HEWLETT PACKARD

HP 12016A SCSI Host Bus Adapter Card

Installation and Reference Manual

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HP Computer Museum
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Connect only apparatus complying with BS 6301 to the ports marked with the above warning.

Safety Considerations

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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 (sometimes used in manual to indicate circuit common connected to grounded chassis).

Explanation of Caution

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.

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Printing History

The Printing History below identifies the edition of this manual and any updates that are included. Periodically, update packages are distributed which contain replacement pages to be merged into the manual, including an updated copy of this printing history page.

Each reprinting of this manual will incorporate all past updates; however, no new information will be added. Thus, the reprinted copy will be identical in content to prior printings of the same edition with its user-inserted update information. New editions of this manual will contain new information, as well as all updates.

To determine which manual edition is compatible with your current software revision code, refer to the M92077 Manual Numbering File that is included with your RTE-A software.

First Edition	Jul 1990	
Update 1	Aug 1990	Manual reprinted to include Update 1
Update 2	Sep 1990	
Second Edition	Sep 1991	Add SCSI Boot Chapter
Third Edition	Dec 1992	Rev. 6000 (Software Update 6.0)

Preface

This manual describes how to install the SCSI hardware and software, and how to use the product.

Please read the README file on the software media that comes with the product for information about software revisions and software media part numbers, and for descriptions of additional software.

Throughout the manual, the term "SCSI Card" is used for the phrase "Hewlett-Packard 12016A Small Computer Systems Interface Host Bus Adapter Card". The term "Host" refers to an HP 1000 A-Series Computer System.

A glossary has been added to the rear of the manual to aid in understanding the terms used throughout the manual. Refer to the index, following the glossary, as an aid to locating information in the manual by topic.

Note that, at this revision of the manual, the programming information that was in Chapter 5 has been moved to the *RTE-A Driver Reference Manual*, part number 92077-90011. Please refer to that manual for detailed information regarding the SCSI drivers.

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General SCSI Information

This chapter introduces the HP 12016A Small Computer System Interface Host Bus Adapter Card (hereafter referred to as the SCSI Card) and contains the following information:

- An overview of the SCSI Card.
- A list of the equipment provided with the card.
- Tested products.
- Manuals and guides related to the host system (the HP 1000 A-Series Computer system).
- Product specifications.

The README file on the software media that comes with the SCSI product contains information about software revisions and software media part numbers, and descriptions of additional software.

SCSI Card Overview

The SCSI Card connects SCSI or SCSI-II compatible peripheral controllers to an HP 1000 A-Series computer. You can connect up to seven controllers for disk drives, magnetic tape drives, printers and other peripherals to the SCSI Card. The SCSI Card supports both single-ended and differential SCSI bus configurations.

The RTE-A Operating System controls concurrent SCSI peripheral transactions on multiple buses while maintaining compatibility with non-HP peripherals. Testing has not been performed on all possible SCSI peripherals and software device drivers; however, many peripherals and device drivers that conform to the current state of the SCSI specifications are compatible with the SCSI Card.

Connection to Peripherals

The standard SCSI card comes with a single-ended, two-meter cable that connects the SCSI interface card to the SCSI bus. The A-Series end of the cable connects to the card (connector P3) with an 80-pin female printed circuit edge connector; the other end of the cable connects to a 50-pin D-type connector on the SCSI bus.

Some SCSI devices require a differential bus that is supplied by HP 12016A option 001. The single-ended cable does not come with this option. Option 001 includes a cable that connects to differential devices and uses a 50-pin D-type connector. It also includes the differential bus terminator that must be used on a differential bus.

You cannot mix single-ended and differential devices on the same SCSI interface. If you want to connect both single-ended and differential devices, you need two SCSI Cards.

Appendixes B, C, and D describe the pin-to-signal designations for the single-ended cable, differential cable, and card connector P3, respectively.

Software

The SCSI Card and software are compatible with HP 1000 A-Series Computers operating under the RTE-A Operating System (revision 5010 or later).

Three drivers come with the SCSI Card. The interface driver, IDQ35, couples the SCSI Card to the RTE-A Operating System. The disk device driver, DDQ30, generates the device-dependent commands required to support HP disks. A generation record file, DDQ30_GEN, provides the default generation records for products supported by the DDQ30 device driver. The tape device driver, DDQ24, generates tape device commands and DDQ24_GEN provides the default generation records for products the DDQ24 driver supports. You must install at least one device driver in order for the interface to communicate with the devices.

Note All Optical Disks must be formatted prior to use on an HP 1000 computer. You can use the online verification program, VSCSI, to format disks, as described in Chapter 4.

You can write your own special device drivers to connect the devices. This manual and the disk device driver source code file DDQ30.MAC contain the information necessary to write your own device drivers. In addition, you can contract with Hewlett-Packard to obtain any necessary consulting to write device drivers. However, Hewlett-Packard assumes no responsibility for user-written device drivers.

Equipment Checklist

There are two SCSI Card configurations, one for standard (single-ended) devices and one for differential devices. You cannot mix single-ended and differential devices on one SCSI interface card. The standard HP 12016A SCSI Card product is supplied with the following hardware:

- SCSI Interface Card, part number 12016-60101.
- SCSI Interface Cable, part number 12016-60002.
- Cable Terminator, part number 1252-3251.
- Fuse, part number 2110-0517, 2 amps, 125 volts. This extra fuse is provided in case the on-board fuse opens.
- *HP 12016A SCSI Host Bus Adapter Card Installation and Reference Manual*, part number 12016-90001 (this manual).

The HP 12016A SCSI Interface product, option 001 (for differential target devices), is supplied with the following hardware:

- SCSI Interface Card, part number 12016-60101.
- SCSI Interface Differential Cable, part number 12016-60003.
- Differential Cable Terminator, part number 12016-80003.
- Fuse, part number 2110-0517, 2 amps, 125 volts. This extra fuse is provided in case the on-board fuse opens.
- *HP 12016A SCSI Host Bus Adapter Card Installation and Reference Manual*, part number 12016-90001 (this manual).

You can order four different types of additional connecting cables with the SCSI product. Connecting cables HP 92222A (.5 meters / 1.6 feet), HP 92222B (one meter / 3.3 feet) and HP 92222C (2 meters / 6.6 feet) connect SCSI peripheral devices to each other. These three cables connect (daisy chain) one SCSI device to another SCSI device.

The fourth type of cable you can order is a one meter (3.3 feet) extender cable, product number HP 92222D. This cable connects to the SCSI cable itself to extend its length. It does not interconnect SCSI devices.

The SCSI Card has two software media options as follows. Each media option includes an Interface Driver (IDQ35), supported device drivers, and an online verification program (VSCSI). For more information, please read the README file on the software media.

Option	Description
022	CS/80 Cartridge Tape
051	1600 BPI Magnetic Tape

All of the media options contain the following drivers and verification program:

IDQ35.REL	SCSI Interface Driver IDQ35 (Relocatable).
DDQ30.REL	Disk Device Driver (Relocatable).
DDQ30.MAC	Disk Device Driver (Source Code).
DDQ30_GEN.REL	Disk Generation Records (Relocatable).
DDQ30_GEN.MAC	Disk Generation Records (Source).
DDQ24.REL	Tape Device Driver (Relocatable).
DDQ24_GEN.REL	Tape Generation Records (Relocatable).
VSCSI.REL	Online Verification Program (Relocatable).
VSCSILIB.REL	Macro/1000 support routine.
ZRAMTST.HEX	Downloaded Z180 RAM test.
ZLPBK.HEX	Downloaded Z180 Loop Back test.
SCSI.SNF	SCSI software numbering file.
README	A file that contains a description of additional software provided with the SCSI product and information about software media part numbers and software revisions. The software is from RTE-A and other subsystems that complement the SCSI device.

The disk device driver source code and relocatable, as listed above, are included to provide an example of a SCSI device driver to help you write your own driver(s).

Tested Peripheral Devices and Supported Drivers

Table 1-1 lists the tested peripherals and the supported SCSI drivers.

Table 1-1. Tested Peripherals and Supported SCSI Drivers

Peripheral Device		Supported Device in Enclosure Specified in First Column		Interface Driver	Device Driver
C1503B C1512A C1520B 7980S 7980XS	DAT Tape Drive – 2.0 Gigabyte DAT Tape Drive – 1.3 Gigabyte DAT Tape Drive – 2.0 Gigabyte 1/2-Inch Tape Drive 1/2-Inch Tape Drive			IDQ35	DDQ24
C1701A	Magneto-Optical Disk Drive			IDQ35	DDQ30
Device and Enclosure Type				IDQ35	DDQ30
C2212A C2213A	330 MB Disk Drive in rack-mountable enclosure 660 MB Disk Drive in rack-mountable enclosure	C2290A C2291A C2292A C2294A C2295B C2297A	330 MB Disk Upgrade Kit 660 MB Disk Upgrade Kit 1.3 GB DDS (DAT) Upgrade Kit 650 MB Magneto-Optic Upgr. Kit 1.3 GB Disk Upgrade Kit 2.0 GB DDS (DAT) Upgrade Kit		
C2214B	670 MB Disk Drive in rack-mountable enclosure	C2292A C2294A C2295B C2297A	1.3 GB DDS (DAT) Upgrade Kit 650 MB Magneto-Optic Upgr. Kit 1.3 GB Disk Upgrade Kit 2.0 GB DDS (DAT) Upgrade Kit		
C2216T C2217T	670 MB Disk Drive in mini-tower enclosure 1.3 GB Disk Drive in mini-tower enclosure	C2292T C2294T C2297T C2473T C2474T	1.3 GB DDS (DAT) Upgrade Kit 650 MB Magneto-Optic Upgr. Kit 2.0 GB DDS (DAT) Upgrade Kit 670 MB Disk Upgrade Kit 1.3 GB Disk Upgrade Kit		
C2460F C2461F C2462F	422 MB Disk Drive in mini-tower enclosure 670 MB Disk Drive in mini-tower enclosure 1.3 GB Disk Drive in mini-tower enclosure	C2472F C2473F C2474F C2475F C2477F	422 MB Disk Upgrade Kit 670 MB Disk Upgrade Kit 1.3 GB Disk Upgrade Kit 1.3 GB DDS (DAT) Upgrade Kit 2.0 GB DDS (DAT) Upgrade Kit		
C2460R C2461R C2462R	422 MB Disk Drive in rack-mountable enclosure 670 MB Disk Drive in rack-mountable enclosure 1.3 GB Disk Drive in rack-mountable enclosure	C2472R C2473R C2474R C2475R C2477R	422 MB Disk Upgrade Kit 670 MB Disk Upgrade Kit 1.3 GB Disk Upgrade Kit 1.3 GB DDS (DAT) Upgrade Kit 2.0 GB DDS (DAT) Upgrade Kit		
C2481A C2482A	670 MB Differential Disk Drive in mini-tower enclosure 1.3 GB Differential Disk Drive in mini-tower enclosure	C2491A C2492A	670 MB Differential Disk Upgrade Kit 1.3 GB Disk Differential Disk Upgrade Kit		

Related Manuals

The following technical documents associated with the HP 1000 computer are available from Hewlett-Packard.

RTE-A System Generation and Installation Manual, part number 92077-90034.

HP 1000 A-Series Computer I/O Interfacing Guide, part number 02103-90055.

RTE-A Programmer's Reference Manual, part number 92077-90007.

RTE-A Driver Reference Manual, part number 92077-90011.

RTE-A Driver Designer's Manual, part number 92077-90019.

Computer reference manual for your HP 1000 computer.

Schematics, parts lists, and serviceable parts lists are not provided in this manual because the SCSI Card is a Field Replaceable Unit (FRU).

Specifications

This section describes the physical and environmental specifications for the SCSI Card. This section also contains a list of national and international regulatory approvals.

Physical Specifications

Dimensions:

Length:	28.9 cm (11.38 inches)
Width:	17.2 cm (6.75 inches)
Weight:	720 gm (25.3 ounces)

Standards:

Conforms to Hewlett-Packard's implementation of HP SCSI.

Electrical

Power Requirements:

1.0 A at 5.1 V, 5.1 W (includes TERMPOWER)
15 ma at +12 V, 0.18 W
15 ma at −12 V, 0.18 W

Power Source:

This product generates termination power. It is designed to supply the power to the termination network at each end of the cable. The termination network at the computer end is integrated onto the card. The power available to the user is greater than 4.5 V at up to 0.5 A.

Maximum Bus Data Rate

2.56 megabytes per second

Environmental Specifications

The SCSI Card meets or exceeds the specifications of its HP 1000 host computer. Refer to the installation and service manual for your computer.

Temperature

Operating	0 to 55 degrees C
Storage	−40 to 75 degrees C
Relative Humidity	5% to 95% noncondensing

Altitude

Operating	To 4.6 km (14,088 ft)
Non-Operating	To 15.3 km (50,284 ft)

Regulatory Approvals

The SCSI Card meets or exceeds the following EMI and safety standards when correctly installed in an HP 1000:

FCC Class A	(USA EMI)
VDE Level A	(Germany EMI)
CISPR22 Class A	(International EMI)
UL 478	(USA Safety)
CSA 220	(Canada Safety)
IEC 380	(International Safety)

2

Hardware Installation

This chapter describes how to install the HP 12016A SCSI Card and also describes the SCSI Card self-test. Installation procedures include checking the product for shipping damage and completeness, setting the switches, installing the card, and connecting the cables. Customers who follow the step-by-step instructions in this chapter can install the SCSI Interface hardware. Customers who do not wish to install the card can contact the local HP sales office for assistance.

Caution Wear an anti-static wrist strap connected to a ground during *all* phases of handling and installing the SCSI Card. Failure to wear properly grounded anti-static wrist straps will result in static electricity damaging components on the card.

Pre-Installation Tasks

This section describes shipment receiving procedures and how to return the product, if necessary.

Unpacking and Inspecting the SCSI Card

Always wear properly grounded anti-static wrist straps when you handle the SCSI Card. Inspect the shipping cartons for visible damage. If visible damage exists, immediately submit a damage report to the carrier company and to Hewlett-Packard (or an authorized HP dealer). Follow the repacking procedures described later in this chapter to return the card, if necessary.

Make sure that the shipment you receive agrees with the product list on the shipping documents and that the contents of the cartons match the parts listed in Chapter 1 under the heading "Equipment Checklist." If any items are not included, immediately notify your local Hewlett-Packard sales and service office.

Reshipping Instructions

If it is necessary to reship the SCSI Card, contact your nearest HP Sales and Support Office to coordinate the product's return. Attach a tag to the card explaining the reason for returning the product. Include your computer's model number and full serial number on the tag. Mark the shipping container "FRAGILE" to ensure careful handling. In any follow-up correspondence, please refer to your computer by model and serial number.

If possible, use the original packing material. If the original packing material is not available, use a commercially available anti-static shipping package, or purchase one from your nearest HP Sales and Support Office.

Installation Procedures

This section describes how to install the SCSI Card in your system. Figure 2-1 shows a typical SCSI Card installation in an HP 1000 computer.

Required Tools

To install the SCSI Card, all you need are the tools necessary to open the back door of your computer.

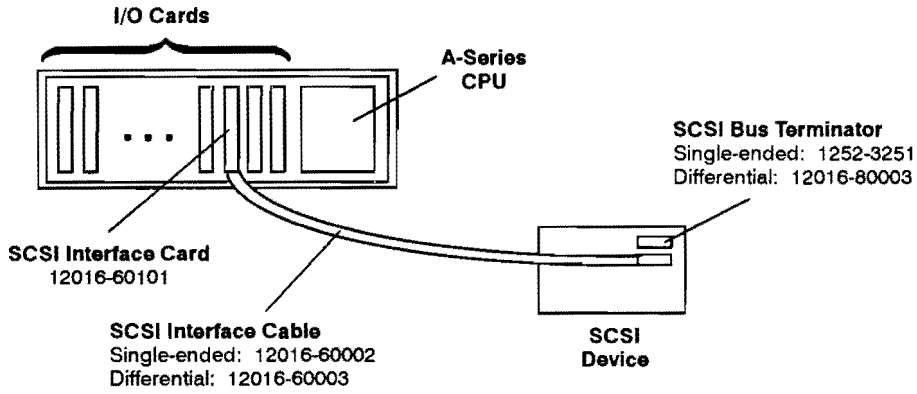
Power Budgeting

All cards installed in the HP 1000 computer put a load on the computer power supply. The SCSI Card draws 1.0 ampere at 5.1 volts. To ensure that the additional power drawn by the SCSI Card is within the power budget of your computer, refer to the installation and reference manual for your computer to find the computer's power supply limits.

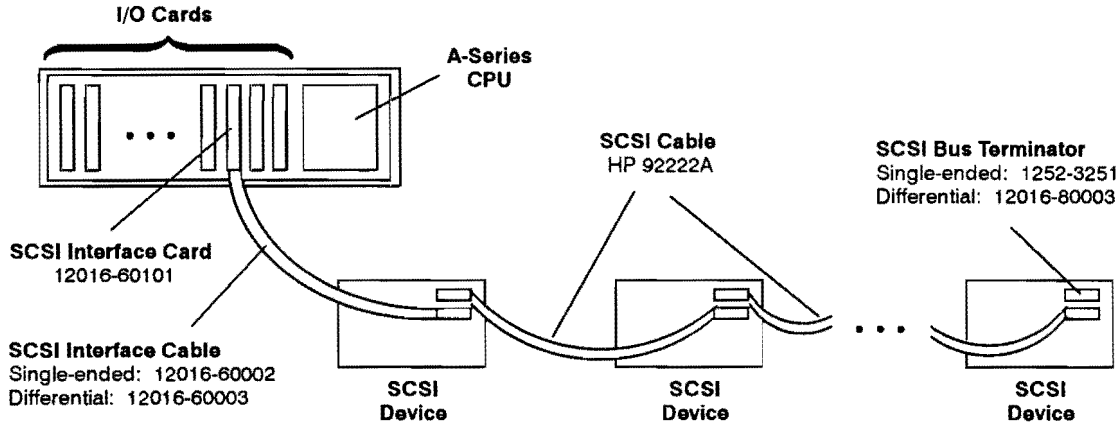
SCSI Card Layout

Figure 2-2 shows the layout of the SCSI Card, including the locations of the switches, the on-board fuse, the SCSI firmware PROM, the self-test LEDs (Light Emitting Diodes) and edge connectors P1, P2, and P3. Use this diagram to locate the switches you need to set before you install the SCSI card.

Do not use the modular jack shown in Figure 2-2. The modular jack is for Hewlett-Packard testing only, not for customer use. If you connect a telephone to this jack, you can damage the SCSI Card.



Single Device Configuration



Multiple Device Configuration

Notes:

1. The above diagrams show typical installations of the SCSI card in a 20-slot box configuration. The SCSI card can be installed similarly into a 6-slot or 16-slot box.
2. Only one SCSI card is shown in each computer. Multiple SCSI cards can be installed in the backplane in any priority slot.
3. The first I/O slot to the right of the CPU for an A900 configuration is not shown although the SCSI card is supported in that slot.

Figure 2-1. SCSI Card Typical Installation

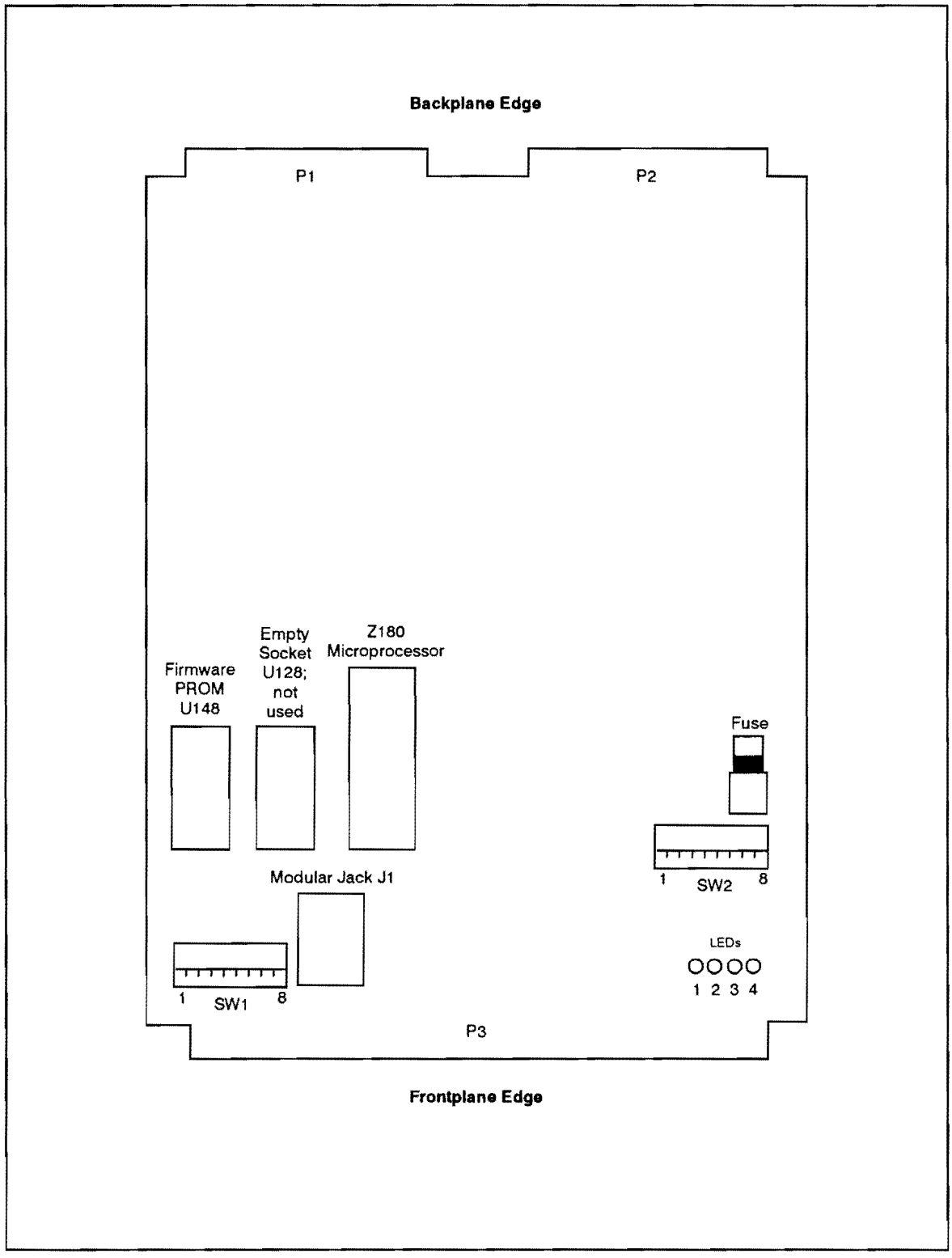


Figure 2-2. SCSI Card Layout

Switch Settings

This section describes how to set the two SCSI Card switches that specify the card's select code, address, and enable bus termination power.

Caution Wear a properly grounded anti-static wrist strap during *all* phases of handling and installing the SCSI Card. Failure to wear properly grounded anti-static wrist straps will result in static electricity damaging components on the card.

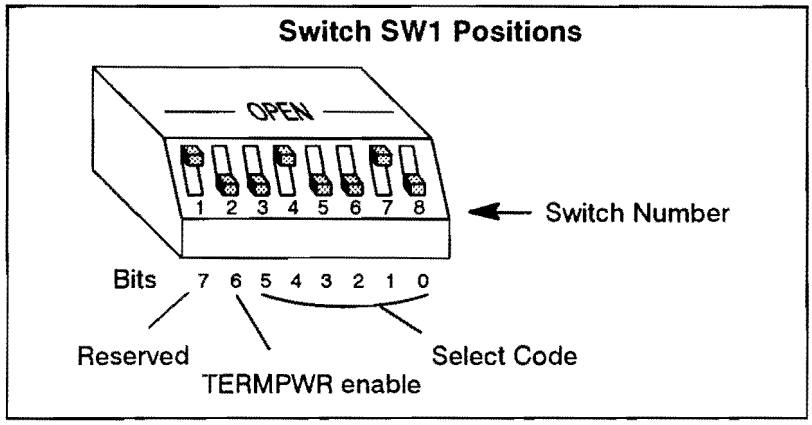
The SCSI Card has two 8-position switches. Switch SW1 specifies the select code of the card and enables SCSI bus TERMPWR (bus termination power) from the card. Switch SW2 defines the card's SCSI address. *Before* you install the card, set these two switches. The open (up) position = 1. The closed (down) position = 0. Figure 2-3 shows an example of switch settings for SW1 and Figure 2-4 shows an example of switch settings for SW2.

Setting Switch SW1

Configure the eight switches on SW1 as follows:

SW1-1	Reserved, must be in the open (up) position.
SW1-2	Leave in closed (down) position to enable TERMPWR from the card. When SW1-2 is in the down position, the SCSI Card supplies the voltage for the SCSI bus terminators. If you open this switch (up position), the SCSI Card does not supply TERMPWR. In this case, another device on the SCSI bus *must* supply TERMPWR. Only *one* device on the SCSI bus should supply TERMPWR.
SW1-3 through 8	Specifies the card's interface select code. You cannot have duplicate select codes in the backplane. Ensure that the select code you specify here is unique. Switch 3 of SW1 is the most significant bit. Switch 8 is the least significant bit. All interface cards must have unique I/O select codes ranging from 20 to 77, inclusive. However, note that for the A400 computer, the on-board I/O is hardwired to select code 77.

Figure 2-3 shows reserved switch SW1-1 in the open (up) position and SW1-2 in the closed (down) position. Switches SW1-3 through 8 specify the SCSI Card's select code. In this case, the example select code is 22 octal (switches 4 and 7 are open). This select code is only an example; the select code you use may differ. If you want to boot automatically from SCSI on power up, the select code should be 27. Make sure that no other interface card in your system uses this select code.



Switch Number	1	2	3	4	5	6	7	8
Octal Value			40	20	10	4	2	1

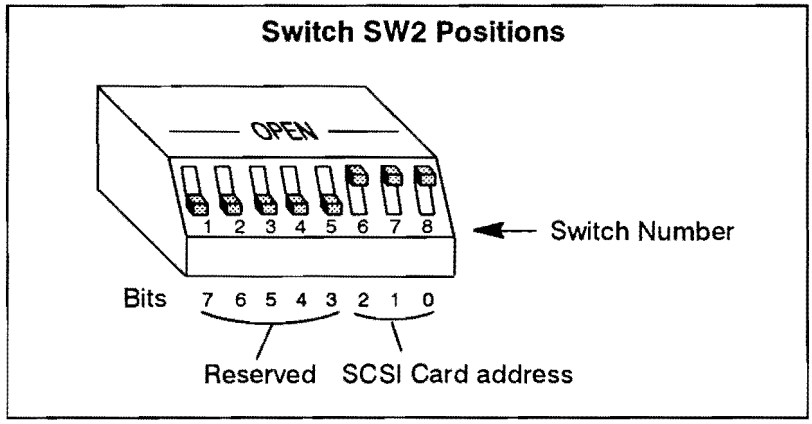
Figure 2-3. SW1 Settings

Setting Switch SW2

Configure the eight switches on SW2 as follows:

SW2-1 through 5 — Reserved, leave in closed (down) position.

SW2-6 through 8 — These three switches determine the SCSI Card address. Switch 8 is the least significant bit. For a single initiator system (a card with one host computer and one to seven peripherals), the recommended setting is 7, as shown in Figure 2-4 (Switches 6 through 8 are open).



Switch Number	1	2	3	4	5	6	7	8
Octal Value						4	2	1

Figure 2-4. SW2 Settings

SCSI Card On-Board Fuse

The SCSI Card has a customer replaceable, two ampere, 125 V on-board fuse, part number 2110-0517, to protect the card from shorts on the SCSI bus. See Figure 2-2 for the location of the fuse on the SCSI Card. Hewlett-Packard provides an extra fuse with the SCSI product (both the single-ended and differential versions) for your convenience.

