



Product summary

Ultrastar 18ES

FC-AL



Models: DNEF-318350
DNEF-309170

Introducing

The Ultrastar 18ES offers a rotational speed of 7200 RPM. The high reliability and excellent performance of the Ultrastar 18ES are the result of the implementation of a number of advanced disk drive technologies, including GMR head technology, No-ID sector formatting, S.M.A.R.T., and the Drive Temperature Indicator (Drive-TIP) feature.

Applications

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

Features

- 9.1 GB and 18.2 GB formatted capacity
- Dual 1.06 Gb/s Fibre Channel Arbitrated Loop
- 7.0 ms seek time in read operation
- Average latency 4.17 ms
- 12.7–20.2 MB/sec sustained data transfer rate
- 159–244 Mbits/sec media transfer rate
- Rotational speed of 7200 RPM
- 2MB multi-segmented sector buffer
- Low command overhead
- ECC on the fly (EOTF)
- Giant magnetoresistive (GMR) head technology
- No-ID sector formatting
- PRML data channel
- Predictive Failure Analysis (S.M.A.R.T. compliant)
- Drive Temperature Indicator Processor (Drive-TIP) feature

Benefits

- Range of capacities to meet the need for increasing storage requirements
 - Fast interface data rate: 200 MB/sec
 - Fast access to data
 - High data rate across entire disk surface
 - Fast data retrieval in single and multi-tasking applications
 - Improved data throughput
 - High areal density
 - More data stored per track, increased sustained data transfer rate
 - High reliability and availability
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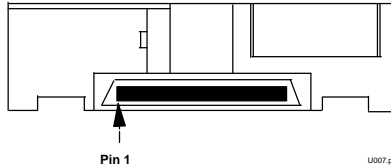


ATTENTION: The drive must be protected against electrostatic discharge especially when being handled. The safest way to avoid damage is to put the drive in an anti-static bag before an ESD wrist strap is removed.

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 representative if you do not have an approved shipping container.

FC-AL electrical connector

The electrical connector is located as shown.



40-Pin SCA-2 SFF-8045 FC-AL connector definition

The Ultrastar 9LZX and 18ZX use the 40 pin SCA-2 connector defined by the ANSI SFF-8045 specification. The SFF-8067 specification is also supported. The connector allows for plugging a drive directly into a back plane by providing the necessary electrical connections. Mechanical stability and device retention must be provided by other mechanisms outside the drive. There are many signals defining the 40 pin connector and several definitions are included in the following text.

Signal Name	Connector Contact Number		Signal Name
-ENBL BYP CH1	1	21	12 V dc Charge
12 Volts dc	2	22	12 V dc Ground
12 Volts dc	3	23	12 V dc Ground
12 Volts dc	4	24	+Port 1_In
-Parallel ESI	5*	25	-Port 1_In
-Drive Present	6	26	12 V dc Ground
Ready LED Out	7	27	+Port 2_In
Spindle Sync	8	28	-Port 2_In
Start_1/Mated	9	29	12 V dc Ground
Start_2/Mated	10	30	+Port 1_Out
-ENBL BYP CH2	11	31	-Port 1_Out
Sel_6/ -EFW	12*	32	5 V/3.3 V dc Ground
Sel_5/ -P_ESI_5	13*	33	+Port 2_Out
Sel_4/ -P_ESI_4	14*	34	-Port 2_Out
Sel_3/ -P_ESI_3	15*	35	5V/3.3V dc Ground
Fault LED Out	16	36*	Sel_2/ -P_ESI_2
OPT 3.3 Volts dc	17	37*	Sel_1/ -P_ESI_1
OPT 3.3 Volts dc	18	38*	Sel_0/ -P_ESI_0
5 Volts dc	19	39	OPT 3.3 V dc Charge
5 Volts dc	20	40	5 V dc Charge

Notes: The 3.3 V contacts are not connected in the drive. The Guide Pins are connected to 5 V/3.3 V ground.

