American National Standard

Adopted for Use by the Federal Government

FIPS PUB 130
See Notice on Inside Front Cover

for information systems –

intelligent peripheral interface – device-generic command set for magnetic tape drives

ANSI X3.147-1988

american national standards institute, inc.
1430 broadway, new york, new york 10018

This standard has been adopted for Federal Government use.

Details concerning its use within the Federal Government are contained in Federal Information Processing Standards Publication 130, Intelligent Peripheral Interface (IPI). For a complete list of the publications available in the Federal Information Processing Standards Series, write to the Standards Processing Coordinator (ADP), Institute for Computer Sciences and Technology, National Bureau of Standards, Gaithersburg, MD 20899.

ANSI®
X3.147-1988

American National Standard
for Information Systems –

Intelligent Peripheral Interface – Device-Generic Command Set for Magnetic Tape Drives

Secretariat

Computer and Business Equipment Manufacturers Association

Approved January 27, 1988

American National Standards Institute, Inc

American National Standard

Approval of an American National Standard requires verification by ANSI that the requirements for due process, consensus, and other criteria for approval have been met by the standards developer.

Consensus is established when, in the judgment of the ANSI Board of Standards Review, substantial agreement has been reached by directly and materially affected interests. Substantial agreement means much more than a simple majority, but not necessarily unanimity. Consensus requires that all views and objections be considered, and that a concerted effort be made toward their resolution.

The use of American National Standards is completely voluntary; their existence does not in any respect preclude anyone, whether he has approved the standards or not, from manufacturing, marketing, purchasing, or using products, processes, or procedures not conforming to the standards.

The American National Standards Institute does not develop standards and will in no circumstances give an interpretation of any American National Standard. Moreover, no person shall have the right or authority to issue an interpretation of an American National Standard in the name of the American National Standards Institute. Requests for interpretations should be addressed to the secretariat or sponsor whose name appears on the title page of this standard.

CAUTION NOTICE: This American National Standard may be revised or withdrawn at any time. The procedures of the American National Standards Institute require that action be taken periodically to reaffirm, revise, or withdraw this standard. Purchasers of American National Standards may receive current information on all standards by calling or writing the American National Standards Institute.

Published by

American National Standards Institute
1430 Broadway, New York, New York 10018

Printed in the United States of America

A1M588/18

Foreword

(This Foreword is not part of American National Standard X3.147-1988.)

This standard provides a definition of the device-generic portion of a family of standards called the Intelligent Peripheral Interface (IPI). It is a new high-performance, general-purpose parallel peripheral interface. This standard responds to an industry market need (expressed both by users and manufacturers) to limit the increasing costs in hosts associated with changes in peripherals. The intent of the IPI is to isolate the host (CPU), both hardware and software, from changes in peripherals by providing a "function-generic" command set to allow the connection of multiple types of peripherals (disks, printers, tapes, communications). To smooth the transition from the current methods to the generic approach, the IPI also supports device-specific command sets to aid in bridging the gap between the two approaches.

To accomplish this set of goals, the design of the IPI includes device-specific and device-generic command sets, both utilizing a common physical bus. The device-specific command set provides:

(1) Device-oriented control
(2) Physical Data Addressing
(3) Timing Critical Operations
(4) Lower Device Cost

The device-generic command set provides a higher level of functionality and portability. It includes:

(1) Host/Device Independence
(2) Logical Data Addressing
(3) Timing Independence
(4) Command Queuing Capability

A system is not restricted to the use of one level of command set or the other. It is possible that both levels of command sets will be utilized with a given system's architecture to balance such parameters as system performance, cost, and peripheral availability. It is also possible for the host to provide for migration from device-specific to device-generic levels while still retaining the same physical interface.

The development of an Intelligent Peripheral Interface (IPI) was begun after a preliminary investigation had been completed. The earliest proposals were made by participants of Task Group X3T9.3 in late 1978. At that time, the Task Group decided generic-oriented peripheral interfaces were not yet ready for standardization and that the group should concentrate on device-oriented interfaces and the system-oriented, high-speed serial interfaces. The group acknowledged the desirability of higher level intelligent commands by reserving code fields in American National Standard for Information Systems — Interface between Rigid Disk Drive(s) and Host(s), ANSI X3.101-1984, during its April 1980 meeting.

The basic architecture of the resultant IPI was first proposed at the X3T9.3 August 1980 meeting. In addition to the 1978 proposal, complete company implementations were proposed by several manufacturers from August 1980 to August 1981. These proposals resulted from the initiative of the contributors and from wide-spread solicitation by the task group.

Task Group X3T9.3 agreed upon preliminary functional requirements during the October 1980 meeting, which included the following:

(1) Parallel transfer
(2) Command and Data Handshaking
(3) Allowance for high-speed transfers without Handshaking
(4) Transfer rate up to 10 Megaoctets per second

Task Group X3T9.3 began work on the IPI in 1981 in response to an emerging need for a higher performance peripheral interface. Coincidental with the need for higher performance was the availability of low-cost VLSI circuit technologies, allowing increased intelligence in the peripheral device. These needs were confirmed by large and active participation from all areas of the computer industry.

The fundamental characteristics that the group achieved included the following:

(1) Single or dual octet transfers
(2) Data rates of at least 10 megabytes per second
(3) Cable lengths extending from 5 to 125 meters depending upon type of transmitter and cable type
(4) Low-cost, commonly available components
(5) High level of maintainability and availability
(6) A multilevel command structure allowing different levels of intelligence in the peripherals
(7) A definition that facilitates evolutionary changes in the levels with minimal impact on software and hardware components
(8) Definitions supporting an extensive group of peripheral devices including disks, tape, communications equipment, printers, and the like, with a common choice of interface hardware and commands

Suggestions for improvement of this standard will be welcome. They should be sent to the Computer and Business Equipment Manufacturers Association, 311 First Street, NW, Suite 500, Washington, D.C. 20001.

This standard was processed and approved for submittal to ANSI by Accredited Standards Committee on Information Processing Systems, X3. Committee approval of the standard does not imply that all committee members voted for approval. At the time it approved this standard, the X3 Committee had the following members:

Richard Gibson, Chair
Donald C. Loughry, Vice-Chair
Catherine A. Kachurik, Administrative Secretary

Organization Represented	*Name of Representative*
American Library Association	Paul Peters
American Nuclear Society	Geraldine C. Main
	Sally Hartzell (Alt)
	Edward Kelly
AMP Incorporated	
Association of the Institute for Certification of Computer Professionals	
AT&T	Thomas M. Kurihara
	Paul D. Bartoli
	Thomas F. Frost (Alt)
Control Data Corporation	Charles E. Cooper
	Keith Lucke (Alt)
Cooperating Users of Burroughs Equipment	Thomas Easterday
	Donald Miller (Alt)

Organization Represented	*Name of Representative*
Data General Corporation	Lee Schiller
	Lyman Chapin (Alt)
Data Processing Management Association	Ward Arrington
	Wallace R. McPherson (Alt)
Digital Equipment Computer Users Society	Dennis Perry
Digital Equipment Corporation	Gary S. Robinson
	Delbert L. Shoemaker (Alt)
Eastman Kodak	Gary Haines
	Charleton C. Bard (Alt)
General Electric Company	Richard W. Signor
	William R. Kruesi (Alt)
GUIDE International	Frank Kirshenbaum
	Sandra Swartz Abraham (Alt)
Hewlett-Packard	Donald C. Loughry
Honeywell Bull	David M. Taylor
IBM Corporation	Mary Anne Gray
	Robert H. Follett (Alt)
IEEE Computer Society	Sava I. Sherr
	Thomas A. Varetoni (Alt)
	Helen Wood (Alt)
Lawrence Berkeley Laboratory	David F. Stevens
	Robert L. Fink (Alt)
MAP/TOP	James D. Converse
	Mike Kaminski (Alt)
Moore Business Forms	Delmer H. Oddy
National Bureau of Standards	Robert E. Rountree
	James H. Burrows (Alt)
National Communications System	Dennis Bodson
	George White (Alt)
NCR Corporation	William E. Snyder
	A. Raymond Daniels (Alt)
OMNICOM	Harold C. Folts
	Catherine Howells (Alt)
Prime Computer, Inc	Arthur Norton
	Donna A. Poulack (Alt)
Railinc Corporation	Moncure N. Lyon
Recognition Technology Users Association	Herbert F. Schantz
	G. W. Wetzel (Alt)
Scientific Computer Systems Corporation	James A Baker
	Carl Haberland (Alt)
SHARE, Inc	Thomas B. Steel
	Robert A. Rannie (Alt)
3M Company	Paul D. Jahnke
Travelers Insurance Companies, Inc	Joseph T. Brophy
Unisis	Marvin W. Bass
	Stanley Fenner (Alt)
U.S. Department of Defense	Fred Virtue
	Belkis Leong-Hong (Alt)
U.S. General Services Administration	William C. Rinehuls
	Larry L. Jackson (Alt)
VIM	Chris Tanner
	Madeleine Sparks (Alt)
VISA U.S.A.	Jean T. McKenna
	Patty Greenhalgh (Alt)
Xerox Corporation	John L. Wheeler
	Roy Pierce (Alt)

Subcommittee X3T9 on I/O interfaces, which reviewed this standard, had the following members:

Delbert L. Shoemaker, Chair
William E. Burr, Vice-Chair

Dennis Appleyard
James R. Barnette
Steve Cooper
Duane Barney
Louis C. Domshy
Robert Dugan
Reinhard Knerr
Patrick Lannan
John B. Lohmeyer
John McCool
Gene Milligan
Ted Petrowich
Gary S. Robinson
Arnold J. Roccati
Floyd E. Ross
Robert B. Anthony (Alt)
Charles Brill (Alt)
George Clark (Alt)
Roger Cormier (Alt)
Mark Hammang (Alt)
John Hancock (Alt)
Sunil Joshi (Alt)
Kris Kowal (Alt)
Dennis Krob (Alt)
Kirk Moulton (Alt)

Task Group X3T9.3 on Device Level Interfaces, which was responsible for the development of this standard, had the following participants:

Gary S. Robinson, Chair
I. Dal Allan, Vice-Chair

J. Amstutz
D. Appleyard
R. Barnes
D. Barney
R. Bender
R. Bergey
F. Berkowitz
B. Bonner
M. Bradac
C. Brill
B. Brown
R. Brown
W. Burr
E. Calkins
C. Chen
E. Cieniawa
S. Cooper
R. Davidelt
R. Davis
R. Derr
S. Dick
R. Dillon
R. Driscal
T. Eiland
D. Filpus
S. Finch
R. Fish
M. Fitzpatrick
M. Gamerl
R. Geller
S. Gersten
M. Glier
W. Grace
B. Graham
E. Grivna
D. Guss
K. Hallam
M. Hammang
D. Hartig
P. Hayden
C. Hess
C. Jarboe
S. Juhasz
D. Klang
K. Kong
A. Kononov
T. Leland
J. Lohmeyer
R. Lopez
J. Luttrull
R. Matheson
T. McClendon
D. McIntyre
P. Mclean
F. Meadows
J. Meyer
G. Milligan
P. Mizera
D. Moczarny
K. Moe
J. Monaco
R. Morris
J. Mulligan
R. Notari
T. O'Connor
M. O'Donnell
J. Patton
R. Peacock
J. Peterson
T. Petrowich
P. Phillips
M. Poehler
D. Ray
B. Reago
C. Ridgeway
D. Roberts
W. Roberts
A. Roccati
F. Ross
L. Russell
A. Salthouse
W. Sanderson
E. Sandoval
K. Scharf
D. Schneider
J. Schuessler
R. Schultz
D. Shoemaker
E. Slater
J. Smith
R. Snively
C. Stead
H. Stehle
M. Stewart
H. Truestedt
D. Tsai
N. Vashi
D. Voigt
C. Walker
O. Weeden
D. Williams
L. Zorza

Contents

American National Standard
for Information Systems –

Intelligent Peripheral Interface – Device-Generic Command Set for Magnetic Tape Drives

1. Scope and Editorial Conventions

1.1 Scope. This document describes the Logical Level 3 Interface for tape drives. The physical, electrical, and configuration characteristics and the transmission protocol of this interface are in accordance with American National Standard for Information Systems — Intelligent Peripheral Interface — Physical Level, ANSI X3.129-1986. The interface is capable of handling data rates from 0 to at least 10 megaoctets per second, depending on driver and receiver classes.

The purpose of this standard is to facilitate the development and utilization of a device level interface which permits the interconnection of tape slave peripherals to a controller.

1.2 Editorial Conventions. Certain terms used in this standard that are proper names of signals are printed in uppercase to avoid possible confusion with other uses of the same words; e.g., ATTENTION IN. Any lowercase uses of these words have the normal English meaning.

A number of conditions, sequence parameters, events, English text, states or similar terms are printed with the first letter of each word in uppercase and the rest lowercase; e.g., In, Out, Selective Reset, Bidirectional, Bus Control, Operation Response. Any lowercase uses of these words have the normal English meaning.

1.3 Description of Sections. Section 1 provides an introduction to the characteristics of magnetic tape.

Section 2 lists the publications referenced in this standard.

Section 3 provides a glossary.

Section 4 describes the characteristics of the Tape Logical Interface.

Section 5 describes the message package structure.

Section 6 describes the Control commands.

Section 7 describes the Position commands.

Section 8 describes the most generic Transfer commands.

Section 9 describes the Combination Transfer commands that require a minimum of two sets of extents.

Section 10 describes the other Transfer commands that are more device specific than those in Section 9.

Section 11 describes the Diagnostic commands.

Section 12 summarizes the tape commands defined in Sections 6 through 11.

1.4 Interface Levels. The IPI has adopted a layered approach to functionality, described as levels. In Section 6 of American National Standard for Information Systems - Intelligent Peripheral Interface - Physical Level, ANSI X3.129-1986, the relationship between the various levels is described. The description of Level 3 (6.2.2 in ANSI X3.129-1986) is as follows:

6.2.2 Level 3 - Device Generic. Level 3 is oriented to the generic characteristics of devices (disk, tape, printer, and the like), and typically not the device-unique components (e.g., cylinders, heads). Level 3 uses a packet structure that provides independence of the command repertoire from the Physical Interface. Some of the Device-Generic characteristics are:

(1) Operations may be Individual or Queued.

(2) The data area is defined by the facility addressibility to the media and is specified by the attributes of the slave.

(3) The Transfer of data may or may not be timing critical, and typically is buffered.

(4) Data is addressed by DataBlock address, but PhysicalBlock addresses may be used.

(5) DataBlock lengths typically are fixed over an addressable data area, and can vary between different addressable areas on the media as well as varying between medias. Tape DataBlocks may vary between any two blocks.

(6) Data is normally requested as "perfect" (data errors, if any, corrected), or may be requested as "raw" (data errors, if any, are not corrected).

(7) Positioning is requested implicitly, but may be explicit.

(8) Media defect handling is transparent to the master, but may be managed by the master.

(9) Error correction is transparent to the master, but may be managed by the master.

(10) Error retry is transparent to the master, but may be managed by the master.

1.5 Conceptual Overview. These concepts are described relative to their usage in a Device-Generic environment. These relationships may be defined differently in other levels of IPI implementation.

1.5.1 Relationship of Master, Slave, and Facility. A master is an entity that has need for some form of information transfer or storage. The master makes use of slaves and facilities to perform the needed operation. The slave or facility (addressee) to which the master addresses a service request is expected to have sufficient intelligence and capability to perform the requested service.

A slave is subservient to one master per port. The slave provides services to the attached master or master, and is responsible for the control and operation of the facilities (if any) attached to it. The slave may also perform additional functions as it finds necessary.

A facility may be a unit of storage (e.g., disk drives and tape drives) or a unit of functionality (e.g., a communications interface). Facilities are not limited to these devices, or even to being devices. Facilities are defined as having capabilities. A facility may be subservient to one or more slaves.

1.5.2 Relationship of Facilities and Partitions. As an option, a slave may allow the subdivision of a facility into partitions. In a facility that is capable of being subdivided, there are two types of subdividing possible that could be supported. The first is ability of the slave to subdivide the facility into a default data partition and up to 7 maintenance partitions.

For disks, the second is the ability of the master to subdivide the default data partition into up to 239 data partitions and up to 8 maintenance partitions.

For tapes, the second is the ability of the slave to define 112 additional partitions and the master to subdivide the default data partition into 127 data partitions and up to 8 maintenanced partitions.

Maintenance partitions are typically used for maintenance purposes, but their use is not restricted thereto, and may be otherwise used for storage of specific data for the slave, the facility, or both.

Maintenance partitions are not accessed by the master during normal operation, but access by the master is possible via the OPERATING MODE command.

The total area of a facility that is defined by the slave as the default data partition may be used for storage of the master's data. The partitioning and control of the partitions created in the default data area is the responsibility of the master.

1.5.3 Command Structure. The Device-Generic command structure is based on message packets that are of variable length. The basic command and response packets are expanded by appending parameters that identify the specific actions to be taken. This provides a powerful tool for providing flexibility for future growth, since the addition of new functions over time should not require major changes to the command repertoire, but add functionality to the existing commands.

The Device-Specific (known also as Level 2) command repertoire described in American National Standard - Intelligent Peripheral Interface - Device-Specific Command Set for Magnetic Disk Drives, ANSI X3.130-1986 uses a different command structure to the Device-Generic level. The major objective achieved by being different is the ability to execute timing-critical operations. Because both levels use the same Physical interface, it is possible for Device-Specific slaves to co-exist on the same daisy-chained cable as Device-Generic slaves. If the master daisychains Device-Specific and Device-Generic slaves, this places the requirement on the master to be able to handle both command structures.

Device-Generic commands need to be consistant with the characterisitics of the general device type (e.g., the master must know if general device type is a disk or tape). The commands provide for logical data addressing, buffers, error detection, error retry, error correction, and the like, at the slave. There are no timing-critical dependencies between commands.

1.6 Application Environments. The degree of intelligence provided by the slave varies, and is defined by Attributes provided by the manufacturer. The master can either select or respond to, the level of intelligence provided by the slave.

It is possible for the manufacturer of a computer system to implement products that are master oriented, and that support software constraints for current operating systems. By adding different degrees of functionality, the manufacturer could migrate over time to a distributed-intelligence, slave-oriented environment.

1.6.1 Control of Facilities by the Master. The master performs Facility Selection and issues Individual commands. This is a master-oriented environment that typifies the operation of most of today's host system I/O interfaces. The master prioritizes tasks and dispenses them to the various peripherals attached to it in a fashion that optimizes the system performance from the master's perspective.

Since the master controls all activity on the interface, it shall poll both the slave and facility interrupts in order to maximize the efficiency of data transfers. The master-oriented environment is typified by the following features of the interface:

(1) Command execution sequenced by the master
(2) Individual commands
(3) Selection to the facility
(4) Polling of both slaves and facilities by the Master
(5) Bus Control established by the master
(6) Command queuing done by the master.

1.6.2 Shared Control of Facilities. In this environment, a slave has functional control of the facilities, but the master has explicit control over some aspects of facility management. Some tasks, such as command queuing may be left to the discretion of the slave, but the master may choose to sequence the flow of data between specific facilities based on its own algorithms.

This environment is typified by the following features of the interface:

(1) Command execution between facilities sequenced by the master
(2) Queued commands
(3) Selection to the facility
(4) Polling of both slaves and facilities by the Master
(5) Bus Control established by the master
(6) Command queuing done by the slave

1.6.3 Control of Facilities by the Slave. In this environment the slave has functional control of the facilities, and the master has limited control (if any), over facility management. The slave has the intelligence necessary to control operations on behalf of the master.

This is a slave-oriented environment because of the degree of control the slave exercises over system performance and optimization. This environment is typified by the following features of the interface:

(1) Command execution between facilities sequenced by the slave
(2) Queued commands
(3) Selection to the slave
(4) Polling of the slave by the Master
(5) Bus Control established by the master or (optionally) by the slave.
(6) Command queuing done by the slave

2. Referenced and Related American National Standards

2.1 Referenced American National Standards. This standard is intended to be used in conjunction with the following American National Standards. When these standards are superseded by a revision approved by the American National Standards Institute, Inc. the revision shall apply.