This fuse can open if power is not turned off while you are connecting a cable to the device. This is one reason why it is very important to ensure that all power is off when you install the SCSI card and its cables, including power to all peripheral controllers on the SCSI bus.

The SCSI Card fuse is socketed so that it can be replaced easily.

Card Installation

This section describes how to install the SCSI Card in an HP 1000 computer.

Warning High current may be present. Failure to turn off power before opening the computer may allow contact with energy that may result in personal injury.

Caution Turn off power to the computer before installing the interface card and cables. If there is a battery BACKUP switch, set it to DISABLE. Failure to turn the power off and disable the battery BACKUP switch may result in damage to the interface card or attached I/O device.

Wear a properly grounded anti-static wrist strap during *all* phases of handling and installing the SCSI Card. Failure to wear properly grounded anti-static wrist straps will result in static electricity damaging components on the card.

Take the following steps to install the SCSI Card:

1. Turn the computer's power OFF (0) at the LINE ON/OFF switch and disconnect the power cord. Check for a battery backup switch and set it to DISABLE.
2. Remove or open the back door of your HP 1000 computer.
3. After setting the appropriate switches according to the previous instructions, slide the interface card into a slot in your computer's I/O backplane. The card's components should face upward or to the right, depending on whether your computer has vertically or horizontally oriented slots. Make sure that you *do not leave any empty slots above or to the right of the last I/O card in the backplane*. Empty slots between cards break the DMA (Direct Memory Access) and interrupt priority chains. The closer the card is to the CPU (by ascending slot order), the higher its DMA and interrupt priorities.

4. Firmly and evenly press the card into the backplane until edge connectors P1 and P2 slide completely into the backplane edge connectors. Figure 2-2 shows the locations of edge connectors P1 and P2. Ensure that the extractor handles facing the computer's back door do not bind on the card cage.

5. Replace the back door if you are not going to install the cables at this time. If you are going to install the cables now, leave the back door open and follow the steps described in the "Cable Installation" section.

Cable Installation

A single-ended or differential cable (part numbers 12016-60002 and 12016-60003, respectively) connects the SCSI Card to the bus. Do not connect a single-ended cable to a differential device, or vice versa. This does not damage the hardware, but will cause data errors. Do not connect the SCSI cable to any connector except as described in this section. Connecting a SCSI cable to the wrong connector may open the fuse on the SCSI Card.

See Figure 2-1 for a diagram of a typical SCSI Card installation. To connect the SCSI cables, take the following steps:

1. Ensure that: (1) the computer's power is off, (2) the battery enable switch is in the DISABLE position, (3) the peripheral power is off, and (4) the power cable is disconnected. If the computer's back door is closed, remove or open it.

Caution Power supply voltages (5 Vdc) exist in the SCSI cable. POWER MUST BE TURNED OFF! Failure to heed this caution will result in damage to the equipment and will open the fuse on the card -- *ensure that computer and peripheral device power is off.*

---

2. Connect the other end of the cable to the first device on the SCSI bus.
3. Connect the hooded cable connector to the edge connector of the SCSI Card, with the cable leading toward the right, or toward the bottom for a 20-slot card cage.
4. Close and secure the computer's back door. The computer's back door must be closed to ensure proper cooling and EMI compliance.
5. Connect additional devices to each other.
6. Plug the terminator into the last cable connector of the last physical unit on the SCSI bus. Make sure that your terminator matches your devices and cable. That is, the cables and devices all must be single-ended or differential, but not a combination of the two.
7. Reconnect the power cable to the computer, set the LINE ON/OFF switch to ON (1), set the battery backup to ENABLE, turn on the peripheral(s), and reboot your system.

The SCSI Card supports one bus terminator at the end of the bus string with the interface card at the other end. The interface card contains terminations for its end of the cable. The card does not support a bus "T" configuration because the card's termination resistors are soldered in place.

Verification of Correct Installation

Use the following checklist to troubleshoot problems that may occur during the installation and operation of the SCSI Card.

1. Check that the SCSI Card is seated firmly in the HP 1000 backplane.
2. Verify that the cable to the SCSI Card is properly connected.
3. Verify that the bus terminator is properly connected.
4. Turn on system power.
5. Check the four Light Emitting Diodes (LEDs) to see whether the self-test has been successfully completed or not. Refer to Table 2-1 for definitions of the LED test patterns.
6. Verify correct completion of HP 1000 computer microcode and VCP self-tests. Refer to the installation and service manual for your computer for the LED test patterns.

SCSI Self-Test

A self-test program resident in PROM on the SCSI Card runs automatically when you turn on the power, reset the computer, or execute the %P or %T commands from the VCP prompt. The self-test performs the following tasks:

1. Verifies the integrity of the firmware in PROM.
2. Performs a simple test of the SCSI card on-board memory.
3. Tests the SCSI protocol interface chip for its ability to communicate with the SCSI Card microprocessor.

The SCSI self-test program does not check the device cable or the ability to communicate with the HP 1000 computer. The computer processor's self-test tests the backplane communication between the SCSI Card and itself.

Four red Light Emitting Diodes (LEDs) display SCSI Card status and report errors (if any) that result from the SCSI self-test. The LEDs are located on the SCSI Card (see Figure 2-2 for a diagram of the SCSI Card layout). Table 2-5 shows the possible self-test LED patterns and their definitions.

Table 2-1. LED Self-Test Status

LED 1	LED 2	LED 3	LED 4	Status
OFF	ON	ON	ON	Card PROM Checksum Error
OFF	ON	ON	OFF	RAM Test Failed
OFF	ON	OFF	ON	Reserved
OFF	ON	OFF	OFF	DMA Test Failed
OFF	OFF	ON	ON	Timer Test Failed
OFF	OFF	ON	OFF	SCSI Chip Test Failed
OFF	OFF	OFF	ON	Reserved
OFF	OFF	OFF	OFF	Passed Test *
BLINK	OFF	OFF	OFF	Normal Operation **

* The all-LEDs-off condition that indicates successful self-test completion only exists briefly; after this, LED number one blinks continuously, which indicates a normally functioning SCSI Card.

** The rate at which LED one blinks indicates the activity of the card. Faster blinking indicates an idle card. Slower blinking indicates a heavier load on the card. A rate as low as several seconds between blinks is normal.

You can see whether or not the SCSI Card has passed the SCSI self-test by checking the LEDs. A frozen LED pattern (the LEDs' pattern does not change and some LEDs are in a steady "on" condition) denotes a self-test failure. When the card passes the self-test, all of the LEDs briefly turn off. After this occurs, LED number one begins to blink, which indicates a normally functioning SCSI card.

If the SCSI Card fails the self-test, record the frozen self-test LED pattern, then return the card to Hewlett-Packard as described in this chapter under "Reshipping Instructions". The SCSI Card is not a user-repairable unit. If the card does not function correctly, please return it to Hewlett-Packard for repair or replacement.

If the SCSI Card passes the self-test and the LEDs remain off, the card is malfunctioning. Cycle the power to reinitiate the SCSI self-test.

Card Removal

Take the following steps to remove the SCSI Card from the HP 1000 computer backplane.

Warning High current may be present. Failure to turn off power before opening the computer may allow contact with energy that may result in personal injury.

Caution Turn off power to the computer and peripherals before removing the interface card and cables. If there is a battery backup switch, set it to DISABLE before removing the hardware. Failure to turn off power and disable the battery back-up switch may result in damage to the interface card or attached I/O device.

---

1. Set the computer's power OFF (0) at the LINE ON/OFF switch and disconnect the power cord. Check for a battery backup and set the switch to disable. Turn off power to any connected peripherals.
2. Remove or open the back doors of the computer.
3. Unplug the SCSI cable from the interface card.

Caution Wear a properly grounded anti-static wrist strap during *all* phases of handling and removing the SCSI Card. Failure to wear properly grounded anti-static wrist straps will result in static electricity damaging components on the card.

---

4. Use the two extractor levers on the card edge to remove the SCSI Card from the backplane.
5. Slide the card out of the card cage.

   To ensure the integrity of the DMA and interrupt priority chains, make sure that you do not leave a vacant card slot. Vacant slots between cards break the DMA and interrupt priority chains. If this occurs, your system will not function.
6. Replace and secure the back door.

3

Software Installation

This chapter describes how to install the SCSI Driver software, including boot preparation procedures. Note that the software that comes with the HP 12016A product is revision 5270. If you are running RTE-A Revision 6000, do not restore the software that is shipped with the SCSI product. Use the SCSI software included with RTE-A.

The boot preparation procedure given in this chapter can also be used as a general guideline to install your own device driver. To install the SCSI software, you must be familiar with the RTE-A Operating System. You also must be familiar with the generation process, know how to boot your computer, and know how to use the Edit/1000 editing program. If you do not have this experience, do not install the software yourself. Find a qualified person who has the experience to install the software. For additional information, refer to the *RTE-A System Generation and Installation Manual*, part number 92077-90034.

Before you install the software, we recommend that you *back up your entire system and preserve the original copies of the system, snap, and answer files*. Do not delete the existing system. You should preserve it, just in case errors occur during software installation. If you are not familiar with the computer's operating system, we recommend that a Hewlett-Packard Customer Engineer (CE) or other qualified person install the SCSI software.

Take the following steps to install the SCSI software:

1. Copy the Revision 5270 software from the shipped media to your system **only** if you are running RTE-A Revision 5020 or earlier.
2. Create a new answer file based on your current answer file and preserve the old file. Add the SCSI changes to the new file.
3. Run the generator, RTAGN, on the new answer file.
4. Copy the system and snap files to the /SYSTEM directory, but do *not* overwrite or replace the old system files.
5. Create a new boot command file while preserving the old boot command file; create a new welcome file while preserving the old welcome file.
6. Reboot the system, specifying the new boot command file.
7. Verify correct system operation, and rename and preserve the old files. Rename the new files to their permanent names.

The following sections describe each of these steps in detail.

Copying the Software

Note The software supplied with the HP 12016A product is Revision 5270. You must copy the SCSI software to your system only if you are running Revision 5020 or earlier.

The SCSI peripheral media software includes the following Revision 5270 drivers and programs (plus additional files):

IDQ35.REL	SCSI Interface Driver (Relocatable)
DDQ30.REL	Disk Device Driver (Relocatable)
DDQ30.MAC	Disk Device Driver (Source Code)
DDQ30_GEN.REL	Disk Generation Records (Relocatable)
DDQ30_GEN.MAC	Disk Generation Records (Source Code)
DDQ24.REL	Tape Device Driver (Relocatable)
DDQ24_GEN.REL	Tape Generation Records (Relocatable)
VSCSI.REL	SCSI Online Verification Program
VSCSILIB.REL	MACRO/1000 Support Routine
ZRAMTST.HEX	Downloaded Z180 RAM Test
ZLPBK.HEX	Downloaded Z180 LOOPBACK Test
SCSI.SNF	Software Numbering File (describes each piece of software that comes with the SCSI product)
README	text file containing information regarding additional software shipped with the SCSI product

To copy the SCSI software from tape, create a directory called /SCSI, then copy the software to the /SCSI directory as follows:

```
CI> crdir /scsi lu
```
(creates the /SCSI directory on *lu*. Ensure that the LU you select has enough space for the SCSI software which uses approximately 2,000 blocks.)

```
CI>  wd /scsi
CI>  fst
FST> mt lu
FST> re @
FST> go
FST> ex
```
(where *lu* is the LU number of your tape drive)

The procedure described above copies the drivers and files to the /SCSI directory. To *load* the additional software described in the README file, list the README file and follow the instructions it contains.

Create a New Answer File

Take the following steps to create a new answer file that includes the SCSI changes. Make sure that you follow the steps to preserve your current answer file.

1. Create a new answer file by copying your current answer file to /SCSI/YourFavoriteName.ans. Make sure that you do not delete your old answer file.

2. If you are installing a hard disk or a rewritable optical disk, read the source file DDQ30_GEN.MAC to gain an understanding of the GEN records that will be used in the DVT statements in the next step.

3. Copy the files IDQ35.REL, DDQ30.REL, DDQ30_GEN.REL, DDQ24.REL, and DDQ24_GEN.REL to the /RTE_A directory. Edit YourFavoriteName.ans to add the following:

   a. Decide upon the LUs for the device(s).

   b. In the OS/Driver partitions section of the System Relocation Phase, add the appropriate RE lines. You do not need to add both of the device driver lines unless you have both disk and tape devices. Add the line "`RE /RTE_A/DDQ30.REL`" to support disk devices, and the line "`RE /RTE_A/DDQ24.REL`" to support tape devices.

```
RE /RTE_A/IDQ35.REL      (approximately 1659 words in size*)
RE /RTE_A/DDQ30.REL      (approximately 581 words in size*)
RE /RTE_A/DDQ24.REL      (approximately 705 words in size*)
```

   * *Size may vary slightly with each revision of the software.*

   Note that driver partitioning is not mandatory.

   c. In the Table Generation Phase, add an IFT (Interface Table) statement for each SCSI Card in your system. If you have one SCSI Card, you will have one IFT statement, and so on. Below each IFT statement, add one DVT statement for each device LU on the interface, in the format shown below.

   RTE-A allows you to subdivide the total disk storage into logical disks of more manageable size, if necessary, because the capacity of the physical drive may not be appropriate for your application. The DVT (Device Table) statements in your answer file define these physical disk subdivisions. Refer to the DDQ30_GEN.MAC source code if you need more information to choose the correct DVT statement entries.

   For disk device driver DDQ30, make sure that you set driver parameter 8 to match your disk drive's physical block size. The following table shows the valid DVP08 (bits 1 and 0) values:

DVP08	SCSI Block Size
0	256 bytes per SCSI block
1	512 bytes per SCSI block
2	768 bytes per SCSI block
3	1024 bytes per SCSI block

The following example shows statements for a system with two SCSI Cards with both disk and tape device drivers.

Note The bold numbers (LU and select code numbers) are *examples only*. They are not necessarily the LUs and select codes you will use. Generation of the SCSI rewritable optical disk in these examples assumes 1024-byte sectors, which is the sector density of the HP 92280A Optical Disk Cartridge media. Lines with an asterisk (*) indicate comments, not generation instructions.

```
IFT /RTE_A/IDQ35.REL  sc:22b
*
* Device #1 (SCSI rewritable optical disk address 0)
*
  DVT /RTE_A/DDQ30_GEN.REL m650A_3, lu:30, dp:1:0
*
* Device #2 (SCSI 7980S tape drive address 1)
*
  DVT /RTE_A/DDQ24_GEN.REL m7980, lu:33, dp:1:1

IFT /RTE_A/IDQ35.REL  sc:23b
*
* Device #1 (SCSI hard disk address 6)
*
  DVT /RTE_A/DDQ30_GEN.REL m512mb:0, lu:34, dp:1:6, dp:8:1
  DVT /RTE_A/DDQ30_GEN.REL m64mb:8, lu:35, dp:1:6, dp:8:1
  DVT /RTE_A/DDQ30_GEN.REL m57mb_1:b, lu:36, dp:1:6, dp:8:1
*
* Device #2 (SCSI DAT tape drive address 1)
*
  DVT /RTE_A/DDQ24_GEN.REL,, lu:37, dp:1:1
```

Each IFT statement indicates an interface card. If you have three SCSI Cards in your computer, you will need three IFT statements in the new answer file.

You must associate at least one DVT statement with each IFT statement, as shown in the previous example. Interfaces without DVT statements cannot communicate with any devices.

d. If you have more than one LU on a *device*, you need to define node list entries. You do not need to define node list entries if you have more than one device on one SCSI Card, unless the device has more than one LU. For example, if you have a SCSI device at select code 23 with LUs 34, 35, and 36 on it, specify the following node list entries:

```
*
* SCSI device at select code 23, address 6
*
  node,34,35,36
```

System Generation

To generate the system, enter the following command:

```
CI>  rtagn,/SCSI/YourFavoriteName.ans,-,-,-
```

Note that you must use the .ans extension in order to use the dashes to indicate the default system, snap, and list files. The file names default to YourFavoriteName.sys, YourFavoriteName.snp, and YourFavoriteName.lst, respectively.

If system generation is successful, the message "Zero Errors" appears on the screen.

If system generation is not successful, an error message appears on the screen. Check the modifications you made to your answer file to ensure that you did not make any errors.

Copy System and Snap Files to the /SYSTEM Directory

When system generation completes without errors, enter the following commands to copy the system and snap files to the /SYSTEM directory:

```
CI>  co  YourFavoriteName.sys  /system/@
CI>  co  YourFavoriteName.snp  /system/@
```

Create New Boot Command and Welcome Files

The following steps describe how to create new boot command and welcome files while preserving your current files:

1. Copy your current boot command file to /SYSTEM/YourFavoriteName.cmd.
2. Copy your current Welcome file to /SYSTEM/Welcomexx.cmd, where xx is any number from 0-99, inclusive, that is not used for another welcome file.
3. Edit the "*file*.sys" and "*file*.snp" commands in your new boot command file (YourFavoriteName.cmd) to refer to your new system and snap files.
4. Edit the "st,,xx" command in your new boot command file (YourFavoriteName.cmd) to reference the new welcome file (welcomexx.cmd).

Reboot the System

Press the BREAK key to get the VCP prompt, and reboot the system, specifying the new Boot Command as shown in the following example.

```
VCP>  %bdc27YourFavoriteName.cmd
```

The number 27 is the select code of the device from which you are booting. Select code 27 is used here as an example only; 27 is the default select code value for booting from the SCSI Card (refer to Chapter 6 for more information on booting from SCSI).

If you have a 650/A Rewritable Optical Disk Drive installed, you can also use the "mc,*lu*" command to mount your SCSI LUs. When the LUs are mounted, you can create directories on your new SCSI device and copy software to it.

Finalizing the Software Installation

Confirm that the new LUs have been generated by executing the IO command. Next, manually verify that the new disks are functioning correctly by running the online verification test, VSCSI. You can do this by entering the following command at the CI> prompt:

```
CI>  vscsi <lu> -all
```

This command executes six SCSI verification tests and displays the test results on screen. For more information about VSCSI, see Chapter 4 under the heading "Online Verification Program"; for a description of the "–all" command, see Chapter 4 under the heading "Non-Interactive Interface".

Perform the following commands to finalize your software installation:

1. Rename your old system files to preserve them as shown in the following example.

   ```
   CI> rn Boot.cmd OLD_BOOT.cmd
   ```

   Do not delete your old files!

2. If it is appropriate, edit Welcomexx.cmd to mount the new disk LUs you defined when you created the new answer file.

3. Rename your new system files to the standard names.

Your SCSI software is now installed.

4

Troubleshooting

This chapter describes troubleshooting procedures for the SCSI Card. It includes a troubleshooting checklist, descriptions of the SCSI self-test, and the VSCSI verification program.

Troubleshooting

Use the following checklist to troubleshoot problems that may occur during the installation of a SCSI Card.

1. Ensure that the card is seated firmly in the backplane.
2. Ensure that the cables to the card are tightly and properly connected.
3. Verify that the SCSI bus terminator is correctly installed.
4. Ensure that the power to the SCSI devices is on.
5. Run the self-test by cycling the computer's power or using the %P or %T commands from the VCP prompt. For more extensive testing of the SCSI Card, for example looping on self-test or performing other tests of the SCSI card, run the VSCSI online verification program or the SCSI diagnostic.

   VSCSI is shipped with the SCSI software and its use is described in this chapter. The SCSI diagnostic is shipped as part of the HP 24612A Diagnostics product. It is a Diagnostic Design Language (DDL) program; refer to Chapter 7 of this manual for information on how to use the SCSI DDL diagnostic.

If the SCSI Card fails the self-test or diagnostic, record the self-test LED pattern, then return the card to Hewlett-Packard as described in Chapter 2 under the heading "Reshipping Instructions". The SCSI Card is *not* a user-repairable unit. If the card does not function correctly, please return it to Hewlett-Packard for repair or replacement.

SCSI Self-Test

When you turn power on, reset the computer, or execute the %P or %T commands from the VCP prompt, the SCSI microprocessor executes the SCSI self-test firmware. The program runs the following tests:

- Checks the integrity of the firmware in the PROM.
- Performs a simple test of the SCSI Card on-board memory.
- Tests the SCSI protocol interface chip for its ability to communicate with the SCSI Card microprocessor.

The SCSI self-test program does not check the device cable or the ability to communicate with the HP 1000 computer. The host processor's self-test tests the backplane communication between the SCSI Card and the host processor.

Four red Light Emitting Diodes (LEDs) display SCSI Card status and report errors (if any) that result from the self-test. The LEDs are located on the SCSI Card (see Figure 2-2 for a diagram of the SCSI Card layout). Table 4-1 shows the possible self-test LED patterns and their definitions.

Table 4-1. LED Self-Test Status

LED 1	LED 2	LED 3	LED 4	Status
OFF	ON	ON	ON	Card PROM Checksum Error
OFF	ON	ON	OFF	RAM Test Failed
OFF	ON	OFF	ON	Reserved
OFF	ON	OFF	OFF	DMA Test Failed
OFF	OFF	ON	ON	Timer Test Failed
OFF	OFF	ON	OFF	SCSI Chip Test Failed
OFF	OFF	OFF	ON	Reserved
OFF	OFF	OFF	OFF	Passed Test *
BLINK	OFF	OFF	OFF	Normal Operation **

* The all-LEDs-off condition that indicates successful self-test completion only exists briefly; after this, LED number one blinks continuously, which indicates a normally functioning SCSI Card.

** The rate at which LED one blinks indicates the activity of the card. Faster blinking indicates an idle card. Slower blinking indicates a heavier load on the card. A rate as low as several seconds between blinks is normal.

You can see whether or not the SCSI Card has passed the SCSI self-test by checking the LEDs. A frozen LED pattern (the LEDs' pattern does not change and some LEDs are in a steady "on" condition) denotes a self-test failure. When the card passes the self-test, all of the LEDs briefly turn off. After this occurs, LED number 1 begins to blink, which indicates a normally functioning SCSI card.

If the SCSI Card fails the self-test, record the self-test LED pattern, and return the card to Hewlett-Packard as described in chapter 2 under the heading "Reshipping Instructions". The SCSI Card is not a user-repairable unit. If the card does not function correctly, please return it to Hewlett-Packard for repair or replacement.

If the SCSI Card passes the self-test and the LEDs remain off, the card is malfunctioning. Cycle the power to reinitiate the SCSI self-test.

Online Verification Program

This section describes the SCSI online verification program (VSCSI), how to initiate it, its two user interfaces, the tests you can run, and possible error messages. VSCSI is an RTE-A application program which verifies that the SCSI Card is functioning correctly.

The verification program provides two different interfaces:

1. An Interactive Interface. Using this interface, you can enter commands that run specific verification tests, one test at a time. You can also specify the number of times to run each test. The test results are displayed on screen after you run each test. After a test runs, a command prompt reappears, and you can run another test or exit the program.
2. A Non-Interactive Interface. To use the non-interactive interface, specify the tests you want to execute and the number of times to execute the tests in the VSCSI runstring. You can run all tests or just selected tests. As VSCSI runs in non-interactive mode, the test results appear on screen, and the program terminates. You can run the non-interactive verification program from CI command files. You can test $RETURN1 to see if the program executed successfully (the result is 0 for success; a non-zero return is failure).

VSCSI Usage Help

You can get help at the CI prompt by entering

```
CI> vscsi ?
```

at the prompt without specifying an LU number or any other parameters. The following program usage message appears on screen:

```
Usage: VSCSI [SCSILU] [-I] [-V] [-HP] [-L LOGFILE] [-LOOP COUNT]
    [-ALL] [-SELFTEST] [-DI] [-ID] [-FMP] [-TERMPWR] [-TIMESTAMP]
    [-DEVFLAG] [-RAMTEST] [-LOOPBACK]

-I = ignore errors; -V = verbose; -HP = non-HP terminal
-L LOGFILE = echoes messages to user specified LOGFILE
-LOOP COUNT = repetitively executes specified tests

Specifying one or more of the following tests causes VSCSI to
execute non-interactively (and callable from a CI CMD file).
Otherwise, VSCSI executes interactively with the user entering
commands at a prompt.

-ALL                  =  All tests (except SELFTEST and LOOPBACK)
-SELFTEST (or -SE)    =  On-board SELFTEST
-DI                   =  Display LUs with vendor-model information
-ID                   =  BOARD ID test
-FMP                  =  FMP test
-TIMESTAMP (or -TS)   =  TIMESTAMP test
-TERMPWR (or -TE)     =  TERMPWR test
-DEVFLAG (or -DE)     =  Check device flag operation
-RAMTEST (or -RAM)    =  SCSI board RAM test (32KB-512KB)
-LOOPBACK             =  LOOPBACK test (requires test hood)
```

Interactive Interface

The SCSI verification program has online commands that you can execute when you run the SCSI verification program in interactive mode. To call the interactive version of the verification program, at the CI prompt enter:

```
CI> VSCSI [scsilu] [optional nontest parameter] [optional nontest parameter] ...
```

where `VSCSI` calls the verification program and [*scsilu*] is the logical unit number of one of the SCSI device LUs associated with the SCSI Card you are testing. You can include any or all of the following optional nontest parameters in the runstring when you call the interactive version of the verification program. If you enter any test parameter in the runstring, you invoke the non-interactive version of the program (see the section titled "Non-Interactive Interface" in this chapter for more information):

`-HP`	This parameter notifies the verification program that the terminal is not a Hewlett-Packard terminal. This means that cursor positioning (<ESC> + <a> column c row R), homeup (<ESC> + <h>) and clear screen (<ESC> + <j>) are not supported.
`-V`	This parameter specifies verbose mode. Verbose mode displays information on screen about what the program is doing.
`-I`	This parameter tells the program to ignore all errors and continue with the verification program tests. This command is especially useful when you use the loop command to run commands repetitively. When you specify this parameter in the runstring, the program prints error messages on screen, and continues to run tests, instead of printing the error message and aborting. You could use the loop command to run a test many times (for example, 30,000 iterations) and find out from the on screen messages how many failures occurred, without interrupting the program. We recommend that you use the −I parameter in conjunction with the −L *logfile* parameter so that you have a record of all errors encountered.
`-L` *logfile*	This parameter produces a log file that records the verification test results. The "−L" indicates that the next parameter is the name of the log file. The parameter *logfile* is the name of the log file. You can specify a full path name to produce the log file in a directory other than the working directory. If you do not specify a path name, the log file is created in the working directory. Note that if a file with the specified name already exists, it will be overwritten.

It is possible to call the verification program in interactive mode without specifying an LU number if you specify one or more of the four parameters described above (that is, −HP, −V, −I or −L *logfile*) in the runstring, without test parameters. (The section titled "Non-Interactive Interface" in this chapter describes runstring test parameters.)

When you call up the interactive interface, the command prompt `VSCSI:` appears on screen. You can execute the following commands from the prompt:

`?, ??, HELP`	Any of these three commands displays a list of all valid commands with brief descriptions.

LU [*scsilu*]

Defines the card you will test with the verification program, where [*scsilu*] is an LU number associated with a device on the SCSI Card. This command enables you to test different LUs without having to exit the verification program. For example, the command "LU 42" tells the verification program to verify the SCSI Card to which LU 42 is assigned.

If you do not specify an LU number and there is already an LU number specified, the program displays the message

```
SCSI LU = xx
```

where *xx* is the current LU number. If you do not specify an LU number and no LU number was specified in the runstring, the program displays the message

```
SCSI LU undefined. Use "LU <lu>" command.

where <lu> is the SCSI LU number.
```

FORMAT

Formats the disk associated with the current SCSI LU (for example, the Rewritable Optical Disk). This command also performs a disk initialization function as part of the formatting process, so that the disk is ready to use after formatting is complete. (The CI command "IN" is part of the formatting procedure.) The initialization provides the data structure necessary to access files and a description of which areas are available. Use this command to format disks before using them with the SCSI system. To format a disk, enter

```
VSCSI : format
```

at the command prompt. The message

```
Formatting the SCSI drive will DESTROY all data on the
disk. This includes all LUs defined for the drive!!!

OK to proceed [no] ?
```

appears on screen. No is the default response. To abort the format process, press the RETURN key, which displays the message

```
FORMAT not performed.
```

To proceed with the format process, enter *yes* or *OK* at the prompt. The program displays the message

```
Formatting .... Please be patient.
```

to indicate that the format has begun. When the disk format is complete, the program displays the message

```
FORMAT complete.
```

If you attempt to format a SCSI drive that contains mounted LUs, the program displays the message

```
One or more lus on the SCSI drive are mounted.
Unable to format drive.
```

This message means that either the LU you want to format is mounted, or another LU with the same SCSI ID may be mounted, preventing your format command from executing. You can check this by executing the DISPLAY command. To dismount an LU, exit to the CI prompt, and execute a dismount command. When you use the format command, all LUs on the disk will be formatted.

