IBM OEM STORAGE PRODUCTS
0662 MODEL A10

The 0662 Model A10 provides 1.05 GB in a 1" high, 3.5" form factor. Using industry leading areal density made possible by our exclusive magneto-resistive head and second generation channel chip 1.05 GB is packed on just three disks.

APPLICATIONS

- Technical/commercial workstations
- Network servers
- Mass storage arrays
- High end personal computers

FEATURES

- 1.05 GB formatted capacity (512 bytes/sector).
- Industry standard ATA/IDE interface.
- Data transfer rate (max) 13 MB/sec.
- 5.0/6.0 MB/sec media data rate.
- Rotational speed 5400 RPM.
- 2 recording zones.
- Average seek time 9 ms (read)
- Magneto resistive heads.
- PRDF data channel (partial response maximum likelihood (PRML) with digital filter).
- 512 KB multi-segmented data buffer.
- Industry standard mounting
- Low command overhead.
- Write cache support.
- 3 disk design
- Idle power 6.8 watts.
- Read ahead caching.
- 1 inch high form factor.
- MTBF 500,000 hours

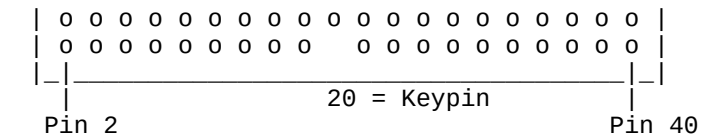
BENEFITS

- Popular capacity point.
- High interface data rate.
- Exceptionally high data rate across entire disk surface.
- Fast access to data
- Industry leading areal density 354/319 Mb/sq in.
- Robust data channel for improved data integrity.
- Fast data retrieval in multi-tasking environments
- Easy installation.
- Improved data throughput.
- Assured reliability

ELECTRICAL CONNECTOR LOCATIONS

ATA/IDE Signal Connector

The pin configuration of the ATA connector is as follows:

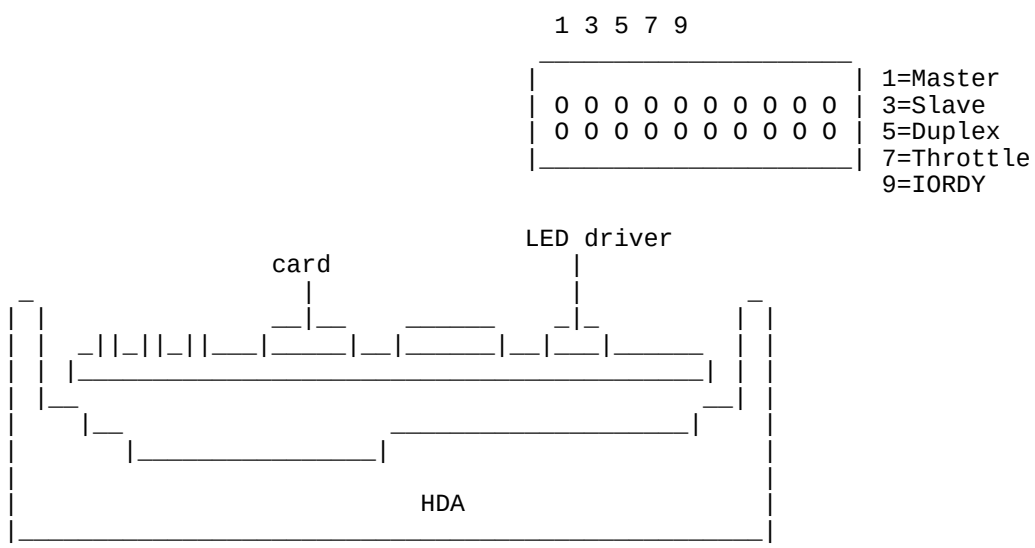


ATA 40 Pin Connector

This connector is designed to mate with:

Connector 40 pin	3M	3417-7000 or equivalent
Strain relief	3M	3448-2040 or equivalent
Flat cable (stranded 28AWG)	3M	3565-40 or equivalent
Flat cable (stranded 28AWG)	3M	3517-40 (shielded) or equivalent

OPTION BLOCK



Master	This is the default setting and sets the drive to be a master The CSEL line overrides this jumper
Slave	This jumper sets the drive to be a slave. The handshaking protocol for -DASP and -PDIAG apply.
DPX	DUPLEX. This jumper sets the drive to appear to the system a master and a slave. There is only one setting for master or or duplex.
THR	THROTTLE. Customer specification.

IORDY This jumper setting disables the IORDY function.

Spare Not used.

IDX INDEX. This is a test point and not used as a jumper setting

LED DRIVER

The card provides a 2 pin male connector for external LED. The line is driven low whenever the drive is executing a valid ATA command. It is intended that the system will provide a front mounted LED with a flying lead to connect to the drive. (0.1 inch pitch).

One pin is connected to +5 volts via a series 180 ohm resistor.

The second pin is connected to the LED driver.

SIGNAL DEFINITION

The pin assignments of interface signals are listed as follows:

PIN	Signal	I/O	PIN	Signal	I/O
01	-HRESET	I/P	02	GND	
03	HB07	I/O	04	HG08	I/O
05	HB06	I/O	06	HG09	I/O
07	HB05	I/O	08	HG10	I/O
09	HB04	I/O	10	HG11	I/O
11	HB03	I/O	12	HG12	I/O
13	HB02	I/O	14	HG13	I/O
15	HB01	I/O	16	HG14	I/O
17	HB00	I/O	18	HG15	I/O
19	GND		20	Key	
21	DMARQ	O/P	22	GND	
23	-H10W	I/P	24	GND	
25	-H10R	I/P	26	GND	
27	IORDY	I/O	28	CSEL	I/P
29	-DMACK	I/P	30	GND	
31	HIRQ	I/O	32	-10CS16	O/P
33	HA1	I/P	34	-PDIAG	I/O
35	HA0	I/P	36	HA2	I/P
37	-CS1FX	I/P	38	-CS3FX	I/P
29	-DASP	I/P	40	GND	

MODES OF OPERATION

Translate Mode

The cylinder, head and sector geometry of the drive as presented to the host may differ from the actual physical geometry. The recommended translate parameters are defined in the "Translate Table".

Translate mode is only valid in CHS mode. For some systems or ATA adapter cards the full capacity of the drive cannot be accessed unless in Duplex mode.

Note: Prior to the introduction of the LBA mode of addressing, the higher number of cylinders that the drive could address was fixed by the two low order bits in the cylinder high register and the 8 bit cylinder low register (10 bits total). This limited the maximum number of cylinders of 1024. Rev 3.x allowed for the full 8 bits of the cylinder high register to be used.

In Duplex mode the driver appears to the system as two identical drives

configured as Master and Slave. See the translate table "Translate Table for definition. This drive uses variable sector density which is transparent to the interface in "CHS" or "LBA" mode.

Translate Table

The following translate table is recommended for single "CHS" mode or Duplex Master and Slave.

"CHS" Host to Drive Translate Table

Parameter	Single	Duplex Master	Duplex Slave
Cylinders	0-2037	0-1017	0-1017
Heads	0-15	0-15	0-15
Sectors	1-63	1-63	1-63

CHS and LBA

A drive can operate in either of two addressing modes, CHS or LBA, on a command by command basis. If the host selects LBA mode in the Drive/Head register, Sector Number, Cylinder Low, Cylinder High and HS3-HS0 of the Drive/Head Register contains the zero based-LBA.

In LBA mode, the sectors on the drive are assumed to be linearly mapped with an Initial definition of:
LBA 0 = Cylinder 0/head 0/sector 1.

In the LBA mode cylinder, head and sector boundaries are transparent. The absolute capacity of the drive can be addressed since the "LBA" address can be mapped directly to the physical characteristics of the drive.

"LBA" Host to Drive Addressing

Parameter	Single	Duplex Master	Duplex Slave
Logical Block Address	2,054,304	1,026,144	1,026,144

DUPLEX MODE OF OPERATION

In PIO translate mode of operation the cylinder, head and sector register in some systems, limit the maximum capacity that the host can address. In LBA mode or extended cylinder this upper capacity limit is substantially increased.

