



Product summary

Ultrastar 146Z10

Ultra 160 and 320 SCSI



Models: IC35L018UWDY10 IC35L073UWDY10
 IC35L018UCDY10 IC35L073UCD210
 IC35L036UWDY10 IC35L146UCDY10
 IC35L036UCDY10 IC35L146UWDY10

Introduction

IBM's new Ultrastar 146Z10 offers capacities of 146.8 GB, 73.4 GB, 36.7 GB, and 18.35 GB in Ultra 160 and 320 SCSI models. The high reliability and excellent performance of the Ultrastar 146Z10 are the result of the implementation of a number of advanced disk drive technologies, including giant magnetoresistive head technology, No-ID sector formatting, Predictive Failure Analysis, and ECC on the fly correction.

Applications

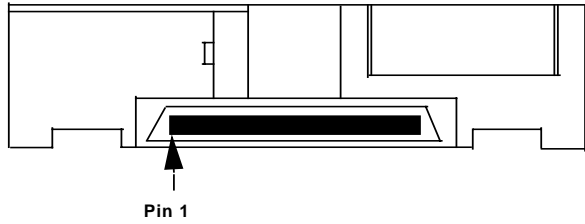
- Technical/commercial workstations
- Network servers
- High-end personal computers
- CAD/CAM
- Multimedia
- Transaction processing
- Data mining applications

Features

Benefits

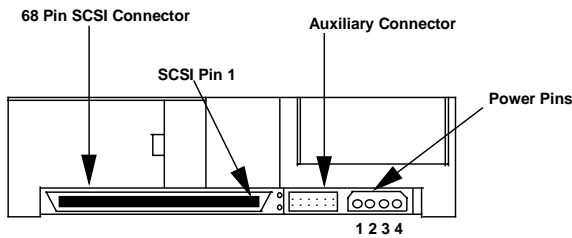
<ul style="list-style-type: none"> • Capacities of 146.8 GB, 73.4 GB, 36.7 GB, and 18.35 GB 	<ul style="list-style-type: none"> • Wide range of capacities
<ul style="list-style-type: none"> • 68- and 80-pin Ultra 160 and 320 industry standard interface 	<ul style="list-style-type: none"> • Interface data rates of 160 and 320 MB/s
<ul style="list-style-type: none"> • Shock: 75 G (11 ms) nonoperational; 10 G (11 ms) operational 	<ul style="list-style-type: none"> • Robust design for portable computing applications
<ul style="list-style-type: none"> • Rotational speed: 10,000 RPM 	<ul style="list-style-type: none"> • Excellent data rate across disk surface
<ul style="list-style-type: none"> • Average seek time: 4.9 ms (read) • Average latency: 3.0 ms 	<ul style="list-style-type: none"> • Fast access to data
<ul style="list-style-type: none"> • Areal density: 26.3 Gbits/square inch 	<ul style="list-style-type: none"> • Increased storage capacity
<ul style="list-style-type: none"> • No-ID sector formatting • PRML data channel 	<ul style="list-style-type: none"> • More data stored per track, increased sustained data transfer rate
<ul style="list-style-type: none"> • 8 MB buffer for read and write • On The Fly correction 	<ul style="list-style-type: none"> • Fast access to data and improved throughput • High reliability
<ul style="list-style-type: none"> • Load/Unload heads 	<ul style="list-style-type: none"> • Increased durability during power save modes and non-operation
<ul style="list-style-type: none"> • Predictive Failure Analysis 	<ul style="list-style-type: none"> • High reliability and availability
<ul style="list-style-type: none"> • Giant Magnetoresistive heads • No-ID sector formatting 	<ul style="list-style-type: none"> • High areal density, low component count
<ul style="list-style-type: none"> • Adaptive power save control 	<ul style="list-style-type: none"> • Low power for battery powered applications

Electrical connectors



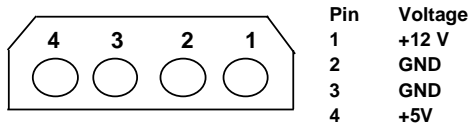
80-pin SCA models (rear view)

Uses a DDK connector which is compatible with SCSI Parallel Interface 3 (SPI-3).

