



CQS-23/T
Dual-Wide Q-bus SCSI
Tape Host Adapter
Technical Manual

Revision 1.0

8/03/89

©1989 by
CMS Enhancements, Inc.
1372 Valencia Avenue
Tustin, California 92680

FCC Warning

This equipment generates, uses and can radiate radio frequency energy, and if not installed and used in accordance with the technical manual, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of part 15 of Federal Communications Commission (FCC) Rules, which are designed to provide reasonable protection against such interference when operating in a commercial environment. Operation of this equipment in a residential area is likely to cause interference in which case the user will be required to take whatever measures may be required to correct the interference.

WARNING

This technical manual is intended only for use by qualified service personnel. Procedures outlined in this manual, if not performed properly, could result in damage to the equipment, or system outages.

STATIC DISCHARGE

This device is sensitive to electro-static discharge. Appropriate static discharge preventive measures should be adhered to. Failure to do so may result in premature or intermittent failures of this device.

Copyright © 1989 CMS Enhancements, Inc.

The information in this document is for informational purposes and is subject to change without notice. CMS Enhancements, Inc. assumes no responsibility for any error herein.

Table of Contents

Chapter 1	Introduction	3
Chapter 2	CQS-23/T Specifications	4
Chapter 3	Installation	5
	3.1 Jumper Settings	5
	3.1.1 CSR Address Selection	5
	3.1.2 Interrupt Level Selection	5
	3.1.3 SCSI Host Adapter ID Selection	5
	3.1.4 SCSI Terminator Power Option	6
	3.1.5 Tape Format Mode Selection	6
	3.2 Mounting Slot Selection	10
	3.3 LED Indicators	10
	3.4 SCSI Bus Cabling and Termination	10
Chapter 4	On-Board Utility	11
	4.1 Configure LUN Offset	11
Chapter 5	SCSI Information	13
	5.1 SCSI Definitions	13
	5.2 SCSI Commands	14
	5.3 SCSI Status	14
	5.4 SCSI Messages	14
	5.5 SCSI Single-Ended Signals	15
Appendix A	Devices Supported by the CQS-23/T	16
Appendix B	Using the EXABYTE EXB-8200 Tape Unit	17
Appendix C	CMS Enhancements Product Warranty	19

Figures

Figure 1	Jumper Block Location Diagram	9
----------	-------------------------------------	---

Tables

Table 1	Jumper Setting on the CQS-23/T	7
---------	--------------------------------------	---

Chapter 1

CQS-23/T Dual-Wide Q-bus SCSI Tape Host Adapter

INTRODUCTION

The CQS-23/T is an intelligent, dual-wide Q-bus SCSI tape host adapter which is fully compatible with the DEC Tape Mass Storage Control Protocol (TMSCP).

The CQS-23/T is designed for use with Digital Equipment Corporations MicroVAX III systems utilizing the FCC compliant BA200 Series enclosures. The CMS adapter is fully compatible with VMS, ULTRIX and UNIX operating systems utilizing the MU device driver.

The CQS-23/T features 22-bit Q-bus addressing, block mode DMA transfer, 16K bytes data buffer, command queuing, standard SCSI bus arbitration, disconnect and reconnect, and all SCSI commands. Up to seven SCSI tape drives can be connected to the CQS-23/T with SCSI bus data transfer rates up to 2 M bytes per second.

The CQS-23/T has an on-board utility for users to configure drive Logic Unit Number (LUN) Offset. The drive configuration is stored in an on-board non volatile RAM (NOVRAM).

The CQS-23/T comes standard with installation manual and one year warranty.

