cipher 3000i

INTERFACE SPECIFICATION

3830 Series
Half-Inch Cartridge
Tape Drive
Cipher Interface

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Chapter 1 General Description

1.0 INTRODUCTION

This manual provides information on the Cipher® Interface for the 3830 Series Half-Inch Cartridge Tape Drives.

This document, for brevity, refers to the Cipher model 3832 and the 3834 family of tape drives as the 3830 Series. The exact model number is used when specific model references are required. Detailed information on the Cipher Interface for both models is covered in the following chapters.

This chapter provides a general understanding of the functions performed by the Cipher Interface. A more detailed description of the electronic circuits, signals, and hardware components, referenced by physical task and location, is provided in Chapter 2.

1.1 CIPHER INTERFACE

The basic functions of the host computer interface are to translate and transfer data and commands from the host to the drive's control circuits and to return the resulting data and status signals.

The following paragraphs describe how the Cipher Interface monitors the commands from the host computer, determines whether they can be executed, and sets the appropriate signal lines to the drive's control circuits. As data and status information are made available by the drive, in response to commands, the Cipher Interface makes the data available to the host.

The Control Unit Electronics (CUE) Circuit Board, which connects to the Cipher Interface Circuit Board, initiates control sequences for all electrical and mechanical parts of the drive. Using Direct Memory Access (DMA), the CUE Board also controls data movement from Cache Memory to the Read/Write (R/W) Circuit Board and back through that path to the Cipher Interface.

The basic functions of the interface are illustrated in Figure 1-1. The signals shown on the right are exchanged with the host. The signal lines going to the left connect to the interface circuits on the CUE Board.

