

**Quantum Fireball™ 1.0/1.2/1.7/2.1/2.5/3.2/3.8 GB
AT
Product Manual**

October 1996
81-111394-02

Quantum reserves the right to make changes and improvements to its products, without incurring any obligation to incorporate such changes or improvements into units previously sold or shipped.

You can request Quantum publications from your Quantum Sales Representative or order them directly from Quantum.

Publication Number: 81-111394-01

UL/CSA/TUV/CE

UL standard 1950 recognition granted under File No. E78016

CSA standard C22.2 No. 950 certification granted under File No. LR49896

TUV Rheinland EN 60 950 granted under File No. _____

Tested to FCC Rules for Radiated and Conducted Emissions, Part 15, Sub Part J, for Class-B Equipment.

SERVICE CENTERS

Quantum Service Center
715 Sycamore Avenue
Milpitas, California 95035
Phone: (408) 894-4000
Fax: (408) 894-3218
<http://www.quantum.com>

Quantum Asia-Pacific Pte. Ltd.
50 Tagore Lane #b1-04
Singapore, 2678
Phone: (65) 450-9333
Fax: (65) 452-2544

PATENTS

These products are covered by or licensed under one or more of the following U.S. Patents: 4,419,701; 4, 538,193 4,625,109; 4,639,798; 4,647,769; 4,647,997; 4,661,696; 4,669,004; 4,675,652; 4,703,176; 4,730,321; 4,772,974; 4,783,705; 4,819,153; 4,882,671; 4,920,442; 4,920,434; 4,982,296; 5,005,089; 5,027,241; 5,031,061; 5,084,791; 5,119,254; 5,160,865; 5,170,229; 5,177,771; Other U.S. and Foreign Patents Pending.

Copyright© 1996 Quantum Corporation. All rights reserved. Printed in U.S.A.

This product or document is protected by copyright and distributed under licenses restricting its use, copying, distribution, and decompilation. No part of this product or document may be reproduced in any form by any means without prior written authorization of Quantum and its licensors, if any.

RESTRICTED RIGHTS LEGEND: Use, duplication, or disclosure by the government is subject to restrictions as set forth in subparagraph (c)(1)(ii) of the Rights in Technical Data and Computer Software clause at DFARS 252.227-7013 and FAR 52.227-19.

THIS PUBLICATION IS PROVIDED "AS IS" WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR NON-INFRINGEMENT.

Quantum Fireball TM™ is a trade mark of Quantum Corporation and AIRLOCK, WriteCache, DisCache, and the Quantum logo are registered trademarks of Quantum Corporation. PC-AT is a registered trademark of International Business Machine. MS-DOS is a registered trademark of Microsoft Corporation.

Table of Contents

Chapter 1**ABOUT THIS MANUAL**

1.1 AUDIENCE DEFINITION	1-1
1.2 MANUAL ORGANIZATION	1-1
1.3 TERMINOLOGY AND CONVENTIONS	1-1
1.4 REFERENCES	1-3

Chapter 2**GENERAL DESCRIPTION**

2.1 PRODUCT OVERVIEW	2-1
2.2 KEY FEATURES	2-1
2.3 STANDARDS AND REGULATIONS	2-2
2.4 HARDWARE REQUIREMENTS.....	2-3

Chapter 3**INSTALLATION**

3.1 SPACE REQUIREMENTS.....	3-1
3.2 UNPACKING INSTRUCTIONS	3-2
3.3 HARDWARE OPTIONS.....	3-4
3.3.1 Cable Select (CS) Jumper	3-5
3.3.2 Drive Select (DS) Jumper	3-5
3.3.3 Jumper Parking (PK) Position	3-5
3.3.4 Slave Present (SP) Jumper	3-6
3.4 IDE BUS ADAPTER	3-6
3.4.1 40-Pin IDE Bus Connector	3-6
3.4.2 Adapter Board	3-6
3.5 MOUNTING	3-7
3.5.1 Orientation	3-7
3.5.2 Clearance	3-11
3.5.3 Ventilation	3-11
3.6 COMBINATION CONNECTOR (J1)	3-11
3.6.1 DC Power (J1, Sections A and B)	3-12
3.6.2 External Drive Activity LED	3-13
3.6.3 IDE Bus Interface Connector (J1, Section C)	3-13
3.7 FOR SYSTEMS WITH A MOTHERBOARD IDE ADAPTER.....	3-13
3.8 FOR SYSTEMS WITH AN IDE ADAPTER BOARD.....	3-13
3.8.1 Adapter Board Installation	3-13

