



Product summary

Deskstar 60GXP

Ultra ATA/100

Models: IC35L010AVER07
 IC35L020AVER07
 IC35L030AVER07
 IC35L040AVER07
 IC35L060AVER07



Introduction

IBM's latest Deskstar drives are ideal for high performance desktop users. These drives offer capacities of up to 60 GB, a rotational speed of 7200 RPM and an average seek time of 8.5 ms. The Deskstar 60GXP combines new and proven technologies to greatly enhance system performance and capacity.

Applications

- Advanced desktop and audio/video
- Low-cost routers
- Entry-level servers
- Switches
- Video editing

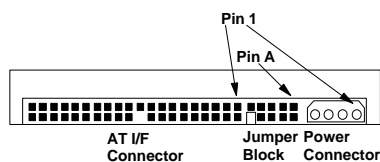
Features

- Formatted capacities of 10 GB, 20 GB, 30 GB, 40 GB, and 60 GB
- Rotational speed 7200 RPM
- Ultra ATA/100 interface
- Self Diagnostics on Power On and resident diagnostics
- Operating shock—No data loss occurs with a 55 G half-sine shock pulse of 2 ms duration in all models
- Idle power consumption of 6.7 Watts
- Circuits and motors optimized to save power and reduce system temperature
- 2 MB data buffer
- Media transfer rates—40 MB/s (maximum)
- 494 Mbits/s internal transfer rates
- Average seek time 8.5 ms
- Average latency 4.17 ms
- Ceramic spindle bearings and tri-laminate top cover reduce acoustics to: 3.1 Bels (3 disks)—2.9 Bels (1 disk) models
- Glass substrate disks

Advantages

- Supports higher quality digital audio/video storage, superior digital content creation capabilities, and significantly faster processing
 - Optimizes system performance
 - Protection for drive mishandling
 - Increased reliability
 - Lower system power supply and cooling requirements
 - Extending system life and reliability
 - Fast access to data and improved throughput
 - Lower acoustics
 - Greater rigidity to reduce the impact of shock
 - Smoother disc surface, reduced head fly height—improved disk readability
-

Connectors



The DC power connector is designed to mate with AMP (P/N 1-80424-0) using AMP pins (strip P/N 350078-4) or (loose piece P/N 61173-4), or their equivalents. Pin assignments are shown below.

Note: The AT signal connector is a 40-pin connector.

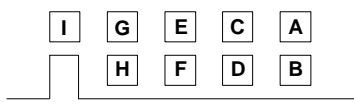
Cabling

The maximum length of the cable from the host system to the drive must not exceed 18 inches.

For systems operating with Ultra DMA mode 3, 4, or 5 the 80-conductor ATA cable assembly must be used.

Jumper block

Jumper pin letter designations



A jumper attaches two pins together to configure the drive for the proper mode of operation.

Jumper settings

16 head logical architecture

Master active*	A-B and G-H
Slave active	A-B and C-D
Cable Select	A-B and E-F
Master/Slave present	E-F and G-H
Reserved	I

15 head logical architecture

Master active	A-C and G-H
Slave active	A-C
Cable select	A-C and E-F
Master/Slave present	A-C, E-F & G-H
Reserved	I

All other jumper settings are reserved. Do not make other settings!

*Shipping default

DC power requirements

Damage to the drive electronics may result if the power supply cable is connected or disconnected while power is on. There is no special power on/off sequencing required. The following voltage specification is applied at the power connector of the drive.

Supply Input voltage (Volts)	During run and spin up (Volts)	Absolute maximum spike voltage (Volts)
+5	5 ± 5%	7 ¹
+12	12 +10%, -8%	15 ¹

¹Power supply voltage spikes in excess of the maximum values specified in the table may damage the drive electronics.

Power supply current

Applies to all models.

	Amps RMS		Total Watts
	+5 Volts	+12 Volts	
Idle average	0.29	0.43	6.7
Idle ripple (peak-to-peak)	0.36	0.50	—
Seek peak	0.54	2.00	—
Seek average ¹	0.34	0.67	9.8
Start up (max.)	0.80	2.00	—
RND R/W peak	1.13	2.00	—
RND R/W average ²	0.49	0.63	10.1
Standby average	0.17	0.015	1.0
Sleep average	0.10	0.015	0.7

¹ Random seeks at 40% duty cycle

² Seek duty = 30%, W/R duty = 45%, Idle Duty = 25%

Power supply generated ripple

Output (V)	Maximum (mV p-p)	Freq. range (MHz)
+5	100	0-10
+12	150	0-10

Data organization (logical)

Number of heads	16
Sectors/track	63
Number of cylinders (2)	16,383

Drive Capacity (GB)	Total logical data bytes
10	10,278,501,840
20	20,576,747,520
30	30,738,677,760
40	41,174,138,880
60	61,492,838,400

Hot Plug/Unplug support

Hot plugging/unplugging is not allowed because damage to the drive electronics may result if the power supply cable is connected or disconnected while power is being applied to the drive.

