



# Ultrastar 2XP DCHS-34550 and DCHS-39100

IBM OEM has introduced a new range of disk drives intended for advanced-storage applications which demand fast access to large amounts of data. The drives spin at 7200 rpm have an EPRML channel, embedded sector servo, S.M.A.R.T and media data rate 10.3–15.4MB/s.

## Applications

- Technical/commercial workstations
- Network servers
- Mass storage arrays
- High end personal computers
- Large scale imaging and graphics
- Video servers
- Video editing

## Models

- SCSI 2 FAST (50 Pin Single-Ended)
- SCSI 2 FAST (68 Pin Single-Ended and Differential)
- SCSI 3 FAST 20 (68 Pin Single-Ended and Differential)
- SCSI 3 FAST 20 (80 Pin Single-Ended SCA-2)



## Features

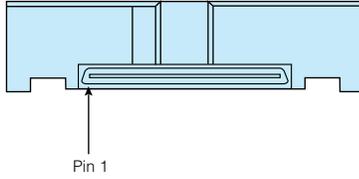
- **4550 and 9111MB formatted capacity (512 byte/sector)**
- **Industry standard interface**
  - 50 pin ANSI SCSI-2
  - 68 pin ANSI SCSI-2
  - 68 pin ANSI SCSI-3
  - 80 pin ANSI SCSI-3
- **10.3/15.4 MB/s media data rate**
- **Rotational speed 7200 rpm**
- **Average seek time 7.5 ms (4.55GB) 8.5 ms (9.10GB)**
- **Latency 4.17 ms**
- **512 KB multi-segmented dual port data buffer**
- **Spindle Synchronisation**
- **Low command overhead • Read ahead caching**
- **ECC on the fly (EOF)**
- **Industry standard mounting**
- **Predictive Failure Analysis (S.M.A.R.T. Compliant)**

## Benefits

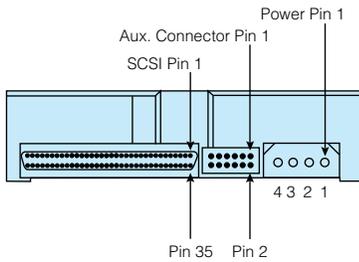
- Popular capacity points.
- High interface data rates
  - 10MB/sec data transfer speed
  - 20MB/sec data transfer speed
  - 40MB/sec data transfer speed
  - 40MB/sec data transfer speed
- High data rate across entire disk surface
- Fast access to data
- Fast data retrieval in single and multi-tasking applications
- Data Server Applications
- Improved data throughput
- Ease of installation
- High reliability and availability

## Connectors

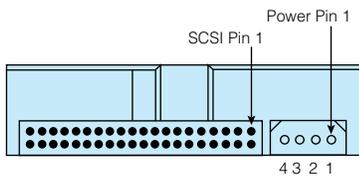
The electrical connectors are located as shown.



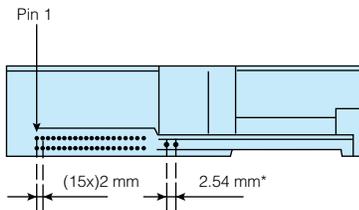
Electrical Connectors (rear view) 80 Pin SCA models



Electrical Connectors (rear view) 68 Pin models



Electrical Connectors (rear view) 50 Pin models



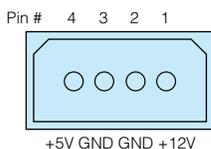
Jumper Pin locations (front view) - all models

\* Not available on 80 Pin SCA.

**Note:** See electrical interface specifications for power pin assignment.

The DC power connector is designed to mate with AMP part 1-480424 (using AMP pins P/N 350078-4). Equivalent connectors may be used.