ANSI X3.129-1986, Information Systems — Intelligent Peripheral Interface — Physical Level.

ANSI X3.132-1987, Information Systems — Intelligent Peripheral Interface — Device-Generic Command Set for Magnetic and Optical Disk Drives

2.2 Related American National Standards. The following standard is not essential for the completion of the requirements of this standard and is intended to be used solely for explanation or clarification.

ANSI X3.130-1986, Information Systems — Intelligent Peripheral Interface — Device-Specific Command Set for Magnetic Disks

3. Definitions

alias. This term names a partition within a facility.

beginning of file. A recorded mark on the medium that marks the beginning of a file.

beginning of media (BOM). The beginning of the default data partition. This media position is usually marked by some physical (not recorded) marker on the medium. The marker is detectable by a facility and allows the tape to be automatically positioned at the beginning of the default data partition and to be properly positioned to the beginning of the default data partition when rewound. The implementation of the BOM marker is defined in the vendor specification.

NOTE: Certain American National Standards contain physical requirements for the position of the BOM marker in the default data partition (Beginning-of-Tape (BOT) marker on 1/2-inch reel-to-reel tape).

end-of-media warning (EMW). Usually a physical marker on the medium that indicates the end of the normal recording area of a partition.

NOTE: Certain American National Standards contain physical requirements for the position of the EMW marker in the default data partition (End-of-Tape (EOT) marker on 1/2-inch reel-to-reel tape).

end of file. A mark recorded on the medium to mark the end of a file detectable by a facility.

erase gap. The physical sections of the medium that contain no recognizable data. An Erase Gap may be used to overcome media defects by extending an interblock gap such that the next recorded element occurs past the defect on the medium.

file mark. See *Tape Mark.*

forward motion. The tape motion logically proceeding from BOM toward Physical End of Media (PEOM).

ID burst. A burst of special recorded data that may be used by the facility to identify the recording format or density of data written on the medium usually occurring as the first recorded element on a volume. The ID Burst content is an attribute of a volume and not considered part of any partition.

interblock gap. A physical section of the medium that contains no recognizable data and separates adjacent recorded elements (i.e., PhysicalBlocks and file marks). Interblock gaps are automatically introduced by a facility between adjacent recorded elements without explicit action by a master.

level 2 (device specific). This term refers to commands that may be timing critical and that are used to define the execution of device-dependent operations. (See ANSI X3.130-1986 for a further explanation and description of these commands.)

level 3 (device generic). This term refers to commands that are not timing critical and that are in an intelligent environment in which the slave has functional control (which may or may not be overridden by the master) over the attached facility or facilities. (See ANSI X3.132-1987 for a further explanation and description of these commands).

logical interface. This term refers collectively to all protocols higher than the Physical Interface.

mandatory. To conform to the standard, all functions described as mandatory shall be implemented as defined in this document.

multiplex. This term defines the ability of a master to intersperse the execution of commands between addressees; or of a slave to intersperse the execution of commands between different facilities; or of a slave to intersperse transfer information in bursts that are less than the requested transfer size.

optional. This term describes features that are not required by the standard. However, if any feature defined by the standard is implemented, it shall be done in the same way as defined by the standard.

partition. This term defines a recording area that may be logically addressed. A partition may

be slave defined (e.g., data area, CE area, IML area) or may be master defined (e.g., an addressable set of contiguous blocks within the data area). See also *alias*.

A partition may be defined to exist within a tape volume by the slave, the master, or both. Since tape volumes are removable, such a partition will be removed with the volume. A slave or facility may define other partitions that are not associated with a volume and that may or may not be removable. Typically, such partitions may be used for Maintenance partitions as defined in 5.5.15 of ANSI X3.132-1987, but are not limited to such use.

PhysicalBlock. This term is uniquely defined in this document as meaning the physical representation of data on the media (e.g., sectors or records on disk and blocks or records on tape). It is used to prevent confusion between industry usage of terms.

A facility may record any two adjacent blocks with different physical lengths, depending upon the capability of the facility and the selection of a master. Tape volumes typically are not preformatted, as disks are, so that references to DataBlocks or PhysicalBlocks within a partition that has not been previously written usually fail.

A tape volume having preformatted PhysicalBlocks is very similar to a fixed-block disk volume and may be used in a similar fashion.

physical end of media (PEOM). A position on the medium beyond which normal tape operation is impossible (i.e., data cannot be written or the medium cannot be positioned).

physical interface. This term refers to the mechanical, electrical, and bus protocol characteristics specified in ANSI X3.129-1986.

queued. This term refers to the ability of a slave to accept multiple commands per Facility Address from the master and execute them in a sequence according to slave-defined or master-defined algorithms.

ready.This term is used to indicate that a slave or facility can execute its intended functions.

response. This term refers to the response made by a slave to advise the master of the results of a command, or of conditions within the slave.

reverse motion. The tape motion contrary to Forward Motion (i.e., logical motion from PEOM toward BOM).

selection address. This is the address used by the master at the Physical Interface to select a slave, a facility, or both. (This may not be the same as the Actual Address if Synonyms are used.)

synonym. This term describes the ability to redefine the Facility Address of a facility. There may be more than one synonym to address the same facility.

tape mark. A recorded element on the medium, not containing data that is used to separate or otherwise identify groups of DataBlocks on the medium. The most common tape mark is known as a file mark.

volume. A removable entity of tape media.

vendor unique. This term defines those features that can be defined by a vendor in a specific implementation. Caution should be exercised in defining and using such features since they may or may not be standard between vendors.

write protect. An attribute of a tape volume, usually requiring some physical sensing by a facility, indicating whether the facility is allowed to write data on the medium. When a volume is write protected, the facility is prevented from writing on the medium.

4. Logical Interface Characteristics of the Tape

4.1 Data Groupings. The basic unit of data is the 8-bit octet. The unit of transfer between a master and a slave/facility is a DataBlock or PhysicalBlock. The unit of transfer between a slave/facility and the medium is a PhysicalBlock.

4.1.1 PhysicalBlocks. Tape PhysicalBlocks may be fixed or variable. In the case of fixed PhysicalBlocks, the block size may be preset in manufacture or may be specified by the master using the OPERATING MODE command. A tape recording fixed blocks shall pad to the end of

the block if the master does not supply enough information in a TRANSFER command to fill the block. Once recorded, the size of fixed PhysicalBlocks shall become an attribute of the volume (or partition, if applicable).

A slave/facility that adds padding octets shall be capable of removing such padding when the PhysicalBlocks are subsequently read and thus may require some control information to be added to the PhysicalBlock contents.

Tapes that record variable PhysicalBlocks shall record blocks of any size within the bounds reported in ATTRIBUTES. The master may record multiple equal length blocks by setting the block size with the OPERATING MODE command and transferring. However, it is then the responsibility of the master to pad any blocks that do not contain enough data to fill the block. Variable PhysicalBlock Size is not an attribute of the volume (or the partition, if applicable). If the master does not transfer enough information to fill a variable PhysicalBlock, the addressee shall record a short PhysicalBlock.

Facilities may be implemented to record PhysicalBlocks of the exact size specified by the master or may record the PhysicalBlock size plus some control information (e.g., data plus a block numbering field).

The relationship between PhysicalBlock and DataBlock size is not fixed, the DataBlock being the master-defined unit of preference. Depending on addressee implementation, DataBlock size may be the same as PhysicalBlock size, an integer multiple of the PhysicalBlock size, or a noninteger multiple.

4.1.2 DataBlocks. DataBlock size is not an attribute of a volume or a partition. It specifies the master-to-slave transfer unit size (not to be confused with Burst Size) until changed by the ATTRIBUTES or OPERATING MODE command or overridden in a data transfer command Command Extent parameter (when transferring in Octet mode).

4.1.3 Extents. The general definition of an extent applies to tape. However, a slave/facility may have no method for knowing in advance, when reading, that all blocks defined for an extent are present. When writing, the slave/facility may not be able to determine in advance of beginning data transfer whether all blocks can be transferred to the medium. Thus, Command Exceptions resulting from detection of an invalid data extent are infrequent.

The Incomplete major status is used in most instances instead of Command Exception with indications such as File Mark, End of Media Warning, and the like, indicated in the Incomplete parameter.

4.2 Partitions. Historically, tape volumes have been considered as having only one data partition (the default data partition), starting at BOM at one end of the medium and continuing until EMW at the other end of the medium. The size of this default data partition varied with the density and recording format of the slave/facility.

With the advent of track-addressable tape devices and serpentine recording, it may be possible to define and manage partitions that subdivide the total recording area of a volume. Such partitions may be slave defined or master defined. Partitions may hold usage and error information, selected data from Disk volumes, independent application data files, and other data.

Since tape volumes are removable, the partition concept is extended for tape to include semi-permanent storage areas (other than the medium) associated with a volume, that may be retained in the slave/facility. Such areas may contain IML data for the slave/facility, usage/error informationfor the slave/facility, and the like. Slaves/facilities shall support a default data partition on the storage medium. Other partitions and their location, Partition ID, size, and the like (if any) shall be defined by the vendor.

Each partition residing on the medium shall define a BOM, an EMW, and PEOM. All operations related to a partition shall operate within this defined storage space. Tape slaves/facilities typically perform no data transfer operations while in the process of transitioning between partitions.

4.3 Alternate Data Areas. Tape processing typically does not reserve seperate space on the medium for storing blocks when a write error occurs. The lack of such alternate data areas is assumed in this standard. For performance reasons, various methods of error recovery in the general vicinity of the original error have been implemented as opposed to block reallocation common in disk processing.

One method for error recovery common in tape data processing erases the area of the medium in

which the error was detected and rewrites the block farther down the medium, but within the same partition; the process may be repeated multiple times in an attempt to write an acceptable quality block.

4.4 Partition Parameters. Tape position shall be maintained relative to the last position operation or BOM within a partition (i.e., the medium is static between operations). Owing to the use of this positioning method, a new relative position shall be established whenever a partition transition is made. This and other performance-related issues prevent tape devices from making the rapid partition transitions common in disks. The use of Partition Parameters is, therefore, redefined here to be consistant with tape operations.

Partition transitions define a semipermanent state change similar to a physical volume change. Once the partition transition has been ordered by issuing a command with a Partition Parameter appended, all subsequent commands shall execute in the specified partition. This condition shall persist until the master explicitly changes the partition by issuing a command with a partition parameter appended. Chains to commands containing a Partition Parameter shall not continue to operate in a partition other than the default partition. Such command chains shall not be precluded by the tape definition, but an automatic transition back to the default partition at the end of the chain shall not occur.

When a transition is made to a new partition all attributes and operating mode conditions assosciated with the volume shall persist in the new partition.

4.5 Block Numbering. Block Numbering is defined as a slave/facility adding to the recording medium (without master intervention) information about a PhysicalBlock relative to the block attributes. Typical block numbering fields contain (but are not limited to) information about the block location within the partition, block translation flags, error recovery information, and the like. The size and content of block numbering fields is vendor specific and shall be transparent to the master.

4.6 Data Buffer Operation. A tape slave/facility may contain buffer space capable of containing multiple blocks of data. This data buffer may contain data "read ahead" from the medium or data waiting to be written to the medium. When performing a write, a slave/facility capable of storing multiple blocks in the data buffer may transfer an operation response indicating Successful status to the master once all the write data has been transferred from the master and successfully stored in the data buffer. If an unrecoverable write error is subsequently encountered while attempting to record the data on the medium, the addressee shall generate an Asynchronous Response Packet to inform the master of the failure. The master may then use the REPORT POSITION command to determine the number and addresses of the data blocks remaining to be fixed to tape. Unwritten data may then be recovered by using the READ FROM BUFFER command.

Addressees that "read ahead" into a data buffer shall not report an unrecoverable read error to the master until the unrecoverable data is requested by the master.

Tape slaves/facilities that provide the asynchronous buffer mode described shall also support a synchronous mode of operation that may be controled by the master (i.e., the addressee shall be capable of disabling the data buffer). Enabling and disabling the data buffer is accomplished using the ATTRIBUTES and OPERATING MODE commands. In addition, a master may instruct an addressee, operating in the asynchronous mode, to synchronize its buffer and media position by issuing a POSITION CONTROL command with the Synchronize bit asserted.

4.7 Positioning. Positioning of the medium is relative to recorded elements or the BOM in a partition.

4.7.1 Mount or Rewind. When a volume is first mounted and made ready, or is rewound, the medium shall be positioned relative to the BOM such that the first recorded element of the default data partition can be read or written.

4.7.2 Partition Transition. If a partition parameter is appended to a command that contains no implicit or explicit positioning information (e.g., a Command Extent parameter or POSITION CONTROL command), the slave/facility shall position to the BOM within the new partition. A Partition Parameter appended to a command that contains valid position information shall cause the addressee to position to the specified

address in the new partition. If a specified position cannot be located, the new position is indeterminate and Incomplete major status shall be returned with No Block Found indicated in the substatus parameter.

4.7.3 Normal Data Operation Completion. After successful completion of a read, write, or space operation, the medium shall be logically positioned to process the next recorded element in the same direction as the previous operation.

4.7.4 Abnormal Data Operation Completion. After a read or write error, and any automatic error recovery has been performed, the medium shall be positioned such that the recorded element that caused the exception can be read in a direction opposite from that which was used when the exception occurred.

4.7.5 Normal Position Operation Completion. After successful completion of an explicit position to a recorded element, the medium shall be positioned to process the specified recorded element.

4.7.6 Abnormal Position Operation Completion. If an error is detected while performing a position operation to a specific recorded element, the final position of the medium shall be as defined in the vendor specification.

4.7.7 Tape Mark Detected. If a Tape Mark is detected while performing a read or space block operation, the medium shall be positioned to process the next sequential recorded element after the Tape Mark in the same direction as the just completed read or space block operation.

4.7.8 BOM Detected (Reverse Operations). After detecting BOM while reading, spacing, or positioning to a specific recorded element, the medium shall be positioned to process, in the forward direction, the first recorded element after BOM.

Write reverse is a vendor-specific operation. If BOM is encountered while performing a WRITE in the reverse direction, the vendor specification shall be consulted to define the media position.

4.7.9 EMW Detected. The position of the medium relative to EMW is command dependent and defined with the individual command descriptions.

4.7.10 PEOM Detected. If PEOM is detected while moving the media in a forward direction, the position of the medium is defined in the vendor specification (e.g., the media may have left the tape path).

4.8 Command Usage. Where possible, the tape commands have been defined to be identical to the disk commands, and in the sections that follow a command may be named with a reference to the disk command. In the disk description, any minor exceptions for tape have been appended to the disk text and clearly noted as applying to tape. The disk text may also indicate certain items (usually an Opcode Modifier bit) not used for disk (i.e., the Reverse modifier in some transfer and position commands).

When a command that is common to disk and tape is used quite differently by the two media, a complete description of the command and its use is included in this standard.

Some unique commands are required for tape and their complete descriptions are found in the sections that follow.

5. Message Packet Structure

The message packet structure for magnetic tape is functionally identical to the packet structure for the magnetic and optical disk and shall be as described in Section 5 of ANSI X3.132-1987.

6. Control Commands

The commands in this section use basic packets and shall be used as Control commands in Level 3 of the Logical Interface.

6.1 NOP. This command is identical to the NOP command in the IPI device-generic command set for magnetic and optical disk as described in 6.1 of ANSI X3.132-1987.

6.2 FACILITY OPERATION. This command is identical to the FACILITY OPERATION command in 6.2 of ANSI X3.132-1987.

6.3 ATTRIBUTES. The command packet for this command shall be as shown in Figure 1. The response packet for this command shall be as shown in Figure 2.

The ATTRIBUTES command allows operation on the slave or facility attributes that are used to tell the master what the addressee's operational characteristics are and to allow them to be examined or modified. The opera-

```
+----+----+----+----+----+----+----+-------------
|PKT |REF | OP |COM | OP |SLAV|FAC | PARAMETERS
| LTH| NO |CODE| MOD| MOD|ADDR|ADDR|
|    | 0 1|  2 |    3    |  4 |  5 | 6 through n
+----+----+----+---------+----+----+-------------
 xxxx xxxx   02  bbbb bbbb  xx   xx
                 7654 3210
                      ||||        Bits 0, 1, 3 have encoded meaning of:
                      |||        x'0'=Report
                      ||         x'1'=Initialize  x'2'=Restore
                      |
                                 x'9'=Load        x'A'=Save
```

Figure 1
Command Packet for ATTRIBUTES

```
+----+------------+-------------------+------------
|PKT | Echoed From|    MAJOR STATUS    | PARAMETERS
| LTH|   Command  | CODES   |TYPE|CODE|
|    | 0 1 2 3 4 5|    6    |    7    | 8 through n
+----+------------+---------+----+----+------------
 xxxx eeeeeeeeeeee bbbb bbbb 0001 bbbb
                   7654 3210      3210
```

Figure 2
Response Packet for ATTRIBUTES

tional characteristics that may be modified in the addressee shall be implementation dependent.

The operating mode of ATTRIBUTES is determined by the opcode modifier that allows the master to Report, Initialize, Restore, Load, or Save the addressee attributes. The modifiers shall be mutually exclusive (i.e., only one action may be specified by the command modifier).

NOTE: Bits 0, 1, and 3 (x'1', x'2', and x'8') are encoded.

Report requires the addressee to respond with a list of parameters that detail the attributes requested by the command.

Initialize allows the master to require the addressee to set its attributes to their default value.

Restore allows the restoration of saved attributes.

Load requires the addressee to modify attributes within the addressee (if they are valid).

Save allows the addressee attributes, including those associated with this command, to be saved prior to power down or removal of the media from a removable media facility.

At power on, slaves and facilities shall perform an automatic Restore. If no attributes have been Saved by the master, the Restore values shall be a valid configuration of the Initialize attributes.

When the Initialize, Report, Save, or Restore modifiers are set, and no parameters are transmitted with the command packet, the addressee acts upon all attributes. If the master wishes to be selective about attributes to be affected, it shall provide a list of the parameter IDs (via the Request Parm parameter) with the Report or Initialize modifiers.

The master and slave have parameters that are either unique or common to both. Common parameters are used by the slave to report, and by the master to modify. A consistent sequence is necessary to properly manage parameters that are common.

If the master wishes to find out the Initial settings of the slave (rather than the Restored settings), it issues an ATTRIBUTES command with the Initialize modifier set. The slave shall set the Attributes parameters to their initial factory values. The master issues an ATTRIBUTES command with the Report modifier set,

to look at the parameter or parameters of interest.

The master can change the Attribute parameters by issuing an ATTRIBUTES command with the Load or Save modifier set, and thus instruct the slave to act upon the new values.

If the master does not wish the new values to be kept beyond Power Off, the Load modifier is set.

If the master wishes the new values to be kept beyond Power Off, and Restored by the slave after Power On, the Save modifier is set.

The master can use the Restore modifier to have the slave return to its previously Saved values.

Almost all of the attributes apply equally to either slave or facility (e.g., number of ports). In the case of an integrated slave and facility, many of the device attributes need to be applied as well. For this reason, it is impossible to clearly define attributes as belonging to either slave or facility unless the configuration of intended use is known. Therefore, all attributes are shown as being relative to the addressee, even though some are specifically slave oriented and others are specifically facility oriented.

Within the parameters, there are sets of octets that may need to be repeated several times to provide all of the information. These repetitive octet sets are noted in the parameter tables.

On devices that may support more than one type of partition, the Partition parameter shall precede every set of information for that partition. In this manner every partition can be described in complete detail as a group. If on a Report modifier, no Partition parameter is appended to the command, the slave shall respond with information on the currently defined partition. On a Load or Save, the absence of a Partition parameter means the currently defined partition is to be used.

If any fields are not needed in a parameter, the parameter length can be cut short (e.g., tape drives that support only one tape speed, recording density, and recording format need not support those fields in the Tape Characteristics parameter). It should be noted, however, that unused fields that are followed by fields that are used cannot be deleted.

Implementation Note: There is a need for three types of memory to completely manage Attributes. Permanent memory shall be used to retain all Attributes; semi-permanent memory or current memory shall be used to retain Attributes changed by the master.

(1) *Permanent.* Contains all of the attributes as defined by the manufacturer. This memory contains the Initial value of Attributes. The Initial Attributes may not be set to a valid configuration (e.g., two features that are mutually exclusive may be capable of being supported by the slave).

(2) *Semi-Permanent.* At the point of manufacture, these values are set to a valid configuration of the Initial Attributes. The contents may be replaced by the master performing a Save. The slave uses the contents of this memory to Restore Attributes at Power On, or under command of the master when the Restore modifier is set.

(3) *Current.* After Power On, the contents are the same as Semi-Permanent memory, that is, Restored. Individual Attributes may be changed by the master performing either a Load or a Save with parameters.

The following modifiers permit operations upon individual Attributes:

(1) *Report.* The current memory contents are reported to the master. If no parameters are present, the slave responds with all attributes (which can be a very large length). The Request Parms parameter may be used to specifically identify Attributes.

(2) *Load.* This modifier requires that parameters be present for modifiable Attributes. The slave shall replace the contents of the designated parameters in Current memory with the ones in the command parameter list (if valid).

(3) *Save.* If this modifier has associated parameters, the command is executed compatibly with Load, and then the contents of Current memory shall be written into Semi-Permanent memory.

The following modifiers operate upon all changeable Attributes:

(1) *Initialize.* No parameters are accepted. The contents of Permanent memory shall be written into Current memory.

(2) *Restore.* No parameters are accepted. The contents of Semi-Permanent memory shall be written into Current memory.

(3) *Save.* If no parameters are present, the contents of Current memory shall be written into Semi-Permanent Memory.

Table 1
Attribute Parameters

@	LTH	ID	OCTET	X/b	DEF	ATTRIBUTE PARAMETERS
B	n+1	3A	01- n			DATA ADDRESS PARAMETER
B	n+1	3E	01- n			PARTITION PARAMETER
S	n+1	50	01-10			VENDOR ID (in ASCII)

Table 2
Attribute Parameters 51-58

@	LTH	ID	OCTET	X/b	DEF	ATTRIBUTE PARAMETERS	
B	05	51	01-04			SIZE OF DataBlocks	
B	05	52	01-04			SIZE OF PhysicalBlocks	
S	n+1	55				VARIABLE DataBlock SIZES SUPPORTED	
			01-04			Smallest Block Size Supported	
			05-08			Largest Block Size Supported	
			09-0C			Increment Size	
			n-B:8			Smallest Block Size	Repeated as many
			n-7:4			Largest Block Size	times as needed
			n-3:n			Increment Size	
S	n+1	56				VARIABLE PhysicalBlock SIZES SUPPORTED	
			01-04			Smallest Block Size Supported	
			05-08			Largest Block Size Supported	
			09-0C			Increment Size	
			n-B:8			Smallest Block Size	Repeated as many
			n-7:4			Largest Block Size	times as needed
			n-3:n			Increment Size	
S	n+1	57				FIXED DataBlock SIZE(S) SUPPORTED	
			01-04			Block Size (first)	Repeated as many
			n-3:n			Block Size (last)	times as needed
S	n+1	58				FIXED PhysicalBlock SIZE(S) SUPPORTED	
			01-04			Block Size (first)	Repeated as many
			n-3:n			Block Size (last)	times as needed

6.3.1 Attribute Parameters (see Table 1)

6.3.1.1 Data Address (Common) Parameter. This parameter shall be as described in 5.5.11 of ANSI X3.132-1987.

6.3.1.2 Partition (Common) Parameter. This parameter shall be as described in 5.5.15 of ANSI X3.132-1987.

6.3.1.3 Vendor ID Parameter. This parameter shall be as described in 6.3.4.1.3 of ANSI X3.132-1987.

6.3.2 Attribute Parameters 51-58 (see Table 2)

6.3.2.1 Size of DataBlocks Parameter. This parameter contains an unsigned binary number specifying the size of the DataBlocks currently set in the slave. The master may use this parameter to set the DataBlock size in the slave.

6.3.2.2 Size of PhysicalBlocks Parameter. This field contains an unsigned binary number specifying the size of the PhysicalBlocks currently set in the slave. The master may use this parameter to set the PhysicalBlock size in the slave.

6.3.2.3 Variable DataBlock Sizes Supported Parameter. The first field contains an unsigned binary number specifying the smallest value of a range of DataBlock sizes. The second field contains an unsigned binary number specifying the largest value of the range supported. The third field is an unsigned binary number that specifies the increment by which the block size may be increased from smallest to largest.

If more than one range is suppported, these three fields are repeated as many times as required.

Table 3
Attribute Parameters 59-5B

@	LTH	ID	OCTET	X/b	DEF	ATTRIBUTE PARAMETERS
S	02	59				ATTRIBUTE TABLE CONDITIONS
B	n+1	5A				PAD WITH FILL CHARACTERS
B	n+1	5B				PARTITION DEFINITION

Table 4
Attribute Parameters 5C-5E

@	LTH	ID	OCTET	X/b	DEF	ATTRIBUTE PARAMETERS
B	n+1	5C				SYNONYM DEFINITION
B	n+1	5D				ALIAS DEFINITION
S	04	5E				MULTI-PORT CHARACTERISTICS

6.3.2.4 Variable PhysicalBlock Sizes Supported Parameter. The first field contains an unsigned binary number specifying the smallest value of a range of PhysicalBlock sizes. The second field contains an unsigned binary number specifying the largest value of the range supported. The third field is an unsigned binary number that specifies the increment by which the block size may be increased from smallest to largest.

If more than one range is suppported, these three fields are repeated as many times as required.

6.3.2.5 Fixed DataBlock Size(s) Supported Parameter. The first field contains an unsigned binary number specifying the DataBlock size supported. If more than one size is supported, this field is repeated as many times as needed.

6.3.2.6 Fixed PhysicalBlock Size(s) Supported Parameter. The first field contains an unsigned binary number specifying the Physical-Block size supported. If more than one size is supported, this field is repeated as many times as needed.

6.3.3 Attribute Parameters 59-5B (see Table 3)

6.3.3.1 Attribute Table Conditions Parameter. This parameter shall be as described in 6.3.4.3.1 of ANSI X3.132-1987.

6.3.3.2 Pad with Fill Characters Parameter. This parameter shall be as described in 6.3.4.3.2 of ANSI X3.132-1987.

6.3.3.3 Partition Definition Parameter. This parameter shall be as described in 6.3.4.4.1 of ANSI X3.132-1987.

6.3.4 Attribute Parameters 5C-5E (see Table 4)

6.3.4.1 Synonym Definition Parameter. This parameter shall be as described in 6.3.4.4.2 of ANSI X3.132-1987.

6.3.4.2 Alias Definition Parameter. This parameter shall be as described in 6.3.4.4.3 of ANSI X3.132-1987.

6.3.4.3 Multi-Port Characteristics Parameter. This parameter shall be as described in 6.3.4.5.1 of ANSI X3.132-1987.

6.3.5 Attribute Parameters 61-65 (see Table 5)

6.3.5.1 Transfer Rate Parameter. This parameter shall be as described in 6.3.4.6.2 of ANSI X3.132-1987.

6.3.5.2 Physical Interface Attributes Parameter. This parameter shall be as described in 6.3.4.7.1 of ANSI X3.132-1987.

6.3.5.3 Addressee Configuration Parameter. This parameter shall be as described in 6.3.4.7.2 of ANSI X3.132-1987.

Table 5
Attribute Parameters 61-65

@	LTH	ID	OCTET	X/b	DEF	ATTRIBUTE PARAMETERS
S	09	61				TRANSFER RATE (Octets/second)
S	15	64				PHYSICAL INTERFACE ATTRIBUTES PARAMETER
S	n+1	65				ADDRESSEE CONFIGURATION PARAMETER

Table 6
Attribute Parameters 66-67

@	LTH	ID	OCTET	X/b	DEF	ATTRIBUTE PARAMETERS
S	n+1	66				SLAVE CONFIGURATION
S	n+1	67				SLAVE CONFIGURATION 2

Table 7
Attribute Parameter 68

@	LTH	ID	OCTET	X/b	DEF	ATTRIBUTE PARAMETERS	
S	n+1	68				FACILITIES ATTACHED TO SLAVE PARAMETER	
			01			Actual Facility Address	
			02			Facility Class	
				01		Magnetic Disk	
				02		Optical Disk	
				03		Magnetic Tape	
				04		Communications	
			03-04			Reserved	
			n-3			Actual Facility Address	repeated as
			n-2			Facility Class	many times
			n-1:n			Reserved	as needed

6.3.6 Attribute Parameters 66-67 (see Table 6)

6.3.6.1 Slave Configuration Parameter 1. This parameter shall be as described in 6.3.4.8 of ANSI X3.132-1987.

6.3.6.2 Slave Configuration Parameter 2. This parameter shall be as described in 6.3.4.9 of ANSI X3.132-1987.

6.3.7 Attribute Parameter 68 (Facilities Attached to Slave Parameter) (see Table 7). This parameter is addressed to the slave, and contains four octets per facility, which are repeated for as many facilities as there are attached to the slave.

The first octet contains the actual address of the facility, which is typically a device, and the second octet is used to identify the class of facility.

6.3.8 Attribute Parameters 69-6A (see Table 8)

6.3.8.1 Common Parameters Supported Parameter. This parameter consists of a list of the IDs of the common parameters that are supported.

6.3.8.2 Command-Supported Parameter. This parameter shall be as described in 6.3.4.11.2 of ANSI X3.132-1987.

6.3.9 Attribute Parameters 6B-6F (see Table 9)

Table 8
Attribute Parameters 69-6A

@	LTH	ID	OCTET	X/b	DEF	ATTRIBUTE PARAMETERS	
S	n+1	69				COMMON PARAMETERS SUPPORTED	
			01			Parameter ID (first)	repeated as many
			n			Parameter ID (last)	times as needed
S	n+1	6A				COMMAND SUPPORTED	

Table 9
Attribute Parameters 6B-6F

@	LTH	ID	OCTET	X/b	DEF	ATTRIBUTE PARAMETERS
S	n+1	6B				MASKS OF OCTETS SUPPORTED
M	n+1	6C				REQUEST PARM PARAMETER
S	05	6D				PARM LENGTH PARAMETER
B	n+1	6E				SLAVE RECONFIGURATION PARAMETER 1
B	n+1	6F				SLAVE RECONFIGURATION 2

Table 10
Attribute Parameters 70-71

@	LTH	ID	OCTET	X/b	DEF	ATTRIBUTE PARAMETERS	
B	05	70	01-04			SIZE OF DATA BUFFER BLOCKS	
S	n+1	71				DATA BUFFER BLOCK SIZES SUPPORTED	
			01-04			Smallest Block Size Supported	
			05-08			Largest Block Size Supported	
			09-0C			Increment Size	
			n-8:8			Smallest Block Size	Repeated as many
			n-7:4			Largest Block Size	times as needed
			n-3:n			Increment Size	

6.3.9.1 Masks of Octets Supported Parameter. This parameter shall be as described in 6.3.4.12 of ANSI X3.132-1987.

6.3.9.2 Request Parm Parameter. This parameter shall be as described in 6.3.4.13.1 of ANSI X3.132-1987.

6.3.9.3 Parm Length Parameter. This parameter shall be as described in 6.3.4.13.2 of ANSI X3.132-1987.

6.3.9.4 Slave Reconfiguration Parameter 1. This parameter shall be as described in 6.3.4.14 of ANSI X3.132-1987.

6.3.9.5 Slave Reconfiguration Parameter 2. This parameter shall be as described in 6.3.4.15 of ANSI X3.132-1987.

6.3.10 Attribute Parameters 70-71 (see Table 10)

6.3.10.1 Size of Data Buffer Blocks Parameter. This is an unsigned binary number used to specify the block size currently set in the Data Buffer.

6.3.10.2 Data Buffer Block Size Supported Parameter. The first field contains an unsigned binary number that specifies the smallest value of a range of Data Buffer Block sizes. The second field contains an unsigned binary number that specifies the largest value of the range supported. The third field is an unsigned binary number that specifies the increment by which the block size may be incremented from smallest to largest.

If more than one range is suppported, these three fields are repeated as many times as required. If the Data Buffer Block size is

fixed, the fixed value is reported for both maximum and minimum block size and the increment is reported as zero.

6.3.11 Tape Characteristics Parameters (see Tables 11 and 12)

6.3.11.1 Tape Characteristics 1

6.3.11.1.1 Suppression of Repositioning. This bit indicates that any repositioning activity that may be required under normal operating conditions can be suppressed.

6.3.11.1.2 Fixed PhysicalBlock. This bit, when set, indicates that the addressee is capable of operating in a "Fixed Block" mode.

6.3.11.1.3 Variable PhysicalBlock. This bit indicates that the addressee can accept PhysicalBlock sizes of any size from the Master, up to the maximum block size specified in the Variable PhysicalBlock Size parameter.

6.3.11.1.4 DataBlocks Same as PhysicalBlock. This bit informs the Master that the addressee will only accept DataBlocks that are the same size as the PhysicalBlocks.

6.3.11.1.5 DataBlock Multiple of PhysicalBlock. When set, this bit means that the addressee will accept DataBlock sizes that are larger than the PhysicalBlock size in increments equal in size to whole PhysicalBlocks. To illustrate: if the PhysicalBlock size is set to 256 octets, then the DataBlock size may be 256 or 512 or 768 or 1024 ... and so on. Any DataBlock sizes that are not multiples of the PhysicalBlock size shall be rejected.

6.3.11.1.6 DataBlock Nonmultiple of PhysicalBlock. This bit indicates that the size of the DataBlock may be of any size with no regard for the size of the PhysicalBlock. In cases where the DataBlock size results in a PhysicalBlock that is not completely utilized the facility will fill the remainder of the incomplete PhysicalBlock with vendor-unique padding characters, unless the External fill character-specification-supported bit is set.

6.3.11.1.7 External Fill Character Supported. This bit indicates that the fill characters specified by the Set Attributes command, parameter 5A Pad with fill characters, will be used by the Facility to fill all PhysicalBlocks that are not completely filled with data while in the Fixed PhysicalBlock mode.

6.3.11.1.8 Automatic Error Recovery. This bit indicates that the Facility is capable of performing Automatic (unassisted by the Master) Error Recovery according to a vendor-unique Error Recovery algorithm.

6.3.11.1.9 Data Buffer. The presence of this bit indicates that the addressee has a Data Buffer available. The data buffer size is reported in the Addressee Configuration parameter (ID 65).

6.3.11.1.10 Streaming Tape. When set, this bit informs the Master that the attached addressee is capable of operating in the streaming mode.

6.3.11.1.11 Start-Stop Tape. This bit indicates that the addressee is capable of operating in the start-stop mode.

NOTE: Start-Stop and Streaming are not mutually exclusive; a drive may be capable of operating in either the start-stop or the streaming mode.

6.3.11.1.12 Block Numbering Supported. This bit indicates to the master that the addressee supports internal block numbering and is capable of using the block number field to perform explicit position operations (see POSITION CONTROL) and other internal control functions. The actual recorded block number field and the algorithm used to develop the block number are not specified in this standard.

6.3.11.1.13 Encryption Supported. This bit is used to inform the master that some data encryption capability is available in the Addressee.

6.3.11.1.14 Compression Supported. This bit informs the master that the Addressee has an internal compression algorithm that can be applied to the data.

6.3.11.1.15 Translation Supported. This bit informs the master that the Addressee can translate data being written to or read from the media.

6.3.11.1.16 Implicit Positioning Supported. This bit, when set, indicates that the addressee is capable of using the address field in the command extent parameter to perform implicit and explicit space operations when required.

6.3.11.1.17 Track Addressable. When this bit is set, the facility is capable of supporting track addressing.

6.3.11.1.18 Serpentine. When this bit is set, the facility utilizes a format for writing or reading data that requires more than one full excursion of the medium past the read-write head to obtain a full volume.

6.3.11.1.19 Auto Speed Control. When this bit is set, the addressee has the capability of using an internal algorithm to

Table 11
Tape Characteristics 1

@	LTH	ID	OCTET	X/b	DEF	ATTRIBUTE PARAMETERS
S	n+1	72				TAPE CHARACTERISTICS 1
			01			Tape Slave Attributes
				7		Suppression of Repositioning
				6		Fixed PhysicalBlock
				5		Variable PhysicalBlock
				4		DataBlocks same as PhysicalBlocks
				3		DataBlock Mulitiple of PhysicalBlock
				2		DataBlock Non-Mulitiple of PhysicalBlock
				1		External Fill Character
				0		Automatic Error Recovery
			02	7		Data Buffer
				6		Streaming tape
				5		Start stop tape
				4		Block Numbering Supported
				3		Encryption Supported
				2		Compression Supported
				1		Translation Supported
				0		Implicit Positioning supported
			03	7		Track addressable
				6		Serpentine
				5		Auto Speed Control
				4		Multiple Fixed Gaps
				3		Read Reverse
				2		Write Reverse
				1		Edit capability
				0		Variable Gap
			04	7-0		Reserved

Table 12
Tape Characteristics 2

@	LTH	ID	OCTET	X/b	DEF	ATTRIBUTE PARAMETERS
S	n+1	73				TAPE CHARACTERISTICS 2
			01			Maximum Write Retry Count
			02			Maximum Read Retry Count
			03			Number of Translation Tables Supported
			04			Number of Alterable Translation Tables
			05			Units of Measure
				7-6		Tape Speed
				5-4		Gap Size
				3-2		Density
				1-0		Format
			06			Minimum Gap Size
			07			Maximum Gap Size
			08			Gap Size Increment
			09			Maximum Erase Multiplier Supported
			0A	7		Default
				6		0 = Start/Stop 1 = Streaming
				5-0		Reserved
			0B-0C			Recording Density
			0D-0E			Tape Speed
			n-9			Units of Measure
			n-8			Minimum Gap Size
			n-7			Maximum Gap Size
			n-6			Gap Size Increment
			n-5			Maximum Erase Repeated as many
			n-4	7		Default times as needed
				6		0 = Start/Stop 1 = Streaming
				5-0		Reserved
			n-3:2			Recording Density
			n-1:n			Tape Speed

optimize tape speed to achieve the best transfer rate and reinstruct window on a streaming tape drive.

6.3.11.1.20 Multiple Fixed Gaps. This bit informs the master that the addressee has the capability to write fixed Interblock Gaps of varying size. The sizes supported by the addressee shall be as specified in the fields for Minimum and Maximum Gap sizes.

6.3.11.1.21 Read Reverse. This bit indicates that the addressee is capable of performing a Read in the reverse direction.

6.3.11.1.22 Write Reverse. This bit indicates to the master that the addressee is capable of writing in the reverse direction.

6.3.11.1.23 Edit Capability. This bit indicates to the master that the addressee has the ability to rewrite an existing PhysicalBlock or DataBlock, from a PhysicalBlock or DataBlock of the same size, without destroying the adjacent PhysicalBlocks or DataBlocks on the media. When Edit is not supported and the master attempts to write a PhysicalBlock or DataBlock over an existing PhysicalBlock or DataBlock, it is assumed that the block(s) immediately following the block being written will be destroyed. If the addressee has the property that it can overwrite without causing the destruction of any adjacent PhysicalBlocks or DataBlocks, it shall set this bit.

NOTE: This function requires that the master use the edit modifier with the WRITE command for each write edit to be performed. Leaving an addressee constantly in edit mode could cause the tape drive/subsystem to perform needless repositioning and control functions during all write operations.

