

QTD-30

**INTELLIGENT Q-BUS
SCSI HOST ADAPTER**

USER'S MANUAL



Micro Technology

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PREFACE

This manual is intended to provide the user with information necessary to install and operate the Micro Technology QTD-30, a Q-BUS SCSI disk/tape host adapter. It consists of the following sections.

Section 1 OVERVIEW

Describes the features, functions, and specifications of the QTD-30.

Section 2 INSTALLATION

Explains how to install the QTD-30 in a DEC system. Includes information about setting jumpers, selecting a mounting slot, interpreting QTD-30 LEDs, terminating and cabling the SCSI bus, and selecting SCSI IDs.

Section 3 MULTIHOSTING

Describes special installation procedure for multihost environments.

Section 4 OPERATION

Explains how to access and use the on-board utilities to configure, format, test, and qualify SCSI devices connected to the QTD-30.

Appendixes Contain general SCSI information, connector pin assignments, lists of supported operating systems and SCSI peripheral devices, and procedures for the VMS SYSGEN Connect command and ANALYZE/ERROR utility.

General Knowledge Level

Before starting the installation, the user should be familiar with installing and configuring board-level products in VAX or LSI-11 systems. A general understanding of SCSI technology is also recommended. If no on-site expertise is available, contact Micro Technology Field Service Technical Support at 1-800-FON-4MTI for assistance.

Document Conventions

This manual uses different fonts to identify text used in specific ways. The fonts are used as follows:

Times Roman is the standard font for normal text. This sentence is written in Times Roman.

Helvetica is used to show front panel displays or something displayed on the computer screen.

Helvetica bold is used to show something that the user must type verbatim to the computer.

Notes, cautions, and warnings within text have the following meanings:

- | | |
|----------------|---|
| NOTE | Notes contain important information set off from text. |
| CAUTION | Cautions alert the user to situations or practices that could result in loss of data or equipment damage. |
| WARNING | Warnings alert the user to situations or practices that could cause personal injury. |

1. OVERVIEW

The QTD-30 is a high-performance, intelligent, quad-wide, Q-bus SCSI host adapter. It is fully compatible with the DEC Mass Storage Control Protocol (MSCP), the Tape Mass Storage Control Protocol (TMSCP), and the following operating systems: RT-11, TSX, DSM-11, ISM-11, RSX, RSTS, MicroVMS, UNIX, and other operating systems which use DU/TU drivers.

The user can install the QTD-30 in any of the following systems:

- LSI-11/23
- PDP-11/23+
- Micro-PDP-11/53, 11/73, or 11/83
- MicroVAX II
- MicroVAX III
- VAX5400

1.1 Features

The QTD-30 features:

- 18-bit or 22-bit Q-bus addressing
- Adaptive block mode DMA transfer
- Virtual data buffer
- Command queuing
- Dynamic defect management
- Standard SCSI bus arbitration
- Disconnect and reconnect capability
- Multiple SCSI host capability
- Support of all required SCSI commands

Up to seven SCSI devices (either single-ended or differential) can be connected to the QTD-30 with SCSI bus data transfer rate up to 4.8 megabytes per second in synchronous mode and 3 megabytes per second in asynchronous mode. A variety of synchronous/asynchronous SCSI devices can be supported simultaneously, including magnetic disk, magnetic tape, and optical disk drives.

There are two SCSI ports on the QTD-30. Port 0 supports both single-ended and differential SCSI channels. The user can use either single-end SCSI devices with a total cable length not exceeding 20 feet (6 meters) or differential SCSI devices with a total cable length not exceeding 80 feet (25 meters). Port 1 supports single-ended SCSI devices only.

The QTD-30 has an on-board utility used to format and configure SCSI devices, scan for bad blocks, and replace bad blocks automatically. It also contains a user selectable bootstrap option which can boot up the system on power up or reset, boot up the system from tape, and exercise the tape drives.

In addition, the QTD-30 has an on-board non-volatile RAM (NOVRAM) to store the drive Logical Unit Number (LUN) Offset and other important information about the drives.

1.2 Adapter Kits

A QTD-30 Kit consists of the QTD-30 and a MicroVAX 3300 handle kit or the QTD-30 and a MicroVAX II handle kit. Each kit also contains a shielded SCSI cable to connect the QTD-30 to the SCSI target devices.

1.3 Supported Drives

Micro Technology limits drive support to those drives in its Mustang Series of products.

1.4 Product Specifications

Emulation:	MSCP (DU driver) / TMSCP (TU driver)
Bus Interface:	Standard MicroVAX or LSI-11 Q-Bus
Addressing:	18 or 22-bit addressing
CSR Address (disk):	Up to 30 CSR addresses
CSR Address (tape):	Up to 31 CSR addresses
Interrupt Priority:	Level 4 or 5
Interrupt Vector:	Software programmable
Transfer Mode:	Normal or adaptive block mode DMA
Command Queuing:	16 commands with optimized seek
Data Buffer Capacity:	Virtual (infinite) data buffer
Bootstrap:	Auto bootstrap or utility bootstrap
Defect Management:	Dynamic defect management
Multihosting:	For disks, optical drives, and tapes
Formatting:	On board format and bad block replacement (ISO standard for optical erasable disk format)
Partitioning:	2 or 4 equally divided partitions for disk drives
Software Supported:	All standard DEC operating systems
LED Indicators:	Self test, error conditions
Front Panel Interface:	Write protect up to 2 disk drives
Peripheral Interface:	Small Computer System Interface (SCSI)
SCSI Transfer Rate:	4.8 megabytes per second (synchronous) 3.0 megabytes per second (asynchronous)
SCSI Bus Parity:	Odd parity
Devices Supported:	Up to 7 SCSI single-ended or differential devices

System Performance: Support disconnect/reconnect capability and multiple host configuration

SCSI Driver/Receiver: Single-ended and differential

SCSI Cable Length: Single-ended, up to 20 feet (6 meters)
Differential, up to 80 feet (25 meters)

Operating Temperature: 5° C to 50° C

Relative Humidity: 10% to 90%, non-condensing

Power Requirement: 5V DC, 2.8A

2. INSTALLATION

QTD-30 installation consists of:

- Setting jumpers
- Mounting the QTD-30
- Interpreting QTD-30 LEDs
- Cabling and terminating the SCSI bus
- Selecting SCSI target IDs

2.1 Setting Jumpers

This section explains how to configure jumpers on the QTD-30 before installation. To locate the jumper blocks mentioned in this section, refer to Figure 2-1. (For a list of default jumper settings, refer to Table 2-3.)

NOTE

Normally, the user should not need to change the default jumper settings except for the CSR addresses and the SCSI terminator power.

2.1.1 CSR Addresses

The QTD-30 requires two CSR addresses: one for disk and one for tape. The user can choose from 31 addresses for tape and 30 addresses for disk (Tables 2-1 and 2-2).

As indicated in the tables, the default CSR addresses are 17772150 for disk and 17774500 for tape. To select a different address for disk or tape, install switch settings as indicated in the tables.

If the user requires other CSR addresses than those listed, please contact Micro Technology.

