IBM Storage Products

Travelstar 4GN
DKLA-22160, DKLA-23240, and DKLA-24320

The latest 2.5" disk drives from IBM provide up to 4320MB in a slim 9.5mm high package. Using the latest GMR head technology, IBM's patented No-ID sector formatting, the SMART function, advanced power saving modes, and IBM's new 'Load/Unload heads' technology, IBM provides high performance, high capacity drives, particularly suited to the mobile computing market and its increasing application of multimedia.

Applications

- High performance portable computers
- Non-IT - process control/fax
- Removable/secure storage units.

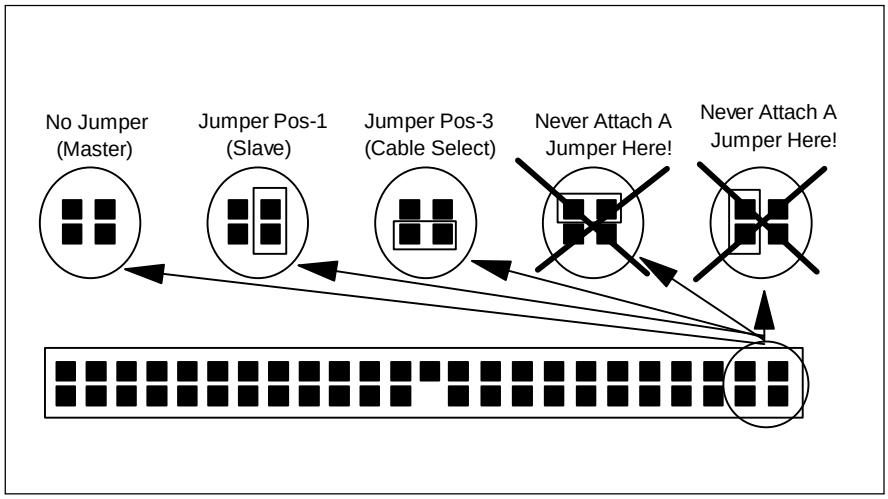
Features	*Benefits*
2160/3240/4320MB at (512 bytes/sector)	*High capacity in slim 2.5 inch form factor*
Enhanced IDE interface with Ultra-DMA data transfer *Single word:mode 2 (8.3MB/sec)* *Multi word:mode 2(33.3MB/sec)* ***PIO data transfer - mode 4(16.6MB/sec)***	*Popular interface with excellent performance*
Shock 700G(1ms) non-operational ***Shock 150G(2ms) operational***	*Robust design for portable computing applications*
Media data rate 61.5 - 102.6 Mbits/s ***Rotational speed 4200 rpm*** ***Average seek 13 milliseconds (Read)***	*Excellent data rate across disk surface*
Giant Magneto resistive heads	*High areal density, low component count*
No-ID sector formatting ***PRML Data channel***	*More data stored per track, increased sustained data transfer rate*
463KB segmented buffer with write cache ***Enhanced ECC on the fly***	*Fast access to data and improved throughput* *High reliability*
Advanced power saving modes	*Low power for battery powered applications (0.65 watt at idle state)*
Load/unload heads	*Increased durability during power save modes and non-operation*
Spin up 2.8 sec (typical)	*Fast recovery from standby*
S.M.A.R.T. function	*Protection of user data*

Electrical Connector Locations

Drive Address

Jumper positions are available at the interface connector to determine the drive address.

Using Cable Selection, the drive address depends on the condition of pin 28 of the AT interface cable. In the case when pin 28 is ground or low level, the drive is a Master. If pin 28 is open or high level, the drive is a Slave.

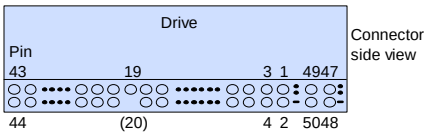


Cabling

The maximum cable length from the host system to the HDD plus circuit pattern in the host system shall not exceed 18 inches.

AT Signal Connector

The AT signal connector is designed to mate with Dupont part number 69764- 044 or equivalent.



Note:

Pin position 20 is left blank for secure connector insertion.

Warning: This disk drive can be damaged by Electrostatic Discharge, please follow recommended ESD procedures when unpacking or handling the drive. Ask your dealer for details if you need assistance.

