

0663 MODEL E

IBM OEM STORAGE PRODUCTS

FEATURES

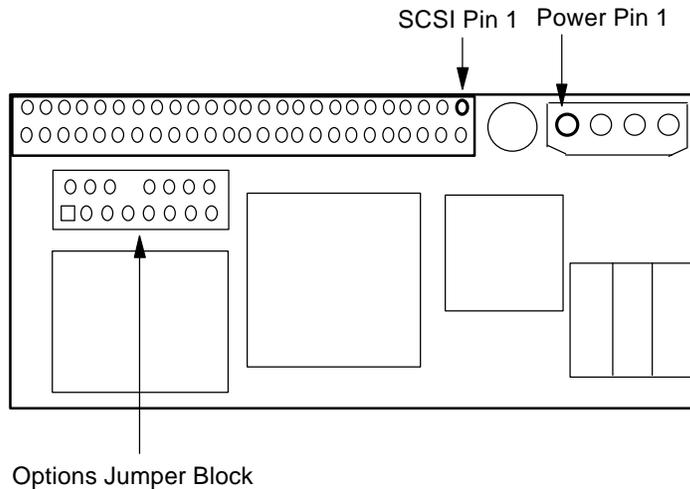
- 1,206 MB formatted capacity (512 & 520 bytes/sector) (model E15)
- 1,043 MB formatted capacity (512 & 520 bytes/sector) (model E12)
- Industry-standard interface: ANSI/SCSI-2
- Thermal Compensation
- Integrated controller
- Logical block addressing
- Implied seeks
- SCSI disconnect and reconnect capability
- SCSI bus parity
- Closed loop actuator servo (dedicated disk servo surface plus data reference)
- Multiple initiator support
- 1:1 interleave
- (0,4/4) 8/9 rate encoding
- Media data transfer rate: 3 MB/S
- SCSI data transfer rate: up to 10 MB/S (synchronous)
- 256K byte dual-ported data buffer
- Read-ahead caching
- Write caching (selectable)
- Multi-segmented data buffer
- Scatter/Gather function support
- Tagged and Untagged command queuing (selectable)
- Command recording supported (selectable)
- Back-to-back sequential writes supported
- Automatic bad sector reallocation (selectable)
- Error logging
- Variable logical block lengths (256 - 6000 bytes with exceptions). Shipped format is 512 bytes/sector
- Automatic retry and data correction on read errors
- Sector reassignment without reformat
- Predictive Failure Analysis
- Spindle Synchronization
- Drive supplied terminator power option
- LED driver available

PERFORMANCE

Data transfer rate	
Buffer to/ from media	3 MB/S (instantaneous)
Host to buffer	up to 10 MB/S (synchronous)
Host from buffer	up to 10 MB/S (synchronous)
Rotational speed	4316 RPM

Average latency	6.95 mS		
Seek time (E12, E15)		Read	Write
Single cylinder		0.6 mS	2.5 mS
Average		9.4 mS	11.4 mS (weighted)
Full stroke		18.5 mS	20.5 mS

ELECTRICAL CONNECTOR LOCATIONS



Electrical Connectors (view from back of Disk Drive)

JUMPER SETTINGS

The jumper block shown above is used to select the SCSI device ID, to control the spindle motor start and to select the appropriate option pin (B1) function. There are four ground pins, A1, A2, A3, B2. If pin B1 is jumpered to ground, drive initiated synchronous negotiation is disabled, but requests from the initiator will still be accepted. Option block ground pins must only be used for selecting jumper block functions.