Electromagnetic compatibility

When installed in a suitable enclosure and exercised with a random accessing routine—at the maximum data rate—the hard disk drive meets the following worldwide EMC requirements listed below:

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

CE Mark

The product is declared to be in conformity with requirements of the following EC directives under the sole responsibility of Yamato Lab, IBM Japan Ltd. or IBM United Kingdom Ltd.

The product is declared to be in conformity with Council Directive 89/336/EEC on the approximation of laws of the Member States relating to electromagnetic compatibility.

C-Tick Mark

The drive complies with the following Australian EMC standard: Limits and methods of measurement of radio disturbance characteristics of information technology equipment, AS/NZS 3548:1995 CLASS B.

Environment

Operating conditions

Temperature	5 to 55°C ¹
Relative humidity (noncondensing)	8 to 90%RH
Maximum wet bulb temperature (noncondensing)	29.4°C
Maximum temperature gradient	15°C/hour
Altitude	-300 to 3048 m

¹The system is responsible for providing sufficient air movement to maintain a surface temperature below 60°C at the center of the top cover of the drive.

Operating shock

The hard disk drive meets IBM Standard C-S 1-9711-007 for the S5 product classification.

The drive meets the following criteria while operating in respective conditions described in the following bullet list. The shock test consists of ten shocks inputs in each axis and in each direction for a total of 60. There must be a delay between shock pulses that is long enough to allow the drive to complete all of the necessary error recovery procedure.

- No error occurs with a 10 G half-sine shock pulse of 11 ms duration in all models.
- No data loss occurs with a 30 G half-sine shock pulse of 4 ms duration in all models.
- No data loss occurs with a 55 G half-sine shock pulse of 2 ms duration in all models.

Nonoperating shock

The drives will operate with no degradation of performance after being subjected to a shock pulses with the following characteristics. The tests involved trapezoidal and sinusoidal shock wave.

Trapezoidal shock wave

- Approximately square (trapezoidal) pulse shape.

- Approximate rise and fall time of pulse = 1 ms.
- Average acceleration level equals 50 G. (Average response curve value during the time following the 1ms rise time and before the 1ms fall with a time "duration of 11 ms")
- Minimum velocity change equals 4.23 m/s.

Sinusoidal shock wave

The shape is approximately a half-sine pulse. The following table shows the maximum acceleration level and duration.

Acceleration level (G)	Duration (ms)
75 (all models)	11
350	2 (3 disks)
400	2 (1 disk)
400	2 (2 disks)

Rotational shock

No data loss is incurred with the following rotational shocks applied around the axis of the actuator pivot:

- 30,000 rad/s² for a duration of 1 ms
- 20,000 rad/s² for a duration of 2 ms

Acoustics

The upper limit criteria of the octave sound power levels are given in Bels relative to one pico watt and are shown below. The measurement method is in accordance with ISO7779.

1 & 2 disk models

Mode	Typical (Bel)	Max. (Bel)
Idle	3.0	3.2
Operating		
Performance seek mode	3.4	3.7
Quiet seek mode	3.1	3.5

3 disk models

Mode	Typical (Bel)	Max. (Bel)
Idle	3.1	3.4
Operating		
Performance seek mode	3.4	3.7
Quiet seek mode	3.2	3.5



ATTENTION: The drive must be protected against electrostatic 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 are removed.

Drives must 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 representative if you do not have an approved shipping container.

Command descriptions

The following commands are supported by the drive:

Commands	(Hex)	P
Check Power Mode	E5	3
Check Power Mode*	98	3
Execute Device Diagnostic	90	3
Flush Cache	E7	3
Format Track	50	2
Identify Device	EC	1
Idle	E3	3
Idle*	97	3
Idle Immediate	E1	3
Idle Immediate*	95	3
Initialize Device Parameters	91	3
NOP	00	3
Read Buffer	E4	1
Read DMA (retry)	C8	4
Read DMA (no retry)	C9	4
Read DMA Queued	C7	5
Read Long (retry)	22	1
Read long (no retry)	23	1
Read Multiple	C4	1
Read Native Max Address	F8	3
Read Sectors (retry)	20	1
Read Sectors (no retry)	21	1
Read Verify Sectors (retry)	40	3
Read Verify Sectors (no retry)	41	3
Recalibrate	1x	3
Security Disable Password	F6	2
Security Erase Prepare	F3	3
Security Erase Unit	F4	2
Security Freeze Lock	F5	3
Security Set Password	F1	2
Security Unlock	F2	2
Seek	7x	3
Service	A2	5
Set Features	EF	3
Set Max Address	F9	3
Set Multiple Mode	C6	3
Sleep	E6	3
Sleep*	99	3
SMART Disable Operations	B0	3
S.M.A.R.T. Enable/Disable Attribute Auto save	B0	3
S.M.A.R.T. Enable Operations	B0	3
S.M.A.R.T. Execute Off-line Data Collection	B0	3