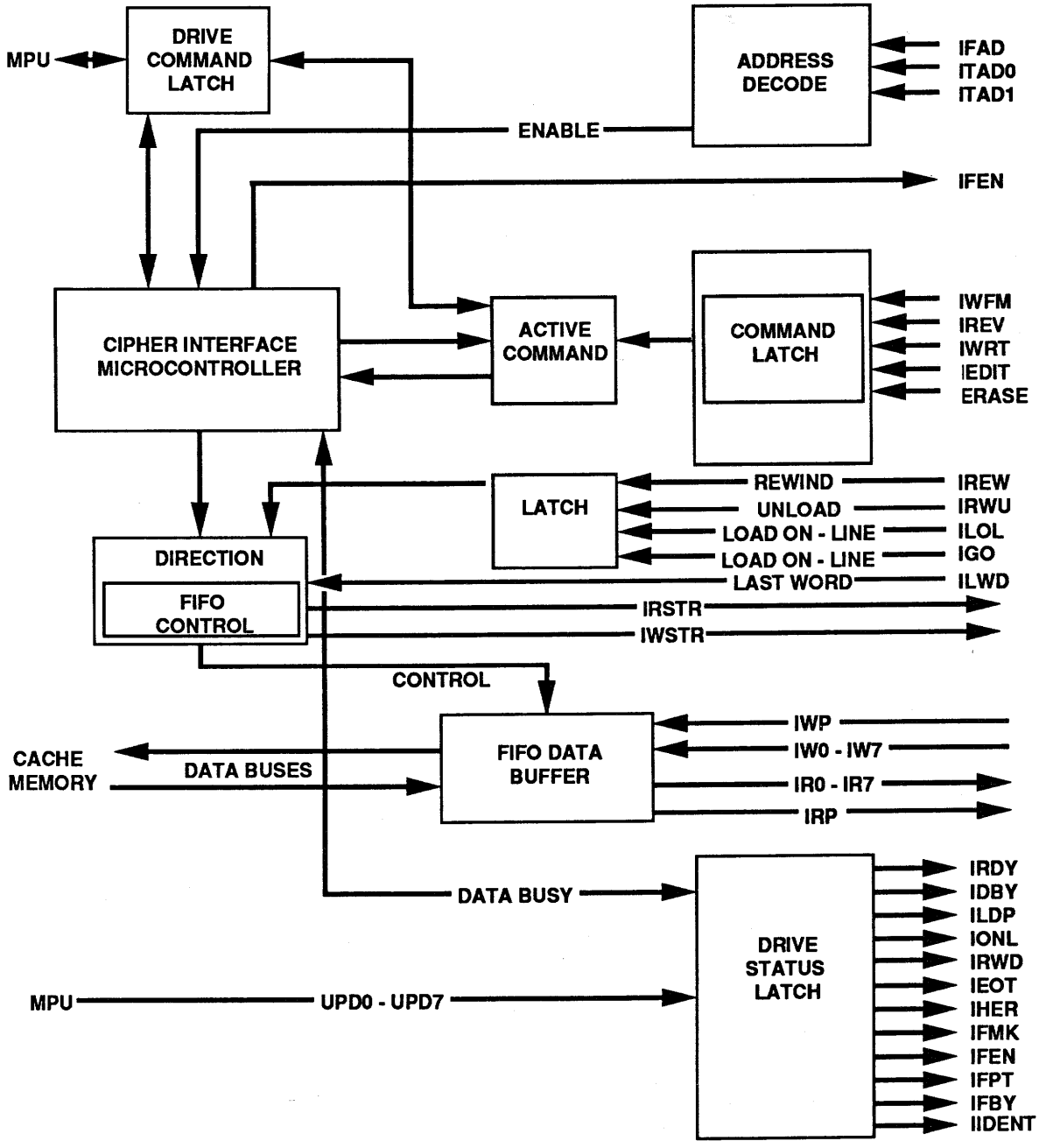


Figure 1-1. Block Diagram of the Cipher Interface

1.2 BASIC INTERFACE FUNCTIONS

The basic functions of the Cipher Interface are executed by its Microcontroller. The various functions of the Cipher Interface are described in the following paragraphs. The titled signal lines, shown in Figure 1-1, are defined in Chapter 2.

1.2.1 Microcontroller

An 8031 Microcontroller monitors commands from the host and translates them to the appropriate commands for the drive's control circuits. It also monitors the status of the drive and makes it available to the host.

Information transfers during read and write commands are done via FIFO (first-in-first-out) Data Registers. When data is being read from or written into the Cache Memory, the command/status transfer and the data transfer circuits function as two separate interfaces allowing both to operate at maximum speed.

The Microcontroller operates in four modes: Idle Loop, Active, Power-on Reset, and Timer 0 Interrupt.

1.2.1.1 Idle Loop Mode

When no other mode is active and there are no commands pending execution, the Microcontroller continuously polls the Command Latch and the Drive Command Latch.

1.2.1.2 Active Mode

The Microcontroller assumes the Active Mode while executing commands from the drive or the host.

1.2.1.3 Power-On Reset Mode

When the Power-On Reset Mode is activated, the Microcontroller executes a diagnostic routine that includes interconnecting the data buses for a back-to-back check. Then, it clears the Drive Status Latch, resets the interface, and goes to the Idle Loop Mode.

1.2.1.4 Timer 0 Interrupt Mode

When a Timer 0 Interrupt occurs, the Microcontroller checks for Data Busy (IDBY). If it is set, the Microcontroller stops the timer and checks for a Write command. If no Write command is present, or when the data transfer is started, the Microcontroller clears the interrupt and returns to the Idle Mode Loop. If Data Busy is not set, the Microcontroller sets Data Busy (IDBY), reloads the timer, and returns to the Idle Mode Loop.

1.2.2 Address Decode

The Address Decode circuits compare the state of the address lines from the host with the address set in the NVRAM of the CUE Board. If the lines match, an enable signal is passed to the Microcontroller.

1.2.3 Command Latch

When enabled by the Microcontroller, the state of the command signal lines is loaded into the Command Latch when the Go signal (IGO) is strobed by the host.

1.2.4 Drive Command Latch

The Drive Command Latch transfers commands to and from the drive's control circuits and the Cipher Interface.

1.2.5 Drive Status Latch

All changes to the drive's status are loaded into the Drive Status Latch. The status lines from the MPU on the CUE Board are decoded by a Programmable Array Logic (PAL) chip to establish the Cipher Interface signals required by the host.

