HEWLETT PACKARD

INSTALLATION AND SERVICE MANUAL

12962A/B/C/D CARTRIDGE DISC (7905A) SUBSYSTEM

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Options Covered

This manual covers option 015 as well as the basic cartridge disc subsystem.

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LIST OF EFFECTIVE PAGES

Changed pages are identified by a change number adjacent to the page number. Changed information is indicated by a vertical line in the margin of the page. Original pages (Change 0) do not include a change number. Insert latest changed pages and destroy superseded pages.

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All pages in this edition are original.

PREFACE

This manual provides field service information for the Hewlett-Packard 12962A/B/C/D Cartridge Disc Subsystem. The subsystem described in this manual provides a low cost, mass-storage memory capability to a system which contains an HP 2100-Series Computer.

The contents of this manual are organized in four sections as follows:

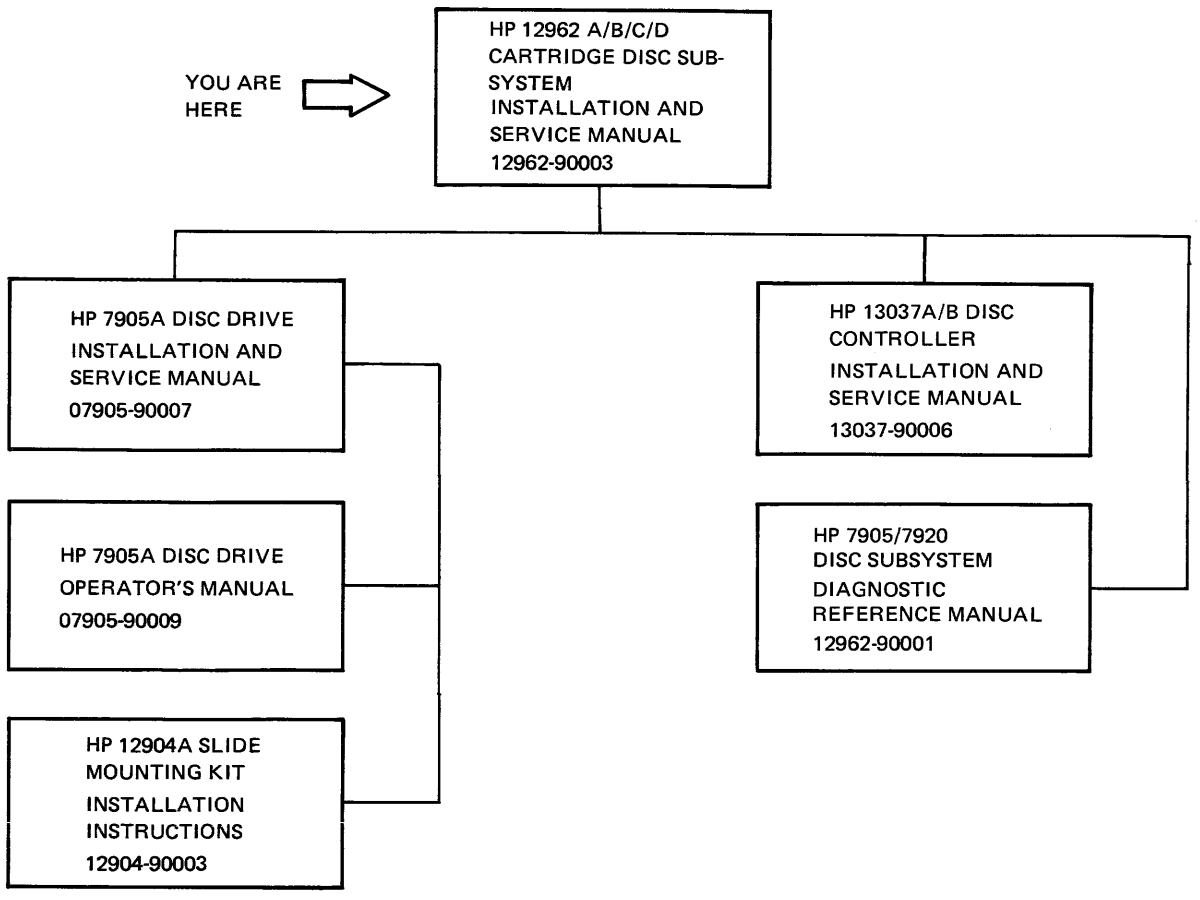
a. Section I provides a general description of the subsystem, lists of equipment furnished, options, accessories, and specifications.

b. Section II provides information relative to installation requirements, jumper configurations, interface installation and cabling, and repackaging for shipment.

c. Section III provides a brief description of the subsystem, a functional description of the interface PCA,and signal data information.

d. Section IV provides general servicing information, preventive maintenance instructions, troubleshooting and subsystem diagnostic test information, replacement procedures, and interface PCA modification instructions.

HP 12962A/B/C/D (7905A, 13037A/B) DOCUMENTATION MAP



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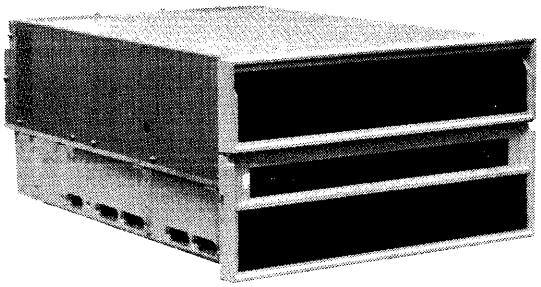
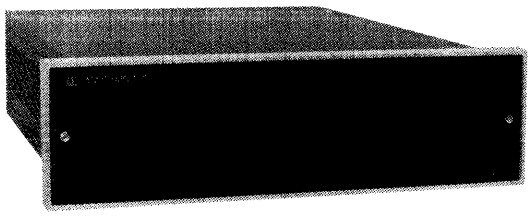


HP 7905A DISC DRIVE



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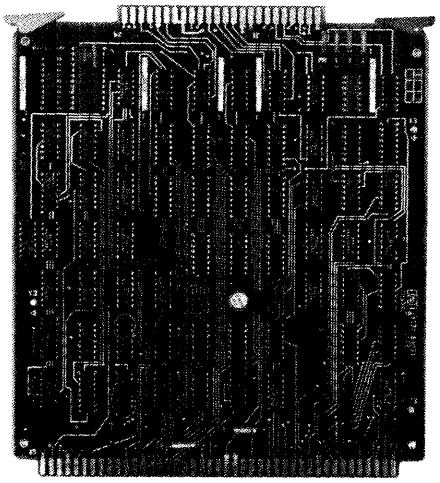

HP 2100 SERIES INTERFACE PCA,
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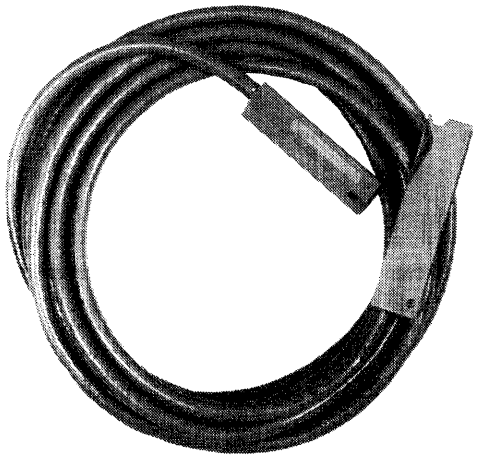

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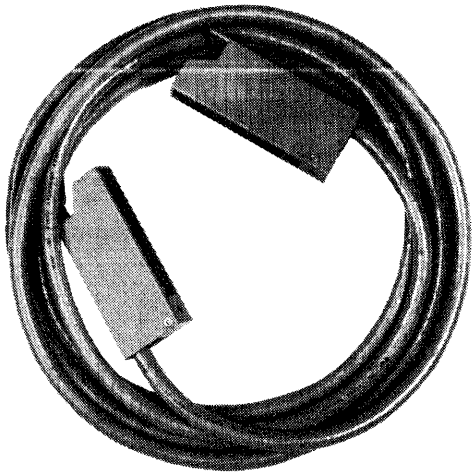


HP 13013A MULTI-UNIT CABLE

HP 13213A DATA CABLE

7096-1D

Figure 1-1. Cartridge Disc Subsystem Components

GENERAL INFORMATION

SECTION I

1-1. INTRODUCTION

This section contains a general description of the HP 12962A/B/C/D Cartridge Disc Subsystem, a list of equipment furnished, a list of options and accessories, and a list of specifications.

1-2. DESCRIPTION

Major components of the cartridge disc subsystem include a disc drive, a disc controller, an interface, cable assemblies, and diagnostic software for operation with HP 21MX M-Series, 21MX E-Series, or 2100A/S Computers.* Figure 1-1 shows the hardware components of the subsystem.

The subsystem provides an HP 2100-Series Computer with low-cost mass-storage memory. The disc drive has a removable disc in conjunction with a fixed disc. Together they provide storage for 14.7 megabytes of information. The removable disc is permanently enclosed in a cartridge for protection against contamination and damage. In a typical operating system the user has the flexibility of using the cartridge as a removable medium for off-line storage while using the fixed disc for on-line storage.

The HP 12962A Subsystem may use up to eight HP 7905A Disc Drives and up to two HP 21MX M-Series or 2100A/S computers in conjunction with one HP 13037A Disc Controller. Figure 1-2 shows a simplified block diagram of the subsystem. The HP 12962B Subsystem consists of the HP 12962A components, housed in an HP 29425A Cabinet containing an HP 40019A Prefilter Assembly and a power panel assembly. The principal features of the HP 12962A/B are summarized in table 1-1.

The HP 12962C Subsystem may use up to eight HP 7905A Disc Drives and up to eight HP 21MX M-Series, 21MX E-Series, or 2100A/S Computers in conjunction with one HP 13037B Disc Controller. See figure 1-3 for a simplified block diagram of the subsystem. The HP 12962D Subsystem consists of the HP 12962C components, housed in an HP 29425A Cabinet fitted with an HP 40019A Prefilter Assembly and a power panel assembly. Features of the HP 12962C/D are summarized in table 1-1.

*The term "2100-Series Computer" will be used as a general reference to any of the above mentioned computers. When specifically required, the term "21MX" will be used to specify a 21MX M-Series or a 21MX E-Series Computer.

Note: The HP 40019A Prefilter Assembly replaced the HP 40018A Plenum. For information on the HP 40018A Plenum, refer to the *HP 40018A Plenum Assembly Installation and Service Manual*, part no. 40018-90002.

Unless otherwise noted, the operating instructions contained in this manual apply to all four subsystems. However, since the HP 12962B/D includes a dedicated cabinet, the installation portions of the manual describing the cabinet mounting and the slide mounting kit for the HP 12962A/C Subsystem do not apply to the HP 12962B/D Subsystem.

1-3. HP 7905A DISC DRIVE

The HP 7905A Disc Drive (hereafter referred to as the disc drive) is a compactly-designed, random-access, mass-storage device. The disc drive consists of a mainframe assembly designed for rack mounting in a standard 48.26-centimetre (19-inch) equipment rack cabinet. The mainframe assembly includes an electromagnetic head-positioning mechanism, a spindle with integral drive motor, an operator control panel, a front-loading cartridge receiving mechanism, an air filtration and cooling system, a built-in power supply, and a full complement of easy to replace printed-circuit assemblies (PCA's).

As stated in paragraph 1-2, up to eight disc drives may be used in this subsystem. The HP 13180A or HP 13180B Add-On Disc Drive is used to add units 1 through 7 to the subsystem. The add-on disc drives consist of the following:

HP Model/ Part No.	Description
HP 13180A:	
7905A	Disc Drive (with standard Accessories)
12904A	Slide Mounting Kit
12940A	Formatted Disc Cartridge
13013A	Multi-Unit Cable
13213A	Data Cable
HP 13180B:	
7905A	Disc Drive (with standard Accessories)
12940A	Formatted Disc Cartridge
13013A	Multi-Unit Cable
13213A	Data Cable
29425A	Cabinet for 120-Vac, 60-Hz, single-phase mains power source
40019A	Prefilter Assembly
These add-on disc drives are also available to support option 015.	

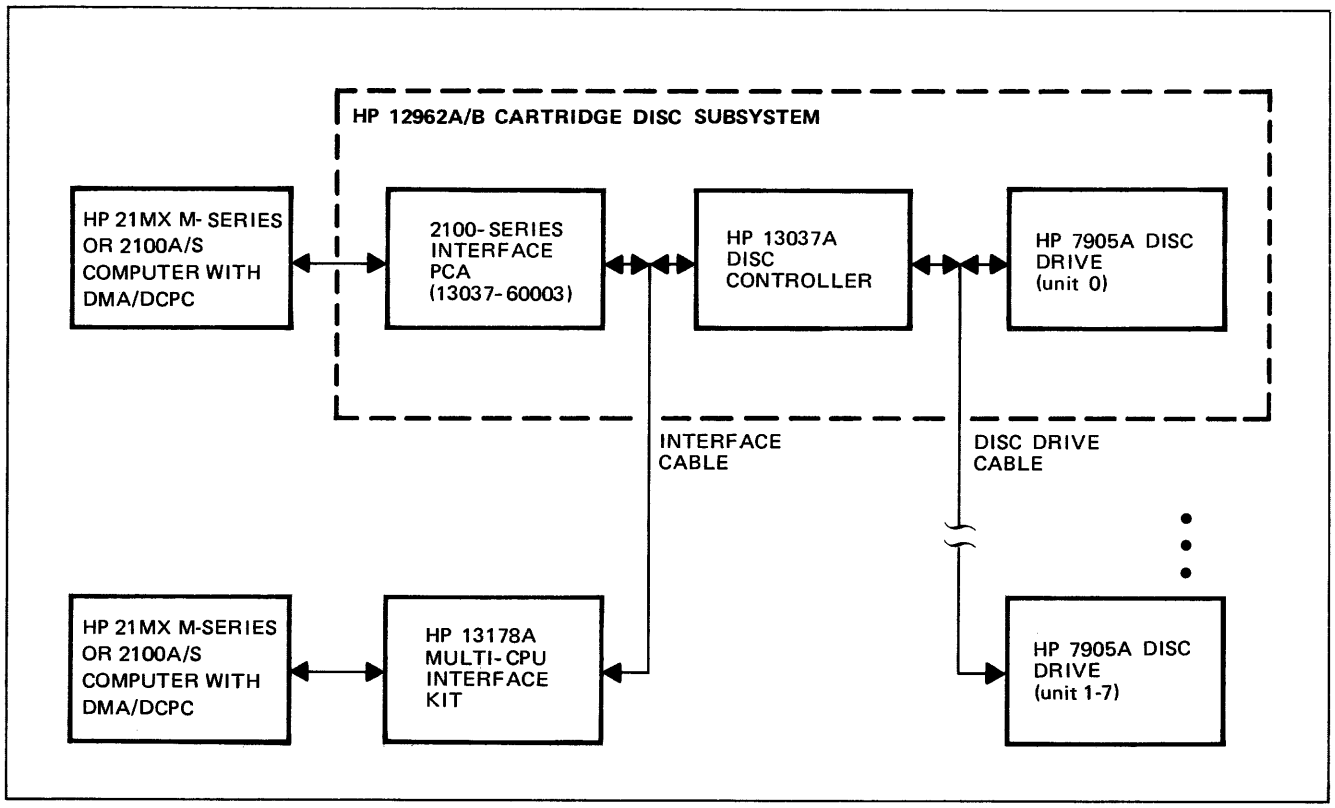


Figure 1-2. HP 12962A/B Cartridge Disc Subsystem Simplified Block Diagram

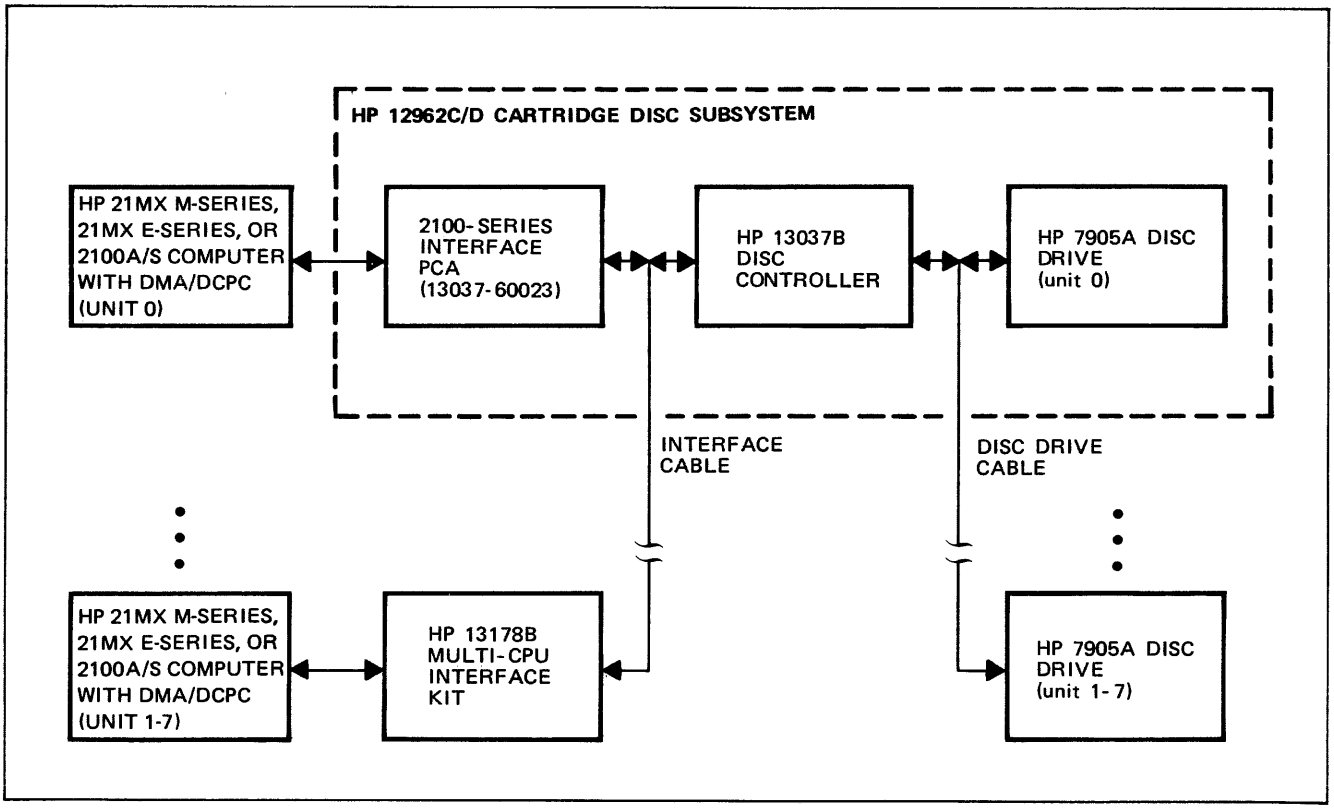


Figure 1-3. HP 12962C/D Cartridge Disc Subsystem Simplified Block Diagram

Table 1-1. Summary of Subsystem Features

SUBSYSTEM MODEL NO.	MAXIMUM NUMBER OF DISC DRIVES	COMPUTER		CABINET MODEL NO.	DISC CONTROLLER MODEL NO.	INTERFACE PCA PART NO.	ADD-ON INTERFACE PCA PART NO.
		MAXIMUM NUMBER	MODEL NO.				
12962A	8	2	Note 1	Note 2	13037A	13037-60003	13037-60013
12962B	8	2	Note 1	29425A	13037A	13037-60003	13037-60013
12962C	8	8	Note 3	Note 2	13037B	13037-60023	13037-60025
12962D	8	8	Note 3	29425A	13037B	13037-60023	13037-60025

Notes:
1. HP 21MX M-Series or 2100A/S Computer.
2. Subsystem is configured for installation in an HP 29402B Cabinet (not part of subsystem).
3. HP 21MX M-Series, 21MX E-Series, or 2100A/S Computer.
4. HP 12962A/B Systems may be delivered with interface PCA, part no. 13037-60023.