To maintain downward compatibility this drive support "Duplex" mode. The host sees this mode as two drives, master and slave, even though physically there is only one drive attached.

Note: If the drive is set to Duplex mode the other port on the 40 way cable cannot be used.

Since one drive is emulating a master and a slave some unique conditions

The translate table is fixed and cannot be changed.

Set features command applies to both master and slave. The conventional

translate criteria still apply and the Drive bit must be set to address each pseudo drive independently.

The -DASP and -PDIAG signal lines during Reset and Diagnostics commands emulate the master slave handshaking.

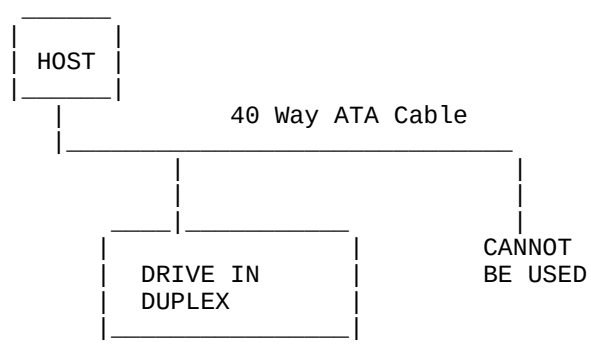
There are two Status and Error registers that can be interrogated independently in the Duplex mode. All other registers contain only the information valid for the last command. Since the Duplex mode simulates two real drives some limit to conventional protocol apply.

- Features apply to both drives except where a command requires the Features Register to be written.

- Buffer contents will be updated by a command for either drive.

- If each drive is required to operate in a different mode, then the features command must be executed whenever a different drive is selected.

Data integrity is not maintained when switching between Duplex and single mode operation.



Duplex Mode Attachment

PIO AND DMA MODES

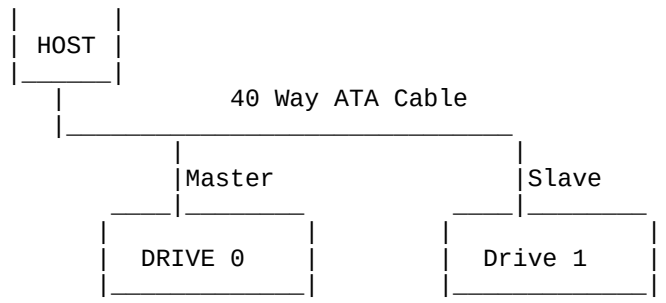
"PIO" stands for Programmed Input/Output and "DMA" stands for Direct Memo Access. The most common method to transfer data between the host and drive or drive and host is by PIO transfers. This is normally done on a sector basis unless the multi sector command is used.

DMA transfers use the DMARQ and DMACK to control the flow of data on the bus.

HOST DRIVE TO CONNECTION

In an ATA system the maximum number of drives that can be attached to a 40 way ATA cable is "Two".

The 40 way cable is "daisy chained" to the two drives. One drive is designated the Master and the other the Slave (Drive 0 and Drive 1).



Attachment of Drives to a System

The drive can be set to Master or Slave in two ways:

- Jumper Setting

- Using the CSEL

In PIO mode the upper capacity limit, set by registers, may be less that total capacity for the drive. To allow the full capacity of the drive to be used by the customer the Duplex jumper sets the drive to appear as a master and slave. "Duplex Mode of Operation".

CSEL (Cable Select)

This signal has a 10K ohm pull-up resistor on the drive.

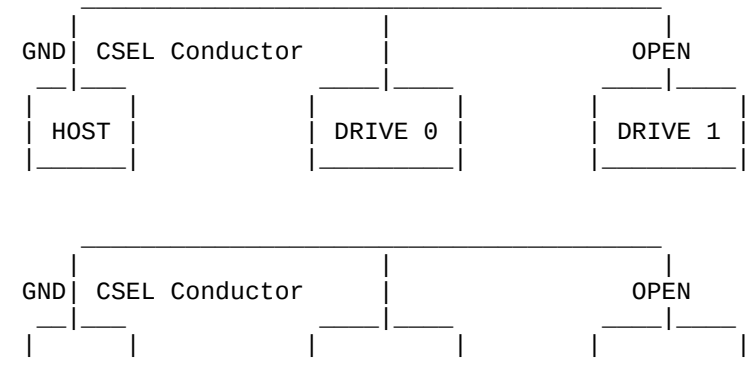
The drive is configured as either Drive 0 or Drive 1 depending upon the value of CSEL.

