comp.periphs.scsi FAQ part 2 of 2

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SCSI FAQ:
Frequently Asked Questions for comp.periphs.scsi

VOLUME 2

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QUESTION: What is the difference between SCSI-1 and SCSI-2?
ANSWER From Dal Allen:
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SCSI-1_versus_SCSI-2

In 1985, when the first SCSI standard was being finalized as an American National Standard, the X3T9.2 Task Group was approached by a group of manufacturers. The group wanted to increase the mandatory requirements of SCSI and to define further features for direct-access devices. Rather than delay the SCSI standard, X3T9.2 formed an ad hoc group to develop a working paper that was eventually called the Common Command Set (CCS). Many products were designed to this working paper.

In parallel with the development of the CCS working paper, X3T9.2 sought permission to begin working on an enhanced SCSI standard, to be called SCSI-2. SCSI-2 would include the results of the CCS working paper, caching commands, performance enhancement features, and whatever else X3T9.2 deemed worthwhile. While SCSI-2 was to go beyond the original SCSI standard (now referred to as SCSI-1), it was to retain a high degree of compatibility with SCSI-1 devices.

How is SCSI-2 different from SCSI-1?

1. Several options were removed from SCSI-1:

   a. Single initiator option was removed.
   b. Non-arbitrating Systems option was removed.
   c. Non-extended sense data option was removed.
   d. Reservation queuing option was removed.
   e. The read-only device command set was replaced by the CD-ROM command set.
   f. The alternative 1 shielded connector was dropped.

2. There are several new low-level requirements in SCSI-2:

   a. Parity must be implemented.
   b. Initiators must provide TERMPWR -- Targets may provide TERMPWR.
   c. The arbitration delay was extended to 2.4 us from 2.2 us.
   d. Message support is now required.

3. Many options significantly enhancing SCSI were added:

   a. Wide SCSI (up to 32 bits wide using a second cable)
   b. Fast SCSI (synchronous data transfers of up to 10 Mega-transfers per second -- up to 40 MegaBytes per second when combined with wide SCSI)
   c. Command queuing (up to 256 commands per initiator on each logical unit)
   d. High-density connector alternatives were added for both shielded and non- shielded connectors.
   e. Improved termination for single-ended buses (Alternative 2)
   f. Asynchronous event notification
   g. Extended contingent allegiance
   h. Terminate I/O Process messaging for time- critical process termination

4. New command sets were added to SCSI-2 including:

   a. CD-ROM (replaces read-only devices)
   b. Scanner devices
   c. Optical memory devices (provides for write-once, read-only, and erasable media)
   d. Medium changer devices
   e. Communications devices

5. All command sets were enhanced:

   a. Device Models were added
   b. Extended sense was expanded to add:
      + Additional sense codes
      + Additional sense code qualifiers
      + Field replaceable unit code
      + Sense key specific bytes

   c. INQUIRY DATA was expanded to add:
      + An implemented options byte
      + Vendor identification field
      + Product identification field
      + Product revision level field
      + Vital product data (more extensive product reporting)

   d. The MODE SELECT and MODE SENSE commands were paged for all device types

e. The following commands were added for all device types:

   + CHANGE DEFINITION
   + LOG SELECT
   + LOG SENSE
   + READ BUFFER
   + WRITE BUFFER

f. The COPY command definition was expanded to include information on how to handle inexact block sizes and to include an image copy option.

g. The direct-access device command set was enhanced as follows:

   + The FORMAT UNIT command provides more control over defect management
   + Cache management was added:
     - LOCK/UNLOCK CACHE command
     - PREFETCH command
     - SYNCHRONIZE CACHE command
     - Force unit access bit
     - Disable page out bit

   + Several new commands were added:
     - READ DEFECT DATA
     - READ LONG
     - WRITE LONG
     - WRITE SAME

   + The sequential-access device command set was enhanced as follows:

     - Partitioned media concept was added:
       * LOCATE command
       * READ POSITION command

     - Several mode pages were added
     - Buffered mode 2 was added
     - An immediate bit was added to the WRITE FILEMARKS command

   + The printer device command set was enhanced as follows:
     - Several mode pages defined:
       * Disconnect/reconnect
       * Parallel printer
       * Serial printer
       * Printer options

   + The write-once (optical) device command set was enhanced by:
     - Several new commands were added:
       * MEDIUM SCAN
       * READ UPDATED BLOCK
       * UPDATE BLOCK

     - Twelve-byte command descriptor blocks were defined for several commands to accommodate larger transfer lengths.

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The following article was written by Dal Allan of ENDL in April 1990. It was published nine months later in the January 1991 issue of "Computer Technology Review". While it appeared in the Tape Storage Technology Section of CTR, the article is general in nature and tape-specific. In spite of the less than timely publication, most of the information is still valid.

What's New in SCSI-2

Scuzzy is the pronunciation and SCSI (Small Computer System Interface) is the acronym, for the best known and most widely used ANSI (American National Standards Institute) interface.

Despite use of the term "Small" in its name, everyone has to agree that Scuzzy is large - in use, in market impact, in influence, and unfortunately, in documentation. The standards effort that began with a 20-page specification in 1980 has grown to a 600 page extravaganza of technical information.

Even before ANSI (American National Standards Institute) published the first run of SCSI as standards document in 1986, ASC (Accredited Standards Committee) X3T9.2 was hard at work on SCSI-2.

No technical rationale can be offered as to why SCSI-1 ended and SCSI-2 began, or as to why SCSI-2 ended and SCSI-3 began. The justification is much more simple - you have to stop sometime and get a standard printed. Popular interfaces never stop evolving, adapting, and expanding to meet more uses than originally envisaged.

Interfaces even live far beyond their technological lifespan. SMD (Storage Module Drive) has been called technically obsolete for 5 years but every year there are more megabytes shipped on the SMD interface than the year before. This will probably continue for another year or so before the high point is reached, and it will at least a decade before SMD is considered to be insignificant.

If SCSI enhancements are cut off at an arbitrary point, what initiates the decision? Impatience is as good an answer as any. The committee and the market get sick of promises that the revision process will "end soon," and assert pressure to "do it now."

The SCSI-3 effort is actively under way right now, and the workload of the committee seems to be no less than it was a year ago. What is pleasant, is that the political pressures have eased.

There is a major difference between the standards for SCSI in 1986 and SCSI-2 in 1990. The stated goal of compatibility between manufacturers had not been achieved in SCSI in 1986 due to a proliferation of undocumented "features."

Each implementation was different enough that new software drivers had to be written for each device. OEMs defined variations in hardware that required custom development programs and unique microcode. Out of this diversity arose a cry for commonality that turned into CCS (Common Command Set), and became so popular that it took on an identity of its own.

CCS defined the data structures of Mode Select and Mode Sense commands, defect management on the Format command and error recovery procedures. CCS succeeded because the goals were limited, the objectives clear and the time was right.

CCS was the beginning of SCSI-2, but it was only for disks. Tape and optical disks suffered from diversity, and so it was that the first working group efforts on SCSI-2 were focused on tapes and optical disks. However, opening up a new standards effort is like lifting the lid on Pandora's Box - it's hard to stay focused on a single task. SCSI-2 went far beyond extending and consolidating CCS for multiple device types.

SCSI-2 represents three years of creative thought by some of the best minds in the business. Many of the new features will be useful only in advanced systems; a few will find their way into the average user's system. Some may never appear in any useful form and will atrophy, as did some original SCSI features like Extended Identify.

Before beginning coverage of "what's new in SCSI-2," it might be well to list some of the things that aren't new. The silicon chips designed for SCSI are still usable. No new features were introduced which obsolete chips. The cause of silicon obsolescence has been rapid market shifts in integrating functions to provide higher performance.

