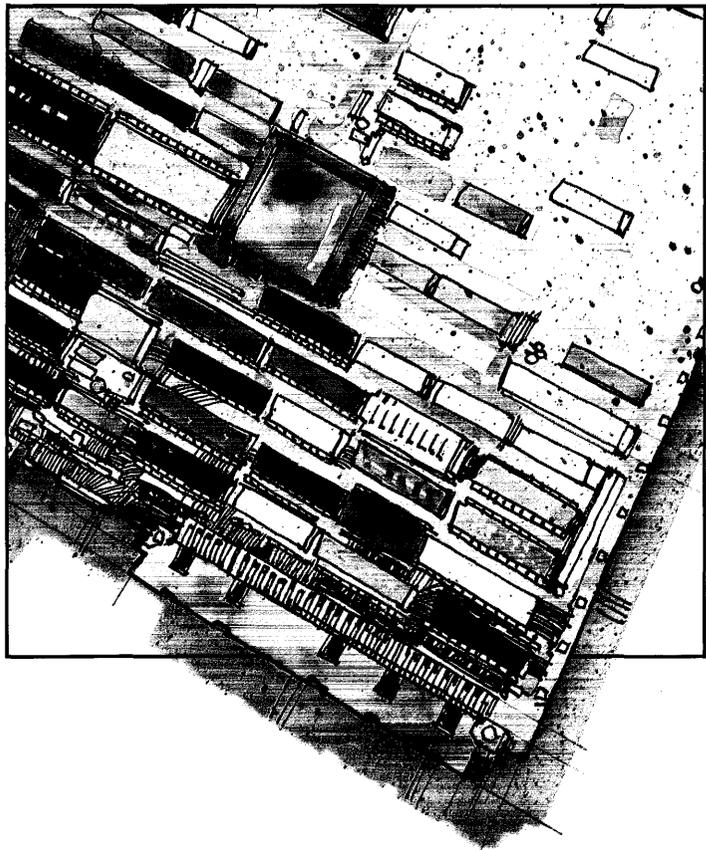


V/ESDI 4201 Panther SCSI PORT

User's Guide



INTERPHASE
CORPORATION

V/ESDI 4201 Panther
SCSI PORT

User's Guide

V/ESDI 4201 Panther
SCSI PORT FOR TAPE BACKUP
USER'S GUIDE

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**INTERPHASE APPLICATIONS ENGINEERING DEPARTMENT
(214) 350-9000**

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PREFACE

The V/ESDI 4201 Panther allows the user to not only control up to four ESDI disk drives, but also with the addition of the optional SCSI port, control up to seven SCSI tape backup units. This User's Guide is intended to serve as a reference document for the applications associated with only the SCSI port. Except where noted, the V/ESDI 4201 will function just as it does without the addition of the SCSI port. Therefore, it is necessary to first have an understanding of the Panther operation.

For information regarding the operation of the V/ESDI 4201 Panther, refer to the V/ESDI Panther 4201 User's Guide.

This manual is designed to supplement the V/ESDI 4201 User's Guide, and as such, applicable references are made to that document. The following information is provided in this User's Guide:

- Section 1** - Introduction
- Section 2** - Operation
- Section 3** - Specifications and Installation
- Appendix A** - SCSI Command Codes
- Appendix B** - Error Codes
- Index**

If you have any questions regarding the operation or features of the V/ESDI 4201 Panther SCSI Port, please call us at INTERPHASE. We would be happy to answer any questions.

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SECTION 1

INTRODUCTION TO THE V/ESDI 4201 PANTHER SCSI PORT FOR TAPE BACKUP

OVERVIEW

The V/ESDI 4201 Panther is a high-performance ESDI disk controller. It is equipped with Interphase's proprietary BUSpacket Interface to increase DMA transfer rates to 30 MB/s and above. In addition, the V/ESDI 4201 Panther can be equipped with an optional SCSI port for tape backup. This addition enables the Panther to control not only four ESDI disk drives, but at the same time, control up to seven SCSI tape drives.

The V/ESDI 4201 has 128 Kbytes of on-board RAM; 16 Kbytes are used for a buffer between system memory and the tape drives. This buffer allows the V/ESDI 4201 to operate concurrent bus and tape operations. While the tape is processing transactions, the V/ESDI 4201 is reading/writing to/from the buffer to prepare for the next tape operation. This provides tape streaming on a command basis:

DATA TRANSFERS

Data transfers to/from the V/ESDI 4201 SCSI port are handled just like transfers to/from the ESDI disks. The V/ESDI 4201 functions as a full 32-bit data and address bus master. The V/ESDI 4201 SCSI tape backup command contains a pointer to the data in system memory and upon receipt of a command, the V/ESDI 4201 will become a bus master and handle all the DMA (direct memory access) transfers between the tape and system memory.

All command and status blocks for the V/ESDI 4201 SCSI tape backup can be read from or written to using 8- or 16-bit data transfers with the V/ESDI 4201 functioning as a slave device. Thirty-two bit wide long-word transfers are not supported for command and status transfers. Data transfers to or from the data buffer can be 16 or 32 bits, and are performed with the V/ESDI 4201 in bus master mode. System CPU access to Short I/O space is switch-selectable between supervisory and user, or supervisory only Short I/O accesses. The VMEbus address modifiers for this selection are 29 (Hex) and 2D (Hex), respectively.

SOFTWARE INTERFACE

The software interface to the V/ESDI 4201 SCSI tape backup is handled via command blocks and status blocks located in the Short I/O interface memory on the controller. The V/ESDI 4201 command parameter blocks are called Input/Output Parameter Blocks (IOPB). The IOPBs are high-level macro commands which simplify the software interface (e.g., Read, Write, Space Forward, etc.). The V/ESDI 4201 processor interprets the macro commands and handles all the necessary tasks to complete the command, thereby relieving the system CPU of tape handling tasks. The V/ESDI 4201 even supervises the DMA transfers of the data, so as not to burden the system CPU with the data transfers.

Parameters describing each tape unit are loaded via blocks of data referred to as the Unit Initialization Block (UIB). A copy of a UIB is stored in on-board memory and is presented to the controller with an initialize command. Default parameters are loaded upon power-up or reset.

Interrupts

HARDWARE INTERFACE

The physical interface between the V/ESDI 4201 SCSI tape backup and the tape transports is a 50-pin flat cable. All of the tape interface signals are also available on the VMEbus P2 connector, to allow for alternate connections via the backplane. The layout of the connector is shown in Section 3 of this user's guide.

SUMMARY OF FEATURES AND FUNCTIONS

- Software programmable interrupt levels (1-7).
- Software programmable drive parameters.
- Simple macro-level software interface; a powerful 68000 family processor relieves system CPU of tape handling tasks.
- Seven separate host interrupt vectors.
- Self-diagnostic reporting.
- Programmable 16- or 32-bit wide data transfers.
- SCSI compatible drive interface.
- Overlapped rewinds.
- Host interrupt on drive status change; useful for overlapped rewinds.
- Bus priority selectable from 0-3.
- A 16 Kbyte on-board data buffer memory.
- Addressing capability of 16-, 24-, or 32-bits.

SECTION 2

V/ESDI 4201 SCSI PORT OPERATION

OVERVIEW

All commands for the V/ESDI 4201 SCSI tape backup and status from the V/ESDI 4201 are transferred within the Short I/O address space of the VMEbus. The V/ESDI 4201 has a total of 256 bytes of Short I/O memory space that contains the SCSI Tape Status registers, the SCSI Command/Status Registers, a SCSI Input/Output Parameter Block (IOPB), and a SCSI Status Change Register (SCR), in addition to the ESDI control information.

The SCSI CSR (base address +100h) is associated with the IOPB which immediately follows the SCSI CSR in on-board Short I/O memory space. The IOPB contains a block of data for the command parameters such as buffer location, interrupt vector, and other control parameters. Output status fields are also present in the IOPB. The individual IOPB fields are described fully in the section titled, later in this User's Guide.

Each of the seven drives which may be present has its own Tape Status Register (TSR) which describes the status of the drive hardware. There is also a SCSI Status Change Register (SCR) which contains the unit number of the tape drive having a status change. The structures of the TSR and SCR are also described in this User's Guide.

ADDRESSING AND DATA TRANSFER MODES

Part of the VMEbus consists of a high-speed, asynchronous parallel data transfer bus (DTB). Each data transfer on the DTB involves a functional bus master and a functional bus slave. The V/ESDI 4201 will act as the bus master, moving data between the tape drive and system memory. The DTB is also used to transfer control information to the V/ESDI 4201 interface memory.

The interface memory space is shared by the V/ESDI 4201 and the system (host CPU). The system CPU can access this memory space through Short I/O addressing only. The addressing type is specified using a six-bit address modifier code, which also indicates the nature of the access. For example, address modifier 2D (hex) is commonly used to specify supervisory (restricted) Short I/O memory access and address modifier 29 (hex) is used to specify user (nonprivileged) Short I/O memory access. Address modifiers other than 29 or 2D are not allowed for V/ESDI 4201 Short I/O accesses.

