CFP1080S/CFP1080E

Intelligent Disk Drive
Product Manual

Production Release Per ECO 6561
P/N 20401007-001
Revision A

August 1995

CONNER®
The Storage Answer

3081 Zanker Road
San Jose, CA 95134-2128
(408) 456-4500

FCC Notice

This equipment generates and uses radio frequency energy and, if not installed and used properly; that is, in strict accordance with the manufacturer's instructions, may cause interference to radio and television reception. It has been type tested and found to comply with the limits for a Class B computing device in accordance with the specifications in Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television reception, which can be determined by turning the equipment on and off, you are encouraged to try to correct the interference by one or more of the following measures:

- Reorient the receiving antenna.
- Relocate the computer with respect to the receiver.
- Move the computer into a different outlet so that the computer and receiver are on different branch circuits.

If necessary, you should consult the dealer or an experienced radio/television technician for additional suggestions. You may find the following booklet prepared by the Federal Communications Commission helpful:

How to Identify and Resolve Radio-TV Interference Problems

This booklet (Stock No. 004-000-00345-4) is available from the U.S. Government Printing Office, Washington, DC 20402.

Warning: Changes or modifications made to this equipment which have not been expressly approved by Conner Peripherals, Inc. may cause radio and television interference problems that could void the user's authority to operate the equipment.

Further, this equipment complies with the limits for a Class B digital apparatus in accordance with Canadian Radio Interference Regulations.

Cet appareil numérique de la classe B est conforme au Règlement sur le brouillage radioélectrique, C.R.C., ch. 1374.

Document No. 501-082 08/95

Important Information About this Manual

All information contained in or disclosed by this document is considered proprietary by Conner Peripherals, Inc. By accepting this material, the recipient agrees that this material and the information contained therein are held in confidence and in trust and will not be used, reproduced in whole or in part, nor its contents revealed to others, except to meet the purpose for which it was delivered. It is understood that no right is conveyed to reproduce or translate any item herein disclosed without express written permission from Conner Peripherals, Inc.

Conner Peripherals, Inc. provides this manual "as is," without warranty of any kind, either expressed or implied, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose. Conner Peripherals, Inc. reserves the right to change, without notification, the specifications contained in this manual.

Conner Peripherals, Inc. assumes no responsibility for the accuracy, completeness, sufficiency, or usefulness of this manual, nor for any problem that might arise from the use of the information in this manual.

Table of Contents

Drive Overview 1

Drive Description

The CFP1080S and CFP1080E are high performance 3.5-inch low-profile (1.0 inch high) disk drives. The both offer 11 millisecond average seek time for Reading, 11.5 millisecond seek time for Writing, with an average latency of only 5.56ms. High capacity is achieved by utilizing a zone density recording technique using 8 recording zones at an areal density of 247 Mbits per square inch. These drives feature high performance while maintaining low power consumption to reduce power supply current and system cooling requirements in disk arrays.

They are designed to operate on the Small Computer System Interface (SCSI) and are SCSI-2 command compatible. The mechanical and major electronic components are identical between the models and differ only in the SCSI physical interface.

Drive Model	*Form Factor*	*Interface*	*Capacity*
CFP1080S	1 inch high, 3.5 inch	50-pin Single Ended FAST	1080MB
CFP1080E	1 inch high, 3.5 inch	80-pin Single Ended FAST	1080MB

For simplicity, we often refer to these drives collectively in this manual as “the drive.”

Drive Features

The drives provide the following features:

- 256 KB segmented cache buffer in the CFP1080S and 512 KB segmented cache buffer in the CFP1080E.
- Tagged Command Queuing with Minimum Access Time Re-ordering and Write/Read Coalescing
- Down-loadable Code through SCSI Interface
- SCSI-2 Compatibility
- 88 bit Reed-Solomon EDAC with on the fly error correction
- Microprocessor-controlled diagnostic routines execute at start-up
- Automatic Spindle Synchronization
- Voltage Regulated Termination Power with removable Resistor Packs (SCSI-2, Alternative 2)
- Active Negation output drivers
- High performance rotary voice coil actuator with embedded servo system
- No thermal recalibration required to maintain performance levels
- High Shock resistance
- Automatic actuator latch against the inner stop upon power down with dedicated landing zone
- Sealed HDA
- 1,7 run length limited code

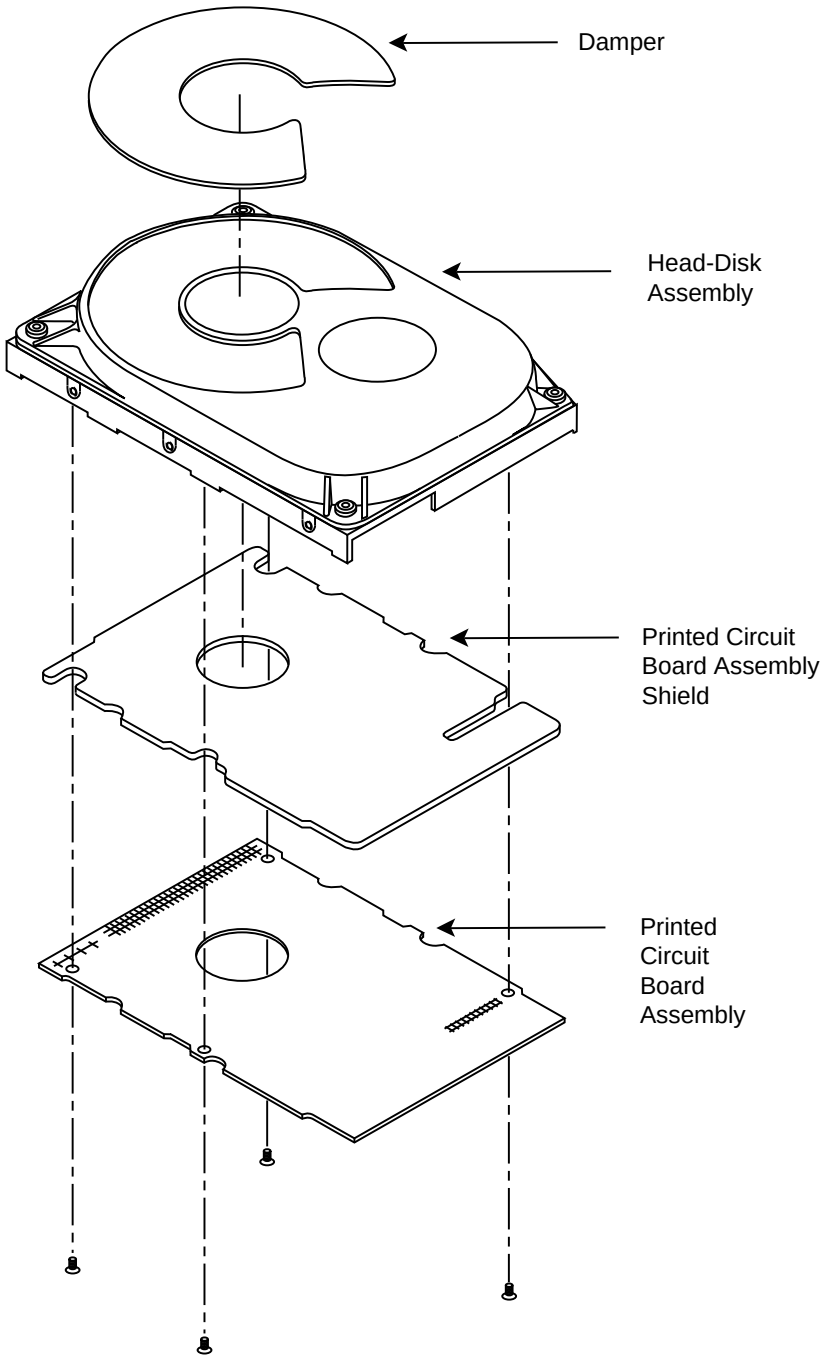
Drive Components

The drive is composed of **mechanical**, **electrical**, and **firmware** elements.

Mechanical Design Features

The drive's hardware includes the components described in the following sections. Figure 1-1 shows the drive top level assembly.

Figure 1-1
Drive Top Level Assembly

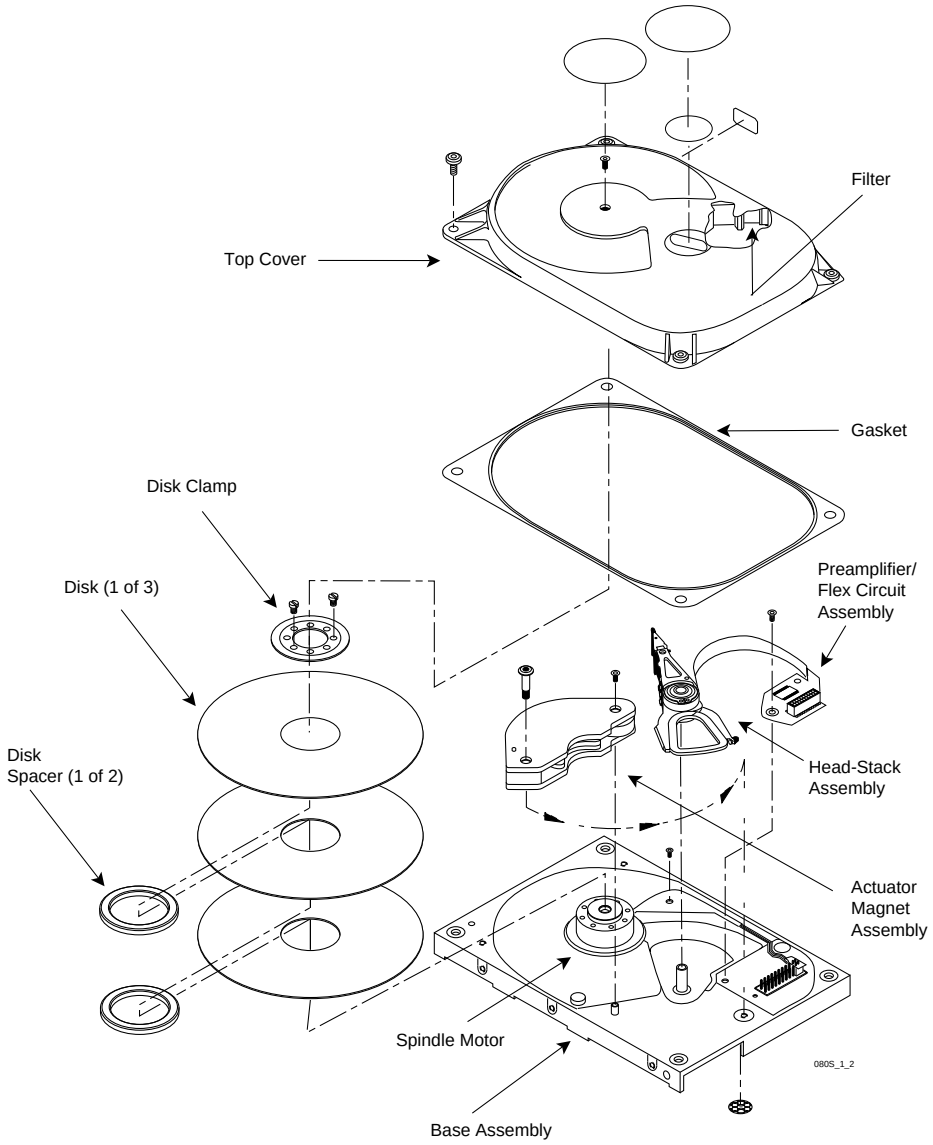


Drive Assembly Housing

The drive assembly housing, or Head-Disk Assembly (HDA) consists of a die-cast aluminum base on which is mounted a die-cast aluminum cover. Both the base and the cover are fabricated using an alloy and surface finishing process designed to inhibit oxidation. A gasket seals the joint between the base and cover to retard the entry of moisture and environmental contaminants from the assembly.

