



HEWLETT
PACKARD

INSTALLATION AND SERVICE MANUAL

13175D/13178D DISC CONTROLLER INTERFACE KITS

(FOR HP 1000 COMPUTER SERIES)

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IMPORTANT NOTICE

This manual applies to 13175D and 13178D Interface Kits. Earlier 13175A/B and 13178B/C Interface Kits are documented in *Installation and Service Manual* part no. 13037-90015.

NOTE

The 13175/13178 Interface Kits are not compatible with disc drives/controllers with HP-IB capability.

OPTIONS COVERED

This manual covers 13175D option 025 and 13178D options 001 and 002 as well as the standard interface kits.

FOR U.S.A. ONLY

The Federal Communications Commission (in 47 CFR 15.818) has specified that the following notice be brought to the attention of the users of this product.

FEDERAL COMMUNICATIONS COMMISSION RADIO FREQUENCY INTERFERENCE STATEMENT

Warning: This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instructions manual, may cause interference to radio communications. It has been tested and found to comply with the limits for Class A computing devices pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

PRINTING HISTORY

New editions incorporate all update material since the previous edition. Updating Supplements, which are issued between editions, contain additional and revised information to be incorporated into the manual by the user. The date on the title page changes only when a new edition is published.

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NOTICE

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SAFETY CONSIDERATIONS

KEEP WITH MANUAL

GENERAL - This product and related documentation must be reviewed for familiarization with safety markings and instructions before operation.

SAFETY SYMBOLS



Instruction manual symbol: the product will be marked with this symbol when it is necessary for the user to refer to the instruction manual in order to protect the product against damage.



Indicates hazardous voltages.



Indicates earth (ground) terminal.

WARNING

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

CAUTION

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

SAFETY EARTH GROUND - This is a safety class I product and is provided with a protective earthing terminal. An uninterruptible safety earth ground must be provided from the main power source to the product input wiring terminals, power cord, or supplied power cord set. Whenever it is likely that the protection has been impaired, the product must be made inoperative and be secured against any unintended operation.

BEFORE APPLYING POWER - Verify that the product is configured to match the available main power source per the input power configuration instructions provided in this manual.

If this product is to be energized via an auto-transformer (for voltage reduction) make sure the common terminal is connected to the earth terminal of the main power source.

SERVICING

WARNING

Any servicing, adjustment, maintenance, or repair of this product must be performed only by service-trained personnel.

Adjustments described in this manual may be performed with power supplied to the product while protective covers are removed. Energy available at many points may, if contacted, result in personal injury.

Capacitors inside this product may still be charged even when disconnected from its power source.

To avoid a fire hazard, only fuses with the required current rating and of the specified type (normal blow, time delay, etc.) are to be used for replacement.

To install or remove a fuse, first disconnect the power cord from the device. Then, using a small screwdriver, turn the fuseholder cap counterclockwise until the cap releases. Install the proper fuse in the cap — either end of the fuse can be installed in the cap. Next, install the fuse and fuseholder cap in the fuseholder by pressing the cap inwards and then turning it clockwise until it locks in place.

GENERAL INFORMATION

SECTION

I

1-1. INTRODUCTION

This section contains a general description of the single computer and multiple computer interface kits, a list of the contents of each kit, and specifications for the printed-circuit assemblies.

1-2. GENERAL DESCRIPTION

The HP 13175D Single Computer Interface Kit (figure 1-1) interfaces the HP 13037 Disc Controller with an HP 1000 Computer Series.* The interface printed-circuit assembly (PCA) occupies one input/output (I/O) slot in the computer and provides the means to transfer information between the computer, disc controller, and 7906 and/or 7920 and/or 7925 Disc Drives. The HP 13175D Kit is used to interface the disc controller to a single computer as depicted in figure 1-3.

The 13178D Multiple Computer Interface Kit (figure 1-2) is similar to the 13175D Interface Kit and is used to interface the 13037 Disc Controller to multiple 1000 Computer Series.*

*The term "1000 Computer Series" will be used as a general reference to HP 1000 E-Series and F-Series Computers.

The 13037 Disc Controller will accommodate up to seven additional computers (eight total) and 7906/7920/7925 Disc Drives. Figure 1-4 depicts multiple computer and multiple disc drive configurations.

The interface PCA's used in the kits are identical, except part no. 13037-60023 used in the 13175D Kit has terminating resistors and must be used in a single computer configuration or in the last computer in a multiple computer chain.

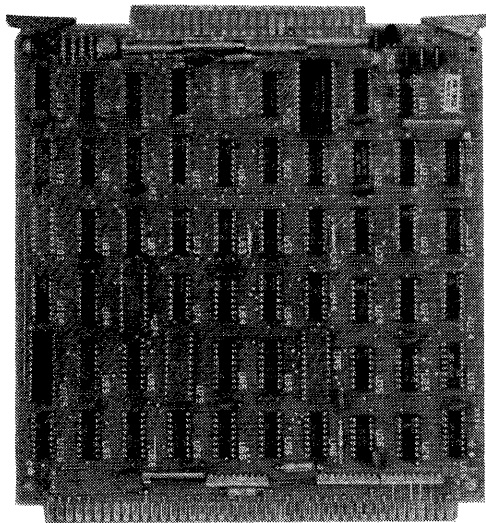
1-3. KIT CONTENTS

1-4. HP 13175D INTERFACE KIT

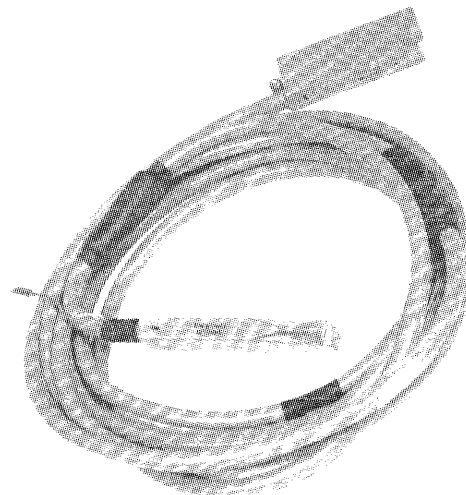
The HP 13175D Kit consists of one each of the following items:

- Interface Cable, 5.49 metres (18 ft), part no. 13037-60043.
- Interface PCA, part no. 13037-60023.
- HP 13175D/13178D Disc Controller Interface Kits Installation and Service Manual*, part no. 13037-90921.

Option 025 to the 13175D Kit replaces part no. 13037-60043 Interface Cable with a shorter cable, 1.85 metres (6 ft), part no. 13037-60047.



INTERFACE PCA
PART NO. 13037-60023



INTERFACE CABLE
PART NO. 13037-60043

Figure 1-1. HP 13175D Single Computer Interface Kit

1-5. HP 13178D INTERFACE KIT

The HP 13178D Kit consists of one each of the following items:

- a. Bracket and Adapter Assembly, part no. 13037-60049, consisting of the following:
 - (1) Two Hex Head Screws (no. 10-32, 0.375 in.), part no. 2680-0244.
 - (2) Two Pan Head Screws w/ext tooth (no. 6-32, 0.375 in.), part no. 2360-0117.
 - (3) Two Hex Nuts w/ext tooth (no. 6-32), part no. 2420-0001.
 - (4) Two Pan Head Screws (4-40, 0.5 in.), part no. 2200-0147.
 - (5) Two Hex Nuts w/ext tooth (no. 4-40), part no. 2260-0009.
 - (6) Two Flat Washers (no. 4), part no. 2190-0376.
 - (7) One T-Connector Assembly, part no. 07905-60040.

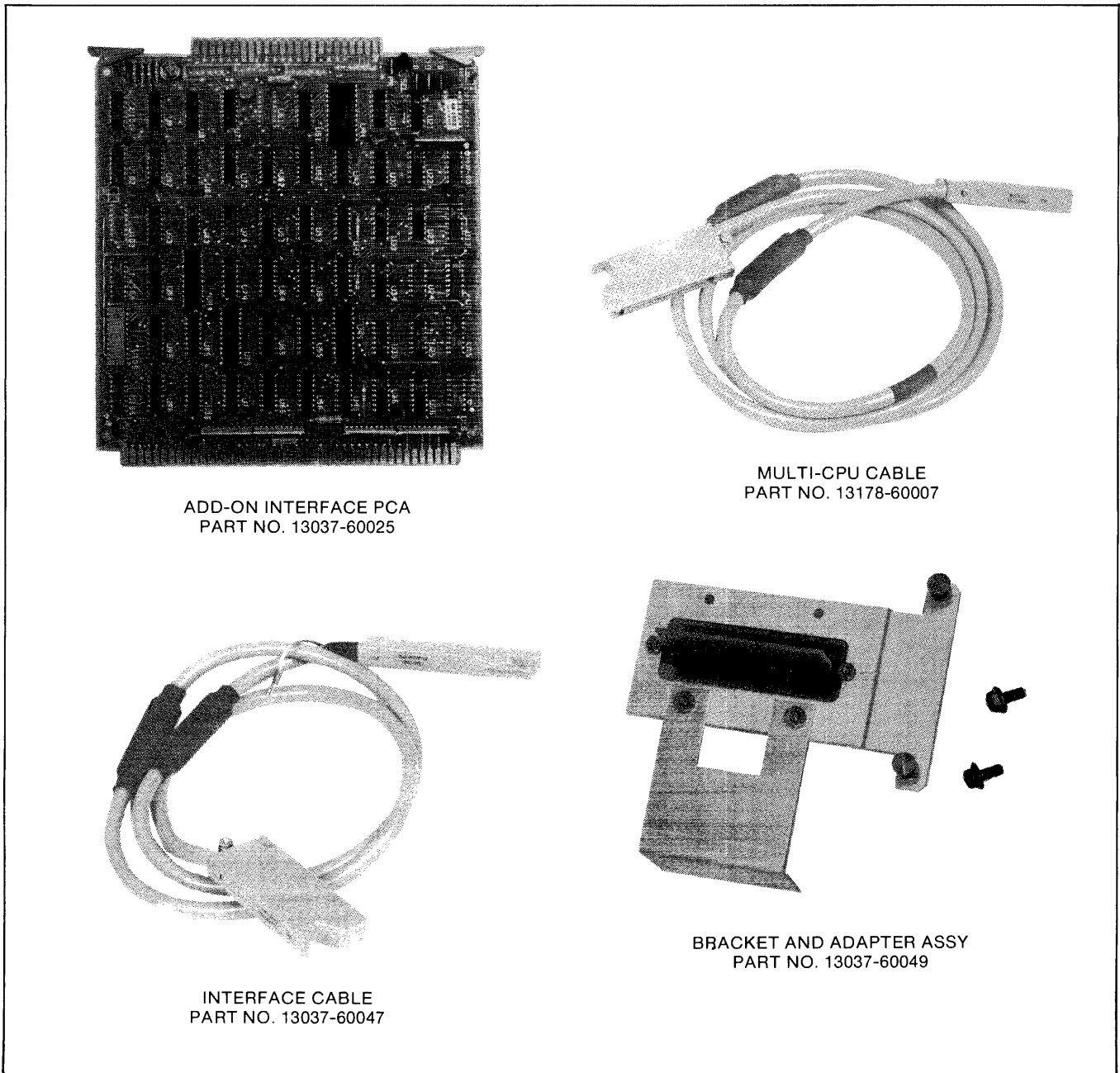


Figure 1-2. HP 13178D Multiple Computer Interface Kit

- (8) One Cable-to-Cable Adapter, part no. 07905-80010.
- (9) One T-Connector Bracket, part no. 07906-00055.
- (10) One Angle Bracket, part no. 07925-00050.
- b. Interface Cable, 1.85 metres (6 ft), part no. 13037-60047.
- c. Add-On Interface PCA, part no. 13037-60025.
- d. Multi-CPU Cable, 2.44 metres (8 ft), part no. 13178-60007.
- e. *HP 13175D/13178D Disc Controller Interface Kits Installation and Service Manual*, part no. 13037-90921.

Option 001 to the 13178D Kit replaces part no. 13178-60007 Multi-CPU Cable with a longer cable, 4.88 metres (16 ft), part no. 13178-60008.

Option 002 to the 13178D Kit replaces part no. 13037-60047 Interface Cable with a longer cable, 5.49 metres (18 ft), part no. 13037-60043.

1-6. SPECIFICATIONS

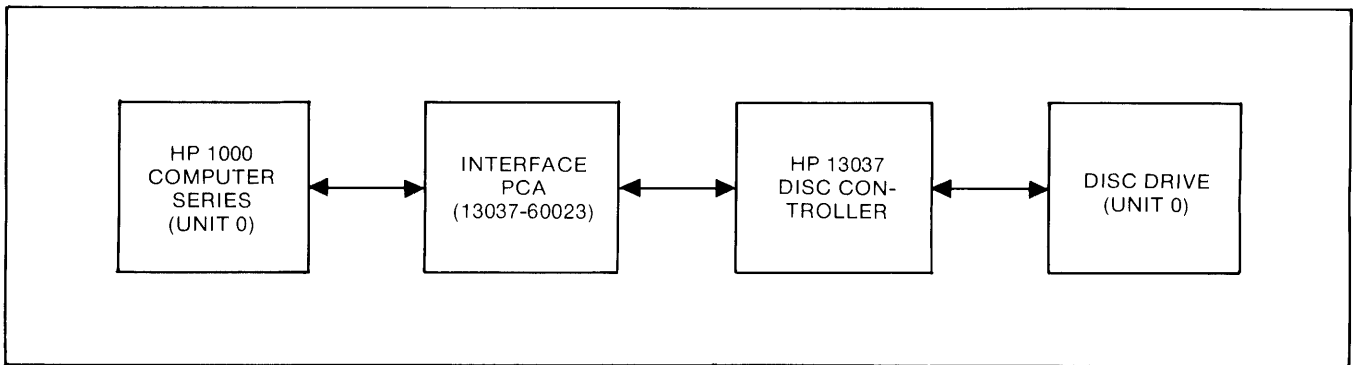
Current requirements for the interface PCA's, part no. 13037-60023 and part no. 13037-60025, are as follows:

- a. Two amperes at +5 volts dc.
- b. One hundred milliamperes at -2 volts dc.

1-7. RELATED DOCUMENTATION

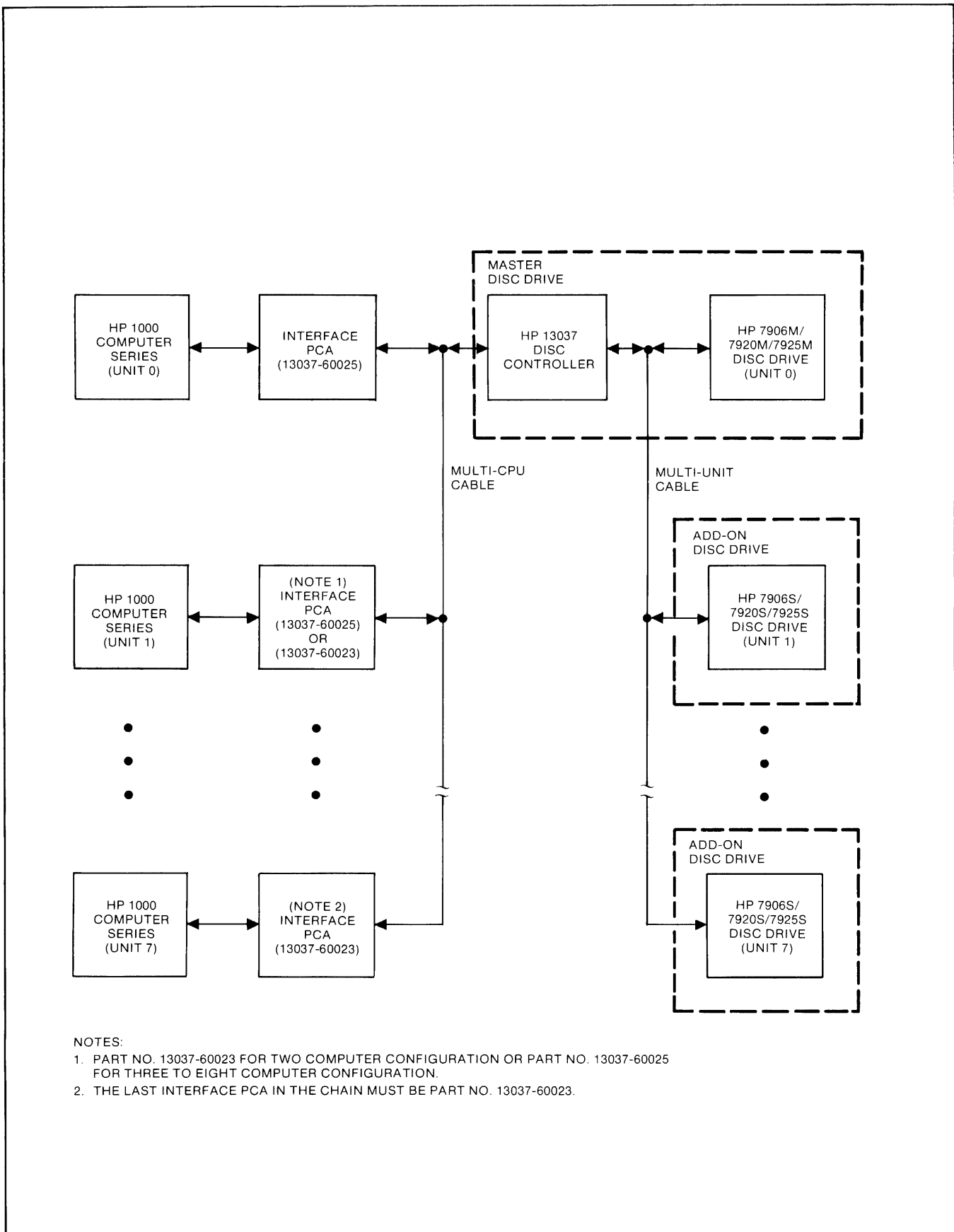
The following related documentation may be ordered from a Hewlett-Packard Sales and Support Office. HP Sales and Support Offices are listed at the back of this manual.

- a. *HP 7906D Disc Drive Installation Manual*, part no. 07906-90912.
- b. *HP 7906D Disc Drive Service Manual*, part no. 07906-90913.
- c. *HP 7920D Disc Drive Installation Manual*, part no. 07920-90912.
- d. *HP 7920D Disc Drive Service Manual*, part no. 07920-90913.
- e. *HP 7925D Disc Drive Installation Manual*, part no. 07925-90912.
- f. *HP 7925D Disc Drive Service Manual*, part no. 07925-90913.
- g. *HP 13037D Disc Controller Installation and Service Manual*, part no. 13037-90911.
- h. *HP 13037B/C Disc Controller Installation and Service Manual*, part no. 13037-90006.
- i. *HP 79XX/13037 Disc Memory Diagnostic Reference Manual*, part no. 12962-90001.