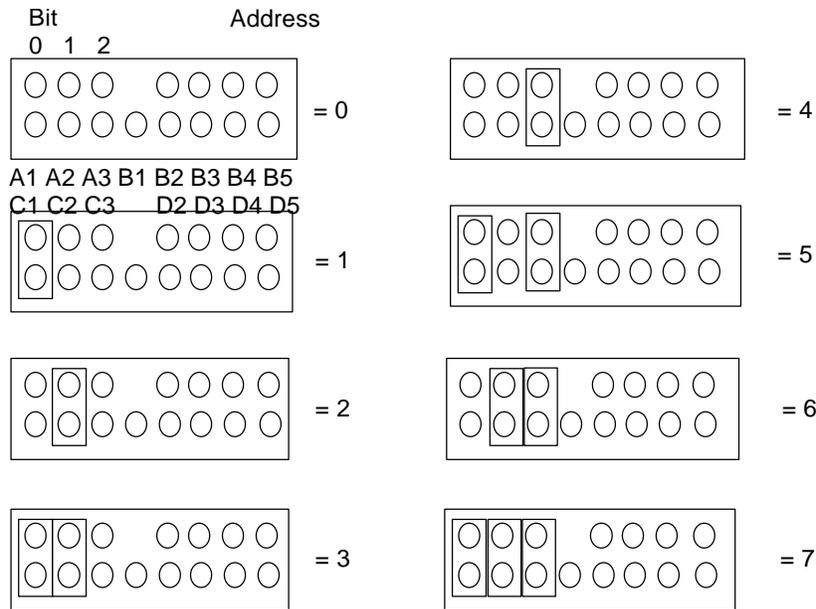


Figure 1 Option Block

With the auto start jumper in place the motor spins up when power is applied. With the auto start jumper removed the motor spins up when the drive is issued a Start Unit command. Jumper block pins B3 and D3 provide spindle synchronization capability. Jumper block pins B4 and D5 provide direct drive capability to an activity LED.

Note: During the power up sequence the option pin is interrogated. If it is grounded the pin remains an input. If it is not grounded it becomes an output, indicating Motor Active or Command Active depending on the state of the CMDAC bit in Mode page 0.

As an input the option pin has several effects upon the SCSI function. Please refer to the 0663E SCSI Specification for details.

MODE SELECT OPTIONS

Certain 'Mode Select' parameters are alterable via the SCSI 'Mode Select' command. This allows certain drive characteristics to be modified to optimize performance on a particular system. Refer to the 0663 Enhanced Disk Drive SCSI Specification for detailed definition of Mode Select parameters. Changeable parameters are:

Block Descriptor

- Number of Blocks
- Block length

Page 0

- QPE (Qualify Post Error)
- UQE (Untagged Queueing Enable)
- DWD (Disable Write Disconnect)
- ASDPE (Additional Save Data Pointer Enable)
- CMDAC

RPF AE (Report Predictive Failure Analysis Error)
CPE (Concurrent Processing Enable)

Page 1

AWRE (Automatic Write Reallocation Enable)
ARRE (Automatic Read Reallocation Enable)
TB (Transfer Block)
RC (Read Continuous)
PER (Post Error)
DTE (Disable Transfer on Error)
DCR (Disable Correction)
Read Retry Count

Page 2

Read Buffer Full Ratio
Write Buffer Empty Ratio
Maximum Burst Size

Page 4

RPL (Rotational Position Locking)
Rotational Offset

Page 7

PER
DCR

Page 8

WCE (Write Cache Enable)
MF (Multiplication Factor)
RCD (Read Cache Disable)
Demand Read Retention Priority
Write Retention Priority
Disable Pre-fetch Transfer Length
Maximum Pre-fetch
Maximum Pre-fetch Ceiling
Number of Cache Segments

Page A

Queue Algorithm Modifier
QErr (Queue Error Management)
DQue (Disable Queueing)

DATA ORGANIZATION

CAPACITY

	<i>Model E15</i>		
bytes/ logical block	gross sectors/ track	formatted capacity (bytes)	logical blocks/ file
256	111	1,028,788,480	4,018,705
512	66	1,206,364,160	2,356,180
520	65	1,206,002,200	2,319,235

524	64	1,195,919,960	2,282,290
1024	66	1,206,364,160	1,178,090
2048	66	1,206,364,160	589,045
4096	66	1,206,362,112	294,522
6000	47	1,240,668,000	206,778