1.2.6 FIFO Control

The FIFO Control circuitry receives its directions from the Microcontroller. The signals latched into the FIFO Control establish the direction of data flow through the FIFO Data Registers and enable the data to and from the host bus lines. Once initiated, data transfers to or from the Cache Memory can proceed without intervention by the Microcontroller.

1.2.7 FIFO Data Registers

The FIFO Data Registers consist of two sets of transfer registers that can be separately enabled to the host bus lines.

Chapter 2 Detailed Description

2.0 INTRODUCTION

This chapter provides a detailed description of the Cipher Interface.

2.1 CIPHER INTERFACE

The Microcontroller in the Cipher Interface monitors the commands and operations that pass through the interface and translates them to match the requirements of the drive's control electronics and the host. It also monitors the status of the drive and outputs the status, on command, to the host. Information transferred during read or write operations is done through first-in-first-out (FIFO) registers.

The following paragraphs describe the interface timing requirements and define the various signals exchanged between the interface and the host computer.

2.1.1 Interface Timing

The major timing considerations for the 3830 Series drives are the handshaking between the Cipher Interface and the host and the requirement to reinstruct the drive as quickly as possible to keep the drive in the streaming mode.

In order to maintain the drive in the streaming mode, the host must maintain a throughput of 480 kilobytes per second for the model 3832 and 960 kilobytes per second for the 3834. In addition, the Cipher Interface must be set for a faster burst rate than the desired throughput and the host must reinstruct the drive as quickly as possible. The higher the burst rate, the more time the host has available to reinstruct the drive.

2.1.2 Data Transfer Timing

The read and write data transfer timing depends on the Cipher Interface's Configuration Parameters. The selectable burst rates, listed below, are measured in kilobytes per second.

150 KB/sec	375 KB/sec	800 KB/sec
187 KB/sec	480 KB/sec	1200 KB/sec
250 KB/sec	600 KB/sec	

2.1.3 Host Interconnect Signals

The Cipher Interface and the host exchange data via two 50-pin connectors and a shielded interconnect cable. The signal lines, which may be grouped as follows, are described in the following paragraphs.

Address Select Lines
Data Transfer Lines
Acknowledge Signals
Command Signals
Status Signals

2.1.3.1 Address Select Lines

The host selects the tape drive for read and write operations using the three address select lines listed below. Only one drive, with the matching logical address, responds to the command associated with the address.

IFAD	=	Formatter Address
ITAD0	=	Tape Address bit 0
ITAD1	=	Tape Address bit 1

2.1.3.2 Data Transfer Lines

The host exchanges data for storage or retrieval on nine data write and nine data read lines. The data to be written to tape is received by the drive on an 8-bit bus (IW0-IW7) with its associated parity bit (IWP). The data read from the tape is returned on another 8-bit bus (IR0-IR7) with its associated parity bit (IRP)

2.1.3.3 Acknowledge Signals

When data, with the correct parity, is received on IW0-IW7 by the Cipher Interface, the receive acknowledge line (IWSTR) is strobed. The send active line (IRSTR) is strobed each time data is placed on IR0-IR7 for the host computer.

IRSTR	=	Read Strobe
IWSTR	=	Write Strobe

2.1.3.4 Command Signals

The host passes commands to the drive's Cipher Interface with the 10 command signal lines listed below. Each of the signal lines, when set individually, controls a specific function. The five signals marked with an asterisk (*), which are loaded into the interface when IGO goes low, may also be used in combinations that are decoded for special functions. How the individual and combined signals are used is described in Chapter 5.

IGO	=	Go strobe
IEDIT	*	Edit Command
IERASE	*	Erase Command
IREW	*	Rewind Command
IWFM	*	Write File Mark Command

IWRT	*	Write Command
ILWD	=	Last Word
IRWU	=	Unload Command
IREV	=	Reverse Command
IFEN	=	Formatter Enabled

2.1.3.5 Status Signals

The status of the drive is reported by the Cipher Interface using the signal lines listed below.