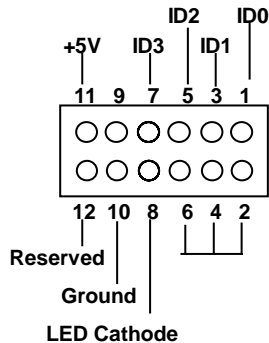


68-pin models (rear view)

Complies with the ANSI SCSI "P" connector specifications.

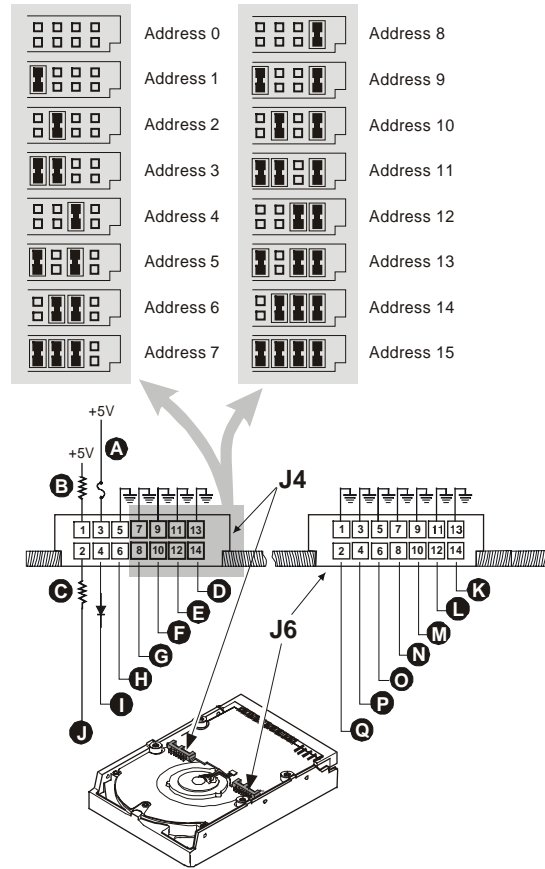


Power pin assignment of 68-pin models



Auxiliary block of 68-pin models

Option jumper blocks



The drive has two option jumper blocks designated as 'J-4' and 'J-6' located on the circuit board.

J-4 Jumper settings

SCSI ID (address) settings

Assign a SCSI address by placing jumpers on the appropriate address pins (D, E, F, and G). Refer to address settings in the illustration above.

LED pins

The LED pins are used to drive an external Light Emitting Diode. Up to 30 mA of sink current is provided. Refer to the Ultrastar 146Z10 Hard Disk Drive Specifications for a detailed functional description of this pin.

Termination Power

If a jumper is installed on pins 3 & 4 (position I) of the 68-pin models, termination power is supplied to pins 17, 18, 51, and 52 of the 68-pin SCSI interface.

Force SE Mode

Installing a jumper on pins 5 & 6 (position H) causes the drive to function in single-ended mode.

J-6 Jumper settings

Enable Auto Spin Up – 68-pin models

Installing a jumper on pins 1 & 2 (position Q) on 68-pin models causes the drive to spin up automatically after a power on reset. If this position is not jumpered, the drive will not spin up unless a START UNIT command is received.

Disable Auto Spin Up – 80-pin models

If pins 1 & 2 (position Q) on 80-pin models are not jumpered, the drive will spin up automatically after a power on reset. Installing a jumper on this position prevents the drive from spinning up unless a START UNIT command is received.

Auto Start Delay/Delay Start 6/12

Installing a jumper on pins 3 & 4 (position P) and 5 & 6 (position O) controls when and how the drive spins up in conjunction with pins 1 & 2. When both Auto Spin Up and Auto Start Delay are enabled, the drive start is delayed by a period of time multiplied by the SCSI address of the drive. If Auto Spin Up is disabled, these jumpers will be ignored.

Disable SCSI Parity Check

Installing a jumper on pins 7 & 8 (position N) disables SCSI Parity checking.

Enable TI-SDTR

Installing a jumper on pins 9 & 10 (position M) enables Target Initiated Synchronous Data Transfer Request Negotiation.