Chapter 2 CQS-23/T Specifications

Emulation:	TMSCP compatible
Bus Interface:	DEC Q-22 Bus
Addressing:	22-bit Addressing
CSR Addresses:	20001940, 20000104, 20000124, 20000144, 20000164, 20000108, 20000128, 2000012C
Interrupt Priority:	Level 4 or 5
Interrupt Vector:	Software Programmable
Transfer Mode:	Normal or Block Mode DMA
Command Queuing:	16 commands with optimized seek
Data Buffer Capacity:	16K-byte data buffer
Software Supported:	All standard DEC operating systems
LED Indicators:	Self test, error condition
Peripheral Interface:	Small Computer System Interface (SCSI)
SCSI Transfer Rate:	2MB/sec (maximum)
SCSI Bus Parity:	Odd parity
Devices Supported:	Up to 7 SCSI tape drives
System Performance:	Supports disconnect/reconnect capability
SCSI Driver/Receiver:	Single ended
SCSI Cable Length:	Up to 20 ft. (6m)
Operating Temperatures:	5° C to 50° C
Relative Humidity:	10% to 90%, non-condensing
Power Requirement:	5V DC, 2.8A

Chapter 3 Installation

3.1 CQS-23/T Jumper Settings

3.1.1 *CSR Address Selection*

The CQS-23/T has jumpers to select different CSR addresses. Select the desired address by installing jumper plugs as listed in Table 1 later in this manual. The standard address is 20001940.

If you require CSR addresses other than those listed in the table, please consult CMS Enhancements, Inc.

Figure 1 shows the jumper locations on the board.

3.1.2 *Interrupt Level Selection*

The CQS-23/T is shipped with interrupt level 4 selected. This is the standard interrupt priority for TMSCP devices as recommended by Digital Equipment Corporation. The CQS-23/T may be jumper selected to interrupt at level 5.

Refer to Figure 1 for jumper block locations.

W11	1-2 IN	Interrupt Level 5	
	2-3 IN	Interrupt Level 4	(Standard)

3.1.3 *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 ID 0 has the lowest. The CQS-23/T SCSI Host Adapter is factory configured to SCSI ID 7. To alter the ID, change the jumper settings of W2-3, W2-4 and W2-5.

<u>W2-5</u>	<u>W2-4</u>	<u>W2-3</u>	
IN	IN	IN	Host Adapter ID = 7, Highest Priority
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

3.1.4 *SCSI Terminator Power Option*

The CQS-23/T supplies terminator power to the TERMPWR pin (pin 26) of SCSI connector (J2) through a diode and jumper block W1. To prevent accidental grounding or misconnection of terminator power, no jumper shunt is installed in location W1. To use this option, add a jumper shunt in location W1. Be sure that the pin 1 mark on the SCSI cable matches the pin 1 mark on the SCSI device's connector before turning on the power.

W1	IN	SCSI Terminator Power Enabled
	OUT	SCSI Terminator Power Disabled

3.1.5 *Tape Format Mode Selection*

The CQS-23/T, with firmware version F200TxB1 and higher, supports ANSI standard compatible tape format (ANSI mode), CMS' proprietary format which writes additional control blocks to the tape (CMS mode), and the combination of ANSI and CMS modes (MIX mode).

- In ANSI mode the controller reads and writes in ANSI format only.
- In CMS mode the controller reads and writes in CMS format only.
- In MIX mode the controller reads tapes with either CMS format or ANSI format, but only writes ANSI format to the tape.

The advantage of ANSI mode is format compatibility. Tapes written by CMS' controller (in ANSI mode), can be read by any other manufacturer's controller that supports ANSI standard tape format and vice versa.

The advantage of CMS mode is that files are written in proprietary format. Only CMS' controller boards can read tapes with CMS format.

The controller only supports homogeneous format on the tape, i.e. the controller can only write files in a format for which the tape was initialized. For example, if files are going to be appended to an existing CMS formatted tape, the controller must be set to CMS mode instead of MIX mode.

Table 1. Jumper Settings on the CQS-23/T

W1	IN OUT	SCSI Terminator Power Enabled SCSI Terminator Power Disabled (F)	
W2-1	W2-2		
IN	IN	ANSI Mode Selection (F)	
IN	OUT	MIX Mode Selection	
OUT	OUT	CMS Mode Selection	
W2-5	W2-4	W2-3	
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
W2-6	IN	Enable Tape Fast Search Option	
W2-6	OUT	Normal Operation	
W2-7	OUT	Reserved (F)	
W3	OUT	All Reserved (F)	

CSR Address Decoder PAL P20012B

W4-1	W4-2	W4-3	W4-4	W4-5	MicroVAX III	
IN	OUT	OUT	IN	IN	Standard CSR:	20001940 (F)
IN	OUT	OUT	IN	OUT	2	20000104 ←
IN	OUT	OUT	OUT	IN	3	20000124
IN	OUT	OUT	OUT	OUT	4	20000144
IN	OUT	IN	IN	IN	5	20000164
IN	OUT	IN	IN	OUT	6	20000108
IN	OUT	IN	OUT	IN	7	20000128
IN	OUT	IN	OUT	OUT	8	2000012C
<hr/>						
IN	IN	OUT	IN	IN	9	2000010C
IN	IN	OUT	IN	OUT	10	20000110
IN	IN	OUT	OUT	IN	11	20000130
IN	IN	OUT	OUT	OUT	12	20000148
IN	IN	IN	IN	IN	13	2000014C
IN	IN	IN	IN	OUT	14	20000150
IN	IN	IN	OUT	IN	15	20000168
IN	IN	IN	OUT	OUT	16	2000016C

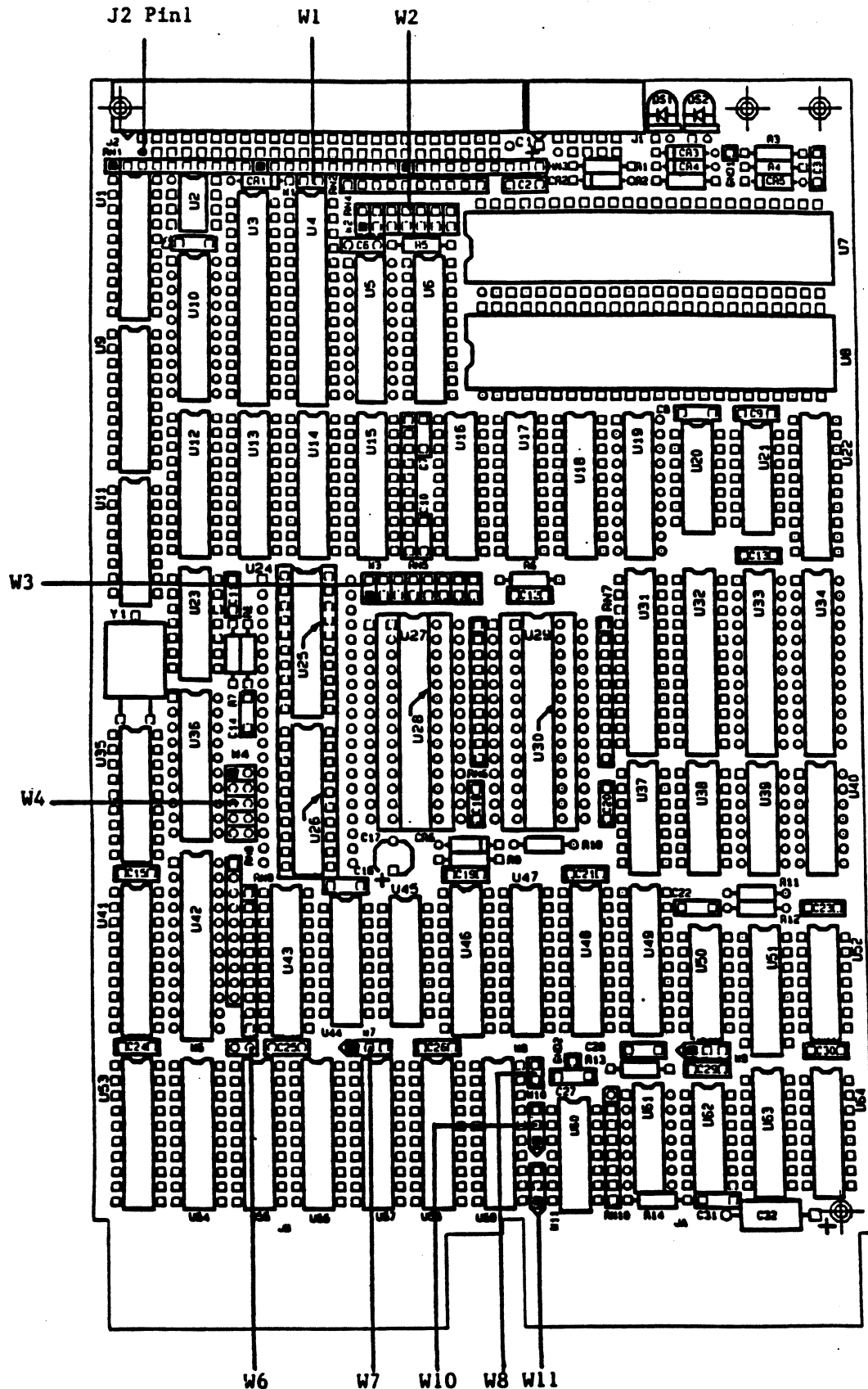
Table 1. Jumper Settings on the CQS-23/T (Continued)