This assembly, the head-disk assembly (HDA), contains an integral 0.3 micron filter, which maintains a clean environment. Critical drive components are contained within this contaminant-free environment. Figure 1-2 shows the HDA and the major assemblies contained within it:

Figure 1-2
Head-Disk Assembly



Drive Motor and Spindle

A brushless DC direct-drive motor assembly is mounted on the drive's base. The motor rotates the drive's spindle at 5400 RPM. The motor/spindle assembly is dynamically balanced to provide minimal mechanical runout to the disks. A dynamic brake is used to provide a fast stop to the spindle motor and return the heads to the landing zone when power is removed.

Head Positioning Mechanism

The read/write heads are supported by a mechanism coupled to a rotary voice coil actuator.

Read/Write Heads and Disks

Data is recorded on 95mm diameter disks through 3370-type 70% nano-slider thin film heads. The drive contains three sputtered thin film disks with six data surfaces and six read/write heads.

At power-down, the heads are automatically retracted to the inner diameter of the disk and are latched and parked on a landing zone that is inside the data tracks.

Data and Power Connections

Data and power connections to the drive are differ between the drive models. Refer to chapter 4 for information regarding a specific model's requirements.

Electrical Design Features

Integrated Circuit

A single integrated circuit (IC) is mounted within the sealed hard drive assembly in close proximity to the read/write heads. The IC provides head selection, read pre-amplification, and write drive circuitry.

Circuit Board

The drive's microprocessor-controlled circuit board provides the remaining electronic functions, which include:

- read/write circuitry
- rotary actuator control
- interface control
- spin speed control
- auto-park
- power management

The processor is a 16-bit Motorola 68HC16. The entire data path between the serializer-deserializer and the interface chip, including the buffer (cache) is 8 bits wide to provide high data throughput. The CFP1080E has a 16-bit wide data path.

The data buffer (cache) utilizes two 256 KB x 4 Dynamic RAMs in the CFP1080S and a single 256K x 16 Dynamic RAM in the CFP1080E. Data path integrity is ensured by appending a 4-byte CRC to blocks as they are transferred from the interface to the buffer through the SCSI controller chip. This CRC is verified by the buffer manager chip as blocks are transferred from the buffer to the disk. A sector data field consists of 512 bytes of data, 4 bytes of CRC and 11 bytes of Error Detection And Correction (EDAC) code. The CRC is checked by the SCSI controller chip as blocks are transferred from the buffer to the interface. The CRC is not sent to the initiator.

Low SCSI transaction overhead is maintained by automating common SCSI bus phases with the SCSI controller chip.

Read/Write Channel

The Read/Write channel, in addition to the preamplifier discussed earlier, consists of three integrated functions in a single IC:

- Pulse Detector
- Data Separator
- Time base

Firmware

The drive's firmware can be considered in three parts. There are two types of SCSI control code and the disk control code with SCSI boot code.

The disk control and SCSI boot code reside in the ROM for the 68HC16 processor. This firmware is responsible for:

- starting the spindle motor and maintaining precise rotational speed
- controlling track following and actuator motion during seeking
- managing disk (media) R/W activity
- power management
- monitoring the overall health of the drive
- serial port communications
- uploading SCSI control code from the disk to RAM
- downloading SCSI control code to the disk
- supporting SCSI commands which do not require disk access

The SCSI control microcode resides in both ROM and RAM. The RAM portion of the code can be upgraded in the field with the SCSI Write Buffer command or through the drive's serial port. Additional information regarding the RAM code can be found in Chapter 3, page 21. The SCSI firmware functions include:

- Operating the SCSI bus through the SCSI controller chip.
- reporting drive status and error conditions to the initiator
- manage operating parameters for the drive
- parsing the Command Descriptor Block
- converting the LBA to the respective physical address, then initiating read and write operations by the disk control code
- grown defect management
- cache management
- queued command reordering (queuing SCSI only)

For more information on the drive's interface implementation and command set, refer to the Eighth Generation Disk Drive SCSI Interface Manual.

Specifications 2

Specifications in this Chapter

This chapter provides the following specifications for the drive:

- drive capacity
- physical configuration
- performance characteristics
- read/write characteristics
- reliability
- power requirements
- environmental tolerances
- safety standards
- physical characteristics

Drive Capacity

Formatted Capacity*

- CFP1080S: 1080.7MB
- CFP1080E: 1080.7MB

*1MB is equal to 10^6 or 1,000,000 bytes

Physical Configuration

Specification	*CFP1080S*	*CFP1080E:*
Disk Type	Sputtered Thin Film	Sputtered Thin Film
Head Type	Thin Film	Thin Film
Actuator Type	Rotary Voice Coil	Rotary Voice Coil
Number of Disks	3	3
Data Surfaces	6	6
Data Heads	6	6
Servo	Embedded	Embedded
Tracks per Surface (user)	3658	3658
Buffer Size	256 KB	512 KB
Track Density	3849 tpi	3849 tpi
Bytes per Sector	512	512
Sectors per Drive (user)	2,110,812	2,110,812

Physical Configuration per Zone

	Data Rate (Mbits/sec)	*Sustained Data Rate (MB/sec)*	*User Sectors per Track **
Zone 0 (OD)	55.7	4.53	119
Zone 1	50.4	3.96	104
Zone 2	47.9	3.77	99
Zone 3	43.1	3.39	89
Zone 4	40.7	3.20	84
Zone 5	37.3	2.93	77
Zone 6	34.4	2.70	71
Zone 7 (ID)	31.5	2.74	65

Averaged sustained data rate for the entire disk: 3.66MB/second.

* The physical track configuration includes one spare sector per track.

Performance Characteristics

Seek Times (typical)[1]

- Track to Track: 3.0 msec
- Average (read/write): 11/11.5 msec [2]
- Full Stroke: 26 msec

1 Drive operating at nominal DC input voltage and nominal operating temperature.

2 The average seek time is determined by averaging the seek time for a minimum of 1000 seeks of random length over the surface of the disk. The apparent average seek time is reduced if multiple tagged commands are queued to the drive.

Average Latency

- 5.56 milliseconds

Rotation Speed (+0.1%)

- 5400 RPM

Controller Overhead [3]

- 700 µsec, typical

3 Measured from the time the disconnect message is acknowledged by the host to the time the drive begins to execute the command.

Start Time(Power Up)[4]

- 0 RPM to Ready
  - Typical: 8.5 seconds
  - Maximum: 20 seconds

4 These numbers assume spin recovery is not invoked. If spin recovery is invoked, the maximum could be 40 seconds. Briefly removing power can lead to spin recovery being invoked.

Stop Time at Power Down

- Typical: 15 seconds
- Maximum: 20 seconds

Interleave

- 1:1

Read/Write Characteristics

Recording Method

- 1,7 RLL code

Recording Density (maximum)

- 64,600 bits per inch

Flux Density (maximum)

- 48,400 flux reversals per inch

SCSI Characteristics

Command Set

- SCSI-2 (refer to the Eighth Generation Disk Drive SCSI Interface Manual for command implementation)

Data Transfer Rate

- To/from Buffer, synchronous narrow: 10.0 MByte/second
- To/from Buffer, synchronous wide (CFP1080E only): 20.0 MByte/second

Maximum Synchronous Transfer Offset:

- 15 bytes

Maximum Tagged Command Queue Depth:

- 32 commands

Reliability

Data Reliability

- < 1 non-recoverable error in 10^{14} bits read

Component Design Life

- 5 years

Start/Stop cycles

- 40,000 minimum

Mean Time Between Failures:

- 500,000 power-on hours*

* Projected MTBF based on comparison of similar Conner products

Mean Time to Repair

- 10 minutes, typical

Preventive Maintenance

- None

Power Requirements

Mode[1]:	+5 Volts (typical):	+12 Volts (typical):	Watts (typical):	Watts (maximum):
Read/Write	450 mA	200 mA	4.7 W	5.0 W
Seek (30%)	450 mA	250 mA	5.3 W	5.5 W
Idle	300 mA	200 mA	3.9 W	4.5 W
Standby	300 mA	0 mA	1.5 W	1.7 W
Spin-Up	500 mA	1500 mA	N/A	N/A

[1] Refer to Chapter 3 for a definition of the modes. Typical conditions are both voltages at nominal value, room temperature (25° C) ambient to the drive without terminators installed. Maximum power is when the supply voltage is at the worst case condition.

Minimum/Maximum Voltage:

- +5V: +5%
- +12V: +10%

Maximum Allowable Peak-to Peak Noise (DC to 1 Mhz: equivalent resistive load):

- +5V: 2%
- +12V: 1%

Environmental Tolerances

Temperature:

- Operating: 5° to 55° C
- Non-operating: -40° to 60° C
- Thermal Gradient: 20° C per hour maximum

Relative Humidity (non-condensing):

- Operating: 5 to 95%
- Non-operating: 5 to 95%
- Maximum Wet Bulb: 29°C

Altitude (relative to sea level):

- Operating: -200 to 10,000 feet
- Non-operating: 40,000 feet (maximum)
- Altitude Gradient: 1,000 feet/minute

Shock (half-sine pulse, 11 ms duration):

- Operating: 5G peak without non-recoverable errors
- Non-operating: 75G without non-recoverable errors

Vibration (swept-sine, one octave per minute):

- Operating
  - 5 - 32 Hz: 0.010 inch displacement; peak to peak
  - 32 - 400 Hz: 0.5G without non-recoverable errors
- Non-operating
  - 5 - 28 Hz: 0.020 inch displacement; double amplitude
  - 28 - 400 Hz: 4G peak

Magnetic Field:

- The disk drive will meet its specified performance while operating in the presence of an externally-produced magnetic field under the following conditions:

Field Frequency	Intensity
DC	6 gauss
to 700 Khz	7 milligauss
700 Khz to 1.5 Mhz	3 milligauss

Acoustic Noise:

- The acoustic level will not exceed 37 dBA sound pressure at a distance of 1 meter from the drive or 4.3 Bels sound power in Idle Mode .