Model E12

bytes/ logical block	gross sectors/ track	formatted capacity (bytes)	logical blocks/ file
256	111	890,915,328	3,480,138
512	66	1,044,112,896	2,039,283
520	65	1,043,777,280	2,007,264
524	64	1,035,028,380	1,975,245
1024	66	1,044,112,384	1,019,641
2048	66	1,044,111,360	509,820
4096	66	1,044,112,360	254,910
6000	47	1,073,190,000	178,865

Cylinders

Total cylinders 2469

User cylinders 2463

Disks 8 (E15)

7 (E12)

Tracks/cylinder 15 (E15)

13 (E12)

User bytes/sector 256 - 750

User bytes/logical block 256 - 6000

with exceptions

(increments in bytes)= 1 256 - 750

= 2 752 - 1500

= 4 1504 - 3000

= 8 3008 - 6000

Band 1 user cylinders 1641

spares/cylinders 30 (E15)

27 (E12)

Band 2 user cylinders 822

spares/cylinder 40 (E15)

36 (E12)

Last cylinder extra spares 80 (E15)

72 (E12)

Note: Banding as defined here refers to the number of spare sectors provided per cylinder to reallocate defective sectors. Band 2 cylinders are those nearer the inside diameter of the data surfaces. These have additional spare sectors since the likelihood of defective sectors is higher in

this region. This feature does not affect the instantaneous media data rate which is constant across all cylinders.

OPERATING ENVIRONMENT

The drive operates within its' performance limits when the following environment is maintained. Product life calculations are based on the nominal environment for a typical application.

Humidity:

Operating	8% to 90% noncondensing
Storage	5% to 95% noncondensing
Shipping	5% to 100% (applies at a packaged level)

Wet Bulb Temperature:

Operating	80 degrees F (26.7 degrees C) maximum
Shipping/Storage	85 degrees F (29.4 degrees C) maximum

Elevation:

Operating	-1000 to 10,000 feet (-304 to 3048 meters)
Shipping/Storage	-1000 to 40,000 feet (-304 to 12,192 meters)

Temperature:

Operating ambient	41 to 131 degrees F (5 to 55 degrees C)
Operating casting temperature	41 to 131 degrees F (5 to 60 degrees C)
Operating casting temperature delta	Not to exceed 3.6 degrees F (2 degrees C) (see note below)
Shipping	-40 to 149 degrees F (-40 to 65 degrees C)
Storage	34 to 149 degrees F (1.1 to 65 degrees C)

Temperature Gradient

Operating	18 degrees F (10 degrees C) per hour
Shipping/Storage	below condensation

These temperature limits are extremely important and must not be exceeded at the worst case drive and system operating conditions with the drive randomly seeking, reading, and writing.

Note: Measured between top and bottom of disk enclosure. See Figure 3 for the location of measurement points.

COOLING

This drive does require airflow in order to fulfill its reliability performance.

Please refer to Environmental section of the 0663 Enhanced Disk Drive product specification for full details of the maximum allowable temperatures and measurement points.

A summary of the measurements is given on the back page of this data sheet.

INTEGRATION INTO USING SYSTEM

- The drive's mounting frame is electrically isolated from the drive's disk enclosure.

NOTE: THE DISK ENCLOSURE IS NOT AT GROUND POTENTIAL.

Any user mounting scheme must not result in the disk enclosure being shorted to ground. Drive malfunction will result if this occurs.

COMPATIBILITY

- Testing should be carried out to ensure that the drive is fully compatible with the using system.

System BIOS, Operating system, Device drivers and interface card BIOS/characteristics can effect the ability to attach the drive to the system. All need to be verified jointly as compatible with the drive.

The drive should be verified in the mode it will be attached to the system.

It cannot be assumed that a drive which attaches as an additional SCSI device on a system providing only additional data storage will have no problems when attached as the only/boot drive.

SCSI ADAPTERS

- The following SCSI Adapters have been operated with the 0663E drives on typical ISA E15A platforms under MS-DOS and worked in these Environments with no observed problems.

