

Superior performance, reliability, and capacity for advanced workstation, subsystem, and enterprise server applications



IBM Ultrastar family of disk drives

2nd Quarter 1999

Highlights

High capacities up to 36.4 GB provide the storage necessary for a wide range of data-intensive applications.

Rotational speeds up to 10,020 RPM and rapid seek times as fast as 5.3 ms provide exceptional performance.

A number of advanced features such as Predictive Failure Analysis* (PFA) and Drive Temperature Indicator Processor (Drive-TIP*) help provide outstanding data protection and drive reliability.

IBM offers Ultra SCSI, Ultra2 SCSI (LVD), Fibre Channel-Arbitrated Loop (FC-AL), and Serial Storage Architecture (SSA) interfaces.

All IBM Ultrastar* hard disk drives feature a five-year warranty.

Leading drive technology

With capacities up to 36.4 GB and areal densities up to 3.03 Gbits/sq. inch, IBM Ultrastar disk drives provide reliable, high-performance storage for today's data-intensive applications.

IBM Ultrastar hard drives achieve their high level of reliability, performance, and affordability by leveraging the experience of IBM in the development and implementation of advanced disk drive technologies.

Advancements include giant magnetoresistive (GMR) head technology, which dramatically increases areal density and reduces the number of disks and heads required for a given capacity.

Support for advanced applications

Improvements in data throughput are increasingly important in advanced applications, such as video editing, multimedia, and data mining. IBM Ultrastar hard disk drives provide necessary high sustained data rates by combining features such as high areal density through advanced servo technology, an embedded servo with efficient No-ID* sector formatting, a powerful ECC "on-the-fly" implementation, and the IBM advanced Partial Response Maximum Likelihood (PRML) digital data channel.

Advanced interfaces

IBM offers a comprehensive set of SCSI and serial host interface solutions for the server industry, including Ultra SCSI, Ultra2 SCSI, Serial Storage Architecture (SSA), and Fibre Channel-Arbitrated Loop (FC-AL).



IBM Ultrastar 9LZX 3.5-inch low-profile Ultra2 SCSI (LVD) 9.1 GB 10,020 RPM disk drive



IBM Ultrastar 36XP 3.5-inch half-height Ultra2 SCSI (LVD) 36.4 GB 7200 RPM disk drive

