

OPERATING AND SERVICE MANUAL

**HP 12732A/12733A
FLEXIBLE DISC SUBSYSTEM**

Manual Part No. 12732-90005
Microfiche Part No. 12732-90006

Printed: OCT 1978

HEWLETT  PACKARD

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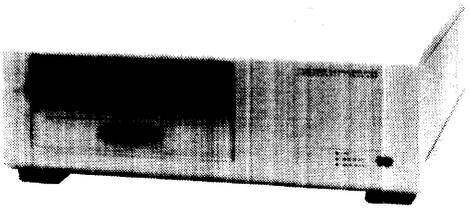
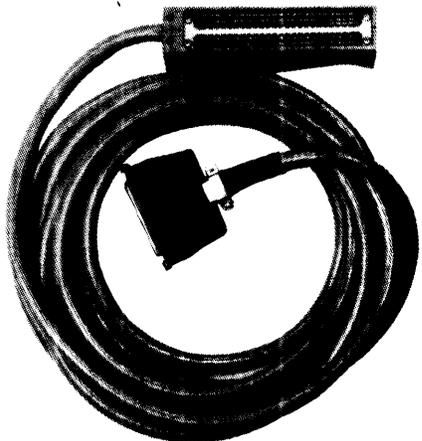
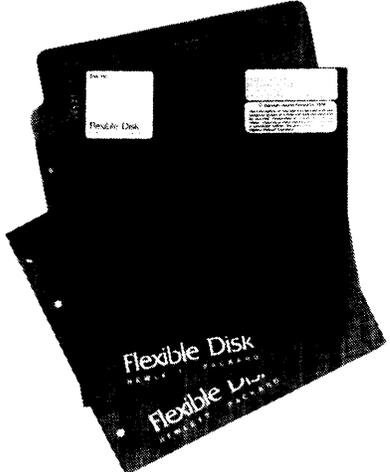
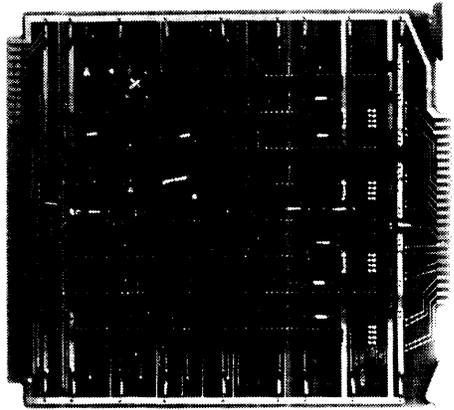
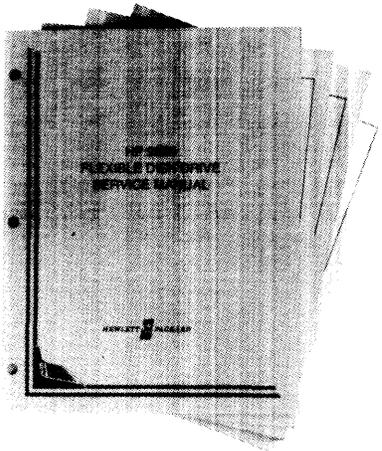
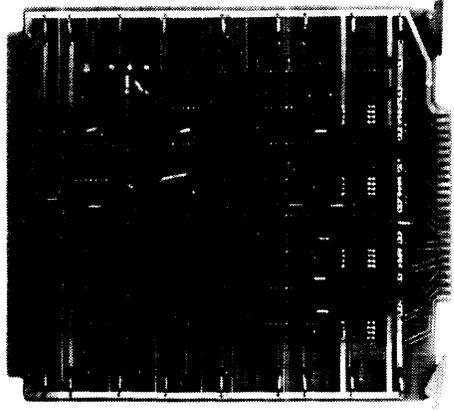
HP 9885M FLEXIBLE DISC DRIVE	HP 12735A COMPUTER INTERFACE
	
<p data-bbox="259 682 609 714">HP 9885M FLEXIBLE DISC DRIVE</p>  <p data-bbox="259 1228 609 1260">BLANK AND INITIALIZED DISCS</p>	<p data-bbox="885 682 1226 714">INTERFACE CABLE 12735-60003</p>  <p data-bbox="868 1228 1242 1260">DATA INTERFACE PCA 12735-60002</p>
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Figure 1-1. HP 12732A Flexible Disc Subsystem

1-1. INTRODUCTION

This manual provides operating, installation, and service information for the HP 12732A Flexible Disc Subsystem and its components. (See figure 1-1.) The six sections of the manual contain general information, installation, disc drive operation, principles of operation, service, and replaceable parts. A separate manual included with the subsystem provides disc-drive service information. Service information for the control and data interface printed circuit assemblies (PCA's) are covered in this manual. The remainder of this section provides a general description of the subsystem and lists the equipment furnished, options, and specifications.

1-2. GENERAL DESCRIPTION

The HP 12732A Flexible Disc Subsystem consists of an HP 9885M (Master) Flexible Disc Drive, an HP 12735A Computer Interface, disc formatting software, subsystem diagnostic software, and associated manuals. An optional HP 12733A Add-On Flexible Disc Drive includes an HP 9885S (Slave) Flexible Disc Drive and a cable for connection to either the master disc drive or another slave. The subsystem is designed for use with the HP 21MX M-Series, and HP 21MX E-Series computers. Driver software is available for operation in Real Time Executive (RTE) systems.

1-3. HP 9885M/S FLEXIBLE DISC DRIVE

The HP 9885M/S Flexible Disc Drive is a random-access, mass-storage device with a capacity of up to 514,300 bytes on one removable disc. The HP 9885M (Master) Flexible Disc Drive contains a built-in controller. Up to three HP 9885S (Slave) Flexible Disc Drives can be connected to each HP 9885M. The flexible disc drive is self contained and incorporates a self-test feature. The master drive's controller controls read/write head positioning and the transfer of data to and from the disc. Information in computer memory is moved into the disc, using an output buffer, with a "write" command and from the disc into computer memory, using an input buffer, with a "read" command. A disc can be "write" protected to prevent new information from being written over stored files. Each drive has its own internal power supply.

1-4. COMPUTER INTERFACE

The HP 12735A Computer Interface for the flexible disc drive subsystem consists of a control interface PCA (I/F1), part no. 12735-60001, a data interface PCA (I/F2), part no.

12735-60002, and an interface cable, part no. 12735-60003. The interface PCA's plug into I/O (Input/Output) PCA slots of the computer and attach to the drive through the interface cable. The subsystem components and interconnections are illustrated in figure 1-2.

1-5. EQUIPMENT FURNISHED

The following equipment, software, and manuals are supplied with the HP 12732A Flexible Disc Subsystem:

- a. HP 9885M (Master) Flexible Disc Drive with the following:
 - (1) Blank disc (two), part no. 09885-10500
 - (2) Power cord, part no. 8120-1378
 - (3) Spare fuse (one), 2A SB, part no. 2110-0303 (for 220V service)
 - (4) Spare fuse (one), 3A SB, part no. 2110-0381 (for 120V service)
 - (5) Fuse cap, part no. 2110-0544
 - (6) Rack-mount kit (mounting ears and side panels and hardware)
 - (7) Sheet of write-enable tabs, part no. 7120-5388
 - (8) Sheet of disc labels, part no. 7120-5330
 - (9) *HP 9885 Flexible Disc Drive Service Manual*, part no. 09885-90031.
 - (10) *Flexible Disc Maintenance Note*, part no. 09885-90020.
- b. HP 12735A Flexible Disc Interface consisting of:
 - (1) Control interface PCA, part no. 12735-60001
 - (2) Data Interface PCA, part no. 12735-60002
 - (3) Interface cable, 4.5 meters (15 feet), part no. 12735-60003.
- c. *HP 12732A Flexible Disc Subsystem Diagnostic Reference Manual*, part no. 12732-90003.
- d. Diagnostic Program (absolute binary), paper tape, part no. 12732-16003.

General Information

- e. *HP 12732A/12733A Flexible Disc Subsystem Operating and Service Manual*, part no. 12732-90005.
- f. Initialized Disc containing RTE files %DSKET (relocatable) and !MFLEX (absolute), part no. 12732-13401.
- g. Mounting Rails, assembly no. 12679B.
- h. HP 12992E Flexible Disc Loader ROM.

1-6. OPTIONS AND ACCESSORIES

The following options and accessories are available for the HP 12732A/12733A Flexible Disc Subsystem:

- a. HP 12733A Slave Flexible Disc Drive which includes the HP 9885S, a 6 ft. (2 m) chaining cable, part no. 09885-61617, and all items listed for the HP 9885M in paragraph 1-5.
- b. HP 12732A-001

Table top style substituted for rack mounting the HP 9885M (Master)
- c. HP 12733A-001

Table top style substituted for rack mounting the HP 9885S (Slave)
- d. HP 12732A-015

50-Hz power operation

- e. HP 12733A-015

50-Hz power operation.

A Disc Kit, part no. 09885-80004, containing five flexible discs may be ordered from any Hewlett-Packard Sales and Service Office.

1-7. SPECIFICATIONS

Environmental specifications for the flexible disc drive are provided in the Installation Section of this manual. Operational specifications are given in table 1-1. The control and data interface PCA's each require 1.1A at +5.0V and 0.05A at -2V. This current must be supplied by the host computer or its I/O extender.

1-8. INTERFACE IDENTIFICATION

Printed-circuit assembly (PCA) revisions are identified by a letter, a date code, and a division code stamped on the PCA; e.g., A-1632-22. The letter code identifies the version of the unloaded PCA. The date code (middle four digits) refers to the electrical characteristics of the loaded PCA. The division code (last two digits) identifies the Hewlett-Packard division that manufactured the PCA. If the date code stamped on the PCA does not agree with the date code shown on the title page of this manual, there are differences between your PCA and the PCA described herein. These differences are described in Manual Update Supplements available at the nearest HP Sales and Service Office. (A list of Sales and Service Offices is provided at the back of this manual.)

Table 1-1. HP 9885M/S Flexible Disc Drive Operating Specifications

Disc Format	
Tracks per Disc:	67 (maximum)
Sectors per Track:	30
Bytes per Sector:	256
Bytes per Disc:	514,300 (maximum)
Transfer Rate	
Latency:	166.7 ms (maximum)
Head Load:	50 ms (typical)
Step Track:	10 ms/step + 10 ms settling (typical)
DCPC (DMA) Transfer Rate:	31,000 words/second
Access Time	Equals [50 ms head load, if not loaded] + [steps × 10 ms] + [10 ms settling] + [83.3 ms average latency]
Transfer Time	
Single Sector:	5.5 ms
Additional Sectors:	5.5 ms (fast format) 28 ms (single sector format)

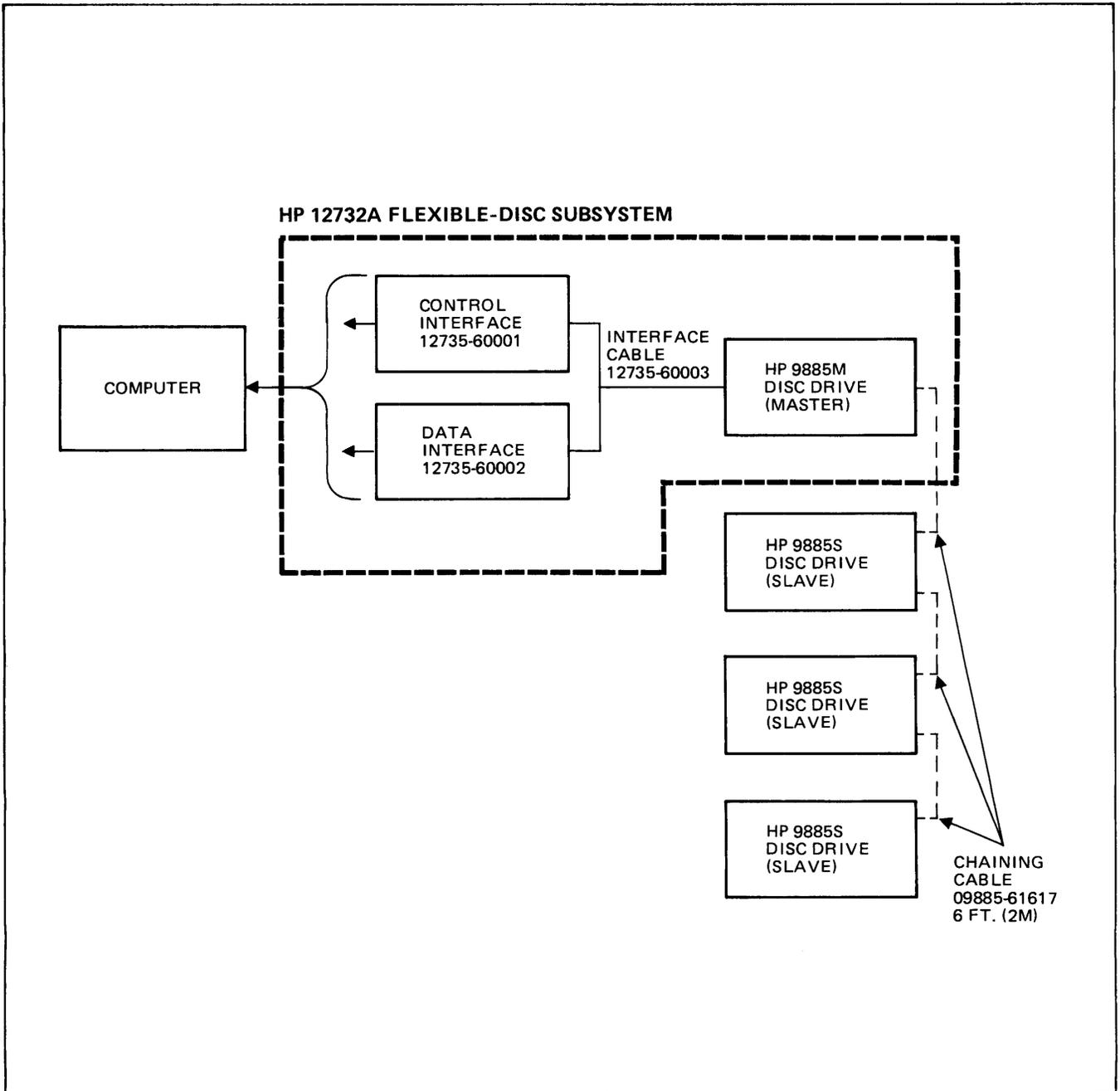


Figure 1-2. HP 12732A Flexible Disc Subsystem Block Diagram

2-1. INTRODUCTION

This section provides installation instructions for the flexible disc subsystem. Included in these instructions are installation requirements, unpacking and inspection information, installation procedures, claims procedure, and recommended packing and shipping methods.