Data Organization (Logical)

DKLA	22160	23240	24320
Head Number	16	16	15
Sectors/Track	63	63	63
Cylinder Number	4200	6304	8944
Sector Size	512	512	512
Total Customer Usable Data Sectors	4233600	6354432	8452080
Total Customer Usable Data Bytes	2167603200	3253469184	4327464960

DC Power Requirements

Nominal Supply	+ 5 volts
Power Supply Ripple (0-20Mhz) [1]	100mv p-p max
Tolerance [2]	± 5%
Supply Current	Pop.Mean (Nominal Condition)
Low Power Idle [3]	< 0.13A RMS Max (0.65W)
Active Idle	<0.17A RMS Max (0.85W)
Performance Idle	< 0.37A RMS Max (1.85W)
Read average [4]	<0.40A RMS Max (2.0W)
Write average [4]	< 0.42A RMS Max (2.1W)
Seek average [5]	< 0.46A RMS Max (2.3W)
Standby	< 0.06A RMS Max (0.3W)
Sleep	< 0.02A RMS Max (0. 1W)
Start up (max.) [6]	< 0.94A RMS Max (4.7W)
(average from power on to ready) [6]	< 0.66A RMS Max (3.3W)
Supply Rise Time	7 -100 ms

Notes:

[1] The maximum supply ripple is measured at 5V input of the drive.

[2] The disk drive shall not incur damage for an over voltage condition of +25% (maximum duration of 20 ms) on the 5-volt nominal supply.

[3] The Idle current is specified at an inner track.

[4] The read/write current is specified based on three operations of 63 sector read/write per 100 msec.

[5] The seek average current is specified based on three operations per 100 msec.

[6] The worst case operating current Includes motor surge.

PACKAGING: 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 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.

Command Description

The following Commands are supported by the Drive:

Commands	(Hex)	P
Check Power Mode	(E5)	3
Check Power Mode*	(98)	3
Execute Device Diagnostics	(90)	3
Flush Cache	(E7)	3
Format Track	(50)	2
Format Unit	(F7)	3+
Identify Device	(EC)	1
Identify Device DMA	(EE)	4
Idle	(E3)	3
Idle*	(97)	3
Idle Immediate	(E1)	3
Idle Immediate*	(95)	3
Initialise Drive Parameters	(91)	3
Read Buffer	(E4)	1
Read DMA (retry)	(C8)	4
Read DMA (no retry)	(C9)	4
Read Long (retry)	(22)	1
Read Long (no retry)	(23)	1
Read Multiple	(C4)	1
Read Native Max LBA/CYL	(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
Set Features	(EF)	3
Set Max LBA/CYL	(F9)	3+
Set Multiple Mode	(C6)	3
Sleep	(E6)	3
Sleep*	(99)	3
SMART Disable Operations	(B0)	3
SMART Enable/Disable Attribute Autosave	(B0)	3
SMART Enable Operations	(B0)	3
SMART Execute Off-Line Immediate	(B0)	3
SMART Read Attribute Values	(B0)	1
SMART Read Attribute Thresholds	(B0)	1
SMART Return Status	(B0)	3
SMART Save Attribute Values	(B0)	3
Standby	(E2)	3
Standby*	(96)	3
Standby Immediate	(EO)	3
Standby Immediate*	(94)	3
Write Buffer	(E8)	2
Write DMA (retry)	(CA)	4
Write DMA (no retry)	(CB)	4
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
Write Verify	(3C)	2

Protocol:

1 PIO data IN command
2 PIO data OUT command
3 Non data command
4 DMA command
\+ Vendor specific command

*Alternate command codes for previously defined commands.

Signal Definition

The pin assignments of interface signals are listed as follows:

PIN	Signal	I/O	PIN	Signal	I/O
01	-RESET	I	02	GND	
03	DDO7	I/O	04	DDO8	I/O
05	DDO6	I/O	06	DDO9	I/O
07	DDO5	I/O	08	DD10	I/O
09	DDO4	I/O	10	DD11	I/O
11	DDO3	I/O	12	DD12	I/O
13	DDO2	I/O	14	DD13	I/O
15	DDO1	I/O	16	DD14	I/O
17	DDOO	I/O	18	DD15	I/O
19	GND		(20)	Key	
21	DMARQ	O	22	GND	
23	-DIOW*	I	24	GND	
25	-DIOR*	I	26	GND	
27	IORDY*	O	28	CSEL	I
29	-DMACK	I	30	GND	
31	INTRQ	O	32	- HIOCS16	O
33	DAO1	I	34	-PDIAG	I/O
35	DAOO	I	36	DAO2	I
37	-CSO	I	38	-CS1	I
39	-DASP	I/O	40	GND	
41	+5V Logic	PWR	42	+5V Motor	PWR
43	GND		44	(Res)	

Note:

"O" Designates an output from the Drive.
"I" Designates an input to the Drive.
"I/O" Designates an input/output common.
"PWR" Designates a power supply to the Drive.
"(Res)" Designates reserved pins which must be left unconnected.
"*" These signal lines are redefined during the Ultra DMA protocol to provide special functions as detailed in the table below:

	Special Definition (Ultra DMA)	Conventional Definition
Write Operation	-DDMARDY HSTROBE STOP	IORDY -DIOR -DIOW
Read Operation	-HDMARDY DSTROBE STOP	-DIOR IORDY -DIOW

Note: There are two input pins for +5 Volt power supply, "+5V LOGIC" and "+5V MOTOR". "+5V LOGIC" is connected to the internal logic circuits and "+5V MOTOR" is connected to the spindle motor and motor driver.

