Proposal for Storage and Access of Data on Media Auxiliary Memory

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Revision History

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Version	Date	Comment
A	9 Dec 1998	Initial release for review
0.9	26 Jan 1999	Release for HP internal review
1.0	1 Feb 1999	External release to TapeAlert Working Group
2.0	6 Mar 1999	Update following comments from Sony and Intellistor. Main changes: • "Media Fixed" MAM section renamed to "Media Mandatory" • Cartridge Serial Number parameter increased in length from 10 bytes to 32 bytes. • Media Length parameter format changed from ASCII to binary and reduced from 4 to 2 bytes. • Parameter Format Version parameter added to Device Mandatory section to for upwards compatibility. • Load Count added to Device Mandatory section. • Parameter sections increased in length (and renumbered) to allow greater flexibility. • Timestamp appended added to Date Last Written parameter. • "Media Vendor Unique" MAM section added.
3.0	16 Mar 1999	Added ANSI X3/T10 proposal reference number

4.0	9 April 1999	• Radical changes to Log Page 0Ah to accommodate Sony AIT compatibility:
		  • AIT Compatibility area added at parameter IDs 0000h-01FFh
		  • Existing MAM parameter IDs have been offset by 200h to accommodate the AIT Compatibility area below them
		• Media Auxiliary Memory Capacity Mode page (page code 1Dh) has been deleted. The total MAM Capacity is available as a parameter in the Media Mandatory area, and the MAM Space Remaining is now available as a parameter in the Device Mandatory area.
		• Added Media Manufacture Date parameter in the Media Mandatory area.
		• Device load history parameters added to Device Mandatory area

5.0	22 April 1999	Input from Sony following review of AIT Compatibility concept: • Media Manufacture Date in the Media Mandatory Area reduced from 12 to 8 bytes as is not necessary to record the time of day. • Non-AIT support for the AIT Compatibility area clarified, including addition of Appendix 1 to show the details of 'partially supported' parameters.

		• Support for Special Cartridges added to Media Mandatory Area. • Support for invertable (double-sided) media added to the Media Mandatory Area plus a new set of Alternate Volume parameters defined at location 8000h onwards. • Drive Mandatory Area renamed to Device Mandatory Area to reflect the technology independent nature of this proposal. • Number of device serial numbers held in the MAM reduced from 10 to 4. • Application Name parameter increased in length from 10 to 32 bytes. • Parameters added to the Device Mandatory Area for representing the total MBytes of data written, read, re-written and re-read. • TSD description added to Data Format section. • Test Localisation Identifier added to the Host Mandatory Area to allow non-English character sets to be identified. • PC bits in Log Sense and Log Select commands are now disregarded.
5.1	14 May 1999	Unnecessary 'padding' Reserved fields removed from parameter 15 in the AIT Compatibility Area (Appendix 1)
5.2	19 May 1999	• Increased 'Total Mbytes Written' and related parameters in the Device Mandatory Area from 4 bytes to 8 bytes to allow for future media capacities and maximum number of write passes. • "Data Percentage Re-written/Re-read" parameters in the Device Mandatory Area deleted due to lack of uniform interpretation across different media technologies. There are already TapeAlert flags defined as media condition indicators and these should be used instead. • Corrected minor typos prior to release to TapeAlert Working Group email reflector.

References

ANSI X3/T10 SSC proposal reference T10/99-148r1

Please that this document constitutes a proposal. New SCSI identifiers shown, such as Log Page numbers, have not yet been approved.

Introduction

Small amounts (~4Kbytes currently) of re-writeable memory are currently being added to the removable media of several of the major tape technologies. Examples are Cartridge Memory (HP/Seagate/IBM LTO) and MIC (Sony AIT). Throughout this proposal Media Auxiliary Memory (MAM) will be used to refer to this memory.

Media Auxiliary Memory is typically used internally by the devices to speed up operations and increase reliability invisibly to application software. There are several scenarios, however, where it would be useful for an application to be able to store and retrieve data from this memory in a standardized manner. Although this would require changes to the application, significant customer benefits will result.

