M-Systems
Flash Disk Pioneers

FFD 2.5" Ultra ATA Flash Disk

Product Specification and User Manual

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Flash Disk Pioneers

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1. SCOPE

This specification and user manual defines the performance, design and acceptance requirements for the FFD 2.5” Ultra ATA Flash Disk. It also provides instructions for proper installation and use.

2. APPLICABLE DOCUMENTS

- ANSI-INCITS.361-2002 (ATA-6)
- ANSI-NCITS.340-2000 (ATA-5)
- ANSI-NCITS.317-1998 (ATA-4)
- ANSI-X3.298-1997 (ATA-3)
- ANSI-X3.279-1996 (ATA-2)

3. SPECIFICATIONS

3.1. Product Definition

The Ultra ATA is a non-volatile mass memory storage unit equipped with an ATA interface. The Ultra ATA, whose dimensions enable mounting in a standard 2.5” disk drive enclosure, contains the following components:

- CPU
- 2.5” ATA connector
- ATA controller
- Flash memory

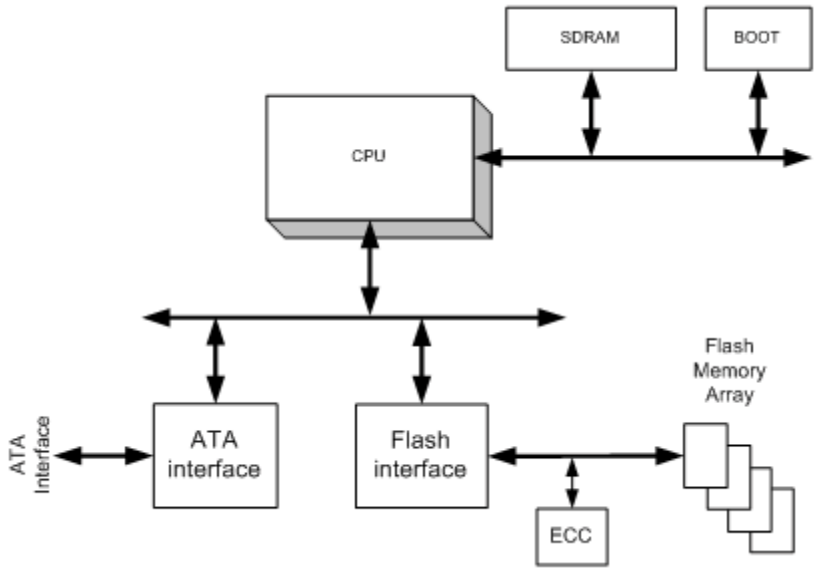


Figure 1: FFD 2.5” Ultra ATA Block Diagram

3.2. Interface Description

The Ultra ATA interface complies with the ATA-6 standard. For specific details refer to the applicable documents, as specified in Section 2.

3.3. Characteristics

3.3.1. ATA Modes

The Ultra ATA supports the following ATA modes:

- PIO mode 0, 1, 2, 3, 4
- DMA mode 0, 1, 2
- Ultra DMA mode 0, 1, 2, 3, 4, 5

3.3.2. Burst Read/Write Performance

The Ultra ATA burst read/write rate is 100 MB/sec.

3.3.3. Sustained Read/Write Performance

The Ultra ATA meets the performance requirements specified in Table 1. Performance was measured on a computer using the following setup:

- Capacity: 4GB
- Configuration: Ultra DMA Mode 5, with 128K blocks aligned on 128K boundaries
- Platform: ASUS P4T533-C with Intel 2.4 GHz
- Testing Utility:
  - QBench (DOS)
  - HDtach 2.61 (Windows)
  - IOmeter 16.12.03 (Windows)

Table 1: FFD 2.5" Ultra ATA DMA Mode 2 Transfer Rates

Operation	Burst Rate[1] (MB/sec)	Sustained[2] Rate 128KBs Blocks (MB/sec)
Read	100.0	40.0
Write	100.0	40.0

3.3.4. Access Time

Maximum access time for the Ultra ATA is < 0.04 msec.

3.3.5. Seek Time

The Ultra ATA has no seek time.

3.3.6. Memory Capacity

Ultra ATA memory capacity information is described in Table 2.

Table 2: FFD 2.5" Ultra ATA Capacities

Unformatted Disk Capacity (MB)	**Total Number of User-Addressable Sectors in LBA Mode** (Words 60/61 of IDENTIFY information)	**Number of Logical Sectors per Track** (Words 6 and 56 after power-on of IDENTIFY information)	**Number of Logical Heads** (Words 3 and 55 after power-on of IDENTIFY information)	**Number of Logical Cylinders** (Words 1 and 54 after power-on) of IDENTIFY information)	**Current CHS Capacity (Sectors)** (Words 57/58 after power-on of IDENTIFY information)
1024	1982464	63	16	1936	1951488
2048	3995648	63	16	3963	3994704
4096	8022016	63	16	7958	8021664
6144	12048384	63	16	11952	12047616
8192	16074752	63	16	15947	16074576
12288	24127488	63	16	16383	16514064
16384	32180224	63	16	16383	16514064
20480	40232960	63	16	16383	16514064
24576	48285696	63	16	16383	16514064
28672	56340480	63	16	16383	16514064
32768	64393216	63	16	16383	16514064
36864	72445952	63	16	16383	16514064
40960	80498688	63	16	16383	16514064
45056	88551424	63	16	16383	16514064
49,152	96604160	63	16	16383	16514064
53248	104658944	63	16	16383	16514064
57344	112711680	63	16	16383	16514064
61440	120764416	63	16	16383	16514064
65536	128817152	63	16	16383	16514064
69632	136869888	63	16	16383	16514064
73728	144922624	63	16	16383	16514064
77824	152977408	63	16	16383	16514064
81920	161030144	63	16	16383	16514064
86016	169082880	63	16	16383	16514064
90112	177135616	63	16	16383	16514064

3.3.7. Power Consumption

The Ultra ATA requires input voltage of +5VDC, with a tolerance of 5% (4.75V-5.25V) and a maximum ripple of 250 mV peak-to-peak. Table 3 describes the power consumption based on

capacity. The power consumptions depend on the disk capacity and the flash components being used.

Table 3: FFD Ultra ATA Typical Power Consumption (Watts/mA)

Disk Mode/Unformatted Disk Capacity	1GB	4GB	16GB	28GB
Power Mode STANDBY	2.54w/500mA	2.48w/489mA	3.29w/568 mA	2.84 w/568 mA
Power Mode IDLE	2.54w/500mA	2.66w/524mA	3.29w/568 mA	2.9 w/580 mA
Sustained Write/Read	2.64w/520mA	2.66w/524mA	3.29w/568 mA	3.0 w/600 mA
Sanitize ERASE/FILL	2.69w/530mA	3.02w/595mA	4.78w/940 mA	5.7 w/1140 mA

3.3.8. Endurance

The Ultra ATA sustains more than 5,000,000 erase cycles and an unlimited number of read cycles. Performance is enhanced by the following features:

- **Dynamic Wear-Leveling Algorithm**: This algorithm guarantees the use of all flash blocks at the same level of stress (write/erase cycle). The dynamic wear-leveling algorithm eliminates situations where repeated writes to the same logical location cause flash block wear-out. The dynamic wear-leveling algorithm functions by mapping logical blocks to physical blocks (transparent to the customer application).
- **Garbage Collection Process**: The garbage collection process eliminates the need to perform erasure prior to every write, thus eliminating excessive disk deterioration.
- **EDC/ECC (Error Detection Code/Error Correction)**: The EDC/ECC extends disk endurance by detecting and then fixing flash bits.
- **Bad-Block Mapping Algorithm**: This algorithm replaces bad blocks with new ones from available spares.

