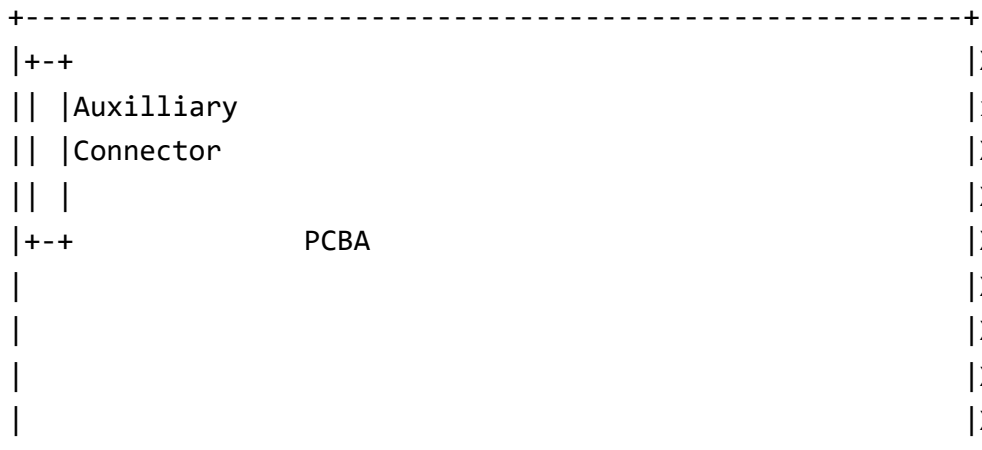
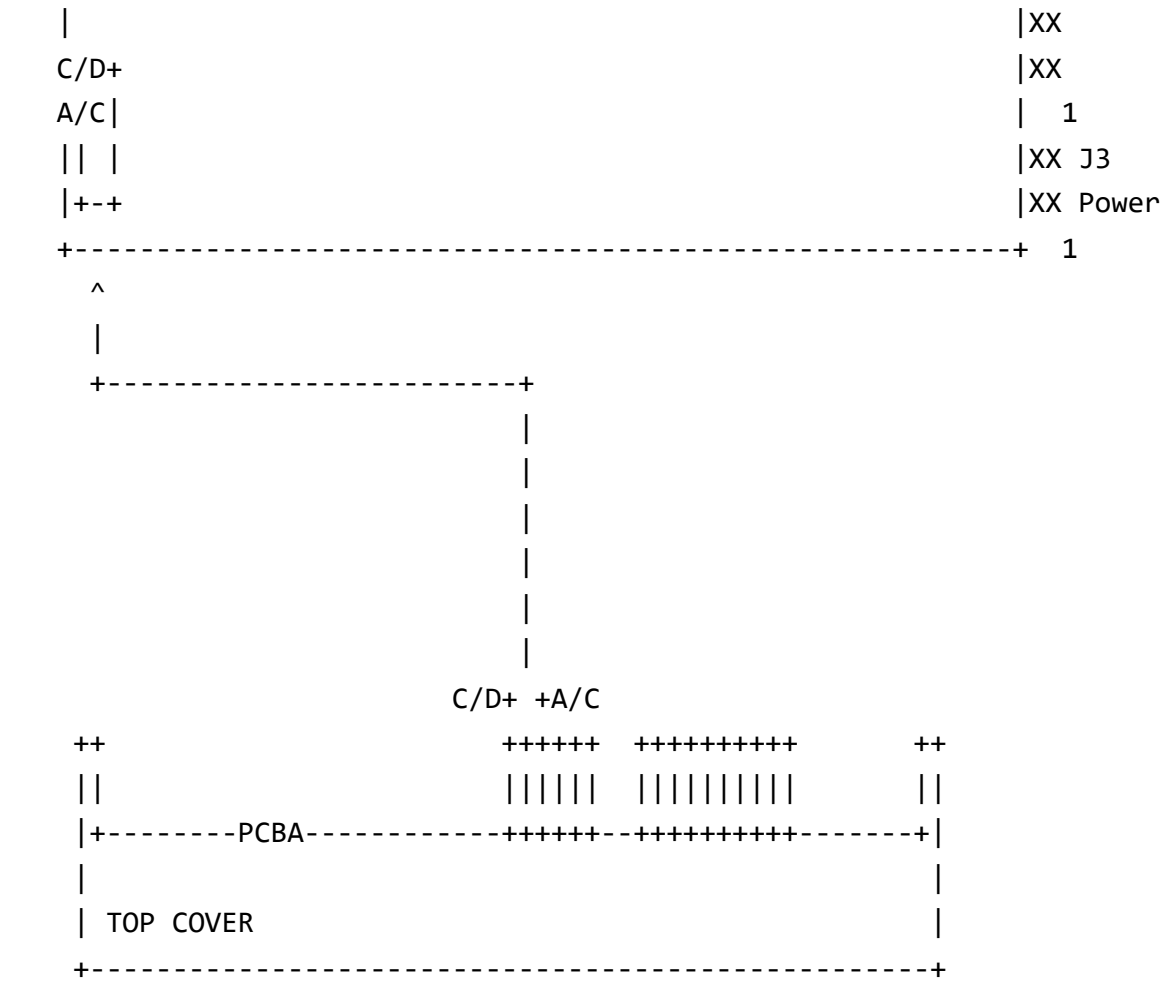
Hard Drive: CONNER: CFS-420A 420MB 3.5"/SL IDE / AT

```
C F S - 4 2 0 A    CONNER
NO MORE PRODUCED                                          Native|  Translation
                                                          ------+-----+-----+-----
Form                  3.5"/SLIMLINE         Cylinders     2388|  826|     |
Capacity form/unform   420/      MB         Heads            4|   16|     |
Seek time   / track  14.0/ 3.0 ms           Sector/track      |   63|     |
Controller           IDE / AT               Precompensation
Cache/Buffer            32 KB READ-AHEAD    Landing Zone
Data transfer rate    3.000 MB/S int        Bytes/Sector      512
                      7.500 MB/S ext
Recording method     RLL 1/7                            operating  | non-operating
                                                       -------------+--------------
Supply voltage     5/12 V       Temperature *C          5 55     |    -40 60
Power: sleep          0.8 W     Humidity     %          8 80     |      8 80
       standby        1.3 W     Altitude    km     -0.061  4.500| -0.061  4.500
       idle           3.0 W     Shock        g          5       |     75
       seek           6.2 W     Rotation   RPM       3600
       read/write     4.4 W     Acoustic   dBA         47
       spin-up            W     ECC        Bit    32,ON THE FLY
                                MTBF         h      250000
                                Warranty Month
Lift/Lock/Park     YES          Certificates      CSA,FCC,IEC380,IEC950,UL19...
```