Caution If an LU is mounted, it is already formatted. Other users may be using the LU or have files on the LU. The FORMAT command affects *all LUs* on the drive, not just the LU that VSCSI is using to refer the board/drive. All data on the drive will be destroyed.

`DISPLAY` or `DI`

Displays a list of the LUs associated with the SCSI Card, including the address, the device's vendor and model, and its current status. The following diagram is an example of what the DISPLAY command shows on screen; the numbers and status shown are examples only.

```
    SCSI Verification Program                Rev. 5022

lu   Addr       Vendor-Model                 Status
---  ------  -------------------------  ----------
50     0       HP S6300.650A             Mounted
51     0       HP S6300.650A             Device Down
52     0       HP S6300.650A
53     0       HP S6300.650A
54     1       HP 2212A                  Not Connected
55     1       HP 2212A                  Not Connected
XX     2                                 No Lu defined

IFT select code: 71
```

In this display, "lu" is a list of the LU numbers associated with the SCSI Card, "Addr" lists the SCSI addresses, "Vendor-Model" gives the device vendor and model designations, and "Status" shows the current status of the LU.

The Status field in the display screen can contain one of the following messages:

`Mounted` -- the LU is mounted to the FMP system.

`Device Down` -- the RTE-A operating system considers this LU down as indicated by DVT word 6.

`Not Connected` -- this LU is generated into the RTE-A system but is not attached to the SCSI bus.

`No LU defined` -- an LU is not defined for this SCSI device (it is possible that the switches on the device are incorrectly set).

`Inquiry failed` -- this is a device failure. VSCSI was not able to retrieve Vendor-Model information from the device.

Note If TERMPWR is not on, the Vendor-Model field displays the message "Unavailable".

`UNITSIZE` or `UN`

Reports the total number of blocks on a disk unit. With a SCSI disk LU previously specified, the UNITSIZE command queries the disk drive to determine the total number of blocks available on the unit and the number of bytes in each of those blocks. These values are displayed in addition to the number of RTE blocks which can be created on that disk unit. The following is an example of what the UNITSIZE command displays:

```
Information on SCSI disk UNIT containing LU 11:
-----------------------------------------------

Number of PHYSICAL blocks on this unit: 1296512.
Size of each PHYSICAL block on this unit: 512 bytes.
This is equivalent to 2593042 RTE blocks (which are 256
bytes per block).
```

Note that this information is for the entire unit (device) containing the LU specified. It is not the size of just the LU. This command may be useful if you are experiencing problems with some disk LUs and wish to compare the total number of blocks available on that disk unit versus what was assumed in the system generation.

UNITSIZE works only on SCSI disk LUs. It is only available in the interactive mode of VSCSI, not in the runstring.

`UP` *lu*

Notifies the system that an LU is available. *lu* is any valid SCSI LU number. For example, RTE-A takes a device down when an error such as a time-out occurs. The LU will not be available again for use until you execute an UP command. It does not cause an error if you use UP on a device that is not down.

`VERBOSE [on/off]` or `VE [on/off]`

Turns verbose mode on and off from the command line. Verbose mode displays more information on screen about what the program is doing (current status) and how the program is doing it.

If you enter this command without the [on] or [off] parameter, a message that shows whether verbose mode is currently on or off appears.

`LOOP` [*n*] or `REPEAT` [*n*]

Defines how many times to execute the SELFTEST, FMP, ID, TIMESTAMP, TERMPWR, RAMTEST, LOOPBACK and DEVFLAG test commands described below. [*n*] is the number of times to repeat the subsequent test commands you enter at the command prompt; you can repeat a command a maximum of 32,767 times. To force commands to execute repeatedly, type LOOP or REPEAT at the command prompt, and type the number of times you want subsequent commands to run. After you enter a LOOP or REPEAT command, every subsequent FMP, ID, TIMESTAMP, TERMPWR, DEVFLAG, RAMTEST, LOOPBACK and SELFTEST command executes the number of times you specified. To return to executing those commands only once, type LOOP or REPEAT with one (1) as the number of times to repeat the test. If you enter the LOOP or REPEAT command without specifying a number of times to repeat, the current loop count appears on screen.

For example, if you enter the command

```
VSCSI : loop 4
```

all subsequent commands that looping affects are executed four times until you change the repeat/loop number. If you enter the command

```
VSCSI : fmp
```

after entering LOOP 4, the program issues four FMP calls and displays the results. Any subsequent commands that can repeat also repeat four times. If you then enter the command

```
VSCSI : loop 1
```

the command repeat factor returns to one. You could use REPEAT 4 and REPEAT 1 instead of LOOP 4 and LOOP 1 to get the same results.

`SELFTEST` or `SE` — Issues a hard reset command (OTA 32B) to the SCSI Card to force it to execute the SCSI self-test.

`FMP` — Issues FMP calls to the SCSI LU to check the overall functioning of the SCSI Card, disk and cables. Tests include mounting and dismounting the disk and reading directories. This command does not isolate any faults to the main SCSI components (that is, the SCSI Card, the SCSI disk or the SCSI cable). Note that this test takes several seconds to execute; a message appears on screen to notify you that the test is executing.

`ID` or `REVCODE` — Displays the ID and revision code of the SCSI Card. The ID of the SCSI Card is 115. This tests the SCSI Card's I/O processor and select code switch.

`DEVFLAG` or `DE` — Checks device flag operation.

`TERMPWR` or `TE` — Displays the status of the TERMPOWER status bit.

`TIMESTAMP` or `TS` — Displays the SCSI Card's firmware timestamp and address. The timestamp field is formatted as YYMMDD.MMNN, where YYMMDD is the year, month and day of the firmware release, and MM and NN are the major and minor firmware revision codes. The SCSI Address field contains the address of the SCSI Card itself, which should be 7. VSCSI obtains this value from switch SW2 on the SCSI Card (see Chapter 2 for more information on switch settings).

`RAMTEST` or `RAM` — Tests SCSI Card RAM (32KB - 512KB). This test only reports "PASSED" or "FAILED". The RAMTEST requires the file "ZRAMTST.HEX" to be located in the /PROGRAMS, /SYSTEM, /SCSI or working directory.

`LOOPBACK` — The LOOPBACK test requires a test hood, part number 12016-60007, which you can order from your local HP sales office. If you do not have the test hood, the message "LOOPBACK test FAILED" appears. The LOOPBACK test also requires the file "ZLPBK.HEX" to be located in the /PROGRAMS, /SYSTEM, /SCSI or working directory.

`EXIT, QUIT` or `ABORT`	Exits the interactive verification program.

If you enter an invalid command, the message "Unknown command. Use ?? for help" appears.

Non-Interactive Interface

This section describes the tests that run when you call the SCSI verification program in non-interactive mode. You can call the non-interactive mode verification program from a CI command file. To call the verification program in non-interactive mode at the CI prompt enter:

`CI> vscsi` *scsilu* [*optional parameter*] [*optional parameter*] ...

where `VSCSI` calls the verification program and *scsilu* is the LU number of one of the SCSI device LUs associated with the SCSI Card you are testing. In the runstring, you can enter any number of optional parameters which are described below. The non-interactive verification program runs the tests specified by the parameters and exits back to the CI prompt. Unless you tell the program to ignore errors (described below), the program terminates on the first failure leaving an error message on screen.

Omitting test parameters from the runstring calls the interactive version of the verification program. Specifying any test (that is, −SELFTEST, −FMP, −ID, −DEVFLAG, −TERMPWR, −TIMESTAMP, −DISPLAY, −RAMTEST, −LOOPBACK or −ALL) in the runstring invokes non-interactive mode. The optional parameters you can specify when calling the non-interactive version of the verification program are as follows:

`-L` *logfile*	This parameter produces a log file that records the verification test results. The "−L" indicates that the next parameter is the name of the log file. The parameter *logfile* is the name of the log file. You can specify a full path name to produce the log file in a directory other than the working directory. If you do not specify a path name, the log file is created in the working directory. Note that if a file with the specified name already exists, it will be overwritten.
`-HP`	This parameter notifies the verification program that the terminal is not a Hewlett-Packard terminal. This means that cursor positioning (<ESC> + <a> column c row R), homeup (<ESC> + <h>) and clear screen (<ESC> + <j>) are not supported.
`-V`	This parameter specifies verbose mode. Verbose mode displays more information on screen about what the program is doing.
`-I`	This parameter tells the program to ignore all errors and continue with the verification program tests. It is meaningful only when you specify a loop count of more than one in the runstring. When you specify this parameter, the program prints error messages on screen, then continues to run the tests specified in the runstring. You could use the −LOOP parameter to run a test many times (for example, 30,000 iterations) and find out from the on screen messages how many failures occurred, without interrupting the program. We recommend that you use this parameter in conjunction with the −L <logfile> parameter, so that you have a record of all errors encountered.

`-LOOP [n]`

Defines how many times to execute the −SELFTEST, −FMP, −ID, −TIMESTAMP, −TERMPWR, −RAMTEST, −DISPLAY, −ALL, −LOOPBACK and −DEVFLAG, command parameters described below. [*n*] is the number of times to repeat any of these commands entered as parameters in the verification program runstring; you can repeat a command a maximum of 32,767 times. To force commands to execute more than once, enter −LOOP and a number in the verification program runstring. For example, the runstring

```
CI> vscsi 33 -loop 4 -fmp
```

calls the program in non-interactive mode for LU 33, executes the FMP test four times, and exits to the CI prompt.

`-SELFTEST` or `-SE`

This parameter forces a hard reset of the SCSI Card (OTA 32B) to run the SCSI self-test when you call the verification program. (The self-test is described earlier in this chapter under the heading "Self-Test".) If you do not specify this parameter, the verification program does not execute the SCSI self-test as part of the verification process.

`-DISPLAY` or `-DI`

Displays a list of the LUs associated with the SCSI Card, including the address, the device's vendor and model and its current status. The DISPLAY command description in the section titled "Interactive Interface" in this chapter shows a diagram of the display screen. The following diagram is an example of the display screen with all possible non-interactive runstring tests executed and their results displayed. (You can do this by specifying the −ALL and −SELFTEST commands in the runstring.) The numbers and status shown are examples only. The runstring test results appear in the column on the right side of the screen.

```
              SCSI Verification Program         Rev.5270

  lu   Addr         Vendor-Model              Status      | IFT select code: 25
 ---   ----  ------------------------------  ----------- |
  50     0   HP      S6300.650A              Mounted     | Board ID:       115
  51     0   HP      S6300.650A              Device Down | Board revision:   0
  52     0   HP      S6300.650A                          | Select code:     25
  53     1   HP      S6300.650A                          |
  54     1   HP      2212A                   Not Connected | TERMPWR: ON
  55     1   HP      2212A                   Not Connected | Cable: SINGLE-ENDED
  ??     2                                   No LU Defined |
                                                          | Timestamp: 910805.0005
                                                          | SCSI addr: 7
                                                          |
                                                          | Selftest PASSED.
                                                          | FMP test PASSED.
                                                          | RAM test PASSED.
```

In this display, "lu" is a list of the LU numbers associated with the SCSI Card. In non-interactive mode, there is a limit of 15 LUs in the display, because the non-interactive display does not scroll. "Addr" lists the LU addresses, "Vendor-Model" gives the device vendor and model designations, and "Status" shows the current status of the LU. The right hand side of the display screen shows the IFT select code, the SCSI board ID, revision and select code, whether or not TERMPWR is on, and what type of cable is connected. In addition, information from other VSCSI tests you are running is displayed in the right column.

The Status field in the display screen can contain one of the following messages:

`Mounted` -- the LU is mounted to the FMP system.

`Device Down` -- the RTE-A operating system considers this LU down as indicated by DVT word 6.

`Not Connected` -- this LU is generated into the RTE-A system, but is not attached to the SCSI bus.

`No LU defined` -- an LU is not defined for this SCSI device. (It is possible that the switches on the device are incorrectly set.)

`Inquiry failed` -- this is a device failure. VSCSI was not able to retrieve Vendor-Model information from the device.

The Cable field in the right display column can contain one of the following messages:

`SINGLE-ENDED` -- A single-ended cable is attached and there are no differential devices on the bus.

`DIFFERENTIAL` -- A differential cable is attached and no single-ended devices are on the bus.

`DF cable-SE device` -- A differential cable is attached, but the bus has a single-ended device or NO cable is attached to the SCSI card.

`SE cable-DF device` -- A single-ended cable is attached, but there is at least one differential device on the bus.

Note If TERMPWR is not on, the Vendor-Model field displays the message "Unavailable".

`-FMP` Issues FMP calls to the SCSI LU to check the overall functioning of the SCSI subsystem (card, disk, cables). Tests include mounting and dismounting the disk and reading directories. This command does not isolate any faults to the main components (the SCSI Card, disk or cable). Note that this test takes several seconds to execute; a message appears on screen to notify you that the test is executing.

-ID	Displays the ID and revision code of the SCSI Card. The SCSI ID number is 115. This tests the SCSI Card's I/O processor and select code switch.
-DEVFLAG or -DE	Checks device flag operation.
-TERMPWR or -TE	Displays TERMPWR status and cable type.
-TIMESTAMP or -TS	Displays the SCSI Card's firmware timestamp and address. The timestamp field is formatted as YYMMDD.MMNN, where YYMMDD is the year, month and day of the firmware release, and MM and NN are the major and minor firmware revision codes. The SCSI Address field contains the address of the SCSI Card itself, which should be 7. VSCSI obtains this value from switch SW2 on the SCSI Card (see Chapter 2 for more information on switch settings).
-RAMTEST or -RAM	Tests SCSI Card RAM (32KB - 512KB). This test only reports "PASSED" or "FAILED". The RAMTEST requires the file "ZRAMTST.HEX" to be located in the /PROGRAMS, /SYSTEM, /SCSI or working directory.
-LOOPBACK	The LOOPBACK test requires a test hood, part number 12016-60007, which you can order from your local sales office. If you do not have the test hood, the message "LOOPBACK test FAILED" appears. The LOOPBACK test also requires the file "ZLPBK.HEX" to be located in the /PROGRAMS, /SYSTEM, /SCSI or working directory.
-ALL	Runs all verification program tests except the SCSI self-test and loopback test. You can specify the -SELFTEST, -I or -LOOP parameters in conjunction with -ALL. The -ALL parameter runs the -ID, -TERMPWR, -TIMESTAMP, -DISPLAY, -FMP and -DEVFLAG tests.

For example, the SCSI verification program runstring

```
CI> vscsi 41 -l test.log -v -fmp
```

calls up the non-interactive version of the verification program (because the test name -fmp was specified in the runstring) and specifies LU 41. The parameters tell the program to: (1) create a logfile called "test.log" in the working directory, (2) run in verbose mode, and (3) execute the FMP test. If a failure occurs, the program prints an error message on screen, and exits to the CI prompt. If no failures occur, the program runs the FMP test, then exits to the CI prompt.

VSCSI Program Error and Information Messages

VSCSI detects error conditions in SCSI operation. Errors can occur when attempting to validate the SCSI LU, during command parsing, in the runstring, and while attempting to access the SCSI LU. Additionally, errors can occur in relation to the SCSI self-test, FMP test, RAMTEST and LOOPBACK test, and in getting the firmware timestamp. The verification program also detects driver errors and provides several status messages.

Most of the VSCSI status messages do not appear on screen unless you are running the program in verbose mode. Status messages are self-explanatory and simply inform the user about what the program is doing. For example, when you execute the FMP test, the message "FMP test executing. Please wait." appears. This message notifies you that the FMP test is running because this test takes several seconds to execute.

The non-interactive version of the verification program also returns an error code in the CI variable $return1. The error code can be tested in CI command files.

Error Messages During SCSI LU Validation

The following error messages are related to validating the SCSI LU. When the verification program detects an LU validation error, it displays an error message and terminates. The program cannot display the LU table or any specific information, because the LU number entered in the runstring is illegal.

`SCSI LU not supplied`

Error: No SCSI LU number was included in the verification program runstring. This message appears only when you are invoking non-interactive mode.

Solution: Enter a valid LU number in the runstring when invoking the verification program.

`SCSI LU undefined. Use "LU <lu>" command`

Error: In the interactive interface, you entered a hardware test command without specifying an LU number. This can occur if you invoke the interactive interface without specifying an LU number. For example, the runstring "VSCSI –V" invokes the interactive version of the verification program without an LU number.

Solution: Use the LU command (described in the section titled "Interactive Interface" in this chapter) to specify a valid LU on which to run the test(s).

`LU xxx illegal. Valid range is 1 - maxlu`

Error: The SCSI LU number entered in the runstring or the LU number specified in the "LU" command is outside the range of valid LU numbers. The supplied LU number is either less than one or greater than the maximum LU generated into the system. The variable *maxlu* is the highest LU number generated into the system.

Solution: Enter a valid LU number within the range the error message reported.

`LU xxx not assigned`

Error: The SCSI LU entered in the runstring or the command has a DVT (device table) address of zero. This means that the LU is not assigned to a device.

Solution: Make sure that the LU number you enter is assigned to a SCSI Card.

`LU xxx is wrong IFT type. Was xxxB, should be 35B`

Error: The SCSI LU entered in the runstring or the command (xxx) is not associated with the SCSI Card. The IFT (interface table) type associated with the given LU number (the first "xxxB" in the error message) is displayed along with the expected IFT type (35B).

Solution: Enter an LU number that is associated with a SCSI Card. This ensures that the IFT type will be correct.

Command Parsing Errors

A command parsing error can only occur when using the interactive interface. (No commands are parsed in the non-interactive interface; all of the commands are in the program runstring.)

`Invalid LOOP value`

Error: A non-numeric value was entered with the LOOP or REPEAT command. This occurs when you enter any non-numeric value (any alphabetic character, punctuation mark or special character other than numbers) or invalid number as the number of times to repeat a command in command line mode. You can repeat commands up to 32,767 times.

Solution: Enter a valid numeric value after the REPEAT or LOOP command.

`Unknown command`

Error: The command entered is unknown or misspelled.

Solution: Enter the command again or use the HELP, ? or ?? command to get a list of valid commands.

Runstring Parsing Errors

A runstring parsing error can occur only when using the non-interactive interface. (You do not enter commands in the runstring when using the interactive interface.)

`Error In Specifying [-LOOP count] parameter`

Error: A non-numeric value was entered with the −LOOP parameter in the verification program runstring. This error is similar to the "Invalid LOOP value" error, except that it occurs in the runstring, not in the command line.

Solution: Enter a numeric value after the −LOOP parameter in the runstring.

`Runstring parameter "[invalid parameter]" illegal`

Error: One or more parameters in the verification program runstring are illegal or invalid. The error message identifies the first illegal parameter in the runstring.

Solution: Enter the runstring again using only legal parameters.

`No LOGFILE name supplied`

Error: In the runstring, the parameter −L, which echoes the verification program test results into a log file, did not have a LOGFILE file name following it.

Solution: When you use the parameter −L in the runstring, make sure that you specify a file name for the LOGFILE data.

SCSI LU Table Access Errors

These errors occur when you invoke the ID, REVCODE, TIMESTAMP (TS), DEVFLAG, FMP, TERMPOWER or SELFTEST commands without the correct select code specified in the verification program runstring.

```
DIAGNOSE MODE FAILED. SCSI Card not installed or has wrong select code
```

Error: The verification program attempted to retrieve the SCSI Card's ID and revision code by entering diagnose mode 1 for the select code given in the IFT (interface table). Diagnose mode fails if the select code of the card does not agree with the select code in the IFT. The CPU requires the installed card to have a select code equal to the select code in the IFT. If the select codes are not the same, this error message appears.

Solution: First make sure that there is an installed SCSI Card. If the card is installed in the system, make sure that it has a valid select code and is generated into the system correctly, so that the SCSI Card's select code is equal to the select code in the IFT table. Switch SW1 determines the SCSI Card's select code (see Chapter 2 under the heading "Switch Settings" for a detailed description of how to set the card's select code).

```
Device Flag Cannot Be Cleared
```

Error: This message indicates that the program found Flag 30B set and that a CLF 30B command (clear Flag 30B) did not clear the flag.

Solution: This is a hardware failure; return the SCSI Card to Hewlett-Packard as indicated in chapter 2.

Self-Test Messages and Errors

The following error messages can occur only when you invoke the SCSI Card self-test ("−SELFTEST" parameter) in the verification program runstring.

```
Performing a HARD RESET on card
```

This is not an error message. This message indicates that the program is beginning the self-test portion of the verification tests.

```
SELFTEST FAILED. Device flag not set within 10 seconds.
```

Error: The verification program issued an OTA 32B command (hard reset) to force a SCSI Card self-test and waited for the device flag to be set. The flag was not set within the ten-second window (this time limit is defined by the VCP code.)

Solution: Perform a power cycle of the system and check the status of the LEDs on the SCSI Card. Refer to the section titled "SCSI Self-Test" in this chapter.

FMP Test Errors

`FMP Device down.`

Error: The SCSI LU is down.

Solution: Use the command "UP [scsilu]" to up the device.

`Miscompare error at record xxxx.`

Error: The FMP test failed. The text in record xxxx does not equal the expected value.

Solution: Check record xxxx for errors.

In addition to these messages, errors that the FMP routines detect can report other error messages. Refer to the *RTE-A Programmer's Reference Manual*, part number 92077-90007, for information about these errors.

RAMTEST and LOOPBACK Test Errors

The RAMTEST requires a file named "ZRAMTST.HEX" and the LOOPBACK test requires a file named "ZLPBK.HEX". These two files must be located in either the working directory, the /PROGRAMS directory, the /SYSTEM directory, or the /SCSI directory.

If the required files are not in one of the appropriate directories, the following message appears:

```
No such file XXXXX.HEX
```

where XXXXX.HEX is either ZRAMTST.HEX if you are running the RAMTEST or ZLPBK.HEX if you are running the LOOPBACK test.

The following errors can appear in response to a corrupt .HEX file. The solution to all of these errors is to replace the corrupt .HEX file.

`Unexpected EOF`

Error: The end of the file was detected before the Intel END record was encountered.

`Record too short.`

Error: The record is shorter than 11 (eleven) bytes.

`Not INTEL Hex format.`

Error: The record contained non-hexadecimal characters.

`Record type must be 0 or 1.`

Error: The Record Type field contained a value other than 0 or 1.

`Checksum error.`

Error: The record is corrupt so that the sum of the length, address, type, and data bytes did not equal the checksum value.

Firmware Timestamp Errors

The following errors can occur when the verification program attempts to get the firmware timestamp.

`Timeout waiting for interrupt`

Error: The verification program did not receive the expected device flag (SFS sc) after sending the command to retrieve the firmware timestamp.

Solution: Run the self-test to verify that this is a hardware failure. Return the SCSI Card to Hewlett-Packard as indicated in Chapter 2 if this condition persists.

`Protocol error: Response FIFO empty`

Error: The verification program received the correct device flag after sending the command to retrieve the timestamp, but the SCSI Card status word (LIA 32B) indicated that the response FIFO was empty. The verification program expects the response "FIFO" to contain the timestamp response; therefore, the response "FIFO" should not be empty.

Solution: Run the self-test to verify that this is a hardware failure. Return the SCSI Card to Hewlett-Packard as indicated in chapter 2 if this condition persists.

`Bad response type in returning timestamp`

Error: The response to the timestamp retrieval command did not contain the expected response type 5.

Solution: Verify that the proper drivers and firmware are installed. If this error persists, return the SCSI Card to Hewlett-Packard as indicated in Chapter 2.

`SCSI Card not installed or select code incorrect`

Error: The global register on the SCSI Card is not set properly. This means that the switch setting for the card's select code is incorrectly set on switch SW1 or the select code is incorrectly generated in the interface table. That is, the select codes in the interface table and on the card itself are not the same. Because the select codes do not agree, the program cannot find the SCSI Card.

Solution: Reboot the computer and check the list of SCSI Cards and their select codes to ensure that each select code is correctly set on SW1 and correctly generated into the system.

Driver Errors

`Driver Error: TERMPWR not Enabled`

Error: The termination power is not enabled on the SCSI Card and is not enabled from any of the SCSI devices.

Solution: Enable termination power from the SCSI Card as described in chapter 2 or enable termination power from one of the devices.

If VSCSI detects driver errors when issuing EXEC calls to a SCSI device, VSCSI prints the error condition, but does not print the error number. Driver error messages are preceded by the phrase "Driver Error:", followed by a description of the error condition. Appendix A describes driver error messages and provides solutions for the errors. If the driver returns an error code unknown to VSCSI, VSCSI displays the error code in decimal. For example, an unknown error might be "Driver Error: 47 (decimal)".

VSCSI prints the following errors originating in the device driver (the decimal error number is provided in this description, even though it is not reported on screen):

Error Number	Error Message
1	Illegal request.
2	Device not ready.
3	Device timeout.
5	Transmission error.
6	Device write protect.
7	Address error.
10	Disk fault.
12	Insufficient driver table space.
20	Disk not mounted.
21	Wrong media; No disk in drive.
22	Incompatible cartridge.
23	Medium un-initialized or format corrupt.
24	No spares available.
25	Automatic re-allocation failed.
26	Defect list update failed.
27	Defect list not available.
29	Illegal logical block address.
62	Device busy.

VSCSI prints the following errors originating in the interface driver (the decimal error number is provided in this description, even though it is not reported on screen):

Error Number	Error Message
28	Protocol error.
40	TERMPWR not enabled.
41	Device driver bypassed on 1st call.
42	Card SCSI address = Device SCSI address.
43	Select error. SCSI device not on bus.
44	CDB length or CDB type illegal.
45	Firmware/driver rev codes incompatible.

Other Errors

Several other error messages can appear during VSCSI testing. For more information about these errors, refer to the *RTE-A Programmer's Reference Manual*, part number 92077-90007.

`FORMAT operation failed.`

Error: FORMAT operation did not succeed. This message appears in conjunction with other error messages that specify the exact error condition.

`System ABORTED call. Error code = AABB`

Error: An EXEC call was aborted. AA and BB are the contents of the A- and B-Registers, respectively.

`TERMPWR missing.`

Error: A cable is not connected or a fuse has opened.

5

Programming Reference Material

Note The information that was previously provided in this chapter has been moved to the *RTE-A Driver Reference Manual*, part number 92077-90011, as of RTE-A Revision 6000. Please refer to that manual for detailed information regarding the SCSI drivers.

6

Booting the System from SCSI

This chapter describes how to configure and boot your system from a SCSI device (disk or tape). Also included is information about SCSI boot device parameters and media formats, and VCP SCSI loader errors.

Configuring Your System to Boot from a SCSI Device

You must perform the following seven steps to set up your system to boot from a SCSI device. You can set up your system as a SCSI-only system or retain your HP-IB disk while implementing SCSI boot capability. After you configure your system, you can boot from a SCSI device as described later in this chapter. The SCSI boot device can be an optical or hard disk, or a tape drive.