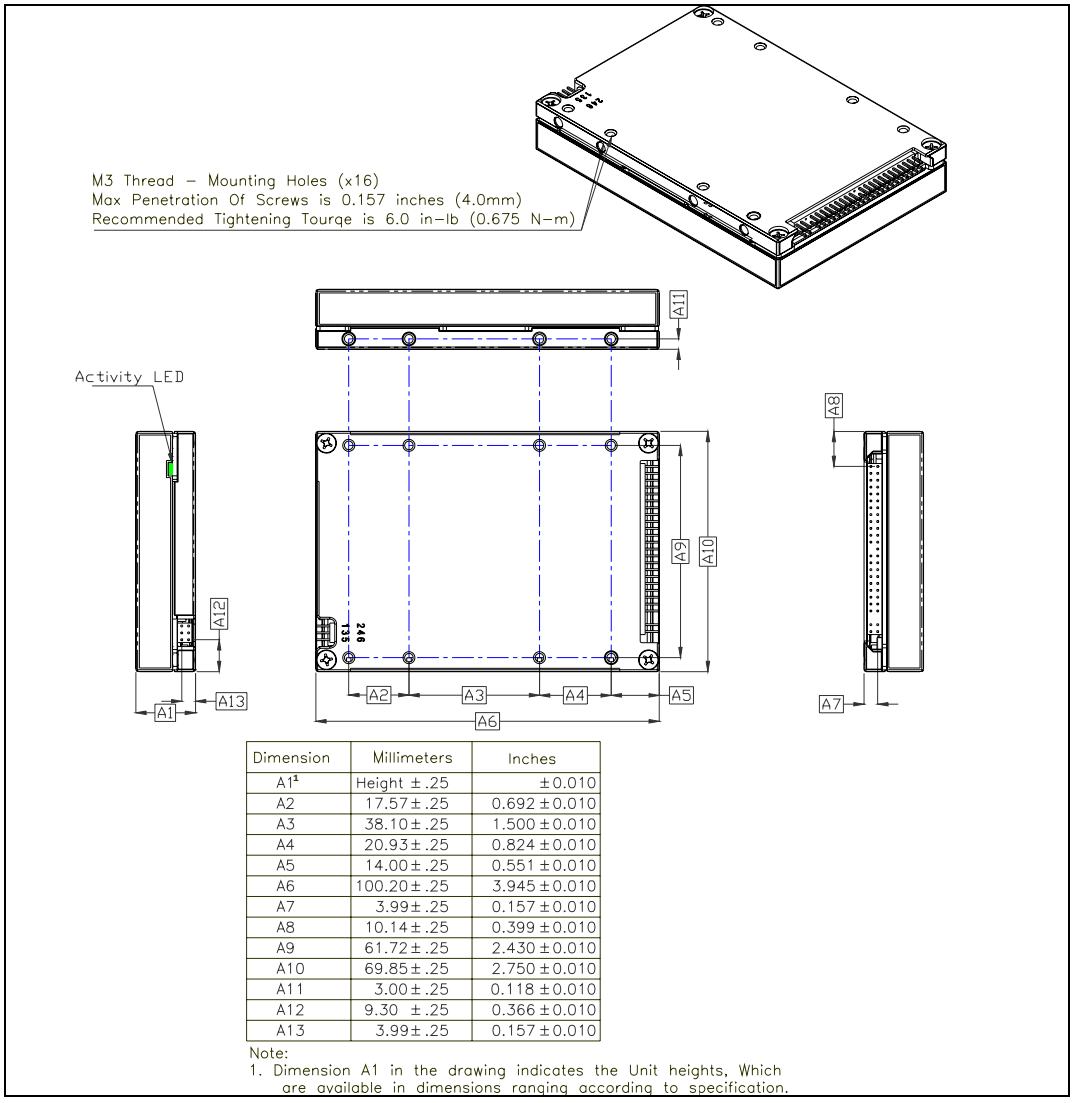
3.3.9. Physical Characteristics

Table 4 contains the nominal dimensions of the Ultra ATA, with the maximum weight for each unit case.

Table 4: Nominal Dimensions, Maximum Capacity and Weight

	Inches	Millimeters	Max. Capacity (GB)	Max. Unit Weight (kg)
H:				
A	0.370	9.4	4.0	0.10
B	0.527	13.4	16.3	0.14
C	0.685	17.4	28.6	0.18
D	0.842	21.4	40.9	0.22
F	1.157	29.9	65.5	0.28
H	1.472	37.9	90.1	0.38
W:	2.75	69.85	-	-
L:	3.945	100.2	-	-

For detailed mounting configuration dimensions, refer to Figure 2.



Dimension	Millimeters	Inches
A1[1]	Height ±.25	±0.010
A2	17.57±.25	0.692±0.010
A3	38.10±.25	1.500±0.010
A4	20.93±.25	0.824±0.010
A5	14.00±.25	0.551±0.010
A6	100.20±.25	3.945±0.010
A7	3.99±.25	0.157±0.010
A8	10.14±.25	0.399±0.010
A9	61.72±.25	2.430±0.010
A10	69.85±.25	2.750±0.010
A11	3.00±.25	0.118±0.010
A12	9.30 ±.25	0.366±0.010
A13	3.99±.25	0.157±0.010

Note:
1. Dimension A1 in the drawing indicates the Unit heights, Which are available in dimensions ranging according to specification.

Figure 2: FFD 2.5″ Ultra ATA Assembly

A1 in Figure 2 indicates the case heights, which are available in dimensions ranging from 9.4 mm to 37.9 mm. For available cases heights, please refer to Table 4.

3.3.10. LED Indicator

The Ultra ATA includes two LEDs, one green and one red, located on the rear panel. These LEDs indicate the following:

- **Power (Green) LED**: This is the Ultra ATA power indicator. When the Power LED is lit, the Ultra ATA is receiving power.
- **Busy (Red) LED**: This is the Ultra ATA busy indicator. When the Busy LED is lit, the Ultra ATA is active.

3.3.11. Connector Interface

The FFD 2.5" Ultra ATA interface connector pinout is described in Table 5, Table 6 and Figure 3.

Table 5: FFD 2.5" Ultra ATA J1 Pin Assignment

Pin #	Signal Name	Pin #	Signal Name
1	RESET-	2	GND
3	HD7	4	HD8
5	HD6	6	HD9
7	HD5	8	HD10
9	HD4	10	HD11
11	HD3	12	HD12
13	HD2	14	HD13
15	HD1	16	HD14
17	HD0	18	HD15
19	GND	20	KEY
21	DMARQ	22	GND
23	HIOW-	24	GND
25	HIOR-	26	GND
27	IORDY	28	CSEL
29	DMACK-	30	GND
31	INTRQ	32	IOCS16-
33	HA1	34	PDIAG
35	HA0	36	HA2
37	CS0-	38	CS1-
39	DASP-	40	GND
41	VCC	42	VCC
43	GND	44	Reserved

Table 6: FFD 2.5" Ultra ATA J2 Pin Assignment

Pin #	Signal Name	Pin #	Signal Name
47		48	
49	Reserved	50	Reserved

Pins 47, 48, 49 and 50 are used for the Master/Slave settings, as described in Section 4.

