	4		CAPACITOR-FXD .047UF +-20% 50VDC CER	28480	0160-0575
A4C133	0160-0575	4		CAPACITOR-FXD .047UF +-20% 50VDC CER	28480	0160-0575
A4C134	0160-4031	5		CAPACITOR-FXD 330PF +-20% 50VDC CER	28480	0160-4031
A4C135	0160-0575	4		CAPACITOR-FXD .047UF +-20% 50VDC CER	28480	0160-0575
A4C136	0160-0575	4		CAPACITOR-FXD .047UF +-20% 50VDC CER	28480	0160-0575
A4C137	0160-0575	4		CAPACITOR-FXD .047UF +-20% 50VDC CER	28480	0160-0575
A4C138	0160-0575	4		CAPACITOR-FXD .047UF +-20% 50VDC CER	28480	0160-0575
A4C139	0160-4535	4		CAPACITOR-FXD 1UF +-10% 50VDC CER	28480	0160-4535
A4CR1	1901-0050	3	18	DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A4CR2	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A4CR3	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A4CR4	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A4CR5	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A4CR6	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A4CR7	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A4CR8	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A4CR9	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A4CR10	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A4CR11	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A4CR12	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A4CR13	1901-1231	4	4	D MTC 8V1.0P15	28480	1901-1231
A4CR14	1901-1231	4		D MTC 8V1.0P15	28480	1901-1231
A4CR15	1901-1231	4		D MTC 8V1.0P15	28480	1901-1231
A4CR16	1901-1231	4		D MTC 8V1.0P15	28480	1901-1231
A4CR17	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A4CR18	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A4CR20	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A4CR21	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A4CR22	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A4CR23	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A4J2	1250-2097	1	1	CONN RF M SMB PC	28480	1250-2097
A4J3	1250-1955	8	5	CONNECTOR-RF SM-SLD FEM PC 50-OHM	28480	1250-1955
A4J4	1250-1955	8		CONNECTOR-RF SM-SLD FEM PC 50-OHM	28480	1250-1955
A4J5	1250-1955	8		CONNECTOR-RF SM-SLD FEM PC 50-OHM	28480	1250-1955
A4J6	1250-1955	8		CONNECTOR-RF SM-SLD FEM PC 50-OHM	28480	1250-1955
A4J7	1250-1955	8		CONNECTOR-RF SM-SLD FEM PC 50-OHM	28480	1250-1955
A4K1	0490-1183	1	2	RELAY-REED 1B 500MA 100VDC 5VDC-COIL	28480	0490-1183
A4K2	0490-1183	1		RELAY-REED 1B 500MA 100VDC 5VDC-COIL	28480	0490-1183
A4K3	0490-0670	9	1	RELAY 2C 5VDC-COIL 1A 28VDC	28480	0490-0670
A4K4	0490-0617	4	4	RELAY-REED 1C 250MA 28VDC 5VDC-COIL	28480	0490-0617
A4K5	0490-0617	4		RELAY-REED 1C 250MA 28VDC 5VDC-COIL	28480	0490-0617
A4K6	0490-0617	4		RELAY-REED 1C 250MA 28VDC 5VDC-COIL	28480	0490-0617
A4K7	0490-0617	4		RELAY-REED 1C 250MA 28VDC 5VDC-COIL	28480	0490-0617
A4L1	9100-3912	2	2	INDUCTOR RF-CH-MLD 15UH 5%	28480	9100-3912
A4L2	9100-3912	2		INDUCTOR RF-CH-MLD 15UH 5%	28480	9100-3912
A4L3	9140-0144	0	2	INDUCTOR RF-CH-MLD 4.7UH 10%	28480	9140-0144
A4L4	9140-0144	0		INDUCTOR RF-CH-MLD 4.7UH 10%	28480	9140-0144
A4MP2	1480-0059	8	2	PIN-ROLL .062-IN-DIA .25-IN-LG STL	28480	1480-0059
A4MP3	4040-0752	9	2	EXTR-PC BD YEL POLYC .062-IN-BD-THKNS	28480	4040-0752

Table 6-7. A4 Replaceable Parts (4 of 8)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A4MP4	2950-0078	9	5	NUT-HEX-DBL-CHAM 10-32-THD .067-IN-THK	28480	2950-0078
A4P1	1251-8767	6	2	CONN-POST TYPE .100-PIN-SPCG 50-CONT	28480	1251-8767
A4P2	1251-8767	6		CONN-POST TYPE .100-PIN-SPCG 50-CONT	28480	1251-8767
A4Q1	1854-0720	3	4	TRANSISTOR NPN SI PD=500MW FT=4GHZ	28480	1854-0720
A4Q2	1854-0720	3		TRANSISTOR NPN SI PD=500MW FT=4GHZ	28480	1854-0720
A4Q4	1854-0720	3		TRANSISTOR NPN SI PD=500MW FT=4GHZ	28480	1854-0720
A4Q6	1853-0018	0	2	TRANSISTOR PNP SI TO-72 PD=200MW FT=1GHZ	28480	1853-0018
A4Q7	1854-0720	3		TRANSISTOR NPN SI PD=500MW FT=4GHZ	28480	1854-0720
A4Q8	1853-0018	0		TRANSISTOR PNP SI TO-72 PD=200MW FT=1GHZ	28480	1853-0018
A4Q9	1855-0507	6	2	TRANSISTOR-JFET DUAL 2N5912 N-CHAN	24355	2N5912
A4Q10	1853-0075	9	1	TRANSISTOR-DUAL PNP PD=400MW	28480	1853-0075
A4Q11	1854-1032	2	2	TRANSISTOR NPN SI PD=2.5W	04713	MRF581
A4Q12	1854-1032	2		TRANSISTOR NPN SI PD=2.5W	04713	MRF581
A4Q13	1855-0507	6		TRANSISTOR-JFET DUAL 2N5912 N-CHAN	24355	2N5912
A4Q14	1853-0036	2	1	TRANSISTOR PNP SI PD=310MW FT=250MHZ	27014	2N3906
A4R1	0698-7252	7	6	RESISTOR 4.64K 1% .05W F TC=0+-100	24546	C3-1/8-T0-4641-F
A4R2	0698-7252	7		RESISTOR 4.64K 1% .05W F TC=0+-100	24546	C3-1/8-T0-4641-F
A4R3	0698-7252	7		RESISTOR 4.64K 1% .05W F TC=0+-100	24546	C3-1/8-T0-4641-F
A4R4	0698-7252	7		RESISTOR 4.64K 1% .05W F TC=0+-100	24546	C3-1/8-T0-4641-F
A4R5	0698-7252	7		RESISTOR 4.64K 1% .05W F TC=0+-100	24546	C3-1/8-T0-4641-F
A4R6	0698-7236	7	8	RESISTOR 1K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1001-F
A4R7	0698-7236	7		RESISTOR 1K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1001-F
A4R9	0698-7220	9	5	RESISTOR 215 1% .05W F TC=0+-100	24546	C3-1/8-T0-215R-F
A4R10	0698-7220	9		RESISTOR 215 1% .05W F TC=0+-100	24546	C3-1/8-T0-215R-F
A4R11	0698-7236	7		RESISTOR 1K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1001-F
A4R12	0698-7220	9		RESISTOR 215 1% .05W F TC=0+-100	24546	C3-1/8-T0-215R-F
A4R13	0698-7265	2	2	RESISTOR 16.2K 1% .05W F TC=0+-100	28480	0698-7265
A4R14	0698-8824	1	1	RESISTOR 562K 1% .125W F TC=0+-100	28480	0698-8524
A4R15	0698-7248	1	1	RESISTOR 3.16K 1% .05W F TC=0+-100	28480	0689-7248
A4R16	0698-7265	2		RESISTOR 16.2K 1% .05W F TC=0+-100	28480	0698-7265
A4R17	0757-0394	0	1	RESISTOR 51.1 1% .125W F TC=0+-100	24546	CT4-1/8-T0-51R1-F
A4R25	0698-7236	7	8	RESISTOR 1K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1001-F
A4R26	0698-7236	7		RESISTOR 1K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1001-F
A4R27	0698-7236	7		RESISTOR 1K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1001-F
A4R28	0698-7236	7		RESISTOR 1K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1001-F
A4R30	0698-7188	8	12	RESISTOR 10 1% .05W F TC=0+-100	24546	C3-1/8-T0-10R-F
A4R31	0698-3454	3	1	RESISTOR 215K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2153-F
A4R32	0699-0306	0	1	RESISTOR 6K .025% .1W F TC=0+-5	28480	0699-0306
A4R33	0757-0442	9	1	RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A4R34	0698-5388	6	1	RESISTOR 1.5K .05% .1W F TC=0+-15	28480	0698-5388
A4R35	0698-6755	3	1	RESISTOR 8K .5% .125W F TC=0+-50	24546	NC55-1/8-T2-8001D
A4R36	0698-7188	8		RESISTOR 10 1% .05W F TC=0+-100	24546	C3-1/8-T0-10R-F
A4R37	0757-0401	0	2	RESISTOR 100 1% .125W F TC=0+-100	24546	CT4-1/8-T0-101-F
A4R38	0698-8961	7	1	RESISTOR 909K 1% .125W F TC=0+-100	28480	0698-8961
A4R39	0698-7284	5	1	RESISTOR 100K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1003-F
A4R40	0698-7188	8		RESISTOR 10 1% .05W F TC=0+-100	24546	C3-1/8-T0-10R-F
A4R41	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	CT4-1/8-T0-101-F
A4R42	0698-7188	8		RESISTOR 10 1% .05W F TC=0+-100	24546	C3-1/8-T0-10R-F
A4R43	0698-7241	4	2	RESISTOR 1.62K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1621-F
A4R44	0698-7232	3	1	RESISTOR 681 1% .05W F TC=0+-100	24546	C3-1/8-T0-681R-F
A4R50	0698-7237	8	2	RESISTOR 1.1K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1101-F
A4R51	0698-7250	5	3	RESISTOR 3.83K 1% .05W F TC=0+-100	24546	C3-1/8-T0-3831-F