The V/ESDI 4201 requires that all data transfers of control information, command parameters, and status that occur with the host CPU acting as the bus master must be done through the short (16-bit) address space. Address modifier 29 (hex) for user mode, or 2D (hex) for supervisor mode must be specified.

BUS MASTER MODE

In Bus Master mode, all data transfers are done with the V/ESDI 4201 as the VMEbus master. When data is to be transferred, the V/ESDI 4201 requests the bus at the request level set by the bus request level on-board jumpers. These jumpers are on-board the V/ESDI 4201 and apply to all V/ESDI 4201 bus requests, regardless of which port over which the transfer is to occur. When the V/ESDI 4201 is granted the bus, the data is transferred to or from system memory starting at the address specified in the IOPB (Buffer address, words five and six of the IOPB). When the transfer is complete, the V/ESDI 4201 releases the bus. An interrupt is generated at the end of the command, if enabled. A description of how to configure the bus request jumper block is shown in Section 5 of the V/ESDI 4201 User's Guide.

The data transfer mode is determined by the buffer memory type specified in IOPB word seven, upper byte. There are three memory types used by the V/ESDI 4201 for SCSI tape backup:

- 01 - V/ESDI 4201 Internal Memory (Initialization and Status Commands Only)
- 02 - 16-Bit Wide Data Transfer - (Bus Master Mode)
- 03 - 32-Bit Wide Data Transfer - (Bus Master Mode)

Memory types 02 and 03 are both used for Bus Master mode transfers. The only difference between these two memory types is the width of the VMEbus data transfer. With memory types of 02 and 03, a maximum of 64K blocks of four gigabytes each can be transferred with each IOPB. Memory type 01 is only used for command codes 86h and 87h. Refer to Appendix A for details of these commands.

The following diagram illustrates the data transfer process when memory type 02 or 03 is specified.

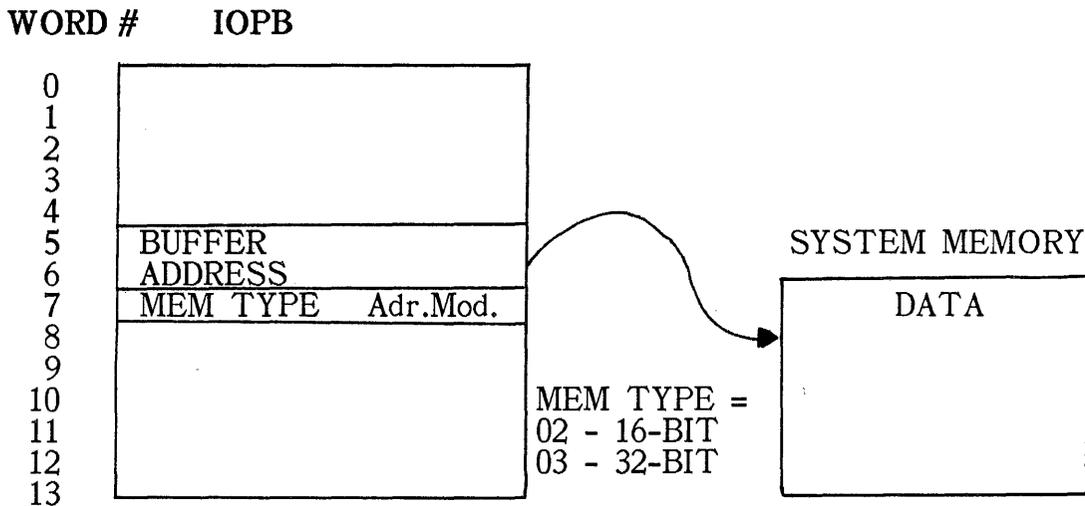


Figure 1. Data Transfer Diagram

STRUCTURE OF V/ESDI 4201 INTERFACE MEMORY

The V/ESDI 4201 interface memory acts as the software interface between the V/ESDI 4201 and the system. It contains the commands, parameters, and status information required to perform the tape operations. This memory can only be addressed by the system through the Short I/O space. The format of this interface memory without the SCSI port is shown in Figure 2 on the following page. The format of the V/ESDI 4201 with SCSI port interface memory is shown in Figure 3 on the following page. The remainder of this discussion will focus only on the interface memory of the V/ESDI 4201 with SCSI.

The V/ESDI 4201 interface memory is logically partitioned into two, 256-byte sections. The upper 256 bytes of memory are used for set up and control of the V/ESDI 4201 SCSI port. These 256 bytes contain the Command/Status Register and provide a storage area for the IOPB. In addition, there are seven Tape Status Registers and a SCSI Status Change Register. Each of these data structures is discussed in more detail in the following sections.

HEX OFFSET	EVEN/LOW BYTE	ODD/HIGH BYTE
000	DISK DRIVE 1 STATUS (2 UNIT)	DISK DRIVE 0 STATUS (2 UNIT)
002	COMMAND STATUS REGISTER	
004	COMMAND CODE	COMMAND OPTIONS
006	STATUS CODE	ERROR CODE
008	CYLINDER HIGH (LOG D31-24)	CYLINDER LOW (LOG D23-16)
00A	HEAD (LOG D15-8)	SECTOR (LOG D07-00)
00C	SECTOR COUNT HIGH	SECTOR COUNT LOW
00E	BUFFER ADDR (A31-24)	BUFFER ADDR (A23-16)
010	BUFFER ADDR (A15-08)	BUFFER ADDR (A07-00)
012	BUFFER MEMORY TYPE	BUFFER ADDRESS MODIFIER
014	4 UNIT DRIVE / INT LEVEL	NORMAL INT VECTOR
016	DMA BURST COUNT	ERROR INT VECTOR
018	IOPB PTR (A31-24)	IOPB PTR (A23-16)
01A	IOPB PTR (A15-08)	IOPB PTR (A07-00)
01C	IOPB MEMORY TYPE	IOPB ADDRESS MODIFIER
01E	ABSOLUTE SKEW	ENTRY COUNT
020 . 1F9	USER AVAILABLE MEMORY (1DA Bytes Available)	
1FA	DISK DRIVE 3 STATUS (4 UNIT)	DISK DRIVE 2 STATUS (4 UNIT)
1FC	DISK DRIVE 1 STATUS (4 UNIT)	DISK DRIVE 0 STATUS (4 UNIT)
1FE	OPTIONAL DISK STATUS CHANGE REGISTER	

Figure 2. V/ESDI 4201 Memory Format

HEX OFFSET	EVEN/LOW BYTE	ODD/HIGH BYTE
000	DISK DRIVE 1 STATUS (2 UNIT)	DISK DRIVE 0 STATUS (2 UNIT)
002	DISK COMMAND STATUS REGISTER	
004	COMMAND CODE	COMMAND OPTIONS
006	STATUS CODE	ERROR CODE
008	CYLINDER HIGH (LOG D31-24)	CYLINDER LOW (LOG D23-16)
00A	HEAD (LOG D15-8)	SECTOR (LOG D07-00)
00C	SECTOR COUNT HIGH	SECTOR COUNT LOW
00E	BUFFER ADDR (A31-24)	BUFFER ADDR (A23-16)
010	BUFFER ADDR (A15-08)	BUFFER ADDR (A07-00)
012	BUFFER MEMORY TYPE	BUFFER ADDRESS MODIFIER
014	4 UNIT DRIVE / INT LEVEL	NORMAL INT VECTOR
016	DMA BURST COUNT	ERROR INT VECTOR
018	IOPB PTR (A31-24)	IOPB PTR (A23-16)
01A	IOPB PTR (A15-08)	IOPB PTR (A07-00)
01C	IOPB MEMORY TYPE	IOPB ADDRESS MODIFIER
01E	ABSOLUTE SKEW	ENTRY COUNT
020 :	USER AVAILABLE MEMORY (0E0 Bytes Available)	
100	TAPE COMMAND STATUS REGISTER	
102	COMMAND CODE	COMMAND OPTIONS
104	STATUS CODE	ERROR CODE
106	BYTES/RECORD HI WORD	BYTES/RECORD HI WORD
108	BYTES/RECORD LO WORD	BYTES/RECORD LO WORD
10A	RECORD COUNT HI	RECORD COUNT LO
10C	BUFFER ADDR (A31-24)	BUFFER ADDR (A23-16)
10E	BUFFER ADDR (A15-08)	BUFFER ADDR (A07-00)
110	BUFFER MEMORY TYPE	BUFFER ADDRESS MODIFIER
112	INTERRUPT LEVEL	DMA BURST COUNT
114	NORMAL INT VECTOR	ERROR INT VECTOR
116	FILEMARK COUNT	RESERVED '0'
118	RESDL BYTES MSB HI WORD	RESDL BYTES LSB HI WORD
11A	RESDL BYTES MSB LO WORD	RESDL BYTES LSB LO WORD
11C	RESDL RECORDS MSB	RESDL RECORDS LSB
11E	RESERVED '0'	RESERVED '0'
120	USER AVAILABLE MEMORY (0C0 Bytes Available)	
1E0	TAPE DRIVE 0 STATUS REGISTER	
1E2	TAPE DRIVE 1 STATUS REGISTER	
1E4	TAPE DRIVE 2 STATUS REGISTER	
1E6	TAPE DRIVE 3 STATUS REGISTER	
1E8	TAPE DRIVE 4 STATUS REGISTER	
1EA	TAPE DRIVE 5 STATUS REGISTER	
1EC	TAPE DRIVE 6 STATUS REGISTER	
1EE	RESERVED '0'	
1F0	TAPE STATUS CHANGE REGISTER	
1F2	RESERVED '0' (008 Bytes)	
1FA	DISK DRIVE 3 STATUS (4 UNIT)	DISK DRIVE 2 STATUS (4 UNIT)
1FC	DISK DRIVE 1 STATUS (4 UNIT)	DISK DRIVE 0 STATUS (4 UNIT)
1FE	OPTIONAL DISK STATUS CHANGE REGISTER	

DISK
IOPBTAPE
IOPB

Figure 3. V/ESDI 4201 With SCSI Port Memory Format

HOW TO ISSUE A COMMAND

A typical command might request the V/ESDI 4201 to perform a tape function, such as write a specified number of records to tape.