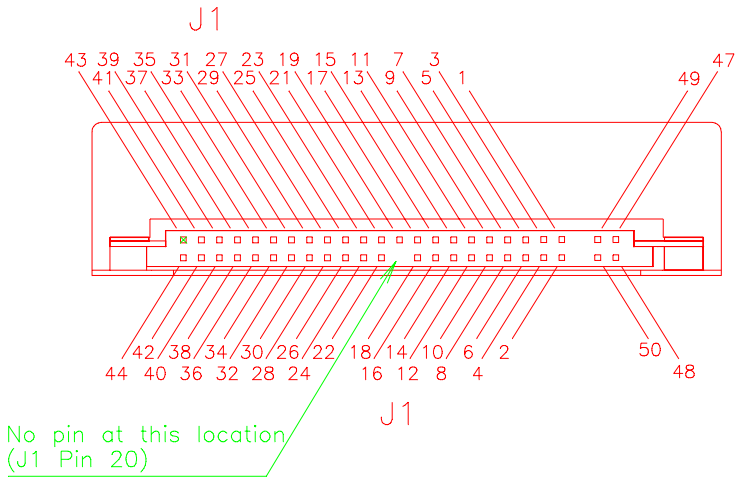


Figure 3: FFD 2.5″ Ultra ATA Pin Configuration

3.4. Reliability - Mean Time Between Failures (MTBF)

The following MTBF statistics for the Ultra ATA were calculated based on Telcordia SR-332, GB, 25°C:

- 4.0 GB capacity: 1,493,418 hours
- 8.0 GB capacity: 835,876 hours
- 40.0 GB capacity: 444,504 hours
- 90.1 GB capacity: 229,552 hours

A detailed report can be supplied upon request.

3.5. Error Detection/Correction Code (EDC/ECC)

The Ultra ATA has embedded error detection and error correction hardware and software mechanisms. The EDC/ECC uses the BCH algorithm, which can detect up to 5 errors in 512 bytes of data, and correct up to 4 errors.

3.6. Environmental Conditions

The Ultra ATA complies with the specified performance requirements after exposure to non-operating environmental conditions, or during and after exposure to operating environmental conditions.

3.6.1. Temperature

3.6.1.1 Operating

The Ultra ATA operates without degradation over the following ambient air temperature range (the maximal temperature change rate shall not exceed 5°C per minute):

- Commercial temperature version: 0°C to +70°C
- Enhanced temperature version: -25°C to +75°C
- Extended/Industrial temperature version: -40°C to +85°C

3.6.1.2 Non-Operating

The Ultra ATA complies with the specified performance requirements after exposure to the following conditions (the maximal temperature change rate shall not exceed 5°C per minute):

- Nominal ambient temperature of -55°C for less than 24 hours
- +95°C for a period of less than 24 hours

3.6.2. Altitude

The Ultra ATA is capable of full operation at altitudes from sea level to 80,000 feet above sea level, and can withstand air transportation in non-pressurized flights at altitudes of up to 80,000 feet above sea level.

3.6.3. Relative Humidity

The Ultra ATA withstands 5% to 95% non-condensing relative humidity.

3.6.4. Shock

The Ultra ATA operates without degradation when subjected to shock testing of 1500 G half-sine pulses of 0.5 ms.

Shock analysis was performed according to standard MIL-STD-810F.

3.6.5. Vibration

The Ultra ATA operates without degradation when subjected to the following vibration conditions:

- 16.3 G rms
- Random vibrations: 3 vibration axes, 20 Hz to 2000 Hz.

Vibration analysis was performed according to standard MIL-STD-810F.

4. FFD 2.5” ULTRA ATA DRIVE CONFIGURATION

4.1. Master and Slave Jumper Settings

Prior to mounting the drive in the system drive bay, the Ultra ATA must be configured according to Figure 4 and Figure 5.

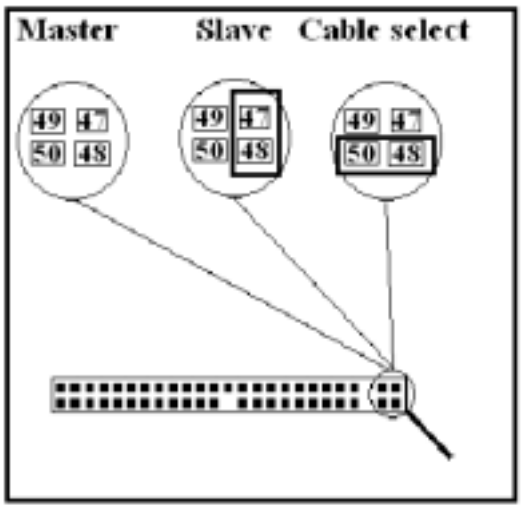


Figure 4: FFD 2.5" Ultra ATA Address Setting by Jumper

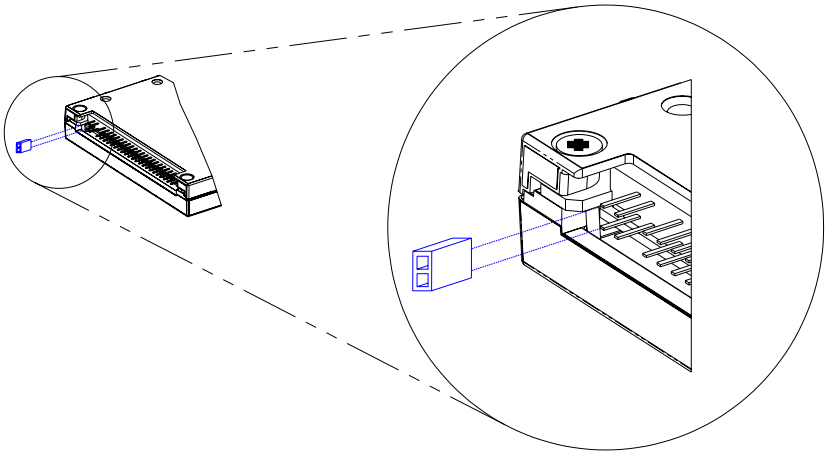


Figure 5: FFD 2.5″ Ultra ATA Slave Setting by Jumper

4.2. Optional Jumper Setting

The Ultra ATA has an optional header located on the back panel for supporting the following options:

- Secure Erase
- Write Protect

The Write Protect jumper shall not be placed when the unit is powered.

4.2.1. Secure Erase Jumper

When a jumper is placed between positions 1 - 2 of the J15 header, the Ultra ATA erases the media.

4.2.2. Write-Protect Jumper Settings

When a jumper is placed between positions 3 - 4 of the J15 header, the Ultra ATA is write protected.

4.2.3. Optional Jumper

Positions 5 - 6 of the J15 header are reserved.

Caution: The Secure Erase jumper overrides the Write-Protect jumper and erases the media.