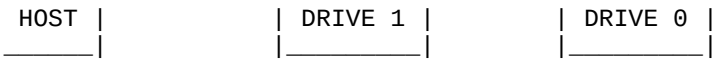
- If CSEL is grounded then the drive address is 0.

- If CSEL is open then drive address is 1.

Special cabling can be used by the system manufacturer to selectively ground CSEL (eg, CSEL of Drive 0 is connected to the SCEL conductor in the cable is grounded, thus allowing the drive to recognize itself as Drive 0. CSEL Drive 1 is not connected to CSEL because the conductor is removed, thus the drive can recognize itself as Drive 1.

Drives that do not support this function cannot be mixed.





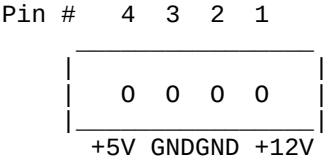
Cable Selection of Drive 0 and 1

CSEL has priority over the Drive's jumper settings for Master and Slave.
Duplex has priority over CSEL.

ELECTRICAL INTERFACE SPECIFICATIONS

Power Connector

The DC power connector used in 0662 is a Molex 8981-4V6. It is designed to mate with a Molex 8981-4P4 crimp connector, or a Molex A-70156-2000 insulator displacement connector, or their equivalent. Pin assignments are shown below.



Power Connector Pin Assignments

DC POWER REQUIREMENT LIMITS

The following voltage specifications apply at the drive power connector. There are no special power on/off sequencing requirements.

+5 Volt Supply
Plus or minus 5.0% (during run and spin-up)

+12 Volt Supply
Plus or minus 5.0% (during run)
- 7.0% + 5.0% (during spin-up)

Power Supply Current +5 VDC	Notes	Population Mean	Population Stand Dev
Power up	Minimum voltage slew rate = 4.5 V/sec		
Idle average		0.742 Amps (1)	.0025 Amps
R/W average		1.017 Amps	.0970 Amps
Spin-up	Max	0.802 Amps	
Power Supply Current +12 VDC			
Power up	Minimum voltage slew rate = 7.4 V/sec		
Idle average		0.306 (2)	.013 Amps
R/W average	1 op/sec	0.576 Amps	.496 Amps

Spin-up	Max	1.548 Amps	
File Power			
Idle average		6.803 Watts	.11 Watts
R/W power	Average	11.99 Watts	.496 Amps

(1) The file automatically goes into standby after 3 seconds of idle. There is no additional command overhead incurred when coming out of standby. The spindle motor is not shut off during standby.

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

DATA ORGANIZATION

Capacity

			Model A10	
bytes/ logical block	gross sectors/ track		formatted capacity (bytes)	logical blocks/ file
512	108	90	1,052,175,360	2,055,030
	Notch 1	Notch 2		

Notch*			Notch 1	Notch 2
Total cylinders (total cyl)			3016	1120
User cylinders (user cyl)			3002	1117
Band 1 user cylinders (b1ucyl)			1998	746
Band 2 user cylinders (b2ucyl)			1004	371
Tracks/cylinder (trk/cyl)				
Model A10		3		
Gross bytes/track (gb/trk)			66667	55556
Overhead bytes/sector (ob/set			104.4	011.5
User bytes/sector (ub/set		512		
Sectors/logical blck (set/1ba)		1		
Band 1 spares/cylinder (b2spr/cyl)			15	15
Band 2 spares/cylinder (b2spr/cyl)			20	20
Last cylinder extra spares (1cpsr)		32		

Note*: The recording band located towards the outer diameter (OD) is ref referred to as Notch 1 while the recording band located towards the inner diameter is called Notch 1.