Executing a tape function requires that the host build an IOPB and then set the Go/Busy bit in the SCSI Command/Status Register. A read-modify-write operation is suggested when setting the Go/Busy bit to avoid releasing the bus, but it is not mandatory for proper V/ESDI 4201 SCSI port operation. The V/ESDI 4201 will perform the operation, handle any error conditions and then update the IOPB, the TSR, and the CSR. The V/ESDI 4201 may also issue an interrupt (if enabled). The host can then read the updated status and the appropriate information in the IOPB. The interrupt is taken off the bus when the interrupt acknowledge cycle is performed in accordance with VME specifications. The host then clears the operation done interrupt bit in the CSR to acknowledge that the interrupt has been serviced. Figure 3 illustrates the timing sequence of this process.

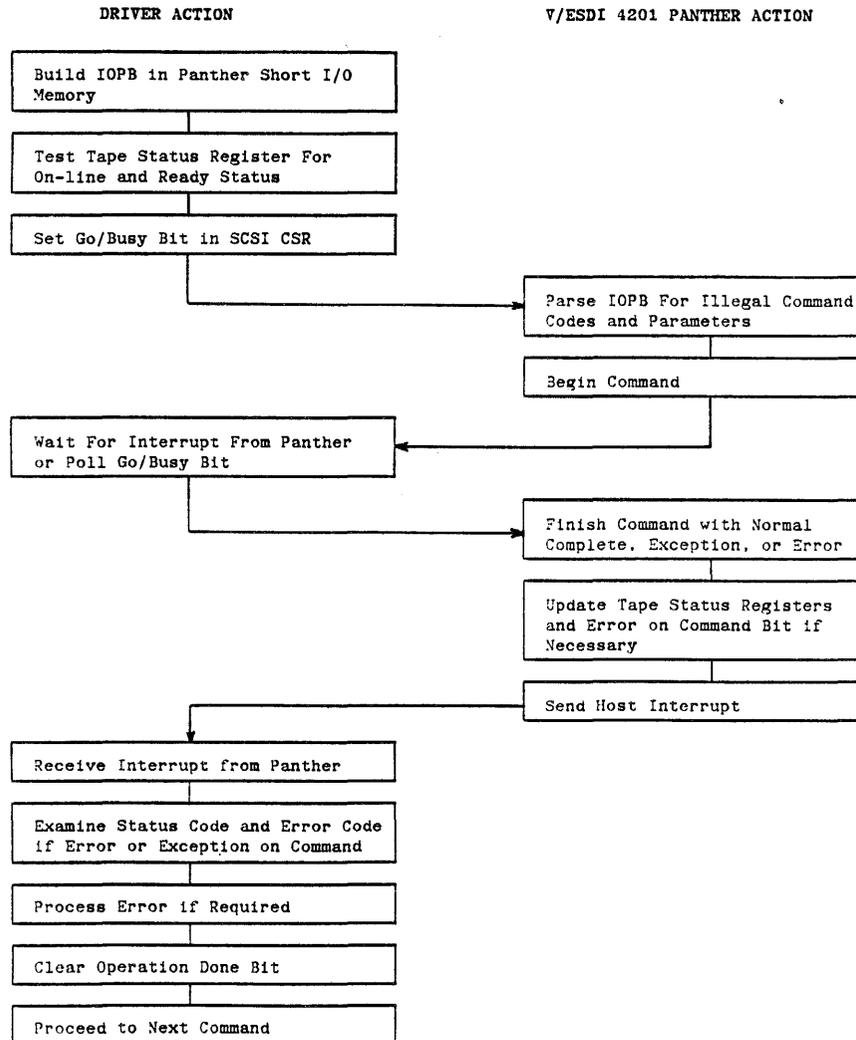


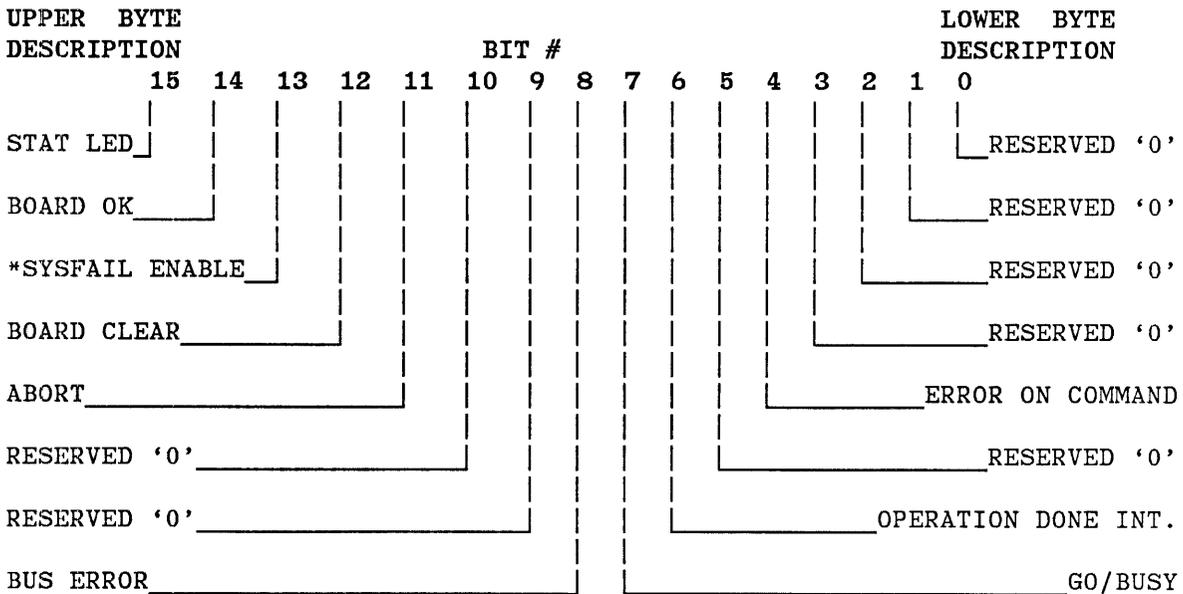
Figure 4. Command Execution Sequence

THE COMMAND/STATUS REGISTER

The Command/Status Register (CSR) is located in the first word of the second 256-byte page of Short I/O memory. The CSR is accessible both over the VMEbus and by the V/ESDI 4201. VMEbus access is through the Short I/O space. Both byte and word accesses to the CSR through the VMEbus are supported. Long word accesses to the CSR are not supported.

The Command/Status register (CSR) is used to initiate commands and report their status upon completion. Each CSR contains bits labeled "Go/Busy" and "Abort" that are used by the system to start and stop execution of a command contained in the associated IOPB.

The CSR also contains status bits that describe the following conditions: Bus Error, Busy, Operation Done and Error on Command. The Command/Status register bits can be physically read or written by both the system and the V/ESDI 4201, but certain bits are logically read only or write only. The Go/Busy bit is reset by the V/ESDI 4201, and the completion status of the command is posted in the Command/Status register (completed successfully or error occurred).



* - Denotes active low signal

Figure 5. Format of the Command/Status SCSI Register

NOTE

The control and status bits, bits 13 through 11, labeled BOARD OK, *SYSFAIL ENABLE, BOARD CLEAR, and ABORT control V/ESDI 4201 board level functions and are only present in the ESDI CSR located at the Short I/O base address +2.

