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Rev. 2.8

CQD-220/223

SCSI Host Adapter
User's Manual

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

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GENERAL TERMS - The above warranties shall not apply to expendable components such as fuses, bulbs, and the like, nor to connectors, adapters, and other items not a part of the basic product. CMD shall have no obligation to make repairs or to cause replacement required through normal wear and tear or necessitated in whole or in part by catastrophe, fault or negligence of the user, improper or unauthorized use of the product, or use of the product in such a manner for which it was not designed, or by causes external to the product, such as, but not limited to, power failure or air conditioning. CMD's sole obligation hereunder shall be to repair or replace any defective product, and, unless stated, pay return transportation costs within the United States of America for such replacement. Purchaser shall provide labor for removal of the defective product, shipping charges for return to CMD and installation of its replacement. On-site services are not a part of this warranty. Above warranties are subject to change without notice.

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Return and Repair Policy

WARRANTY PERIOD

The following warranty period is from the date of shipment:

CMD Host Adapter	one year
Cable	90 days
Drive	manufacturer's warranty

RETURN FOR CREDIT

The allowable period of return for credit from the date of shipment is as follows

CMD Host Adapter	less than 30 days
Cable	less than 30 days
Drive	not applicable

RETURN FOR REPAIR

CMD Host Adapter

In-Warranty (Less than 1 year)

- CMD offers a *15 working day turnaround repair service* at the cost of parts only. Defective boards will be repaired and returned to the customer within 15 working days from the date of return to CMD.
- CMD also offers two *in-warranty 24 hour expediting services:*

  24 Hour Turnaround Loaner Service:

  Under this policy, CMD will ship a loaner in 24 hours during regular working days to the customer for a charge of $100.00 per loaner. Upon receiving the loaner, customer must return the defective board to CMD within seven (7) days for repair. CMD will repair the defective board and return the board to the customer. Customer must then return the loaner in seven (7) days after the receipt of the repaired board. Approval for loaner service is based on credit verification.

  24 Hour Turnaround Swap Service:

  In the case that the defective board is within the first six (6) months of the warranty, CMD, at its own option, offers a 24 hour turnaround swap service. CMD will ship the same model of the board to customer within 24 hours during working days in exchange for the defective board. CMD will swap with a new board if board is not functional upon arrival. For all other cases, swap will occur with either a new or refurbished board for a charge of $200.00. CMD does not offer swap services for boards that are purchased more than six months from the date of shipment. Customer is responsible for returning the defective board to CMD within seven (7) days after receipt of the swapped board.
- The remaining warranty period shall apply to the repaired or swapped board.

Out-of-Warranty (more than 1 year)

- CMD offers a *15 working day turnaround repair service* at a rate of $300.00 plus parts and freight for all out-of-warranty host adapter boards. Defective boards will be repaired and returned to customer within 15 working days starting with date of return to CMD.
- CMD also offers an *Out-of-Warranty 24 Hour Turnaround Loaner Service:*

  Under this policy, CMD will ship the same model loaner in the 24 hour time frame of working days to customer for an additional charge of $100.00 plus freight per loaner. The loaner is for use by the customer during the period that the defective board is being repaired. Customer is responsible for returning the defective board to CMD within seven days after the receipt of loaner and returning the loaner in seven (7) days once the defective board is repaired and received. The approval of the loaner service is at CMD's option and based upon customer credit verification.
- CMD will extend warranty for a period of six (6) months on any out of- warranty repaired board.

Cable

In-Warranty (90 days) - free swap.

Out-of-Warranty (90 days) - not applicable.

Drive

In-Warranty (per manufacturer) - manufacturer charge only.
Out-of-Warranty (per manufacturer) - manufacturer charge plus $100 CMD handling.

RETURN FOR UPGRADE/ UPDATE

CMD Host Adapter

In-Warranty (less than 1 year)

- CMD offers a *15 working day turnaround different function upgrade service* for boards that can be upgraded to a higher function; and a *free 15 working day turnaround ECO Field Upgrade* for all its boards. CMD will *upgrade* the hardware of its board to a higher function for a charge of the difference of list prices of the original and upgraded functions. CMD will also update its board to its latest firmware release at no charge to the customer. Boards will be upgraded/updated and returned to the customer within 15 working days from the date of return to CMD.
- CMD also offers *24 hour turnaround loaner service* as stated in "RETURN FOR REPAIR."
- The remaining warranty period shall apply to the updated board. For upgraded boards, CMD will extend warranty for a period of six months.

Out-of-Warranty (More than 1 year)

- CMD offers a *15 working day turnaround different function upgrade service* for boards that can be upgraded to a higher function at a charge of the difference of list prices of two functions. CMD also offers a *free 15 working day turnaround ECO Field Upgrade* for all its boards. Boards will be upgraded/updated and returned to customer within 15 working days from the date of return to CMD.
- CMD also offers *24 hours turnaround Loaner Service* as stated in "RETURN FOR REPAIR."
- There will be no warranty extension for same function firmware update. For different function Hardware upgrade, CMD will extend warranty for a period of six (6) months.

Drive—same as in RETURN FOR REPAIR.

SHIPPING CHARGES

The following shipping charges apply to all REPAIR, SWAP, LOANER, and UPGRADE UNITS.

In-Warranty

- Domestic - freight from CMD to customer is to be paid by CMD; freight from customer to CMD is to be paid by customer.
- International - all fees are to be paid by customer (including custom duty and broker fees).

Out-of Warranty

- Domestic - all fees are to be paid by customer.
- International - all fees are to be paid by customer (including custom duty and broker fees).

GENERAL CONDITIONS

All goods returned to CMD including returns for credit, swap returns, loaner returns, and evaluation returns shall remain in good condition. Any damage or alteration done by the customer will result in a rejection or additional charge to the customer.

Customer must consult CMD Technical Support for authorization of CMD not functional upon arrival boards and swap requests. CMD Sales personnel must be consulted for authorization of returned goods for credit and/or evaluation.

Preface

The CQD-220/223 Rev 2.8 contains the following changes to the previous manual:

- Minor grammatical changes.
- Eprom Size Selection option has been added to Chapter 4.

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1
Introduction

This User's Guide explains the basics of your CQD-220™. It includes information on setting up and configuring your system and the CQD-220 for use.

How to Use This Manual

This guide has five chapters and five appendices. Each chapter explains a different aspect of preparing your CQD-220 for use. You may refer to the appendices for further configuration and troubleshooting information. The following descriptions summarize each section.

Chapter 1: Introduction explains the purpose of this guide and details the conventions used.

Chapter 2: CQD-220 Features describes the CQD-220 and details its features, special features, and specifications.

Chapter 3: Installation describes hardware configuration and installation procedures for the CQD-220.

Chapter 4: Setup describes setting up and configuring the CQD-220 and your system for use. This chapter includes Multi-hosting, Partitioning, Shadowing, and VMS® and ULTRIX® configuration.

Chapter 5: SCSI Basics lists a glossary on SCSI terms, SCSI status, and command codes for the CQD-220.

Appendix A: Supported Devices and Operating Systems lists the SCSI devices and operating systems compatible with the CQD-220.

Appendix B: Troubleshooting gives some troubleshooting guidelines for the CQD-220.

Appendix C: Jumper Settings lists the jumpers settings, pin assignments, and the CSR addresses for the present revision of the CQD-220.

Appendix D: VMS SYSGEN Connect Statement describes the proper use of the VMS Sysgen Connect Statement.

Appendix E: Old Hardware Rev. A describes the jumper settings for the CQD-220 Revision A.

Conventions

The following conventions are used in the CQD-220 User's Guide.

Keycaps—Characters in square brackets represent keys on your keyboard. For example, "Press **[ENTER]**" means press the **[ENTER]** key. When two or more keys are joined by a plus sign (+), press those keys at the same time.

Commands—Text in *italics* represent commands that can be used on a system, such *show dev du*.

NOTE Sometimes *italics* will be used for emphasis; at this time no action is necessary; for example, *do not* remove jumper shunt W13.

Entering Text or Commands on Screen—Text or commands that must be entered on screen will be in italics and bold as ***show dev du;*** be sure to enter the text or command and press **[ENTER]**.

2

Features and Specifications

The CQD-220 is a dual wide Q-Bus synchronous/asynchronous (sync/async) SCSI Host Adapter. The following sections describe the CQD-220 in more detail.

Features

The CQD-220 is an intelligent high performance dual-wide Q-bus SCSI host adapter which is fully compatible with the DEC Mass Storage Control Protocol (MSCP) and Tape Mass Storage Control protocol (TMSCP).

The CQD-220 can be used with the LSI-11/23®, PDP-11/23+®, Micro-PDP-11/53®, 11/73, 11/83, 11/93, MicroVAX II®, and MicroVAX III®, VAX 4000® and DECsystem® 5400 systems. It supports RT-11®, TSX®, DSM-11®, ISM-11®, RSX®, RSTS®, VMS, UNIX®, ULTRIX, and other operating systems which use *du/tu* drivers.

The CQD-220 features 18-bit or 22-bit Q-bus addressing, block mode and adaptive DMA transfer, virtual data buffer, command queuing, dynamic defect management, standard SCSI bus arbitration, disconnect and reconnect capability, multiple-host capability, and all required SCSI commands. Up to seven single-ended (synchronous, asynchronous or mixed) SCSI devices can be connected to the CQD-220 with SCSI bus data transfer rate up to 4.8 MB/sec in synchronous mode and 3 MB/sec in asynchronous mode.

The CQD-220 supports a variety of sync/async SCSI devices including magnetic disk, magnetic tape, and optical disk drives. Table 2-1 lists the different models of the CQD-220 and their features.

Table 2-1 CQD-220 Models

CQD-220/M	supports disk drives only.
CQD-220/T	supports tape drives only.
CQD-220/TM	supports disk and tape drives simultaneously.
CQD-220/TMJ	supports disk and tape drives and jukeboxes simultaneously.
CQD-220/TMP	supports disk and tape drives simultaneously in pass-through mode.
CQD-220/TMS	supports disk and tape drives and hardware shadowing.
CQD-223	contains the CQD-220 and is availabled with the different CQD-220 models; also contains a MicroVAX III and VAX4000 adapter kit with shielded connectors. A SCSI cable with shielded connectors is required for connecting the CQD-223 to SCSI devices.

NOTE Unless otherwise specified, the CQD-220 will represent all variations, and the CQD-220/TM will represent the CQD-220/TMJ, CQD-220/TMP, and CQD-220/TMS throughout this manual.

The CQD-220/M and CQD-220/TM have an On-Board Utility for you to format and configure SCSI devices, and scan bad blocks and replace them automatically.

For LSI systems only, the CQD-220/M and CQD-220/TM contain a selectable bootstrap option which can boot the system on power up or reset. The CQD-220/M, CQD-220/T and CQD-220/TM have an On-Board Utility to boot up the system or exercise the tape drives.

The CQD-220 has an on-board non-volatile RAM (NOVRAM) to store the Logical Unit Number (LUN) Offset and other important information of the controller configuration.

The CQD-220 SCSI host adapter provides you with a 10-pin connector (J1) to interface with the On-Board RS-232 Utility. The CQD-223 provides you with a DEC compatible RJ-11/Modified Module 423 Jack (MMJ) for accessing the On-Board RS-232 Utility. See Appendix C for pin assignments.

LED Indicators

The CQD-220 has two LEDs in the front of the board as shown in Figure 2-1.

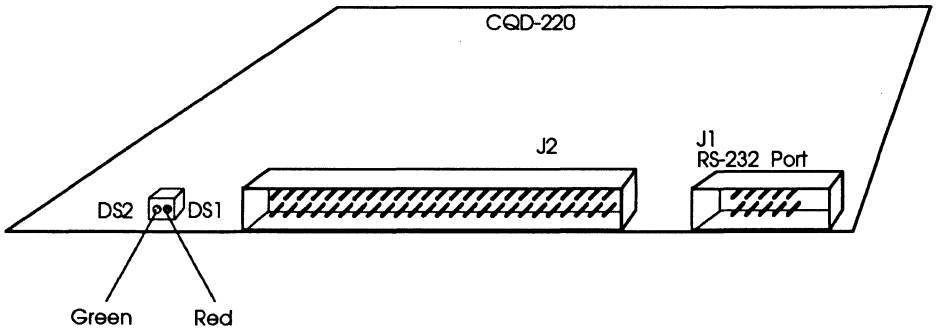

Figure 2-1: LED Indicators

Table 2-2 lists the LED indicators.

Table 2-2 LED Indicators

LED	Color	Indication
DS1	Red	Error condition occurred
DS2	Green	Power up is OK; activity is indicated. Upon power up, this LED lights as the CQD-220 succeeds its self-diagnostic test. During normal operation, this LED blinks to show controller activity.

Special Features

The CMD CQD-220 provides special features, such as multi-hosting, partitioning, hardware shadowing, Tape Monitor Utility™(TMU), online formatting (FMT), SCSI Library Manager™ (SLM), and Generic SCSI Adapter™ (GSA). Table 2-3 lists the special features.

Table 2-3 Special Feature Support List

Model	Multi-hosting	Partitioning	TMU	FMT	Shadowing	SLM	GSA
/T	No*	No	Yes	No	No	No	No
/M	Yes	Yes	No	Yes	No	No	No
/TM	Yes	Yes	Yes	Yes	No	No	No
/TMS	No	No	Yes	Yes	Yes	No	No
/TMJ	Yes	Yes	Yes	Yes	No	Yes	No
/TMP	Yes	No	Yes	Yes	No	No	Yes

* Two hosts can share tape drives.

Multi-Hosting

CMD's multi-host solution can support disk, tape, and optical devices including jukeboxes. It gives you the ability to completely share an array of disks and tapes between multiple VAX systems running VAX cluster software. Multi-hosting configuration instructions are given in Chapter 4. Refer to Appendix A for supported multi-hosting disk and tape devices.

Partitioning

CQD-220 gives you the ability to partition devices. Partitioning makes one physical device appear as two or four equal-sized logical devices. Partitioning is used for operating systems that do not support large devices such as RT-11. Partitioning configuration instructions are given in Chapter 4.

Tape Monitor Utility

The Tape Monitor Utility (TMU) is an application software that works exclusively with CMD SCSI host adapters as an **optional** feature for VAX/VMS systems.

This Tape Monitor Utility displays the tape drive vendor identification, drive firmware revision, the remaining tape capacity, percentage or number of rewrites during writes, or percentage or number of ECC retrys during reads (consult manufacturer's documentation for return of percentages or numbers).

TMU also displays and current tape operations such as read, write, write file mark, space, rewind, and many more. You can install multiple CQD-220s and tape drives in one site and observe all tape activity from any VAX terminal, locally or across the network, without any additional add-in hardware. You can also open a file to log all the information during unattended backup.

To install the Tape Monitor Utility, follow the instructions given in Chapter 3, "Hardware Configuration," and then in the accompanying CMD Tape Monitor Utility User's Manual part number MAN-000TMU-000.

SCSIformat ON-LINE

The SCSIformat ON-LINE™ (FMT) is an application software that works exclusively with CMD SCSI host adapters as an **optional** feature for VAX/VMS systems. FMT allows you to format disk drives without interfering with other devices on the SCSI bus. To install SCSIformat ON-LINE follow the instructions given in Chapter 3, "Hardware Configuration," and then in the accompanying SCSIformat ON-LINE User's Manual.

Hardware Shadowing

The Super Shadow CQD-220/TMS is a hardware variation of the CQD-220/TM. Installation and setup of CMD shadowing host adapters are simplified with the CMD On-Board Utility. This easy to use, menu-driven utility allows you to quickly configure virtually any combination of disk shadow sets. See Chapter 4 for Hardware Shadowing Configuration.

The hardware disk shadowing on DEC computers enables simultaneous writing of data to two shadow set members. This feature provides an exact real-time duplicate data set that can later be retrieved if data on primary disk becomes unaccessible.

Access performance benefits are derived from the ability to read data from the particular disk in the shadow set that responds faster. By adapting specific host adapter resident firmware algorithms, CQD-220/TMS provides incredible performance benefits with disk access time reduced 100% or more during reads.

The hardware-based shadowing technique also results in far less VMS overhead and much higher data availability than software solutions. Using the CQD-220/TMS you can configure complete SCSI drive failure tolerant subsystems built around Super Shadow host adapters.

SCSI Library Manager

The SCSI Library Manager (SLM) is an **optional** application software that works exclusively with CMD SCSI host adapter CQD-220/TMJ for VAX/VMS systems.

SLM was designed to work with multiple jukeboxes as well as a single jukebox with from one to five erasable optical or WORM drives installed. With just a few menu-driven keystrokes SLM controls all basic operations like inserting, removing, and flipping erasable or WORM cartridges from the drive unit.

In addition to giving you complete control of jukebox functions, SLM also has a build-in callable user interface allowing you to customize SLM to your needs. This feature is especially useful for applications supporting file management.