IDBY	=	Data Busy
IEOT	=	End Of Tape
IFBY	=	Formatter Busy
IFMK	=	Filemark Located
IFPT	=	File Write-Protected
IHER	=	Hard Error
ILDP	=	Tape at Load Point
IONL	=	Drive Online
IRDY	=	Drive Ready
IRWD	=	Rewinding Tape
IIDENT	=	Identification Burst

2.1.4 Terminator Resistors

Three terminator resistor packs provide impedance matching for the host interface cable when the drive is a stand-alone drive or is the last drive in a daisy chain. Figure 2-1 shows the location of the terminators (RP5, RP6, and RP7).

2.2 DAISY CHAIN OPERATION

2.2.1 Power-up Sequencing

When powering up the drive in a daisy chain configuration, the last drive in the chain (i.e., the drive with the terminator resistors) must be powered up first to ensure reliable operation. The intermediate drives can be powered up in any sequence.

2.2.2 Power Cycling

Cycling power to any drives in a daisy chain is not supported and can cause improper operation.

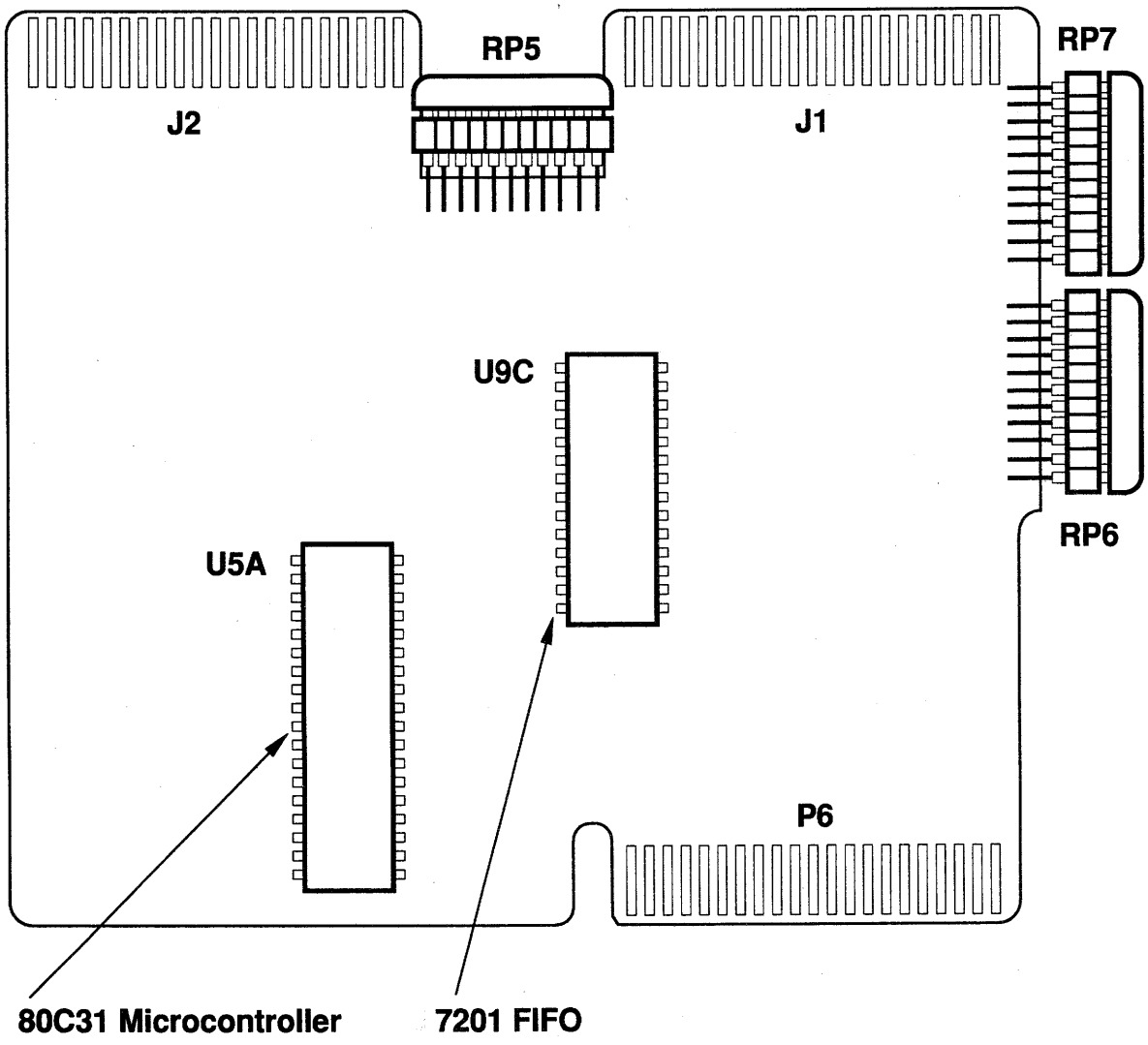


Figure 2-1. Cipher Interface Circuit Board

Chapter 3 Specifications

3.0 INTRODUCTION

The specifications listed here apply to the Cipher Interface.

3.1 REQUIRED HOST DATA THROUGHPUT

The following throughput rates are the minimum the host must maintain to ensure that the drive can keep the tape streaming.

Model 3832	480 kilobytes per second
Model 3834	960 kilobytes per second

3.2 HOST TIMING REQUIREMENTS

The host computer's interconnect cable interface must meet or exceed the following timing requirements.

IREW, IRWU, IGO	≥ 1 microseconds
IWRT, IWFM, etc. (stable until IGO goes false)	≥ 500 nanoseconds
IGO false to IWRT, IWFM, etc. (hold time)	≥ 0 nanoseconds
IDBY false to IGO true (new command)	≥ 0 nanoseconds

3.3 INTERFACE TIMING

The Cipher Interface complies with the following signal timing:

IREW true to IRWD true	≤ 1 microseconds
IREW true to IRDY false	≤ 1 microseconds
IRWU true to IONL false	≤ 1 microseconds
IGO false to IFBY true	≤ 1 microseconds
IFBY true to IDBY true (Ramp Delay disabled)	≥ 100 microseconds
