IBM OEM STORAGE PRODUCTS
0664 MODELS CSH & ESH

The 0664 Models CSH and ESH combine two 3.5" drives into one single device which offers industry standard 5.25" form factor. Data is striped across the two actuators to provide a media data rate of 10 MB/s. This is ideal for applications requiring high capacity and data rate, eg, video, audio, and image processing.

Applications

- Video, audio, and image processing
- High-end workstations
- Network servers- Mass storage arrays

Features

- 4.0 gigabytes formatted capacity (at 512 bytes/sector)
- CSH-Fast-10 MB/s, SCSI-2 50 pin SE
  ESH-Fast-10 MB/s, SCSI-2 68 pin SE
- 5.22 MB/s media data rate per actuator.
  Dual striped actuators--programmable interleave
- Rotational speed 5400 rpm
- Constant areal density of 259 Mb/sq in
- Average seek time 9.5ms-
- Magneto Resistive Heads
- PRDF data channel (Partial Response Maximum Likelihood with Digital Filter).
- 1 MB multi-segmented buffer
- Drive supported SCSI terminator power
- Industry standard mounting holes
- Low command overhead
- ECC on the fly
- Read ahead Caching
- Spindle sychronization
- MTBF 375,000 hours
- Write back caching
- Back to back writes
- Command reordering

Benefits

- Very high capacity in 5.25" form factor
- Improved interface data rate
- Exceptional data rate at 10.44 MB/s across entire disk surface
- Fast access to data
- Innovative industry leading technology providing high performance and improved levels of data integrity
- Fast data retrieval in multitasking environments
- Easy integration across multiple platforms
- Improved data throughput

• Exceptional reliability

Electrical Connector Locations

The electrical connectors are located as shown in Figure 1 and Figure 2 and consist of an option block, a SCSI connector, and a power connector.

Option Block   SCSI Connector   Power Connector
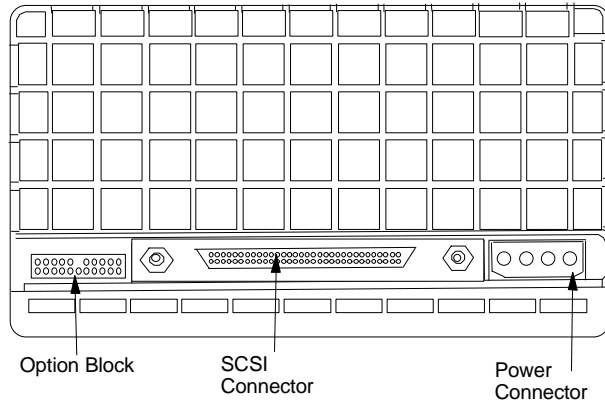
Figure 1 Electrical Connectors (rear view) 68 Pin SCSI
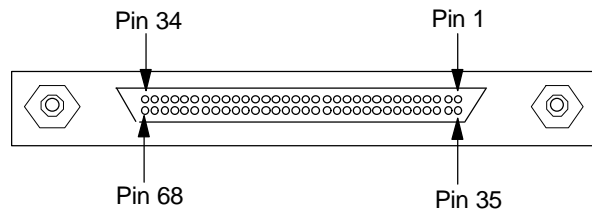

Option Block   SCSI Connector   Power Connector
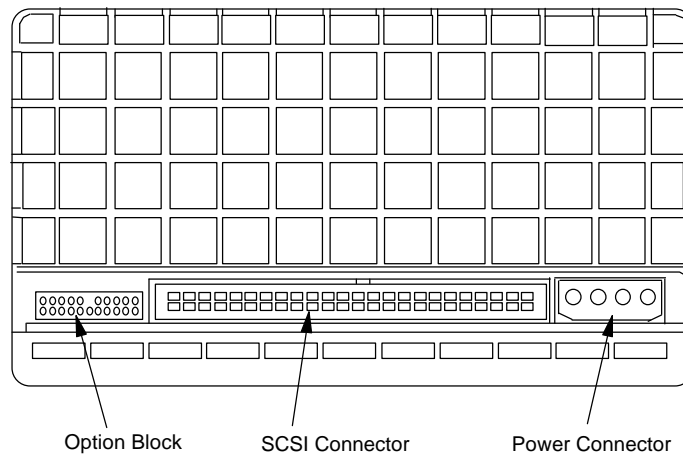
Electrical Connectors (rear view) 50 pin SCSI