Generic SCSI Adapter

The Generic SCSI Adapter (GSA) is an application software that works exclusively with CMD SCSI host adapter CQD-220/TMP for VAX/VMS systems. GSA allows you to send the generic SCSI commands to the disk or tape drives through the standard DEC *du* driver. GSA itself is a simple and straightforward callable user interface providing an easier way for you to communicate with the device directly.

Specifications

Table 2-4 lists the CSR addresses for the CQD-220 for Rev. B and higher.

Table 2-4 CSR Addesses

CQD-220/M (Disk only) IC P22016A,B (U40)	772150, 760334, 760354, 760374, 760340, 760344, 760350, 760360 and up to 29 CSR addresses
CQD-220/T (Tape only) IC P22017A (U40)	774500, 760404, 760444, 760504, 760544, 760410, 760450, 760454 and up to 31 CSR addresses
CQD-220/TM (Disk and Tape) IC P22015A (U40)	772150, 760334, 760354, 760374, 760340, 760344, 760350 (Disk), 774500, 760404, 760444, 760504, 760544, 760410, 760450 (Tape)

For complete CSR addresses, see Chapter 3 and Appendix C.

Table 2-5 lists the controller specifications for the CQD-220.

Table 2-5 Controller Specifications

Emulation	MSCP (*du* driver) / TMSCP (*tu* driver)
Bus Interface	Standard MicroVAX or LSI-11 Q-bus
Addressing	18-bit or 22-bit Addressing
Interrupt Priority	Level 4 or 5
Interrupt Vector	Software programmable
Transfer Mode	Normal or block mode DMA
Command Queuing	Commands with optimized seek
Data Buffer Capacity	Virtual data buffer (infinite size)
Bootstrap	Auto bootstrap or utility bootstrap
Defect Management	Dynamic defect management
Software Supported	All standard DEC operating systems
Multiple-Hosting	Support multi-hosting for disks, optical drives, and tapes
Formatting	On-board format and bad block replacement (ISO standard for optical erasable disk format)
Partitioning	Two or four equally divided partitions for disk drives
Shadowing	Any two disk drives on the bus can form a shadow set (for /TMS version only)
Optional Software	Tape Monitor Utility (TMU), SCSIformat ON-LINE (FMT), SCSI Library Manager (SLM for /TMJ only), Generic SCSI Adapter (GSA for /TMP only)
LED Indicators	Self test, error conditions
Peripheral Interface	Small Computer System Interface (SCSI)
SCSI Transfer Rate:	4.8 MB/sec in Synchronous mode 3.0 MB/sec in Asynchronous mode
SCSI Bus Parity	Odd parity
Devices Supported	Up to seven SCSI devices CQD-220/M disk drives CQD-220/T tape drives CQD-220/TM disk and tape drives (default is four disks and three tapes)
System Performance	Support disconnect/reconnect capability and multi-host configuration
SCSI Driver/Receiver	Single-ended
SCSI Cable Length	Up to 20 feet (6 meters)
Operating Temperature	5° C to 50° C
Relative Humidity	10% to 90% , Noncondensing
Power Requirement	5 V DC, 2.3 A

3
Installation

This chapter guides you in configuring the CQD-220 and installing it into your system. Follow the instructions in this chapter in the order presented.

Determining CSR Address

Before you install the CQD-220 SCSI host adapter under the VMS operating system you must determine the Control and Status Register (CSR) address from which the CQD-220 will be accessed.

For the CQD-220/M or CQD-220/T only, one CSR address is required. For the CQD-220/TM, two CSR addresses are required. The following procedure shows one method of determining the new CSR address to be used for the CQD-220.

WARNING Do not install the new CQD-220 in the system at this time.

1 Boot the VMS system and log into the system manager account.

2 At the *dcl $* prompt, enter ***mc sysgen.***

3 At the prompt *sysgen*, enter ***show/config.*** The Sysgen Utility will display all the device controllers installed in the system and their corresponding CSR addresses and vectors. Make a note of this list.

4 At the prompt *sysgen*, enter ***config.*** This will bring you to the *device* prompt.

5 At the prompt *device,* enter the following for your CQD-220 model.

For CQD-220/M	enter ***uda, X***
For CQD-220/T	enter ***tu81, Y***
For CQD-220/TM	enter ***uda, X*** and ***tu81, Y***

where
X is the number of installed *uda* type controllers plus 1 (for the new controller being added)
Y is the number of installed *tu81* type controllers plus 1 (for the new controller being added)

NOTE Enter all devices on the Q-bus, not just the new device being added at present.

6 At the prompt *device,* enter **[CTRL] + Z**. The Sysgen Utility will display the CSR addresses for all the controllers. Make sure that no other vectors or CSR addresses have changed; if they have, make the appropriate changes to the devices.

The VMS mnemonic for MSCP disk controllers are *pua, pub, puc,* etc. The VMS mnemonic for TMSCP tape controllers are *pta, ptb, ptc,* etc. For other mnemonics, refer to VMS system manager's guide.

Use the corresponding CSR address to configure the CSR jumper settings of the CQD-220 (see "CSR Address Selection").

7 At the prompt *sysgen,* enter **[CTRL] + Z** to exit the Sysgen Utility.

NOTE VMS will automatically program the CQD-220's interrupt vector register to match the vector assigned by the system. The vectors of DHV11 or other controllers might change when the CQD-220 is added to the system; see manufacturer's documentation to configure vectors and device CSR addresses of other controllers if they are hardware selectable.

The example in Figure 3-1 explains the Sysgen Utility procedure for installing the CQD-220/TM in VMS system. In this example, the CSR addresses of *pub* and *ptb* should be used to configure the CSR jumpers of the CQD-220/TM.

```
$ MC SYSGEN
SYSGEN> SHOW/CONFIG

System CSR and VECTOR on 2-JUN-1989 04:10:43.30

Name: PUA Units:1  Nexus:0 (UBA)  CSR:772150  Vector:774  Vector2:0
Name: PTA Units:1  Nexus:0 (UBA)  CSR:774500  Vector:260  Vector2:0
Name: TXA Units:16 Nexus:0 (UBA)  CSR:760440  Vector:300  Vector2:304

SYSGEN> CONFIG
DEVICE> UDA,2
DEVICE> TU81,2
DEVICE> DHV11,1
DEVICE> ^Z

Device: UDA    Name: PUA  CSR: 772150   Vector:154   Support: Y
Device: TU81   Name: PTA  CSR: 774500   Vector:260   Support: Y
Device: UDA    Name: PUB  CSR: 760334*  Vector:300*  Support: Y
Device: TU81   Name: PTB  CSR: 760404*  Vector:304*  Support: Y
Device: DHV11  Name: TXA  CSR: 760500*  Vector:310*  Support: Y

SYSGEN>  ^Z
$
```

Figure 3-1: Example of Sysgen Utility

In this example, notice the CSR address and vector changes for the DHV11.

Hardware Configuration

Normally, you do not need to change the factory jumper settings of the CQD-220 except for the CSR address jumper W6-2 to W6-7 as shown in the following subsections.

CSR Address Selection

The CQD-220 jumpers allow you to select different CSR addresses. If you require other CSR addresses than listed, consult CMD Technology.

The CQD-220/M (with the IC P22016A or P22016B in U40) supports 29 disk CSR addresses. Only eight disk CSR jumper settings are shown in Table 3-1. Refer to Appendix C for the other CSR jumper settings.

WARNING **Be sure to wear anti-static wrist straps or equivalent to protect the CQD-220 from electro-static damage.**

Table 3-1 CSR Address Selection for CQD-220/M

Address	LSI-11	MicroVAX	W6-2	W6-3	W6-4	W6-5	W6-6
1	17772150	20001468	IN	IN	IN	OUT	OUT
2	17760334	200000DC	IN	IN	OUT	OUT	OUT
3	17760354	200000EC	IN	OUT	IN	OUT	OUT
4	17760374	200000FC	IN	OUT	OUT	OUT	OUT
5	17760340	200000E0	OUT	IN	IN	OUT	OUT
6	17760344	200000E4	OUT	IN	OUT	OUT	OUT
7	17760350	200000E8	OUT	OUT	IN	OUT	OUT
8	17760360	200000F0	OUT	OUT	OUT	OUT	OUT

For these CSR address selections, W6-7 can be IN or OUT; it does not matter.

The CQD-220/T (with the IC P22017A in U40) supports 31 tape CSR addresses. Only eight tape CSR jumper settings are shown in Table 3-2. Refer to Appendix C for the other CSR jumper settings.

Table 3-2 CSR Address Selection for CQD-220/T

Address	LSI-11	MicroVAX	W6-3	W6-4	W6-5	W6-6	W6-7
1	17774500	20001940	OUT	OUT	IN	IN	IN
2	17760404	20000104	OUT	OUT	IN	IN	OUT
3	17760444	20000124	OUT	OUT	IN	OUT	IN
4	17760504	20000144	OUT	OUT	IN	OUT	OUT
5	17760544	20000164	OUT	OUT	OUT	IN	IN
6	17760410	20000108	OUT	OUT	OUT	IN	OUT
7	17760450	20000128	OUT	OUT	OUT	OUT	IN
8	17760454	2000012C	OUT	OUT	OUT	OUT	OUT

For these CSR address selections, W6-2 can be IN or OUT; it does not matter.

Please refer to Figure 3-2 for jumper locations.

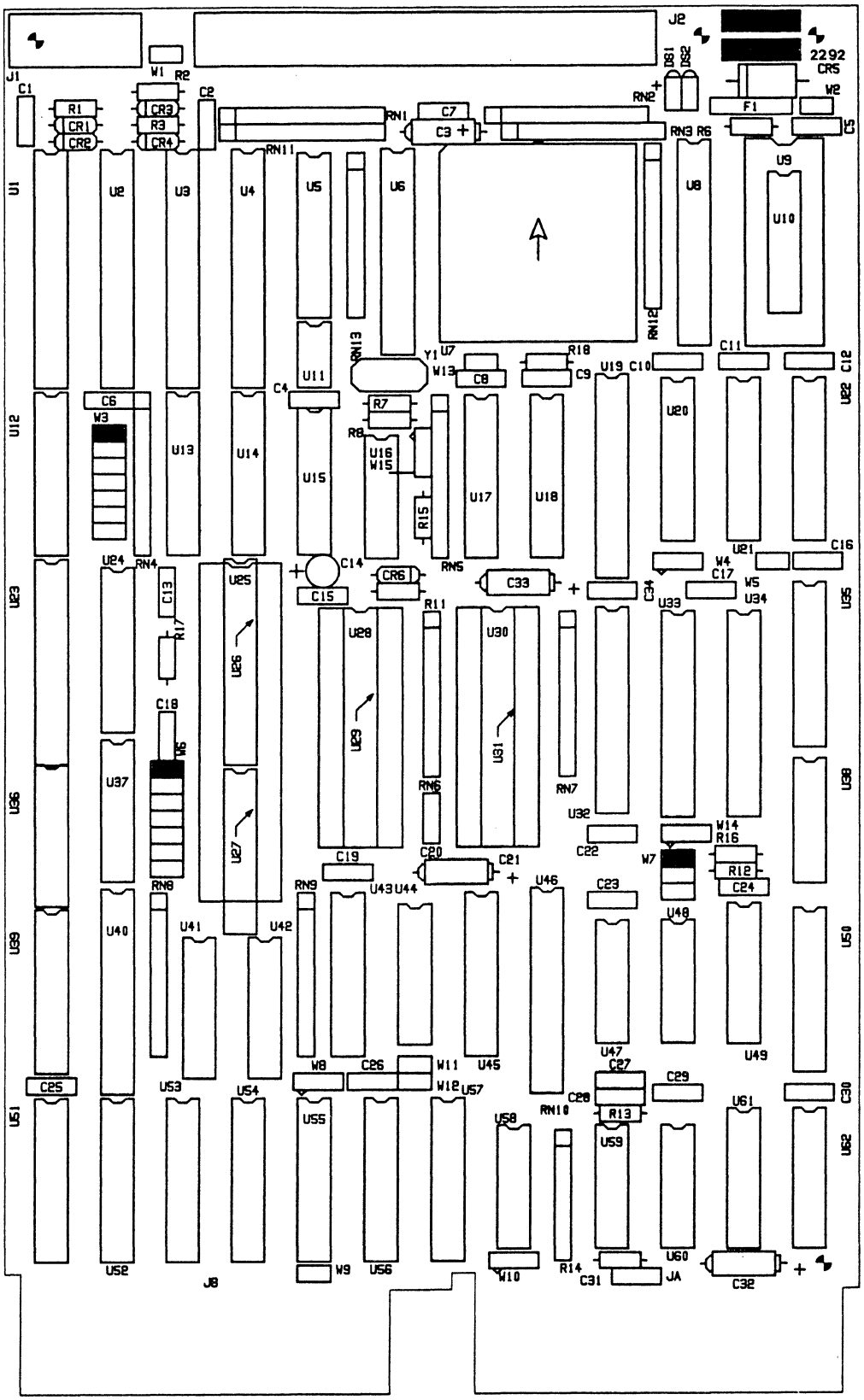

Figure 3-2: Jumper block location diagram hardware Rev. C

The CQD-220/TM (with the IC P22015A in U40) supports seven tape and seven disk CSR addresses. The CSR jumper settings are shown in Tables 3-3 and 3-4.

Table 3-3 CQD-220/TM CSR jumper settings for disk

Address	LSI-11	MicroVAX	W6-2	W6-3	W6-4
Standard	17772150	20001468	IN	IN	IN
Second	17760334	200000DC	IN	IN	OUT
Third	17760354	200000EC	IN	OUT	IN
Fourth	17760374	200000FC	IN	OUT	OUT
Fifth	17760340	200000E0	OUT	IN	IN
Sixth	17760344	200000E4	OUT	IN	OUT
Seventh	17760350	200000E8	OUT	OUT	IN
Disable disk			OUT	OUT	OUT

Table 3-4 CQD-220/TM CSR jumper settings for tape

Address	LSI-11	MicroVAX	W6-5	W6-6	W6-7
Standard	17774500	20001940	IN	IN	IN
Second	17760404	20000104	IN	IN	OUT
Third	17760444	20000124	IN	OUT	IN
Fourth	17760504	20000144	IN	OUT	OUT
Fifth	17760544	20000164	OUT	IN	IN
Sixth	17760410	20000108	OUT	IN	OUT
Seventh	17760450	20000128	OUT	OUT	IN
Disable tape			OUT	OUT	OUT

Disk Auto-Boot Selection

Disk Auto-Boot Selection is used for the LSI-11 processors only. The CQD-220/M or CQD-220/TM may be set to provide an auto-bootstrap at 773000 or 771000 on power up or whenever the "boot" switch is pressed. The CQD-220/M will automatically boot only if the controller CSR is set to the standard address, 772150. Disk drive 0 will be bootstrapped. Table 3-5 lists Disk Auto Boot Selections.

Table 3-5 Disk Auto-Boot Selection

W6-1	IN	Auto-Bootstrap address = 773000 (F)
W6-1	OUT	Auto-Bootstrap address = 771000
W8	1-2 IN	Auto-Bootstrap enabled
W8	2-3 IN	Auto-Bootstrap disabled (F)

Note that (F) means factory setting.

If there is an existing bootstrap ROM at 773000, you must set the CQD-220 auto-bootstrap address at 771000. To boot the CQD-220, type 771000G from ODT instead of the normal 773000G.

18-Bit or 22-Bit Address Selection

The CQD-220 is factory configured to 22-bit addressing which is used in systems with the MicroVAX, LSI-11/23/53/73/83/93 processors. 22-bit addressing can cause problems if used with an 18-bit processor such as the LSI-11/2. In this case, configure the board to 18-bit by removing jumper W9 (see Figure 3-2 for jumper block locations.)

Table 3-6 18-Bit or 22-Bit Address Selection

W9	IN	22-bit addressing (F)
W9	OUT	18-bit addressing

Note that (F) means factory setting. Hardware Rev. C supports 22-bit addressing only.

Interrupt Level Selection

Interrupt Level Selection allows you to select the priority of interrupting the CPU for MSCP devices. CMD recommends you use level 4 which is the standard interrupt priority for MSCP devices. Level 5 is reserved for future use.

Table 3-7 Interrupt Level Selection

W10	1-2 IN	Interrupt level 5
W10	2-3 IN	Interrupt level 4 (F)

Note that (F) means factory setting.

Block Mode DMA

Block Mode DMA allows the CQD-220 to transfer data in blocks rather than single word-per-memory address assertion. In a Block Mode Direct Memory Access (DMA) transfer, the starting memory address is asserted, followed by data for that address and data for consecutive addresses. Because the assertion of the address for other data words are eliminated, higher data throughput can be achieved. The CQD-220 is shipped with Block Mode DMA enabled as shown in Table 3-8.

Table 3-8 Block Mode DMA

W4	1-2 IN	Block mode DMA enabled (F)
W4	2-3 IN	Block mode DMA disabled

Note that (F) means factory setting.

Adaptive DMA

Adaptive DMA allows the CQD-220 to release the Q-bus after a block (eight words) transfer if other DMA devices assert DMA request. Otherwise, the CQD-220 will continue the DMA transfer for an additional block then release the Q-bus. Adaptive DMA is implemented to utilize the Q-bus bandwidth. The CQD-220 is shipped with Adaptive DMA enabled as shown in Table 3-9.