ISA Bus Adapters

ADAPTEC AHA1542BS6

INFOSYS C5630B

WESTERN DIGITAL WD7000-ASC

DATA TECHNOLOGY CORP DTC3180

DATA TECHNOLOGY CORP DTC3280A

DATA TECHNOLOGY CORP DTC3150

FUTURE DOMAIN TMC 850M

FUTURE DOMAIN TMC 860M

FUTURE DOMAIN TMC 885M

TENTIME TNT-6000

EISA Bus Adapters

ADAPTEC AHA1740

DATA TECHNOLOGY CORP DTC3290

- The Adaptec AHA1542B SCSI controller is not compatible with the 0663-E12/E15 drives.

Adaptec provides an upgrade kit comprising new BIOS and Microcode PROMS to allow conversion of existing AHA1542B cards to the AHA1542B56 version.

KNOWN INTEGRATION SOLUTIONS

- The drive initiates negotiation for synchronous data transfer rate during the initialization sequence. This may cause problems which prevent attachment to some systems/SCSI controller cards. Jumpering the option pin to ground on the jumper block prevents the drive sending the synchronous negotiation message. However, other changes are also made to the drive's behavior ref error reporting and sense information returned. These are detailed in the Disk Drive SCSI specification.

Platform(s) DECDECStation3100
 DECVAXStation3100
 DECMicroVax3100
Operating System(s) VMS V5.4.2
 VMS V5.5
 VMS V5.6

Note: Attachment to earlier versions of the VMS operating system is not possible.

Configuration Required:

Alter MODE SELECT Page 1, Byte 2 to '04'

Alter MODE SELECT Page 7, Byte 2 to '04'

Platform(s) DECDECStation3100
 DECVAXStation3100
 DECMicroVax3100

Operating System(s) Ultrix V4.1
 Ultrix V4.2

Configuration Required:

Connect 'OPTION PIN' on drive jumper block to ground.

Platform DECStation5000
Operating System(s) Ultrix V4.1
 Ultrix V4.2

Configuration Required:

No modifications to the drive are required. However it is necessary to modify the list of device types in the table of known drives contained in the 'usr/sys/data/scsi-data,c' system file as follows: Change first line from '/*UNKNOWN DISK*/to'/* IBM OEM */'. Following this change, the operating system kernel must be rebuilt (recompiled).

Platform SUNSpareStation
Operating System(s) Sunos V4.1.2

- The drive reports status in response to the SCSI 'Sense' command and this is a powerful troubleshooting tool on any drive whose failure mode still allows it to communicate.
- If the drive is interrupted by powering down during a format operation it will enter degraded mode. In this mode it will return a 'Unit Attention' condition to most SCSI commands.

Issuing a 'Sense' Command immediately after issuing a 'Test Unit Ready' Command will return sense data which indicates that the drive is in degraded mode.

The way to recover the drive is to issue the SCSI 'Format' command and allow the drive to format to completion

PRODUCT VARIATIONS

Model	Comments
Corsair 2E E15 PN 55F9824	This is the standard 1.2 GB version of the 2E drive suitable for most applications. NB: This drive is not suitable for attachment to 'Apple' systems as it does not support the 'Blind Write' and 'Unit Attention Disable' features used by the majority of these systems.
Corsair 2E E15 PN 55F9841	This is the special 1.2 GB version of the 2E drive required for compatibility with 'Apple' systems. It features microcode changes to support the Apple 'Blind Write' and 'Unit Attention Disable' requirements. Integrators attaching to 'Apple' systems must evaluate this version of the 1.2 GB E15.
Corsair 2E E12 PN 55F9825	This is the standard 1 GB version of the 2E drive suitable for most applications. NB: This drive is not suitable for attachment to 'Apple' systems as it does not support the 'Blind Write' and 'Unit Attention Disable' features used by the majority of these systems.
Corsair 2E E12 PN 55F9849	This is the special 1 GB version of the 2E drive required for compatibility with 'Apple' systems. It features microcode changes to support the Apple 'Blind Write' and 'Unit Attention Disable' requirements. Integrators attaching to 'Apple' systems must evaluate this version of the 1 GB E12.