No standard method has currently been defined to read and write this data. The aim of this document is to propose methods that can be used from both Media Changers and Tape Devices to achieve this aim. The proposal has also been designed to support future extension. Note however that the SCSI commands used do introduce an upper limit of 64KB (including overheads) for the amount of data returned.

This proposal makes no attempt to standardize the location or format of the data stored on the memory just the SCSI commands used to access it. Any such definitions will be technology dependent.

Overview

This proposal has several aims:

- Allow a unique tape serial number, stored in MAM, to be accessed from tape drives and suitably equipped libraries using standardized commands.
- Allow application-level label information to be accessed and used, in a standard manner, by libraries and tape drives.
- Allow software applications to use the MAM in a standard, extensible manner.

To allow this to happen, the following items have been defined.

- Tape drive commands to allow access and control over MAM contents.
  - A Vital Product Data Page has been defined for the Inquiry command to allow a subset of the available data to be accessed in a multi-initiator environment.
  - Log page 0Ah has been defined to allow the contents of the MAM to be read and changed, and to retrieve data about the size and remaining capacity of the MAM.
- An extension to the Read Element Status command has been defined to allow the MAM information for multiple media to be returned by a suitably equipped library.
- A parameter assignment structure which defines certain parameters and allows applications to define their own.

Data Representation

The data in the MAM will be represented as a number of parameters, each having a unique parameter ID. This is a logical representation only and implies nothing about the physical representation of the data in the MAM. The following parameters have been defined and are split up into *areas* according to the source of changes or updates and whether they are optional or mandatory. The parameter data may be accessed by the SCSI commands shown later in this specification. The parameter areas are:

Parameter IDs	Maximum Number of Parameters	Area Name	Support in AIT media	Support in non-AIT media
0000h - 01FFh	512	AIT Compatibility area	Mandatory	Partial 1
0200h - 03FFh	512	Media Mandatory area	Mandatory	Mandatory
0400h - 04FFh	256	Device Mandatory area	Mandatory	Mandatory
0500h - 05FFh	256	Host Mandatory area	Mandatory	Mandatory
0600h - 06FFh	256	Media Vendor Unique area	Optional	Optional
0700h - 09FFh	768	Device Vendor Unique area	Optional	Optional
0A00h - 7FFFh	30208	Host Vendor Unique area	Optional	Optional
8000h - FFFFh	32768	Parameter set for Alternate Volume	Optional	Optional

Notes:
1. The extent of this partial support is detailed in the “AIT Compatibility Area” section of this document.

AIT Compatibility Area

- Provided for compatibility with Sony’s existing MIC format for AIT media, and other multi-partition devices that wish to follow the AIT model.
- Non-AIT devices are only required to have partial mandatory support for the parameters in this area - see the notes below.

ID	Parameter Name	#Bytes	Format	Support by Non-AIT drives	Notes
0001h	Memory Logical Format	2	Binary	all FFh	
0002h	Device Configuration bits	2	Binary	all 00h	
0003h	Available Free Byte Count	2	Binary	yes	1
0004h	User Volume Note size	2	Binary	all 00h	
0005h	Reserved	8	Binary	all 00h	
0006h	Cassette Serial Number	36	ASCII	partial	2
0007h - 0013h	Reserved	36 per parameter		all 00h	
0014h	User Partition Note Map	32	Binary	all 00h	
0015h	Accumulative System Log	62	Binary	partial	2
0016h	Volume Information	94	Binary	partial	2
0017h	Element Address	4	Binary	all 00h	
0018h	User Partition Note size for Partition #0	2	Binary	all 00h	
0019h	User Partition Note size for Partition #1	2	Binary	all 00h	
(0018+n)h	User Partition Note size for Partition #n	2	Binary	all 00h	3

Notes:
1. **Available Free Byte Count**: This is identical to the "MAM Space Remaining" parameter in the Device Mandatory area.
2. **Cassette Serial Number, Accumulative System Log, Volume Information**: See Appendix 1 for full details of the partial mandatory support required for these parameters.
3. An AIT device supporting 256 partitions will return parameters up to ID 0117h. A device supporting only one partition will return parameters up to ID 0017h.
4. Where a hex value is shown in the "Support by Non-AIT Devices" column, this is the fixed value that non-AIT drives will always return. Note that parameters having a value of 00h must actually be returned - they cannot be omitted from a list of returned parameters.