Safety Standards

The drive is designed to comply with relevant product safety standards, including:

- UL 478, 5th edition, Standard for Safety of Information Processing and Business Equipment
- UL 1950, Standard for Safety of Information Technology Equipment
- CSA 22.2 #220, Information Processing and Business Equipment
- CSA 22.2 #950, Safety of Information Technology Equipment
- IEC 380, Safety of Electrically Energized Office Machines
- IEC 950, Safety of information Technology Equipment Including Electrical Business Equipment
- VDE 0805, VDE 0805 TIEL 100, and VDE 0806
- Complies with FCC Class B, Part 15, Subpart J

Physical Characteristics - CFP1080E

Height:

- 1.0 inch ± .030

Width:

- 4.0 inches ± .020

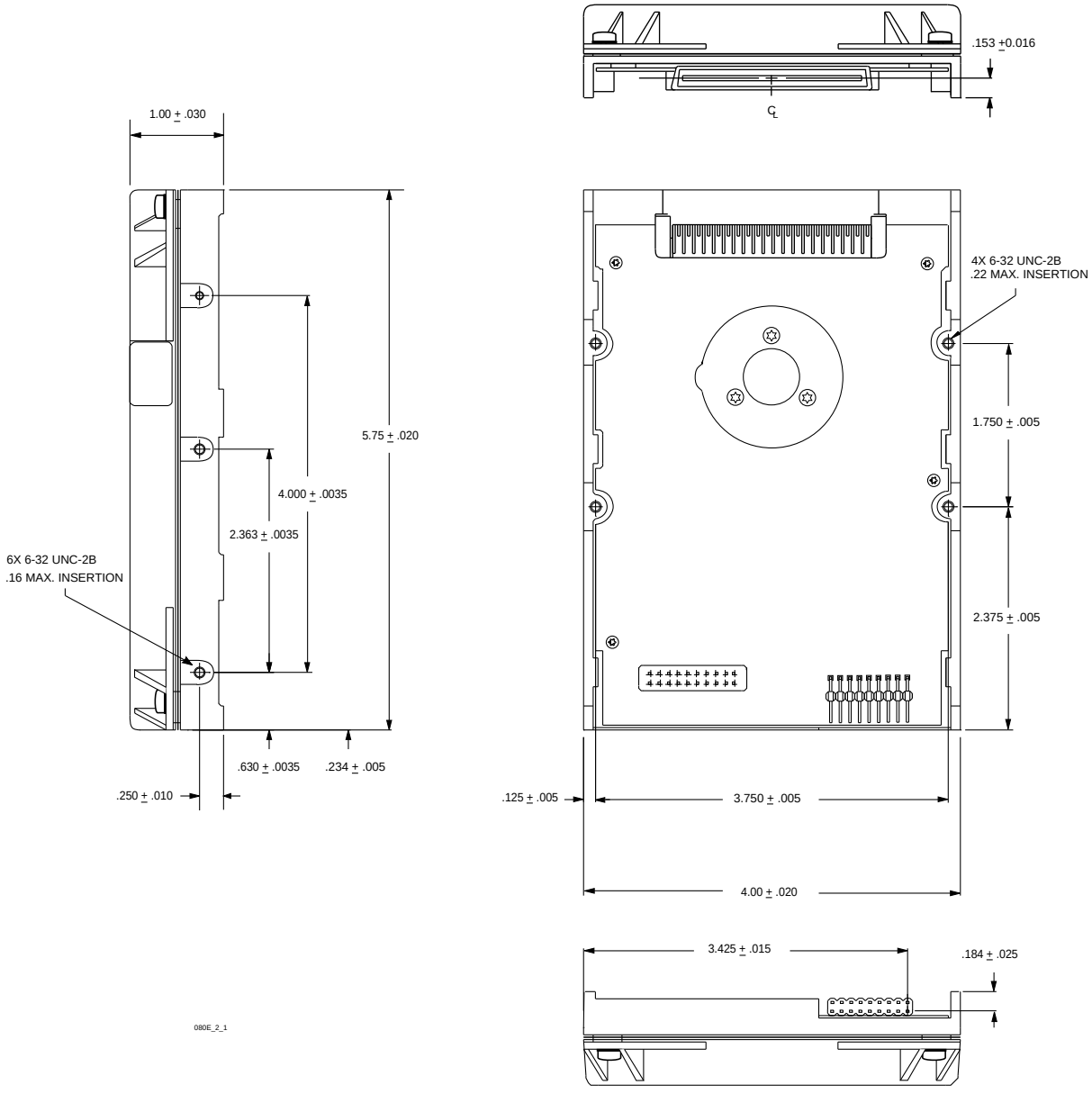
Depth:

- 5.75 inches ± .020

Weight:

- 1.3 pounds

Figure 2-1
The Drive's Physical Dimensions



Physical Characteristics - CFP1080S

Height:

- 1.0 inch ± .030

Width:

- 4.0 inches ± .020

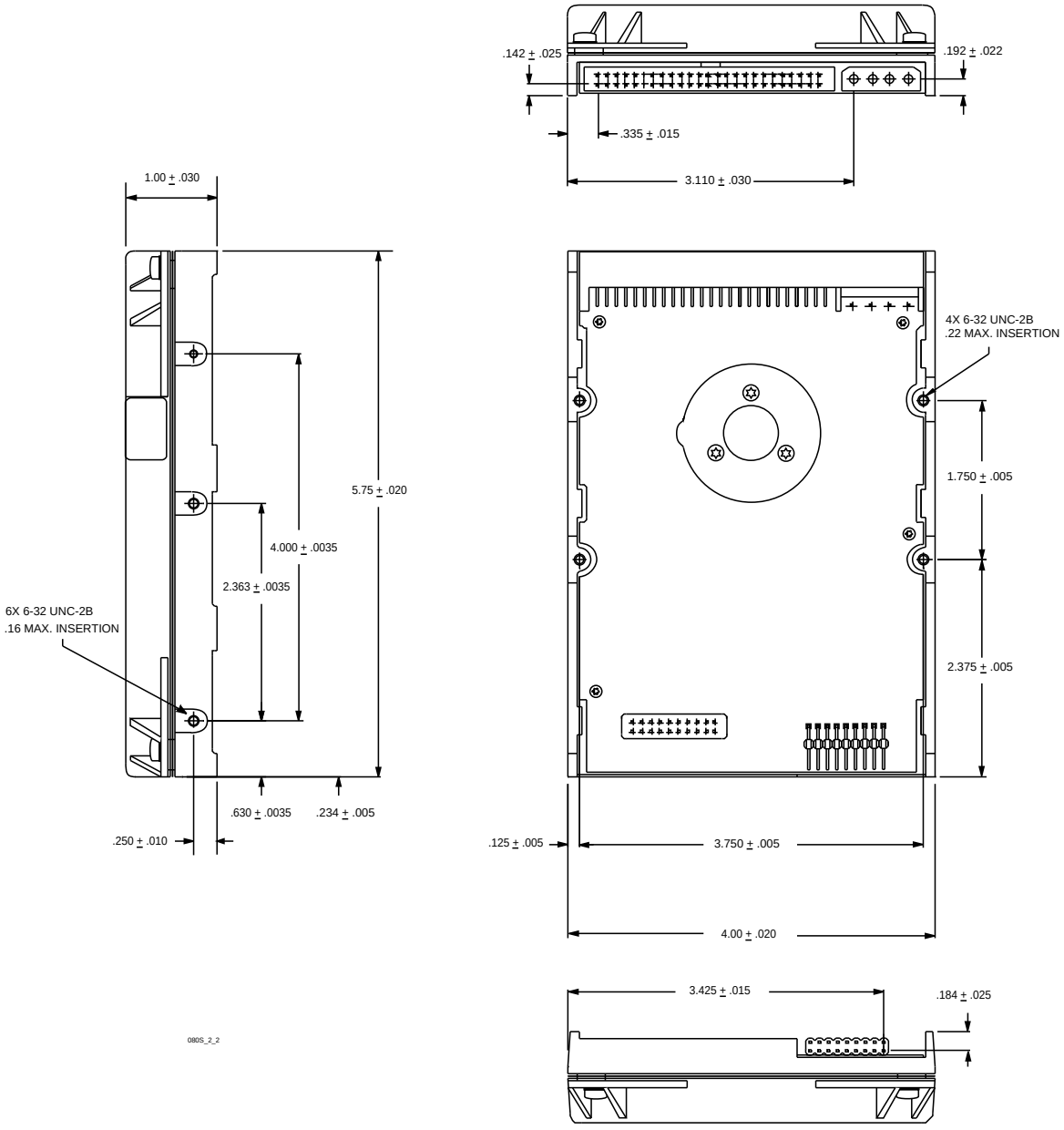
Depth:

- 5.75 inches ± .020

Weight:

- 1.3 pounds

Figure 2-2
The Drive's Physical Dimensions



Drive Operation 3

Drive Functions

This chapter describes certain operational aspects of the drive, including discussions of:

- drive operational modes
- error correction
- read error recovery
- downloadable microcode
- buffer management

Drive Operational Modes

The drive operates in the following modes:

- **Read/Write Mode** occurs when data is read from or written to the disk. The power consumption specified for this mode is an averaged value assuming a duty cycle of 35% read and 65% write.

- **Seek Mode** occurs when the actuator is in motion 100% of the time.

- **Seek (30%) Mode** simulates typical random write/read activity on the drive where seek has a 30% duty cycle.

- **Idle Mode** occurs when the drive is not reading, writing, or seeking. The motor is up to speed and the **Drive Ready** condition exists. The actuator is residing on the last-accessed track.

- **Standby Mode** occurs when the motor is stopped and the actuator is latched in the landing zone. The drive will enter Standby mode after power-on reset if the Disable Spin jumper is installed or the Disable Spin Up bit in the vendor-specific Mode Page 0 is set. A START STOP UNIT command with Start = 0 will also place a drive into Standby Mode. The drive will spin up and go into Idle mode when a START STOP UNIT command is issued with Start = 1 or on a timed basis by SCSI ID if the Delay Spin Up bit is set in the vendor-specific Mode Page 0. Refer to the MODE SELECT and MODE SENSE commands in the Eighth Generation Disk Drive SCSI Interface Manual for additional details.

- **Spin-Up Mode** occurs while the drive's spindle motor is being spun up to speed after initial power on or after exiting Standby Mode.

Error Correction

The drive uses a Reed-Solomon code to perform error detection and correction. For each 512-byte block, the software error correction polynomial is capable of correcting:

- one error burst of up to 22 bits in length
- two error bursts each up to 11 bits in length

Single bursts of 11 bits or less are corrected on the fly (OTF) with no performance degradation. A larger defect up to 22 bits in length or a second defect of up to 11 bits in length is corrected using firmware within one latency period, after all retries have been exhausted.