S.M.A.R.T. Read Attribute Values	B0	1
S.M.A.R.T. Read Attribute Thresholds	B0	1
S.M.A.R.T. Return Status	B0	3
S.M.A.R.T. Save Attribute Values	B0	3
S.M.A.R.T. Read Log Sector	B0	1
S.M.A.R.T. Write Log Sector	B0	2
S.M.A.R.T. Enable/Disable Automatic Off-line Data Collection	B0	3
Standby	E2	3
Standby*	96	3
Standby Immediate	E0	3
Standby Immediate*	94	3
Write Buffer	E8	2
Write DMA (retry)	CA	4
Write DMA (no retry)	CB	4
Write DMA Queued	CC	5
Write Long (retry)	32	2
Write Long (no retry)	33	2
Write Multiple	C5	2
Write Sectors (retry)	30	2
Write Sectors (no retry)	31	2

Protocol

- 1 : PIO data IN command
- 2 : PIO data OUT command
- 3 : Non data command
- 4 : DMA command
- 5 : DMA queued command
- + : Vendor specific command

Note: Commands marked * are alternate command codes for previously defined commands

Signal definition

Pin	Signal	I/O	Type
01	RESET-	I	(2)
02	GND	-	-
03	DD7	I/O	(1)
04	DD8	I/O	(1)
05	DD6	I/O	(1)
06	DD9	I/O	(1)
07	DD5	I/O	(1)
08	DD10	I/O	(1)
09	DD4	I/O	(1)
10	DD11	I/O	(1)
11	DD3	I/O	(1)
12	DD12	I/O	(1)
13	DD2	I/O	(1)
14	DD13	I/O	(1)
15	DD1	I/O	(1)
16	DD14	I/O	(1)
17	DD0	I/O	(1)
18	DD15	I/O	(1)
19	GND	-	-
(20)	Key	-	-
21	DMARQ	O	(1)
22	GND	-	-
23	DIOW-(**)	I	(2)
24	GND	-	-
25	DIOR-(**)	I	(2)
26	GND	-	-
27	IORDY(**)	O	(1)
28	CSEL	I	(2)
29	DMACK-	I	(2)
30	GND	-	-
31	INTRQ	O	(1)
32	IOCS16-(***)	O	(3)
33	DA1	I	(2)
34	PDIAG-	I/O	(3)
35	DA0	I	(2)
36	DA2	I	(2)
37	CS0-	I	(2)
38	CS1-	I	(2)
39	DASP-	I/O	(3)
40	GND	-	-

Notes:

Type: (1) 3-state; (2) TTL; (3) open-collector or open drain output

(***) at ATA-2

"O" designates an output from the drive.

"I" designates an input to the drive.

"I/O" designates an input/output common.

The signal lines marked with (**) are redefined during the Ultra DMA protocol to provide special functions. These lines change from the conventional to special definitions at the moment the Host decides to allow a DMA burst if the Ultra DMA transfer mode was

previously chosen via SetFeatures. The Drive becomes aware of this change upon assertion of the DMACK- line. These lines revert back to their original definitions upon the deassertion of DMACK- at the termination of the DMA burst. See table below.

Ultra DMA definitions

	Special definition (for Ultra DMA)	Conventional definition
Write operation	DDMARDY- HSTROBE STOP	IORDY DIOR- DIOW-
Read operation	HDMARDY - DSTROBE STOP	DIOR- IORDY DIOW-

Mechanical data

Height	25.4 mm ± 0.4
Width	101.6 mm ± 0.4
Length	146.0 mm ± 0.6

Maximum Weight 600 grams

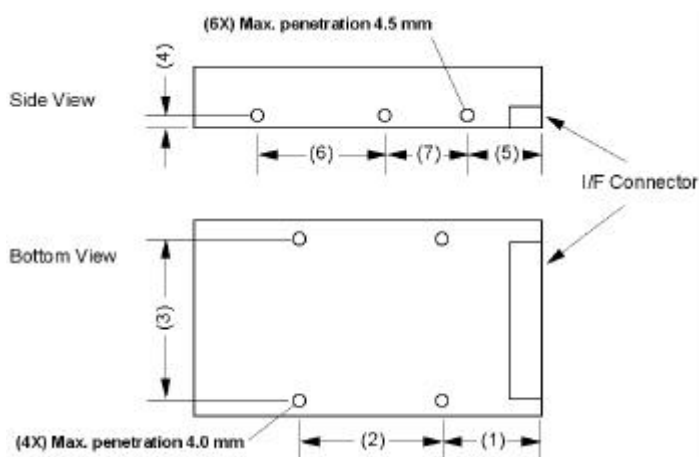
Mounting

The drive will operate in all axes (six directions). Performance and error rate will stay within specification limits if the drive is operated in the other permissible orientations from which it was formatted.