1. ASAVE your current system. This step preserves your system, in case any errors occur. For a description of the ASAVE utility, refer to the *RTE-A Utilities Manual*, part number 92077-90004.
2. Install the SCSI software and generate the system as described in Chapter 3. If you have been accessing your SCSI device with earlier revision SCSI drivers, you do not have to reboot at this time. If this is a new installation, or if you want to format your new SCSI disk, you must reboot with the new system in order to access your SCSI device.
3. If your SCSI device has not been formatted, format it now. You can use the VSCSI online verification program's FORMAT command to do this as described in Chapter 4.
4. Initialize the first LU on the SCSI device with *n* x 768 reserved blocks as the system LU, where *n* is the multiplier of the number of 768 reserved blocks. For a description of how to do this, refer to Chapter 6 of the *RTE-A Users Manual*, part number 92077-90002.
5. Install the new BOOTEX file (revision 5250 or later), from the SCSI release media, to the SCSI device system LU reserved area. This is described in Chapter 7 of the *RTE-A Utilities Manual*, part number 92077-90004.

6. Copy the directories from the HP-IB disks to the SCSI disks.

   a. Copy the files from the HP-IB system directory to the SCSI system directory:

```
CI> rn /system /sys1              rename the HP-IB system directory
CI> crdir /system <scsi_lu>       create the SCSI system directory
CI> co /sys1/@ /system/@
```

   b. You now have the option to configure your system in three different ways. Choose one of the following three options and perform the steps indicated.

      (1) Option 1: Boot from SCSI (directories may reside on HP-IB or SCSI).
      Go to step 7 below.

      (2) Option 2: Boot from either HP-IB or SCSI disk.
      Copy the rest of the directories from the HP-IB disk LU that contains the /SYSTEM directory to the SCSI device LU that contains the /system directory:

```
CI> rn /directory1 /dir1
CI> crdir /directory1 <scsi_lu>
CI> co /dir1/@ /directory1/@
CI> rn /directory2 /dir2
CI> crdir /directory2 <scsi_lu>
CI> co /dir2/@ /directory2/@
CI> ...
```

      Make sure that: (1) the boot command and welcome files in the HP-IB system directory do not mount the SCSI device LU that contains the /SYSTEM directory, and (2) the boot command and welcome files in the SCSI system directory do not mount the HP-IB disk LU that contains the /SYSTEM directory. You can now dismount the SCSI LU and rename the HP-IB directories back.

```
CI> dc <scsi_lu>
CI> rn /sys1 /system
CI> rn /dir1 /directory1
CI> rn /dir2 /directory2
CI> ...
```

      (3) Option 3: Boot from SCSI system (HP-IB disk not required).
      Copy *all* directories and their contents from HP-IB disks to SCSI disks, and modify the boot command and welcome files to mount only the SCSI LUs:

```
CI> [mc <hp_ib_lu1>]              if it has not been mounted
CI> rn /programs /pro1
CI> [mc <scsi_lu1>]               if you want to copy to SCSI LU 1
CI> crdir /programs <scsi_lu1>
CI> co /pro1/@ /programs/@
CI> rn /libraries /lib1
CI> crdir /libraries <scsi_lu1>
CI> co /lib1/@ /libraries/@
CI> ...
```

7. Install the new VCP PROMs (revision 4021 or later) as described in the documentation that came with the new PROMs.

Your system is now ready to boot from the SCSI device. Before we describe how to do this, you must be familiar with boot device parameters and media formats.

Boot Device Parameters and Media Formats

You can use a disk or a tape as the SCSI boot device medium. There is a specific data format for each of these which the following subsections provide. The information includes specific devices, the interface, default parameters, media format, and boot protocol and sequence. The default parameters are for the SCSI boot command which is discussed in the next section.

The computer reference manual for your computer contains detailed information about booting the system, formats for other interface cards (such as HP-IB), the VCP program and its interfaces, and VCP commands.

SCSI Disk Drive Parameters

Device: Hard Disk, or Magneto-Optical Disk. (Refer to Table 1-1 for a list of supported drives.)

Interface: HP 12016A SCSI Card.

Default Boot Parameters: 000006027
The first five zeros are the file number of a boot extension file, 6 is the SCSI device address, the sixth zero is the unit number, and 27 is the SCSI Card select code.

Format: Count-Partial Data.
The Count is the number of 32 K word blocks. The Partial is a "leftover" block of less than 32 K words. The Count is stored in location 00000, and the Partial is stored in location 00001.

Loader: Uses SCSI protocol to communicate with the disk. The load sequence is:

1. Device ID
2. Status check
3. Read disk capacity
4. Status check
5. Read/write 32k words via DMA
6. Status check

SCSI Tape Parameters

Device:	Digital audio tape or half-inch tape drive.
Interface:	HP 12016A SCSI Card.
Default Boot Parameters:	004027 The first two zeros are the file number, 4 is the SCSI device address, the third zero is the unit number, and 27 is the SCSI Card select code.
Format:	Memory image file. Count-Partial-Data. Count = the number of 32 K word blocks. Partial = the number of words in a partial 32 K word block. Data = 256 byte records read until the EOF (end of file) mark, or until Count and Partial are satisfied.
Loader:	Uses SCSI protocol to communicate with the DAT. The load sequence is: 1. Device ID 2. Status check 3. Rewind/file forward (if file specified) 4. Read/write 5. Status check

Booting the System from a SCSI Device (Loader Command)

The following SCSI bootstring description assumes that you have configured your system to boot from a SCSI device as described previously in this chapter.

You can boot the system using the %B or %L loader command. The bootstring consists of four parts, which are described below in detail. The first part is the loader command (%B or %L) which is a mandatory parameter in the bootstring. The second part specifies the device type which is also mandatory. The third part consists of four optional parameters. The fourth part, a text string which is also optional, can only be used with the %B or %L command.

The loader command (bootstring) has the following form:

`%B/L/`*Wdvfffffbusctext*

where you enter one and only one of the loader commands %B, %L, or %W, followed by the parameters. You must specify a loader command in the bootstring. Blank spaces cannot be used in the bootstring (see the subsection titled "Bootstring Examples"). The parameters are:

dv, the second part of the bootstring, which specifies the device type. You must specify a device type in the bootstring. The device can be:

`DC`, for SCSI disk drive.
`MT`, for SCSI tape drive.

The third part of the bootstring consists of four optional parameters, *fffffbusc*:

fffff is the file number (octal 0 to 77777) of a boot extension file. The default value is 0 which points to the first 256 blocks on disk.

b is the SCSI bus address of the disk drive. The default value is 6 for a SCSI disk, and 4 for a SCSI tape device.

u is a unit number from 0 to 7, if a unit number is used on the device. For SCSI boot devices, the unit number defaults to 0, and always must be 0.

sc is the select code of the SCSI Card. You must specify this parameter if you are going to use any of the other parameters because the last two digits of this part of the bootstring are always read as the select code. For example, if you specify a bus address and a unit number, but not a select code, the bus address and unit number are read as the select code. If you do not specify a select code in the bootstring, the default is 27 octal. Use 27 as the select code for the SCSI Card if you want to boot from SCSI automatically on power-up.

The fourth part of the bootstring is an optional parameter. You can only specify it when you use the %B or %L loader command at the beginning of the bootstring:

text, which is a file name or ASCII string to be passed to the program after the program is loaded. The text parameter can be one of two types of files:

1. A type 1 system file that has been previously loaded at least once (that is, had boot.cmd executed on it) or is a memory-based type 1 system.

2. A type 4 boot command file.

   The text string cannot begin with a numeric character; it must begin with an alphabetic character.

The following two subsections describe bootstring formats, and provide specific examples of bootstrings.

Bootstring Formats

`VCP> %B`*dvtext*	Boots the system and specifies the device type. Device parameters are the defaults, and a text string beginning with an alphabetic character is passed to the program after it loads.
`VCP> %B`*dvfffffbusc*	Boots the system and specifies the device type. The bootstring specifies the file number, disk drive bus address, unit number (which is always 0 for SCSI devices), and select code parameters. The select code is read first, followed by the unit number, the bus address, and the file number. This means that you must specify the select code if you use any of the other three optional parameters *fffffbu*.
`VCP> %B`*dvfffffbusctext*	Boots the system and specifies the device type. The bootstring specifies the file number, disk drive bus address, unit number, and select code parameters, and a text string is passed to the program after it is loaded. The select code must be entered in the bootstring if you enter any of the optional parameters *fffffbu*.

Bootstring Examples

The following are specific examples of SCSI boot strings using all three loader commands:

`VCP> %BDC`	Loads and starts execution of the default program on the disk. The DC parameter specifies that the disk is the device; the disk parameters default to 006027 (file number 0, SCSI bus address 6, unit number 0, select code 27). Refer to the section titled "SCSI Disk Drive Parameters" in this chapter.
`VCP> %BDC27`	Loads and starts execution of the default program on the disk at select code 27.
`VCP> %BDC27SCSIONLY.CMD`	Loads and starts execution of the boot command file on the disk at select code 27.

`VCP> %LDC36027`

Loads but does not execute the default program on the disk, and specifies the following parameter values:

file number 3 (the fourth offset of 256 blocks).
SCSI bus address 6.
unit number 0.
select code 27.

If you want to boot from SCSI, and you have not given the SCSI Card select code 27, you must specify the SCSI select code in the bootstring.

VCP Loader Errors for SCSI

For all of the following errors, check the SCSI address, card LEDs connectors, and cable. When you have verified that all of these are correct, retry your procedure.

Disk loader errors:

`LDER ERR 411` Check condition after inquiry command.

This is a timeout error reading the disk, or an error in the intialization process.

`LDER ERR 415` Check condition after Read/Write, parity error/timeout during DMA transfer.

This is a timeout error during a seek.

Tape loader errors:

`LDER ERR 510` Check condition after inquiry command.

`LDER ERR 513` Check condition after Read/Write, parity error/timeout during DMA transfer.

`LDER ERR 560` Check condition after rewind command.

7

DDL Diagnostic Program

This chapter describes the Diagnostic Design Language (DDL) diagnostic program for the SCSI interface.

General Information

Load and execute the Diagnostic Control System (DCS) and the SCSI interface diagnostic program, using the desired diagnostic operating mode (as described in the *HP 1000 A-Series Computer Diagnostic Operating and Troubleshooting Manual*, part number 24612-90013). After the diagnostic has been loaded, the program name and revision number appear on the screen.

The diagnostic operating procedures provided in this chapter assume that a VCP terminal is connected and enabled. Chapter 3 of the Diagnostic Operating and Troubleshooting Manual describes the operation and error codes for the "without VCP" DDL mode.

Refer to Appendix E for a listing of the SCSI interface diagnostic program source code.

Additional Equipment

The SCSI loopback test panel, part number 12016-60007, is required to execute the SCSI interface diagnostic loopback tests. The section titled "Loopback Test Panel" in this chapter describes the loopback panel configuration. You can order the loopback test panel from Hewlett-Packard.

Diagnostic Limitations

The SCSI interface diagnostic does not test the I/O processor chip and its support logic. These circuits are common to every A-Series I/O interface card and are tested by the power-on self-test and the IOM Kernel Diagnostic (refer to the *HP 1000 A-Series Computer Kernel Diagnostic Reference Manual*, part number 24612-90017).

Diagnostic Modes

The SCSI interface diagnostic provides two modes of program execution, automatic and interactive. Automatic mode runs a series of tests on one specified SCSI card or on all of the SCSI cards in the computer card cage.

In interactive mode, you can run a test on a specified SCSI card. You can automatically repeat the test(s) up to 32,767 times, using the interactive mode loop command parameter. Interactive mode also enables you to download Z180 code from a specified file on a specified device.

Both modes run the same tests (SCSI card self-test, TERMPWR check, firmware timestamp display, RAM test, and loopback test), which the following section describes. Later in the chapter, both diagnostic modes are described.

Test Descriptions

The SCSI diagnostic provides five tests:

SCSI card self-test
TERMPWR check
Firmware timestamp display
RAM
Loopback

You can run these tests in both automatic and interactive diagnostic modes.

SCSI Card Self-Test

Running this test causes the SCSI diagnostic to issue an OTA 32B instruction to the specified SCSI card, which forces the card to execute its power-on self-test. If the card passes the self-test, the diagnostic prints the following message:

```
SELFTEST PASSED.
```

If the card fails the self-test, one of the following two messages appears:

```
DEVICE FLAG NOT SET.
```

or

```
SELFTEST FAILED.
```

The DEVICE FLAG NOT SET message appears if the SCSI card does not set the device flag. The SCSI card sets the device flag to indicate that the self-test has completed. Test completion does not necessarily mean that the card has passed or failed, just that the firmware has finished the test. This error can be caused by nonexistent or misloaded firmware ROMs, or by an IOP (input/output processor) failure. This is a hardware failure; return the card to Hewlett-Packard.

The SELFTEST FAILED message appears if the device flag is set (that is, the self-test has completed), but an area of the self-test has failed. If this message appears, check the LEDs on the SCSI card.

Four red Light Emitting Diodes (LEDs) display SCSI Card status and report errors (if any) that result from the SCSI self-test (see Figure 2-1 for a diagram of the SCSI Card layout). Table 7-1 shows the possible self-test LED patterns and their definitions.

You can see whether or not the SCSI Card has passed the SCSI self-test by checking the LEDs. A frozen LED pattern (the LEDs' pattern does not change and some LEDs are in a steady "on" condition) denotes a self-test failure.

If the SCSI Card fails the self-test, record the frozen LED pattern, then return the card to Hewlett-Packard.

If the SCSI Card passes the self-test, but the LEDs remain off, the card is malfunctioning. Check the cable connections and ensure that the card is firmly seated, then execute the self-test again. If this condition persists, return the card to Hewlett-Packard.

Table 7-1. LED Self-Test Status

LED 1	LED 2	LED 3	LED 4	Status
OFF	ON	ON	ON	Card PROM Checksum Error
OFF	ON	ON	OFF	RAM Test Failed
OFF	ON	OFF	ON	Reserved
OFF	ON	OFF	OFF	DMA Test Failed
OFF	OFF	ON	ON	Timer Test Failed
OFF	OFF	ON	OFF	SCSI Chip Test Failed
OFF	OFF	OFF	ON	Reserved
OFF	OFF	OFF	OFF	Passed Test *
BLINK	OFF	OFF	OFF	Normal Operation **

* The all-LEDs-off condition that indicates successful self-test completion only exists briefly; after this, LED number one blinks continuously, which indicates a normally functioning SCSI Card.

** The rate at which LED one blinks indicates the activity of the card. Faster blinking indicates an idle card. Slower blinking indicates a heavier load on the card. A rate as low as several seconds between blinks is normal.

TERMPWR Check

This test reports the status of the SCSI card's bus termination power. TERMPWR status simply indicates whether or not TERMPWR is present. It does not indicate the TERMPWR source, which can be the SCSI card (when Switch SW1−2 is closed) or a SCSI device.

If the SCSI card or a SCSI device is providing TERMPWR, the message

```
TERMPWR ENABLED.
```

appears.

If neither a device nor the SCSI card (SW1-2 is open) is supplying TERMPWR, the message

```
TERMPWR DISABLED
```

appears.

If TERMPWR is disabled on the SCSI card (SW1−2 is open), one of the devices connected to the card must provide TERMPWR.

Firmware Timestamp Display

This test confirms the basic functioning of two parts of the SCSI card:

1. The Z180 microprocessor
2. The data path between the A-Series computer (HP 1000) and the SCSI card.

The firmware timestamp test does not check the SCSI chip itself or the data paths between the SCSI card and its device(s).

This test sends a "peek" script (a command that reads data without moving the data from its current location) to the SCSI card. The peek script requests the card to transmit the firmware timestamp (the contents of memory location 0x40 through 0x4F) to the HP 1000 computer's CPU. If the CPU receives the firmware timestamp, a message appears in the following form:

```
FIRMWARE TIMESTAMP:  yymmdd.aabb
```

where *yy* is the year, *mm* is the month, and *dd* is the day of the firmware release; *aa* is the major revision code, and *bb* is the minor revision code. A period separates the date and revision code fields.

For example, if the date of the firmware timestamp is January 30, 1991, the major revision code is 00, and the minor revision code is 04, the following message appears:

```
FIRMWARE TIMESTAMP:  910130.0004
```

If the peek script request fails, one of the following three error messages appears, depending on the failure:

```
DEVFLAG NOT SET

RESPONSE FIFO EMPTY
```

or

```
RESPONSE TYPE INCORRECT
```

The DEVFLAG NOT SET error indicates a hardware failure. Return the SCSI card to Hewlett-Packard.

The RESPONSE FIFO EMPTY error indicates that the diagnostic program received the correct device flag after sending the command to retrieve the timestamp, but the SCSI card status word (LIA 32B) indicated that the response FIFO was empty. The diagnostic program expects the response FIFO to contain the firmware timestamp response, which means that the response FIFO should not be empty. Run the SCSI card self-test to verify that this is a hardware failure. If this condition persists, return the SCSI card to Hewlett-Packard.

The RESPONSE TYPE INCORRECT error indicates that the response to the firmware timestamp request did not contain the expected response type, which is five (5). Verify that the proper drivers and firmware are installed, then run this test again. If this error persists, return the SCSI card to Hewlett-Packard.

RAM Test

The RAM test detects stuck-at-0 and stuck-at-1 conditions (that is, a bit always reports a 0 or a 1) in the address range 32KB to 512KB. The address range 0KB through 32KB is not tested, because these memory locations contain the on-board firmware code and the downloaded RAM test code itself.

You cannot execute the RAM test if the SCSI card's firmware timestamp is 900711.0003 or earlier (July 11, 1990, major revision 00, minor revision 03). In order to execute the RAM test, the firmware revision must be major revision 00, minor revision 04, or greater.

Because the RAM test takes approximately seven (7) seconds to execute, the following message prints during test execution:

```
RAM TEST EXECUTING
```

If the RAM test passes, the following message appears:

```
RAM TEST PASSED
```

If the RAM test fails, the following two messages appear:

```
RAM FAILURE AT ADDR: xxxxx; BIT y.
SUSPECT DRAM AT POSITION zzzz.
```

where *xxxxx* is the hexadecimal address where the failure was detected, *y* is the bit position, and *zzzz* is the DRAM IC that is associated with the address/bit position that failed. The DRAM IC designation will be U124, U114, U123 or U113.

You can bypass RAM test execution when running the diagnostic program by setting the variable Z to any nonzero integer at the DDL prompt, before executing any tests. For example,

```
DDL> Z=1
```

disables the RAM test. If you disable the RAM test, then attempt to run the RAM test later, a message appears that indicates that the RAM test has been disabled. When you run the diagnostic program, the message

```
RAMTEST NOT EXECUTED
```

appears with the results of the other diagnostic tests.

To enable the RAM test, set Z=0 at the DDL prompt.

The diagnostic program provides the RAM test bypass because this test takes a relatively long period of time to execute.

Loopback Test

The loopback test checks for failures in the data and control lines that go from the SCSI chip to the card edge and cable end. This test utilizes the loopback mode built into the SCSI chip. The SCSI chip loopback mode takes data written onto the data lines and reads it back on the control lines; it also takes data written onto the control lines and reads it back on the data lines. The test checks for stuck-at-1 bits, stuck-at-0 bits, and multiple assertions of a single bit. The loopback test panel (part number 12016-60007) allows loopback testing to the card edge, as well as to the end of both single-ended and differential cables.

If the loopback test passes, the diagnostic returns the following message:

```
LOOPBACK TEST PASSED
```

If the loopback test detects a stuck-at-1 failure (that is, a zero was written on the line, but a one was read back), the DDL program prints a message in the following form:

```
LOOPBACK ERROR:  DATAx -> yyy BITS ALWAYS HI (0V).
LOOPBACK ERROR:  yyy -> DATAx BITS ALWAYS HI (0V).
```

where DATA*x* is the name of the data signal associated with the failure, and *yyy* is the name of the control line associated with the failure.

If the loopback test returns a stuck-at-0 failure (that is, a one was written on the line, but a zero was read back), the DDL program prints a message in the following form:

```
LOOPBACK ERROR:  DATAx -> yyy BITS NOT ASSERTED.
LOOPBACK ERROR:  yyy -> DATAx BITS NOT ASSERTED.
```

where DATA*x* identifies the data signal associated with the failure, and *yyy* identifies the control line associated with the failure.

If bits in addition to the bit being tested assert during the stuck-at-0 test (multiple bit error), the diagnostic program prints a message in the following form:

```
LOOPBACK ERROR:  DATAx -> yyy CAUSE MULTIPLE BIT ERRORS.
LOOPBACK ERROR:  yyy -> DATAx CAUSE MULTIPLE BIT ERRORS.
```

Again, DATA*x* identifies the data signal, and *yyy* identifies the control line.

Stuck-at-1 bits do not cause multiple bit errors, because they are already reported as stuck in an "on" condition.

Loopback Test Panel

The SCSI loopback test panel, part number 12016-60007, is necessary to execute the diagnostic program's loopback test. Table 7-2 defines the configuration of the loopback test panel. Each data line DATA*x* (DATA0 through DATAP) is associated with a control line *yyy* (I/O through RST).

Table 7-2. Loopback Test Panel Configuration

Data Line		Control Line
DATA0	↔	I/O
DATA1	↔	C/D
DATA2	↔	MSG
DATA3	↔	REQ
DATA4	↔	ACK
DATA5	↔	ATN
DATA6	↔	SEL
DATA7	↔	BSY
DATAP	↔	RST

Automatic Mode Diagnostic Operation

The SCSI diagnostic program's automatic mode runs a series of tests on a single SCSI card or on all of the SCSI cards in the computer card cage.

Single SCSI Card Automatic Mode Execution

To initiate automatic execution of the SCSI interface diagnostic for one SCSI card, enter:

```
DDL> RUN
```

When you enter *RUN* at the DDL prompt, a message stating the program name and revision number appears, followed by a prompt for the select code of the SCSI card you want to test:

```
INPUT SELECT CODE
```

Enter the octal select code of the card (do not use the @ sign before the code number; the test expects an octal number). The tests affect the selected card only. After you select the SCSI card, a prompt asks you if the loopback test panel has been installed:

```
HOOD INSTALLED?
```

Hood refers to the loopback test panel. If you have attached the loopback panel and answer *yes*, the loopback test is included in the test sequence. Otherwise, only the firmware timestamp, TERMPWR check, self-test and RAM tests are executed (unless you have set the Z variable to a nonzero integer, which disables the RAM test). When the tests have executed, the prompt

```
INPUT SELECT CODE
```

appears again. If an error has occurred, the error message prints before the select code prompt appears. To run the diagnostic again, enter the select code of the desired SCSI interface card.

You can run the diagnostic on the same card or on a different card, or exit the program. To exit the diagnostic program and return to the DDL prompt, enter *0* (zero) at the INPUT SELECT CODE prompt.

If you press the RETURN key at the INPUT SELECT CODE prompt without entering a select code value, the program loops (repeats the tests) continuously on the last selected SCSI card. After every successful pass, the following message prints:

```
PASS n
```

where *n* is the pass number. Looping continues until an error occurs or you press the BREAK key. After you press the BREAK key, enter the %E command, which sends you to the BCM> prompt. From there, you can enter the DDL command at the prompt to return to the SCSI diagnostic program.

The following is an example SCSI DDL session, in automatic single card test mode, where *xx* is the octal select code of a SCSI card (0 returns you to the DDL prompt).

```
DDL> RUN <RET>
12016A SCSI INTERFACE DIAGNOSTIC - REV.5270
INPUT SELECT CODE  xx <RET>
HOOD INSTALLED?  YES <RET>
SELFTEST PASSED.
TERMPWR ENABLED.
FIRMWARE TIMESTAMP:  900130.0004
EXECUTING RAM TEST.  PLEASE WAIT.
RAM TEST PASSED.
LOOPBACK TEST PASSED.
PASS COMPLETE
INPUT SELECT CODE  xx <RET>
.  .
.  .
.  .
INPUT SELECT CODE  0
DDL>
```

Multiple SCSI Card Automatic Mode Execution

To initiate automatic execution of the SCSI interface diagnostic for multiple SCSI cards (in the same computer card cage), enter:

```
DDL> RUN !
```

The *RUN !* command tests the SCSI cards in the order of their priority (note that there is a space between *RUN* and *!*). The multiple card diagnostic mode does not run the loopback test (the loopback test panel connects to one card at a time). Multiple card automatic mode executes the self-test, TERMPWR check, firmware timestamp test, and the RAM test (unless you have set the Z variable to a nonzero integer, which disables the RAM test).

When you enter *RUN !* at the DDL prompt, a message stating the program name and revision number appears, followed by the select code of the card being tested, the test results, then the select code of the next card, until all cards have been tested. The diagnostic tests the highest priority SCSI card first. If the diagnostic detects a failure, it prints an error message, terminates the program, and returns to the DDL prompt. If no errors occur, the program proceeds to the next highest priority SCSI card and reports the results. When all of the SCSI cards have been tested (without error), the diagnostic program terminates and returns to the DDL prompt.

The following is an example SCSI DDL session, in automatic multiple card test mode, where *xx* and *yy* are the octal select codes of SCSI cards.

```
DDL> RUN ! <RET>
12016 SCSI-1000 DIAGNOSTIC - REV.5022
SELECT CODE xx UNDER TEST
SELFTEST PASSED.
TERMPWR ENABLED.
FIRMWARE TIMESTAMP:  900130.0004
EXECUTING RAM TEST.  PLEASE WAIT.
RAM TEST PASSED.
PASS COMPLETE
SELECT CODE yy UNDER TEST
SELFTEST PASSED.
TERMPWR ENABLED.
.  .
.  .
.  .
PASS COMPLETE
DDL>
```

Interactive Mode Diagnostic Operation

The SCSI diagnostic program's interactive mode runs one of five tests on a specified SCSI card and enables you to download Z180 code from a specified file on a specified device. You can execute a test multiple times.

You initiate interactive mode by entering

```
DDL> RUN T
```

with or without runstring command parameters. If you enter *RUN T* without parameters, the diagnostic displays a list of tests you can run and commands you can execute, followed by a test selection prompt:

```
 1 - SELF-TEST
 2 - TERMPWR ENABLED CHECK
 3 - FIRMWARE TIMESTAMP DISPLAY
 4 - RAM TEST
 5 - LOOPBACK TEST
10 - DEFINE DOWNLOAD DEVICE:FILE
11 - DOWNLOAD Z180 CODE
-1 - EXIT DIAGNOSTIC

ENTER TEST NUMBER:
```

You can either enter a test number or exit to the DDL prompt (−1) from the ENTER TEST NUMBER: prompt. If you enter a test number, the prompt INPUT SELECT CODE appears, enabling you to choose the SCSI card on which to run the test. Enter the octal select code of the card (do not use @ before the code number; the test expects an octal number). The test affects the selected card only. After the test executes, the diagnostic returns to the DDL prompt.

Tests one through five are described in a previous section of this chapter. Options 10 (DEFINE DOWNLOAD DEVICE:FILE) and 11 (DOWNLOAD Z180 CODE) are used in conjunction with one another. Together, they enable you to download Z180 code from a specified file on a specified load device. To do this, first select option 10. Selecting option 10 brings up the prompt

```
ENTER DEVICE NUMBER:
```

Enter the number of the load device from which you want to download the Z180 code (for example, a CS/80 cartridge or a tape drive). The prompt

```
ENTER FILE NUMBER:
```

appears. Enter the number of the file that contains the Z180 code you want to download. The SCSI device and the file containing the Z180 code on that device are now specified. Next, select option 11. This automatically downloads the Z180 code to the SCSI card.

Note that the DEFINE DOWNLOAD DEVICE:FILE option assumes that device numbers have been assigned to the SCSI devices. The DOWNLOAD Z180 CODE option assumes that you have defined a device and named a file using option 10.

You can also download Z180 code to a SCSI card by using the RUN T command runstring twice. To do this, enter the 10 option in the first RUN T command runstring, execute it, then enter the 11 option in the next RUN T command runstring.