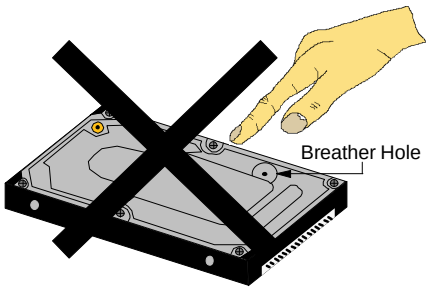
It is possible to turn on and off "+5V LOGIC" by an external switch circuit to reduce power consumption. In this mode, a voltage drop out due to the motor spin up current can be reduced by connecting "+5V MOTOR" line into the system power source directly.

If the above power management option is used, all signal lines that will be electrically active in the host system while the HDD is disconnected from the power line shall be isolated by Three-State line drivers. Internal leakage through the ESD protection circuit may pull down LPUL (Least Positive Up Level) of logic signal below specification.

Use both lines in parallel, for regular HDD applications.

Caution

DO NOT PRESS!



- ***Do not press when you take out the drive.***
- ***Do not press when you carry the drive.***
- ***Attach the drive free from pressing force.***
- ***Do not cover Breather Hole.***

Load / Unload Heads

One of the major advances in this generation of products is the Load/Unload mechanism. When properly used, it allows 300,000 start/stops, an 8-10x advancement. The heads are unloaded by invoking one of the following commands:

SOFT RESET
STANDBY
STANDBY IMMEDIATE
SLEEP

It is also invoked as one of the idle modes. After a short period of inactivity the adaptive Battery Life Extender power management will unload the heads to conserve energy. When the heads are unloaded, they rest in a small detent. To prevent the heads from being thrown off the ramp during angular acceleration, a bi-directional, normally open, mechanical latch engages with the actuator to stop it turning in the head loading direction. This action causes a 'rattle' sound to be heard which can be mistaken for loose parts.

Adaptive Battery Life Extension

IBM Travelstar products incorporate software which automatically determines the correct time to start removing power from the drive electronics.

Most software and operating systems make use of a disk drive in bursts. The Travelstar drives monitor the commands which are sent from the host to detect patterns which indicate that a command sequence is active or has completed. The drive can then conserve power after each command sequence is finished by putting the drive into low overall power consumption and longer battery life with no loss in performance. If the host system changes the number or frequency of commands which it sends then the disk drive will adapt automatically to this new pattern.

Operating Models

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.

Active Mode
The drive is performing a command, writing cached data to disk or filling a read ahead buffer.

Performance Idle
The drive is spinning but is not performing a command. It can respond immediately if a new command is received. The transition from active mode to performance idle mode is controlled by the arrival and completion of commands from the host system.

Active Idle
The drive is spinning but is not performing a command. Additionally the drive has determined that the previous command sequence (group of associated commands) is complete. Some of the drive electronics have been powered down but it can still respond to a new command within 40 milliseconds. The transition from performance idle to active idle is controlled by IBM's patented Adaptive Battery Life Extender technology.

Low Power Idle
The drive is spinning but is not performing a command. Additionally the drive had determined that the previous command sequence (group of associated commands) is complete. Some of the drive electronics have been powered down but it can still respond to a new command within about 40 milliseconds. The transition from performance idle to low power idle is controlled by IBM's patented Adaptive Battery Life Extender technology.

Standby
The drive is not spinning and is not performing a command. All electronics except for the command interface are turned off. The transition to standby is controlled by a programmable timer which is set by the host system using standard ATA commands. After receiving a new command, the drive will start spinning again and perform the command within 2 to 3 seconds (typically).

Sleep
The drive is not spinning and is not performing commands. All of the electronics are turned off. The transition to sleep mode is controlled by a command which is sent by the host system. The transition from sleep can only be triggered by a reset.

Electromagnetic Compatibility

The drive meets the following EMC requirements when installed in a host system and exercised with a random accessing routine at maximum data rate:

United States Federal Communication Commission (FCC) Rules and Regulations Part 15, subject J - Computer Devices "Class B Limits".

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

The product is certified for compliance to EC directive 89/336/EEC.