Table 6-7. A4 Replaceable Parts (5 of 8)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A4R53	0698-7220	9		RESISTOR 215 1% .05W F TC=0+-100	24546	C3-1/8-T0-215R-F
A4R55	0698-7252	7		RESISTOR 4.64K 1% .05W F TC=0+-100	24546	C3-1/8-T0-4641-F
A4R56	0698-7250	5		RESISTOR 3.83K 1% .05W F TC=0+-100	24546	C3-1/8-T0-3831-F
A4R57	0698-7220	9		RESISTOR 215 1% .05W F TC=0+-100	24546	C3-1/8-T0-215R-F
A4R58	0698-7188	8		RESISTOR 10 1% .05W F TC=0+-100	24546	C3-1/8-T0-10R-F
A4R59	0698-7230	1	4	RESISTOR 562 1% .05W F TC=0+-100	24546	C3-1/8-T0-562R-F
A4R60	0698-7230	1		RESISTOR 562 1% .05W F TC=0+-100	24546	C3-1/8-T0-562R-F
A4R61	0698-7212	9	4	RESISTOR 100 1% .05W F TC=0+-100	24546	C3-1/8-T0-100R-F
A4R62	0698-7212	9		RESISTOR 100 1% .05W F TC=0+-100	24546	C3-1/8-T0-100R-F
A4R63*	0698-7194	6		RESISTOR 17.8 1% .05W F TC=0=-100	28480	0698-7194
A4R64	0698-7230	1		RESISTOR 562 1% .05W F TC=0+-100	24546	C3-1/8-T0-562R-F
A4R65	0698-7230	1		RESISTOR 562 1% .05W F TC=0+-100	24546	C3-1/8-T0-562R-F
A4R68	0698-7205	0	11	RESISTOR 51.1 1% .05W F TC=0+-100	24546	C3-1/8-T0-51R1-F
A4R69	0698-7205	0		RESISTOR 51.1 1% .05W F TC=0+-100	24546	C3-1/8-T0-51R1-F
A4R70	0698-7207	2	1	RESISTOR 61.9 1% .05W F TC=0+-100	24546	C3-1/8-T0-61R9-F
A4R71	0698-7188	8		RESISTOR 10 1% .05W F TC=0+-100	24546	C3-1/8-T0-10R-F
A4R74	0698-7188	8		RESISTOR 10 1% .05W F TC=0+-100	24546	C3-1/8-T0-10R-F
A4R75	0698-7205	0		RESISTOR 51.1 1% .05W F TC=0+-100	24546	C3-1/8-T0-51R1-F
A4R76	0698-7205	0		RESISTOR 51.1 1% .05W F TC=0+-100	24546	C3-1/8-T0-51R1-F
A4R77	0698-7234	5	5	RESISTOR 825 1% .05W F TC=0+-100	24546	C3-1/8-T0-825R-F
A4R78	0698-7212	9		RESISTOR 100 1% .05W F TC=0+-100	24546	C3-1/8-T0-100R-F
A4R79	0698-7212	9		RESISTOR 100 1% .05W F TC=0+-100	24546	C3-1/8-T0-100R-F
A4R80	0698-7235	6	1	RESISTOR 909 1% .05W F TC=0+-100	24546	C3-1/8-T0-909R-F
A4R81	0698-7277	6	1	RESISTOR 51.1K 1% .05W F TC=0+-100	24546	C3-1/8-T0-5112-F
A4R82	0698-7241	4		RESISTOR 1.62K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1621-F
A4R83	0698-7239	0	2	RESISTOR 1.33K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1331-F
A4R84	0698-7239	0		RESISTOR 1.33K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1331-F
A4R85	0698-7237	8		RESISTOR 1.1K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1101-F
A4R86	0698-7188	8		RESISTOR 10 1% .05W F TC=0+-100	24546	C3-1/8-T0-10R-F
A4R87	0698-7188	8		RESISTOR 10 1% .05W F TC=0+-100	24546	C3-1/8-T0-10R-F
A4R88	0698-7234	5		RESISTOR 825 1% .05W F TC=0+-100	24546	C3-1/8-T0-825R-F
A4R89	0698-7234	5		RESISTOR 825 1% .05W F TC=0+-100	24546	C3-1/8-T0-825R-F
A4R90	0698-7234	5		RESISTOR 825 1% .05W F TC=0+-100	24546	C3-1/8-T0-825R-F
A4R91	0698-7205	0		RESISTOR 51.1 1% .05W F TC=0+-100	24546	C3-1/8-T0-51R1-F
A4R92	0698-7192	4	3	RESISTOR 14.7 1% .05W F TC=0+-100	24546	C3-1/8-T0-14R7-F
A4R93	0698-7192	4		RESISTOR 14.7 1% .05W F TC=0+-100	24546	C3-1/8-T0-14R7-F
A4R94	0698-7222	1	1	RESISTOR 261 1% .05W F TC=0+-100	24546	C3-1/8-T0-261R-F
A4R95	0698-7188	8		RESISTOR 10 1% .05W F TC=0+-100	24546	C3-1/8-T0-10R-F
A4R96	0698-7205	0		RESISTOR 51.1 1% .05W F TC=0+-100	24546	C3-1/8-T0-51R1-F
A4R97	0698-7205	0		RESISTOR 51.1 1% .05W F TC=0+-100	24546	C3-1/8-T0-51R1-F
A4R98	0698-7205	0		RESISTOR 51.1 1% .05W F TC=0+-100	24546	C3-1/8-T0-51R1-F
A4R99	0698-7246	9	2	RESISTOR 2.61K 1% .05W F TC=0+-100	24546	C3-1/8-T0-2611-F
A4R100	0698-7205	0		RESISTOR 51.1 1% .05W F TC=0+-100	24546	C3-1/8-T0-51R1-F
A4R101	0698-7246	9		RESISTOR 2.61K 1% .05W F TC=0+-100	24546	C3-1/8-T0-2611-F
A4R102	0698-7205	0		RESISTOR 51.1 1% .05W F TC=0+-100	24546	C3-1/8-T0-51R1-F
A4R103	0698-7216	3	1	RESISTOR 147 1% .05W F TC=0+-100	24546	C3-1/8-T0-147R-F
A4R104	0698-7234	5		RESISTOR 825 1% .05W F TC=0+-100	24546	C3-1/8-T0-825R-F
A4R105	0698-7205	0		RESISTOR 51.1 1% .05W F TC=0+-100	24546	C3-1/8-T0-51R1-F
A4R106	0698-7215	2	1	RESISTOR 133 1% .05W F TC=0+-100	24546	C3-1/8-T0-133R-F
A4R107	0698-7188	8		RESISTOR 10 1% .05W F TC=0+-100	24546	C3-1/8-T0-10R-F

*Note: A4R63 and A4U68 are interrelated. Refer to the Adjustments chapter for more information.