- BIT 15 STATUS LED (SLED):** If the host sets SLED to '0' the on-board LED status indicator turns red. Setting this bit to a '1' turns the LED green, provided Board OK has been set by the V/ESDI 4201. SLED is written by the host CPU only.
- BIT 14 BOARD OK (BOK):** When set by the V/ESDI 4201 to '1', this bit indicates no board-detected faults and the LED will be green. If there is a board detected fault (BOK is '0'), the LED will be red. Upon power up, the BOK bit must be set and then cleared, or a Diagnostic command is issued, in which case the BOK bit is set and then cleared after the diagnostics complete successfully. The system CPU must set the SLED bit to turn the LED from red to green. If either BOK or SLED is '0', the LED will be red. This bit is written by the V/ESDI 4201.
- BIT 13 SYSFAIL ENABLE* (SFEN*):** Setting this bit active '0' enables a false value of Board OK ('0') to cause the SYSFAIL* signal to be asserted on the VMEbus. Resetting this bit to '1' disables the SYSFAIL* signal from V/ESDI 4201. This bit is written by the host CPU. The * symbol indicates an active low signal.
- BIT 12 BOARD CLEAR (BDCLR):** When the host CPU sets this bit to '1', and then to '0', a hardware reset is generated on the V/ESDI 4201 board. As long as this bit is set to a '1', V/ESDI 4201 will be held in reset. Following reset, the controller will execute it's power-up diagnostics. (Go/Busy in CSR 0 is set during execution of the diagnostics.) When finished, the Go/Busy bit in CSR 0 is reset and Board OK is set to '1', if the power-up diagnostics complete successfully, otherwise Board OK is set to '0'. The BDCLR bit is written by the host CPU. If this bit is set to a '1', then it must remain set for 50 microseconds before being set to '0' again.

- BIT 11 ABORT FROM HOST:** This bit stops execution of the current IOPB. This bit is written by the host CPU. Results from the IOPB in progress are undefined. When an IOPB is aborted, the Operation Done and Error on Command bits of the CSR for that IOPB are set. The abort bit is cleared by V/ESDI 4201, and a Status Code of 82 (hex), Error on Command, and an Error Code of 80 (hex), Command Aborted, are written to the IOPB. An error interrupt is presented to the host CPU, if enabled. If the V/ESDI 4201 is in queued IOPB mode, the other IOPBs in the queue are not affected.
- BIT 10 RESERVED:** (Must be zero.)
- BIT 9 RESERVED:** (Must be zero.)
- BIT 8 BUS ERROR (BERR):** When set by the V/ESDI 4201, this bit indicates a VMEbus error has occurred while V/ESDI 4201 was the Bus Master.
- BIT 7 GO/BUSY:** When set to '1' by the host CPU, this bit initiates command execution. When read by the host CPU, this bit serves as the busy indication, showing that the tape controller is currently executing a command. When the command is finished, this bit is reset to '0' by the V/ESDI 4201. When the host sets the Go/Busy bit to '1', it agrees not to change any CSR or IOPB parameters until the V/ESDI 4201 has cleared the Go/Busy bit. When the Go/Busy bit is set, bits six through zero in the CSR are not valid. However, they are valid when Go/Busy is reset. This bit is set by the system CPU and cleared by the V/ESDI 4201.
- BIT 6 OPERATION DONE INTERRUPT:** This bit is set to '1' by the V/ESDI 4201 when an operation has been completed. This bit should be cleared (set to '0') by the host CPU after servicing the interrupt from V/ESDI 4201. This bit must be cleared after the completion of every command, even if the host interrupt feature is disabled.
- BIT 5 RESERVED:** (Must be zero.)
- BIT 4 ERROR ON COMMAND:** This bit is set to '1' if an error occurred during execution of the last command. This bit is written by the V/ESDI 4201 and does not need to be cleared by the host.

NOTE

Bit six in the SCSI CSR and bit seven of the Status Change register are the interrupt bits. These bits are used to determine the type of interrupt and to acknowledge that the interrupt has been serviced. Bit six of the CSR is the Operation Done Bit, and bit seven of the SCR is the Status Change Interrupt bit. Drive and controller status is presented when one of these bits is set.

NOTE

Once an interrupt bit is set, the status registers will not change until the interrupt is acknowledged. This is done by resetting the interrupting bit in the SCSI CSR or SCSI SCR. The controller can then present status for the next interrupt (if one exists), or to go to the idle loop and resume polling the drives for a status change. If interrupts are disabled and the controller is being run in polled mode, the interrupt bit of the SCSI CSR must be reset before new status will be presented. The controller can stack up to ten interrupts in this manner.

BIT 3 **RESERVED:** (Must be zero.)

BIT 1 **RESERVED:** (Must be zero.)

BIT 0 **RESERVED:** (Must be zero.)

THE IOPB

Each SCSI IOPB consists of a 15-word structure. The IOPB must start at the base address plus 02, immediately after the V/ESDI 4201 SCSI Command/Status Register. The IOPB format is shown below in Table 1.

Table 1 - Format of IOPB

WORD #	<---UPPER BYTE--->	<---LOWER BYTE--->
0	COMMAND CODE	COMMAND OPTIONS
1	STATUS CODE	ERROR CODE
2	BYTES/RECORD HIGH WORD	BYTES/RECORD HIGH WORD
3	BYTES/RECORD LOW WORD	BYTES/RECORD LOW WORD
4	RECORD COUNT HIGH	RECORD COUNT LOW
5	BUFFER ADDRESS (A24-A31)	BUFFER ADDRESS (A16-A23)
6	BUFFER ADDRESS (A08-A15)	BUFFER ADDRESS (A00-A07)
7	BUFFER MEMORY TYPE	BUFFER ADDRESS MODIFIER CODE
8	INTERRUPT LEVEL (1-7)	DMA BURST COUNT
9	NORMAL COMPLETE INT. VECTOR	ERROR INTERRUPT VECTOR
10	FILEMARK COUNT	RESERVED '0'
11	RSDL. BYTES (MSB) HIGH WORD	RESIDUAL BYTES (LSB) HIGH WORD
12	RSDL. BYTES (MSB) LOW WORD	RESIDUAL BYTES (LSB) LOW WORD
13	RESIDUAL RECORDS (MSB)	RESIDUAL RECORDS (LSB)
14	RESERVED '0'	RESERVED '0'

IOPB COMMAND CODES AND OPTIONS

The command codes and options fields of the IOPB each take up eight bits of the first word of the IOPB. The command field is contained in the upper byte of the word and the command options field in the lower byte. For complete details of IOPB commands, refer to Appendix A.

Table 2. IOPB SCSI Tape Commands

CODE (hex)	COMMAND
81	READ n BLOCK(S) FORWARD
82	WRITE n BLOCK(S)
84	WRITE n FILEMARKS
86	HANDSHAKE
87	INITIALIZE
89	REWIND (TO LOAD POINT)
8A	REWIND QUICK
8D	MOVE FORWARD n BLOCKS
8E	MOVE BACKWARD n BLOCKS
91	MOVE FORWARD n FILEMARKS
92	MOVE BACKWARD n FILEMARKS
9C	ERASE TO EOT
A0	SCSI MODE SELECT

COMMAND OPTIONS

The command options field is the lower byte of word zero of the IOPB. The upper byte of this field is the command code field. The command options contain parameters and conditions used as part of the command execution. The bits of this field are delineated in the following figure.

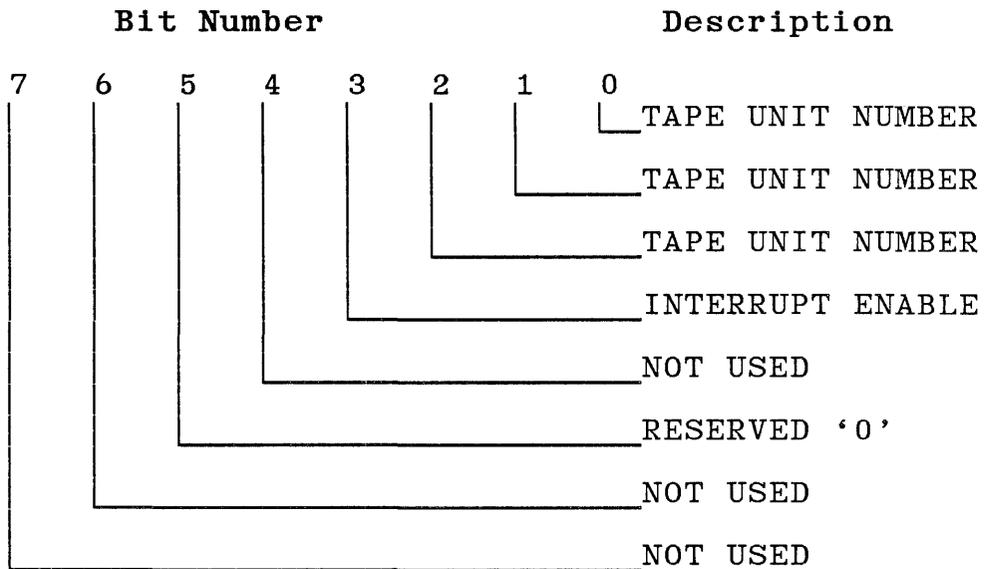


Figure 6. Command Options Byte Format

Each of the command option bits is defined on the following page.

Command Option Bits: (Word zero, lower byte)

BIT 7 NOT USED.

BIT 6 NOT USED.