2-2. INSTALLATION REQUIREMENTS

Certain computer requirements and the operating environment must be observed for proper subsystem installation. These considerations are covered in the following paragraphs. Other important requirements concerning the storing and loading of flexible discs are covered in section III of this manual.

2-3. COMPUTER

The HP 12732A Flexible Disc Subsystem is designed for operation with either the HP 21MX M-series or E- Series

computers. The two subsystem I/O interface PCA's are designed for installation in the I/O slots of the host computer or its I/O extender. A loader ROM, product no. 12992E, is supplied for installation in the computer. Installation of the ROM is covered in the *HP 12992 Loader ROM Installation Manual*, part no. 12992-90001.

2-4 DISC DRIVE

Compliance with the HP 9885M/S Flexible Disc Drive specifications for temperature and humidity are imperative to obtain reliable operation. When the drive is rack mounted in a system cabinet, the temperature rise within the cabinet and restriction to air flow around the drive will reduce the maximum allowable ambient temperature (outside the cabinet). The allowable temperature/humidity operating range is shown in figure 2-1. Environmental specifications are given in table 2-1. The ac power line source voltage for the drive can be 100V, 120V, 220V, or 240V at +5% to -10% and a line frequency of 60 Hz $\pm 3.5\%$ (standard) or a line frequency of 50 Hz $\pm 3.5\%$ (option 015). Power requirements are given in table 2-2.

Table 2-1. Environmental Specifications

Operating Ambient Temperature Range:	10°C to 45°C (50°F to 113°F)*
Storage Temperature Range:	-40°C to 60°C (-40°F to 140°F)
Relative Humidity:	20% to 80% (25.5°C max. wet bulb temperature)
Heat Dissipation	
HP 9885M:	160W (nominal)
HP 9885S:	130W (nominal)
Attitude:	$\pm 45^\circ$ from horizontal position
Operating Vibration:	± 0.127 mm displacement from 5 Hz to 55 Hz
*When rack mounting, care must be taken to limit the temperature around the disc to this range.	

Table 2-2. Power Requirements

Power Source:	100V ac (+5% to -10%)															
	120V ac (+5% to -10%)															
	220V ac (+5% to -10%)															
	240V ac (+5% to -10%)															
Line Frequency:	50 Hz or 60 Hz ($\pm 3.5\%$)															
Power Load (maximum):																
	<table border="1"> <thead> <tr> <th>SOURCE</th> <th>9885M</th> <th>9885S</th> </tr> </thead> <tbody> <tr> <td>100V</td> <td>2.0A</td> <td>1.8A</td> </tr> <tr> <td>120V</td> <td>1.6A</td> <td>1.5A</td> </tr> <tr> <td>220V</td> <td>0.89A</td> <td>0.82A</td> </tr> <tr> <td>240V</td> <td>0.8A</td> <td>0.73A</td> </tr> </tbody> </table>	SOURCE	9885M	9885S	100V	2.0A	1.8A	120V	1.6A	1.5A	220V	0.89A	0.82A	240V	0.8A	0.73A
SOURCE	9885M	9885S														
100V	2.0A	1.8A														
120V	1.6A	1.5A														
220V	0.89A	0.82A														
240V	0.8A	0.73A														

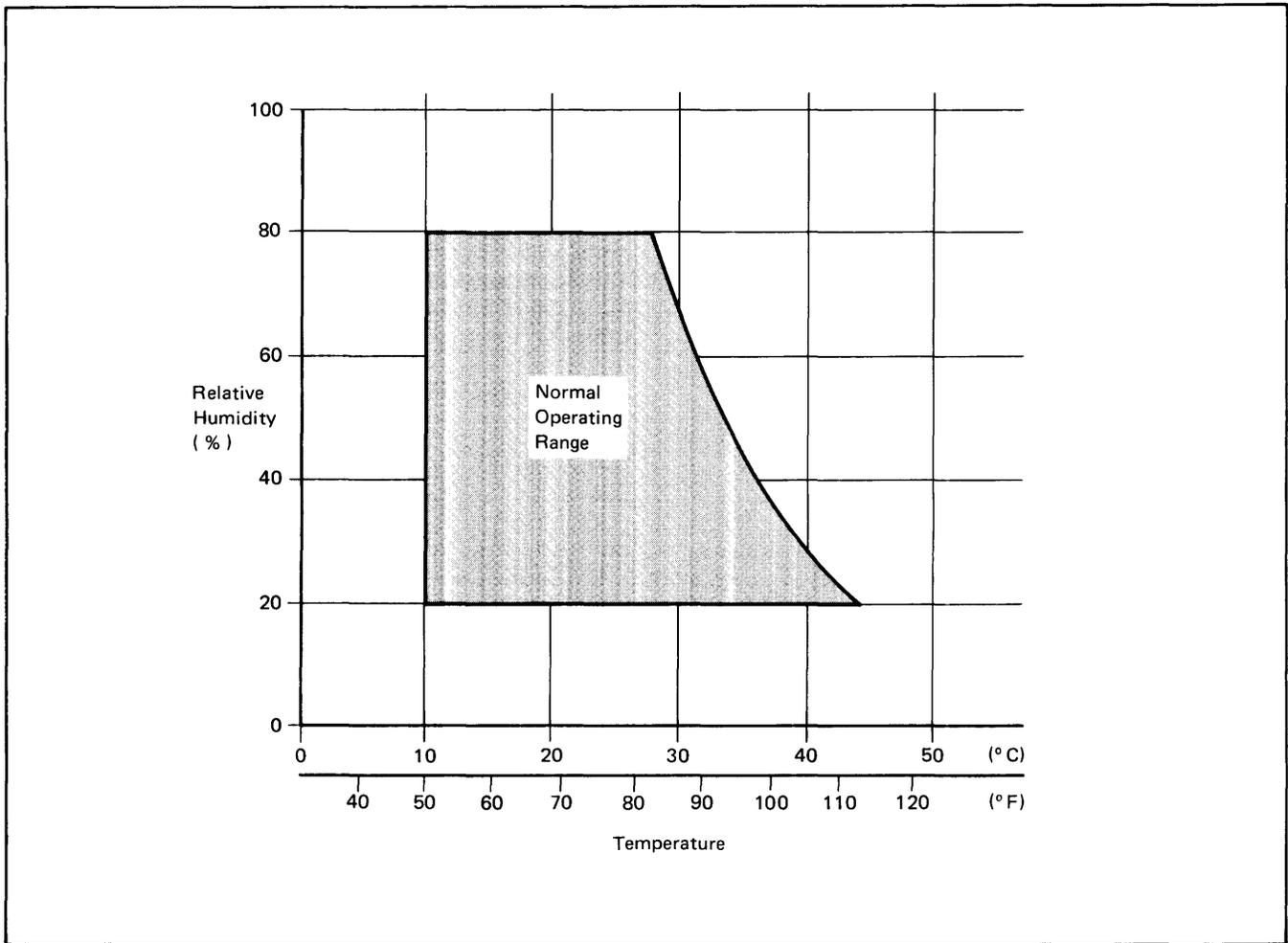


Figure 2-1. Temperature/Humidity Operating Range

2-5. FUSES

A different fuse rating is required for each of the two voltage ranges of 100-120V ac and 220-240V ac. Be sure that the fuse on the rear panel is of the proper type and rating as given in table 2-3.

WARNING

Always disconnect the drive from the power source before changing the fuse.

2-6. LINE VOLTAGE SELECTOR SWITCHES

WARNING

Do not apply ac power until voltage selector switch positions are checked.

Table 2-3. Flexible Disc Drive Fuses

VOLTAGE SOURCE	FUSE RATING	HP PART NO.
100 - 120V	3 AMP (SB)	2110-0381
220 - 240V	2 AMP (SB)	2110-0303

Check and, if necessary, set the line voltage selector switches on the rear panel for the nominal line voltage to be used. The switch settings are shown in figure 2-2. If it is necessary to alter the position of either switch, insert the tip of a small screwdriver (or other small tool) into the slot on the switch; slide the switch so that the position corresponds to the appropriate voltage shown.

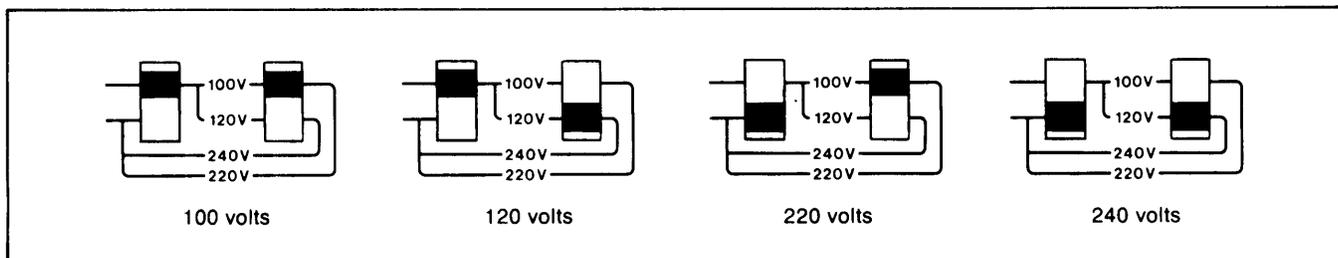


Figure 2-2. Line Voltage Selector Switches

2-7. POWER CORDS

Normally, the power cord shipped with stand-alone equipment is selected for the country in which it will be used. Connectors used in the United States for compliance with the National Electrical Manufacturers Association (NEMA) requirements are illustrated in figure 2-3. Other power cord connectors are shown in figure 2-4. The cord for 230V ac operation is provided when option 015 is specified. For rack mounted equipment, the NEMA power cord is supplied to mate with cabinet power strips. Make sure that the local electrical code permits use of the furnished power cord. Have a qualified electrician check the power outlet to ensure that it is wired correctly with respect to ac high potential, ac neutral, and equipment ground.

WARNING

The disc drive power cable is equipped with a three-wire connector. Do not defeat the ground connection by using an adapter or break the grounding pin of the connector. Isolating the unit from ground may create a hazardous condition which can result in serious injury.

To install the power cord, connect the female polarized connector of the power cord, part no. 8120-1378, to the male power connector on the rear panel of the disc drive. Route the cable to the AC RECEPTACLE (or power outlet) which has been checked as having the voltage which has been selected on the disc drive (see paragraph 2-6). For system installation, refer to the applicable system service or installation manual for instructions on cable routing.

2-8. DISC DRIVE MOUNTING

The HP 9885M/S Flexible Disc Drive, as used in the HP 12732A Flexible Disc Subsystem may be either rack mounted or installed on a table top. The rack mount hardware is for standard 19-inch (483 mm), system cabinets. Table-top disc drives (option 001) do not require additional mounting hardware.

Anti-slip rubber feet are installed on the rear of table-top units so that they may be safely stacked, one on the other. Stacking more than three units high is not recommended. When stacking, place the top unit so that its front feet just touch the back of the front trim strip of the bottom unit.

Rack mounting is shown in figure 2-5. The procedure is as follows:

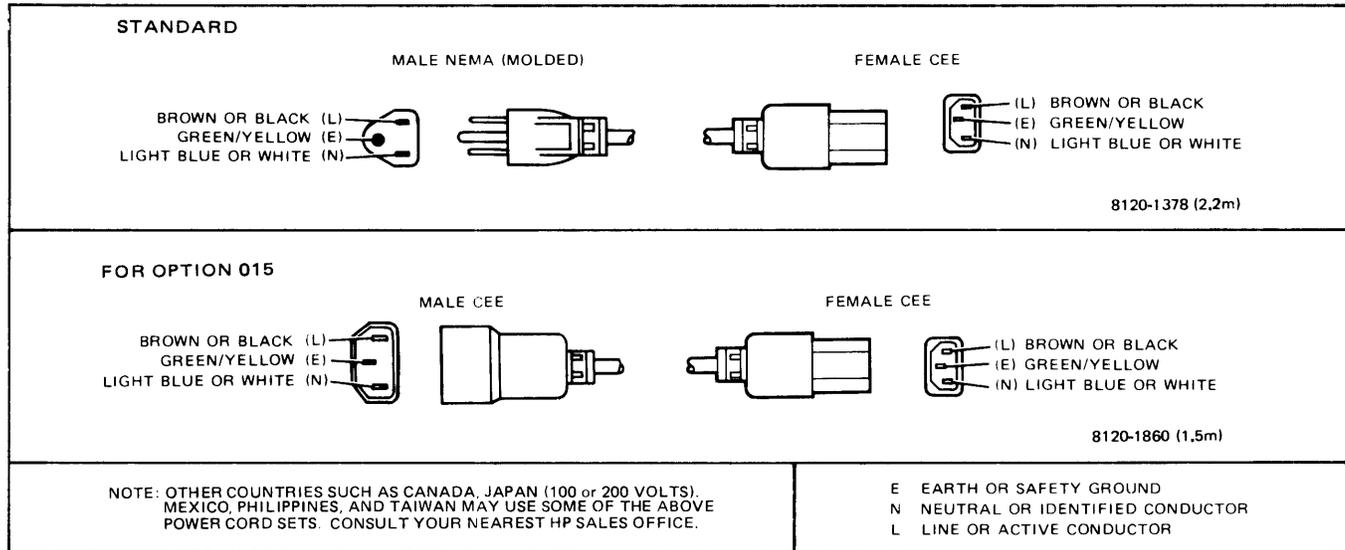
- a. A rack space of 5.25-inch (133 mm) is required for each HP 9885M/S unit. To find the proper location, refer to the applicable *System Configuration Guide*.
- b. The disc drive front panel must coincide with a front door opening to allow the changing of discs. If the door panel must be changed to provide this opening, remove the door by lifting it off its hinges. Lay the door flat on a table, front side down, and remove the screws holding the inside panel. Install a new panel with the disc drive opening. Put door back on its hinges after racking the disc drive.
- c. Install Support Angles (rails), part no. 12679-20001 (30-inch) (762 mm) as follows:
 1. Insert Channel Nut, part no. 0590-0789, into side channels of cabinet (front and rear) with spring side inward so that the nut is held in place by the spring pressure.
 2. Place Lock Washer, part no. 2190-0032, under head of 0.25-inch diameter, 0.5-inch long Screw, part no. 2940-0103, and insert screw through front mounting hole of support angle and into the front channel nut.
 3. Use same procedure to fasten the rear portion of the support angle with a screw and channel nut.
 4. Tighten both screws.
 5. Repeat steps (1) through (4) above to mount a support angle on the other side of the cabinet.

Installation

- d. Slide the disc drive into the cabinet on the support angles. Insert screws, part no. 2680-0119, with cup washers, part no. 3050-0007, and nylon washers, part no. 3050-0248, in the bracket. Slide the unit in further until the screws can engage the threaded mounting holes of the cabinet.
- e. Tighten all four front panel screws.

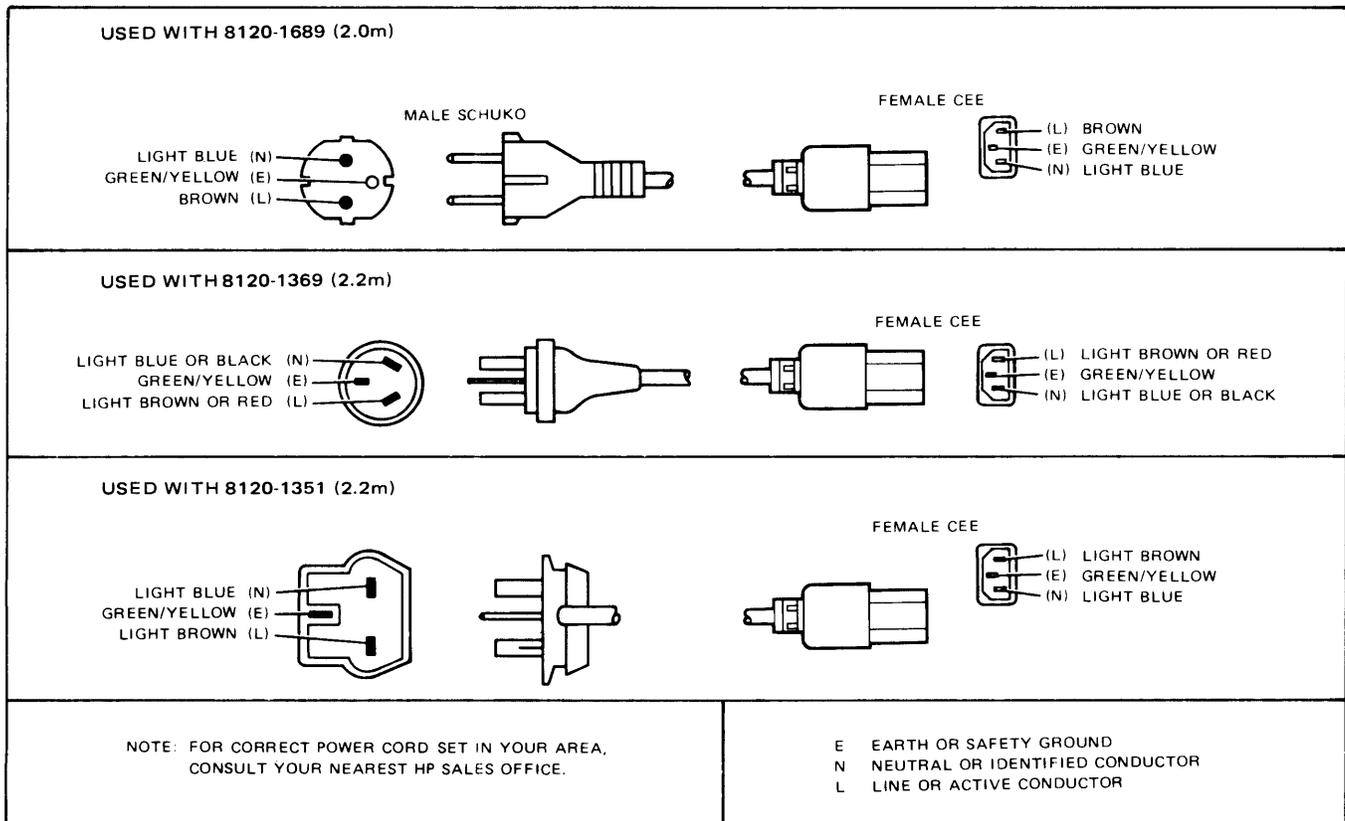
The flexible disc drive's physical specifications are as follows:

- a. Height: 133.2 mm (5.25 inch)
- b. Width: 425.4 mm (16.75 inch)
- c. Depth: 425.4 mm (16.75 inch)
- d. Net Weight: 14.75 kg (32.5 lb.)



7306-1

Figure 2-3. AC Power Cord Sets (USA)



7306-2

Figure 2-4. AC Power Cord Sets (Non-USA)

2-9. UNPACKING AND INSPECTION

When the flexible disc drive subsystem shipment arrives, check to ensure receipt of the proper container as specified by the carrier's papers. Inspect the shipping container immediately upon receipt for evidence of mishandling during transit. If the container is damaged in any way, or if it is waterstained, request the carrier's agent be present when the container is opened.

Open the shipping container and 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. Unpack the shipping container and inspect each item for external damage. Look for damage such as broken controls and connectors, dented corners, bent panels, scratches, and loose components.

If the visual examination reveals any damage to the drive, follow the damage claim procedure described in paragraph

2-21. Retain the shipping container and packing material for examination in the settlement of claims or for future reuse.

2-10. DISC STORAGE

The plastic-jacketed flexible disc is protected by a filing envelope which can be stored in looseleaf binders. Observe the following precautions in storing discs:

- Keep disc in its storage envelope when not in use.
- Storage area should be free of any strong magnetic field, which could distort the recorded data.
- The storage area should not be exposed to direct sunlight, high temperature (above 52°C or 125°F), low temperature (below 10°C or 50°F), or relative humidity outside the range of 20% to 80% (wet bulb at 25.5°C).

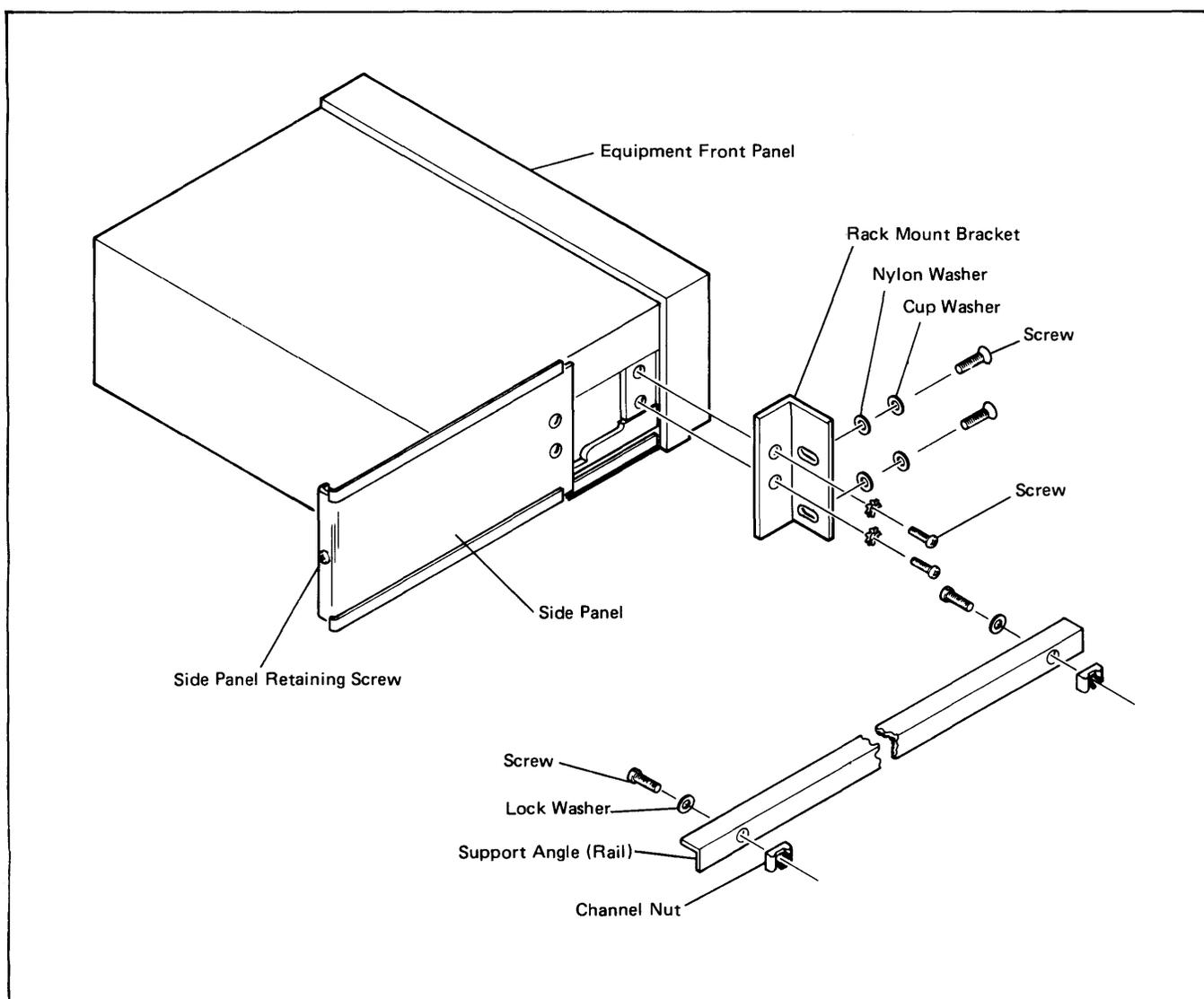


Figure 2-5. Disc Drive Rack-Mounting Details

2-11. INSTALLATION PROCEDURES

Observe the flexible disc drive requirements for environment and mounting as described in previous paragraphs. Installation procedures include the installation of interface PCA's in the computer (or I/O extender), cable installation, setting ac power source switches (if necessary), and verification of operation. Refer to figure 2-6 for the location of connectors and controls on the disc drive rear panel.

2-12. PCA JUMPER VERIFICATION

The control interface PCA (FLEX. DISK I/F1), part no. 12735-60001, and the data interface PCA (FLEX. DISK I/F2), part no. 12735-60002, are identical except for jumper configurations. Verify that jumpers are configured as listed in table 2-3.