Disable Unit Attention

Installing a jumper on pins 11 & 12 (position L) enables control of the Unit Attention Inhibit (UAI) bit in Mode Page 0.

Data organization (logical)

Model	Heads	Disks
146.8 GB	12	6
73.4 GB	6	3
36.7 GB	3	2
18.35 GB	2	1

Model	Total usable data bytes
146.8GB	146,815,800,320
73.4 GB	73,407,900,160
36.7 GB	36,703,918,080
18.3 GB	18,351,959,040

Seek times (typical - ms)

Average	Read	4.7
		5.9 (146 GB)
Average	Write	5.3 (all other models)
Full stroke	Read	10.5
Full stroke	Write	11.5

DC power requirements

The following voltage specifications apply at the drive power connector. Connection to the drive should be made in safety extra low voltage (SELV) circuits. No special power on/off sequencing is required.

+5 volt supply	5V ± 5%
+12 volt supply*	12V ± 5%

*A deviation up to –8% is acceptable during drive spin up, however spin up time is not guaranteed

Power supply current:

+5V pop mean (in Amps) all models

Idle average	0.50
Seek average	0.55
Start up Maximum	1.07

+12V pop mean (in Amps)

	146 GB	73 GB
Idle avg	0.64	0.43
Seek avg	1.10	0.92
Start upmax	2.40	2.23
	36 GB	18 GB
Idle avg	0.37	0.28
Seek avg	0.86	0.77
Start upmax	2.12	1.98

Generated ripple at drive power connector

During drive start up and seeking, 12-volt ripple is generated by the drive (referred to as dynamic loading). If the power of several drives is daisy chained together, the power supply ripple as well as the

dynamic loading of other drives must remain within the regulation tolerance of ±5%. A more desirable method of power distribution is a common supply with separate power leads to each drive.

Hot Plug/Unplug support

The term 'Hot Plug' refers to the action of mechanically engaging a device to the power and/or bus when other devices may be active on the same bus.

While every effort was made to design the drive not to influence the SCSI bus during these events, it is the responsibility of the system to insure voltage regulation and conformance to operational and non-operational shock limits. During Hot Plug events the non-operational shock levels should not be exceeded. The operational shock levels of adjacent drives should also not be exceeded. The recommended procedure is to prohibit write operations to adjacent drives during Hot Plug and Hot Unplug actions.

During Hot Unplug the operational shock limit specifications should not be exceeded. If this cannot be guaranteed, the drive should be issued a SCSI Stop Unit command that is allowed to complete before unplugging. The basic requirement is that the operational shock limits are in effect while the drive is operational or spinning down.

Once the drive has completely stopped, the nonoperational shock limits are in effect. The recommended procedure is to allow the unplugged drive to rest in the drive bay for a minimum of 15 seconds and then complete the removal. During Hot Plug or Unplug events the power supply ripple on adjacent operational drives should not be outside the ±5% regulation tolerance.

SCSI bus connectors and cable

Refer to ANSI SCSI Parallel Interface-3 T10/1302D, revision 11, for detailed specifications.

SCSI bus terminators (optional)

On board SCSI active termination is not supported. The using system is responsible for making sure that all required signals are terminated at both ends of the bus cable.

Terminator power

Terminator power can be provided by the 5V power supply through current limiter and Schottky diode. This function can be selected by jumper. 80-pin SCA-2 models do not support SCSI bus Terminator Power.

Vibration and shock

Operating vibration

The overall RMS (root mean square) level of horizontal vibration is 0.67 G. The overall RMS level of vertical vibration is 0.56 G.

Non-operating vibration

The overall RMS level of vibration is 1.04 G.

Operating shock

The drive withstands with no data loss a half-sine shock pulse of 10 G of 11 ms duration and a half-sine shock pulse of 45 G of 2 ms duration

The shock pulses are applied ten pulses for each direction and for all three axes for a total of 60 pulses. There must be a minimum delay of 30 seconds between shock pulses to allow the drive to complete all necessary error recovery procedures.