BIT 5 RESERVED: (Must Be Zero.)

BIT 4 NOT USED.

BIT 3 INTERRUPT ENABLE: If set, this bit enables system interrupt when the operation completes.

BITS 2-0 TAPE UNIT NUMBER: The drive number is specified with bits two, one and zero. The least significant bit of the drive number is bit zero.

IOPB STATUS AND ERROR CODES

The status and error code fields of the IOPB are contained in word one of the IOPB. The command status field is the upper byte and the error code field is contained in the lower byte. After the command completes, there are three possibilities: command completed with no error, command completed with exception, or an error is posted.

No error indicates that the command completed normally and V/ESDI 4201 detected no errors. In this case, the error code field will be zero. A command completed with a status of exception indicates that the command was successfully completed but the V/ESDI 4201 encountered conditions that required some extra work, for example, rewriting a record. The error field should be checked for further information. A command completing with an error status indicates there was a problem with the command execution. The error code field should be checked.

The status and error code fields are not valid unless bit six, operation done interrupt, of the SCSI CSR is set to a '1'. Appendix B contains a list of error codes and a definition for each error code.

COMMAND STATUS CODES: (Word one, upper byte)

- 80 - Command Completed with No Error
- 81 - Command Execution in Progress (Busy)
- 82 - Command Completed with Error
- 83 - Command Completed with Exception

COMMAND ERROR CODES AND EXCEPTION CODES: (Word one, lower byte)**Error Codes (Status = 82h):**

See Appendix B for error codes.

DEFINITION OF IOPB PARAMETERS

The remaining IOPB words are used along with the the command/options word and the status/error code word to define specific operations to be performed. These parameters are used much the same way as parameters passed to a subroutine. They allow the command to be general purpose and give the programmer a wide range of values to tailor the command for the specific function to be performed. These parameters are defined in the following paragraphs. Their position is given referencing the first IOPB word as word zero.

Words 2 & 3 **BYTES/RECORD:** This 32-bit field allows the user to easily change the tape record size (bytes per record) when dealing with tapes with different record sizes.

Word 4 **RECORD COUNT:** This count specifies the number of records to be transferred. If there is an error, this field will indicate the number of records remaining to be transferred.

Words 5 & 6 **BUFFER ADDRESS:** The buffer address is the starting system memory address where the data is to be transferred to or from.

Word 7 **BUFFER MEMORY TYPE/BUFFER ADDRESS MODIFIER CODE:**

Memory Type: (Word seven, upper byte)

- 00** - Not Used (reserved)
- 01** - V/ESDI 4201 Internal Memory (Init. and Status Commands Only)
- 02** - 16-Bit (Word-Wide) Data Transfers (Bus Master Mode)
- 03** - 32-Bit (Long Word) Data Transfers (Bus Master Mode)

Address Modifier Codes: (Word seven, lower byte)

These are the VMEbus standard address modifiers. The address modifier is the mechanism used on the VMEbus to define the type of memory space being accessed. Any legal value (0-3F [hex]) may be issued.

Word 8 INTERRUPT LEVEL/DMA BURST COUNT:**Interrupt Level: (word 8, upper byte)**

This field specifies the interrupt level generated by the V/ESDI 4201 to the host. Valid levels are one to seven. An interrupt level of zero is never valid. To disable interrupts, set bit 3 of the Command Options byte to '0'.

DMA Burst Count: (Word 8, lower byte)

The DMA burst count is used in systems that are not using the VMEbus priority arbitration option, i.e., do not support BUSCLEAR. It specifies how many transfers V/ESDI 4201 performs before releasing the VMEbus and re-requesting it. If the DMA burst count equals zero, then the bus is not guaranteed to be released at any time during the record (block) unless BUSCLEAR is asserted. The burst count is independent of BUSCLEAR. Anytime BUSCLEAR is detected by the V/ESDI 4201 it will release the VMEbus upon completion of the current bus transfer.

The DMA burst count should be set to '0' in priority arbitration option systems, since the arbitrator will assert BUSCLEAR when a higher priority device requires the bus.

Word 9 NORMAL COMPLETION AND ERROR INTERRUPT VECTOR:**Normal Completion Interrupt Vector: (Word 9, upper byte)**

This vector will be returned during the interrupt acknowledge cycle for a normal completion.

Error Interrupt Vector: (Word 9, lower byte)

This is the vector to be returned if an error occurs. It may be the same as the normal completion interrupt vector.

Word 10 FILEMARK COUNT:

(Word 10, upper byte):

This count specifies the number of filemarks to be written during a Write Filemark command.

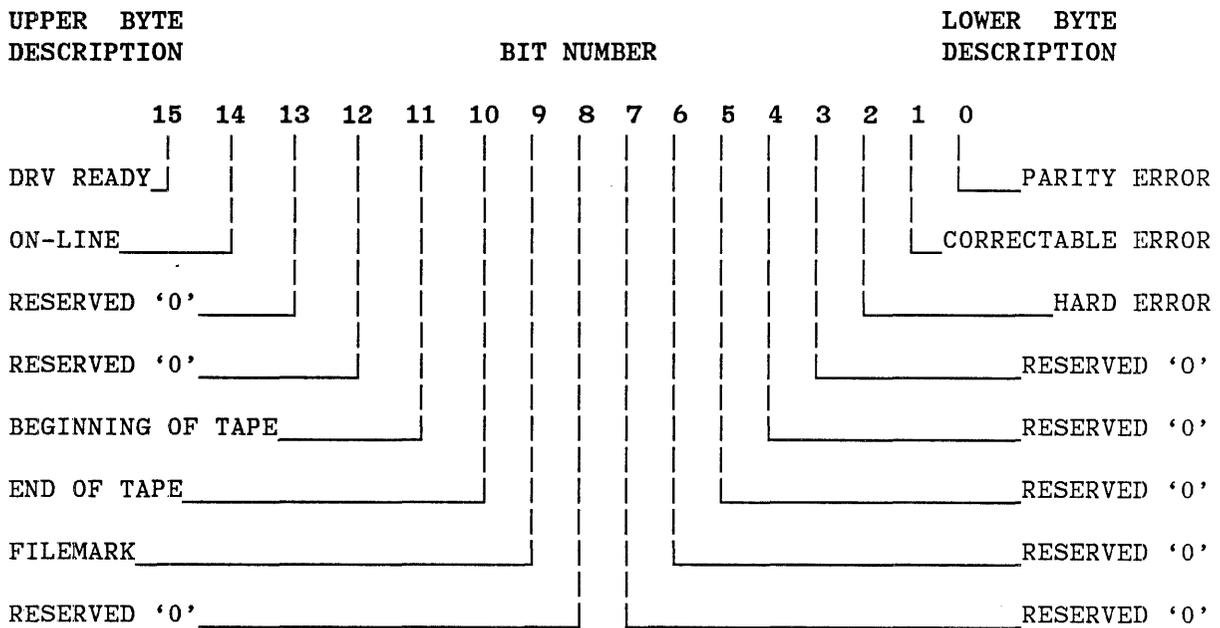
(Word 10, lower byte):

RESERVED (Must be zero.)

WORD 14 RESERVED

TAPE STATUS REGISTERS

There are two types of registers used for monitoring the status of the tape drives: seven Tape Status Registers, one for each possible tape drive, and one Status Change Register that is used to identify the tape unit that has undergone a status change. Tape status Registers are maintained by the V/ESDI 4201 and can be read by the host at any time. If more than one drive has a status change, the tape identifiers are written to the Status Change Register in FIFO order after each interrupt is serviced.



(opt) - Optional status provided by some drives.
 Note: 1 = true for all bits

Figure 7. Format of the Tape Status Register

Tape Status Register Bits

BIT 15 DRIVE READY: Unit is loaded and ready.

BIT 14 ON-LINE: Drive is on-line.

- BIT 13 **RESERVED:** This bit must be '0'.
- BIT 12 **RESERVED:** This bit must be '0'.
- BIT 11 **BOT:** Beginning of tape (Load Point) reported by the drive.
- BIT 10 **EOT:** End of tape was reported by the drive.
- BIT 9 **FILEMARK:** A filemark was detected on the tape.
- BIT 8 **RESERVED:** This bit must be '0'.
- BIT 7 **RESERVED:** This bit must be zero.
- BIT 6 **RESERVED:** This bit must be '0'.
- BIT 5 **RESERVED:** This bit must be '0'.
- BIT 4 **RESERVED:** This bit must be '0'.
- BIT 3 **RESERVED:** This bit must be zero.
- BIT 2 **HARD ERROR:** A hard error (uncorrectable) was reported by the formatter.
- BIT 1 **CORRECTABLE ERROR:** A data error was corrected by the formatter.
- BIT 0 **PARITY ERROR:** Parity error was detected by V/ESDI 4201 on a data read from the tape.