IFBY true to IDBY true (Ramp Delay enabled)	≥ 850 microseconds
IDBY true to IWSTR true	≥ 100 microseconds
IDBY true to IRSTR true	≥ 100 microseconds
IDBY false to IFBY false	≥ 1 microseconds
IHER, IFMK true (Status pulse width)	≥ 1 microseconds

3.4 BURST AND R/W STROBE TIMING

The pulse timing for the signals listed below is based on the selected burst rate for the Cipher Interface. The duration of the true and false pulse cycles are expressed in nanoseconds and are accurate to ± 25 nanoseconds.

Burst Rate KB/sec	1200	800	600	480	375	250	187	150
IWSTR true	333	500	666	833	500	750	1000	1250
IWSTR false	500	750	1000	1250	2167	3250	4333	5417
IWx to IWSTR false*	100	100	100	100	100	100	100	100
IWSTR false to IWx†	0	0	0	0	0	0	0	0
IRSTR true	333	500	666	833	500	750	1000	1250
IRSTR false	500	750	1000	1250	2167	3250	4333	5417
IRx to IRSTR false*	250	400	600	750	250	400	600	750
IWSTR false to IWx†	100	200	280	350	1000	1000	1000	1000

*Data set up
†Data hold

Chapter 4 Installation and Configuration

4.0 INTRODUCTION

This chapter provides information for installing and configuring the Cipher Interface. The installation procedures described in this chapter must be performed in addition to the procedures for the tape drive.

4.1 INSTALLATION

4.1.1 Interconnect Cable

The Cipher Interface requires a shielded cable to connect the two 50-pin connectors of the drive to the host.

4.1.2 Terminator Resistors

If the drive is an intermediate drive in a daisy chain, the three Terminator Resistor packs at locations RP5, RP6, and RP7 on the Cipher Interface Circuit Board must be removed. The Terminator Resistors are identified in Figure 2-1.

4.2 CONFIGURATION

The drive's default configuration parameters are listed in Table 6-1 of the *3830 Series Half-Inch Cartridge Tape Drive Product Specification* (799916-001). Configuration parameters may be reviewed with the User Diagnostics and reset with the Customer Engineer (CE) Diagnostics.

The optional settings for the three parameters that are available only for the Cipher Interface are listed in Table 4-1.