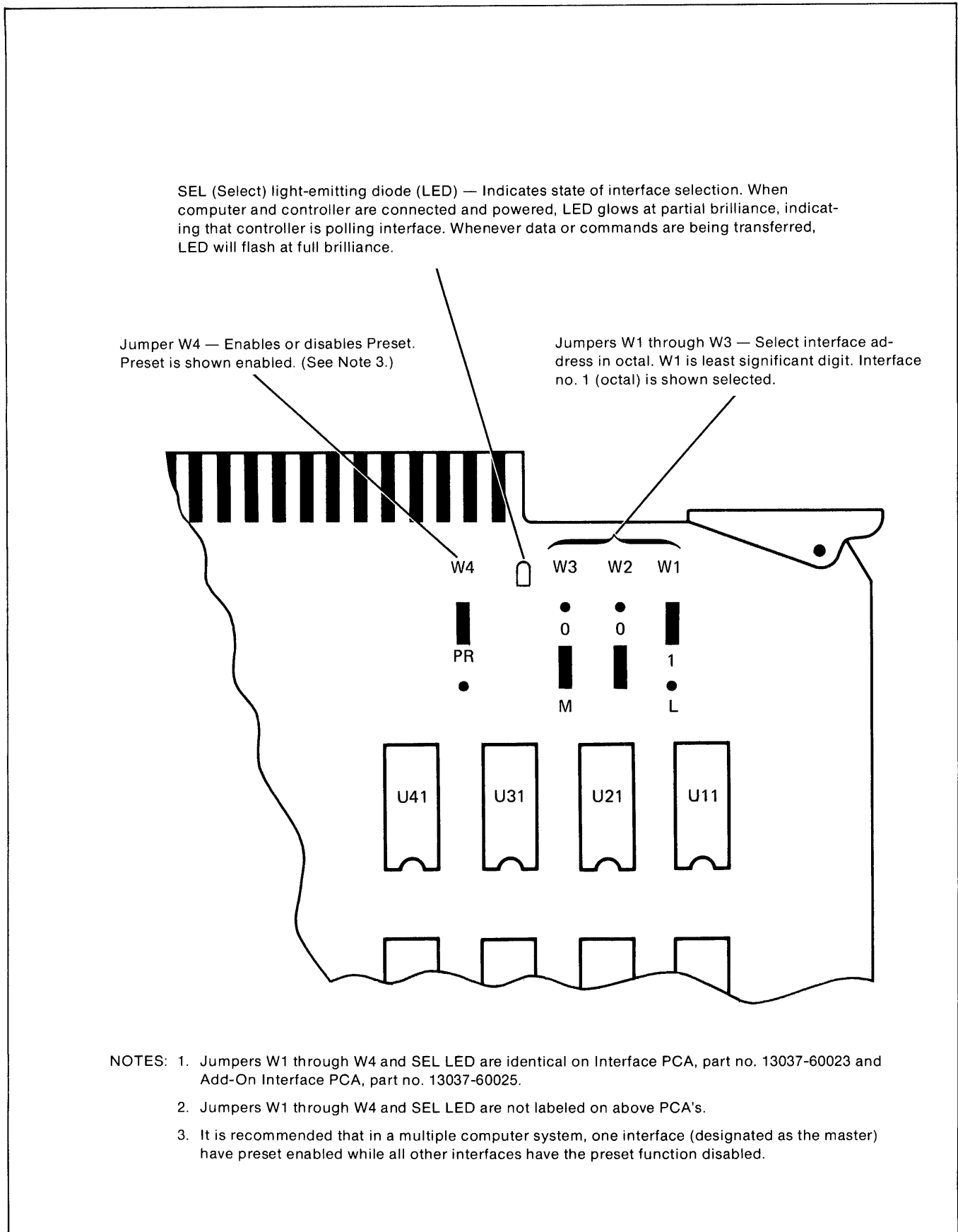
7305-8D

Figure 1-3. Single Computer Configuration, Block Diagram



7305-3E

Figure 1-4. Multiple Computer and/or Disc Drive Configuration, Block Diagram



7305-4

Figure 2-1. Interface PCA Jumper Locations

2-8. SINGLE COMPUTER CABLING

Figure 2-2 shows the interconnecting cabling configuration for a single computer installation with the controller using the HP 13175D Interface Kit. Interconnection procedures are as follows:

- a. Install the interface PCA in the computer according to the instructions in the following appropriate computer manual:
 - (1) *21MX E-Series Computer Installation and Service Manual*, part no. 02109-90015.
 - (2) *2111F/2117F Installation and Service Manual*, part no. 02111-90002.
- b. For each disc drive in the system, set RUN/STOP switch to STOP.
- c. On controller rear panel, set POWER switch to 0 (off).

WARNING

Hazardous voltages are present inside the controller mainframe. Before cabling the controller, set the POWER switch to 0 (off) and disconnect the ac power cord.

- d. Remove controller top cover and front panel.
- e. Disconnect the HP 13013D Multi-Unit Cable and any HP 13213D Data Cables from the device controller PCA if any are connected.
- f. Remove the cable bracket assembly from the rear of the controller and separate the two brackets (see figure 2-2, view A).
- g. Locate and completely remove the clear piece of shrink tubing from the Interface Cable (part no. 13037-60043 or 13037-60047) to expose the small area of shield braid. Use extreme care to prevent damaging the cable.
- h. Locate the package of hardware (two for 13037-60043) attached to the interface cable. The package includes the following:
 - (1) Two 6-32 nuts, part no. 2420-0003.
 - (2) Two 6-32 screws, part no. 2360-0183.
 - (3) One clamp, part no. 5021-1604.
 - (4) One spacer, part no. 5001-3320.
 - (5) One clamp, part no. 5021-1603.
- i. Mount hardware on the interface cable oriented as shown in figure 2-2, view A. Make sure that the 5021-1604 clamp makes firm contact with the exposed shield braid.

- j. Prepare and mount the HP 13013D Multi-Unit Cable to the main cable bracket as described in the *HP 13037D Disc Controller Installation and Service Manual*, part no. 13037-90911 or *HP 13037B/C Disc Controller Installation and Service Manual*, part no. 13037-90006.
 - k. Secure the interface cable prepared in step i to the main cable bracket oriented as shown in figure 2-2, view A, using the attached knurled-head screws.
 - l. Prepare and mount all HP 13213D Data Cables to the data cable bracket as described in the *HP 13037D Disc Controller Installation and Service Manual*, part no. 13037-90911 or *HP 13037B/C Disc Controller Installation and Service Manual*, part no. 13037-90006.
 - m. Attach the data cable bracket to the main cable bracket with the two attached captive screws.
 - n. Pass the cables through the opening at the rear of the controller and secure the cable bracket assembly to the controller with the two attached captive screws. Be sure that none of the toroid assemblies on the cables are within the controller.
 - o. Position the cables in the channel provided and lying to the right of the fan.
 - p. Connect each data cable to the device controller PCA at connectors J4 through J11 and secure each cable to the data cable retainer assembly on the PCA with the attached spring-loaded captive screws (see figure 2-2, view B).
- Note: Any data cable may be connected to any of the connectors on the PCA.
- q. Connect the multi-unit cable to the device controller PCA connector DRV J3.
 - r. Connect the interface cable to the device controller PCA connector IF J1.
 - s. Ensure that Jumper Cable, part no. 13037-60021, is connected between connector J2 on the error processor PCA and connector J2 on the micro-processor PCA.
 - t. Replace controller top cover and front panel.
 - u. If a 13037-60047 Interface Cable is used and the computer and disc controller are mounted in the same HP 29431F Cabinet, connect the interface cable to the interface PCA at the computer and connect the ground strap according to the instructions in the appropriate computer manual (refer to step a). Then proceed to step y.

- v. If a 13037-60043 Interface Cable is used and the disc controller is not in the same HP 29431F Cabinet as the computer, proceed as follows:
 - (1) Locate and completely remove from the interface cable the black piece of shrink tubing located about 60 inches from the 48-pin connector end. Use extreme care to prevent damaging the cable.
 - (2) Mount the hardware from the second package provided with the interface cable on the interface cable as shown in figure 2-2, view A. Make sure that the 5021-1604 clamp makes firm contact with the exposed shield braid.
 - (3) At the computer, connect the interface cable to the interface PCA and connect the ground strap and the grounding clamp according to the instructions in the appropriate computer manual (refer to step a). Then proceed to step y.
- w. If the system is installed in an HP 29400B-Series Cabinet and the 13037-60043 Interface Cable is used, discard the second package of hardware provided with the interface cable and connect the cable to the interface card according to the instructions in the appropriate computer manual. Then proceed to step y.
- x. If systems are configured such that the grounding clamps are not required, discard the hardware and use the cables as is. If cables are used which have grounding clamps attached, remove the clamps and wrap the exposed shield braid with electrical tape and secure and insulate any ground straps which are not used.
- y. Replace the computer rear cover.
- z. Perform diagnostic test as described in paragraph 4-5.
- c. On controller rear panel, set POWER switch to 0 (off).

WARNING

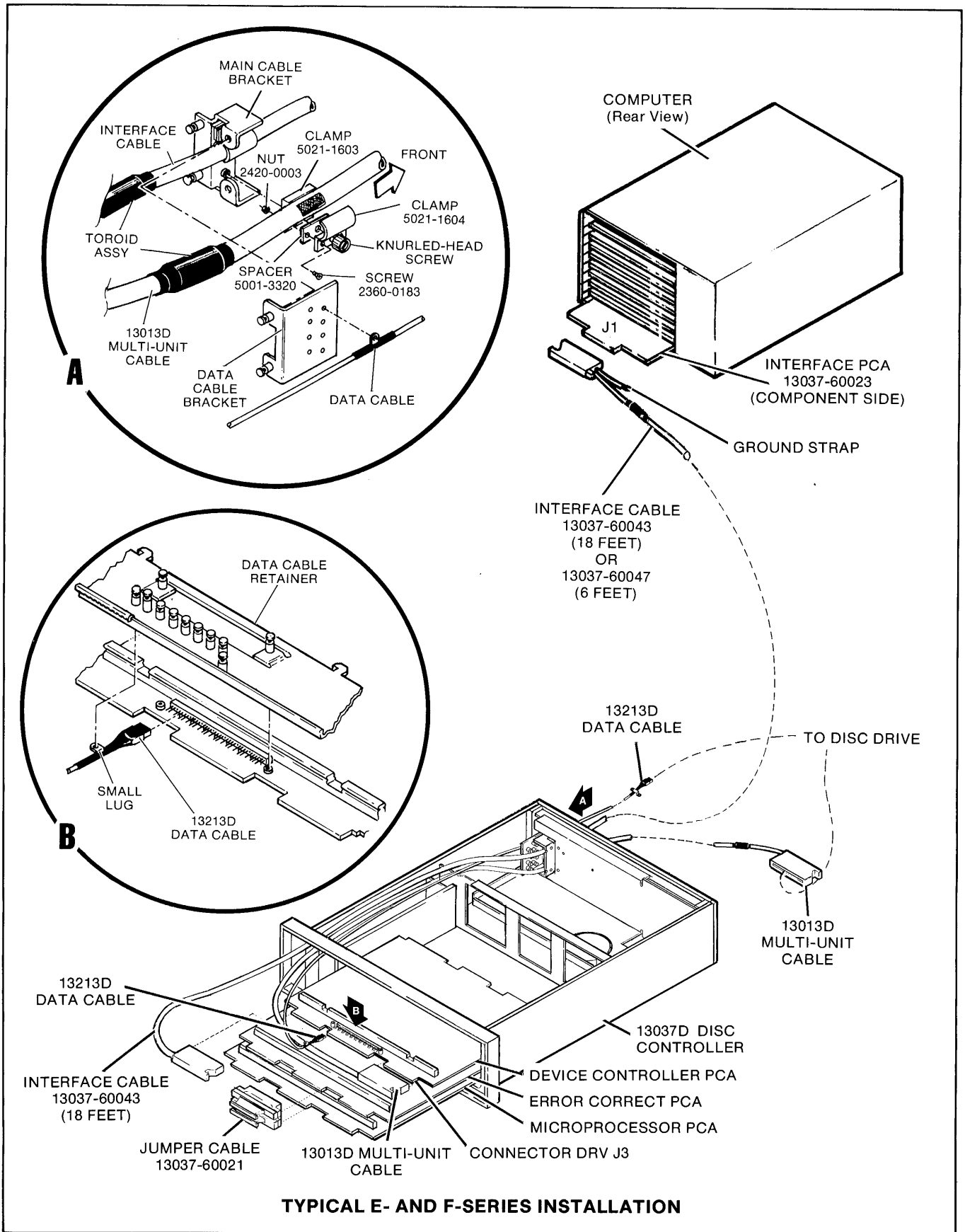
Hazardous voltages are present inside the controller mainframe. Before cabling the controller, set the POWER switch to 0 (off) and disconnect the ac power cord.