Option Jumper Blocks

68 Pin SCSI Bus Connector
The SCSI signal connector is a 68-pin connector, HONDA part number PGS-XE68SLFDUNG1-HSU2 meeting ANSI/SCSI specifications.
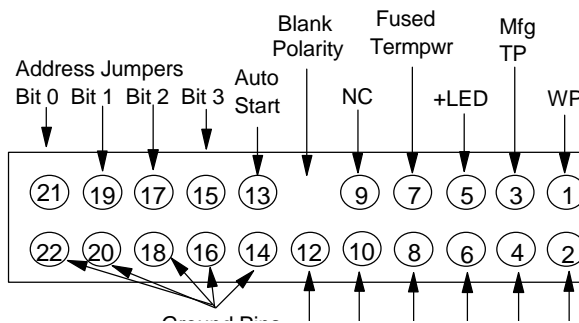
68 Pin SCSI Bus Connector

Option Block Layout (68 Pin SCSI Connector)
The 0664 drive with a 68 pin SCSI connector contains a 2 x 11 option block (shown in Figure 1), which controls the following functions.
· Target SCSI address (0-15)
· Automatic motor start
· Whether or not the target supplies SCSI termination power
· Write protect

Option Jumper Block for 68 pin SCSI connector planar card.

50 Pin SCSI Bux Connector
The SCSI signal connector is a 50 pin MOLEX part number 70247 (right angle) meeting ANSI/SCSI specifications.

Pin 49

Pin 1

Pin 50

Pin 2

50 Pin SCSI Bus Connector

Option Block Layout (50 pin SCSI connector)
The 0664 drive with a 50 pin SCSI connector contains a 2 X 11 option block (shown in Figure 2), which controls the following functions.
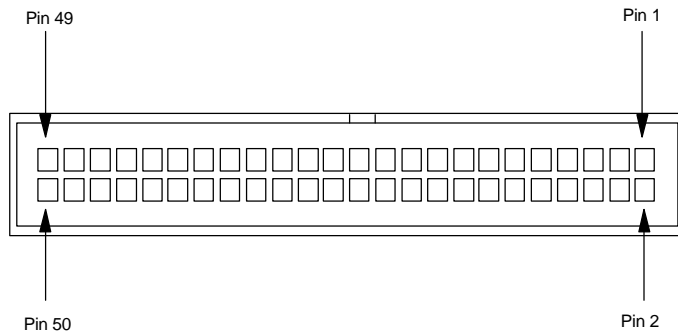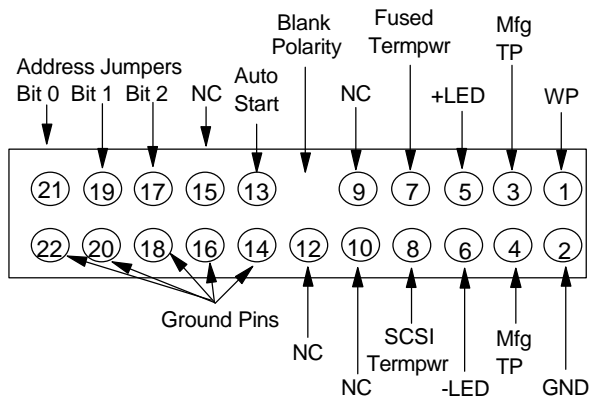- Target SCSI address (0-7)
- Automatic motor start
- Whether or not the target supplies SCSI termination power
- LED driver
- Write protect

Address Jumpers
Bit 0 Bit 1 Bit 2   NC   Auto
                            Start

Blank   Fused   Mfg
Polarity   Termpwr   TP
        NC   +LED   WP

(21) (19) (17) (15) (13)   (9) (7) (5) (3) (1)
(22) (20) (18) (16) (14) (12) (10) (8) (6) (4) (2)

Ground Pins

NC

NC

SCSI
Termpwr

NC

-LED

Mfg
TP

GND

Option Jumper Block for 50 pin SCSI connector planar card

Note:
All signal option lines can be driven from one ground line but the groundpins should only be used for driving option lines.
Note:
The +/- LED signals are intended to directly connect to the two wires of an LED (Light Emitting Diode).
Note:

The reversed address lines are used to retain compatibility with earlier products.