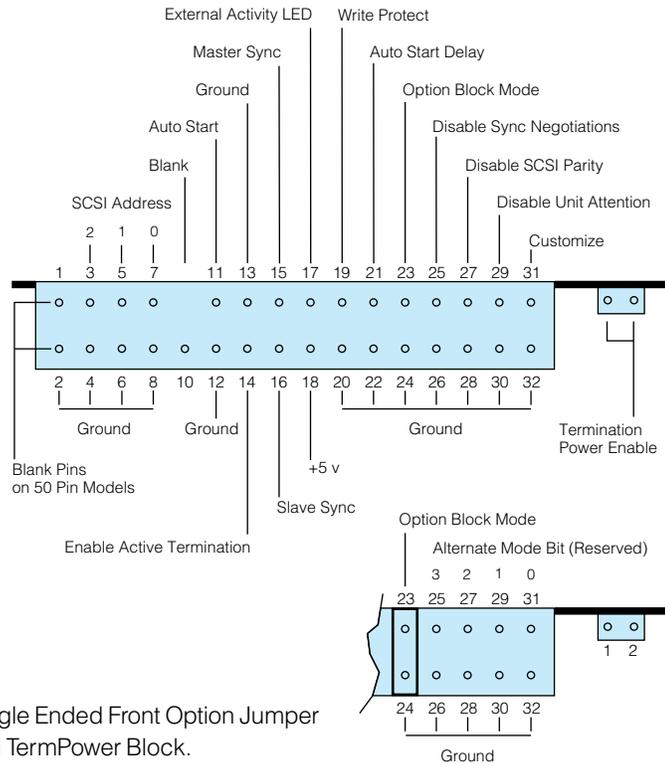
Pin assignments are shown below, as viewed from the end of the drive.



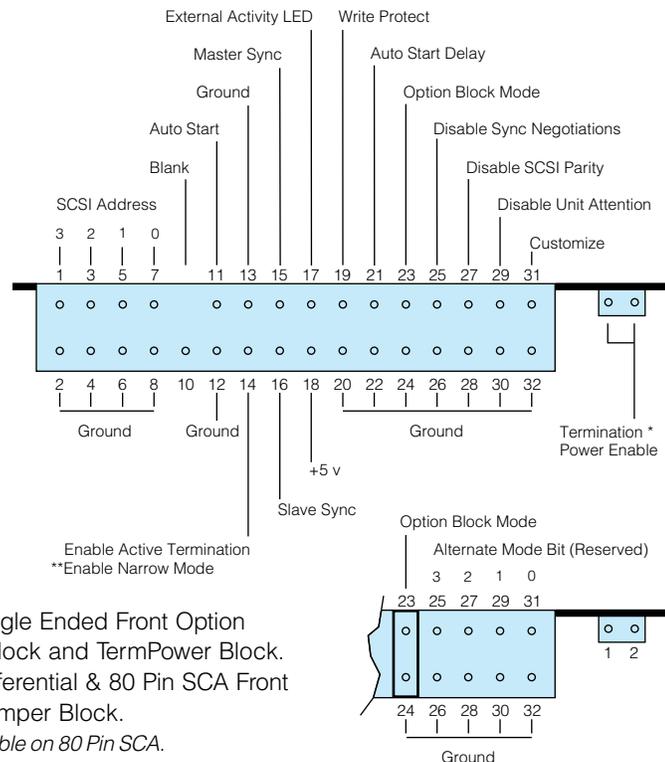
## Option Block

### Jumper Setting

Jumper position and function are as shown below. Pin pitch is 2 mm. Termination power enable 2.54 mm pitch.



50 Pin Single Ended Front Option Jumper Block and TermPower Block.

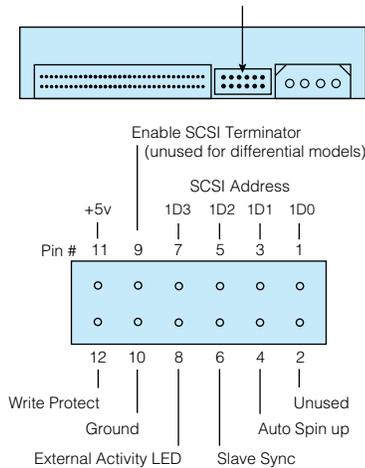


68 Pin Single Ended Front Option Jumper Block and TermPower Block. 68 Pin Differential & 80 Pin SCA Front Option Jumper Block.

\* Not available on 80 Pin SCA.

\*\* 68 Pin Differential & 80 Pin SCA.