Parameter	Optional Settings
Interface Parity	Parity
	No Parity
Transfer Rate	150 kilobytes per second
	187 kilobytes per second
	250 kilobytes per second
	375 kilobytes per second
	480 kilobytes per second
	600 kilobytes per second
	800 kilobytes per second
	1200 kilobytes per second
Ramp Delay	100 microseconds
	850 microseconds

Table 4-1. Cipher Interface Configuration Parameters

Chapter 5 Commands

5.0 INTRODUCTION

This chapter describes the command set of the Cipher Interface.

5.1 COMMANDS

The Cipher Interface commands are derived by decoding the IWRT, IWFM, IERASE, IREV, and IEDIT signal lines. The Rewind (IREW) and Unload (IRWU) signal lines are processed directly. If the interface receives an illegal command, the command is terminated with a Hard Error. Table 5-1 lists the command set.

Command	IREV	IWRT	IWFM	IEDIT	IERASE
Set Format 2	1	0	1	1	1
Set Format 4	1	1	0	0	0
Security Erase	0	1	1	1	1
Read Forward	0	0	0	0	0
Read Reverse	1	0	0	0	0
Read Extended Status	0	0	0	1	0
Current Status	0	0	0	0	0
Configuration Status	1	0	0	0	0
Error Log 1	0	0	0	1	0
Error Log 2	1	0	0	1	0
Error History Reset	1	0	0	1	1
Write	0	1	0	0	0
Write Synchronize	0	0	0	1	1
Write File Mark	0	1	1	0	0
Space Forward	0	0	0	0	1

Table 5-1. Cipher Interface Command Set (1 of 2)

Command	IREV	IWRT	IWFM	IEDIT	IERASE
Space Reverse	1	0	0	0	1
File Search Forward	0	0	1	0	X
File Search Reverse	1	0	1	0	X
Start Diagnostic Sequence	1	1	1	1	1
Transfer Write Data	0	1	0	0	0
Transfer Read Data	0	0	0	0	0
Transfer Response	1	0	0	0	0
Select Default Partition	1	0	1	1	0
Select Data Partition 1	1	1	1	1	0

Table 5-1. Cipher Interface Command Set (2 of 2)

5.1.1 Set Format 2/Set Format 4

The Set Format commands allow changing the tape format of the 4-track model 3834. The model 3832 drive can only use Format 2 and returns Error Code 03 if Format 4 is requested.

The drive automatically selects the correct format if a tape has previously been written to. If a requested format is not available or the tape is not at Logical Beginning of Tape (LBOT) or Physical Beginning Of Tape (PBOT), the drive sets an Error Code.

5.1.2 Security Erase

This command erases the tape from the current position to the Read End Of Partition for the current partition.

5.1.3 Read Forward

When the Read Forward command is received, the next record is sent to the host. Initially, the drive checks cache memory to see if the requested record is present. If not, the tape is positioned and the record is transferred into cache memory. When the record is complete, the data is transferred to the host.

5.1.4 Read Reverse

The Read Reverse command functions the same as the Read Forward Command except the drive reads the tape in the reverse direction.

5.1.5 Read Extended Status

The Read Extended Status command may be used to request any of four 16-byte records or reset the Buffered Error Log (BEL). To access the status records, the host must first set the Read Extended Status command to the interface. The interface then enters the Read Extended Status Mode and notifies the host it is ready by setting Data Busy (IDBY) and Formatter Busy (IFBY) low.

The second command must be one of the five codes – Current Status, Configuration Status, Error Log 1, Error Log 2, or Error History Reset – for the desired status or log. The 16-byte record is then transferred to the host as a normal read operation on the read data (IR0-IR7) lines. The Buffered Error Log (BEL) is unaltered unless the Error History Reset is used. If the command for Error History Reset is used, the 16 bytes for Error Log 2 are transferred, and the BEL is cleared and reset.

5.1.5.1 Current Status

The Current Status command returns the information in Table 5-2.

5.1.5.2 Configuration Status

The Configuration Status command returns the information described in Table 5-3.