OPERATING ENVIRONMENT

The drive operates within its' performance limits when the following environment is maintained. Product life calculations are based on the no environment for a typical application.

Humidity:

Operating	5% 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 10000 feet (-304 to 3048 meters)
Shipping/Storage	-1000 to 40000 feet (-304 to 12912 meters)

Temperature:

Operating ambient	41 to 131 degrees F (5 to 55 degrees C)
Operating casting temperature	41 to 140 degrees F (5 to 60 degrees C)
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.

RIPPLE

Externally Generated Ripple

as seen at drive connector

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

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

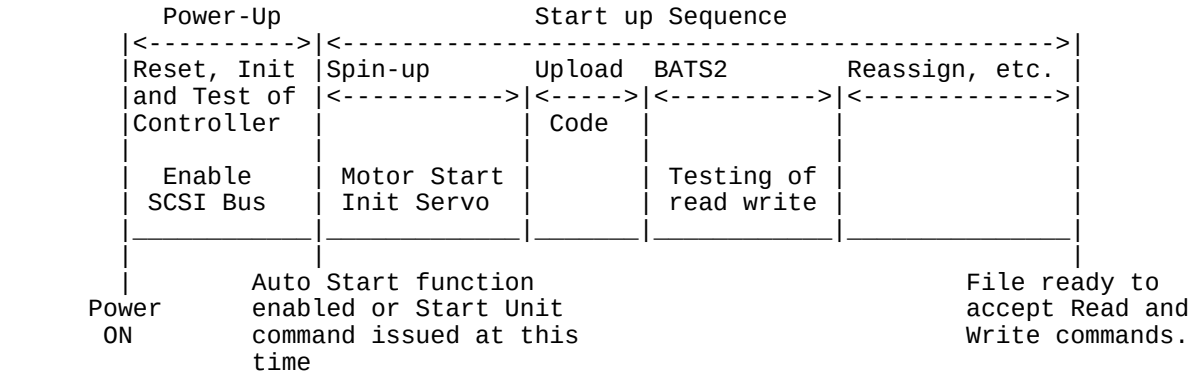
The file's mounting holes are electrically isolated from the file's disk enclosure. The disk enclosure is not a ground potential; therefore, any user mounting scheme must not result in the disk enclosure being shorted to ground.

Note: Hot plugging is NOT supported.

START AND STOP TIMES

Time	Nominal	Maximum
Power-Up	2.0 sec	2.4 sec
Start-up	15 sec	30 sec
Spin-up	6.7 sec	15 sec
Stop Time	9.0 sec	12.5 sec

Bring-up Sequence Times and Stop Times



Note: BATS is the abbreviation for Basic Assurance Tests. Start-up sequence spins up the spindle motor, uploads code, performs BATS2 (verifies read/write hardware), resume "Reassign in Progress" operations, and more. For more information on the start-up sequence, refer to the 0662 Interface Specification.

Note: If a RESET is issued before the drive comes ready the power on sequence will start again. In all other cases when a RESET is issued the present state of the motor is not altered.

MECHANICAL SPECIFICATIONS

This section details the mechanical specifications of the IBM OEM 0662 disk drive.

Weight

Approximately 1.0 pounds (0.46 kilograms)

Dimensions

	U.S.	S.I Metric
Height	1.00 in	25.4 mm
Width	4.00 in	101.6 mm
Depth	5.75 in	146.0 mm

Clearances

A minimum of 2 mm clearance should be given to the bottom surface except for a 10 mm diameter area around the bottom mounting holes. Figure 13

shows a 2 mm clearance requirements (see 1 figure 13). For proper cooling it is suggested that a clearance of 6 mm be provided under the drive and on top of the file.

There should be 7 mm of clearance between drives that are mounted with their top sides facing each other.

Note: The top of the drive will not exceed the height dimension by more than 2 millimeters during a nonoperating shock.