6.3.11.1.24 Variable Gap. This bit advises the Master that the addressee is capable of providing variable Interblock gaps that vary from the Minimum Gap size up to the Maximum Gap Size set by the master.

6.3.11.2 Tape Characteristics 2

6.3.11.2.1 Maximum Write Retry Count. This is a 1-octet field, containing an unsigned binary number, that specifies the largest write retry count supported by the Addressee. If this field is set to zero, the addressee does not perform automatic write retries.

6.3.11.2.2 Maximum Read Retry Count. This is a 1-octet field, containing an unsigned binary number, that specifies the largest read retry count supported by the Addressee. If this field is set to zero, the addressee does not perform automatic read retries.

6.3.11.2.3 Number of Translation Tables Supported. This is a 1-octet field that specifies the number of translation tables supported by the addressee.

6.3.11.2.4 Number of Alterable Translation Tables. This is a 1-octet field that specifies the number of translation tables supported by the addressee that can be altered by the master.

NOTE: Translation tables may be contained in alterable or unalterable storage within the addressee (RAM or ROM). Translation tables are numbered consecutively from x00 to xFE with unalterable tables located in the lowest numbered tables. An addressee that reports a "Number of Tables Supported" as x0F and an "Alterable Table Count" of x03 shall have ROM translation tables numbered x00 through x0B and alterable (RAM) translation tables numbered x0C, x0D, and x0E.

6.3.11.2.5 Units of Measure. This is a 1-octet field containing four 2-bit fields encoded to indicate the units of measure used by the master to interpret the associated tape attribute field. Unassigned codes are reserved for vendor-unique units of measure.

bit 7-6 Tape Speed
- 00 = Inch/second
- 01 = Centimeters/second
- 10 = Vendor Units
- 11 = Vendor Units

bit 5-4 Gap Size
- 00 = Tenths of an inch
- 01 = Millimeters
- 10 = Centimeters
- 11 = Vendor Units

bit 3-2 Density
- 00 = Bits/Inch per track
- 01 = Bits/Millimeter per track
- 10 = Vendor Units
- 11 = Vendor Units

bit 1-0 Format
- 00 = ANSI
- 01 = Vendor Units
- 10 = Vendor Units
- 11 = Vendor Units

6.3.11.2.6 Minimum Gap Size. This is an unsigned binary number that specifies the minimum gap size that the addressee supports, expressed in units defined in the Units of Measure field.

6.3.11.2.7 Maximum Gap Size. This is an unsigned binary number that represents the

largest interblock gap (in units specified in the Units of Measure field) the addressee can record on the media without the use of the ERASE command.

NOTE: If the addressee does not support variable gaps or multiple fixed gaps, the maximum and the minimum gap size shall both be set to the addressee's fixed gap size.

6.3.11.2.8 Gap Size Increment. This is an unsigned binary number that specifies the incremental value by which the addressee can lengthen or shorten the gap. If the addressee does not support more than one gap size, the increment shall be set to zero.

6.3.11.2.9 Maximum Erase Multiplier Supported. This bit informs the master of the largest number that the addressee will accept to be used in calculating a long erase gap.

NOTE: The Erase Multiplier is a number that, when multiplied by the minimum interblock gap size, produces a nominal erase gap size.

6.3.11.2.10 Default. When set to 1, this bit indicates to the master that the described configuration is the addressee's default configuration.

6.3.11.2.11 Mode. This bit indicates that the addressee, when set to the reported configuration, operates in the Streaming or Start - Stop mode of operation.

6.3.11.3 Recording Density. This is an unsigned binary number that is used to report the recording density supported by the addressee, expressed in units specified in the Units of Measure field.

NOTE: When the format code in the Units of Measure field indicates a recording format described in an American National Standard, the Recording Density field implies the recording format (1600 CPI is Phase Encoded, 6250 is a GCR format, and so on).

6.3.11.4 Tape Speed. This is an unsigned binary number that is used to specify tape speed in units contained in the Units of Measure field.

NOTE: More than one combination of Tape Speed, Recording Density may be supported by the addressee. The addressee may repeat octets 1 through 0A as many times as needed to describe all supported configurations.

6.3.12 Attribute Parameters 74-75 (Current Tape Configuration 1 and 2) (see Table 13). This parameter is used by the master to determine or change the current configuration of the addressee (i.e., recording density, tape speed, and the like) (see 6.3.11 for field descriptions).

6.3.13 Attribute Parameters 76-79 (see Table 14)

6.3.13.1 Block Numbering Parameter. This parameter is used to inform the master of the information carried in the addressee's Block Number field. This information is useful when the master uses special addressee functions, such as encryption or compression.

6.3.13.1.1 Encrypted. When set to 1, this bit informs the master that the addressee can mark encrypted blocks. If this function is supported, the master may encrypt data by block as opposed to encrypting an entire volume.

6.3.13.1.2 Compressed. This bit informs the master that compressed blocks can be marked when written and detected when read. This allows the master to invoke compression on a block basis.

6.3.13.1.3 Translated. When set, this bit indicates that the addressee can mark and detect translated blocks.

6.3.13.2 Encryption Parameter. This parameter contains vendor-unique encryption information, such as keys, passwords, and control data, required to set up and enable the addressee encryption mechanism.

6.3.13.3 Translation Table Parameter. The Translation Table Parameter is used by the addressee to report to the master the size of the translation tables specified by the translation table number. If no Translation Table Number field is present in the parameter, the table size specified in the Translation Table Size field applies to all translation tables supported by the addressee. If more than one translation table size is supported by the addressee, the table size and table number fields may be repeated as many times as needed.

6.3.13.3.1 Translation Table Size. This is a 1-octet field that informs the master of the addressee translation table size.

6.3.13.3.2 Translation Table Number. This is a 1-octet field that specifies the Translation Table for which the table size is provided.

6.3.13.4 Translation Parameter. The Translation Parameter is used to transfer vendor-unique translation tables between the master and the addressee. The addressee shall report the Table Number and content of the translation table currently being used when requested by the master. The master may also use this parameter to load an alterable translation table contained in the addressee.

Table 13
Attribute Parameters 74-75

@	LTH	ID	OCTET	X/b	DEF	ATTRIBUTE PARAMETERS
B	n+1	74				CURRENT TAPE CONFIGURATION 1
			01			Tape Slave Attributes
				7		Suppression of Repositioning Enabled
				6		Fixed PhysicalBlock 1=Fixed 0=Variable
				5		Serpentine
				4		Automatic Error Recovery
				3		Data Buffer
				2		Streaming tape mode
				1		Start Stop tape mode
				0		Variable Gap Enabled
			02	7		Block Numbering
				6		Encryption
				5		Compression
				4		Translation
				3		Auto Speed Control
				2		Multiple Fixed Gap
				1-0		Reserved
			03			Current Operating Characteristics
B	n+1	75				CURRENT TAPE CONFIGURATION 2
			01			Write Retry Count
			02			Read Retry Count
			03			Current Translation Table Number
			04			Units of Measure
				7-6		Tape Speed
				5-4		Gap Size
				3-2		Density
				1-0		Format
			05			Current Gap Size
			06			Current Erase Multiplier
			07-08			Recording Density
			09-0A			Tape Speed

Table 14
Attribute Parameters 76-79

@	LTH	ID	OCTET	X/b	DEF	ATTRIBUTE PARAMETERS
S	02	76				BLOCK NUMBERING PARAMETER
			01	7		Encrypted
				6		Compressed
				5		Translated
				4-0		Reserved
M	n+1	77				ENCRYPTION PARAMETER
		01-n				Vendor Unique
S	n+1	78				TRANSLATION TABLE PARAMETER
			01			Translation Table size
			02			Translation Table Number
		n - 1				Translation Table Size — Repeated as many
		n				Translation Table Number — times as needed
B	n+1	79				TRANSLATION PARAMETER
			01			Translation Table Number
		02-n				Translation Table — (vendor unique)

PKT LTH	REF NO 0 1	OP CODE 2	COM MOD 3	OP MOD	SLAV ADDR 4	FAC ADDR 5	PARAMETERS 6 through n
xxxx	xxxx	03	bbbb 7654	bbbb 3210	xx	xx	

Condition
Extended Condition

Figure 3
Command Packet for REPORT ADDRESSEE STATUS

PKT LTH	Echoed From Command 0 1 2 3 4 5	MAJOR STATUS CODES 6	TYPE 7	CODE	PARAMETERS 8 through n
xxxx	eeeeeeeeeee	bbbb bbbb 7654 3210	0001	bbbb 3210	

Figure 4
Response Packet for REPORT ADDRESSEE STATUS

6.4 REPORT ADDRESSEE STATUS. The command packet for this command shall be as shown in Figure 3. The response packet for this command shall be as shown in Figure 4.

When the modifier for Condition is set, the REPORT ADDRESSEE STATUS command shall cause the addressee to report its condition by appending the condition parameter to the response. When the modifier for Extended Condition is set, the addressee shall append the Extended Condition Parameter to the response packet. The REPORT ADDRESSEE STATUS command is only valid when the Condition or the Extended Condition modifier is set to 1. The Condition and Extended Condition modifiers are not mutually exclusive and both parameters may be requested by setting both modifiers.

The parameters are shown in Table 15 and shall be as described in 6.4.1 - 6.4.4.

6.4.1 Port Mask Parameter. This parameter shall be as described in 6.4.4.1 of ANSI X3.132-1987.

6.4.2 Condition Parameter. This parameter shall be as described in 6.4.4.2 of ANSI X3.132-1987.

6.4.3 Media Status. Media Status is a bit-significant field used to inform the master of the tape drive general status in relation to the media.

6.4.3.1 Beginning Of Media (BOM). This bit, when set to 1, indicates that the tape is positioned at load point.

6.4.3.2 End of Media Warning (EMW). When set to 1, this bit informs the master that a previous command has left the media positioned at or beyond the EMW indicator (the reflective EOT marker on 1/2-inch reel-to-reel tape). When positioned before (on the logical BOM side) the EMW indicator, either because EMW has not yet been reached or because a subsequent operation leaves the media positioned before EMW, this bit shall be set to 0.

6.4.3.3 Media Present. This bit informs the master that a volume is mounted and correctly loaded. This bit shall be set to 0 to inform the master of conditions such as broken tape or no volume mounted.

6.4.3.4 Logical End Of Media (LEOM) Warning. This bit informs the master that the tape is positioned at the LEOM warning.

6.4.3.5 Default Recording Format. This bit, when set to 1, indicates that the tape drive is set to process data with the drive default recording density.

Table 15
REPORT ADDRESSEE STATUS Parameter

@	LTH	ID	OCTET	X/b	DEF	REPORT ADDRESSEE STATUS PARAMETERS
B	05	50	01-04			PORT MASK PARAMETER
S	n+1	51	01-02			CONDITION
S	02	52				MEDIA STATUS
			01	7		Beginning of Media
				6		End of Media Warning
				5		Media Present
				4		Logical End Of Media Warning
				3-2		Reserved
				1		Default Recording Format
				0		Write Protect
S	n+1	90	01-n			EXTENDED CONDITION (Vendor Specific)

PKT LTH	REF NO 0 1	OP CODE 2	COM MOD 3	OP MOD	SLAV ADDR 4	FAC ADDR 5	PARAMETERS 6 through n
xxxx	xxxx	07	bbbb 7654	bbbb 3210	xx	xx	

1=Set 0=Report

Figure 5
Command Packet for OPERATING MODE

PKT LTH	Echoed From Command 0 1 2 3 4 5	MAJOR STATUS CODES 6	TYPE	CODE 7	PARAMETERS 8 through n
xxxx	eeeeeeeeeee	bbbb 7654 bbbb 3210	0001	bbbb 3210	

Figure 6
Response Packet for OPERATING MODE

6.4.3.6 **Write Protect**. When set, this bit indicates to the master that the tape volume is write protected (i.e., the absence of a "write ring").

6.4.4 **Extended Condition Parameter**. This parameter is used to advise the master of vendor-specific conditions, if any.

6.5 **PORT ADDRESS**. This command shall be as described in 6.5 of ANSI X3.132-1987.

6.6 **PORT CONTROL**. This command shall be as described in 6.6 of ANSI X3.132-1987.

6.7 **ATTENTION CONTROL**. This command shall be as described in 6.7 of ANSI X3.132-1987.

6.8 **OPERATING MODE**. The command packet for this command shall be as shown in Figure 5. The response packet shall be as shown in Figure 6.

The OPERATING MODE command allows the master to change the operating modes of the slave or facility dynamically. The parameter field of the command packet defines what action the slave or facility is to take (e.g., those associated with establishing device-unique operating characteristics, such as recording

density on tape, removal of media, and the like).

The master may direct transfer commands to nonprimary data spaces, such as the CE Partition, IML Partition, and the like. Data transfer commands shall be Chained or Sequenced to OPERATING MODE with the Partition parameter in order to access the one desired.

Execution of transfer commands in slave-defined areas other than that for data may require different types of response information. The Response Conditions parameter is used to override the conditions established by Housekeeping Attributes.

The parameters associated with this command shall remain in effect until a subsequent Operating Mode command is issued with the SET modifier active, or until the volume is dismounted. The current Operating Mode shall not persist across partition boundries.

6.8.1 Operating Mode Parameters 3E-50 (see Table 16)

6.8.1.1 Partition (Common) Parameter. This parameter shall be as described in 5.5.15 of ANSI X3.132-1987.

6.8.1.2 Response Conditions Parameter. This parameter shall be as described in 6.8.4.2 of ANSI X3.132-1987.

6.8.2 Operating Mode Parameters 52-53 (See Table 17)

6.8.2.1 Tape Modes 1. The first three octets of the Tape Modes parameter consist of pairs of bits used by the master to enable and disable optional features. Each pair consists of two bits that are mutually exclusive (e.g., Enable Data Buffer and Disable Data Buffer). If neither of the two bits are set, no action shall be taken by the addressee.

NOTE: The Disable Writing and Enable Writing bits provide a path for the master to remotely enable and disable writing on a volume. The Enable Writing bit shall not override a hardware write protect (e.g., the "write ring" on 1/2-inch reel-to-reel tape).

The fourth octet has two pairs of bits whose use is the same as that defined for the pairs of bits in the first three octets. A single bit is used to inform the addressee to employ its default recording density. If the recording density is to be anything other than the default recording density, it shall be set using the Recording Density field.

6.8.2.2 Tape Modes 2

6.8.2.2.1 Write Retry Count. This is a 1-octet field containing an unsigned binary number that specifies the current setting of the write retry count. If this field is set to 0, the addressee is not enabled to perform automatic write retries.

6.8.2.2.2 Read Retry Count. This is a 1-octet field containing an unsigned binary number that specifies the current setting of the read retry count. If this field is set to 0, the addressee is not enabled to perform automatic read retries.

6.8.2.2.3 Translation Table Address. This is a 1-octet field that specifies the translation table address currently being used by the addressee.

6.8.2.2.4 Units of Measure. This is a 1-octet field containing four 2-bit fields encoded to indicate the units of measure used by the master to interpret the associated tape Operating Mode field. Unassigned codes are reserved for vendor-unique units of measure.

bit 7-6 Tape Speed
- 00 = Inch/second
- 01 = Centimeters/second
- 10 = Vendor Units
- 11 = Vendor Units

bit 5-4 Gap Size
- 00 = Tenths of an inch
- 01 = Millimeters
- 10 = Centimeters
- 11 = Vendor Units

bit 3-2 Density
- 00 = Bits/Inch per track
- 01 = Bits/Millimeter per track
- 10 = Vendor Units
- 11 = Vendor Units

bit 0-1 Format
- 00 = ANSI
- 01 = Vendor Units
- 10 = Vendor Units
- 11 = Vendor Units

6.8.2.2.5 Gap Size. This is an unsigned binary number that specifies the current gap size the addressee is configured to write, expressed in units defined in the Units of Measure field.

6.8.2.2.6 Erase Multiplier. This bit informs the master of the current erase multiplier value to be used in calculating a long erase gap.

6.8.2.2.7 Recording Format. This is an unsigned binary number used to report the

Table 16
Operating Mode Parameters 3E-50

@	LTH	ID	OCTET	X/b	DEF	OPERATING MODE PARAMETERS
B	n+1	3E				PARTITION PARAMETER
B	02	50				RESPONSE CONDITIONS

Table 17
Operating Mode Parameters 52-53

@	LTH	ID	OCTET	X/b	DEF	OPERATING MODE PARAMETERS
B	n+1	52				TAPE MODES 1
			01	7		on-line
				6		off-line
				5		Enable Suppress Repositioning
				4		Disable Suppress Repositioning
				3		Fixed PhysicalBlock
				2		Variable PhysicalBlock
				1		Enable Automatic Error Recovery
				0		Disable Automatic Error Recovery
			02	7		Enable Streaming Mode
				6		Enable Start/Stop Mode
				5		Enable Variable Gap
				4		Disable Variable Gap
				3		Enable Data Buffer
				2		Disable Data Buffer
				1		Enable Writing
				0		Disable Writing
			03	7		Enable Stop at End Of Media Warning
				6		Disable Stop at End Of Media Warning
				5		Enable Block Numbering
				4		Disable Block Numbering
				3		Enable Encryption
				2		Disable Encryption
				1		Enable Compression
				0		Disable Compression
			04	7		Enable Translation
				6		Disable Translation
				5		Enable Auto Speed Control
				4		Disable Auto Speed Control
				3		Default Recording Density
				2		Unrecognized Format
				1-0		Reserved
B	n+1	53				TAPE MODES 2
			01			Write Retry Count
			02			Read Retry Count
			03			Translation Table Address
			04			Units of Measure
				7-6		Tape Speed
				5-4		Gap Size
				3-2		Density
				1-0		Format
			05			Gap Size
			06			Erase Multiplier
			07-08			Recording Density
			09-0A			Tape Speed
			0B-0E			DataBlock Size
			0F-12			PhysicalBlock Size
			13-16			Data Buffer Block Size

addressee's current recording density expressed in units specified in the Units of Measure field. If the format used in American National Standards is specified in the Units Specifier (bits 1-0), the encoding scheme used to record data on the media shall be specified by the density (i.e., 1600 is Phase Encoded, 6250 is Group Coded, and so on).

6.8.2.2.8 Tape Speed. This is an unsigned binary number used to specify the current setting of tape speed in units contained in the Units of Measure field.

6.8.2.2.9 DataBlock Size. This is an unsigned binary number used to specify the DataBlock Size, in octets.

6.8.2.2.10 PhysicalBlock Size. This is an unsigned binary number used to specify the PhysicalBlock Size, in octets. This may or may not be equal to the DataBlock Size.

6.8.2.2.11 Data Buffer Block Size. This is an unsigned binary number used to specify the block size in the data buffer. This number may or may not be equal to the DataBlock Size or PhysicalBlock Size.

6.8.3 Operating Mode Parameter 54 (Data Operation Parameter)(see Table 18). This parameter is used by the Master to inform the addressee of special operations to be performed on the data being written or read.

6.8.3.1 Compress. This bit indicates that the addressee is to compress or decompress the data. If, during a Read operation, the addressee detects that the block being read is not compressed, this bit shall be ignored.

6.8.3.2 Encrypt. This bit informs the addressee that the data is to be encrypted or decrypted. If, during a Read operation, the addressee detects that the block being read is not encrypted or if the master has not properly set up and enabled the encryption function, the addressee shall transfer the data as read and shall ignore the Encrypt bit.

6.8.3.3 Translate. This bit indicates to the addressee that it shall translate the data being written or read and shall use the translation table indicated by the Translation Index octet.

6.8.3.4 Translation Index. This is a hexidecimal code that identifies the translation table within the addressee that is to be used. Valid codes are x01 through xFF. The translation indexes supported by the addressee are reported in ATTRIBUTES.

6.9 ABORT. This command is identical to the ABORT command described in 6.9 of ANSI X3.132-1987 and the same requirements shall be observed.