Table 3-9 Adaptive DMA

W5	IN	Adaptive DMA enabled (F)
W5	OUT	Adaptive DMA disabled

Note that (F) means factory setting.

DMA Dwell Time

DMA Dwell Time is the relaxation period between DMA requests. Normally, if multiple DMA data transfers are performed, consideration must be given to the Q-bus for other system functions, such as communication multiplexer, network, etc. During the DMA dwell time, the CQD-220 will not arbitrate for the use of the Q-bus. You can select the period of the DMA Dwell Time by changing the jumper shunts listed in Table 3-10.

Table 3-10 DMA Dwell Time

W7-1	W7-2	W7-3	DMA dwell time
IN	OUT	OUT	1.2 us
OUT	IN	OUT	2.4 us
OUT	OUT	IN	4.8 us (F)

Note that (F) means factory setting.

Tape Fast Search Option

This option is supported only by the CQD-220/T or CQD-220/TM. When set to the Tape Fast Search mode, the CQD-220/T or CQD-220/TM will enable high speed forward and reverse filemark search. VMS may use this mode if you do 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 application, this option needs to be disabled.** For the ISM-11 operating system, this jumper shunt has to be installed. For ULTRIX and UNIX systems, CMD recommends you use this option Table 3-11 lists the jumper settings.

Table 3-11 Tape Fast Search Option

W3-4	IN	Enable tape fast search option
W3-4	OUT	Normal operation (F)

Note that (F) means factory setting.

Sync/Async Mode Selection

The CQD-220 comes standard in synchronous (sync.) mode. Most SCSI devices support sync. mode. In sync. mode, CQD-220 will automatically communicate with each SCSI device connected to find out whether the sync. mode is supported by the device.

In asynchronous (async.) mode, CQD-220 will communicate with the SCSI device asynchronously even if the SCSI device supports sync. mode. Most of the sync. SCSI devices also support async. mode.

You can change the CQD-220 to async. mode using the jumpers listed in Table 3-12; these jumpers control the overall sync./async. mode selection and will override the On-Board Utility sync. mode setup.

Table 3-12 Sync./Async. Mode Selection

W3-6	IN	Tape sync. mode disabled
W3-6	OUT	Tape sync. mode enabled (F)
W3-7	IN	Disk sync. mode disabled
W3-7	OUT	Disk sync. mode enabled (F)

Note that (F) means factory setting.

Tape Monitor Utility and SCSIformat ON-LINE

As explained in Chapter 2, the Tape Monitor Utility allows you to monitor tape devices on the SCSI bus, and the SCSIformat ON-LINE allows you to format SCSI devices through the CQD-220 and the software provided. To enable these features, install jumper shunt in W3-5 (see Table 3-13) and Tape Monitor Utility and SCSIformat ON-LINE software as explained in their respective User's Manuals. For any operating system other than VMS, W3-5 must not be installed.

WARNING **Do not insert this jumper shunt if the TMU or FMT application software is not installed. The factory setting of W3-5 is OUT (disabled).**

Table 3-13 Tape Monitor Utility and SCSIformat ON-LINE Options

W3-5	IN	Tape Monitor Utility enabled (/T, /TM) Disk SCSIformat ON-LINE enabled (/M, /TM)
W3-5	OUT	Tape Monitor Utility disabled (F) Disk SCSIformat ON-LINE disabled (F)

Note that (F) means factory setting.

Eprom Size Selection

Eprom Size Selection allows you to upgrade your CQD-220 for faster SCSI interface; it involves installing jumper shunt in W14 and replacing Eproms on the CQD-220. To change Eprom size, remove the 27256 Eproms and install 27C512 Eproms into U28 and U30. Pin 1 align on the socket must with pin 1 on the socket. Then install W14 as shown in Table 3-14.

Table 3-14 Eprom Size Selection

W14 1-2 IN	27256 Eprom hardware Rev. C
W14 2-3 IN	27512 Eprom hardware Rev. C (F)

Installation

This section explains the different facets and gives you instructions on installing the CQD-220 into your system.

SCSI Host Adapter ID Selection

Each device on the SCSI bus requires 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 CQD-220 SCSI Host Adapter is factory configured to SCSI ID 7. Do not change this setting unless you are setting a multi-hosting configuration (see "Multi-Hosting Configuration" in Chapter 4).

SCSI ID for Target Devices

Each SCSI device (initiator or target) on the SCSI bus requires a unique SCSI ID number. Since the CQD-220 has been set to SCSI ID 7 (initiator), target devices must be configured from SCSI ID 0 to 6.

The factory setting on the CQD-220/M is seven disk devices, and the CQD-220/T is seven tape devices. The factory setting of the CQD-220/TM is four disk devices (SCSI ID=0 to 3) and three tape devices (SCSI ID=4 to 6). For the CQD-220/TM with more than four disks drives or three tapes drives, use the On-Board Utility to change the configuration; otherwise, *do not* change the configuration. See Table 3-15 for SCSI Device ID Selections.

Table 3-15 Device ID Selection

Model	Device Support	Target SCSI ID
CQD-220/M	up to 7 disk drives	SCSI ID = 0 to 6
CQD-220/T	up to 7 tape drives	SCSI ID = 0 to 6
CQD-220/TM	up to 7 disk/tape drives combined 4 disk drives and 3 tape drives (F)	SCSI ID = 0 to 3 disks (F) SCSI ID = 4 to 6 tapes (F)

Note that (F) means factory setting.

CQD-220 Mounting Slot Selection

The CQD-220 can be installed in any slot of the standard MicroVAX or LSI-11 Q-Bus backplane as long as the Q-Bus interrupt acknowledge/DMA grant daisy chain is not broken.

SCSI Bus Cabling

The CQD-220 Host Adapter provides a 50-pin connector (J2) to interface with external SCSI devices.

When the CQD-220 and the SCSI devices are installed in the same cabinet, which meets EMI/RFI shielding requirements, a 25-signal **twisted-pair cable** must be used for connecting the CQD-220 (J2) and the SCSI devices. When the CQD-220 and the SCSI devices are installed in separate cabinets, the shielded SCSI cable should be used to meet FCC requirements.

A minimum conductor size of 28 AWG should be used to minimize noise effects and ensure proper distribution of optional terminator power. The maximum cable length is 6.0 meters or 20 feet in single-ended mode.

SCSI Bus Termination

The SCSI bus signals should be terminated with 220 ohms to +5 volts and 330 ohms to ground at each end of the cable. The CQD-220 provides on-board removable terminators (RN1, RN2, RN3), which are next to the SCSI connector J2. Therefore, the CQD-220 can be installed in any position of the SCSI cable. If the CQD-220 is installed in either end of SCSI cable, the

on-board terminators should remain on board; otherwise, the on-board terminators should be removed.

Anytime an external SCSI terminator (instead of the on-drive SCSI terminator) is used, the SCSI terminator power option of the CQD-220 must be enabled by installing jumper shunt at W2 location.

The CQD-220 supplies terminator power to the TERMPWR pin (pin 26) and the CQD-223 to the TERMPWR pin (pin 38) of SCSI connector (J2) through a fuse, a diode, and jumper block W2. In order to prevent accidental grounding or misconnection of terminator power, make sure that the pin 1 mark of SCSI cable matches with the pin 1 mark of SCSI device's connector before turning on the power. Table 3-16 illustrates the terminator power option.

Table 3-16 Terminator Power Option

W2	IN	SCSI terminator power enabled (F)
W2	OUT	SCSI terminator power disabled

Note that (F) means factory setting.

Installation Procedures

1 Determine the CSR address for the CQD-220 as explained in "Determining CSR Address."

WARNING **Be sure to wear anti-static wrist straps or equivalent to protect the CQD-220 from electro-static damage.**

2 Configure the hardware as explained in "Hardware Configuration."

3 Set the CQD-220 and device SCSI IDs as explained in "SCSI Host Adapter ID Selection" and "SCSI Device ID Selection."

4 Choose a proper slot to place the CQD-220 and install it into that slot; see "CQD-220 Mounting Slot Selection."

5 Connect SCSI cable to J2 on the CQD-220 or CQD-223. For the CQD-220, connector will be a nonshielded connector, see Figure 3-3.

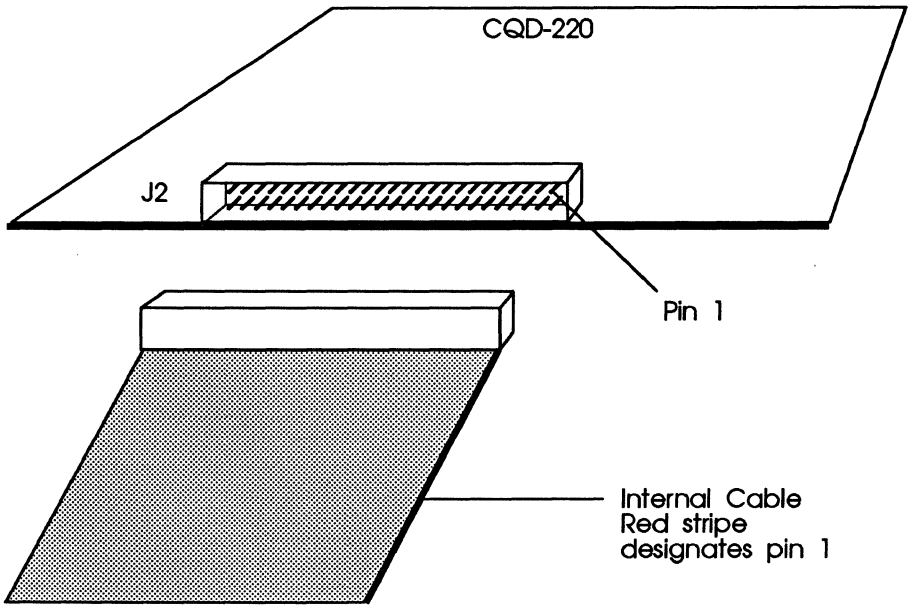

Figure 3-3: CQD-220 nonshielded cable connection

For the CQD-223, the connector will be shielded, see Figure 3-4.

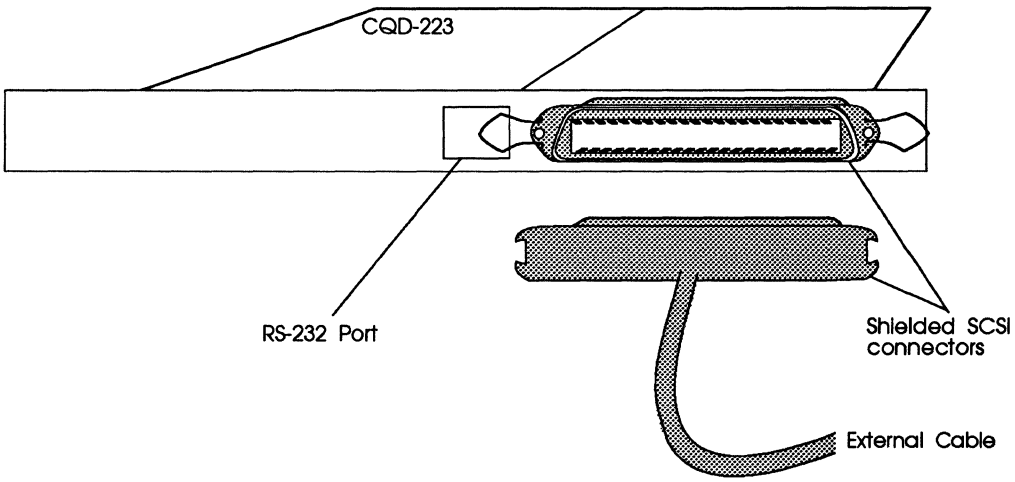

Figure 3-4: CQD-223 shielded connection

6 Cable SCSI devices using the cable specifications given in the section "SCSI Bus Cabling." See Figure 3-5.

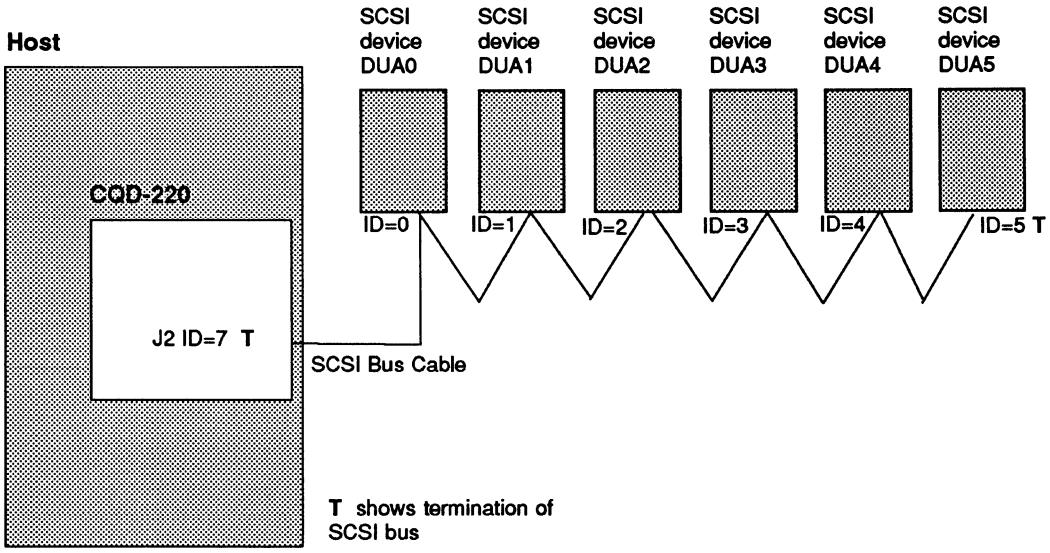

Figure 3-5: SCSI ID and Cabling

7 Terminate the SCSI bus at each *physical* end; if the CQD-220 is at one physical end of the SCSI bus, place terminators in RN1, RN2, RN3. If TERMPWR is needed for the bus, place jumper shunt on W2 (see Figure 3-5).

8 Power up the system and execute On-Board Utility to scan for the SCSI devices and assure that all devices are seen and functioning properly (see Chapter 4 for On-Board Utility).

9 Boot the system and test with the operating system.

4
Setup

This chapter will assist you in setting up the CQD-220 and your system for use.

On-Board Utility

The CQD-220 SCSI host adapter comes with a general purpose On-Board Utility for all systems. The On-Board Utility can test the system slot, SCSI cable, and SCSI devices connected to the CQD-220. Accessing the Utility can be done through LSI or VAX system or the RS-232 Port. Make sure you complete all utility functions, explained at the end of this chapter.

Accessing the Utility Through the LSI or VAX System

The On-Board Utility Program can be accessed through an ODT command for LSI and VAX systems. One example is shown here with the SCSI host adapter set to the first disk CSR address. Because the formats and features of the On-Board Utilities for LSI-11 systems and MicroVAX systems are similar (except different start up procedures), the MicroVAX utility will be not described here. Instructions for using the Disk Utility with **LSI-11 Systems** are listed below:

1 Halt the processor.

2 Hit the Boot Switch.

3 Enter the ***CSR address plus 2*** (in octal), ***a slash,*** and ***123456.*** For example, for CSR address 17772150 enter: ***17772152/005400 123456.*** CSR addresses can be found in Chapter 3 or Appendix C.

4 Enter ***CSR address plus 2*** (in octal), ***a slash,*** and ***100*** to load the utility to the system memory. For example, for CSR address 17772150 enter: ***17772152/001000 100.***

5 Enter ***5000g.*** The Utility program will begin executing.

EXAMPLE For steps **3** to **5** with CSR 17772150, enter the following:

772152/005400 123456 **[ENTER]**
772152/ 100 **[ENTER]**
5000G **[ENTER]**

Instructions for using this utility with **VAX Systems** are listed below:

1 Halt the CPU.

2 At the prompt >>>, enter ***u*** to unlock the CPU.

3 At the prompt >>>, enter ***i*** to initialize the CPU.

4 At the prompt >>>, enter ***d/p/w 20001F40 20*** to enable Q-bus memory access.

5 At the prompt >>>, enter ***d/l 20088008 80000002*** to set up Q-bus map.

6 At the prompt >>>, enter ***d/w YYYYYYY a72e*** to deposit to the base CSR address plus 2 (in hex). CSR addresses can be found in Chapter 3 or Appendix C.

Where
YYYYYYY—the CSR address plus 2 (in hex). See Table 4-1 for disk and Table 4-2 for tape.

Table 4-1 Disk CSR Addresses Plus 2 Configurations

CSR Reference	CSR Addresses	CSR Addresses Plus 2: YYYYYYY
772150	20001468	2000146A
760334	200000DC	200000DE
760354	200000EC	200000EE
760374	200000FC	200000FE
760340	200000E0	200000E2
760344	200000E4	200000E6
760350	200000E8	200000EA
760360	200000F0	200000F2

Table 4-2 Tape CSR Addresses Plus 2 Configurations

CSR Reference	CSR Addresses	CSR Addresses Plus 2: YYYYYYY
774500	20001940	20001942
760404	20000104	20000106
760444	20000124	20000126
760504	20000144	20000146
760544	20000164	20000166
760410	20000108	2000010A
760450	20000128	2000012A
760454	2000012C	2000012E

7 At the prompt >>> enter ***d * 100*** to load the utility to system memory. This command deposits 100 to current address.