Table 6-7. A4 Replaceable Parts (6 of 8)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A4R108	0698-7199	1	1	RESISTOR 28.7 1% .05W F TC=0+-100	28480	0698-7199
A4R109	0698-7210	7	1	RESISTOR 82.5 1% .05W F TC=0+-100	24546	C3-1/8-TO-82R5-F
A4R110	0698-7194	6	1	RESISTOR 17.8 1% .05W F TC=0+-100	24546	C3-1/8-TO-17R8-F
A4R111	0698-7188	8		RESISTOR 10 1% .05W F TC=0+-100	24546	C3-1/8-TO-10R-F
A4R112	0698-7205	0		RESISTOR 51.1 1% .05W F TC=0+-100	24546	C3-1/8-TO-51R1-F
A4R113	0698-7205	0		RESISTOR 51.1 1% .05W F TC=0+-100	24546	C3-1/8-TO-51R1-F
A4R114	0698-7192	4		RESISTOR 14.7 1% .05W F TC=0+-100	24546	C3-1/8-TO-14R7-F
A4R120	0698-7250	5		RESISTOR 3.83K 1% .05W F TC=0+-100	24546	C3-1/8-TO-3831-F
A4T1	08552-6044	1	1	TRANSF RF 5 PIN	28480	08552-6044
A4TP1	0360-1682	0	11	TERMINAL-STUD SGL-TUR PRESS-MTG	28480	0360-1682
A4TP5	0360-1682	0		TERMINAL-STUD SGL-TUR PRESS-MTG	28480	0360-1682
A4TP12	0360-1682	0		TERMINAL-STUD SGL-TUR PRESS-MTG	28480	0360-1682
A4TP13	0360-1682	0		TERMINAL-STUD SGL-TUR PRESS-MTG	28480	0360-1682
A4TP14	0360-1682	0		TERMINAL-STUD SGL-TUR PRESS-MTG	28480	0360-1682
A4TP15	0360-1682	0		TERMINAL-STUD SGL-TUR PRESS-MTG	28480	0360-1682
A4TP16	0360-1682	0		TERMINAL-STUD SGL-TUR PRESS-MTG	28480	0360-1682
A4TP17	0360-1682	0		TERMINAL-STUD SGL-TUR PRESS-MTG	28480	0360-1682
A4TP18	0360-1682	0		TERMINAL-STUD SGL-TUR PRESS-MTG	28480	0360-1682
A4TP19	0360-1682	0		TERMINAL-STUD SGL-TUR PRESS-MTG	28480	0360-1682
A4TP20	08443-00041	6	1	TEST POINT	28480	08443-00041
A4TP21	0360-1682	0		TERMINAL-STUD SGL-TUR PRESS-MTG	28480	0360-1682
A4U1	1818-4017	3	10	IC RAM S 32KX8 (256K)	28480	1818-4017
A4U2	1818-4017	3		IC RAM S 32KX8 (256K)	28480	1818-4017
A4U3	1818-4017	3		IC RAM S 32KX8 (256K)	28480	1818-4017
A4U4	1818-4017	3		IC RAM S 32KX8 (256K)	28480	1818-4017
A4U5	1818-4017	3		IC RAM S 32KX8 (256K)	28480	1818-4017
A4U6	1820-4608	3	10	IC MUXR/DATA-SEL CMOS/74HC 8-TO-1-LINE	01295	SN74HCT652NT
A4U7	1820-4608	3		IC MUXR/DATA-SEL CMOS/74HC 8-TO-1-LINE	01295	SN74HCT652NT
A4U8	1820-4608	3		IC MUXR/DATA-SEL CMOS/74HC 8-TO-1-LINE	01295	SN74HCT652NT
A4U9	1820-4608	3		IC MUXR/DATA-SEL CMOS/74HC 8-TO-1-LINE	01295	SN74HCT652NT
A4U10	1820-3344	2	10	IC SHF-RGTR CMOS/74HC ASYNCHRO SERIAL-IN	04713	MC74HC595N
A4U11	1820-3344	2		IC SHF-RGTR CMOS/74HC ASYNCHRO SERIAL-IN	04713	MC74HC595N
A4U12	1820-3344	2		IC SHF-RGTR CMOS/74HC ASYNCHRO SERIAL-IN	04713	MC74HC595N
A4U13	1820-3344	2		IC SHF-RGTR CMOS/74HC ASYNCHRO SERIAL-IN	04713	MC74HC595N
A4U14	1820-3344	2		IC SHF-RGTR CMOS/74HC ASYNCHRO SERIAL-IN	04713	MC74HC595N
A4U15	1820-3344	2		IC SHF-RGTR CMOS/74HC ASYNCHRO SERIAL-IN	04713	MC74HC595N
A4U16	1820-3344	2		IC SHF-RGTR CMOS/74HC ASYNCHRO SERIAL-IN	04713	MC74HC595N
A4U17	1820-3344	2		IC SHF-RGTR CMOS/74HC ASYNCHRO SERIAL-IN	04713	MC74HC595N
A4U18	1820-4608	3		IC MUXR/DATA-SEL CMOS/74HC 8-TO-1-LINE	01295	SN74HCT652NT
A4U19	1820-3344	2		IC SHF-RGTR CMOS/74HC ASYNCHRO SERIAL-IN	04713	MC74HC595N
A4U20	1820-4608	3		IC MUXR/DATA-SEL CMOS/74HC 8-TO-1-LINE	01295	SN74HCT652NT
A4U21	1820-4608	3		IC MUXR/DATA-SEL CMOS/74HC 8-TO-1-LINE	01295	SN74HCT652NT
A4U22	1820-4608	3		IC MUXR/DATA-SEL CMOS/74HC 8-TO-1-LINE	01295	SN74HCT652NT
A4U23	1820-4608	3		IC MUXR/DATA-SEL CMOS/74HC 8-TO-1-LINE	01295	SN74HCT652NT
A4U24	1820-4608	3		IC MUXR/DATA-SEL CMOS/74HC 8-TO-1-LINE	01295	SN74HCT652NT
A4U25	1818-4017	3		IC RAM S 32KX8 (256K)	28480	1818-4017
A4U26	1818-4017	3		IC RAM S 32KX8 (256K)	28480	1818-4017
A4U27	1818-4017	3		IC RAM S 32KX8 (256K)	28480	1818-4017
A4U28	1818-4017	3		IC RAM S 32KX8 (256K)	28480	1818-4017
A4U29	1818-4017	3		IC RAM S 32KX8 (256K)	28480	1818-4017
A4U30	1820-3344	2		IC SHF-RGTR CMOS/74HC ASYNCHRO SERIAL-IN	04713	MC74HC595N

REPLACEABLE PARTS

Table 6-7. A4 Replaceable Parts (7 of 8)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A4U31	1820-3789	9	2	IC FF CMOS/74HC D-TYPE POS-EDGE-TRIG COM	27014	MM74HC574N
A4U32	1820-3591	1	6	IC GATE TTL AS NAND QUAD 2-INP	01295	SN74AS00N
A4U33	1820-3591	1		IC GATE TTL AS NAND QUAD 2-INP	01295	SN74AS00N
A4U34	1820-3749	1	3	IC MUXR/DATA-SEL TTL AS 2-TO-1-LINE QUAD	01295	SN74AS258N
A4U35	1820-4652	7	3	IC FF TTL AS D-TYPE POS-EDGE-TRIG COM	01295	SN74AS823NT
A4U36	1820-4594	6	2	IC COMPTR TTL AS MAGTD 8-BIT	01295	SN74AS866N
A4U37	1820-4594	6		IC COMPTR TTL AS MAGTD 8-BIT	01295	SN74AS866N
A4U38	1820-4652	7		IC FF TTL AS D-TYPE POS-EDGE-TRIG COM	01295	SN74AS823NT
A4U39	1820-3749	1		IC MUXR/DATA-SEL TTL AS 2-TO-1-LINE QUAD	01295	SN74AS258N
A4U40	1820-3749	1		IC MUXR/DATA-SEL TTL AS 2-TO-1-LINE QUAD	01295	SN74AS258N
A4U41	1820-3493	2	3	IC FF TTL AS D-TYPE POS-EDGE-TRIG	01295	SN74AS74N
A4U42	1820-2777	3	1	IC CNTR TTL ALS BIN SYNCHRO	01295	SN74ALS161BN
A4U43	1820-2488	3	1	IC FF TTL ALS D-TYPE POS-EDGE-TRIG	01295	SN74ALS74AN
A4U44	1820-2739	7	1	IC GATE TTL ALS NOR QUAD 2-INP	01295	SN74ALS02N
A4U45	1820-3789	9		IC FF CMOS/74HC D-TYPE POS-EDGE-TRIG COM	27014	MM74HC574N
A4U46	1820-2757	9	2	IC FF TTL ALS D-TYPE POS-EDGE-TRIG OCTL	01295	SN74ALS574AN
A4U47	1820-2693	2	1	IC FF TTL F J-K BAR POS-EDGE-TRIG	07263	74F109PC
A4U48	1820-3731	1	1	IC GATE TTL AS NAND TPL 3-INP	01295	SN74AS10N
A4U49	1820-3729	7	1	IC GATE TTL AS NOR QUAD 2-INP	01295	SN74AS02N
A4U50	1820-3493	2		IC FF TTL AS D-TYPE POS-EDGE-TRIG	01295	SN74AS74N
A4U51	1820-3591	1		IC GATE TTL AS NAND QUAD 2-INP	01295	SN74AS00N
A4U52	1820-3493	2		IC FF TTL AS D-TYPE POS-EDGE-TRIG	01295	SN74AS74N
A4U53	1820-4652	7		IC FF TTL AS D-TYPE POS-EDGE-TRIG COM	01295	SN74AS823NT
A4U54	1820-3465	8	2	IC FF TTL ALS D-TYPE POS-EDGE-TRIG COM	01295	SN74ALS174N
A4U55	1820-3920	0	1	IC DRVR TTL AS AND QUAD 2-INP	01295	SN74AS1008N
A4U56	1820-3591	1		IC GATE TTL AS NAND QUAD 2-INP	01295	SN74AS00N
A4U57	1820-3591	1		IC GATE TTL AS NAND QUAD 2-INP	01295	SN74AS00N
A4U58	1820-2656	7	1	IC GATE TTL ALS NAND QUAD 2-INP	01295	SN74ALS00AN
A4U59	1820-2676	1	1	IC GATE TTL F AND-OR-INV	07263	74F64PC
A4U60	1820-3397	5	1	IC MUXR/DATA-SEL TTL ALS 4-TO-1-LINE	01295	SN74ALS153N
A4U61	1820-3591	1		IC GATE TTL AS NAND QUAD 2-INP	01295	SN74AS00N
A4U62	1820-2694	3	1	IC FF TTL F J-K NEG-EDGE-TRIG	07263	74F112PC
A4U63	1820-4079	2	4	IC XLTR ECL/10KH ECL-TO-TTL QUAD	04713	MC10H125P
A4U64	1820-4079	2		IC XLTR ECL/10KH ECL-TO-TTL QUAD	04713	MC10H125P
A4U65	1820-4079	2		IC XLTR ECL/10KH ECL-TO-TTL QUAD	04713	MC10H125P
A4U66	1820-3465	8		IC FF TTL ALS D-TYPE POS-EDGE-TRIG COM	01295	SN74ALS174N
A4U67	1820-0919	1	1	IC COMPTR ECL A/D DUAL	04713	MC1650L
A4U68	1826-1556	6	1	A/D 10-BIT 28-DIP-C (See Note*)	08452	CX20220-1
A4U69	1820-4079	2		IC XLTR ECL/10KH ECL-TO-TTL QUAD	04713	MC10H125P
A4U70	1820-3973	3	1	IC GATE TTL ALS EXCL-OR QUAD 2-INP	01295	SN74ALS86N
A4U71	1826-0858	9	3	D/A 8-BIT 16-CBRZ/SDR BPLR	24355	AD558JD
A4U72	1826-0858	9		D/A 8-BIT 16-CBRZ/SDR BPLR	24355	AD558JD
A4U73	1820-2757	9		IC FF TTL ALS D-TYPE POS-EDGE-TRIG OCTL	01295	SN74ALS574AN
A4U74	1820-0803	2	1	IC GATE ECL OR-NOR TPL	04713	MC10105P
A4U75	1820-2508	8	1	IC GATE ECL EXCL-OR QUAD 2-INP	04713	MC10113P
A4U76	1826-0858	9		D/A 8-BIT 16-CBRZ/SDR BPLR	24355	AD558JD
A4U77	1826-1222	3	1	IC OP AMP H-SLEW-RATE QUAD 14-DIP-C PKG	28480	1826-1222
A4U78	1826-0650	9	1	IC-AD 584KH	28480	1826-0650
A4U79	1820-2696	5	1	IC FF TTL F D-TYPE POS-EDGE-TRIG COM CLK	07263	74F175PC
A4U90	1810-0204	6	3	NETWORK-RES 8-SIP 1.0K OHM X 7	11236	750-81-R1K

*NOTE: A4R63 and A4U68 are interrelated.
Refer to the Adjustments chapter for
more information.