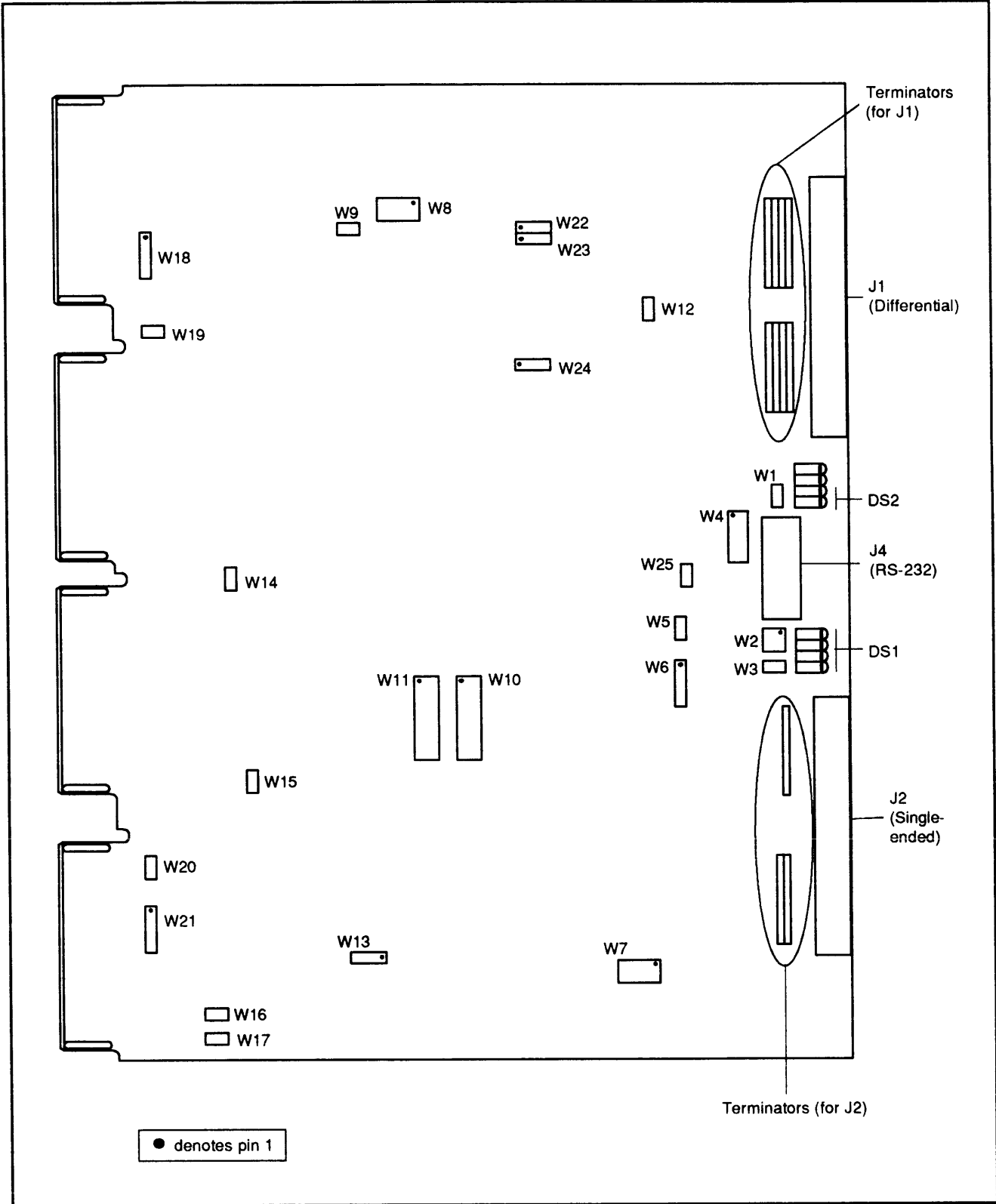


Figure 2-1. QTD-30 Jumper Block Locations

Avoiding CSR Address Conflicts

If the user has other disk or tape controllers installed in the system, use the following procedure to select non-conflicting CSR addresses for the QTD-30.

1. Boot the VMS system and log into the system manager account.
2. At the DCL \$ prompt, type **MC SYSGEN <cr>**.
3. At the SYSGEN prompt, type **SHOW/CONFIG <cr>**. The SYSGEN utility displays all the device controllers installed in the system and their corresponding CSR addresses and vectors. Make a note of this list.
4. At the SYSGEN prompt, type **CONFIG <cr>**.
5. At the DEVICE prompt, type **UDA n <cr>**. *n* is the number of UDA-type (disk) controllers listed in Step 3 plus 1.
6. At the DEVICE prompt, type **TU81 n <cr>**. *n* is the number of TU81-type (tape) controllers listed in Step 3 plus 1.
7. At the DEVICE prompt, enter **<Ctrl>-Z**. The SYSGEN utility displays all controllers and their CSR address numbers. The UDA-type controller entered in Step 5 is given the next available PUX name (PUA, PUB, PUC, etc.). The TU81-type controller entered in Step 6 is given the next available PTX name (PTA, PTB, etc.). Make a note of the CSR addresses for the latest PUX and PTX devices.

NOTE

The QTD-30 will automatically program the on-board interrupt vector to match the vector assigned by the system in Step 7. The vectors of other controllers might change as a result of installing the QTD-30 in the system.

8. At the SYSGEN prompt, enter **<Ctrl>-Z** to exit the SYSGEN utility.
9. Assign the CSR addresses identified in Step 7 by changing the jumper settings on the QTD-30 board. Refer to Tables 2-1 and 2-2.

Table 2-1. CSR Addresses for Disk

Address	LSI-11	MicroVAX	SW1				
			-1	-2	-3	-4	-5
1 (D)	17772150	20001468	ON	ON	ON	ON	ON
2	17760334	200000DC	ON	ON	ON	ON	OFF
3	17760354	200000EC	ON	ON	ON	OFF	ON
4	17760374	200000FC	ON	ON	ON	OFF	OFF
5	17760340	200000E0	ON	ON	OFF	ON	ON
6	17760344	200000E4	ON	ON	OFF	ON	OFF
7	17760350	200000E8	ON	ON	OFF	OFF	ON
8	17760360	200000F0	ON	ON	OFF	OFF	OFF
9	17760364	200000F4	ON	OFF	ON	ON	ON
10	17760370	200000F8	ON	OFF	ON	ON	OFF
11	17760400	20000100	ON	OFF	ON	OFF	ON
12	17760404	20000104	ON	OFF	ON	OFF	OFF
13	17760410	20000108	ON	OFF	OFF	ON	ON
14	17760414	2000010C	ON	OFF	OFF	ON	OFF
15	17760420	20000110	ON	OFF	OFF	OFF	ON
16	17760424	20000114	ON	OFF	OFF	OFF	OFF
17	17760430	20000118	OFF	ON	ON	ON	ON
18	17760434	2000011C	OFF	ON	ON	ON	OFF
19	17760440	20000120	OFF	ON	ON	OFF	ON
20	17760444	20000124	OFF	ON	ON	OFF	OFF
21	17760450	20000128	OFF	ON	OFF	ON	ON
22	17760454	2000012C	OFF	ON	OFF	ON	OFF
23	17760460	20000130	OFF	ON	OFF	OFF	ON
24	17760464	20000134	OFF	ON	OFF	OFF	OFF
25	17760470	20000138	OFF	OFF	ON	ON	ON
26	17760474	2000013C	OFF	OFF	ON	ON	OFF
27	17760500	20000140	OFF	OFF	ON	OFF	ON
28	17760504	20000144	OFF	OFF	ON	OFF	OFF
29	17760510	20000148	OFF	OFF	OFF	ON	ON
30	17760514	2000014C	OFF	OFF	OFF	ON	OFF

Note: (D) means default setting.