Similarly, initiators which were designed properly, according to SCSI in 1986, will successfully support SCSI-2 peripherals. However, it should be pointed out that not all the initiators sold over the last few years behaved according to the standard, and they can be "blown away "by SCSI-2 targets.

The 1986 standard allows either initiators or targets to begin negotiation for synchronous transfers, and requires that both initiators and targets properly handle the sequence. A surprisingly large percentage of SCSI initiators will fail if the target begins negotiation. This has not been as much of a problem to date as it will become in the future, and you know as well as I do, that these non-compliant initiators are going to blame the SCSI-2 targets for being "incompatible."

Quirks in the 1986 standard, like 4 bytes being transferred on Request Sense, even if the requested length was zero have been corrected in SCSI-2. Initiators which relied on this quirk instead of requesting 4 bytes will get into trouble with a SCSI-2 target.

A sincere effort has been made to ensure that a 1986-compliant initiator does not fail or have problems with a SCSI-2 target. If problems occur, look for a non-compliant initiator before you blame the SCSI-2 standard.

After that little lecture, let us turn to the features you will find in SCSI-2 which include:

o Wide SCSI: SCSI may now transfer data at bus widths of 16 and 32 bits. Commands, status, messages and arbitration are still 8 bits, and the B-Cable has 68 pins for data bits. Cabling was a confusing issue in the closing days of SCSI-2, because the first project of SCSI-3 was the definition of a 16-bit wide P-Cable which supported 16-bit arbitration as well as 16-bit data transfers. Although SCSI-2 does not contain a definition of the P-Cable, it is quite possible that within the year, the P-Cable will be most popular non-SCSI-2 feature on SCSI-2 products. The market responds to what it wants, not the the arbitrary cutoffs of standards committees.

o Fast SCSI: A 10 MHz transfer rate for SCSI came out of a joint effort with the IPI (Intelligent Peripheral Interface) committee in ASC X3T9.3. Fast SCSI achieves 10 Megabytes/second on the A-Cable and with wider data paths of 16- and 32-bits can rise to 20 Megabytes/second and even 40 Megabytes/second. However, by the time the market starts demanding 40 Megabytes/second it is likely that the effort to serialize the physical interface for SCSI-3 will attract high-performance SCSI users to the Fiber Channel.

A word of caution. At this time the fast parameters cannot be met by the Single Ended electrical class, and is only suitable for Differential. One of the goals in SCSI-3 is to identify the improvements needed to achieve 10 MHz operation with Single Ended components.

o Termination: The Single Ended electrical class depends on very tight termination tolerances, but the passive 132 ohm termination defined in 1986 is mismatched with the cable impedance (typically below 100 ohms). Although not a problem at low speeds when only a few devices are connected, reflections can cause errors when transfer rates increase and/or more devices are added. In SCSI-2, an active terminator has been defined which lowers termination to 110 ohms and is a major boost to system integrity.

o Bus Arbitration, Parity and the Identify Message were options of SCSI, but are required in SCSI-2. All but the earliest and most primitive SCSI implementations had these features anyway, so SCSI-2 only legitimizes the de facto market choices. The Identify message has been enhanced to allow the target to execute processes, so that commands can be issued to the target and not just the LUNs.

o Connectors: The tab and receptacle microconnectors chosen for SCSI-2 are available from several sources. A smaller connector was seen as essential for the shrinking form factor of disk drives and other peripherals. This selection was one of the most argued over and contentious decisions made during SCSI-2 development.

o Rotational Position Locking: A rose by any other name, this feature defines synchronized spindles, so than an initiator can manage disk targets which have their spindles locked in a known relative position to each other. Synchronized disks do not all have to be at Index, they can be set to an offset in time relative to the master drive. By arraying banks of synchronized disks, faster transfer rates can be achieved.

o Contingent Allegiance: This existed in SCSI-1, even though it was not defined, and is required to prevent the corruption of error sense data. Targets in the Contingent Allegiance state reject all commands from other initiators until the error status is cleared by the initiator that received the Check Condition when the error occurred.