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Table 6-7. A4 Replaceable Parts (8 of 8)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A4U91	1810-0204	6		NETWORK-RES 8-SIP 1.0K OHM X 7	11236	750-81-R1K
A4U92	1810-0204	6		NETWORK-RES 8-SIP 1.0K OHM X 7	11236	750-81-R1K
A4U93	1810-0382	1	2	NETWORK-RES 10-SIP 100.0 OHM X 9	11236	750-101-R100
A4U94	1810-0382	1		NETWORK-RES 10-SIP 100.0 OHM X 9	11236	750-101-R100
A4U95	1810-0279	5	1	NETWORK-RES 10-SIP 4.7K OHM X 9	91637	CSC10A01-472G/MSP
A4U96	1810-0205	7	2	NETWORK-RES 8-SIP 4.7K OHM X 7	11236	750-81-R4.7K
A4U97	1810-0205	7		NETWORK-RES 8-SIP 4.7K OHM X 7	11236	750-81-R4.7K
A4U99	1810-0332	1	1	NETWORK-RES 8-SIP 680.0 OHM X 7	11236	750-81-R680
A4W1	8159-0005	0	2	JUMPER-22 AWG LEAD DIA	28480	8159-0005
A4W2	8159-0005	0		JUMPER-22 AWG LEAD DIA	28480	8159-0005
A4XU68	1200-1156	6	1	SOCKET-IC 28-CONT DIP DIP-SLDR	28480	1200-1156

Table 6-8. A5 Replaceable Parts (1 of 6)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A5	70700-60004	0	1	PROCESSOR BOARD ASSEMBLY	28480	70700-60004
A5BT1	1420-0331	3	1	BATTERY 3.4V 1.75A-HR LITHIUM THIONYL	28480	1420-0331
A5C1	0160-4554	7	29	CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A5C6	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A5C7	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A5C8	0160-4812	0	1	CAPACITOR-FXD 220PF +-5% 100VDC CER	28480	0160-4812
A5C9	0180-0228	6	1	CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A5C10	0180-0291	3	3	CAPACITOR-FXD 1UF+-10% 35VDC TA	56289	150D105X9035A2
A5C11	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A5C12	0160-3451	1	3	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A5C13	0180-3635	5	2	CAPACITOR-FXD 470UF+-20% 25VDC AL	28480	0180-3635
A5C14	0180-3635	5		CAPACITOR-FXD 470UF+-20% 25VDC AL	28480	0180-3635
A5C17	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A5C18	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A5C19	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A5C20	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A5C21	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A5C22	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A5C23	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A5C24	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A5C25	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A5C26	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A5C27	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A5C28	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A5C29	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A5C30	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A5C31	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A5C33	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A5C34	0160-3451	1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A5C35	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A5C36	0180-0291	3		CAPACITOR-FXD 1UF+-10% 35VDC TA	56289	150D105X9035A2
A5C37	0160-3451	1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A5C38	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A5C39	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A5C40	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A5C41	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A5C42	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A5C43	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A5C44	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A5C45	0180-3634	4	4	CAPACITOR-FXD 2200UF+-20% 10VDC AL	28480	0180-3634
A5C46	0180-3634	4		CAPACITOR-FXD 2200UF+-20% 10VDC AL	28480	0180-3634
A5C47	0160-5422	0	2	CAPACITOR-FXD .047UF +-20% 50VDC CER	28480	0160-5422
A5C48	0160-4835	7	1	CAPACITOR-FXD .1UF +-10% 50VDC CER	28480	0160-4835
A5C49	0160-5422	0		CAPACITOR-FXD .047UF +-20% 50VDC CER	28480	0160-5422
A5C50	0180-3634	4		CAPACITOR-FXD 2200UF+-20% 10VDC AL	28480	0180-3634
A5C51	0180-3634	4		CAPACITOR-FXD 2200UF+-20% 10VDC AL	28480	0180-3634
A5C52	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A5C53	0180-0291	3		CAPACITOR-FXD 1UF+-10% 35VDC TA	56289	150D105X9035A2
A5C54	0160-0575	4	3	CAPACITOR-FXD .047UF +-20% 50VDC CER	28480	0160-0575
A5C56	0160-4801	7	2	CAPACITOR-FXD 100PF +-5% 100VDC CER	28480	0160-4801

Table 6-8. A5 Replaceable Parts (2 of 6)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A5C57	0160-4801	7		CAPACITOR-FXD 100PF +-5% 100VDC CER	28480	0160-4801
A5C58	0160-0575	4		CAPACITOR-FXD .047UF +-20% 50VDC CER	28480	0160-0575
A5C59	0160-0575	4		CAPACITOR-FXD .047UF +-20% 50VDC CER	28480	0160-0575
A5CR1	1901-0050	3	5	DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A5CR2	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A5CR3	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A5CR4	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A5CR5	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A5CR6	1901-0518	8	1	DIODE-SM SIG SCHOTTKY	28480	1901-0518
A5DS1	1990-0933	3	2	LED-RED 4 ARY .5MCD	28480	1990-0933
A5DS2	1990-0933	3		LED-RED 4 ARY .5MCD	28480	1990-0933
A5DS9	1990-0678	8	4	LED-LAMP LUM-INT=800UCD IF=30MA-MAX	28480	1990-0678
A5DS10	1990-0678	8		LED-LAMP LUM-INT=800UCD IF=30MA-MAX	28480	1990-0678
A5DS11	1990-0678	8		LED-LAMP LUM-INT=800UCD IF=30MA-MAX	28480	1990-0678
A5DS12	1990-0678	8		LED-LAMP LUM-INT=800UCD IF=30MA-MAX	28480	1990-0678
A5F1	2110-0701	5	1	FUSE 1.6A 250V NTD IEC	28480	2110-0701
A5J1	1251-8767	6	3	CONN-POST TYPE .100-PIN-SPCG 50-CONT	28480	1251-8767
A5J2	1250-1955	8	2	CONNECTOR-RF SM-SLD FEM PC 50-OHM	28480	1250-1955
A5J3	1250-1955	8		CONNECTOR-RF SM-SLD FEM PC 50-OHM	28480	1250-1955
A5J4	1252-0718	3	1	CONN-POST TYPE .100-PIN-SPCG 5-CONT	28480	1252-0718
A5L1	9140-0158	6	3	INDUCTOR RF-CH-MLD 1UH 10%	28480	9140-0158
A5L2	9140-0158	6		INDUCTOR RF-CH-MLD 1UH 10%	28480	9140-0158
A5L3	9140-0158	6		INDUCTOR RF-CH-MLD 1UH 10%	28480	9140-0158
A5L4	5180-8084	3	2	33.6NH INDUCTOR	28480	5180-8084
A5L5	5180-8084	3		33.6NH INDUCTOR	28480	5180-8084
A5L6	5180-8085	4	2	149UH INDUCTOR	28480	5180-8085
A5L7	5180-8085	4		149UH INDUCTOR	28480	5180-8085
A5MP2	1205-0639	8	2	HEAT SINK TO-220-CS	30161	5910B
A5MP3	1480-0059	8	2	PIN-ROLL .062-IN-DIA .25-IN-LG STL	28480	1480-0059
A5MP4	4040-0753	0	2	EXTR-PC BD GRN POLYC .062-IN-BD-THKNS	28480	4040-0753
A5MP5	2110-0714	0	1	FUSEHOLDER-BLOCK 2A 250 V 1-FU	28480	2110-0714
A5MP6	1400-1267	4	1	HOLDER-BAT .531-.656-DIA FOR AA CELLS	28480	1400-1267
A5MP7	0361-0166	5	1	RIVET-SEMITUB OVH .099DIA .156LG	28480	0361-0166
A5MP8	2950-0078	9	2	NUT-HEX-DBL-CHAM 10-32-THD .067-IN-THK	28480	2950-0078
A5P1	1251-8767	6		CONN-POST TYPE .100-PIN-SPCG 50-CONT	28480	1251-8767
A5P2	1251-8767	6		CONN-POST TYPE .100-PIN-SPCG 50-CONT	28480	1251-8767
A5Q1	1854-0215	1	1	TRANSISTOR NPN SI TO-92 PD=350MW	04713	2N3904
A5Q2	1853-0281	9	5	TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A5Q3	1854-0477	7	6	TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A5Q4	1853-0281	9		TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A5Q5	1854-0477	7		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A5Q6	1853-0281	9		TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A5Q7	1855-0645	3	2	TRANSISTOR MOSFET N-CHAN E-MODE TO-220	03051	IFRZ30
A5Q8	1855-0645	3		TRANSISTOR MOSFET N-CHAN E-MODE TO-220	03051	IFRZ30
A5Q9	1854-0477	7		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A5Q10	1853-0281	9		TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A5Q11	1855-0517	8	2	TRANSISTOR MOSFET P-CHAN E-MODE TO-220	9M011	IRF9532
A5Q12	1853-0281	9		TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A5Q13	1854-0477	7		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A5Q14	1855-0517	8		TRANSISTOR MOSFET P-CHAN E-MODE TO-220	9M011	IRF9532
A5Q15	1854-0477	7		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A5Q16	1853-0389	8	1	TRANSISTOR PNP SI TO-92 PD=350MW FT=4MHZ	28480	1853-0389