DC POWER REQUIREMENT LIMITS

The following voltage specifications apply at the file voltage connector, there are no special power on/off sequencing requirements.

+12 Volt Supply

+/- 5.0% (during run)

-7.0% +5.0% (during start)

+5 Volt Supply

+/- 5.0%

Power supply

current (Amps)

+5 Volt

+12 Volt

Idle average

1.09

0.389

Seek peak

--

1.84 (see note 1)

Spin-up

--

2.6 (see note 2)

Note 1: The idle average, communication and seek peak should be added together to determine the total 12 volt peak current.

Note 2: The current at start is the total 12 volt current required (ie, the motor start current, module current and voice coil retract current).

ELECTRICAL INTERFACE SPECIFICATIONS

The IBM OEM 0663 Model E Disk Drive uses single-ended drivers and receivers that permit cable lengths of up to 6 meters (19.68 feet).

CONNECTORS

The drive has two connectors: one for power, the other for connecting to the SCSI bus.

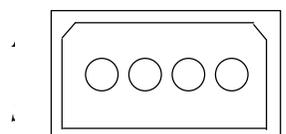
POWER

The DC power connector is designed to mate with AMP PN 1-480424-0 connector or equivalent. Pin assignments are shown in figure 2.

Figure 2 Power Connector Pin Assignments

SCSI SIGNAL CONNECTOR

Pin# 1 2 3 4



+5V GND GND +12V

tor is a 50-pin connector, Molex PN 70248 or equivalent, meeting that 1.

ower.

Termination power is optionally provided for systems that desire it. In order to use the termination power, the user needs to install a jumper between pins D4 and B4 of the Option block. The jumper only needs to be installed on the last device on the SCSI bus (ie, The file that is physically closest to the terminator). The 0663-E can source up to 1.5 Amps of current at 5.0 volts (+/- 5%) for termination power.

The drive has no internal SCSI bus terminators. The user is responsible for properly terminating and powering the SCSI bus in the system.

AMP PN 88-4163-081-1, DATA MATE DM500-06-8, or equivalent external terminator may be used.

For a single-ended cable, a 50-conductor flat cable or a 25 twisted pair cable can be used, with a maximum length of 6.0 meters and a stub length not to exceed 0.1 meters.

This file has a maximum internal stub length of 0.072 meters on all SCSI signals except -RST; the -RST signal has an internal stub length of 0.096 meters. To remain compliant with ANSI, the SCSI bus cable must not add more than 0.028 meters additional stub length of all SCSI signals except -RST, and no more than 0.004 meters additional stub length to -RST

SCSI BUS ELECTRICAL CHARACTERISTICS

Note: The drive incorporates the Western Digital WD33C93B SCSI Interface Controller and conforms to the ANSI/SCSI Interface standard.

LED PINS

The LED pins (D5/B5 on the options block) can be used to drive an external LED. The LED cathode should be connected to pin B5 of the option block, and the LED anode should be connected to pin D5 of the option Block.

The 0663-E provides up to 20 mA of drive capability.

START AND STOP TIMES

<i>Time</i>	<i>Nominal</i>	<i>Maximum</i>
Power Up	2.0 sec	2.4 sec
Start Unit	19.5 sec	1 min
Stop	9 sec	12.5 sec

During the start sequence diagnostics are performed and are divided into two sections. Power-up pre motor-start diagnostics test the static RAM (control store memory), post motor-start diagnostics test the data buffer, upload the code, perform channel testing, and 'Reassign in Progress' operations. For more information on diagnostics see the 0663 Enhanced Disk Drive SCSI Specification.

If a Reset is issued before the drive is ready, the power-on sequence starts again. Otherwise, when a Reset is issued the present state of the motor is not altered.