Table 2-2. CSR Addresses for Tape

Address	LSI-11	MicroVAX	SW1				
			-6	-7	-8	-9	-10
1 (D)	17774500	20001940	ON	ON	ON	ON	ON
2	17760404	20000104	ON	ON	ON	ON	OFF
3	17760444	20000124	ON	ON	ON	OFF	ON
4	17760504	20000144	ON	ON	ON	OFF	OFF
5	17760544	20000164	ON	ON	OFF	ON	ON
6	17760410	20000108	ON	ON	OFF	ON	OFF
7	17760450	20000128	ON	ON	OFF	OFF	ON
8	17760454	2000012C	ON	ON	OFF	OFF	OFF
9	17760414	2000010C	ON	OFF	ON	ON	ON
10	17760420	20000110	ON	OFF	ON	ON	OFF
11	17760460	20000130	ON	OFF	ON	OFF	ON
12	17760510	20000148	ON	OFF	ON	OFF	OFF
13	17760514	2000014C	ON	OFF	OFF	ON	ON
14	17760520	20000150	ON	OFF	OFF	ON	OFF
15	17760550	20000168	ON	OFF	OFF	OFF	ON
16	17760554	2000016C	ON	OFF	OFF	OFF	OFF
17	17760560	20000170	OFF	ON	ON	ON	ON
18	17760604	20000184	OFF	ON	ON	ON	OFF
19	17760610	20000188	OFF	ON	ON	OFF	ON
20	17760614	2000018C	OFF	ON	ON	OFF	OFF
21	17760620	20000190	OFF	ON	OFF	ON	ON
22	17760644	200001A4	OFF	ON	OFF	ON	OFF
23	17760650	200001A8	OFF	ON	OFF	OFF	ON
24	17760654	200001AC	OFF	ON	OFF	OFF	OFF
25	17760660	200001B0	OFF	OFF	ON	ON	ON
26	17760704	200001C4	OFF	OFF	ON	ON	OFF
27	17760710	200001C8	OFF	OFF	ON	OFF	ON
28	17760714	200001CC	OFF	OFF	ON	OFF	OFF
29	17760744	200001E4	OFF	OFF	OFF	ON	ON
30	17760750	200001E8	OFF	OFF	OFF	ON	OFF
31	17760754	200001EC	OFF	OFF	OFF	OFF	ON

Notes: (D) means default setting.
All OFF means no tape.

2.1.2 18/22-Bit Address

The QTD-30 supports both 18- and 22-bit addressing. The default setting (22-bit addressing) provides maximum efficiency in systems with MicroVAX, LSI-11/23, LSI-11/53 and LSI-11/73 processors, but can cause problems if the QTD-30 is installed in a 22-bit backplane with the LSI-11/2 processor (not designed for a 22-bit backplane). The LSI-11/2 processor brings out some of its test points on the extra address lines.

If the user intends to install the QTD-30 in a system with a LSI-11/2 processor, the QTD-30 must be configured to 18 bits by removing the jumper at W20.

W20 IN 22-bit addressing (default)
 OUT 18-bit addressing

2.1.3 Interrupt Level

The QTD-30 is shipped with interrupt level 4 selected. This is the standard interrupt priority for MSCP devices. If necessary, this setting may be changed to interrupt level 5.

W21 1-2 IN Interrupt level 5
 2-3 IN Interrupt level 4 (default)

2.1.4 Block Mode DMA

In a block mode DMA transfer, the starting memory address is asserted, then the data for the starting address is transferred, followed immediately by data for consecutive addresses. Because the address for each data word is not asserted, higher data throughput is achieved. The QTD-30 is shipped with block mode DMA enabled.

W18 1-2 IN Block mode DMA enabled (default)
 2-3 IN Block mode DMA disabled

2.1.5 Adaptive DMA

When adaptive DMA is enabled, the QTD-30 releases the Q-bus after 8 words transfer if other DMA devices assert DMA requests. Otherwise, the QTD-30 will continue the DMA transfer for additional 8 words then release the Q-bus. The QTD-30 is shipped with adaptive DMA disabled.

W19 IN Adaptive DMA enabled
 OUT Adaptive DMA disabled (default)

2.1.6 DMA Dwell Time

This jumper setting causes a certain amount of time to be inserted between DMA data transfers. This "dwell time" gives other system functions (like the communication multiplexer, network, etc.) use of the Q-bus.

W7-3	IN	1.2 us DMA dwell time
W7-4	IN	2.4 us DMA dwell time (default)
W7-2	IN	4.8 us DMA dwell time
W7-1	IN	9.6 us DMA dwell time

2.1.7 SCSI ID

Each device (initiator or target) on the SCSI bus must have a unique SCSI identification address (0-7). SCSI ID 7 has the highest priority on the bus and SCSI ID 0 has the lowest priority. The QTD-30 SCSI Host Adapter is factory configured to SCSI ID 7. To alter this designation, the user must change jumper setting of W10-3, W10-4 and W10-5.

Jumpers			ID Address
W10-3	W10-4	W10-5	
IN	IN	IN	Host adapter ID = 7 highest priority (default)
IN	IN	OUT	Host adapter ID = 6
IN	OUT	IN	Host adapter ID = 5
IN	OUT	OUT	Host adapter ID = 4
OUT	IN	IN	Host adapter ID = 3
OUT	IN	OUT	Host adapter ID = 2
OUT	OUT	IN	Host adapter ID = 1
OUT	OUT	OUT	Host adapter ID = 0 lowest priority

2.1.8 Mode Selection

The QTD-30 comes with both single-ended and differential SCSI drivers and receivers. When a jumper plug is installed in W2, pin 1-3, single-ended SCSI drivers and receivers are enabled and the DS1 right green LED is on. (Single-ended SCSI devices should be connected to the J2 connector.) This is the default condition.

When a jumper plug is installed in W2, pin 2-4, the differential drivers and receivers are enabled and the DS2 second-left green LED is on. (Differential SCSI devices should be connected to the J1 connector).

2.1.9 Terminator Power

The QTD-30 can supply termination power to single-ended and differential SCSI devices. This is required when the SCSI bus has external termination (rather than on-drive termination), when the terminated SCSI device needs to be turned off during computer operation, or when the Exabyte tape drive is installed on the SCSI bus.

Single-ended

W3	IN	SCSI terminator power enabled (default)
	OUT	SCSI terminator power disabled

Differential

W1	IN	SCSI terminator power enabled (default)
	OUT	SCSI terminator power disabled

To prevent accidental grounding or misconnection of terminator power, be sure to turn off system and SCSI device power before connecting SCSI cables and terminators. Also, be sure to match the pin 1 mark of SCSI cable/terminator with the pin 1 mark of SCSI device's connector.

2.1.10 Tape Fast Search

When set to the Tape Fast Search mode, the QTD-30 will enable high speed forward and reverse filemark search. VMS may use this mode if the user does not attempt a stand-alone boot or run other programs that require the controller to keep track of the number of data records between filemarks. In VMS stand-alone boot applications, this option must be disabled. For the ISM-11 operating system, this option must be enabled.

W10-6	IN	Enable tape fast search option
	OUT	Normal operation (default)

2.1.11 Front Panel Interface (RS-232)

The QTD-30 SCSI Host Adapter provides users with a 10-pin RS-232 connector (J4) for a system front panel interface. To enable the front panel interface signals, the user must connect a front panel circuit to J4 and install jumper plugs at W4-1, W4-2, W4-3, W4-4, W4-5, and W5. In default configuration, no jumper plugs are installed in these locations.

CAUTION

Do not install W5 jumper plug unless there is a front panel circuit connected to J4.

The physical pin number assignment and functions of Connector J4 are described below. For more information about the circuit necessary to implement the front panel interface, contact Micro Technology.

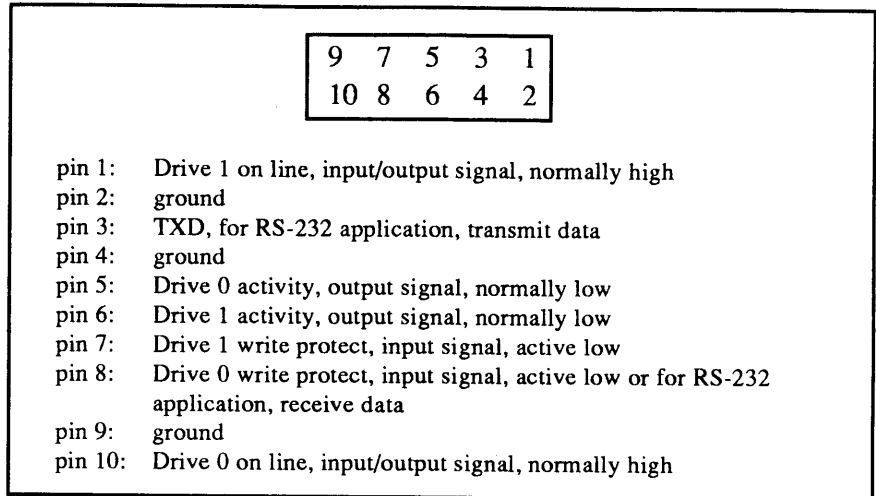


Figure 2-2. Connector J4 Pin Assignments

2.1.12 Disk Auto Boot

For LSI-11 processors only, the QTD-30 may be set to provide an auto-bootstrap at 773000 or 771000 on power up or whenever the "Boot" switch is pressed. This option may be enabled by installing a jumper plug in jumper block W13 pin 1 and 2.