Table 6-8. A5 Replaceable Parts (3 of 6)

Reference Designation	HP Part Number	CD	Qty	Description	Mfr Code	Mfr Part Number
A5Q17	1854-0477	7		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A5R1	0698-7236	7	7	RESISTOR 1K 1% .05W F TC=0+-100	24546	C3-1/8-TO-1001-F
A5R2	0698-7188	8	2	RESISTOR 10 1% .05W F TC=0+-100	24546	C3-1/8-TO-10R-F
A5R3	0698-7260	7	3	RESISTOR 10K 1% .05W F TC=0+-100	24546	C3-1/8-TO-1002-F
A5R4	0698-7219	6	1	RESISTOR 196 1% .05W F TC=0+-100	24546	C3-1/8-TO-196R-F
A5R5	0698-7244	7	2	RESISTOR 2.15K 1% .05W F TC=0+-100	24546	C3-1/8-TO-2151-F
A5R6	0757-0416	7	15	RESISTOR 511 1% .125W F TC=0+-100	24546	CT4-1/8-TO-511R-F
A5R7	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	CT4-1/8-TO-511R-F
A5R8	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	CT4-1/8-TO-511R-F
A5R9	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	CT4-1/8-TO-511R-F
A5R10	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	CT4-1/8-TO-511R-F
A5R11	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	CT4-1/8-TO-511R-F
A5R12	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	CT4-1/8-TO-511R-F
A5R13	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	CT4-1/8-TO-511R-F
A5R18	0698-7212	9	1	RESISTOR 100 1% .05W F TC=0+-100	24546	C3-1/8-TO-100R-F
A5R19	0698-7284	5	5	RESISTOR 100K 1% .05W F TC=0+-100	24546	C3-1/8-TO-1003-F
A5R20	0698-7260	7		RESISTOR 10K 1% .05W F TC=0+-100	24546	C3-1/8-TO-1002-F
A5R21	0698-7240	3	1	RESISTOR 1.47K 1% .05W F TC=0+-100	24546	C3-1/8-TO-1471-F
A5R22	0698-7239	0	5	RESISTOR 1.33K 1% .05W F TC=0+-100	24546	C3-1/8-TO-1331-F
A5R23	0698-7279	8	2	RESISTOR 61.9K 1% .05W F TC=0+-100	24546	C3-1/8-TO-6192-F
A5R24	0698-7244	7		RESISTOR 2.15K 1% .05W F TC=0+-100	24546	C3-1/8-TO-2151-F
A5R25	0698-7260	7		RESISTOR 10K 1% .05W F TC=0+-100	24546	C3-1/8-TO-1002-F
A5R26	0698-7239	0		RESISTOR 1.33K 1% .05W F TC=0+-100	24546	C3-1/8-TO-1331-F
A5R27	0698-7279	8		RESISTOR 61.9K 1% .05W F TC=0+-100	24546	C3-1/8-TO-6192-F
A5R28	0698-7238	9	1	RESISTOR 1.21K 1% .05W F TC=0+-100	24546	C3-1/8-TO-1211-F
A5R29	0698-3441	8	2	RESISTOR 215 1% .125W F TC=0+-100	24546	CT4-1/8-TO-215R-F
A5R30	0698-3446	3	2	RESISTOR 383 1% .125W F TC=0+-100	24546	CT4-1/8-TO-383R-F
A5R31	0698-0084	9	4	RESISTOR 2.15K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-2151-F
A5R32	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-2151-F
A5R33	0698-3446	3		RESISTOR 383 1% .125W F TC=0+-100	24546	CT4-1/8-TO-383R-F
A5R34	0698-4037	0	1	RESISTOR 46.4 1% .125W F TC=0+-100	28480	0698-4037
A5R35	0698-3155	1	9	RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-4641-F
A5R36	0686-1005	1	4	RESISTOR 10 5% .5W CC TC=0+412	01121	EB1005
A5R37	0686-1005	1		RESISTOR 10 5% .5W CC TC=0+412	01121	EB1005
A5R38	0757-0280	3	4	RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-1001-F
A5R39	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-1001-F
A5R40	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-4641-F
A5R42	0686-1005	1		RESISTOR 10 5% .5W CC TC=0+412	01121	EB1005
A5R43	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-1001-F
A5R44	0686-1005	1		RESISTOR 10 5% .5W CC TC=0+412	01121	EB1005
A5R45	0757-0279	0	2	RESISTOR 3.16K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-3161-F
A5R46	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-4641-F
A5R47	0757-0440	7	2	RESISTOR 7.5K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-7501-F
A5R48	0757-0440	7		RESISTOR 7.5K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-7501-F
A5R50	0698-3441	8		RESISTOR 215 1% .125W F TC=0+-100	24546	CT4-1/8-TO-215R-F
A5R51	0757-0279	0		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-3161-F
A5R52	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-4641-F
A5R53	0698-3427	0	2	RESISTOR 13.3 1% .125W F TC=0+-100	03888	PME55-1/8-T013R3F
A5R54	0698-7236	7		RESISTOR 1K 1% .05W F TC=0+-100	24546	C3-1/8-TO-1001-F
A5R55	0698-7284	5		RESISTOR 100K 1% .05W F TC=0+-100	24546	C3-1/8-TO-1003-F

Table 6-8. A5 Replaceable Parts (4 of 6)

Reference Designation	HP Part Number	CD	Qty	Description	Mfr Code	Mfr Part Number
A5R56	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
A5R57	0698-7236	7		RESISTOR 1K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1001-F
A5R58	0698-7284	5		RESISTOR 100K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1003-F
A5R59	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
A5R60	0698-3427	0		RESISTOR 13.3 1% .125W F TC=0+-100	03888	PME55-1/8-T013R3F
A5R61	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A5R62	0698-7239	0		RESISTOR 1.33K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1331-F
A5R63	0757-0463	4	1	RESISTOR 82.5K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-8252-F
A5R64	0698-3151	7	1	RESISTOR 2.87K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2871-F
A5R65	0698-7284	5		RESISTOR 100K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1003-F
A5R66	0698-7239	0		RESISTOR 1.33K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1331-F
A5R67	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2151-F
A5R68	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2151-F
A5R69	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	CT4-1/8-T0-511R-F
A5R70	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	CT4-1/8-T0-511R-F
A5R71	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	CT4-1/8-T0-511R-F
A5R72	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	CT4-1/8-T0-511R-F
A5R73	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	CT4-1/8-T0-511R-F
A5R74	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	CT4-1/8-T0-511R-F
A5R75	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	CT4-1/8-T0-511R-F
A5R76	0698-7239	0		RESISTOR 1.33K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1331-F
A5R80	0698-7284	5		RESISTOR 100K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1003-F
A5R85	0698-7188	8		RESISTOR 10 1% .05W F TC=0+-100	24546	C3-1/8-T0-10R-F
A5R86	0698-7236	7		RESISTOR 1K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1001-F
A5R87	0698-7236	7		RESISTOR 1K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1001-F
A5R88	0698-7236	7		RESISTOR 1K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1001-F
A5R89	0698-7224	3	1	RESISTOR 316 1% .05W F TC=0+-100	24546	C3-1/8-T0-316R-F
A5R90	0698-7252	7	2	RESISTOR 4.64K 1% .05W F TC=0+-100	24546	C3-1/8-T0-4641-F
A5R91	0698-7252	7		RESISTOR 4.64K 1% .05W F TC=0+-100	24546	C3-1/8-T0-4641-F
A5R92	0698-7236	7		RESISTOR 1K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1001-F
A5R93	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
A5R94	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
A5R95	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
A5S1	3101-1756	4	1	SWITCH-SL SPDT MINTR .3A 125VAC PC	28480	3101-1756
A5S2	3101-2243	6	1	SWITCH-RKR DIP-RKR-ASSY 8-1A .05A 30VDC	28480	3101-2243
A5T1	5180-2375	3	1	COIL 35/75UH	28480	5180-2375
A5T2	70700-80001	9	1	XFMR-24.3V 40KHZ	28480	70700-80001
A5T3	5180-8086	5	1	CMM MODE CHOKE	28480	5180-8086
A5TP1	0360-1682	0	22	TERMINAL-STUD SGL-TUR PRESS-MTG	28480	0360-1682
A5TP2	0360-1682	0		TERMINAL-STUD SGL-TUR PRESS-MTG	28480	0360-1682
A5TP3	0360-1682	0		TERMINAL-STUD SGL-TUR PRESS-MTG	28480	0360-1682
A5TP4	0360-1682	0		TERMINAL-STUD SGL-TUR PRESS-MTG	28480	0360-1682
A5TP5	0360-1682	0		TERMINAL-STUD SGL-TUR PRESS-MTG	28480	0360-1682
A5TP6	0360-1682	0		TERMINAL-STUD SGL-TUR PRESS-MTG	28480	0360-1682
A5TP7	0360-1682	0		TERMINAL-STUD SGL-TUR PRESS-MTG	28480	0360-1682
A5TP8	0360-1682	0		TERMINAL-STUD SGL-TUR PRESS-MTG	28480	0360-1682
A5TP9	0360-1682	0		TERMINAL-STUD SGL-TUR PRESS-MTG	28480	0360-1682
A5TP10	0360-1682	0		TERMINAL-STUD SGL-TUR PRESS-MTG	28480	0360-1682
A5TP11	0360-1682	0		TERMINAL-STUD SGL-TUR PRESS-MTG	28480	0360-1682
A5TP12	0360-1682	0		TERMINAL-STUD SGL-TUR PRESS-MTG	28480	0360-1682
A5TP13	0360-1682	0		TERMINAL-STUD SGL-TUR PRESS-MTG	28480	0360-1682