1-4. HP 13037A/B DISC CONTROLLER

The HP 13037A/B Disc Controller (hereafter referred to as the controller) is a microprogrammable device capable of controlling up to eight disc drives via computer interfaces. The HP 13037A is capable of controlling up to eight disc drives via up to two computer interfaces; the HP 13037B is capable of controlling up to eight disc drives via up to eight computer interfaces.

The 13037A/B controller is housed in a 13.31-centimetre (5 1/4-inch) by 48.26-centimetre (19-inch) chassis. Five PCA's make up the controller, three of which are plugged into the controller PCA cage. The jumper cable (part no. 13037-60022) requires that the microprocessor PCA (part no. 13037-60001) be installed adjacent to the error correct PCA (part no. 13037-60004 in the HP 13037A; part no. 13037-60024 in the HP 13037B). In addition, the device controller PCA (part no. 13037-60002) must also be installed adjacent to the error correct PCA.

1-5. HP 2100-SERIES INTERFACE PCA

The HP 2100-Series Interface printed-circuit assembly (hereafter referred to as the interface PCA) interfaces the controller with an HP 2100-Series Computer. The interface PCA occupies one input/output (I/O) slot in the computer and provides the means to transfer information between the computer and the controller. Interface PCA part no. 13037-60003 interfaces the controller with an HP 21MX M-Series or 2100A/S Computer; interface PCA part no. 13037-60023 interfaces the controller with an HP 21MX M-Series, 21MX E-Series, or 2100A/S Computer.

As previously mentioned, the subsystem may be accessed by additional HP 2100-Series Computers. This is achieved by using an HP 13178A/B Multi-CPU Interface Kit. The HP 13178A Kit, for use with the HP 12962A/B Subsystem, consists of the following:

a. 13178-60001 Cable.
b. 13037-60016 Interface Cable (1.82 metres/6 feet).
c. 13037-60013 Add-On Interface PCA.
d. 13037-60014 Cable Mounting Bracket Assembly.

The HP 13178B Kit, for use with the HP 12962C/D Subsystem, consists of the items listed for the HP 13178A Kit except deleting the 13037-60013 Add-On Interface PCA (item c) and substituting the following:

c. 13037-60025 Add-On Interface PCA.

1-6. EQUIPMENT FURNISHED

The following equipment and software are furnished with the HP 12962A Cartridge Disc Subsystem:

a. One HP 7905A Disc Drive (with standard Accessories).
b. One HP 12904A Slide Mounting Kit.
c. One HP 12940A Formatted Disc Cartridge.
d. One HP 13013A Multi-Unit Cable.
e. One HP 13213A Data Cable.

f. One HP 13037A Disc Controller.

g. One Interface PCA, part no. 13037-60003.

h. One Interface Cable, part no. 13037-60015, 5.49m (18 ft.).

i. One Cartridge Disc Subsystem Diagnostic binary tape, part no. 12962-16001.

j. One *HP 7905A Disc Drive Installation and Service Manual*, part no. 07905-90007.

k. One *HP 7905A Disc Drive Operator's Manual*, part no. 07905-90009.

l. One *HP 12962A/B/C/D Cartridge Disc Subsystem Installation and Service Manual*, part no. 12962-90003.

m. One *HP 13037A/B Disc Controller Installation and Service Manual*, part no. 13037-90006.

n. One *HP 7905/7920 Disc Subsystem Diagnostic Reference Manual*, part no. 12962-90001.

The HP 12962B Cartridge Disc Subsystem consists of the following:

a. One HP 7905A Disc Drive (with standard Accessories).

b. One HP 12940A Formatted Disc Cartridge.

c. One HP 13013A Multi-Unit Cable.

d. One HP 13213A Data Cable.

e. One HP 13037A Disc Controller.

f. One HP 29425A Cabinet for 120-Vac, 60-Hz, single phase mains power source.

g. One HP 40019A Prefilter Assembly.

h. One Interface PCA, part no. 13037-60003.

i. One Interface Cable, part no. 13037-60015, 5.49m (18 ft.).

j. One Cartridge Disc Subsystem Diagnostic binary tape, part no. 12962-16001.

k. One *HP 7905A Disc Drive Installation and Service Manual*, part no. 07905-90007.

l. One *HP 7905A Disc Drive Operator's Manual*, part no. 07905-90009.

m. One *HP 12962A/B/C/D Cartridge Disc Subsystem Installation and Service Manual*, part no. 12962-90003.

n. One *HP 13037A/B Disc Controller Installation and Service Manual*, part no. 13037-90006.

o. One *HP 7905/7920 Disc Subsystem Diagnostic Reference Manual*, part no. 12962-90001.

p. One *HP 29425A Cabinet Installation and Service Manual*, part no. 29425-90001.

q. One *HP 40019A Prefilter Assembly Installation and Service Manual*, part no. 40019-90901.

The HP 12962C Cartridge Disc Subsystem consists of the following:

a. One HP 7905A Disc Drive (with standard Accessories).

b. One HP 12904A Slide Mounting Kit.

c. One HP 12940A Formatted Disc Cartridge.

d. One HP 13013A Multi-Unit Cable.

e. One HP 13213A Data Cable.

f. One HP 13037B Disc Controller.

g. One HP 13175A 21XX Interface Kit.

h. One Cartridge Disc Subsystem Diagnostic binary tape, part no. 12962-16001.

i. One *HP 7905A Disc Drive Installation and Service Manual*, part no. 07905-90007.

j. One *HP 7905A Disc Drive Operator's Manual*, part no. 07905-90009.

k. One *HP 12962A/B/C/D Cartridge Disc Subsystem Installation and Service Manual*, part no. 12962-90003.

l. One *HP 13037A/B Disc Controller Installation and Service Manual*, part no. 13037-90006.

m. One *HP 7905/7920 Disc Subsystem Diagnostic Reference Manual*, part no. 12962-90001.

The HP 12962D Cartridge Disc Subsystem consists of the following:

a. One HP 7905A Disc Drive (with standard Accessories).

b. One HP 12940A Formatted Disc Cartridge.

c. One HP 13013A Multi-Unit Cable.

d. One HP 13213A Data Cable.

e. One HP 13037B Disc Controller.

f. One HP 29425A Cabinet for 120-Vac, 60-Hz, single phase mains power source.

g. One HP 40019A Prefilter Assembly.

h. One HP 13175A 21XX Interface Kit.

i. One Cartridge Disc Subsystem Diagnostic binary tape, part no. 12962-16001.

j. One *HP 7905A Disc Drive Installation and Service Manual*, part no. 07905-90007.

k. One *HP 7905A Disc Drive Operator's Manual*, part no. 07905-90009.

l. One *HP 12962A/B/C/D Cartridge Disc Subsystem Installation and Service Manual*, part no. 12962-90003.

m. One *HP 13037A/B Disc Controller Installation and Service Manual*, part no. 13037-90006.

n. One *HP 7905/7920 Disc Subsystem Diagnostic Reference Manual*, part no. 12962-90001.

o. One *HP 29425A Cabinet Installation and Service Manual*, part no. 29425-90001.

p. One *HP 40019A Prefilter Assembly Installation and Service Manual*, part no. 40019-90901.

1-7. OPTIONS AVAILABLE

Options are factory modifications of a standard subsystem that are requested by the customer. HP 12962A/B/C/D Subsystem Option 015 provides for operating the subsystem from a 220/240-Vac, 47.5-66-Hz (nominally 230-Vac, 50-Hz) single phase mains power source.

1-8. ACCESSORIES AVAILABLE

The following accessories may be ordered with the Subsystem or separately from your local Hewlett-Packard Sales and Service Office. Sales and Service Offices are listed at the back of the *HP 7905A Disc Drive Installation and Service Manual*, part no. 07905-90007.

HP Model/ Part No.	Description
13013A	Multi-Unit Cable, 3.66m (12 ft)
13013A-001	Multi-Unit Cable, 1.52m (5 ft)
13013A-002	Multi-Unit Cable, 5.49m (18 ft)
13013A-003	Multi-Unit Cable, 2.44m (8 ft)
13178-60001	Cable, 2.44m (8 ft)
13178-60002	Cable, 4.88m (16 ft)
13213A	Data Cable, 3.05m (10 ft)
13213A-001	Data Cable, 7.62m (25 ft)
13213A-002	Data Cable, 15.24m (50 ft)
13213A-003	Data Cable, 22.86m (75 ft)
13178A	21MX M-Series/2100A/S Multi-CPU Interface Kit. Includes an add-on interface PCA, multi-unit cable, an interface cable, and a cable mounting bracket assembly.
13178B	21MX M-Series/21MX E-Series/2100A/S Multi-CPU Interface Kit. Includes an add-on interface PCA, multi-unit cable, an interface cable, and a cable mounting bracket assembly.
13180A	Add-on Disc Drive. Includes a disc drive, a slide mounting kit, a formatted disc cartridge, a multi-unit cable, a data cable, and a cable terminator bracket assembly.
13180B	Same as HP 13180A, but with the addition of a cabinet and plenum assembly and without the slide mounting kit.
13180A-015	Same as HP 13180A, but for 220/240-Vac, 47-66 Hz (nominally 230-Vac, 50-Hz) operation.
13180B-015	Same as HP 13180B, but for 220/240-Vac, 47-66 Hz (nominally 230-Vac, 50-Hz) operation.

1-9. MAINS POWER

The HP 29425A Cabinet is equipped with a power panel assembly which is set up in the standard subsystem for operation from 120-Vac, 60-Hz, single-phase mains and in the option 015 subsystem it is set up for 230-Vac, 50-Hz, single-phase mains. The subsystem is supplied with a removable power cord terminated with a NEMA or CEE plug. The power panel assembly has a 15-ampere circuit breaker. Refer to the *HP 29425A Cabinet Installation and Service Manual*, part no. 29425-90001, for cabinet electrical specifications, installation procedures (including power cord connection for option 015), physical details, and preventive maintenance.

1-10. SPECIFICATIONS

Specifications for the disc drive are found in section I of the *HP 7905A Disc Drive Installation and Service Manual*, part no. 07905-90007. Environmental limitations for the controller are found in section II of the *HP 13037A/B Disc Controller Installation and Service Manual*, part no. 13037-90006. Current requirements for Interface PCA's 13037-60003 and 13037-60023 and Add-on Interface PCA's 13037-60013 and 13037-60025 are: 2 amperes at + 5 volts dc and 100 milliamperes at − 2 volts dc.

The net weight of the HP 12962B/D Subsystem is 149 kilograms (328.5 pounds) and the net weight of the HP 13180B Add-On Disc Drive is 133.13 kilograms (293.5 pounds). Net weights for the disc drive, controller, prefilter, and HP 29425A Cabinet are found in their *Installation and Service Manuals.*

INSTALLATION

SECTION II

2-1. INTRODUCTION

This section provides installation information needed to integrate the HP 12962A/B/C/D Cartridge Disc Subsystem into a system containing an HP 2100-Series Computer. Included in this information are installation requirements, jumper configurations, interface PCA installation and cabling instructions, and recommended packing and shipping methods.

2-2. UNPACKING AND INSPECTION

Unpacking and inspection of the HP 12962A/C Cartridge Disc Subsystem or the HP 13180A Add-On Disc Drive is dependent upon the subsystem component. A subsystem component is defined to be a disc drive, a controller, or an interface PCA. Instructions for the disc drive are provided in the *HP 7905A Disc Drive Installation and Service Manual*, part no. 07905-90007. Instructions for the controller are provided in the *HP 13037A/B Disc Controller Installation and Service Manual*, part no. 13037-90006.

The HP 12962B/D Cartridge Disc Subsystem and HP 13180B Add-On Disc Drive are shipped in a reusable container. When shipment arrives, ensure that the container has been received as specified by the carrier's bill of lading. Inspect the shipping container immediately upon receipt for evidence of mishandling during transit. If the container is damaged or water-stained, request that the carrier's agent be present when the container is unpacked.

If the container appears to be received in satisfactory condition, proceed with the unpacking instructions. The unit is unpacked as follows:

a. Using a large screwdriver, remove the climp fasteners that secure the top of the container to the base. Set the top aside and retain the fasteners.

b. Locate the envelope marked "CUSTOMER RECORDS". One of the items in this envelope is a list of equipment supplied. Compare this list against the purchase order to verify that the shipment is correct.

c. Remove packing material from around the unit.

d. Inspect the unit for damage such as dented corners, surface scratches, and loose components. Also, check the rigid foam-plastic cushioning (if used) for any signs of deformation which could indicate rough handling during transit.

e. Cut the strap that secures the ramp to the unit and lift out the ramp.

f. Position the ramp at the rear of the container base and ensure that the ramp is firmly seated on base.

g. At each corner of the container base, loosen the bolts that secure the leveling feet retainers. At the rear container base (rear of unit) ensure that bolts are free from the threaded sleeves mounted in the container base.

h. On the container base, as viewed from the rear of the unit, remove the two screws that secure the rear retaining member to the base and slide out member.

i. On the unit, ensure that leveling feet are fully threaded into the enclosure to prevent possible dragging or bending when the unit is rolled down the ramp and onto the floor.

CAUTION

When moving the unit off the container base, stand on the ramp side to prevent a "runaway" condition and possibly damaging the unit.

j. Move the unit off the container base and onto the floor using the ramp.

k. Inspect the unit for damage as described in the following paragraph and follow the claims instructions. Retain the shipping container and packing material for future use.

Look for damage such as broken controls and connections, dented corners, bent panels, and scratches. Check the sides of the container for signs of rough handling. If the visual examination reveals any damage to the cabinet or its contents or it fails to meet specifications, notify the nearest Hewlett-Packard Sales and Service Office. If damage occurred in transit, notify the carrier also. Hewlett-Packard will arrange for replacement or repair without waiting for settlement of claims against the carrier. In the event of damage in transit, retain the packing container for inspection.

2-3. HP 12962A/C INSTALLATION REQUIREMENTS

Certain requirements regarding disc drive operating environment and mounting configuration must be observed

wherever disc drives are installed. The cooling air must be sufficient to maintain the drive temperature within its specifications, otherwise operating problems may be experienced, especially when disc cartridges are changed. Special consideration must be given to the storage of the disc cartridges because their temperature and cleanliness can directly affect their interchangeability between disc drives, data integrity, and useful life. The following paragraphs discuss these requirements in detail and the reasons behind them.

2-4. ENVIRONMENTAL CONSIDERATIONS

Compliance with the HP 7905A Disc Drive temperature and relative humidity specifications is imperative to ensure cartridge interchangeability and data integrity. Consideration should be given to expected ambient temperature variations and the effect of other equipment in the cabinet.* The environmental specifications to be applied to the disc drive installation are covered in table 2-1.

The position of the disc drive in the cabinet may be crucial to maintain operation within specifications. For the first disc drive in the cabinet, if placed directly above the cabinet inlet fan, there will be proper air flow to maintain the temperature within operational requirements. Second and third drives, or a first drive not directly over the cabinet inlet fan, will require the addition of the HP 40019A Prefilter Assembly for each drive to draw in sufficient ambient air for the drive's air intake.

Instructions for installation of the prefilter assembly are provided in the *HP 40019A Prefilter Assembly Installation and Service Manual*, part no. 40019-90901. To facilitate exhaust air flow while maintaining positive cabinet pressure, perforations are used in the cabinet rear doors of HP 29400B-Series Cabinets when housing HP 7905A Disc Drives. Also, the inlet air of the disc drive should be within 2 celsius degrees (4 fahrenheit degrees) of room ambient to ensure disc interchangeability (refer to paragraph on Media Storage, following). The equipment cabinet should not include a front door which restricts the air flow through the prefilter assembly front panel air intake.

2-5. MOUNTING ON SLIDES

Whenever a disc drive is to be mounted on rack slides in an equipment cabinet, the cabinet must be equipped with a weighted base with extendable legs. An HP 29400B Series Cabinet with the HP 40017A Cabinet Stabilizer Assembly is recommended. When extendable legs are employed, they MUST be fully extended with the pads down and locked in place prior to pulling out a disc drive on its rack slides. For additional information regarding the installation of a disc drive on rack slides, refer to the *Installation Instructions for the HP 12904A Slide Mounting Kit*, part no. 12904-90003, furnished with the kit.