- | | | |
|-----|-----|---------------------------------|
| W14 | IN | Auto-Bootstrap address = 773000 |
| | OUT | Auto-Bootstrap address = 771000 |
| | | |
| W13 | 1-2 | IN Auto-Bootstrap enabled |
| | 2-3 | IN Auto-Bootstrap disabled |

If there is an existing bootstrap ROM at 773000, the user may set the controller auto-bootstrap address at 771000 and type 771000G from ODT to bootstrap the software.

2.1.13 Synchronous Mode

The synchronous mode selection jumpers override the on-board utility synchronous/asynchronous selection for each device on the SCSI bus. When synchronous mode is enabled (default), the QTD-30 tests each SCSI device to find out if synchronous communication is possible. If it is, synchronous mode will be used automatically for faster data transfers. If it is not, asynchronous mode will be used.

If the user has asynchronous-only devices, this option should be disabled.

W10-1	IN	Tape sync mode disabled
	OUT	Tape sync mode enabled (default)

W10-2	IN	Disk sync mode disabled
	OUT	Disk sync mode enabled (default)

2.1.14 Tape Monitor Utility Software

The Tape Monitor Utility (TMU) is application software written exclusively for Micro Technology SCSI host adapters in VAX/VMS systems.

The Tape Monitor Utility displays the tape drive vendor identification, firmware revision, remaining tape capacity, percentage of rewrite and ECC retry, and current tape operations such as read, write, write file mark, space, rewind, etc. The user can install multiple tape subsystems in one site and observe the tape activity from any VAX terminal locally or across the network without additional add-in hardware. The user can also open a file to log all the information for unattended backup.

To make the Tape Monitor Utility work properly, a jumper plug must be installed at W10-7. This jumper plug should only be installed if the user has a VAX/VMS system and plans to run the Tape Monitor Utility.

Table 2-3. QTD-30 Jumper Settings

W1	IN	Differential SCSI terminator power enabled (D)	
	OUT	Differential SCSI terminator power disabled	
W2	1-3 IN	Single-ended channel enabled (D)	
	2-4 IN	Differential channel enabled	
W3	IN	Single-ended SCSI terminator power enabled (D)	
	OUT	Single-ended SCSI terminator power disabled	
W4	1-5 IN	Front panel interface enabled	
W5	IN		
W4	1-5 OUT	Front panel interface disabled (D)	
W5	OUT		
W6	1-2 IN	Reserved	
	2-3 IN	RS-232 transmit enabled (D)	
W7-1	IN	9.6 uS DMA dwell time	
W7-2	IN	4.8 uS DMA dwell time (D)	
W7-3	IN	1.2 uS DMA dwell time	
W7-4	IN	2.4 uS DMA dwell time	
W8-1	OUT	Reserved (D)	
W8-2	OUT	Reserved (D)	
W8-3	OUT	Reserved (D)	
W9	1-2 IN	Reserved (D)	
W10-1	IN	Tape sync mode disabled	
	OUT	Tape sync mode enabled (D)	
W10-2	IN	Disk sync mode disabled	
	OUT	Disk sync mode enabled (D)	
W10-3	W10-4	W10-5	
IN	IN	IN	Host adapter ID = 7 highest priority (D)
IN	IN	OUT	Host adapter ID = 6
IN	OUT	IN	Host adapter ID = 5
IN	OUT	OUT	Host adapter ID = 4
OUT	IN	IN	Host adapter ID = 3
OUT	IN	OUT	Host adapter ID = 2
OUT	OUT	IN	Host adapter ID = 1
OUT	OUT	OUT	Host adapter ID = 0 lowest priority

Table 2-3. QTD-30 Jumper Settings (continued)

W10-6	IN OUT	Enable tape fast search option Normal operation (D)
W10-7	IN OUT	Tape Monitor Utility (TMU) enabled TMU disabled (D)
W13	1-2 IN 2-3 IN	Auto-Boot enabled Auto-Boot disabled (D)
W14	IN OUT	Bootstrap address 773000 (D) Bootstrap address 771000
W15	OUT	Reserved (D)
W16	OUT	Reserved (D)
W17	OUT	Reserved (D)
W18	1-2 IN 2-3 IN	Block-mode DMA enabled (D) Block-mode DMA disabled
W19	IN OUT	Adaptive DMA enabled Adaptive DMA disabled (D)
W20	IN OUT	22-bit addressing (D) 18-bit addressing
W21	1-2 IN 2-3 IN	Interrupt level 5 Interrupt level 4 (D)
W22	1-2 IN	Reserved (D)
W23	1-2 IN	Reserved (D)
W24	1-2 IN	Reserved (D)
W25	OUT	Reserved (D)

Note: (D) means default setting.

2.2 Mounting the QTD-30

The QTD-30 can be installed in any priority on the standard MicroVAX or LSI-11 Q-Bus backplane as long as the Q-Bus interrupt acknowledge/DMA grant daisy chain is not broken. However, it is recommended that the QTD-30 be placed last in the Q-Bus daisy chain because the QTD-30 can buffer up data while waiting for slower devices in front of it (like a magnetic tape controller) to complete DMA on the Q-Bus.

NOTE

If the QTD-30 is installed in a system with DEC DEQNA Ethernet controller, the QTD-30 must be installed in front of the Ethernet controller in the DMA grant daisy chain.

When installing the QTD-30, be sure to use the appropriate handle kit supplied by Micro Technology. The handle provides an interface between the external cable and the QTD-30. These handles are illustrated in Figures 2-3 and 2-4.