The code has the following error detection capability:

- three error bursts each up to 11 bits in length
- a single burst of up to 51 bits in length

Read Retry Operations

The drive retries data field read operations in the following sequence if it detects an error which cannot be corrected on-the-fly. The default retry algorithm repeats up to four times for a total of 64 retry steps or until the data is recovered.

1. Initial read
2. First retry
3. Read retry with data threshold offset +1
4. Read retry with data threshold offset -1
5. Read retry with data window offset +1
6. Read retry with data window offset -1
7. Write Spash
8. Read retry with data threshold offset +2
9. Read retry with data threshold offset -2
10. Read retry with data window offset +2
11. Read retry with data window offset -2
12. Normal read retry
13. Read retry with servo offset +8%
14. Read retry with servo offset -8%
15. Normal read retry
16. Software (2-burst) EDAC correction attempt

If retries are disabled, the drive retries the operation one time before it reports an error.

Downloadable Microcode

The SCSI interface code is split into three functional parts which execute from either ROM or RAM. The SCSI boot code resides in ROM with the disk control code. It contains the boot-up routines and supports commands such as INQUIRY, TEST UNIT READY, REQUEST SENSE, START/STOP UNIT, which do not require media access. The code which supports the rest of the commands resides on an area of the disk which is reserved to the drive and is not accessible through the user addressable space. This code is read from the disk and loaded into static RAM after power is applied and the drive is able to read from the disk.

Two different types of SCSI control code reside on the disk. The SCSI Look-Ahead code is the default and is loaded into RAM during the initial power-on sequence. If a Queue Tag message is received by the drive, the drive will execute the command and while in Status Phase, will read the SCSI Queuing code from the disk and load it into the RAM. This operation typically takes about 100 ms, after which the drive will complete the command by sending the status. The drive will continue to operate with SCSI Queuing code residing in RAM until the next Power-On sequence.

Refer to the next section for a discussion of the buffer management implications for the different types of SCSI control code.

The SCSI control code may be upgraded and saved on the disk via the drive's serial port or through SCSI using the WRITE BUFFER command. Refer to the WRITE BUFFER command in the Eighth Generation Disk Drive SCSI Interface Manual for a discussion of the procedure.

Buffer Management and Command Execution

SCSI Look Ahead Control Code

The SCSI Look Ahead control code executes commands sequentially as they are received from the initiator(s). Commands from multiple initiators may be received but will not be reordered.

The drive's data buffer is configured as multiple segments. These segments allow the drive to cache sequential data from separate areas on the disk. This can significantly improve performance in any environment in which multiple disk files are kept open simultaneously and operated upon in some interleaved fashion.

Buffer operations default on power-up with Read Caching and Write Caching enabled. The Caching Page RCD bit (Mode Page 8, byte 2, bit 0) when set to one disables the read cache function. The Caching Page WCE bit (Mode Page 0, byte 2, bit 2) when set to zero disables write cache. In addition, the Caching Page contains two fields which control the retention priority for reads and writes. Refer to the Eighth Generation Disk Drive SCSI Interface Manual for additional details.

When a read command is received by the disk drive, the segment records are searched to determine if the requested data is cached in a segment (a cache hit). If there is no cache hit, the next inactive segment is selected and a read from disk is initiated into that segment. The retention of data already transferred to the host is controlled by the state of the Demand Read Retention Priority value in the Caching Page.

The SCSI control firmware always initiates a "read forever" command and the buffer segment is treated as a circular buffer. Data is retained until the control firmware determines that it is no longer needed or that performance would be improved if additional blocks were prefetched. There are three different situations which would be considered a cache hit on a subsequent read.

- **Full Hit:** All of the requested data is cached in a buffer segment. The data may be transferred to the initiator immediately.

- **Partial Hit:** This is when at least the first block, but not all of the data, is cached in a buffer segment. Remaining data must be read from the disk, either by the currently executing disk read process or by a newly instigated disk read.

- **Potential Hit:** None of the data is cached; however, the currently executing disk read is within one revolution of the first block. The current disk read process is left active and the data is transferred to the initiator after it is read into the buffer.

Write Caching

SCSI Write Caching allows write commands to send status and a command complete message before the data is written to the disk. This potentially allows data for multiple sequential write commands to be written to the disk without a disk revolution intervening between commands. Write caching is enabled by setting the WCE bit in the Caching Page to one. The WCE bit is only supported by the Look Ahead code. The WCE bit is ignored by the Queuing code. Write coalescing allows the same performance advantages.

The drive will send Good status and Command Complete immediately following the end of the data out phase of a cached write command.

If the drive encounters an error during a cached write operation, the drive will respond by:

If AWRE (Read-Write Error Recovery Page) is 0: the drive will report a CHECK CONDITION on the next command and the response to a REQUEST SENSE will be a deferred error. (Asynchronous event notification is not supported by this drive.) Refer to the Eighth Generation Disk Drive SCSI Interface Manual for additional details.

If AWRE is set to 1: the drive will attempt to reassign the block and complete the operation. If the reassignment fails, the drive will report Check Condition status on the next command and the response to a Request Sense command will be a deferred error.

SCSI Queuing Control Code

The drive, operating using the SCSI Queuing control code, can queue up to 32 commands. Reads and writes are re-ordered using minimum access time prediction. Sequential Read and Write commands are coalesced to maximize performance.

Command Re-ordering

Commands are re-ordered using a minimum access time prediction algorithm.

Command re-ordering is controlled by Queue Tag Messages (Simple, Head of Queue or Ordered Queue). Re-ordering of commands may also be restricted using the Queue Algorithm Modifier bits in the Control Mode Page. Refer to the Eighth Generation Disk Drive SCSI Interface Manual for additional information on Messages and Mode Pages.

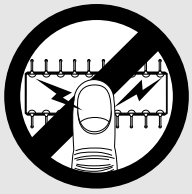
Buffer Management

The buffer is treated by the SCSI queuing code as multiple segments. Pre-fetch reads are performed by the drive following a read when there are no commands in the queue awaiting execution.

Sequential read or write commands are coalesced. For coalesced reads, the data is transmitted to the initiator as it is read from the disk using a single segment. On write operations, the drive will transmit the data sequentially into one segment. The data will be written to the disk as it is available in the buffer using the single segment and without pause between coalesced commands (if the SCSI data transfer stays ahead of the disk). This operation provides the performance of write caching without the exposure of informing the initiator that the command has completed prior to writing the data to the disk.

Installing the Drive 4

Take These Precautions



To protect your equipment from electrostatic damage, perform the installation at a static-safe workstation. If one is not available, follow these guidelines:

1. Work in an uncarpeted area.

2. Before removing the equipment from its anti-static bag, discharge static electricity by touching your computer's metal chassis (or any other grounded object) while touching the anti-static bag.

3. Do not touch circuit boards unless instructed to do so.

0170

Installing the Drive

To install the drive, you must:

- set the drive's jumpers, if desired
- attach a data cable to the drive
- attach power to the drive
- mount the drive

These procedures differ between the various drive models.

Installing a CFP1080E

The following paragraphs describe the installation procedure for a 16-bit Single Connector Attachment (SCA) interface, model CFP1080E drive.

Setting the Drive's Jumpers - CFP1080E

There are no jumpers to set on the model CFP1080E drive since all the necessary control signals are on the SCA connector. This drive is intended for applications where the drive is configured by asserting the appropriate control signal on the cable or the backplane.

Setting the SCSI Bus Address - CFP1080E

The SCSI bus ID of the drive is set by grounding the Interface bus signals shown below in Table 4-1. Refer to Table 5-8 on page 44 for interface connector pin assignments.

Table 4-1
Setting the SCSI ID

SCSI ID	SCSI ID(0)	SCSI ID(1)	SCSI ID(2)
0	Open	Open	Open
1	Ground	Open	Open
2	Open	Ground	Open
3	Ground	Ground	Open
4	Open	Open	Ground
5	Ground	Open	Ground
6	Open	Ground	Ground
7	Ground	Ground	Ground

Disabling Spin-Up at Power On - CFP1080E

Spin up upon application of power to the drive can be disabled by grounding the RMT_START line on the interface. Disabling spin up on application of power can also be enabled by setting the DSPN bit in MODE SELECT page 00_H (Vendor Specific Parameters). The Host must issue a START STOP UNIT command to cause the drive to spin up. Refer to the Eighth Generation Disk Drive SCSI Interface Manual for additional information regarding the MODE SELECT and START STOP UNIT commands.

Table 4-2
Disabling Spin Up at Power On

RMT_START Interface Pin	Mode Page 0 DSPN bit	Power-On Behavior
Ground	0	Spin Disabled
Ground	1	Spin Disabled
Open	0	Spin up on Power On
Open	1	Spin Disabled

Delaying Spin Up at Power On - CFP1080E

Grounding the DLYD_START signal on the interface delays spin up on power-up by the value of the drive's SCSI ID multiplied by 4 seconds (i.e. SCSI ID 4 will delay 16 seconds). Delaying spin up on application of power can also be enabled by setting the SDLY bit in MODE SELECT page 00_H (Vendor Specific Parameters). Refer to Eighth Generation Disk Drive SCSI Interface Manual for additional information regarding the MODE SELECT command.

Table 4-3
Delaying Spin Up at Power On

DLYD_START Interface Pin	Mode Page 0 *SDLY* bit	Power-On Behavior
Ground	0	Spin Delayed
Ground	1	Spin Delayed
Open	0	Spin up on Power On
Open	1	Spin Delayed

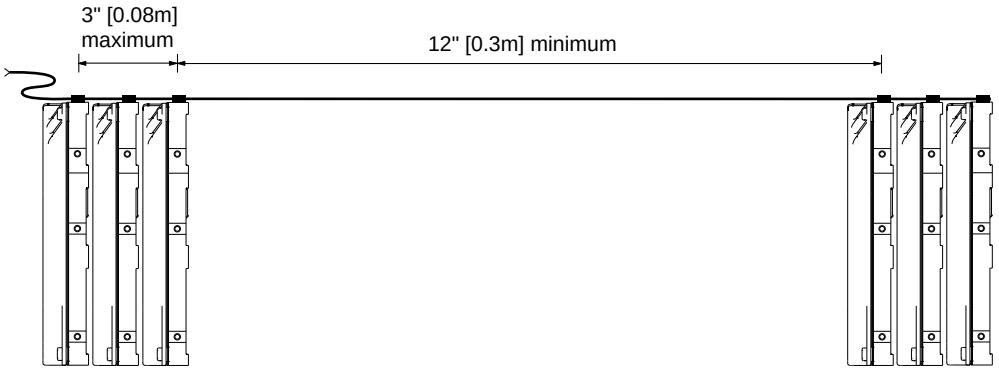
Host Interface Connection - CFP1080E

The drive may be connected to the host SCSI interface directly through a backplane SCA connector or through cabling. Both the connector and cabling is described in Chapter 5.