6.10 ACCESS PERMITS. This command is identical to the ACCESS PERMITS command described in 6.10 of ANSI X3.132-1987 and the same requirements shall be observed.

6.11 RESUME. This command is identical to the RESUME command described in 6.11 of ANSI X3.132-1987 and the same requirements shall be observed.

7. Position Commands

The commands in this section require the Command Extent parameter unless otherwise noted.

7.1 SPACE BLOCK/FILE MARK. The command packet for this command shall be as shown in Figure 7. The response packet for this command shall be as shown in Figure 8.

The SPACE BLOCK/FILE MARK command causes the tape facility to position (in the direction specified by the modifier octet) over the number of Blocks/File Marks specified in the Extent parameter, if present. Upon normal completion of this command, the tape shall be positioned to process the next recorded element immediately following the last Block/File Mark spaced over, in the same direction as the space that was just completed. If no Extent parameter accompanies this command, the addressee shall space over one Block/File Mark. Data is not transferred by this command, and data errors, if any, are not reported.

If the Block modifier is set and an Extent parameter is present, the facility spaces over the number of Blocks specified in the Count in the direction specified.

If a File Mark is detected before the count is exhausted, the tape shall be positioned to process the next sequential recorded element after the file mark in the specified direction. Then, the command shall be terminated with the appropriate status and a Residual Count in the Response Extent parameter.

If the addressee encounters EOM before the count is exhausted, the command shall terminate with the appropriate status and a residual count in the Response Extent Parameter.

Table 18
Operating Mode Parameter 54

@	LTH	ID	OCTET	X/b	DEF	OPERATING MODE PARAMETERS
M	n+1	54				DATA OPERATION PARAMETER
			01		7	Compress
					6	Encrypt
					5	Translate
					4-0	Reserved
			02			Translation Index

PKT LTH	REF NO	OP CODE	COM MOD	OP MOD	SLAV ADDR	FAC ADDR	COMMAND PARAMETERS
	0 1	2	3		4	5	6 through n
xxxx	xxxx	40	bbbb	bbbb	xx	xx	

0=Block 1=File Mark
Stop at End of Track
Logical End Of Media Warning (LEOM)
Direction 0=Forward 1=Reverse

Figure 7
Command Packet for SPACE BLOCK/FILE MARK

PKT LTH	Echoed From Command	MAJOR STATUS CODES	TYPE	CODE	RESPONSE PARAMETERS
	0 1 2 3 4 5	6	7		8 through n
xxxx	eeeeeeeeeee	bbbb bbbb	0010	bbbb	
		7654 3210		3210	

Figure 8
Response Packet for SPACE BLOCK/FILE MARK

If the reverse modifier is set and BOM is detected before the count is exhausted, the tape shall be positioned at BOM. Then, the command shall be terminated with the appropriate status and a residual count in the Response Extent Parameter.

If the File modifier is set and an Extent parameter is present, the Facility shall position the tape in the direction specified, stopping after detecting the number of File Marks specified in the count, and shall then position the tape in preparation for processing the next sequential recorded element in the specified direction.

If EOM is encountered before the File Mark count is exhausted, the command shall terminate with the appropriate status and a residual count in the Response Extent Parameter.

If the Reverse modifier is set and BOM is encountered before the File Mark count is exhausted, positioning shall be stopped at beginning of media and the command shall be terminated with the appropriate status and a residual count in the Response Extent Parameter.

A LEOM Warning is an optional recorded tape mark that may be used to separate two large data sets on tape or mark the end of the recorded portion of the media. If the LEOM modifier is set, the addressee shall position in the direction specified and shall stop, prepared to process the first recorded element after LEOM in the same direction. If PEOM is encountered before a LEOM is detected, the addressee shall terminate the command with the appropriate status. If the reverse modifier is set and BOM is encountered before a LEOM is detected, the

addressee shall position to BOM, and the command shall be terminated with the appropriate status.

Implementation Note: LEOM is a vendor-unique function and no attempt is made in this document to define the actual mark on the tape or the way in which the mark is detected or used. It should be noted, however, that the implementation of a LEOM could affect interchangeability of tapes between devices that support LEOM and devices that do not support LEOM. One possible implementation would be two successive tape marks recorded on the media. This implementation would allow a device to use the LEOM function without affecting the interchangeability of the volume.

For facilities with automatic track addressing, an end of track condition shall cause the slave to select the next track, in the appropriate direction, and to continue spacing as instructed by the command. Automatic track selection shall continue until either the command is completed or BOM or EOM is detected. Automatic track selection may be inhibited by the Stop at End of Track modifier.

The data address field of the Command and Response Extent is not used by the SPACE BLOCK/FILE MARK.

NOTE: The POSITION CONTROL command is the preferred command for positioning the media on addressees that are capable of positioning to a specified block address. The SPACE BLOCK/FILE MARK command is provided for tape facilities that do not support implicit positioning and cannot position the media to a specified block address.

The parameters shall be as listed in Table 19 and shall be as described in 7.1.1 and 7.1.2.

7.1.1 Command Extent (Common) Parameter. This parameter is used to specify the number of blocks or file marks to be spaced over. This parameter shall be as described in 5.5.2 of ANSI X3.132-1987.

7.1.2 Response Extent (Common) Parameter. If the command should fail, this parameter is used to report the number of file marks or blocks remaining to be spaced. This parameter shall be as described in 5.5.3 of ANSI X3.132-1987.

7.2 POSITION CONTROL. The command packet for this command shall be as shown in Figure 9. The response packet for this command shall be as shown in Figure 10.

The count modifier is not used for Tapes.

The POSITION CONTROL command causes the tape to be positioned according to the Extent parameter Data Address, which may be either logical or physical (e.g., on tape, it may be serpentine head position). The Tape Position parameter is mutually exclusive with the Command Extent parameters.

If the addressee is positioning to a block specified by the Command Extent Data Address and a block numbering sequence error is detected, the command shall be terminated with Incomplete status and Block Not Found substatus. If PEOM, BOM, or a Tape Mark is encountered before the block is found, the command shall be terminated with the appropriate status.

The count field of the Command and Response Extent parameters is not used by the POSITION CONTROL command. If the count contains a value other than 0, it shall be ignored. The POSITION CONTROL parameters shall be as listed in Table 20 and shall be as described in 7.2.1 - 7.2.5.

7.2.1 Command Extent (Common) Parameter. This parameter is used to define the Data Address at which a tape is to be positioned. The value in the Count field shall be ignored. This parameter shall be as described in 5.5.2 of ANSI X3.132-1987.

7.2.2 Response Extent (Common) Parameter. If the command fails, this parameter is used to return the Data Address of the last block accessed prior to failure. The count field is not used. This parameter shall be as described in 5.5.3 of ANSI X3.132-1987.

7.2.3 Data Address (Common) Parameter. This parameter shall be as described in 5.5.11 of ANSI X3.132-1987.

7.2.4 Partition (Common) Parameter. This parameter shall be as described in 5.5.15 of ANSI X3.132-1987.

7.2.5 Tape Position Parameter

7.2.5.1 Initialize Position. When set, this bit causes the addressee to position the tape to its initial position and to perform whatever initial load action it would normally perform when a new volume is installed. An example might be to rewind to BOM, read the ID burst on the media, initialize speed and density consistant with the volume mounted, and prepare to process the first record in the forward direction.

7.2.5.2 Position to Beginning. When set, this bit causes the addressee to position the tape to the beginning of the data area on the tape and to prepare to process the first record in the forward direction.

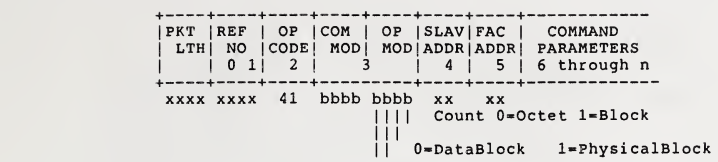


Figure 9
Command Packet for POSITION CONTROL

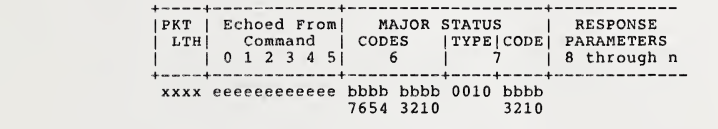


Figure 10
Response Packet for POSITION CONTROL

Table 19
SPACE BLOCK/FILE MARK Parameters

@	LTH	ID	OCTET	X/b	DEF	SPACE BLOCK/FILE MARK PARAMETERS
M	n+1	31				COMMAND EXTENT
			01-04			Count
			05-08			Data Address (Set to 0)
S	n+1	32				RESPONSE EXTENT
			01-04			Residual Count
			05-08			Data Address (Set to 0)

Table 20
POSITION CONTROL Parameters

@	LTH	ID	OCTET	X/b	DEF	POSITION CONTROL PARAMETERS
M	n+1	31				COMMAND EXTENT PARAMETER
			01-04			Count (not used)
			05-08			Data Address
S	n+1	32				RESPONSE EXTENT PARAMETER
			01-04			Residual Count (not used)
			05-08			Data Address
B	n+1	3A				DATA ADDRESS PARAMETER
M	n+1	3E				PARTITION PARAMETER
M	02	51	01			TAPE POSITION PARAMETER*
				7		Initialize Position
				6		Position to Beginning
				5		Unload
				4		Load
				3		Rewind
				2		Synchronize
				1		Retension
				0		Position to End Of Media Warning

* All bits in the Tape Position Parameter are mutually exclusive.

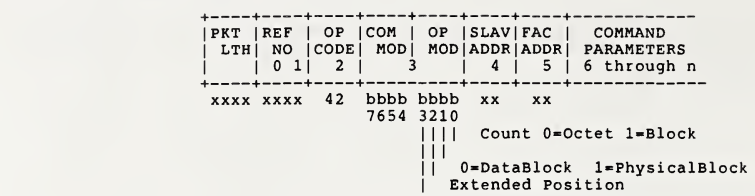


Figure 11
Command Packet for REPORT POSITION

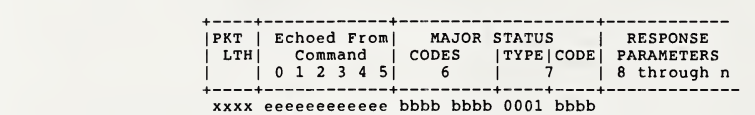


Figure 12
Response Packet for REPORT POSITION

7.2.5.3 Unload. When set, this bit causes the addressee to position the tape in preparation for removal from the device.

7.2.5.4 Load. When set, this bit causes the addressee to position a newly mounted volume in preparation for executing commands directed to the addressee and to perform whatever initialization procedures are necessary to make the volume accessable to the master (e.g., initialize speed and density, read volume ID, prepare to move tape, and the like).

7.2.5.5 Rewind. When set, this bit causes the addressee to position to the beginning of the media (e.g., the BOM marker on the tape) and to prepare to move in the forward direction.

7.2.5.6 Synchronize. When set, this bit instructs the addressee to record all data that may be in its buffer on the media. This bit is associated with cached devices in which data may have been received and a good response sent to the master, but the data actually had not been recorded on tape.

7.2.5.7 Retension. When set, this bit causes the addressee to perform whatever internal procedures are necessary to redistribute tension on the tape and then return to the position on tape at which the command was received.

7.2.5.8 Position to End Of Media Warning. When set, this bit instructs the addressee to position to the beginning of the first recorded element beyond the EMW marker.

7.3 REPORT POSITION. The command packet for this command shall be as shown in Figure 11. The response packet for this command shall be as shown in Figure 12.

The Count modifier is not used for tape.

The REPORT POSITION command instructs the addressee to report its current position. The position is returned in the Data Address field of the Response Extent parameter. On an addressee that is fully buffered, this command can also be used to determine how much data is remaining in the buffer and how much has been fixed on the media by use of the Extended Position parameter. The Extended Position parameter shall only be appended to the response when the Extended Position modifier is set to 1. The REPORT POSITION parameters shall be as listed in Table 21 and shall be as described in 7.3.1 - 7.3.5.

7.3.1 Response Extent (Common) Parameter. This parameter is used to return the Data Address of the current position of the media (i.e., the address of the next sequential record

Table 21
REPORT POSITION Parameters

@	LTH	ID	OCTET	X/b	DEF	REPORT POSITION PARAMETERS
S	n+1	32				RESPONSE EXTENT PARAMETER
			01-04			Residual Count
			05-08			Data Address
S	n+1	3A				DATA ADDRESS PARAMETER
S	n+1	3E				PARTITION PARAMETER
S	02	52				MEDIA POSITION
			01	7		Beginning of Media
				6		End of Media Warning
				5		Media Present
				4		Logical End Of Media (LEOM)
				3-2		Reserved
				1		Default Recording Format
				0		Write Protect
S	09	51				EXTENDED POSITION
			01-04			Logical Position
			05-08			Physical Position

to be processed in the forward direction). The residual count is not used.

NOTE: The Response Extent may not be sufficient for the master to manage fully buffered devices.

7.3.2 Data Address (Common) Parameter. This parameter shall be as described in 5.5.11 of ANSI X3.132-1987.

7.3.3 Partition (Common) Parameter. This parameter shall be as described in 5.5.15 of ANSI X3.132-1987.

7.3.4 Media Position. This is a bit-significant octet used to report the general position of the media to the master.

7.3.4.1 Beginning Of Media. This bit, when set to 1, indicates that the tape is positioned at load point.

7.3.4.2 End Of Media Warning. When set to 1, this bit informs the master that a previous command has left the media positioned at or beyond the EMW indicator (the reflective EOT marker on 1/2-inch reel tape). When positioned before the EMW indicator (on the logical BOM side), either because the EMW has not yet been reached or because a subsequent operation leaves the media positioned before EMW, this bit shall be set to 0.

7.3.4.3 Media Present. This bit informs the master that a volume is mounted and correctly loaded. This bit shall be set to 0 to inform the master of such conditions as broken tape or no volume mounted.

7.3.4.4 Logical End Of Media. This bit informs the master that the tape is positioned at the LEOM warning.

7.3.4.5 Default Recording Format. This bit, when set to 1, indicates that the tape drive is set to process data with the drive default recording density.

7.3.4.6 Write Protect. When set, this bit indicates to the master that the tape volume is write protected (i.e., the absence of a "write ring").

7.3.5 Extended Position. This parameter is used to report the logical and physical position of the media. This information is useful to a master that is attempting to recover data from an addressee that has experienced an unrecoverable error and still has data in its buffer that has not yet been fixed to the media.

7.3.5.1 Logical Position. This field contains the address of the next recorded element to be transferred across the IPI. The address reported shall always be the address of the next recorded element to be processed in the forward direction.

7.3.5.2 Physical Position. This field contains the address of the next recorded element to be transferred between the media and the buffer. The address reported shall always be the address of the next recorded element to be processed in the forward direction.

NOTE: All recorded elements that are in the buffer that have not been fixed to the media are reported by the addressee (i.e., the buffer may hold tape marks as well as data).

Table 22
RECORD POSITION Parameters

@	LTH	ID	OCTET	X/b	DEF	RECORD POSITION PARAMETERS
M	n+1	31				COMMAND EXTENT
			01-04			Count
			05-08			Data Address
S	n+1	32				RESPONSE EXTENT
			01-04			Residual Count
			05-08			Data Address
M	02	51	01			TAPE MARK PARAMETER
				7		File Mark *
				6		Beginning of File *
				5		End of File *
				4		Logical End Of Media (LEOM) *
				3-0		Reserved

* These bits are mutually exclusive.

PKT LTH	REF NO 0 1	OP CODE 2	COM MOD 3	OP MOD	SLAV ADDR 4	FAC ADDR 5	COMMAND PARAMETERS 6 through n
xxxx xxxx		43	bbbb bbbb		xx	xx	

Figure 13
Command Packet for RECORD POSITION

PKT LTH	Echoed From Command 0 1 2 3 4 5	MAJOR STATUS CODES 6	TYPE 7	CODE 8	RESPONSE PARAMETERS 9 through n
xxxx	eeeeeeeeeee	bbbb bbbb 0010 bbbb 7654 3210		3210	

Figure 14
Response Packet for RECORD POSITION

7.4 RECORD POSITION. The command packet for this command shall be as shown in Figure 13. The reponse packet for this command shall be as shown in Figure 14.

The RECORD POSITION command instructs the facility to record at its current position the tape mark defined by the Tape Mark Parameter. The RECORD POSITION parameters shall be as listed in Table 22 and shall be as described in 7.4.1 - 7.4.3.

7.4.1 Command Extent Parameter. This parameter shall be as described in 5.5.2 of ANSI X3.132-1987 with the following additions. The Command Extent parameter, if present, specifies the number of times the specified tape mark is to be recorded. If the Data Address is any value other than zero, it shall agree with the current position of the addressee (e.g., if on multi-track tape, a serpentine track number in the Data Address shall agree with the track upon which the addressee is to Record Position). If the Command Extent parameter is not present, one tape mark shall be recorded.

7.4.2 Response Extent Parameter. This parameter shall be as described in 5.5.3 of ANSI X3.132-1987 with the following additions. If the command fails, this parameter shall be used to report to the master the number of tape marks remaining to be recorded. The Data Address field shall not be used.

```
+----+----+----+----+----+----+----+------------
|PKT |REF | OP |COM | OP |SLAV|FAC |  COMMAND
| LTH| NO |CODE| MOD| MOD|ADDR|ADDR| PARAMETERS
|    | 0 1|  2 |    3    |  4 |  5 | 6 through n
+----+----+----+---------+----+----+------------
 xxxx xxxx  10  bbbb bbbb  xx   xx
                7654 3210
                     ||||  Count  0=Octet  1=Block
                     |||  Data Recovery  0=On  1=Off
                     ||  0=DataBlock  1=PhysicalBlock
                     |  Direction  0=Forward  1=Reverse
```

Figure 15
Command Packet for READ

```
+----+------------+-------------------+------------
|PKT | Echoed From|    MAJOR STATUS    |  RESPONSE
| LTH|   Command  | CODES   |TYPE|CODE| PARAMETERS
|    | 0 1 2 3 4 5|    6    |    7    | 8 through n
+----+------------+---------+----+----+------------
 xxxx eeeeeeeeeeee bbbb bbbb 0010 bbbb
                   7654 3210      3210
```

Figure 16
Response Packet for READ

7.4.3 Tape Mark Parameter. This is a bit-significant octet used to specify the mark to be recorded on the media. When this parameter is present, the specified tape mark shall be recorded. If the tape mark parameter is not present, a File Mark shall be recorded.

NOTE: The bits of the tape mark parameter are all mutually exclusive and shall only be set one at a time.

7.4.3.1 File Mark. When set, this bit specifies that a File Mark is to be recorded.

7.4.3.2 Beginning of File. This bit instructs the addressee to record a Beginning of File mark.

7.4.3.3 End of File. This bit instructs the addressee to record an End of File mark.

7.4.3.4 Logical End of Media. When set, this bit instructs the addressee to record a Logical End of Media Warning mark.

8. Transfer Commands

Transfer commands allow for multiple block transfers across physical boundaries. Upon recognizing a transfer command, the slave or facility shall position to the Data Address specified in the Command Extent parameter, locate the block, and perform the required action. The command terminates when the amount of data specified by the Count has been transferred, or an error occurs that requires earlier termination. The status provided in the response packet shall identify what actions occurred during the execution of the command.

When a transfer command that reads data from the medium is executed in the reverse direction, the first octet read from the medium shall be the first octet transferred to the master (i.e., logically the last octet written is the first octet read).

8.1 READ. The command packet for this command shall be as shown in Figure 15. The response packet for this command shall be as shown in Figure 16.