Non-operating shock

The drive withstands with no data loss a half-sine shock pulse of 75 G of 11 ms duration. In addition the 146-GB models withstand a half-sine shock pulse of 225 G of 2 ms duration. All other models withstand a half-sine shock pulse of 300 G of 2 ms duration.

The shocks are applied in each direction of the three mutually perpendicular axes of the drive.

Rotational shock

The drive withstands with no data loss a rotational shock of 30,000 rad/s² applied around the axis of the actuator pivot for a duration of 1 ms.

Operating environment

The drive operates within its performance limits when the following environmental conditions are maintained.

Operating conditions

Temperature	5 – 55°C
Relative humidity (non condensing)	8 – 90%
Max wet bulb temp (non condensing)	29.4°C
Max temp gradient	15°C/hour
Altitude (meters)	–300 to 3048

Non-operating conditions

Temperature:	–40 to +65°C
Relative humidity (non condensing)	5 – 95%
Max wet bulb temp (non condensing)	35°C/hour
Max temp gradient	15°C/hour
Altitude (meters)	–300 to 12,000

NOTE: The system must provide sufficient ventilation to maintain a surface temperature not to exceed 60°C at the center of the top cover of the drive. Non-condensing conditions should be kept at all times.

Maximum storage period in the shipping package is one year.

Corrosion test

The hard disk drive shows no signs of corrosion inside or outside of the hard disk assembly and is functional after subjection to a temperature of 50°C with a relative humidity of 90% for seven days



ATTENTION: The drive must be protected against electrostatic discharge (ESD) 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.

Acoustics

The criteria of the A-weighted sound power levels are given in Bel relative to one pico watt and are shown in the following table. The measurement method is in accordance with ISO7779. Drives must meet these criteria in both board up and board down orientations.

A-weighted sound power levels:

146 GB model

Mode	Typical (bels)	Max (bels)
Idle	3.7	4.1
Operating	4.5	4.8

All other models

Mode	Typical (bels)	Max (bels)
Idle	3.4	3.8
Operating	4.5	4.8

The acoustical characteristics of the drive subsystem are measured under the following conditions:

Idle mode

powered on, disks spinning, track following, unit ready to receive and respond to control line commands

Operating mode

continuous random cylinder selection and seek operation of the actuator with a dwell time at each cylinder. The seek rate N_s is to be calculated according to the following formula:

$$N_s = 0.4 / (T_t + T_1)$$

where

N_s = avg seeks per second

T_t = published random seek time, and

T₁ = time for the drive to rotate by half a revolution.

Operating modes

To provide the greatest flexibility of operation with optimum performance and power consumption, the drive has a number of operating modes. These are defined below.

Spin Up

Start up time period from spindle stop or power down.

Seek

Seek operation mode

Write

Write operation mode

Read

Read operation mode

Performance idle

The device is capable of responding immediately to media access requests. All electronic components remain powered and full frequency servo remains operational.

Low Power idle

Spindle motor is rotating normally with actuator unloaded to the parking positions.

Standby

The device interface is capable of accepting commands. Spindle motor is stopped. All circuitry except host interface is in power saving mode. The execution of commands is delayed until spindle becomes ready.

Electromagnetic compatibility

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

- United States Federal Communications Commission (FCC) Rules and Regulations (Class B), Part 15
- This drive is certified for compliance to EC directive 89/336/EEC
- C-Tick Mark complies with Australian EMC standard, AS/NZS 3548:1995 Class B

- The drive complies with Taiwan BSMI EMC standard

Physical dimensions

Height (mm)	25.4±0.4
Width (mm)	101.6±0.4
Length (mm)	146.0±0.6
Weight (grams max)	780

Refer to the illustration below.

