IBM

Ultrastar ES *DORS 32160*

Models: *SCSI-2 FAST (50 pin Single-Ended)*
SCSI-3 FAST 20 (50 pin Single-Ended)
SCSI-3 FAST 20 wide (68 pin Single-Ended)
SCSI-3 FAST 20 wide (80 pin Single-Ended)

The performance characteristics of the DORS family make it ideal for desktop applications where high performance and capacity are required. The drives spin at 5400 rpm, have sector servo, PFA (S.M.A.R.T.) and a media data rate of 6-9MB/sec.

Applications

- High-end desktop
- Entry workstations
- Low capacity servers and arrays

| Features	Benefits
• **2.16GB formatted capacity**	• *Popular capacity point*
• **Industry standard interface**	• *High interface data rates*
– 50 pin ANSI SCSI-2	• *– 10MB/sec data transfer speed*
– 50 pin ANSI SCSI-3	• *– 20MB/sec data transfer speed*
– 68 pin ANSI SCSI-3	• *– 40MB/sec data transfer speed*
– 80 pin ANSI SCSI-3	• *– 40MB/sec data transfer speed*
• **5.93/8.95 MB/s media data rate**	• *High data rate across entire disk surface*
• **Rotational speed 5400 rpm**	
• **Sustained data rate 3.8 – 5.7 MB/s**	• *Fast access to data*
• **Average seek time 8.5 ms**	
• **Average latency 5.56 ms**	
• **Magneto resistive heads**	• *Areal density 731 Mbit/sq in. (Max)*
• **Connection for external activity LED**	• *Visibility of Drive Activity*
• **Sector servo**	• *No thermal recalibration*
• **448 KB multi-segmented dual port data buffer**	• *Fast data retrieval in multi-tasking environments*
• **On-board SCSI bus terminator (50 & 68 pin models)** •	*Easy integration across multiple platforms*
• **SCAM 2 Compliant (SCSI-3 models)**	
• **Industry standard mounting**	• *Easy installation*
• **Low command overhead • Read ahead caching**	• *Improved data throughput*
• **ECC on the fly • Write cache support**	
• **Predictive Failure Analysis (S.M.A.R.T. Compliant)** •	*Improved data reliability*
• **MTBF 800,000 hours**	
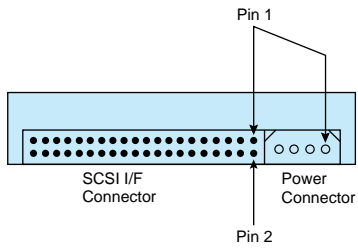
Connectors

Electrical Connectors (rear view) 50 Pin models

- Pin 1
- SCSI I/F Connector
- Power Connector
- Pin 2
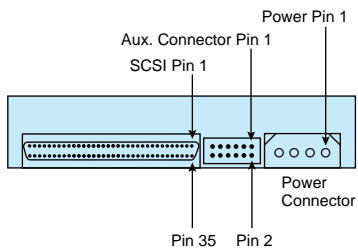
Electrical Connectors (rear view) 68 Pin models

- Power Pin 1
- Aux. Connector Pin 1
- SCSI Pin 1
- Power Connector
- Pin 35
- Pin 2
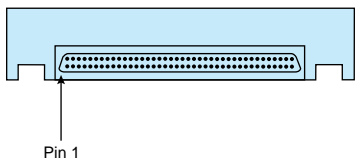
Electrical Connectors (rear view) 80 Pin SCA models

- Pin 1
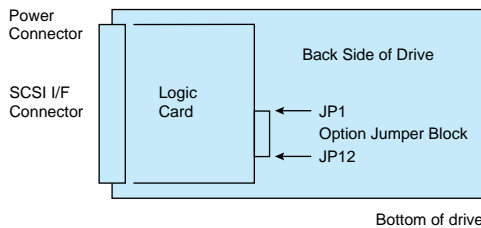
- Power Connector
- SCSI I/F Connector
- Logic Card
- Back Side of Drive
- JP1
- Option Jumper Block
- JP12
- Bottom of drive