The READ command transfers data from the addressee to the master starting at the location given in the Data Address of the Command Extent parameter or at the current location if implicit positioning is not supported. When the addressee supports implicit positioning and positioning is required before the data can be accessed, the slave shall initiate the positioning operation. If the addressee does

not support implicit positioning, the master shall position the media explicitly, and the Data Address of the Command Extent parameter shall be ignored by the slave. (See the SPACE BLOCK/FILE MARK command (7.1) and the POSITION CONTROL command (7.2) for details of the positioning operation.)

When the access is complete, the addressee shall read, and transfer to the master, the number of sequentially addressed blocks or octets specified by the Count. If the Command Extent parameter is not appended to the READ command, one block shall be sent to the master starting at the current position. (The count modifier shall be ignored).

When the Data Recovery modifier is set to On (data recovery enabled), the slave or facility shall initiate data error recovery to attempt to recover data read with errors. If the error is unrecoverable, data shall be transferred up to the error and the command shall terminate. If the recovery attempts are successful, the transfer shall continue until all of the requested data has been transferred.

NOTE: When the modifier specifies blocks to be transferred, a partial block in error may be transferred to the master. However, the Residual Count in the Response Extent parameter shall indicate that the block in error was not transferred. When the addressee has received a read command specifying an octet transfer, data shall be transferred up to the octet in error and the Residual Count shall indicate the remaining octets to be transferred.

When the Data Recovery modifier is set to Off (data recovery disabled), the slave or facility shall terminate the command if a data error is detected. The data in error shall be transferred. Recovery from nondata transfer errors are not suppressed by the Data Recovery Off modifier.

If a File Mark or End Of Media is encountered during a transfer, the command shall be terminated, and the appropriate status and substatus codes shall be sent to the master. If, while reading in the reverse direction, a File Mark or the Beginning Of Media is detected, the command shall be terminated, and Incomplete Status with the appropriate substatus code shall be returned to the master in the command response.

If the READ command modifier specified an octet transfer and the end of the block to be read was encountered before the Count in the Command Extent parameter was exhausted, the command shall be terminated with Incomplete status and Length Error indicated in Substatus.

The slave shall present only valid data to the master if the Data Recovery modifier is set. Recovery from data errors detected during reading shall be attempted by the slave prior to transfer of the data in error to the master. If the data error is not corrected by the slave, processing of the command shall be terminated with a Machine Exception indicated in Major Status. The cause of the termination shall be indicated in substatus and extended substatus (if applicable).

The READ parameters shall be as listed in Table 23 and shall be as described in 8.1.1 - 8.1.5.

8.1.1 Command Extent (Common) Parameter. The Count specifies the number of blocks (or octets) to be transferred and cannot be zero. A zero value shall cause the command to be terminated with a Command Exception. The Data Address specifies the starting location. If the Data Address is not valid for the addressee, processing shall be terminated with Command Exception. (See 5.5.2 of ANSI X3.132-1987 for further information about this parameter.)

8.1.2 Response Extent (Common) Parameter. This parameter shall be used to return the Residual Count of blocks (or octets) remaining in the transfer after it terminated. The Data Address varies in accordance with those modifiers that had been set. (See the Implementation Note in 5.5.3.1 of ANSI X3.132-1987.)

8.1.3 Data Address (Common) Parameter. This parameter shall be as described in 5.5.11 of ANSI X3.132-1987.

8.1.4 Partition (Common) Parameter. This parameter shall be as described in 5.5.15 of ANSI X3.132-1987.

8.1.5 Master Termination Parameter. This parameter shall be as described in 8.1.4 of ANSI X3.132-1987.

8.2 READ RAW DATA. The command packet for this command shall be as shown in Figure 17. The response packet shall be as shown in Figure 18.

The READ RAW DATA command reads data from the addressee and transfers it to the master, regardless of data errors encountered in the read. An error shall be reported only if the data cannot be transferred because of a condition such as inability to access the block, or if an unrecoverable slave or facility error (not associated with data transfer) is encountered.

Table 23
READ Parameters

@	LTH	ID	OCTET	X/b	DEF	READ PARAMETERS
M	n+1	31				COMMAND EXTENT PARAMETER
			01-04			Count
			05-08			Data Address
S	n+1	32				RESPONSE EXTENT PARAMETER
			01-04			Residual Count
			05-08			Data Address
B	n+1	3A				DATA ADDRESS PARAMETER
M	n+1	3E				PARTITION PARAMETER
M	01	52				MASTER TERMINATION PARAMETER

PKT LTH	REF NO 0 1	OP CODE 2	COM MOD 3	OP MOD 4	SLAV ADDR 5	FAC ADDR 6	COMMAND PARAMETERS 6 through n
xxxx	xxxx	11	bbbb bbbb 7654 3210	xx	xx		

```
                    ||||  Count  0=Octet  1=Block
                    |||
                    ||  0=DataBlock  1=PhysicalBlock
                    |  Direction  0=Forward  1=Reverse
```

Figure 17
Command Packet for READ RAW DATA

PKT LTH	Echoed From Command 0 1 2 3 4 5	MAJOR STATUS CODES 6	TYPE 7	CODE	RESPONSE PARAMETERS 8 through n
xxxx	eeeeeeeeeee	bbbb bbbb 7654 3210	0010	bbbb 3210	

Figure 18
Response Packet for READ RAW DATA

The operation starts at the location given in the Data Address of the Command Extent parameter or at the current location, if implicit positioning is not supported. When the addressee supports implicit positioning and positioning is required before the data can be accessed, the slave shall initiate the positioning operation. If the addressee does not support implicit positioning, the master shall position the media explicitly, and the Data Address of the Command Extent parameter shall be ignored by the slave. (See the SPACE BLOCK/FILE MARK command (7.1) and the POSITION CONTROL command (7.2) for details of the positioning operation.)

When the access is complete, the addressee shall execute the command on the number of sequentially addressed blocks or octets specified by the Count. If the Command Extent parameter is not appended to the command, one block shall be processed starting at the current position. (The count modifier shall be ignored).

The READ RAW DATA parameters shall be as listed in Table 24 and shall be as shown in 8.2.1 - 8.2.4.

8.2.1 Command Extent (Common) Parameter. This parameter shall be as described in 8.1.1 of this standard.

8.2.2 Response Extent (Common) Parameter. This parameter shall be as described in 8.1.2 of this standard.

8.2.3 Data Address (Common) Parameter. This parameter shall be as described in 5.5.11 of ANSI X3.132-1987.

8.2.4 Partition (Common) Parameter. This parameter shall be as described in 5.5.15 of ANSI X3.132-1987.

8.3 SEARCH. This command shall be as described in the section on the SEARCH command in 8.4 of ANSI X3.132-1987.

8.4 WRITE. The command packet for this command shall be as shown Figure 19. The response packet for this command shall be as shown in Figure 20.

The WRITE command transfers data from the master to the addressee starting at the position specified in the Data Address of the Command Extent parameter or at the current position, if implicit positioning is not supported by the slave. When the addressee supports implicit positioning and positioning is required before the data can be accessed, the slave shall initiate the positioning operation. If the addressee does not support implicit positioning, the master shall position the media explicitly, and the Data Address of the Command Extent parameter shall be ignored by the slave. (See the SPACE BLOCK/FILE MARK command (7.1) and the POSITION CONTROL command for details of the positioning operation. The mode and direction of the command shall be specified by the modifier octet.

If EMW is detected during the execution of a WRITE in the forward direction,the command shall be terminated after the current block is written, and the appropriate status shall be presented to the Master. As long as the media is positioned at or beyond EMW, all forward write operations shall be terminated after the first block is written and the appropriate status shall be returned to the Master. If PEOM is encountered during the execution of a forward write, the command shall be terminated and the appropriate status shall be presented to the Master. Data being written when PEOM was encountered may not be recoverable. If the BOM is detected while writing in the reverse direction, the command shall be terminated, and the appropriate status code shall be returned to the master in the command response.

If the Write Edit modifier is set, the addressee is to perform an update to the record at the address specified in the Command Extent Parameter. If the addressee does not support the Edit function (as specified in Attributes), the command shall be rejected and Invalid Command status returned to the master.

The WRITE parameters shall be as listed in Table 25 and shall be as described in 8.4.1 - 8.4.6.

8.4.1 Command Extent (Common) Parameter. This parameter shall be as described in 8.1.1 of this standard.

8.4.2 Response Extent (Common) Parameter. This parameter shall be as described in 8.1.2 of this standard.

8.4.3 Data Address (Common) Parameter. This parameter shall be as described in 5.5.11 of ANSI X3.132-1987.

8.4.4 Transfer (Common) Parameter. This parameter shall be used to specify the actions to be taken by the slave when writing to the media. If this parameter is not present, the addressee shall verify the data immediately after it is written (i.e, "Verify" is the

Table 24
READ RAW DATA Parameters

@	LTH	ID	OCTET	X/b	DEF	READ RAW DATA PARAMETERS
M	n+1	31				COMMAND EXTENT PARAMETER
			01-04			Count
			05-08			Data Address
S	n+1	32				RESPONSE EXTENT PARAMETER
			01-04			Residual Count
			05-08			Data Address
B	n+1	3A				DATA ADDRESS PARAMETER
M	n+1	3E				PARTITION PARAMETER

PKT LTH	REF NO 0 1	OP CODE 2	COM MOD 3	OP MOD 4	SLAV ADDR	FAC ADDR 5	COMMAND PARAMETERS 6 through n
xxxx	xxxx	20	bbbb	bbbb	xx	xx	

7654 3210
|||| Count 0=Octet 1=Block
||| 1 = Write Edit
|| 0=DataBlock 1=PhysicalBlock
| Direction 0=Forward 1=Reverse

Figure 19
Command Packet for WRITE

PKT LTH	Echoed From Command 0 1 2 3 4 5	MAJOR STATUS CODES 6	TYPE 7	CODE	RESPONSE PARAMETERS 8 through n
xxxx	eeeeeeeeeee	bbbb bbbb	0010	bbbb	
		7654 3210		3210	

Figure 20
Response Packet for WRITE

Table 25
WRITE Parameters

@	LTH	ID	OCTET	X/b	DEF	WRITE PARAMETERS
M	n+1	31				COMMAND EXTENT PARAMETER
			01-04			Count
			05-08			Data Address
S	n+1	32				RESPONSE EXTENT PARAMETER
			01-04			Residual Count
			05-08			Data Address
B	n+1	3A				DATA ADDRESS PARAMETER
M	02	3C				TRANSFER PARAMETERS
M	n+1	3E				PARTITION PARAMETER
M	01	52				MASTER TERMINATION PARAMETER

default mode for tape). (See 5.5.13 of ANSI X3.132-1987 for more information on this parameter.)

8.4.5 Partition (Common) Parameter. This parameter shall be as described in 5.5.15 of ANSI X3.132-1987.

8.4.6 Master Termination Parameter. This parameter shall be as described in 8.1.4 of ANSI X3.132-1987.

8.5 WRITE PATTERN. The WRITE PATTERN command for Magnetic Tape is functionally identical to the WRITE PATTERN command described in 8.6 of ANSI X3.132-1987 and the same requirements shall apply.

9. Combination Commands

9.1 COPY. This command shall be as described in 9.1 of ANSI X3.132-1987.

9.2 COMPARE SLAVE DATA. This command shall be as described in 9.2 of ANSI X3.132-1987.

9.3 COMPARE DATA. This command shall be as described in 9.3 of ANSI X3.132-1987.

9.4 SHADOW READ. This command shall be as described in 9.6 of ANSI X3.132-1987.

9.5 SHADOW WRITE. This command shall be as described in 9.7 of ANSI X3.132-1987.

9.6 SHADOW RESTORE. This command shall be as described in 9.8 of ANSI X3.132-1987.

10. Other Transfer Commands

The data transfer commands in this section are used for specific functions other than typical read and write activity. In many situations, these commands may be used to compliment diagnostics. These commands by their very nature are either device specific or vendor specific. Refer carefully to vendor specifications as to their implementation.

10.1 READ VERIFY. The command packet for this command shall be as shown in Figure 21. The response packet for this command shall be as shown in Figure 22.

The READ VERIFY command reads data from the addressee and verifies that the data is correct as determined by the slave or facility's error detection/correction scheme. Data is not transferred to the master.

When used with tape, this command shall be used to verify data integrity on the media. Every PhysicalBlock within the extent is read and the CRC/ECC is checked. If an error is detected, the operation is terminated, and the Data Address in the Response Extent parameter identifies the block containing the error. The Residual count may be used to determine the block in error.

The operation starts at the location given in the Data Address of the Command Extent parameter or at the current location, if implicit positioning is not supported. When the addressee supports implicit positioning and positioning is required before the data can be accessed, the slave shall initiate the positioning operation. If the addressee does not support implicit positioning, the master shall position the media explicitly, and the Data Address of the Command Extent parameter shall be ignored by the slave. (See the SPACE BLOCK/FILE MARK command (7.1) and the POSITION CONTROL command (7.2) for details of the positioning operation.)

When the access is complete the addressee shall execute the command on the number of sequentially addressed blocks or octets specified by the Count. If the Command Extent parameter is not appended to the command, one block shall be processed starting at the current position. (The count modifier shall be ignored).

If the Volume modifier in the parameters is set, the slave shall verify the entire volume.

The High Margin modifier, when set, indicates to the addressee that an error-detecting threshold lower than the normal read threshold shall be used while executing the READ VERIFY operation.

No error correction or automatic error recovery procedures shall be performed while executing a READ VERIFY command.

The READ VERIFY parameters shall be as listed in Table 26 and shall be as described in 10.1.1 - 10.1.5.

10.1.1 Command Extent (Common) Parameter. This parameter shall be as described in 8.1.1 of this standard.

10.1.2 Response Extent (Common) Parameter. This parameter shall be as described in 8.1.2 of this standard.

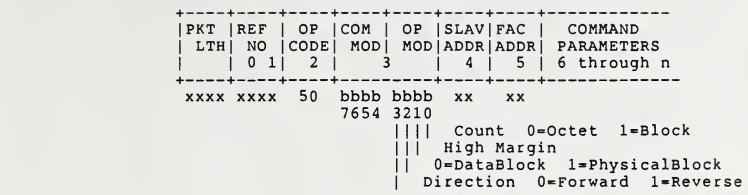


Figure 21
Command Packet for READ VERIFY

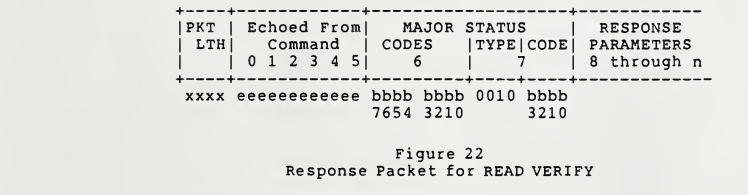


Figure 22
Response Packet for READ VERIFY

Table 26
READ VERIFY Parameters

@	LTH	ID	OCTET	X/b	DEF	READ VERIFY PARAMETERS
M	n+1	31				COMMAND EXTENT PARAMETER
			01-04			Count
			05-08			Data Address
S	n+1	32				RESPONSE EXTENT PARAMETER
			01-04			Residual Count
			05-08			Data Address
B	n+1	3A				DATA ADDRESS PARAMETER
M	02	3C				TRANSFER PARAMETERS
M	n+1	3E				PARTITION PARAMETER

```
+----+----+----+----+----+----+----+-------------
|PKT |REF | OP |COM | OP |SLAV|FAC |  COMMAND
| LTH| NO |CODE| MOD| MOD|ADDR|ADDR| PARAMETERS
|    | 0 1|  2 |    3    |  4 |  5 | 6 through n
+----+----+----+---------+----+----+-------------
 xxxx xxxx  52  bbbb bbbb  xx   xx
                7654 3210
                     ||||  Count  0=Octet  1=Block
                     |||  0=Diagnostic    1=Recovery
                     ||  0=DataBlock    1=PhysicalBlock
                     |  0=FIFO    1=LIFO
```

Figure 23
Command Packet for READ FROM BUFFER

```
+----+------------+--------------------+------------
|PKT | Echoed From|    MAJOR STATUS    |  RESPONSE
| LTH|   Command  | CODES   |TYPE|CODE| PARAMETERS
|    | 0 1 2 3 4 5|    6    |    7    | 8 through n
+----+------------+---------+----+----+-------------
 xxxx eeeeeeeeeeee bbbb bbbb 0010 bbbb
                   7654 3210      3210
```

Figure 24
Response Packet for READ FROM BUFFER

10.1.3 Data Address (Common) Parameter. This parameter shall be as described in 5.5.11 of ANSI X3.132-1987.

10.1.4 Transfer (Common) Parameter. This parameter shall be as described in 5.5.13 of ANSI X3.132-1987.

10.1.5 Partition (Common) Parameter. This parameter shall be as described in 5.5.15 of ANSI X3.132-1987.

10.2 READ FROM BUFFER. The command packet for this command shall be as shown in Figure 23. The response packet shall be as shown in Figure 24.

The READ FROM BUFFER command transfers the contents of the addressee buffer to the master beginning at the octet offset or the block address contained in the Data Address of the Command Extent parameter. The Command Extent Count specifies the number of octets or blocks that are to be transferred to the master.

When the Diagnostic/Recovery modifier is set to Diagnostic, the READ FROM BUFFER may be used in conjunction with WRITE TO BUFFER to test the addressee's data buffer. The addressee shall transfer the specified number of blocks or octets from its internal buffer to the master. The FIFO/LIFO modifier shall be ignored, and all data shall be transferred to the master in a "logical forward" direction. When the Octet/Block modifier is set to Octet, the addressee shall begin transferring data at an octet from zero equal to the value contained in the Command Extent Data Address field. If the modifier is set to Block, the addressee shall transfer data at the specified block address. In both cases, the addressee shall transfer the number of octets or blocks specified in the Command Extent Count field.

When the Diagnostic/Recovery modifier is set to Recovery, the READ FROM BUFFER command shall be executed in a manner similar to a normal read, except that the read is limited to data contained in the addressee data buffer. When present, the Data Address field of the Command Extent specifies the block address at which the addressee is to begin the transfer. The Command Extent Count field specifies the number of octets or blocks the addressee is to transfer.

If in the Recovery mode the Octet/Block modifier is set to Octet, the addressee shall transfer, starting at the Data Address, one block of data or the number of octets specified in the count, whichever is less. If the addressee transfers an entire block of data

Table 27
READ FROM BUFFER Parameters

@	LTH	ID	OCTET	X/b	DEF	READ FROM BUFFER PARAMETERS
M	n+1	31				COMMAND EXTENT PARAMETER
			01-04			Count
			05-08			Data Address
S	n+1	32				RESPONSE EXTENT PARAMETER
			01-04			Residual Count
			05-08			Data Address
B	n+1	3A				DATA ADDRESS PARAMETER
M	n+1	3E				PARTITION PARAMETER
M	03	50	01			BUFFER ADDRESS PARAMETER

without exhausting the Command Extent Count, the command shall terminate with Incomplete Status and a residual count in the Response Extent parameter.

If the Octet/Block modifier is set to Block while in the Recovery mode, the addressee shall transfer, starting at the Data Address, the number of blocks specified in the Count. If transferring in block mode the addressee reads a block whose length is not equal to the addressee's currently defined block length, the command shall be terminated with Incomplete status and a residual count in the Response Extent parameter.

When executing a READ FROM BUFFER command in Recovery mode, the FIFO/LIFO modifier shall be used to specify the starting read position in the absence of the Data Address field of the Command Extent. If the Command Extent does not contain a Data Address and the FIFO/LIFO modifier is set to FIFO, the addressee shall start the transfer at the address of the next block to be transferred between the data buffer and the media as reported in the REPORT POSITION Extended Position parameter. The addressee shall continue to the transfer in FIFO order until the Command Extent Count is exhausted (or to the end of the block if in Octet mode and the Count exceeds the block size). If the FIFO/LIFO bit is set to LIFO, the addressee shall begin the transfer at the block address of the next block to be transferred between the master and the addressee as reported in the REPORT POSITION Extended Position parameter. The transfer shall proceed, transferring blocks in LIFO order until the count is exhausted (or to the end of the block if in Octet mode and the Count exceeds the block size). In either FIFO or LIFO mode, all octets within a block are transferred to the master such that the octet having the lowest offset from the origin of the block is transferred first. As blocks are transferred to the master, the addressee buffer pointers shall be adjusted such that a succeeding READ FROM BUFFER command in FIFO or LIFO mode will transfer the next sequential block.