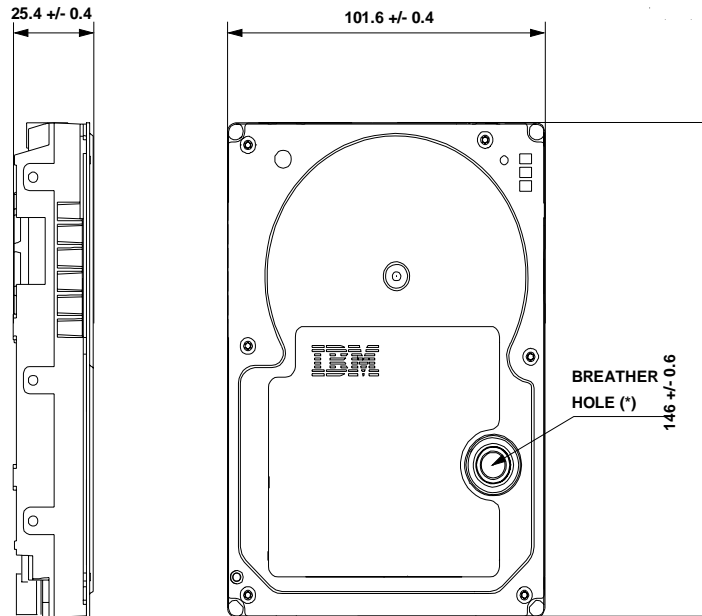
Mounting

The drive will operate in all axes (six directions). To avoid performance degradation the drive must be mounted securely in the system.

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

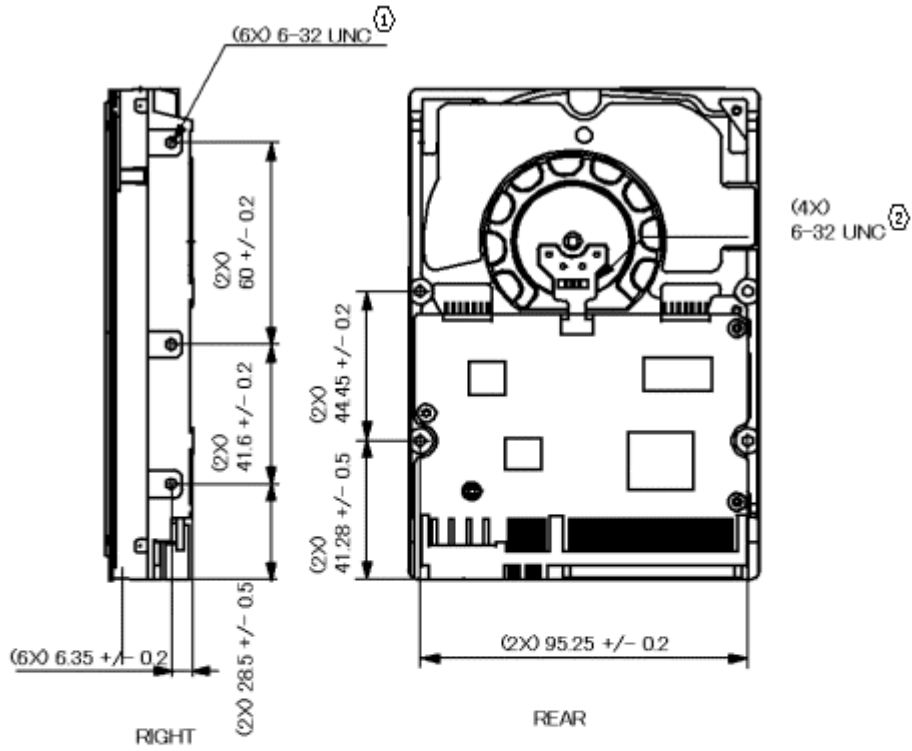
Refer to the illustration on the next page for mounting positions and tappings.

Mechanical dimensions



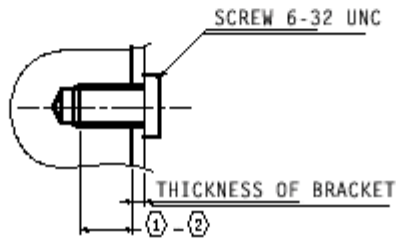
* DO NOT BLOCK THE BREATHING HOLE

Mounting



RECOMMENDED TORQUE 0.6 - 1.0 Nm

- ① MAX ALLOWABLE PENETRATION OF NOTED SCREW TO BE 45mm.
- ② MAX ALLOWABLE PENETRATION OF NOTED SCREW TO BE 40mm.





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