The design of the SCSI bus interconnect system should meet the following guidelines, particularly with FAST SCSI-2 systems:

- Do not route the data signals next to any high frequency or large current switching signals. Unreliable drive operation can result from improper signal routing.
- Signal line stubs should not exceed 0.1 meter (4 inches).
- There should be 0.3 meters (12 inches) of transmission line between drives.
- The total length of any signal line should not exceed 6 meters (20 feet) and may have to be reduced if excessive impedance discontinuities exist on the bus.
- Maintain a minimum of 0.050 inches (1.27mm) gap between adjacent signal.runs to control crosstalk between signal lines.
- Signals routed over a ground plane or between ground planes have different characteristic impedance. Signals with critical timing like REQ, ACK and Data should be routed similarly.

The signal length between devices should either be spaced shorter than the stub length, which treats a group of devices as a lumped element, or far enough apart that a transmission line exists (0.3 meters or 12 inches). These signal length considerations should include the length of signal traces and connectors on the printed circuit board. The diagram below shows how it is possible to interconnect six 1-inch height drives over a relatively short length of interconnect.



These guidelines apply to both cabled and backplane implementations. Guidelines specifically for cabled implementations can be found on page 36. While it is possible to connect SCA drives using a cable, users should be aware that the mating connector is designed for 0.025 inch (0.63 mm) pitch 30 AWG wire. There are four +12 volt and three +5 volt line pairs carrying power to the drive on the SCA so spin up must be staggered to connect two drives on the same cable. Otherwise, there should only be one drive per cable.

Attaching Power to the Drive - CFP1080E

The drive is powered through the SCA interface.

Mounting the Drive - CFP1080E

The drive is designed to be used in applications where the unit may experience shock and vibrations at greater levels than larger and heavier disk drives will tolerate.

The design features which allow greater shock tolerance are the use of rugged heads and media, a dedicated landing zone, closed loop servo positioning and specially designed motor and actuator assemblies.

Eight side, or four bottom base mounting points are provided to the customer. The drive is mounted using 6-32 UNC -2B X 0.16 maximum insertion length screws. Refer to Figure 2-1 in Chapter 2 for the location of the mounting holes. The system integrator should allow ventilation to the drive to ensure reliable drive operation over the operating temperature range. The drive may be mounted in any orientation.

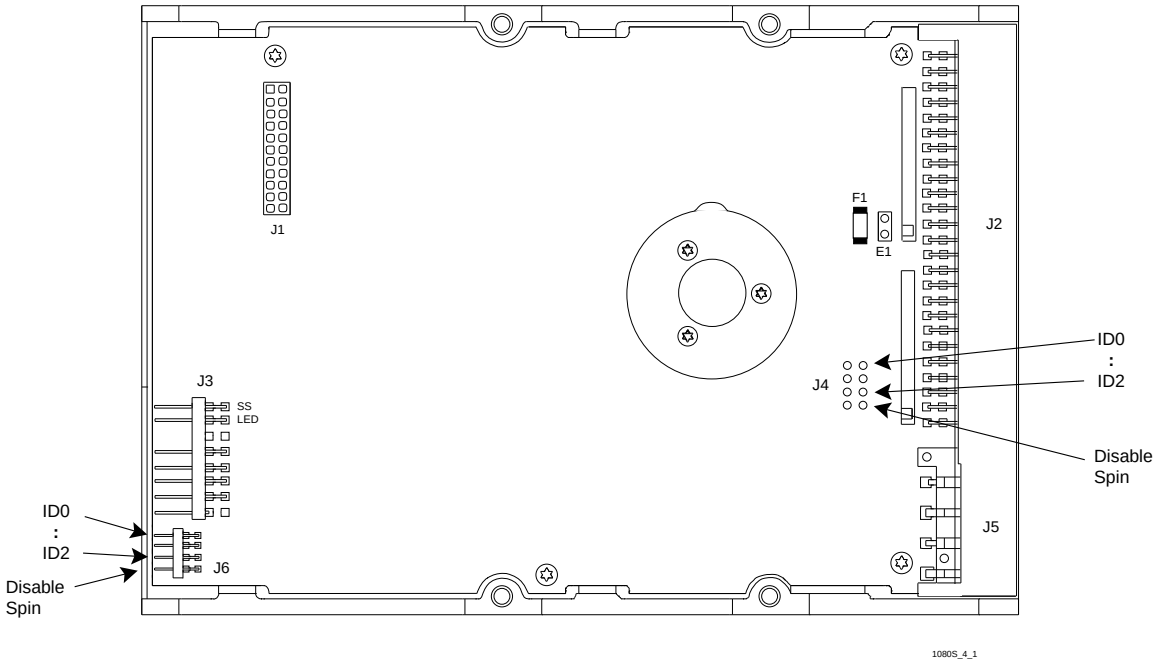
Installing a CFP1080S

The following paragraphs describe the installation procedure for an 8-bit, 50-pin SCSI-2 interface, model CFP1080S drive.

Setting the Drive's Jumpers - CFP1080S

Figure 4-1 shows you where the drive's jumpers are located.

Figure 4-1
Jumper Locations



Setting the SCSI Bus Address - CFP1080S

There are three jumpers available for configuration of the SCSI ID: ID0, ID1, and ID2 located on two different headers. One set is located at J4, behind the SCSI interface connector. The additional 2mm pin pitch right angle header is located on the front of the PCBA (opposite the SCSI interface connector).

Either header may be used to configure the SCSI ID of the drive. These headers may also be used to cable the SCSI ID select to a remote switch. A receptacle connector Amp P/N 111622-1 or equivalent can be used to connect to this header.

Table 4-4 defines the relationship between the jumpers and the SCSI ID:

Table 4-4
Setting the SCSI ID

SCSI ID	ID0	ID1	ID2
0	Out	Out	Out
1	In	Out	Out
2	Out	In	Out
3	In	In	Out
4	Out	Out	In
5	In	Out	In
6	Out	In	In
7	In	In	In

Note: When controlling the SCSI ID remotely, In = Ground or TTL Low and Out = Open or TTL High. The signal pins are the odd numbered pins (1,3,5,7) on both J4 and J6).

Disabling Spin-Up at Power On - CFP1080S

A jumper in the **Disable Spin** location, disables spin up after power-on for applications where spin up sequencing is necessary. An optional 2mm pin pitch right angle header is located on the front of the PCBA (opposite the SCSI interface connector) can alternatively be used to disable spin up. Disabling spin up on application of power can also be enabled by setting the DSPN bit in MODE SELECT page 00_H (Vendor Specific Parameters). The Host must issue a START STOP UNIT command with Start=1 to cause the drive to spin up. Refer to the Eighth Generation Disk Drive SCSI Interface Manual for additional information regarding the MODE SELECT and START STOP UNIT commands. Refer to Figure 4-5 for the location of the Disable Spin jumper.

Table 4-5
Disabling Spin Up at Power-On

Disable Spin Jumper	Mode Page 0 DSPN bit	Power-On Behavior
In	0	Spin Disabled
In	1	Spin Disabled
Out	0	Spin up on Power On
Out	1	Spin Disabled

Note: In = Ground or TTL Low and Out = Open or TTL High. The signal is on pin 7 and the low reference is on pin 8 of both J4 and J6.

Disabling SCSI Bus Terminator Power (TERMPWR) - CFP1080S

Power to the on-board terminators is provided by the higher of the voltage supplied at Pin #26, J2 or the voltage level at the 5 Volt power input to the drive minus one diode drop. Termination Power to external terminators can be supplied by the drive through Pin #26, J2. The signal output characteristics are described in chapter 5. The TERMPWR line can be disconnected from the drive by removing Jumper E1.

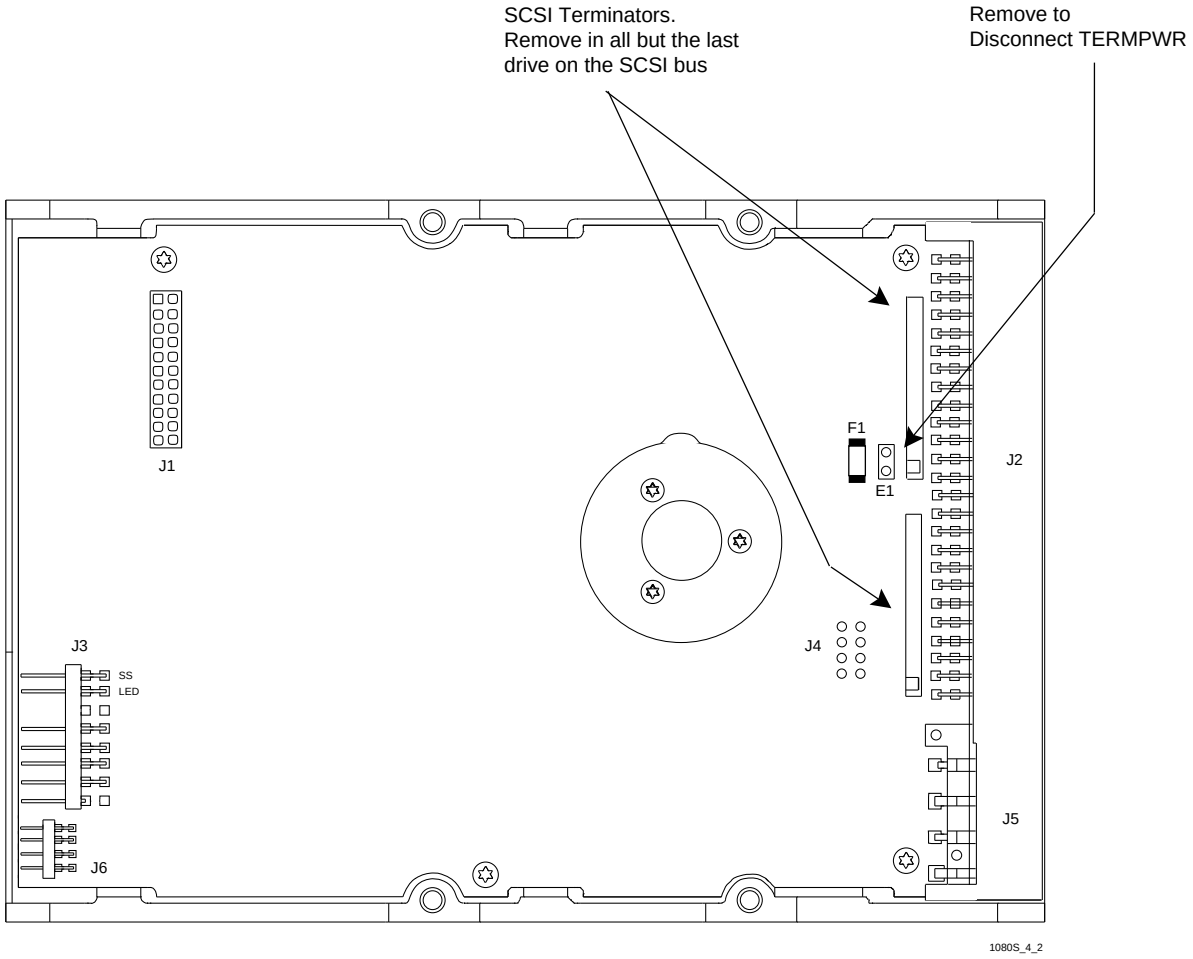
Table 4-6
Disabling SCSI Bus TERMPWR

Jumper E1	*Result*
In	TERMPWR (J2, Pin #26) connected to the drive's internal termination power.
Out	TERMPWR (J2, Pin #26) open circuit.