 - d. Make connections to the disc controller by performing steps d through t of paragraph 2-8, except in step g use the Multi-Unit Cable, part no. 13178-60007, instead of the Interface Cable, part no. 13037-60043 or 13037-60047.
 - e. Attach the T-Connector, part no. 07905-60040, to the T-Connector Bracket, part no. 07906-00055, using the two Screws, part no. 2200-0147, two Washers, part no. 2190-0376, and two Nuts, part no. 2260-0009. Do not tighten completely.
 - f. If the disc controller and the first computer or both computers are mounted in the same HP 29431F Cabinet, remove the second package of hardware provided with the Multi-CPU Cable and discard the hardware. Then proceed to step i.
 - g. If the disc controller and computers are not in the same HP 29431F Cabinet, proceed as follows:
 - (1) Locate and completely remove from the Multi-CPU Cable the black piece of shrink tubing located about 20 inches from the end of the cable. Use extreme care to prevent damaging the cable.
 - (2) Mount the hardware from the second package provided with the Multi-CPU Cable as shown in figure 2-3, view A. Make sure that the 5021-1604 clamp makes firm contact with the exposed shield braid. Then proceed to step i.
 - h. If the system is installed in one or more HP 29400B-Series Cabinets or in a system configuration that does not require use of the grounding clamps, discard the hardware and use the cables as is. If cables are used which have grounding clamps attached, remove the clamps and wrap the exposed shield braid with electrical tape and secure and insulate any ground straps which are not used.
 - i. Connect the free end of the Multi-CPU Cable to the right edge (as viewed from the rear) of the T-connector. Secure the cable connector to the T-connector bracket with the attached spring-loaded captive screw.
 - j. Connect the 50-pin connector end of the Interface Cable, part no. 13037-60043 or 13037-60047, to the left edge (as viewed from the rear) of the T-

2-9. TWO COMPUTER CABLING

Figure 2-3 shows the interconnecting cabling configuration for a two computer configuration using one each HP 13175D and HP 13178D Interface Kits. Interconnection procedures are as follows:

- a. Install the interface PCA's in the computers according to the instructions in the following appropriate computer manual:
 - (1) *21MX E-Series Computer Installation and Service Manual*, part no. 02109-90015.
 - (2) *2111F/2117F Installation and Service Manual*, part no. 02111-90002.
- b. For each disc drive in the system, set RUN/STOP switch to STOP.



7305-11

Figure 2-2. Single Computer Configuration, Cabling Diagram

- connector. Secure the cable connector to the T-connector bracket with the attached spring-loaded captive screw.
- k. Tighten the screws installed in step e that attach the T-connector to the T-connector bracket.
 - l. Attach the Angle Bracket, part no. 07925-00050, to the T-Connector Bracket, part no. 07906-00055, using the two Screws, part no. 2360-0117, and Nuts, part no. 2420-0001. The angle bracket may be attached for either right- or left-hand mounting in the equipment cabinet. Refer to the appropriate computer manual (refer to step a) for proper location of the bracket assembly.
 - m. Mount the bracket assembly to the inside of the equipment cabinet using the two Hex Head Screws, part no. 2680-0244, supplied with the kit.
 - n. Insert the Cable-to-Cable Adapter, part no. 07905-80010, into the female connector on the T-connector.
 - o. Connect the 50-pin connector end of the Interface Cable, part no. 13037-60047, to the cable-to-cable adapter. Connect the other end to the Add-On Interface PCA, part no. 13037-60025. Connect the ground strap according to the instructions in the appropriate computer manual (refer to step a).
 - p. Connect the free end of the interface cable attached in step j to the Interface PCA, part no. 13037-60023. Connect the ground strap and grounding clamp according to the instructions in the appropriate computer manual (refer to step a).
 - q. Replace each computer rear cover.
 - r. Perform diagnostic test as described in paragraph 4-5 (only one computer should be running during the diagnostic).
- b. For each disc drive in the system, set RUN/STOP switch to STOP.
 - c. On controller rear panel, set POWER switch to 0 (off).

WARNING

Hazardous voltages are present inside the controller mainframe. Before cabling the controller, set the POWER switch to 0 (off) and disconnect the ac power cord.

- d. Make connections to the disc controller by performing steps d through t of paragraph 2-8, except in step g use the Multi-Unit Cable, part no. 13178-60007, instead of the Interface Cable, part no. 13037-60043 or 13037-60047.
- e. Attach the T-Connector, part no. 07905-60040, to the T-Connector Bracket, part no. 07906-00055, using the two Screws, part no. 2200-0147, two Washers, part no. 2190-0376, and two Nuts, part no. 2260-0009. Do not tighten completely.
- f. If the disc controller and the first computer are mounted in the same HP 29431F Cabinet, remove the second package of hardware provided with the Multi-CPU Cable and discard the hardware. Then proceed to step i.
- g. If the disc controller and computers are not in the same HP 29431F Cabinet, proceed as follows:
 - (1) Locate and completely remove from each Multi-CPU Cable the black piece of shrink tubing located about 20 inches from the end of the cable. Use extreme care to prevent damaging the cable.
 - (2) Mount the hardware from the second package provided with each Multi-CPU Cable as shown in figure 2-4, view A. Make sure that the 5021-1604 clamp makes firm contact with the exposed shield braid. Then proceed to step i.
- h. If the system is installed in one or more HP 29400B-Series Cabinets or in a system configuration that does not require use of the grounding clamps, discard the hardware and use the cable as is. If cables are used which have grounding clamps attached, remove the clamps and wrap the exposed shield braid with electrical tape and secure and insulate any ground straps which are not used.
- i. Connect the free end of the Multi-CPU Cable to the right edge (as viewed from the rear) of the T-connector. Secure the cable connector to the T-connector bracket with the attached spring-loaded captive screw.

2-10. THREE TO EIGHT COMPUTER CABLING

Figure 2-4 shows the interconnecting cabling configuration for a three to eight multiple computer installation with the HP 13037D Controller using one HP 13175D Interface Kit and two to seven HP 13178D Interface Kits. Interconnection procedures are as follows:

- a. Install the interface PCA's in the computers according to the instructions in the following appropriate computer manual.
 - (1) *21MX E-Series Computer Installation and Service Manual*, part no. 02109-90015.
 - (2) *2111F/2117F Installation and Service Manual*, part no. 0211-90002.

- j. Connect one end of another Multi-CPU Cable, part no. 13178-60007, to the left edge (as viewed from the rear) of the T-connector. Secure the cable connector to the T-connector bracket with the attached spring-loaded captive screw.
- k. Tighten the screws installed in step e that attach the T-connector to the T-connector bracket.
- l. Attach the Angle Bracket, part no. 07925-00050, to the T-Connector Bracket, part no. 07906-00055, using the two Screws, part no. 2360-0117, and Nuts, part no. 2420-0001. The angle bracket may be attached for either right- or left-hand mounting in the equipment cabinet. Refer to the appropriate computer manual (refer to step a) for proper location of the bracket.
- m. Mount the bracket assembly to the inside of the equipment cabinet using the two Hex Head Screws, part no. 2680-0244, supplied with the kit.
- n. Insert the Cable-to-Cable Adapter, part no. 07905-80010, into the female connector on the T-connector.
- o. Connect the 50-pin connector end of the Interface Cable, part no. 13037-60047, to the cable-to-cable adapter. Connect the other end to the Add-On Interface PCA, part no. 13037-60025. Connect the ground strap according to the instructions in the appropriate computer manual (refer to step a).
- p. For succeeding computers, connect a Multi-CPU Cable, part no. 13178-60007, to the left edge of the T-connector and the other end of this cable to the next T-connector. See figure 2-4. From here, continue cabling to the interface PCA's. The last PCA and cable in the chain must be part no. 13037-60023 interface PCA (not an add-on interface PCA) and part no. 13037-60043 interface cable, 5.49 metres (18 ft). Connect each ground strap and grounding clamp according to the instructions in the appropriate computer manual (refer to step a).
- q. Replace each computer rear cover.

- r. Perform diagnostic test as described in paragraph 4-5 (only one computer should be running during the diagnostic).

2-11. DISC DRIVE INSTALLATION

Disc drive cabling, including the interconnection of add-on disc drives is covered in the appropriate installation manual (see paragraph 1-7). The disc system may 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 a common ground.

2-12. DISC CONTROLLER INSTALLATION

Refer to the *HP 13037D Disc Controller Installation and Service Manual*, part no. 13037-90911, or *HP 13037B/C Disc Controller Installation and Service Manual*, part no. 13037-90006, for disc controller installation instructions.

2-13. REPACKING FOR SHIPMENT

If an item of a kit is to be shipped to Hewlett-Packard for repair, attach a tag to the item identifying the owner and indicating the service to be performed. Include the interface kit number.

Pack the item in the original factory packing material. If the original material is not available, standard factory packing material can be obtained from the nearest HP Sales and Support Office.

If standard packing material is not used, wrap the item in Air Cap TH-240 cushioning (manufactured by Sealed Air Corporation, Hawthorne, N.J.) or equivalent and place in a corrugated carton (200-pound test material). Seal the shipping carton securely and mark it "FRAGILE" to ensure careful handling. Refer any questions to the nearest Hewlett-Packard Sales and Support Office.

2-1. INTRODUCTION

This section provides installation information needed to interface the HP 13037 Disc Controller with an HP 1000 Computer Series. Included in this information are installation requirements, interface PCA jumper configuration and installation details, cabling instructions, and recommended packing and shipping methods.

2-2. UNPACKING AND INSPECTION

Inspect the kit container before opening. If there is external evidence of damage, request that the carrier's agent be present when the container is opened.

Inspect each item of the kit as the parts are unpacked. If the parts are damaged and fail to meet specifications, notify the carrier and the nearest Hewlett-Packard Sales and Support Office immediately. (HP Sales and Support Offices are listed at the back of this manual.) Retain the shipping container and packing material for the carrier's inspection. The HP Sales and Support Office will arrange for repair or replacement of the damaged part without waiting for any claims against the carrier to be settled.