*Where other instruments are mounted above the disc drive, the total power of the added instruments should be less than 1 kW.

Table 2-1. HP 7905A Disc Drive Environmental Considerations

AMBIENT TEMPERATURE	
Operating:	10°C to 40°C (50°F to 104°F) rate of temperature change not to exceed 20°C (36°F)/hr.
Non-operating	−40°C to 65°C (−40°F to 149°F) rate of temperature change not to exceed 20°C (36°F)/hr.
RELATIVE HUMIDITY	
Operating:	8% to 80% with maximum wet bulb temperature not to exceed 25.6°C (78°F).
Non-operating:	05% to 95% with maximum wet bulb temperature not to exceed 25.6°C (78°F).
HEAT DISSIPATION	430 kilocalories (1700 BTU's)/hr (maximum).
AIR FLOW	100 cfm @ 60 Hz; 85 cfm @ 50 Hz.

2-6. HP 12962B/D INSTALLATION REQUIREMENTS

The HP 12962B/D Cartridge Disc Subsystem is fully integrated in an HP 29425A Cabinet and thus only requires jumper configuration, interface PCA installation, external cabling, and cabinet installation. The cabinet should be rolled into position on its casters and then the levelers (22, figure 4-1) adjacent to the casters can be set to firmly position and level it. If additional information is needed for cabinet installation, refer to the *HP 29425A Cabinet Installation and Service Manual*, part no. 29425-90001.

2-7. FLOOR LOADING

It is the customer's responsibility to determine safe floor loading for Hewlett-Packard computer systems. When calculating floor loading, include weight of cabinet and its contents, and any equipment placed on top of the cabinet. For raised floors, include the weight of the raised floor in the primary floor loading.

The weight of the HP 29425A Cabinet and its contents is concentrated over four levelers (or casters). The floor supporting an HP 12962B/D Cartridge Disc Subsystem or the HP 13180B Add-On Disc Drive with levelers extended should withstand 162 pounds per square inch (11 Kg per square cm).

2-8. MEDIA STORAGE REQUIREMENTS

To ensure cartridge interchangeability between disc drives and to ensure data integrity, it is highly desirable to have disc cartridges stored in environmental surroundings that are nearly identical to those of the operating area. Storing disc cartridges in the same area where the disc drive is located will avoid the waiting time for disc drive and disc cartridge temperature equalization.

The temperature of the disc drive and disc cartridge must be within ±3°C (±5.4°F) of each other to ensure optimum performance. If the waiting time is not critical and disc cartridges are stored in another area, the temperature of the storage area should be maintained between −15°C and 60°C (5°F and 140°F) with the relative humidity between 0 and 95 percent. If the temperature and relative humidity of the storage area are different than the disc cartridge operating requirements, the disc cartridges must be allowed 2 hours for environmental stabilization when brought into the operating area.

Disc cartridges should always be stored in a clean, dust-free area and should not be stacked more than two high when lying flat. It is advisable to provide steel storage cabinets with shelves adjusted to the appropriate height. Disc cartridges should not come in contact with any magnetic material and should not be stored directly on top of the disc drive. A magnetic field with an intensity greater than 50 oersteds near a disc cartridge can cause loss of information.

2-9. JUMPER CONFIGURATIONS

Figure 2-1 shows the location of the jumpers on the interface PCA. There are two sets of jumpers which must be configured before the interface is installed in the computer. These sets represent interface address and preset.

2-10. INTERFACE ADDRESS JUMPERS

The interface address jumpers (W1 through W3) select the unit identification number of each interface PCA connected to the controller. The octal number (0 through 7) assigned to an interface PCA is arbitrary but must be different from that assigned to any other interface when more than one interface is connected to a single controller. Jumpers W1 through W3 may be placed in one of two positions. If a jumper is placed in the upper position (see figure 2-1), a logical "1" is represented. If a jumper is placed in the lower position, a logical "0" is represented.

2-11. PRESET JUMPER

The preset (PR) jumper (W4) is used to enable or disable the CLEAR signal from the interface PCA to the controller. If there is only one computer system using the controller, the preset jumper should be placed in the enable position as shown in figure 2-1.

In a multiple computer system, none or any number of preset jumpers of the interface PCA's may be placed in the enable position. Use the preset jumper with caution since the clear signal (thus enabled) will immediately reset the controller to its "power on" condition, regardless of how the controller may be engaged with another interface PCA. Best system performance may be achieved by enabling CLEAR in no more than one interface PCA.

2-12. INTERFACE PCA INSTALLATION

Installation of the interface PCA depends upon the system configuration. The 12962A/B Subsystem may be configured to operate with one or two computers; the HP 12962C/D Subsystem may be configured to operate with up to eight computers. One interface PCA is required to interface each computer to the controller. Before installing an interface PCA, ensure that it has the correct part number for the subsystem in use (refer to figure 2-3, note 1). Next the current requirements must be computed (refer to paragraph 1-10) and the jumper configurations verified (refer to paragraphs 2-9 through 2-11).

After ensuring that the computer power supply can handle the added load, and the PCA's part number is correct and its jumpers properly configured, install the PCA as follows:

a. Determine the I/O select code to be used for the interface PCA and the corresponding I/O slot in the computer or I/O extender.

b. For an HP 2100A/S installation, proceed as follows:

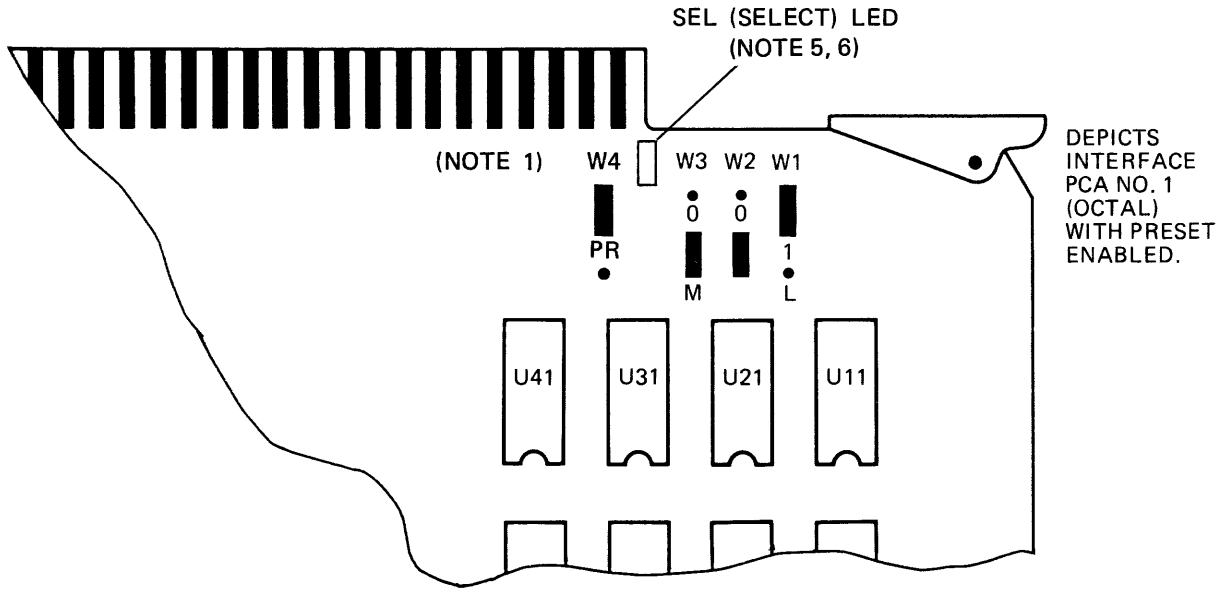
   (1) Turn off power at the computer and I/O extender (if used).

   (2) Remove top cover from the computer or I/O extender (if used).

c. For an HP 21MX installation, proceed as follows:

   (1) Rotate key-operated switch to the STANDBY position to remove CPU and I/O power. If an I/O extender is used, set extender ~LINE switch to OFF.

Note: Do not set computer ~LINE switch to OFF and if the computer is housed in a system cabinet, do not set system power switch to remove ac power, because the power to memory would be removed and its contents would be lost.



NOTES:

1. THE JUMPERS ARE NOT LABELLED ON THE PCA.

2. JUMPERS W1 THRU W4 ARE IDENTICAL ON THE FOLLOWING PCA's:
   (a) INTERFACE PCA, PART NO. 13037-60003.
   (b) ADD-ON INTERFACE PCA, PART NO. 13037-60013.
   (c) INTERFACE PCA, PART NO. 13037-60023.
   (d) ADD-ON INTERFACE PCA, PART NO. 13037-60025.

3. JUMPERS W1 THRU W3 SELECT INTERFACE ADDRESS NUMBER IN OCTAL. W1 IS LEAST SIGNIFICANT DIGIT.

4. W4 ENABLES OR DISABLES PRESET.

5. SEL (SELECT) LIGHT-EMITTING DIODE (LED) INDICATES STATE OF INTERFACE SELECTION. WHEN COMPUTER AND 13037B DISC CONTROLLER ARE CONNECTED AND POWERED, THE LED GLOWS AT PARTIAL BRILLIANCE, INDICATING THAT THE CONTROLLER IS POLLING THE INTERFACE. WHENEVER DATA OR COMMANDS ARE BEING TRANSFERRED, THE LED WILL FLASH AT FULL BRILLIANCE.

6. SEL (SELECT) LIGHT-EMITTING DIODE IS NOT FITTED ON INTERFACE PCA, PART NO. 13037-60003 AND ADD-ON INTERFACE PCA, PART NO. 13037-60013.

Figure 2-1. Interface PCA Jumper Locations

(2) If the computer is equipped with the optional power fail recovery system, set BATTERY switch to OFF and remove battery cable(s) from the BAT. INPUT connector(s).

(3) Remove the I/O PCA cage cover from the computer or I/O extender rear panel.

(4) Loosen the PCA retainer on the computer or I/O extender rear panel and slide the PCA retainer to the right.

d. For a single computer installation, install the interface PCA in the required I/O slot in the computer or I/O extender (See figure 2-2.) Exercise care not to damage components or traces on the interface PCA or on adjacent PCA's. Components on the interface PCA must be oriented in the same direction as those on other PCA's in the I/O section of the computer or I/O extender.

For installations with two or more computers, any one computer can hold the interface PCA, while the others have the add-on interface PCA's. Check from figure 2-3 that the add-on interface PCA's have the correct part number for the subsystem in use.

2-13. CABLING

Interconnecting the interface PCA to the controller depends upon the system configuration. Cabling procedures for a single computer installation, a multiple computer installation, and an add-on computer installation are provided in paragraphs 2-14 through 2-16.

Disc drive installation and cabling information is provided in the installation section of the *HP 7905A Disc Drive Installation and Service Manual*, part no. 07905-90007.

In the HP 12962B/D Cartridge Disc Subsystem with cabinet, the cables enter the cabinet through a cable entry opening located in the center of the power panel assembly. Two sets of strain relief clamps are inside the cabinet directly behind the opening. To gain access to the opening, loosen the two screws securing the shutter and slide it upward. When installing the cables through the opening and through the strain relief clamps, lay them in orderly rows so that when the shutter is closed over the cables there will be minimum air leakage.

2-14. SINGLE COMPUTER CABLING

Figure 2-2 shows the subsystem interconnecting cabling configuration for a single computer installation with the controller. Interconnection procedures are as follows:

a. For an HP 2100A/S installation, perform steps b and d in paragraph 2-12.

b. For an HP 21MX installation, perform steps c and d in paragraph 2-12.

c. For each disc drive in the subsystem, set RUN/STOP switch to STOP.

d. On controller rear panel, set POWER switch to OFF.

WARNING

Hazardous voltages are present inside the controller mainframe!! Before cabling the controller, set the POWER switch to OFF. Failure to observe this precaution can result in serious injury.

e. Remove controller top cover and front panel.

f. Connect one end of the Interface Cable, part no. 13037-60015, to the interface PCA connector.

g. Pass free end of the interface cable through the controller rear opening and connect it to the device controller PCA interface connector IFJ1.

h. Replace controller top cover and front panel, and each computer top cover or rear cover.

i. Perform subsystem diagnostic as described in paragraph 4-15.

2-15. MULTIPLE COMPUTER CABLING

Figure 2-3 shows the subsystem interconnecting cabling configuration for a multiple computer installation with the controller. Interconnection procedures are as follows:

a. For each HP 2100A/S installation, perform steps b and d in paragraph 2-12.

b. For each HP 21MX installation, perform steps c and d in paragraph 2-12.

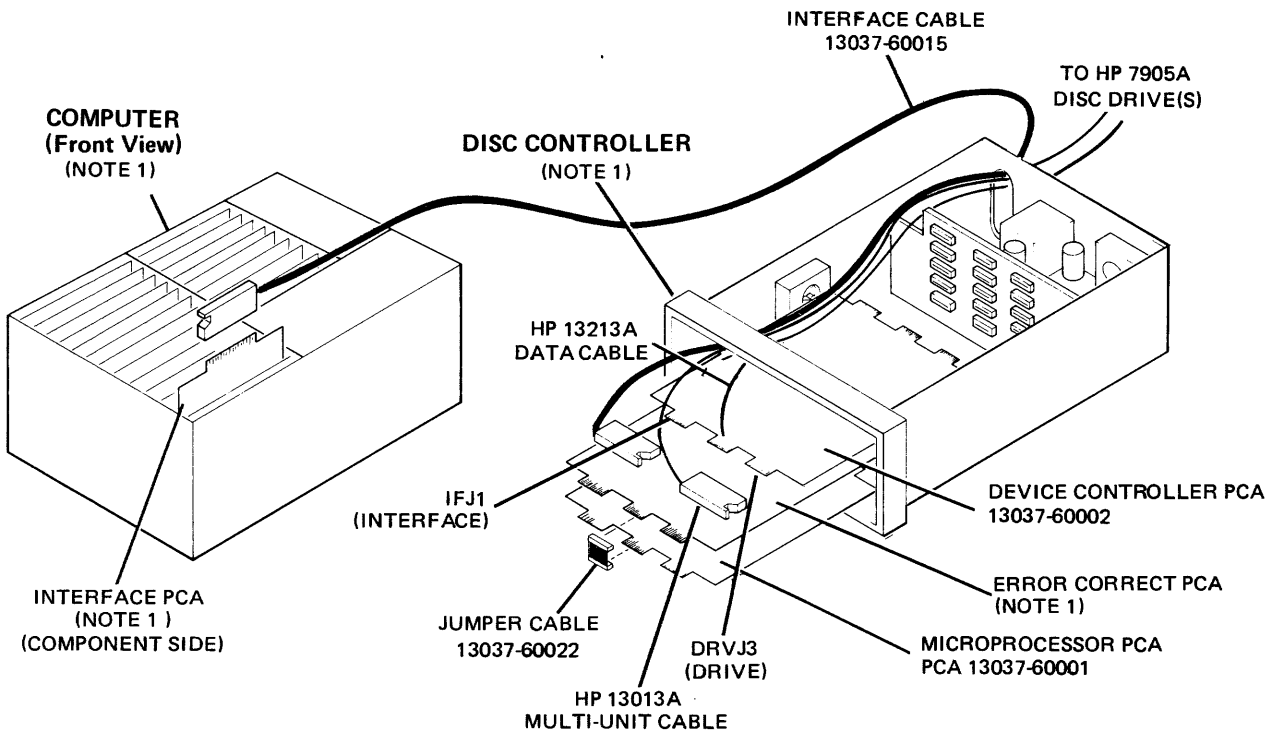
c. For each disc drive in the subsystem, set RUN/STOP switch to STOP.

d. On controller rear panel, set POWER switch to OFF.

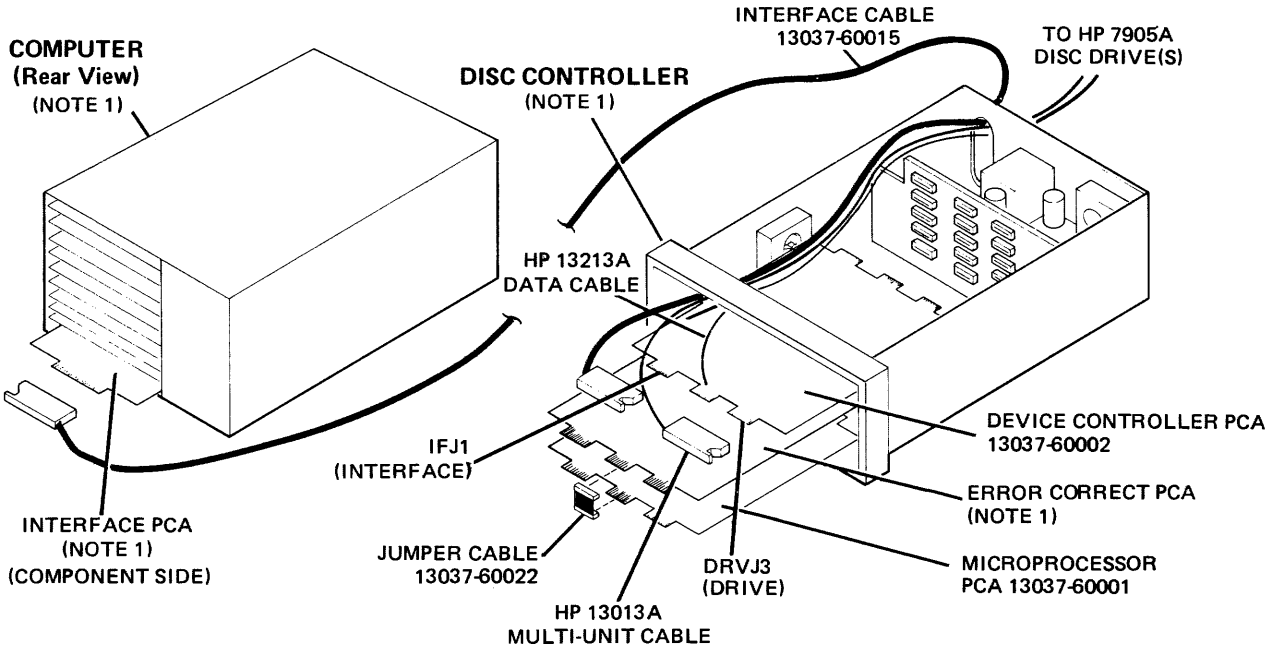
WARNING

Hazardous voltages are present inside the controller mainframe!! Before cabling the controller, set the POWER switch to OFF. Failure to observe this precaution can result in serious injury.

e. Remove controller top cover and front panel.