8 At the prompt >>> enter ***s 400*** to start the utility.

EXAMPLE For steps **2** and **8**, enter:

```
u  [ENTER]
i  [ENTER]
d/p/w 20001f40 20  [ENTER]
d/l 20088008 80000002  [ENTER]
d/w YYYYYYY a72e  [ENTER] (YYYYYYY = CSR +2)
d * 100  [ENTER]
s 400
```

The utility will display as shown in Figure 4-1:

```
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
```

Figure 4-1: Utility CSR address

9 Enter the corresponding CSR address for the CQD-220. The Main Menu will appear as shown in Figure 4-2.

```
MAIN MENU                              CSR=772150 (20001468)

1 = HALT SYSTEM
2 = CONFIGURE LUN OFFSET
3 = FORMAT DRIVE
4 = QUALIFY DRIVE
7 = ADDITIONAL SCSI COMMANDS

SELECT OPTION :
```

Figure 4-2: Main Menu

NOTE LSI systems will display this Main Menu differently as item 1 = Boot Drive.

If the message appears "CONTROLLER NOT PRESENT," make sure CSR address is correct.

10 From the Main Menu only select option *1* or *7*. *1* will halt the system and *7* will bring you to the SCSI Host Adapter Utility.

Accessing the Utility Through the RS-232 Port

To access the utility from the RS-232 port, follow the instructions below.

1 Connect a terminal to the CQD-220's RS-232 port (10-pin connector) or to the CQD-223's RS-232 port (DEC compatible RJ-11/Modified Module 423 Jack connector). See Figures 4-3 and 4-4.

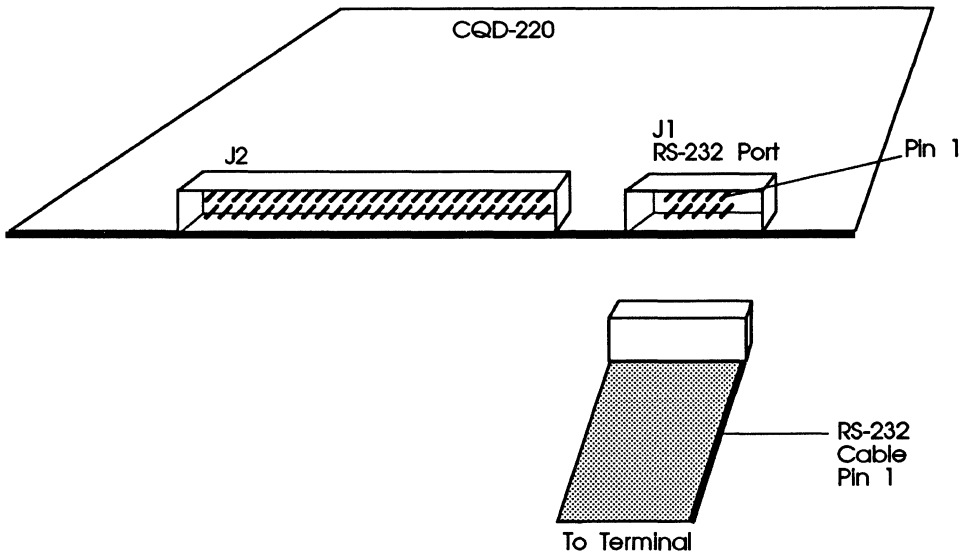

Figure 4-3: CQD-220 RS-232 Port

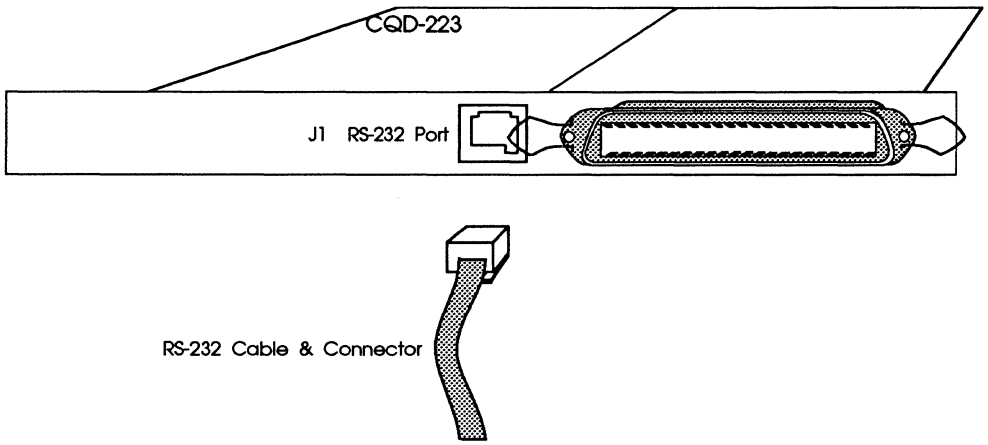

Figure 4-4: CQD-223 RS-232 Port

2 Set the terminal baud rate to 9600 (8-bit data, 1-stop bit, no parity) jump scroll.

3 Halt the system's CPU, reset the system, and hit carriage return on the terminal. The SCSI Host Adapter Utility will display as shown in Figure 4-5.

```
SCSI HOST ADAPTER UTILITY (REV. YYYxZZ)

X = UTILITY EXIT

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

SELECT OPTION ?
```

Figure 4-5: SCSI Host Adapter Utility

Once the SCSI Host Adapter Utility displays, key in the number to select the desired option. Press **[CTRL] + C** or enter *X* at any time to return to the Main Menu.

4 Refer the next subsections for configurations. When completed, unplug the terminal, reset the system, and boot. *Do not* use the On-Board Utility while the system is running.

NOTE The following sections will illustrate the On-Board Utility from the RS-232 Port. There may be some variation in the Main Menu and the SCSI Host Adapter Utility Menu. If you are accessing from the Main Menu, simply chose the correct number for each option.

Changing LUN Offset

When a system has a HSC or is in a VAX cluster it will be necessary to change the LUN (logical unit number) offset. Each MSCP drive requires a different unit number so that the unit numbers are not duplicated. If there is no other MSCP controller in the system, the LUN offset can be 0.

If there is another MSCP controller with four drives (0 to 3) in a VAX cluster configuration, then the LUN offset should be 4 or above. In the case that LUN offset is equal to 10, SCSI ID 0 will be *dub10* and SCSI ID 1 will be

dub11. The drives will show up as such *dua0, dua1, dua2, dua3, dub10, dub11* (see section, "SCSI ID for Target Drives" in Chapter 3 for explanation).

1 Select option ***1*** from the SCSI Host Adapter Utility for disk drives; ***6*** for tape drives.

2 Enter the new value for LUN offset at the statement: LUN OFFSET IS 0, ENTER NEW VALUE:

3 At the statement: SAVE NEW VALUE (Y or N)? enter **Y**.

4 The monitor will display FORMAT COMPLETE when finished executing.

Formatting the Drive

This section details formatting a drive. The CQD-220 issues a Format Unit Command to the selected SCSI disk drive and requests it to map out the defects on the Manufacture Defect List (MDL). Remember formatting a drive will rewrite all the sectors of that drive.

CMD recommends that you format all new drives. To format a drive, follow the steps below:

1 Select option **2** from the SCSI Host Adapter Utility.

2 Enter the device number from 0 to 6 in the statement: DEVICE NUMBER? <0 TO 6> DEV X.

3 Answer **Y** to the question FORMAT DRIVE X, ARE YOU SURE? if you want to continue.

4 At the statement: WARNING DATA WILL BE DESTROYED, ARE YOU SURE? enter **Y** if you want to continue.

5 The monitor displays WAIT while the drive is executing the format process.

6 The monitor will display COMPLETE when finished executing.

Qualifying the Drive

After formatting the device, CMD recommends you qualify devices by running this procedure at lease once without errors detected. The qualify program writes different patterns to the drive and then verifies the data. If any bad sectors are found, the sectors will automatically be replaced and the statement XX XXXXXXXX BAD BLOCK REPLACED will appear. Follow the instructions below to qualify a drive.

1 Select option *3* from the SCSI Host Adapter Utility.

2 Enter the device number at the statement: DEVICE NUMBER? DEV <0 TO 6> DEV X.

3 At the statement, READY TO TEST DEVICE X, ARE YOU SURE enter *Y* if you want to continue.

4 At the statement: *** WILL DESTROY DATA ON THIS DEVICE, ARE YOU SURE? enter *Y* to continue.

5 The monitor will display QUALIFY STARTED <SEQUENTIAL WRITE & READ>! <HIT <Break> TO ABORT>.

6 The monitor will display TESTING LOOP COUNT & BLOCK NUMBER:

7 Press **[BREAK]** to exit back to the SCSI Host Adapter Utility after you are satisfied with the qualifying process.

Manually Replacing Bad Sectors

This option allows you to replace bad sectors manually. The CQD-220 supports dynamic defect management which replaces defective sectors online so there is no need to manually replace bad sectors. However, if you wish to replace bad sectors manually, follow these instructions. Remember that any data in the sector will be lost.

1 Select option *4* from the SCSI Host Adapter Utility.

2 Enter the device number at the statement: DEVICE NUMBER ? DEV <0 TO 6> DEV X:

3 Enter the logical block number in HEX at the statement:

READY TO TEST DEVICE X,
ENTER THE BAD BLOCK NUMBER <HEX> : xxxxx

4 The monitor will display --BAD BLOCK REPLACED-- when finished executing.

Additional Utilities

To access additional utilities for disk drives, select option **5** from the Main Menu. To access additional utilities for tape drives, select option **7** from the Main Menu. The Additional Utilities Menu will display as shown in Figure 4-6.

```
ADDITIONAL UTILITIES  (REV. YYYxZZ)  SN = 1278

D = DISPLAY SCSI DEVICE AND SET UP CONFIGURATION
S = SEND SCSI COMMAND TO THE DEVICE
T = TEST SCSI DEVICE
R = FORMAT RCT BLOCK

SELECT OPTION ?
```

Figure 4-6: Utility Sub-menu

Displaying SCSI Device and Setting Up Configuration

Selection 'D' can be used to change the controller default configurations such as those listed below:

- reset to default.
- number of disk and tape devices supported.
- SCSI reset enable/disable.
- SCSI disconnect enable/disable.
- sync/async mode selection.
- tape buffer mode enable/disable.
- prevent medium removal enable/disable.
- disk write with verify enable/disable.
- remote density mode enable/disable.
- default tape enable/disable.
- reconfigure device.

- autoboot start from floppy enable/disable.
- write protect from controller jumper setting.
- truncate disk size for volume shadowing.
- eject removable disk cartridge after dismount.

This utility can scan and display the SCSI devices attached to the CQD-220. The CQD-220/TM is shown as an example in the following display. To display SCSI devices and set up configuration follow the procedures below.

1 Select option ***D*** at the sub-menu (Figure 4-6), the following current configuration is displayed as shown in Figure 4-7.

```
DEV0  DU0, SCSI ID 0, LUN 0
      Disconnect ON, Sync Mode ON, Prevent Medium Removal ON, Write W/Verify OFF

DEV1  DU1, SCSI ID 1, LUN 0
      Disconnect ON, Sync Mode ON, Prevent Medium Removal ON, Write W/Verify OFF

DEV2  DU2, SCSI ID 2, LUN 0
      Disconnect ON, Sync Mode ON, Prevent Medium Removal ON, Write W/Verify OFF

DEV3  DU3, SCSI ID 3, LUN 0
      Disconnect ON, Sync Mode ON, Prevent Medium Removal ON, Write W/Verify OFF

DEV4  MU0, SCSI ID 4, LUN 0
      Disconnect ON, Sync Mode ON, Buffer Mode ON

DEV5  MU1, SCSI ID 5, LUN 0
      Disconnect ON, Sync Mode ON, Buffer Mode ON

DEV6  MU2, SCSI ID 6, LUN 0
      Disconnect ON, Sync Mode ON, Buffer Mode ON

DEV7  SCSI ID 7, HOST ADAPTER SCSI Reset ON, Density Mode ON, Default Tape OFF
      Boot Floppy OFF, Jumper Write Protect OFF, Eject Disk ON, Truncate Size OFF
```

Figure 4-7: Current configuration, default

NOTE If Truncate Size is toggled, "Truncate Mode ON" will display under each disk device options and at the bottom when configuration is displayed.

2 To change the configuration, enter *y* at the statement: CHANGE CONFIGURATION ? (Y/N) The menu shown in Figure 4-8 will display.

NOTE See subsection, "Unit Numbering" before trying to reconfigure devices.

```
R = Toggle SCSI Reset                    M = Toggle Density Mode
D = Toggle Disconnect                    B = Toggle Buffer/Truncate Mode (Tape/Disk)
S = Toggle Sync/Async                    W = Toggle Write W/Verify (Disk only)
C = Reconfigure Device                   P = Toggle Prevent Medium Removal (Disk only)
U = Toggle Default Tape (Tape Only)
A = Autoboot Start From Floppy Drive
N = Write Protect from Controller Jumper Setting
V = Truncate Disk Size for Volume Shadowing
E = Eject Disk after Dismount
L = Reserve/Release Disk Option
T = Reset All Device Modes to Default
Z = Reset Controller to Default Configurtation
```

Figure 4-8: Configuration change

The following list is an explanation of the selections in Figure 4-8.

R = Toggle SCSI reset—If SCSI reset is enabled, a reset to the SCSI bus will be issued on power up. This should be turned OFF when multi-hosting is desired.

D = Toggle Disconnect—This option allows you to enable or disable SCSI disconnect for each device. If enabled, the controller will indicate its ability to disconnect during the SCSI identify message.

S = Toggle Sync./Async.—This option allows you to configure each device for synchronous or asynchronous operations. If synchronous is selected, the controller will attempt a synchronous handshake transfer data synchronously, otherwise data will transfer asynchronously.

C = Reconfigure Device—This option allows you to reconfigure the device at any time.

M = Toggle Density Mode—This option allows you to configure the controller for remote density selection. If enabled, remote density selection may take place. If enabled, the controller reports itself as a 'TU81.' If disabled, it reports itself as a 'TK50.'

B = Toggle Buffer/Truncate Mode (Tape/Disk)—For tape devices, this option allows the controller to configure each individual tape device for write caching. If enabled, the tape device will send command complete message and good status to the controller once the data has been transferred to the tape device's internal buffers. If disabled, such message and status is sent when the data is actually written to the tape.

W = Toggle Write W/Verify—This option will allows the SCSI command Write With Verify to be issued for MSCP write with verify modifier. When set to OFF (which is the default), the normal write command will be issued.

P = Prevent Medium Removal—This option is for removable disk drives only. If this feature is ON, a "Prevent Medium Removal" is issued to a drive when mounted by VMS, and the eject media push button in front of the drive is disabled. An "Allow Medium Removal" is issued when the drive is dismounted by VMS, and the push button is then enabled. This feature can be disabled to eject the media at anytime.

U = Toggle Default Tape—This option allows you to force the presence of a tape unit to the operating system even if one does not exist. Some operating systems need this feature when the CQD-220 is connected to devices with a long self-test procedure (after power up). If it is disabled, only units connected to the controller are seen by the operating system.

A = Autoboot Start From Floppy Drive—For LSI-11 systems only, this option allows you to set the system to boot directly from the first floppy drive. If no floppy drive is present, the system will begin to boot from the first device.

N = Write Protect from Controller Jumper Setting—This option should not be used at this time; contact CMD for details.

V = Truncate Disk Size for VMS Volume Shadowing—This option allows the size of the disk to be truncated to multiples of 126 blocks allowing VMS volume shadowing copy process to reach higher performance. The message "** WARNING ** TRUNCATE SIZE ON/OFF WILL BE TOGGLED, ARE YOU SURE?" will display before truncate switch can be toggled. With disks containing valid data, the data must be removed before turning this feature ON and later restored (after turning this feature ON). Use option "B" to toggle individual devices.

E = Eject Disk After Dismount—This option allows you to specify whether the removable disk cartridges will eject from the drive after dismount.

L = Reserve/Release Disk Option—This option is to let the MSCP online exclusive use modifier to be operable.

T = Reset All Device Modes to Default—These modes are disconnect, synchronous, Prevent Medium Removal, Write with Verify, and Buffer modes.

Z = Reset Controller to Default Configuration—This option allows the you to reset the controller to its factory default configuration. The CQD-220/TM will reset to support four disk drives and three tape drives; the CQD-220/M, seven disk drives; and CQD-220/T, seven tape drives. Other features reset to include SCSI disconnect, SCSI reset, synchronous communication, buffer mode, prevent medium removal and density selection enabled, write with verify, write protect disabled, reserve/release disk disabled, and default tape disabled. **ALWAYS** use this feature before reconfiguring the CQD-220.