Byte	Bit	Description
0		Tape Status
	7	IFPT
	6	IRWD
	5	IONL
	4	IRDY
	3	IFMK
	2	0
	1	IHER
	0	0
1		Tape Status
	7-2	0
	5	Illegal Command
	4	0
	3	Write Parity Error at Interface
	2	0
	1	IEOT
	0	ILDP
2		Cache Size 08h = 512K
3		Fault Symptom Code
4-5		0
6		Format Code
	7-6	0
	5-3	Current Format (010 = MSR-2; 011 = MSR-4)
	2-0	Last Format Requested (010 = MSR-2; 011 = MSR-4)
7		0
8-10		Current Block Position
11-15		0

Table 5-2. Current Status Response

5.1.5.3 Error Log 1

The Error Log 1 command returns the first 16-bytes of the Buffered Error Log (BEL).

5.1.5.4 Error Log 2

The Error Log 2 command returns the second 16-bytes of the Buffered Error Log (BEL).

Byte	Bit	Description
0		Capability
	7-4	0
	3	1 = MSR-4 Enabled
	2	1 = MSR-2 Enabled
	1-0	0
1		Vendor Code
2		Model Code
	7-5	0
	4	1
	3	0 = 3832 1 = 3834
	2-1	1
	0	0
3		Configuration
	7-5	0
	4	0 = Ramp Enabled 1 = Ramp Disabled
	3-2	11b = Maximum Block Size (64K)
	1	0 = Internal Parity 1 = External Parity
	0	0
4-15		0

Table 5-3. Configuration Status Responses

5.1.5.5 Error History Reset

The Error Log 2 command returns the second 16-bytes of the Buffered Error Log (BEL), then and resets it.

5.1.6 Write

When the Write command is sent to the Cipher Interface, the next block of data transferred on the write data (IW0-IW7) lines is stored in cache for subsequent recording to tape.

The host sets the Last Word (ILWD) signal line true when the last character is placed on the data lines to signal termination of the record.

5.1.7 Write Synchronize

When the Write Synchronize command is sent to the Cipher Interface, all data in the cache is written to the tape.

The Write Synchronize command is used to purge the cache before other tape handling is initiated. When received, all pending writes in cache are completed.

5.1.8 Write File Mark

The Write File Mark command causes a file mark to be written at the current tape position.

5.1.9 Space Forward/Space Reverse

The Space Forward and Space Reverse commands cause the drive to skip the next record on the tape. Read strobes (IRSTR) are not sent during the skip.

5.1.10 File Search Forward/Reverse

The File Search Forward and File Search Reverse commands allow positioning the tape at the end of a file mark. Execution of the command causes the drive to skip records until one of the following conditions occurs:

File mark detected
LEOT is reached
LBOT is reached
Blank tape detected

Read strobes (IRSTR) are not sent during the skips. When one of the four conditions is encountered the drive stops the tape and sets the appropriate status lines to the host.

5.1.11 Start Diagnostic Sequence

The Start Diagnostic Sequence command allows more direct access to the drive. The following four types of information transfer are available by sending a sequence of three commands to the Cipher Interface.

Command Packet transfer
Write Data transfer
Read Data transfer
Response Packet Transfer

The host sends the command to initiate a diagnostic data transfer. The command codes are sent as a Command Packet, similar to a Write command.

If the command sent to the drive requires a Read Data transfer, the second command must be a Read Forward Command. If the command requires a Write Data transfer, the second command must be a Write Command.

The data transfer is then accomplished the same way as a normal Read or Write command. When the transfer is completed, the Cipher Interface terminates the command and waits for a third command.

If a data transfer is not required or has been completed, the third command must be a Read Reverse command. This causes the Cipher Interface to transfer the Response packet to the host and resume normal operation.

All commands sent during the diagnostic sequence are terminated with Hard Error set.

NOTE

Care should be taken when using this command. The Cipher Interface and the drive controller do not update the tape status and the drive must be instructed to reposition the tape at the end of any Diagnostic Sequence commands.

5.1.12 Select Default Partition

At power-up and cartridge insertion the tape is positioned at the beginning of the default partition, Partition 0.

5.1.13 Select Data Partition 1

This command positions the tape at the beginning of Partition 1.

5.2 ERROR MESSAGES

Error Codes are stored in the Cipher Interface's Buffered Error Log (BEL). The BEL may be retrieved by the host using the Read Extended Status command.

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