CSR Address Decoder PAL P20012B (Continued)

W4-1	W4-2	W4-3	W4-4	W4-5	MicroVAX III	
OUT	OUT	OUT	IN	IN	17	20000170
OUT	OUT	OUT	IN	OUT	18	20000184
OUT	OUT	OUT	OUT	IN	19	20000188
OUT	OUT	OUT	OUT	OUT	20	2000018C
OUT	OUT	IN	IN	IN	21	20000190
OUT	OUT	IN	IN	OUT	22	200001A4
OUT	OUT	IN	OUT	IN	23	200001A8
OUT	OUT	IN	OUT	OUT	24	200001AC
<hr/>						
OUT	IN	OUT	IN	IN	25	200001B0
OUT	IN	OUT	IN	OUT	26	200001C4
OUT	IN	OUT	OUT	IN	27	200001C8
OUT	IN	OUT	OUT	OUT	28	200001CC
OUT	IN	IN	IN	IN	29	200001E4
OUT	IN	IN	IN	OUT	30	200001E8
<hr/>						
W6	OUT	Reserved (F)				
<hr/>						
W7	2-3 IN	Reserved (F)				
<hr/>						
W8	IN OUT	22-Bit Addressing (F) 18-Bit Addressing				
<hr/>						
W10	1-2 IN 2-3 IN	Block-Mode DMA Enabled (F) Block-Mode DMA Disabled				
<hr/>						
W11	1-2 IN 2-3 IN	Interrupt Level 5 Interrupt Level 4 (F)				

Note: (F) = Factory Setting.

Figure 1. Jumper Block Location Diagram



Note: The darkened areas in the jumper locations indicate pin 1.

3.2 *Mounting Slot Selection*

The CQS-23/T can be installed at any priority in the standard MicroVAX III Q-bus backplane as long as the Q-bus interrupt acknowledge/DMA grant daisy-chain is not broken.

3.3 *LED Indicators*

The CQS-23/T has two LED's on the front of the board (See Figure 1). The LED's are labeled DS1 and DS2.

<u>LED</u>	<u>Color</u>	<u>Indication</u>
DS1	Red	Error condition occurred.
DS2	Green	Power-up OK and activity indicator. On power up, this LED lights up.

3.4 *SCSI Bus Cabling and Termination*

The CQS-23/T Host Adapter provides a 50-pin connector (J2), to interface with external SCSI devices.