IBM Ultrastar family specifications, 2nd Quarter 1999

| Product family name | Ultrastar 9ES | Ultrastar 9ES | Ultrastar 9LP | Ultrastar 18ES |
|---|---|---|--|---|
| Capacity | | | | |
| Capacity (512 bytes) | 4.5 GB | 9.1 GB | 9.1 GB | 9.1 GB |
| Interface¹ | | | | |
| Available interfaces | Ultra SCSI (50T) Ultra SCSI (68T) Ultra SCSI (80) Ultra2 SCSI (68) LVD Ultra2 SCSI (80) LVD | Ultra SCSI (50T) Ultra SCSI (68T) Ultra SCSI (80) Ultra2 SCSI (68) LVD Ultra2 SCSI (80) LVD | Ultra SCSI (50T) Ultra SCSI (68T) Ultra SCSI (80) Ultra2 SCSI (68) LVD Ultra2 SCSI (80) LVD SSA | Ultra SCSI (50T) Ultra SCSI (68T) Ultra2 SCSI (68) LVD Ultra2 SCSI (80) LVD FC-AL |
| Performance | | | | |
| Data buffer | 512 KB | 512 KB | 1 MB | 2 MB |
| Rotational speed (RPM) | 7200 | 7200 | 7200 | 7200 |
| Latency (average ms) | 4.17 | 4.17 | 4.17 | 4.17 |
| Media transfer rate (Mbits/sec, inner-outer) | 108.6–171.1 | 108.6–171.1 | 92.2–179.2 | 159.0–244.0 |
| Interface transfer rate (MB/sec) ² | 20/40/80 | 20/40/80 | 20/40/80/160 | 20/40/80/200 |
| Seek time (typical) | | | | |
| Average ³ (ms) | 7.5 | 7.5 | 6.5 | 7.0 |
| Track to track (ms) | 0.8 | 0.8 | 0.7 | 0.8 |
| Full track (ms) | 15 | 15 | 14 | 13 |
| Configuration | | | | |
| Sector size (bytes) | 512 | 512 | 512-732 | 512 (fixed) 512–524 (variable, 2-byte incr.) |
| Recording zones | 8 | 8 | 16 | 11 |
| User cylinders | 8420 | 8420 | 8151 | 11,347 |
| Data heads | 5 | 10 | 10 | 5 |
| Disks | 3 | 5 | 5 | 3 |
| Areal density (Gbits/sq. in) | 1.56 | 1.56 | 1.25 | 3.03 |
| Recording density (max. KBPI) | 156 | 156 | 150 | 220 |
| Track density (TPI) | 10,000 | 10,000 | 8356 | 13,700 |
| Reliability | | | | |
| Warranty (years) | 5 | 5 | 5 | 5 |
| Error rates (non-recoverable bits read) | <10 in 10E 14 | <10 in 10E 14 | <10 in 10E 15 | <10 in 10E 14 |
| Power | | | | |
| Dissipation (typical) | | | | |
| Start-up (max. peak) amps | 0.27 (5V), 2.0 (12V) | 0.27 (5V), 2.0 (12V) | 1.6 (12V) | 0.75 (5V), 2.0 (12V) 1.35 (5V), 2.0 (12V) FC-AL |
| Idle (avg.) watts | 5.3 | 7.1 | 9.2 | 5.3 ⁴ |
| Power save (avg.) watts | — | — | 8.5 | — |
| Power consumption | | | | |
| Efficiency index (watts/MB) | 0.0012 | 0.0008 | 0.00010 | 0.0006 |
| Environmental (operating/nonoperating) | | | | |
| Ambient temperature | 5 to 55° C/-40 to 65° C | 5 to 55° C/-40 to 65° C | 5 to 50° C/-40 to 65° C | 5 to 55° C/-40 to 65° C |
| Relative humidity | 8% to 90%/5% to 95% | 8% to 90%/5% to 95% | 5% to 90%/5% to 95% | 8% to 90%/5% to 95% |
| Shock (half sine wave) | 10 G (11 ms)/175 G (2 ms) | 10 G (11 ms)/175 G (2 ms) | 10 G (2,11 ms)/150 G (2 ms) | 10 G (11 ms)/175 G (2 ms) |
| Random vibration (RMS) | 0.67 G (5 to 500 Hz)/ 1.04 G (2 to 200 Hz) | 0.67 G (5 to 500 Hz)/ 1.04 G (2 to 200 Hz) | 0.56 G (5 to 500 Hz)/ 2.0 G (5 to 300 Hz) | 0.67 G (5 to 500 Hz)/ 1.04 G (2 to 200 Hz) |
| Physical size | | | | |
| Height | 25.4 mm/1 in | 25.4 mm/1 in | 25.4 mm/1 in | 25.4 mm/1 in |
| Width | 101.6 mm/4 in | 101.6 mm/4 in | 101.85 mm/4 in | 101.6 mm/4 in |
| Depth | 146 mm/5.75 in | 146 mm/5.75 in | 147 mm/5.77 in | 146 mm/5.75 in |
| Weight (max.) | 630 g/1.39 lb | 630 g/1.39 lb | 570 g/1.41 lb | 630 g/1.39 lb |
| Ordering information | | | | |
| Model | DDRS-34560 | DDRS-39130 | DGHS (Ultra SCSI, Ultra2 SCSI) DGHC (SSA) | DNES-309170 (Ultra SCSI, Ultra2 SCSI) DNEF-309170 (FC-AL) |

¹ FC-AL=Fibre Channel-Arbitrated Loop, LVD=Low Voltage Differential, SSA=Serial Storage Architecture, SCA=Single Connector, T=Terminal

² Interface transfer rates vary based on the interface type (Ultra SCSI, Ultra2 SCSI, SSA, and FC-AL).

³ Average read seek for drive population

⁴ Add 3 watts for FC-AL drives.