Table 2-3. Interface PCA Jumper Configurations

JUMPER	POSITION	
	CONTROL INTERFACE	DATA INTERFACE
	12735-60001	12735-60002
W1	A	A
W2	B	A
W3	B	B
W4	B	B
W5	IN	IN
W6	IN	IN
W7	IN	IN
W8	OUT	IN
W9	B	B

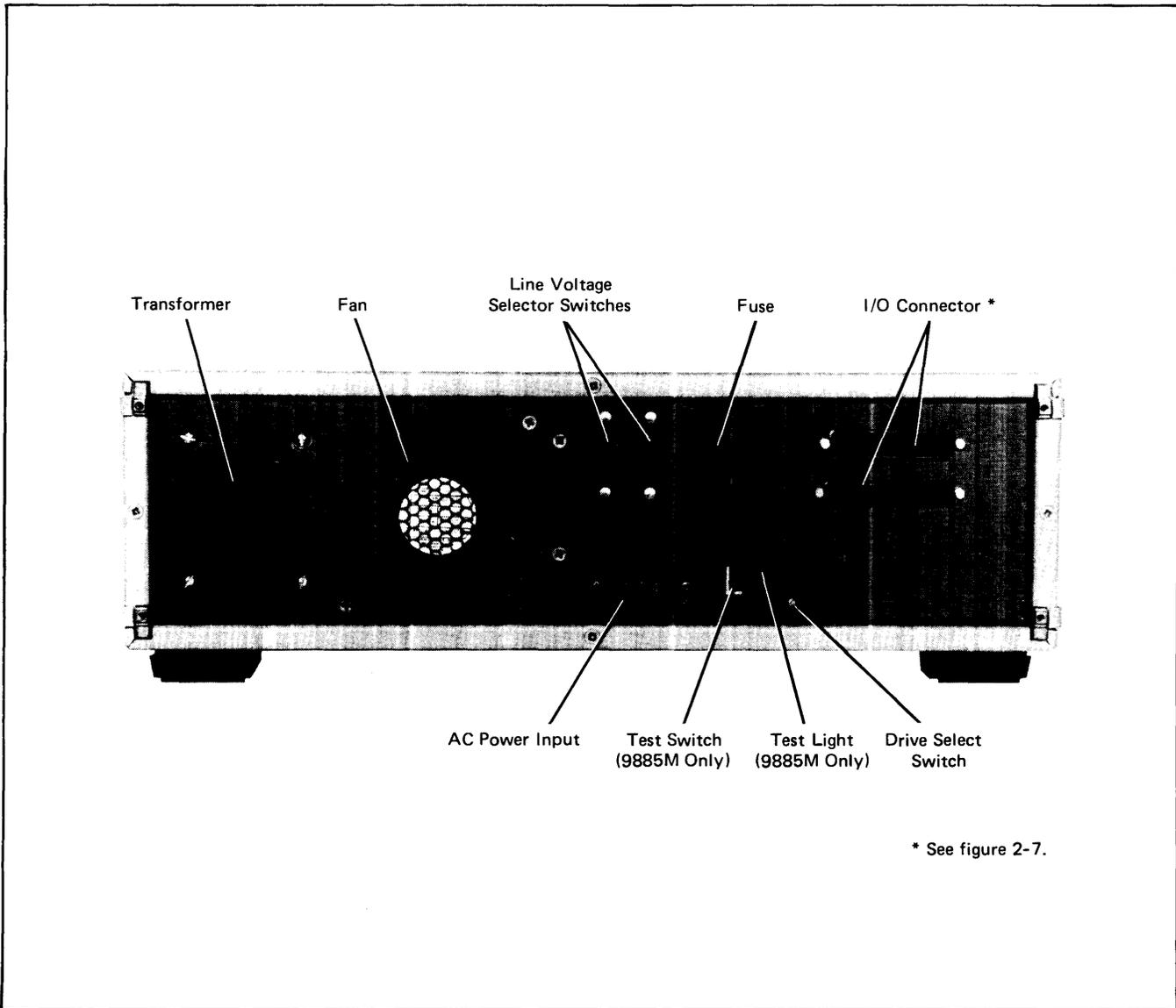


Figure 2-6. Flexible Disc Drive Rear Panel

2-13. INTERFACE PCA INSTALLATION

Before installing the control and data interface PCA's in the computer (or I/O extender), make certain that the additional current requirement does not exceed the total current available to the computer (extender) I/O PCA cage. (Refer to paragraph 1-7.) Install the interface PCA in the computer (extender) I/O PCA cage as follows:

- a. Set computer operator panel switch to STANDBY.
- b. Gain access to I/O PCA cage and determine I/O select code and corresponding slot for control interface PCA. Install control and data interface PCA's in adjacent slots with the control interface PCA occupying the lower number slot (higher priority). One extractor lever on the control interface PCA is labeled "FLX DSK I/F1"; one extractor lever on the data interface PCA is labeled "FLX DSK I/F2."
- c. Seat PCA's fully in I/O backplane receptacles by pressing firmly inward on their extractor levers.
- d. Install interface cable, part no. 12735-60003, as described in paragraph 2-14.

2-14. INTERFACE CABLE

Install the interface cable after inserting the interface PCA's in their I/O slots (described above) as follows:

- a. For the HP 21MX M-Series and E-Series Computers, and the HP 12979A I/O Extender, the cable (part no. 12735-60003) feeds from the PCA's through the cable exit area at the rear of the cabinet.
- b. The dual-hooded connector pushes onto the PCA's with the cable going toward the right. Position the connector on the PCA's so that the side labeled "FLEX DISK I/F 1" goes onto the PCA in the lower numbered (higher priority) slot and the other side labeled "FLEX DISK I/F 2" goes onto the PCA in the higher numbered (lower priority) slot. Press down firmly on the connector so it seats fully on the two PCA's.
- c. Connect the connector on the opposite end to the top I/O connector on the rear of the HP 9885M Flexible Disc Drive.

For reference and for use in case of difficulty, the wiring data for the interface cable assembly is given in table 2-4.

2-15. MULTIPLE DISC DRIVES

Up to four drives consisting of one HP 9885M and three HP 9885S's can be interfaced through one I/O card pair. Multiple drives are connected in a "daisy" chain using the chaining cable, part no. 09885-61617. The first drive in the chain must be the HP 9885M (Master) Flexible Disc Drive and the others must be the HP 9885S (Slave) Flexi-

ble Disc Drive. Do not connect any slave unit directly to the computer. The method of interconnection is shown in figure 2-7.

Table 2-4. Computer/Disc-Drive Interface Wiring Data

INTERFACE PCA 12735-60001		
SIGNAL (see note 4)	P1A	P2
PRESET	A	6
CTL0 (Control)	B	4
PSTS (Status)	16	14
EIR (Error Flag)	AA, 23	7
Ground	BB, 24	8, 9, 11, 12
INTERFACE PCA 12735-60002		
SIGNAL (see note 4)	P1B	P2
DIO 00 (Data)	A, 1	33
DIO 01 (Data)	B, 2	32
DIO 02 (Data)	C, 3	31
DIO 03 (Data)	D, 4	30
DIO 04 (Data)	E, 5	29
DIO 05 (Data)	F, 6	28
DIO 06 (Data)	H, 7	27
DIO 07 (Data)	J, 8	26
DIO 08 (Data)	K, 9	25
DIO 09 (Data)	L, 10	24
DIO 10 (Data)	M, 11	23
DIO 11 (Data)	N, 12	22
DIO 12 (Data)	P, 13	21
DIO 13 (Data)	R, 14	20
DIO 14 (Data)	S, 15	19
DIO 15 (Data)	T, 16	18
PCTL (Encode)	Z, 22	10
PFLAG (Flag)	AA, 23	13
Ground	BB, 24	8, 9, 11, 12
<p>Notes:</p> <ol style="list-style-type: none"> 1. P1A Connector Label: FLEX DISK I/F1 LOWER SEL. 2. P1B Connector Label: FLEX DISK I/F2 UPPER SEL. 3. P2 Connector: 50-Pin Slide Lock, Connects to J1 on 9885M. 4. All listed signals are logically inverted except for PRESET. 		

2-16. DRIVE SELECTION SWITCH

The DRIVE SELECT switch on the rear panel of the disc drive must be set so that each drive on an interface cable has a different drive number in the range of 0 thru 3. The drive number selected is opposite the dot on the switch. Set the switch to 0 for a single drive system.

2-17. VERIFICATION

After installation of the flexible disc subsystem, its operation should be checked out before placing it on-line. There are two methods available. The flexible disc "self-test" checks out the drive and its electronics without the interface, and the "diagnostic" test exercises the disc drive along with the interface.

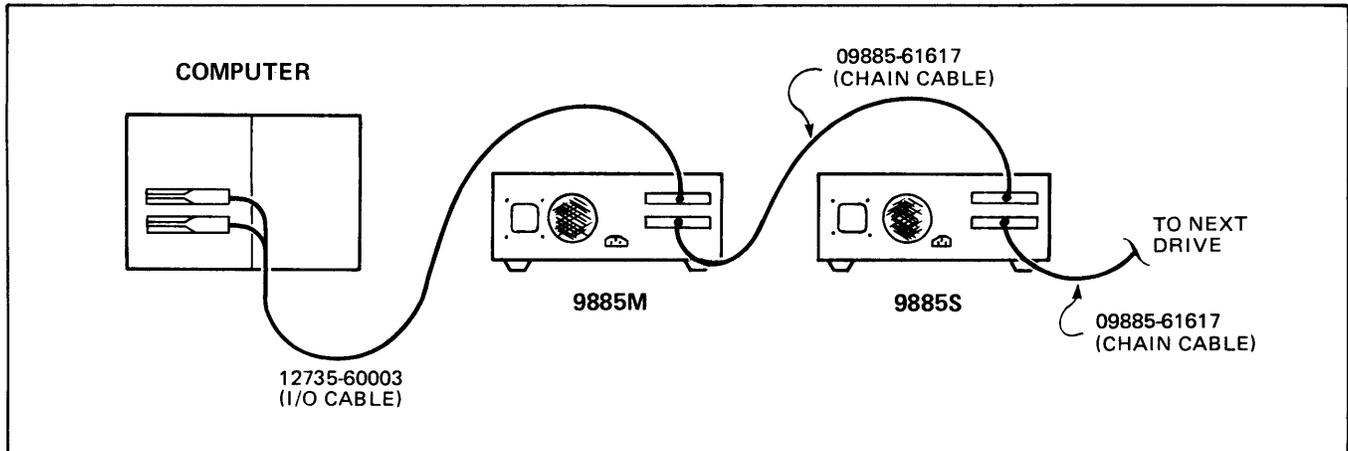


Figure 2-7. Subsystem Interconnection

2-18. SELF TEST

The self test checks the performance of the flexible disc drive including any slaves connected to the master. The self test does not check out the interface to the computer. Use a blank disc for this test because performance of the test will destroy data on the disc. Instructions on operating the test are given in section III of this manual.

2-19. SUBSYSTEM TEST

The computer interface PCA's and the flexible disc drive can be tested as a subsystem by loading and running the subsystem diagnostic program, part no. 12732-16003. Instructions on loading and running the diagnostic are given in the *HP 12732A/12733A Flexible-Disc Subsystem Diagnostic Reference Manual*, part no. 12732-90003. This program is available on paper tape and on the Initialized Flexible Disc, part no. 12732-13401 (see paragraph 2-20). If the subsystem installation performs properly all through the program without an error message, the proper installation and correct operation of the flexible-disc drive as a subsystem has been verified.

2-20. COPY !MFLEX FILE

The flexible disc diagnostic, part no. 12732-16003, resides on the Initialized Disc, part no. 12732-13401, as RTE file !MFLEX. (This disc also contains file %DSKET used for disc formatting.) Because this program cannot be used directly from the disc, and it may not be possible to read it if the disc drive has a malfunction, it is recommended that !MFLEX be copied to a usable medium such as a cartridge tape. Systems having a punched tape reader can use the paper tape version of the diagnostic without copying !MFLEX.

The !MFLEX program must be transferred by using the RTE File Manager. All transfer under control of the RTE File Manager requires the disc to have a Write Enable Tab. Operating procedures for RTE II and RTE III are

given in the *Batch Spool Monitor Reference Manual*, part no. 92060-90013, and operating procedures for RTE M are given in the *RTE-M Programming Reference Manual*, part no. 92064-90002.

2-21. CLAIMS

If the shipment is incomplete, or if the equipment is damaged or fails to meet specifications, notify the nearest Hewlett-Packard Sales and Service Office. If damage occurred in transit, notify the carrier, as well. 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 shipping container(s) and packaging material for inspection.

2-22. REPACKAGING FOR SHIPMENT

The following paragraphs provide instructions for repackaging the disc drive for shipment. Included are instructions for using the original packaging or new packaging. HP 9885M PCA's and the interface PCA's should be repaired or replaced through HP's PCA exchange procedures. The procedures and proper shipping cartons are available from Hewlett-Packard Sales and Service Offices.

2-23. HP 9885M/S SHIPMENT USING ORIGINAL PACKAGING

The same container and materials used in factory packaging are preferred for reshipment. If they were not saved, they may be obtained through Hewlett-Packard Sales and Service Offices. Use the following instructions:

- a. Attach a tag specifying the return address, model number, full serial number, and the service required or other instruction.
- b. Secure front door of disc drive so that it remains open during shipment (e.g., use tape from door to top of cover).

- c. Place in carton on the foam base and cover with the foam cushion.
- d. Seal the shipping container securely and mark it "FRAGILE".
- e. In any subsequent correspondence with the factory or Sales and Service Office refer to the unit by model number and full serial number.

2-24. HP 9885M/S SHIPMENT USING NEW PACKAGING

The following instructions should be used as a guide when packaging the disc drive with commercially available materials:

- a. Secure front door of disc drive so that it remains open during shipment (e.g., use tape from door to top of cover).
- b. Wrap in Air Cap TH-240 cushioning (or equivalent) manufactured by Sealed Air Corp., Hawthorne, N.J.