## 68 Pin Auxiliary Connector



## SCSI ID (Address) Pins

**Note:** In the address determination tables, “off” means jumper is not in place and “on” means jumper is in place.

| Bit 3 | Bit 2 | Bit 1 | Bit 0 | Address |
|-------|-------|-------|-------|---------|
| off   | off   | off   | off   | 0       |
| off   | off   | off   | on    | 1       |
| off   | off   | on    | off   | 2       |
| off   | off   | on    | on    | 3       |
| off   | on    | off   | off   | 4       |
| off   | on    | off   | on    | 5       |
| off   | on    | on    | off   | 6       |
| off   | on    | on    | on    | 7       |
| on    | off   | off   | off   | 8       |
| on    | off   | off   | on    | 9       |
| on    | off   | on    | off   | 10      |
| on    | off   | on    | on    | 11      |
| on    | on    | off   | off   | 12      |
| on    | on    | off   | on    | 13      |
| on    | on    | on    | off   | 14      |
| on    | on    | on    | on    | 15      |

## Address Determination 68 and 80 pin models

| Bit 2 | Bit 1 | Bit 0 | Address |
|-------|-------|-------|---------|
| off   | off   | off   | 0       |
| off   | off   | on    | 1       |
| off   | on    | off   | 2       |
| off   | on    | on    | 3       |
| on    | off   | off   | 4       |
| on    | off   | on    | 5       |
| on    | on    | off   | 6       |
| on    | on    | on    | 7       |

## Address Determination of 50 pin models

## Auto Start and Delay pins

The Auto Start and Auto Start Delay pins control when and how the drive can spin up and come ready. When configured for Auto-Startup, the motor spins up after power is applied without the need of a SCSI Start Unit command. For no Auto-Start, a SCSI Start Unit command is required to make the drive spin and be ready for media access operations. When in Auto-Start mode, the drive will delay its start time by a period of time multiplied by its own SCSI address.

| Pins (50 and 68 interface pin models) |            | Drive Behaviour |                        |
|---------------------------------------|------------|-----------------|------------------------|
| Auto Start Delay                      | Auto Start | Auto Start      | Delay (sec) Multiplier |
| off                                   | off        | No              | N/A                    |
| off                                   | on         | Yes             | 0                      |
| on                                    | off        | Yes             | 10                     |
| on                                    | on         | Yes             | 4                      |

## Auto-Startup Modes selectable by Auto-Start/Delay Pin Combinations

| Pins (80 interface pin models) |            | Drive Behaviour |                        |
|--------------------------------|------------|-----------------|------------------------|
| Auto Start Delay               | Auto Start | Auto Start      | Delay (sec) Multiplier |
| off                            | off        | Yes             | 0                      |
| off                            | on         | No              | N/A                    |
| on                             | off        | Yes             | 10                     |
| on                             | on         | No              | N/A                    |

## Auto-Startup Modes selectable by Auto-Start/Delay Pin Combinations

 **PACKAGING:** The drive must be protected against Electro-Static Discharge especially when being handled. The safest way to avoid damage is to put the drive in an anti static bag before ESD wrist straps etc are removed. Drives should only be shipped in approved containers, severe damage can be caused to the drive if the packaging does not adequately protect against the shock levels induced when a box is dropped. Consult your IBM marketing representative if you do not have an approved shipping container.

## External Activity (LED) Pins

The LED pins can be used to drive an external Light Emitting Diode. Please refer to the LED pin section of the Ultrastar 2XP Interface Specification for a detailed functional description of this pin, which is controlled by Mode Select (Page 0).

Up to 33mA ( $\pm 5\%$ ) of TTL level LED drive capability is provided. Current limiting for the LED is provided on the electronics card. The LED Anode may be tied to the + 5V source provided on pin 11 of the Auxiliary connector on the 68 pin Unitized connector or the 5V power source on the 80 pin SCA model. The LED Cathode is then connected to the EXTERNAL ACTIVITY Pin to complete the circuit.

**Note:** 68 pin and 80 pin SCA SCSI models have two sets of pins, a set on the front and a set on the back, that are connected to the same LED driver circuit. The combined drive capability is stated above.

## Write Protect Pin

If the Write Protect pin is jumpered to ground, the drive will prohibit SCSI commands that alter the customer data area portion of the media from being performed. The state of this pin is monitored on a per command basis. See the Ultrastar 2XP interface specification for functional details.