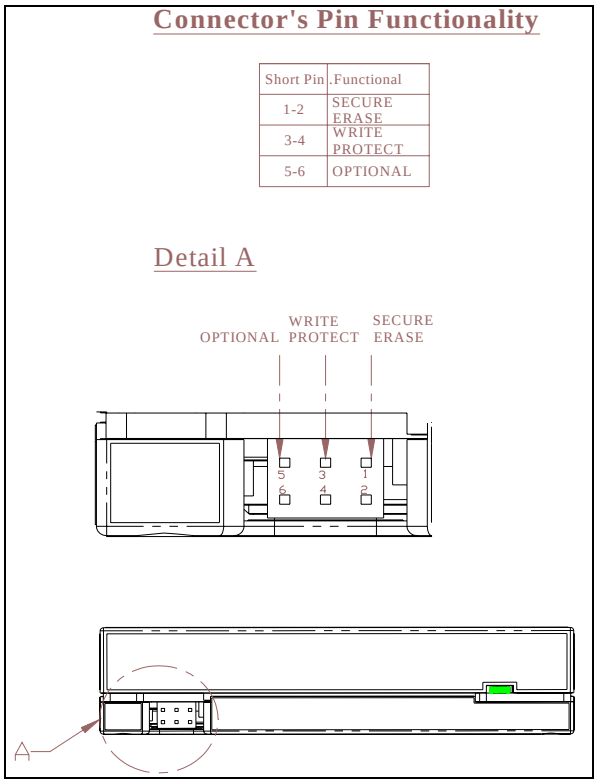


Figure 6: FFD 2.5″ Ultra ATA Write Protect Jumper Settings

4.3. Interface Connectors

The Ultra ATA has a 2.00 mm pitch interface connector located on the rear panel. The DC power and ATA bus are input through a non-shielded 44-pin flat cable.

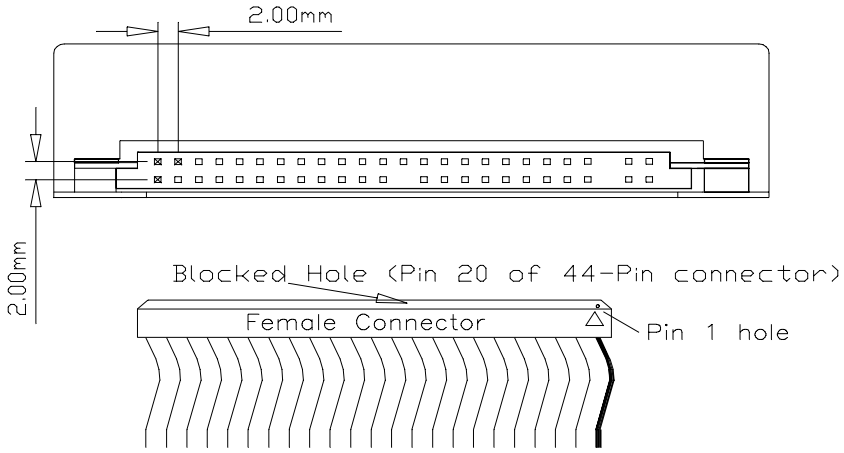


Figure 7: FFD 2.5" Ultra ATA Interface Connector

It is recommended that the mating connector be blocked at pin 20 using a special plastic key (key can be ordered from the connector manufacturer). This prevents possible damage to the disk caused by connecting the cable with a 180º rotation.

4.4. ATA Cable

The cable length should not exceed 18 inches.

Note: According to ATA standards, an 80-conductor cable is required to use the Ultra ATA in Ultra DMA modes 3-5.

4.5. Supported ATA Commands

The Ultra ATA supports the commands listed in Table 7. For a complete description of these commands, refer to the ATA-6 Standard.

Table 7: ATA Commands

Command Name	Command Code (HEX)
CHECK POWER MODE	98h E5h
DOWNLOAD MICROCODE	92h
EXECUTE DEVICE DIAGNOSTIC	90h
FLUSH CACHE	E7h
FORMAT UNIT	F7h
IDENTIFY DEVICE	ECh
IDENTIFY DEVICE DMA	EEh
IDLE	97h E3h

Command Name	Command Code (HEX)
IDLE IMMEDIATE	95h E1h
INITIALIZE DEVICE PARAMETERS	91h
NOP	00h
READ BUFFER	E4h
READ DMA (w/ retry)	C8h
READ DMA (w/o retry)	C9h
READ MULTIPLE	C4h
READ SECTOR(S) (w/ retry)	20h
READ SECTOR(S) (w/o retry)	21h
READ VERIFY SECTOR(S) (w/ retry)	40h
READ VERIFY SECTOR(S) (w/o retry)	41h
RECALIBRATE	10h
SANITIZE (including fast secure erase)	82H
SECURITY DISABLE PASSWORD	F6h
SECURITY ERASE PREPARE	F3h
SECURITY ERASE UNIT	F4h
SECURITY FREEZE	F5h
SECURITY SET PASSWORD	F1h
SECURITY UNLOCK	F2h
SEEK	70h
SET FEATURES	EFh
SET MULTIPLE MODE	C6h
SLEEP	99h E6h
SMART	B0h
STANDBY	96h E2h
STANDBY IMMEDIATE	94h E0h
WRITE BUFFER	E8h
WRITE DMA (w/ retry)	CAh
WRITE DMA (w/o retry)	CBh
WRITE MULTIPLE	C5h
WRITE SECTOR(S) (w/ retry)	30h
WRITE SECTOR(S) (w/o retry)	31h
WRITE VERIFY	3Ch

4.6. Vendor-Specific Commands

4.6.1. Sanitize

4.6.1.1 Sanitize (Purge) Command Interface

The Sanitize command enables distraction (purging/declassifying) of the information on the media.

Bad blocks accumulated since the unit was manufactured will undergo the same process as good blocks. The default sanitize procedure can be activated using either the Sanitize command itself, or using the Sanitize Interrupt command.

The Sanitize command provides a high degree of flexibility, which enables executing declassification procedures defined in various standards by providing different arguments to the command.

Specifically, the Sanitize command parameters enable defining up to three stages of the declassification process. Each stage can be either erasing the media and overwriting it with a given character, or erasing the media and filling it with random information a specified number of times.

If the number of erase-fill cycles is 0, the Sanitize command performs a complete erase but does not fill the media. This is the fastest option; and is also known as the Security Erase option.

The structure of the Security Erase command is described in Table 8.

Table 8: Vendor-Specific Sanitize Command

Register	0	1	2	3	4	5	6	7
Features	Secondary operation code							
Sector Count	Master command							
Sector Number	Parameter 1							
Cylinder Low	Parameter 2							
Cylinder High	Parameter 3							
Device/Head	Partition Mask				D	1		1
Command	82h							

The Secondary Operation code may be one of the following:

- 0x21 (corresponding to the character ‘!’): Immediately activates the Sanitize procedure.
- 0x44 (corresponding to character ‘D’): Saves the specified parameters as the default Sanitize configuration, but does not activate the Sanitize procedure itself.

The default Sanitize procedure is factory-preset to the Security Erase option (erase the media without media fill).

The Master Command has the following layout:

Bits 6-7: Subcommand selection

Value of 00b: Execute default Sanitize procedure

Value of 01b: Execute 1 subcommand, defined in bits 0-1

Value of 10b: Execute 2 subcommands, defined in bits 0-1 and 2-3

Value of 11b: Execute 3 subcommands, defined in bits 0-1, 2-3 and 4-5

Attempting to save the default Sanitize configuration (option 'D') using subcommand selection 00b will result in an aborted command and no changes will be made.