The RUN T command runstring (entered after RUN T at the DDL prompt) includes a parameter that enables you to loop on (repeat) a specified test on a single SCSI card. You cannot loop on the DEFINE DOWNLOAD DEVICE:FILE and DOWNLOAD Z180 CODE options. Multiple test runs are particularly useful for executing the loopback test on a card (remember to connect the loopback test panel, or this does not work). The interactive diagnostic runstring has the following form:

```
RUN T [test number] [select code] [number of test executions]
```

where RUN T initiates the diagnostic program, and the test number identifies the test or command to run. The select code is the octal select code number of the SCSI card you want to test; you must precede this number with an at sign (@) to indicate that it is octal (if you so desire, you can enter the select code as a decimal number). The test execution multiple is a positive decimal integer that specifies the number of times to run a specified test on the SCSI card (a negative number causes the program to loop indefinitely, until the user presses the BREAK key). You can loop a test up to 32,767 times. When the test finishes executing, it returns to the DDL prompt. For example, the runstring:

```
DDL> RUN T 5 @71 3
```

runs test five (the loopback test) three times on the SCSI card that has the select code 71 octal, then returns to the DDL prompt.

Execution Times

The execution time for the SCSI diagnostic program's automatic mode is approximately 9 seconds per card.

The execution times for the interactive mode tests are as follows:

SCSI self-test	= 1 second
RAM test	= 7 seconds
TERMPWR check	< 1 second
Firmware timestamp display	< 1 second
Loopback test	< 1 second

Error Messages

The following error messages can appear on screen when you run the SCSI interface diagnostic program.

`DEVICE FLAG NOT SET.`

The SCSI card did not set the device flag within 5 seconds after the self-test command was issued to the card. This error can be caused by nonexistent or misloaded firmware ROMs, or by an IOP failure. This is a hardware failure; return the card to Hewlett-Packard.

`SELFTEST FAILED.`

The self-test failed. The device flag was set (that is, the self-test completed), but an area of the self-test failed. If this message appears, check the LEDs on the SCSI card (refer to the self-test test description in this chapter for detailed information about the LED error patterns).

`TIMEOUT WAITING FOR DEVICE FLAG.`

The device flag was not set within 5 seconds after the timestamp script was sent to the SCSI card. This indicates a hardware failure; return the card to Hewlett-Packard.

`RESPONSE FIFO EMPTY.`

The diagnostic program received the correct device flag after sending the command to retrieve the timestamp, but the SCSI card status word (LIA 32B) indicated that the response FIFO was empty. The diagnostic program expects the response FIFO to contain the firmware timestamp response, which means that the response FIFO should not be empty. Run the SCSI card self-test to verify that this is a hardware failure. If this condition persists, return the SCSI card to Hewlett-Packard.

`RESPONSE TYPE INCORRECT.`

The response to the firmware timestamp request did not contain the expected response type, which is 5 (a value other than 5 was returned). Verify that the proper drivers and firmware are installed, then run this test again. If this error persists, return the SCSI card to Hewlett-Packard.

`TERMPWR MISSING.`

A cable is not connected or a fuse has opened. Check the cable connections and the on-card fuse.

`RAM FAILURE at` *xxxx* `(hex)`

The diagnostic program detected a failure at RAM address *xxxx* (hexadecimal).

`SELECT CODE` *xx* `ILLEGAL.`

An illegal octal select value was entered at the INPUT SELECT CODE prompt. The octal select code entered does not correspond to a card in the computer card cage. Enter a valid select code; if you believe the code is valid, check the list of SCSI cards and their select codes to ensure that each select code is correctly set on switch SW1 on the SCSI card.

RAM TEST NOT EXECUTED.

The firmware timestamp is equal to or earlier than revision yymmdd.0003 (major revision 00, minor revision 03) or the user has disabled RAM test execution by setting the Z variable to a nonzero value. If the firmware timestamp of your SCSI card is greater than revision yymmdd.0003, set the Z variable to 0 (zero) at the DDL prompt (DDL> Z=0).

Downloaded Z180 Code Errors

The following errors can occur only when you use option 11 (DOWNLOAD Z180 CODE) in the interactive version of the diagnostic program. All of these errors indicate a corrupt .HEX file. The solution to .HEX file errors is to replace the corrupt .HEX file.

EOF BEFORE END RECORD

When reading the HEX file, the end of file marker (EOF) was detected before the Intel END record was encountered.

INVALID INTEL FORMAT AT RECORD XXXXX

When reading the HEX file, record xxxxx was not a valid INTEL HEX record. One of the following two errors was detected:

1. The first character was not a colon (:), semi−colon (;) or asterisk (*).

or

2. The length, address, type, data bytes or checksum fields contained a nonhexadecimal character.

UNKNOWN RECORD TYPE AT RECORD XXXXX

When reading the HEX file, the type field in the record was not 00x or 01x.

CHECKSUM ERROR AT RECORD XXXXX

When reading the HEX file, the sum of the length, address and data byte fields did not equal the checksum field.

TIMEOUT ERROR - NO RESPONSE

When downloading the HEX file to the SCSI card, the SCSI card did not respond.

A

Error Messages

Errors can come from the rewritable disk drive, the interface driver or the device drivers. This appendix lists the possible error messages by place of origin to help you find the message and what to do about it. The first part of the appendix covers error messages from the device drivers. The second part describes interface driver errors and the last part describes device-specific errors.

Tape Device Driver (DDQ24) Errors

Driver Error (DVT Word 16)

DVT word 16, bits 5 through 0 (zero) contain error codes for the DDQ24 device driver. The error codes are as follows:

Dec.	Octal		Error and Solution
0	0B	=	Normal request completion.
1	1B	=	Illegal request. Check the syntax of your EXEC request call. The EXEC call could have illegal parameters or specify an unused LU or an unimplemented command. Retry the request after you check it.
2	2B	=	Device not ready. The drive is offline, but media is present in the drive. If this occurs, first try unloading, then reloading the tape. Second, send a SCSI Command Descriptor Block (CDB) to load the tape. If this does not work, ensure that the device is correctly connected, not busy, and correctly generated into the system.
3	3B	=	Device timeout. Use the TO command to increase the timeout period.
6	6B	=	Device write protected. Remove the tape's write protection.
7	7B	=	Address error. Ensure that the SCSI address is correct.
10	12B	=	Tape fault. Check the tape for any problems.
12	14B	=	Insufficient driver table space generated. Generate more driver table space.
21	25B	=	Medium is not present. Insert the medium into the drive.
22	26B	=	Incompatible cartridge. Use the correct type of tape cartridge.
23	27B	=	Positioning error detected. First try ejecting, then reloading the tape. If this does not solve the error, a hardware error is indicated.
24	30B	=	Hardware error. Check all connections, and ensure that tape drive is functioning correctly.

Dec.	Octal		Error and Solution
25	31B	=	Unknown error. This message should not appear. If it does, decode the error by checking DVT 19 which contains specific SCSI error codes.
26	32B	=	End of Data.
27	33B	=	Drive is offline or tape is unloading. Check the tape device.
63	77B	=	Driver retry request. This message can appear only if the Control Word user error bit (UE bit 13) is set. Control Word bit 13 enables the user to interpret errors and take action on them instead of allowing the system to handle errors. If you receive this message, check your request's syntax and try the request again.

All codes of 28 decimal (34B octal) or higher are interface driver error codes, except for 63 (77B), which indicates a driver retry request.

Disk Device Driver (DDQ30) Errors

The device driver generates the following errors which are returned in bits 5 through 0 of $DVT 16. All error number values are decimal numbers.

Error: 1 illegal request. A track or sector address error has occurred.
Error: 2 device not ready. The device is not mounted. Mount the device and try again.
Error: 3 device timeout.
Error: 5 transmission error. Check extended status.
Error: 6 device write protect. Either remove the write protect from the current device or write to a different device.
Error: 7 address error. Check the address on the device and compare it to the generation record's address.
Error: 10 disk fault. Format the disk.
Error: 12 insufficient driver table space generated. Regenerate the system.
Error: 21 no disk in drive.
Error: 22 incompatible cartridge. Change cartridges.
Error: 23 medium uninitialized or format corrupted. Format the disk.
Error: 24 no spares available. Replace the disk.
Error: 25 automatic reallocation failed.
Error: 26 defect list update failed. This is not implemented with our format.
Error: 27 defect list not available. This is not implemented with our format.
Error: 29 illegal logical block address.
Error: 62 device busy.

Interface Driver (IDQ35) Errors

The error descriptions in this section list the error number and the type of error, and provide a description of the error and a solution to the error. All error number values are decimal numbers. Interface driver IDQ35 can produce the following errors:

Error: 1 driver rejected call. This error indicates illegal subfunction bits.
Solution: Check your user program and make sure that the EXEC call is correct.

Error: 12 generation error. This error indicates that the number of IFT extensionwords was not sufficient.
Solution: Correct the answer file so that the interface table contains the correct number of extension words (see Chapter 3 under the heading "Create A New Answer File"), then regenerate the system.

Error: 28 driver defined error. This indicates a protocol failure. The SCSI Card returned a response that the driver was not expecting.
Solution: Reboot the system. If the problem persists, there may be a SCSI Card hardware failure.

Error: 40 driver defined error. This error message can occur for three reasons. Either the TERMPWR switch is not enabled, the SCSI Card fuse is open, or the SCSI cable is not attached.
Solution: Check the TERMPWR switch to ensure that TERMPWR is enabled (switch 2 on switch SW1 should be closed to enable TERMPWR; see Chapter 2 under the heading "Setting Switch SW1" for a detailed description of this switch). Make sure that the SCSI cable is firmly seated. Check the SCSI Card fuse (see Figure 2-2 in Chapter 2 for a diagram of the card layout); if the fuse is open, replace it with the spare fuse provided with the SCSI product.

Error: 41 driver defined error. This message indicates that the first call to the SCSI Card went directly to the interface driver (IDQ35), bypassing the device driver (DDQ30). This is not allowed, because the device driver's LU setup must be done before the first call to the interface driver.
Solution: Reboot the system. Do not bypass the device driver until after the first normal call.

Error: 42 driver defined error. The SCSI Card address is the same as the SCSI device address.
Solution: The addresses of the SCSI Card and its devices must be unique. Define different addresses for the SCSI Card and each device.

Error: 43 driver defined error. The SCSI address is incorrect, or no device on the SCSI bus responded to the SCSI address received from DVP01 (Driver Parameter 1).
Solution: Make sure that all devices are connected and turned on. Check all address switches on the devices. Check the answer file for correct DVT (Driver Table) entry for driver parameter one.

Error: 44 driver defined error. Incorrect length for CDB (Command Descriptor Block) in Z-Buffer call or illegal CDB type (per SCSI-II standard).
Solution: Check the user program and make sure that the Z-Buffer format is correct.

Error: 45 driver defined error. The revision level of the interface driver and the SCSI Card firmware are incompatible with each other. This means that either the interface driver was changed to a revision incompatible with the SCSI Card firmware, or the SCSI Card firmware was changed to a revision incompatible with the interface driver.
Solution: Ensure that the interface driver and SCSI Card firmware revisions are compatible with each other.

IDQ35 Warning Message

The interface driver will issue the following warning message when an interface timeout occurs:

```
Warning:  SCSI Interface Driver timeout.
```

The above warning indicates a communication problem between the interface driver and the SCSI Card firmware. Word 7 of the IFT extension is a counter for the number of timeouts that have occurred for the interface associated to that IFT.

Record all warning messages and timeout messages; call your Hewlett-Packard Representative.

SCSI Disk Drive Sense Key and Additional Sense Code

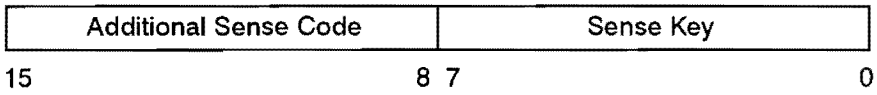
The sense key provides general error information. The additional sense code provides more detailed information about the error. Both of these codes are contained in DVT word 19.

You can get these messages by calling RMPAR as described in the *RTE-A Programmer's Reference Manual*, part number 92077-90007.

The following program segment is an example of a RMPAR call in FORTRAN to retrieve the extended status:

```
Integer*2 ExtendedStatus(0:4)
*
CALL EXEC(1,DISKLU,DBUF,DLEN,TRACK,SECTOR)
CALL ABREG(STATUS,TLOG)
CALL RMPAR(ExtendedStatus)
```

The format of extended status (3) in DVT 19 is as follows:



Sense Keys

The sense key error messages provide general error information. They are contained in the lower byte (0-7) of DVT word 19. All error number values are decimal numbers.

0 NO SENSE. This indicates that there is no specific sense key information to report for the designated logical unit. The 0 sense key is returned when the command completed successfully.

1 RECOVERED ERROR. This shows that the last command completed successfully with some recovery action performed by the target.

2 NOT READY. This indicates that the logical unit cannot be accessed. Check if the LU is correctly connected, and that the power is on.

3 MEDIUM ERROR. The command terminated with an unrecovered error condition caused by a medium defect. Check to see if the disk has been formatted or try another disk.

4 HARDWARE ERROR. The controller detected a hardware error. This indicates a possible problem with the 650/A Magneto Optical Drive.

5 ILLEGAL REQUEST. The command descriptor block or the additional command parameters (supplied as data for some commands) contained an illegal parameter. Check the EXEC call to make sure that the parameters are correct.

6 UNIT ATTENTION. The medium has been loaded, the unit has been reset, or the Mode Select parameters have been changed. Retry the request. If several retries fail, a possible problem with the 650/A Magneto Optical Drive is indicated.

7 DATA PROTECT. The Write Protect condition of the medium cartridge switch cannot perform a command to write the medium (that is, the medium is write protected). Write to a medium that is not write protected.

10 COPY ABORTED. An error condition on the source device, the destination device, or both, caused a COPY or a COPY AND VERIFY command to abort. This indicates a possible problem with the 650/A Magneto Optical Drive.

Additional Sense Code

The additional sense code error messages provide detailed error information. They are contained in the higher byte (bits 8 through 15) of DVT word 19. All error number values are decimal numbers.

0 No Additional Sense Information (NO SENSE).

There is no error to report.

2 No ESDI Command Complete (HARDWARE ERROR).

The drive unit did not return the ESDI command complete. This indicates a possible problem with the 650/A Magneto Optical Drive.

3 Write Fault (HARDWARE ERROR).

The write command failed. The logical block address where the fault was detected may be returned in the Logical Block Address field or information Byte field of the sense data. Make sure that the media you are trying to write is not write protected.

4 Drive Not Ready (NOT READY).

The READY signal of ESDI was negated. Make sure that the medium is fully inserted in the drive, that the drive unit spins up and that the focus or slide servo is unlocked.

5 Drive Not Selected (NOT READY).

The drive unit is not selected. This indicates a possible problem with the 650/A Magneto Optical Drive.

7 Multiple Drives Selected (HARDWARE ERROR).

More than one drive responded for the same drive number. This indicates a possible problem with the 650/A Magneto Optical Drive.

8 Logical Unit Communication Failure (HARDWARE ERROR).

An error was detected during the communication between the drive unit and the controller unit (for example, a parity error). This indicates a possible problem with the 650/A Magneto Optical Drive.

9 Track Following Error (HARDWARE ERROR).

Still-jump failed and the optical disk's head could not stay on the same track. This indicates a possible problem with the 650/A Magneto Optical Drive.

10 No Disk (NOT READY).

Medium not inserted into the drive unit. Make sure that there is a medium and that it is fully inserted into the drive.

11 Load/Unload Failure (HARDWARE ERROR).

A failure was detected during loading or unloading the cartridge. This indicates a possible problem with the 650/A Magneto Optical Drive.

12 Spindle Failure (HARDWARE ERROR).

The spindle servo did not lock with the reference signal and the medium did not rotate correctly. This indicates a possible problem with the 650/A Magneto Optical Drive.

13 Focus Failure. (HARDWARE ERROR).

The focus servo was missed. Issue a START/STOP UNIT command with its Start bit set to one (1) to restart the drive. If this fails, a possible problem with the 650/A Magneto Optical Drive is indicated.

14 Tracking Failure. (HARDWARE ERROR).

Tracking servo could not be locked. This indicates a possible problem with the 650/A Magneto Optical Drive.

15 Drive Initialization Failure (HARDWARE ERROR).

The drive's power on diagnostics failed. This indicates a possible problem with the 650/A Magneto Optical Drive.

16 ID CRC Error (HARDWARE ERROR).

The controller detected the error of ID cyclic check code transferred from the drive unit. This indicates a possible problem with the 650/A Magneto Optical Drive.

17 Unrecovered Read Error Of Data Blocks (MEDIUM ERROR).

The error correction code could not correct the data errors. The logical block address where the fault was detected may be returned in the Logical Block Address field or information Byte field of the sense data. To correct this error, replace the medium. If this error persists, a problem with the 650/A Magneto Optical Drive may exist.

21 Seek Positioning Error (HARDWARE ERROR).

The seek to the specified track failed after retrials. To correct this error, replace the medium. If this error persists, a problem with the 650/A Magneto Optical Drive may exist.

24 Recovered Read Data With ECC Procedure (RECOVERED ERROR).

There was an interleave that contained seven or eight byte errors. The error correction succeeded. This indicates a possible problem with the 650/A Magneto Optical Drive.

32 Invalid Command Operation Code (ILLEGAL REQUEST).

The specified command operation code is not implemented. This indicates a possible problem with the 650/A Magneto Optical Drive.

33 Illegal Logical Block Address (ILLEGAL REQUEST).

The specified logical block address was outside the valid area. This indicates a possible problem with the 650/A Magneto Optical Drive.

35 Illegal Function For Medium Type (ILLEGAL REQUEST).

The format parameter is invalid for the medium type. This indicates a possible problem with the 650/A Magneto Optical Drive.

36 Illegal Field In CDB (ILLEGAL REQUEST).

The received Command Descriptor Block (CDB) contained an error. This Additional Sense Code is returned in the following situations:

- Reserved field in CDB is not zero.
- Invalid combination of parameters. For example, both the eject bit and the start bit are set in the START/STOP UNIT command.
- Illegal parameter at that state. For example, a command using the relative address (RelAdr) bit set to one (1) is issued after the command whose link bit is not set to one. This indicates a possible problem with the 650/A Magneto Optical Drive.

37 Invalid LUN (ILLEGAL REQUEST).

LUN 2 through 7 is specified or the specified LUN (0 or 1) does not respond to the selection from the controller unit. This indicates a possible problem with the 650/A Magneto Optical Drive.

38 Invalid Field in Parameter List (ILLEGAL REQUEST).

The received parameters contained an error. This indicates a possible problem with the 650/A Magneto Optical Drive.

39 Write Protected (DATA PROTECT).

Erasing or writing was aborted because the write protect switch of the cartridge is on. Either switch the write protect on the cartridge off or change the media.

40 Medium Changed (UNIT ATTENTION).

The medium was loaded. The Additional Sense Code notifies the initiator that the medium has been changed since the execution of the last command. This code implies Mode Select Parameters changed (Additional Sense Code message 42). This indicates a possible problem with the 650/A Magneto Optical Drive.

41 Power On or Reset or Bus Device Reset Occurred (UNIT ATTENTION).

This message notifies the initiator that the reset condition has happened since the last command. This code implies that Mode Select Parameters changed (Additional Sense Code 42). This indicates a possible problem with the 650/A Magneto Optical Drive.

42 Mode Select Parameters Changed (UNIT ATTENTION).

This message notifies the initiator that the mode select parameters have been changed since the execution of the last command. This indicates a possible problem with the 650/A Magneto Optical Drive.

48 Incompatible Cartridge (MEDIUM ERROR).

The cartridge's ID hole is invalid. Change the cartridge to correct this error.

49 Medium Format Corrupted (MEDIUM ERROR).

PEP, SFP or the format information sector in the CDA is invalid. This indicates a possible problem with the 650/A Magneto Optical Drive.

50 No Defect Spare Location Available (MEDIUM ERROR).

The number of defect sectors listed in the PDL and SDL (DTA) exceeded 1024, or the number of defect sectors listed in the SDL exceeded the specified value calculated by the number of groups and spare blocks per group. This message means that the disk is defective and you should replace it.

56 Recovered with Automatic Reallocation (RECOVERED ERROR).

Automatic write reallocation executed successfully. This indicates a possible problem with the 650/A Magneto Optical Drive.

57 Automatic Reallocation Failure (MEDIUM ERROR).

Automatic write reallocation failed after retrying three times. This indicates a possible problem with the 650/A Magneto Optical Drive.

58 Defect List Update Failure (MEDIUM ERROR).

Attempt to update the defect table failed after the successful sparing of the data sector. This indicates a possible problem with the 650/A Magneto Optical Drive.

61 Defect List Not Available (MEDIUM ERROR or RECOVERED ERROR).

Specified defect list is not available. This indicates a possible problem with the 650/A Magneto Optical Drive.

66 Power On Diagnostic Failure (HARDWARE ERROR).

Power on diagnostic failed. This indicates a possible problem with the 650/A Magneto Optical Drive.

67 Message Reject Error (HARDWARE ERROR).

The command was aborted because the initiator rejected the message from the SMO-C501 by issuing a MESSAGE REJECT message. This indicates a possible problem with the 650/A Magneto Optical Drive.

68 Internal Controller Error (HARDWARE ERROR).

The controller detected an error related to the controller hardware or firmware. This indicates a possible problem with the 650/A Magneto Optical Drive.

71 SCSI Interface Parity Error (HARDWARE ERROR).

The command was aborted due to parity error of the SCSI bus. This indicates a possible problem with the 650/A Magneto Optical Drive.

72 Initiator Detected Error (HARDWARE ERROR).

The command was aborted because the initiator sent the INITIATOR DETECTED ERROR message. This indicates a possible problem with the 650/A Magneto Optical Drive.

SCSI Tape Drive Sense Key and Additional Sense Code

The SCSI tape drive sense key provides general error information. The additional sense code provides more detailed information about the error. Both of these codes are contained in DVT word 19.

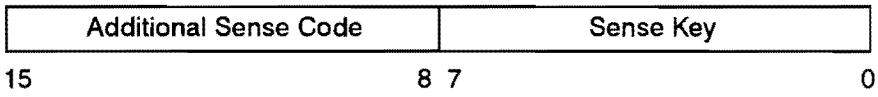
You can get these messages by calling RMPAR as described in the *RTE-A Programmer's Reference Manual*, part number 92077-90007.

The following program segment is an example of a RMPAR call in FORTRAN to retrieve the extended status:

```
Integer*2          ExtendedStatus(0:4)

CALL EXEC(1,DISKLU,DBUF,DLEN,TRACK,SECTOR)
CALL ABREG(STATUS,TLOG)
CALL RMPAR(EXTENDEDSTATUS)
```

The format of extended status (3) in DVT 19 is as follows:



The error descriptions are split into three columns. The first column gives the sense key code (bits 0 - 7 of DVT 19), the second column gives the additional sense code (bits 8 - 15 of DVT 19), and the third column contains a description of the error.

Sense Key	Add. Sense	Descrpition
0H		NO SENSE
	00	This indicates that there is no specific sense key information to report for the designated logical unit. This normally indicates a successful command. This can also indicate the detection of a Filemark, an End-of-Partition/Media, a Save-Set Mark, a Beginning-of-Partition/Media, or an End-of-Data. These are not errors.
	0A	Error-rate warning.
	81	Humidity warning.
2H		DRIVE NOT READY
	04	This indicates that the drive is offline, but media is present in the drive. The drive returns this status for any commands that cause tape motion following an UNLOAD with the Immed bit set, or if the front panel EJECT button was pressed. The drive continues to return this status until the tape is physically ejected. The drive returns this status following a LOAD with the Immed bit set for any subsequent commands which would cause tape motion, until the tape is loaded. The drive contines to return this Sense information if the host previously executed a PREVENT MEDIA REMOVAL command followed by an UNLOAD. The host cannot perform any operation which would cause tape motion, such as Write, Read, Verify and Space commands. The host may load the tape when the unit is offline. The host may also execute any diagnostic commands which do not access the tape. This message can also indicate that the drive is in the process of becoming ready; in other words, the tape is being loaded.
	3A	Medium is not present. This is returned when in a quiescent state with no media in the drive, for all commands which would cause tape motion.
3H		MEDIUM ERROR
	00	Drive has encountered the physical EOP/M.
	0C	The drive has a write error where the RAW Retry Limit was exceeded. The non-recovered error condition was probably caused by a flaw in the tape or a dirty head. A hardware problem may cause this error, but it is most likely to be media-related.
	11	The drive had an unrecovered read error because of flaws in the meduim, which means that the sub-area was unreadable, or there were an excessive number of uncorrectable tracks.
	30	Incompatible Medium Installed or unknown format (audio) encountered. The drive cannot read or space along the tape because either a format violation was encountered or the format is unknown.
	3B	Positioning Error Detected. The drive either lost position during a Read, Verify or Space operation, or was not positioned at BOT for a Write Lead-In-Area operation.
	50	The drive had an error when appending new data during a write-type operation. It either could not find the end of the group, or could not write the new group successfully.

Sense Key	Add. Sense	Description
4H		HARDWARE ERROR
	03	A hardware failure occurred during a Write operation.
	09	A track-following hardware error occurred, generated by the servo/mechan-ism.
	44	The drive returns this error for all unexpected internal error conditions. It indicates that the drive detected a non-recoverable hardware failure while performing the command. The Sub-Assembly Code field will identify which sub-assembly is causing the error. If this field is zero, the host should issue a SEND DIAGNOSTIC command with the self-test bit set, to test the drive thoroughly and identify the failing component. It is also returned if the drive has a diagnostic failure. The SEND DIAGNOSTIC command generates a CHECK CONDITION status with this sense data set if the drive fails the requested diagnostic test or sequence. The RECEIVE DIAGNOSTICS RESULTS command provides further information.
	53	Media Load/Eject failed. The drive has been unable to complete its load se-quence successfully. This may be due to mechanical problems, or because the drive could not successfully read and write from the test region of the tape.
	82	Moisture detected.
5H		ILLEGAL REQUEST
	1A	This indicates a parameter length error in the command descriptor block (the value requested does not fall on header, page or block descriptor boundaries), or that the Parameter List Length is too large for the specified command (the drive is not expecting so much data).
	20	Invalid command operation code.
	24	Invalid field in the command descriptor block. Either the field is not sup-ported, or a reserved field was used illegally. The Sense Key Specific Bytes should be checked, as the Field Pointer bytes will identify the illegal bit or field.
	25	Logical Unit not supported. The LUNTRN field in the Identify message was not set to either 80H or C0H.
	26	This indicates an invalid test number, header or field in the Parameter List, or that the parameter page is not supported. The Sense Key Specific Bytes should be checked, as the Field Pointer bytes will identify the illegal bit or field.
	39	Invalid bits in the IDENTIFY message. The message was not set to either 80H or C0H

Sense Key	Add. Sense	Description
6H		UNIT ATTENTION
	28	Indicates that the tape may have been changed.
	29	The drive has had a reset, a Bus Device reset, or the drive failed its power-on self-test or diagnostics.
	2A	The Mode or Log parameters may have changed.
7H		WRITE-PROTECTED
	27	Indicates that a command that writes to the tape was attempted on a write-protected cartridge.
8H		BLANK CHECK
	00	Blank tape was encountered at BOT or EOD was encountered on a ready type of operation.
AH		COPY ABORTED
	00	Indicates that a COPY command was aborted due to an error condition on the source or the destination device.
	28	COPY cannot execute because the host cannot disconnect.
BH		ABORTED COMMAND
	00	Host aborted current command by sending an ABORT message.
	2C	The Phase sequence during command execution was not as expected.
	43	The Message phase indicated by the communicating device was not as expected by the drive.
	45	A SCSI Selection/Reselection error occurred.
	47	The drive detected a SCSI parity error and proceeded to the Status phase without completing execution of the command.
	48	The drive received an INITIATOR DETECTED ERROR message.
	49	The drive received an illegal message and proceeded to the Status phase without completing execution of the command.
	4A	The Command phase indicated by the communicating device was not as expected by the drive.
	4B	The Data phase indicated by the communicating device was not as expected by the drive. A DMA error could cause this report.
	4E	The host sent a new command to the drive while a previous command was executing.
DH		VOLUME OVERFLOW -- unused.
	00	The drive encountered the physical EOP/M on a Write Filemark command.