Setting the Bus Termination - CFP1080S

This drive provides on-board Alternative 2 active termination for the SCSI bus. The termination resistors, which are contained in two Single Inline Packs (SIPs) should be removed from the drive unless it is a SCSI device at the physical end of the bus. Figure 4-2 shows the location of the terminator resistors.

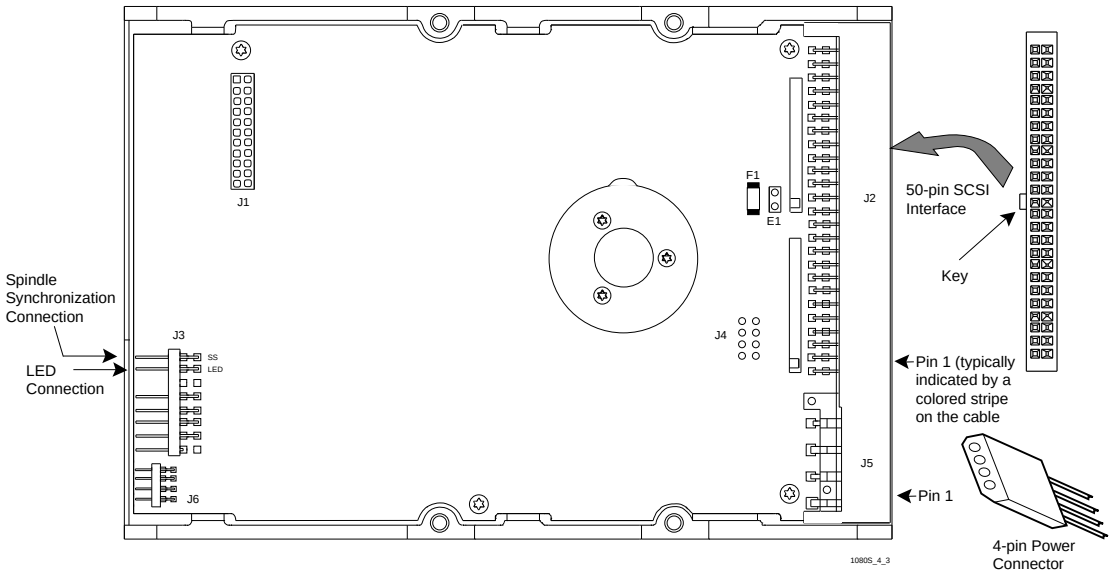
Figure 4-2
Terminator Resistor Locations



Cabling the Drive - CFP1080S

Connect the SCSI interface cable and the spindle synchronization cable (when needed) as shown in Figure 4-3.

Figure 4-3
Connecting the cabling



SCSI Bus Cable

The cable and mating connector required to connect the drive to the SCSI bus are described in Chapter 5. In addition, the cable should meet the following guidelines, particularly with FAST SCSI-2 systems:

- Do not route the data cable next to the drive PCB or any other high frequency or large current switching signals. Unreliable drive operation can result from improper cable routing.
- Cable stubs should not exceed 0.1 meter (4 inches).
- There should be 0.3 meters (12 inches) of cable between drives.
- The total cable length should not exceed 6 meters (20 feet) and may have to be reduced if a mixture of round and flat cable are used.
- Do not tightly bundle excess flat cable against each other since this promotes cross coupling of signals on the cable. Use spacers to maintain a minimum of 0.050 inches (1.27mm) gap between cable runs.
- Do not clamp the cable tightly against a metal chassis since this will degrade the signal. Use spacers or a non-flammable insulation material to maintain a gap between the chassis and the cable.

Spindle Synchronization

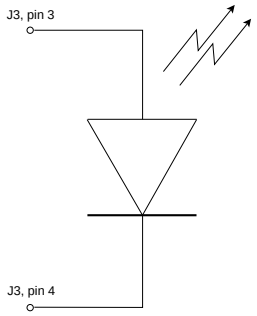
The spindle rotation of up to 35 drives may be synchronized together by daisy chaining pin 1 to pin 1 and pin 2 to pin 2 on connector J3. The spindles are synchronized using a "floating master" concept, where the drives will synchronize to the first drive to reach full speed. The synchronization tolerance is 1%.

Attaching Power to the Drive - CFP1080S

The drive has a 4-pin DC power connector, J4 mounted on the PCB. The recommended mating connector is AMP part number 1-480424-0 utilizing AMP pins, part number 350078-4 or equivalent.

Connect the DC Power cable to the drive as shown in Figure 4-3.

Attaching a Remote LED - CFP1080S



A remote LED can be attached using a 0.1 inch center, 2-pin connector to pins 3 and 4 of J3. The anode of the LED should be connected to pin 3 and the cathode to pin 4. The external LED is connected in parallel to the on board LED and is powered through a 200 ohm current limiting resistor to the +5 volt power.

Mounting the Drive - CFP1080S

The drive is designed to be used in applications where the unit may experience shock and vibrations at greater levels than larger and heavier disk drives will tolerate.

The design features which allow greater shock tolerance are the use of rugged heads and media, a dedicated landing zone, closed loop servo positioning and specially designed motor and actuator assemblies.

Eight side, or four bottom base mounting points are provided to the customer. The drive is mounted using 6-32 UNC -2B X 0.16 maximum insertion length screws. Refer to Figure 2-3 in Chapter 2 for the location of the mounting holes. The system integrator should allow ventilation to the drive to ensure reliable drive operation over the operating temperature range. The drive may be mounted in any orientation.

Interface Physical Characteristics 5

Electrical Description

The paragraphs which follow describe the input and output electrical characteristics of the drive.

Output Characteristics

The output drivers for Data, Parity, REQ and ACK are optionally active negation. When they are set for active negation, they have three states: asserted, negated and high impedance. The remainder of the signals have open collector (drain) outputs. The drivers maintain a high impedance state during power-on and power-off cycles. The driven signals have the following output characteristics when measured at the drive connector:

Table 5-1
Active Negation Driver Output Signal Characteristics

Signal Characteristic	*Value*
Signal Assertion	0.1 VDC to 0.5 VDC at 48 mA
Minimum Driver Output Capability	48 mA (sinking) at 0.5 VDC
Signal Negation	2.0 VDC to 3.24 VDC at 7 mA 3.0 VDC at 20 mA

Table 5-2
Open Collector Driver Output Signal Characteristics

Signal Characteristic	*Value*
Signal Assertion	0.0 VDC to 0.5 VDC at 48 mA
Minimum Driver Output Capability	48 mA (sinking) at 0.5 VDC
Signal Negation	2.5 VDC to 5.25 VDC

Input Characteristics

The characteristics of the input receivers and the requirements for each signal received by the drive as measured at the drive connector are shown in table 5-3:

Table 5-3
Drive Input Signal Characteristics

Signal Characteristic	*Value*
Signal Assertion	0.0 VDC to 0.8 VDC
Signal Negation	2.0 VDC to 5.25 VDC
Input Load (low level)	-20 μA to 0.0 mA at 0.5 VDC
Input Load (high level)	0.0 mA to 20 μA at 2.7 VDC

Model-Specific SCSI Physical Characteristics

The sections which follow describe, for each of the drive models, those SCSI characteristics which vary from model to model. These characteristics include:

- Termination
- Cable requirements
- Connector requirements
- Connector Pin assignments
- Interface Timing requirements

CFP1080E (WIDE, 80-pin Single Connector Attachment [SCA])

External Terminator Power

The interface connector carries both power and ground so a separate TERMPWR interface line is not provided.

Internal Termination

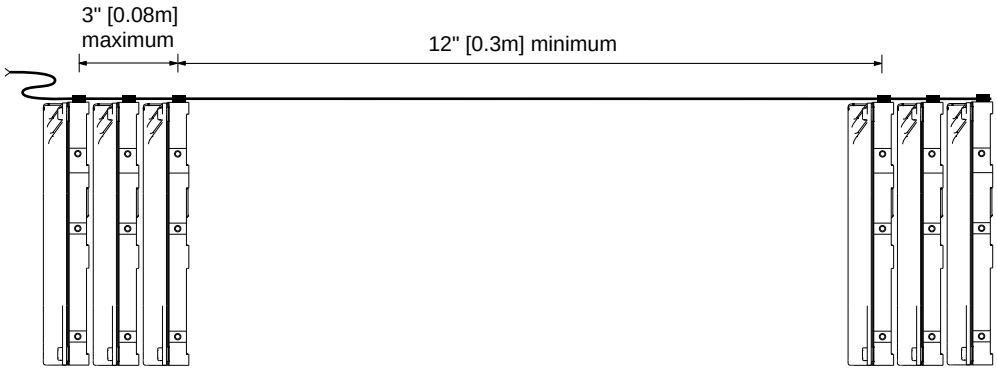
This version of the drive has no on-board termination so the drive must be externally terminated. Alternative 2 active termination is recommended.

Cable Requirements

This version of the drive is designed to facilitate interfacing directly to a mating connector which is on a passive back plane or directly into a motherboard. The design of the SCSI bus interconnect system should meet the following guidelines, particularly with FAST SCSI-2 systems:

- Do not route the data signals next to any high frequency or large current switching signals. Unreliable drive operation can result from improper signal routing.
- Signal line stubs should not exceed 0.1 meter (4 inches).
- There should be 0.3 meters (12 inches) of transmission line between drives.
- The total length of any signal line should not exceed 6 meters (20 feet) and may have to be reduced if excessive impedance discontinuities exist on the bus.
- Maintain a minimum of 0.050 inches (1.27mm) gap between adjacent signal.runs to control crosstalk between signal lines.
- Signals routed over a ground plane or between ground planes have different characteristic impedance. Signals with critical timing like REQ, ACK and Data should be routed similarly.

The signal length between devices should either be spaced shorter than the stub length, which treats a group of devices as a lumped element, or far enough apart that a transmission line exists (0.3 meters or 12 inches). These signal length considerations should include the length of signal traces and connectors on the printed circuit board. The diagram below shows how it is possible to interconnect six 1-inch height drives over a relatively short length of interconnect.



Connector Requirements

The drive's connector will mate with a AMP Champ 2-557103-1 vertical receptacle or the AMP Champ 2-557101-1 right angle receptacle. A mating connector which is compatible with 0.025 inch (0.63 mm) centerline #30 AWG solid PVC insulation cabling is AMP Camp 1-557089-3. Refer to figure 2-1 for the location of the connector on the drive.

Single Connector Attachment (SCA) Signal Definitions

Power

Four +12 volt signals and four +12 volt ground signals provide the +12 volt power to the drive. The maximum current that can be provided to the drive through the +12 Volt signal pins is 3 Amperes. The supply current and return current must be distributed as evenly as possible among the pins. The maximum current is while the drive motor is starting.

Three +5 volt signals and three +5 volt ground signals provide +5 volt power to the drive. The +5 volt ground signals are at the same level as the digital logic ground on the SCSI bus. The maximum current that can be provided to the drive through the +5 Volt signal pins is 2 Amperes. The supply current and return current must be distributed as evenly as possible among the pins.

These specifications refer to the connector's characteristics. Refer to Chapter 2 for the drive's power requirements.

Spindle Sync

The spindle rotation of up to 35 drives may be synchronized together by daisy chaining pin 1 to pin 1 and pin 2 to pin 2 of each drive on connector J3. The spindles are synchronized using a "floating master" concept, where the drives will synchronize to the first drive to reach full speed. The synchronization tolerance is 1%.

Table 5-4
Electrical Characteristics for the Spindle Sync Signal

STATE	Current	Voltage
High	$0 < I_{IH} < 20\ \mu A$	$2.5\ V < V_{IH} < V_{CC} + 0.3\ V$
Low	$0 < I_{OH} < -48\ mA$	$-0.1\ V < V_{IL} < 0.4\ V$

LED Out

The LED out signal is driven by the drive when the drive is performing a SCSI operation. The LED out signal is designed to pull down the cathode of an LED. The anode is attached to the proper +5 volt supply through an appropriate current limiting resistor. The LED and the current limiting resistor are external to the drive.

Table 5-5
Output Characteristics of the LED Driver Signal

STATE	Current Drive Available	Output Voltage
Drive LED Off	$0 < I_{OH} < 100\ \mu A$	
Drive LED On	$I_{OL} < -30$ mA	$0 < V_{OL} < 0.8$ Volts

Motor Start Controls

Table 5-6
Electrical Characteristics for RMT_START and DLYD_START

STATE	Current	Voltage
Open	$0 < I_{IH} < \pm 100\ \mu A$	$2.4\ V < V_{IH} < V_{CC} + 0.5\ V$
Ground	$0 < I_{OH} < -3$ mA	$-0.5\ V < V_{IL} < 0.4\ V$

SCSI ID Selection

Table 5-7
Electrical Characteristics for the SCSI ID Signals SCSI ID (0) - (3)

STATE	Current	Voltage
Open	$0 < I_{IH} < \pm 100\ \mu A$	$2.4\ V < V_{IH} < V_{CC} + 0.5\ V$
Ground	$0 < I_{OH} < -3$ mA	$-0.5\ V < V_{IL} < 0.4\ V$

Interface Pin Assignments

The pin assignments for the interface connector are shown below:

Table 5-8
Interface Signal Definitions

Pin	Signal	Pin	Signal
1	+12 Volt	41	+12 Volt Ground
2	+12 Volt	42	+12 Volt Ground
3	+12 Volt	43	+12 Volt Ground
4	+12 Volt	44	+12 Volt Ground
5	Reserved / NC	45	Reserved / NC
6	Reserved / NC	46	Reserved / NC
7	-DB(11)	47	Ground
8	-DB(10)	48	Ground
9	-DB(9)	49	Ground
10	-DB(8)	50	Ground
11	-I/O	51	Ground
12	-REQ	52	Ground
13	-C/D	53	Ground
14	-SEL	54	Ground
15	-MSG	55	Ground
16	-RST	56	Ground
17	-ACK	57	Ground
18	-BSY	58	Ground
19	-ATN	59	Ground
20	-DB(P0)	60	Ground
21	-DB(7)	61	Ground
22	-DB(6)	62	Ground
23	-DB(5)	63	Ground
24	-DB(4)	64	Ground
25	-DB(3)	65	Ground
26	-DB(2)	66	Ground
27	-DB(1)	67	Ground
28	-DB(0)	68	Ground
29	-DB(P1)	69	Ground
30	-DB(15)	70	Ground
31	-DB(14)	71	Ground
32	-DB(13)	72	Ground
33	-DB(12)	73	Ground
34	+5 Volt	74	+5 Volt Ground
35	+5 Volt	75	+5 Volt Ground
36	+5 Volt	76	+5 Volt Ground
37	SYNC	77	LED
38	RMT_START	78	DLYD_START
39	SCSI ID (0)	79	SCSI ID (1)
40	SCSI ID (2)	80	SCSI ID (3)

Notes:
1. The minus sign (-) indicates active low.
2. Pins marked Reserved are not connected.

Model CFP1080S (Narrow, 50-pin SCSI)

External Terminator Power

Power to the on-board terminators is provided by the higher of the voltage supplied at Pin #26, J2 or the voltage level at the 5 Volt power input to the drive minus one diode drop. The diode prevents back flow of current to the drive. Termination Power to external terminators can be supplied by the drive through Pin #26, J2. The TERMPWR line can be disconnected from the drive by removing Jumper E8. Table 5-9 describes the electrical characteristics of the TERMPWR line when it is used to supply power to an external terminator. Table 5-10 describes the required electrical characteristics for any external source of termination power.

Table 5-9
TERMPWR Output Electrical Characteristics

Signal Characteristic	*Value*
Supply voltage	4.06 VDC to 4.56 VDC
Minimum source capability:	800 mA (fused at 1000 mA)

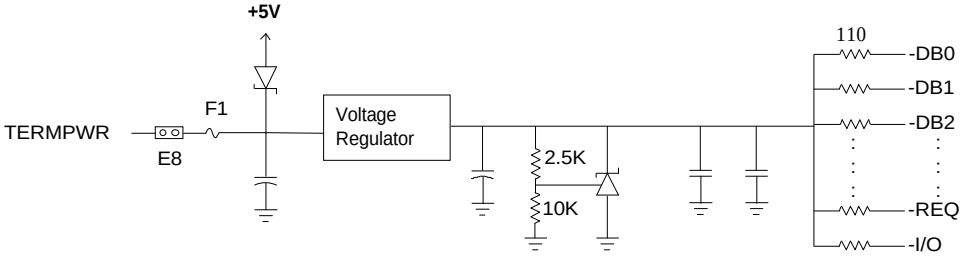
Table 5-10
TERMPWR Input Electrical Characteristics

Signal Characteristic	*Value*
Input voltage	4.00 VDC to 5.25 VDC
Minimum source capability:	1000 mA (fused at 1000 mA)
Sink current:	1.0 mA maximum, excluding power to the internal terminator.

Internal Termination

This drive provides on-board Alternative 2 termination for the SCSI bus. The termination resistors, which are contained in two Single Inline Packs (SIPs) should be removed from the drive unless it is a SCSI device at a physical end of the bus. The terminator equivalent circuit is shown below for reference:

Figure 5-1
Terminator Equivalent Circuit



Cable Requirements

A 50 conductor cable no more than 6 meters (19.68 feet) cumulative length with at least 28 AWG wire size and a characteristic impedance of 70 to 100 ohms (84 ohms nominal) is required. In systems which use the fast synchronous transfer option, the cable should meet the following additional requirements:

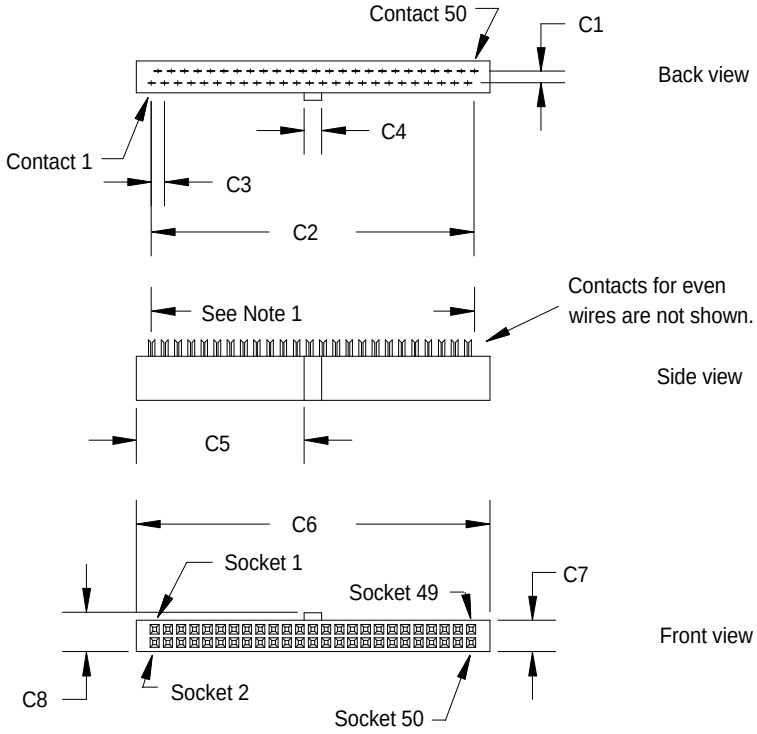
Table 5-11
Interface Cable Electrical Characteristics

Specification	*Value*
Signal Attenuation	0.095 dB maximum per meter at 5 Mhz
Pair-to-Pair Propagation Delay Delta	0.20 ns maximum per meter
DC Resistance	0.230 ohms maximum per meter at 20° C

Connector Requirements

The connector on the drive is a 50-position header which consists of 2 rows of 25 male pins on 0.100 inch centers. The mating connector is a SCSI-2 Non-shielded Alternative 1, A-cable connector which is shown below:

Figure 5-2
A-Cable Connector



Dimensions	Millimeters	Inches
C1	2.540	0.100
C2	60.960	2.400
C3	2.540	0.100
C4	3.302	0.130
C5	32.385	1.275
C6	68.072	2.680
C7	6.096	0.240
C8	7.620	0.300

Notes:

(1) Fifty contacts on 1.27mm (0.05 inch) staggered spacing = 62.23 mm (2.450 inch) [ref.]

(2) Tolerances +0.127 mm (0.005 inch) noncumulative unless specified otherwise.

(3) Connector cover and strain relief are optional

Interface Pin Assignments

The pin assignments for the interface connector are shown below:

Table 5-12
Interface Signal Definitions

Pin	Signal	Pin	Signal
01	GND	02	-DB0
03	GND	04	-DB1
05	GND	06	-DB2
07	GND	08	-DB3
09	GND	10	-DB4
11	GND	12	-DB5
13	GND	14	-DB6
15	GND	16	-DB7
17	GND	18	-DBP
19	GND	20	GND
21	GND	22	GND
23	RESERVED	24	RESERVED
25	OPEN	26	TERMPWR
27	RESERVED	28	RESERVED
29	GND	30	GND
31	GND	32	-ATN
33	GND	34	GND
35	GND	36	-BSY
37	GND	38	-ACK
39	GND	40	-RST
41	GND	42	-MSG
43	GND	44	-SEL
45	GND	46	-C/D
47	GND	48	-REQ
49	GND	50	-I/O

Notes:
1. The minus sign (-) indicates active low.
2. All odd pins except pin 25 must be connected to ground. Pin 25 is left open.
3. Pins marked Reserved are connected to ground.

Interface Timing Requirements

Unless otherwise noted, the delay-time measurements are calculated from signal conditions existing at the drive's own SCSI bus connector. Normally these measurements (except cable skew delay) can be made without considering delays in the cable.

Table 5-13
SCSI Bus Timing Values

	Timing Value *		
Timing Description	*fast*	*slow*	*asynch*
Arbitration Delay	2.4 ms	2.4 ms	2.4 ms
Bus Clear Delay	800 ns	800 ns	800 ns
Bus Free Delay	800 ns	800 ns	800 ns
Bus Set Delay	1.8 ms	1.8 ms	1.8 ms
Bus Settle Delay	400 ns	400 ns	400 ns
Cable Skew Delay [1]	4 ns	4 ns	4 ns
Data Release Delay	400 ns	400 ns	400 ns
Receive Assertion Period	22 ns	70 ns	n/a
Receive Hold Time	25 ns	25 ns	n/a
Receive Negation Period	22 ns	70 ns	n/a
Receive Setup Time	15 ns	15 ns	n/a
Reset Hold Time	25 ms	25 ms	25 ms
Selection Abort Time	200 ms	200 ms	200 ms
Selection Time-out Delay [2]	250 ms	250 ms	250 ms
System Deskew Delay	20 ns	45 ns	45 ns
Transmit Assertion Period	30 ns	80 ns	n/a
Transmit Hold Time	33 ns	53 ns	n/a
Transmit Negation Period	30 ns	80 ns	n/a
Transmit Setup Time	23 ns	23 ns	n/a

Notes:

1 This time does not apply at the SCSI connector of the drive.

2 This is a recommended time. It is not mandatory.

SCSI Command Implementation 6

This section contains a list of the SCSI Interface commands implemented in the drive and the MODE SENSE pages specifically for the drives covered by this manual. For additional details regarding command descriptions, please refer to the Eighth Generation Disk Drive SCSI Interface Manual.

SCSI Command Summary

Following is a list of commands that the drive supports:

Format Unit	04_H
Inquiry	12_H
Mode Select	15_H
Mode Sense	$1A_H$
Read (6)	08_H
Read Buffer	$3C_H$
Read Capacity	25_H
Read Defect Data	37_H
Read Extended (10)	28_H
Read Long	$3E_H$
Reassign Blocks	07_H
Receive Diagnostics	$1C_H$
Release	17_H
Request Sense	03_H
Reserve	16_H
Re-zero Unit	01_H
Seek (6)	$0B_H$
Seek Extended (10)	$2B_H$
Send Diagnostic	$1D_H$
Start/Stop Unit	$1B_H$
Test Unit Ready	00_H
Verify	$2F_H$
Write (6)	$0A_H$
Write Extended (10)	$2A_H$
Write and Verify	$2E_H$
Write Buffer	$3B_H$
Write Long	$3F_H$

Drive Dependent SCSI Mode Sense Data

The following pages show the drive dependent Mode Sense information for this drive. The default values are noted in parenthesis (). Parameters not specified are 00_H.

Format Device Page - 03_H

The Format Device Page contains parameters which specify the medium format.

Table 6-1
Format Drive Page Format

Bit Byte	*7*	*6*	*5*	*4*	*3*	*2*	*1*	*0*
0	Rsvd	Rsvd	Page Code = 03_H					
1	Page Length = 16_H							
2	Tracks per Zone (MSB) (00_H)							
3	Tracks per Zone (LSB) (01_H)							
4	Alternate Sectors per Zone (MSB) (00_H)							
5	Alternate Sectors per Zone (LSB) (01_H)							
6	Alternate Tracks per Zone (MSB)							
7	Alternate Tracks per Zone (LSB)							
8	Alternate Tracks per Logical Unit (MSB)							
9	Alternate Tracks per Logical Unit (LSB)							
10	Sectors per Track (MSB) (00_H)							
11	Sectors per Track (LSB) ($78*_H$)							
12	Data Bytes per Physical Sector (MSB) (02_H)							
13	Data Bytes per Physical Sector (LSB) (00_H)							
14	Interleave (MSB) (00_H)							
15	Interleave (LSB) (01_H)							
16	Track Skew Factor (MSB) (00_H)							
17	Track Skew Factor (LSB) ($0C_H$)							
18	Cylinder Skew Factor (MSB) (00_H)							
19	Cylinder Skew Factor (LSB) (10_H)							
20	SSEC	HSEC (1)	RMB	SURF	Reserved			
21-23	Reserved							

** These values are dependent upon the active notch. The values shown are for the default Active Notch value of 1.*

Tracks Per Zone: Defines the number of tracks per zone to use in dividing the capacity of the drive for the purpose of allocating alternate sectors. A value of zero means that one zone is defined for the entire drive.

Alternate Sectors Per Zone: Defines the number of spare sectors per zone the drive reserves for defect handling. Not supported. Must be set to zero.

Alternate Tracks Per Logical Unit: Not supported. Must be set to zero.

Sectors Per Track: Defines the number of physical sectors per track. The number includes the one alternate sector per track the drive allocates. The value reported for the number of sectors per track is dependent on the active notch value.

Data Bytes Per Physical Sector: Defines the number of data bytes per physical sector.

Interleave: Defines the interleave value used by the drive.

Track Skew Factor: Defines the number of physical sectors between the last logical block of one track, and the first logical block on the next sequential track of the same cylinder.

Cylinder Skew Factor: Specifies the number of physical sectors between the last logical block of one cylinder and the first logical block on the next sequential cylinder.

SSEC (Soft Sector Format): Set to zero to indicate the drive does not support a soft sector format.

HSEC (Hard Sector Format): Set to one to indicate the drive supports a hard sector format.

RMB (Removable Media): Set to zero to indicate the drive does not have removable media.

SURF (Surface Format): The SURF bit is set to zero, meaning the drive allocates progressive addresses to all logical blocks within a cylinder prior to allocating addresses on the next cylinder.

Rigid Disk Geometry Page - 04_H

Table 6-2
Rigid Disk Geometry Page

Bit Byte	*7*	*6*	*5*	*4*	*3*	*2*	*1*	*0*
0	Rsvd	Rsvd	Page Code = 04_H					
1	Page Length = 16_H							
2	Number of Cylinders (MSB) (00_H)							
3	Number of Cylinders ($0E_H$)							
4	Number of Cylinders (LSB) ($A4_H$)							
5	Number of Heads (06_H)							
6	Starting Cylinder - Write Precompensation (MSB) (00_H)							
7	Starting Cylinder - Write Precompensation (00_H)							
8	Starting Cylinder - Write Precompensation (LSB) (00_H)							
9	Starting Cylinder - Reduced Write Current (MSB)							
10	Starting Cylinder - Reduced Write Current							
11	Starting Cylinder - Reduced Write Current (LSB)							
12	Drive Step Rate (MSB)							
13	Drive Step Rate (LSB)							
14	Landing Zone Cylinder (MSB)							
15	Landing Zone Cylinder							
16	Landing Zone Cylinder (LSB)							
17	Reserved							RPL (0_H)
18	Rotational Offset							
19	Reserved							
20	Medium Rotation Rate (MSB) (15_H)							
21	Medium Rotation Rate (LSB) (18_H)							
22-23	Reserved							

Only one copy of this page is maintained. There is only one changeable field, RPL. All other fields are described in the MODE SENSE Command.

RPL (Rotational Position Locking): Enables spindle synchronization. Setting either bit 0 or 1, or both, causes multiple drives which have their spindle synchronization (SS) pins daisy chained together to synchronize their spindles.

Notch Page - $0C_H$

The Notch Page contains information which pertains to each notch of the drive. Each section of the drive with a different number of logical blocks per cylinder is referred to as a notch or zone. Only one copy of this page is maintained. The only changeable field in this page is Active Notch.

Table 6-3
CFP1080E/CFP1080S - Notch Parameters Page Format

Bit / ***Byte***	***7***	***6***	***5***	***4***	***3***	***2***	***1***	***0***
0	Rsvd	Rsvd	Page Code - OC_H					
1	Page Length = 16_H							
2	ND (1)	LPN	Reserved					
3	Reserved							
4	Maximum Number of Notches (MSB) (00_H)							
5	Maximum Number of Notches (LSB) (08_H)							
6	Active Notch (MSB) (00_H)							
7	Active Notch (LSB) (0_H)				($1*_H$)			
8	Starting Boundary (MSB) ($00*_H$)							
9	Starting Boundary ($00*_H$)							
10	Starting Boundary ($08*_H$)							
11	Starting Boundary (LSB) ($00*_H$)							
12	Ending Boundary (MSB) ($00*_H$)							
13	Ending Boundary ($0A*_H$)							
14	Ending Boundary ($F7*_H$)							
15	Ending Boundary (LSB) ($00*_H$)							
16	3F	Pages Notched (MSB)						38
17	37	Pages Notched						30
18	2F	Pages Notched						28
19	27	Pages Notched						20
20	1F	Pages Notched						18
21	17	Pages Notched						10
22	0F	Pages Notched						08
23	07	Pages Notched (LSB) (08_H)						00

** Varies depending on active notch.*

ND (Notched Drive): If set to zero, the drive is not notched and all other parameters in this page are returned as zeros. If set to one, the drive is notched and this page defines the starting and ending boundaries for each active notch. This parameter is always set to one.

LPN (Logical or Physical Notch): When set to zero, indicates the notch boundaries are physical addresses (i.e., cylinder and head). An LPN bit of one is not supported.

The **Maximum Number of Notches** field indicates the maximum number of notches supported by the drive.

The **Active Notch** field indicates which notch is being referred to by this and subsequent MODE SELECT and MODE SENSE commands, until changed by a later MODE SELECT command. Active notches are numbered beginning from one up to the maximum number of notches.

The **Starting Boundary** field indicates the beginning of the active notch; the three most significant bytes represent the cylinder number and the least significant byte represents the head number.

The **Ending Boundary** field indicates the ending of the active notch; the three most significant bytes represent the cylinder and the least significant byte represents the head number.

The **Pages Notched** field is a bit map of the MODE SELECT page codes which indicates the pages containing parameters that are changed for different notches. The most significant bit of this field corresponds to page code 3F and the least significant bit represents page code 0. If a bit is a one, the corresponding MODE SELECT page contains parameters that are changed for different notches. If a bit is a zero, the corresponding MODE SELECT page parameters are constant for all notches.