When Master Command specifies only 1 or 2 subcommands, parameters for the remaining subcommands are reserved and should be set to 0 for compatibility with future versions.

For the default Sanitize procedure, all other bits in the Master Command and parameters1-3 are reserved and should be set to 0 for compatibility with future versions.

Bits 0-1, 2-3 and **4-5** of the Master Command contain the following subcommands:

Value of 0: Erase and fill with given character. The character is provided in the corresponding parameter.

Value of 1: Erase and fill with random data, several times. The number of erase/fill loops is provided in the corresponding parameter. Zero number of loops means erase once and do not fill. Only the 7 least significant bits in the parameter are used to specify the number of loops. The most significant bit is reserved for future extensions.

Value of 2 or **3**: These subcommands are reserved for future extensions.

Parameter1 corresponds to the subcommand in bits 0-1.

Parameter2 corresponds to the subcommand in bits 2-3.

Parameter3 corresponds to the subcommand in bits 4-5.

Partition Mask is either a bitmap of partitions to be sanitized or value 0. In the bitmap mode, least-significant bit 1 corresponds to partition 0. Value of zero is a special value; it corresponds to sanitizing the whole media regardless of partition configuration.

For example, Value of 0xF (or 1111 binary) corresponds to sanitizing of all 4 partitions,

Value of 0x8 (or 1000 binary) corresponds to sanitizing partition number 3,

Value of 0x1 (or 0001 binary) corresponds to sanitizing partition number 0,

Value of 0x5 (or 0101 binary) corresponds to sanitizing partitions 0 and 2,

Value of 0 (or 0000 binary) corresponds to sanitizing the whole media.

See Section 4.6.4 for additional information on sanitizing partitions.

4.6.1.2 Compliance with Existing Sanitize (Purge) Standards

The interface specified in Table 9 enables defining a wide range of Sanitize procedures.

Table 9: Supported Sanitizing Procedures

Operation	Master Command	Parameter 1	Parameter 2	Parameter 3
Execute the default Sanitize procedure.	0x00	0x00	0x00	0x00
Erase the media (Security Erase).	0x41	0x00	0x00	0x00
USA-AF AFSSI 5020 Erase the media and overwrite with random data.	0x41	0x01	0x00	0x00
USA Navy NAVSO P-5239-26 Erase the media and overwrite with random data, then erase again.	0x85	0x01	0x00	0x00
DoD 5220.22-M Erase the media and overwrite with single character, then erase again.	0x84	Char	0x00	0x00
NSA Manual 130-2 Erase the media and overwrite with random data 2 times, then erase and overwrite with a character.	0x81	0x02	Char	0x00
USA-Army 380-19 Erase the media and overwrite with random data, erase and overwrite with a character, then erase and overwrite with complement of the character.	0xC1	0x01	Char	~Char
NISPOMSUP Chap 8, Sect. 8-501 Overwrite all locations with a character, its complement, and then random data.	0xD0	Char	~Char	0x01
IREC (IRIG) 106: Erase the media, overwrite with 0x55, erase, overwrite with 0xAA, erase.	0xD0	0x55	0xAA	0x00
Erase the media and overwrite with random data (different data each time) 21 times.	0x41	0x15	0x00	0x00
Erase the media and overwrite with random data (different data each time) 381 times	0xD5	0x7F	0x7F	0x7F

Notes: 1. Before every overwrite process, all blocks are erased as per the flash specification.

2. Blocks subjected to the Sanitize procedure are all blocks not registered in the original manufacturer's Bad Block Table.

4.6.1.3 Sanitize Interrupt

The Sanitize Interrupt command has the following characteristics:

- The Ultra ATA receives the Sanitize Interrupt at any time.
- The Sanitize Interrupt initiates the immediate execution of the default Sanitize procedure.
- The default factory-preset Sanitize procedure is to erase the entire media and leave it empty (to perform the Security Erase option).
- If unit is powered up with Sanitize Interrupt active, the default Sanitize procedure is launched immediately.
- If the Sanitize Interrupt is still active upon completion of the default Sanitize procedure, the Ultra ATA restarts the default Sanitize procedure. This cycle is repeated indefinitely for as long as the Sanitize Interrupt command is active.

Note: Please contact the M-Systems sales offices for information regarding the available hardware Sanitize Interrupt options.

4.6.1.4 Auto-Resume Sanitize Feature

When Auto-Resume is enabled (the factory default setting), if a power interruption occurs during a Sanitize procedure the Ultra ATA restarts the Sanitize procedure on the next power-up.

If the Sanitize Interrupt command is active during power-up, the unit first completes the Sanitize procedure that was initiated before the power interruption. If the Sanitize Interrupt command is still active when the procedure is complete, the Ultra ATA re-launches the default Sanitize procedure, as described in Table 9.

4.6.1.5 Random Data Written During the Sanitize Procedure

The random data used to overwrite user data is a digest of pseudo-random generation and real random data. The pseudo-random generation is seeded in such a manner that even if the Ultra ATA launches the Sanitize command under identical external conditions (for example, if the unit is powered on with Sanitize Interrupt active), it will produce different seeds and different pseudo-random data.

4.6.1.6 LED Activity During the Sanitize Procedure

During the Format and Sanitize procedures, the red LED provides the following indications:

a. Remains lit during the Erase phase (for the Sanitize procedure, during each erase phase)
b. Blinks during the Media Fill phase (for the Sanitize procedure, during each fill phase)
c. Remains lit for a short period while the disk achieves ready status after completing the Sanitize procedures.

4.6.1.7 Using the Ultra ATA After a Sanitize Procedure

After performing Sanitize Procedure, if fill option is not activated, the user must perform a low-level format on the media. Failing to perform the low-level format may result in a longer start-up time.

4.6.1.8 Sanitizing Based on DoD 5220.22-M

The USA DoD 5220.22-M National Industrial Security Program Operating Manual (NISPOM), January 1995, specifies the sanitization processes for each media type (in order to be considered declassified) in Chapter 8, Automated Information System Security. For Flash EPROM media type, the sanitize process is as follows:

- "Overwrite all addressable location with a single character."
  Then
- "Perform a full chip erase as per manufacturer's data sheet."

The Ultra ATA complies with the above requirement, as described in Table 9.

4.6.1.9 Sanitizing Based on NSA Manual 130-2

The USA National Security Agency (NSA) specifies the procedure for sanitizing semiconductor memory devices in its 130-2 Media Declassification and Destruction Manual (Paragraph 5, Section 7). In the updated document version dated November 2000 Section 4.6c indicates the procedure for sanitizing EEPROM:

- "Overwriting all locations with a pseudo-random pattern twice".
  Then
- "Overwriting all locations with a known pattern".

The Ultra ATA complies with the above requirement, as described in Table 9.

4.6.1.10 Sanitizing Based on USA Air Force AFSSI 5020

The USA Air Force System Security Instruction (AFSSI) 5020, dated 20 August, 1996, specifies the procedure for sanitizing confidential media. Chapter 5, Semiconductor Devices, describes the security procedure for all types of semiconductor media. In Paragraph 5.3, the procedure for sanitizing flash memory is described as follows:

- "Pulsing the erase control gate and verifying the erasure".
  Then
- "Overwrite all bit locations with arbitrary unclassified data".