C-Tick Mark complies with Australian EMC standard, AS/NZS 3348:1995 CLASS-B.

Operating Environment

Relative Humidity:	
Operating	8% to 90% non-condensing
Non-Operating	5% to 95% non-condensing
Wet Bulb Temperature:	
Maximum Wet Bulb:	
Operating	29.4°C non-condensing
Non-Operating	40°C non-condensing
Elevation:	
Operating Altitude	-300 to 3000m
Non Operating Altitude	-300 to 12000m
Temperature:	
Operating	5° to 55°C
Non Operating	-40° to 65°C
Temperature Gradient	20°C per hour

Air Cooling Requirement
The host system must provide sufficient air flow across the drive to maintain the temperature at less than 60°C (measured at the centre of the files' top cover).

Operating Shock
The drive will withstand (with no hard error) a 150G half-sine wave shock pulse of 2ms duration or 10G for 11ms.

Non-Operating Shock
The drive will withstand (with no permanent damage or degradation in performance) a 120G half-sine wave shock pulse of 11ms duration or 700G for 1ms.

Operating and non Operating Vibration
Due to the complexity of this subject we recommend that users contact the Distributor to discuss how to perform the necessary measurements if they believe this to be an area which requires evaluation.

S.M.A.R.T. Function

The intent of self - monitoring, analysis and reporting technology (S.M.A.R.T.) is to protect user data and prevent unscheduled system downtime that may be caused by predictable degradation and/ or fault of the device. By monitoring and storing critical performance and calibration parameters, S.M.A.R.T. devices employ sophisticated data analysis algorithms to predict the likelihood of near - term degradation or fault condition. By alerting the host system of a negative reliability status condition, the host system can warn the user of the impending risk of data loss and advise the user of appropriate action.

Since S.M.A.R.T. utilises the internal device microprocessor and other device's resources, there may be some small overhead associated with its operation. However, special care has been taken in the design of the S.M.A.R.T. algorithms to minimise the impact to host system performance. Actual impact of S.M.A.R.T. overhead is dependent on the specific device design and the usage patterns of the host system. To further ensure minimal impact to the user, S.M.A.R.T. capable devices are shipped from the device manufacturer's factory with the S.M.A.R.T. feature disabled. S.M.A.R.T. capable devices can be enabled by the system OEMs at time of system integration or in the field by after market products.

Note: For further details see drive specification.

Mechanical Data

Dimensions
DKLA-22160/23240/24320

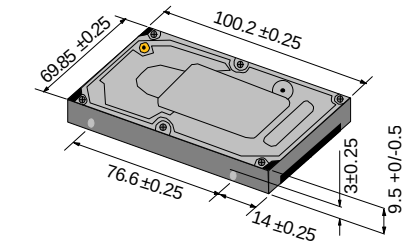
Height (mm)	9.5 ± 0.2
Width (mm)	69.85 ± 0.25
Length (mm)	100.2 ± 0.25
Weight (grams)	99 Typical 101 Maximum

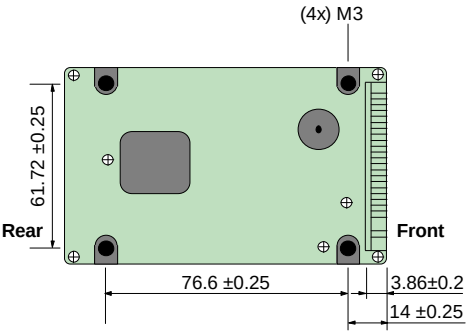
Drive Usage Condition

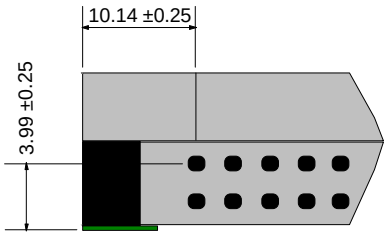
The Drive is designed to be used under the following conditions:

- Within specification of Shock, Vibration, Temperature, Humidity, Altitude and Magnetic Field.
- ESD protective handling.
- Without covering breathing hole on top cover.
- Without pressing top cover.
- Less than 140 power-on hours per month.
- Seeing/Writing/Reading operation to be less than 20% of power-on hours.
- The power requirements to be satisfied.
- Drive frame be grounded electrically to the system through four screws.
- Mounting with recommended screw depth and torque.
- Interface physical and electrical requirements be satisfied per ATA-3.
- Power off sequence (see Spec. for further details).

Mounting Orientation







The recommended mounting screw torque is 3.0 ± 0.5 kgf.cm.

The recommended mounting screw depth is 3.0 ± 0.3mm for bottom and 3.5 ± 0.5mm for horizontal mounting.

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UK company-wide registration to ISO90001.
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