Media Mandatory Area

- Hard coded into MAM at cartridge manufacture time.
- All parameters are read-only.

ID	Parameter Name	#Bytes	Format	Comment	Notes
0200h	Cartridge Manufacturer	8	ASCII	Vendor ID	1, 4
0201h	Cartridge Serial Number	32	ASCII	Alphanumeric string	1
0202h	Media Length	2	Binary	Physical tape length in metres	
0203h	Media Type	2	Binary	Media Density Code	2
0204h	Media Manufacture Date	8	ASCII	Format: YYYYMMDD	
0205h	MAM capacity	4	Binary	In bytes	3
0206h	Special Cartridge Identifier	1	Binary	For cleaning cartridges etc.	5
0207h	Special Cartridge Information	2	Binary	Info about special cartridges	5
0208h	Invertable Media Indicator	1	Binary	For rotatable/flippable media	6
0209h - 03FFh				Reserved	

Notes:
1. ASCII strings are padded with trailing spaces where necessary.
2. **Media Type**: This is the same numeric Density Code as reported in the SCSI Mode Block Descriptor and Report Density Support command - this allows the media type to be detected. A value of zero will be returned for a cleaning cartridge.
3. **MAM Capacity**: This is the total capacity of the MAM, in bytes, at manufacture time. It does not indicate the free space of a 'blank' MAM as some of the MAM space may be reserved for device-specific use which is inaccessible to the host.
4. **Cartridge Manufacturer**: Vendor IDs have not yet been defined for this proposal.
5. **Special Cartridge Identifier**: Identifies non-data cartridges and other special types of cartridge. **Special Cartridge Information**: Provides additional information about special cartridge types. This parameter must be interpreted according to type of cartridge indicated by the Special Cartridge Identifier. Defined values are:

Special Cartridge Identifier	Meaning	Interpretation of Special Cartridge Information
00h	Cleaning cartridge	Maximum number of cleaning cycles permitted
01h-7Fh	Reserved	Reserved
80h	Write-once cartridge	Reserved
81h-FFh	Reserved	Reserved

6. **Invertable Media Indicator**: This indicates that the media may be rotated or flipped in order for a device to access each side of the double-sided media. A value of *zero* indicates that the media is single-sided and a value of *one* indicates that it is double-sided. If the media is double-sided then the MAM will contain separate information about each side of the cartridge. The sides of the cartridge will be known as the Primary and Alternate Volumes. If (and only if) the media is double-sided then a separate set of MAM parameters for the Alternate volume must be maintained. These will be located at parameter ID 8000h onwards - the parameter ID numbers are given later in this document. Single-sided media types will never return any parameters for the Alternate Volume.

Device Mandatory Area

- Must be maintained by the device.