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.
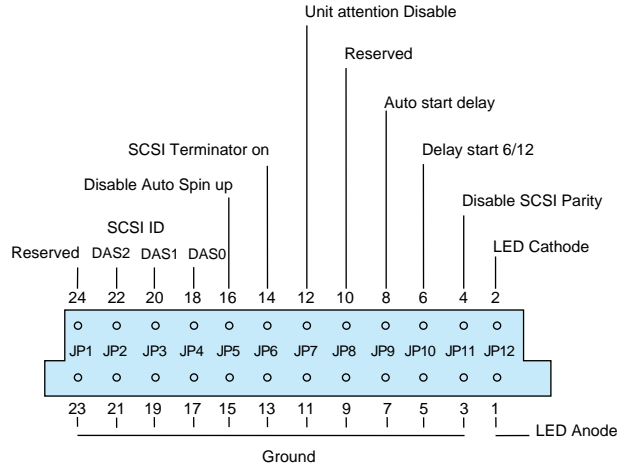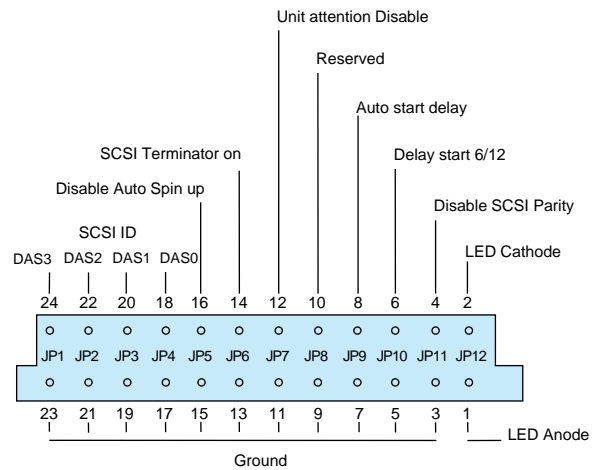
Pin #   4   3   2   1

+5V GND GND +12V
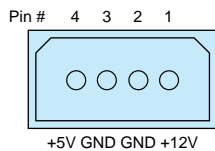
Option Block

Jumper Setting

Jumper position and function are as shown below. Pin pitch is 2mm.

50 Pin Model Jumper Pins Assignment

- Unit attention Disable
- Reserved
- Auto start delay
- Delay start 6/12
- Disable SCSI Parity
- LED Cathode
- SCSI Terminator on
- Disable Auto Spin up
- SCSI ID
- Reserved   DAS2   DAS1   DAS0
- 24 22 20 18 16 14 12 10 8 6 4 2
- JP1 JP2 JP3 JP4 JP5 JP6 JP7 JP8 JP9 JP10 JP11 JP12
- 23 21 19 17 15 13 11 9 7 5 3 1
- Ground
- LED Anode

68 Pin Model Jumper Pins Assignment

- Unit attention Disable
- Reserved
- Auto start delay
- Delay start 6/12
- Disable SCSI Parity
- LED Cathode
- SCSI Terminator on
- Disable Auto Spin up
- SCSI ID
- DAS3   DAS2   DAS1   DAS0
- 24 22 20 18 16 14 12 10 8 6 4 2
- JP1 JP2 JP3 JP4 JP5 JP6 JP7 JP8 JP9 JP10 JP11 JP12
- 23 21 19 17 15 13 11 9 7 5 3 1
- Ground
- LED Anode

80 Pin Model Jumper Pins Assignment

- Unit attention Disable
- Reserved
- Auto start delay
- Delay start 6/12
- Disable SCSI Parity
- LED Cathode
- Reserved
- Disable Auto Spin up
- SCSI ID
- DAS3   DAS2   DAS1   DAS0
- 24 22 20 18 16 14 12 10 8 6 4 2
- JP1 JP2 JP3 JP4 JP5 JP6 JP7 JP8 JP9 JP10 JP11 JP12
- 23 21 19 17 15 13 11 9 7 5 3 1
- Ground
- LED Anode

Jumper Options

SCSI ID (Address) Pins

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

50 pin model SCSI ID (Address) pins

– DSA2 JP2	–DSA1 JP3	–DSA0 JP4	Device ID
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

* Shipping default ID

68 and 80 pin model SCSI ID (Address) pins

– DAS3 JP1	– DAS2 JP2	–DAS1 JP3	–DAS0 JP4	Device ID
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

* Shipping default ID for 80 pin drive
** Shipping default ID for 68 pin drive

Enable SCSI Terminator

		SCSI ID			
+5v	DAS3	DAS2	DAS1	DAS0
Pin # 11	9	7	5	3	1

| 12 | 10 | 8 | 6 | 4 | 2 |

Reserved — Reserved
Ground — Disable Auto Spin up
LED Cathode — Reserved
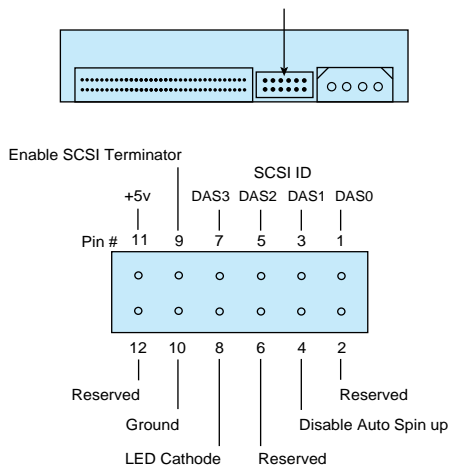
68 Pin Auxiliary Connector