## Option Block Mode Pin

The Option Block Mode Pin is used to modify the function of the Front Option Jumper Block. When the Option Block Mode Pin is not grounded the pin function of the Front Option Jumper Block will be as defined by the upper portion of the referenced figures, When the Option Block Mode Pin is grounded the pins (25, 27, 29, 31) will be redefined to control what is referred to as ‘Alternate Mode’. ‘Alternate Mode’ is reserved for future use.



## Hot plug/unplug support

The drives do support Hot Plug/Unplug -refer to Ultrastar 2XP Hardware/Functional Specification for more details.

Hot plugging the SCSI bus may cause glitches on the bus. To minimize the chance of glitching, it is recommended to plug in the SCSI bus before the power is applied.

During hot plugging, the supplies must not go over the upper voltage limits. This means that proper ESD protection must be used during the plugging event.

Care must be taken not to exceed shock limits whilst hotplugging or unplugging.

### 50 Pin SCSI Signal Connector

50 pin models use an AMP PN 84160-1 connector. The connector is compatible with the ANSI SCSI 'A' connector specifications. It is limited to 8 bit data transfers only.

### 68 Pin SCSI Signal Connector

68 pin models use an AMP connector (PN 786963-1) that is compatible with the

ANSI SCSI 'P' connector specifications. It can transfer data in both 8 bit (narrow) and 16 bit (wide) modes. Both single-ended and differential versions are supported.

The differential 68 pin models are electrically compatible with differential 50 pin models and other 50 pin differential SCSI products and therefore can coexist on the same bus. In order to do so, the differences in connector types would need to be accounted for in the cable. Connecting 68 and 50 pin single-ended models to the same bus can also coexist. Differential and single-ended models do not work connected to the same bus.

### 80 Pin (Single Connector Attachment)

Connector 80 pin SCA-2 models use an AMP connector (PN 5-917593-9) that is compatible with the specification of: 'Single Connector Attachment for Small SCSI Disk Drives' SFF 8046. It can transfer data in both 8 bit (Narrow) and 16 bit (wide) modes.

**Note:** The 'SCA-2' connector is not mechanically compatible with the 50 pin 'A' connector or

the 68 pin 'P' connector as defined in the ANSI SCSI standard. This connector is intended for direct backplane attachment and is not intended to be cable attached to the bus.

### SCSI Bus Cable

Single-ended models permit cable lengths of up to 6 metres (19.68 feet). It should be noted however that users who plan to use "Fast" data transfers with single-ended models should follow all of the ANSI SCSI guidelines for single-ended "Fast" operations. This may include a cable length of less than 6 metres.

SCSI 3 Fast 20 models can be cable connected to a 3 metre (9.8 feet) cable when a maximum of 4 devices are attached, and a 1.5 metre (4.9 feet) cable with up to 8 devices attached.

SCA-2 connector models are not designed for direct cable attachment due to the combination of power and SCSI bus signals. "Fast & Fast 20" data transfers with SCA models should follow all of the ANSI SCSI guidelines.

Differential models permit cable lengths of up to 25 metres (82.02 feet). Cables must meet the requirements for differential cables as set forth in the ANSI SCSI standard under "Cable Requirements - Differential Cable".

The ANSI SCSI standard states that any stub from main cable must not exceed 0.1 metres for single-ended cables and 0.2 metres for differential cables. Ultrastar 2XP has a maximum internal stub length of 0.05 metres on all 'single-ended' SCSI signals, and 0.1 metres on all 'differential' SCSI signals. To remain compliant with the standard the SCSI bus cable must not add more than 0.05 metres additional stub length to any of the single-ended SCSI signals or 0.1 metres to any differential SCSI signals.

## Models

| DCHS Model No. | Capacity GB (at 512 Byte) | SCSI Pins/ Connector Type | SCSI Electrical Signal Type |
|----------------|---------------------------|---------------------------|-----------------------------|
| 04F            | 4.55                      | 50                        | SEF                         |
| 04W            | 4.55                      | 68                        | SEFW                        |
| 04E            | 4.55                      | 68                        | DFW                         |
| 04S            | 4.55                      | 80 SCA-2                  | SEFW                        |
| 04U            | 4.55                      | 68                        | SEF20W                      |
| 04X            | 4.55                      | 68                        | DEF20W                      |
| 04Y            | 4.55                      | 80 SCA-2                  | SEF20W                      |
| 09F            | 9.11                      | 50                        | SEF                         |
| 09W            | 9.11                      | 68                        | SEFW                        |
| 09E            | 9.11                      | 68                        | DFW                         |
| 09S            | 9.11                      | 80 SCA-2                  | SEFW                        |
| 09U            | 9.11                      | 68                        | SEF20W                      |
| 09X            | 9.11                      | 68                        | DEF20W                      |
| 09Y            | 9.11                      | 80 SCA-2                  | SEF20W                      |

### Notes:

'SEF' stands for Single Ended Fast

'SEFW' stands for Single Ended Fast Wide

'DFW' stands for Differential Fast Wide

'SEF20W' stands for Single Ended Fast 20 Wide

'DEF20W' stands for Differential Fast 20 Wide

50 pin SCSI connector models offer an 8 bit SCSI bus using the SCSI 'A' connector.

68 pin SCSI connector model offers an 8/16 bit SCSI bus using the SCSI 'P' connector which supports Wide data transfers.

80 pin SCSI connector models offer an 8/16 bit SCSI bus using the SCA connector.

All models support Fast SCSI data transfers and the U, X and Y models also support SCSI-3 FAST 20 data transfer.

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### **SCSI Bus Terminators (Optional)**

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For those drives having the Active Termination feature, this function can be enabled by installing a jumper between pins 13 and 14 of the Front Option Jumper Block or connecting pins 9 and 10 of the Auxiliary Connector on 68 SCSI pin models. The using system is responsible for making sure that all required signals are terminated at both ends of the cable.

80 pin SCA models do not have internal SCSI bus terminators.

Some external terminator possibilities for single-ended cabled systems are listed below:

| <b>50 Pin Model Terminators</b>        | <b>68 Pin Model Terminators</b>             |
|--|---|
| Data Mate<br>DM2000-02-R<br>DM500-06-R | Data Mate<br>DM2050-02-68S<br>DM2050-02-68R |

#### *Single-ended SCSI Terminators*

Differential models do not have internal SCSI bus terminators. Some terminator possibilities are shown below:

| <b>50 Pin Model Terminators</b>        | <b>68 Pin Model Terminators</b> |
|--|---------------------------------|
| Data Mate<br>DM550-05-0<br>DM1050-02-0 | Data Mate<br>DM2050-01-68D      |

#### *Differential SCSI Terminators*

**Note:** A Meritec model 940900-4 or a DataMate DM5000-5068-11 can be used to connect a 68 pin connector to a 50 pin connector. The drive will now perform 8 bit transfers.

### **SCSI Bus Termination Power**

Termination power is optionally provided for systems that desire to use it. In order to use the termination power, the user needs to install a jumper between pins 1 and 2 of the TermPower Block. The jumper should only be installed on one device, which should be the last device on the SCSI bus. 68 pin models can source up to 2.0 Amps of current at 5.0 Volts ( $\pm 5\%$ ) for termination power. 50 pin models can source up to 1.5 Amps of current at 5.0 Volts ( $\pm 5\%$ ) for termination power.

### **SCSI Bus Termination Power Short Circuit Protection**

The ANSI SCSI specification recommends for devices that optionally supply TERMPWR, to include current limited protection for accidental short circuits. It also recommends that the maximum current available for TERMPWR should not exceed 2 Amps, UL has a different requirement that they call the 8 Amp rule. This rule states that when a power source leaves an enclosure (like SCSI TERMPWR in the SCSI cable), it must trip 8 Amps of current within 1 minute.

The drive limits current to 5.0 Amps through the use of a permanent fuse mounted on the electronic card. Systems may also provide short circuit protection for drive supplied TERMPWR by limiting the current of the 5v power it supplies to the drive.

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### **Operating Environment**

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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.