SCSI STATUS CHANGE REGISTER

The SCSI Status Change Register contains the three-bit (three least significant bits) drive identifier of the drive with a status change. This identifier consists of a one-bit formatter number and a two-bit unit number. If a status change has occurred, bit seven (Status Change interrupt) of the SCSI SCR is set to a '1'. The Status Change interrupt must be cleared by resetting this bit to '0'. All other bits in the SCSI SCR are '0'.

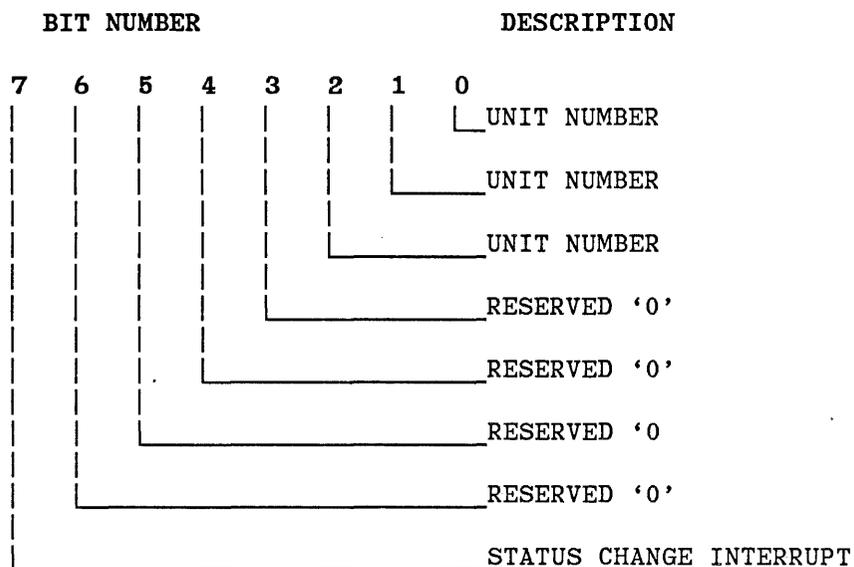


Figure 8. Format of the SCSI Status Change Register

INITIALIZING THE V/ESDI 4201 SCSI PORT

The function of the Initialize command is to present a Unit Initialization Block (UIB) to the V/ESDI 4201. The UIB is the data structure used to pass any nonstandard drive parameters to the V/ESDI 4201. Whenever the system is powered up, and/or when the V/ESDI 4201 is powered up or reset, operating parameters must be specified via the Initialize command (87h). A separate Initialize command is required for each ESDI disk drive and for each SCSI tape drive. This means that as many as 11 Initialize commands may be required. However, if default parameters (default UIB) are sufficient for any of the drives, no Initialize command is required for that drive.

The Unit Initialization Block is an 18-byte data structure containing various drive parameters. A full description of each of the parameters is given in the following section. If an Initialize command is not sent after power-up, then the default UIB parameters will be used by V/ESDI 4201. These default values are shown in Figure 11.

The Initialize command is sent just like any other V/ESDI 4201 command. The command code is set to a value of 87 (hex) and the SCSI command options byte, bits 0 through 2, are set to correspond to the unit number of the tape drive for which a UIB is being presented. Bit 3 of the SCSI command options byte will determine if a system interrupt will be generated after completion of the Initialize command. Words five and six of the IOPB must point to a VMEbus Short I/O address that is resident on the V/ESDI 4201. This address corresponds to the top address of the UIB being presented to the V/ESDI 4201. The buffer memory type field of the IOPB must be set to a value of 01, internal memory, and the address modifier code must be 29 or 2D (hex), since the UIB is located in the Short I/O memory space.

NOTE

Due to timeout considerations, when attempting to access nonexistent devices, the V/ESDI 4201 only polls drives that have been initialized. It is highly recommended that the controller only be initialized for as many drives as are present.

UNIT INITIALIZATION BLOCK (UIB)

There is one UIB per tape drive. The definitions of the individual bytes of the UIB follow. One initialize command is needed for each tape transport if the default UIB is not acceptable.

BYTE #	DESCRIPTION
0	RESERVED (Must be 0)
1	RESERVED (Must be 0)
2	RESERVED (Must be 0)
3	RESERVED (Must be 0)
4	RESERVED (Must be 0)
5	RESERVED (Must be 0)
6	RESERVED (Must be 0)
7	RESERVED (Must be 0)
8	RESERVED (Must be 0)
9	RESERVED (Must be 0)
A	RESERVED (Must be 0)
B	RESERVED (Must be 0)
C	RESERVED (Must be 0)
D	RESERVED (Must be 0)
E	ATTRIB - ATTRIBUTE FLAGS
F	RESERVED (Must be 0)
10	STATUS CHANGE INTERRUPT LEVEL FOR REWIND COMPLETE
11	STATUS CHANGE INTERRUPT VECTOR FOR REWIND COMPLETE
12	STATUS CHANGE INTERRUPT LEVEL
13	STATUS CHANGE INTERRUPT VECTOR

Figure 9. Unit Initialization Block Format

BYTES 0-D RESERVED: (Must be zero.)

BYTE E ATTRIBUTES FLAG: The bits in the attribute flags are defined below.

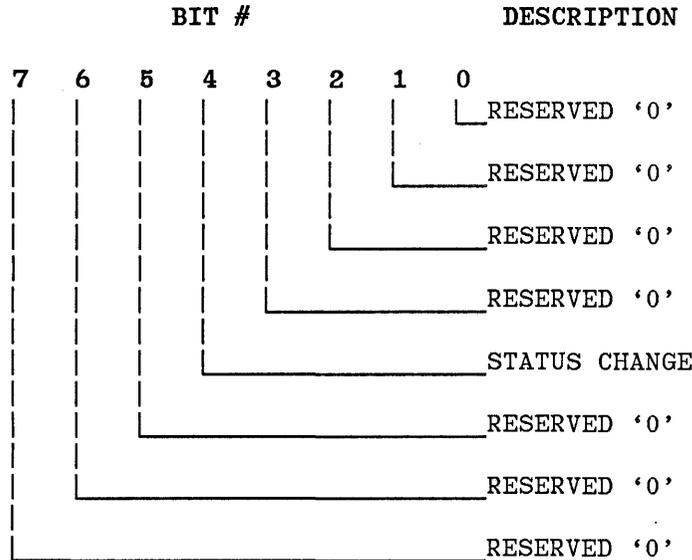


Figure 10. UIB Attributes Flag Format

BITS 7-5 RESERVED: (Must be zero.)

BIT 4 STATUS CHANGE: If set to a '1', enables interrupt when any unit's status changes (ready to not ready, rewind complete, on-line to off-line), except for write protect.

BITS 3-0 RESERVED: (Must be zero.)

BYTES 10, 11 STATUS CHANGE INT. LEVEL / VECTOR FOR REWIND:
 Bytes 10 and 11 are the interrupt level and interrupt vector for a "rewind complete" status change. Valid Interrupt levels are one through seven.

BYTES 12, 13 STATUS CHANGE INTERRUPT LEVEL / VECTOR: Bytes 12 and 13 are the interrupt level and the interrupt vector for any status change other than rewind complete (on-line, off-line, ready, and not ready). Valid interrupt levels are 1 through 7.

DEFAULT UIB

The default UIB is initialized internally upon power-up or reset (hardware or software). The default UIB is set up for a typical SCSI tape transport. The default UIB provides information needed to use a drive. If the default UIB is acceptable for use, the V/ESDI 4201 SCSI tape backup need not be initialized before use.

UIB BYTE #	CONTENTS (HEX)	DEFAULT SETTING
0	0	- Reserved
1	0	- Reserved
2	0	- Reserved
3	0	- Reserved
4	0	- Reserved
5	0	- Reserved
6	0	- Reserved
7	0	- Reserved
8	0	- Reserved
9	0	- Reserved
A	0	- Reserved
B	0	- Reserved
C	0	- Reserved
D	0	- Reserved
E	0	- Attributes: No Status Change Ints.
F	0	- Reserved
10	1	- Level 1 Interrupt for Rewind Complete
11	FF	- Vector = 255
12	1	- Level 1 interrupt any other Status Change
13	FE	- Vector = 254

Figure 11. Default UIB Definition

SECTION 3
SPECIFICATIONS AND INSTALLATION

VMEbus SPECIFICATIONS:

DTB Master :	A32, D16, D32 DMA Transfers
DTB Slave :	A16, D8, D16 (Commands & Status)
Requester :	Any of R(0-3), Static
Interrupter :	Any of I(1-7), Dynamic
Peripheral Data Rate :	Up to 24 Mbits/s

ENVIRONMENTAL SPECIFICATIONS:

Operating Temperature :	32-131 deg. F (0-55 deg. C)
Max. Relative humidity :	10-90% noncondensing

ELECTRICAL SPECIFICATIONS:

Power :	1.0 A max @ +5V DC ($\pm 5\%$)
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MECHANICAL SPECIFICATIONS:

Length :	3.50 inches
Width :	3.00 inches
Thickness :	.063 inches
Weight :	2.70 ounces

SCSI SPECIFICATIONS:

Data Transfer Rate :	
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PRELIMINARY INSTALLATION PROCEDURES

Before V/ESDI 4201 SCSI tape backup operation can begin, the V/ESDI 4201 Panther board must first be configured for the specific system in which it resides. Configuring the board consists of setting the starting base address, setting the address modifier, indicating EPROM size, selecting bus priority, and indicating which I/O connectors will be used.