3 To reconfigure the device select option *C*, and the screen will prompt you to answer the next series of questions as shown in Figure 4-9.

```
Number of Disks? (0-7)    4
   DU0 to be Reconfigured ? (Y/N)  N
   DU1 to be Reconfigured ? (Y/N)  N
   DU2 to be Reconfigured ? (Y/N)  N
   DU3 to be Reconfigured ? (Y/N)  N

Number of Tapes? (0-3)    3
   MU0 to be Reconfigured ? (Y/N)  N
   MU1 to be Reconfigured ? (Y/N)  N
   MU2 to be Reconfigured ? (Y/N)  N
```

Figure 4-9: SCSI host adapter ID change

4 Enter the number of disk and/or tapes. Default configuration is four disks and three tapes for CQD-220/TM; it is not necessary to configure if you are running less than four disks and three tapes.

NOTE If zero is selected for the number of disks or tapes, disable the corresponding CSR address as shown in Tables 3-1 to 3-4. **Do not use 0 disk and/or 0 tape configuration in the above setup.**

Answer *y* or *n* to reconfigure each of the disks or tapes. If you answer *y*, the screen will prompt you with these questions:

```
DUX SCSI ID? <0-7>
DUX LUN? <0-3>
```

Figure 4-10: Disk and Tape Configuration Change

NOTE This LUN is SCSI LUN and is normally 0. This is used only for devices that support multiple LUNs.

5 When you have completed these instructions, the display will show your current configuration and prompt you with the question CHANGE CONFIGURATION ? (Y/N). Enter *n;* this will cause the CQD-220 to scan the SCSI bus.

The utility will display your current configuration with manufacturer's name, model number, and firmware revisions for each device. Record this information for future use.

Sending SCSI Commands To The Device

Selection 'S' can be used to send SCSI commands to the selected disk/tape drives directly. This option is used to send a 6-byte, 10-byte, or 12-byte command to a SCSI device. Follow these procedures to send SCSI commands to the device.

1 Enter *S* from the "Additional Utilities" Menu. (Be sure you have correctly selected either *5* from the SCSI Host Adapter Utility for disk drives, or *7* for tape drives.)

2 At the question DEVICE NUMBER ? DEV <0-6> DEV enter the device number.

3 Enter the command sequence at the statement:

```
READY TO TEST DEVICE X
   EDIT CDB <HEX>  ***<ESC> TO TERMINATE EDITING***
   BYTE  0000= 00
```

If a 6-byte or 10-byte command is used, press **[ESC]** to terminate command editing. If a 12-byte command is used, command editing is terminated automatically.

4 At the statement WRITE DATA TO THE DEVICE ? <Y OR N>, enter ***n*** to immediately send the command if SCSI command does not require a data out phase.

Or enter ***y*** to send data to the device after the command phase if SCSI command requires a data out phase. Enter the data and then **[ESC]** to terminate editing. The statement SAVE EDITED DATA IN BUFFER ? <Y OR N> will appear. Enter ***y*** to save data in the buffer or ***n*** to erase edited data after the command is sent.

Testing SCSI Device

Selection 'T' can be used to read only, write and read selected disk drive, and/or write and read selected tape drive continuously. This is a diagnostic tool to assist with installation and testing. Follow the procedures below to test the SCSI device.

1 Enter ***T*** from the "Additional Utilities" menu. (Be sure you have correctly selected either *5* from the SCSI Host Adapter Utility for disk drives, or *7* for tape drives.)

2 At the question DEVICE NUMBER ? DEV <0-6> DEV enter the device number.

3 When testing for *disk devices*, at the statement READY TO TEST DEVICE X, DO YOU WANT TO READ ONLY ? <Y OR N> enter ***y*** to read only.

Enter ***n*** to write and read. The question ARE YOU SURE? will display. Enter ***y*** to write and read to the device.

WARNING *N* will destroy all data on the device.

When testing for *tape devices*, the statement ARE YOU SURE? will display. Enter ***y*** to test the device.

4 At the statement, IS THIS FOR DUAL HOSTS QUALIFICATION TEST? <Y/N>, enter ***y***. Enter ***n*** for single host qualification. The test will continue until you abort. Allow the test to continue for a few minutes for new devices and ten minutes for suspected bad devices. Press **[BREAK]** or **[CTRL] + C** to abort and exit back to the SCSI Host Adapter Utility.

Formatting RCT Block

Selection 'R' can be used to format the RCT blocks of the disk drive selected. This command writes zeros in the last logical block of the device. If you try to skip the formatting process and directly use the drive, you *must* use this option to eliminate "unrecoverable bad RCT block." However, CMD recommends you format the whole drive. To format the RCT block, follow these instructions.

1 Select ***R*** from the "Additional Utilities." (Be sure you have previously selected *5* from the SCSI Host Adapter Utility for disk drives.)

2 Enter device number at the statement: DEVICE NUMBER? DEV <0-6> DEV.

If device is offline the following statement will appear, DEVICE OFFLINE, RESELECT OR PROCEED ? (R/P). Enter ***R*** to reselect or ***P*** to proceed.

3 FORMAT COMPLETE will display when RCT block has been formatted.

Completing Utility Functions

The following procedures should be completed when you have accessed the On-Board Utility through the RS-232 port.

1 Use the On-Board Utility to verify SCSI cable and SCSI devices connected to the CQD-220 after installing the CQD-220 in the Q-bus slot.

2 After verifying the SCSI connections, disconnect RS-232 cable from the back panel, and reset the system.

NOTE You cannot use the CQD-220 when the RS-232 port connector is in place. Be sure to remove the connector in J1 before using the board.

The following procedures should be completed when you have accessed the On-Board Utility through the Virtual Console of the LSI or VAX systems.

1 Use the On-Board Utility to verify the Q-bus slot seating, SCSI cable, and SCSI devices connected to the CQD-220 after installing the CQD-220 in the Q-bus slot.

2 After verifying the SCSI connections, reset the system.

Unit Numbering For Devices

This section explains configuring unit numbers. Unit numbers are necessary for the operating system to differentiate between devices on each controller. These may be changed by using the "Configure LUN Offset" from the Main Menu. If you used the 'D' option from the "Additional Utilities" Menu, the terminal will display the *mu* and/or *du* numbers as shown in Table 4-3, factory default settings for unit numbers.

Table 4-3 Default for Unit Numbers

CQD-220/T	SCSI ID	On-Board Utility	Operating System Unit No.
	0	MU0	0
	1	MU1	1
	2	MU2	2
	3	MU3	3
	4	MU4	4
	5	MU5	5
	6	MU6	6
CQD-220/M	**SCSI ID**	**On-Board Utility**	**Operating System Unit No.**
	0	DU0	0
	1	DU1	1
	2	DU2	2
	3	DU3	3
	4	DU4	4
	5	DU5	5
	6	DU6	6
CQD-220/TM	**SCSI ID**	**On-Board Utility**	**Operating System Unit No.**
	0	DU0	0
	1	DU1	1
	2	DU2	2
	3	DU3	3
	4	MU0	0
	5	MU1	1
	6	MU2	2

An example on the next page is given for each type of controller to show how the unit numbers can be determined. Refer to Figure 4-7 if necessary.

CQD-220/T—Tape drives must be configured starting from SCSI ID 0 to properly use the information from Table 4-3. *mu0* will be unit number 0; this is with LUN offset set to 0. Setting the LUN offset to 10 will change the *mu* number to 10 (ie., *mu10*), making the unit number 10.

CQD-220/M—Disk drives must be configured starting from SCSI ID 0 to properly use the information from Table 4-3. *du0* will be unit number 0. This is with LUN offset set to 0. Setting the LUN offset to 10 will change the *du* number to 10 (ie., *du10*), making the unit number 10.

CQD-220/TM—Default is four disk drives and three tape drives as shown in Table 4-3. If you have more than four disk drives or three tape drives, follow these guidelines—disk drives must start at SCSI ID 0 and tape drives must start after the last disk drive's SCSI ID number and reconfigure the CQD-220/TM (see subsection, "Displaying SCSI Devices and Setting Up Configuration"). Note the example below.

SCSI ID 0 disk
SCSI ID 1 disk
SCSI ID 2 disk
SCSI ID 3 disk
SCSI ID 4 disk

SCSI ID 5 tape
SCSI ID 6 tape

SCSI ID 7 is initiator (CQD-220/TM)

The *mu* and *du* numbers are the unit numbers mapped back to the operating system. If the CQD-220/TM is configured following these guidelines, you can apply this formula to determine the unit number mapped back to the operating system:

	SCSI ID of the disk drive		SCSI ID of tape drive
+	the LUN offset for disk	–	number of disk drives
=	unit number for disk	+	LUN offset for tapes
		=	unit number for tape

Multi-Hosting Configuration

The following is a list of software requirements for multi-hosting; refer to Appendix A for supported multi-hosting devices.

- VMS version 5.3 or above.
- VAX cluster software must be running on both systems with at least one of the DEC's interconnects operational.
- Tape drives can only be mounted to one system at a time.
- Allocation classes must be the same for all systems when installing disk drives (value must not equal 0).

Using VMS and the CQD-220/M or CQD-220/TM, you can multi-host by following the instructions below:

1 Configure the CQD-220 to SCSI ID 7 for the first computer; configure the CQD-220 to SCSI ID 6 for the second computer. If you need to alter the Host Adapter SCSI ID change the jumper settings as shown in Table 4-4.

Table 4-4 Host Adapter ID Selection

W3-1	W3-2	W3-3	Initiator ID
IN	IN	IN	Host adapter ID = 7 highest priority (F)
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

Note that (F) means factory setting.

2 From the Additional Utilities Menu in the On-Board Utility, follow these instructions:

a Select option *D* to display current configuration.
b Answer *Y* to the statement: CHANGE CONFIGURATION ? (Y/N) The menu shown in Figure 4-8 will display.
c Select *Z* to reset configuration back to default.

d Answer ***Y*** to reconfigure the adapter.

NOTE If you ever reconfigure the board, you must reset the configuration to default using selection Z.

e Select ***R*** to toggle SCSI reset. Then set the SCSI reset to OFF. Do this for all SCSI host adapters to be multi-hosted.
f Answer ***Y*** to reconfigure the adapter.
g Select ***C*** to reconfigure the device. Then configure the CQD-220 for exact number of disks and tapes. This will inhibit scanning of other host adapters (see Figure 4-9).
h If other MSCP disks are in the cluster, follow the rules in the subsection "Changing LUN Offset" in "On-Board Utility" so that each device has a unique unit number.
i Exit out of the On-Board Utility.

NOTE In a multi-hosting system the *physical* disk device name must be identical on both systems.

3 Terminate both *physical* ends of the SCSI bus.

If the CQD-220 is at either end of the SCSI bus, remove on-board terminators, RN1, RN2, RN3, and use a pass-through terminator as close to the board as possible.

If the CQD-220 is in the middle of the SCSI bus, RN1, RN2 and RN3 terminators *must* be removed. Do not use pass-through terminators.

When one system becomes inoperable with only two nodes in the VAX cluster, a quorum disk must be used to count as a vote; this keeps the other system running. Refer to VMS VAXcluster manual order number AA-LA27A-TE to set up a quorum disk and a VAX cluster.

NOTE When running *cluster_config.com* on a system with only Ethernet as a computer interconnect, answer ***Yes*** for the question, "WILL THIS BE A SATELLITE NODE?"

Partitioning Configuration

You may partition a device into two or four sections under VMS or ULTRIX using the CQD-220/M or CQD-220/TM. To partition a device, follow the instructions below.

1 Configure the SCSI devices as explained in the section "Displaying SCSI Device and Setting Up Configuration."

2 Select *D* from "Additional Utilities." The current configuration will display all physical devices as shown in the example in Figure 4-11:

```
DEV0  DU0, SCSI ID 0, LUN 0
      Disconnect ON, Sync Mode ON, Prevent Medium Removal ON, Write W/Verify OFF

DEV1  DU1, SCSI ID 1, LUN 0
      Disconnect ON, Sync Mode ON, Prevent Medium Removal ON, Write W/Verify OFF

DEV2  DU2, SCSI ID 2, LUN 0
      Disconnect ON, Sync Mode ON, Prevent Medium Removal ON, Write W/Verify OFF

DEV3  DU3, SCSI ID 3, LUN 0
      Disconnect ON, Sync Mode ON, Prevent Medium Removal ON, Write W/Verify OFF

DEV4  MU0, SCSI ID 4, LUN 0
      Disconnect ON, Sync Mode ON, Buffer Mode ON

DEV5  MU1, SCSI ID 5, LUN 0
      Disconnect ON, Sync Mode ON, Buffer Mode ON

DEV6  MU2, SCSI ID 6, LUN 0
      Disconnect ON, Sync Mode ON, Buffer Mode ON

DEV7  SCSI ID 7, HOST ADAPTER SCSI Reset ON, Density Mode ON, Default Tape OFF
      Boot Floppy OFF, Jumper Write Protect OFF, Eject Disk ON, Truncate Size OFF
```

Figure 4-11: Current configuration

3 Answer *y* to the question that appears on the screen: CHANGE CONFIGURATION (Y/N)? Figure 4-12 will display:

```
R = Toggle SCSI Reset                    M = Toggle Density Mode
D = Toggle Disconnect                    B = Toggle Buffer/Truncate Mode (Tape/Disk)
S = Toggle Sync/Async                    W = Toggle Write W/Verify (Disk only)
C = Reconfigure Device                   P = Toggle Prevent Medium Removal (Disk only)
U = Toggle Default Tape (Tape Only)
A = Autoboot Start From Floppy Drive
N = Write Protect from Controller Jumper Setting
V = Truncate Disk Size for Volume Shadowing
E = Eject Disk after Dismount
T = Reset All Device Modes to Default
Z = Reset Controller to Default Configurtation
```

Figure 4-12: Configuration change

4 Select *Z* to reset configuration back to default. Answer *Y* to reconfigure the adapter. This step is **IMPERATIVE!**

NOTE If you ever reconfigure the board, you must reset the configuration to default using selection Z.

5 Select option *C*. Answer *y* to the devices to be partitioned as shown in the example in Figure 4-13:

```
Number of Disks? (0-7)    4                          [total number of logical disks]
   DU0 to be Reconfigured ? (Y/N)    Y
   DU0 SCSI ID ? (0-7)    0
   DU0 LUN ? (0-3)    0
   Number of Partitions  ? (NONE, 2, 4)    2     [N is the default]
   DU2 to be Reconfigured ? (Y/N)    Y
   DU2 SCSI ID ? (0-7)    1
   DU2 LUN ? (0-3)    1
   Number of Partitions  ? (NONE, 2, 4)    2     [N is the default]

Number of Tapes? (0-3)    3
   MU0 to be Reconfigured ? (Y/N)    N
   MU1 to be Reconfigured ? (Y/N)    N
   MU2 to be Reconfigured ? (Y/N)    N
```

Figure 4-13: Partitioning example

After you have completed configuration, the system will display device configuration as shown in the example in Figure 4-14:

```
DEV0  DU0, SCSI ID 0, LUN 0 MICROP 1598-15MD1063303SI125
      Disconnect ON, Sync Mode ON, Prevent Medium Removal ON, Write W/Verify OFF

DEV1  DU1, SCSI ID 0, LUN 0 MICROP 1598-15MD1063303SI125
      Disconnect ON, Sync Mode ON, Prevent Medium Removal ON, Write W/Verify OFF

DEV2  DU2, SCSI ID 1, LUN 0 MICROP 1588-15MB1036810IC09
      Disconnect ON, Sync Mode ON, Prevent Medium Removal ON, Write W/Verify OFF

DEV3  DU3, SCSI ID 1, LUN 0 MICROP 1588-15MB1036810IC09
      Disconnect ON, Sync Mode ON, Prevent Medium Removal ON, Write W/Verify OFF

DEV4  MU0, SCSI ID 4, LUN 0
      Disconnect ON, Sync Mode ON, Buffer Mode ON

DEV5  MU1, SCSI ID 5, LUN 0
      Disconnect ON, Sync Mode ON, Buffer Mode ON

DEV6  MU2, SCSI ID 6, LUN 0
      Disconnect ON, Sync Mode ON, Buffer Mode ON

DEV7  SCSI ID 7, HOST ADAPTER SCSI Reset ON, Density Mode ON, Default Tape OFF
      Boot Floppy OFF, Jumper Write Protect OFF, Eject Disk ON, Truncate Size OFF
```

Figure 4-14: Current configuration

6 Format RCT block for each partition of each device. See "Formatting RCT Block" in "Additional Utilities."

7 Exit out of the On-Board Utility.

NOTE The system considers each partition as a device even though the location (LUN) is the same.

Hardware Shadowing Configuration

This section explains how to configure drives into shadow sets. A maximum of three shadow sets can be formed with each controller. For the purpose of this explanation, four disk drives will be divided into two shadow sets with three remaining tape drives as shown below.