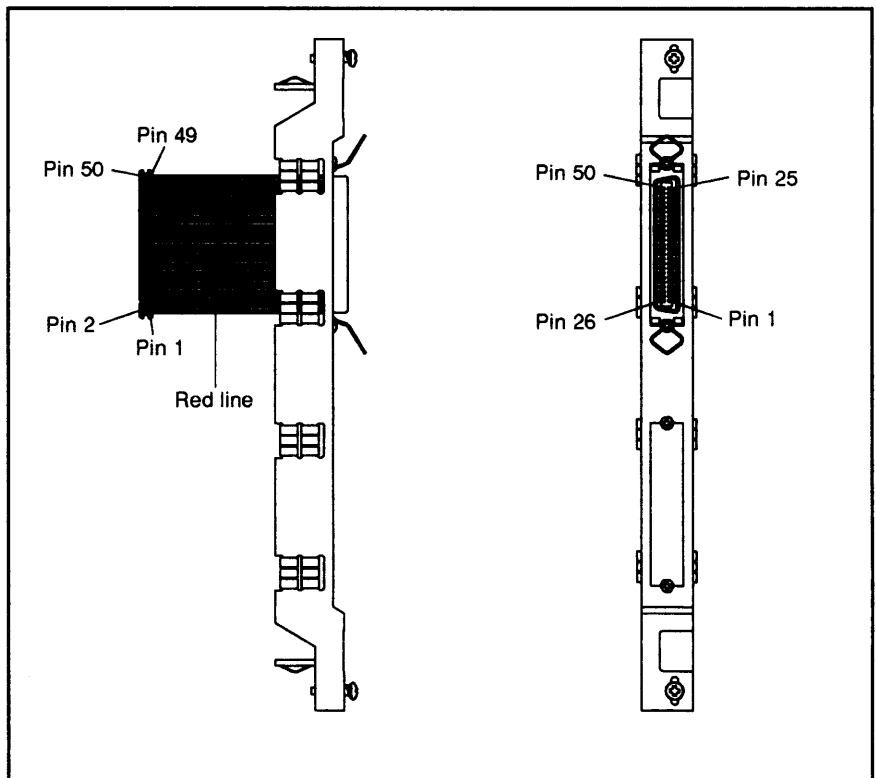


Figure 2-3. MicroVAX 3300 Handle

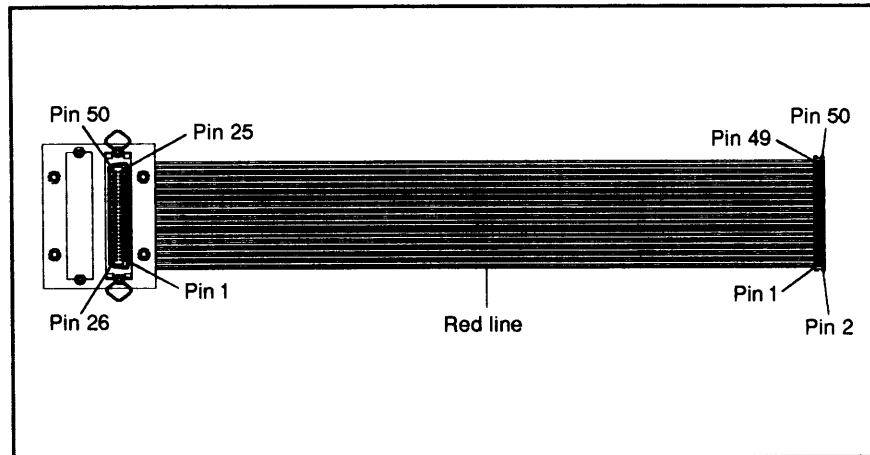


Figure 2-4. MicroVAX II Handle

2.3 LED Indicators

The QTD-30 has two LED modules in the front of the board: DS1 and DS2 (Figure 2-5). DS1 consists of four LEDs while DS2 consists of two LEDs.

LED	COLOR	INDICATION
DS1, far left	green	Power-up OK and activity indicator. On power up, this LED is turned on when the QTD-30 succeeds in the self-diagnostic testing. During normal controller operation, this LED is blinked to show controller activity.
DS1, middle left	red	Error condition occurred.
DS1, middle right	green	J2 single-ended terminator power pin supplied with power.
DS1, far right	green	J2 single-ended SCSI channel enabled.
DS2, left	green	J1 differential terminator power pin supplied with power.
DS2, right	green	J1 differential SCSI channel enabled.

Figure 2-5. QTD-30 LEDs (front view)

2.4 Cabling and Terminating the SCSI Bus

The QTD-30 provides two 50-pin connectors (J1 and J2) to interface with SCSI devices. Connector J1 is for differential devices and connector J2 is for single-ended devices.

If the QTD-30 and the external SCSI devices are installed in a single cabinet which meets EMI/RFI shielding requirements, a 50-conductor flat cable or 25-signal twisted-pair cable may be used. If the QTD-30 and the external SCSI devices are installed in separate cabinets, shielded SCSI cables which meet FCC requirements must be used.

2.4.1 Differential Devices

When cabling differential SCSI devices within a single shielded cabinet, twisted-pair cable is strongly recommended to prevent crosstalk between adjacent signals. Each pair should be connected to the same signal, one wire to positive and the other wire to negative. Cables should consist of 26 or 28 AWG conductors. Maximum cable length is 80 feet (25 meters).

Every differential signal pair should be terminated with a 330 ohm resistor between the negative signal and +5 volts, a 330 ohm resistor between the positive signal and ground, and a 150 ohm resistor between the positive and negative signal at each end of the SCSI cable.

The QTD-30 has on-board, removable terminators for differential operation (RN1, RN2, RN3, RN4, RN5, RN6, RN7, and RN8) located next to the J1 connector (see Figure 2-1). If the QTD-30 is installed at either end of the of the SCSI bus, these terminators should remain installed. If the QTD-30 is installed in the middle of the bus supporting differential devices, remove these terminators.

2.4.2 Single-Ended Devices

When cabling single-ended SCSI devices, a minimum conductor size of 28 AWG shall be employed to eliminate noise effects and ensure proper distribution of optional terminator power. Maximum cable length is 20 feet (6 meters).

The single-ended SCSI bus should be terminated with a 220 ohm resistor to the +5 volts and a 330 ohm resistor to ground at each end of the SCSI cable.

The QTD-30 has on-board, removable terminators for single-ended operation (RN9, RN10, and RN11) located next to the J2 connector (see Figure 2-1). If the QTD-30 is installed at either end of the of the SCSI bus, these terminators should remain installed. If the QTD-30 is installed in the middle of the bus supporting single-ended devices, remove these terminators.

2.5 Selecting SCSI IDs

Every SCSI device on the SCSI bus (including the QTD-30) requires a unique SCSI ID. Since the QTD-30 SCSI host adapter is factory configured to SCSI ID 7, the SCSI ID of the target devices (disk or tape) connected to the QTD-30 should be set from SCSI ID 0 to 6, beginning with ID 0. The QTD-30 can support up to four disk drives and three tape drives. For disk drives, use IDs 0 to 3; for tape drives, use IDs 4 to 6.

The following example is provided to show the mapping of SCSI IDs to the VMS system. This example assumes that the first disk CSR and tape CSR addresses are used and the on-board disk and tape LUN offsets are 0.

SCSI ID	VMS device
0	DUA0 SCSI ID + Disk LUN Offset
1	DUA1
2	DUA2
3	DUA3
4	MUA0 (SCSI ID 4) + Tape LUN Offset
5	MUA1
6	MUA2
7	PUA0 and PTA0 (QTD-30)

3. **MULTIHOSTING**

The QTD-30 provides true multihosting capabilities. Multihosting means that multiple DEC systems running Local Area Cluster (LAVc) software can share a common array of disk and tape devices (Figure 3-1). The QTD-30's multihost solution has every feature found in DSSI with the additional capability to support tape and optical devices (including jukeboxes).

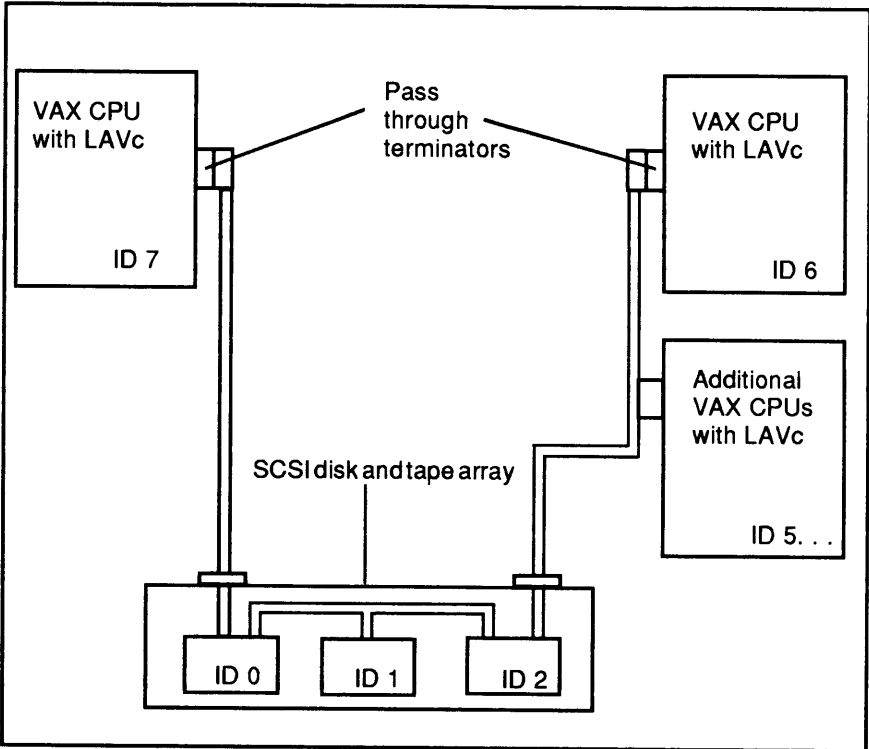


Figure 3-1. Typical Multihosting Hardware Configuration

To install a multihost system:

1. Configure each QTD-30 as explained in Section 2.1. Make sure each QTD-30 has a unique SCSI ID with the highest priority available (ID 7, ID 6, ID 5, etc.). Make sure all other devices (disks, tapes, etc.) have unique low priority SCSI IDs (ID 0, ID 1, ID 2, etc.).
2. Remove all on-board terminators from each QTD-30 (see Section 2.4).
3. Install a QTD-30 in the Q-bus slot of each DEC host system. Be sure to use the host adapter kit included with the QTD-30.
4. Cable the multihost system as shown in Figure 3-1. Limit total cable length (including internal subsystem loop cables) to 20 feet for single-ended devices or 80 feet for differential devices.
5. As shown in Figure 3-1, use pass-through external terminators at each end of the SCSI bus.
6. Run the on-board utility of each QTD-30 (see Section 4). Select **Additional SCSI Commands** and enter **D** for **Display SCSI Devices**. Once in **Display SCSI Devices**, disable SCSI reset so that powering down a host adapter will not interfere with the operation of the other(s).

Also, make sure the host adapter with ID 7 does not address other host adapters as target devices.

4. OPERATION

The QTD-30 comes with on-board disk, tape, RS-232, and ODT utilities. This section explains how each of these utilities operate.

4.1 Disk Utility

The QTD-30 disk utility provides a convenient means of formatting and configuring SCSI disk drives connected to LSI-11 and MicroVAX II systems. The instructions in this section show you how to access the disk utility main menu. These instructions assume that the QTD-30 has been set to the first disk CSR address.

LSI-11 SYSTEMS

1. Hit the boot switch.
2. Halt the processor.
3. **17772152/005400 123456 <cr>** ;CSR base address + 2
4. **17772152/001000 100 <cr>** ;Load utility to memory
5. **5000G** ;5000 and a G

The address shown in Step 3 is equal to the CSR address of the QTD-30 (selected by the switches SW1-1 to SW1-5) plus 2.

MicroVAX II SYSTEMS

1. Halt the CPU.
- 2.>>>**I <cr>** ;Initialize
- 3.>>>**U <cr>** ;Unlock
- 4.>>>**D/P/W20001F40 20 <cr>** ;Enable Q-bus memory
- 5.>>>**D/L 20088008 80000002<cr>** ;Set up Q-bus map
- 6.>>>**D/W 2000146A A72E <cr>** ;Deposit to base CSR + 2
- 7.>>>**D * 100 <cr>** ;Load utility to memory
- 8.>>>**S 400 <cr>** ;Start the utility

The address shown in Step 6 is equal to the CSR address of the QTD-30 (selected by the switch SW1-1 to SW1-5) plus 2.

The utility displays:

```
SCSI UTILITY PROGRAM

DISK                                TAPE
1=772150                            A=774500
2=760334                            B=760404
3=760354                            C=760444
4=760374                            D=760504
5=760340                            E=760544
6=760344                            F=760410
7=760350                            G=760450
8=760360                            H=760454

SELECT CSR ADDRESS
```

The user then selects the number that matches the CSR address selected by the switch SW-1 to SW-5 on the QTD-30. The main menu displays:

```
MAIN MENU

1 = BOOT DRIVE
2 = CONFIGURE LUN OFFSET
3 = FORMAT DRIVE
4 = QUALIFY DRIVE
5 = MANUAL REPLACE BAD SECTORS
6 = READ, WRITE AND VERIFY TEST
7 = ADDITIONAL SCSI COMMANDS

SELECT OPTION :
```

The user selects the desired option by typing the corresponding number. If the user types **<Ctrl>-C** at any time, the command is aborted and the utility program returns to the main menu. If the user types **<cr>** with no value, the existing parameter remains unchanged.

NOTE

These options can also be selected using the ODT utility. For more information, refer to Section 4.4.

4.1.1 Boot Drive

To bootstrap the operating system on a particular drive, select option **1** from the main menu. The utility requests a drive ID and then asks for confirmation before copying operating system files to the drive.

4.1.2 Configure LUN Offset

For LSI-11 systems, each MSCP drive requires a different Logical Unit Number (LUN). If there are no other MSCP controllers in the system, then the LUN offset number is 0 (Drive 0 will be LUN 0, and Drive 1 will be LUN 1). If another MSCP controller exists in the system with 4 LUN units (0 to 3), then the LUN offset should be 4. In this case, Drive 0 will be LUN 4 and Drive 1 will be LUN 5. Normally, when the QTD-30 is used with VMS, the default LUN offset (LUN=0) should not be changed.

To change the LUN offset, select option **2** from the main menu. When the utility requests a new LUN value, enter the appropriate number. Then, type **Y** to save the new configuration.

4.1.3 Format Drive

Formatting rewrites all the sectors on a drive. During formatting, the QTD-30 issues a format unit command to the selected drive and maps out the defects on the Manufacture Defect List (MDL).

To format a drive, select option **3** from the main menu. Then, enter the ID of the drive to be formatted. Since this procedure destroys all data on the disk, the utility asks for confirmation before starting (type **Y** to continue).

NOTE

Micro Technology recommends that the user select the qualify drive option after formatting a drive.

4.1.4 Qualify Drive

The qualify drive option writes different patterns into the drive and then verifies the pattern. If any bad sectors are detected, they are automatically mapped out. To begin, select option **4** from the main menu. Since this procedure destroys all data on the disk, the utility asks for confirmation before starting (type **Y** to continue).

To end the qualify procedure at any time, enter **<Ctrl>-C**. To ensure a defect-free drive, the qualify program should be run for at least ten passes.

4.1.5 Manual Replace Bad Sectors

This option allows the user to replace any bad sectors found by the read, write, and verify test. Sometimes, a bad sector can prevent access to an entire file or directory.

NOTE

Before using this option, the user must obtain the logical block number of the bad sector(s) by running the read, write, and verify test (option 6).

To replace a bad sector, select option **5** from the main menu. When prompted, enter the drive ID and then the logical block number of the bad sector. Type **Y** when asked to confirm the sector to be replaced. Repeat this procedure until all sectors have been replaced.

CAUTION

Any data contained in the bad sector will be lost when it is replaced.

4.1.6 Read, Write, and Verify Test

The read, write, and verify test option generates random data patterns on the disk to test the integrity of the controller board, drive cable, and disk drive.

To run the test, select option **6** from the main menu. When prompted, type **Y** for read-only or **N** for read-write testing (read-only testing is non-destructive). Then, select the drive ID to be tested. If the user selected read-write testing, a warning message appears that all data will be destroyed. Type **Y** to continue.

The user is then prompted to enter start and finish block numbers. This allows the user to test only a portion of the disk, if desired. The user can enter any range of block numbers for testing or enter **<Cr>** two times to test the entire disk.

To abort the test at any time, enter **<Ctrl>-C**.

4.1.7 Additional SCSI Commands

The additional SCSI commands option can be used to display the SCSI IDs of attached devices, issue SCSI commands to a selected device, test a selected device, and format the replacement and caching table (RCT) blocks for a selected device.

To open the additional SCSI commands menu, select option **7** from the main menu.

ADDITIONAL UTILITIES SN = 0000

D = DISPLAY SCSI DEVICES ATTACHED
S = SEND SCSI COMMAND TO THE DEVICE
T = TEST SCSI DEVICE
R = FORMAT RCT BLOCK

SELECT OPTION ?