Table 6-8. A5 Replaceable Parts (5 of 6)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A5TP14	0360-1682	0		TERMINAL-STUD SGL-TUR PRESS-MTG	28480	0360-1682
A5TP15	0360-1682	0		TERMINAL-STUD SGL-TUR PRESS-MTG	28480	0360-1682
A5TP16	0360-1682	0		TERMINAL-STUD SGL-TUR PRESS-MTG	28480	0360-1682
A5TP17	0360-1682	0		TERMINAL-STUD SGL-TUR PRESS-MTG	28480	0360-1682
A5TP18	0360-1682	0		TERMINAL-STUD SGL-TUR PRESS-MTG	28480	0360-1682
A5TP19	0360-1682	0		TERMINAL-STUD SGL-TUR PRESS-MTG	28480	0360-1682
A5TP20	0360-1682	0		TERMINAL-STUD SGL-TUR PRESS-MTG	28480	0360-1682
A5TP21	0360-1682	0		TERMINAL-STUD SGL-TUR PRESS-MTG	28480	0360-1682
A5TP22	0360-1682	0		TERMINAL-STUD SGL-TUR PRESS-MTG	28480	0360-1682
A5U1	1813-0119	8	1	IC-XOSC 40.0 MHZ .01%	34344	K1100A-40MHZ
A5U2	1810-0279	5	7	NETWORK-RES 10-SIP 4.7K OHM X 9	91637	CSC10A01-472G/MSP
A5U3	1810-0279	5		NETWORK-RES 10-SIP 4.7K OHM X 9	91637	CSC10A01-472G/MSP
A5U4	1820-2777	3	2	IC CNTR TTL ALS BIN SYNCHRO	01295	SN74ALS161BN
A5U5	1820-3298	5	4	IC GATE CMOS/74HC OR QUAD 2-INP	27014	MM74HC32N
A5U6	1820-2488	3	1	IC FF TTL ALS D-TYPE POS-EDGE-TRIG	01295	SN74ALS74AN
A5U7	1820-3081	4	2	IC FF CMOS/74HC D-TYPE POS-EDGE-TRIG	04713	MC74HC74N
A5U8	1826-0544	0	1	IC V RGLTR-V-REF-FXD 2.5V 8-DIP-C PKG	28480	1826-0544
A5U9	1820-3757	1	1	IC DRVR TTL AS OR QUAD 2-INP	01295	SN74AS1032AN
A5U10	1820-3493	2	1	IC FF TTL AS D-TYPE POS-EDGE-TRIG	01295	SN74AS74N
A5U11	1820-3297	4	1	IC DRVR CMOS/74HC BUS OCTL	04713	MC74HC244N
A5U12	1810-0279	5		NETWORK-RES 10-SIP 4.7K OHM X 9	91637	CSC10A01-472G/MSP
A5U13	1820-3396	4	1	IC GATE CMOS/74HC AND-OR-INV DUAL 2-INP	04713	MC74HC51N
A5U14	1820-2923	1	1	IC GATE CMOS/74HC NAND TPL 3-INP	04713	MC74HC10N
A5U15	1820-2922	0	2	IC GATE CMOS/74HC NAND QUAD 2-INP	04713	MC74HC00N
A5U16	1826-1229	0	1	IC COMPARATOR PRCN DUAL 8-DIP-C PKG	28480	1826-1229
A5U17	1820-2485	0	1	IC TRANSCEIVER TTL LS INSTR-BUS IEEE-488	01295	SN75160AN
A5U18	1820-2483	8	1	IC RCVR TTL LS BUS OCTL	01295	SN75161AN
A5U19	1820-3793	5	1	IC GATE CMOS/74HC AND DUAL 4-INP	01295	SN74HC21N
A5U20	1820-3789	9	2	IC FF CMOS/74HC D-TYPE POS-EDGE-TRIG COM	27014	MM74HC574N
A5U21	1820-0344	6	1	IC-VERSATILE INTERFACE ADAPTER 2MHZ	28480	1820-0344
A5U22	1820-2774	0	1	IC GATE TTL ALS NAND DUAL 4-INP	01295	SN74ALS20AN
A5U23	1820-2921	9	1	IC INV CMOS/74HC HEX	27014	MM74HC04N
A5U24	1820-2922	0		IC GATE CMOS/74HC NAND QUAD 2-INP	04713	MC74HC00N
A5U25	1820-3794	6	1	IC CNTR CMOS/74HC BIN UP/DOWN SYNCHRO	27014	MM74HC191N
A5U26	1820-3298	5		IC GATE CMOS/74HC OR QUAD 2-INP	27014	MM74HC32N
A5U27	1820-3298	5		IC GATE CMOS/74HC OR QUAD 2-INP	27014	MM74HC32N
A5U28	1820-2924	2	2	IC GATE CMOS/74HC NOR QUAD 2-INP	04713	MC74HC02N
A5U29	1820-2924	2		IC GATE CMOS/74HC NOR QUAD 2-INP	04713	MC74HC02N
A5U30	1820-2458	7	1	IC MISC TTL S 4-BIT	34335	AM25S10PC
A5U31	1818-4017	3	2	IC CMOS 262144 (256K) STAT RAM 120-NS	S0562	TC55257PL-12
A5U32	1818-4017	3		IC CMOS 262144 (256K) STAT RAM 120-NS	S0562	TC55257PL-12
A5U33	1810-0279	5		NETWORK-RES 10-SIP 4.7K OHM X 9	91637	CSC10A01-472G/MSP
A5U34	1820-4675	4	1	IC ENCDR CMOS/74HC PRIORITY 8-TO-3-LINE	28480	1820-4675
A5U35	1820-2777	3		IC CNTR TTL ALS BIN SYNCHRO	01295	SN74ALS161BN
A5U36	1820-3079	0	4	IC DCDR CMOS/74HC 3-TO-8-LINE	04713	MC74HC138N
A5U37	1820-3298	5		IC GATE CMOS/74HC OR QUAD 2-INP	27014	MM74HC32N
A5U38	1820-3081	4		IC FF CMOS/74HC D-TYPE POS-EDGE-TRIG	04713	MC74HC74N
A5U39	1820-4053	2	1	IC INV CMOS/74HC HEX	01295	SN74HC05N
A5U40	1810-0279	5		NETWORK-RES 10-SIP 4.7K OHM X 9	91637	CSC10A01-472G/MSP
A5U41	1810-0136	3	2	NETWORK-RES 10-SIP MULTI-VALUE	28480	1810-0136

Table 6-8. A5 Replaceable Parts (6 of 6)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A5U42	1820-3010	9	1	IC GATE-ARY CMOS 2-INP	10411	LL5320
A5U43	70700-80002	0	1	PROGRAMMED EPROM	28480	70700-80002
A5U44	70700-80014	4	1	PROGRAMMED EPROM	28480	70700-80014
A5U45	1258-0177	0	1	SHUNT-PROGRAMMABLE 8 DBL PIN SETS; .800	91506	8136-475G8
A5U46	1820-4850	7	1	IC68HC000C MPU	28480	1820-4850
A5U47	1906-0229	8	1	DIODE-ARRAY 50V 400MA	01295	TID133
A5U48	1820-3426	1	1	IC TRANSCEIVER TTL S BUS 9-BIT	34335	AM29863DC
A5U49	1820-3330	6	2	IC TRANSCEIVER CMOS/74HC BUS OCTL	27014	MM74HC245N
A5U50	1820-3330	6		IC TRANSCEIVER CMOS/74HC BUS OCTL	27014	MM74HC245N
A5U51	1820-3789	9		IC FF CMOS/74HC D-TYPE POS-EDGE-TRIG COM	27014	MM74HC574N
A5U52	1810-0279	5		NETWORK-RES 10-SIP 4.7K OHM X 9	91637	CSC10A01-472G/MSP
A5U53	1810-0279	5		NETWORK-RES 10-SIP 4.7K OHM X 9	91637	CSC10A01-472G/MSP
A5U54	1820-3079	0		IC DCDR CMOS/74HC 3-TO-8-LINE	04713	MC74HC138N
A5U55	1820-3079	0		IC DCDR CMOS/74HC 3-TO-8-LINE	04713	MC74HC138N
A5U56	1820-3079	0		IC DCDR CMOS/74HC 3-TO-8-LINE	04713	MC74HC138N
A5U57	1906-0289	0	1	DIODE-FW BRDG 200V 800MA	1B546	VM28X
A5U58	1826-0141	3	1	IC COMPARATOR GP DUAL 14-DIP-C PKG	27014	LM319J
A5U59	1826-0990	0	1	IC OP AMP GP DUAL 8-DIP-C PKG	28480	1826-0990
A5U60	1810-0136	3		NETWORK-RES 10-SIP MULTI-VALUE	28480	1810-0136
A5VR1	1902-0202	9	9	DIODE-ZNR 15V 5% PD=1W IR=5UA	28480	1902-0202
A5VR2	1902-0202	9		DIODE-ZNR 15V 5% PD=1W IR=5UA	28480	1902-0202
A5VR3	1902-0202	9		DIODE-ZNR 15V 5% PD=1W IR=5UA	28480	1902-0202
A5VR4	1902-0202	9		DIODE-ZNR 15V 5% PD=1W IR=5UA	28480	1902-0202
A5VR5	1902-3048	7	1	DIODE-ZNR 3.48V 5% DO-35 PD=.4W	28480	1902-3048
A5VR6	1902-0202	9		DIODE-ZNR 15V 5% PD=1W IR=5UA	28480	1902-0202
A5VR7	1902-0556	6	4	DIODE-ZNR 20V 5% PD=1W IR=5UA	28480	1902-0556
A5VR8	1902-0556	6		DIODE-ZNR 20V 5% PD=1W IR=5UA	28480	1902-0556
A5VR9	1902-0556	6		DIODE-ZNR 20V 5% PD=1W IR=5UA	28480	1902-0556
A5VR10	1902-0556	6		DIODE-ZNR 20V 5% PD=1W IR=5UA	28480	1902-0556
A5W2	8159-0005	0	2	JUMPER-22 AWG LEAD DIA	28480	8159-0005
A5W5	8159-0005	0		JUMPER-22 AWG LEAD DIA	28480	8159-0005
A5XA1	1200-0567	1	2	SOCKET-IC 28-CONT DIP DIP-SLDR	28480	1200-0567
A5XA2	1200-0567	1		SOCKET-IC 28-CONT DIP DIP-SLDR	28480	1200-0567
A5XA3	1200-0607	0	1	SOCKET-IC 16-CONT DIP DIP-SLDR	28480	1200-0607