When the CQS-23/T and the external SCSI drives are installed in the same cabinet (one that meets EMI/RFI shielding requirements), a 50-conductor flat cable or 25-signal twisted-pair cable can be used for connecting the CQS-23/T and the external SCSI drives. When the CQS-23/T and the external SCSI drives are installed in separate cabinets, the shielded SCSI cable should be used to meet FCC requirements.

Note that a minimum conductor size of 28 AWG shall be employed to minimize noise effects and ensure proper distribution of optional terminator power. The maximum cable length is 6.0 meters, or 20 feet.

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 CQS-23/T provides on-board removable terminators (RN1, RN2, RN3), which are next to SCSI connector J2. Therefore, the CQS-23/T can be installed at either end of the SCSI cable. The on-board terminators should remain on the board.

Chapter 4 On-Board Utility

The CMS Enhancements Utility Program is started by an ODT command.

MicroVAX III

CMS Enhancements Utility Program Rev. A
© Copyright 1989, CMS Enhancements, Inc.

Select CSR Address

1 = 20001940	; The user selects
2 = 20000104	; the number that
3 = 20000124	; matches the CSR
4 = 20000144	; address selected by
5 = 20000164	; jumpers W4-4 to W4-5
6 = 20000108	
7 = 20000128	
8 = 2000012C	
Which CSR #	

4.1 Configure LUN Offset

LUN Offset: TMSCP requires that each TMSCP drive has a different Logical Unit Number. If there are no other TMSCP controllers in your system, the LUN offset number is 0 (Drive 0 will be LUN 0, and Drive 1 will be LUN 1). If there exists another TMSCP controller with 4 LUN (units 0 to 3), then the LUN offset should be 4. In this case Drive 0 will be LUN 4 and Drive 1 will be LUN 5.

Note: Normally, when the CQS-23/T is used in MicroVAX III systems, it is not necessary to change from the factory default setting (LUN=0).

To configure the LUN offset, type in a 1 at the Main Menu. If at any time you wish to cancel the command, type in a CTRL C. The command is aborted and the utility program returns to the Main Menu. If you type in <CR> with no value, the parameters remain unchanged.

To store changes permanently, enter the correct password, which is CMS.

Main Menu

1 = Configure LUN Offset

Select Option: 1

Present LUN offset = 0, Enter new value:

Save new configuration (Y or N)? Y

Enter password: CMS

Complete.

Chapter 5 SCSI Information

5.1 *SCSI Definitions*

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

Disconnect: The function that occurs when a target releases 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 a SCSI device. This address would normally be assigned and set in the SCSI device during system installation.

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

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

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

5.2 SCSI commands used by the CQS-23/T for TMSCP emulation are listed below.

SCSI Commands

<u>Code</u>	<u>Command Name</u>
00h	Test Unit Ready
01h	Rewind
03h	Request Sense
08h	Read
0Ah	Write
10h	Write Filemarks
11h	Space
12h	Inquiry
15h	Mode Select
19h	Erase
1Ah	Mode Sense
1Bh	Load/Unload

5.3 SCSI status codes used by the CQS-23/T:

SCSI Status

<u>Code</u>	<u>Status Name</u>
00h	Good
02h	Check Condition
08h	Busy

5.4 SCSI messages used by the CQS-23/T:

SCSI Messages

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

5.5

SCSI Single-Ended Signals

Pin assignments of the CQS-23/T SCSI Cable Connector (J2):

<u>Signal</u>	<u>Pin Number</u>
-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.

Appendix A Devices Supported by the CQS-23/T

All DEC-compatible products designed by CMS Enhancements, Inc. implement TMSCP (Tape Mass Storage Control Protocol). CMS supports its implementation of TMSCP beginning with the indicated version of the following operating systems.