The Ultra ATA complies with the above requirement, as described in Table 9.

4.6.1.11 Sanitizing (Purging) Based on USA Army Regulation 380-19

The USA Army Regulation 380-19, Information Systems Security (ISS), effective 27 March, 1998, provides the security requirements for systems processing Special Access Program (SAP) information and describes the ISS policy as it applies to security in hardware, software procedures, telecommunication, personal use, physical environment, networks and firmware. Section VII, Automated Information System Media, Section 2-20, describes cleaning, purging, declassifying and destroying media. Appendix F-2 describes the following for sanitizing flash EPROM (FEPROM):

- "Overwrite all location with a random character, a specific character, then its complement"
  Then

- "Check with the DAA (Designated Approval Authority)/SCO (Service Certifying Organization) to see if additional procedures are required".

The Ultra ATA complies with the above requirement, as described in Table 9.

4.6.1.12 Sanitizing (Purging) Based on USA Navy NAVSO P-5239-26

The Navy Staff Office Publication (NAVSO) 5239, "Information Systems Security (INFOSEC) Program Guidelines" is issued by the Naval Information Systems Management Center and provides policy, guidelines, and procedures for clearing and purging computer system memory and other storage media for release outside of and for reuse within controlled environments. It pertains to both classified and sensitive unclassified information. Implements DOD 5200.28-M and CSC-STD-005-85. Chapter 3 describes the cleaning and purging of data storage media, and section 3.5 describes the purging of EEPROM and EAROM. To purge EEPROM:

- "Overwrite all location with any pattern," then erase.

The Ultra ATA complies with the above requirement, as described in Table 9.

4.6.1.13 Declassification Based on IRIG-106 (NTISSP-9)

The Telemetry Group (TG) of the Range Commanders Council (RCC) has prepared documents to foster the compatibility of telemetry transmitting, receiving, and signal processing equipment at the member ranges under the cognizance of the RCC.
IRIG (Inter-Range Instrumentation Group) 106 are set of Telemetry standards which provide the necessary criteria on which to base equipment design and modification.
The National Telecommunication & Information Security Systems (NTISSP-9) Chapter 10 describes the requirements for SOLID STATE RECORDER STANDARD. Section 10.8 (declassification) addresses declassification for various Solid-State Disks as follows:

- First Erase – Every memory block on the board is erased
- First write 0x55 – Every memory chip location is recorded with a pattern 0x55
- Second Erase – Every memory block on the board is erased
- Second write 0xAA – Every memory chip location is recorded with a pattern 0xAA
- Third Erase – Every memory block on the board is erased

M-Systems' FFD Sanitize feature complies with the above requirements as described in Table 9.

4.6.2. Security Erase Functionality

The Security Erase option enables quickly erasing all the data stored on the Ultra ATA. This function is activated by the vendor-unique Sanitize command (see Section 4.6.1) or via the Sanitize hardware interrupt triggered by the Secure Erase header (if available).

The time required to perform the security erase depends on the disk capacity and the type of flash components being used. Table 10 describes typical time required to complete the security erase for typical capacities.

Table 10: Typical Erase Time (According to Disk Capacity)

Capacity (MB)	Time to Erase Entire Media (sec) Security Erase	Time to Erase Entire Media + FILL (sec) *USA-AF AFSSI 5020*	*NSA 130-2* (erase + fill random twice, erase + fill char)
1024	4.0 (+1.0 sec mount unformatted media)	70.3 (+0.2 sec mount)	510.3 (+0.2 sec mount)
2048	6.4 (+1.9 sec mount unformatted media)	124.6 (+0.2 sec mount)	302.7 (+0.2 sec mount)
4096	6.7 (+3.6 sec mount unformatted media)	274.4 (+0.3 sec mount)	601.7 (+0.3 sec mount)
8192	7.2 (+7.3 sec mount unformatted media)	195.3 (+0.5 sec mount)	920.0 (+0.5 sec mount)
20480	12 (+18.3 sec mount)	1351.9 (+1.3 sec mount)	3168.7 (+1.3 sec mount)

Typical power consumption during security erase depends on both the device capacity and on the NAND flash type. Table 11 describes the specifications for Security Erase operations. The Ultra ATA input voltage is +5VDC, with a tolerance of 5% (4.75V-5.25V) and maximum ripple of 250 mV peak-to-peak.

Table 11: Typical Power Consumption During Security Erase

Disk Capacity (MB)	Flash Component Density	Power Consumption During Security Erase
1024	128MB	2.69W / 530 mA
2048	256MB	3.81W / 750 mA
4096	512MB	3.91W / 770 mA
8192	256MB	3.33W / 655 mA
20480	256MB	4.01W / 790 mA

4.6.3. Configuration

4.6.3.1 Configurable Parameters

The following parameter can be configured:

Sanitize Partition Information for four partitions. Each partition is defined as pair of numbers, <Start Sector> and <Partition Length in Sectors>.

4.6.3.2 Setting the Configurable Parameters

The structure of the SET PARAMETERS command is described in Table 12:

Table 12: Vendor-Specific Set Parameters Command

Register	0	1	2	3	4	5	6	7
Features	0xF0							
Sector Count	0							
Sector Number	0							
Cylinder Low	0							
Cylinder High	0							
Device/Head	0				D	1		1
Command	B0h							

The command transfers one sector of data with configurable parameters to the Ultra ATA. The format of the data is described in Table 13.

Table 13: Data Format on the Ultra ATA

Word 0	Signature: 0x4E56
Word 1	Version: 0x100
Word 2	Reserved
Word 3	Number of Parameters in whole command
Word 4	Parameter 1 ID, MSB
Word 5	Parameter 1 ID, LSB
Word 6	Parameter 1 Value, MSB
Word 7	Parameter 1 Value, LSB
Word 8	...
	...
Word 251	
Word 252	Parameter 63 ID, MSB
Word 253	Parameter 63 ID, LSB
Word 254	Parameter 63 Value, MSB
Word 255	Parameter 63 Value, LSB

Each parameter ID is a 32-bit number. Each parameter value is also a 32-bit number. The following parameter IDs are currently defined:

Partition 0 Start Sector 0x10000

Partition 0 Length in Sectors 0x10001

Partition 1 Start Sector 0x10002

Partition 1 Length in Sectors	0x10003
Partition 2 Start Sector	0x10004
Partition 2 Length in Sectors	0x10005
Partition 3 Start Sector	0x10006
Partition 3 Length in Sectors	0x10007

The SET PARAMETERS command is aborted if an invalid Parameter ID or Parameter ID value is given, for example, if the partition size exceeds the media capacity.

4.6.3.3 Retrieving the Configurable Parameters

The structure of the GET PARAMETERS command is described in Table 14:

Table 14: Vendor-Specific Get Parameters Command

Register	0	1	2	3	4	5	6	7
Features	0xEF							
Sector Count	Parameter ID bits 0-7 (LSB)							
Sector Number	Parameter ID bits 8-15							
Cylinder Low	Parameter ID bits 16-23							
Cylinder High	Parameter ID bits 24-31 (MSB)							
Device/Head	0				D	1		1
Command	B0h							

The command transfers one sector of data with configurable parameters from the Ultra ATA, in the format described in Table 13 on page 27. If the parameter ID specified in the command registers is one of those listed in Section 4.6.3.2, the returned sector contains the value of that single ID. In addition, a group-ID is defined as:

All Partition IDs	0x1FFFF

In response to a group-ID given in the command registers, the returned sector will contain a list of parameter IDs from that group, and all their respective values.