If the Data Address field is present in the Command Extent parameter and the READ FROM BUFFER command is being executed in the Recovery mode, the addressee begins reading at the specified block address. The FIFO/LIFO modifier shall be used by the addressee to determine whether to increment or decrement the block address pointer (i.e., read "forward" or "reverse" through the data buffer).

Whether or not an addressee stores special control characters in the data buffer is implementation dependent. If the addressee encounters a tape mark during the execution of a READ FROM BUFFER command, the command shall be terminated with the appropriate status and a residual count in the Response Extent parameter.

If the combination of the Data Address and the Count in the Command Extent exceeds the addressee buffer size, the command shall be rejected by the addressee with Command Exception status.

The READ FROM BUFFER parameters shall be as listed in Table 27 and shall be as described in 10.2.1 - 10.2.5.

10.2.1 Command Extent (Common) Parameter. This parameter shall be as described in 8.1.1 of this standard.

10.2.2 Response Extent (Common) Parameter. This parameter shall be as described in 8.1.2 of this standard.

10.2.3 Data Address (Common) Parameter. This parameter shall be as described in 5.5.11 of ANSI X3.132-1987.

10.2.4 Partition (Common) Parameter. This parameter shall be as described in 5.5.15 of ANSI X3.132-1987.

10.2.5 Buffer Address Parameter. This parameter shall be as described in 10.3.4.6 of ANSI X3.132-1987.

10.3 READ FACILITY DATA TO BUFFER. This command is identical to the READ FACILITY DATA TO BUFFER command in 10.4 of ANSI X3.132-1987 and the same requirements shall apply.

10.4 READ PHYSICAL DATA AND ECC. The READ PHYSICAL DATA AND ECC command for Magnetic Tape is functionally identical to the READ PHYSICAL DATA AND ECC command described in 10.5 of ANSI X3.132-1987 and the same requirements shall apply.

10.5 READ PHYSICAL HEADER. With the exception of the Direction modifier, this command is functionally identical to the READ PHYSICAL HEADER command described in 10.6 of ANSI X3.132-1987 and the same requirements shall apply.

10.6 READ IPL. The command packet for this command shall be as shown in Figure 25. The response packet shall be as shown in Figure 26.

Read IPL (Initial Program Load) causes the first block of IPL data to be transferred to the master. Typically, receipt of the Read IPL command shall cause the slave to initialize its position and to access Block 0 in the forward direction on the addressed facility. When the access is complete, the addressee shall transfer one block of data to the master. This command may not be chained from any other command and always executes from the default data partition.

10.7 READ PHYSICAL HEADER AND ECC. With the exception of the Direction modifier, this command is functionally identical to the READ PHYSICAL HEADER AND ECC command described in 10.8 of ANSI X3.132-1987 and the same requirements shall apply.

10.8 WRITE TO BUFFER. This command is identical to the WRITE TO BUFFER command in 10.9 of ANSI X3.132-1987 and the same requirements shall apply.

10.9 WRITE BUFFER TO FACILITY. This command is identical to the WRITE BUFFER TO FACILITY command in 10.10 of ANSI X3.132-1987 and the same requirements shall apply.

10.10 WRITE PHYSICAL DATA AND ECC. With the exception of the Direction modifier, this command is functionally identical to the WRITE PHYSICAL DATA AND ECC command described in 10.11 of ANSI X3.132-1987 and the same requirements apply.

10.11 WRITE PHYSICAL HEADER. With the exception of the Direction modifier, this command is functionally identical to the WRITE PHYSICAL HEADER command described in 10.12 of ANSI X3.132-1987 and the same requirements apply.

10.12 LOAD SLAVE IML. This command is identical to the LOAD SLAVE IML command in 10.13 of ANSI X3.132-1987 and the same requirements apply.

10.13 ERASE. The command packet for this command shall be as shown in Figure 27. The response packet shall be as shown in Figure 28.

The ERASE command instructs the addressee to erase a gap beginning at the current tape position and extending beyond EMW (security erase) or to erase a gap of specified length beginning at the current location, depending on the command modifier.

When a Gap Erase is indicated by the erase modifier, the Gap modifier specifies the method to be used in calculating the gap length. When the Gap modifier is set to 0, the gap length shall be equal to the length of tape required to record the number of octets or blocks specified in the Command Extent Parameter Count. If the Gap modifier is set to 1, the gap length shall be equal to the length produced by multiplying the Erase Multiplier by the minimum gap length. When performing a long erase, the Command Extent Parameter Count field specifies the number of

```
+----+----+----+----+----+----+----+------------
|PKT |REF | OP |COM | OP |SLAV|FAC |  COMMAND
| LTH| NO |CODE| MOD| MOD|ADDR|ADDR| PARAMETERS
|    | 0 1|  2 |    3    |  4 |  5 | 6 through n
+----+----+----+---------+----+----+------------
 xxxx xxxx  56  bbbb bbbb  xx   xx
```

Figure 25
Command Packet for READ IPL

```
+----+------------+--------------------+------------
|PKT | Echoed From|    MAJOR STATUS    |  RESPONSE
| LTH|   Command  | CODES   |TYPE|CODE| PARAMETERS
|    | 0 1 2 3 4 5|    6    |    7    | 8 through n
+----+------------+---------+----+----+-------------
 xxxx eeeeeeeeeeee bbbb bbbb 0010 bbbb
                   7654 3210      3210
```

Figure 26
Response Packet for READ IPL

```
+----+----+----+----+----+----+----+------------
|PKT |REF | OP |COM | OP |SLAV|FAC |  COMMAND
| LTH| NO |CODE| MOD| MOD|ADDR|ADDR| PARAMETERS
|    | 0 1|  2 |    3    |  4 |  5 | 6 through n
+----+----+----+---------+----+----+------------
 xxxx xxxx  67  bbbb bbbb  xx   xx
                7654 3210
                     ||||  Count 0=Octet  1=Block
                     |||  0=Security Erase  1=Gap Erase
                     ||  Gap  0=Short  1=Long
                     |  Direction  0=Forward  1=Reverse
```

Figure 27
Command Packet for ERASE

```
+----+------------+--------------------+------------
|PKT | Echoed From|    MAJOR STATUS    |  RESPONSE
| LTH|   Command  | CODES   |TYPE|CODE| PARAMETERS
|    | 0 1 2 3 4 5|    6    |    7    | 8 through n
+----+------------+---------+----+----+-------------
 xxxx eeeeeeeeeeee bbbb bbbb 0010 bbbb
                   7654 3210      3210
```

Figure 28
Response Packet for ERASE

long gaps to be erased. The Data Address field of the Command and Response Extent parameters shall not be used. When executing a Gap Erase, the gap actually recorded on the media shall be the gap specified by the ERASE command and an Inter-Block gap of the currently defined size.

NOTE: Explicit positioning is required for execution of this command. Therefore, Operation Modifier Bit 2 has been redefined to specify Security Erase/Gap Erase instead of DataBlock/PhysicalBlock.

The ERASE parameters shall be as listed in Table 28 and shall be as described in 10.13.1 - 10.13.4.

10.13.1 Command Extent (Common) Parameter. This parameter shall be as described in 5.5.2 of ANSI X3.132-1987 and as modified by the description of this command.

10.13.2 Response Extent (Common) Parameter. This parameter shall be as described in 5.5.3 of ANSI X3.132-1987.

10.13.3 Data Address (Common) Parameter. This parameter shall be as described in 5.5.11 of ANSI X3.132-1987.

10.13.4 Partition (Common) Parameter. This parameter shall be as described in 5.5.15 of ANSI X3.132-1987.

10.14 WRITE PHYSICAL HEADER AND ECC. With the exception of the Direction modifier, this command is functionally identical to the WRITE PHYSICAL HEADER AND ECC command described in 10.15 of ANSI X3.132-1987 and the same requirements shall apply.

11. Diagnostic Commands

The commands in this section are the maintenance and diagnostic commands of the Logical Interface. These commands by their very nature are either device specific or vendor specific. Refer to vendor specifications as to their implementation.

11.1 PERFORM SLAVE DIAGNOSTICS. This command is identical to the PERFORM SLAVE DIAGNOSTICS command in 11.1 of ANSI X3.132-1987 and the same requirements shall apply.

11.2 PERFORM FACILITY DIAGNOSTICS. This command is identical to the PERFORM FACILITY DIAGNOSTICS command in 11.2 of ANSI X3.132-1987 and the same requirements shall apply.

11.3 READ ERROR LOG. The command packet for this command shall be as shown in Figure 29. The response packet shall be as shown in Figure 30.

The READ ERROR LOG command provides a method for the master to request usage information, error information, or both from the addressee because it transfers the recorded error log data from the addressee. The error log contents and format are slave or facility specific.

Note that the error log contents may be returned as data. If the error log is returned as data, parameter ID 50 is not required in the response.

The error log data may be maintained automatically by the slave, maintained under direct control of the master, or by a combination of both. Whether or not usage or error counters within the addressee are reset after the successful completion of the READ ERROR LOG command is vendor specific. If the vendor does not automatically clear error and usage counters, the master shall specifically do so via the WRITE ERROR LOG command with the Create modifier set. If the addressee normally clears the error log after successful completion of a Read Error Log command, the clearing of the log shall be inhibited when the Clear Error Log modifier is set to one.

The READ ERROR LOG parameters shall be as listed in Table 29.

11.4 WRITE ERROR LOG. This command is identical to the WRITE ERROR LOG command in 11.6 of ANSI X3.132-1987 and the same requirements shall apply.

11.5 DIAGNOSTIC CONTROL. This command is identical to the DIAGNOSTIC CONTROL command in 11.7 of ANSI X3.132-1987 and the same requirements shall apply.

Table 28
ERASE Parameters

@	LTH	ID	OCTET	X/b	DEF	ERASE PARAMETERS
M	n+1	31				COMMAND EXTENT PARAMETER
			01-04			Count
			05-08			Data Address
S	n+1	32				RESPONSE EXTENT PARAMETER
			01-04			Residual Count
			05-08			Data Address
M	n+1	3E				PARTITION PARAMETER

PKT LTH	REF NO 0 1	OP CODE 2	COM MOD 3	OP MOD	SLAV ADDR 4	FAC ADDR 5	COMMAND PARAMETERS 6 through n
xxxx	xxxx	84	bbbb	bbbb	xx	xx	

xx = 0 Clear Error Log

Figure 29
Command Packet for READ ERROR LOG

PKT LTH	Echoed From Command 0 1 2 3 4 5	MAJOR STATUS CODES 6	TYPE 7	CODE 7	RESPONSE PARAMETERS 8 through n
xxxx	eeeeeeeeeee	bbbb bbbb	0010	bbbb	
		7654 3210		3210	

Figure 30
Response Packet for READ ERROR LOG

Table 29
READ ERROR LOG Parameters

@	LTH	ID	OCTET	X/b	DEF	READ ERROR LOG PARAMETERS
S	n+1	50	01- n			Vendor-specific Error Log data

12. Command Summary

12.1 Control Commands

OP	COMMAND	OPCODE MODIFIERS
00	NOP	None
01	FACILITY OPERATION	None
02	ATTRIBUTES	x'0' - Report x'1' - Initialize x'2' - Report/Restore x'9' - Load x'A' - Save
03	REPORT ADDRESSEE STATUS	0 - Condition 1 - Extended Condition
04	PORT ADDRESS	0 - Reserve/Release 1 - Priority Reserve 2 - Notify Alternate Ports of Priority Reserve 3 - Unqualified Reserve
05	PORT CONTROL	0 - Purge Commands Outstanding at Disabled Port 1 - Suspend Command Initiation from Disabled Port
06	ATTENTION CONTROL	x'0' - Enable x'2' - Disable x'4' - Clear x'6' - Set
07	OPERATING MODE	2 - Set /Report
08	ABORT	0 - Orderly Termination 1 - Terminate Command In Progress 2 - Terminate All Commands Not In Progress 3 - Selective Reset
09	ACCESS PERMITS	x'0' - Report x'1' - Initialize x'2' - Report/Restore x'9' - Load x'A' - Save 2 - DataBlock/PhysicalBlock
0A	RESUME	None

12.2 Position Commands

OP	COMMAND	OPCODE MODIFIERS
40	SPACE BLOCK/FILE MARK	0 - Block/File Mark 1 - Stop at End of Track 2 - Logical End Of Media Warning 3 - Forward/Reverse
41	POSITION CONTROL	0 - Octet/Block Count 2 - DataBlock/PhysicalBlock
42	REPORT POSITION	0 - Octet/Block Count 2 - DataBlock/PhysicalBlock
43	RECORD POSITION	None

12.3 Transfer Commands

OP	COMMAND	OPCODE MODIFIERS
10	READ	0 - Octet/Block Count 1 - Data Recovery On/Off 2 - DataBlock/Physical-Block 3 - Forward/Reverse
11	READ RAW DATA	0 - Octet/Block Count 1 - Data Recovery On/Off 2 - DataBlock/Physical-Block 3 - Forward/Reverse
18	SEARCH	0 - Octet/Block Count 2 - DataBlock/Physical-Block 3 - Forward/Reverse
20	WRITE	0 - Octet/Block Count 1 - Write Edit 2 - DataBlock/Physical-Block 3 - Forward/Reverse
21	WRITE PATTERN	0 - Octet/Block Count 2 - DataBlock/Physical-Block 3 - Forward/Reverse

12.4 Combination Commands

OP	COMMAND	OPCODE MODIFIERS
30	COPY	None
31	COMPARE SLAVE DATA	None
32	COMPARE DATA	None
35	SHADOW READ	None
36	SHADOW WRITE	None
37	SHADOW RESTORE	None

12.5 Other Transfer Commands

OP	COMMAND	OPCODE MODIFIERS
50	READ VERIFY	0 - Octet/Block Count 1 - High Margin 2 - DataBlock/PhysicalBlock 3 - Forward/Reverse
52	READ FROM BUFFER	0 - Octet/Block Count 1 - Diagnostic/Recovery 2 - DataBlock/PhysicalBlock 3 - FIFO/LIFO
53	READ FACILITY DATA TO BUFFER	0 - Octet/Block Count 1 - Data Recovery On/Off 2 - DataBlock/PhysicalBlock 3 - Forward/Reverse
54	READ PHYSICAL DATA AND ECC	0 - Octet/Block Count 1 - ECC/Syndrome 3 - Forward/Reverse
55	READ PHYSICAL HEADER AND ECC	1 - Data Recovery On/Off 3 - Forward/Reverse
56	READ IPL	None
58	READ PHYSICAL HEADER	1 - ECC/Syndrome 3 - Forward/Reverse
62	WRITE TO BUFFER	0 - Octet/Block Count 3 - Forward/Reverse

63	WRITE BUFFER TO FACILITY	0 - Octet/Block Count 2 - DataBlock/Physical-Block 3 - Forward/Reverse
64	WRITE PHYSICAL DATA AND ECC	0 - Octet/Block Count 3 - Forward/Reverse
65	WRITE PHYSICAL HEADER	0 - Octet/Block Count 3 - Forward/Reverse
66	LOAD SLAVE IML	None
67	ERASE	0 - Octet/Block Count 1 - Security/Gap Erase 2 - Short/Long Erase 3 - Forward/Reverse
68	WRITE PHYSICAL HEADER AND ECC	0 - Octet/Block Count 1 - ECC/Syndrome 3 - Forward/Reverse

12.6 Diagnostic Commands

OP	COMMAND	OPCODE MODIFIERS
80	PERFORM SLAVE DIAG	None
81	PERFORM FACILITY DIAG	None
84	READ ERROR LOG	0 - Clear Error Log
85	WRITE ERROR LOG	3 - Append/Create
90	DIAGNOSTIC CONTROL	None

X3.115-1984 Unformatted 80 Megabyte Trident Pack for Use at 370 tpi and 6000 bpi (General, Physical, and Magnetic Characteristics)
X3.116-1986 Recorded Magnetic Tape Cartridge, 4-Track, Serial 0.250 Inch (6.30 mm) 6400 bpi (252 bpmm), Inverted Modified Frequency Modulation Encoded
X3.117-1984 Printable/Image Areas for Text and Facsimile Communication Equipment
X3.118-1984 Financial Services — Personal Identification Number — PIN Pad
X3.119-1984 Contact Start/Stop Storage Disk, 158361 Flux Transitions per Track, 8.268 Inch (210 mm) Outer Diameter and 3.937 inch (100 mm) Inner Diameter
X3.120-1984 Contact Start/Stop Storage Disk
X3.121-1984 Two-Sided, Unformatted, 8-Inch (200-mm), 48-tpi, Double-Density, Flexible Disk Cartridge for 13 262 ftpr Two-Headed Application
X3.122-1986 Computer Graphics Metafile for the Storage and Transfer of Picture Description Information
X3.124-1985 Graphical Kernel System (GKS) Functional Description
X3.124.1-1985 Graphical Kernel System (GKS) FORTRAN Binding
X3.125-1985 Two-Sided, Double-Density, Unformatted 5.25-inch (130-mm), 48-tpi (1,9-tpmm), Flexible Disk Cartridge for 7958 bpr Use
X3.126-1986 One- or Two-Sided Double-Density Unformatted 5.25-inch (130-mm), 96 Tracks per Inch, Flexible Disk Cartridge
X3.127-1987 Unrecorded Magnetic Tape Cartridge for Information Interchange
X3.128-1986 Contact Start-Stop Storage Disk — 83 000 Flux Transitions per Track, 130-mm (5.118-in) Outer Diameter and 40-mm (1.575-in) Inner Diameter
X3.129-1986 Intelligent Peripheral Interface, Physical Level
X3.130-1986 Intelligent Peripheral Interface, Logical Device Specific Command Sets for Magnetic Disk Drive
X3.131-1986 Small Computer Systems Interface
X3.132-1987 Intelligent Peripheral Interface — Logical Device Generic Command Set for Optical and Magnetic Disks
X3.133-1986 Database Language —NDL
X3.135-1986 Database Language — SQL
X3.136-1986 Serial Recorded Magnetic Tape Cartridge for Information Interchange, Four and Nine Track
X3.139-1987 Fiber Distributed Data Interface (FDDI) Token Ring Media Access Control (MAC)
X3.140-1986 Open Systems Interconnection — Connection Oriented Transport Layer Protocol Specification
X3.141-1987 Data Communication Systems and Services — Measurement Methods for User-Oriented Performance Evaluation
X3.146-1987 Device Level Interface for Streaming Cartridge and Cassette Tape Drives
X3.147-1988 Intelligent Peripheral Interface — Logical Device Generic Command Set for Magnetic Tapes
X3.153-1987 Open Systems Interconnection — Basic Connection Oriented Session Protocol Specification
X3.156-1987 Nominal 8-Inch Rigid Disk Removable Cartridge
X3.157-1987 Recorded Magnetic Tape for Information Interchange, 3200 CPI
X3.158-1987 Serial Recorded Magnetic Tape Cassette for Information Interchange, 0.150 Inch (3.81 mm), 8000 bpi (315 bpmm), Group Code Recording.
X11.1-1977 Programming Language MUMPS
IEEE 416-1978 Abbreviated Test Language for All Systems (ATLAS)
IEEE 716-1982 Standard C/ATLAS Language
IEEE 717-1982 Standard C/ATLAS Syntax
IEEE 770X3.97-1983 Programming Language PASCAL
IEEE 771-1980 Guide to the Use of ATLAS
ISO 8211-1986 Specifications for a Data Descriptive File for Information Interchange
MIL-STD-1815A-1983 Reference Manual for the Ada Programming Language
NBS-ICST 1-1986 Fingerprint Identification — Data Format for Information Interchange