Attach a tag specifying the return address, model number, full serial number, and the service required or other instruction.

- c. Use a strong shipping container. A double-wall carton construction of 159-kilogram (350-pound) test material is adequate for the disc drive. A carton of 90.5-kilogram (200-pound) test material is adequate for the interface PCA's.
- d. Use sufficient shock-absorbing material on all sides of the unit to provide a firm cushion and to prevent movement inside the container. Use particular care to protect the corners and chassis of the disc drive.
- e. Seal the shipping container securely and mark it "FRAGILE".
- f. In any subsequent correspondence with the factory or Sales and Service Office, refer to the unit by model number and full serial number.

3-1. DISC CONSIDERATIONS

3-2. DISC HANDLING

To ensure error free disc operation, follow the care and handling precautions below:

- a. Use only Hewlett-Packard approved discs since the use of others may result in damage to the drive mechanism, high maintenance costs, and loss of data.
- b. Return the disc to its storage envelope whenever it is removed from the drive.
- c. Keep discs away from magnetic fields and from ferromagnetic materials which might become magnetized. Strong magnetic fields can distort recorded data on the disc.
- d. Replace storage envelopes when they become worn, cracked or distorted. The envelopes are designed to protect the discs.
- e. **Do not write on the plastic jacket with a lead pencil or ball-point pen.** Use a felt tip pen, and write only on the label area.
- f. Heat and contamination from a carelessly dropped ash can damage the disc.
- g. Do not expose the disc to heat or sunlight, extreme cold, or excessive humidity.*
- h. Do not touch or attempt to clean the disc surface. Abrasions or fingerprints may cause loss of stored data.

3-3. DISC LOADING

The flexible disc is enclosed in a sealed plastic jacket which is lined with a wiping material to clean the disc surface. To load the disc in the drive, first open the disc door on the front of the drive by pressing on the door latch. Insert the disc with the label facing up and out; then close the door by pressing it down. The disc can be loaded or unloaded with power on and the drive spindle rotating. When the disc is removed from the drive, it should be stored in an envelope to protect it.

*The flexible disc temperature range is 10°C (50°F) to 52°C (125°F) and relative humidity of 20% to 80%.

3-4. WRITE PROTECT

The HP disc can be "write protected"; i.e., writing on the disc can be inhibited. The write protect feature is enabled (disc protected) when the write protect hole is open. The hole is covered to allow writing by placing a tab over the top of the hole and folding the tab over covering the bottom of the hole. All transfer under control of the RTE File Manager requires the disc to have a Write Enable Tab. Other types of discs may not have a write protect hole. For instructions on forming a hole in one of these discs, refer to the *HP 9885M/S Flexible Disc Drive Service Manual*, part no. 09885-90031.

3-5. TURN-ON

Turn on the HP 9885M and all HP 9885S Flexible-Disc Drives with the power switch located at the right front panel of each drive. All drives in the system must be turned on before the system can be operated.

3-6. SELF TEST

The self test checks the performance of the flexible-disc drive. The test can be made with or without a disc installed but the disc door must be closed in either case. The "write protect" hole of the disc must be covered to allow writing.

CAUTION

Performing the self test with a disc installed will destroy data on the disc; therefore, use a blank disc.

Perform the test as follows:

- a. Disconnect interface cable between the master disc drive and the computer PCA's.
- b. Close doors on all drives in the system.
- c. Insert screwdriver blade into slot of TEST switch on rear panel of the master disc drive.
- d. Press switch down and release it.
- e. SELF TEST light, next to switch, comes on while test is in progress. The test takes less than one minute. SELF TEST light goes off when test finishes. *If test fails, the light will remain on longer than one minute.* Turn off, then on and repeat test by pressing SELF TEST switch again.

If the test continues to fail, there is probably a problem in the drive and service may be required (contact the nearest Hewlett-Packard Sales and Service Office).

Without a disc installed, the test checks the following:

- a. Microprocessor and program memory.
- b. Drive control and drive status circuits.
- c. I/O functions.

With the disc installed, the test checks the following:

- a. The three checks listed above.
- b. Read/Write electronics.
- c. Head positioning circuits.

With multiple disc drives in the subsystem, the self-test will start at drive 0 and run in sequence to drive 3. If any two drives are set incorrectly with the same drive number, the test will not function.

3-7. DISC FORMAT

All new discs must be formatted by writing track and sector addresses on them. A relocatable utility program named "%DSKET", part no. 12732-16002 is provided with the HP 12732A Flexible Disc Subsystem for this purpose. DSKET is normally supplied on a flexible disc, part no. 12732-13401.

Discs can be formatted in two ways: *standard* and *fast format*. The standard format optimizes single sector transfers by allowing time for system RTE processing of the sector before the next read/write request. The sequential format provides fast throughput for multiple sector read/write requests, such as for high speed A-D measurements; however, a large buffer area is required.

The standard format has a transfer time of 28 ms per sector and the fast format has a transfer time of 5.5 ms per sector. A buffer of over 1000 words should be used with the fast format. There is a maximum of 67 tracks per disc, 3840 words per track, and 128 words per sector. The maximum number of good tracks is reduced by the number of bad tracks.

For complete details on disc format, refer to the *RTE Driver DVR33 for HP 12732A/12733A Disc Driver Programming Manual*, part no. 12732-90001.

4-1. INTRODUCTION

The HP 12732A Flexible Disc Subsystem, operates with Hewlett-Packard 21MX M-Series and E-Series Computers. The subsystem includes interface PCA's and cable, and the HP 9885M Flexible Disc Drive. RTE driver DVR33 is configured into the software operating system by a process called "System Generation." Driver structure and operation is described in the *RTE Operating Systems Drivers and Device Subroutines Programming and Operating Manual*, part no. 92200-93005. Configuration of the driver is covered in the *Programming and Operating or Reference Manual* for the operating system being used; i.e., RTE II, RTE III, or RTE-M. Operation of the RTE driver DVR33, including the required subsystem programming calls, is given in the *RTE Driver DVR33 for HP 12732A/12733A Disc Drives Programming Manual*, part no. 12732-90001. Principles of operation for the subsystem interface hardware are covered in the following paragraphs.

Refer to the *HP 9885 Flexible Disc Drive Service Manual*, part no. 09885-90031, for operating principles of the disc drive.

4-2. INTERFACE SIGNALS

The interface connections and signals of the flexible disc subsystem are shown in figure 4-1. There is one interface PCA for control and another for data signals. The control interface PCA must be placed in a higher priority I/O slot of the computer than the data interface PCA which is placed in the adjacent slot of lower priority. The two PCA's are identical except for jumper positions.

The control PCA (interface 1) connects to the HP 9885M (Master) Flexible Disc Drive through connector P1A. The control signals at interface 1 are as follows:

- PRESET from Output Bit 0 on PCA pin A (set on positive edge).
- $\overline{CTL0}$ control from Output Bit 1 on PCA pin B (set on negative edge).
- \overline{PSTS} status to Input Bit 15 on PCA pin 16 (set on negative edge).
- \overline{EIR} error indicator to Device Flag Input on PCA pin 23 (set on negative edge).

The $\overline{CTL0}$ signal notifies the disc drive controller whenever the number of words to be transferred does not equal the 128 words of a sector. The purpose is to suppress an Error Status signal which is generated in the disc drive when the sector word count does not check at 128 words.

The system software driver looks at the data request for multiples of 128 words and makes a decision to provide $\overline{CTL0}$ if necessary.

The \overline{EIR} signal which goes to the Device Flag of the control interface PCA, is true when an error occurs during data transfer. These errors can be from a number of occurrences such as "door opened during data transfer", "sector-or-track not found", and "data overrun" where the handshake flag was not received from the CPU in time. The \overline{EIR} sets the control interface for interrupt so that when the driver sees this, it is interpreted as an error condition.

The \overline{PSTS} signal is for status from the disc drive controller to the control interface PCA to show "power up" and "ready" conditions. The PRESET signal from the control interface PCA to the disc drive controller initializes the drive to the "power on" state where internal buffers and registers are clear and the drive heads go to track 0.

The data PCA (interface 2) connects to the HP 9885M (Master) Flexible Disc Drive through connector P1B. The signals are as follows:

- 16 data lines ($\overline{DIO00}$ thru $\overline{DIO15}$).
- \overline{PCTL} handshake on the Device Command line (clears on positive edge of \overline{PFLAG}).
- \overline{PFLAG} handshake on the Device Flag line (strokes input/output buffers on negative edge).

The handshake provides two conditions for read and write, respectively. For write, the \overline{PCTL} signal signifies to the drive that data is ready to output and the \overline{PFLAG} signal indicates that the data has been accepted. For read, the \overline{PCTL} signal indicates to the drive that the data interface PCA is ready to receive data, and the \overline{PFLAG} signal strobes the data into the input register and triggers a computer interrupt to input the data via DCPC (DMA). The bidirectional data lines carry Drive Control and Status Words, as well as the data to be read from or written on the disc.

4-3. CPU INTERFACE FUNCTIONAL CIRCUIT DESCRIPTION

The following paragraphs describe operation of the various circuits contained on the interface PCA's. For further information about the computer input/output system, refer to the instruction manuals supplied with the computer. A flowchart, figure 4-2, is provided to show the overall operating details of the PCA and the time relationships of the various signals.

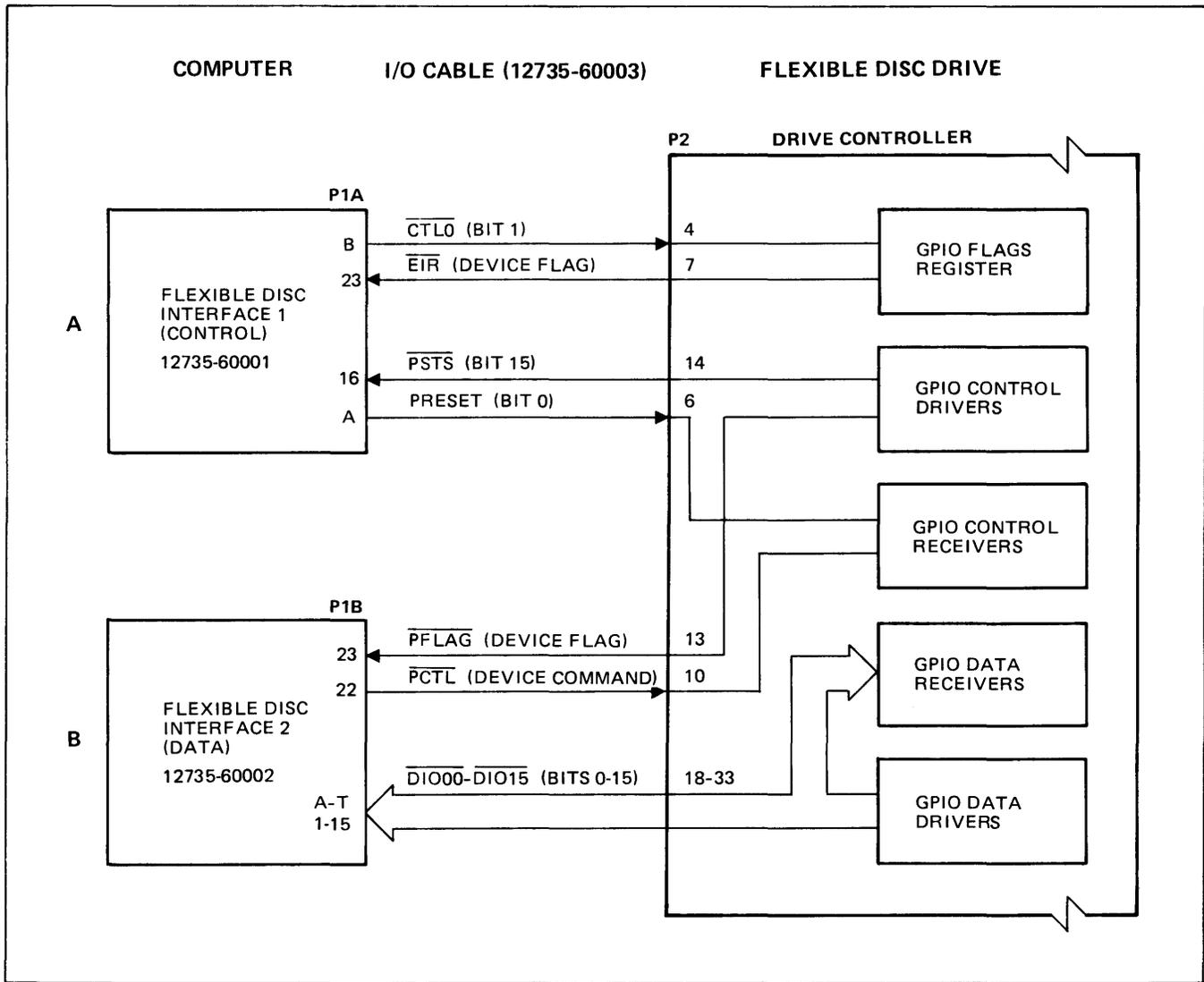


Figure 4-1. Subsystem Interface Functional Diagram

4-4. POWER-ON AND PRESET CIRCUIT

When computer power is turned on or the PRESET switch is pressed, the computer sends POPIO(B) and CRS signals to the interface PCA's. The POPIO(B) signal is inverted and sets the Flag Buffer FF; the Flag Buffer FF and the ENF signal set the Flag FF at computer time T2. Inverted again to its original logic level by gate U85A, the POPIO(B) signal clocks the output register. Since the IOBO lines from the computer are low (false) during turn-on or preset, the POPIO(B) signal clears the output register. The inverted CRS signal clears both the Control and Device Command FFs.