A timeout of one minute or more is recommended for the Start Unit command. This allows the system to take advantage of the extended ERP that the drive does in order to successfully start up

Note: Start-up sequence time may increase by as much as 2.5 sec (1.5 sec nominally) when the device is requested via Mode Select Parameters to synchronize the spindle motor to another device.

Note: It is the integrators' responsibility to ensure that equipment into which this drive is fitted meets the relevant regulatory requirements (EMC etc).

ELECTROMAGNETIC COMPATIBILITY

The drive meets the following EMC requirements when installed in the user system and exercised with a random accessing routine at maximum data rate:

- United States Federal Communication Commission (FCC) Rules and Regulations, Part 15, Subject J--Computer Devices 'Class B Limits'.
- European Economic Community EEC directive #76/889 related to the control of radio frequency interference and the Verband Deutscher Elektrotechniker (VDE) requirements of Germany (GOP).

MECHANICAL SPECIFICATIONS

This section details the mechanical specifications of the IBM OEM 0063E disk drive.

WEIGHT

Approximately 2.2 pounds (1.0 kilograms)

DIMENSIONS

	U.S.	S.I. Metric
Height	1.63 in	41.3 mm
Width	4.00 in	101.6 mm
Depth*	5.75 in	146.0 mm

* The connector exceed the depth dimension by 6.37 mm.

CLEARANCES

A minimum of 2 mm clearance should be given to the top and bottom surfaces except for a 10 mm diameter area around the bottom mounting holes.

To assist cooling, it is recommended that a clearance of 6 mm be provided above and below the drive.

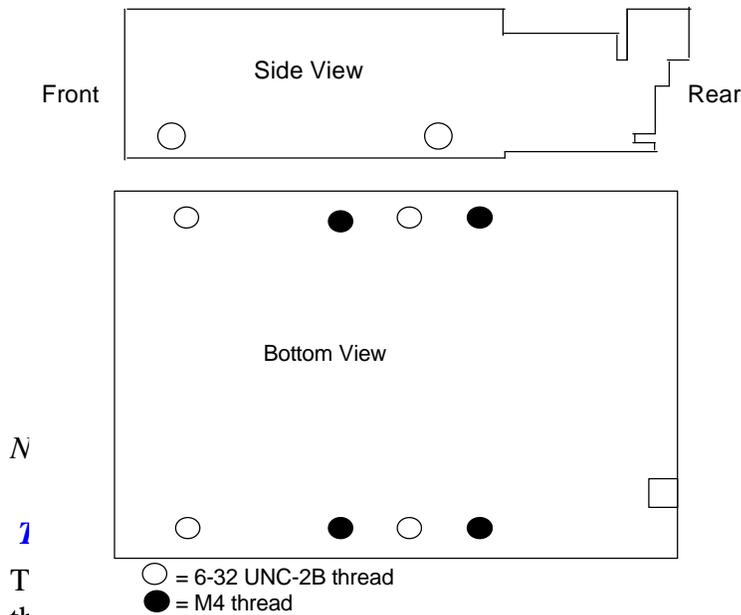
Precautions must be taken to avoid blocking any of the vent holes (on the side and ends of the drive).

MOUNTING

The drive can be mounted with any surface facing down.

See diagram below for location of mounting holes.