---

X3/TR1-82 Dictionary for Information Processing Systems (Technical Report)

American National Standards for Information Processing

X3.1-1987 Synchronous Signaling Rates for Data Transmission
X3.2-1970 Print Specifications for Magnetic Ink Character Recognition
X3.4-1986 Coded Character Sets — 7-Bit ASCII
X3.5-1970 Flowchart Symbols and Their Usage
X3.6-1965 Perforated Tape Code
X3.9-1978 Programming Language FORTRAN
X3.11-1969 General Purpose Paper Cards
X3.14-1983 Recorded Magnetic Tape (200 CPI, NRZI)
X3.15-1976 Bit Sequencing of the American National Standard Code for Information Interchange in Serial-by-Bit Data Transmission
X3.16-1976 Character Structure and Character Parity Sense for Serial-by-Bit Data Communication in the American National Standard Code for Information Interchange
X3.17-1981 Character Set for Optical Character Recognition (OCR-A)
X3.18-1974 One-Inch Perforated Paper Tape
X3.19-1974 Eleven-Sixteenths-Inch Perforated Paper Tape
X3.20-1967 Take-Up Reels for One-Inch Perforated Tape
X3.21-1967 Rectangular Holes in Twelve-Row Punched Cards
X3.22-1983 Recorded Magnetic Tape (800 CPI, NRZI)
X3.23-1985 Programming Language COBOL
X3.25-1976 Character Structure and Character Parity Sense for Parallel-by-Bit Data Communication in the American National Standard Code for Information Interchange
X3.26-1980 Hollerith Punched Card Code
X3.27-1987 Magnetic Tape Labels and File Structure
X3.28-1976 Procedures for the Use of the Communication Control Characters of American National Standard Code for Information Interchange in Specified Data Communication Links
X3.29-1971 Specifications for Properties of Unpunched Oiled Paper Perforator Tape
X3.30-1986 Representation for Calendar Date and Ordinal Date
X3.31-1973 Structure for the Identification of the Counties of the United States
X3.32-1973 Graphic Representation of the Control Characters of American National Standard Code for Information Interchange
X3.34-1972 Interchange Rolls of Perforated Tape
X3.37-1987 Programming Language APT
X3.38-1972 Identification of States of the United States (Including the District of Columbia)
X3.39-1986 Recorded Magnetic Tape (1600 CPI, PE)
X3.40-1983 Unrecorded Magnetic Tape (9-Track 800 CPI, NRZI; 1600 CPI, PE; and 6250 CPI, GCR)
X3.41-1974 Code Extension Techniques for Use with the 7-Bit Coded Character Set of American National Standard Code for Information Interchange
X3.42-1975 Representation of Numeric Values in Character Strings
X3.43-1986 Representations of Local Time of Day
X3.44-1974 Determination of the Performance of Data Communication Systems
X3.45-1982 Character Set for Handprinting
X3.46-1974 Unrecorded Magnetic Six-Disk Pack (General, Physical, and Magnetic Characteristics)
X3.47-1977 Structure for the Identification of Named Populated Places and Related Entities of the States of the United States for Information Interchange
X3.48-1986 Magnetic Tape Cassettes (3.81-mm [0.150-Inch] Tape at 32 bpmm [800 bpi], PE)
X3.49-1975 Character Set for Optical Character Recognition (OCR-B)
X3.50-1986 Representations for U.S. Customary, SI, and Other Units to Be Used in Systems with Limited Character Sets
X3.51-1986 Representations of Universal Time, Local Time Differentials, and United States Time Zone References
X3.52-1976 Unrecorded Single-Disk Cartridge (Front Loading, 2200 BPI) (General, Physical, and Magnetic Requirements)
X3.53-1976 Programming Language PL/I
X3.54-1986 Recorded Magnetic Tape (6250 CPI, Group Coded Recording)
X3.55-1982 Unrecorded Magnetic Tape Cartridge, 0.250 Inch (6.30 mm), 1600 bpi (63 bpmm), Phase encoded
X3.56-1986 Recorded Magnetic Tape Cartridge, 4 Track, 0.250 Inch (6.30 mm), 1600 bpi (63 bpmm), Phase Encoded
X3.57-1977 Structure for Formatting Message Headings Using the American National Standard Code for Information Interchange for Data Communication Systems Control
X3.58-1977 Unrecorded Eleven-Disk Pack (General, Physical, and Magnetic Requirements)
X3.60-1978 Programming Language Minimal BASIC
X3.61-1986 Representation of Geographic Point Locations
X3.62-1987 Paper Used in Optical Character Recognition (OCR) Systems
X3.63-1981 Unrecorded Twelve-Disk Pack (100 Megabytes) (General, Physical, and Magnetic Requirements)
X3.64-1979 Additional Controls for Use with American National Standard Code for Information Interchange
X3.66-1979 Advanced Data Communication Control Procedures (ADCCP)
X3.72-1981 Parallel Recorded Magnetic Tape Cartridge, 4 Track, 0.250 Inch (6.30 mm), 1600 bpi (63 bpmm), Phase Encoded
X3.73-1980 Single-Sided Unformatted Flexible Disk Cartridge (for 6631-BPR Use)
X3.74-1987 Programming Language PL/I, General-Purpose Subset
X3.76-1981 Unformatted Single-Disk Cartridge (Top Loading 200 tpi 4400 bpi) (General, Physical, and Magnetic Requirements)
X3.77-1980 Representation of Pocket Select Characters
X3.78-1981 Representation of Vertical Carriage Positioning Characters in Information Interchange
X3.79-1981 Determination of Performance of Data Communications Systems That Use Bit-Oriented Communication Procedures
X3.80-1981 Interfaces between Flexible Disk Cartridge Drives and Their Host Controllers
X3.82-1980 One-Sided Single-Density Unformatted 5.25-Inch Flexible Disk Cartridge (for 3979-BPR Use)
X3.83-1980 ANSI Sponsorship Procedures for ISO Registration According to ISO 2375
X3.84-1981 Unformatted Twelve-Disk Pack (200 Megabytes) (General, Physical, and Magnetic Requirements
X3.85-1981 1/2-Inch Magnetic Tape Interchange Using a Self Loading Cartridge
X3.86-1980 Optical Character Recognition (OCR) Inks
X3.88-1981 Computer Program Abstracts
X3.89-1981 Unrecorded Single-Disk, Double-Density Cartridge (Front Loading, 2200 bpi, 200 tpi) (General, Physical, and Magnetic Requirements)
X3.91M-1987 Storage Module Interfaces
X3.92-1981 Data Encryption Algorithm
X3.93M-1981 OCR Character Positioning
X3.94-1985 Programming Language PANCM
X3.95-1982 Microprocessors — Hexadecimal Input/Output, Using 5-Bit and 7-Bit Teleprinters
X3.96-1983 Continuous Business Forms (Single-Part)
X3.98-1983 Text Information Interchange in Page Image Format (PIF)
X3.99-1983 Print Quality Guideline for Optical Character Recognition (OCR)
X3.100-1983 Interface Between Data Terminal Equipment and Data Circuit-Terminating Equipment for Packet Mode Operation with Packet Switched Data Communications Network
X3.101-1984 Interfaces Between Rigid Disk Drive(s) and Host(s)
X3.102-1983 Data Communication Systems and Services — User-Oriented Performance Parameters
X3.103-1983 Unrecorded Magnetic Tape Minicassette for Information Interchange, Coplanar 3.81 mm (0.150 in)
X3.104-1983 Recorded Magnetic Tape Minicassette for Information Interchange, Coplanar 3.81 mm (0.150 in), Phase Encoded
X3.105-1983 Data Link Encryption
X3.106-1983 Modes of Operation for the Data Encryption Algorithm
X3.110-1983 Videotex/Teletext Presentation Level Protocol Syntax
X3.111-1986 Optical Character Recognition (OCR) Matrix Character Sets for OCR-M
X3.112-1984 14-in (356-mm) Diameter Low-Surface-Friction Magnetic Storage Disk
X3.113-1987 Programming Language FULL BASIC
X3.114-1984 Alphanumeric Machines; Coded Character Sets for Keyboard Arrangements in ANSI X4.23-1982 and X4.22-1983

(*Continued on reverse*)

October 1987

NIST-772
(REV. 10-88)

U.S. DEPARTMENT OF COMMERCE
NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY

FIPS PUBLICATION CHANGE NOTICE

CHANGE NUMBER 2 - FIPS 60-2 & 62
1-FIPS 61-1,63-1,97,111,130&131

DATE OF CHANGE
1990 December 26

FIPS PUBLICATION NUMBER
See above.

PUBLICATION TITLE FIPS 60-2, I/O Channel Interface; 62, Operational Specifications for Magnetic Tape Subsystems; 61-1, Channel Level Power Control Interface; 63-1, Operational Specifications for Variable Block Rotating Mass Storage Subsystems; 97, Operational Specifications for Fixed Block Rotating Mass Storage Subsystems; 111, Storage Module Interfaces (w/extens. for enhanced storage module interface); 130, Intelligent Peripheral Interface (IPI); 131, Small Computer System Interface (SCSI).

THIS OFFICE HAS A RECORD OF YOUR INTEREST IN RECEIVING CHANGES TO THE ABOVE FIPS PUBLICATION. THE CHANGE(S) INDICATED BELOW HAVE BEEN PROVIDED BY THE MAINTENANCE AGENCY FOR THIS PUBLICATION AND WILL BE INCLUDED IN THE NEXT PUBLISHED REVISION TO THIS FIPS PUBLICATION. QUESTIONS OR REQUESTS FOR ADDITIONAL INFORMATION SHOULD BE ADDRESSED TO THE MAINTENANCE AGENCY:

Department of Commerce
National Institute of Standards and Technology
National Computer Systems Laboratory
Gaithersburg, MD 20899

CHANGE ITEM(S)

Attached is a reprint from the December 18, 1990, FEDERAL REGISTER (55 FR 51941) which provides approved revisions by the Secretary of Commerce to the FIPS family of input/output interface standards, and the approved discontinuation of the Exclusion and Verification Lists for these standards.

These approved revisions became effective on December 18, 1990, and become an integral part of FIPS 60-2, 61-1, 62, 63-1, 97, 111, 130 and 131, and, as such, are considered to be included whenever reference is made to them.

These approved revisions should be filed with each FIPS listed above.

Attachment

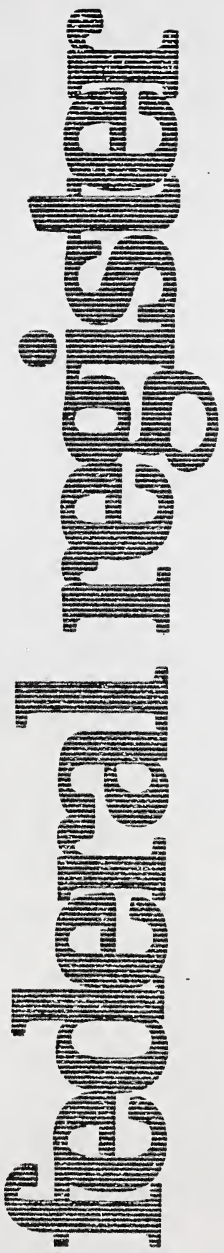
Copies of FIPS are available from:

National Technical Information Service (NTIS)
ATTN: Sales Office, Sills Building
5285 Port Royal Road
Springfield, Virginia 22161

Phone - 703/487-4650 Office Hours - 7:45 a.m. to 4:15 p.m.

ELECTRONIC FORM

12-18-90
Vol. 55 No. 243
Pages 51895-52038



Tuesday
December 18, 1990

National Institute of Standards and Technology

[Docket No. 900101-0219]

RIN 0693-AA59

Approval of Revisions to Federal Information Processing Standards (FIPS) Family of Input/Output Interface Standards

AGENCY: National Institute of Standards and Technology (NIST), Commerce.
ACTION: The purpose of this notice is to announce that the Secretary of Commerce has approved revisions to the Federal Information Processing Standards (FIPS) family of input/output interface standards, and has approved discontinuation of the exclusion and verification lists for these standards.

SUMMARY: On March 20, 1990, notice was published in the Federal Register (55 FR 10272) proposing revision of Federal Information Processing Standards (FIPS) 60-2, 61-1, 62, 63-1, 97, 111, 130, and 131 to make them non-mandatory, and discontinue the exclusion and verification lists for these standards. This proposal superseded the proposal for revision of these standards announced in the Federal Register (52 FR 44462) of November 19, 1987. Procedures for the Exclusion List for FIPS 60, 61, 62, 63, and 97 were published in the Federal Register on

September 3, 1982 (47 FR 38959–38960). Procedures for the Verification List for FIPS 60, 61, 62, 63, and 97 were published in the Federal Register on December 11, 1979 (44 FR 71444–71445) and on April 7, 1981 (46 FR 20719–20720).

The written comments submitted by interested parties and other material available to the Department relevant to these proposed revisions were reviewed by NIST. On the basis of this review, NIST recommended that the Secretary approve revisions to the input/output family of standards and approve discontinuation of the exclusion and verification lists for these standards. NIST prepared a detailed justification document for the Secretary's review in support of those recommendations.

This notice provides only the changes to the revised standards.

EFFECTIVE DATE: These revisions are effective December 18, 1990.

ADDRESSES: Interested parties may obtain copies of FIPS PUBS 60–2, 61–1, 62, 63–1, 97, 111, 130, and 131 from the National Technical Information Service, U.S. Department of Commerce, Springfield, VA 22161.

FOR FURTHER INFORMATION CONTACT: Ms. Shirley Radack, National Institute of Standards and Technology, Gaithersburg, MD 20899, telephone (301) 975–2833.

SUPPLEMENTARY INFORMATION: Under the provisions of 40 U.S.C. 759(d), the Secretary of Commerce is authorized to promulgate standards and guidelines for Federal computer systems, and to make such standards compulsory and binding to the extent to which the Secretary determines necessary to improve the efficiency of operation, or security and privacy of Federal computer systems.

The family of I/O interface standards currently includes:

a. FIPS 60–2, I/O Channel Interface, revised July 29, 1983.

b. FIPS 61–1, Channel Level Power Control Interface, revised July 13, 1982.

c. FIPS 62, Operational Specifications for Magnetic Tape Subsystems, revised December 30, 1980.

d. FIPS 63–1, Operational Specifications for Variable Block Rotating Mass Storage Subsystems, revised April 14, 1983; Supplement to FIPS PUB. 63–1, Additional Operational Specifications for Variable Block Rotating Mass Storage Subsystems, April 14, 1983.

e. FIPS 97, Operational Specifications for Fixed Block Rotating Mass Storage Subsystems, February 4, 1983.

f. FIPS 111, Storage Module Interfaces (with extensions for enhanced storage module interfaces), April 18, 1985.

g. FIPS 130, Intelligent Peripheral Interface (IPI), July 16, 1987.

h. FIPS 131, Small Computer System Interface (SCSI) July 16, 1987.

The following revisions are being made effective immediately upon publication. A delayed effective date is not required because these standards are exempt from the Administrative Procedure Act by U.S.C. 553(a)(2).

Revisions to Federal Information Processing Standards 60–2, 61–1, 62, 63–1, 97, 111, 130, and 131.

FIPS 60–2, I/O Channel Interface, is revised as follows:

Applicability. This standard addresses the interconnection of computer peripheral equipment as a part of ADP systems for the following types of peripherals: (1) Magnetic tape equipment employing open reel-to-reel magnetic tape storage devices, specifically excluding magnetic tape cassette and tape cartridge storage devices, (2) magnetic disk storage equipment employing disk drives each having a capacity greater than 7 megabytes per storage module, excluding flexible disk and disk cartridge devices having a smaller storage capacity per device, and (3) other peripheral equipment employing peripheral device types for which operational specifications standards have been issued as Federal Information Processing Standards. This standard is recommended for use in the acquisition of peripheral equipment for ADP systems with input/output channel interfaces as specified in the technical specifications, when it is determined that interchange of equipment between different systems is likely.

Implementation. The original version of this standard became effective December 13, 1979. The first revision became effective June 23, 1980, and the second revision became effective July 29, 1983. This revision becomes effective December 18, 1990.

Waivers. This standard is non-mandatory. No waivers are required.

FIPS 61–1, Channel Level Power Control Interface, is revised as follows:

Applicability. This standard addresses the power control interface in connecting computer peripheral equipment to ADP systems. It is recommended for use when FIPS 60–2 is used, when it is determined that interchange of equipment between different systems is likely.

Implementation. The original version of this standard became effective June 23, 1980, and the first revision became effective July 13, 1982. This revision becomes effective December 18, 1990.

Waivers. This standard is non-mandatory. No waivers are required.

FIPS 62, Operational Specifications for Magnetic Tape Subsystems, is revised as follows:

Applicability. This standard addresses magnetic tape equipment connected to ADP systems through FIPS 60 interfaces. It is recommended for use in the acquisition of such equipment, when it is determined that interchange of equipment between different systems is likely.

Implementation. The original version of this standard became effective June 23, 1980. This revision becomes effective December 18, 1990.

Waivers. This standard is non-mandatory. No waivers are required.

FIPS 63–1, Operational Specifications for Variable Block Rotating Mass Storage Subsystems, is revised as follows:

Applicability. This standard addresses peripheral device dependent operational interfaces for connecting variable block rotating mass storage equipment to ADP systems through FIPS 60 interfaces. It is recommended for use in the acquisition of such variable block rotating mass storage equipment for connection to ADP systems, when it is determined that interchange of equipment between different systems is likely.

Implementation. This standard became effective June 23, 1980, and the first revision became effective April 14, 1983. This revision becomes effective December 18, 1990.

Waivers. This standard is non-mandatory. No waivers are required.

FIPS 97, Operational Specifications for Fixed Block Rotating Mass Storage Subsystems, is revised as follows:

Applicability. This standard addresses the peripheral device dependent operational interface specifications for connecting fixed block rotating mass storage equipment to ADP systems through FIPS 60 interfaces. It is recommended for use in the acquisition of such fixed block rotating mass storage equipment for connection to ADP systems, when it is determined that interchange of equipment between different systems is likely.

Implementation. The original version of this standard became effective February 4, 1983. This revision becomes effective December 18, 1990.

Waivers. This standard is non-mandatory. No waivers are required.

FIPS 111, Storage Module Interfaces, is revised as follows:

Applicability. This standard addresses connection of a disk drive to a controller as part of an ADP system. This standard is recommended for use in the acquisition of disk systems that are

connected to small and medium sized computer systems, when it is determined that interchange of equipment between different systems is likely.

Implementation. This standard became effective May 18, 1985. This revision becomes effective December 18, 1990.

Waivers. This standard is non-mandatory. No waivers are required.

FIPS 130, Intelligent Peripheral Interface (IPI), is revised as follows:

Section 8, Applicability. This standard applies to the connection of computers to storage peripheral device controllers. This standard is recommended for use in the acquisition of magnetic disk drives, optical disk drives, and tape drives to be connected to minicomputer systems, when it is determined that interchange of equipment between different systems is likely.

Section 10, Implementation. This standard became effective December 16, 1987. This revision becomes effective December 18, 1990.

Section 11, Waivers. This standard is non-mandatory. No waivers are required.

FIPS 131, Small Computer System Interface (SCSI) is revised as follows:

Section 8, Applicability. This standard addresses the connection of small computers to peripheral devices with integral controllers. This standard is recommended for use in the acquisition of storage peripherals and small computer systems for office or laboratory use, when it is determined that interchange of equipment between different systems is likely.

Section 10, Implementation. This standard became effective December 16, 1987. This revision becomes effective December 18, 1990.

Section 11, Waivers. This standard is non-mandatory. No waivers are required.

Dated: December 12, 1990.

John W. Lyons,

Director.

[FR Doc. 90-29563 Filed 12-17-90; 6:45 am]

BILLING CODE 3510-CN-M