<u>Operating System</u>	<u>Version</u>
VMS	4.0
Ultrix	1.2
UNIX/Berkeley	4.2

Tape Drives Supported by the CQS-23/T SCSI Host Adapter

09/08/1988

Exabyte	EXB-8200 8mm Helical Scan Tape Unit
Wangtek	1/4" streaming
Kennedy	1/4" streaming
Archive	1/4" streaming
CaliPer	1/4" streaming
Tandberg	1/4" TDC3600 series
Fujitsu	1/2" Pending qualification

Appendix B

Using the EXABYTE EXB-8200 Tape Unit with CMS Controllers

If you are configuring more than one tape unit or multiple initiators, or moving a unit from another system, you will need to adjust the SCSI ID configuration of the tape accordingly. This is done by setting the appropriate configuration into SW1, located on the tape unit back panel.

<u>SW1-1</u>	<u>SW1-2</u>	<u>SW1-3</u>	<u>SCSI ID</u>
OFF	OFF	OFF	0
ON	OFF	OFF	1
OFF	ON	OFF	2
ON	ON	OFF	3
OFF	OFF	ON	4
ON	OFF	ON	5
OFF	ON	ON	6
ON	ON	ON	7

If you are installing additional tape units, the SCSI terminator packs should be removed from all units except for the last unit on the SCSI bus. These terminators are located on the back panel, next to the SW1, and are labeled U16 and U17.

Indicators

During power-up initialization, the amber and green LEDs are both turned on, indicating that the EXB-8200 is performing self tests. The time required to complete self tests is 120 seconds maximum. When diagnostics are complete, both LEDs are turned off. If the self tests fail, both the amber and green LEDs flash off and on.

Operation

1. Ensure the write protect tab on the data cartridge has been set correctly for the desired operation (tab to the left is write protected, to the right is write enabled).
2. If the tape access door is closed, press the unload switch to open the drive door.
3. Insert the data cartridge, label side up, with the cartridge lid facing towards the drive.
4. Gently close the drive door. The cartridge loads automatically.
5. Press the load/unload button to load the tape. The green LED lights up indicating that the drive is loaded and ready.
6. After the desired operation is complete, unload the data cartridge by pressing the unload switch, or by dismounting the unit logically from the operating system (unless the No Unload command has been issued).

Appendix C CMS Enhancements Product Warranty

CONTROLLER WARRANTY - CMS Enhancements, Inc. warrants products of its manufacture to be free from defects in material and workmanship for a period of one year from date of shipment.

CABLE WARRANTY - All CMS Enhancements, Inc. provided cables are warranted for ninety (90) days from the time of shipment.

The above warranties shall not apply to expendable components such as fuses, bulbs, and the like, nor to connectors, adaptors, and other items not a part of the basic product. CMS Enhancements, Inc. 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 of 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. The sole obligation of CMS Enhancements, Inc. 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 CMS Enhancements, Inc. and installation of its replacement.

THE EXPRESSED WARRANTIES SET FORTH IN THIS AGREEMENT ARE IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING WITH LIMITATION, ANY WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, AND ALL SUCH OTHER WARRANTIES ARE HEREBY DISCLAIMED AND EXCLUDED BY CMS ENHANCEMENTS, INC. THE STATED EXPRESS WARRANTIES ARE IN LIEU OF ALL OBLIGATIONS OR LIABILITIES ON THE PART OF CMS ENHANCEMENTS, INC. FOR DAMAGES, INCLUDING BUT NOT LIMITED TO SPECIAL, INDIRECT, OR CONSEQUENTIAL DAMAGES ARISING OUT OF OR IN CONNECTION WITH THE USE OR PERFORMANCE OF THE PRODUCTS.

RETURNED MATERIAL - Warranty claims must be received by CMS Enhancements, Inc. within the applicable warranty period. A replaced product, or part thereof, shall become the property of CMS Enhancements, Inc. and shall be returned to CMS Enhancements, Inc. at Purchaser's expense. All returned material must be accompanied by a RETURN MATERIAL AUTHORIZATION (RMA) number assigned by CMS Enhancements, Inc.