2-3. JUMPER CONSIDERATIONS

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.

Note: In the following instructions, "interface PCA" refers to both Interface PCA, part no. 13037-60023 and Add-On Interface PCA, part no. 13037-60025.

2-4. 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.

2-5. 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. However, 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.

Note: It is recommended that in a multiple computer system, one interface (designated as the master) have the preset jumper enabled while all other interfaces have this function disabled.

2-6. INTERFACE PCA INSTALLATION

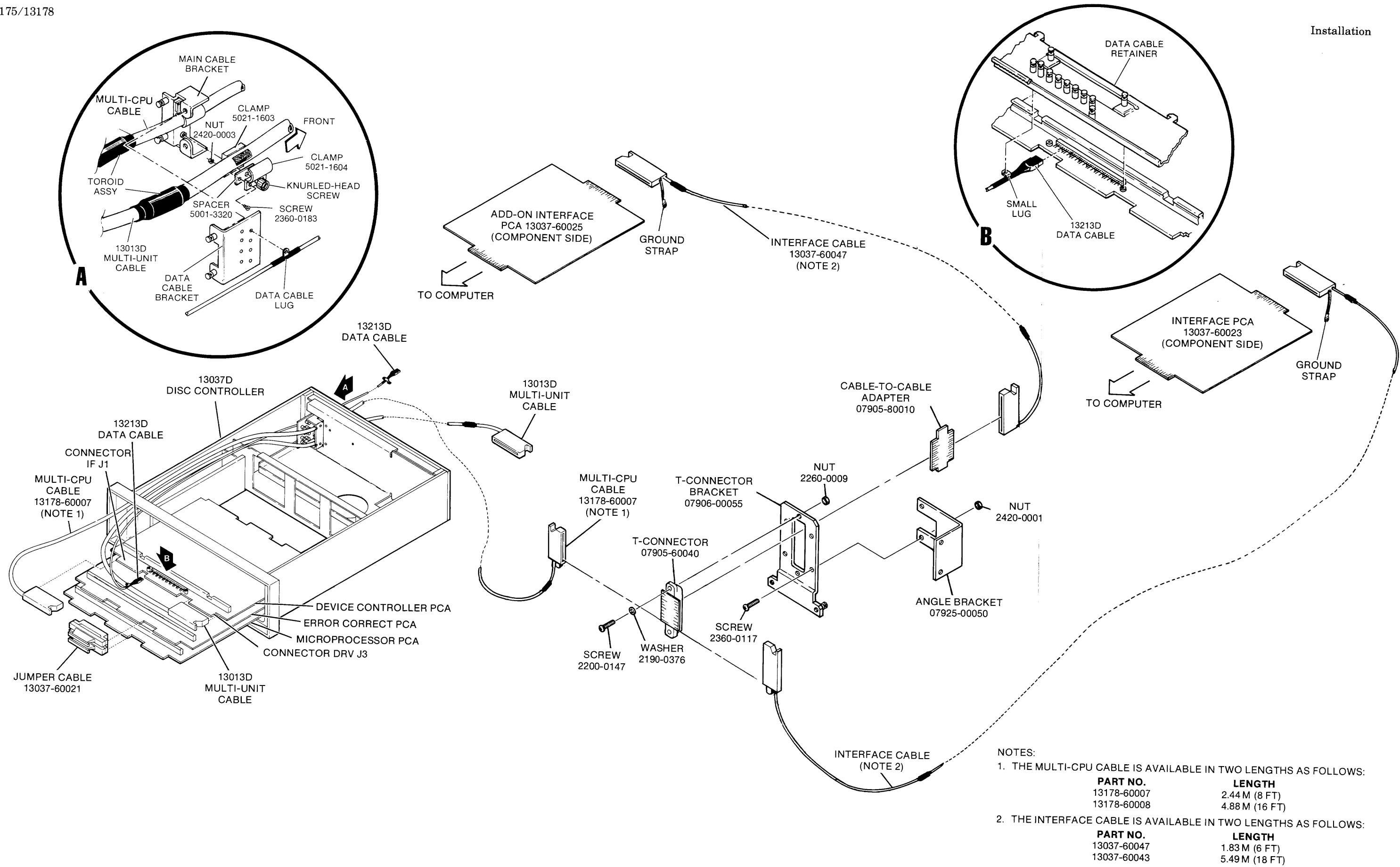
The HP 13037 Controller may be configured to operate with up to eight computers. One interface PCA is required to interface each computer to the controller. Before installing an interface PCA, ensure that it has the correct part number (refer to figure 2-4). Next, the current requirements must be computed (refer to paragraph 1-6) and the jumper configurations verified (refer to paragraphs 2-3 through 2-5).

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 in the computer according to the instructions in the appropriate computer manual.

For installations with two or more computers, the last computer in the chain must hold the interface PCA, part no. 13037-60023, while the others have the add-on interface PCA's, part no. 13037-60025. Check figure 2-4 to ensure that the interface PCA's have the correct part number.

2-7. CABLING

Interconnecting the interface PCA to the controller depends upon the system configuration. Cabling procedures for a single computer installation, a two computer installation, and a three to eight computer installation are provided in paragraphs 2-8 through 2-10.



- NOTES:
1. THE MULTI-CPU CABLE IS AVAILABLE IN TWO LENGTHS AS FOLLOWS:

PART NO.	LENGTH
13178-60007	2.44 M (8 FT)
13178-60008	4.88 M (16 FT)
 2. THE INTERFACE CABLE IS AVAILABLE IN TWO LENGTHS AS FOLLOWS:

PART NO.	LENGTH
13037-60047	1.83 M (6 FT)
13037-60043	5.49 M (18 FT)

Figure 2-3. Two Computer Configuration, Cabling Diagram

NOTES:

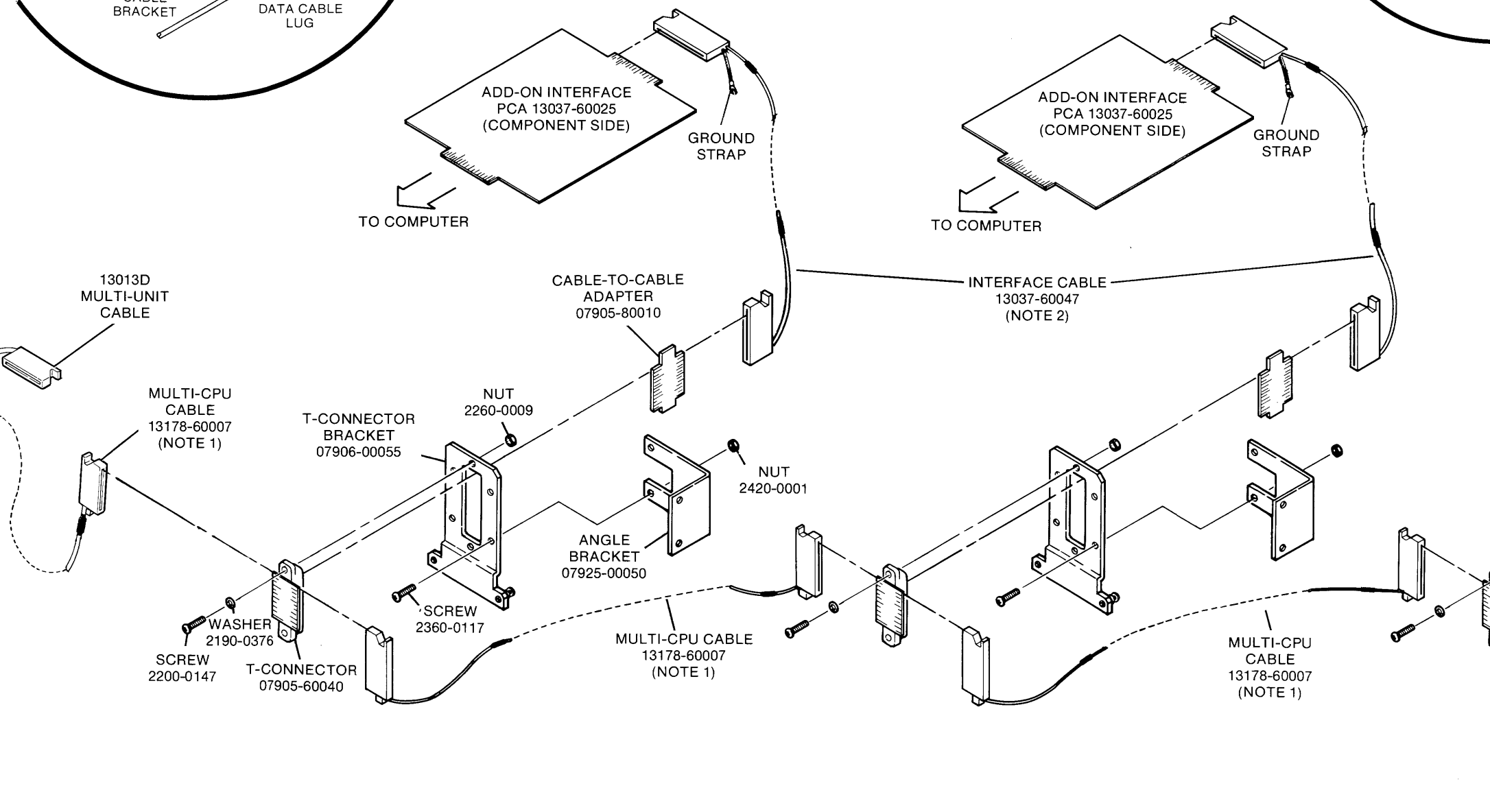
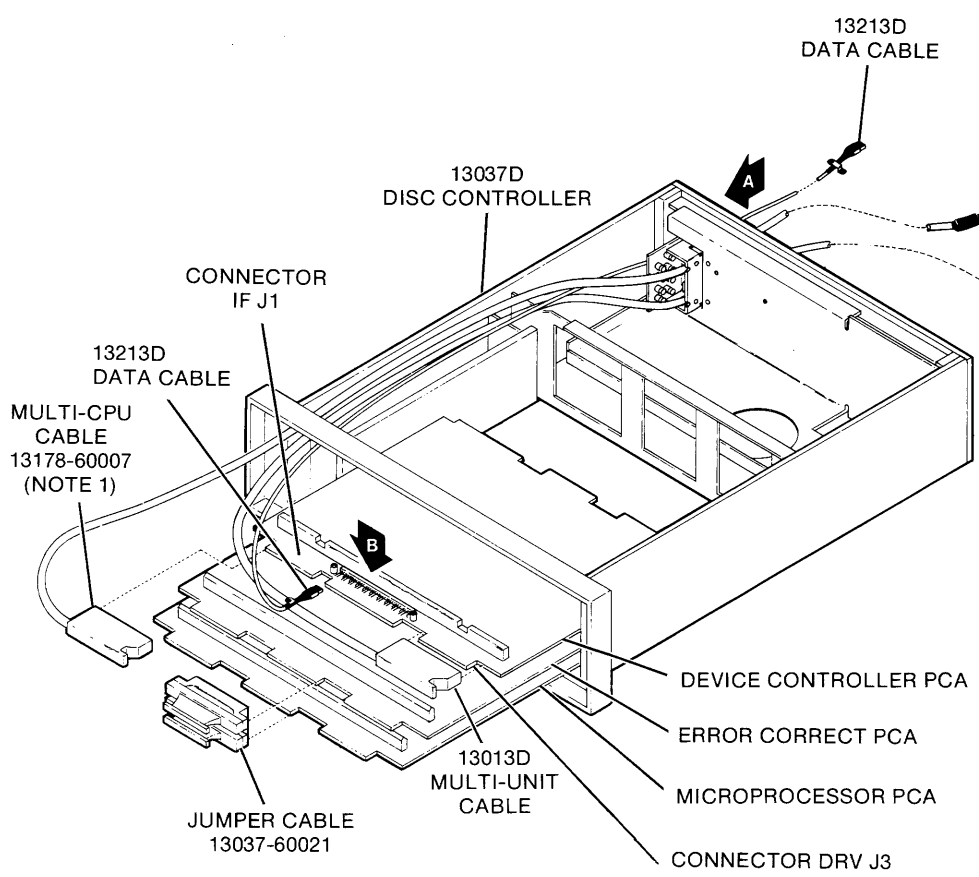
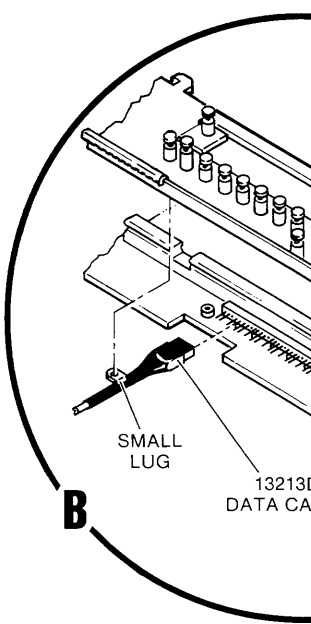
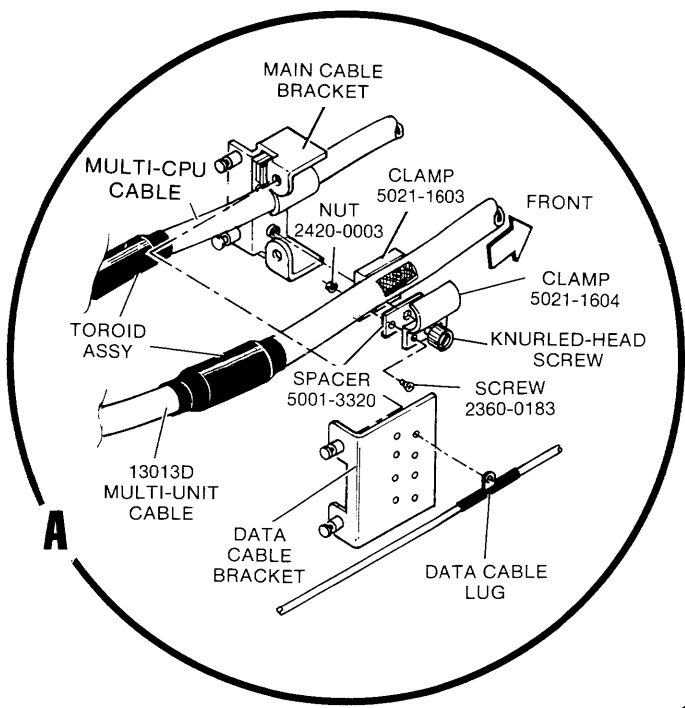
1. THE MULTI-CPU CABLE IS AVAILABLE IN TWO LENGTHS AS FOLLOWS:

PART NO.	LENGTH
13178-60007	2.44 M (8 FT)
13178-60008	4.88 M (16 FT)

2. THE INTERFACE CABLE IS AVAILABLE IN TWO LENGTHS AS FOLLOWS:

PART NO.	LENGTH
13037-60047	1.83 M (6 FT)
13037-60043	5.49 M (18 FT)

3. CABLING IS SHOWN FOR A THREE-INTERFACE SYSTEM. FOR ADDITIONAL INTERFACES, CONNECT THE 13178-60007 MULTI-CPU CABLE TO THE 07905-60040 T-CONNECTOR AND EXTEND SYSTEM AS SHOWN. THE LAST PCA IN THE CHAIN MUST BE THE INTERFACE PCA, PART NO. 13037-60023. THE OVERALL LENGTH OF THE CHAIN SHOULD NOT EXCEED 22.6 METRES (74 FEET).



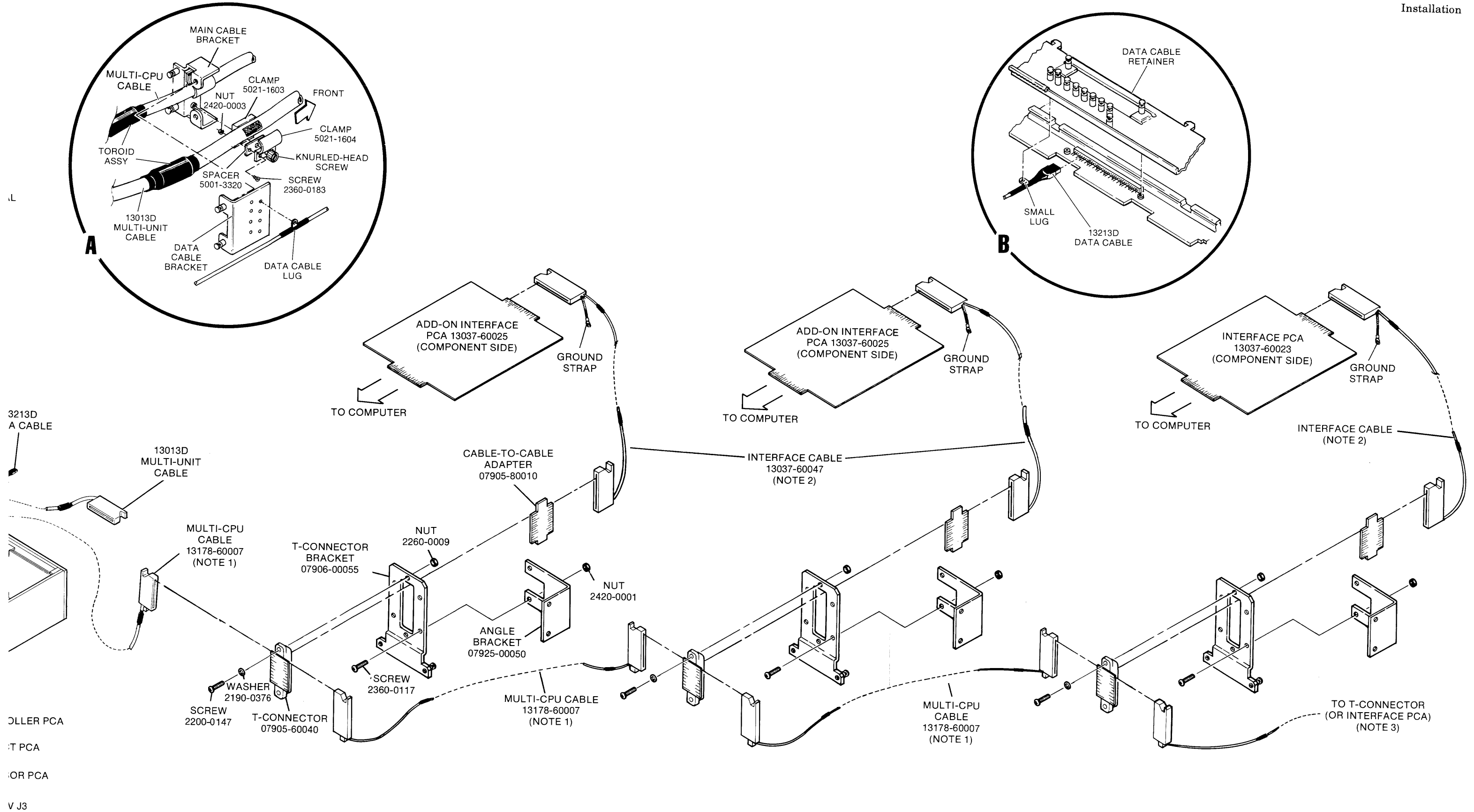


Figure 2-4. Three to Eight Computer Configuration, Cabling Diagram

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. Figure 3-1 is a block diagram representation of data transfer between the computer and disc drive via the interface PCA and controller. Paragraphs 3-2 through 3-22 provide a functional description of the interface PCA.

3-2. FUNCTIONAL DESCRIPTION

Figure 3-2 shows an overall functional logic diagram of the Interface PCA. Using figure 3-2, a block-level discussion is provided in the following paragraphs.

3-3. 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 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.

3-4. FUNCTION DECODING AND VALIDATION

The function decoding and validation circuit is responsible for decoding the four-bit Interface Function bus (IFN0-3) 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 3-6.

3-5. DATA BUS DRIVERS/RECEIVERS

The Interface Bus (IBUS0-15) 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.

3-6. 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 2-4.

Note: No two interfaces on the same system may contain the same combination of jumpers W1 through W3.

When the Select Interface (SELIF) function is validated, Interface bus bits 0-2 (IBUS0-2) 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 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.