B

Single-Ended Cable Pin-to-Signal List

Single-Ended Cable

Figure B-1 provides a pin-to-signal list for the single-ended (standard) cable.

Notes for Figure B-1:

1. Connector A = 80-pin Connector B = 50-pin
2. TERMPWR pins provide 4.5 V at 0.5 A for SCSI bus terminator power. This line is designed to drive the external bus terminator. It is not intended for general use.

Terminator Power

Figures B-1 and C-1 show the assignment of terminator power pins on the single-ended and differential cable connectors respectively. Either the SCSI Card or a peripheral device can supply terminator power. If terminator power comes from the SCSI Card, it is not applied until the cable connector hood is properly connected. The SCSI cable has a built-in interlock that tells the SCSI Card to enable TERMPWR to the terminators when it is connected unless TERMPWR comes from a device. For a description of how to enable and disable terminator power on the SCSI Card, see the description of switch SW1-2 in chapter 2 under the heading "Setting Switch SW1".

SCSI Card TERMPWR is designed to supply power to the termination network at each end of the cable. The termination network at the computer end is integrated onto the card. The power available to the user is greater than 4.5 V at up to 0.5 A.

Note Only *one* device on the SCSI bus should supply TERMPWR.

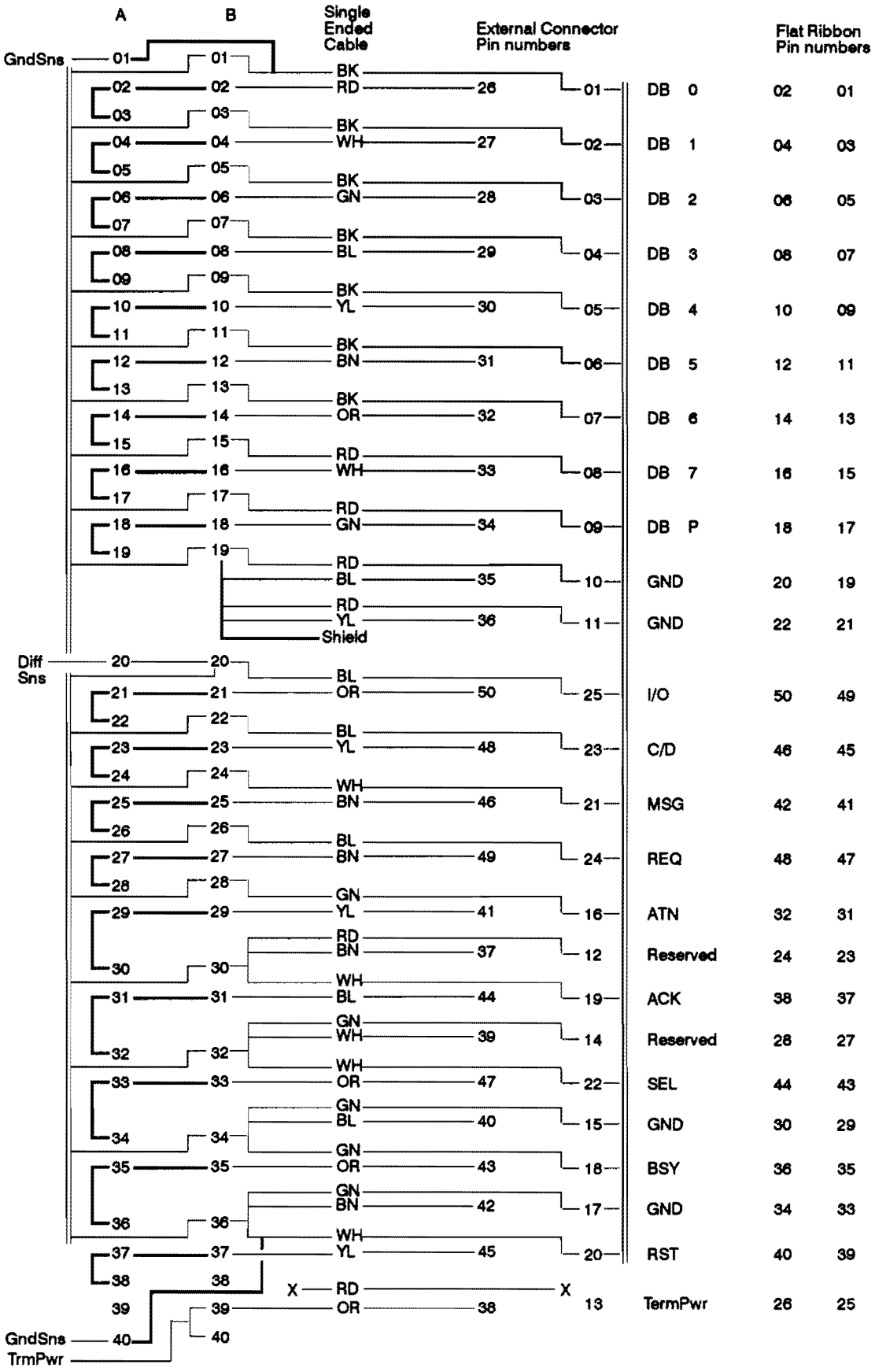


Table B-1. Single-Ended Cable Pin-to-Signal List

C

Differential Cable Pin-to-Signal List

Differential Cable

Table C-1 on the following page provides a pin-to-signal list for the differential cable (option 001).

Notes for figure C-1:

1. TERMPWR pins provide 4.5 V at 0.5 A for SCSI bus terminator power.
2. Connector A = 80-pin Connector B = 50-pin

Caution Make certain that the power is turned off when you connect the cables to the SCSI product and all peripherals, to prevent shorting the TERMPWR pins to the equipment. The TERMPWR pins carry live voltage. Failure to turn off the power will result in damage to the equipment.

Terminator Power

Figures B-1 and C-1 show the assignment of terminator power pins on the single-ended and differential cable connectors. Either the SCSI Card or a peripheral device can supply terminator power. If terminator power comes from the SCSI Card, it is not applied until the cable connector hood is properly connected. The SCSI cable has a built-in interlock that tells the SCSI Card to enable TERMPWR to the terminators when it is connected, unless TERMPWR comes from a device. For a description of how to enable and disable terminator power on the SCSI Card, see the description of switch SW1-2 in Chapter 2 under the heading "Setting Switch SW1".

SCSI Card TERMPWR is designed to supply the power to the termination network at each end of the cable. The termination network at the computer end is integrated onto the card. The power available to the user is greater than 4.5 volts at up to .5 amps.

Note Only *one* device on the SCSI bus should supply TERMPWR.

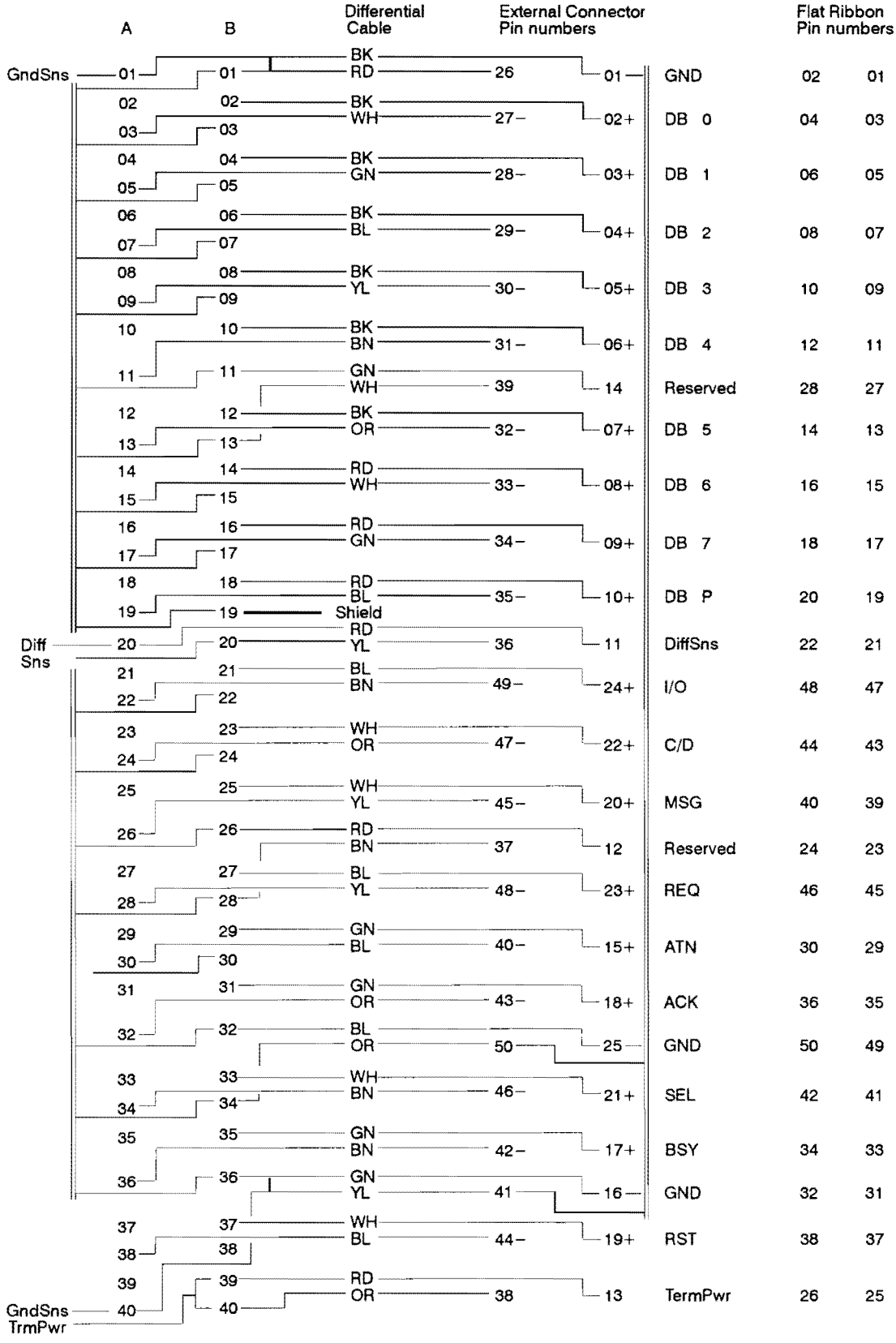


Table C-1. Differential Cable Pin-to-Signal List

D

Card Connector P3 Pin-to-Signal List

Table D-1. Connector P3 Pin-to-Signal List

Pin	Signal Name	Pin	Signal Name
A1	GNDSENSA	B1	GROUND
A2	DBSE0	B2	DBCOM0
A3	DBDF0	B3	GROUND
A4	DBSE1	B4	DBCOM1
A5	DBDF1	B5	GROUND
A6	DBSE2	B6	DBCOM2
A7	DBDF2	B7	GROUND
A8	DBSE3	B8	DBCOM3
A9	DBDF3	B9	GROUND
A10	DBSE4	B10	DBCOM4
A11	DBDF4	B11	GROUND
A12	DBSE5	B12	DBCOM5
A13	DBDF5	B13	GROUND
A14	DBSE6	B14	DBCOM6
A15	DBDF6	B15	GROUND
A16	DBSE7	B16	DBCOM7
A17	DBDF7	B17	GROUND
A18	DBSEP	B18	DBCOMP
A19	DBDFP	B19	GROUND
A20	DIFFSENS	B20	GROUND
A21	IOSE	B21	IOCOM
A22	IODF	B22	GROUND
A23	CDSE	B23	CDCOM
A24	CDDF	B24	GROUND
A25	MSGSE	B25	MSGCOM
A26	MSGDF	B26	GROUND
A27	REQSE	B27	REQCOM
A28	REQDF	B28	GROUND
A29	ATNSE	B29	ATNCOM
A30	ATNDF	B30	GROUND
A31	ACKSE	B31	ACKCOM
A32	ACKDF	B32	GROUND
A33	SELSE	B33	SELCOM
A34	SELDF	B34	GROUND
A35	BSYSE	B35	BSYCOM
A36	BSYDF	B36	GROUND
A37	RSTSE	B37	RSTCOM
A38	RSTDF	B38	
A39	–	B39	TERMPWR *
A40	GNDSENSB	B40	TERMPWR *

* The TERMPWR pins provide 4.5V at 0.5 A for SCSI bus terminator power.