4.6.4. Sanitizing Partitions

The Ultra ATA can be subdivided into a maximum of four partitions. When configuring your system for a Sanitize procedure, the following must be taken into account:

- A partition may be as small as one sector, or occupy the entire media.
- When a partition has a length of 0, if it is included in the Partition Mask it will have no effect on the Sanitize procedure.
- Partition values are always defined. The factory default is all partitions having length 0, i.e. nothing is erased if you use Sanitize with a Partition Mask value other than 0 without setting some new partition boundaries.

- Sanitizing all four partitions is not necessarily the same as sanitizing the whole media; it depends on the configuration of the partitions (starting block and length of each).
- Partitions may overlap in any fashion. Their combined set of sectors will be sanitized.
- You can define the default Sanitize procedure to have any Partition Mask.

4.6.5. S.M.A.R.T Command

In an effort to help users to avoid data loss, mechanical disk manufacturers incorporate logic into their drives that acts as an "early warning system". This system is called Self-Monitoring Analysis and Reporting Technology, or S.M.A.R.T. The hard disk's integrated controller works with sensors to monitor various aspects of the drive's performance, and determines from this information whether or not the drive is behaving normally and reports its status. The fundamental principle behind S.M.A.R.T. is that many problems within mechanical hard disks do not occur suddenly, but result from a slow degradation of various mechanical components. Mechanical characteristics commonly analyzed by the S.M.A.R.T. command are head-flying height, number of remapped sectors, spin-up time, drive temperature and data throughput.

S.M.A.R.T implementation in the Ultra ATA takes an alternate approach. As the Ultra ATA is a solid-state disk with no moving parts, there is no point in testing Ultra ATA mechanical functionality. The S.M.A.R.T. command in the Ultra ATA analyzes the number of bad blocks that were accumulated in the Ultra ATA relative to the total amount of spare blocks.

When the flash media returns a failure at a block, the data from that block is transferred to a spare block (transparently to the host), and the failed block is marked as bad. The number of spare blocks on the media is close to 4%, which provides balance between cost and reliability.

When the S.M.A.R.T. command is executed, subcommand is RETURN STATUS and the Ultra ATA calculates the following parameters:

- The total number of spare blocks reserved at the time the Ultra ATA was shipped from the factory.
- The current number of spare blocks available on the Ultra ATA.

For the S.M.A.R.T. command, the subcommand RETURN STATUS returns one of two possible statuses:

- **Passed**: If less than 95% of the total reserved spare blocks at the time of shipment were already used.
- **Failed**: If more than 95% of the total reserved spare blocks at the time of shipment were already used

The S.M.A.R.T remote monitoring analysis can be used as a trigger for disk alarm and for immediate preventative maintenance, namely to replace the Ultra ATA before it passes into read-only mode.

4.6.6. Format Unit Command

The drive is shipped from the factory low-level formatted and ready for use. In order to initiate a low-level format, the initiator must issue a low-level format command (opcode F7h).

The Format Unit command performs low-level formatting on the Ultra ATA.

Table 15: Format Unit Command

Register	0	1	2	3	4	5	6	7
Features								
Sector Count								
Sector Number								
Cylinder Low								
Cylinder High								
Device/Head					D	1		1
Command	F7h							

5. FIRMWARE UPGRADE

The Ultra ATA is a firmware upgradeable disk.

6. MOUNT TIME

The total time required to mount the Ultra ATA, described in Table 16, depends on the device capacity.

Table 16: Mount Time (According to Capacity, After Low-Level Format)

Capacity (MB)	Duration (sec)
1024	0.1
2048	0.2
4096	0.4
8192	0.6
20480	1.3

7. COMPATIBILITY

The Ultra ATA is guaranteed to comply with the following requirements:

CE, UL, EN 55022 Class B, CISPR 22 Class B, AS/NZS 3548 Class B, BSMI CNS 13438 Class B, CAN/CSA-V-3/2001.04 (VCCI), FCC Part 15 Class B, EN 61000-3-2, EN 61000-3-3, IEC 61000-4-2/3/4/5/6/8/11.



8. LABEL INFORMATION

The bottom cover label contains the following information:



Figure 8: FFD Ultra ATA Label

1. Ordering Information
2. Part Number
3. Shipping Number
4. ESD Warning
5. M-Systems Logo
6. Product Logo
7. Declaration of Origin
8. Compliance

9. BUILT-IN TEST (BIT)

The Ultra ATA performs a power-up test to ensure that its basic components are functioning. Upon power-up the following is tested:

- RAM
- Boot Flash
- ATA Controller
- Timers
- DMA Controller
- Flash Media

10. INSTALLING AND USING THE FFD 2.5" ULTRA ATA

This section provides you with the information you need to properly install your new FFD 2.5" Ultra ATA Flash Disk. M-Systems recommends that qualified and trained personnel install the drive.

The following chapters contain handling information, mounting considerations, address and configuration setups, cabling and connector information and information about obtaining technical assistance and service.

Remember - Always back up your data before adding disk drives to your system!

10.1. Kit Contents

Ensure that your kit contains the following items:

- FFD 2.5" Ultra ATA Flash Disk
- Four mounting screws and three jumpers, M-Systems part no. 41-pk-001-00.

If any items are missing, please contact your dealer.

10.2. Visual Inspection

Before unpacking or handling a drive, take all proper electrostatic discharge (ESD) precautions, including personnel and equipment grounding.

Before you begin installing the Ultra ATA, inspect the package and device as follows:

- If the shipping container appears to be damaged or water stained, notify your dealer.
- Remove the disk from its shipping enclosure and inspect it for any damage that may have occurred during shipment. If any damage is observed, notify your dealer.
- Record the disk serial number and shipment date.
- Retain the original shipping enclosure and all packing material for re-shipment.

10.3. Handling Instructions

You can prolong the life of your Ultra ATA, increase its reliability, and prevent unnecessary damage by following the instructions listed below. Failure to follow any of these instructions may void your warranty.

- Always take all proper electrostatic discharge (ESD) precautions, including personnel and equipment grounding.
- Always operate the Ultra ATA within the environmental specifications.
- Always use a grounded wrist strap when handling the Ultra ATA. Drives that are not installed in the system are sensitive to ESD damage.
- Always handle the Ultra ATA carefully.

- Never switch DC power to the drive by plugging an electrically live source cable into the drive's power connector.
- Pay attention to the cable polarity whenever connecting the drive to the cable.

10.4. Installation

10.4.1. System Requirements

In order to install the Ultra ATA in your system, ensure that you have the following items:

- System mounting hardware
- 80-conductors ribbon ATA cable for the Ultra ATA for using Ultra DMA modes 3-5. A 40-conductor ribbon ATA cable will enable working in PIO and Ultra DMA modes 0-2 only. Higher speed transfers may subject to failures.

10.4.2. FFD Ultra-ATA Configuration

Before mounting the drive into the system drive bay, you must first configure the Ultra ATA by setting the Master/Slave and the Optional Jumpers setting jumper to comply with your system requirements. See section 4.1 for details.