Select option **D** to display the SCSI devices attached to the controller and to change the following: number of disk and tape devices supported, SCSI ID and LUN assignments, disk partition selection, SCSI reset enable/disable, SCSI disconnect enable/disable, sync/async mode selection, tape buffer mode selection, prevent medium removal enable/disable, and disk write with verify enable/disable.

NOTE

Disks can only be partitioned into two or four partitions of equal size. After a disk has been partitioned, select option **R** (see below) to format the RCT blocks for each partition.

Select option **S** to send generic SCSI commands to the selected drive directly.

Select option **T** to read test or write/read/verify test the selected disk/tape drive.

Select option **R** to format the RCT blocks of the selected disk drive.

4.2 Tape Utility

The QTD-30 tape utility program is designed for LSI-11 systems only. This utility can be started by means of an ODT command as shown in the example below. This example assumes that the SCSI host adapter is set to the first tape CSR address.

LSI-11 SYSTEMS

1. Hit the boot switch.
2. Halt the processor.
3. **17774502/005700 123456 <cr>** ;CSR base address + 2
4. **17774502/001000 100 <cr>** ;Load utility to memory
5. **5000G** ;5000 and a G

The address shown in Step 3 is equal to the CSR address of the QTD-30 (selected by the switches SW1-6 to SW1-10) plus 2.

The utility displays:

```
SCSI UTILITY PROGRAM

DISK                                TAPE
1=772150                            A=774500
2=760334                            B=760404
3=760354                            C=760444
4=760374                            D=760504
5=760340                            E=760544
6=760344                            F=760410
7=760350                            G=760450
8=760360                            H=760454

SELECT CSR ADDRESS
```

The user then selects the number that matches the CSR address selected by the switch SW-1 to SW-5 on the QTD-30. The main menu displays:

```
MAIN MENU

1 = BOOT DRIVE
2 = CONFIGURE LUN OFFSET
3 = TAPE DIAGNOSTIC

SELECT OPTION :
```

4.2.1 Boot Drive

The user selects the desired option by typing the corresponding number. If the user types **<Ctrl>-C** at any time, the command is aborted and the utility program returns to the main menu. If the user enters **<cr>** with no value, the parameters remain unchanged.

To bootstrap the operating system on a particular device, select option **1** from the main menu. The utility requests a device ID and then asks for confirmation before copying operating system files to the device.

4.2.2 Configure LUN Offset

For LSI-11 systems, each MSCP drive requires a different Logical Unit Number (LUN). If there are no other MSCP controllers in the system, then the LUN offset number is 0 (Drive 0 will be LUN 0, and Drive 1 will be LUN 1). If another MSCP controller exists in the system with 4 LUN units (0 to 3), then the LUN offset should be 4. In this case, Drive 0 will be LUN 4 and Drive 1 will be LUN 5. Normally, when the QTD-30 is used with VMS, the default LUN offset (LUN=0) should not be changed.

To change the LUN offset, select option **2** from the main menu. When the utility requests a new LUN value, enter the appropriate number. Then, type **Y** to save the new configuration.

4.2.3 Tape Diagnostic

The tape diagnostic option can be used to test the integrity of the QTD-30, SCSI cable, and the tape drives. To start the tape diagnostic, select option **3**. When prompted, enter the ID of the tape drive to be tested.

4.2.4 Additional SCSI Commands

The user can display, reconfigure, and test tape devices with the additional SCSI commands option from the disk utility. To use this option, open the disk utility as explained in Section 4.1 and select option **7** from the main menu.

4.3 RS-232 Utility

The RS-232 utility is a general purpose utility for any DEC system with Q-bus. To access this utility, the user must first connect a terminal and cable to the QTD-30 RS-232 port and set the terminal baud rate to 9600 (8 bit data with no parity). Then, the user must halt the system, toggle the reset switch, and enter **<cr>**. The main menu then appears on the terminal.

SCSI HOST ADAPTER UTILITY (REV. XX)

[DISK]	[TAPE]
1 = LUN OFFSET	6 = LUN OFFSET
2 = FORMAT DRIVE	7 = ADDITIONAL UTILITIES
3 = QUALIFY DRIVE	
4 = MANUALLY REPLACE BAD BLOCKS	
5 = ADDITIONAL UTILITIES	

SELECT OPTION ?

Once the main utility menu appears, the user can enter a number followed by **<cr>** to select the desired option. These options work as described in Sections 4.1 and 4.2.

NOTE

Pin 8 (receive data) of the RS-232 connector is also used as a write-protect input for the front panel interface of the controller. To insure normal operation of the QTD-30, remove the terminal cable from the RS-232 port after using the SCSI utility.

4.4 ODT Utility

The ODT utility can be used by LSI and VAX users to communicate directly with the QTD-30. The options described in Sections 4.1 and 4.2 can be performed using ODT commands listed below.

4.4.1 ODT Bootstrap

LSI-11

17772150/000000 0	;Enter 0 to CSR address
17772152/005400 123456	;ODT utility, CSR+2
/001000 600	;BOO
/004000 0	;Logic unit number
R0/xxxxxx 0	;boot from LUN 0
R1/xxxxxx 172150	;CSR address
R7/xxxxxx 0	;Start from 0
RS/xxxxxx 340	;Highest priority
P	;Proceed

4.4.2 Specify LUN Offset

LSI-11

```
17772150/000000 0 ;CSR address
17772152/005400 123456 ;CSR+2
/001000 42
/004000 0 ;LUN offset
```

VAX

```
>>>D/W/P/ 20001468 0 ;CSR address
>>>D/W/P/ 2000146A A72E ;CSR+2
>>>D * 22 ;If * is not accepted, then
;type D/W/P 2000146A 22
>>>D * 0 ;CSR + 2 with LUN offset
```

4.4.3 Verify LUN Offset

LSI-11

```
17772150/000000 0 ;CSR address
17772152/005400 123456 ;CSR+2
/001000 43
/offset 0 ;Display LUN offset
```

VAX

```
>>>D/W/P 20001468 0 ;CSR address
>>>D/W/P 2000146A A72E ;CSR+2
>>>D * 23 ;CSR+2
>>>E * ;CSR+2, Display LUN offset
```

4.4.4 Format Drive

LSI-11

```
17772150/000000 0 ;CSR address
17772152/005400 123456 ;CSR + 2
/001000 40
/004000 0 ;Select drive 0
/010000 0 ;Drive volume serial number
/020000 ;Value = 20000, formatting
;Value = 0, format complete
```

VAX

```

>>>D/W/P 20001468 0 ;CSR address
>>>D/W/P 2000146A A72E ;CSR + 2
>>>D * 20 ;CSR + 2, if * is not accepted,
;then type D/W/P 2000146A 20
>>>D * 0 ;CSR + 2, Select drive 0
>>>D * 0 ;Drive volume serial number
>>>E * ;Value = 2000, formatting
;Value = 0, format complete
    
```

4.4.5 Qualify Drive

LSI-11

```

17772150/000000 0 ;CSR address
17772152/005400 123456 ;CSR + 2
/001000 41
/004000 0 ;Select drive 0
/loop count ;Select current qualify loop
;count
    
```

VAX

```

>>>D/W/P 20001468 0 ;CSR address
>>>D/W/P 2000146A A72E ;CSR + 2
>>>D * 21 ;CSR + 2 if * is not accepted
;then type D/W/P 200146A 21.
>>>D * 0 ;CSR + 2, select drive 0
>>>E * ;Show current qualify loop
;count at CSR + 2
    
```

A. SCSI INFORMATION

This section describes the SCSI codes, signals, and pin assignments used by the QTD-30.