Disable auto spin up (JP5)

This jumper controls how the drive starts when power is applied. If the jumper is NOT installed then the file will spin up automatically after power-on reset. If the jumper IS installed the file will NOT spin up unless the host system issues a 'START UNIT' command to the file.

SCSI Terminator On (JP6)

When this jumper is installed, the on-card SCSI bus terminator is enabled. No Terminator on 80 pin model.

Unit Attention Disable (JP7)

When this jumper is installed the drive will not generate a Unit Attention following a Power On Reset (POR) or SCSI Bus Reset. Any pending Unit Attention conditions will also be cleared at POR or SCSI Bus Reset.

Auto start delay and Delay start (JP9, JP10)

The auto Start Delay and Delay Start pins control when and how the drive can spin up, with the combination of Auto Spin up option (pin #5).

When in Auto Spin up and Start delay mode the drive start will be delayed by a period of time multiplied by its own SCSI address. If Auto Spin up is disabled, these jumpers will be ignored.

Disable Auto Spin up JP5	Auto Start Delay JP9	Delay Start 6/12 JP10	Option
on	don't care	don't care	Drive will NOT spin up Requires Start Command
off	off	off	Spin up immediately after POR
off	on	off	Spin up six seconds multiplied by SCSI address after POR
off	on	on	Spin up twelve seconds multiplied by SCSI address after POR

Disable SCSI parity (JP11)

When this jumper is installed, the drive's SCSI parity checking is disabled.

External Activity (LED) pins (JP12)

The LED pins can be used to drive an external Light Emitting Diode. Up to 8 mA of sink current capability is provided. The LED Anode must be tied to the current limited + 5V source provided on Pin # 1 of the Option Jumper Block. The LED Cathode is then connected to the Pin # 2 to complete the circuit.

Default Setting

The default jumper setting at shipment is as follows. *Jumpers installed on 50 and 68 pin models.*

JP2
JP3 } SCSI Address #6

JP6   SCSI Terminator enabled

SCSI Signal Connector

The SCSI 50 and 68 pin Signal Connector meets the ANSI SCSI specification. The SCSI SCA -80 pin Connector conforms to SFF 8046.

Note: It is intended that the hard disk drive should only be in electrical contact with the chassis of the system at a designated set of mounting holes. Other electrical contact may degrade error rate performance. As a result of this it is recommended that there should be no metal contact to the hard disk drive except at the mounting holes or the side rails into which the mounting holes are tapped.

Operating Environment

Operating Conditions

Temperature	5 to 55°C
Relative Humidity	8 to 90% non-condensing
Maximum Wet Bulb Temperature	29.4°C non-condensing
Maximum Temperature Gradient	15°C/Hour
Altitude	–300 to 3000m

Non-operating Conditions

Temperature	–40 to 65°C (shipping)
	0 to 65°C (storage)
Relative Humidity	5 to 95% non-condensing
Maximum Wet Bulb Temperature	35°C non-condensing
Altitude	–300 to 12,000m

Notes:
The system is responsible to provide sufficient air movement to maintain surface temperature below 60°C at the centre of top cover of the drive.

Operating Shock
The hard disk drive meets the following criteria while operating in respective conditions described below. There must be a delay between shock pulses, long enough to allow the drive to complete all necessary error recovery procedure.

No errors
5G, 11ms half-sine shock pulse

No data loss, seek errors or permanent damage
10G, 11ms half-sine shock pulse

No data loss or permanent damage
15G, 5ms half-sine shock pulse
30G, 4 ms half-sine shock pulse

Operating and Non-Operating Vibration
Due to the complexity of this subject we recommend that users contact the IBM technical support group representative to discuss how to perform the necessary measurements if they believe this to be an area which requires evaluation.

DC Power Requirements

The following voltage specifications apply at the file power connector. Damage to the file electronics may result if the power supply cable is connected or disconnected while power is being applied to the file (no hot plug/unplug is allowed except on 80 pin model). There are inductive loads in the file which could cause destructively high voltage spikes on the file if the power connection is opened. There is no special power on/off sequencing required.