Chapter 7
MAJOR ASSEMBLY AND CABLE LOCATIONS

This section contains the assembly location diagrams for the HP 70700A Digitizer. Instructions describing the disassembly and assembly of the major parts of the module are included in Chapter 5 of this manual, Replacement Procedures.
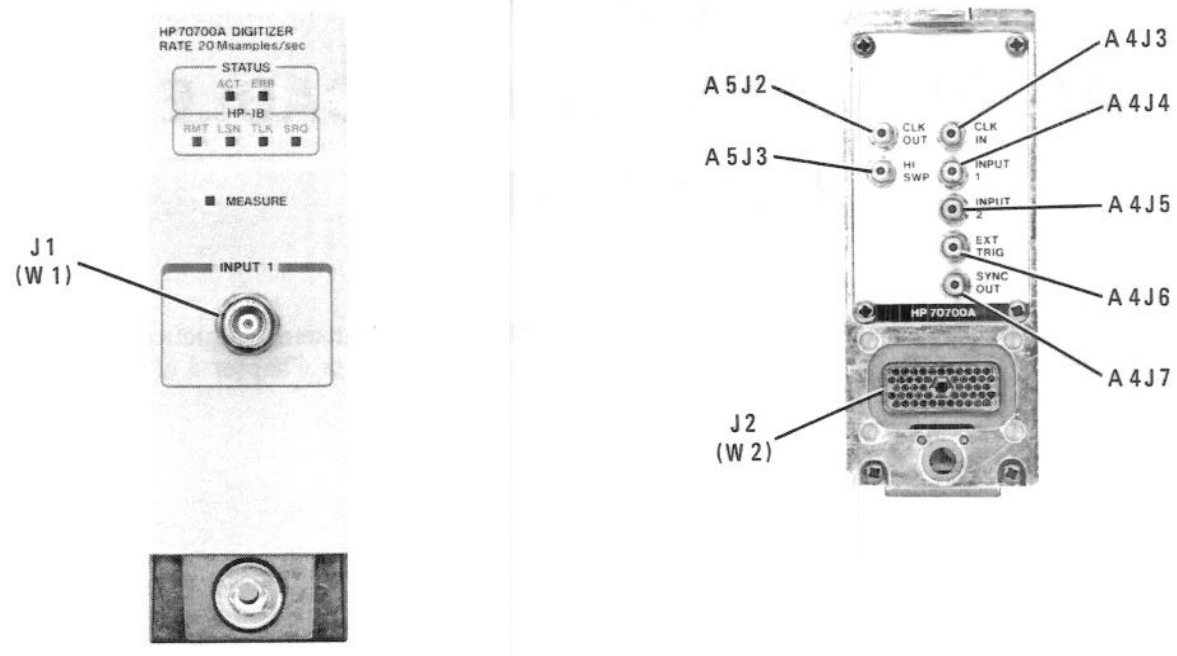
Figure 7-1. HP 70700A Front and Rear Panels
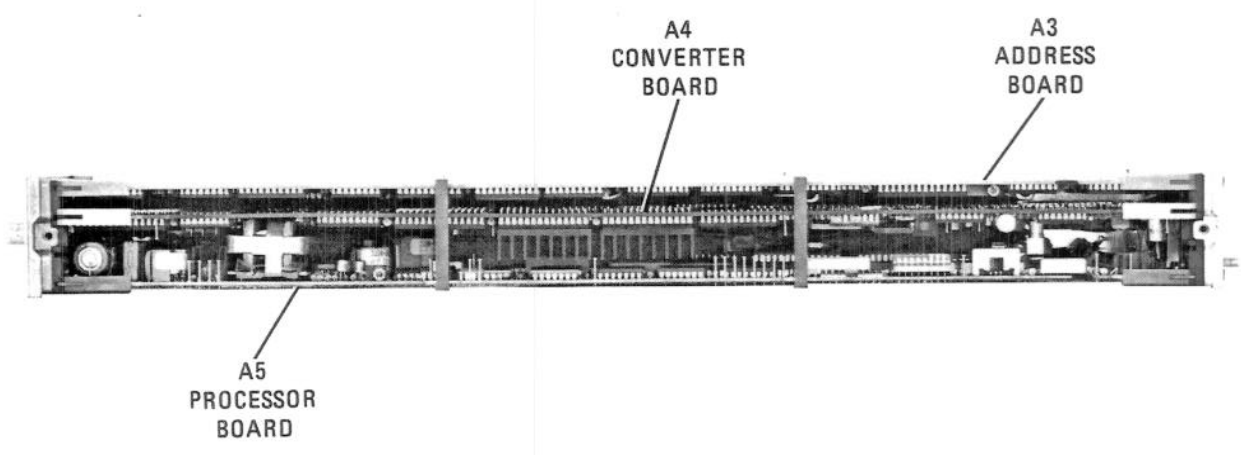
Figure 7-2. Major Assembly Locations
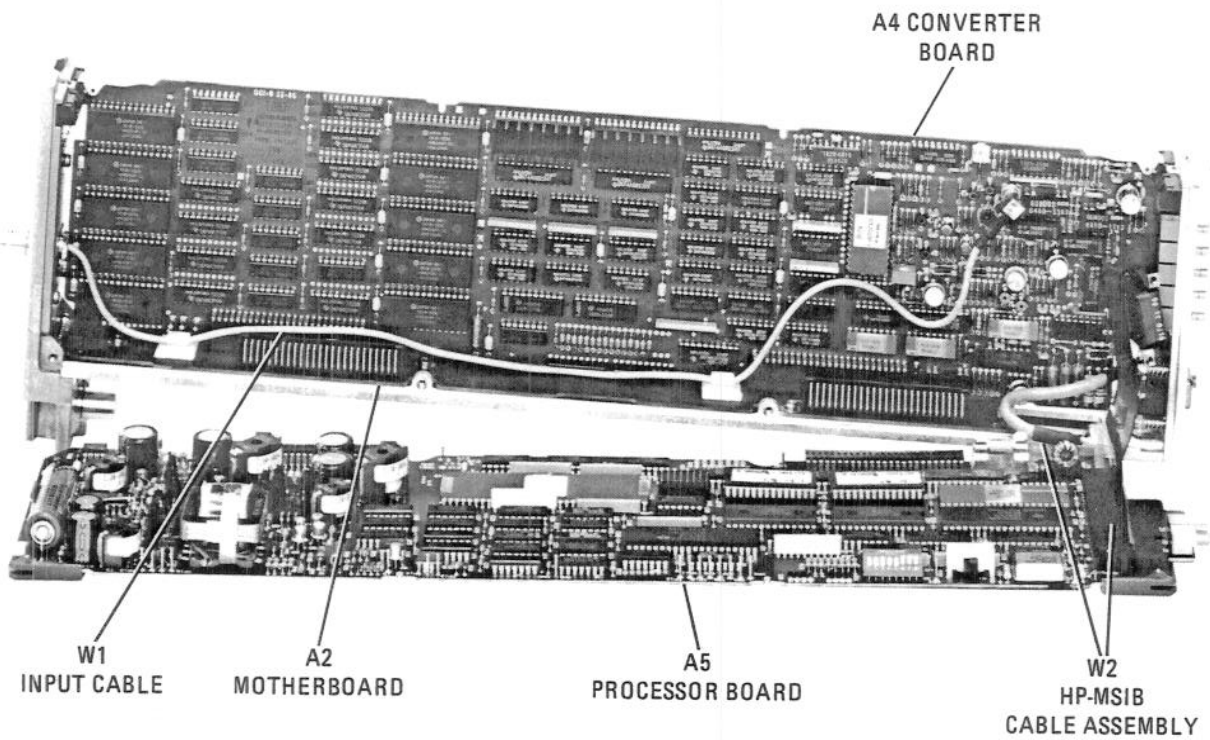
Figure 7-3. Cable Locations
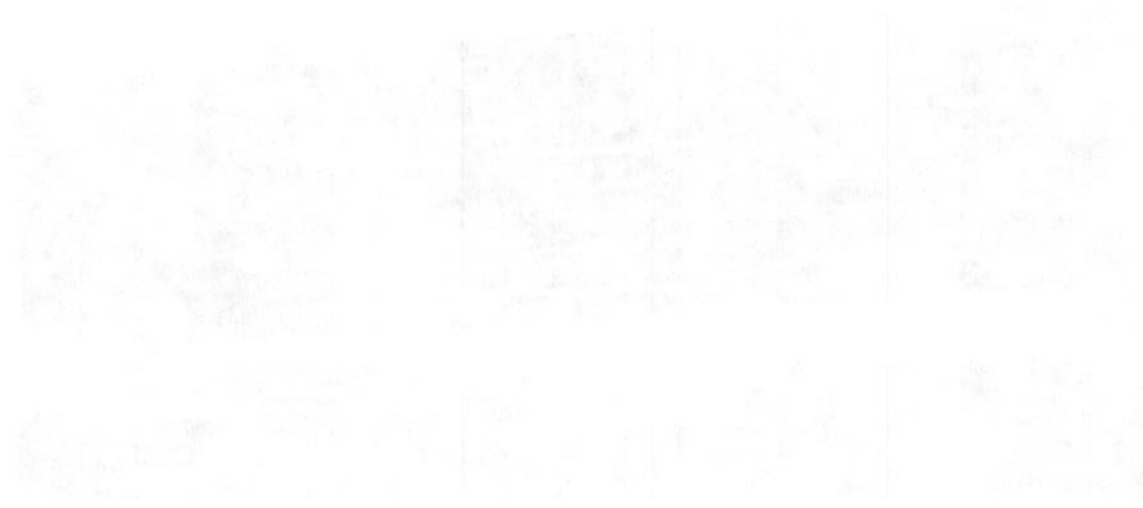
Chapter 8
SCHEMATICS AND
COMPONENT LOCATIONS