*The definition changes for the ANSI SFF-8067 40-pin SCA-2 connector. Refer to the Ultrastar 9LZX & 18ZX FC-AL hardware/functional specifications for the details.

Voltage and ground signals

The +12 V dc and +5 V dc voltage contacts provide all of the voltages required by the drive. The two voltages share a common ground plane to which all of the ground contacts are connected. The 3.3 V dc contacts are left open.

Spindle sync

Spindle sync (connector pin 8) is not supported by this drive.

Fault LED out

The Fault LED is driven by the following conditions:

- both enable bypass signals are asserted by the drive
- an internal failure has been detected by the drive
- the drive has been instructed by the host to turn on the LED

The drive provides an open-collector transistor-transistor logic (TTL) driver with up to 30 mA of current sink capability to the drive Fault LED. The cathode of the LED is connected to this signal. The LED and the current-limiting resistor must be provided by the enclosure.

Ready LED out

The Ready LED has the following indications (per the Hot Plug implementation):

- *Drive not mated*: The signal is de-asserted, that is, high. The LED is off.
- *Drive mated, motor not spinning*: The LED is generally off. The LED is turned on long enough to be seen by an observer whenever a SCSI command is received.
- *Drive mated, spinning up or spinning down*: The LED is flashing with an equal on and off period of 1/2 second.

- *Drive mated, motor spinning*: The signal is normally on continuously. Whenever a SCSI command is received, the signal is off long enough to be seen by an observer.

The drive provides an open-collector TTL driver with up to 30 mA of current sink capability to drive the Ready LED. The cathode of the LED is connected to this signal. The LED and the current-limiting resistor must be provided by the enclosure.

Start_X/Mated controls (pins 9 and 10)

These two signals are TTL inputs to the drive and have associated 10 KOhm resistors. The following table shows the logic combinations and motor spin functions that can be created.

Start_2 Mated	Start_1 Mated	Motor spin function
Open	Open	Drive is not mated. No spin-up will occur.
Open	GND	The motor will spin up with the SCSI Unit Start Command.
GND	Open	The motor will spin up after a delay of 12 times the modulo 8 value of Sel_ID (in seconds).
GND	GND	The motor will spin up after drive initialization.

SEL_n and enclosure service signals

These signals have different definitions depending on the state of

-Parallel ESI (pin 5) and the level of enclosure service supported by the back plane. When **-Parallel ESI** is de-asserted (high), the back plane must present SEL_ID information on these signals (within 1 us). When **-Parallel ESI** is asserted (low), the back plane (if supported) will present enclosure service information on these signals (within 1 us). The drive will then go through a discovery phase to determine the level of enclosure services that the back plane supports (for example; none, SFF-8045, or SFF-8067) and behave accordingly. Seven signals define 128 possible values and are directly translated into an Arbitrated Loop Physical Address (AL-PA). The drive will attempt to acquire the data for its own during part of the loop initialization process of the drive.

-ENBL BYP CH1, -EnBL BYP CH2

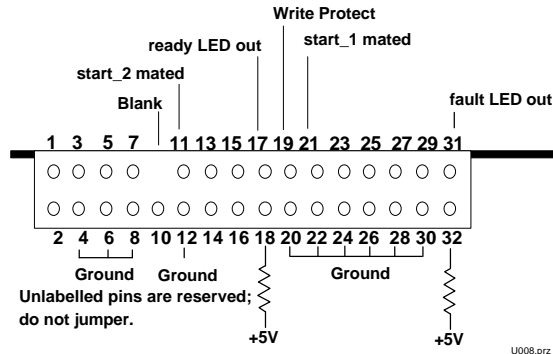
These TTL outputs from the drive provide up to 4 mA of sink current. The outputs are intended to control the state of a loop port bypass circuit on the back plane. The drive powers up with these signals turned off. The back plane must provide a 10 KOhm pull-up resistor that will ensure that the drive is bypassed on the loop when it is not present or when it is powering up. After a successful power-up, the drive will attempt to enable itself on both loops (if allowed to do so via SCSI mode page 0x19). These signals are also controllable by the host with the LPB and LPE Fibre Channel primitives command sequence.