E

SCSI DDL Diagnostic Source Listing

The following is a listing of the source program of the SCSI Card Diagnostic (revision code 5270). Diagnostic programs with revision codes greater than 5270 may vary slightly from this copy. To list the diagnostic statement file that is in memory on the Virtual Control Panel screen, use the DDL "LIST" command following the ">" DDL prompt character (refer to the *DDL Operating and Programming Manual*, part number 24612-90015).

```
 10 FMT  ("12016A SCSI INTERFACE DIAGNOSTIC - REV.5270"/)
 12 REM  HEWLETT-PACKARD CO.   ALL RIGHTS RESERVED.
 14 REM  SOURCE: 24612-18065  REV.5270   <911203.1534>
 20 REM
 22 REM  VARIABLES:
 24 REM  A: PSEUDO A-REGISTER          N: PASS COUNT
 25 REM  B: NOT USED                   O: NOT USED
 26 REM  C: DO LOOP COUNTER            P: LOAD ADDR/PACKED FLAG
 28 REM  D: DEVICE REFERENCE NUMBER    Q: CHECKSUM
 29 REM  E: ERROR CODE                 R: RECORD NUMBER
 30 REM  F: FILE # OF HEX FILE         S: SELECT CODE
 31 REM  G: FWA OF BUFFER "B"          T: TEMPORARY USES
 32 REM  H: HOOD ATTACHED (0=F,1=T)    U: DEBUG FLAG
 34 REM  I: BUFFER INDEX (INPUT)       V: HEX VALUE
 35 REM  J: BUFFER INDEX (OUTPUT)      W: WORD INDEX
 36 REM  K: BUFFER INDEX (BUFFER U)    X: NEXT CHAR
 37 REM  L: RECORD LEN                 Y: RECORD TYPE
 38 REM  M: NUMBER OF DATA BYTES       Z: IF NON-ZERO, NO RAMTEST
 70 REM
 72 REM  ARRAYS:
 74 REM  B - TIMESTAMP/DOWNLOAD BUFFER
 76 REM  U - HOLDING BUFFER FOR HEX DATA BYTES
 82 REM  Z - HEX FILE RECORD
 90 REM
 92 REM
100 PRNT 10
150 LET  S=0          !! INITIALIZE SELECT CODE VALUE FOR GTSC
200 REM  ***** GET NEXT SCSI BOARD *****
210 GTSC @115000 S    !! GET S/C FOR USER
220 GOSB 1000         !! CHECK IF VALID SELECT CODE
230 GOTO 210          !!   *** ILLEGAL SELECT CODE
240 LET  H=1
250 HOOD              !! SET H FLAG IF HOOD ATTACHED
260 LET  H=0
270 GOSB 2000         !! FORCE ON-BOARD SELFTEST
280 GOSB 2300         !! PRINT TERMPWR ENABLED STATUS
290 GOSB 2400         !! GET/PRINT FIRMWARE TIMESTAMP
300 GOSB 2500         !! EXECUTE RAM TEST
310 SKIF H=0          !! EXECUTE LOOPBACK TEST,
320 GOSB 2600         !!   IF HOOD INSTALLED
330 GOTO 200
1000 REM  *** VERIFY SELECT CODE ***
1020 SKIF S#-1
1030 GOTO 32766       !! IGNORE -1 RESPONSE
1040 OTAC 2 S         !! ENABLE GLOBAL REGISTER
1050 LIA  2 T
1060 SKIF S#T         !! CHECK IF VALID SELECT CODE
1070 RTN  1
1080 PRNT 1095 S      !!   ILLEGAL SELECT CODE
1090 RTN              !!   TRY AGAIN
```

```
1095 FMT  ("SELECT CODE "K3" ILLEGAL."/)
1200 REM
1210 REM  **** WAIT FOR Z180 TEST RESULT ****
1212 REM  Y=EXPECTED RESPONSE TYPE
1220 WFI  S 8000       !! WAIT FOR DEVICE FLAG
1230 GOTO 2120         !!   ERROR - FLAG NOT SET
1240 OTA  @31 0        !! GET DATA FROM BACKPLANE REGS
1250 LIAC @30 E        !! GET TEST RESULT
1260 SKIF E#0
1270 RTN               !!  NO ERROR. TAKE IMMEDIATE RETURN
1290 REM
1300 REM  **** READ RESPONSE FIFO ****
1310 OTA  @31 @20000   !! SET CONTROL WORD TO ADDR FIFO
1320 LIA  @32 A        !! GET CARD STATUS
1330 SKIF 0=A.@10000   !!  BIT 12 - STATE OF RESPONSE FIFO
1340 GOTO 3520         !!  ERROR - RESPONSE FIFO EMPTY
1350 LIA  @30 A        !! GET DUMMY DVT ADDRESSES
1355 LIA  @30 A        !!  "    "    "     "
1360 LIA  @30 A        !! GET RESPONSE TYPE
1370 SKIF Y#0          !! DO NOT CHECK RESP TYPE
1375 GOTO 1400         !!  IF DOWNLOADING FROM DEVICE.
1380 SKIF Y=A.@377     !! IS RESP TYPE CORRECT ?
1390 GOTO 3530         !!  ERROR -
1400 LET  J=0          !! INITIALIZE BUFFER INDEX
1410 LIA  @30 C        !! GET BYTE COUNT.
1420 LET  C=C.@377     !! DISGARD BOARD STATUS
1430 SKIF J<C
1440 GOTO 1480         !! ONLY GET "BYTE COUNT" CHARS
1450 LET  J=J+1
1460 LIA  @30 T        !! GET NEXT CHAR OF RESPONSE FIFO
1465 LET  B(J)=T.@377  !! DISGARD BOARD STATUS
1470 GOTO 1430
1480 SKIF U<3          !! **DEBUG**
1485 GOSB 31000        !! **DEBUG**
1490 RTN               !!  DONE
1495 REM
1900 REM DETERMINE IF "OLD" FIRMWARE (071190.0003) OR "NEW"
1910 REM  RTN = OLD FIRMWARE; RTN 1 = NEW FIRMWARE
1920 GOSB 3000         !! GET FIRMWARE TIMESTAMP
1930 SKIF B(17)=0
1940 RTN 1             !! MAJOR REV CODE > 0  (NEW)
1950 SKIF B(18)<4
1960 RTN 1             !! MINOR REV CODE > 3  (NEW)
1970 RTN
2000 REM  **** ON-BOARD SELFTEST ****
2005 OTA  @31 0        !! ADDRESS BACKPLANE REGS (NOT FIFO)
2010 OTA  @32 A        !! FORCE SELFTEST
2015 STCC @30
2020 WFI  S 5000       !! WAIT FOR DEVICE FLAG (5 SECONDS)
2030 GOTO 2120         !!   ERROR - FLAG NOT SET
2040 LIAC @30 T        !! GET SELFTEST RESULTS
2045 STCC @30
2050 SKIF T=@100000    !! A-REGISTER MUST = 100000B
2060 GOTO 2130         !!  ERROR - SELFTEST FAILED
2070 PRNT 2210         !!  OK    - SELFTEST PASSED
2090 RTN
2100 REM  ***** ERROR HANDLING ****
2120 PRNT 2220         !! PRINT: DEVICE FLAG NOT SET.
2121 STOP
2130 PRNT 2230         !! PRINT: SELFTEST FAILED.
2131 STOP
2210 FMT  ("SELF-TEST PASSED."/)
2220 FMT  ("DEVICE FLAG NOT SET."/)
2230 FMT  ("SELF-TEST FAILED."/)
2240 REM
2300 REM  ****** TERMPOWER ENABLED CHECK ******
2310 LIA  @32 A
2320 SKIF 0=A.@4000    !! TERMPWR ENABLED STATUS IS BIT 11
2330 GOTO 2360
2340 PRNT 2380         !! TERMPWR DISABLED
2350 RTN
2360 PRNT 2390         !! TERMPWR ENABLED
2370 RTN
2380 FMT  ("TERMPWR DISABLED."/)
2390 FMT  ("TERMPWR ENABLED."/)
```

```
2395 REM
2400 REM  **** GET / PRINT FIRMWARE TIMESTAMP ****
2410 GOSB 3000          !! GET FIRMWARE TIMESTAMP
2420 GOSB 3400          !! PRINT TIMESTAMP
2430 RTN
2500 REM  **** RAM TEST *****
2505 SKIF Z#0           !! SKIP RAMTEST OF Z NON-ZERO
2510 GOSB 1900          !! DETERMINE IF OLD/NEW FIRMWARE
2515 GOTO 2580          !!   OLD - DO NOT DO RAMTEST.
2520 GOSB 10000         !! BUILD RAM TEST Z180 ARRAY
2530 GOSB 5700          !! SEND DOWNLOAD SCRIPT TO CARD
2535 RTN                !!  DOWNLOAD ERROR
2540 PRNT 2593
2550 LET  Y=98          !! SET RESPONSE TYPE
2555 GOSB 1200          !! GET TEST RESULTS
2560 GOSB 7000          !!  PRINT RAM TEST FAILURES
2570 RTN
2580 PRNT 2592          !! "RAM TEST NOT EXECUTED"
2590 RTN
2592 FMT  ("RAM TEST NOT EXECUTED."/)
2593 FMT  ("EXECUTING RAM TEST. PLEASE WAIT."/)
2595 REM
2600 REM  ***** LOOPBACK TEST *****
2610 GOSB 15000         !! BUILD LOOPBACK TEST ARRAY
2620 GOSB 5700          !! SEND DOWNLOAD SCRIPT TO CARD
2630 RTN                !!  DOWNLOAD ERROR
2640 LET  Y=99          !! SET RESPONSE TYPE
2650 GOSB 1200          !! GET TEST RESULTS
2660 GOSB 8000          !!  PRINT TEST FAILURES
2670 RTN
2680 REM
2700 REM  **** CHANGE DOWNLOAD DEVICE:FILE ****
2710 PRNT 2810 D F      !! TELL OP: CURRENT DEVICE:FILE
2720 PRNT 2820          !! ASK IF CHANGE IS DESIRED
2730 YES? 2750
2740 RTN
2750 PRNT 2830          !! YES - PROMPT FOR DEVICE
2760 INPT D
2770 PRNT 2840          !!  AND FOR FILE
2780 INPT F
2790 RTN
2810 FMT  ("CURRENT DOWNLOAD DEVICE:FILE IS "%I2":"%I3/)
2820 FMT  ("  ANY CHANGES (YES/NO)? ")
2830 FMT  (" ENTER DEVICE NUMBER: ")
2840 FMT  (" ENTER FILE NUMBER: ")
2850 REM
2900 REM  **** DOWNLOAD TEST (TEMPORARY CODE) ****
2910 GOSB 5000          !! DOWNLOAD THE CODE
2920 RTN                !!   DOWNLOAD ERROR
2930 LET  Y=0
2940 GOSB 1200          !! GET TEST RESULTS
2950 GOSB 31000         !! PRINT TEST RESULTS
2960 RTN
3000 REM  **** GET FIRMWARE TIMESTAMP  ****
3010 BUF                !! DELETE PREVIOUS BUFFERS
3015 BUF  B(80)         !! - TIMESTAMP BUFFER
3030 LET  J=0           !! ASSUME NO CHARACTERS READ
3040 STCC @30
3050 OTA  @31 @20000    !! SET CNTL WORD TO ADDRESS FIFO (BIT 13)
3055 OTA  @30 @160      !! SEND "PEEK" COMMAND BYTE
3060 OTA  @30 B(!)      !! SEND DUMMY DVT ADDRESS
3070 OTA  @30 B(!)
3080 OTA  @30 0         !! SEND "RESERVED" BYTE
3090 OTA  @30 0         !! SEND Z180 ADDR TO PEEK AT
3100 OTA  @30 @100      !!   X4000
3110 OTA  @30 23        !!  SPECIFY 23 BYTES
3120 WFI  S 500         !! WAIT FOR INTERRUPT  (500MS)
3130 GOTO 3510          !!    ERROR - FLAG NOT SET
3140 OTA  @31 @20000    !! SET CONTROL WORD TO ADDR FIFO
3150 LIA  @32 A         !! GET CARD STATUS
3160 SKIF 0=A.@10000    !!  BIT 12 - STATE OF RESPONSE FIFO
3170 GOTO 3520          !!  ERROR - RESPONSE FIFO EMPTY
3180 LIA  @30 A         !! GET DUMMY DVT ADDRESSES
3190 LIA  @30 A         !!  "    "    "     "
3200 LIA  @30 A         !! GET RESPONSE TYPE
```

```
3210 SKIF 5=A.7        !! RESP TYPE SHOULD EQUAL 5
3220 GOTO 3530         !!  ERROR -
3230 LIA  @30 A        !! GET BYTE COUNT. DISGARD IT.
3240 LET  J=J+1
3250 LIA  @30 B(J)     !! GET NEXT CHAR OF TIMESTAMP
3260 SKIF J=23         !!  GET ONLY 23 CHARACTERS
3270 GOTO 3240
3280 LET  B(17)=B(17).@377     !! MAJOR REVISION
3290 LET  B(18)=B(18).@377     !! MINOR REVISION
3300 LIA  @31 A                !! CLEAR IRQ FF
3310 CLF  @30                  !! AND DEVFLAG
3320 RTN
3400 FMT  ("FIRMWARE TIMESTAMP: "6A1"."K2K2/)
3410 PRNT 3400 B(2) B(17) B(18)  !! PRINT TIMESTAMP
3420 RTN
3500 REM
3505 REM  **** ERROR HANDLING ****
3510 PRNT 3591         !! FLAG NEVER RECIEVED TO TIMESTAMP REQ
3511 STOP
3520 PRNT 3592         !! RESP FIFO EMPTY. SHOULD CONTAIN TIMESTAMP
3521 STOP
3530 PRNT 3593         !! BAD RESPONSE TYPE.
3531 STOP
3591 FMT  ("DEVFLAG NOT SET"/)
3592 FMT  ("RESPONSE FIFO EMPTY"/)
3593 FMT  ("RESPONSE TYPE INCORRECT"/)
3600 REM
3602 REM  **** FLUSH RESPONSE FIFO ****
3610 OTA  @31 @20000   !! SET CONTROL WORD TO ADDR FIFO
3620 LIA  @32 A        !! GET CARD STATUS
3630 SKIF 0=A.@10000
3640 RTN                  !! EXIT - RESPONSE FIFO EMPTY
3650 LIA  @30 A        !! GET BYTE FROM RESPONSE FIFO
3660 GOTO 3620         !! AND CHECK IF MORE AVAILABLE
3670 REM
4000 REM
4100 REM  ASSEMBLY LANGUAGE ROUTINE TO STORE A BYTE INTO THE
4110 REM  DOWNLOAD BUFFER. IT IS REQUIRED BECAUSE DDL DOES NOT
4120 REM  HAVE A "SHIFT" OPERATOR.  INTEGER DIVISION BY 256
4130 REM  DOES NOT WORK - TRY SHIFTING &FFFF (-1) TO THE RIGHT.
4140 REM  DIVISION BY 256 GIVES 0.  SHIFTING 8 PLACES GIVES 255.
4160 REM  THIS RTN BASICALLY PERFORMS A "SBT" INSTRUCTION.
4170 REM
4180 REM  G = FWA OF DOWNLOAD BUFFER
4190 REM  J = BYTE INDEX INTO BUFFER
4200 REM  W = WORD INDEX INTO BUFFER
4210 REM
4220 IOCA              !! CLEAR ASSEMBLY RTN "A" AREA
4230 IOA  LDA J
4240 IOA  INA          !!  BUMP BUFFER INDEX
4250 IOA  STA J
4260 IOA  ADA .-1      !! CONVERT BYTE INDEX TO WORD INDEX
4270 IOA  ARS
4280 IOA  ADA G        !! WORD ADDR = (BYTE ADDR+1) / 2
4290 IOA  STA W        !! SAVE WORD ADDRESS
4300 IOA  LDB J
4310 IOA  LDA X        !! GET CHAR TO STORE
4320 IOA  AND .377     !! KEEP ONLY LOWER BYTE
4330 IOA  SLB          !! DETERMINE IF ADDING UPPER/LOWER BYTE
4340 IOA  ALF,ALF
4350 IOA  STA T        !! SAVE CHAR IN PROPER U/L BYTE
4360 IOA  LDA .377
4370 IOA  SLB,RSS      !! POSITION MASK TO DISGARD OLD BYTE
4380 IOA  ALF,ALF
4390 IOA  AND W,I      !! GET WORD. DISGARD OLD BYTE
4400 IOA  IOR T        !! MERGE IN NEW BYTE
4410 IOA  STA W,I      !!  AND SAVE
4420 IOA  JSB RTN
4430 REM
4500 REM  ** ROUTINE TO SWAP UPPER/LOWER BYTES **
4510 IOCB
4520 IOB  LDA X
4530 IOB  ALF,ALF      !! SWAP UPPER/LOWER BYTES
4540 IOB  STA X
4550 IOB  JSB RTN
```

```
4560 RTN
4570 REM
5000 REM  ****** DOWN LOAD Z180 HEX FILE TO SCSI BOARD *****
5010 BUF              !! REMOVE PREVIOUS BUFFER DEFINITIONS
5020 BUF  B(4000)     !! - DOWNLOAD BUFFER
5030 BUF  U(80)       !! - HOLDING BUFFER FOR HEX BYTES (UNPACKED)
5040 BUF  Z(40)       !! - HEX FILE RECORD BUFFER       (PACKED)
5050 GOSB 4000        !! CREATE ASSEMBLY ROUTINES
5060 DVIO D 0 0       !! INITIALIZE DEVICE
5065 DVRQ D F -1      !! OPEN FOR READING
5070 LET  R=0         !! INIT RECORD CNT
5080 LET  P=-1        !! INIT START ADDRESS
5090 LET  J=0         !! INIT DOWNLOAD SCRIPT INDEX (B BUFFER)
5100 REM  ** READ NEXT HEX FILE RECORD **
5102 LET  C=-80       !! SPECIFY 80 BYTES (-X INDICATES INPUT)
5104 LET  Z(1)=-1     !! IN CASE, READ FAILS IN SOME WAY
5110 DVIO D C Z(!)    !! READ HEX FILE RECORD
5120 LET  R=R+1       !! BUMP RECORD COUNT
5130 SKIF C#-1        !! CHECK FOR EOF
5135 GOTO 5910        !!    *** EOF
5140 LET  I=1
5145 GOSB 6000        !! GET FIRST CHAR OF RECORD
5150 SKIF X=@52
5152 SKIF X#@73       !! IGNORE LINES BEG. WITH "*" OR ";"
5155 GOTO 5100
5160 SKIF X=@72       !! FIRST CHAR MUST BE ":"
5165 GOTO 5920        !!  - ERROR
5170 SKIF C>10        !! MIN REC SIZE IS 11 (:+LEN+ADR+TYPE+XSUM)
5175 GOTO 5920        !!  RECORD SIZE ERROR
5180 LET  C=2
5185 GOSB 6400        !! GET BYTE COUNT (RETURNED IN "V")
5190 LET  L=V         !! SAVE LENGTH IN "L"
5192 LET  C=4
5200 GOSB 6400        !! GET LOAD ADDRESS
5210 LET  A=V         !!  "A" IS LOAD ADDRESS
5220 LET  C=2
5230 GOSB 6400        !! GET RECORD TYPE
5240 LET  Y=V         !! SAVE RECORD TYPE IN "Y"
5250 SKIF Y#0
5260 GOTO 5300        !!  ONLY KNOW ABOUT TYPES 0 AND 1.
5270 SKIF Y=1
5280 GOTO 5930        !!  UNKNOWN RECORD TYPE.
5290 REM  NOTE THAT "A/256.." IS DONE RATHER THAN "L+A/256.." DU
5292 REM  TO THE LEFT-TO-RIGHT OPERATOR PRECEDENCE RULES OF DDL.
5300 LET  Q=A/256+A+Y+L.@377    !! INIT CHECKSUM;
5310 LET  K=0         !! INIT INDEX FOR SAVING DATA BYTES
5315 SKIF K<L         !! ANY MORE BYTES ??
5317 GOTO 5370
5320 LET  C=2
5325 GOSB 6400        !! GET NEXT 2 BYTES
5330 LET  K=K+1
5335 LET  U(K)=V      !! SAVE BYTE IN DATA BUFFER
5340 LET  Q=Q+V       !! UPDATE CHECKSUM
5360 GOTO 5315        !!   YES -
5370 LET  C=2         !!   NO
5375 GOSB 6400        !! LAST 2 BYTES ARE CHECKSUM
5380 SKIF 0=Q+V.@377
5390 GOTO 5940        !!  CHECKSUM ERROR
5397 REM
5400 SKIF Y=0         !! END RECORD OR DATA RECORD ?
5410 GOTO 5600        !!   END RECORD
5415 REM  ** DATA RECORD **
5420 SKIF P#A         !! BREAK IN INSTRUCTION SEQUENCE ??
5425 GOTO 5500        !!  NO
5430 REM  BREAK IN INSTRUCTION SEQUENCE; EMIT NEW ADDR/ LENGTH
5435 LET  P=A         !! INIT EXPECTED ADDRESS
5440 LET  V=A         !! EMIT LOAD ADDRESS
5445 GOSB 6600
5450 LET  V=0         !! EMIT 2-BYTE PLACE HOLDER FOR LENGTH
5455 GOSB 6600
5460 LET  M=0         !! INITIALIZE DATA BYTE COUNTER TO 0.
5500 REM  COPY INSTRUCTIONS TO DOWNLOAD BUFFER
5510 LET  K=0         !! SET UP LOOP COUNTER
5520 LET  K=K+1       !! BUMP INDEX
5530 LET  X=U(K)
```

```
5535 GOSB 6800          !! STORE DATA BYTE IN DOWNLOAD BUFFER
5540 SKIF K=L           !! ANY MORE DATA??
5545 GOTO 5520          !!  YES - GO EMIT NEXT ONE
5550 REM  GO BACK AND STORE LENGTH WORD
5555 LET  P=P+L         !! CALCULATE EXPECTED ADDRESS
5560 LET  M=M+L         !! BUMP NUMBER OF DATA BYTES STORED
5570 LET  K=J           !! SAVE CURRENT INDEX OF BUFFER "B"
5575 LET  J=J-M-2
5580 LET  V=M           !! GET NUMBER OF BYTES EMITTED SO FAR
5585 GOSB 6600          !! UPDATE LENGTH WORD
5590 LET  J=K           !! RESET INDEX TO ORIGINAL VALUE
5595 GOTO 5100          !! GET NEXT RECORD
5600 REM  ** END RECORD **
5610 LET  V=&FFFF       !! ADD &FFFF TO DOWNLOAD RECORD
5620 GOSB 6600
5630 LET  V=A           !! ADD TRANSFER ADDR TO DOWNLOAD RECORD
5640 GOSB 6600
5650 DVRQ D -1 -1       !! RELEASE DEVICE
5660 SKIF U=0           !! **DEBUG**
5670 PRNT 5680
5680 FMT  ("HEX FILE READ W/O ERROR."/)
5700 REM
5710 REM  ** SEND SCRIPT TO SCSI BOARD **
5711 REM  1ST RTN = ERROR DETECTED; 2ND RTN = NO ERRORS
5720 SKIF U<5           !! **DEBUG**
5722 GOSB 30000
5730 OTAC 2 S           !! ENABLE GLOBAL REGISTER
5734 LIA  @31 A         !! CLEAR IRQ FF         \  BEFORE DOWN-
5735 CLF  @30           !! CLEAR DEVICE FLAG    /  LOADING CODE
5740 OTA  @31 @20000    !! PUT CARD INTO COMMAND MODE
5745 OTA  @30 @140      !! SEND "DOWNLOAD" COMMAND BYTE
5750 LET  I=0           !! INIT BUFFER INDEX
5760 SKIF I<J           !! ANY MORE DATA ??
5770 GOTO 5890          !!   NO
5780 SKIF P#0           !! PACKED OR UNPACKED BUFFER ??
5785 LET  I=I+1         !!   UNPACKED - BUMP INDEX BY 2.
5790 LET  I=I+1         !! BUMP BUFFER INDEX
5795 LET  W=I+1/2       !! CONVERT BYTE INDEX TO WORD INDEX
5800 LET  X=B(W)        !! ASSUME LOWER BYTE
5810 SKIF 0=I.1         !! DETERMINE IF UPPER/LOWER BYTE
5820 IORB               !!  MOVE UPPER BYTE TO LOW BYTE
5830 OTA  @30 X         !! SEND BYTE TO COMMAND FIFO
5835 LET  C=1000        !! INIT TIMEOUT COUNTER
5840 LIA  @32 A         !! GET CARD STATUS
5845 SKIF 0=A.@40000    !! COMMAND FIFO EMPTY ?
5850 GOTO 5760          !!  YES - GET NEXT BYTE
5860 LET  C=C-1
5865 SKIF C=0           !! TIMEOUT ERROR ??
5870 GOTO 5840          !!  NO  - CONTINUE CHECKING
5875 PRNT 5999          !!  YES -
5880 GOTO 5970
5890 SKIF U=0           !!  ** DEBUG **
5892 PRNT 5894          !!  ** DEBUG **
5894 FMT  ("Z180 CODE DOWNLOADED W/O ERROR."/)
5896 RTN  1             !! TAKE NON-ERROR RETURN (P+2)
5900 REM
5905 REM  ***** ERROR HANDLING *****
5910 PRNT 5991          !! EOF BEFORE END RECORD
5911 GOTO 5960
5920 PRNT 5992 R        !! INVALID INTEL FORMAT
5921 GOTO 5960
5930 PRNT 5993 R        !! UNKNOWN RECORD TYPE
5931 GOTO 5960
5940 PRNT 5994 R        !! CHECKSUM ERROR
5941 GOTO 5960
5950 PRNT 5995          !! SCSI BOARD XSUM ERROR (UNUSED)
5959 REM
5960 DVRQ D -1 -1       !! RELEASE DEVICE
5970 RTN                !! TAKE ERROR RETURN (P+1)
5990 REM
5991 FMT  ("EOF BEFORE END RECORD"/)
5992 FMT  ("INVALID INTEL FORMAT AT RECORD "I4/)
5993 FMT  ("UNKNOWN RECORD TYPE IN RECORD "I4/)
5994 FMT  ("CHECKSUM ERROR AT RECORD "I4/)
5995 FMT  ("DOWNLOAD FAILED - CHECKSUM ERROR"/)
```

```
5999 FMT  ("TIMEOUT ERROR - NO RESPONSE"/)
6000 REM
6005 REM  ***** GET NEXT CHARACTER ******
6010 LET  W=I+1/2      !! CONVERT BYTE INDEX TO WORD INDEX
6020 LET  X=Z(W)       !! GET BUFFER ELEMENT OF INTEREST
6030 SKIF 0=I.1        !! DETERMINE IF UPPER/LOWER BYTE
6040 IORB              !!  SWAP UPPER/LOWER BYTES
6050 LET  X=X.@377     !! RETURN BYTE IN "X"
6060 LET  I=I+1        !! BUMP BUFFER INDEX
6070 RTN
6190 REM
6200 REM  ***** CHECK IF HEX CHARACTER ******
6210 SKIF X>@57        !! CHECK IF
6220 GOTO 6300         !!   CHARACTER IS IN
6230 SKIF X>@72        !!     THE RANGE 0-9  (@60-@71)
6240 RTN
6250 SKIF X>@100       !!  CHECK IF CHARACTER
6260 GOTO 6300         !!    IS IN THE
6270 SKIF X>@106       !!      RANGE A-F   (@101-@106)
6280 RTN
6300 PRNT 6320 R       !! TELL OP: INVALID HEX CHAR
6310 STOP              !! ABORT DIAGNOSTIC
6320 FMT  ("INVALID HEX CHAR IN RECORD "I4/)
6390 REM
6392 REM
6400 REM  ***** CONVERT ASCII TO HEX VALUE *****
6410 LET  V=0          !! INIT HEX VALUE
6420 GOSB 6000         !! GET NEXT CHARACTER (RETURNED IN "X")
6430 GOSB 6200         !! CHECK IF HEX DIGIT
6440 SKIF X<@72
6450 LET  X=X+9        !! CONVERT ASCII TO BINARY
6460 LET  X=X.@17
6470 LET  V=V*16+X     !! ADD VALUE INTO ACCUMULATING SUM
6480 LET  C=C-1
6490 SKIF C=0          !! ANY MORE CHARACTERS ??
6500 GOTO 6420         !!   YES, CONTINUE
6510 RTN                  !!    NO
6600 REM  ***** WRITE 1 WORD TO DOWNLOAD SCRIPT *****
6610 LET  X=V
6620 IORB              !! SWAP UPPER/ LOWER BYTES
6630 GOSB 6800         !! OUTPUT HI-ORDER BYTE
6640 LET  X=V
6650 GOSB 6800         !! OUTPUT LOW-ORDER BYTE
6660 RTN
6800 REM  ***** WRITE 1 BYTE TO DOWNLOAD SCRIPT *****
6810 SKIF J<4000       !! IS THERE ENOUGH ROOM IN BUFFER ?
6820 GOTO 6880         !!   NO
6830 LET  G=B(!)       !! PASS ADDR OF BUFFER "B" TO ASSEM RTN
6840 IORA
6850 RTN
6870 FMT  ("HEX FILE TOO LARGE"/)
6880 PRNT 6870
6890 STOP
7000 REM  **** PRINT RAM TEST FAILURES ****
7010 SKIF E=0
7020 GOTO 7050         !! RAMTEST FAILED
7030 PRNT 7310         !! RAMTEST PASSED
7040 RTN
7050 PRNT 7320 B(1) B(2) B(3) B(4)
7100 REM  DETERMINE WHICH OF THE 4 DRAM IC'S ARE SUSPECT
7110 REM  U124=BITS  3-0; U114=BITS 7-4;   (ODD ADDR)
7120 REM  U123=BITS 11-8; U113=BITS 15-12; (EVEN ADDR)
7130 ASC  U124  U114  U123  U113   ;
7140 BUF  Z(12)
7150 IBP  Z(1)  Z(12) PA 7130
7160 LET  W=B(3).1     !! ODD OR EVEN ADDR
7170 LET  X=B(4)/4     !! BIT NUMBER COMPONENT
7180 LET  T=W+W+X*3+1  !! 3(2W+X)+1
7190 PRNT 7330 Z(T)
7200 RTN
7310 FMT  ("RAM TEST PASSED."/)
7320 FMT  ("RAM FAILURE AT ADDR: "H1H2H2"; BIT "I1"."/)
7330 FMT  ("SUSPECT DRAM AT POSITION "2A2/)
7340 REM
8000 REM  **** PRINT LOOPBACK ERRORS ****
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8005 REM  E=ERROR CODE RETURNED BY LOOPBACK TEST
8010 SKIF E=0
8020 GOTO 8100         !! FAILED
8030 PRNT 8050
8050 FMT  ("LOOPBACK TEST PASSED."/)
8060 RTN
8100 REM  LOOPBACK TEST FAILED.  PRINT ERROR MSGS
8110 ASC  0   1   2   3   4   5   6   7   P     ;
8120 ASC  I/O C/D MSG REQ ACK ATN SEL BSY RST   ;
8130 BUF  D(18) C(18) Z(20)
8140 IBP  D(1) D(18)  PA 8110      !! INIT DATA SIGNAL ARRAY
8150 IBP  C(1) C(18)  PA 8120      !! INIT CONTROL SIGNAL ARRAY
8160 REM
8200 REM  CHECK FOR "STUCK" BITS
8205 ASC  BITS ALWAYS HIGH (0V).
8210 SKIF 1=E.1        !! ANY DATA/CTRL BITS "STUCK" ??
8220 GOTO 8300         !!   NO
8230 IBP  Z(1) Z(20)  CL @20040
8235 IBP  Z(1) Z(11)  PA 8205
8240 LET  X=B(1)
8250 LET  Y=B(3)       !!  DATA->CTRL STUCK BIT ERRORS
8260 GOSB 8500
8270 LET  X=B(2)       !!  CTRL->DATA STUCK BIT ERRORS
8280 GOSB 8600
8290 REM
8300 REM  CHECK FOR "NON-ASSERTED" BITS
8305 ASC  BITS NOT-ASSERTED.
8310 SKIF 2=E.2        !! ANY NON-ASSERTED BITS ??
8320 GOTO 8400
8330 IBP  Z(1) Z(20)  CL @20040
8335 IBP  Z(1) Z(9)   PA 8305
8340 LET  X=B(4)
8350 LET  Y=B(6)       !!  DATA->CTRL BITS NOT ASSERTED
8360 GOSB 8500
8370 LET  X=B(5)       !!  CTRL->DATA BITS NOT ASSERTED
8380 GOSB 8600
8390 REM
8400 REM  CHECK FOR MULTIPLE BITS HIGH
8405 ASC  BITS CAUSE MULTIPLE BIT ERRORS.  ;
8410 SKIF 4=E.4        !! MULTIPLE BITS HIGH ?
8420 GOTO 8490         !!   NO
8430 IBP  Z(1) Z(20)  CL @20040
8435 IBP  Z(1) Z(16)  PA 8405
8440 LET  X=B(7)
8450 LET  Y=B(9)       !!  DATA->CTRL MULTIPLE BIT ERROR
8460 GOSB 8500
8470 LET  X=B(8)       !!  CTRL->DATA MULTIPLE BIT ERROR
8480 GOSB 8600
8490 RTN
8500 REM  **** PRINT DATA-CTRL ERRORS ****
8505 REM  X=DATA0-DATA7 WORD; Y=DATAP WORD
8510 LET  I=1                  !! INITIALIZE INDEX AND BIT MASK
8515 LET  M=1
8520 SKIF 0=X.M                !! CHECK NEXT BIT
8530 PRNT 8590 D(I) C(I) Z(1)  !!  PRINT ERROR
8540 LET  I=I+2                !! UPDATE INDEX AND BIT MASK
8545 LET  M=M*2
8550 SKIF I>16                 !! TESTED ALL 8 BITS YET ?
8560 GOTO 8520
8570 SKIF 0=Y.1                !! CHECK DATAP BIT
8575 PRNT 8590 D(17) C(17) Z(1) !!  ERROR
8580 RTN
8590 FMT  ("LOOPBACK ERROR: DATA"A2"-> "2A2,20A2/)
8595 REM
8600 REM  **** PRINT CTRL-DATA ERRORS ****
8605 REM  X=I/O-BSY WORD; Y=RST WORD
8610 LET  I=1                  !! INITIALIZE INDEX AND BIT MASK
8615 LET  M=1
8620 SKIF 0=X.M                !! CHECK NEXT BIT
8630 PRNT 8690 C(I) D(I) Z(1)  !!   ERROR
8640 LET  I=I+2                !! UPDATE INDEX AND BIT MASK
8645 LET  M=M*2
8650 SKIF I>16                 !! TESTED ALL 8 BITS YET ?
8660 GOTO 8620
8670 SKIF 0=Y.2                !! CHECK RST BIT
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 8675 PRNT 8690 C(17) D(17) Z(1) !!   ERROR
 8680 RTN
 8690 FMT  ("LOOPBACK ERROR: "2A2"-> DATA"A2,20A2/)
 8695 REM
10000 REM  **** RAM TEST *****
10010 BUF                          !! RELEASE PREVIOUS BUFFERS
10020 BUF  B(233)                  !! DOWNLOAD SCRIPT ARRAY
10030 LET  J=466                   !!   ** LEN OF ARRAY  **
10100 LET  B(1)=&64,&00            !!   ** LOAD ADDRESS **
10110 LET  B(3)=&00,&E1            !!   **  BYTE COUNT  **
10120 LET  B(5)=&39,&31,&30,&31    !! TIMESTAMP DB '910118.5022'
10130 LET  B(9)=&31,&38,&2E,&35    !!
10140 LET  B(13)=&30,&32,&32       !!
10150 LET  B(16)=&AF               !! ZRAMTST  XOR    A
10160 LET  B(17)=&32,&0F,&00       !!   LD     (RETCODE),A
10170 LET  B(20)=&3E,&80           !!   LD     A,80H
10180 LET  B(22)=&ED,&39,&3A       !!   OUT0_A CBAR
10190 LET  B(25)=&3E,&00           !!   LD     A,0H
10200 LET  B(27)=&ED,&39,&38       !! RAMLOOP0 OUT0_A CBR
10210 LET  B(30)=&21,&00,&80       !! RAMLOOP1 LD     HL,RAMBEGIN
10220 LET  B(33)=&3E,&55           !!   LD     A,01010101B
10230 LET  B(35)=&77               !!   LD     (HL),A
10240 LET  B(36)=&11,&01,&80       !!   LD     DE,RAMBEGIN+1
10250 LET  B(39)=&01,&FF,&7F       !!   LD     BC,RAMSIZE-1
10260 LET  B(42)=&ED,&B0           !!   LDIR
10270 LET  B(44)=&21,&00,&80       !!   LD     HL,RAMBEGIN
10280 LET  B(47)=&01,&80,&00       !!   LD     BC,RAMSEG
10290 LET  B(50)=&16,&55           !!   LD     D,01010101B
10300 LET  B(52)=&7E               !! RAMLOOP2 LD     A,(HL)
10310 LET  B(53)=&BA               !!   CP     D
10320 LET  B(54)=&20,&23           !!   JR     NZ,RAMERR
10330 LET  B(56)=&2F               !!   CPL
10340 LET  B(57)=&77               !!   LD     (HL),A
10350 LET  B(58)=&FE,&55           !!   CP     01010101B
10360 LET  B(60)=&20,&03           !!   JR     NZ,BOT2TOP
10370 LET  B(62)=&2B               !!   DEC    HL
10380 LET  B(63)=&18,&01           !!   JR     BUMPCNTR
10390 LET  B(65)=&23               !! BOT2TOP  INC    HL
10400 LET  B(66)=&10,&F0           !! BUMPCNTR DJNZ   RAMLOOP2
10410 LET  B(68)=&0D               !!   DEC    C
10420 LET  B(69)=&20,&ED           !!   JR     NZ,RAMLOOP2
10430 LET  B(71)=&01,&80,&00       !!   LD     BC,RAMSEG
10440 LET  B(74)=&2B               !!   DEC    HL
10450 LET  B(75)=&57               !!   LD     D,A
10460 LET  B(76)=&FE,&AA           !!   CP     10101010B
10470 LET  B(78)=&28,&E4           !!   JR     Z,RAMLOOP2
10480 LET  B(80)=&ED,&38,&38       !!   IN0_A  CBR
10490 LET  B(83)=&C6,&08           !!   ADD    A,8H
10500 LET  B(85)=&FE,&78           !!   CP     78H
10510 LET  B(87)=&20,&C2           !!   JR     NZ,RAMLOOP0
10520 LET  B(89)=&18,&32           !!   JR     TELLHOST
10530 LET  B(91)=&AA               !! RAMERR   XOR    D
10540 LET  B(92)=&06,&FF           !!   LD     B,-1
10550 LET  B(94)=&04               !! RMERRLP  INC    B
10560 LET  B(95)=&CB,&3F           !!   SRL    A
10570 LET  B(97)=&D2,&59,&64       !!   JP     NC,RMERRLP
10580 LET  B(100)=&78              !!   LD     A,B
10590 LET  B(101)=&32,&D8,&64      !!   LD     (BITNUM),A
10600 LET  B(104)=&ED,&38,&38      !!   IN0_A  CBR
10610 LET  B(107)=&47              !!   LD     B,A
10620 LET  B(108)=&AF              !!   XOR    A
10630 LET  B(109)=&CB,&38          !!   SRL    B
10640 LET  B(111)=&1F              !!   RRA
10650 LET  B(112)=&CB,&38          !!   SRL    B
10660 LET  B(114)=&1F              !!   RRA
10670 LET  B(115)=&CB,&38          !!   SRL    B
10680 LET  B(117)=&1F              !!   RRA
10690 LET  B(118)=&CB,&38          !!   SRL    B
10700 LET  B(120)=&1F              !!   RRA
10710 LET  B(121)=&84              !!   ADD    A,H
10720 LET  B(122)=&30,&01          !!   JR     NC,SAVADDR
10730 LET  B(124)=&04              !!   INC    B
10740 LET  B(125)=&32,&D6,&64      !! SAVADDR  LD     (MIDADDR),A
10750 LET  B(128)=&78              !!   LD     A,B
10760 LET  B(129)=&32,&D5,&64      !!   LD     (HIADDR),A
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10770 LET  B(132)=&7D              !!   LD    A,L
10780 LET  B(133)=&32,&D7,&64      !!   LD    (LOWADDR),A
10790 LET  B(136)=&3E,&01          !!   LD     A,1
10800 LET  B(138)=&32,&0F,&00      !!   LD     (RETCODE),A
10810 LET  B(141)=&3A,&0F,&00      !! TELLHOST  LD     A,(RETCODE)
10820 LET  B(144)=&B7              !!   OR     A
10830 LET  B(145)=&CA,&B0,&64      !!   JP     Z,SENDRCODE
10840 LET  B(148)=&AF              !!   XOR    A
10850 LET  B(149)=&D3,&42          !!   OUT    (WFIFO),A
10860 LET  B(151)=&D3,&42          !!   OUT    (WFIFO),A
10870 LET  B(153)=&3E,&62          !!   LD     A,98
10880 LET  B(155)=&D3,&42          !!   OUT    (WFIFO),A
10890 LET  B(157)=&3E,&04          !!   LD     A,4
10900 LET  B(159)=&D3,&42          !!   OUT    (WFIFO),A
10910 LET  B(161)=&3A,&D5,&64      !!   LD     A,(HIADDR)
10920 LET  B(164)=&D3,&42          !!   OUT    (WFIFO),A
10930 LET  B(166)=&3A,&D6,&64      !!   LD     A,(MIDADDR)
10940 LET  B(169)=&D3,&42          !!   OUT    (WFIFO),A
10950 LET  B(171)=&3A,&D7,&64      !!   LD     A,(LOWADDR)
10960 LET  B(174)=&D3,&42          !!   OUT    (WFIFO),A
10970 LET  B(176)=&3A,&D8,&64      !!   LD     A,(BITNUM)
10980 LET  B(179)=&D3,&42          !!   OUT    (WFIFO),A
10990 LET  B(181)=&21,&D9,&64      !! SENDRCODE LD     HL,DMAQUAD
11000 LET  B(184)=&01,&28,&08      !!   LD     BC,0800H+MAR1L
11010 LET  B(187)=&ED,&93          !!   OTIMR
11020 LET  B(189)=&3E,&80          !!   LD     A,80H
11030 LET  B(191)=&ED,&39,&30      !!   OUT0_A DSTAT
11040 LET  B(194)=&DB,&47          !!   IN     A,(STDMA)
11050 LET  B(196)=&D3,&47          !!   OUT    (STDMA),A
11060 LET  B(198)=&AF              !!   XOR    A
11070 LET  B(199)=&ED,&39,&30      !!   OUT0_A DSTAT
11080 LET  B(202)=&ED,&38,&43      !! WAITEMPTY IN0_A  RZCOM
11090 LET  B(205)=&E6,&40          !!   AND    40H
11100 LET  B(207)=&CA,&C5,&64      !!   JP     Z,WAITEMPTY
11110 LET  B(210)=&AF              !! ENDTEST   XOR    A
11120 LET  B(211)=&ED,&39,&38      !!   OUT0_A CBR
11130 LET  B(214)=&2A,&54,&00      !!   LD     HL,(MONITLP)
11140 LET  B(217)=&E9              !!   JP     (HL)
11150 LET  B(218)=&00              !! HIADDR   DB       0
11160 LET  B(219)=&00              !! MIDADDR  DB       0
11170 LET  B(220)=&00              !! LOWADDR  DB       0
11180 LET  B(221)=&00              !! BITNUM   DB       0
11190 LET  B(222)=&07,&00          !! DMAQUAD  DEFW     TFAIL
11200 LET  B(224)=&00              !!   DEFB    ZERO
11210 LET  B(225)=&41,&00          !!   DEFW    RDIOP
11220 LET  B(227)=&00              !!   DEFB    ZERO
11230 LET  B(228)=&01,&00          !!   DEFW    1
11240 LET  B(230)=&FF,&FF          !!   **  END RECORD  **
11250 LET  B(232)=&64,&0B          !!   ** TRANSFER ADDR *
14000 LET  P=0                     !! INDICATE "UNPACKED"
14010 RTN
15000 REM  **** LOOPBACK TEST *****
15010 BUF                          !! RELEASE PREVIOUS BUFFERS
15020 BUF  B(507)                  !! DOWNLOAD SCRIPT ARRAY
15030 LET  J=1014                  !!   **  LEN OF ARRAY  **
15100 LET  B(1)=&64,&00            !!   ** LOAD ADDRESS **
15110 LET  B(3)=&01,&F3            !!   **  BYTE COUNT  **
15120 LET  B(5)=&39,&31,&30,&31    !! TIMESTAMP DB '910123.5022'
15130 LET  B(9)=&32,&33,&2E,&35    !!
15140 LET  B(13)=&30,&32,&32       !!
15150 LET  B(16)=&AF               !! LBKTEST   XOR    A
15160 LET  B(17)=&32,&0F,&00       !!   LD     (RETCODE),A
15170 LET  B(20)=&3E,&80           !!   LD     A,80H
15180 LET  B(22)=&ED,&39,&79       !!   OUT0_A LOOPC
15190 LET  B(25)=&AF               !!   XOR    A
15200 LET  B(26)=&ED,&39,&7A       !!   OUT0_A LOOPD
15210 LET  B(29)=&ED,&38,&7A       !!   IN0_A  LOOPD
15220 LET  B(32)=&32,&E9,&65       !!   LD     (DSTUCK),A
15230 LET  B(35)=&CA,&29,&64       !!   JP     Z,CKDATAP
15240 LET  B(38)=&3A,&0F,&00       !!   LD     A,(RETCODE)
15250 LET  B(41)=&F6,&01           !!   OR     1
15260 LET  B(43)=&32,&0F,&00       !!   LD     (RETCODE),A
15270 LET  B(46)=&ED,&38,&79       !! CKDATAP   IN0_A  LOOPC
15280 LET  B(49)=&E6,&01           !!   AND    1
15290 LET  B(51)=&32,&EB,&65       !!   LD     (PSTUCK),A
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15300 LET  B(54)=&CA,&3C,&64     !!   JP     Z,CKSTUCKC
15310 LET  B(57)=&3A,&0F,&00     !!   LD     A,(RETCODE)
15320 LET  B(60)=&F6,&01         !!   OR     1
15330 LET  B(62)=&32,&0F,&00     !!   LD     (RETCODE),A
15340 LET  B(65)=&3E,&C0         !! CKSTUCKC  LD     A,0C0H
15350 LET  B(67)=&ED,&39,&79     !!   OUT0_A LOOPC
15360 LET  B(70)=&AF             !!   XOR    A
15370 LET  B(71)=&ED,&39,&7A     !!   OUT0_A LOOPD
15380 LET  B(74)=&ED,&38,&7A     !!   IN0_A  LOOPD
15390 LET  B(77)=&32,&EA,&65     !!   LD     (CSTUCK),A
15400 LET  B(80)=&CA,&56,&64     !!   JP     Z,CKRSTBIT
15410 LET  B(83)=&3A,&0F,&00     !!   LD     A,(RETCODE)
15420 LET  B(86)=&F6,&01         !!   OR     1
15430 LET  B(88)=&32,&0F,&00     !!   LD     (RETCODE),A
15440 LET  B(91)=&ED,&38,&79     !! CKRSTBIT  IN0_A  LOOPC
15450 LET  B(94)=&E6,&01         !!   AND    1
15460 LET  B(96)=&CA,&6E,&64     !!   JP     Z,CIR1LPBK
15470 LET  B(99)=&3A,&EB,&65     !!   LD     A,(PSTUCK)
15480 LET  B(102)=&F6,&02        !!   OR     2
15490 LET  B(104)=&32,&EB,&65    !!   LD     (PSTUCK),A
15500 LET  B(107)=&3A,&0F,&00    !!   LD     A,(RETCODE)
15510 LET  B(110)=&F6,&01        !!   OR     1
15520 LET  B(112)=&32,&0F,&00    !!   LD     (RETCODE),A
15530 LET  B(115)=&3E,&80        !! CIR1LPBK  LD     A,80H
15540 LET  B(117)=&ED,&39,&79    !!   OUT0_A LOOPC
15550 LET  B(120)=&06,&01        !!   LD     B,1
15560 LET  B(122)=&78            !! SEND1BIT  LD     A,B
15570 LET  B(123)=&ED,&39,&7A    !!   OUT0_A LOOPD
15580 LET  B(126)=&ED,&38,&7A    !!   IN0_A  LOOPD
15590 LET  B(129)=&32,&F2,&65    !!   LD     (TEMP),A
15600 LET  B(132)=&A0            !!   AND    B
15610 LET  B(133)=&B8            !!   CP     B
15620 LET  B(134)=&CA,&93,&64    !!   JP     Z,D1XTALK
15630 LET  B(137)=&3A,&EC,&65    !! D1FAIL    LD     A,(XASSERT)
15640 LET  B(140)=&B0            !!   OR     B
15650 LET  B(141)=&32,&EC,&65    !!   LD     (XASSERT),A
15660 LET  B(144)=&3A,&0F,&00    !!   LD     A,(RETCODE)
15670 LET  B(147)=&F6,&02        !!   OR     2
15680 LET  B(149)=&32,&0F,&00    !!   LD     (RETCODE),A
15690 LET  B(152)=&3A,&E9,&65    !! D1XTALK   LD     A,(DSTUCK)
15700 LET  B(155)=&4F            !!   LD     C,A
15710 LET  B(156)=&3A,&F2,&65    !!   LD     A,(TEMP)
15720 LET  B(159)=&A9            !!   XOR    C
15730 LET  B(160)=&B0            !!   OR     B
15740 LET  B(161)=&B8            !!   CP     B
15750 LET  B(162)=&CA,&AF,&64    !!   JP     Z,D1ENDCHK
15760 LET  B(165)=&3A,&EF,&65    !!   LD     A,(DXTLK)
15770 LET  B(168)=&B0            !!   OR     B
15780 LET  B(169)=&32,&EF,&65    !!   LD     (DXTLK),A
15790 LET  B(172)=&3A,&0F,&00    !!   LD     A,(RETCODE)
15800 LET  B(175)=&F6,&04        !!   OR     4
15810 LET  B(177)=&32,&0F,&00    !!   LD     (RETCODE),A
15820 LET  B(180)=&CB,&20        !! D1ENDCHK  SLA    B
15830 LET  B(182)=&C2,&75,&64    !!   JP     NZ,SEND1BIT
15840 LET  B(185)=&ED,&38,&79    !! D1DATAP   IN0_A  LOOPC
15850 LET  B(188)=&F6,&01        !!   OR     1
15860 LET  B(190)=&ED,&39,&79    !!   OUT0_A LOOPC
15870 LET  B(193)=&ED,&38,&79    !!   IN0_A  LOOPC
15880 LET  B(196)=&E6,&01        !!   AND    1
15890 LET  B(198)=&C2,&D1,&64    !!   JP     NZ,D1PXTALK
15900 LET  B(201)=&3E,&01        !!   LD     A,1
15910 LET  B(203)=&32,&EE,&65    !!   LD     (PASSERT),A
15920 LET  B(206)=&3A,&0F,&00    !!   LD     A,(RETCODE)
15930 LET  B(209)=&F6,&02        !!   OR     2
15940 LET  B(211)=&32,&0F,&00    !!   LD     (RETCODE),A
15950 LET  B(214)=&3A,&E9,&65    !! D1PXTALK  LD     A,(DSTUCK)
15960 LET  B(217)=&4F            !!   LD     C,A
15970 LET  B(218)=&AF            !!   XOR    A
15980 LET  B(219)=&ED,&39,&7A    !!   OUT0_A LOOPD
15990 LET  B(222)=&ED,&38,&7A    !!   IN0_A  LOOPD
16000 LET  B(225)=&A9            !!   XOR    C
16010 LET  B(226)=&CA,&ED,&64    !!   JP     Z,CTRLLINES
16020 LET  B(229)=&3E,&01        !!   LD     A,1
16030 LET  B(231)=&32,&F1,&65    !!   LD     (PXTLK),A
16040 LET  B(234)=&3A,&0F,&00    !!   LD     A,(RETCODE)
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16050 LET  B(237)=&F6,&04        !!   OR     4
16060 LET  B(239)=&32,&0F,&00    !!   LD     (RETCODE),A
16070 LET  B(242)=&3E,&C0        !! CTRLLINES LD     A,0C0H
16080 LET  B(244)=&ED,&39,&79    !!   OUT0_A LOOPC
16090 LET  B(247)=&06,&01        !!   LD     B,1
16100 LET  B(249)=&78            !! SEND1CBIT LD     A,B
16110 LET  B(250)=&ED,&39,&7A    !!   OUT0_A LOOPD
16120 LET  B(253)=&ED,&38,&7A    !!   IN0_A  LOOPD
16130 LET  B(256)=&32,&F2,&65    !!   LD     (TEMP),A
16140 LET  B(259)=&A0            !!   AND    B
16150 LET  B(260)=&B8            !!   CP     B
16160 LET  B(261)=&CA,&12,&65    !!   JP     Z,C1XTALK
16170 LET  B(264)=&3A,&ED,&65    !! C1FAIL    LD     A,(CASSERT)
16180 LET  B(267)=&B0            !!   OR     B
16190 LET  B(268)=&32,&ED,&65    !!   LD     (CASSERT),A
16200 LET  B(271)=&3A,&0F,&00    !!   LD     A,(RETCODE)
16210 LET  B(274)=&F6,&02        !!   OR     2
16220 LET  B(276)=&32,&0F,&00    !!   LD     (RETCODE),A
16230 LET  B(279)=&3A,&EA,&65    !! C1XTALK   LD     A,(CSTUCK)
16240 LET  B(282)=&4F            !!   LD     C,A
16250 LET  B(283)=&3A,&F2,&65    !!   LD     A,(TEMP)
16260 LET  B(286)=&A9            !!   XOR    C
16270 LET  B(287)=&B0            !!   OR     B
16280 LET  B(288)=&B8            !!   CP     B
16290 LET  B(289)=&CA,&2E,&65    !!   JP     Z,C1ENDCHK
16300 LET  B(292)=&3A,&F0,&65    !!   LD     A,(CXTLK)
16310 LET  B(295)=&B0            !!   OR     B
16320 LET  B(296)=&32,&F0,&65    !!   LD     (CXTLK),A
16330 LET  B(299)=&3A,&0F,&00    !!   LD     A,(RETCODE)
16340 LET  B(302)=&F6,&04        !!   OR     4
16350 LET  B(304)=&32,&0F,&00    !!   LD     (RETCODE),A
16360 LET  B(307)=&CB,&20        !! C1ENDCHK  SLA    B
16370 LET  B(309)=&C2,&F4,&64    !!   JP     NZ,SEND1CBIT
16380 LET  B(312)=&ED,&38,&79    !! C1DATAP   IN0_A  LOOPC
16390 LET  B(315)=&F6,&01        !!   OR     1
16400 LET  B(317)=&ED,&39,&79    !!   OUT0_A LOOPC
16410 LET  B(320)=&ED,&38,&79    !!   IN0_A  LOOPC
16420 LET  B(323)=&E6,&01        !!   AND    1
16430 LET  B(325)=&C2,&53,&65    !!   JP     NZ,C1PXTALK
16440 LET  B(328)=&3A,&EE,&65    !!   LD     A,(PASSERT)
16450 LET  B(331)=&F6,&02        !!   OR     2
16460 LET  B(333)=&32,&EE,&65    !!   LD     (PASSERT),A
16470 LET  B(336)=&3A,&0F,&00    !!   LD     A,(RETCODE)
16480 LET  B(339)=&F6,&02        !!   OR     2
16490 LET  B(341)=&32,&0F,&00    !!   LD     (RETCODE),A
16500 LET  B(344)=&3A,&EA,&65    !! C1PXTALK  LD     A,(CSTUCK)
16510 LET  B(347)=&4F            !!   LD     C,A
16520 LET  B(348)=&AF            !!   XOR    A
16530 LET  B(349)=&ED,&39,&7A    !!   OUT0_A LOOPD
16540 LET  B(352)=&ED,&38,&7A    !!   IN0_A  LOOPD
16550 LET  B(355)=&A9            !!   XOR    C
16560 LET  B(356)=&CA,&72,&65    !!   JP     Z,ENDLPBK
16570 LET  B(359)=&3A,&F1,&65    !!   LD     A,(PXTLK)
16580 LET  B(362)=&F6,&02        !!   OR     2
16590 LET  B(364)=&32,&F1,&65    !!   LD     (PXTLK),A
16600 LET  B(367)=&3A,&0F,&00    !!   LD     A,(RETCODE)
16610 LET  B(370)=&F6,&04        !!   OR     4
16620 LET  B(372)=&32,&0F,&00    !!   LD     (RETCODE),A
16630 LET  B(375)=&AF            !! ENDLPBK   XOR    A
16640 LET  B(376)=&ED,&39,&79    !!   OUT0_A LOOPC
16650 LET  B(379)=&3E,&40        !!   LD     A,40H
16660 LET  B(381)=&ED,&39,&77    !!   OUT0_A RSTR
16670 LET  B(384)=&3A,&0F,&00    !! TELLHOST  LD     A,(RETCODE)
16680 LET  B(387)=&B7            !!   OR     A
16690 LET  B(388)=&CA,&BC,&65    !!   JP     Z,SENDRCODE
16700 LET  B(391)=&AF            !!   XOR    A
16710 LET  B(392)=&D3,&42        !!   OUT    (WFIFO),A
16720 LET  B(394)=&D3,&42        !!   OUT    (WFIFO),A
16730 LET  B(396)=&3E,&63        !!   LD     A,99
16740 LET  B(398)=&D3,&42        !!   OUT    (WFIFO),A
16750 LET  B(400)=&3E,&09        !!   LD     A,9
16760 LET  B(402)=&D3,&42        !!   OUT    (WFIFO),A
16770 LET  B(404)=&3A,&E9,&65    !!   LD     A,(DSTUCK)
16780 LET  B(407)=&D3,&42        !!   OUT    (WFIFO),A
16790 LET  B(409)=&3A,&EA,&65    !!   LD     A,(CSTUCK)
```