IBM Ultrastar family specifications, 2nd Quarter 1999

| Product family name | Ultrastar 9LZX | Ultrastar 18ES | Ultrastar 18XP |
|---|--|---|--|
| Capacity | | | |
| Capacity (512 bytes) | 9.1 GB | 18.2 GB | 18.2 GB |
| Interface¹ | | | |
| Available interfaces | Ultra2 SCSI (68) LVD Ultra2 SCSI (80) LVD SSA FC-AL | Ultra SCSI (50T) Ultra SCSI (68T) Ultra2 SCSI (68) LVD Ultra2 SCSI (80) LVD FC-AL | Ultra SCSI (50T) Ultra SCSI (68T) Ultra SCSI (80) Ultra2 SCSI (68) LVD Ultra2 SCSI (80) LVD SSA |
| Performance | | | |
| Data buffer | 4 MB | 2 MB | 1 MB |
| Rotational speed (RPM) | 10,020 | 7200 | 7200 |
| Latency (average ms) | 2.99 | 4.17 | 4.17 |
| Media transfer rate (Mbits/sec, inner-outer) | 187.2–243.7 | 159.0–244.0 | 92.2–179.2 |
| Interface transfer rate (MB/sec) ² | 80/160/200 | 20/40/80/200 | 20/40/80/160 |
| Seek time (typical) | | | |
| Average ³ (ms) | 5.3 | 7.0 | 7.5 |
| Track to track (ms) | 0.7 | 0.8 | 0.7 |
| Full track (ms) | 11.5 | 13 | 17 |
| Configuration | | | |
| Sector size (bytes) | 512–732 | 512 (fixed) 512–524 (variable, 2-byte incr.) | 512–732 |
| Recording zones | 16 | 11 | 16 |
| User cylinders | 7065 | 11,347 | 8151 |
| Data heads | 10 | 10 | 20 |
| Disks | 5 | 5 | 10 |
| Areal density (Gbits/sq. in) | 2.02 | 3.03 | 1.25 |
| Recording density (max. KBPI) | 219 | 220 | 150 |
| Track density (TPI) | 9240 | 13,700 | 8356 |
| Reliability | | | |
| Warranty (years) | 5 | 5 | 5 |
| Error rates (non-recoverable bits read) | < 10 in 10E 15 | < 10 in 10E 14 | < 10 in 10E 15 |
| Power | | | |
| Dissipation (typical) | | | |
| Start-up (max. peak) amps | 2.0 (12V) | 0.75 (5V), 2.0 (12V) 1.35 (5V), 2.0 (12V) FC-AL | 2.7 (12V) |
| Idle (avg.) watts | 11.2 | 6.9 ⁴ | 13.1 |
| Power save (avg.) watts | 10.1 | — | 12.4 |
| Power consumption | | | |
| Efficiency index (watts/MB) | 0.0011 | 0.0004/0.0006 FC-AL | 0.0007 |
| Environmental (operating/nonoperating) | | | |
| Ambient temperature | 5 to 50° C/-40 to 65° C | 5 to 55° C/-40 to 65° C | 5 to 50° C/-40 to 65° C |
| Relative humidity | 5% to 90%/5% to 95% | 8% to 90%/5% to 95% | 5% to 90%/5% to 95% |
| Shock (half sine wave) | 10 G (2,11 ms)/150 G (2 ms) | 10 G (11 ms)/175 G (2 ms) | 10 G (2,11 ms)/140 G (2 ms) |
| Random vibration (RMS) | 1.41 G (5 to 500 Hz)/ 2.23 G (5 to 500 Hz) | 0.67 G (5 to 500 Hz)/ 1.04 G (2 to 200 Hz) | 0.56 G (5 to 500 Hz)/ 2.0 G (5 to 300 Hz) |
| Physical size | | | |
| Height | 25.4 mm/1 in | 25.4 mm/1 in | 41 mm/1.61 in |
| Width | 101.6 mm/4 in | 101.6 mm/4 in | 101.85 mm/4 in |
| Depth | 146.8 mm/5.75 in | 146 mm/5.75 in | 147 mm/5.77 in |
| Weight (max.) | 670 g/1.49 lb | 630 g/1.39 lb | 1.08 kg/2.38 lb |
| Ordering information | | | |
| Model | DRVS (Ultra2 SCSI) DRVC (SSA) DRVL (FC-AL) | DNES-318350 (Ultra SCSI, Ultra2 SCSI) DNEF-318350 (FC-AL) | DGHS (Ultra SCSI, Ultra2 SCSI) DGHC (SSA) |

¹ FC-AL=Fibre Channel-Arbitrated Loop, LVD=Low Voltage Differential, SSA=Serial Storage Architecture, SCA=Single Connector, T=Terminal

² Interface transfer rates vary based on the interface type (Ultra SCSI, Ultra2 SCSI, SSA, and FC-AL).