Compatibility of 50-Pin and 68-Pin SCSI Connectors

Note that the "P" connector is not compatible with the 50-pin "A" connector as defined in the ANSI SCSI-2 standard. Therefore system cables used with 50-pin products cannot be plugged directly into the Allicat S20 68-pin models.

Despite the difference in connector, the 0664 68 pin models are electrically compatible with 0664 50 pin models and other 50 pin single ended SCSI products and therefore can coexist on the same bus. In order to do so, the difference in connector types would need to be accounted for in the cable.

SCSI Target Address

Any chnages to the address portion of the option block will not be recognized except during a power on and after reset, when the address bits are sensed.

Bit 0	Bit 1	Bit 2	Bit 3	SCSI Address
off	off	off	off	0
on	off	off	off	1
off	on	off	off	2
on	on	off	off	3
off	off	on	off	4
on	off	on	off	5
off	on	on	off	6
on	on	on	off	7
off	off	off	on	8
on	off	off	on	9
off	on	off	on	10
on	on	off	on	11
off	off	on	on	12
on	off	on	on	13
off	on	on	on	14
on	on	on	on	15

SCSI address decode of Option block pins

Note:

In the chart above "OFF" means the shunt is not in place and "ON" means the shunt is in place.

Note:

The version of the 0664 which have the 50 pin SCSI connector will not have access to Bit 3, and it should be considered as always off.

Auto Start

The -Auto Start signal will be used to determine if the spindles should be powered on following a power on or reset condition. Without the shunt in place, the spindles can only be spun up by SCSI start unit command. (Refer to the AdStaR Model 0664 (CSH, ESH) Direct Access Storage Device Functional Specification for more details).

Target SCSI Termination Power

The Target TermPwr shunt will directly connect a fused voltage supply of termination power to the appropriate pins on the SCSI connector. This indication cannot be sensed by the initiator.

Option Block Pin Description 68-pin SCSI Connector

Pin #	Related Ground Pin	Pin Name	Direction	Pin Description
21	22	-Address Bit 0	In	LSB of SCSI Address
19	20	-Address Bit 1	In	SCSI Address
17	18	-Address Bit 2	In	SCSI Address
15	16	-Address Bit 3	In	MSB of SCSI Address
13	14	-Auto Start	In	If this pin is shunted to ground, then the drive will automatically start the motor. If this pin is not shunted, then the moter will not start until the receipt of the Start/Stop Unit SCSI Command.
12	NA	NA	NA	NA
11 and	NA	Blank Polarity	NA	This pin position is usedas a polarity pin, should be filled
8	NA	SCSI Target Term Pwr	NA	This pin connects to theappropriate pins on the device SCSI connector to supply TermPwr for the SCSI bus. When shunted to Fused Target TermPwr sufficient current is supplied by the Target to terminate the SCSI bus by some termination scheme outside the Target.
7	NA	Fused Target Term Pwr	NA	This pin connects to a fused voltage source used to supply SCSI connector when the shunt to SCSI Target TermPwr is in place.
6	NA	LED Cathode	NA	Ground side of LED
5	NA	LED Anode	NA	+ 5VDC side of LED
4	NA	NA	NA	NA
3	NA	NA	NA	NA
1	2	Write Protect	In	Inhibits customer data writes

Option Block Pin Description 50-pin SCSI Connector

Pin #	Related Ground Pin #	Pin Name	Direction	Pin Description
21	22	-Address Bit 0	In	SCSI Address
19	20	-Address Bit 1	In	SCSI Address
17	18	-Address Bit 2	In	MSB of SCSI Address
16	N/A	N/A	N/A	N/A
15	N/A	N/A	N/A	N/A