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#### **Humidity**

|           |  |
|-----------|--|
| Operating | 5% to 90% non-condensing                   |
| Storage   | 5% to 95% non-condensing                   |
| Shipping  | 5% to 100% (applies at the packaged level) |

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#### **Wet Bulb Temperature**

|                       |                       |
|-----------------------|-----------------------|
| Operating and Storage | 80°F (26.7°C) maximum |
| Shipping              | 85°F (29.4°C) maximum |

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#### **Elevation**

|                  |   |
|------------------|---|
| Operating        | -1000 to 10000 feet<br>(-304 to 3048 meters)  |
| Shipping/Storage | -1000 to 40000 feet<br>(-304 to 12192 meters) |

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#### **Temperature**

|                          |                            |
|--------------------------|----------------------------|
| Operating ambient        | 41 to 122°F (5 to 50°C)    |
| Operating disk enclosure | 41 to 149°F (5 to 65°C)    |
| Shipping                 | -40 to 149°F (-40 to 65°C) |
| Storage                  | 34 to 149°F (1 to 65°C)    |

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#### **Temperature Gradient**

|                  |                      |
|------------------|----------------------|
| Operating        | 36°F (20°C) per hour |
| Shipping/Storage | Below condensation   |

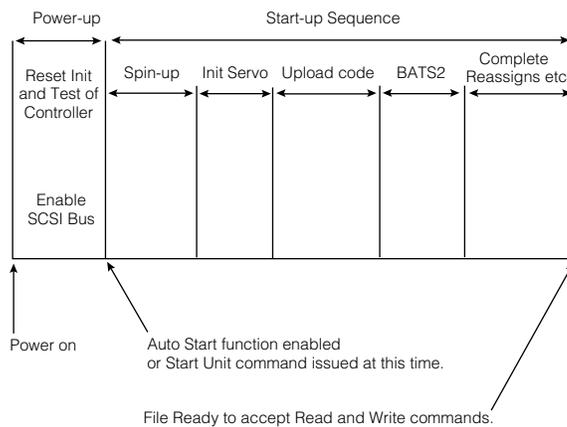
These temperature limits are extremely important and must not be exceeded at the worst case drive and system operating conditions with the drive randomly seeking, reading and writing.

## Start and Stop Times

| Time       | Nominal | Maximum | Nominal | Maximum |
|------------|---------|---------|---------|---------|
| Models     | 4.55GB  | 4.55GB  | 9.11GB  | 9.11GB  |
| Power Up   | 1.5     | 2.0     | 1.5     | 2.0     |
| Start-up   | 25      | 60      | 30      | 90      |
| Spin-up    | 9       | 25      | 11      | 27      |
| Stop Times | 6.0     | 15      | 9.0     | 15      |

All times in seconds

## Bring-up Sequence Times and Stop Time



**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.

**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), resumes "Reassign in Progress" operations, and more. For more information on the start-up sequence, refer to the Ultrastar 2XP Interface Specification.

## Spindle Synchronization

Refer to Ultrastar 2XP Hardware/Functional Specification for spindle synchronization overview.

## 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

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 each of three mutually perpendicular axis, one axis at a time.

### Nonoperating Shock

No damage will occur if the unpackaged drive is subjected to a square wave shock less than 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 millisecond half sine wave shock greater than 70 Gs applied to all three axis, one direction at a time.

## Mechanical Specifications

### Weight

4.55GB Approximately 1.0 pounds (0.46 kilograms)  
9.11GB Approximately 1.87 pounds (0.82 kilograms)

| Dimensions | Inches  | S.I.Metric |
|------------|---------|------------|
| Height     |         |            |
| 4.55GB     | 1.00 in | 25.4 mm    |
| 9.11GB     | 1.63 in | 41.3 mm    |
| Width      | 4.00 in | 101.6 mm   |
| Depth      | 5.75 in | 146.0 mm   |

### Clearances

For proper cooling it is suggested that a clearance of 7 mm be provided under the drive and on top of the drive.



**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.

## Mounting

Refer to Ultrastar 2XP Hardware/ Functional Specification 'Drive Mounting Guidelines' for more details on how to mount the drive.

The drive can be mounted with any surface facing down. The drive has both side and bottom mounting holes. Refer to diagrams below for the location of these mounting holes for each configuration.