TYPICAL HP 2100A/S INSTALLATION



TYPICAL HP 21MX INSTALLATION

NOTES:

1. MODEL/PART NUMBERS ARE AS FOLLOWS:

	12962A/B SUBSYSTEM	12962C/D SUBSYSTEM
DISC CONTROLLER	13037A	13037B
INTERFACE PCA	13037-60003	13037-60023
ERROR CORRECT PCA	13037-60004	13037-60024
COMPUTER	21MX M-SERIES, 2100A/S	21MX M-SERIES, 21MX E-SERIES, 2100A/S

7096-4D

Figure 2-2. Single Computer Cabling Diagram

f. Attach the T-Connector, part no. 07905-60040, to the Mounting Bracket, part no. 13037-00011, using the hardware supplied with the HP 13178A/B Multi-CPU Interface Kit.

g. Insert the Cable-to-Cable Adapter, part no. 07905-80010, into the female connector on the T-connector.

h. Mount the mounting bracket to the inside of the equipment cabinet at any convenient location.

i. Connect one end of the Cable, part no. 13178-60001 to the device controller PCA interface connector IFJ1.

j. Connect the free end of the Cable, part no. 13178-60001 to the right edge (as viewed from the rear) of the T-connector.

k. Connect the 50-pin connector of one Interface Cable, part no. 13037-60016, to the cable-to-cable adapter.

l. Connect the 50-pin connector of the other interface cable, part no. 13037-60015, to the left edges (as viewed from the rear) of the T-connector.

m. Connect the free end of each interface cable to the interface PCA associated with each computer.

n. For an installation with more than two computers, connect a multi-unit cable, part no. 13013A, to the left edges of the T-connector and the other end of this cable to the next T-connector. See figure 2-3. From here, continue cabling to the interface PCA's. The last PCA and cable in the chain must be an interface PCA (not an add-on interface PCA) and interface cable 13037-60015 (18 feet).

o. Replace controller top cover and front panel, and each computer top cover or rear cover.

p. Perform subsystem diagnostic as described in paragraph 4-15 (only one computer should be running during the diagnostic).

2-16. ADD-ON COMPUTER CABLING

Figure 2-3 shows the interconnecting cabling configuration for an add-on computer installation with the controller. Interconnection procedures are as follows:

a. For each HP 2100A/S installation, perform steps b and d in paragraph 2-12.

b. For each HP 21MX installation, perform steps c and d in paragraph 2-12.

c. For each disc drive in the subsystem, set RUN/STOP switch to STOP.

d. On controller rear panel, set POWER switch to OFF.

WARNING

Hazardous voltages are present inside the controller mainframe!! Before cabling the controller, set the POWER switch to OFF. Failure to observe this precaution can result in serious injury.

e. Remove controller top cover and front panel.

f. Attach the T-Connector, part no. 07905-60040, to the Mounting Bracket, part no. 13037-00011, using the hardware supplied with the HP 13178A/B Multi-CPU Interface Kit.

g. Insert the Cable-to-Cable Adapter, part no. 07905-80010, into the female connector on the T-connector.

h. Mount the mounting bracket to the inside of the equipment cabinet at any convenient location.

i. Disconnect the Interface Cable, part no. 13037-60015, from the device controller PCA interface connector IFJ1.

j. Connect one end of the Cable, part no. 13178-60001 to the device controller PCA interface connector IFJ1.

k. Connect the free end of the Cable, part no. 13178-60001 to the right edge (as viewed from the rear) of the T-connector.

l. Connect the free end of the interface cable (the end removed in step i) to the cable-to-cable adapter.

m. Connect the 50-pin connector of the other interface cable, part no. 13037-60016, to the left edge (as viewed from the rear) of the T-connector.

n. Connect the other end of the interface cable to the Add-On Interface PCA.

o. Replace controller top cover and front panel, and each computer top cover or rear cover.

p. Perform subsystem diagnostic as described in paragraph 4-15 (only one computer should be running during the diagnostic).

2-17. DISC DRIVE INSTALLATION

Disc drive mounting instructions and cabling are covered in the *HP 7905A Disc Drive Installation and Service Manual*, part no. 07905-90007. The disc subsystem might be affected by electrical noise if not properly grounded. Good grounding practice does not permit disc drive grounds to be added in series (daisy chained). All disc drives should be grounded to one central point. For this purpose there are two grounding posts, shown in figure 4-1

as item 28. A 10-foot (3-metre) braided plastic-covered ground strap, part no. 29425-60001, is supplied with each HP 29425A Cabinet.

2-18. REPACKAGING HP 12962A/C COMPONENTS FOR SHIPMENT

Repackaging of the HP 12962A/C Cartridge Disc Subsystem (or the HP 13180A Add-On Disc Drive) is dependent upon the subsystem component. A subsystem component is defined to be a disc drive, a controller, or an interface PCA. Repackaging instructions for the disc drive are provided in the *HP 7905A Disc Drive Installation and Service Manual*, part no. 07905-90007. Repackaging instructions for the controller are provided in the *HP 13037A/B Disc Controller Installation and Service Manual*, part no. 13037-90006.

If the interface PCA is to be shipped to Hewlett-Packard for service or repair, attach a tag to it identifying the owner and indicating the service or repair to be accomplished. Include the part number of the interface PCA.

Package the interface PCA in the original factory packaging material, if available. If the original material is not available, standard factory material can be ordered from a local Hewlett-Packard Sales and Service Office.

If standard factory packaging material is not used for the interface, wrap the interface PCA in Air Cap TH-240 Cushioning (or equivalent) manufactured by Sealed Air Corp., Hawthorne, N.J. and place in a corrugated carton (200-pound test material). Seal the shipping carton securely and mark it "FRAGILE" to ensure careful handling.

Note: In any correspondence, identify the interface PCA by part number. Refer any questions to the nearest Hewlett-Packard Sales and Service Office.

2-19. REPACKAGING THE HP 12962B/D FOR SHIPMENT

Repacking of the HP 12962B/D Cartridge Disc Subsystem or the HP 13180B Add-On Disc Drive, both contained in the HP 29425A Cabinet, requires the use of the original container and packing material. If the container is not available, consult your local Hewlett-Packard Sales and Service Office to obtain a container or instructions for fabricating an acceptable alternate. Before shipment the container (or equipment) should have a tag identifying the owner and the service or repair to be accomplished. Include the equipment model number and full serial number.

To package the unit, proceed as follows:

a. Place the ramp on the rear of the container base.

b. Position the unit at the ramp with the front of the enclosure facing the container base.

c. Thread the leveling feet fully into the enclosure to allow freedom of movement of the unit.

d. On the front of the container base, thread the two leveling feet retainer bolts into the threaded sleeves until the retainers are firmly secured but not tight.

e. Align the retainer slots approximately parallel with the side member of the container to receive the unit leveling feet.

CAUTION

Ensure that the retainer slots are wrapped with a protective tape to avoid damage to the leveling feet threads.

f. Roll the unit onto the container base via the ramp and seat the leveling feet in the retainer slots.

g. Install the rear retaining member, seating the retainers on the leveling feet.

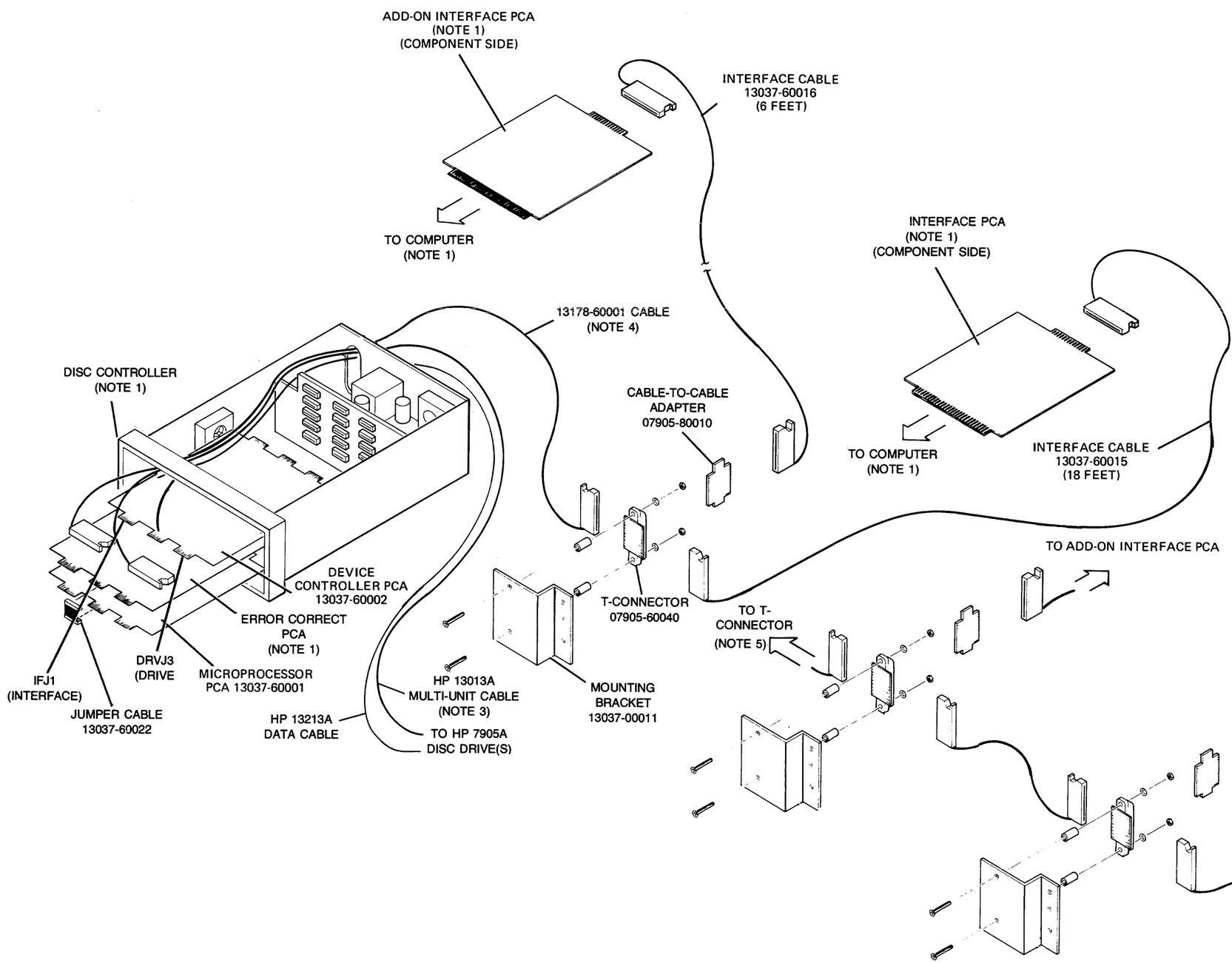
h. Tighten the retainer bolts and the rear retaining member screws.

i. Replace and secure the ramp with tie wrap material of at least 300 lb. strength.

j. Replace the packing material.

k. Replace the top and secure with climp fasteners.

Mark the container "FRAGILE" to ensure careful handling, and with a caution sticker that states "MAGNETIC EQUIPMENT SUITABLE FOR AIR SHIPMENT IF MAINTAINED AT A DISTANCE OF 7.62 METRES (25 FEET) OR MORE FROM COMPASS SENSING DEVICES".



NOTES:

1. Model/Part numbers are as follows:

	12962A/B Subsystem	12962C/D Subsystem
Disc Controller	13037A	13037B
Interface PCA	13037-60003	13037-60023
Add-On Interface PCA	13037-60013	13037-60025
Error Correct PCA	13037-60004	13037-60024
Computer	HP 21MX M-Series, 2100A/S	HP 21MX M-Series, 21MX E-Series, 2100A/S

2. The 13178A Multi- CPU Interface Kit is used for HP 12962A/B Subsystem installation. The kit consists of the following:

Description	Model/Part No.
Cable	13178-60001
Interface Cable	13037-60016
Add-On Interface PCA	13037-60013
Cable Mounting Bracket Assy	13037-60014

The 13178B Multi-CPU Interface Kit is used for HP 12962C/D Subsystem installation. The kit consists of the items listed for the 13178A kit except deleting Add-On Interface PCA 13037-60013 and substituting Add-On Interface PCA 13037-60025.

3. The 13013A Multi-Unit Cable is available in four lengths as follows:

Model/Part No.	Length
13013A	3.66 metres (12 feet)
13013-001	1.52 metres (5 feet)
13013-002	5.49 metres (18 feet)
13013-003	2.44 metres (8 feet)

4. The 13178-6000X Cable is available in two lengths as follows:

Part No.	Length
13178-60001	2.44 metres (8 feet)
13178-60002	4.88 metres (16 feet)

5. Cabling is shown for a two-interface system. For additional interfaces, connect the 13178-60001 cable to the 07905-60040 T-connector and extend subsystem as shown. The last PCA and cable in the chain must be interface PCA 13037-60003/60023 and interface cable 13037-60015 (18 feet). The overall length of the chain should not exceed 22.6 metres (74 feet).

Figure 2-3. Multiple Computer Cabling Diagram

PRINCIPLES OF OPERATION

SECTION III

3-1. INTRODUCTION

This section contains a brief description of the subsystem, a functional description of the interface PCA, and signal data information.

3-2. SUBSYSTEM DESCRIPTION

As shown in figure 3-1, the subsystem provides the means for transferring data between the computer and disc drive via the interface PCA and controller. Paragraphs 3-3 through 3-23 provide a functional description of the interface PCA.

Theory of operation for the disc drive is provided in the *HP 7905A Disc Drive Installation and Service Manual*, part no. 07905-90007. Theory of operation for the controller is provided in the *HP 13037A/B Disc Controller Installation and Service Manual*, part no. 13037-90006.

Note: Figure 3-1 and the functional description contained in paragraphs 3-3 through 3-23 are applicable to Interface PCA 13037-60023, used in the HP 12962C/D Subsystem. They are not applicable to Interface PCA 13037-60003, used in the HP 12962A/B Subsystem.

3-3. INTERFACE DESCRIPTION

Figure 3-2 shows an overall functional logic diagram of Interface PCA, part no. 13037-60023, used with the HP 12962C/D Subsystem. Using figure 3-2, a block-level discussion is provided in the following paragraphs.

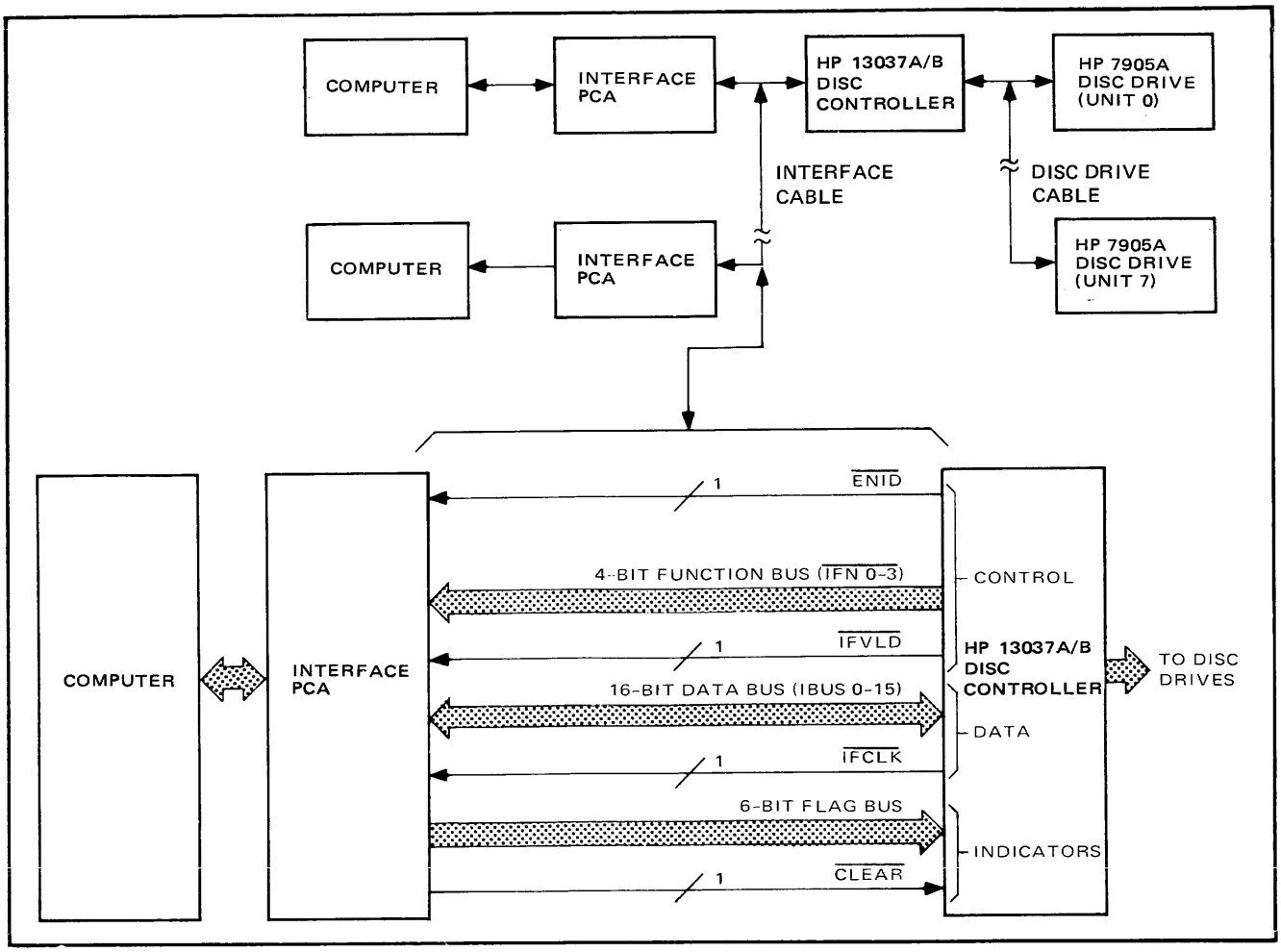


Figure 3-1. Interface PCA to Controller Block Diagram

3-4. FUNCTION BUS RECEIVERS

As shown in figure 3-2, the function bus receiver circuit receives a four-wire Interface Function bus (INF0-3), an Interface Interrupt Function Valid (IFVLD) signal, an Interface Clock (IFCLK), and an Enable Interface Drivers (ENID) signal. These seven active-low signals are inverted and sent to other circuits on the interface PCA.

3-5. FUNCTION DECODING AND VALIDATION

The function decoding and validation circuit is responsible for decoding the four-bit Interface Function bus (IFN 0-3) into the particular function the controller wishes the interface to perform. The interface will execute a particular function only if the Interface Function Valid (IFVLD) line is true. In addition, most functions require that the interface be previously selected by the controller. The only two functions to which all interfaces respond are Disconnect Interface (DSCIF) and Select Interface (SELIF). In the latter case, the interface will only be selected if its address jumpers match the interface number transmitted by the controller. See paragraph 3-10.

3-6. DATA BUS DRIVERS/RECEIVERS

The Interface Bus (IBUS 0-15) is a bidirectional 16-bit bus used to transmit data information between the selected interface and the controller. The data bus drivers/receivers determine which direction information is to travel. When information is to be sent from the selected interface to the controller, the Interface Select and Enable Interface drivers (IFSEL • ENID) signal allows the drivers to place this information on the bus. Note that IFVLD need not be asserted to allow data transfer in either direction.

3-7. INTERFACE ADDRESS SELECTION

The interface address selection circuit allows the controller to select a particular interface so that the interface may respond to those interface functions requiring that the interface be selected. The interface address number of a particular interface PCA is selected by positioning jumpers W1 through W3 as described in paragraph 2-9.

CAUTION

No two interfaces on the same subsystem may contain the same combination of jumpers W1 through W3.

When the Select Interface (SELIF) function is validated, Interface bus bits 0-2 (IBUS 0-2) are compared with select-code jumpers W1 through W3. If they match, the interface is selected. The IFSEL output goes true and remains true until a Disconnect Interface (DSCIF) function is received.

The state of the interface selection is indicated by the SEL (Select) light-emitting diode (LED), located next to the Select Code Jumpers. When the HP 13037B Disc Controller and the computer are connected and powered, the LED will glow at partial brilliance, indicating that the controller is polling the interface. Whenever data or commands are being transferred, the LED will flash to full brilliance.

3-8. FIFO BUFFER

All commands and data passing between the computer and the controller go through the FIFO (First In-First Out) buffer. The FIFO can store up to 16 words, each 16 bits wide.

The FIFO is controlled by three signals. Master Reset (MR) clears the internal control logic and the data output buffer; Parallel Load (PL) stores a new word in the FIFO; the Transfer Out Parallel (TOP) removes a word, enabling the next word in the buffer to be present at the output.

The FIFO supplies two flags to indicate its status. Output Register Empty (ORE) indicates that there is no valid data in the buffer, and Input Register Full (IRF) signifies that no additional data may be entered into the buffer.

3-9. FIFO SELECTOR/REGISTER

Since data passes through the FIFO in only one direction, the source of input data must be selected from either the computer or the controller. During a Read operation, the input selector passes data from the IBUS receivers; a Write operation selects data from the computer 16-bit IOBO bus. The selected word is then latched in a holding register before being loaded into the FIFO.

3-10. COMPUTER INPUT DRIVERS

In a similar manner to the FIFO input selector, the FIFO outputs must be sent to either the computer or the controller. During a Read, driver gates place the data on the computer 16-bit IOBI bus; a Write operation sends the data to the IBUS drivers, to be sent to the controller.

3-11. 10-MHZ CLOCK

The 10-MHz clock consists of a crystal oscillator that provides timing signals to the FIFO circuitry. This local clock is required to synchronize the interface to both the computer and the controller, each of which has independent (unsynchronized) timing circuitry.

3-12. IFCLK DEBOUNCER

The IFCLK signal is sent by the controller to transfer data to and from the interface. The IFCLK debounce circuit reshapes this pulse to eliminate the possibility of false triggering of the FIFO sequencer.

3-13. FIFO SEQUENCER AND SYNCHRONIZER

This circuitry is used to control all transmission of data through the FIFO buffer. A CLCSC signal from the computer will generate the MR signal to clear the FIFO logic. The IOOSC signal from the computer, or a controller IFCLK in the Read mode will generate a LOAD signal to the FIFO selector register, followed by a PL pulse to load the FIFO buffer. Similarly, a computer IOISC signal or a controller IFCLK signal in the Write mode will generate a TOP pulse to remove a word from the FIFO.

Since the computer and controller are running on separate clocks, it is quite possible that one device will enter a word at the same time that the other is removing one. The FIFO buffer automatically handles this situation without loss of data.

3-14. FIFO POINTER

The FIFO pointer indicates how many words are in the FIFO buffer, by means of a shift-register counter. The number of FIFO entries correspond to the number of "ones" in the pointer register.

The MR signal resets the pointer to all zeroes. Each PL pulse to the FIFO also enters another "one" into the pointer; similarly, each TOP pulse will remove a pointer "one" bit. In the event that a PL and a TOP occur simultaneously, the pointer is unchanged.

3-15. OVERRUN DETECTOR

This circuitry utilizes the FIFO Input Register Full (IRF) and Output Register Empty (ORE) flags to determine if data has been lost due to overfilling or underfilling of the FIFO. If the computer or controller attempts to enter a word (PL) when the FIFO is full (IRF), or remove a word (TOP) when the FIFO is empty (ORE), an overrun condition is detected. If this condition occurs before the end of a data block transfer (EOD), the overrun status flag is set and sent to the controller.

3-16. SERVICE REQUEST LOGIC

In a typical HP 2100-Series interface, the DMA Service Request (SRQ) signal is connected to the channel flag bit. Because of timing considerations, this configuration yields a DMA transfer rate that is too slow for the disc and controller, resulting in overruns. On this interface, therefore, a different method is used to request a DMA transfer, based on the direction of data transfer and the level of fullness of the FIFO.

In the Read mode, the SRQ logic tries to keep the buffer from overflowing with words from the disc, i.e., tries to keep it empty. Thus, whenever the ORE signal indicates that there is valid data in the FIFO, an SRQ signal is generated.

During Write, the SRQ logic tries to keep the buffer stocked with words for the controller. Although the FIFO can store 16 words, the Write level has been set to 5 to prevent unnecessary "hogging" of computer memory cycles by the disc. The FIFO pointer tells the SRQ logic when the FIFO level is less than or equal to 5, so that the proper number of DMA requests can be initiated.

3-17. CHANNEL SELECT GATING

The signals shown entering this block are all conditioned by the channel select code of the interface PCA. This select code is wired into the computer backplane, and is determined by the I/O slot into which the disc interface has been installed.

3-18. INTERFACE FLAG BIT LOGIC

The flag bit logic is used to:

a. Request a computer interrupt.

b. Request a direct (non-DMA) transfer of data between the computer and the controller.

c. Signify completion of command processing.

The flag bit is set by the controller STDFL, DVEND, or STINT functions or by the computer STF instruction. (The flag is also set by the Power-On Preset I/O signal, POPIO.) The flag can be cleared only by the computer CLF instruction.

3-19. BUSY BIT

The interface busy bit is required because of the single 16-bit data path between computer and controller. If a direct memory access data transfer is taking place, a direct I/O instruction (e.g., LIA, OTA) will interfere with the data transfer and result in a transmission error. The busy bit is a means for the computer program to determine whether the controller is executing a command without interfering with a DMA data transfer.

When the BUSY function is validated on a selected interface, the status of IBUS0 (high or low) is clocked into the busy bit (true or false). The state of this bit may be tested by the computer program using the SFC instruction. For this interface only, the SFC instruction tests the busy bit, *not* the flag bit. A skip will occur if the interface is not busy.

In addition, the controller uses the busy bit to indicate illegal commands or unavailable disc drives. In these cases, the interface flag bit will be set by the controller, but the busy bit will not.

3-20. CONTROL BIT LOGIC

The control bit, when set, allows computer interrupts to be generated if all other conditions for interrupt are met. (See paragraph 3-21.) In addition, the control bit of a selected interface (IFSEL true) is sent to the controller as the Interrupt OK (INTOK) signal. When the control bit is set, INTOK is true. The INTOK signal allows the controller to send a Set Interrupt (STINT) signal that results from a disc drive attention status. If INTOK is false, these interrupts are inhibited. All other interrupts (e.g., those due to data errors) are reported, no matter what the state of INTOK. The reason for the two types of interrupts is that the attention interrupts may come at unexpected times (say when a disc drive loads or unloads), and the system may not be prepared to handle them. The controller will buffer the attention interrupt until it is able to interrupt (INTOK true) or until the next seek or data transfer command is sent to the drive.

The control bit is set by a computer STC signal and cleared by a CLC signal. CLC is a general reset signal to many parts of the interface. These are summarized here, and are discussed in greater detail elsewhere in this section. CLC performs the following functions:

a. Clears the interface bit.

b. Disallows attention interrupts (INTOK false).

c. Sets the command follows bit.

d. Resets the first-in-first-out (FIFO) buffer and pointer.

Note that the system should not issue a CLC until the controller has finished transferring data, since the FIFO buffer and pointer are reset by the CLC signal, causing a loss of data.

CAUTION

The software routine which prepares the DMA hardware for a data transfer must *not* set bit 13 of DMA Control word 3 (Clear Control, CLC, at end of transfer). Setting this bit will cause the interface to indicate a non-existent overrun error during read operations, and may cause bad data to be written during a write operation.

3-21. INTERRUPT REQUEST

The interrupt request circuit performs its typical function of generating a computer interrupt whenever the seven required conditions are met. These are: 1) the control bit is set, 2) the flag buffer bit is set, 3) the flag bit is set, 4) no higher priority device is requesting an interrupt (PRH is false), 5) the computer interrupt system is on (IEN is true), 6) the first five conditions are validated by the computer Set Interrupt Request (SIR) signal, and 7) no priority-affecting instruction (e.g., CLF, STC, JMP,I, JSB,I) or interrupt trap cell instruction is being executed. In addition, the PRL priority signal is passed on to lower priority devices.

3-22. COMMAND DETECTOR

The command detector allows the controller to determine whether the interface buffer contains a command or data. When the computer program wants to output a command, it first transmits a clear control to the interface select code (CLCSC). This sets a bit (command follows) in the command detector logic. When this bit is set, the next output instruction (OTA/B) addressed to the interface select code sets the Command Ready (CMRDY) flag and clears the command follows bit. The controller tests CMRDY to determine when to begin execution of a new command. CMRDY is cleared when the CLCMRDY function is validated on the interface.

3-23. FLAG DRIVERS

Five status flags are sent from the interface to the controller. These flags are gated onto the Flag bus whenever the interface is selected by the controller (IFSEL). The flags are:

a. DTRDY — Data Ready, which is the complement of the FIFO ORE indicator.

b. CMRDY — Command Ready, from the command detect logic.

c. OVRUN — Overrun, from the corresponding logic.

d. EOD — End of Data transfer, from the computer DMA controller.

e. INTOK — Interrupt OK, from the control bit logic.

In addition, a Clear signal can be sent to the controller which will clear all subsystem status and initiate polling. The POPIO signal (generated at computer power-on or when the front panel PRESET switch is pressed) will initiate the clearing action. In addition, a clear will occur when a computer CLC 00 instruction is executed. This clearing function is enabled or disabled by the PRE jumper, located next to the SEL (Select) LED on the interface PCA.

3-24. SIGNAL DATA

Table 3-1 contains a description of signal flow between the interface PCA and the controller. Table 3-2 lists the connections between interface PCA connector J1 and device controller PCA interface connector IFJ1. Table 3-3 gives signal and pin number assignments for the interface PCA connector J1 and table 3-4 gives signal and pin number assignments for the device controller PCA interface connector IFJ1.

Note: The signals listed in tables 3-1 through 3-4 are applicable to Interface PCA, part no. 13037-60003 and 13037-60023. The exception is signal $\overline{\text{ENIR}}$, which is not used in PCA 13037-60023.

Table 3-1. Interface PCA/Controller Signals

SIGNAL	DESCRIPTION
$\overline{\text{CLEAR}}$	This signal is generated by passing the computer's Power-On Preset I/O (POPIO) signal to the disc controller whenever the preset jumper (see paragraph 2-9) is set to enable. The Clear signal resets the disc controller to its power-on state. If all interfaces can generate this signal, operation of other interfaces may be affected. For this reason, the Clear signal can be disabled on any or all interfaces by setting the preset jumper to disable.
$\overline{\text{IBUS0-15}}$	Interface Bus. Sixteen bit bi-directional data bus used to transmit all data information between the interface and controller.
$\overline{\text{ENID}}$	Enable Interface Drivers. Allows interface drivers to place data on IBUS for transmission to the controller. Interface must have been previously selected.
$\overline{\text{ENIR}}$	Enable Interface Receivers. Enables receptioon of data from IBUS on the interface.
$\overline{\text{IFN0-3}}$	Interface Function Bus. Four-bit bus carrying the coded function commands from the controller. Decoded functions are valid only if the IFVLD signal is true.
$\overline{\text{IFCLK}}$	Interface Clock. Validates data and status word transfers word-by-word while the IFIN, IFOUT, and IFGTC signals are valid.
$\overline{\text{IFVLD}}$	Interface Function Valid. Validates functions on the interface function bus. A function is valid only if this line is true.
$\overline{\text{CMRDY}}$	Command Ready. Held true while a command to the controller is on the interface bus. Cleared by IFGTC from controller. Interface must be selected.
$\overline{\text{DTRDY}}$	Data Ready. Held true whenever the FIFO buffer is not empty. Interface must be selected.
$\overline{\text{EOD}}$	End of Data. True on read when DMA has completed a block transfer. True on write when DMA has completed a block transfer and the FIFO buffer is empty. Interface must be selected. Cleared by CLCSC from computer.
$\overline{\text{OVRUN}}$	Read Overrun. True if the data buffer FIFO is full and the controller or the computer tries to send another word or true if the data buffer FIFO is empty and controller or computer attempts to fetch a word. Interface must be selected. Cleared by CLCSC from computer.
$\overline{\text{INTOK}}$	Interrupt OK. True if interface is selected and the control bit is set.

Table 3-2. Interface Cable Part Nos. 13037-60015 and 13037-60016 Wiring List

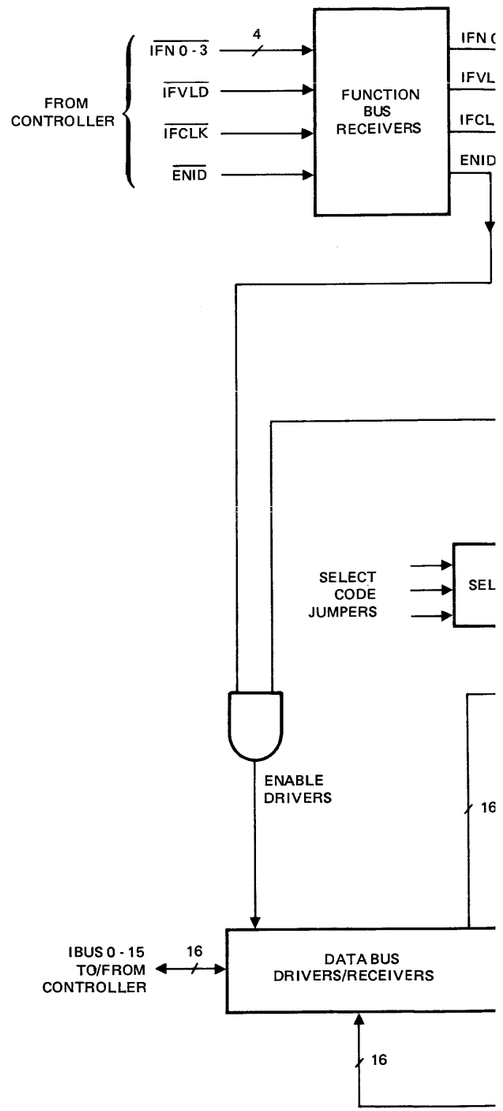
INTERFACE PCA J1 (48 PINS)	DEVICE CONTROLLER PCA IFJ1 (50 PINS)	SIGNAL	INTERFACE PCA J1 (48 PINS)	DEVICE CONTROLLER PCA IFJ1 (50 PINS)	SIGNAL
A (N.C)	—	GND	1 (N.C.)	—	GND
B	4	$\overline{\text{IFN2}}$	2	3	$\overline{\text{IFN0}}$
C	6	$\overline{\text{IFN3}}$	3	5	$\overline{\text{IFN1}}$
D	8	$\overline{\text{IBUS4}}$	4	7	Reserved
E	10	$\overline{\text{IBUS5}}$	5	9	$\overline{\text{CMRDY}}$
F	12	$\overline{\text{IBUS6}}$	6	11	$\overline{\text{EOD}}$
H	14	$\overline{\text{IBUS7}}$	7	13	$\overline{\text{IFVLD}}$
J	20	GND	8	18	Reserved
K	19	GND	9	16	GND
L	15	GND	10	16	GND
M	34	GND	11	21	$\overline{\text{IBUS0}}$
N	50	GND	12	23	$\overline{\text{IBUS1}}$
P	34	GND	13	25	$\overline{\text{IBUS2}}$
R	28	$\overline{\text{CLEAR}}$	14	27	$\overline{\text{IBUS3}}$
S	48	$\overline{\text{INTOK}}$	15	29	$\overline{\text{ENID}}$
T	2	+5V	16	31	$\overline{\text{IFCLK}}$
U (N.C.)	—	GND	17	33	GND
V, 18	49, 50	GND	18, V	49, 50	GND
W	38	$\overline{\text{IBUS12}}$	19	37	$\overline{\text{IBUS8}}$
X	40	$\overline{\text{IBUS13}}$	20	39	$\overline{\text{IBUS9}}$
Y	42	$\overline{\text{IBUS14}}$	21	41	$\overline{\text{IBUS10}}$
Z	44	$\overline{\text{IBUS15}}$	22	43	$\overline{\text{IBUS11}}$
AA	46	$\overline{\text{OVRUN}}$	23	45	$\overline{\text{ENIR}}$
BB	32 1, 22, 35, 36 (N.C.)	NOT USED +5V	24	47 17, 24, 26, 30 (N.C.)	$\overline{\text{DTRDY}}$

Table 3-3. Interface PCA Connector (J1) Pin Assignments

J1 PIN	SIGNAL	J1 PIN	SIGNAL
A	GND	1	GND
B	$\overline{\text{IFN2}}$	2	$\overline{\text{IFN0}}$
C	$\overline{\text{IFN3}}$	3	$\overline{\text{IFN1}}$
D	$\overline{\text{IBUS4}}$	4	(Reserved)
E	$\overline{\text{IBUS5}}$	5	$\overline{\text{CMRDY}}$
F	$\overline{\text{IBUS6}}$	6	$\overline{\text{EOD}}$
H	$\overline{\text{IBUS7}}$	7	$\overline{\text{IFVLD}}$
J	GND	8	(Reserved)
K	GND	9	GND
L	GND	10	GND
M	GND	11	$\overline{\text{IBUS0}}$
N	GND	12	$\overline{\text{IBUS1}}$
P	GND	13	$\overline{\text{IBUS2}}$
R	CLEAR	14	$\overline{\text{IBUS3}}$
S	$\overline{\text{INTOK}}$	15	$\overline{\text{ENID}}$
T	+5V from controller	16	$\overline{\text{IFCLK}}$
U	GND	17	GND
V	GND	18	GND
W	$\overline{\text{IBUS12}}$	19	$\overline{\text{IBUS8}}$
X	$\overline{\text{IBUS13}}$	20	$\overline{\text{IBUS9}}$
Y	$\overline{\text{IBUS14}}$	21	$\overline{\text{IBUS10}}$
Z	$\overline{\text{IBUS15}}$	22	$\overline{\text{IBUS11}}$
AA	$\overline{\text{OVRUN}}$	23	$\overline{\text{ENIR}}$
BB	(Not used)	24	$\overline{\text{DTRDY}}$

Table 3-4. Device Controller PCA Interface Connector (IFJ1) Pin Assignments

IFJ1 PIN	SIGNAL	IFJ1 PIN	SIGNAL
1	+5V	1	+5V
3	$\overline{\text{IFN0}}$	4	$\overline{\text{IFN2}}$
5	$\overline{\text{IFN1}}$	6	$\overline{\text{IFN3}}$
7	(Reserved)	8	$\overline{\text{IBUS4}}$
9	$\overline{\text{CMRDY}}$	10	$\overline{\text{IBUS5}}$
11	$\overline{\text{EOD}}$	12	$\overline{\text{IBUS6}}$
13	$\overline{\text{IFVLD}}$	14	$\overline{\text{IBUS7}}$
15	GND	16	GND
17	NOT USED	18	(Reserved)
19	GND	20	GND
21	$\overline{\text{IBUS0}}$	22	+5V
23	$\overline{\text{IBUS1}}$	24	NOT USED
25	$\overline{\text{IBUS2}}$	26	NOT USED
27	$\overline{\text{IBUS3}}$	28	CLEAR
29	$\overline{\text{ENID}}$	30	NOT USED
31	$\overline{\text{IFCLK}}$	32	NOT USED
33	GND	34	GND
35	+5V	36	+5V
37	$\overline{\text{IBUS8}}$	38	$\overline{\text{IBUS12}}$
39	$\overline{\text{IBUS9}}$	40	$\overline{\text{IBUS13}}$
41	$\overline{\text{IBUS10}}$	42	$\overline{\text{IBUS14}}$
43	$\overline{\text{IBUS11}}$	44	$\overline{\text{IBUS15}}$
45	$\overline{\text{ENIR}}$	46	$\overline{\text{OVRUN}}$
47	$\overline{\text{DTRDY}}$	48	$\overline{\text{INTOK}}$
49	GND	50	GND



7096-12A

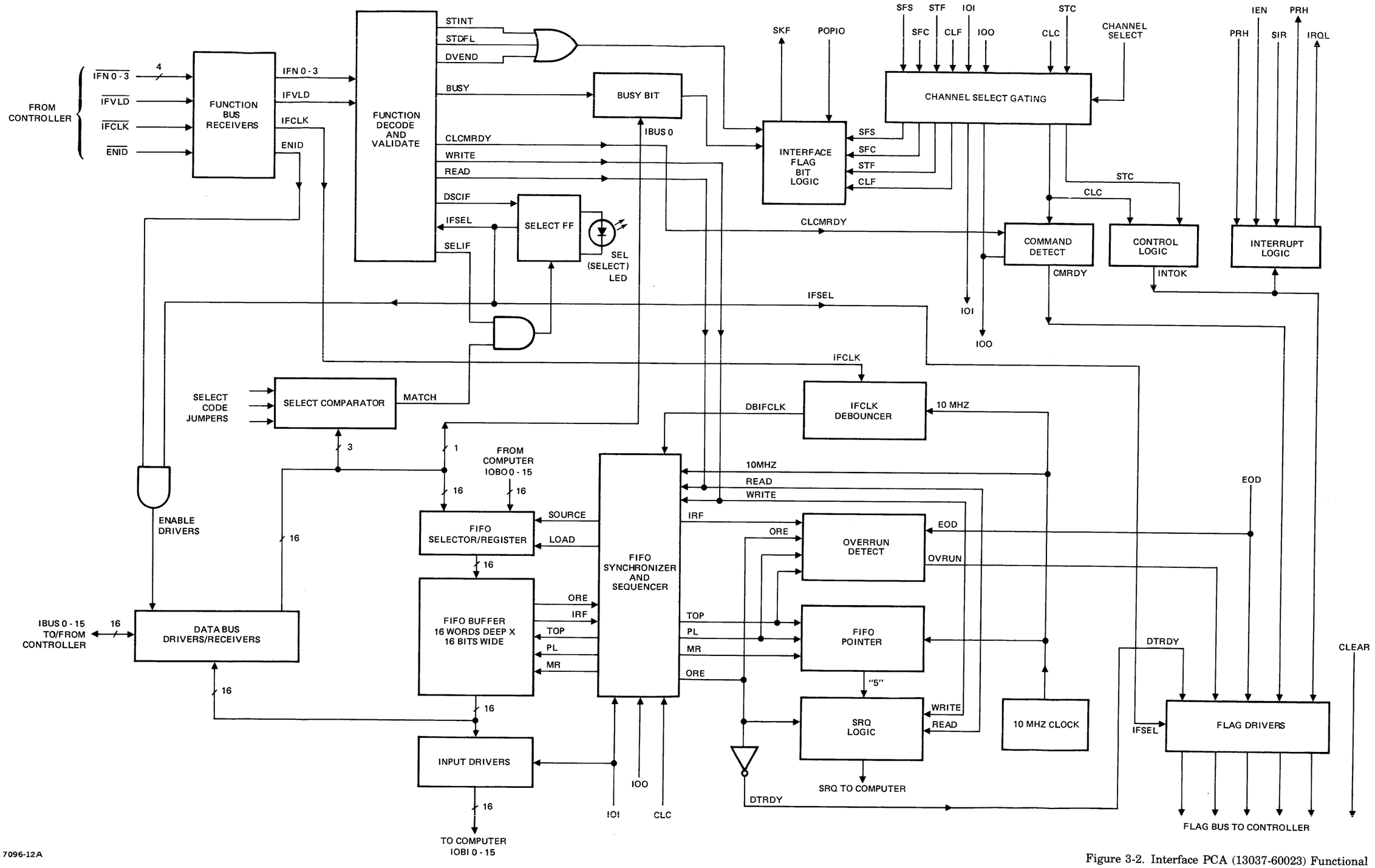


Figure 3-2. Interface PCA (13037-60023) Functional Logical Diagram

MAINTENANCE

SECTION IV

4-1. INTRODUCTION

This section provides general servicing information, preventive maintenance instructions, troubleshooting, subsystem diagnostic test information, replacement procedures, and interface PCA modification instructions for the cartridge disc subsystem. It is assumed that service personnel performing the maintenance have a thorough knowledge of the subsystem hardware.

4-2. GENERAL SERVICING INFORMATION

Servicing information for the disc drive is provided in the *HP 7905A Disc Drive Installation and Service Manual*, part no. 07905-90007. Servicing information for the controller is provided in the *HP 13037A/B Disc Controller Installation and Service Manual*, part no. 13037-90006. The following paragraphs provide general servicing information for the interface PCA.

4-3. SAFETY PRECAUTIONS

To avoid injury to themselves and/or to prevent damage to the equipment, service personnel should observe the following safety precautions:

a. Observe all *warning* and *caution* labels affixed to the device being serviced.

b. Use extreme caution when working on a device with the covers removed, since dangerous line voltage is present within the mainframe. Failure to observe this precaution can result in serious injury.

c. Remove watches, rings, or other such jewelry before working on a device.

d. Do not attempt to remove or change PCA's or interconnecting cables without first removing power from the device.

e. On slide mounted disc drives, ensure that the equipment is stable before extending the drive.

4-4. REQUIRED SERVICING EQUIPMENT

Servicing equipment required to service the subsystem components is listed in the applicable service manual. For the disc drive, refer to the *HP 7905A Disc Drive Installation and Service Manual*, part no. 07905-90007. For the controller, refer to the *HP 13037A/B Disc Controller Installation and Service Manual*, part no. 13037-90006. There is no service equipment required to service the interface PCA. For the cabinet used in the HP 12962B/D Subsystem and the HP 13180B Add-On Disc Drive, refer to the *HP 29425A Cabinet Installation and Service Manual*, part no. 29425-90001. For the prefilter assembly, refer to the *HP 40019A Prefilter Assembly Installation and Service Manual*, part no. 40019-90901.

4-5. OPERATING CONTROLS AND INDICATORS

Familiarization with the subsystem's operating controls and indicators is required when servicing the subsystem. Disc drive operator panel controls and indicators are listed and described in the *HP 7905A Disc Drive Operator's Manual*, part no. 07905-90009. The controller has only a power switch located on the rear panel. There are no controls or indicators on the interface PCA.

4-6. HP 12962B/D AND HP 13180B ACCESS PROCEDURES

Components of the HP 12962B/D Subsystem and the HP 13180B Add-On Disc Drive are contained in the HP 29425A Cabinet. Thus, special disc access procedures and precautions are necessary during maintenance and service. The disc drive is mounted on side rails and bolted down. All disc drive maintenance and service can be carried out without removing it from the cabinet. If the drive must be removed from the cabinet, use extreme caution because the drive weighs 73.5 kg (162 lbs). Two or more people should be employed to handle the drive.

For specific test and maintenance procedures, refer to the appropriate *installation and service manual*. Procedures for access and removal of components housed in the HP 29425A Cabinet are provided in the following paragraphs. Removal details for each part, such as step-by-step instructions for front and rear doors are provided in the *HP 29425A Cabinet Installation and Service Manual*, part no. 29425-90001. All components mentioned in the access procedures have reference numbers to correspond with the call-outs in figure 4-1.

WARNING

Side rails support the drive in the cabinet. The drive should not be pulled out unless proper precautions are taken. A platform elevated to exactly meet the bottom of the drive is required to receive the drive as it slides out the front. Without the platform, the cabinet could tip over. Two persons or more should always be employed in the drive removal operation. Be sure to check the instructions given below under paragraph 4-11.

4-7. ACCESS FOR FILTER PRESSURE TEST

One of the maintenance procedures is the regularly scheduled check of the absolute filter output air pressure. The test port (1) is located on the left side of the disc-drive behind the cabinet left-side panel (4). Remove panel as follows:

a. Take off rear door (6).

b. Remove the two left-side panel retaining screws (3) using a 5/16-inch nutdriver.

c. Grasping panel in both hands, pull bottom of panel (4) outward a short distance to slip the centering tab (on inside of panel) out of the centering bracket (14). Lift panel away from cabinet.

d. After test, replace the side panel by reversing this procedure.

4-8. ABSOLUTE FILTER REMOVAL

The absolute filter unit may be removed for filter replacement through the front of the disc drive without removing any cabinet parts. This procedure is described in the *HP 7905A Disc Drive Installation and Service Manual,* part no. 07905-90007.

4-9. DISC DRIVE TOP COVER REMOVAL

The top cover (9) of the disc drive may be removed for all top-of-drive maintenance and service, including inspection checks, cleaning, and alignment of the heads. Use the following procedure:

a. Turn system power OFF with the circuit breaker on the power panel (rear of cabinet).

b. Remove front and rear doors, (5) and (6).

c. Remove the right-side panel (2) and left-side panel (4) by removing two screws (3) in each using a 5/16-inch nutdriver. Grasping panel in both hands, pull bottom edge of panel out a short distance to disengage its centering tab (on inside of panel) from the centering bracket. Lift panel away from cabinet.

d. Remove cabinet table top (7) by taking out the two 3/8-inch hex head screws (8) securing bottom surface of table top to the two brackets protruding from the cabinet's top-rear horizontal strut. Then pull the top toward the rear to disengage the front-edge clamps from the cabinet's top-front horizontal strut.

WARNING

Use extreme caution when working on the disc drive with the covers removed to prevent contact with hazardous voltages which are present inside the mainframe when the ac power cord is connected to an active ac power source.

e. The disc drive cover (9) can now be taken off. The two front and the two left-rear cover screws which would have been covered by the cabinet's vertical corner columns are absent so that the drive cover can be removed while the drive is in the cabinet and bolted to the side rails.

The procedure is as follows:

(1) Remove four screws (19) from the top-rear edge of cover.

(2) Loosen, but do not remove, the screws and flat washers visible along the lower right and left edges of the drive cover (9).

(3) Carefully take off the top cover by slipping it out the top of the cabinet.

Replace the disc drive top cover by reversing the order and procedure of the above steps. When replacing the screws in the cover, if the two top-rear center screws are screwed in first the hole alignment of the remaining screws will be easier. When replacing the top, ensure that the clamps are engaged and it is centered. The cabinet top is slightly oversize compared to the cabinet frame so that adjacent cabinets will not scrape their sides together.

4-10. ACCESS TO BOTTOM OF DISC DRIVE

The bottom cover of the disc drive can be removed without dismounting the drive from the cabinet for servicing the power supply PCA. The following procedure is recommended:

a. Turn system power OFF with the circuit breaker on power panel (rear of cabinet).

b. Take off the front and rear doors (5) and (6).

c. Remove the right-side panel (2) and left-side panel (4) by removing the two screws (3) in each using a 5/16-inch nutdriver. Grasping panel with both hands, pull bottom edge of panel out a short distance to disengage centering tab (on inside of panel) from centering bracket (14) on the frame. Lift panel away from cabinet.

d. Remove prefilter duct assembly (11) from beneath the disc drive.

The procedure is as follows:

(1) Remove filter element (10) from prefilter duct assembly (11).

(2) Disengage the two quarter-turn fasteners in the prefilter duct opening using an offset blade-type screwdriver.

(3) Lower the front of the prefilter duct and after it has cleared the rubber gasket on the disc drive fan cover plate pull the duct out the front of the cabinet.

e. For the HP 12962B/D Subsystem, remove the controller at the bottom of the cabinet as follows:

(1) Unplug controller power cable from rear panel.

(2) Loosen the two cable clamps at the bottom rear of the cabinet so the extra cable lengths will pull through in sub step (4) below.

(3) Remove controller front panel (26).

(4) Remove the four rack-mounting flange screws (20) holding controller to cabinet and slide controller out the front of the cabinet pulling the cable through the loosened cable clamps.

f. Follow instructions in the *HP 7905A Disc Drive Installation and Service Manual* for bottom of drive procedures. The components removed in the above steps can be replaced by reversing the order and the procedure.

4-11. DISC DRIVE REMOVAL

If the disc drive (15) must be removed, all safety precautions are mandatory. Take note of the *Warning* under paragraph 4-6. Have proper assistance and handling equipment ready. Dismount the disc drive by using the following procedure:

a. Disconnect ac power to cabinet (or set circuit breaker on power unit to OFF).

b. Remove front and rear doors (5) and (6).

c. Remove the right-side panel (2) and left-side panel (4) by removing with a 5/16-inch nutdriver the two screws (3) in each. Grasping the panel with both hands, pull bottom edge of panel out a short distance to disengage the centering tab (on inside of panel) from the centering bracket (14) on the frame. Lift panel away from cabinet.

d. Remove filter element (10) from prefilter duct assembly (11).

e. Disengage the two quarter-turn fasteners in the prefilter duct opening using an offset blade-type screwdriver.

f. Lower the front of the prefilter duct and after it has cleared the rubber gasket on the disc drive fan cover plate pull the duct out the front of the cabinet.

g. Reach under the disc drive (15) with a 3/8-inch socket wrench and take off the six screws (17) holding the disc-drive frame rails (16) to the side rails.

h. Remove the disc drive cables including power cable, data cable (plugged into connector A7P4 through a cutout in the rear panel), and the interconnection flat cable. Disconnect the flat cable at the terminator PCA on the terminator bracket (12).

i. The disc drive can now slide out the front of the cabinet. Slide the drive carefully onto a platform positioned level with the bottom of the drive.

Install a disc drive in the HP 29425A Cabinet using the opposite order and reverse procedures of the above steps. Be sure the drive is centered on the rails or the drive's front door will not open for disc cartridge insertion.

4-12. DISC DRIVE CARD CAGE REMOVAL

The HP 7905A Disc Drive card cage can be taken out while the drive is mounted in the HP 29425A Cabinet. The procedure is as follows:

a. Remove disc drive top cover (9) according to the procedure in paragraph 4-9.

b. Remove card cage as described in the *HP 7905A Disc Drive Installation and Service Manual* except as described below in step (c).

c. Instead of lifting the card cage up and away from the disc drive, carefully slip it out the rear of the cabinet.

On reinstalling the card cage, slide it back into position cautiously while lifting the interfering cables out of the way.

4-13. PREVENTIVE MAINTENANCE

Preventive maintenance is performed at scheduled intervals to prevent or minimize equipment deterioration. Preventive maintenance consists of inspecting and cleaning the subsystem PCA's, cables, controller, and disc drive. Inspect interface cables and connectors for cracks, burns, or wear at yearly intervals. Ensure that interface PCA's are properly seated.

Check the filter element (10, figure 4-1) for contamination and replace as necessary with part no. 3150-0329. Replace at least once every year. Make sure that the element is pushed in all the way and that the airflow arrow is pointing up.

Detailed preventive maintenance procedures for the disc drive are provided in the *HP 7905A Disc Drive Installation and Service Manual*, part no. 07905-90007. Preventive maintenance procedures for the controller are provided in the *HP 13037A/B Disc Controller Installation and Service Manual*, part no. 13037-90006.

4-14. TROUBLESHOOTING

Troubleshooting the subsystem consists of performing the subsystem diagnostic test as described in paragraphs 4-15 through 4-22. Subsystem malfunctions can be isolated to a replaceable assembly when performing the subsystem diagnostic. The suspected faulty assembly is replaced and the subsystem diagnostic test is continued until the malfunction is cleared.

If required, additional disc drive and controller troubleshooting may be performed. For the disc drive, a disc service unit (DSU) is available and operating procedures are given in the *HP 7905A Disc Drive Installation and Service Manual*, part no. 07905-90007. For the controller, service information is given in the *HP 13037A/B Disc Controller Installation and Service Manual,* part no. 13037-90006.

In a multiple computer system, each computer may be tested individually. However, if the interface PCA is found to be faulty then an exact replacement must be used in order to maintain proper termination. An Add-on interface PCA should never be substituted.

4-15. SUBSYSTEM DIAGNOSTIC

The following paragraphs contain diagnostic test information for the cartridge disc subsystem. Included are a description of the diagnostic program used to test the subsystem and step-by-step instructions for loading the diagnostic program and running the diagnostic test. Instructions are also given in the *HP 7905/7920 Disc Subsystem Diagnostic Reference Manual*, part no. 12962-90001.

4-16. HARDWARE AND SOFTWARE REQUIREMENTS

This subsystem diagnostic can be used with an HP 2100-Series Computer with direct memory access (DMA) or dual-channel port controller (DCPC), at least 16,384 (16K) memory locations, and an HP 12962A/B/C/D Cartridge Disc Subsystem. In addition to the computer and subsystem, a paper tape reader and a system console are required.

The HP 12962A/B/C/D Cartridge Disc Subsytem Diagnostic, part no. 12962-16001, and the HP 24296A Diagnostic Configurator, part no. 24296-60001, are required to check the subsystem. The Diagnostic Configurator is used for equipment configuration and as a console device driver. The *Diagnostic Configurator Reference Manual,* part no. 02100-90157, is required to configure the diagnostic configurator.

4-17. DIAGNOSTIC PROGRAM DESCRIPTION

The Cartridge Disc Subsystem Diagnostic is designed to provide a quick, thorough performance test of the subsystem including the combined functions of the disc drive, controller, and interface PCA. Up to eight disc drives can be checked serially and interaction between disc drives is also tested. This diagnostic does not check more than one interface PCA, nor can it be run while another interface PCA is active.

During execution of the diagnostic, error messages (those preceded by an "E") are used to inform the operator that a malfunction occurred in the subsystem. Information messages (those preceded by an "H") are used to inform the operator of the progress of the diagnostic or to instruct the operator to perform some operation related to a device function.

Basically, the program operation sequence consists of loading and configuring the HP 24296A Diagnostic Configurator, loading the HP 12962A/B/C/D Cartridge Disc Subsystem Diagnostic, and executing the combined resultant program. A copy of the combined diagnostic program should be dumped from memory onto paper tape for future use in subsequent diagnostic tests. Then, whenever it becomes necessary to test the operation of the subsystem, the tape can be loaded into memory using the basic binary loader (BBL) or initial binary loader (IBL). A procedure for dumping the combined diagnostic onto paper tape is included in the operating procedures which follow.

4-18. DIAGNOSTIC OPERATING PROCEDURES

The following procedures assume that the computer system and cartridge disc subsystem have been properly installed. It is also assumed that the computer is operating properly. The simplified diagnostic test flowchart in figure 4-2 describes the procedures taken when the subsystem's performance is being evaluated.

4-19. LOADING AND CONFIGURING DIAGNOSTIC. If a paper tape with the combined diagnostic program (Diagnostic Configurator together with the Cartridge Disc Subsystem Diagnostic) is available, load it into memory using the BBL or IBL, then skip to paragraph 4-20. Otherwise, perform the following:

a. Using the BBL or IBL, load the HP 24296A Diagnostic Configurator into memory.

b. Configure the Diagnostic Configurator as outlined in the *Diagnostic Configurator Reference Manual*, part no. 02100-90157.

c. Using the BBL or IBL, load the Cartridge Disc Subsystem Diagnostic into memory.

d. At this point, it is recommended that a permanent copy of the combined diagnostic program be dumped from memory onto paper tape for subsequent subsystem performance tests. A dump routine is included in the Diagnostic Configurator to accomplish this. Use the following procedure:

(1) Set the P-register to address X7677 (octal), where:

X = 3 for 16K words of memory

X = 5 for 24K words of memory

X = 7 for 32K words of memory

(2) Set bits 5-0 of the switch register to the octal select code of the paper tape punch to be used.

(3) Press PRESET (INTERNAL and EXTERNAL).

(4) Press RUN. A punched paper tape consisting of a leader portion, the contents of memory, and a trailer portion will be produced.

(5) Upon completion of the dumping operation, the computer will halt with 102077 (octal) displayed in the Display Register.

Once the paper tape with the combined diagnostic program has been produced and its contents has been stored in memory, configure the diagnostic program as follows:

a. Load a starting address of 100 (octal) into the P-register.

b. Set bits 5-0 of the switch register to the octal select code for the I/O channel containing the interface PCA.

c. Press PRESET (INTERNAL and EXTERNAL).

d. Press RUN. The computer will halt with 102074 (octal) displayed in the Display Register which indicates that the select code entered was valid. If the computer halts with 102073 (octal) displayed, the select code entered was invalid. Re-enter the valid select code and repeat steps a through d.

4-20. VERIFICATION TEST. A minimal subsystem verification test may be performed on the disc cartridge or fixed disc as follows:

a. At the controller rear panel, set the POWER switch to ON.

b. At the disc drive, perform the following:

(1) Set the POWER/OFF switch to POWER.

(2) Ensure that a unique unit number is specified for the disc drive.

(3) Install an HP 12940A Formatted Disc Cartridge.

(4) Set the RUN/STOP switch to RUN.

c. At the computer, perform the following:

(1) Load a starting address of 2000 (octal) into the P-register.

(2) Set switch register to 040011 (octal).

(3) Press PRESET (INTERNAL, EXTERNAL).

(4) Press RUN. At the system console, an introductory message will be printed (message H0) and the program will ask for instructions (message H55).

d. Enter the following instructions on the system console:

SD, X (CR) (LF)
Vz (CR) (LF)
EN (CR) (LF)

Where X = Unit number (0 is most common).
(CR) = Carriage return key.
(LF) = Line feed key.
z = Head number (0-2). The Vz (CR) (LF) line may be repeated to test more than one head.
or z = H. When the VH instruction is used, all heads in the head table are verified. Initially heads 0 and 1 are in the head table.

When the program repeats its request for instructions (message H55), the program has verified once each sector of the head(s) selected. If any error message is reported, the subsystem has failed this minimal test. Repeat the test

starting at step b. If any error message is reported, refer to the messages and halt codes listed in the *HP 7905/7920 Disc Subsystem Diagnostic Reference Manual*, part no. 12962-90001.

4-21. FORMATTING PROCEDURE. A disc cartridge or fixed disc may be formatted as follows:

a. At the controller rear panel, set the POWER switch to ON.

b. At the disc drive, perform the following:

(1) Set the POWER/OFF switch to POWER.

(2) Ensure that a unique unit number is specified for the disc drive.

(3) Install a disc cartridge.

(4) Set FORMAT switch to FORMAT.

(5) Set the RUN/STOP switch to RUN.

c. At the computer, perform the following:

(1) Load a starting address of 2000 (octal) into the P-register.

(2) Set switch register to 040011 (octal).

(3) Press PRESET (INTERNAL, EXTERNAL).

(4) Press RUN. At the system console, an introductory message will be printed (message H0) and the program will ask for instructions (message H55).

d. Enter the following instructions on the system console:

SD, X (CR) (LF)
Fz (CR) (LF)
EN (CR) (LF)

Where X = Unit number (0 is most common).
(CR) = Carriage return key.
(LF) = Line feed key.
z = Head number (0-2). The Fz (CR) (LF) line may be repeated to test more than one head.

or z = H. When the FH instruction is used, all heads in the head table have been formatted. Initially heads 0 and 1 are in the head table. To change the head table set switch register to 040015 (octal) in step c(2) above. Following an introductory message, a series of requests will appear. Answer the first request with "NO." Answer the next request with "YES" to change the head table. To end the dialogue, enter "EN."

When program repeats its request for instructions (message H55), the program has formatted and verified each sector of the head(s) selected. If error message E125 is reported, the head in message H51 has failed for formatting procedure. Repeat the test starting at step b. If this error message is reported, refer to the messages and halt codes listed in *HP 7905/7920 Disc Subsystem Diagnostic Reference Manual*, part no. 12962-90001.

4-22. DIAGNOSTIC TEST. An abbreviated version of the subsystem diagnostic is used to test all selected heads on a disc drive unit. Perform the diagnostic as follows:

a. At the controller rear panel, set the power switch to ON.

b. At the disc drive, perform the following:

(1) Set the POWER/OFF switch to POWER.

(2) Ensure that unit number 0 is specified for the disc drive.

(3) Install an HP 12940A Formatted Disc Cartridge.

(4) Set the RUN/STOP switch to RUN.

c. At the computer, perform the following:

(1) Load a starting address of 2000 (octal) into the P-register.

(2) Set switch register to 040141 (octal).

(3) Press PRESET (INTERNAL, EXTERNAL).

(4) Press RUN. At the system console, an introductory message will be printed (message H0) and the test will begin.

d. Each short pass tests all selected heads. Several short passes should be run. If errors occur, refer to the error messages and halt codes listed in the *HP 7905/7920 Disc Subsystem Diagnostic Reference Manual*, part no. 12962-90001.

4-23. REPLACEMENT PROCEDURES

Subsystem removal and replacement procedures are limited to those assemblies designated as replaceable by the appropriate service manual.

Detailed removal and replacement procedures for the disc drive are provided in the *HP 7905A Disc Drive Installation and Service Manual,* part no. 07905-90007. Complete removal and replacement procedures for the controller are provided in the *HP 13037A/B Disc Controller Installation and Service Manual*, part no. 13037-90006.

If the interface PCA must be removed from the computer system, proceed as follows:

a. For an HP 2100A/S Computer and an HP 2155A I/O Extender, proceed as follows:

   (1) Turn off power at the computer and I/O extender (if used).

   (2) Remove the top cover from the computer or I/O extender (if used).

   (3) Remove PCA retainer and disconnect the cable connector hood from the interface PCA.

   (4) Remove the interface PCA by pulling upward on the PCA extractor levers.

b. For an HP 21MX Computer and an HP 12979A I/O Extender, proceed as follows:

   (1) Rotate key-operated switch to STANDBY on the computer and set ~ LINE switch to OFF on the I/O extender (if used).

   (2) If power fail recovery system is installed, set BATTERY switch to OFF and disconnect battery cable(s) from the BAT. INPUT connector(s).

   (3) Remove I/O PCA cage cover.

   (4) Loosen I/O PCA retainer.

   (5) Disconnect the cable connector hood from the interface PCA.

   (6) Remove the interface PCA by pulling outward on the PCA extractor levers.

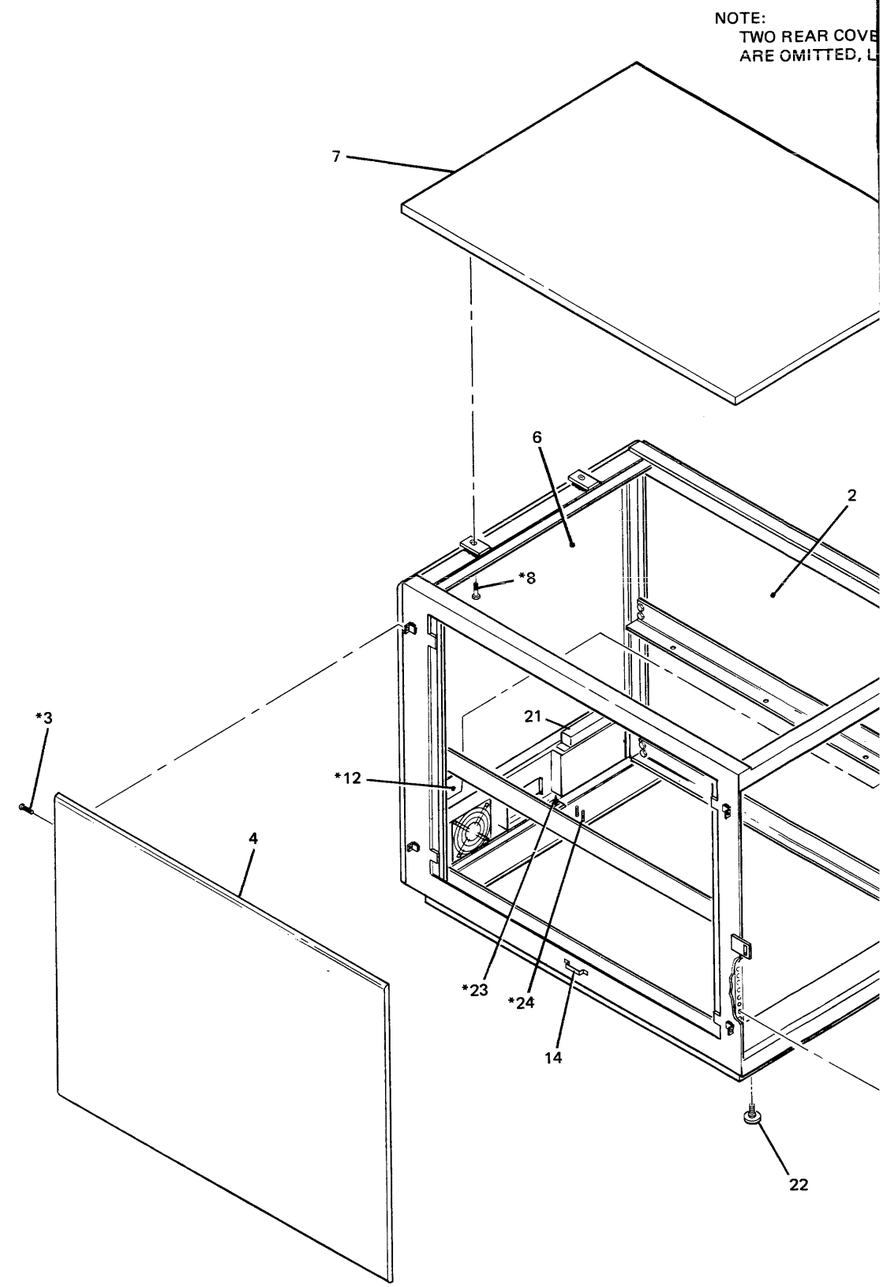
Note: Do not set computer ~ LINE switch to OFF and if the computer is housed in a system cabinet, do not set system power switch to remove ac power, because the power to memory would be removed and its contents would be lost.

Replacement of the interface PCA is accomplished by reversing the removal procedure. Be sure to configure the interface PCA jumpers as described in paragraph 2-9 if a replacement interface PCA is being installed.

REPLACEABLE PARTS*

NO.	QTY.	DESCRIPTION	PART NO.
3	4	SCREW, 10-32 x .625, HEX HD	2680-0244
8	2	SCREW, 1/4 - 20 x .625, HEX HD	2940-0213
12	1	BKT, TERMINATOR	07905-60012
17	6	SCREW, 1/4 - 20 x .625, HEX HD	2940-0213
23	2	SCREW, 10 - 32 x .375, HEX HD	2680-0244
24	2	GROUND LUG (CABINET PART)	—
25	16	SCREW, 18-32 x .375, HEX HD	2510-0254
NOT SHOWN	1	GROUND STRAP (CABINET PART)	29425-60001

For cabinet parts, refer to *HP 29425A Cabinet Installation and Service Manual*, part no. **29425-90001.**



7096-10D

T NO.
-0244
-0213
-60012
-0213
-0244
–
-0254
-60001

29425-90001.

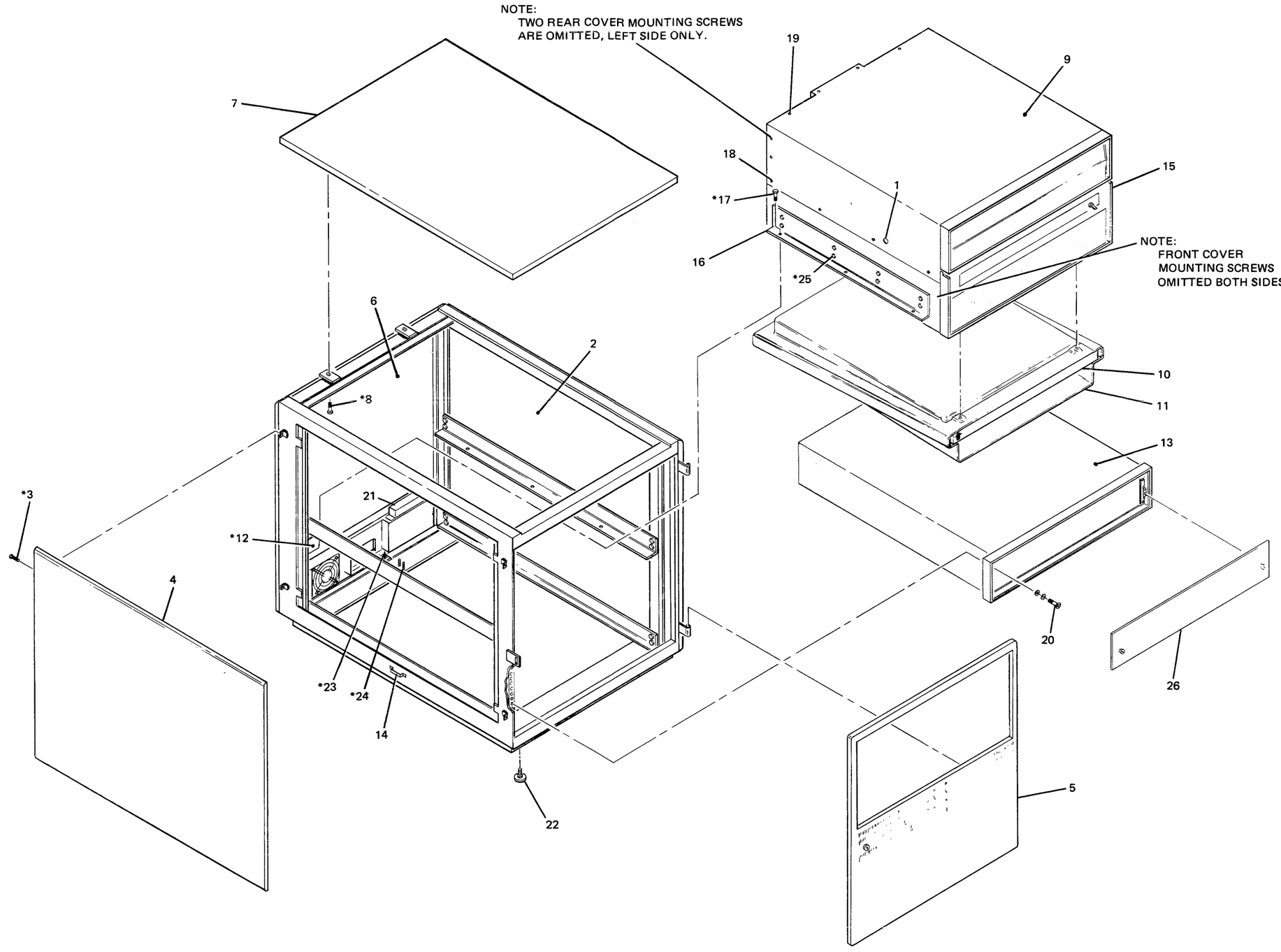
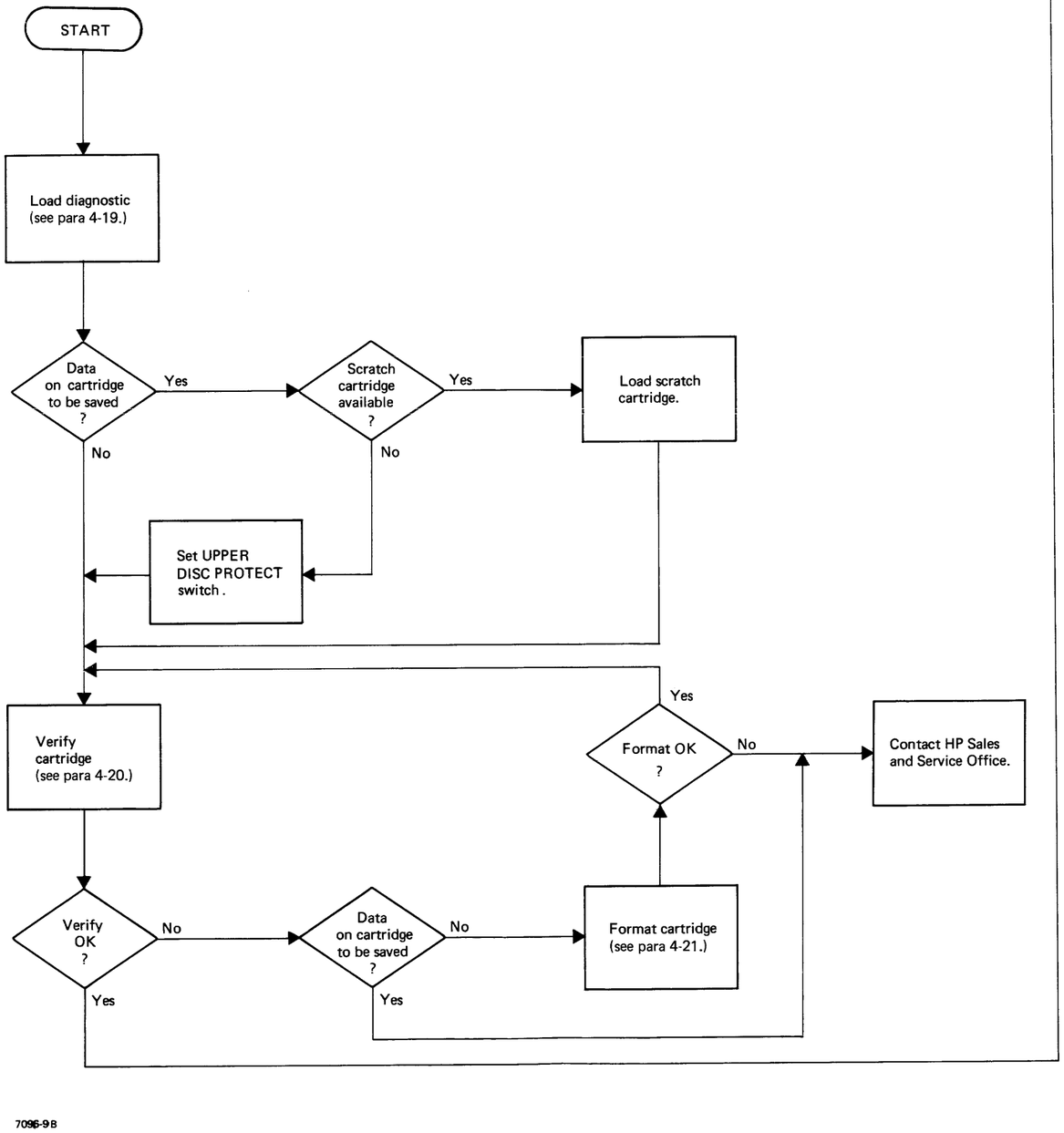
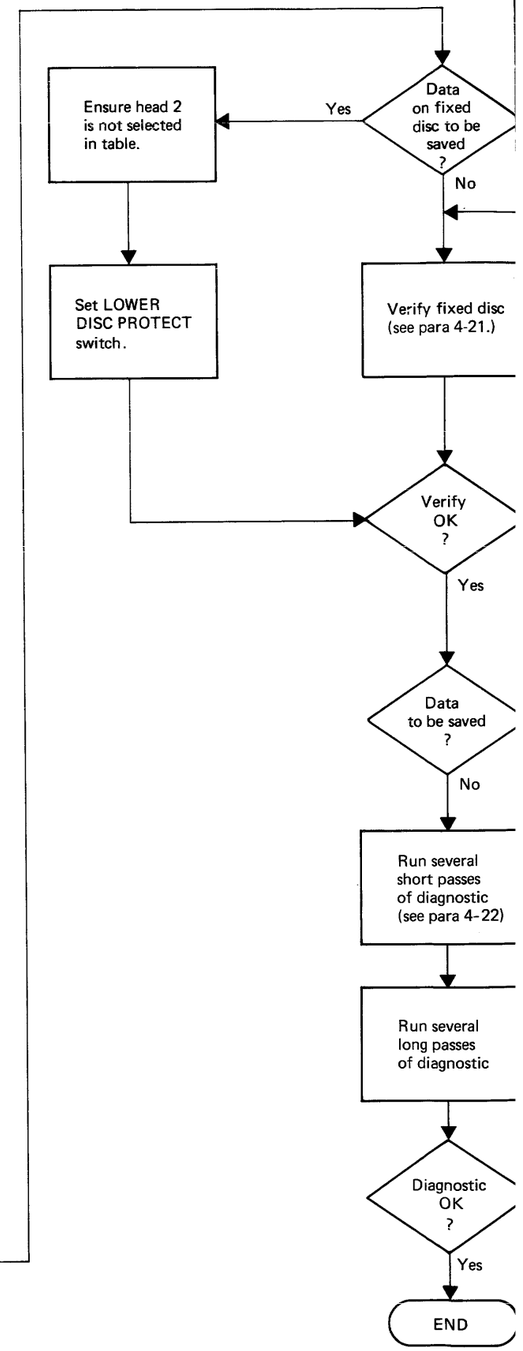
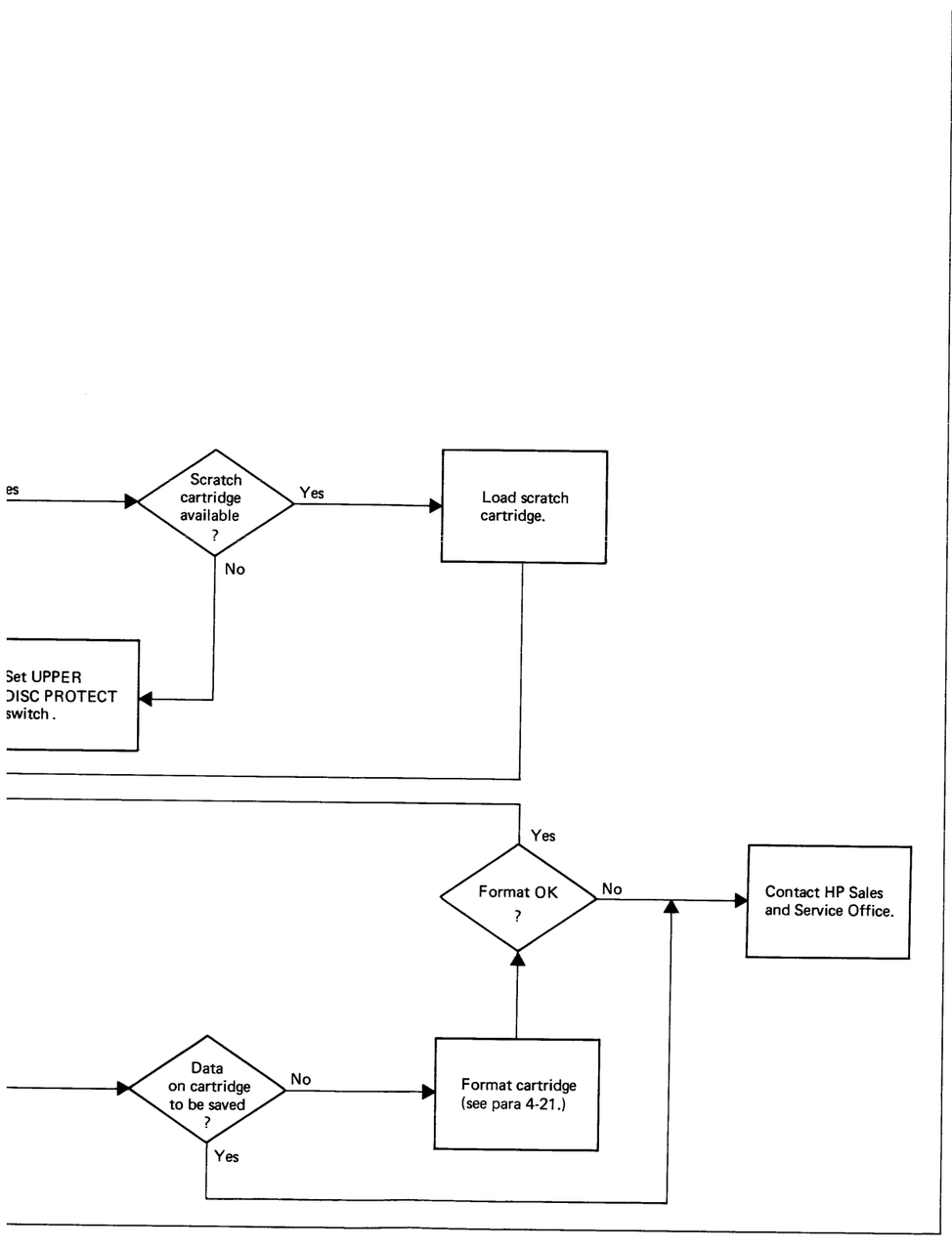


Figure 4-1. Exploded View of HP 12962B/D Cartridge Disc Subsystem


START
Load diagnostic (see para 4-19.)
Data on cartridge to be saved ?
Yes
No
Scratch cartridge available ?
Yes
No
Load scratch cartridge.
Set UPPER DISC PROTECT switch .
Verify cartridge (see para 4-20.)
Verify OK ?
No
Yes
Data on cartridge to be saved ?
No
Yes
Format cartridge (see para 4-21.)
Format OK ?
Yes
No
Contact HP Sales and Service Office.

7096-98


Data on fixed disc to be saved ?
Yes
No
Ensure head 2 is not selected in table.
Set LOWER DISC PROTECT switch.
Verify fixed disc (see para 4-21.)
Verify OK ?
Yes
Data to be saved ?
No
Run several short passes of diagnostic (see para 4-22)
Run several long passes of diagnostic
Diagnostic OK ?
Yes
END



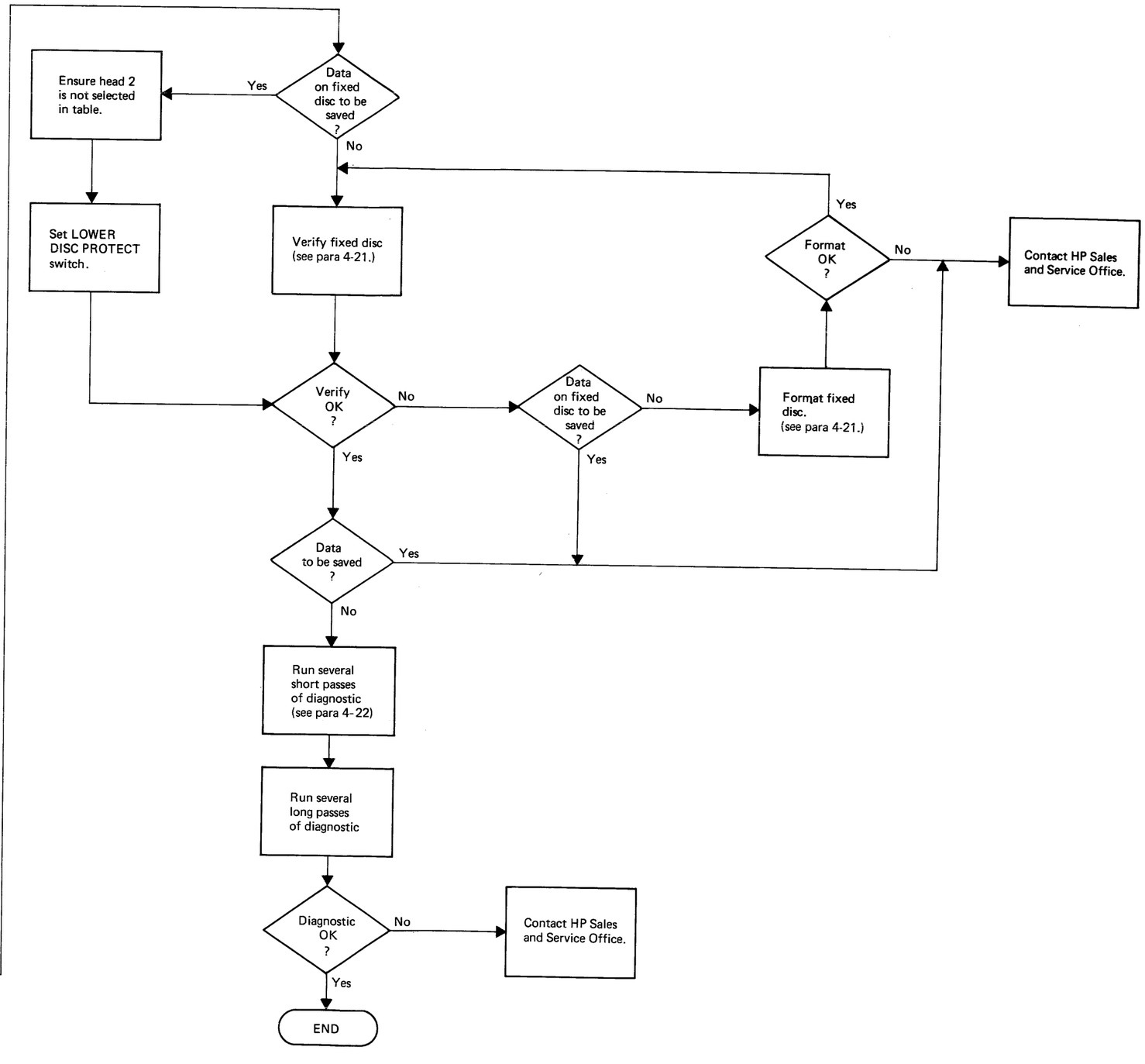


Figure 4-2. Simplified Diagnostic Test Flowchart

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CERTIFICATION

Products, materials, parts, and services furnished on this order have been provided in accordance with all applicable Hewlett-Packard specifications. Actual inspection and test data pertaining to this order is on file and available for examination.

Hewlett-Packard's calibration measurements are traceable to the National Bureau of Standards to the extent allowed by the Bureau's calibration facilities.

The Hewlett-Packard Quality Program satisfies the requirements of MIL-Q-9858, MIL-I-45208, and MIL-C-45662.