³ Average read seek for drive population

⁴ Add 3 watts for FC-AL drives.

IBM Ultrastar family specifications, 2nd Quarter 1999

| Product family name | Ultrastar 18ZX | Ultrastar 36XP |
|---|--|--|
| Capacity | | |
| Capacity (512 bytes) | 18.2 GB | 36.4 GB |
| Interface¹ | | |
| Available interfaces | Ultra2 SCSI (68) LVD Ultra2 SCSI (80) LVD SSA FC-AL | Ultra2 SCSI (68) LVD Ultra2 SCSI (80) LVD SSA FC-AL |
| Performance | | |
| Data buffer | 4 MB | 4 MB |
| Rotational speed (RPM) | 10,020 | 7200 |
| Latency (average ms) | 2.99 | 4.17 |
| Media transfer rate (Mbits/sec, inner-outer) | 187.2-243.7 | 143.2-231.2 |
| Interface transfer rate (MB/sec) ² | 80/160/200 | 80/160/200 |
| Seek time (typical) | | |
| Average ³ (ms) | 6.5 | 7.5 |
| Track to track (ms) | 0.7 | 0.3 |
| Full track (ms) | 13.5 | 14.5 |
| Configuration | | |
| Sector size (bytes) | 512-732 | 512-732 |
| Recording zones | 16 | 16 |
| User cylinders | 7065 | 11,494 |
| Data heads | 20 | 20 |
| Disks | 10 | 10 |
| Areal density (Gbits/sq. inch) | 2.02 | 2.76 |
| Recording density (max. KBPI) | 219 | 238.8 |
| Track density (TPI) | 9240 | 11,550 |
| Reliability | | |
| Warranty (years) | 5 | 5 |
| Error rates (non-recoverable bits read) | <10 in 10E 15 | <10 in 10E 15 |
| Power | | |
| Dissipation (typical) | | |
| Start-up (max. peak) amps | 3.5 (12V) | 2.7 (12V) |
| Idle (avg.) watts | 17.7 | 12.4 ⁴ |
| Power save (avg.) watts | 16.3 | 11.4 |
| Power consumption | | |
| Efficiency index (watts/MB) | 0.0009 | 0.0007 |
| Environmental (operating/nonoperating) | | |
| Ambient temperature | 5 to 50° C/-40 to 60° C | 5 to 50° C/-40 to 60° C |
| Relative humidity | 5% to 90%/5% to 95% | 5% to 90%/5% to 95% |
| Shock (half sine wave) | 10 G (2 ms)/140 G (2 ms) | 10 G (211 ms)/140 G (2 ms) |
| Vibration (random [RMS]) | 1.41 G (5 to 500 Hz)/ 2.23 G (5 to 500 Hz) | 0.56 G (5 to 500 Hz)/ 2.0 G (5 to 300 Hz) |
| Physical size | | |
| Height | 41 mm/1.61 in | 41 mm/1.61 in |
| Width | 101.6 mm/4 in | 101.9 mm/4 in |
| Depth | 146.8 mm/5.75 in | 146.8 mm/5.75 in |
| Weight (max.) | 1.05 kg/2.32 lb | 1.08 kg/2.38 lb |
| Ordering information | | |
| Model | DRVS (Ultra2 SCSI) DRVC (SSA) DRVL (FC-AL) | DRHS (Ultra2 SCSI) DRHC (SSA) DRHL (FC-AL) |

¹ FC-AL=Fibre Channel-Arbitrated Loop, LVD=Low Voltage Differential, SSA=Serial Storage Architecture, SCA=Single Connector, T=Terminal

² Interface transfer rates vary based on the interface type (Ultra SCSI, Ultra2 SCSI, SSA, and FC-AL) and configuration.

³ Average read seek for drive population.

⁴ Add 4 watts for FC-AL interface.

For more information

Internet and e-mail:

- www.ibm.com/harddrive
- drive@us.ibm.com
- reseller@us.ibm.com

IBM TECHFAX document server:

- 408-256-5418 (requires touch-tone phone)
- International callers must call from a fax machine

IBM hard disk drive product information:

- 1 888-IBM-5214 (United States)
- 507-253-4110 (outside of the United States)



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Ultrastar 9LZX
March 1999



Performance
Computing
Outstanding
Product Award
Ultrastar 18XP
December 1998



NewMedia Magazine
Rated Awesome
Ultrastar 9LZX
October 1998