4-5. STORAGE REGISTERS

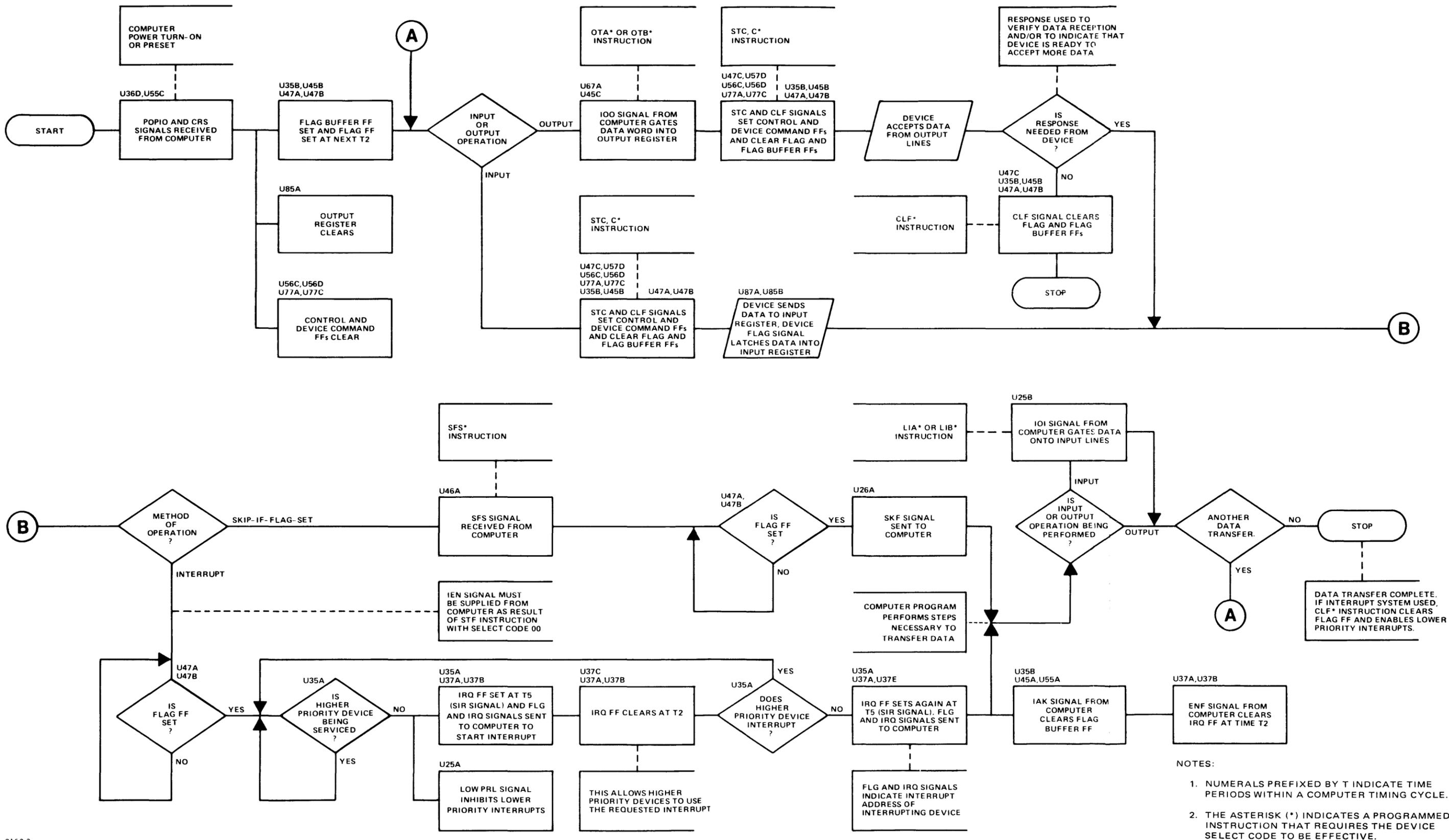
The two storage registers on the interface PCA's contain 16 flip-flops each. Integrated circuits U33, U53, U73, and U93 form the output storage register; U23, U43, U63, and U83 form the input storage register.

The IOO signal from the computer, delayed by the IOO Delay FF, gates computer data from the IOBO lines into the output register. Register contents are present on the output lines to the disc drive at all times (ungated) as determined by jumper W4 in position B.

Jumpers W5 through W8 are connected except for W8 on the control interface PCA. Thus, a Device Flag signal (PFLAG) from the I/O device gates data into the input register. Data from the input register is gated onto the IOBI lines by an IOI signal from the computer. Jumper W8 is OUT on the control interface PCA (interface 1) so that the PSTS signal input to bit 15 is not gated and independent of the Device Flag.

4-6. FLAG CIRCUIT

The Flag FF, Flag Buffer FF, and Device Flag pulse-shaping network comprise the flag circuit. One condition that is required to transfer data between the computer



2160-3

Figure 4-2. Flowchart of Operating Sequence (Each Interface)

and the disc drive is that the Flag FF be set. The Flag FF is always set at time T2 of the machine cycle following setting of the Flag Buffer FF. The Flag Buffer FF is set by any of three methods: during power turn-on or preset by the POPIO(B) signal, by programming an STF instruction, or by a Device Flag signal ($\overline{\text{PFLAG}}$ or $\overline{\text{EIR}}$) from the disc drive. The Flag and Flag Buffer FF's are both cleared by a CLF program instruction, the Flag Buffer FF is also cleared by an IAK signal from the computer when an interrupt request is acknowledged.

The disc drive indicates to the computer that it is ready to receive data, or that it has transferred data to the computer, by sending a Device Flag signal ($\overline{\text{PFLAG}}$) to the interface PCA. The output of the Device Flag pulse-shaping network combines with the clear-side output of the Flag FF to provide a low output from gate U87B. This low output sets the Flag Buffer FF. At computer time T2, the set-side output of the Flag Buffer FF and the ENF signal from the computer set the Flag FF. If the computer interrupt system is enabled, a program interrupt occurs after the Flag FF sets; if the interrupt system is disabled, the computer program must check the status of the Flag FF to determine when it sets.

4-7. CONTROL CIRCUIT

The computer enables the disc drive for a data transfer by sending an STC signal to the interface PCA; the STC signal is the result of an STC program instruction. The Control FF and the Device Command FF form the control circuit, and both flip flops are set by the STC signal. The Control FF sets when the first STC signal is sent to the interface PCA and remains set until a CRS or CLC signal is received. When set, the Control FF fulfills one condition for enabling the interrupt circuit. The Device Command FF, when set, sends a Device Command signal ($\overline{\text{PCTL}}$) to the disc drive enabling its operation. In addition to being cleared by a CRS signal, the Device Command FF is cleared as a result of a Device Flag signal ($\overline{\text{PFLAG}}$).

4-8. INTERRUPT CIRCUIT

The interrupt circuit, formed by the IRQ FF and associated gating, interrupts computer operation on a priority basis. A data transfer between computer and disc drive takes place during the interruption of normal program execution. When the Flag and Control FF's are set and an IEN signal is supplied from the computer, initial conditions for an interrupt are met. The resulting low output of

U25A provides a low PRL signal to lower priority interface cards. The low PRL signal prevents interrupts from all lower priority devices. At time T5 (SIR signal) the low output of U35A sets the IRQ FF. Setting the IRQ FF provides FLG and IRQ signals which cause the computer to initiate a program interrupt.

At the next time T2, the ENF signal clears the IRQ FF to allow any higher priority device to request service during the interrupt. If no higher priority device requests service, the PRH signal remains high, as do the other inputs to gate U35A, and at time T5, the SIR signal sets the IRQ FF a second time. The FLG and IRQ signals are then used to indicate the interrupt address.

The computer sends an IAK signal to the interface PCA to clear the Flag Buffer FF and executes the instruction contained in memory at the interrupt address. At time T2, the ENF signal clears the IRQ FF. Clearing the Flag Buffer FF prevents the IRQ FF from being set again after the requested interrupt is enabled. The Flag FF remains set, however, to maintain the low PRL signal to lower priority devices until processing of the requested interrupt is complete. To clear the Flag FF and enable lower priority devices, a CLF instruction must be programmed.

4-9. SKIP-ON-FLAG CIRCUIT

The skip-on-flag circuit allows a data transfer to occur without use of the computer interrupt system. An SKF signal is sent to the computer from the interface PCA to signal the computer to skip the next program instruction. If an SFS instruction is programmed (SFS signal to the interface PCA), the SKF signal is generated when the Flag FF is set. If an SFC instruction is programmed (SFC signal to the interface PCA) the SKF signal is generated when the Flag FF is cleared. When the computer receives the SKF signal, it performs the program instructions necessary to effect the data transfer.

4-10. SELECT CODE DETECTOR

When the I/O device is addressed by the computer, the SCM and SCL signals are true (high) at the interface PCA. The IOG(B) signal is true when a program instruction pertains to any I/O device. These three signals combine at gate U45A to provide an enabling signal for this specific interface PCA. Thus, the interface PCA responds only to those program instructions specifying the select code of the I/O slot into which the card is inserted.

5-1. INTRODUCTION

Service that may be required for the HP 12732A/12733A Flexible Disc Subsystem falls into two areas. These are the mechanical cleaning and adjustment of the HP 9885M/S Disc Drive, and correction of any malfunction in the electronics which may be in the disc drive's internal controller PCA's or in the control and data interface PCA's. Service of the mechanical and controller portions of the subsystem is adequately covered in the *HP 9885M/S Flexible Disc Drive Service Manual*, part no. 09885-90031. This section concerns itself with overall subsystem operation and its interface.

5-2. PREVENTIVE MAINTENANCE

There are no separate preventive maintenance schedules for the overall subsystem; however, it is good practice to remove dust and visually inspect the interface PCA's whenever the PCA is removed from the computer. The interface cable, chaining cables, and their connectors may also be inspected occasionally. Refer to the *HP 9885 Flexible Disc Drive Service Manual* for disc drive preventive maintenance procedures.

5-3. DIAGNOSTIC TEST

The diagnostic test provided with the subsystem may be used as an operation verification test and to locate problem areas for troubleshooting. The HP 12732A Flexible Disc Diagnostic Program, part no. 12732-16003, is loaded

into the system using the Diagnostic Configurator Absolute Binary Program, part no. 24296-60001. The procedure and instructions for running the diagnostic are given in the *HP 12732A Flexible Disc Subsystem Diagnostic Reference Manual*, part no. 12732-90003. The diagnostic checks out the control and data interface PCA's as well as the disc drive.

If it seems that additional testing of the interface is required, then perform the diagnostic test described in the *General Purpose Register Diagnostic Reference Manual*, part no. 24391-90001. Prior to running this diagnostic, be sure to place data interface PCA jumper W2 in position B. (Do not forget to replace jumper W2 in position A before attempting to operate the subsystem.)

5-4. TROUBLESHOOTING

Troubleshoot the flexible disc subsystem by performing the diagnostic test, followed by the interface diagnostic test if necessary, and analyzing any error halts that occur during the tests. To further isolate troubles, refer to the signal to pin list in table 2-4, the integrated circuit diagrams and characteristics (figure 5-1), the parts location diagram (figure 5-2), and the logic diagram for the interface PCA's (figure 5-3). The control and data interface PCA's have the same logic diagram except for the position of the jumpers; therefore, the control interface PCA is shown in figure 5-3 with the jumper exceptions for the data interface PCA given in the notes. Replaceable parts lists, in order of reference designations, are provided in section VI.