Layout

CONNER CFS-210A/CFS-420A PRODUCT MANUAL REV. A, OCTOBER 1993





Jumpers

CONNER CFS-210A/CFS420A PRODUCT MANUAL REV. A, OCTOBER 1993

Jumper Setting
==========

C/D Master/Slave Configuration

CLOSED Single Drive
CLOSED Master Drive
OPEN Slave Drive

A/C Master/Slave Protocol

CLOSED ATA/CAM master/slave mode
OPEN Conner master/slave mode

Pins 5 16 RESERVED

Master/Slave Configuration

When two drives are daisy-chained on the host interface, one must be designated as the master drive (C: drive) and one as the slave drive

(D: drive). Commands from the host are written in parallel to both drives.

When the C/D jumper on the drive is closed, the drive will assume the role of a master. When C/D is open, the drive will act as a slave. In single-drive configurations, C/D must remain in the closed (master) position.

For each command sent from the host, the DRV bit in the drive/head register selects the master or the slave drive. When the DRV bit is reset (0), the master drive is selected, and when the DRV bit is set (1), the slave drive is selected.

Once the drive receive the command, only the drive with jumper C/D set to the appropriate position will execute the command. For example, if the DRV bit is set, only the slave drive (jumper C/D open) will execute the command.

NOTE
If the command is a diagnostic command, both drives will execute the command and the slave will report its status to the master via the Host PDIAG signal.

Throughout this manual, drive selection always refers to the state of the DRV bit and the position of the C/D jumper.

The drive supports two master/slave modes via the A/C jumper. When A/C is closed, ATA/CAM master/slave mode is selected. When A/C is open, Conner master/slave mode is selected.

Supported Master/Slave Modes

There are three different master/slave methods that Conner supports.

- ISA Original
- Conner
- ATA/CAM

Of these three methods, the drive supports all except ISA/Original mode, with which is compatible.