Nominal Supply Voltages	+5 volts	+12 volts
Power Supply Ripple (mV p-p, 0-10MHz)[1]	100 max	150 max
Tolerance[2]	±5%	+10%/–8%
Supply Current (Population Mean)		
Idle (average)	0.25	0.20
R/W (average)	0.30	0.37
Seek (average)	0.30	0.35
Standby	0.13	0.01
Start up (peak)	0.46	1.10

Notes:
1. The maximum ripple is measured at input of the drive.
2. To avoid damage to the file electronics; spikes on the 5V supply must not exceed 7V and spikes on the 12V supply must not exceed 15V.

During the 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 of +10/–8%. A common supply with separate power leads to each file is a more desirable method of power distribution.

To prevent external electrical noise from interfering with the file's performance, the file must be held by four screws in a user system frame. There should be no electrical level difference at the four screws position, and less than ±300 millivolts peak to peak difference to the file power connector ground.

Data Organisation

Logical Layout	DORS-32160
Bytes per Sector	512
Number of heads	5
Number of Disks	3
Number of LBAs	4226725
Total logical Data Bytes	2164083200

SCSI Cable

SCSI 2
The disk drive uses single-ended drivers and receivers which will permit cable lengths of up to 6 metres (19.68 feet). For a single ended cable a 50 conductor flat cable or a 25 signal twisted cable can be used with a maximum length of 6.0 metres, and a stub length not exceeding 0.1 metres.
SCSI 3
The maximum cable length is 3.0 metres when using up to 4 drives. If you are using greater than 4 drives the cable length must be 1.5 metres or less.

SCSI Bus Terminator (50 and 68 pin models)

The file has an internal Active SCSI bus terminator, which can be controlled on/off at the drive Option block. The user is responsible for properly terminating and powering the SCSI bus in the using system.

Electromagnetic Compatability

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 (FFC) Rules and Regulations Part 15, Subject J – Computer Devices "Class B Limits".

European Economic Community directive number 76/889 related to the control of radio frequency interference and the Verband Deutscher Elektrotechniker (VDE) requirements of Germany (GOP).

Mode Select Options

Certain parameters are alterable using the SCSI 'Mode Select' command. This allows certain drive characteristics to be modified to optimise performance on a particular system. Refer to the DORS-3XXXX Interface Specification for detailed definition of Mode Select parameters.
The changeable parameters are:

Page 0
Vendor Unique Parameters

QPE	– Qualify Post Error	(0)
UQE	– Untagged Queuing Enable	(1)
UAI	– Unit Attention Inhibit	(0)
DADM	– Disable Automatic Drive Maintenance	(0)
CMDAC	– Command Active	(1)
CPE	– Current Processing Enable	(1)
CAEN	– Command Age Limit Enable	(1)
ADC	– Adaptive Cache Enable	(1)
LED Mode		(0000b)
Command Aging Limit		(48)
QPE	– Read Threshold	(10)
QPE	– Write Threshold	(10)

Page 1
Read-Write Error Recovery Parameters

AWRE	– Automatic Write Reallocation Enable	(1)
ARRE	– Automatic Read Reallocation Enable	(1)
TB	– Transfer Block	(0)
PER	– Post Error	(0)
DTE	– Disable Transfer on Error	(0)
DCR	– Disable Correction	(0)
Read Retry Count		(01h)
Write Retry Count		(01h)

Page 2
Disconnect/Reconnect Parameters

Read Buffer Full Ratio	(00h)
Write Buffer Empty Ratio	(00h)

Page 7
Verify Error Recovery Parameters

PER	(0)
DCR	(0)
Verify Retry Count	(01h)

Page 8
Caching Parameters

WCE	– Write Cache Enable	(1)
RCD	– Read Cache Disable	(0)
MF	– Multiplication Factor	(0)
Disable Pre Fetch Transfer Length		(0)
Minimum Pre Fetch		(0)
Maximum Pre Fetch		(0)
Maximum Pre Fetch Ceiling		(0)

Page A
Control Mode Page Parameters

Queue Algorithm Modifier	(0h)
QErr – Queue Error	(0)
DQue – Disable Queuing	(0)

Page 1C
Informational Exceptions Control

DEXCPT – Disable Exception Control	(0)
Method of Reporting	(0)
Report Court	(0)

Page 38
Power Control

Automatic Shutdown Time	(0)

Note: (XX) saved options at Shipment

Mechanical Data

Dimensions

Height	25.4±0.4mm
Width	101.6±0.4mm
Depth	146.0±0.6mm
Weight	570g maximum

Mounting Orientation
The Drive can be mounted in any axis (6 directions).