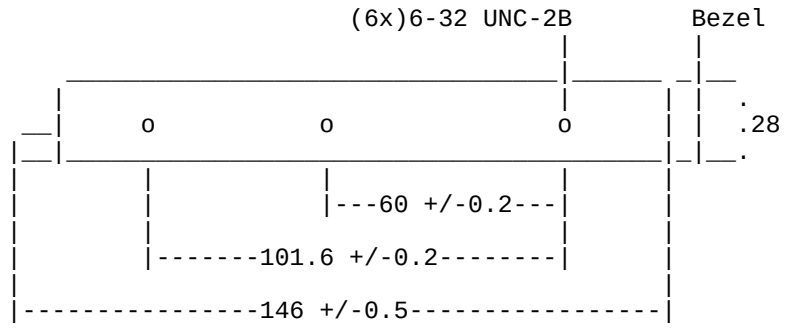


Figure 13 Side View

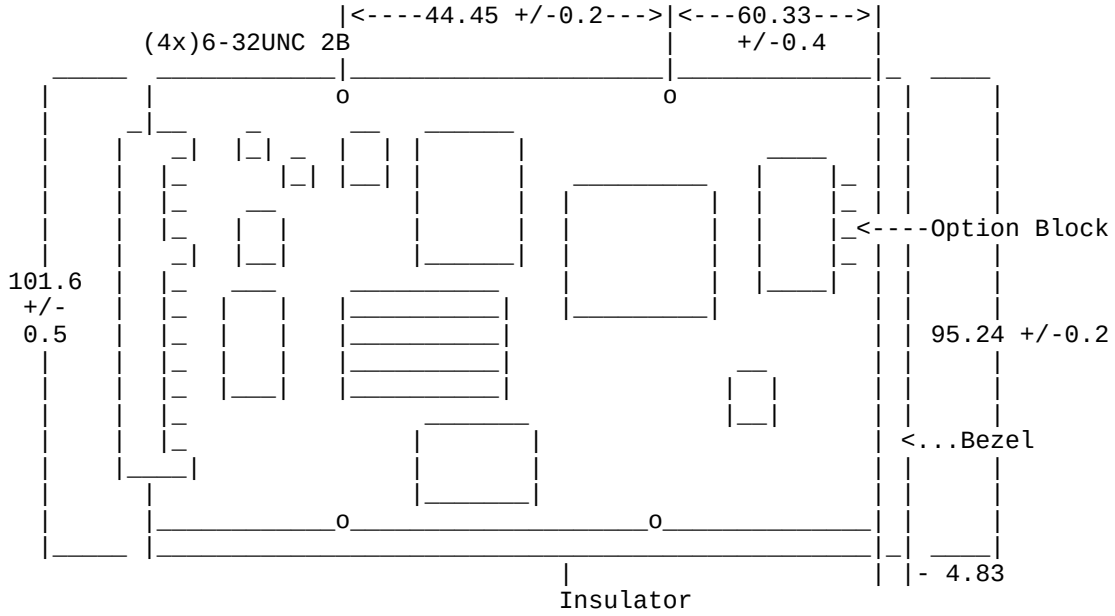


Figure 14 Card Side

Mounting

The drive can be mounted with any surface facing down.

The drive has both side and bottom mounting holes. Refer to figures

13 and 14 for the location of these mounting holes for each configuration.

The maximum allowable penetration of the mounting screws is 3.8mm.

The torque applied to the mounting screws must be 0.45 Newton meters +/-0.1 Newton meters.

WARNING: Except for the isolated mounting holes the disk enclosure is not at ground potential. Therefore any user mounting scheme must not result in the disk enclosure being shorted to ground.

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 will continue 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 milleseconds duration.

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

Nonoperating Shock

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

Additionally, no damage will occur if the unpackaged drive is not subjected to an 11 millesecond half sine wave shock greater than 60 Gs applied to all three axis, one direction at a time.

Temperature Measurements

The following is a list of measurement points and their temperatures (maximum and reliability). Maximum temperatures must not be exceeded at the worst case drive and system operating conditions with the drive randomly seeking, reading and writing.