NOTE
The ATA/CAM master/slave method is not compatible with the other two methods. The Conner mode is backward-compatible to the ISA Original mode, but is not compatible with the other.

These three methods are explained in the following sections. For signals followed by a ' ', activate means go low and deactivate means go high.

ISA Original Master/Slave

The signals used for master/slave operation and determination are Host DASP and Host PDIAG .

Host DASP can be used to:

- drive an activity LED
- indicate that the slave drive is present to the master

The Host PDIAG is used to indicate that the slave has passed diagnostics both at power-on reset (POR) and when the diagnostic command is issued.

At power-on time, the slave drive activates Host PDIAG and Host DASP . Host PDIAG remains activated from POR until a diagnostic command is issued by the host. Once a diagnostic is issued by the host, the slave deactivates Host PDIAG until either:

- the slave successfully completes the diagnostic command
- the host issues a reset

There are no real timing constraints on Host PDIAG and Host DASP . At POR, they are both activated within a second or two. When the diagnostic command is issued by the host, the slave inactivates Host PDIAG within 100-200 microseconds and is required to reactivate it within 5 seconds (the only timing constraint) if it successfully completes the command.

This scheme works fairly well except for two problems:

- There is no way to tell when the slave becomes ready. If the slave becomes ready much later than the master, the slave will miss any command that are issued before it goes not busy because the host only polls the master to see if the "controller" is ready.

- In a two-drive configuration, the Host DASP line is not available to drive a drive activity indicator.

This version of master/slave is present on generations 1, 2, and 3 of Conner drives.

Conner Master/Slave

To remendy the problem of the host not knowing when the slave was ready, Conner developed a backward-compatible solution, which we call Conner Master/Slave.

In Conner Master/Slave, the use of the Host PDIAG signal has been changed slightly during reset so that the slave will indicate when it will go not busy. Its use in the diagnostic command has not been changed.

During POR or any host reset, the slave drive activates Host PDIAG within 1ms. The master drive waits slightly longer that 1 ms for Host PDIAG to be activated before it determines that no slave is present. The slave then deactivates Host PDIAG when it is ready. The master waits:

- up to 14 seconds for the slave to deactivate Host PDIAG on either a POR or a host reset

- 450 ms for the slave to deactivate Host PDIAG on a host software reset

If the master times out, it goes not busy.

In this mode of master/slave, master/slave re-configures with either a hardware or software reset. A hardware reset is either a Power On Reset (POR) or host bus reset.

This solution was implemented in generations 4 and greater of Conner drives.

ATA/CAM Master/Slave

This industry-standard master/slave solution was developed by the CAM shortly after the development of the Conner Master/Slave. The polarity of Host PDIAG is opposite that of the Conner solution and this is what makes this master/slave scheme incompatible with the Conner scheme.

At power-on time, the slave deactivates Host PDIAG and then activates Host DASP within 1 ms of either POR or host reset. Host DASP activate indicates that a slave is present. The slave activates Host PDIAG when it is ready to accept commands or after 30 seconds, whichever occurs first. This period is reduced to 450ms for a software reset. A hardware reset is either a POR or host bus reset.

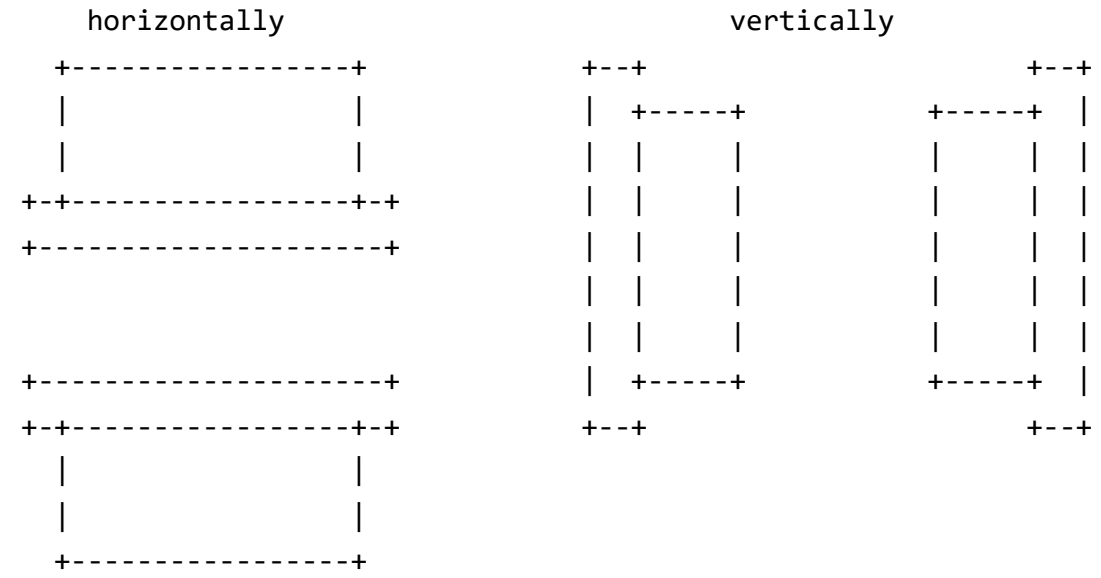
This solution was implemented in generations 4.5 and greater of Conner drives and is selectable with the A/C jumper or the CAM bit in the feature word.