-Drive Present

This signal is connected to the drive's ground plane. The back plane can use this signal to detect the presence of a drive.

Front option jumper block

Jumper position and function are shown below.



Ultrastar 9LZX/18ZX models contain a *Front Option Jumper Block* that can be used to enable optional features. The jumper block provides some useful features not available in SFF-8045, and also provides an alternate means of options access.

The Option Block connector (2x16) is an AMP connector (PN 84156-5) with a pin spacing of 2 mm.

Data organization

Model	9.1 GB	18.2GB
Number of disks	6	3
Number of heads	12	6

Total usable data bytes

9.1 GB	9,265,679,360
18.2GB	18,531,358,720

Seek times (in milliseconds)

Average (typical)	Read	7
	Write	8
Full stroke (typical)	Read	13
	Write	14

DC Power requirement limits

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

Input voltage

V dc	%
+5	±5
+12	±5 ¹

¹ 12V -8% is acceptable during spin up, but the spin up time is not guaranteed.

Caution: To avoid damage to the file electronics, power supply voltage spikes must not exceed:

- +7 V (+5 V dc supply) and
- +15 V (+12 V dc supply).

Power supply current +5 V dc

	18.2GB Pop. mean (A)	9.1GB Pop. mean (A)
Idle average	1.21	1.20
Seek average	1.25	1.24
Start up maximum	0.79	0.79

Power supply current +12 V dc

	18.2GB Pop. mean (A)	9.1GB Pop. mean (A)
Idle average	0.42	0.29
Seek average ²	0.93	0.87
Start up maximum	2.00	2.00

Power supply ripple

V dc	Ripple max. (mV p-p)	Frequency (MHz)
+5	250	0-10
+12	250	0-10

During drive start up and seeking, 12 volt ripple (referred to as dynamic loading) is generated by the drive. 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 ±0.5%. A more desirable method of power distribution is a common supply with separate power leads to each drive.

To prevent external electrical noise from interfering with the drive's performance, the drive must be held by four screws in a user system frame which has no electrical level difference at each four screws position, more than ±300 mV peak-to-peak to the drive power connector grounds.

Hot plug/unplug support

Back plane hot plug and unplug is allowed for Ultrastar 9LZX and 18ZX FC-AL models. It is assumed that port bypasses are active on both FC-AL ports, and that they are both enabled during the plug or unplug event.

During a hot plug-in event the drive will draw a large amount of current when it is plugged in because of the charging of the bypass capacitors on the drive. This current pulse may cause the power supply to go out of regulation. If this supply is shared by other drives then a low voltage power-on reset may be initiated on

those drives. Never daisy-chain the power leads if hot plugging is planned. Hot plugging should be minimized to prevent wear on the power pins of the connector.

If allowed to do so the drive will un-bypass itself on both ports and LIP via the protocol-specific SCSI Mode Page 19 after a plug-in event.

During hot plugging, the supplies must not exceed the drive's upper voltage limit. Proper ESD protection must be used during the plugging event. If the drive's operating shock limit specification can be exceeded during hot-unplugging, then the drive should be spun down completely before it is unplugged.

Operating environment

The drive operates within its performance limits when the following environment is maintained.

Operating conditions

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

Non-operating conditions*

Temperature	-40 to 65°C
Relative humidity	5 to 95%
Maximum temperature gradient	15°C/hour
Altitude	-300 to 12,000 m

(*)Notes:

1. The system is responsible for providing sufficient air movement to maintain a surface temperature below 60°C at the center of top cover of the drive.
2. Non-operating conditions should not continue beyond one year.

Vibration and shock

Operating vibration

The drive will operate without hard errors when subjected to vibration levels within the following table.