13	14	-AutoStart	In	If this pin is shunted to ground, then the drive will automatically start the motor. If this pin is not shunted, then the motor will not start until the receipt of the Start/ Stop Unit SCSI Command.
12	N/A	N/A	N/A	N/A
11	N/A	Blank Polarity	N/A	This pin position is used as a polarity pin, and should be filled.
8	N/A	SCSI Target TermPwr	N/A	This pin connects to the appropriate pins on the device SCSI connector to supply TermPwr for the SCSI bus. When shunted to Fused Target TermPwr sufficient current is supplied by the Target to terminate the SCSI bus by some termination scheme outside the Target.
7	N/A	Fused Target TermPwr	N/A	This pin connects to a fused voltage source used to supply SCSI connector when the shunt to SCSI Target Term Pwr is in place.
6	N/A	LED Cathode	N/A	Ground side of LED.
5	N/A	LED Anode	N/A	+5VDC side of LED.
4	N/A	N/A	N/A	N/A
3	N/A	N/A	N/A	N/A
1	2	Write Protect	In`	Inhibits customer data writes.

Write Protect
The Write Protect feature allows the customer to ensure that no customer data will be overwritten via a SCSI command. The feature is controlled by a jumper on the 0664 option block. The status of the jumper can be sensed via the MODE SENSE command, page 0 (Vendor Unique), byte 9. If the Write Protect jumper is in place, the drive will generate a Condition Check Status for the following commands.
Write (6) command 0Ah
Write (10) command 2Ah
Write and Verify command 2Eh
Write Long command 3Fh
Write Same command 4Ih
Reassign Blocks 07h
Format Unit 04h

Sync Cache 35h
The sense data will show a sense key of Data Protect (7h) with a sense code and data of Write Protected (2700h). Although customer data will not be written, the drives reserved area will be updated with data such as mode select data, error logs, microcode loads, etc.

Data Organization

Capacity

bytes/ logical block	gross sectors/ track	logical blocks/ file	formatted capacity (megabytes)
512	188	7,866,080	4,026
520	184	7,694,660	4,000
524	184	7,694,660	4,032
736	138	5,723,330	4,212

User drive capacity for several common block sizes.

Number data unique HDAs (nHDA)	2 (striped)
Total cylinders/HDA (user cyl)	2,870
User cylinders/HDA (user cyl)	2,857
Tracks/cylinder (trk/cyl)	15
Gross bytes/track (gb/trk)	58,024
User bytes/sector (ub/set)*	512-744 (must be divsible by 2)
Overhead bytes/sector (ob/set)	104
Band 1 user cylinders (b1ucyl)	1903
Band 2 user cylinders (b2ucyl)	953
Band 3 user cylinders (b3ucyl)	1
Band 1 spares/cylinder (b1spr/cyl)	30
Band 2 spares/cylinder (b2spr/cyl)	40
Band 3 spares/cylinder (b3spr/cyl)	120

Note*: Support for other block lengths--contact Technical Support for details.

Mode Select Options

Certain parameters are alterable using the SCSI "Mode Select" command. This allows certain drive characteristics to be modified to optimize performance on a particular system. Refer to the 0664 SCSI CSH, ESH Functional Specification for a detailed definition of Mode Select parameters.

The changeable parameters are:

Block Descriptor
 Number of Blocks
 Block length

Page 0
 QPE (Qualify Post Error)
 UQE (Untagged Queuing Enable)
 DWD (Disable Write Disconnect)
 ASDPE (Additional Save Data Pointer Enable)

CMDAC
RPFAE (Report Predictive Failure Analysis Error)
CPE (Concurrent Processing Enable)
TCHD (Thermal Compensation Head Control Bit)
TCC (Thermal Compensation Control Bit)
DSN (Disable Synchronous Negotiations)
FRDD (Format and Reassign Degraded Disable)
DPSDP (Data Phase Save Data Pointer)
CAEN (Command Ageing Enable Bit)
LITF (Limit Idle Time Function)
QEMC (Queue Error Management Control)
DRD (Disable Read Disconnect)
LED Mode--allows user to choose function of LED pins
ODPE (Overlapped Data Phase Enable)
Command aging time limit
Striping interleave factor
Page 1
AWRE (Automatic Write Reallocation Enable)
ARRE (Automatic Read Reallocation Enable)
TB (Transfer Block)
RC (Read Continuous)
PER (Post Error)
DTE (Disable Transfer on Error)
DCR (Disable Correction)
Read Retry Count
Page 2
Read Buffer Full Ratio
Write Buffer Empty Ratio
Maximum Burst Size
DTDC (Data Transfer Disconnect Control)
Page 4
RPL (Rotational Position Locking)
Rotational Offset
Page 7
PER
DCR
Page 8
WCE (Write Cache Enable)
MF (Multiplication Factor)
RCD (Read Cache Disable)
Demand Read Retention Priority
Write Retention Priority
Disable Pre-fetch Transfer Length
Maximum Pre-fetch
Maximum Pre-fetch Ceiling

Number of Cache Segments
Page A
  Queue Algorithm Modifier
  QErr (Queue Error Management)
  DQue (Disable Queueing)

Models

The drive contains a frame, an electronics planar card, two R/W channel cards, two Disk Assemblies and associated internal cables. The file may be ordered with either a 50 pin or 68 pin SCSI conductor.

50 or 68 Pin SCSI Connector
The drive hardware supports either the low density 50 pin SCSI A cable connector (8 bit SCSI only), or a SCSI-3 high density 68 pin SCSI P cable connector (8 bit or 16 bit SCSI). In order to change a given drive's interface drivers, the planar card needs to be replaced.

Model	SCSI	Interface
Number	Connector	Drivers
CSH	50 Pin A cable	Single Ended
ESH	68 Pin P cable	Single Ended

Electrical Interface Specifications

Power Connector
The DC power connector is designed to mate with AMP part 1-480424-0 using AMP pins part 350078-4 (strip) or part 61173-4 (loose piece), or their equivalent. Pin assignments are shown in Figure 3.
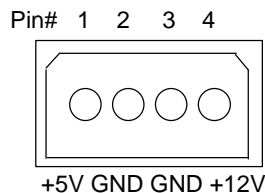
Figure 3 Power Connector Pin Assignments

Single Ended SCSI Cable
The 0664 disk drive uses single ended drivers and receivers which will permit cable lengths of up to 6 meters (19.68 feet). It should be noted however that users who plan to use the 0664 disk drive in fast mode should follow all of the SCSI-3 guidelines for single ended fast operations. This may include a cable length of less than 6 meters.
The SCSI-2 standard states that the total stub length of the cable must not exceed 0.1 meters. This drive has a maximum internal stub length of 0.082 meters on all SCSI signals. To remain compliant with ANSI, the SCSI bus cable must not add more than 0.018 meters additional stub length to all SCSI signals.

Single Ended SCSI Bus Termination
The 0664 drive has no internal SCSI bus terminators. The system is responsible for properly terminating the SCSI bus. A regulated 100 Ohm terminator is recommended for reliable fast

operations (ie, transfer speeds greater than 5M transfer/sec). Split resistor or regulated terminations may be used for systems that do not plan fast data transfers. Some of the terminator possibilities for 0664 disk drive are listed below.

Data Transfer Rates	50 Pin Model Terminators	69 Pin Model Teminators
Less than 5M transfers/sec	AMP 88-4163-081-1	Data Mate DM2050-02-68S
	Data Mate DM500-06-O	Data Mate DM2050-02-68R
	Data Mate DM500-06-R	
more than 5M transfers/sec	Data Mate DM500-06-R	Data Mate DM2050-02-68R

SCSI Bus Termination Power

Termination power is optionally provided for systems that desire to use it. In order to use the 0664 drive termination power, the user needs to install a jumper between 7 and 8 of the Option block. The jumper only needs to be installed on the last device on the SCSI bus (ie, the file that is physically closest to the terminator). The drive can source up to 2.0 Amps of current at 5.0 Volts (+/-5%) for termination power.