Each of the options is selectable via either jumper or switch on board the V/ESDI 4201 Panther. For details of specific jumper and switch setting, refer to Section 5 of the V/ESDI 4201 User's Guide.

INSTALLATION

Once the V/ESDI 4201 is properly configured, carefully install the SCSI daughter card onto the board at J6 and J7 (see Figure 9). Insure that the 50-pin SCSI drive connector is oriented at the top of the V/ESDI 4201 board. Improper orientation of the SCSI daughter card could result in board and/or drive damage. See Figure 12 on the following page for details.

W A R N I N G

When installing the V/ESDI 4201 SCSI daughter card, ensure that all tape drive cables are plugged in correctly. Plugging drive cables in backwards or into the wrong connector could damage the board and/or the drive.

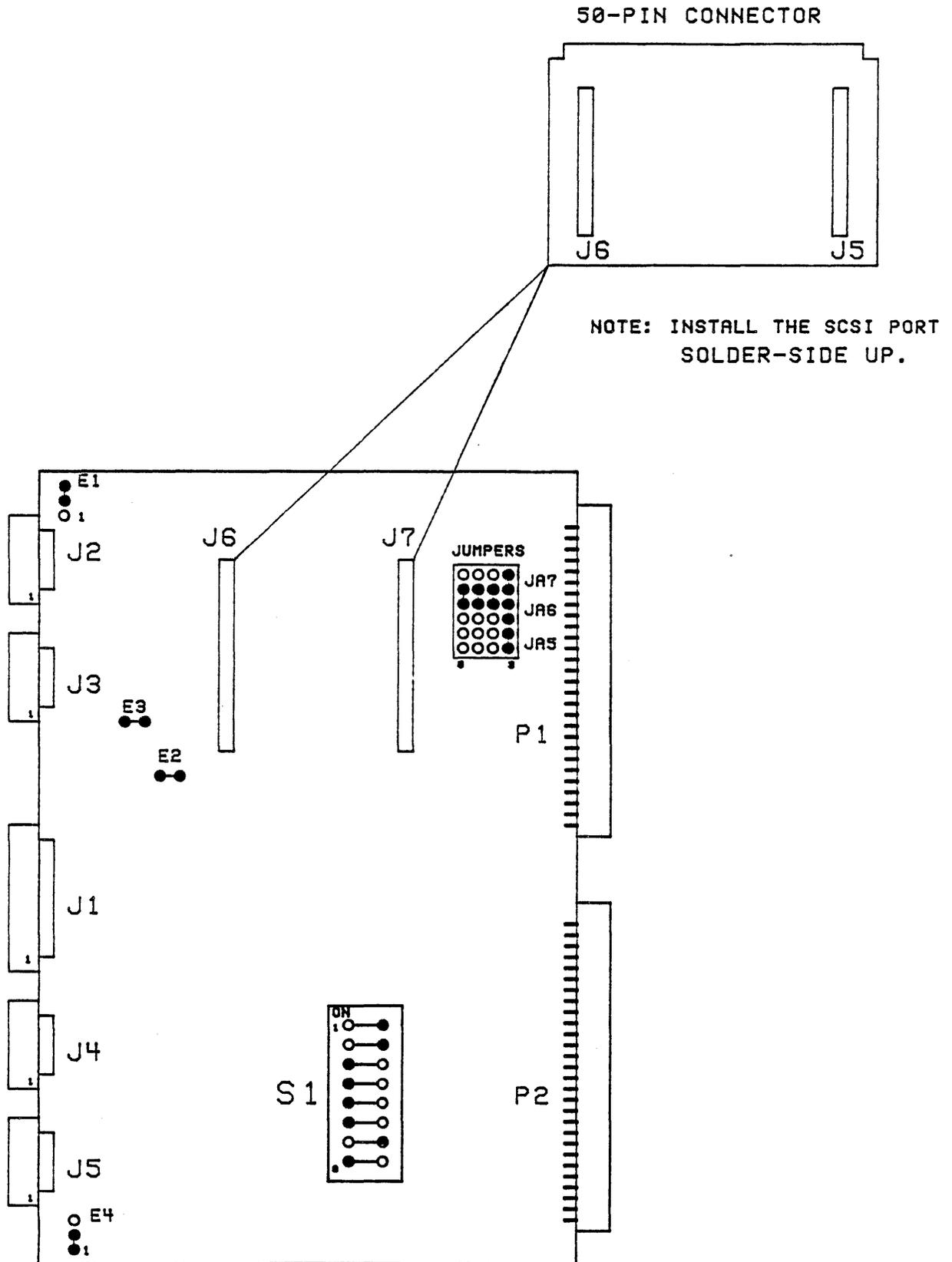


Figure 12. V/ESDI 4201 Panther and SCSI Port Board Layout

Table 3 - VMEbus P2-A Connector*

Pin Number	Signal Name**
1	GND
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	SEL
14	BSY
15	REQ
16	MSG
17	I/O
18	ATN
19	RST
20	ACK
21	C/D
22	DB0
23	DB1
24	DB2
25	DB3
26	DB4
27	DB5
28	DB6
29	DB7
30	DBP
31	+12V
32	GND

* All signals associated with the V/ESDI4201 SCSI port are directed to Row A of VMEbus P2 (when using P2 for the connections).

** If a signal is not listed, then that pin is not used.

Table 4 - 50-Pin SCSI Connector

Pin Number	Signal Name*
2	DB0
4	DB1
6	DB2
8	DB3
10	DB4
12	DB5
14	DB6
16	DB7
18	DBP
20	GND
22	GND
24	GND
26	TRMPWR
28	GND
30	GND
32	ATN
34	GND
36	BSY
38	ACK
40	RST
42	MSG
44	SEL
46	C/D
48	REQ
50	I/O

* All odd-numbered pins are connected to ground.

** All signals except TRMPWR are active low.

APPENDIX A
COMMAND CODES

IOPB COMMANDS

Table 5. IOPB SCSI Tape Commands

CODE (hex)	COMMAND
81	READ n BLOCK(S) FORWARD
82	WRITE n BLOCK(S)
84	WRITE n FILEMARKS
86	HANDSHAKE
87	INITIALIZE
89	REWIND (TO LOAD POINT)
8A	REWIND QUICK
8D	MOVE FORWARD n BLOCKS
8E	MOVE BACKWARD n BLOCKS
91	MOVE FORWARD n FILEMARKS
92	MOVE BACKWARD n FILEMARKS
9C	ERASE TO EOT
A0	SCSI MODE SELECT

COMMAND DEFINITIONS

Each V/ESDI 4201 SCSI port command is defined in ascending hexadecimal command code order. Some of the commands may be supported only on certain tape drives.

- 81 - READ n BLOCKS(S) FORWARD:** Read n Block(s) reads one or more blocks (records) from the specified tape transport and transfers the data to system memory. The transfer starts at the current tape position and the number of records transferred is determined by the record count in the IOPB. The V/ESDI 4201 will automatically transfer the data to system memory as a bus master.
- 82 - WRITE n BLOCK(S):** This command writes one or more blocks to a specified tape transport. The transfer starts at the current tape position and the number of blocks written is determined by the record count bytes in the IOPB. The V/ESDI 4201 will act as a bus master to DMA the data from system memory to the tape.

84 - **WRITE n FILEMARKS:** This command causes one or more filemarks to be written on the selected tape at the current position. The number of filemarks to be written is controlled with the Filemark Count byte of the IOPB.

86 - **HANDSHAKE:** Handshake is a diagnostic command used to verify the operation of the controller. When executed, this command returns product identification information in Words 2-7 (Bytes 4-D, hex) of the IOPB. Each byte is defined below:

Even, Low Byte

4 Product Code - 2SD and LSD(h)
6 Product Code - MSD(h) & Rev. - MSD(h)
8 Reserved - Must be all zeros
A Month - MSD & LSD(h)
C Year - MSD & 3SD(h)

Odd, High Byte

5 Product Variation (ASCII)
7 Rev. Level - 2SD & LSD(h)
9 Rsrv - Must be zeros
B Day - MSD & LSD(h)
D Year - 2SD & LSD(h)

MSD = most significant digit, LSD = least significant digit, 2SD = second most significant digit, and 3SD = third most significant digit.

87 - **INITIALIZE:** The Initialize command is used to initialize the V/ESDI 4201 with parameters that identify the type of tape transport being used. One Initialize command is required for each tape unit if the default UIB is not acceptable. Each tape unit must be initialized after power-up or system reset; however, the Initialize command may be issued at anytime. The UIB must be placed in the board's Short I/O space before the Initialize command is issued. If no Initialize command is issued, the default UIB parameters are used. See Section 2 of this User's Guide for more information.