Deferred errors were a problem in the original SCSI but were not described. A deferred error occurs in buffered systems when the target advises Good Status when it accepts written data into a buffer. Some time later, if anything goes wrong when the buffer contents are being written to the media, you have a deferred error.

o Extended Contingent Allegiance (ECA): This extends the utility of the Contingent Allegiance state for an indefinite period during which the initiator that received the error can perform advanced recovery algorithms.

o Asynchronous Event Notification (AEN): This function compensates for a deficiency in the original SCSI which did not permit a target to advise the initiator of asynchronous events such as a cartridge being loaded into a tape drive.

o Mandatory Messages: The list of mandated messages has grown:

Both	Target	Initiator
Identify	Abort	Disconnect

Message Reject	No Operation	Restore Pointer
Message Parity Error	Bus Device Reset	Save Data Pointer
	Initiator Detected Error	

o Optional messages have been added to negotiate wide transfers and Tags to support command queueing. A last-minute inclusion in SCSI-2 was the ability to Terminate I/O and receive the residue information in Check Condition status (so that only the incomplete part of the command need be re-started by the initiator).

o Command Queueing: In SCSI-1, initiators were limited to one command per LUN e.g. a disk drive. Now up to 256 commands can be outstanding to one LUN. The target is allowed to re-sequence the order of command execution to optimize seek motions. Queued commands require Tag messages which follow the Identify.

o Disk Cacheing: Two control bits are used in the CDB (Command Descriptor Block) to control whether the cache is accessed on a Read or Write command, and some commands have been added to control pre-fetching and locking of data into the cache. Users do not have to change their software to take advantage of cacheing, however, as the Mode Select/Mode Sense Cache page allows parameters to be set which optimize the algorithms used in the target to maximize cache performance. Here is another area in which improvements have already been proposed in SCSI-3, and will turn up in SCSI-2 products shipping later this year.

o Sense Keys and Sense Codes have been formalized and extended. A subscript byte to the Sense Code has been added to provide specifics on the type of error being reported. Although of little value to error recovery, the additional information about error causes is useful to the engineer who has to analyze failures in the field, and can be used by host systems as input to prognostic analysis to anticipate fault conditions.

o Commands: Many old commands have been reworked and several new commands have been added.

o Pages: Some method had to be found to pass parameters between host and target, and the technique used is known as pages. The concept was introduced in CCS and has been expanded mightily in SCSI-2.

A number of new Common Commands have been added, and the opcode space for 10-byte CDBs has been doubled.

o Change Definition allows a SCSI-2 initiator to instruct a SCSI-2 target to stop executing according to the 1986 standard, and provide advanced SCSI-2 features. Most SCSI-2 targets will power on and operate according to the 1986 standard (so that there is no risk of "disturbing" the installed initiators, and will only begin operating in SCSI-2 mode, offering access to the advanced SCSI-2 capabilities, after being instructed to do so by the initiator using the Change Definition command.

o The Mode Select and Mode Sense pages which describe parameters for operation have been greatly expanded, from practically nothing in 1986 to hundreds of items in SCSI-2. Whenever you hear of something being described as powerful and flexible tool, think complicated. Integrators are advised to be judicious in their selection of the pages they decide to support.

o the Inquiry command now provides all sorts of interesting data about the target and its LUNs. Some of this is fixed by the standard, but the main benefit may be in the Vendor Unique data segregated into the special designation of Vital Product Data, which can be used by integrators as a tool to manage the system environment.

o Select Log and Sense Log have been added so that the initiator can gather both historical (e.g. all Check Conditions) and statistical (e.g. number of soft errors requiring ECC) data from the target.