Frequency (Hz)	Random Vibration (x 10 ⁻³ G ² /Hz)
5	4
500	4
RMS*	2.23 G

*Note: The RMS value 2.23 G in the table is obtained by taking the square root of the area defined by the G²/Hz spectrum from 5 to 500 Hz.

Swept sine vibration

The drive will operate without hard errors when subjected to the swept sine vibration of 1.0 G peak from 5 to 500 Hz.

Note: A 1.0 G acceleration at 5 Hz requires 0.78 inch double amplitude displacement.

Nonoperating vibration

The drive withstands the following half-sine shock pulse:

- No data loss with 75 G 11 ms
- No data loss with 175 G 2 ms

The shocks are applied for each direction of the drive for three mutually perpendicular axes and one axis at a time. Input levels are measured on a base plate where the drive is attached with four screws.

Random vibration levels (nonoperating)

Frequency (Hz)	Random Vibration (x 10 ⁻² G ² /Hz)
5	1.0
500	1.0
RMS*	2.23 G

*Note: The RMS value 2.23 G in the

table is obtained by taking the square root of the area defined by the G²/Hz spectrum from 5 to 500 Hz.

Swept sine vibration

The drive will operate without hard errors when subjected to vibration levels within the following table.

Swept sine vibration levels

Frequency (Hz)	Amplitude
5-7	0.8 inch p-p
7-500	2.0 G (peak)

Operating shock

- No data loss with 10 G, 11 ms half-sine shock pulse
- No data loss with 65 G, 2 ms half-sine shock pulse

Square shock, nonoperating shock

No permanent damage occurs with:

- Acceleration level—50 G
- Duration time—11 ms
- Rise and fall time—1 ms
- Minimum velocity change—4.23 m/s

Half-sine shock, nonoperating

Do data loss occurs with:

- Acceleration level, 75 G
 - Duration time, 11 ms
- or
- Acceleration level, 175 G
 - Duration time, 2 ms

Rotational shock, nonoperating

The drive withstands the following rotational shock:

No data loss with an acceleration level of 25000 rad/s² with a time duration of 1 ms.

Note: The actuator is automatically locked at power-off to keep the heads on the landing zone.

Acoustics

The drives meet the following criteria in both circuit board up and circuit board down orientations.

Mode	Typical (Bels)	Maximum (Bels)
Idle	3.8	4.2
Operating	4.8	5.0

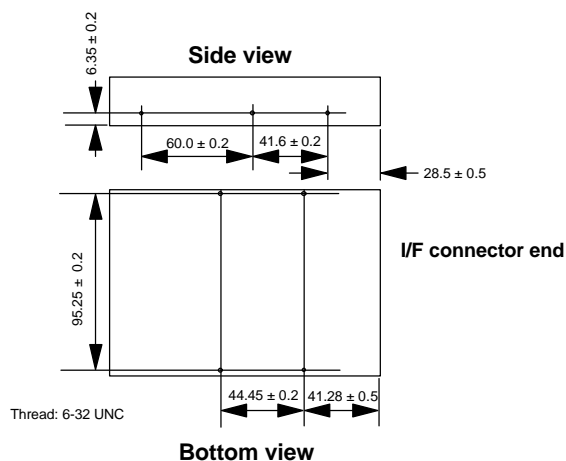
Mechanical specifications

	18.2 GB (g)	9.1 GB (g)
Weight	TBD	630
Dimensions	18.2 GB (mm)	9.1 GB (mm)
Height	TBD	25.4 ± 0.4
Width	101.6 ± 0.4	101.6 ± 0.4
Length	146.0 ± 0.6	146.0 ± 0.6

Mounting

The drive has both side and bottom mounting holes and can be mounted with any surface facing down.

The drive side and bottom mounting hole locations and sizes are shown in the following illustration. All measurements are given in millimeters.



Location of side and bottom mounting holes.

Note: All measurements are in millimeters. Clearance is 7 mm.



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