Install

CONNER CFS-210A/CFS-420A PRODUCT MANUAL REV. A, OCTOBER 1993

Notes On Installation
==========

Installation direction



The drive will operate in all axis (6 directions).

Mounting the drive

You can mount the drive either vertically or horizontally. The drive will meet all performance specifications when mounted at any orientation.

CAUTION

The surface(s) on which you mount the drive should be flat and parallel to prevent uneven pressure on the drive. Mounting the drive on an uneven surface could cause the drive's base to deform, degrading drive performance.

CAUTION

When using the side mounting holes, verify the screw length to ensure clearance from the drive's pronted circuit board before tightening the screw.

Data and Power Connections

The drive has a 40-pin data connector, as well as an auxiliary connector which is reserved for factory or evaluation use.

The drive has two power connectors, only one of which should be used at a time. The two connectors provide connection versatility to a number of host systems.

Power Connectors

The mating connector for the 4-pin connector is AMP 1-480424-0 (housing) and AMP 60619-4 (loose piece) or 61117-4 (strip) contacts.

```
4-Pin Power Connector Pin 1 +12 Volts
                      Pin 2 GND
                      Pin 3 GND
                      Pin 4 + 5 Volts
```

The mating connector for the 3-pin connector is Molex series 54-84 (header), Molex part number 39-01-033 (housing), and terminal part number 39-00-0031 (loose) or 39-00-0023 (strip).

```
3-Pin Power Connector Pin 1 + 5 Volts
                      Pin 2 +12 Volts
                      Pin 3 GND
```

CAUTION
Do not route the power cable next to the drive PCB or any other high frequency or large current switching signals. Improper drive operation can result from improper cable routing.

Task File Interface Connector

The recommended mating connector for the Task File Interface is Molex P/N 15-47-5401 or equivalent. You may daisy-chain two drives on this connector. The maximum cable length is 18 inches.

Pin 1 is typically indicated by a colored stripe on the data cable.

CAUTION
Do not route the data cable next to the drive PCB or any other high frequency or large current switching signals. Improper drive operation can result from improper cable routing.

Signal Levels

All signal levels are TTL compatible. A logic "1" is > 2.0 Volts. A logic "0" is from 0.00 Volts to 0.70 Volts.

Read/Write Heads and Disks

Data is recorded on 95mm diameter disks through 3370-type MIG composite heads.

The CFS210A contains:

- one disk with two data surfaces
- two read/write heads

The CFS420A contains:

- two disks with two data surfaces each
- four 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.

Features

CONNER CFS-210A/CFS420A PRODUCT MANUAL REV. A, OCTOBER 1993

Key Features

The Conner Filepro Series CFS210A and CFS420A are high-performance low-profile drives that are designed to operate with an IBM PC/AT or equivalent host computer system in translate mode.

The drive provides these features:

- can be installed in a wide range of host systems

```
- High performance rotary voice coil actuator with embedded servo
  system.
```

- 1/7 Run length limited code

- High shock resistance

- Sealed HDA

- Automatic actuator latch against inner stop upon power-down

- Microprocessor-controlled diagnostics routines that are automatically executed at start-up.

- Read Look Aehad and optional Write Caching

- Automatic error correction and retries, ECC on the fly

- Block size 512 bytes

- 32K Buffer with adaptive cache management

- emulates IBM Task File and supports additional commands

- allows daisy-chaining up to two drives on the AT interface

- Auto-Translate (Universal Translate)

- 4-byte ECC diagnostic check in read/write

The drive supports either of the following MAster/Slave protocol standards:

- ATA/CAM (AT Attachment/Common Access Method)

- ISA/Conner (Industrie-Standard Architecture)

Universal Translate Mode

Conner has established a Universal Translate Mode which enables the user to configure the drive in an AT environment to any cylinder, head, and sector configuration desired. The translate configuration is limited only by the maximum capacity of the drive. Upon initial power up to the drive it will default to a configuration shown below:

	Cylinders	Heads	Sectors
CFS210A	685	16	38
CFS420A	826	16	63

After the drive is ready, the host system may issue INIT DRIVE PARMS COMMAND (command code 91H) to alter the translate configuration (number of heads and number of sectors per track). The drive will then:

- calculate the total number of available logical tracks based upon the entered sector and head values

- save the drive parameters in non-volatile memory for subsequent drive operations

Seek Times
---

track to track max.	3 ms
Average msec.	14

```
|               Average msec. max. |  26    |
+----------------------------------+--------+
|Latency                 msec. avg. |   8.3  |
+----------------------------------+--------+
```

The timing is measured through the interface with the drive operating at nominal DC input voltages. The timing also assumes that:

- BIOS and PC system hardware dependency have been subtracted from timing measurements.

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.

Head Positioning Mechanism

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

```
Task File Interface Signal Connector Pin 28
-------------------------------------------
Pin 28 +Spindle Sync/Cable Select (I/O)
Optional. This signal may optionally be used for two functions. Some
systems, however, may require this pin to be isolated because it was
defined as ALE prior to the ATA specification.
```

- Spindle Sync is a signal used by the drives which are interconnect on the same cable to synchronize their spindle rotation with each other.

- Cable Select routes the C/D select to this spin. When set high, drive D: is selected; when set low, drive C: is selected.

Error Correction

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

- one error burst up to 22 bits

- two error burst up to 11 bits each

Single bursts of 11 bits or less are corrected on the fly (OTF) with no performance degradation.

Execute Drive Diagnostic

Command Number: 90 hex

Description
This command performs the internal diagnostic tests implemented by the drive. The diagnostic tests are only executed upon receipt of this command.

The drive sets BSY immediately upon of the command. If the drive is a master, the drive performs the diagnostic tests and saves the results. It then checks to see if a slave drive is present and waits up to 5 seconds for the slave to complete its diagnostics. If the slave successfully completes its diagostics, it asserts -HOST PDIAG. If unsuccessful, the master drive resets BSY in the Status register and generates an interrupt. The Error bit (ERR) is set in the Status register and the Error register is updated.

The value in the Error register should be viewed as a unique 8-bit code and not as the single-bit flags defined previously. The interface registers are set to initial values except for the Error register.

The table below details the codes in the Error register and a corresponding explanation.

Error Code Description
01 hex No error detected
02 hex Format device error
03 hex Sector buffer error
8x hex Slave drive failed

Additional codes may be implemented at the manufacturer's option.

NOTE
If the slave drive fails diagnostics, the master drive shall "OR" 80 hex with its own status and load that code into the Error register. If the slave drive passes diaagnostics or there is no slave drive connected, the master drive shall sect bit 7 of the Error register Task File to 0.

Reliability and Maintenace

MTBF 250,000 hours POH
MTTR 10 minutes typical
Preventive Maintenance None
Component Design Life 5 years
Start/Stop Cycles 20,000 minimum

Drive Motor and Spindle

A brushless DC direct-drive motor assembly is mounted on the drive's base. The motor rotates the spindle at 3600 RPM. The motor/spindle assembly is 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.

Safety Standard

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, and UL 1950, Standard for Safety of Information Technology Equipment

- CSA 22.2#220, Information Processing and Business Equipment, CSA 22.2#950, Safety of Electrically Energized Office Machines

- IEC 380, Safety of Electrically Energized Office Machines, and IEC 950, Safety of Information Technology Equipment Including Electrical Business Equipment

- VDE 0805, VDE 0805 TIEL 100, VDE 0806

- Complies with FCC Class B, Part 15, Subpart J