A.1 SCSI Commands

The QTD-30 uses the following SCSI command codes for MSCPEmulation:

Code	Command Name
00h	Test Unit Ready
01h	Rezero Unit
03h	Request Sense
04h	Format Unit (1)
07h	Reassign Block
08h	Read
0Ah	Write
0Bh	Seek
12h	Inquiry
15h	Mode Select
16h	Reserve Unit
17h	Release Unit
1Ah	Mode Sense
1Bh	Start/Stop Unit
1Eh	Prevent/Allow Medium Removal
25h	Read Capacity
28h	Extended Read
2Ah	Extended Write
2Bh	Extended Seek
3Eh	Read Long (2)
3Fh	Write Long (2)

(1) The Format Unit command is used by the on-board utility only.

(2) These commands are used if the drives support them.

The QTD-30 uses the following SCSI command codes for TMSCP emulation:

Code	Command Name
00h	Test Unit Ready
01h	Rewind
03h	Request Sense
08h	Read
0Ah	Write
10h	Write Filemarks
11h	Space
12h	Inquiry
15h	Mode Select
16h	Reserve Unit
17h	Release Unit
19h	Erase
1Ah	Mode Sense
1Bh	Load/Unload
1Eh	Prevent/Allow Medium Removal

A.2 SCSI Status

The QTD-30 uses the following SCSI status codes:

Code	Status Name
00h	Good
02h	Check Condition
08h	Busy
10h	Intermediate/Good
18h	Reservation Conflict

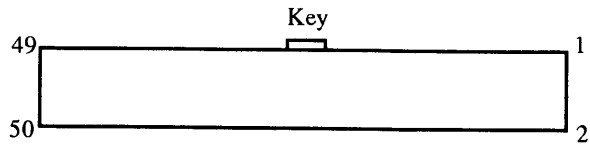
A.3 SCSI Messages

The QTD-30 uses the following SCSI messages:

Code	Message Name
00h	Command Complete
01h	Extended Message
02h	Save Data Pointer
03h	Restore Pointer
04h	Disconnect
05h	Initiator Detected Error
07h	Message Reject
08h	No Operation
09h	Message Parity Error
80-FFh	Identify

A.4 Pin Assignments for Connector J1

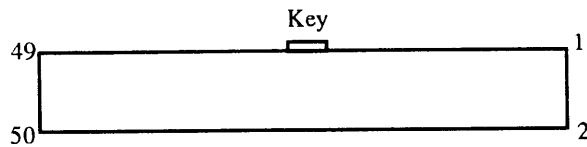
The following are pin assignments for the QTD-30 non-shielded, differential SCSI device connector J1:



Signal	Pin Numbers		Signal
GROUND	1	2	GROUND
+DB (0)	3	4	-DB (0)
+DB (1)	5	6	-DB (1)
+DB (2)	7	8	-DB (2)
+DB (3)	9	10	-DB (3)
+DB (4)	11	12	-DB (4)
+DB (5)	13	14	-DB (5)
+DB (6)	15	16	-DB (6)
+DB (7)	17	18	-DB (7)
+DB (P)	19	20	-DB (P)
DIFFSENS	21	22	GROUND
GROUND	23	24	GROUND
TERMPWR	25	26	TERMPWR
GROUND	27	28	GROUND
+ATN	29	30	-ATN
GROUND	31	32	GROUND
+BSY	33	34	-BSY
+ACK	35	36	-ACK
+RST	37	38	-RST
+MSG	39	40	-MSG
+SEL	41	42	-SEL
+C/D	43	44	-C/D
+REQ	45	46	-REQ
+I/O	47	48	-I/O
GROUND	49	50	GROUND

A.5 Pin Assignments for Connector J2

The following are pin assignments for the QTD-30 non-shielded, single-ended SCSI device connector J2:



Signal	Pin Number
-DB (0)	2
-DB (1)	4
-DB (2)	6
-DB (3)	8
-DB (4)	10
-DB (5)	12
-DB (6)	14
-DB (7)	16
-DB (P)	18
GROUND	20
GROUND	22
GROUND	24
TERMPWR	26
GROUND	28
GROUND	30
-ATN	32
GROUND	34
-BSY	36
-ACK	38
-RST	40
-MSG	42
-SEL	44
-C/D	46
-REQ	48
-I/O	50

NOTE

All odd pins except pin 25 are connected to ground. Pin 25 is left open. A minus sign next to the signal name indicates active low.

**B. OPERATING
SYSTEM
SUPPORT**

All DEC-compatible products manufactured by Micro Technology implement Mass Storage Control Protocol (MSCP) and Tape Mass Storage Control Protocol (TMSCP). Micro Technology supports this implementation of MSCP/TMSCP beginning with the indicated version of the following DEC operating systems.

Operating	
System	Versions
VMS	4.0-5.4
Ultrix	1.2-3.2
UNIX/Berkeley	4.2 and 4.3
RSX-11M	Disk: 4.1-5.3 Tape: 4.2-5.3
RSX-11M-Plus	3.0-4.3
RSTS/E	Disk: 9.0-9.7 Tape: 9.5-9.7
RT-11	Disk 5.1-5.4C Tape: 5.4
DSM-11	3.3-4.1
ISM-11	3.4
TSX+	Disk 5.1-5.4C Tape: 5.4
VAXELN	x.x
AT&T UNIX	System 5

C. USING VMS
SYSGEN
CONNECT

To correctly use the CONNECT statement in the SYSGEN utility of VMS 5.0 and later, follow these steps:

1. Run the SYSGEN utility using either terminal mode or command file. (SYCONFIG.COM is recommended if an automatic command file is to be used.)
2. At the SYSGEN prompt, enter **SHOW/CONFIG**. Make a note of the designation (name), number (nexus), CSR address, and vector of the adapter to be connected.
3. At the SYSGEN prompt, enter the following CONNECT statement to connect the controller:

**CONNECT *aaaa*/ADAPTER=*bbb*/CSR=%O*ccccccc*
VECTOR=%o*ddd*/DRIVER=*ee*DRIVER**

aaaa is the designation of the adapter (like PTB0). *bbb* is the adapter number (like UB0). *ccccccc* is the CSR address of the adapter. *ddd* is the vector of the adapter. *ee* is the driver for the adapter.

4. At the SYSGEN prompt, enter **SHOW/UNIBUS**. Make a note of the SYSIDLOW value in parentheses following the CSR address entered previously.
5. At the SYSGEN prompt, enter the following CONNECT statement to connect the drive:

**CONNECT *fff*/NOADAPTER/SYSIDHIGH=%X*gggg*/
SYSIDLOW=%X*hhhhhhh*/DRIVER=*i*DRIVER**

fff is the designation of the drive (like MUB0). *gggg* is the SYSIDHIGH number (8000 plus the NEXUS number). *hhhhhhh* is the SYSIDLOW number obtained in Step 4.

6. At the SYSGEN prompt, enter **<Ctrl>-Z** to exit SYSGEN.

D. USING VMS ANALYZE/ERROR UTILITY

The QTD-30 logs controller-dependent information in an ERRLOG.SYS file. The user can open this file with the VMS ANALYZE/ERROR utility and display the contents for troubleshooting purposes.

To enter the ANALYZE/ERROR utility, follow these steps:

1. Log onto the system.
2. At the system prompt, enter:

ANA/ERR[/SINCE=*dd-mmm-yyyy*][/INC=*xxxx*]

dd-mmm-yyyy is the start date (day, month, and year) for the error report. *xxxx* is the designation (name) of the device that the user wants error information about (like MUB0).

To view MUB0 errors that have occurred since April 20, 1991 at 2:00 p.m., enter:

ANA/ERR/SINCE=20-APR-1991:14:00/INC=MUB0 <cr>

To view all errors that have occurred only one or more devices, enter:

ANA/ERR/INC=MUB0 <cr> or

ANA/ERR/INC=(PTB, MUB0) <cr>

To view all errors that have occurred on a particular type of device, enter:

ANA/ERR/INC=TAPES <cr> or

ANA/ERR/INC=DISKS <cr>

To view all errors logged by VMS, enter:

ANA/ERR <cr>

NOTE

For assistance in interpreting the error report, contact Micro Technology.

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