10.4.3. Ultra ATA Installation

The Ultra ATA can be installed in the system in any mounting position. Unlike rotating disks that have an axis of rotation, the Ultra ATA is not susceptible to damage due to its orientation.

Note: It is not necessary to perform a low-level format on the Ultra ATA. The drive is shipped low-level formatted and ready for use.

10.4.3.1 Installing the Ultra ATA in a PC Environment

To install the Ultra ATA:

1. Power down the PC and remove the cover.
2. Configure the Ultra ATA jumper settings according to the information provided in Section 4.1
3. Connect a cable between the Ultra ATA and the host. Make sure to orient the cable so that pin 1 of the Ultra ATA is connected to pin 1 of the host adapter.
4. Mount the Ultra ATA in a free drive bay.
5. Close the PC cover and power on the PC.
6. The host BIOS sign-on message will appear and display a key sequence to enter the BIOS setup. Set up the BIOS to recognize the Ultra ATA (refer to the BIOS documentation for the disk installation procedure).

You are now ready to use the Ultra ATA. If you encounter any problems, refer to Section 11 for troubleshooting information.

10.4.3.2 Using the Ultra ATA in an MS-DOS-Based Platform

After installing the Ultra ATA (as described in Section 10.4.3), it must be installed as a disk drive under DOS. Run the DOS commands listed below and follow the instructions displayed for each command. For more information regarding the DOS commands, refer to your DOS manual.

1. Run the DOS FDISK program to partition the Ultra ATA.
2. Run the DOS FORMAT command to high-level format the Ultra ATA.
3. If you want the Ultra ATA to be a bootable drive, run the DOS SYS command and change its partition to active.

10.4.3.3 Using the Ultra ATA in a Windows-Based Platform

The Ultra ATA requires no special adjustments or modifications, and can be used just like a magnetic hard drive.

10.4.3.4 Using the Ultra ATA in a Linux-Based Platform

The Ultra ATA requires no special adjustments or modifications, and can be used just like a magnetic hard drive.

10.4.3.5 Using the Ultra ATA in Other OS/Platforms

The Ultra ATA requires no special adjustments or modifications, and can be used just like a magnetic hard drive.

11. TROUBLESHOOTING

11.1. The Ultra ATA is Not Identified by the System BIOS

11.1.1. Basic Checks

Most disk problems are caused by improper disk installation. First, check the following:

- Cable problems:
  - Homemade, short, flat ribbon cables with bad contacts or cheap cables
  - Mixing round cables with flat cables
  - Cable length exceeds the limit specified in the standard
  - Cables are too long to support the transfer rate
- Device Address Conflict:
  - A new device was added with an ATA setting identical to an existing device on the bus
  - Connection is faulty
  - A cable was connected with reverse polarity
- Power supply is below FFD requirements

11.1.2. BIOS Setup

Verify that the disk is enabled in the BIOS. In most new BIOSs, there is an option to allow auto identification of the drive. This usually works.

11.1.3. Disk Settings

If the Ultra ATA is functioning as master device with a non-compliant slave device, the Ultra ATA may not be identified. To prevent this failure, set the jumpers to “Master with Non-ATA-Compliant Slave”, as described in Section 4.1.

11.2. Disk Performance is Slow

If you are experiencing poor disk performance, it may be due to one of the following reasons:

- The Ultra ATA is operating only with ultra DMA modes 0-2.
- The Ultra ATA is operating in PIO mode under Windows.
- The cable may be 40-conductor cable instead of 80-conductor cable. High transfer rates require the proper cable.
- DMA transfer mode may not be enabled in the Windows OS settings. Windows has a fallback mechanism that causes the disk operating mode to revert to PIO if too many errors occur.

11.3. The Ultra ATA Functions as Additional Drive But Fails to Boot

If the Ultra ATA fails to boot even though the OS recognizes it as an additional drive, check the following:

- Verify that the partition on the drive is active. Some partitioning utilities, such as DOS FDISK, automatically set a partition to active when the Ultra ATA is the only disk in the system. If other disk with an active partition is present in the system, the FDISK utility does not allow setting additional partitions as active.
- Verify that the operating system is properly installed.

11.4. Linux Installation Complete But the System Does Not Boot

Verify that the partitions are large enough. When using small capacity drive, older installation CD fail to properly divide the disk to partitions.

This bug was fixed in new installation utilities.

If you use your own customized Linux verify that you use the latest kernel as a base to your modified version.

11.5. The New Ultra ATA Fails to Operate After Disk Duplication

If you duplicate an Ultra ATA drive and the new drive fails to operate, check the following:

- Verify that the master disk is identical to the target disk.
- Some duplicators or duplicating utilities cannot install large images (created using large drives) on smaller drives.
- Install the OS on the Ultra ATA and use it as the master disk.

12. GETTING HELP

If you need technical assistance with the installation and/or configuration of your Ultra-ATA, contact one of the sources listed on the contact page. Before you call, please be sure to have the following information available for the customer support representative:

- Product and serial number of your Ultra ATA.
- Description of computer hardware (manufacturer, model, attached devices, etc.).
- Description of your ATA host adapter and associated drivers.
- Description of your software (operating system, version, application software, etc.).
- A complete description of the problem.
- The exact wording of any error messages.

Before contacting M-Systems directly, first contact your dealer. If your dealer cannot provide the help you need, you can obtain technical support directly from M-Systems at one of the numbers listed on the contact page.

13. ORDERING INFORMATION

Table 17: Ordering Information for FFD 2.5" Ultra ATA

FFD-25-UATA-CCCCC-T-H		
CCCCC:	Unformatted capacity (MB)	1024, 2048, 4096, 6144, 8192, 12288, 16384, 20480, 24576, 28672, 32768, 36864, 40960, 45056, 49152, 53248, 57344, 61440, 65536, 69632, 73728, 77824, 81920, 86016, 90112
T:	Temperature range	Blank: Commercial 0°C - +70°C N: Enhanced -25°C - +75°C X: Extended -40°C - +85°C
H:	Case height	A – 9.4 mm up to 4.0GB B – 13.4 mm up to 16.3GB C – 17.3 mm up to 28.6GB D – 21.4 mm up to 40.9GB F – 29.9 mm up to 65.5GB H – 37.9 mm up to 90.1GB

M-Systems
Flash Disk Pioneers

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Contact your local M-Systems sales office or distributor, or visit our website at www.m-systems.com to obtain the latest specifications before placing your order.

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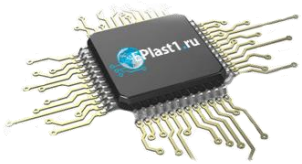
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Наши преимущества:

- Оперативные поставки широкого спектра электронных компонентов отечественного и импортного производства напрямую от производителей и с крупнейших мировых складов;
- Поставка более 17-ти миллионов наименований электронных компонентов;
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- Лицензия ФСБ на осуществление работ с использованием сведений, составляющих государственную тайну;
- Поставка специализированных компонентов (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Aeroflex, Peregrine, Syfer, Eurofarad, Texas Instrument, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits,General Dynamics и др.);

Помимо этого, одним из направлений компании «ЭлектроПласт» является направление «Источники питания». Мы предлагаем Вам помощь Конструкторского отдела:

- Подбор оптимального решения, техническое обоснование при выборе компонента;
- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.



Как с нами связаться

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