o Diagnostic capabilities have been extended on the Read/Write Buffer and Read/Write Long commands. The ways in which the target can manage bad blocks in the user data space have been defined further and regulated to reduce inconsistencies in the 1986 standard. A companion capability to Read Defect Data permits the initiator to use a standard method to be advised of drive defect lists.

o A new group of 12-byte command blocks has been defined for all optical devices to support the large volume sizes and potentially large transfer lengths. The Erase command has been added for rewritable optical disks so that areas on the media can be pre-erased for subsequent recording. Write Once disks need Media Scan, so that the user can find blank areas on the media.

o New command sets have been added for Scanners, Medium Changers, and CD ROMs.

All of this technical detail can get boring, so how about some "goodies" in SCSI-2 which benefit the common man and help the struggling engineer? First, and probably the best feature in SCSI-2 is that the document has been alphabetized. No longer do you have to embark on a hunt for the Read command because you cannot remember the opcode.

In the 1986 standard, everything was in numeric sequence, and the only engineers who could find things easily were the microprogrammers who had memorized all the message and opcode tables. Now, ordinary people can find the Read command because it is in alphabetic sequence. This reorganization may sound like a small matter but it wasn't, it required a considerable amount of effort on the part of the SCSI-2 editors. It was well worth it.

Another boon is the introduction for each device class of models which describe the device class characteristics. The tape model was the most needed, because various tape devices use the same acronym but with different meanings or different acronyms for the same meaning.

The SCSI-2 tape model defines the terms used by SCSI-2, and how they correspond to the acronyms of the different tapes. For example, on a 9-track reel, End of Tape is a warning, and there is sufficient media beyond the reflective spot to record more data and a trailer. Not so on a 1/4" tape cartridge, End of Tape means out of media and no more data can be written. This sort of difference in terms causes nightmares for standardization efforts.

So there it is, a summary of what is in SCSI-2. It's not scary, although it is daunting to imagine plowing through a 600-page document. Time for a commercial here. The "SCSI Bench Reference" available from ENDL Publications (408-867-6642), is a compaction of the standard. It takes the 10% of SCSI-2 which is constantly referenced by any implementor, and puts it in an easy-to-use reference format in a small handbook. The author is Jeff Stai, one of the earliest engineers to become involved with SCSI implementation, and a significant contributor to the development of both the 1986 standard and SCSI-2.

SCSI-2 is not yet published as a standard, but it will be available later this year. Until then, the latest revision can be purchased from Global Engineering (800-854-7179).

Biography

Consultant and analyst I. Dal Allan is the founder of ENDL and publisher of the ENDL Letter and the "SCSI Bench Reference." A pioneer and activist in the development and use of standard interfaces, he is Vice Chairman of ASC X3T9.2 (SCSI) and Chairman of the SCSI-2 Common Access Method Committee.

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QUESTION: What is the difference between SCSI-2 and SCSI-3?
ANSWER From: excerpts of postings by Jeff Stai and others:
(Mohit K Goyall - goyall@utdallas.edu),
(Andrew E. Lowman - lowman@arizona.edu)
====

Are SCSI-3 hard drives and/or controllers available yet?

Allegedly. Previous postings have said "I heard that SCSI-3 has been standardized," but I haven't seen anything firm about it. I've seen controllers advertised by JDR Microdevices and some cheap clones; the Quantum "Empire" drives are also advertised as SCSI-3 by some mail order vendors. Seagate and IBM call their fastest drives (probably comparable in speed to the Quantums, if not faster) "Wide SCSI-2."

That's a misnomer. See below.

What is the difference between SCSI-3 and Fast & Wide SCSI-2?

Wide SCSI-2 required two cables to do 16 bit wide transfers. SCSI-3 defined a single cable, single REQ/ACK 16 bit wide transfer. The reason you are hearing 16-bit single cable being called SCSI-3 is that they CAN. The fact that single cable 16-bit has been around for a while just shows you how much the standardization process lags behind the real world.