	Maximum	Reliability
Disk Enclosure Top	140 F (60 C)	113 F (45 C)
Disk Enclosure Bottom	140 F (60 C)	113 F (45 C)
PRDF Module	185 F (85 C)	158 F (70 C)
WD61C42 Module	167 F (75 C)	149 F (65 C)
BART-3 Module	167 F (75 C)	149 F (65 C)

Note: Figure 10 defines where measurements should be made to determine the top casting temperature during drive operation and shows the location of the PRDF module. Figure 11 defines the modules that are located on the bottom side of the card and the measurement location on the bottom of the casting.

There must be sufficient air flow through the drive so that the casting and module temperature limits defined above are not exceeded.

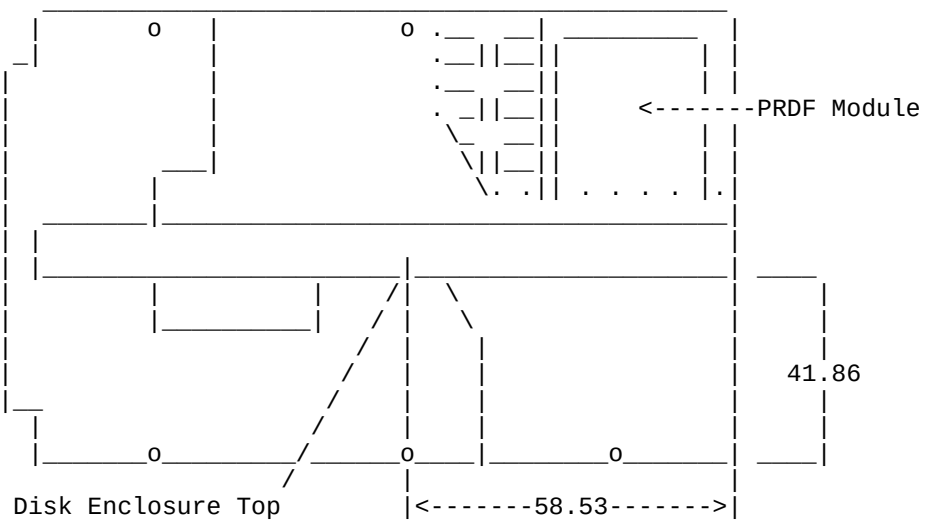


Figure 10 (top view)

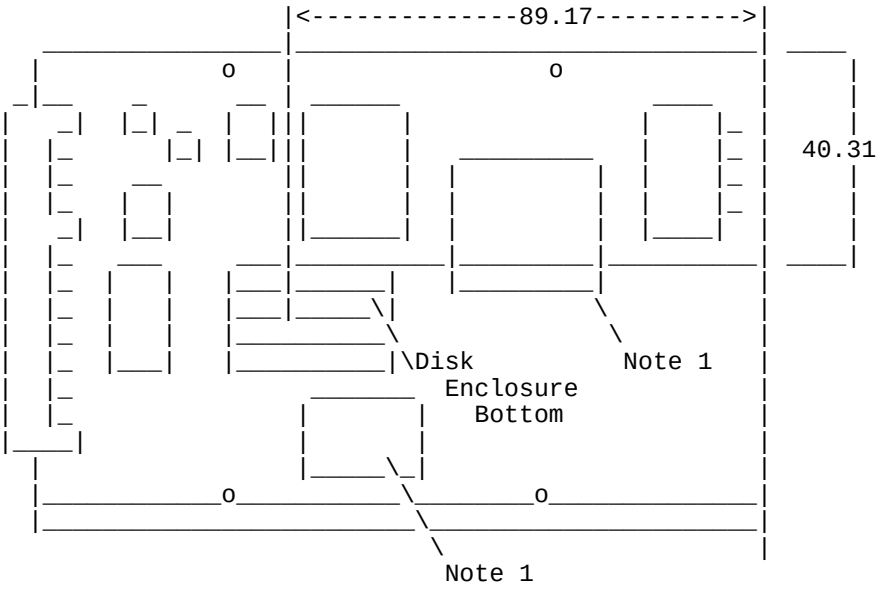


Figure 11 (bottom view)

Module Temperature Measurement Notes

1. Center on the top surface of the module
2. If copper tape is used to attach temperature sensors, it should be no larger than 6mm square.

This data sheet is not a substitute for the full product specification, which should be used when detailed information is required.

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