ID	Parameter Name	#Bytes	Format	Comment	Notes
0400h	Parameter Format Version	2	Binary	Specification ref.	4
0401h	Main Partition Remaining Capacity	4	Binary	In MBytes	1
0402h	Main Partition Maximum Capacity	4	Binary	In MBytes	1
0403h	TapeAlert Flags	8	Binary	One bit per flag	2
0404h	Load Count	4	Binary	For this cartridge	7
0405h	MAM Space Remaining	4	Binary	In bytes	6
0406h	Initialised Format	2	Binary	Density Code	8
0407h	Initialisation Count	2	Binary	Cumulative for life	9
0408h - 0409h	Reserved				
040Ah	Device Make/Serial Number At Last Load	40	ASCII		5
040Bh	Device Make/Serial Number At Load -1	40	ASCII		5
040Ch	Device Make/Serial Number At Load -2	40	ASCII		5
040Dh	Device Make/Serial Number At Load -3	40	ASCII		5
040Eh - 041Fh	Reserved				
0420h	Total MBytes Written In Media Life	8	Binary		10
0421h	Total Mbytes Read In Media Life	8	Binary		10
0422h	Total Mbytes Written In Current/Last Load	8	Binary		11
0423h	Total Mbytes Read In Current/Last Load	8	Binary		11
0424h - 04FFh				Reserved	

Notes:

1. **Maximum/Remaining Capacities**: These are native capacities and assume no data compression. If the device implements additional partitions, capacity information for these partitions should be placed in the Device Vendor Unique section.
2. **TapeAlert Flags**: This field provides a means of reporting the state of the TapeAlert flags for the previous load of the tape. Each TapeAlert flag occupies one bit (Flag 1 = MSB, Byte 1, Flag 64 = LSB, Byte 8). The bits indicate all the TapeAlert flags that were set during the previous load, i.e. the bits are 'sticky' for the load
3. (Note deleted).
4. **Parameter Format Version:** This is a reference for the specification to which the parameter format is compliant. The contents of this parameter are not yet defined, but it may be release number of the ANSI specification which will be derived from this document. This will allow new parameter formats to be defined in the future.

5. **Device make/serial number at previous loads**: This is a rolling history of the last four drives in which the cartridge has been loaded. This allows library controllers or application software to correlate media condition with drive load history in order to identify drives that may be causing media problems. The first 8 bytes are the Device Manufacturer ID, and the last 32 bytes are the Device Serial Number. Both fields should be padded with trailing spaces where necessary.
6. **MAM Space Remaining**: This is the space currently free in the MAM. The *total* MAM capacity is reported in the Media Mandatory area. Note that it may not always be possible to utilise all of the free space in a given MAM implementation. Depending on the internal organisation of the memory and the software that controls it, fragmentation issues may mean that certain parameter sizes might not be fully accommodated as the MAM nears its maximum capacity.
7. **Load Count**: The number of times that this cartridge has been loaded (and threaded, where applicable) into a tape drive. This value is cumulative: It shall not be reset if the media is logically reformatted by a tape drive.
8. **Initialised Format**: If the tape drive formats the media into a format other than the one indicated in the Media Type parameter in the Media Mandatory Area (e.g. for compatibility with a previous generation format), then this parameter indicates the SCSI Density Code of the format chosen.
9. **Initialisation Count**: Indicates the number of times that the medium has been logically formatted by a tape drive. This figure is cumulative over the life of the media and shall never be reset.
10. **Total MBytes Written/Read in Media Life**: This is the total number of MBytes of data transferred to or from the media over the entire media life. These figures are cumulative and must never be reset. Note that the amount of data must be measured from the device/media interface's point of view, not the host's. For example, if a new cartridge is loaded into a drive then the host writes 100MBytes, rewinds and then writes 100MBytes again, then the Total MBytes Written in Media Life will be 200MBytes. This figure must not incorporate data compression, i.e. it must represent the amount of data actually written to the media. Additionally, if the device decides to re-write any data (for example, following a bad read-after-write resulting from a localised media defect), then the amount of re-written data must also be added to this count.
11. **Total Mbytes Written/Read In Current/Last Load**: As above, but for the current load (if the cartridge is currently loaded) or the last load (if the cartridge is currently unloaded). The drive should reset these parameters to zero as soon as a cartridge is loaded.