3-7. FIFO BUFFER

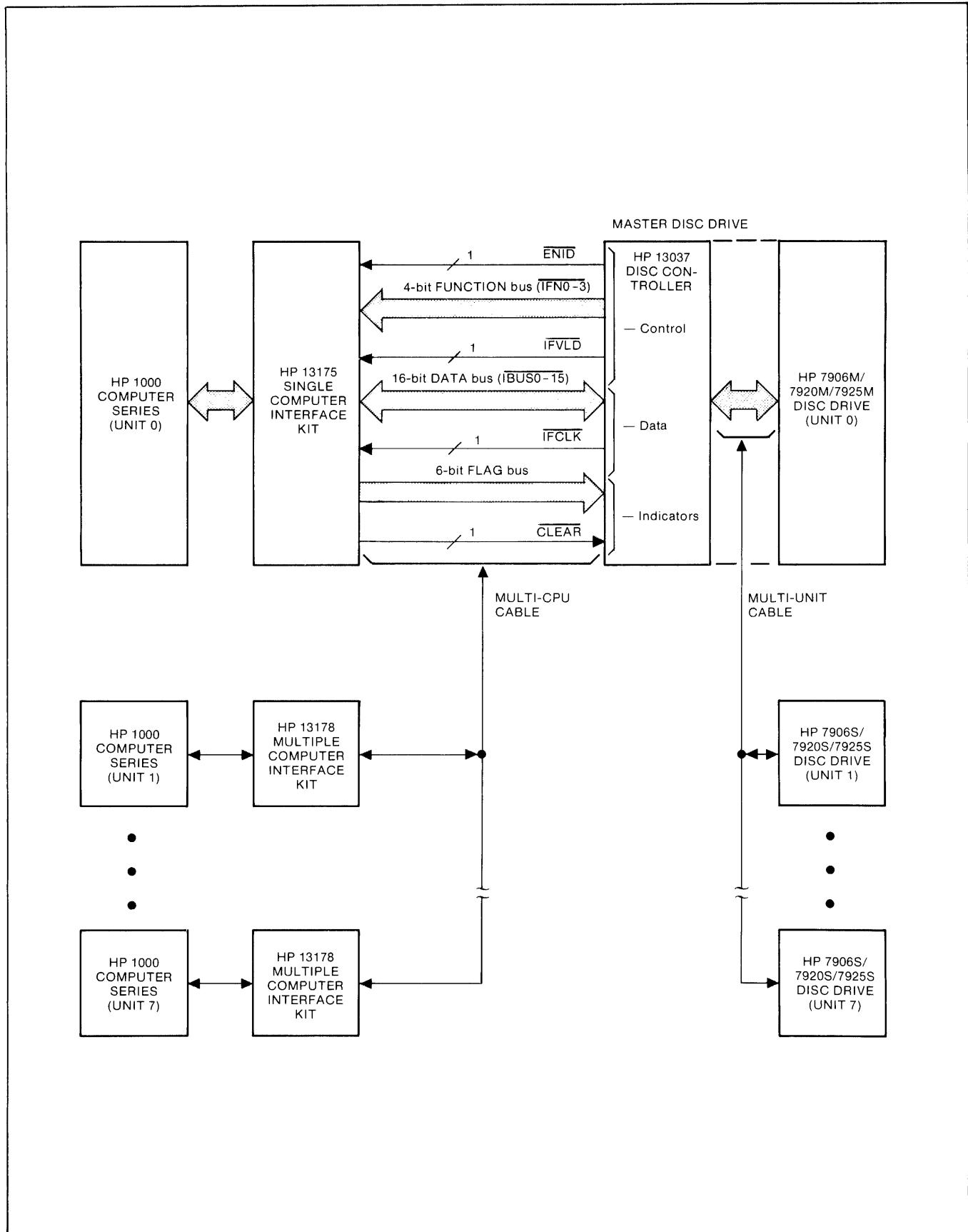
All commands and data passing between the computer and the controller go through the FIFO (First In-First Out) buffer. The FIFO can store up to 16 words, each 16 bits wide.

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.

3-8. FIFO SELECTOR/REGISTER

Since data passes through the FIFO in only one direction, the source of input data must be selected from



7305-7E

Figure 3-1. Interface PCA to Disc Controller, Block Diagram

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.

3-9. 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.

3-10. 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.

3-11. 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.

3-12. 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.

3-13. 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.

3-14. 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.

3-15. SERVICE REQUEST LOGIC

In a typical HP 1000 Computer 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.

3-16. 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.

3-17. 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.

3-18. 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.

3-19. CONTROL BIT LOGIC

The control bit, when set, allows computer interrupts to be generated if all other conditions for interrupt are met. (See paragraph 3-20.) 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.

Note: 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.

3-20. 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, F) or interrupt trap cell instruction is being executed. In addition, the PRL priority signal is passed on to lower priority devices.

3-21. 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.

3-22. 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.

3-23. SIGNAL DATA

Table 3-1 contains a description of the signal flow between the interface PCA and the controller. Table 3-2 is a wiring list for the interface cable connected between interface PCA connector J1 and device controller PCA connector IFJ1. Table 3-3 is a wiring list for the multi-CPU cable connected between the T-connector and device controller PCA connector IFJ1 in a multiple computer configuration. Table 3-4 gives signal and pin number assignments for interface PCA connector J1 and table 3-5 gives signal and pin number assignments for device controller PCA connector IFJ1.

Table 3-1. Interface PCA/Controller Signals

SIGNAL	DESCRIPTION
CLEAR	This signal is generated by passing the computer's Power-On Preset I/O (POPIO) signal to the controller whenever the preset jumper (see paragraph 2-4) is set to enable. The Clear signal resets the 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.
IBUS0-15	Interface Bus. Sixteen bit bi-directional data bus used to transmit all data information between the interface and controller.
ENID	Enable Interface Drivers. Allows interface drivers to place data on IBUS for transmission to the controller. Interface must have been previously selected.
ENIR	Enable Interface Receivers. Enables reception of data from IBUS on the interface.
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.
IFCLK	Interface Clock. Validates data and status word transfers word-by-word.
IFVLD	Interface Function Valid. Validates functions on the interface function bus. A function is valid only if this line is true.
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.
DTRDY	Data Ready. Held true whenever the FIFO buffer is not empty. Interface must be selected.
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.
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.
INTOK	Interrupt OK. True if interface is selected and the control bit is set.

Table 3-2. Interface Cable (Part Numbers 13037-60043 and 13037-60047), Wiring List

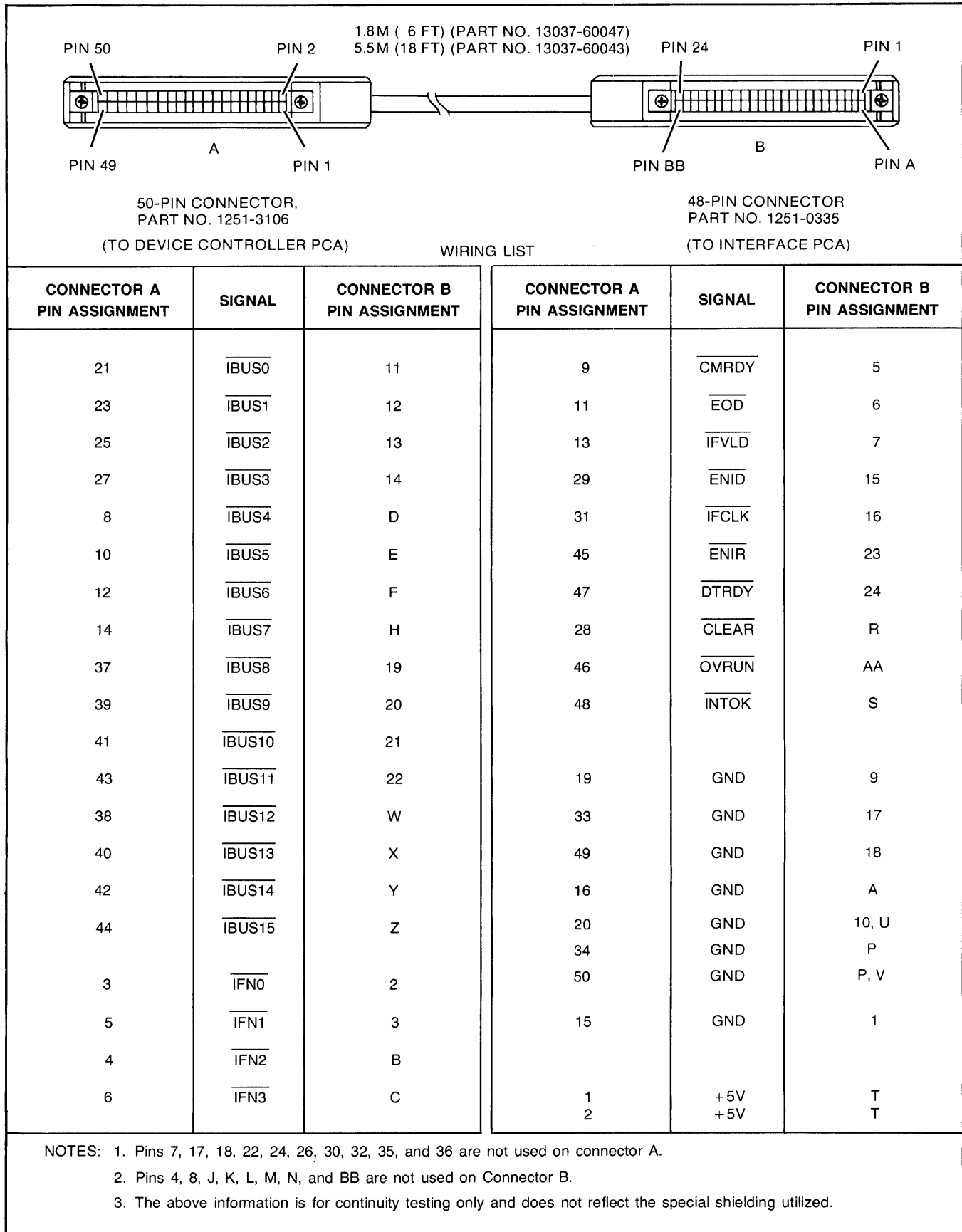
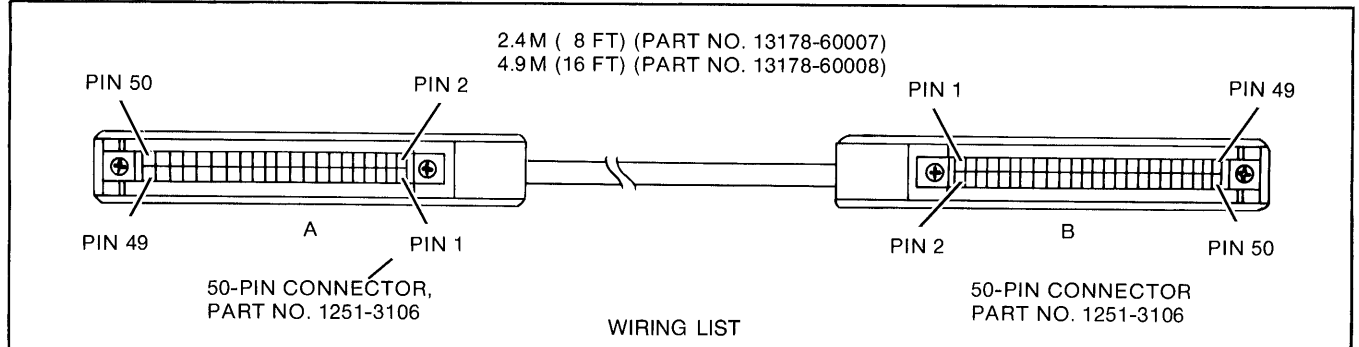