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

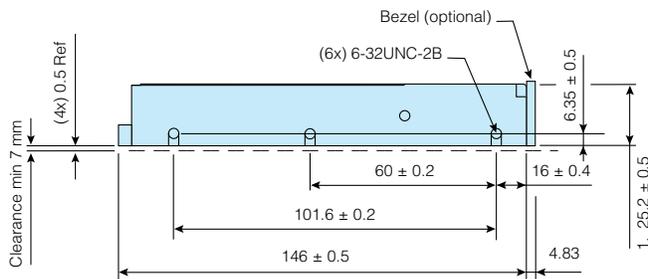
*Screws longer than 3.8 mm may cause permanent damage to the drive.*

The recommended torque to be applied to the mounting screws is 0.8 Newton metres  $\pm$ 0.2 Newton metres.

### Grounding requirements of the disk enclosure

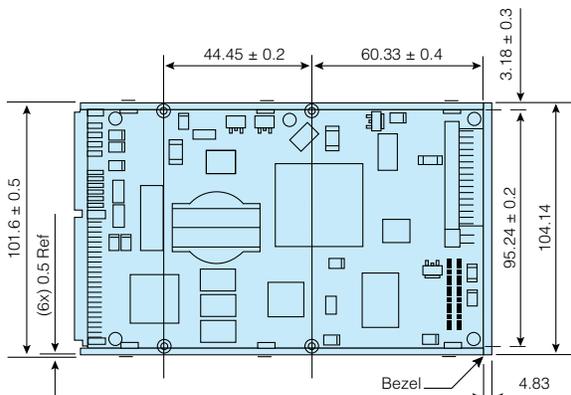
The disk enclosure is at Power Supply ground potential. It is allowable for the user mounting scheme to common the Disk Enclosure to Frame Ground potential or to leave it isolated from Frame Ground.

The drives mounting frame must be within  $\pm$ 150 millivolts of the drives power supply ground. At no time should more than 35 milliamps of current (0 to 100 Mhz) be injected into the disk enclosure.



Location of side mounting holes

1. 41.3mm  $\pm$  0.5 for 9.11 GB models.



## Temperature Measurements

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

### Maximum and Reliable Operating Temperature Limits

|                             | Maximum       | Optimum      |
|-----------------------------|---------------|--------------|
| Disk Enclosure Top          | 149°F (65°C)  | 122°F (50°C) |
| Disk Enclosure Bottom       | 149°F (65°C)  | 122°F (50°C) |
| Channel Module <sup>1</sup> | 194°F (90°C)  | 176°F (80°C) |
| SCSI Module                 | 176°F (80°C)  | 140°F (60°C) |
| Microprocessor Module       | 203°F (95°C)  | 167°F (75°C) |
| Controller Module           | 212°F (100°C) | 167°F (75°C) |
| Spindle Motor Driver Module | 194°F (90°C)  | 176°F (80°C) |
| Voice Coil Driver           | 221°F (105°C) | 176°F (80°C) |

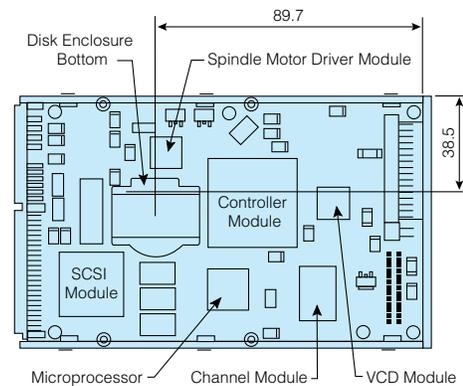
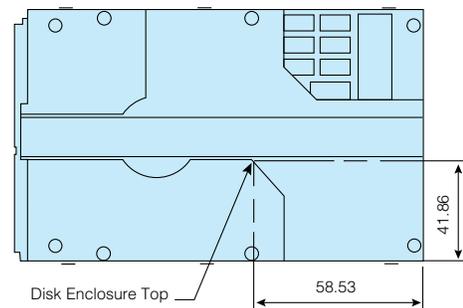
**Note:** Operating the file above the maximum temperatures may cause permanent damage.

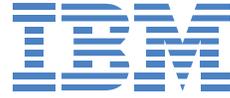
1. For continuous read applications the channel module will run at higher temperatures and will require additional cooling.

**Note:** The diagrams below define where measurements should be made. Showing where the modules are located on the bottom side of the card and the measurement locations on the bottom of the or top 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.

### Module Temperature Measurement Notes:

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





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