Host Mandatory Area

- The Host Mandatory area is the primary means to allow separation or portability of media between different software applications and platforms. Software vendors are encouraged to suggest further parameters for this area that will assist media interchange or make it safer
- Must be maintained by the software application using the Log Select command
- Can be cleared using the PCR bit in the Log Select command

ID	Parameter Name	#Bytes	Format	Comment	Notes
0500h	Application Vendor	8	ASCII	Vendor ID	4
0501h	Application Name	32	ASCII	Alphanumeric string	1
0502h	Application Version	8	ASCII	Alphanumeric string	1
0503h	Application Media Text Label	100	ASCII	Null terminated string	2
0504h	Date & Time Last Written	12	ASCII	Format: YYYYMMDDHHMM	
0505h	Text Localisation Identifier	2	Binary	See note	3
0506h - 05FFh				Reserved	

Notes:

1. ASCII strings are padded with trailing spaces where necessary.
2. **Application Version**: Note that this is a fixed-length parameter - 100 bytes of data must always be returned.
3. **Text Localisation Identifier**: This defines the format of the text held in the textual parameters in the Host Mandatory Area. The two bytes are:

MS Byte	**LS Byte**
Country Code 00h = no code specified 81h = Japan other codes are yet to be defined	Minor Code 00h = no code specified 01h = JIS (old) code 02h = JIS (new) code 03h = Shift JIS code 04h = EUC code 05h = IBM EBCDIC 06h = Unicode other codes are yet to be defined

   If 0000h is returned for this parameter then the host must assume that the encoding of all text fields is plain ASCII and the language is English.

4. **Application Vendor**: Vendor IDs have not yet been defined for this proposal.

Media Vendor Unique Area (Optional)

- This area exposes as parameters any data hardcoded in the MAM at manufacture time that hosts may need access to. Such access must be provided by arrangement with specific device vendors.

ID	Parameter Name	#Bytes	Format	Comment	Notes
0600h - 06FFh				Unique to media vendor	

Device Vendor Unique Area (Optional)

- These parameters allow vendor unique information to be stored by the device. For example, it could include information about additional media partitions created by the device when it formats a cartridge.

ID	Parameter Name	#Bytes	Format	Comment	Notes
0700h - 09FFh				Unique to device vendor	

Host Vendor Unique Area (Optional)

- These parameters are intended to allow software applications to read and write their own parameters.
- They are written using the Log Select command and are removed using the PCR bit of the Log Select Command
- The main restriction on their use will be MAM capacity remaining after the mandatory and Device Vendor Unique usage. This can be determined using the MAM Space Remaining parameter in the Device Mandatory area.

ID	Parameter Name	#Bytes	Format	Comment	Notes
0A00h - 7FFFh				Unique to software vendor	

Invertable Media Support

In order to support invertable media (otherwise known as rotatable or flippable media), the entire set of MAM parameters may be repeated starting at parameter ID 8000h but containing information pertinent to the other side of the media. This effectively allows a single MAM implementation to report information about two distinct data volumes. These shall follow Medium Changer Command set terminology and be known as *Primary* and *Alternate* volumes. The parameters for the Alternate volume will be separated into areas, as for the Primary volume. Within each area the individual parameter ID numbers will be identical to their counterparts for the Primary volume, but will have a fixed offset of 800h (i.e. they will have their top bit set).

ID	Area
8000h - 81FFh	AIT Compatibility Area - Alternate Volume
8200h - 83FFh	Media Mandatory Area - Alternate Volume
8400h - 84FFh	Device Mandatory Area - Alternate Volume
8500h - 85FFh	Host Mandatory Area - Alternate Volume
8600h - 86FFh	Media Vendor Unique Area - Alternate Volume
8700h - 89FFh	Device Vendor Unique Area - Alternate Volume
8A00h - FFFFh	Host Vendor Unique Area - Alternate Volume

A device or host can detect whether the Alternate Volume parameters exist or not by checking the Invertable Media Indicator parameter in the Media Mandatory Area.