The maximum allowable penetration of the mounting screws is ☐1 3.5mm ☐2 6mm

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.
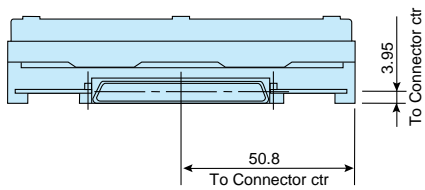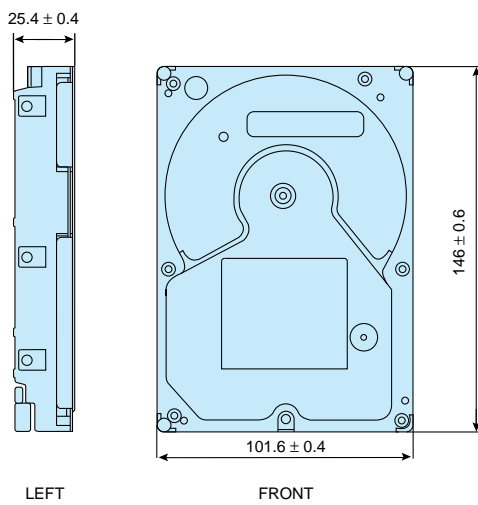
Outline Dimensions
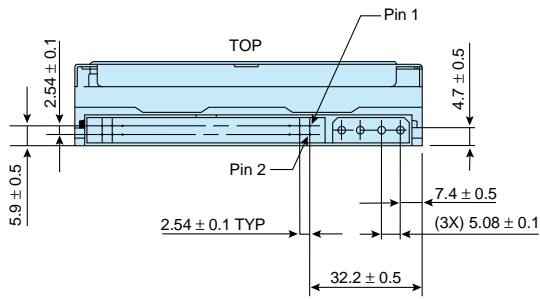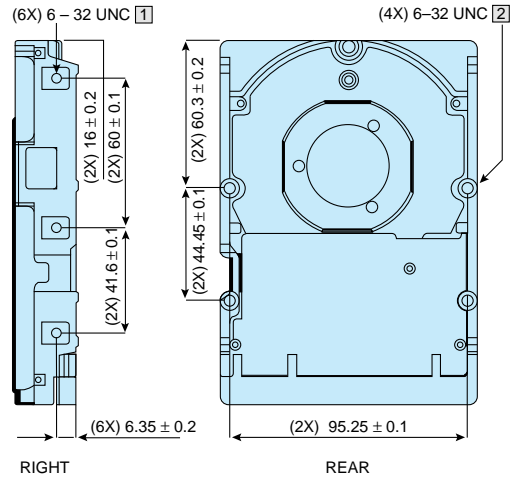

50 Pin Model Connector Locations
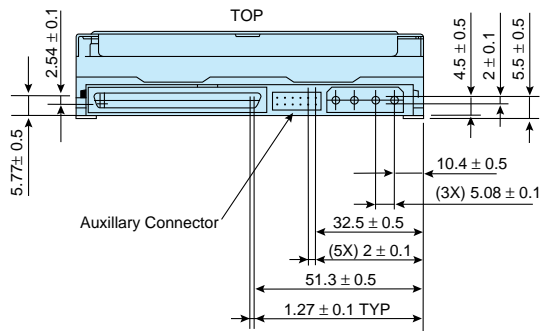
68 Pin Model Connector Locations

80 Pin SCA Model Connector Locations

LEFT   FRONT

Mounting Holes

RIGHT   REAR

IBM

IBM is the registered trademark of International
Business Machines Corporation.

AMP is a trademark of AMP Incorporated
Molex is a trademark of Molex Incorporated
DATA MATE is a trademark of AMP Incorporated

Other company, product and service names may be
trademarks or service marks of others.

References in this publication to IBM products,
programs or services do not imply that IBM intends
to make these available in all countries in which IBM
operates. Any reference to any IBM product, program
or service is not intended to imply that only IBM's
product, program or service may be used. Any
functionally equivalent product, program or service
may be used instead.

IBM hardware products are manufactured from new
parts, or new and used parts. In some cases, the
hardware product may not be new and may have
been previously installed. Regardless, IBM Warranty
terms apply.

This publication is for general guidance only.
Photographs may show design models.

Printed in England by Cedar Colour Limited

Distributor: