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| 0664 Models M1H & N1H |
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IBM OEM STORAGE PRODUCTS

The 0664 Models M1H and N1H provide an industry leading 2 GB of direct access storage in a 3.5" form factor. The drive offers outstanding performance, reliability and function. Performance is tuned for multi-user application in which short block reads and writes dominate.

APPLICATIONS

- High-end workstations
- Network Servers
- Mass Storage arrays

FEATURES

- 2.0 gigabytes formatted capacity (512 bytes/sector).
- Fast SCSI-2 10 MB/S (50 pin model M1H)
  Fast & Wide SCSI-2 20 MB/S (68 pin model N1H).
- 5.22 MB/s media data rate.
- Rotational speed 5400 RPM.
- Average seek time 9.5 ms.
- Magneto resistive heads.
- PRDF data channel (Partial Response Maximum Likelihood with Digital filter).
- 512 KB multi-segmented data buffer
- Drive supported SCSI terminator power.
- Industry standard mounting.
- Low command overhead.
- ECC on the fly.
- Read Ahead caching
- Write Back caching supported
- Spindle synchronization.
- Differential SCSI adapter option.
- MTBF 750,000 hours.

BENEFITS

- Industry leading capacity in 3.5" form factor.*
- Improved interface data rate.
- High data rate across entire disk surface.
- Fast access to data.
- Leading edge areal density 259 Mbits/sq in.*
- Robust data channel for improved data integrity.
- Fast data retrieval in multi-tasking environments.
- Easy integration across multiple platforms.
- Easy installation.
- Improved data throughput.
- Improved performance in arrays.
- Increase SCSI bus length to 25M.
- Industry leading reliability.*

* As at announcement.

ELECTRICAL CONNECTOR LOCATIONS

Jumper Settings

The file contains a jumper block with jumper pins as shown in both Figures 1 and 2. Information on how to select a particular address for the SCSI device ID, are given in Figures 3 and 4.

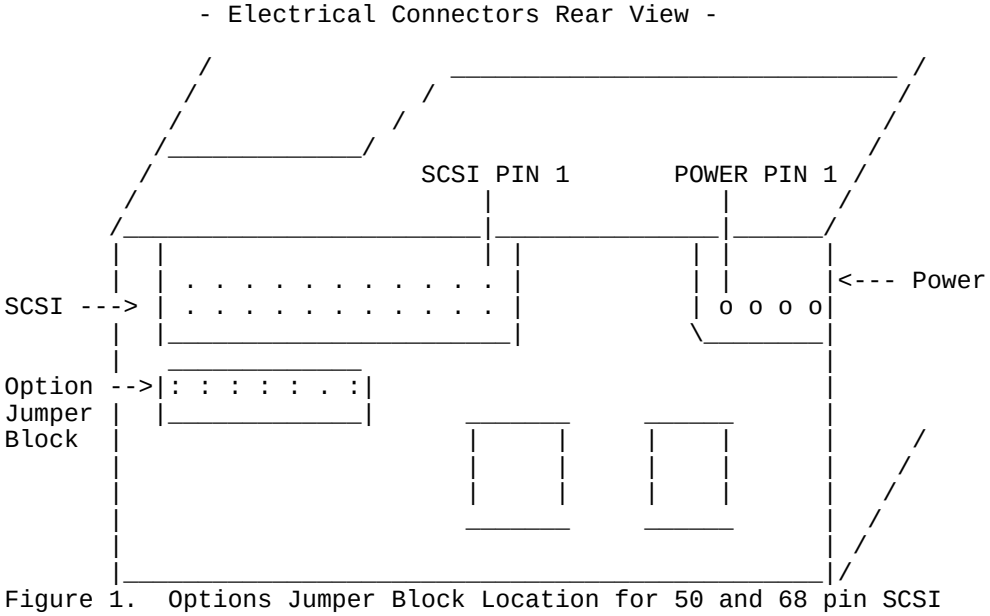


Figure 1. Options Jumper Block Location for 50 and 68 pin SCSI

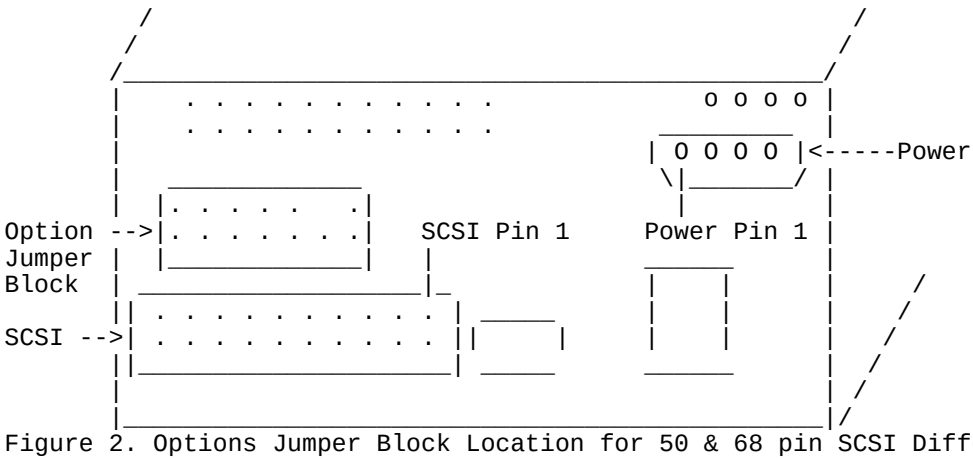


Figure 2. Options Jumper Block Location for 50 & 68 pin SCSI Differential

NOTE: The Options Jumper Block is above the SCSI connector for the Differential models.

50 Pin SCSI Option Jumper Block

```
                          _______________
 Ground Pin   ---------- | O A1  B1 O | ---------  Bit 0 (LSB)
 Ground Pin   ---------- | O A2  B2 O | ---------  Bit 1
 Ground Pin   ---------- | O A3  B3 O | ---------  Bit 2 (MSB)
 Option Pin (Note 1)---- | O A6       | ---------  Blank Polarity
 Ground Pin   ---------- | O A5  B5 O | ---------  Auto Start
-Slave Sync   ---------- | O A7  B7 O | --------- -Master Sync
-Term Power   ---------- | O A8  B8 O | --------- +Term Power
 LED Cathode  ---------- | O A9  B9 O | ---------  LED Anode
                          _______________
```

NOTE 1: If the Auto Start Shunt is not on, the file starts by SCSI command only
NOTE 2: Models with 50 pin SCSI connectors do not have B4.

50 Pin Models

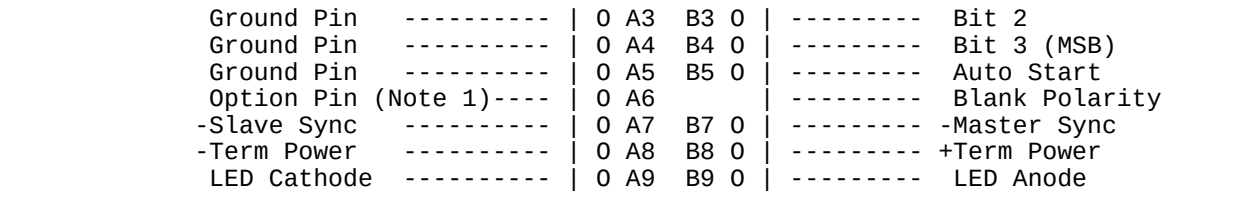
Address	B1	B2	B3
0	off	off	off
1	on	off	off
2	off	on	off
3	on	on	off
4	off	off	on
5	on	off	on
6	off	on	on
7	on	on	on

NOTE: Bit is selected when shunt is in place.

Figure 3 Address Determination for 50 Pin SCSI

68 Pin SCSI Option Jumper Block

```
                          _______________
 Ground Pin   ---------- | O A1  B1 O | ---------  Bit 0 (LSB)
 Ground Pin   ---------- | O A2  B2 O | ---------  Bit 1
```



NOTE 1: If the Auto Start Shunt is not on, the file starts by SCSI command only

68 Pin Models

Address	B1	B2	B3	B4
0	off	off	off	off
1	on	off	off	off
2	off	on	off	off
3	on	on	off	off
4	off	off	on	off
5	on	off	on	off
6	off	on	on	off
7	on	on	on	off
8	off	off	off	on
9	on	off	off	on
10	off	on	off	on
11	on	on	off	on
12	off	off	on	on
13	on	off	on	on
14	off	on	on	on
15	on	on	on	on

NOTE: Bit is selected when shunt is in place.

Figure 4 Address Determination for 68 Pin SCSI

Other Jumpers for the 50 and 68 Pin SCSI connectors
B5: Auto Start
B6: Option Pin
B7: -Master Sync (Top pin in Fig 3 & 4) -Slave Sync (Bottom Pin)
B8: Terminator Power
B9: LED Anode (Top pin in Fig 3 & 4) LED Cathode (Bottom Pin)

NOTE: In the charts above "off" means the jumper is not in place and "on" means the jumper is in place.

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 S10 SCSI 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)
- DSN (Disable Synchronous Negotiations)
- FRDD (Format and Reassign Degraded Disable)
- DPSDP (Data Phase Save Data Pointer)
- WPEN (Write Protect Enable)
- DRD (Disable Read Disconnect)
- LED Mode--allows user to choose function of LED pins

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

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 (hex)
     Queue Algorithm Modifier
     QErr (Queue Error Management)
     DQue (Disable Queueing)

DATA ORGANIZATION

Capacity (All Models)

Bytes/ logical block	gross sectors/ track	formatted capacity (bytes)	logical blocks/ file
256	160	1,730,936,320	6,761,470
512	94	2,013,716,480	3,933,040
520	92	2,000,611,600	3,847,330
524	92	2,016,000,920	3,847,330

Cylinders	
Total cylinders	2870
User cylinders	2857
Tracks/cylinder	15
User bytes/sector	256-744
(even number of bytes only)	
User bytes/logical block	256-744
(numbers of bytes evenly divisible by 2 only)	
Overhead bytes/sector	104
Sectors/logical block	1 (for 256 less than or equal to ub/lba less than or equal to 744)
User bytes/logical block	256-744
(numbers of bytes evenly divisible by 2 only)	
Band 1 user cylinders	1,903
spares/cylinder	30
Band 2 user cylinders	954
spares/cylinder	40
Last cylinder extra spares	80

Note: Banding as defined here refers to the number of spare sectors provided per cylinder to reallocate defective sectors. Band 2 cylinders are those nearer the inside diameter of the data surfaces. These have additional spare sectors since the likelihood of defective sectors is higher in this region. This feature does not affect the instantaneous media data rate which is constant across all cylinders.

WARNING: This disk drive can be damaged by electrostatic discharge, please follow recommended ESD procedures before unpacking or handling the drive. Ask your dealer for details if you need assistance.

OPERATING ENVIRONMENT

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

Humidity:

Operating	8% to 90% noncondensing
Storage	5% to 95% 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	-1,000 to 10,000 feet (-304 to 3,048 meters)
Shipping/Storage	-1,000 to 40,000 feet (-304 to 12,192 meters)

Temperature:

Operating ambient	41 to 131 degrees F (5 to 55 degrees C)
Operating casting temperature	41 to 140 degrees F (5 to 60 degrees C) (see note below)
Operating casting temperature delta	Not to exceed 3.6 degrees F (2 degrees C) (see note below)
Shipping	-40 to 149 degrees F (-40 to 65 decrees C)
Storage	34 to 149 degrees F (1.1 to 65 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 operation conditions with the drive randomly seeking, reading, and writing.

Note: Measure between top and bottom of disk enclosure.

MODELS

The 0664 disk drive is available in 2 different models:

50	50 pin SCSI connector The 50 pin SCSI connector model offers an 8 bit SCSI bus using the SCSI "A" connector.
68	68 pin SCSI connector The 68 pin SCSI connector model offers an 8/16 bit SCSI bus using the SCSI "P" connector.

Model	SCSI

number	Connector	Comments
M1H	50 pin	High performance with Industry Standard mounting hole Frame
N1H	68 pin	High performance with Industry Standard mounting hole Frame

0664 Disk Drive Models

Please Note: The 0664 frame supports Industry Standard mounting holes on the sides and bottom, as well as IBM's bottom mounting holes which are common with the old IBM frame.

User Awareness: The 0664 drive has a new look as compared to previous 3 1/2" family members from IBM. A piece of Kapton tape is wrapped around the entire drive, both the frame and DE. This tape is used as a stiffener to improve the vibration tolerance of the file.

Differential Models

For each model of the 0664 the option of a differential interface is provided. The differential interface is provided to the customer by plugging a differential conversion card onto either of our single-ended models.

DC POWER REQUIREMENT LIMITS

The following voltage specifications apply at the file voltage connector. There are no special power on/off sequencing requirements.

+12 Volt Supply
+/- 5.0% (during run)
-7.0% / +5.0% (during start)
+5 Volt Supply
+/- 5.0%

Power Supply Current +5 VDC	Notes	Population Means	Population Stand Dev

Standby average		0.758 Amps (1)	0.032 Amps
Idle average		1.040 Amps (2)	0.035 Amps
R/W ripple	Peak-to-peak	0.37 Amps	0.09 Amps
Power-up	Minimum voltage slew rate: 4.5 V/sec		

Power Supply Current +12 VDC	Notes	Population Means	Population Stand Dev
Idle average		0.525 Amps	0.013 Amps
Commutation	Pulse height	0.05 Amps	0.015 Amps
Seek average	1 op/sec	0.0088 Amps	0.00012 Amps
Seek peak		1.95 Amps (3)	0.038 Amps
Spin-up	1.5 sec max	2.7 Amps (4)	0.1 Amps
Power-up	Minimum voltage slew rate: 7.4 V/sec		

Power Differences for Differential SCSI

In addition to the current required by the 0664 file, the 50 pin SCSI Differential Adapter Card requires an additional 0.240A to 0.260A while idle. While reading or writing, the average additional current is 0.5A with peaks of 1.1A.

At present, the 68 pin SCSI Differential Adapter Cards current are estimated to use an additional 0.336A to 0.364A while idle and an average of 0.7A with 1.54A peaks when reading or writing.

Note 1: The file automatically goes into standby after 1 second of idle. There is not additional command overhead incurred when coming out of standby mode. The spindle motor is not shut off during standby.

Note 2: 5 volt current is given with all the termination power provided by the using system.

Note 3: The idle average, commutation, and seek peak should be added together to determine the total 12-volt peak current

Note 4: The current at start is the total 12-volt current required (ie, the motor start current, module current, and voice coil retract current).

RIPPLE

Externally Generated Ripple

(as seen at file power connector)

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

During file start up and seeking, 12-volt ripple is generated

by the file (referred to as dynamic loading). If several files have their power daisy chained together then the power supply ripple plus other file's dynamic loading must remain within the regulation tolerance window of plus/minus 5%. A common supply with separate power leads to each file is a more desirable method of power distribution.

To prevent external electrical noise from interfering with the file's performance, the file's mounting frame may be electrically isolated from the system mounting frame. If isolation is not practical then the file's mounting frame must be within plus/minus 150 millivolts of the file's power supply ground. At no time should more than 35 milliamps of current be injected into the file frame. The frequency range that has been tested with this specification is 0 to 100 MHz.

Hot Plug/Unplug Support

Power supply and SCSI bus hot plug and unplug is allowed. There is no special sequence required for connecting 5-volt, 12-volt, or ground. During a hot plug-in event the file being plugged will draw a large amount of current at the instant of plug-in. This current spike is due to charging the bypass capacitors on the file. This current pulse may cause the power supply to go out of regulation. If this supply is shared by other files then a low voltage power on reset may be initiated on those files. Therefore the recommendation for hot plugging is to have one-supply for each file. Never daisy chain the power leads if hot plugging is planned. Hot plugging should be minimized to prevent wear on the power connector.

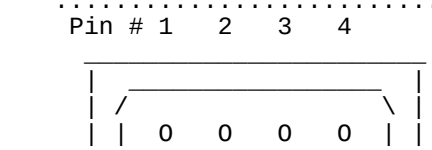
Hot plugging the SCSI bus may cause glitches on the bus. To minimize the chance of glitching, it is recommended to plug in the SCSI bus before the power is applied.

During hot plugging, the supplies must not go over the upper voltage limit. This means that proper ESD protection must be used during the plugging event.

ELECTRICAL INTERFACE SPECIFICATIONS

Power Connector

The DC power connector used in 0664 is a Molex 8981-4V6. It is designed to mate with a Molex 8981-4P4 crimp connector, or a Molex A-70156-2000 insulator displacement connector, or their equivalent. Pin assignments are shown in Figure 5.



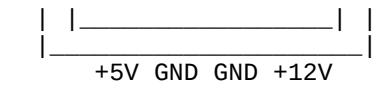


Figure 5 Power connector pin assignments

50 Pin Signal Connector

0664 50-pin models use a Molex 50-pin connector PN 70246. This connector is compatible with the ANSI SCSI-2 "A" connector specifications. It is limited to 8-bit data transfers only. (Refer to Figure 4 for a rear view of the 0664 50-pin model).

68 Pin Signal Connector

0664 68 pin models use Molex 68-pin connector P/N 15-87-0311. This connector is compatible with the ANSI SCSI-3 "P" connector specifications. It can transfer data in both 8-bit (narrow) and 16-bit (wide) modes. Refer to Figure 5 for a rear view of the 0664 68-pin model.

Note: 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 0664 68-pin model.

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 differences in connector types would need to be accounted for in the cable.

SCSI Bus 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 0664 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 any stub from main cable must not exceed 0.1 meters. This file has a maximum internal stub length of 0.077 meters on all SCSI signals. To remain compliant with the standard, the SCSI bus cables must not add more than 0.023 meters additional stub length to any of the SCSI signals.

SCSI Bus Terminators

0664 has no internal SCSI bus terminators. The system is responsible for properly terminating the SCSI bus. A regulated 110 Ohm terminator is recommended for reliable fast operations (ie, transfer speeds greater than 5M transfers/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 are listed in Figure 6.

SCSI Bus Termination Power

Termination power is optionally provided for systems that desire to use it. In order to use the 0664 termination power, the user needs to install a jumper between pins B8 and A8 of the Options block. The jumper should only be installed on one device, which should be the last device on the SCSI bus (ie, the device that is physically closest to the terminator). 0664 68-pin models can source up to 2.0 Amps of current at 5.0 Volts (plus/min 5%) for termination power. 0664 50-pin models can source up to 1.5 Amps of current at 5.0 Volts (plus/min 5%) for termination power.

Data Transfer Rates	50-Pin Model Terminators	68-Pin Model Terminators
Less than 5M transfers/sec	Data Mate DM500-06-0 Data Mate DM500-06-R Data Mate DM2000-02-R	Data Mate DM2050-02-68S Data Mate DM2050-02-68R
More than 5M transfers/sec	Data Mate DM500-06-R Data Mate DM2000-02-R	Data Mate DM2050-02-68R

Figure 6 0664 SCSI Terminators

Recommendations for SCSI Bus 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 the following approach:

- Using regulated 110 ohm terminator
- Use AWG 28 polyolefin shielded cables
- 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

LED Pins

The LED pins (B9/A9 on the options block) can be used to drive an external LED. The LED cathode should be connected to pin A9 of the option block, and the LED anode should be connected to pin B9 of the option block.

The 0664 provided up to 20MA of drive capability.

START AND STOP TIMES
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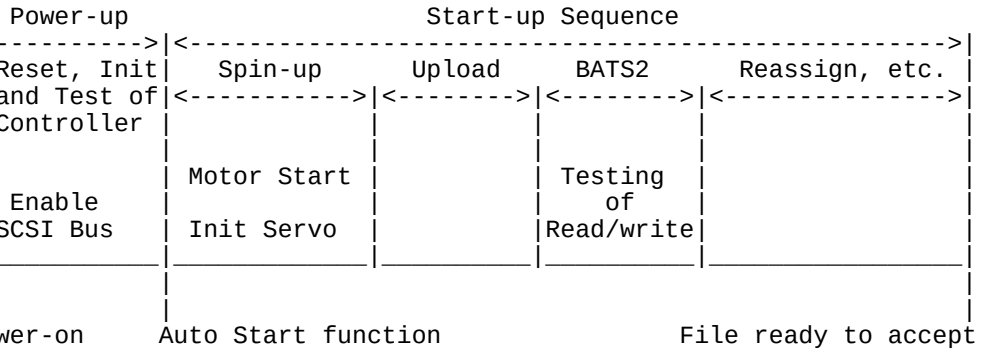
Time	Nominal	Maximum
Power-Up	2.0 sec	2.4 sec
Start-up	15 sec	1 min
Spin-up	6.7 sec	15 sec
Stop Time	9.0 sec	12.5 sec

Note: BATS is the abbreviation for Basic Assurance Tests. Start-up sequence spins up the spindle motor, uploads code, performs BATS2 (verified read/write hardware), resumes "Reassign in Progress" operations, and more. For more information on the start-up sequence, refer to the 0664 Interface Specification.

- Bring-up Sequence Times and Stop Time -



Note: If a RESET is issued before the file comes ready the power on sequence will start again. In all other cases when a RESET is issued the present state of the motor is not altered.

MECHANICAL SPECIFICATIONS
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This section details the mechanical specifications of the IBM OEM 0664 disk drive.

Weight

Approximately 1.8 pounds (0.8 kilograms)

Dimensions

	U.S.	S.I. Metric
Height	1.63 in	41.3 mm

Width	4.00 in	101.6 mm
Depth	5.75 in	146.0 mm
Depth*	6.61 in	168.0 mm

* Differential model only.

Note: The electrical connectors exceed the stated depth dimensions, see Figure 7.

Clearances

A minimum of 2mm clearance should be given to the bottom surface except a 10mm diameter area around the bottom mounting holes. For proper cooling it is suggested that a clearance of 6mm be provided under the file and on top of the file.

Note: The top of the drive will not exceed the height dimensions by more than 2 millimeters during a nonoperating shock.

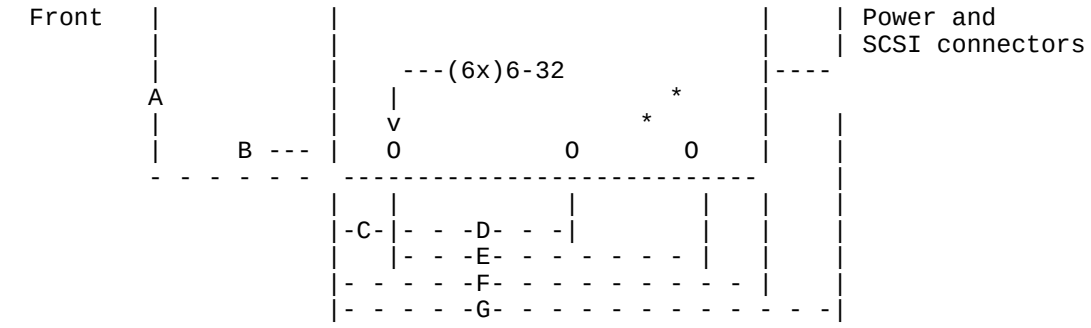
Mounting

The drive can be mounted with any surface facing down.