3.9	TECHNIQUES IN DRIVE CONFIGURATION	3-15
3.9.1	Manual Partition Size in MS-DOS 4.0 and Above	3-15
3.9.2	1024 Cylinder Limitation on Older Computer Systems	3-15
3.9.3	Newer Computer Systems with Extended BIOS Translation	3-16
3.10	SYSTEM STARTUP AND OPERATION	3-16

Chapter 4

SPECIFICATIONS

4.1	SPECIFICATION SUMMARY	4-1
4.2	FORMATTED CAPACITY	4-3
4.3	DATA TRANSFER RATES	4-3
4.4	TIMING SPECIFICATIONS	4-4
4.5	POWER	4-5
4.5.1	Power Sequencing	4-5
4.5.2	Power Reset Limits	4-5
4.5.3	Power Requirements	4-6
4.6	ACOUSTICS	4-7
4.7	MECHANICAL DIMENSIONS	4-7
4.8	ENVIRONMENTAL CONDITIONS	4-8
4.9	SHOCK AND VIBRATION	4-8
4.10	RELIABILITY	4-9
4.11	DISK ERRORS	4-10

Chapter 5

BASIC PRINCIPLES OF OPERATION

5.1	QUANTUM FIREBALL TM DRIVE MECHANISM	5-1
5.1.1	Base Casting Assembly	5-3
5.1.2	DC Motor Assembly	5-3
5.1.3	Disk Stack Assemblies	5-3
5.1.4	Headstack Assembly	5-5
5.1.5	Rotary Positioner Assembly	5-5
5.1.6	Automatic Actuator Lock	5-5
5.1.7	Air Filtration	5-6
5.2	DRIVE ELECTRONICS	5-7
5.2.1	μController	5-8
5.2.2	DCIIA	5-8
5.2.3	Read/Write ASIC	5-11
5.2.4	PreAmplifier and Write Driver	5-12
5.3	SERVO SYSTEM	5-13
5.3.1	General Description	5-13
5.3.2	Servo Burst and Track Information	5-13
5.4	READ AND WRITE OPERATIONS	5-14
5.4.1	The Read Channel	5-14
5.4.2	The Write Channel	5-14
5.4.3	Interface Control	5-15
5.4.4	ID-Less Format	5-15
5.5	FIRMWARE FEATURES	5-16
5.5.1	Disk Caching	5-16

5.5.2	Track and Cylinder Skewing	5-18
5.5.3	Error Detection and Correction	5-19
5.5.4	Defect Management	5-26

Chapter 6

IDE BUS INTERFACE AND ATA COMMANDS

6.1	INTRODUCTION	6-1
6.2	SOFTWARE INTERFACE.....	6-1
6.3	MECHANICAL DESCRIPTION	6-1
6.3.1	Drive Cable and Connector	6-1
6.4	ELECTRICAL INTERFACE.....	6-2
6.4.1	IDE Bus Interface	6-2
6.4.2	Host Interface Timing	6-8
6.5	REGISTER ADDRESS DECODING.....	6-11
6.6	REGISTER DESCRIPTIONS	6-13
6.6.1	Control Block Registers	6-13
6.6.2	Command Block Registers	6-14
6.7	COMMAND DESCRIPTIONS.....	6-19
6.7.1	Recalibrate 1xh	6-19
6.7.2	Read Sectors 20h (with retry), 21h (without retry)	6-19
6.7.3	Write Sector 30h (with retry), 31h (without retry)	6-20
6.7.4	Read Verify Sectors 40h (with retry), 41h (without retry)	6-20
6.7.5	Format Track 50h	6-20
6.7.6	Seek 7xh	6-21
6.7.7	Execute Drive Diagnostic 90h	6-22
6.7.8	Initialize Drive Parameters 91h	6-22
6.7.9	Read Multiple C4h	6-23
6.7.10	Write Multiple C5h	6-23
6.7.11	Set Multiple Mode C6h	6-24
6.7.12	Read Buffer E4h	6-24
6.7.13	Write Buffer E8h	6-24
6.7.14	Power Management Commands	6-24
6.7.15	Identify Drive	6-26
6.7.16	Set Features EFh	6-31
6.7.17	Read Defect List	6-31
6.7.18	Configuration	6-33
6.8	ERROR REPORTING	6-38