Single Ended SCSI Bus Recommendations for Noise Reduction

The SCSI committee has spent a large amount of resource looking into what needs to be done to assure SCSI devices will work as specified in the SCSI-2 standard. As a result of this, the committee is recommending what is being called the 123 approach to reducing noise problems. This approach is:

1. Use the regulated 110 ohm terminator
2. Use AWG 28 polyolefin shielded cables
3. Make sure data and parity are on the outer ring of the cable and that REQ and ACK are in the core of the cable.

Operating Environment

The drive operates within it's performance limits when the following environment is maintained. Product life calculations based on the nominal environment for a typical application.

Humidity:

Operating	8% to 80% noncondensing
Storage	5% to 80% noncondensing
Shipping	5% to 100%

(applies at a packaged level)

Wet Bulb Temperature:

Operating	80 degrees F (26.7 degrees C) maximum
Shipping/Storage	85 degrees F (29.4 degrees C) maximum

Elevation:

Operating	-1000 to 10,000 feet (-304 to 3048 meters)

Shipping/Storage   -1000 to 30,000 feet
                                    (-304 to 9144 meters)
Temperature:
Operating ambient   50 to 122 degrees F (10 to 50 degrees C)
Operating casting   50 to 140 degrees F (10 to 60 degrees C)
Temperature Shipping   -40 to 140 degrees F (-40 to 60 degrees C)
Storage   34 to 140 degrees F (1.1 to 60 degrees C)
Temperature Gradient
Operating   18 degrees F (10 degrees C) per hour
Shipping/Storage   below condensation

These temperature limits are extremely important and must not be exceeded at the worst case drive and system operating conditions with the drive randomly seeking, reading, and writing. The table below defines a list of measuring points and their temperatures (maximum and reliability). Maximum temperatures must not be exceeded at the worst case drive and system operating conditions with the drive randomly seeking, reading, and writing.

0664-CSH/ESH Maximum and Reliable Temperature Ranges

	Maximum	Reliability	Location
Disk Enclosures Top	60 degrees C	42 degrees C	Each HDA
Data Channel Cards	65 degrees C	55 degrees C	Each HDA
Motor Heat Sink	85 degrees C	70 degrees C	Planar Card Bottom
Card Location 1	70 degrees C	45 degrees C	Planar Card Bottom
Card Location 2	70 degrees C	45 degrees C	Planar Card Bottom

Note:
1. If copper tape is used to attach temperature sensors, it should be no longer than 6 mm square.
2. Care should be taken to ensure attaching temperature sensor on printed circuit boards does not affect electrical operation of board.
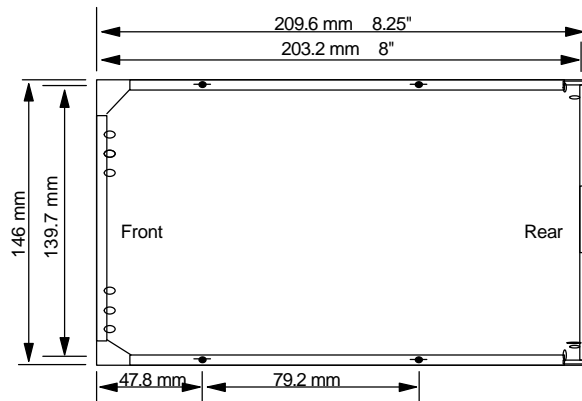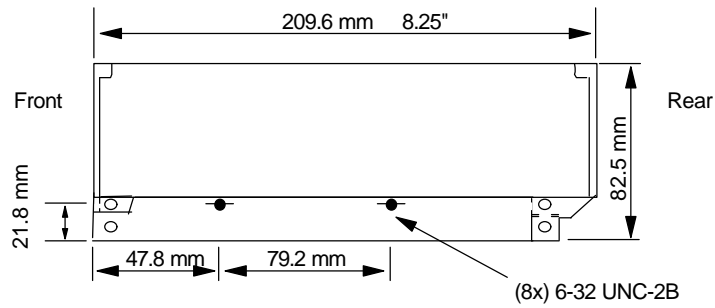3. Components shown with dashed lines are on the opposite side of the printed circuit boards shown.

