Addendum to -
FUNCTIONAL SPECIFICATION
ULTRASTAR (DFMS) SCSI MODELS
1.32/2.32/2.65 GB - 1.0" HIGH
4.32/5.31 GB - 1.6" HIGH
3.5 INCH DISK DRIVES
for *ULTRASTAR-A/V (DFMS)* Models

Version 1.0

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1.0 Preface

This document is an Addendum to the specifications for the ***DFMS*** High Capacity Family of 3.5-inch Direct Access Storage Devices.

This addendum defines new ***DFMS-A/V*** models ideally suited for demanding Audio/Visual applications where capacity and sustained data transfer rates are key parameters. This addition to the ***DFMS*** family is rated at greater than 5.0MB/S sustained over the entire drive capacity. The capacity offering is 5.1 GByte in a 1.6-inch high form factor.

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1.1.1 Document Distribution

Distribution of this document should come directly from your IBM Customer Representative to ensure you are receiving the current specification.

Replacement and disposal of down level versions is the responsibility of the holder.

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3. Description

3.1 Features

General Features

- 5.10 GB formatted capacity (@ 512 Bytes/Sector)
- Industry-standard interface:
  - 50 pin ANSI SCSI-2
  - 68 pin ANSI SCSI-3
  - Single Ended
- **Performance Summary**
  - Average read seek time (5.10 GB) : 7.8 milliseconds
  - Media data transfer rate: 8.06 to 12.58 MegaBytes/second (12 bands)

3.2 Models

The ***DFMS-A/V*** disk drive is available in various models as shown below:

The ***DFMS-A/V*** data storage capacities vary as a function of user block size.

DFMS-35250 Models	HDA type	Capacity GB	SCSI Pins/Connector Type	SCSI Electrical Signal Type
-S5F-A/V	M8	5.10	50/'A' Connector	Single Ended Fast
-S5W-A/V	M8	5.10	68/Unitized Connector	Single Ended Fast/Wide
Note: 50 pin SCSI connector models offer an 8 bit SCSI bus using the SCSI 'A' connector. 68 pin SCSI connector models offer an 8/16 bit SCSI bus using the SCSI 'P' connector which supports Wide data transfers.				
Note: All models support Fast SCSI data transfers				

The DFMS Interface Specification shows that the "ASCII Model Number" field in the SCSI Standard Inquiry Data is only 3 characters long. Bytes 23-26 currently defined as "unused" will be set equal to "-A/V" to help identify these A/V models.

4. Specifications

All specifications are nominal values unless otherwise noted.

4.1 General

Note: The recording band located nearest the disk outer diameter (OD) is referred to as 'Notch #1'. While the recording band located nearest the inner diameter (ID) is called 'Notch #12'. 'Average' values are weighted with respect to the number of LBAs per notch when the drive is formatted with 512 byte blocks.

Data transfer rates

	Notch #1	Notch #12	Average	
Buffer to/from media	12.58	8.06	11.01	MB/s (instantaneous)

	Minimum	Maximum
Recording density (BPI)	115,289	132,817
Areal density (Megabits/square inch)	501.8	578.1

(model numbers - >)	S5x-A/V
Disks	8
User Data Heads (trk/cyl)	16
Seek times (in milliseconds)	
Single cylinder (Read)	0.5
(Write)	2.0
Average (weighted) (Read)	7.8
(Write)	9.3
Full stroke (Read)	16.5
(Write)	18.0

Note: Times are typical for a drive population under nominal voltages and casting temperature of 25 C. Weighted seeks are seeks to the cylinders of random logical block addresses (LBAs).

Total Cylinders (tcyl) & User Cylinders (ucyl)	All Models tcyl	S5x-A/V ucyl
Notch #1	1183	1170
Notch #2	200	199
Notch #3	251	250
Notch #4	108	107
Notch #5	374	373
Notch #6	151	150
Notch #7	265	264
Notch #8	228	227
Notch #9	176	175
Notch #10	246	245
Notch #11	52	51
Notch #12	929	928
Sum of all Notches	4163	4139

Spares Sectors/cylinder (spr/cyl)	S5x-A/V
Notch #1	53
Notch #2	51
Notch #3	50
Notch #4	49
Notch #5	47
Notch #6	46
Notch #7	44
Notch #8	43
Notch #9	41
Notch #10	40
Notch #11	39
Notch #12	36
Last cylinder extra spares (lcspr)	72

Sectors/track (sct/trk) (See Table 1 or contact an IBM Customer Representative for other block lengths.)

	Notch #											
User bytes / logical block	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
256	288	280	270	270	260	240	240	240	240	220	216	180
512	180	171	168	165	160	154	150	144	140	135	133	120
520	171	168	165	160	154	150	144	140	137	133	132	109
522	171	168	163	160	154	150	144	140	137	132	120	108
524	171	168	160	160	154	150	144	140	137	132	120	108
528	171	168	160	160	154	150	144	140	135	120	120	108
688	137	135	130	129	120	120	120	120	109	105	105	87
744	129	120	120	120	120	120	108	105	102	98	98	80

Table 1. Gross sectors per track for several block lengths

	S5x Models	
User bytes / logical block	**formatted capacity (bytes)**	**logical blocks / drive**
256	4,104,545,792	16,033,382
512	5,106,158,592	9,972,966
520	4,944,529,200	9,508,710
522	4,944,462,300	9,472,150
524	4,957,118,600	9,460,150
528	4,954,560,864	9,383,638
688	5,220,757,280	7,588,310
744	5,262,703,344	7,073,526

Table 2. User capacity for several block lengths

5. Performance

5.1 Environment Definition (no changes)

5.2 Workload Definition (no changes)

5.3 Command Execution Time

5.3.1 Basic Component Descriptions

Data Transfer to/from Disk

Rates for drives formatted at 512 bytes/block are located in Table 3.

Model Type	All		S5x-A/V	
Notch #	Instantaneous	Track	Theoretical	Typical
Average	11.01	7.23	6.67	6.64
1	12.58	8.30	7.66	7.63
2	12.30	7.88	7.29	7.26
3	11.96	7.74	7.16	7.12
4	11.82	7.61	7.02	6.98
5	11.26	7.38	6.79	6.76
6	11.05	7.10	6.56	6.52
7	10.64	6.92	6.37	6.34
8	10.29	6.64	6.14	6.11
9	10.01	6.45	5.96	5.93
10	9.66	6.22	5.73	5.70
11	9.59	6.13	5.64	5.61
12	8.06	5.53	5.08	5.06
Note: The values for Typical Data Sector Transfer Rates assume a typically worst case value of 3.16 errors in 10^9 bits read at nominal conditions for soft error rate.				
Note: Contact an IBM Customer Representative for values when formatted at other block lengths.				
Note: 'Average' vales are sums of the individual notch values weighted by the number of LBAs in the associated notches.				

Table 3. Data Sector Transfer Rates. (All rates are in MB/sec)