Data Format

The general method for reporting each parameter's information will be via SCSI commands using the standard Log page parameter format:

	7	6	5	4	3	2	1	0
0	Parameter Code							
1								
2	DU	DS(0)	TSD(0)	ETC(0)	TMC(0)		LBIN	LP(1)
3	Parameter Length (n-3)							
4 .. n	Parameter Value							

The fields in the descriptor are:

- **DU** (Disable Update): When parameters are read using the Log Sense command, this field indicates whether the host can change the contents of the field.
- **DS** (Disable Save): This field indicates that the device will maintain the saving of data itself. Note that the host needs to set the SP bit in a Log Select command otherwise a Check Condition will result.
- **TSD** (Target Save Disable): This will normally be set to zero as the device will save parameter values automatically, and this functionality cannot be disabled.
- **ETC** and **TMC**: concerned with counter thresholds, not applicable to MAM.
- **LBIN**: indicates whether the field contains ASCII or Binary data. If *zero* the parameter consists of ASCII characters, if *one* the parameter consists of binary data.
- **LP** (List Parameter): this field indicates whether the parameter is a counter or a list parameter. All the fields for the MAM are list parameters and so this must be set to *one*.

As an example, the Application Name parameter (parameter 0501h) might be returned as:

```
Byte 0:     05h                 Parameter Code MSB
Byte 1:     01h                 Parameter Code LSB
Byte 2:     01h                 Descriptor ('control byte')
Byte 3:     20h                 Parameter length = 32
Bytes 4-13: "ACME Backup  "     Parameter value (padded with trailing spaces)
```

Device SCSI Commands

The following Primary and Stream Device (Sequential Access) SCSI commands allow the host to access the MAM parameters via the tape device into which the cartridge is currently loaded:

- The ***Inquiry*** command may be used to recover a subset of the available parameters.
- ***Log Sense*** and ***Log Select*** commands may be used to read all of the available parameters and write the re-writeable parameters. This will use the newly-defined **Media Auxiliary Memory Information page 0Ah.**

Using these commands, MAM parameters will generally be returned as a sequence of parameters in numerical order keyed from the Parameter ID. Each parameter will be individually formatted using the Log page format shown in the 'Data Format' section of this document. Reserved mandatory parameters, unused or undefined optional parameters, and parameters that have been cleared used a PCR Log Select are not returned. ***Note that the standard Log page format only allows for single byte to be used to represent any parameter's length. Thus the maximum length parameter that can be returned in any Log page is 256 bytes long. Software applications that intend to create new parameters in the Host Vendor Unique area will have to observe this limit.***

Inquiry Command

A Vital Product Data Page (page code 84h) will be used to return a subset of the parameters available from the MAM. The subset will be:

- Media Mandatory parameters
- Host Mandatory parameters

The intention of this page is to provide a means of returning information about the media in a multi-initiator environment such as a Storage Area Network where an Inquiry will be transparent to Unit Reservations.

Inquiry - Media Auxiliary Memory page

	7	6	5	4	3	2	1	0
0	Peripheral Qualifier (0)				Peripheral Device Type (1)			
1	Page code (84h)							
2	Reserved							
3	Additional Page Length (n-3)							
4 .. n	Parameters							

Notes on usage:

- If the device does not support access to MAM data, an Inquiry command to access this page will be Check Conditioned as an ILLEGAL REQUEST.
- If the device supports access to MAM data but a suitable cartridge is not currently loaded in the device, an Inquiry command to access this page will return a 'blank' page (i.e. an Additional Page Length of zero and no Parameters).

Log Sense/Select Commands

The SCSI Log Sense and Log Select commands are used as general-purpose commands to read and change the parameters in the MAM.

The format of the commands will be as described in the SCSI-3 specification. Command-specific parameters are as follows:

Notes on usage:

- Application software can use the presence of Log page 0Ah to detect whether the device supports access to MAM data or not. If the device does not support access to MAM data then a Log Sense/Select command to access this page will be Check Conditioned as an ILLEGAL REQUEST, and the log page 0Ah will not be included in the list of supported Log pages.
- If a Log Sense/Select command specifying the Media Auxiliary Memory Information page is sent and there is no media installed in the device, the command will be Check Conditioned and the Sense data will be NOT READY / MEDIUM NOT PRESENT.
- It is acceptable for a device to disconnect between receiving a Log Sense command and returning the parameter data.