89 - **REWIND:** This command will cause the specified drive to be rewound to the load point. A command complete will not be generated until the drive has completely rewound.

8A - **REWIND QUICK:** This command causes the specified drive to be rewound to load point. As soon as the tape is set in motion, command complete status is posted and a command complete interrupt generated (if enabled). A status change interrupt of rewind complete is generated (if enabled) when the tape reaches the load point.

- 8D - MOVE FORWARD n BLOCKS:** This command causes the specified tape to be moved forward a specified number of blocks. The number of blocks the tape is moved forward is determined by the record count bytes field in the IOPB. If an EOT is encountered before the move is complete, an error code of 20 (hex), EOT error, will be posted and the Residual Record Count field of the IOPB will show how many blocks were left when the EOT was encountered.
- 8E - MOVE BACKWARD n BLOCKS:** Move Backward n Blocks causes the specified tape to be spaced backwards n blocks, where n is the record count in the IOPB. If the load point is encountered before the move is complete, an error code of 21 (hex), load point, is presented in the IOPB and the Residual Record Count field of the IOPB will show how many blocks were remaining when the load point was encountered.
- 91 - MOVE FORWARD n FILEMARKS:** This command moves the specified tape drive forward over a specified number of filemarks. The number of filemarks moved is specified in the Filemark Count byte of the IOPB. If the EOT is encountered before the command completes. The number of filemarks remaining will not be posted, and the status will show an error code of 20 (hex), EOT error.
- 92 - MOVE BACKWARD n FILEMARKS:** The specified tape is spaced backwards n filemarks, where n is the Filemark Count in the IOPB. If the load point is encountered before the total number of filemarks is found, an error code of 21 (hex), load point error, will be posted in the error code byte of the IOPB.
- 93 - MOVE FORWARD TO EOT:** This command causes the specified drive to be spaced to the end of tape (EOT).
- 9C - ERASE TO EOT:** The specified tape is erased from the current position to the end of the tape.
- A0 - SCSI MODE SELECT:** This command allows the Host system to "pass through" a SCSI Mode Select Command to a particular SCSI device. This provides a means of changing recording density, tape speed, etc. The data beginning at IOPB bytes 4 through 15 is sent to the selected SCSI drive during the data phase of the SCSI Mode Select command. For a description of Mode Select data, refer to the drive manual.

APPENDIX B
ERROR CODES

APPENDIX B
ERROR CODES

CODE
(Hex)

- 10 TAPE NOT READY**
The tape's ready signal output is tested at the beginning of any command requiring tape movement. Error "10" is posted if the tape is not ready.
- 11 INVALID BLOCK SIZE**
The data written on the tape is formatted in a block size different than that being requested.
- 12 UNDEFINED SCSI ERROR**
The SCSI drive reported an error, but none of the error bits obtained from the drive were set.
- 14 INVALID COMMAND CODE**
The command code, byte 0 in the IOPB was not valid.
- 16 INVALID UNIT**
The unit number specified in the the IOPB was seven or greater. Only units zero through six are valid.
- 17 ILLEGAL MEMORY TYPE**
The memory type specified for the buffer address or IOPB address is illegal.
- 18 BUS TIME OUT**
A bus block transfer was not completed within one second after a request.

- 1A TAPE WRITE PROTECTED**
Posted when attempts are made to write to a tape that is write protected.
- 20 END OF TAPE**
A Multiblock transfer or movement exceeded the end of the tape.
- 21 LOAD POINT ERROR**
A multiblock movement encountered the load point before completion.
- 23 UNCORRECTABLE ERROR**
Error correction was attempted by the tape drive on the data field and the error was found to be uncorrectable.
- 25 READ LONG ERROR**
A tape block was read and it was longer than expected. Only the number of bytes specified in the IOPB are transferred. Only the Residual Records Count is valid.
- 26 SHORT READ ERROR**
A tape block was read and transferred, but it was shorter than expected. The count of remaining bytes to be transferred is in the Residual Byte Count of the IOPB. The count of the remaining records to be transferred is in the Residual Record Count of the IOPB.
- 27 SHORT READ ERROR W/NO TRANSFERS**
A tape block was read and was shorter than expected. The count of the remaining bytes to be read is in the the Residual Byte Count of the IOPB. The count of the remaining records to be read is in the Residual Record Count of the IOPB. No data has been transferred to system memory.
- 52 VME BUS ERROR**
The VMEbus system controller activated the BUS ERROR signal during a transfer by V/ESDI 4201.

- 58 FIFO ERROR**
An internal hardware error occurred on the V/ESDI 4201 causing the data buffer to overflow or underflow. This will only happen if the V/ESDI 4201 cannot access the bus for very long periods of time.
- 5A INVALID ADDRESS MODIFIER**
An invalid value (greater than 3F) was detected in the address modifier field of the IOPB. See the VMEbus specification for valid (not reserved) address modifier codes.
- 5B INVALID MEMORY ADDRESS**
An invalid value was detected in the Memory Buffer address field of the IOPB. Only memory addresses starting on word boundaries are supported.
- 5C INVALID INTERRUPT LEVEL**
An invalid value was detected in the interrupt level field of the IOPB; one to seven are valid values.
- 5D ILLEGAL DMA BURST COUNT**
The DMA burst count specified was not within the valid range. Valid values are 8 to 255, or zero for a VMEbus system using priority arbitration.
- 61 DMA FAILED**
A bus error occurred during the DMA transfer of data.
- 63 TAPE TIMEOUT**
The specified tape drive did not respond properly to a command in a calculated period of time. Usually, this error is caused because the tape drive is not turned on.
- 64 INVALID IOPB PARAMETER**
An invalid parameter was found in the IOPB, other than the parameters covered by error codes 52-5D, or 65.

- 65 **INVALID RECORD SIZE**
The bytes per record field of the IOPB contains an odd byte count; only even counts are supported. This error will also be reported if the bytes per record field in the IOPB is larger than the buffer size when a Write Data Buffer command is issued.
- 66 **ILLEGAL TRANSFER SIZE**
A tape block size of less than 16 bytes was issued in the IOPB.
- 68 **FILEMARK ENCOUNTERED**
A filemark was unexpectedly found during a read or a tape movement command.
- 70 **TIME OUT ON REWIND**
The selected drive did not return proper status within 500 milliseconds after the Rewind command was issued.
- 71 **REWIND NOT ACCEPTED**
The selected drive did not acknowledge a rewind command from the controller.
- 80 **COMMAND ABORTED**
The Abort bit of the CSR was set during command execution.
- 91 **RECOVERED ERROR**
The last command completed successfully with some recovery action performed by the target. Details may be determined by examining the additional sense bytes and the information bytes.
- 92 **NOT READY**
The logical unit addressed cannot be accessed. Operator intervention may be required to correct this error.

- 93 MEDIUM ERROR**
The command terminated with a nonrecovered error condition that was probably caused by a flaw in the medium or an error in the recorded data. This sense key may also be returned if the target is unable to distinguish between a flaw in the medium and a specific hardware failure.
- 94 HARDWARE ERROR**
The target detected a nonrecoverable hardware failure (for example, controller failure, device failure, parity error, etc.) while performing the command or during a self-test.
- 95 ILLEGAL REQUEST**
There was an illegal parameter in the command descriptor block or in the additional parameters supplied as data for some commands (FORMAT UNIT, SEARCH DATA, etc.). If the target detects an invalid parameter in the command descriptor block, then it will terminate the command without alerting the medium. If the target detects an invalid parameter in the additional parameters supplied as data, then the target may have already altered the medium.
- 96 UNIT ATTENTION**
The removable medium may have been changed or the target has been reset.
- 97 DATA PROTECT**
A command that reads or writes the medium was attempted on a block that has been protected. The read or write operation is not performed.
- 98 BLANK CHECK**
A write-once-read-multiple device or a sequential access device encountered blank medium or format-defined end-of-medium indication while reading, or a write-once-read-multiple device encountered a nonblank medium while writing.
- 99 VENDOR UNIQUE**
This error code is available for reporting vendor unique error conditions. Refer to sense key 9 in the drive's Request Sense data.

9B ABORTED COMMAND

The target aborted the command. The initiator may be able to recover by trying the command again.

9D VOLUME OVERFLOW

A buffered peripheral device has reached the end-of-medium indication and data remains in the buffer that has not been written to the medium.

9E MISCOMPARE

The source data did not match the data read from the medium.

A2 SCSI CHECK CONDITION

During command execution, a check condition was reported by the drive. As a result, the V/ESDI 4201 issued a Request Sense command that the drive also returned a check condition to. This usually indicates a hardware failure on the drive.

A8 DRIVE BUSY

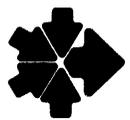
The selected drive is busy with a previous operation.

B8 RESERVATION CONFLICT

The selected drive has already been selected by another SCSI initiator.

C0-FF NONEXTENDED STATUS ERRORS

These error codes represent nonextended status errors which are defined by bits zero through five, of the first byte of a Request Sense command. The exact meaning of the error should be obtained from the drive manual.



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