INTRODUCTION

This chapter contains the schematics and component location diagrams for the printed circuit boards used in the HP 70700A Digitizer.

ASSEMBLY VERSIONS

All assembly versions produced by the print date of the manual will be documented in this manual. Illustrations for versions produced after the manual's print date will be included in a Manual Updating Supplement (see Instruments Covered by Manual in Chapter 1, General Information).

NOTE

Be sure that you are using the correct schematic or component location diagram for the assembly being worked on. Match the assembly version number printed on the circuit board with the version number printed on the diagrams.

The version of a board assembly is identified by the part number printed on the circuit board. The part number is a ten-digit number consisting of a five-digit prefix and five-digit suffix. Prefix numbers identify the module and will always be 70700. The suffix varies for each board type and version produced. Later versions of an assembly will always have a suffix with a higher numerical value than the first version.

GRAPHIC SYMBOLS USED ON SCHEMATIC AND BLOCK DIAGRAMS
BASIC COMPONENT SYMBOLS
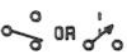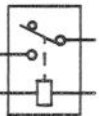
VARIABLE RESISTOR:
WIPER MOVES TOWARD CW WHEN SHAFT IS
ROTATED IN A CLOCKWISE DIRECTION.

THERMISTOR

ELECTROLYTIC CAPACITOR

VARIABLE CAPACITOR

SLIDE, TOGGLE, OR ROCKER SWITCH

FEEDTHROUGH CAPACITOR

TOROIDAL INDUCTOR

RELAY:
BOX OFTEN OMITTED

FERRITE BEAD

SURFACE ACOUSTIC WAVE (SAW)

PUSHBUTTON SWITCH N.C.

PUSHBUTTON SWITCH N.O.

CRYSTAL

SPEAKER

GENERAL PURPOSE DIODE

BREAKDOWN DIODE: ZENER

SCHOTTKY DIODE

VARACTOR DIODE (VARICAP)

ASTERISK DENOTES A FACTORY
SELECTED COMPONENT

FUSE

CIRCUIT ASSEMBLY BORDERLINE

HEAVY LINE WITH ARROWS INDICATES
PATH AND DIRECTION OF MAIN SIGNAL

HEAVY DASHED LINE WITH ARROWS
INDICATES PATH AND DIRECTION OF
MAIN FEEDBACK

DIGITAL BUS

LIGHT-EMITTING DIODE

PIN DIODE

TRIAC

STEP RECOVERY DIODE

TEMPERATURE-COMPENSATED
VOLTAGE-REFERENCE DIODE

SCR (SILICON CONTROLLED RECTIFIER)

TRANSISTOR, PNP

TRANSISTOR, NPN

JUNCTION-FET, N-CHANNEL

JUNCTION-FET, P-CHANNEL

MOS-FET, N-CHANNEL

MOS-FET, P-CHANNEL

INDICATES SHIELDING
CONDUCTOR FOR CABLES

GROUNDED COAXIAL SHIELDING

INDICATES A PLUG-IN CONNECTION

INDICATES A SOLDERED OR
MECHANICAL CONNECTION

INDICATES A SINGLE PIN OF A
PC BOARD EDGE CONNECTOR

CONNECTION SYMBOL INDICATING A JACK
(EXCEPT FOR PC BOARD EDGE CONNECTORS)

CONNECTION SYMBOL INDICATING A PLUG
(EXCEPT FOR PC BOARD EDGE CONNECTORS)

LIMITER

ENCLOSES REAR PANEL DISIGNATION

MULTI-CONDUCTOR CABLE OR BUS

FIGURE 8-1. GRAPHIC SYMBOLS (1 OF 2)

GRAPHIC SYMBOLS USED ON SCHEMATIC AND BLOCK DIAGRAMS
BASIC COMPONENT SYMBOLS (CONT'D)

TEST POINT: TERMINAL PROVIDED FOR TEST PROBE CONNECTION

EARTH GROUND SYMBOL

MEASUREMENT POINT: USED TO INDICATE A CONVENIENT POINT FOR MEASUREMENT. NO TERMINAL PROVIDED FOR TEST PROBE.

INSTRUMENT CHASIS GROUND: MAY BE ACCOMPANIED BY A NUMBER OR LETTER TO SPECIFY A PARTICULAR GROUND.

INDICATES WIRE OR CABLE COLOR CODE. COLOR SAME AS RESISTOR COLOR CODE. FIRST NUMBER INDICATES BASE COLOR, SECOND AND THIRD NUMBERS INDICATE COLORED STRIPES.

SCREWDRIVER ADJUSTMENT

JUMPER WIRE

PANEL CONTROL

COMMONLY USED ASSEMBLY AND CIRCUIT SYMBOLS

OSCILLATOR, RPG (ROTARY PULSE GENERATOR)

TRANSMISSION LINE

FAN MOTOR

OP AMP

MIXER

AMPLIFIER, BUFFER

LOW PASS FILTER

VARIABLE ATTENUATOR

HIGH PASS FILTER

ATTENUATOR (OR PAD)

BANDPASS FILTER

SAMPLER

PHASE-FREQUENCY DETECTOR

BAND REJECT FILTER

SERVICE DETECTOR

BASIC LOGIC SYMBOLS

AMPLIFIER, BUFFER

AND GATE

INVERTER, BUFFER

OR GATE

3-STATE INVERTER BUFFER

EXCLUSIVE OR GATE

3-STATE BUFFER

NAND GATE

SCHMITT TRIGGER

NOR GATE

OPEN-COLLECTOR OUTPUTS ARE INDICATED BY THE PRESENCE OF THE OPEN-COLLECTOR SYMBOL: ◇

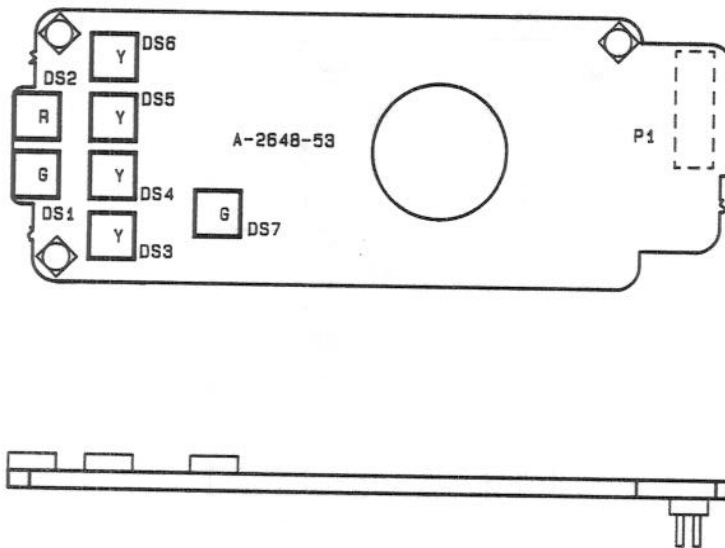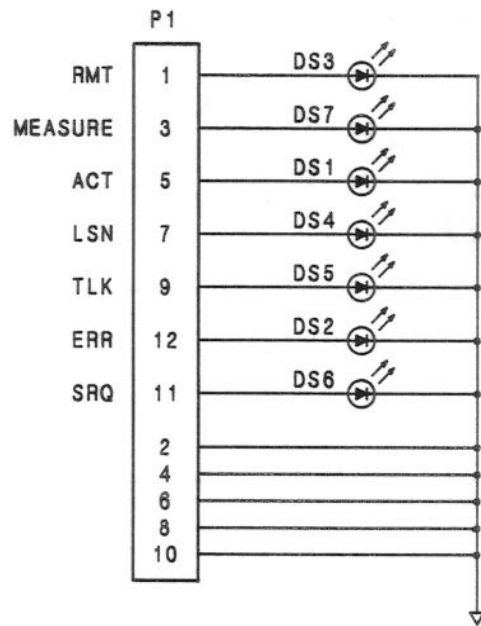FIGURE 8-1. GRAPHIC SYMBOLS (2 OF 2)

A1
STATUS BOARD
70700-60009

FIGURE 8-3. A1 STATUS BOARD, 70700-60009, COMPONENT LOCATIONS

A1 STATUS BOARD
70700-60009

FIGURE 8-4.   A1 STATUS BOARD, 70700-60009, SCHEMATIC DIAGRAM

8-8

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