Log Sense

- **SP** (Save Parameters): Must be set to 0 for this page, otherwise ILLEGAL REQUEST/INVALID FIELD IN CDB is returned.
- **PPC** (Parameter Pointer Control): Must be set to 0 for this page, otherwise ILLEGAL REQUEST/INVALID FIELD IN CDB is returned.
- **Page Code:** Should be set to 0Ah for the Media Auxiliary Memory Information page.
- **PC** (Page Control): This field is disregarded.

All the parameters will be returned in numerical order keyed from the Parameter ID.

Log Select

- **SP** (Save Parameters): Must be set to 1 for this page, otherwise ILLEGAL REQUEST/INVALID FIELD IN CDB is returned.
- **PCR** (Parameter Code Reset): If this field is set then all the host changeable fields will be cleared as follows (provided that the Parameter List Length is zero):
  - Host Mandatory parameters will be cleared to ASCII space characters or binary zeros, as appropriate.
  - Any Host Vendor Unique parameters will be erased and will no longer be returned by the Log Sense command.
  - The Parameter List Length must be set to zero for the logs to be cleared in this way.
- **PC** (Page Control): This field is disregarded. Provided that the PCR bit is zero, and that the specified parameters are actually writeable, data will be written to the MAM using a Log Select command.
- **Parameter List Length**: If this is non-zero then the host may send Log pages to the device in the data out phase.

Writing data to the MAM

In order for the host to write data to the MAM, a formatted Media Auxiliary Memory Log page must be sent using the Log Select command - see below for format details. Note that not all of the MAM parameters need to be sent to the device, just the ones that the host wishes to change. However, all parameters sent should be in ascending numerical order keyed from the Parameter ID.

If new Host Vendor Unique parameters are sent to the device for which there is no space then ILLEGAL REQUEST/ LOG LIST CODES EXHAUSTED will be returned.

Log Sense/Select - Page Format

	7	6	5	4	3	2	1	0
0	**Media Auxiliary Memory Information page (0Ah)**							
1	Reserved							
2	Page Length (n-3)							
3								
Log Parameters								
4 .. x+3	First MAM Parameter (Length x)							
…..								
n-y+1 .. n	Last MAM Parameter (Length y)							

Media Changer SCSI Commands

The following Medium Changer SCSI commands allow the host to access the MAM parameters from compatible cartridges stored in a library equipped with a MAM reader:

Read Element Status Command

The following bullets should be read in conjunction with the SCSI-3 Read Element Status command definition:

- For backwards compatibility with existing software applications, legacy media labels (e.g. those currently represented by physical barcode labels) will be returned as the Primary Volume Tag.
- For backwards compatibility also, the Cartridge Manufacturer ID and Cartridge Serial Number parameters will be returned as the Alternate Volume tag.
- The command format has been modified to include a new Extended Tag (ExtTag) field, since neither the Primary nor Alternate Volume Tag fields can return the quantity of data available in typical MAM implementations. The ExtTag data is returned at the end of the existing SCSI-3 element data.
- All the MAM Parameters will be returned in numerical order keyed from the Parameter ID.

Read Element Status - Command Format

	7	6	5	4	3	2	1	0
0	Operation Code (B8h)							
1	Reserved			VolTag	Element Type Code (4)			
2	Starting Element Address							
3								
4	Number of Elements							
5								
6	Reserved					ExtTag	CurData	DVCID
7	Allocation Length							
8								
9								
10	Reserved							
11	Control							

Note the addition of the ExtTag field. This instructs the Media Changer to return Extended Volume Tag information. This applies to Storage Element Descriptors only. With the ExtTag bit is set, the format of the Element Status Page (including its Storage Element Descriptors) in the returned data is as shown below.