HDA Locations
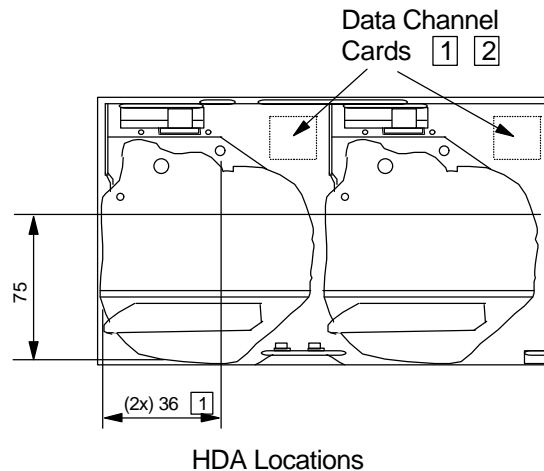
Mechanical Specifications

This section details the mechanical specifications of the IBM 0664 disk drive. (All versions).
Weight
Approximatley 5.8 pounds (2.6 kilograms).

Dimensons	U.S.	S.I. Metric
Height	3.25 in	82.5 mm
Width	5.75 in	146.0 mm
Depth	8.25 in	209.6 mm

Location of Bottom Mounting Holes

Clearances
The 0664 drive contains all sway space internal to the form factor. Therefore, no sway space clearance is required. However, adequate clearance is required around the drive to assure the airflow needed to maintain component temperatures as specified.
Mounting
The drive can be mounted with any surface facing down as listed below.
Bottom Side Down
Top Side Down
Right Side Down

Left Side Down
Rear Side Down
Front Side Down
Four mounting holes are provided on the bottom of the drive, and two mounting holes are
porvided on each side of the drive.
The torque applied to the mounting screws must be 1.0 Newton-meters +/-0.1 Newton-meters.
The maximum allowable penetration of the mounting screw is 7.5 mm.

Ripple

Externally generated ripple as seen at drive power connector.

Voltage	*Maximum*	*Notes*
+5VDC	150 mV peak-to-peak	0-20 MHz
+12VDC	150 mV peak-to-peak	0-20 MHz

During drive start up and seeking, 12-volt ripple is generated by the drive (referred to as dynamic
loading). If several drives have their power daisy chained together then the power supply ripple
plus other drive's dynamic loading must remain within the regulation tolerance window of +/-5%.
A common drive supply with separate power leads to each drive is a more desirable method of
power distribution.

DC Power Requirement Limits

The following voltage specifications apply at the drive power connector. There are no special
power on/off sequencing requirements.
+12 Volt Supply
    +/-5.0% (during run)
    +/-7.0% +5% (during spin-up)
+5 Volt Supply
    +/-5.0% (during run and spin-up)
The following current values are subject to change. Safety factors have not been applied.
Preliminary 0664 CSH, ESH current requirements in amps.

	Average
+ 5 VDC (idle)	2.21
+ 5 VDC (R/W ripple)	0.40
+12 VDC (idle)	1.20
+12 VDC (commutation)	0.10
+12 VDC (seek, adder, average)	.016
+12 VDC (seek, adder, peak)	3.10
+12 VDC (seek total, average)	1.36
+12 VDC (seek total, peak)	4.40
+12 VDC (start total peak)	3.30

Note:
1. Peak seek current assumes both actuators seeking simultaneously.
2. The +12 VDC numbers for seek total peak and start total peak are total current draw during
seek and start (includes idle).

3. Termination current not included.

PACKAGING: The drive must be protected against Electro-Static 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.

WARNING: This disk drive can be damaged by Electro-Static Discharge, please follow recommended ESD procedures before unpacking or handling the drive. Ask your Dealer for details if you need assistance.

This data sheet is not a substitute for the full product specification which should be used when detailed information is required.
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