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16800 LET  B(412)=&D3,&42          !!   OUT    (WFIFO),A
16810 LET  B(414)=&3A,&EB,&65      !!   LD     A,(PSTUCK)
16820 LET  B(417)=&D3,&42          !!   OUT    (WFIFO),A
16830 LET  B(419)=&3A,&EC,&65      !!   LD     A,(XASSERT)
16840 LET  B(422)=&D3,&42          !!   OUT    (WFIFO),A
16850 LET  B(424)=&3A,&ED,&65      !!   LD     A,(CASSERT)
16860 LET  B(427)=&D3,&42          !!   OUT    (WFIFO),A
16870 LET  B(429)=&3A,&EE,&65      !!   LD     A,(PASSERT)
16880 LET  B(432)=&D3,&42          !!   OUT    (WFIFO),A
16890 LET  B(434)=&3A,&EF,&65      !!   LD     A,(DXTLK)
16900 LET  B(437)=&D3,&42          !!   OUT    (WFIFO),A
16910 LET  B(439)=&3A,&F0,&65      !!   LD     A,(CXTLK)
16920 LET  B(442)=&D3,&42          !!   OUT    (WFIFO),A
16930 LET  B(444)=&3A,&F1,&65      !!   LD     A,(PXTLK)
16940 LET  B(447)=&D3,&42          !!   OUT    (WFIFO),A
16950 LET  B(449)=&21,&E1,&65      !! SENDRCODE LD     HL,DMAQUAD
16960 LET  B(452)=&01,&28,&08      !!   LD     BC,0800H+MAR1L
16970 LET  B(455)=&ED,&93          !!   OTIMR
16980 LET  B(457)=&3E,&80          !!   LD     A,80H
16990 LET  B(459)=&ED,&39,&30      !!   OUT0_A DSTAT
17000 LET  B(462)=&DB,&47          !!   IN     A,(STDMA)
17010 LET  B(464)=&D3,&47          !!   OUT    (STDMA),A
17020 LET  B(466)=&AF              !!   XOR    A
17030 LET  B(467)=&ED,&39,&30      !!   OUT0_A DSTAT
17040 LET  B(470)=&ED,&38,&43      !! WAITEMPTY IN0_A  RZCOM
17050 LET  B(473)=&E6,&40          !!   AND    40H
17060 LET  B(475)=&CA,&D1,&65      !!   JP     Z,WAITEMPTY
17070 LET  B(478)=&AF              !! ENDTEST   XOR    A
17080 LET  B(479)=&ED,&39,&38      !!   OUT0_A CBR
17090 LET  B(482)=&2A,&54,&00      !!   LD     HL,(MONITLP)
17100 LET  B(485)=&E9              !!   JP     (HL)
17110 LET  B(486)=&07,&00          !! DMAQUAD   DEFW    TFAIL
17120 LET  B(488)=&00              !!   DEFB    ZERO
17130 LET  B(489)=&41,&00          !!   DEFW    RDIOP
17140 LET  B(491)=&00              !!   DEFB    ZERO
17150 LET  B(492)=&01,&00          !!   DEFW    1
17160 LET  B(494)=&00              !! DSTUCK    DB      0
17170 LET  B(495)=&00              !! CSTUCK    DB      0
17180 LET  B(496)=&00              !! PSTUCK    DB      0
17190 LET  B(497)=&00              !! XASSERT   DB      0
17200 LET  B(498)=&00              !! CASSERT   DB      0
17210 LET  B(499)=&00              !! PASSERT   DB      0
17220 LET  B(500)=&00              !! DXTLK     DB      0
17230 LET  B(501)=&00              !! CXTLK     DB      0
17240 LET  B(502)=&00              !! PXTLK     DB      0
17250 LET  B(503)=&00              !! TEMP      DB      0
17260 LET  B(504)=&FF,&FF          !!   **  END RECORD  **
17270 LET  B(506)=&64,&0B          !!   ** TRANSFER ADDR *
19000 LET  P=0                     !! SET FLAG = UNPACKED BUFFER
19020 RTN                          !!   ERROR RETURN
20000 REM
20002 REM
20010 PRGM TEST [TEST #] [SELECT CODE] [LOOPCOUNT]
20020 REM #500=TEST #;  #501=SELECT CODE;   #502=LOOPCOUNT
20040 LET  S=#501       !! SAVE SELECT CODE
20060 REM
20070 SKIF #500=0       !! PRINT HELP FILE IF TEST # = 0
20080 GOTO 20120
20090 GOSB 23000        !! DISPLAY MENU
20100 PRNT 23400        !! PROMPT FOR TEST NUMBER
20110 INPT #500         !! INPUT TEST NUMBER
20120 SKIF #500#-1
20130 GOTO 32766        !!  EXIT IF TEST NUMBER = -1.
20140 SKIF #500>11
20145 SKIF #500>0       !!  VALID RANGE IS 1-5 AND 10-11.
20150 GOTO 20090
20155 SKIF #500>5       !!  IF INVALID, PROMPT FOR TEST NUMBER
20160 GOTO 20200
20165 SKIF #500>9
20170 GOTO 20090
20180 SKIF #500#10      !! TEST 10 DOES NOT NEED SELECT CODE
20190 GOTO 20300
20200 REM  **** GET SELECT CODE OF SCSI BOARD ****
20220 SKIF S#0          !! GET SELECT CODE OF SCSI BOARD
20230 GTSC @115000 S    !! GET S/C FOR USER
```

```
20240 GOSB 1000         !! CHECK IF VALID SELECT CODE
20250 GOTO 20230        !!   *** ILLEGAL SELECT CODE
20300 REM
20310 LET  N=0          !! INIT PASS COUNT
21000 REM  **** DETERMINE TEST TO EXECUTE ****
21010 SKIF #500#1       !! TEST 1 - SELFTEST ??
21011 GOSB 2000
21020 SKIF #500#2       !! TEST 2 - TERMPWR STATUS ??
21021 GOSB 2300
21030 SKIF #500#3       !! TEST 3 - TIMESTAMP ??
21031 GOSB 2400
21040 SKIF #500#4       !! TEST 4 - RAM TEST ??
21041 GOSB 2500
21050 SKIF #500#5       !! TEST 5 - LOOPBACK TEST ??
21051 GOSB 2600
21100 SKIF #500#10      !! TEST 10 - DEFINE DOWNLOAD DEVICE:FILE
21101 GOSB 2700
21110 SKIF #500#11      !! TEST 11 - DOWNLOAD CODE
21111 GOSB 2900
22000 REM  **** DETERMINE IF WE ARE LOOPING ON TEST ****
22010 REM  NOTE WE FALL INTO THIS CODE FROM ABOVE .....
22020 SKIF #500<6       !! TESTS 10 AND 11 DO NOT LOOP
22030 GOTO 20100
22040 REM
22100 SKIF #502#0       !! IF ORIGINAL LOOP COUNT = 0,
22120 GOTO 20100        !!   WE ARE DONE
22130 LET  N=N+1        !! BUMP PASS COUNT
22140 PRNT 22295 N      !! PRINT "PASS N"
22150 SKIF #502>0       !! CHECK IF LOOP FOREVER CASE
22160 GOTO 21000        !!   YEP - LOOP FOREVER
22170 SKIF N=#502
22180 GOTO 21000        !!  NOT DONE YET
22190 GOTO 20100        !!  DONE
22295 FMT  ("PASS "I6/)
22296 REM
22297 REM
23000 REM  **** TEST SELECTION MENU ****
23010 PRNT 23401
23020 PRNT 23402
23030 PRNT 23403
23040 PRNT 23404
23050 PRNT 23405
23080 PRNT 23410
23090 PRNT 23411
23099 PRNT 23499
23100 RTN
23400 FMT  (/"ENTER TEST NUMBER: ")
23401 FMT  ("  1 - SELF-TEST "/)
23402 FMT  ("  2 - TERMPWR ENABLED CHECK"/)
23403 FMT  ("  3 - FIRMWARE TIMESTAMP DISPLAY"/)
23404 FMT  ("  4 - RAM TEST "/)
23405 FMT  ("  5 - LOOPBACK TEST"/)
23410 FMT  (" 10 - DEFINE DOWNLOAD DEVICE:FILE"/)
23411 FMT  (" 11 - DOWNLOAD Z180 CODE"/)
23499 FMT  (" -1 - EXIT DIAGNOSTIC"//)
23990 REM
23992 REM
30000 REM
30002 REM
30005 REM  ***** PRINT DOWNLOAD BUFFER *****
30010 LET  W=0
30015 LET  W=W+1
30020 LET  T=B(W).@77577        !! DISGARD NON-ASCII CHARS > 127
30025 SKIF 32<T.@177            !! REPLACE CONTROL CHARACTERS IN
30030 LET  T=T.@77400+32        !! LOW ORDER BYTE WITH SPACES
30035 SKIF 32<T.@77400/256
30040 LET  T=T.@177+@20000
30045 PRNT 30050 W B(W) B(W) B(W) T
30050 FMT  (I3":"XXI6XXH4XXK6XXA2/)
30055 SKIF W=J+1/2
30060 GOTO 30015
30100 RTN
30200 REM
31000 REM  ***** PRINT EXTENDED STATUS OF DOWNLOADED CODE ****
31010 SKIF E#0          !! PASS OR FAILED ??
```

```
31020 GOTO 31200        !!   PASSED
31030 PRNT 31300 E      !!   FAILED
31040 SKIF C#0          !! ANY EXTENDED STATUS ??
31050 RTN              !!   NO
31100 PRNT 31310        !! PRINT EXTENDED STATUS HEADER
31120 LET  J=0
31130 LET  J=J+1
31140 LET  T=B(J).@377
31150 PRNT 31320 J T T !! PRINT EXTENDED ERROR VALUE
31160 SKIF J=C
31170 GOTO 31130
31180 RTN
31200 PRNT 31330
31210 RTN
31300 FMT  ("TEST FAILED. ERROR: "I6" (DEC)"/)
31310 FMT  (9X"(DEC)    (OCT)"/)
31320 FMT  (XI3": "I6,5X,K6/)
31330 FMT  ("TEST PASSED."/)
32000 REM
32766 REM  END
```

Glossary

Additional sense code

This provides more specific or additional drive error information for sense code. Additional sense code is located in the high byte (bits 6 – 15) of DVT 19.

Answer file

The file used to generate an RTE system that will match the general hardware and software configuration.

Backlashes

The hardware component that connects the I/O cards, CPU, and memory within the computer.

Blocking Factor

A descriptor that indicates how to map RTE sectors into device sectors.

Boot Command file

This file is used when first loading RTE, to customize the system to its particular hardware and software configuration.

BUFR

Buffer address.

BUFLN

Buffer length.

Checksum

A method of error detection used to verify the integrity of the internal PROM.

Control Request

A command which enables users to make specific requests to the driver other than usual read and write requests.

CNTWD

Control word.

DDQ24

Relocatable SCSI tape device driver.

DDQ30

Relocatable SCSI disk device driver.

DDQ30_GEN

File that contains the default generation records for products supported by the DDQ30 disk device driver.

DDQ30.MAC

File that contains the source code for the 650/A Rewritable Optical Disk Driver.

DMA Priority

This determines the priority between two I/O cards attempting to use the backplane at the same time. The higher priority card gets to transfer data first.

DVP

Device Parameter. Device parameters pass special configuration information about the specific devices to the driver.

DVT

Device Table. This is the table that the system uses to keep information about the device transactions in progress.

EMI

Electro Magnetic Interference.

Extended status

Sense code and additional sense code in DVT 19.

Field Replaceable Unit (FRU)

Any unit or part that customers can replace in the field for return to Hewlett-Packard for repair.

File Management Package

A program in RTE that handles file access.

Firmware

The card control program that resides in PROM on the card.

Firmware timestamp

The year, month and day of the firmware release and firmware revision codes.

IDQ35

Relocatable SCSI Interface Driver.

IFT

Interface table.

Interrupt priority

This determines how the system resolves which I/O card receives service if two cards request it at the same time.

LEDs (Light Emitting Diodes)

Four lights which indicate SCSI self-test results. The LEDs show whether or not the SCSI Card has passed the self-test, and if it has failed, the pattern of the lights indicates the reason for the self-test failure.

Logical Unit (LU)

A number that RTE assigns to each I/O device that was identified during system generation.

Online Verification Program

A program which runs under RTE. It verifies correct operation of the I/O subsystem.

RTAGN

The program that uses an answer file and RTE relocatables to make an RTE system.

Runstring

The command given to RTE that indicates an action, for example, running a program.

SCSI

Small Computer Systems Interface.

SCSI-II

Small Computer Systems Interface II.

Sense key

The sense key provides drive error information in the lower byte (bits 0 −7) of DVT 19.

SW1

A bank of eight switches that specifies the select code of the card and enables SCSI bus terminal power from the card.

SW2

A bank of eight switches that specifies the SCSI address.

Termination Power (TERMPWR)

The SCSI signal that supplies power to the remote termination resistors.

VCP Terminal

The Virtual Control Panel. Through the VCP, you can initiate boot up, access CPU registers and access memory locations.

VSCSI

See glossary entry under Online Verification Program.

Welcome file

A program which configures the user environment that is executed when the user logs onto an RTE system.

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