Glossary.....	G-1
---------------	-----

Index.....	I-1
------------	-----

List of Figures

FIGURE	DESCRIPTION	PAGE
Figure 3-1	Mechanical Dimensions of Quantum Fireball TM One Disk Drive	3-1
Figure 3-2	Mechanical Dimensions for Quantum Fireball TM Two and Three Disk Drives	3-2
Figure 3-3	Drive Packing Assembly	3-3
Figure 3-4	Jumper Locations on the Drive PCB	3-4
Figure 3-5	Mounting Dimensions for Quantum Fireball TM One Disk Drive.....	3-7
Figure 3-6	Mounting Dimensions for Quantum Fireball Two and Three Disk Drives	3-8
Figure 3-7	Mounting Screw Clearance for Quantum Fireball TM One Disk Drive.....	3-9
Figure 3-8	Mounting Screw Clearance for Quantum Fireball TM Two and Three Disk Drives...	3-10
Figure 3-9	J1 DC Power and IDE Bus Combination Connector.....	3-11
Figure 3-10	Drive Power Supply and IDE Bus Interface Cables	3-14
Figure 3-11	Completing the Drive Installation	3-15
Figure 5-1	Quantum Fireball TM Two Disk Drive Exploded View.....	5-2
Figure 5-2	HDA Air Filtration.....	5-6
Figure 5-3	Quantum Fireball TM 1.0/1.2/1.7/2.1/2.5/3.2/3.8AT Hard Disk Drive Block Diagram	5-7
Figure 5-4	DCIIA Block Diagram	5-8
Figure 5-5	Read/Write ASIC Block Diagram	5-11
Figure 5-6	Sector Data Field with ECC Check Bytes	5-20
Figure 5-7	Byte Interleaving	5-21
Figure 5-8	Correctable and Uncorrectable Double-Burst Errors.....	5-22
Figure 5-9	Correctable and Uncorrectable Triple-Burst Errors	5-23
Figure 5-10	Nine Correctable Random Burst Errors.....	5-24
Figure 6-1	PIO Interface Timing	6-9
Figure 6-2	Multiword DMA Bus Interface Timing.....	6-10
Figure 6-3	Host Interface RESET Timing.....	6-10

List of Tables

TABLE	DESCRIPTION	PAGE
Table 3-1	AT Jumper Options	3-5
Table 3-2	J1 Power Connector, Sections A and B.....	3-12
Table 3-3	Logical Addressing Format	3-17
Table 4-1	Specifications.....	4-1
Table 4-2	Formatted Capacity	4-3
Table 4-3	Timing Specifications	4-4
Table 4-4	Power Reset Limits.....	4-5
Table 4-5	Typical Power and Current Consumption.....	4-6
Table 4-6	Acoustical Characteristics—Sound Pressure.....	4-7
Table 4-7	Acoustical Characteristics—Sound Power	4-7
Table 4-8	Environmental Specifications.....	4-8
Table 4-9	Shock and Vibration Specifications.....	4-9
Table 4-10	Error Rates.....	4-10
Table 5-1	Cylinder Contents.....	5-4
Table 5-2	ID-Less Controller Descriptor Format	5-15
Table 5-3	Skews Offsets	5-19
Table 6-1	Drive Connector Pin Assignments (J1, Section C)	6-3
Table 6-2	Relationship of Drive Signals to the IDE Bus.....	6-7
Table 6-3	PIO Host Interface Timing.....	6-8
Table 6-4	Multiword DMA Host Interface Timing.....	6-9
Table 6-5	Host Interface RESET Timing.....	6-10
Table 6-6	I/O Port Functions and Selection Addresses.....	6-12
Table 6-7	Command Block Register Initial Values.....	6-13
Table 6-8	Device Control Register Bits	6-13
Table 6-9	Drive Address Register Bits.....	6-14
Table 6-10	Error Register Bits	6-15
Table 6-11	Drive Head Register Bits.....	6-16
Table 6-12	Status Register Bits	6-17
Table 6-13	Quantum Fireball TM 1.0/1.2/1.7/2.1/2.5/3.2/3.8AT drive Command Codes and Parameters.....	6-18
Table 6-14	Sector Buffer Contents.....	6-21
Table 6-15	Diagnostic Codes	6-22
Table 6-16	Valid Count Range	6-26
Table 6-17	Identify Drive Parameters	6-28
Table 6-18	READ DEFECT LIST LENGTH Command Bytes	6-32
Table 6-19	AT READ DEFECT LIST Command Bytes.....	6-32
Table 6-20	DEFECT LIST DATA FORMAT	6-33
Table 6-21	DEFECT ENTRY DATA FORMAT.....	6-33
Table 6-22	Accessing the READ CONFIGURATION Command.....	6-34
Table 6-23	Accessing the SET CONFIGURATION Command	6-35
Table 6-24	Accessing the SET CONFIGURATION WITHOUT SAVING TO DISK Command.....	6-35
Table 6-25	Configuration Command Format	6-36
Table 6-26	Command Errors.....	6-38