The drive is available with both side and bottom mounting holes. Refer to the Figures 7 and 8 for the location of these mounting holes for each configuration.

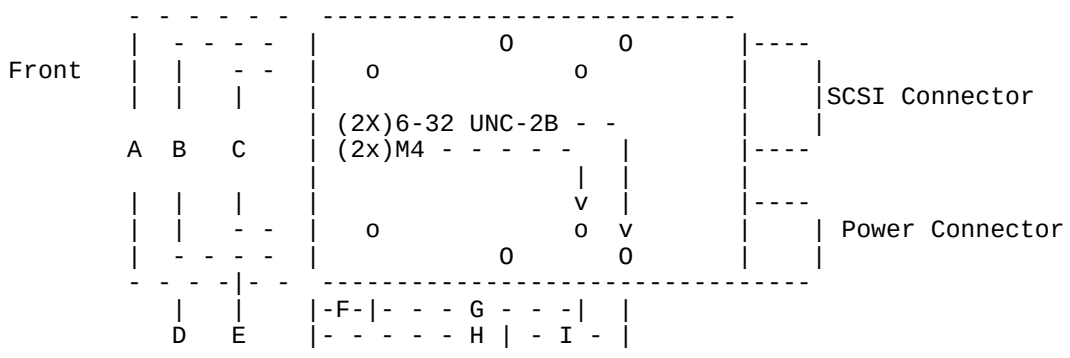
Note: The maximum allowable penetration of the mounting screws is 3.8mm.

The torque applied to the mounting screws must be 1.0 Newton meters plus/minus 0.1 Newton meters.



A = 41.30 +/- 0.5 mm
B = 6.35 +/- 0.5 mm
C = 16.00 +/- 0.4 mm
D = 60.00 +/- 0.2 mm
E = 101.60 +/- 0.2 mm
F = 146.00 +/- 0.5 mm
G = 153.20 +/- 1.5 mm

Figure 7 Side View Mechanical Dimensions



A = 101.60 +/- 0.5 mm
B = 95.24 +/- 0.2 mm
C = 93.00 +/- 0.2 mm
D = 31.80 +/- 0.3 mm
E = 4.30 +/- 0.4 mm
F = 14.20 +/- 0.4 mm
G = 79.50 +/- 0.2 mm
H = 60.33 +/- 0.4 mm
I = 44.45 +/- 0.2 mm

Figure 8 Bottom View Mechanical Dimensions

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WARNING: The file's mounting frame is electrically isolated from the file's disk enclosure. The disk enclosure is not at ground potential. Therefore any user mounting scheme must not result in the disk enclosure being shorted to ground.

PLEASE NOTE: The 0664 frame supports Industry Standard mounting holes on the sides and bottom, as well as IBM's bottom mounting holes which are common with the old IBM frame.

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 antistatic 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 the dealer if you do not have an approved shipping container.

VIBRATION AND SHOCK

Operating/Nonoperating Vibration

Due to the complexity of this subject we recommend that users contact the distributor to discuss how to perform the required measurements if they believe this to be an area which requires evaluation.

Operating Shock

The drive will continue to operate, at the stated "Performance,"

when subjected to a 5 G half sine wave shock pulse of 11 milliseconds duration.

No permanent damage will occur to the drive when subjected to a 10 G half sine wave shock pulse of 11 milliseconds duration.

The shock pulses are applied in either direction in each of three mutually perpendicular axis, one axis at a time.

Nonoperating Shock

No damage will occur if the unpackaged drive is not subjected to a square wave shock greater than a "faired" value of 35 Gs applied to all three axis for a period of 20 milliseconds, one direction at a time.

Additionally, no damage will occur if the unpackaged drive is not subjected to an 11 millisecond half sine wave shock greater than 60 Gs applied to all three axis, one direction at a time.

File last updated on 01/11/95 by jjm