DU0 = SCSI ID 0 Primary
DS0 = SCSI ID 1 Shadow drive of DU0
DU1 = SCSI ID 2 Primary
DS1 = SCSI ID 3 Shadow drive of DU1
MU0 = SCSI ID 4
MU1 = SCSI ID 5
MU2 = SCSI ID 6

Configuration Instructions

Follow the instructions below for configuring shadow sets.

1 Select *5* from the SCSI Host Adapter Utility.

2 Select *D* from the Additional Utilities Menu to display current configuration.

3 Answer *y* to the question: CHANGE CONFIGURATION ? (Y/N). The menu shown in Figure 4-8 will display.

4 Select *Z* to reset configuration back to default. Answer *y* to reconfigure the adapter. This step is **IMPERATIVE!**

NOTE If you ever reconfigure the board, you must reset the configuration to default using selection Z and then reconfigure.

5 Select *C* to reconfigure the device; see Figure 4-15 for instructions.

```
Number of Disks (including shadow units)? (0 - 7)    4
Number of Shadow sets ? (0 - 2)   2
   DU0 to be Reconfigured ? (Y/N)   Y
   DU0 SCSI ID ? (0 - 7)   0
   DU0 LUN ? (0 - 3)   0
Shadow units exist ? (Y/N)   Y
   DS0 SCSI ID ? (0 - 7)   1
   DS0 LUN ? (0-3)   0
   DU1 to be Reconfigured ? (Y/N)   Y
   DU1 SCSI ID ? (0 - 7)   2
   DU1 LUN ? (0 - 3)   0
Shadow units exist ? (Y/N)   Y
   DS1 SCSI ID ? (0 - 7)   3
   DS1 LUN ? (0-3)   0

Number of Tapes? (0-3)   3
   MU0 to be Reconfigured ? (Y/N)   Y
   MU0 SCSI ID ? (0 - 7)   4
   MU0 LUN ? (0 - 3)   0
   MU1 to be Reconfigured ? (Y/N)   Y
   MU1 SCSI ID ? (0 - 7)   5
   MU1 LUN ? (0 - 3)   0
   MU2 to be Reconfigured ? (Y/N)   Y
   MU2 SCSI ID ? (0 - 7)   6
   MU2 LUN ? (0 - 3)   0
```

Figure 4-15: Hardware Shadowing example

6 After you have completed configuration, the system will display device configuration as shown in the example in Figure 4-16:

```
DEV0  DU0, SCSI ID 0, LUN 0
      Disconnect ON, Sync Mode ON, Prevent Medium Removal ON, Write W/Verify OFF

DEV1  DU1, SCSI ID 2, LUN 0
      Disconnect ON, Sync Mode ON, Prevent Medium Removal ON, Write W/Verify OFF

DEV2  DS0, SCSI ID 1, LUN 0
      Disconnect ON, Sync Mode ON, Prevent Medium Removal ON, Write W/Verify OFF

DEV3  DS1, SCSI ID 3, LUN 0
      Disconnect ON, Sync Mode ON, Prevent Medium Removal ON, Write W/Verify OFF

DEV4  MU0, SCSI ID 4, LUN 0
      Disconnect ON, Sync Mode ON, Buffer Mode ON

DEV5  MU1, SCSI ID 5, LUN 0
      Disconnect ON, Sync Mode ON, Buffer Mode ON

DEV6  MU2, SCSI ID 6, LUN 0
      Disconnect ON, Sync Mode ON, Buffer Mode ON

DEV7  SCSI ID 7, HOST ADAPTER SCSI Reset ON, Density Mode ON, Default Tape OFF
      Boot Floppy OFF, Jumper Write Protect OFF, Eject Disk ON, Truncate Size OFF
```

Figure 4-16: Current configuration

7 Then answer *n* to the question: CHANGE CONFIGURATION ? (Y/N) and exit out of the On-Board Utility.

Detecting Shadowing Errors Using VMS

The following instructions will help you detect shadowing errors and shadowing drive failure.

1 At the system prompt, enter ***show dev du.***

2 Check the error count for shadowed disk drives.

3 If errors are detected, follow the instructions given in Appendix C, "Troubleshooting," to view "Controller Dependent Information."

Look for information describing which drive has failed such as given below:

/ID *x*/
/LUN*x*/
/POR*x*/

Where:
x is the variable used to represent the ID, LUN, and Port of the failed disk drive.

4 Back up the remaining good shadow set member.

5 Shut down the system.

6 Replace the drive.

7 Enter the On-Board Utility and follow these instructions:
- **a** Select option *D*. The current configuration will display.
- **b** Answer *y* to the question: DO YOU WANT TO CLEAR SHADOW FAILED STATUS ? <Y/N>
- **c** Answer *n* to the question: CHANGE CONFIGURATION <Y/N>
- **d** Exit On-Board Utility.

8 Boot the system.

9 Initialize the specified shadow set in VMS.

10 Restore the backup copy to the specified shadow set.

11 Put the specified drives back online by mounting them to VMS.

VMS Configuration

If you followed procedures in "Determining CSR Addresses" in Chapter 3, VMS software will automatically configure new devices added. *NO* other configuration is required. If VMS does not, run Auto Configure as shown in Appendix D, "VMS Sysgen Connect Statement."

ULTRIX Configuration

VAX and DEC systems using ULTRIX software must be manually configured to access the CQD-220 boards.

First, examine current configuration file to determine which controllers and devices are already connected to the system. Then refer to the respective sections for configuration procedures for the CQD-220/T, CQD-220/M, CQD-220/TM.

CQD-220/T

Edit the configuration file by performing the following instructions for the CQD-220/T. The CQD-220/T must be configured with a higher *klesiu number*, higher *uq number*, and higher *tms number* than any other *klesiu* controller in the configuration file.

1 Make sure the following two lines are in the configuration file:

adapter uba& at nexus?

Where
? = the system will fill in this variable (simply enter this *?*).
& = the node ID of the Q-bus adapter.

2 Connect the controller to the node on the Q-bus by entering the following line:

controller klesiuϑ at uba&

Where
ϑ = the variable number that represents the CQD-220/T.
& = same number used in step **1**.

3 Tell ULTRIX what the name of the controller will be:

controller uq# at klesiuϑ csr XXXXXXXX vector uqintr

Where
ϑ = the same number used in step **2**.
# = the variable used to represent the controller.
XXXXXXXX = CSR address.

4 Name the tape drives and list drive unit by entering the following line:

***tape tms0 at uq# drive*α**
***tape tms1 at uq# drive*β**

Where
= the same number used to represent the controller in step **3**.
α = the *MU* number in the On-Board Utility displays this configuration.
β = the *MU* number in the On-Board Utility displays this configuration different than α.

CQD-220/M

Edit the configuration file by performing the following instructions for the CQD-220/M. Note the CQD-220/M must be installed with a higher *node ID number,* higher *klesib number,* higher *ra number,* and higher *uq number* than any other *kdb* and *klesib* controller in the configuration file.

1 Make sure the following two lines are in the configuration file:

adapter uba& at nexus?

Where
? = the system will fill in this variable (simply enter this *?*).
& = the node ID of the Q-bus adapter.

2 Connect the controller Q-bus by entering the following line:

controller uda*ϑ ***at uba&

Where
ϑ = the variable number that represents the CQD-220/M.
& = the same number used in step **1**.

3 Tell ULTRIX what the name of the controller will be:

controller uq# at uda*ϑ ***csr XXXXXXXX vector uqintr

Where
= the variable used to represent the controller.
ϑ = the variable used in Step 2.
XXXXXXXX = CSR address.

4 Name the tape drives and list drive unit by entering the following line:

***disk ra0 at uq# drive*α**
***disk ra1 at uq# drive*β**

Where
= the same number used to represent the controller in step 3.
α = the *DU* number in the On-Board Utility displays this configuration.
β = the *DU* number in the On-Board Utility displays this configuration different than α.

CQD-220/TM

Edit the configuration file by performing the following instructions for the CQD-220/TM. Note the CQD-220/TM must be configured with a higher *klesiu number,* higher *uq number,* and higher *tms numbers* than any other *klesiu* controller; and a higher *uda number,* higher *uq number,* and higher *ra number* than any other *uba* controller in the configuration file.

1 Make sure the following two lines are in the configuration file:

adapter uba& at nexus?

Where
? = the system will fill in this variable (simply enter this ?).
& = the node ID of the Q-bus adapter.

2 Connect the controller the Q-bus by entering the following line:

controller klesiu*ϑ ***at uba&
controller uda# at uba&

Where
ϑ = the variable number that represents the CQD-220/TM.
& = the same number used in step 1.

3 Tell ULTRIX what the name of the controller for the different functions will be:

controller uq∇ at klesiuϑ csr XXXXXXXX vector uqintr
controller uqΔ at uda# csr XXXXXXXX vector uqintr

Where
∇ = variable used to represent the controller.
Δ = variable used to represent the controller (unique from∇ above).
ϑ = the same number used in step **3** representing the controller.
= the same number used in step **3** representing the controller.
XXXXXXXX = CSR address.

4 Name the tape drives and list drive unit by entering the following line:

tape tms0 at uq∇ driveα
tape tms1 at uq∇ driveβ
disk ra0 at uqΔ driveα
disk ra1 at uqΔ driveβ

Where
∇ = the same number used to represent the controller in step **4**.
Δ = variable used to represent the controller (unique from ∇ above).
α = the *MU* number in the On-Board Utility displays this configuration.
β = the *DU* number in the On-Board Utility displays this configuration.

5

SCSI Basics

This chapter consists of a SCSI glossary, SCSI commands used by the CQD-220 for MSCP and TMSCP emulation, SCSI status codes, SCSI messages, and SCSI single-ended signals.

SCSI Glossary

The following is a glossary of frequently used SCSI terms.

Connect—The function that occurs when an initiator selects a target to start an operation.

Disconnect—The function that occurs when a target release control of the SCSI bus, allowing it to go to the BUS FREE phase.

Initiator—A SCSI device (usually a host system) that requests an operation to be performed by another SCSI device.

LUN—Logic Unit Number.

Peripheral device—A peripheral that can be attached to a SCSI device (e.g., magnetic disk, magnetic tape, or optical disk).

Reconnect —The function that occurs when a target selects an initiator to continue an operation after a disconnect.

SCSI address—The octal representation of the unique address (0-7) assigned to an SCSI device. This address would normally be assigned and set in the SCSI device during system installation.

SCSI ID—The bit-significant representation of the SCSI address referring to one of the signal lines DB (7-0).

SCSI device—A host computer adapter or a peripheral controller or an intelligent peripheral that can be attached to the SCSI bus.

Target—A SCSI device that performs an operation requested by an initiator.

SCSI Commands

SCSI commands used by CQD-220/M or CQD-220/TM for MSCP emulation are listed in Table 5-1.

Table 5-1 SCSI Commands (MSCP)

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.

SCSI commands used by CQD-220/T or CQD-220/TM for TMSCP emulation are listed in Table 5-2.

Table 5-2 SCSI Commands (TMSCP)

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

SCSI Status

The SCSI status codes used by CQD-220 are listed in Table 5-3.

Table 5-3 SCSI Status

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

SCSI Messages

The SCSI Messages used by CQD-220 are listed in Table 5-4.

Table 5-4 SCSI Messages

Code	Message Name
00h	Command Complete
01h	Extended Message
02h	Save Data Pointer
03h	Restore Pointer
04h	Disconnect
05h	Initiator Detected Error
06h	Abort
07h	Message Reject
08h	No Operation
09h	Message Parity Error
80-FFh	Identify

SCSI Single-Ended Signals

This section illustrates the CQD-220 nonshielded connector and pin assignments and CQD-223 shielded connector and pin assignments for J2.

CQD-220 Nonshielded Connector

Figure 5-1 illustrates the pin locations of the CQD-220 nonshielded SCSI device connector J2.

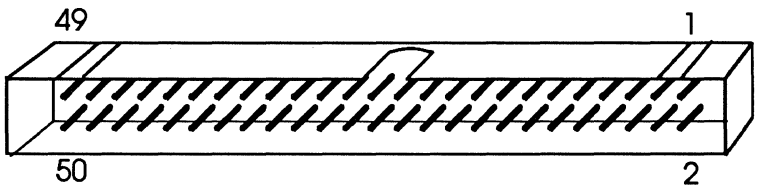

Figure 5-1: SCSI device nonshielded connector

Table 5-5 shows the CQD-220 nonshielded single-ended SCSI connector pin assignments.

Table 5-5 SCSI Nonshielded Connector Pin Assignments

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. The minus sign next to the signal indicates active low.

CQD-223 Shielded Connector

Figure 5-2 illustrates pin locations for the CQD-223 SCSI device shielded connector J2.

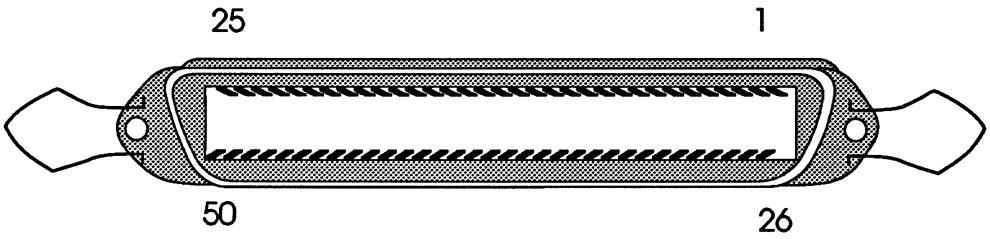

Figure 5-2: SCSI device shielded connector

Table 5-6 illustrates the CQD-223 shielded SCSI connector pin assignments.

Table 5-6 CQD-223 SCSI Shielded Connector (J2) Pin Assignments

Signal	Pin Number
-DB(0)	26
-DB(1)	27
-DB(2)	28
-DB(3)	29
-DB(4)	30
-DB(5)	31
-DB(6)	32
-DB(7)	33
-DB(P)	34
GROUND	35
GROUND	36
GROUND	37
TERMPWR	38
GROUND	39
GROUND	40
-ATN	41
GROUND	42
-BSY	43
-ACK	44
-RST	45
-MSG	46
-SEL	47
-C/D	48
-REQ	49
-I/O	50

NOTE Pin 1 to pin 25 (except pin 13) are connected to ground. Pin 13 is left open. The minus sign next to the signal indicates active low.

Appendix A
Supported Devices and Operating Systems

SCSI Devices

The following subsections list devices supported by the CQD-220. Contact CMD Technical Support for correct firmware revision for the drives listed; devices marked by the following symbols are qualified as follows:

italics	indicates new qualified device
bold	indicates device supports multi-hosting
bolded italics	indicates new qualified device supporting multi-hosting.

Magnetic disk drives supported by CQD-220/M and CQD-220/TM

SEAGATE	**WREN VI** , SWIFT (3½ inch) SABRE 8 inch, **WREN VII,** ***WREN VIII, ELITE I, II (5400 RPM), & III***
CONNER	CP-3100, *CP3200*
CITOH	YD-3042, YD3082
DEC	*RZ23 , RZ24 , RZ56 , RZ57*
FUJITSU	M2246SA Series, ***M2263SA***, M2249SA, M2266SA
HITACHI	**DK515C Series** , *DK516C*
HP	97548S/D series, C2233, C2234, C2235, C3010, C3009, C3007
IBM	320-MB, 3½ inch
MAXTOR	XT-4000S Series, XT-8000S Series
MICROPOLIS	***1588***, 1598, 1908*, 1924*, 1948* (*will dual-host with special firmware)
QUANTUM	ProDrive 40S/80S
TEAC	*FD235HS (3½-inch floppy, DEC RX23 compatible)* *FD55GS (5¼-inch floppy, DEC RX33 compatible)*

More disk drives will be qualified soon.

Erasable Optical disk drives supported by CQD-220/M and CQD-220/TM

MAXOPTICS	Tahiti 1, Tahiti 2
SONY	**SMO-D501, SMO-D502, SMO-E501**
RICOH	*RO-5030E, RO-5030E2*

Erasable Optical disk cartridge manufacturers

SONY, RICOH, MAXOPTICS, PDO, 3M.

CD ROM disk drives supported by CQD-220/M and CQD-220/TM

DEC	RRD40, RRD42
LMS	CM210, CM212
TOSHIBA	XM3200 series

WORM drives supported by CQD-220/M and CQD-220/TM

1 With Ten X Technology Optical Conversion Unit
All WORM drives supported by the Optical Conversion Unit.

2 With LASERDRIVE interface

LASERDRIVE	Model 800 series

Tape drives supported by CQD-220/T and CQD-220/TM

1 8-mm helical scan tape drives

EXABYTE	**EXB-8200**, EXB-8500

2 4-mm DAT (Digital Audio Tape)

Archive	**Python 4520 DAT**
GIGATREND	1200 series DAT
HP	**35450A DAT**, 35470A, 35480A
SONY	**SDT-1000 DAT**
WangDat	**1300 DAT, 2600 DAT**, 3200 DAT
Wangtek	**6130 series DAT**

3 VHS helical scan tape drives

Digidata
Metrum

4 IBM-3480 compatible 18-track cartridge tape drives

ASPEN	System 480
FUJITSU	M2480 series, 2680
LMS	Independence
Storage Tech	4280 series (model Summit)
Cipher	T480

5 9-track reel to reel tape drives

Cipher	F880-II, M990, M995
HP	Model 88780B
KENNEDY	Model 9612
M4 data	Model 9914, 2925
QUALSTAR	Model 340
TELEX	Model 9294
DEC	TSZ07

6 TK50-compatible tape drives

DEC	TZ30

Jukeboxes supported by CQD-220/TMJ

1 Disk Jukebox

Hewlett-Packard	*C1710A*
IDE	6500, *7000*

2 Tape Jukebox

EXABYTE	EXB120, EXB10i

Operating Systems

All DEC-compatible products designed by CMD Technology, Inc. implement MSCP (Mass Storage Control Protocol)/TMSCP (Tape Mass Storage Control Protocol). CMD supports its implementation of MSCP/TMSCP beginning with the indicated version of the DEC operating systems listed in Table A-1.