For reliable operation the drive must be mounted in the system securely enough to prevent damage from excessive motion or vibration during seek operation or spindle rotation, using appropriate screws or equivalent mounting hardware.

Drive level vibration test and shock test are to be conducted with the drive mounted to the table using the bottom four screws.

Mounting holes

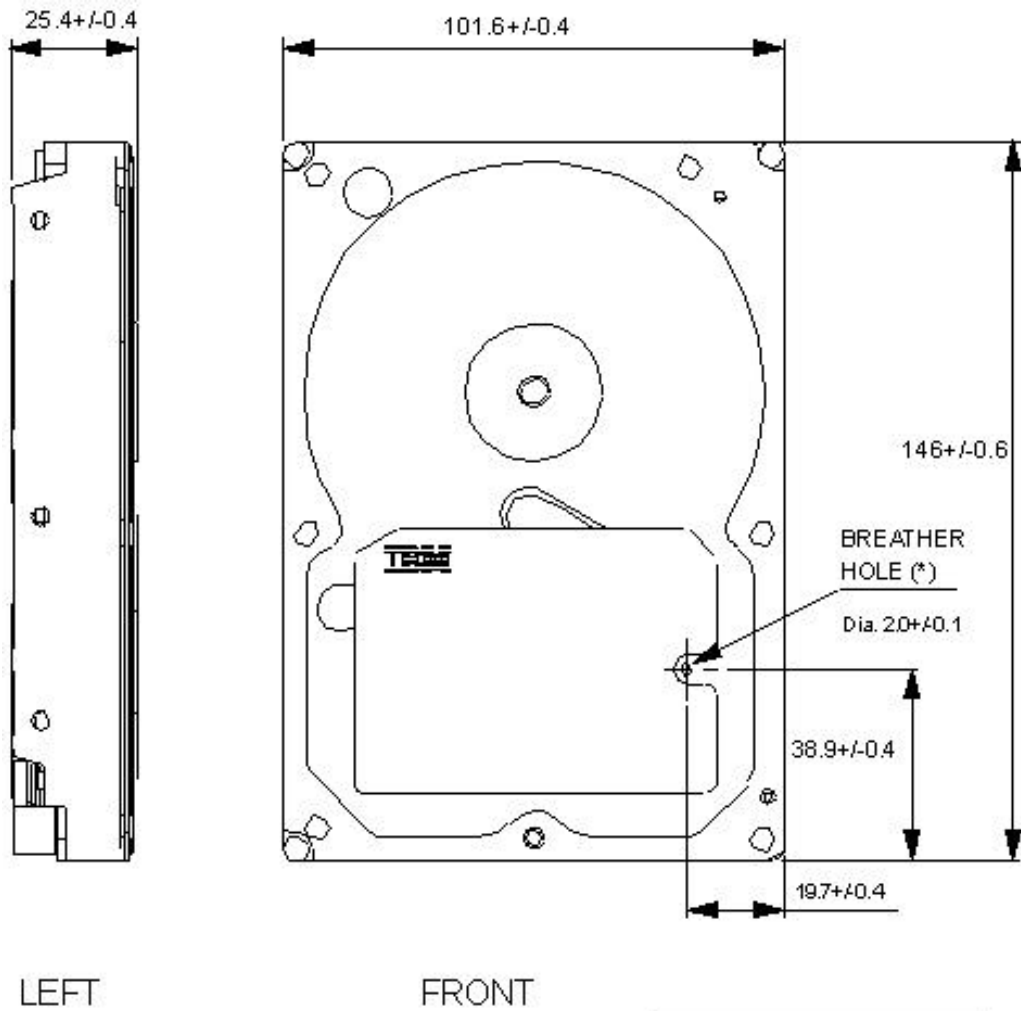


Dimension reference number	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dimension (mm)	41.28 ± 0.5	44.45 ± 0.2	95.25 ± 0.2	6.35 ± 0.2	28.5 ± 0.5	60.0 ± 0.2	41.6 ± 0.2

Mounting screw thread count = 6-32 UNC

Notes: Recommended screw torque to be applied to mounting screws is 0.6–1.0 Nm (6–10 kg-cm).

Mechanical dimensions



* DO NOT BLOCK THE BREATHING HOLE.



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