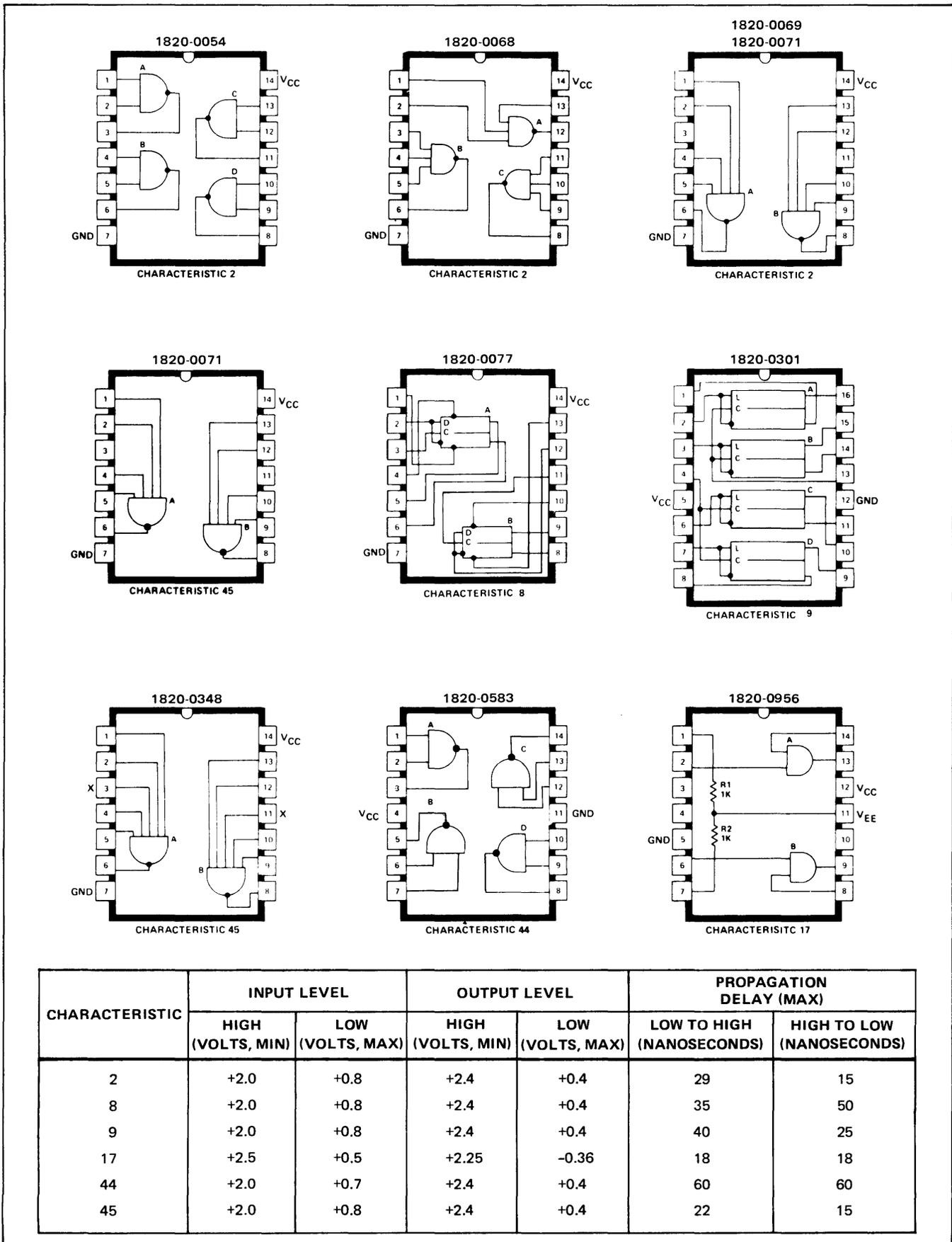


Figure 5-1. Integrated Circuit Diagrams and Characteristics

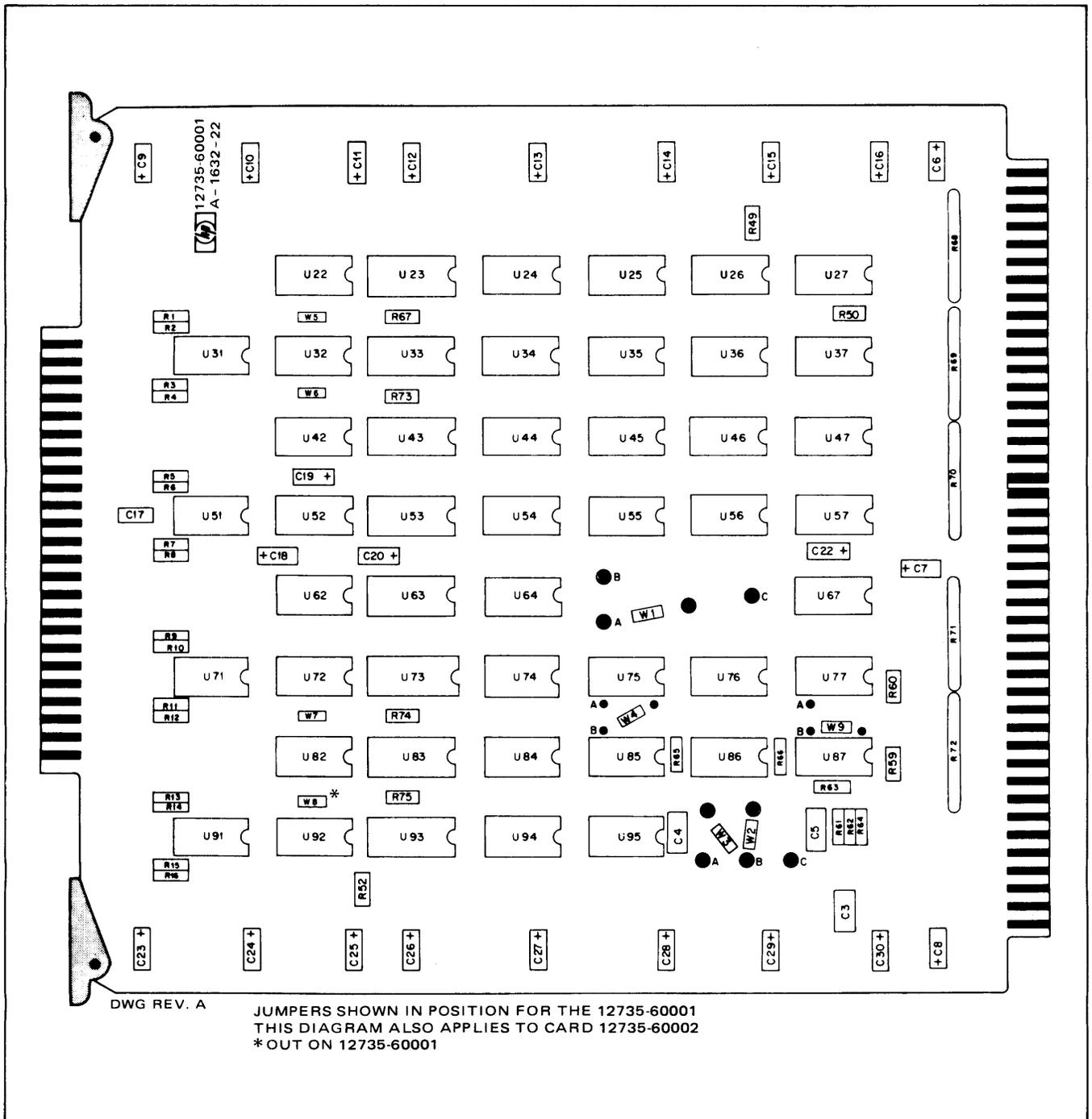
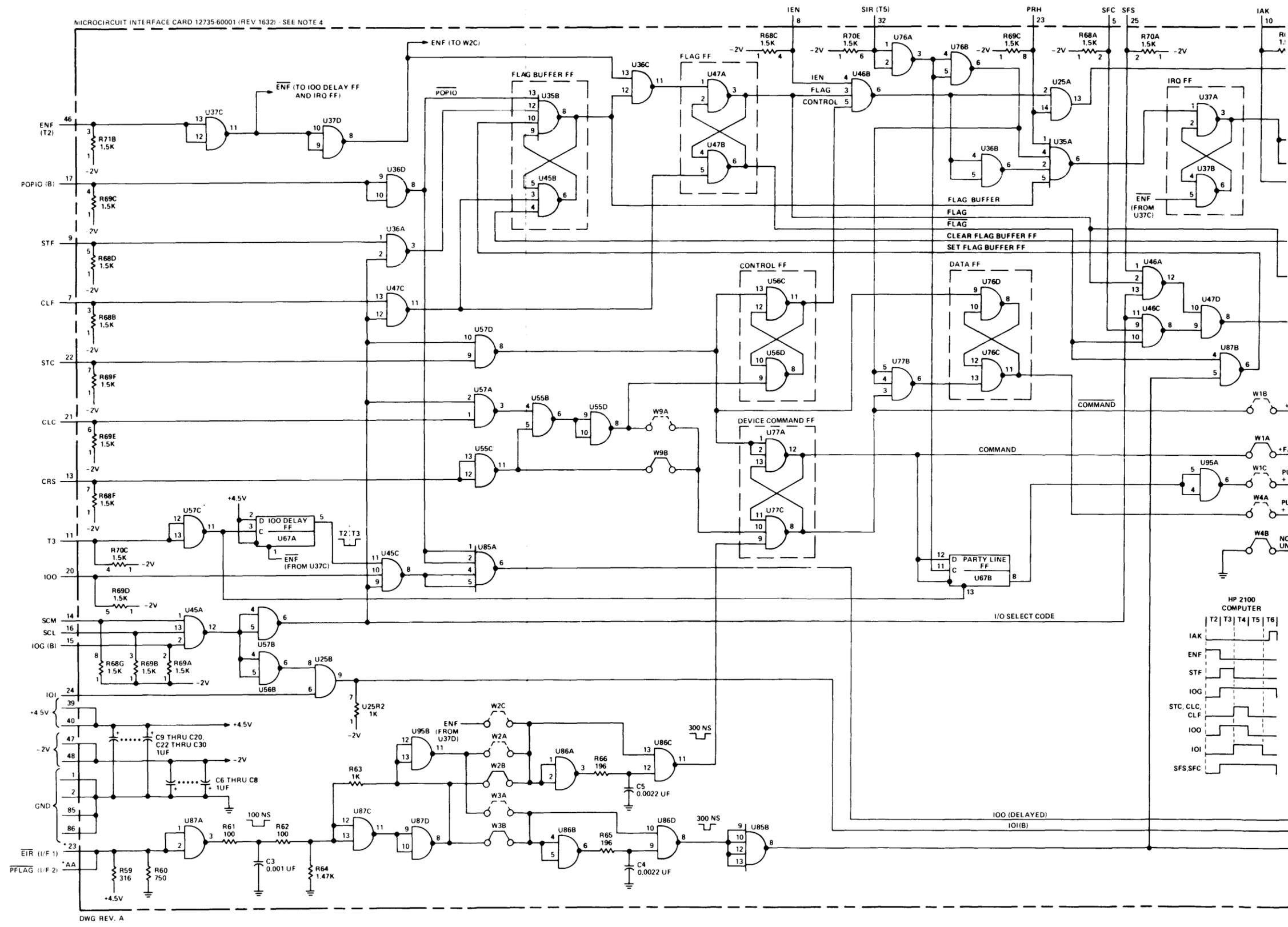
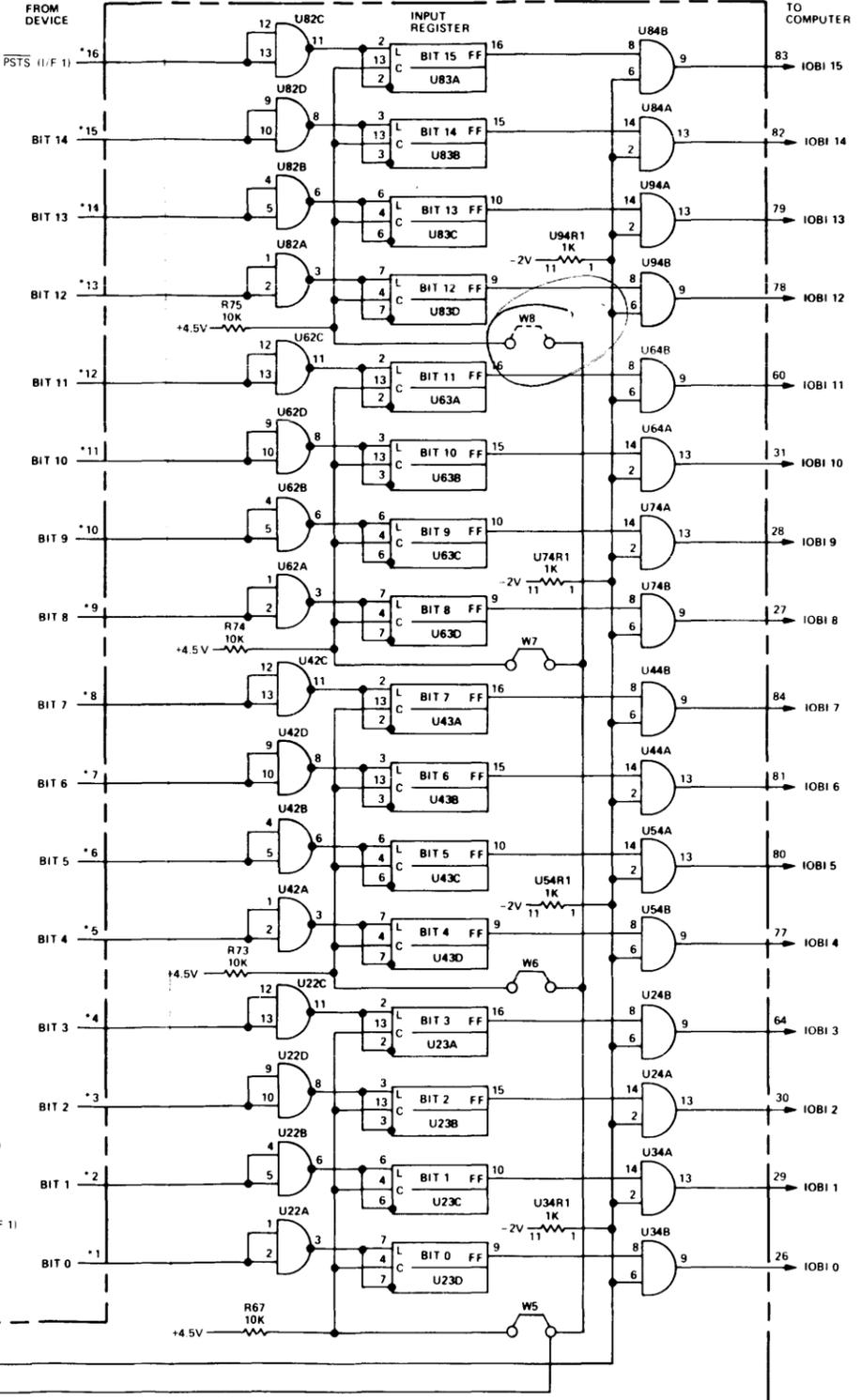
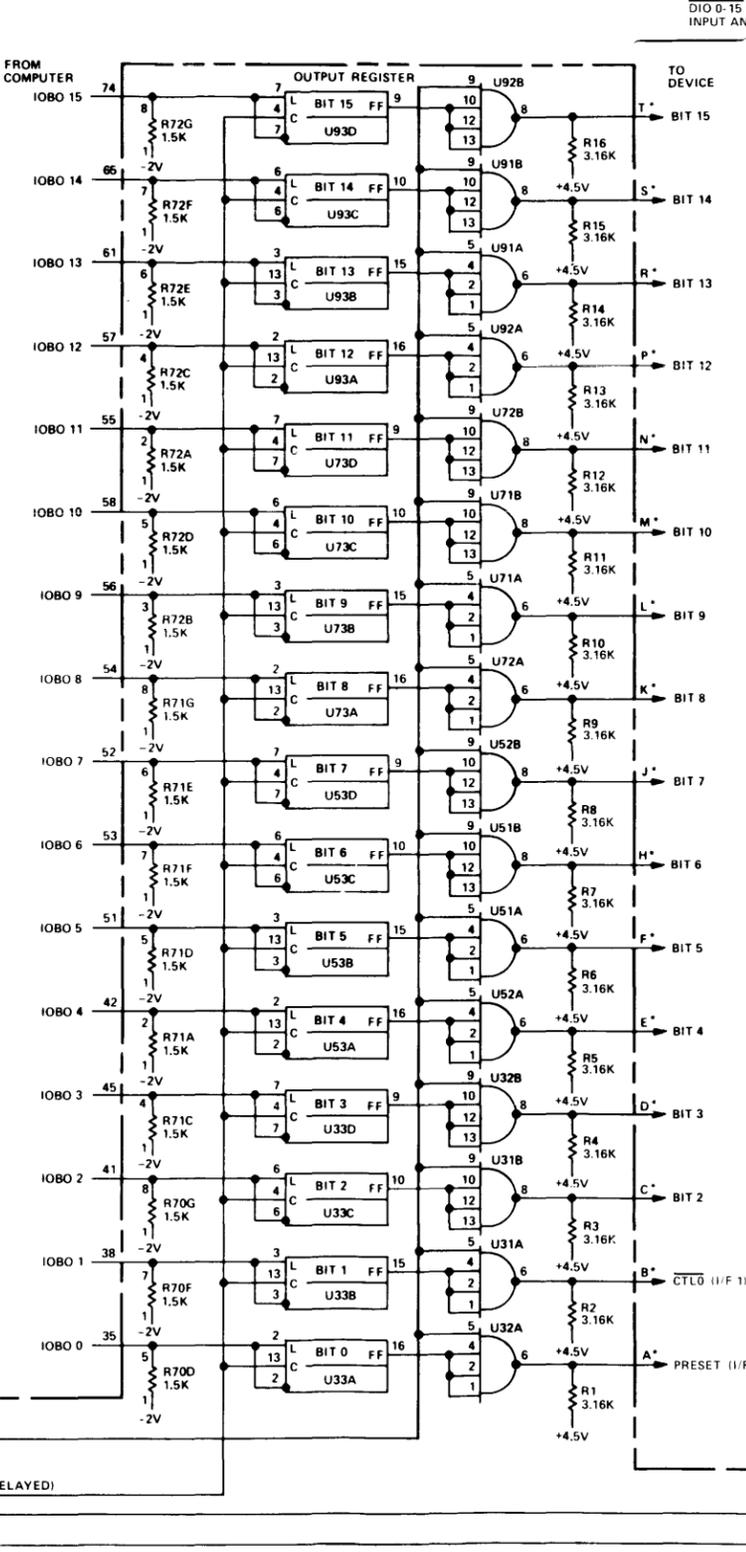
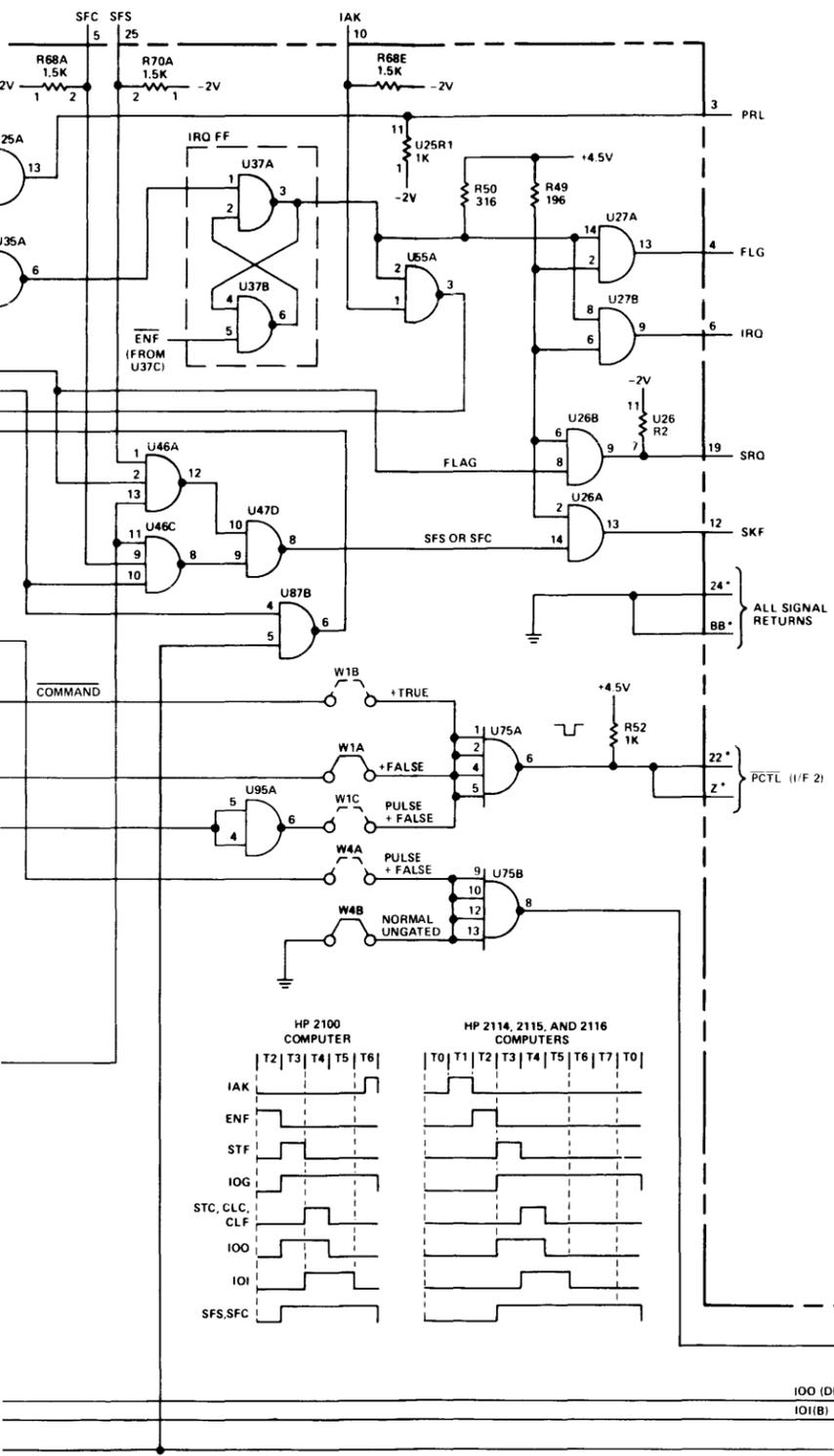


Figure 5-2. Interface PCA Parts Location Diagram





- NOTES:
1. ALL LOGIC IS POSITIVE TRUE
 2. SCHEMATIC DIAGRAM FOR RESISTOR NETWORKS R68 THRU R72:
-
3. AN ASTERISK (*) DENOTES PINS ON THE 48 PIN CONNECTOR. ALL OTHER PINS ARE ON THE 86-PIN CONNECTOR.
 4. INTERFACE CARD 12735 60002 IS IDENTICAL TO THE 12735 60001 EXCEPT FOR THE FOLLOWING JUMPER POSITIONS: J2 IN POSITION A, W8 IN

Figure 5-3. Interface PCA Logic Diagram

REPLACEABLE PARTS

SECTION

VI

6-1. INTRODUCTION

This section contains information for ordering replacement parts for the control and data interface PCA's. All other items are either listed in section I or they are part of the flexible disc drive which is covered in the *HP 9885 Flexible Disc Drive Service Manual*, part no. 09885-90031. Table 6-1 lists parts in reference designation order followed by HP part number, manufacturer, and manufacturer part number. Table 6-2 provides a listing of manufacturer's codes used in table 6-1.

6-2. ORDERING INFORMATION

To order replacement parts, address the order or inquiry to the local Hewlett-Packard Sales and Service Office. (Refer to the list at the back of this manual for addresses.) Specify the following information for each part ordered:

- a. Interface PCA part number.
- b. Interface PCA revision number.
- c. Description of each part.
- d. Circuit reference designation.

Table 6-1. Interface PCA Replaceable Parts

REFERENCE DESIGNATION	HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.
C3	0160-0153	Capacitor, Fxd, My, 1000 pF, 10%, 200 VDCW	28480	0160-0153
C4, 5	0160-0154	Capacitor, Fxd, My, 2200 pF, 10%, 200 VDCW	28480	0160-0154
C6 thru C20, C22 thru C30	0180-0291	Capacitor, Fxd, Elect, 1 μ F, 10%, 35 VDCW	56289	150D105X-9035A2
R1 thru R16	0757-0279	Resistor, Fxd, Flm, 3-6k, 1%, 1/8W	28480	0757-0279
R52, 63	0757-0280	Resistor, Fxd, Flm, 1k, 1%, 1/8W	28480	0757-0280
R50, 59	0698-3444	Resistor, Fxd, Flm, 316 ohms, 1%, 1/8W	28480	0698-3444
R60	0757-0420	Resistor, Fxd, Flm, 750 ohms, 1%, 1/8W	28480	0757-0420
R49, 65, 66	0698-3440	Resistor, Fxd, Flm, 196 ohms, 1%, 1/8W	28480	0698-3440
R61, 62	0757-0401	Resistor, Fxd, Flm, 100 ohms, 1%, 1/8W	28480	0757-0401
R64	0757-1094	Resistor, Fxd, Flm, 1.47k, 1%, 1/8W	28480	0757-1094
R67, R73 thru R75	0757-0442	Resistor, Fxd, Flm, 10k, 1%, 1/8W	28480	0757-0442
R68 thru R72	1810-0020	Resistor, Network (7 fxd flm resistors)	28480	1810-0020
U22, 36, 37, 42, 47, 55, 56, 62, 76, 82, 86, 87, 95	1820-0054	Integrated Circuit, TTL	01295	SN7400N
U23, 33, 43, 53, 63, 73, 83, 93	1820-0301	Integrated Circuit, TTL	01295	SN7475N
U24 thru U27, 34, 44, 54, 64, 74, 84, 94	1820-0956	Integrated Circuit, CTL	07263	U6A995679X
U31, 32, 51, 52, 71, 72, 91, 92	1820-0348	Integrated Circuit, DTL	01295	SN15844N
U35	1820-0069	Integrated Circuit, TTL	01295	SN7420N
U45, 46, 77	1820-0068	Integrated Circuit, TTL	01295	SN7410N
U57	1820-0583	Integrated Circuit, TTL	27014	DM74L00N
U67	1820-0077	Integrated Circuit, TTL	01295	SN7474N
U75, 85	1820-0071	Integrated Circuit, TTL	01295	SN7440N
W1 thru W9	8159-0005	Jumper Wire	28480	8159-00005

Table 6-2. Code List of Manufacturers

The following code numbers are from the Federal Supply Code for Manufacturers Cataloging Handbooks H4-1 and H4-2 and the latest supplements.					
CODE NO.	MANUFACTURER	ADDRESS	CODE NO.	MANUFACTURER	ADDRESS
01295	Texas Instruments, Inc., Transistor		14674	Corning Glass Works	Corning, N.Y.
	Products Div.	Dallas Texas	27014	National Semiconductor Corp.	Santa Clara, Cal.
04713	Motorola Inc., Semiconductor		28480	Hewlett-Packard Co.	Palo Alto, Cal.
	Products Div.	Phoenix, Arizona	56289	Sprague Electric Co.	North Adams, Mass.
07263	Fairchild Camera & Inst. Corp.				
	Semiconductor Div.	Mountain View, Cal.			

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