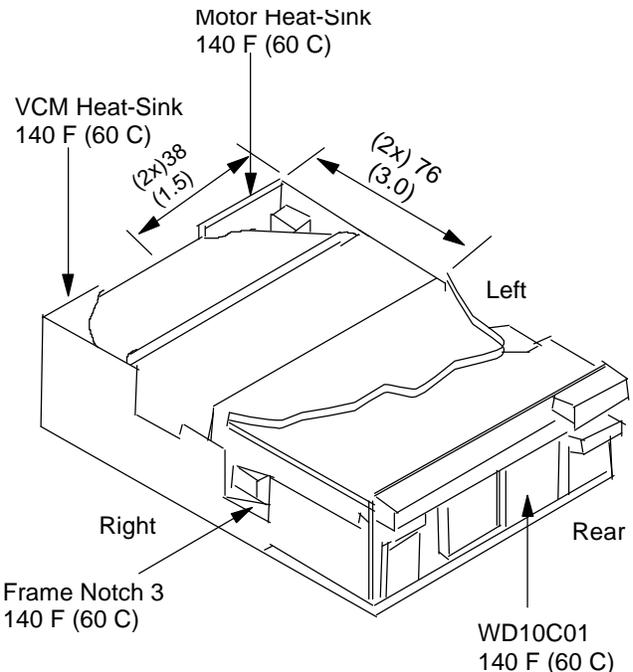
The torque applied to the mounting screws must not exceed 1.0 +/- 0.1 Newton meters. Mounting screws are 6-32 UNC-2B thread (in addition there are 4 M4 threaded holes on the bottom of the drive). The maximum penetration of any mounting screw must NOT exceed 3.8 mm.



N
1
T

shown in the diagram, the ensure that

the maximum values are not exceeded under any circumstances. Forced air cooling may be required in order to achieve this.



le to determine module and casting
e between the two points is defined as the
drive so as not to exceed the casting and

EXTERNALLY GENERATED RIPPLE

(as seen at file power connector)

<i>Voltage</i>	<i>Maximum</i>	<i>Notes</i>
+5 VDC	100 mV peak-to-peak	0-10 MHz
+12 VDC	150 mV peak-to-peak	0-10 MHz

During file start up and seeking, 12 volt ripple is generated by the file (referred to as dynamic loading). If several files have their power daisy chained together then the power supply ripple plus other file's dynamic loading must remain within the regulation tolerance window of +/- 5%. A common supply with separate power leads to each file is a more desirable method of power distribution.

The file's mounting frame is electrically isolated from the file's disk enclosure. The disk enclosure is not at ground potential. Therefore any user mounting scheme must not result in the disk enclosure being shorted to ground.

To prevent external electrical noise from interfering with the file's performance, the file's mounting frame may be electrically isolated from the system mounting frame. If isolation is not practical then the file's mounting frame must be within +/- 150 millivolts of the file's power supply ground. At no time should more than 35 milliamps of current be injected into the file frame. The frequency range that has been tested with this specification is 0 to 100 MHz.

HOT PLUG/UNPLUG SUPPORT

If there is a need to plug or unplug the file while the power supply is active than the using system must assure that the ground pin makes contact first. This prevents a possible CMOS latch-up condition. During the hot 'plug-in' event the 5 or 12 volt power supply voltage must not go out of tolerance on the high voltage direction. During the hot 'unplug' event capacitors on the file will prevent inductive flyback voltages from increasing to the point of damage to the file.

If the SCSI bus is connected while it has power active on any of its lines then a power or signal glitch may occur on the bus. If any other devices are sharing the bus then this glitch may cause them to produce an error.

VIBRATION AND SHOCK

OPERATING/NONOPERATING VIBRATION

Due to the complexity of this subject we recommend that users contact the Distributor to discuss how to perform the required measurements if they believe this to be an area which requires evaluation.

OPERATING SHOCK

The drive continues to operate, at the stated performance, when subjected to a 5 G half sine wave shock pulse of 11 milliseconds duration.

No permanent damage will occur to the drive when subjected to a 10 G half sine wave shock pulse of 11 milliseconds duration.

The shock pulses are applied in either direction in each of three mutually perpendicular axes, one axis at a time.

NON-OPERATING SHOCK

No damage will occur if the unpackaged drive is not subjected to a square wave shock greater than a value of 35 Gs applied to all of the three axes for a period of 20 milliseconds, one direction at a time.

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Western Digital is a trademark of the
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NEXT is a trademark of
NEXT Corporation.

WARNING: This disk drive can be damaged by Electro-Static Discharge, please follow recommended ESD procedures before unpacking or handling the drive. Ask your Dealer for details if you need assistance.



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