Table A-1 Operating Systems Supported by CQD-220/223

VMS	4.0 to 5.5
ULTRIX	1.2 to 4.2
Unix/Berkeley™	4.2 to 4.3
RSX-11M	Disk 4.1-5.3, Tape 4.2-5.3
RSX-11M-Plus	3.0-4.3
RSTS/E	Disk 9.0-10.0, Tape 9.5-10.0
RT-11	Disk 5.1-5.5, Tape 5.4-5.5
DSM-11	3.3-4.1
ISM-11	3.4
TSX+	(see RT-11)
VAXELN	x.x
AT&T UNIX®	System V

Appendix B
Troubleshooting

VMS Analyze/Error Utility

The CQD-220 logs controller dependent information in *errlog.sys* file. You can use the VMS Analyze/Error Utility to open the file *errlog.sys* and display the error messages for troubleshooting. By including option switches such as */since=date* and */include=mub0*, you may define the time reference and device. To enter the Analyze/Error Utility, log onto the system and enter the following command:

ana/err/since=[time]/include=[device]

Some examples are shown by the following:

To view all errors that VMS has logged, enter:

ana/err

To view the errors only on tape devices, enter:

ana/err/inc=tapes

To view the errors that have occured only on one tape unit (*mub0*), enter:

ana/err/inc=mubo
ana/err/inc=(ptb,mubo)

To view the *mub0* errors that occured on April 20, 1990 since 14:22 (02:22 PM), enter:

ana/err/since=20-Apr-1989:14:22/inc=mubo

One example of the error log message is shown in below:

```
BEGINING OF INTERVENING ENTRIES
**********ENTRY    6.**********

ERROR SEQUENCE  9.                      LOGGED ON SID 02005F78
ERL$LOGMESSAGE ENTRY          20-APR-1989  10:21:55.41
                    KA750     REV# 120.    UCODE     REV# 95.
I/O SUB-SYSTEM, UNIT _MUA0:
MESSAGE TYPE          0002
                                TAPE MSCP MESSAGE
MSLG$L_CMD_REF     99730004
MSLG$W_SEQ_NUM        0001
                                SEQUENCE #1.
MSLG$B_FORMAT           00
                                CONTROLLER ERROR
MSLG$B_FLAGS            00
MSLG$W_EVENT          00E8      DATA ERROR
                                UNRECOVERABLE ECC ERROR

MSLG$Q_CNT_ID      00340000
                   03090000
                                UNIQUE IENTIFIER, 000000340000
                                TAPE CLASS DEVICE
                                TK50P
MSLG$B_CNT_SVR          01
                                CONTROLLER SOFTWARE VERSION #1.
MSLG$B_CNT_HVR          01
                                CONTROLLER HARDWARE VERSION #1.
```

Controller Dependent Information is listed below for the CQD-220.

```
                                    ;COMMENTS:
                                    ;SCSI COMMAND, 6 BYTES
 LONGWORD 1.          00000008      ;COMMAND BYTE 3 TO 0
                        /..../      ;(LEFT TO RIGHT, BYTE 3,2,1,0)
 LONGWORD 2.          00000050      ;BYTE 7 TO 6 DONT CARE
                                    ;COMMAND BYTE 5 TO 4
                        /P.../      ;EXTENDED SENSE, 26 BYTES
 LONGWORD 3.          00030070      ;SENSE DATA BYTE 3 TO 0
                        /P.../      ;(LEFT TO RIGHT, BYTE 3,2,1,0)
 LONGWORD 4.          12000000      ;SENSE DATA BYTE 7 TO 4
                        /..../;
 LONGWORD 5.          00000000      ;SENSE DATA BYTE 11 TO 8
                        /..../;
 LONGWORD 6.          00000000      ;SENSE DATA BYTE 15 TO 12
                        /..../;
 LONGWORD 7.          10000000      ;SENSE DATA BYTE 19 TO 16
                        /..../;
 LONGWORD 8.          04000000      ;SENSE DATA BYTE 23 TO 20
                        /..../;
 LONGWORD 9.          0000E202      ;SENSE DATA BYTE 26 TO 24
                        /.b../;
 LONGWORD 10          00000000      ;(RESERVED)
                        /..../;
```

Refer to the SCSI tape drive manual for a description of the error reported by the tape drive or call CMD for more detailed information.

Cables

If the system does not recognize the CQD-220 or devices connected, check the cable connections. Make sure pin 1 on the cable is aligned with pin 1 on the SCSI device or CQD-220. Make sure pins are *NOT* bent.

LED Indicators

When the Red LED is lit, turn system OFF and reboot. If the Red LED is still lit, call CMD technical support at (800) 426-3832 or (714) 454-0800.

CMD Technical Support

Having a CMD board entitles you to responsive technical support. Before you call CMD Technical Support, please gather the information listed below that pertains to your configuration. Make a note of any on-screen messages when a problem occurs and have this manual close by.

CMD
- CMD product model number and serial number.
- Firmware Revision of CMD board as shown on Eprom on the CQD-220 with a blue CMD logo and copyright label.
- List of jumper settings on the board.
- Distributor company and contact.

SCSI
- SCSI devices model numbers and firmware Rev. as displayed using the On-Board Utility.
- Settings of SCSI ID numbers of all devices.

Computer
- Computer model.
- Operating System version.
- Complete list of other controllers in computer backplane.
- Specify multi-hosting or clustering.

Problem
- Describe exact nature of problem.
- Specify detailed error messages.
- Specify any recent modification to the system.
- Is this a new installation?
- Does the problem occur consistently?
- Does the problem occur when you do not use the board?
- Does the problem occur with another system (if available)?

You may contact CMD Technical Support from 8:30 AM to 5:30 PM, Pacific Standard Time, Monday through Friday, excluding major holidays, at:

(714) 454-0800 or
(800) 426-3832 or
(714) 455-1656 FAX

Appendix C
Jumper Settings

This chapter lists the jumper settings and CSR addresses for the CQD-220.

Pin Assignments

Figure C-1 shows the physical pin number assignments and functions of the RS-232 port for accessing the On-Board Utility. Connector J1 pin assignments are listed in Table C-1 when you are facing the 10 pin connector from the controller's top edge.

NOTE For CMD's On-Board RS-232 Utility, only pin 3, 8 and grounds are used.

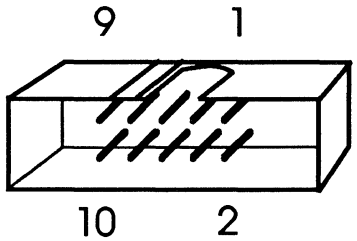

Figure C-1: RS-232 Port connector J1

Table C-1 Pin Assignments for Utility Interface

Pin 1	No Connect
Pin 2	Ground
Pin 3	TXD, transmit data for RS-232 application.
Pin 4	Ground
Pin 5	No Connect
Pin 6	No Connect
Pin 7	No Connect
Pin 8	RXD, receive data for RS-232 application.
Pin 9	Ground
Pin 10	No Connect

NOTE You cannot use the CQD-220 when the RS-232 port connector is in place. Be sure to remove the connector in J1 before using the board.

For write protection, contact CMD.

Table C-2 lists the Host Adapter ID selections; Table C-3 lists all the other jumper selections for the CQD-220.

Table C-2 Host Adapter ID Selections

W3-1	W3-2	W3-3	Initiator ID
IN	IN	IN	Host adapter ID = 7, highest priority (F)
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

Note (F) means factory setting.

Table C-3 CQD-220 Pin Assignments

W1 OUT	Reserved (F)
W2 IN	SCSI terminator power enabled (F)
W2 OUT	SCSI terminator power disabled
W3-4 IN	Enable tape fast search option
W3-4 OUT	Normal operation (F)
W3-5 IN	Tape Monitor Utility enabled (/T, /TM) Disk SCSIformat ON-LINE enabled (/M, /TM)
W3-5 OUT	Tape Monitor Utility disabled (F) Disk SCSIformat ON-LINE disabled (F)
W3-6 IN	Tape sync. mode disabled
W3-6 OUT	Tape sync. mode enabled (F)
W3-7 IN	Disk sync. mode disabled
W3-7 OUT	Disk sync. mode enabled (F)
W4 1-2 IN	Block mode DMA enabled (F)
W4 2-3 IN	Block mode DMA disabled
W5 IN	Adaptive DMA enabled (F)
W5 OUT	Adaptive DMA disabled
W6-1 IN	Auto-Bootstrap address = 773000 (F)
W6-1 OUT	Auto-Bootstrap address = 771000
W7-1 OUT	1.2 us DMA dwell time
W7-2 OUT	2.4 us DMA dwell time
W7-3 IN	4.8 us DMA dwell time (F)
W8 1-2 IN	Auto-Bootstrap enabled
W8 2-3 IN	Auto-Bootstrap disabled (F)
W9 IN	22-Bit addressing (F)**
W9 OUT	18-Bit addressing
W10 1-2 IN	Interrupt level 5
W10 2-3 IN	Interrupt level 4 (F)
W11, W12 OUT	Reserved (F)
W13 IN	Reserved, Rev. C (F)
W14 1-2 IN	27256 Eprom hardware Rev. C
W14 2-3 IN	27C512 Eprom hardware Rev. C (F)

Note (F) means factory setting.

** Hardware Revision C only supports 22-bit addressing.

CSR Address Selections

Table C-4 and C-5 lists the CSR address selection for the CQD-220/TM (Rev. B and higher) with the IC P22015A in U40.

Table C-4 CQD-220/TM CSR jumper settings for disk (Rev. B & higher)

Address	LSI-11	MicroVAX	W6-2	W6-3	W6-4
Standard	17772150	20001468	IN	IN	IN
Second	17760334	200000DC	IN	IN	OUT
Third	17760354	200000EC	IN	OUT	IN
Fourth	17760374	200000FC	IN	OUT	OUT
Fifth	17760340	200000E0	OUT	IN	IN
Sixth	17760344	200000E4	OUT	IN	OUT
Seventh	17760350	200000E8	OUT	OUT	IN
Disable disk			OUT	OUT	OUT

Table C-5 CQD-220/TM CSR jumper settings for tape (Rev. B & higher)

Address	LSI-11	MicroVAX	W6-5	W6-6	W6-7
Standard	17774500	20001940	IN	IN	IN
Second	17760404	20000104	IN	IN	OUT
Third	17760444	20000124	IN	OUT	IN
Fourth	17760504	20000144	IN	OUT	OUT
Fifth	17760544	20000164	OUT	IN	IN
Sixth	17760410	20000108	OUT	IN	OUT
Seventh	17760450	20000128	OUT	OUT	IN
Disable disk			OUT	OUT	OUT

Table C-6 lists the CSR address selection for the CQD-220/M with the IC P22016A or P22016B in U40.

Table C-6 CQD-220/M CSR Address Selections (Rev. B & higher)

Address	LSI-11	Micro VAX	W6-2	W6-3	W6-4	W6-5	W6-6
1	17772150	20001468	IN	IN	IN	OUT	OUT
2	17760334	200000DC	IN	IN	OUT	OUT	OUT
3	17760354	200000EC	IN	OUT	IN	OUT	OUT
4	17760374	200000FC	IN	OUT	OUT	OUT	OUT
5	17760340	200000E0	OUT	IN	IN	OUT	OUT
6	17760344	200000E4	OUT	IN	OUT	OUT	OUT
7	17760350	200000E8	OUT	OUT	IN	OUT	OUT
8	17760360	200000F0	OUT	OUT	OUT	OUT	OUT
9	17760364	200000F4	IN	IN	IN	IN	OUT
10	17760370	200000F8	IN	IN	OUT	IN	OUT
11	17760400	20000100	IN	OUT	IN	IN	OUT
12	17760404	20000104	IN	OUT	OUT	IN	OUT
13	17760410	20000108	OUT	IN	IN	IN	OUT
14	17760414	2000010C	OUT	IN	OUT	IN	OUT
15	17760420	20000110	OUT	OUT	IN	IN	OUT
16	17760424	20000114	OUT	OUT	OUT	IN	OUT
17	17760430	20000118	IN	OUT	IN	OUT	IN
18	17760434	2000011C	IN	OUT	OUT	OUT	IN
19	17760440	20000120	IN	OUT	IN	OUT	IN
20	17760444	20000124	IN	OUT	OUT	OUT	IN
21	17760450	20000128	OUT	IN	IN	OUT	IN
22	17760454	2000012C	OUT	IN	OUT	OUT	IN
23	17760460	20000130	OUT	OUT	IN	OUT	IN
24	17760464	20000134	OUT	OUT	OUT	OUT	IN
25	17760470	20000138	IN	IN	IN	IN	IN
26	17760474	2000013C	IN	IN	OUT	IN	IN
27	17760500	20000140	IN	OUT	IN	IN	IN
28	17760504	20000144	IN	OUT	OUT	IN	IN
29	17760510	20000148	OUT	IN	IN	IN	IN

For these CSR address selections, W6-7 can be IN or OUT; it does not matter.

Table C-7 lists the CSR address selection for the CQD-220/T with the IC P20017A in U40.

Table C-7 CQD-220/T CSR Address Selections (Rev. B & higher)

Address	LSI-11	MicroVAX	W6-3	W6-4	W6-5	W6-6	W6-7
1	17774500	20001940	OUT	OUT	IN	IN	IN
2	17760404	20000104	OUT	OUT	IN	IN	OUT
3	17760444	20000124	OUT	OUT	IN	OUT	IN
4	17760504	20000144	OUT	OUT	IN	OUT	OUT
5	17760544	20000164	OUT	OUT	OUT	IN	IN
6	17760410	20000108	OUT	OUT	OUT	IN	OUT
7	17760450	20000128	OUT	OUT	OUT	OUT	IN
8	17760454	2000012C	OUT	OUT	OUT	OUT	OUT
9	17760414	2000010C	OUT	IN	IN	IN	IN
10	17760420	20000110	OUT	IN	IN	IN	OUT
11	17760460	20000130	OUT	IN	IN	OUT	IN
12	17760510	20000148	OUT	IN	IN	OUT	OUT
13	17760514	2000014C	OUT	IN	OUT	IN	IN
14	17760520	20000150	OUT	IN	OUT	IN	OUT
15	17760550	20000168	OUT	IN	OUT	OUT	IN
16	17760554	2000016C	OUT	IN	OUT	OUT	OUT
17	17760560	20000170	IN	OUT	IN	IN	IN
18	17760604	20000184	IN	OUT	IN	IN	OUT
19	17760610	20000188	IN	OUT	IN	OUT	IN
20	17760614	2000018C	IN	OUT	IN	OUT	OUT
21	17760620	20000190	IN	OUT	OUT	IN	IN
22	17760644	200001A4	IN	OUT	OUT	IN	OUT
23	17760650	200001A8	IN	OUT	OUT	OUT	IN
24	17760654	200001AC	IN	OUT	OUT	OUT	OUT
25	17760660	200001B0	IN	IN	IN	IN	IN
26	17760704	200001C4	IN	IN	IN	IN	OUT
27	17760710	200001C8	IN	IN	IN	OUT	IN
28	17760714	200001CC	IN	IN	IN	OUT	OUT
29	17760744	200001E4	IN	IN	OUT	IN	IN
30	17760750	200001E8	IN	IN	OUT	IN	OUT
31	17760754	200001EC	IN	IN	OUT	OUT	IN

For these CSR address selections, W6-2 can be IN or OUT; it does not matter.

Appendix D

VMS Sysgen Connect Statement

To properly use the *connect* statement in the Sysgen Utility of VMS 5.0 and newer versions, the following rules must be followed.

1 Run the Sysgen Utility, from either terminal mode or through a command file by entering at the system prompt ***mc sysgen.***

It is recommended that you use *syconfig.com* if an automatic command file is used.

2 Issue the *connect* statement to connect the controller by entering the following line at the *sysgen* prompt:

connect AAAA/adapter=BBB/csr=%oCCCCCCCC/
vector=%oddd/driver=eedriver

Where:
AAAA—the designation of the controller (no :) such as *ptb0.*
BBB—the adapter number which can be found from the Sysgen Utility *show/config* (the *nexus* number) in decimal.
CCCCCCCC—the CSR of the controller being added on the specified *nexus* preceeded by %o (letter o) in octal.
DDD—the *vector* of the controller being added on the specified NEXUS preceeded by %o (letter o) in octal.
EE —the name of the driver for the controller being connected.