Table 3-3. Multi-CPU Cable (Part Numbers 13178-60007 and 13178-60008), Wiring List



CONNECTOR A PIN ASSIGNMENT	SIGNAL	CONNECTOR B PIN ASSIGNMENT	CONNECTOR A PIN ASSIGNMENT	SIGNAL	CONNECTOR B PIN ASSIGNMENT
21	$\overline{\text{IBUS0}}$	21	9	$\overline{\text{CMRDY}}$	9
23	$\overline{\text{IBUS1}}$	23	11	$\overline{\text{EOD}}$	11
25	$\overline{\text{IBUS2}}$	25	13	$\overline{\text{IFVLD}}$	13
27	$\overline{\text{IBUS3}}$	27	29	$\overline{\text{ENID}}$	29
8	$\overline{\text{IBUS4}}$	8	31	$\overline{\text{IFCLK}}$	31
10	$\overline{\text{IBUS5}}$	10	45	$\overline{\text{ENIR}}$	45
12	$\overline{\text{IBUS6}}$	12	47	$\overline{\text{DTRDY}}$	47
14	$\overline{\text{IBUS7}}$	14	28	$\overline{\text{CLEAR}}$	28
37	$\overline{\text{IBUS8}}$	37	46	$\overline{\text{OVRUN}}$	46
39	$\overline{\text{IBUS9}}$	39	48	$\overline{\text{INTOK}}$	48
41	$\overline{\text{IBUS10}}$	41			
43	$\overline{\text{IBUS11}}$	43	19	GND	19
38	$\overline{\text{IBUS12}}$	38	33	GND	33
40	$\overline{\text{IBUS13}}$	40	49	GND	49
42	$\overline{\text{IBUS14}}$	42	16	GND	16
44	$\overline{\text{IBUS15}}$	44	20	GND	20
			34	GND	34
3	$\overline{\text{IFN0}}$	3	50	GND	50
5	$\overline{\text{IFN1}}$	5	15	GND	15
4	$\overline{\text{IFN2}}$	4			
6	$\overline{\text{IFN3}}$	6	1	+5V	1
			2	+5V	2

NOTES: 1. Pins 7, 17, 18, 22, 24, 26, 30, 32, 35, and 36 are not used.
2. The above information is for continuity testing only and does not reflect the special shielding utilized.

Table 3-4. Interface PCA Connector J1
Pin Assignments

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

Table 3-5. Device Controller PCA Connector IFJ1
Pin Assignments

IFJ1 PIN	SIGNAL	IFJ1 PIN	SIGNAL
1	+5V	2	+5V
3	IFN0	4	IFN2
5	IFN1	6	IFN3
7	NOT USED	8	IBUS4
9	CMRDY	10	IBUS5
11	EOD	12	IBUS6
13	IFVLD	14	IBUS7
15	GND	16	GND
17	NOT USED	18	NOT USED
19	GND	20	GND
21	IBUS0	22	+5V
23	IBUS1	24	NOT USED
25	IBUS2	26	NOT USED
27	IBUS3	28	CLEAR
29	ENID	30	NOT USED
31	IFCLK	32	NOT USED
33	GND	34	GND
35	+5V	36	+5V
37	IBUS8	38	IBUS12
39	IBUS9	40	IBUS13
41	IBUS10	42	IBUS14
43	IBUS11	44	IBUS15
45	ENIR	46	OVRUN
47	DTRDY	48	INTOK
49	GND	50	GND

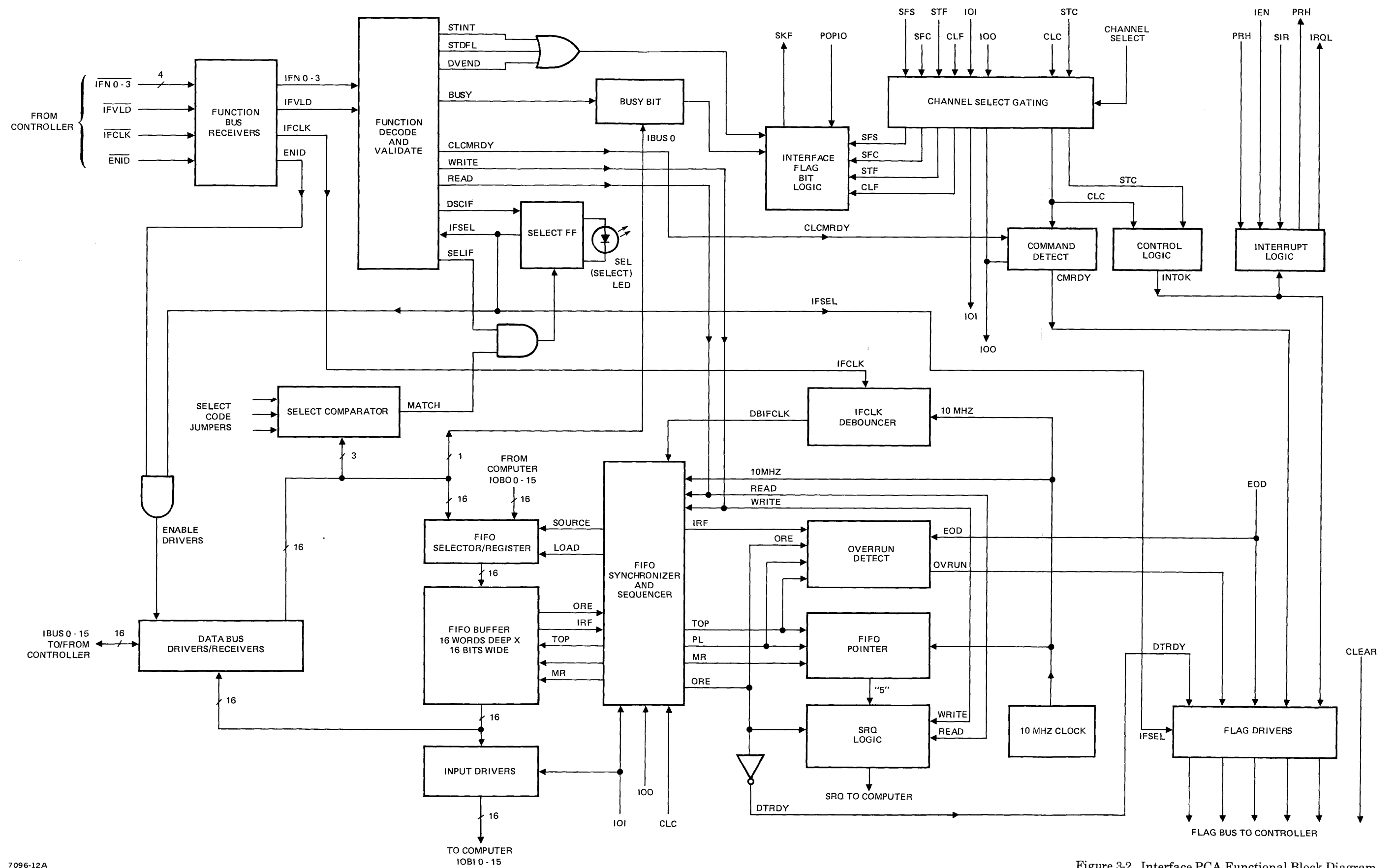


Figure 3-2. Interface PCA Functional Block Diagram

4-1. INTRODUCTION

This section provides safety precautions, preventive maintenance instructions, troubleshooting and diagnostic test information.

4-2. SAFETY PRECAUTIONS

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

- Observe all WARNING and CAUTION labels affixed to the device being tested.
- Use extreme caution when working on a device with the covers removed, since hazardous line voltage is present within the mainframe.
- Remove watches, rings, or other such jewelry before working on a device.
- Do not attempt to remove or change PCA's or interconnecting cables without first removing power from all devices.

4-3. PREVENTIVE MAINTENANCE

Preventive maintenance should be performed at scheduled intervals to prevent or minimize performance degradation. Preventive maintenance consists of inspecting, cleaning and verifying performance of the interface PCA's. Inspect interface cables and connectors for cracks, burns, or wear at yearly intervals. Ensure that interface PCA's are properly seated.

4-4. TROUBLESHOOTING

Troubleshooting consists of performing the diagnostic test as described in paragraph 4-5. Malfunctions can be isolated to a replaceable assembly when performing the diagnostic. The suspected faulty assembly should be replaced and the diagnostic test continued until the malfunction is cleared.

If required, additional disc drive and controller troubleshooting may be performed. For disc drives, a disc

service unit (DSU) is available and operating procedures are given in the appropriate service documentation (refer to paragraph 1-7). For the controller, service information is given in the *HP 13037D Disc Controller Installation and Service Manual*, part no. 13037-90911, or *HP 13037B/C Disc Controller Installation and Service Manual*, part no. 13037-90006.

In a multiple computer system, each computer should be tested individually. However, if the interface PCA, part no. 13037-60023, is found to be faulty then an exact replacement must be used in order to maintain proper termination. The Add-On Interface PCA, part no. 13037-60025, should never be substituted.

4-5. DIAGNOSTIC TEST

The *HP 79XX/13037 Disc Memory Diagnostic*, part no. 12962-16001, and the HP 24296A Diagnostic Configurator, part no. 24296-60001, are required to check the system. *The Diagnostic Configurator Reference Manual*, part no. 02100-90157, is required to configure the diagnostic configurator.

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

Step-by-step instructions for loading the diagnostic program and running the diagnostic test are given in the *HP 79XX/13037 Disc Memory Diagnostic Reference Manual*, part no. 12962-90001.

4-6. REPLACEMENT PROCEDURES

If the interface PCA must be removed from the computer, refer to the removal instructions in the appropriate computer manual.

Replacement of the interface PCA is accomplished by reversing the removal procedure. Be sure to configure the interface PCA jumpers as described in paragraph 2-3 if a replacement interface PCA is being installed.