Read Element Status - Element Status Page Format

	7	6	5	4	3	2	1	0
0	Element Type Code (02 for Storage Elements)							
1	PVolTag	AVolTag	EVolTag	Reserved				
2	Element Descriptor Length							
3								
4	Reserved							
5	Byte Count of Descriptor Data (this page, y-7)							
6								
7								
8	Element Descriptors							
y								

Read Element Status - Storage Element Descriptor

	7	6	5	4	3	2	1	0
0	Element Address							
1								
2	Reserved				Access	Except	RSVD	Full
3	Reserved							
4	Additional Sense Code							
5	Additional Sense Code Qualifier							
6	Reserved							
7								
8								
9	Svalid	Invert	Reserved					
10	Source Storage Element Address							
11								
…								
36 bytes	Primary Volume Tag (field omitted if PVolTag = 0)							
36 bytes	Alternate Volume Tag (field omitted if AVolTag = 0)							
…								
1 byte	Reserved				Code Set (0)			
1 byte	Reserved				Identifier Type (0)			
1 byte	Reserved							
1 byte	Identifier Length (x)							
x bytes	Identifier							
…								
to end	MAM Parameters (field omitted if EVolTag = 0) *[see note 1]*							

Notes:
1. All MAM parameters will be returned in the standard SCSI Log page format shown in the ‘Data Format’ section of this document.

Appendix 1: Details of "Partially Supported" Parameters in the AIT Compatibility Area

For use by non-AIT drives, details of the 'partial' support required for some of the parameters in the AIT Compatibility Area are given here. Mandatory bytes (other than the header information for each parameter) are indicated in **bold type**. Note that the byte numbers shown are relative to the beginning of each parameter - they do not represent absolute byte positions in the returned data.

Parameter 0006h: Cassette Serial Number

	7	6	5	4	3	2	1	0
0	Parameter Code (0006h)							
1								
2	DU	DS(0)	TSD(0)	ETC(0)	TMC(0)		LBIN	LP(1)
3	Parameter Length (36)							
4-35	**Cartridge Serial Number *(duplicate of Media Mandatory parameter 0201h)***							
36	Manufacturer ID (0)							
37	Secondary ID (0)							
38	Checksum (0)							
39	Reserved (0)							

Parameter 0015h: Accumulative System Log

	7	6	5	4	3	2	1	0
0	Parameter Code (0015h)							
1								
2	DU	DS(0)	TSD(0)	ETC(0)	TMC(0)		LBIN	LP(1)
3	Parameter Length (62)							
4-7	Current Number of Groups Written (0)							
8-11	Current RAW Retries (0)							
12-15	Current Number of Groups Read (0)							
16-19	Current C3 ECC Retries (0)							
20-23	Previous Number of Groups Written (0)							
24-27	Previous RAW Retries (0)							
28-31	Previous Number of Groups Read (0)							
32-35	Previous C3 ECC Retries (0)							
36-39	Total Number of Groups Written (0)							
40-43	Total RAW Retries (0)							
44-47	Total Number of Groups Read (0)							
48-51	Total C3 ECC Retries (0)							
52-55	**Load Count *(duplicate of Device Mandatory parameter 0404h)***							
56-59	Access Count (0)							
60-63	Update Replace Count (0)							
64-65	Reserved (0)							

Parameter 0016h: Volume Information

	7	6	5	4	3	2	1	0
0	Parameter Code (0016h)							
1								

2	DU	DS(0)	TSD(0)	ETC(0)	TMC(0)	LBIN	LP(1)
3	Parameter Length (94)						
4-23	Eject Position (0)						
24-27	Reel Diameter (0)						
28	Reserved (0)						
29-31	**Initialisation Count *(duplicate of Device Mandatory parameter 0407h)***						
32	System Log Location (0)						
33	Last Partition Number (0)						
34-65	Volume Information Table (0)						
66-97	Reserved (0)						