3 Issue the next *connect* statement to connect the drive by entering the following line at the *sysgen* prompt:

connect FFFF/noadapter/sysidhigh=%xGGGG/
sysidlow= %xHHHHHHHH/driver=iidriver

Where:
FFFF —the designation of the drive (no :) such as *mub0.*
GGGG—the *sysidhigh* number which is 8000 plus the *nexus* number.
HHHHHHHH—the *sysidlow* number which can be obtained after the controller is connected by using the Sysgen Utility *show/unibus.* The newly attached controller will be seen at the CSR address previously specified followed by the *sysidlow* number seen in (*HHHHHHHH*).

EXAMPLE You may wish to connect a tape drive to a MicroVAX 3300. This tape drive is the third *mu:* device to be added to the Q-bus. The *autoconnect* recommended CSR for this device will not be used but the CSR of 760444 will be used instead with a *vector* of 340.

3 View the configuration files by entering the following line at the system prompt:

mc sysgen
show/config

The screen displays the configuration as shown in Figure D-1:

```
System CSR and Vectors on 11-JAN-1990 10:43:47.59
Name: PUA  Units: 1  Nexus:0  (UBA)  CSR: 772150  Vector1 : 774 ...
Name: PTA  Units: 1  Nexus:0  (UBA)  CSR: 774500  Vector1 : 260 ...
Name: PUB  Units: 1  Nexus:0  (UBA)  CSR: 760334  Vector1 : 300 ...
Name: TXA  Units: 8  Nexus:0  (UBA)  CSR: 760500  Vector1 : 310 ...
```

Figure D-1: Sysgen Configuration File

Note the *nexus* number *0* for the specified bus.

4 Edit the configuration file to connect the devices by entering the following line at the *sysgen* prompt:

connect ptc0/adapter=ub0/csr=%o760444/
vector=%o340/driver=pudriver

5 Find the address for the Q-bus by entering ***show/unibus.***

Figure D-2 shows the address.

```
Address 760444 (8002A924) responds with value 0020 (hex).
```

Figure D-2: Unibus Address

6 Note the *sysidlow* value.

7 Calculate the *sysidhigh* value by adding 8000 to the *nexus* 0 (which is 8000) and enter the following lines at the *sysgen* prompt:

connect muc0/noadapter/sysidhigh=%x8000/
sysidlow=%x8002a924/driver=tudriver

****exit* (control z to exit)***

Appendix E
Old Hardware Rev. A

This addendum features the CQD-220 Old Hardware for Revision A jumper settings and locations and CSR addresses.

Eight CSR addresses are supported by the CQD-220/M old hardware Rev. A with the IC P20011A in U40 and are listed in Table E-1.

Table E-1 CQD-220/M CSR Address (Rev. A)

Address	LSI-11	MicroVAX	W6-2	W6-3	W6-4	W6-5
Standard	17772150	20001468	IN	IN	OUT	OUT
Second	17760334	200000DC	IN	OUT	OUT	OUT
Third	17760354	200000EC	OUT	IN	OUT	OUT
Fourth	17760374	200000FC	OUT	OUT	OUT	OUT
Fifth	17760340	200000E0	IN	IN	IN	OUT
Sixth	17760344	200000E4	IN	OUT	IN	OUT
Seventh	17760350	200000E8	OUT	IN	IN	OUT
Eighth	17760360	200000F0	OUT	OUT	IN	OUT

Table E-2 lists the CSR disk jumper settings for the CQD-220/TM (disk and tape) old hardware Rev. A with the IC P20010A in U40.

Table E-2 CSR Jumper Settings for Disk (Rev. A)

Address	LSI-11	MicroVAX	W6-2	W6-3
Standard	17772150	20001468	IN	IN
Second	17760334	200000DC	IN	OUT
Third	17760354	200000EC	OUT	IN
Disable disk			OUT	OUT

Table E-3 lists the CSR tape jumper settings for the CQD-220/TM (disk and tape) old hardware Rev. A with the IC P20010A in U40.

Table E-3 CSR Jumper Settings for Tape (Rev. A)

Address	LSI-11	MicroVAX	W6-2	W6-3
Standard	17774500	20001940	IN	IN
Second	17760404	20000104	IN	OUT
Third	17760444	20000124	OUT	IN
Disable disk			OUT	OUT

Figure E-1 shows the jumper block locations for the CQD-220 old hardware, Rev. A.

Figure E-1: Jumper block location diagram hardware Rev. A

The CQD-220/T old hardware Rev. A (with the IC P20012B at location U40) supports 30 tape CSR addresses. These are listed in Table E-4.

Table E-4 CQD-220/T CSR Address Selections (Rev. A)

Address	LSI-11	MicroVAX	W6-1	W6-2	W6-3	W6-4	W6-5
1	17774500	20001940	IN	OUT	OUT	IN	IN
2	17760404	20000104	IN	OUT	OUT	IN	OUT
3	17760444	20000124	IN	OUT	OUT	OUT	IN
4	17760504	20000144	IN	OUT	OUT	OUT	OUT
5	17760544	20000164	IN	OUT	IN	IN	IN
6	17760410	20000108	IN	OUT	IN	IN	OUT
7	17760450	20000128	IN	OUT	IN	OUT	IN
8	17760454	2000012C	IN	OUT	IN	OUT	OUT
9	17760414	2000010C	IN	IN	OUT	IN	IN
10	17760420	20000110	IN	IN	OUT	IN	OUT
11	17760460	20000130	IN	IN	OUT	OUT	IN
12	17760510	20000148	IN	IN	OUT	OUT	OUT
13	17760514	2000014C	IN	IN	IN	IN	IN
14	17760520	20000150	IN	IN	IN	IN	OUT
15	17760550	20000168	IN	IN	IN	OUT	IN
16	17760554	2000016C	IN	IN	IN	OUT	OUT
17	17760560	20000170	OUT	OUT	OUT	IN	IN
18	17760604	20000184	OUT	OUT	OUT	IN	OUT
19	17760610	20000188	OUT	OUT	OUT	OUT	IN
20	17760614	2000018C	OUT	OUT	OUT	OUT	OUT
21	17760620	20000190	OUT	OUT	IN	IN	IN
22	17760644	200001A4	OUT	OUT	IN	IN	OUT
23	17760650	200001A8	OUT	OUT	IN	OUT	IN
24	17760654	200001AC	OUT	OUT	IN	OUT	OUT
25	17760660	200001B0	OUT	IN	OUT	IN	IN
26	17760704	200001C4	OUT	IN	OUT	IN	OUT
27	17760710	200001C8	OUT	IN	OUT	OUT	IN
28	17760714	200001CC	OUT	IN	OUT	OUT	OUT
29	17760744	200001E4	OUT	IN	IN	IN	IN
30	17760750	200001E8	OUT	IN	IN	IN	OUT

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III. Installation

1 Configure the hardware as explained in "Hardware Configuration" Chapter 3. [Normally, you do not need to change the factory jumper settings for the CQD-220.] Be sure you have set the CSR addresses as previously described.

2 Set the Device SCSI ID's; see Table 5 for Device ID Selection. If you are changing the factory setting for the CQD-220/TM, refer to Chapter 4, "Unit Numbering."

Table 5 Device ID Selection

Model	Device Support	Target SCSI ID
CQD-220/M	up to 7 disk drives	SCSI ID=0-6
CQD-220/T	up to 7 tape drives	SCSI ID=0-6
CQD-220/TM	up to 7 disk/tape combined 4 disk & 3 tape (F)	SCSI ID=0-3 disks (F) SCSI ID=4-6 tapes (F)

Note that (F) means factory setting.

3 Install the CQD-220 into a slot of the standard Q-Bus backplane that has a Q-Bus interrupt acknowledge/DMA grant daisy chain that is not broken.

4 Cable SCSI devices (see "SCSI Bus Cabling," Chapter 3) to the J2 port of the CQD-220, see Figure 1, 2 and 3.

5 Terminate the SCSI bus at each physical end. If the CQD-220 is at one physical end of the bus, make sure terminators in RN1, RN2, RN3 are in place. If TERMPWR is needed for the bus, place jumper shunt on W2.

6 Power up the system and execute On-Board Utility to scan for the SCSI devices and assure that all devices are seen and functioning properly (see Chapter 4 for On-Board Utility).

7 Boot the system and test with the operating system.

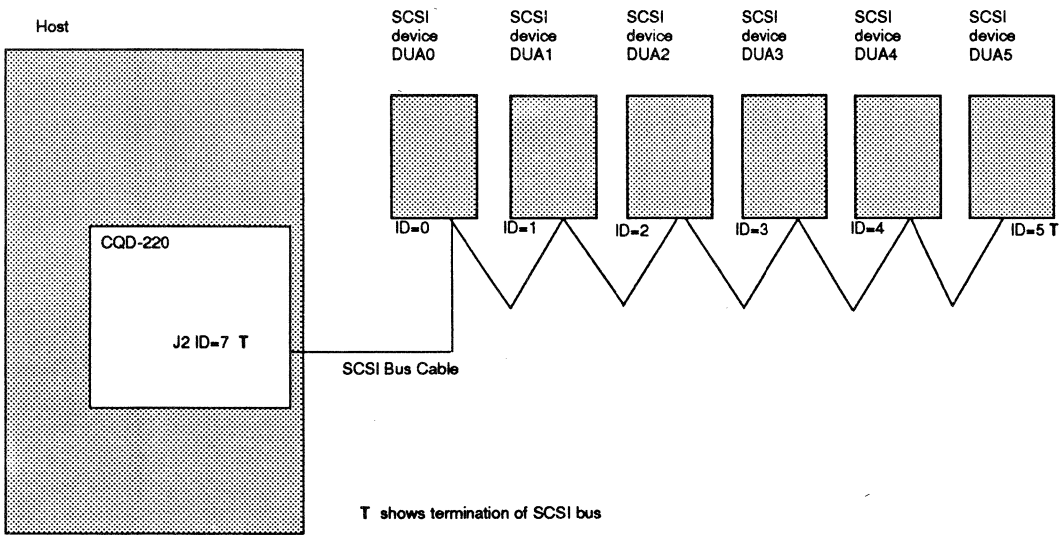

Figure 1: SCSI ID and Cabling

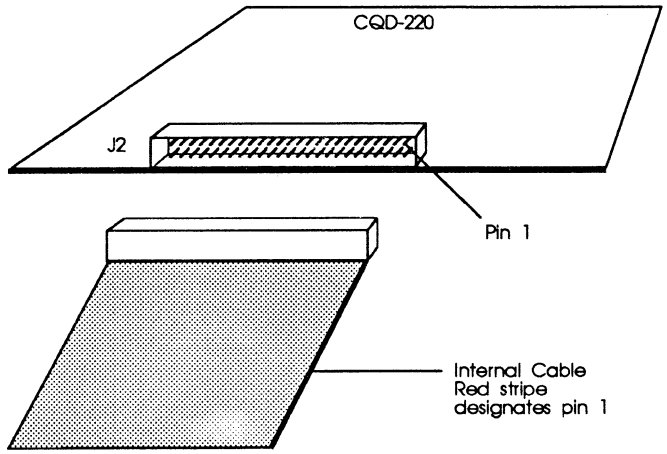

Figure 2: J2 SCSI port

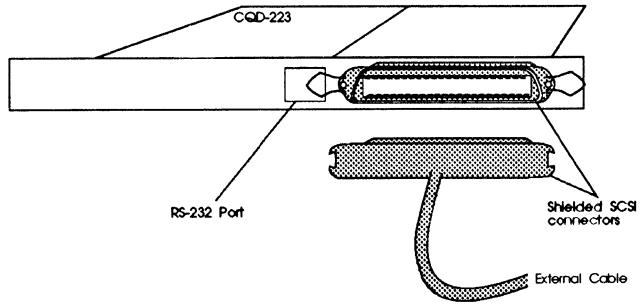

Figure 3: CQD-223 shielded connection

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CQD-220 Quick Reference Guide

I. Determining CSR Address

Before you install the CQD-220 SCSI host adapter under the VMS operating system you must determine the Control and Status Register (CSR) address from which the CQD-220 will be accessed.

For the CQD-220/M, or CQD-220/T, only one CSR address is required. For the CQD-220/TM, two CSR addresses are required. The following procedure shows one method of determining the new CSR address to be used for the CQD-220.

Do not install the new CQD-220 in the system now.

1 Boot the VMS system and log into the system manager account.

2 At the DCL $ prompt, enter *MC SYSGEN*.

3 At the prompt *SYSGEN*, enter *SHOW/CONFIG*. The SYSGEN Utility will display all the device controllers installed in the system and their corresponding CSR addresses and vectors. Make a note of this list.

4 At the prompt *SYSGEN*, enter *CONFIG*. This will bring you to the *DEVICE* prompt.

5 At the prompt *DEVICE*, enter the following for your CQD-220 model.

For CQD-220/M	enter ***UDA, X***
For CQD-220/T	enter ***TU81, Y***
For CQD-220/TM	enter ***UDA, X*** and ***TU81, Y***

where
X is the number of installed *UDA* type controllers plus 1 (for new one being added)
Y is the number of installed *TU81* type controllers plus 1 (for new one being added).

Enter all devices on the Q-bus, not just the new device being added at present.

6 At the prompt *DEVICE*, enter **[CTRL] + Z**. The SYSGEN Utility will display the CSR addresses for all the controllers. Make sure that no other vectors or CSR addresses have changed; if they have, make the appropriate changes to the devices.

The VMS mnemonic for MSCP disk controllers are PUA, PUB, PUC, etc. The VMS mnemonic for TMSCP tape controllers are PTA, PTB, PTC, etc. For other mnemonics, refer to VMS system manager's guide.

7 At the prompt *SYSGEN*, enter **[CTRL] + Z** to exit the SYSGEN Utility. VMS will automatically program the CQD-220's interrupt vector register to match the vector assigned by the system. The vectors of the controllers might change when the CQD-220 is added to the system; see manufacturer's documentation to configure vectors and device CSR addresses if hardware selectable.

II. CSR Address Selection

Use the CSR address obtained above to configure the CSR jumper settings of the CQD-220 as shown in Tables 1-4.

Table 1 CQD-220/M CSR Addresses

Add.	LSI-11	MicroVAX	W6-2	W6-3	W6-4	W6-5	W6-6
1	17772150	20001468	IN	IN	IN	OUT	OUT
2	17760334	200000DC	IN	IN	OUT	OUT	OUT
3	17760354	200000EC	IN	OUT	IN	OUT	OUT
4	17760374	200000FC	IN	OUT	OUT	OUT	OUT
5	17760340	200000E0	OUT	IN	IN	OUT	OUT
6	17760344	200000E4	OUT	IN	OUT	OUT	OUT
7	17760350	200000E8	OUT	OUT	IN	OUT	OUT
8	17760360	200000F0	OUT	OUT	OUT	OUT	OUT

Be sure to wear anti-static wrist straps or equivalent to protect the CQD-220 from electro-static damage.

Table 2 CQD-220/T CSR Addresses

Add.	LSI-11	MicroVAX	W6-3	W6-4	W6-5	W6-6	W6-7
1	17774500	20001940	OUT	OUT	IN	IN	IN
2	17760404	20000104	OUT	OUT	IN	IN	OUT
3	17760444	20000124	OUT	OUT	IN	OUT	IN
4	17760504	20000144	OUT	OUT	IN	OUT	OUT
5	17760544	20000164	OUT	OUT	OUT	IN	IN
6	17760410	20000108	OUT	OUT	OUT	IN	OUT
7	17760450	20000128	OUT	OUT	OUT	OUT	IN
8	17760454	2000012C	OUT	OUT	OUT	OUT	OUT

Table 3 CQD-220/TM CSR Addresses for disk

Address	LSI-11	MicroVAX	W6-2	W6-3	W6-4
Standard	17772150	20001468	IN	IN	IN
Second	17760334	200000DC	IN	IN	OUT
Third	17760354	200000EC	IN	OUT	IN
Fourth	17760374	200000FC	IN	OUT	OUT
Fifth	17760340	200000E0	OUT	IN	IN
Sixth	17760344	200000E4	OUT	IN	OUT
Seventh	17760350	200000E8	OUT	OUT	IN
Disable disk			OUT	OUT	OUT

Table 4 CQD-220/TM CSR Addresses for tape

Address	LSI-11	MicroVAX	W6-5	W6-6	W6-7
Standard	17774500	20001940	IN	IN	IN
Second	17760404	20000104	IN	IN	OUT
Third	17760444	20000124	IN	OUT	IN
Fourth	17760504	20000144	IN	OUT	OUT
Fifth	17760544	20000164	OUT	IN	IN
Sixth	17760410	20000108	OUT	IN	OUT
Seventh	17760450	20000128	OUT	OUT	IN
Disable tape			OUT	OUT	OUT

Refer to Appendix C, CQD-220 User's Manual for other CSR jumper settings.