SCSI-3 is really a family of standards. SCSI was broken up from a single document into different layers and command sets. This was done to allow for different physical transport layers (like fibre channel and SSA) to be defined, and to allow for smaller "bite-sized" projects that maybe get done a little faster ;-)

The family includes the following members with TLAs:

- SCSI-3 Parallel Interface (SPI): Defines the mechanical, timing, phases, and electrical parameters of the parallel cable we all know and love. Some of the electrical and cable parameters are tightened/improved over SCSI-2.

- SCSI-3 Interlock Protocol (SIP): Defines the messages and how the phases are invoked. No real change from SCSI-2, except for some new messages.

- SCSI-3 Architectural Model (SAM): In a nutshell, defines a common set of functions and services and definitions for how a physical transport properly gets commands, data, and status exchanged between two devices, complete with error handling and queueing.

- SCSI-3 Primary Commands (SPC): All of the commands executed by any and all SCSI devices, like REQUEST SENSE and INQUIRY, etc.

- SCSI-3 Block Commands (SBC): Disk commands.

- SCSI-3 Stream Commands (SBC): Tape commands.

- SCSI-3 Controller Commands (SCC): RAID box commands.

- SCSI-3 Multimedia Commands (MMC): For CDROMS etc.

- SCSI-3 Fibre Channel Protocol (FCP): SCSI commands over gigabit Fibre Channel.

- SCSI-3 Serial Bus Protocol (SBP): SCSI commands over IEEE 1394 High Speed Serial Bus (Apple's "Firewire").

- SCSI-3 Serial Storage Protocol (SSP): SCSI commands over SSA.

whew.

After perusing the latest issue of Computer Shopper, I came
away with the impression that companies are calling
F&W scsi-2 hd's SCSI-3. Is this an incorrect assumption,
or is F&W SCSI-2 known as SCSI-3?
Is this really mostly marketing hype?

Actually, there is something to that. TECHNICALLY, what is out there is often a hybrid: SCSI-3 "SPI" silicon with some other hodgepodge of SCSI-3 proposals, all mixed in with SCSI-2 stuff.

An earlier posting said that the Quantum Empire ("SCSI-3") drives contain some commands from the SCSI-3 command set, and Adaptec suggested a specific setting on its 2940W controller to work properly with the drive.

I understand there are some drives with proposed SCSI-3 command features. These are mostly in the MODE SELECT and in error codes, as I recall. Perhaps someone who knows more about this could elaborate?

Note also that the major players (like DC Drives) don't have any "SCSI-3" stuff advertised; only JDR and some cheap clones are promoting it. Besides, Wide SCSI-2 has yet to really catch on (mostly because only a few drives are fast enough to take advantage of it).

There is no "wide SCSI-2" because that would mean two cables. Single cable wide SCSI has always been SCSI-3, it just took too d*** long to get into a standard!-)

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QUESTION: Is SYNCHRONOUS faster than ASYNCHRONOUS?
QUESTION: Is the 53C90 Faster than spec?
ANSWER From: kstewart@ncr-mpd.FtCollins.NCR.COM (Ken Stewart)
====

I've seen a few comments about our 54C90 being faster than spec. While I doubt the author was really complaining (I got twice as much as I paid for--sure makes me mad ;) I'd like to explain the situation.

Along the way, I'll also show that asynchronous is faster on short cables, while synchronous is faster on long cables. The cross-over point occurs somewhere around six feet--assuming that you have our 53C90 family devices at both ends of the cable. The reason has to do with the propagation delay of the cable; the turn around time of the silicon; and the interlocked nature of the asynchronous handshake.

1) We have measured propagation delays from various cables and found an average of 1.7 nanoseconds per foot, which is roughly 5.25 ns per meter.

2) The turn-around time is the amount of time the SCSI chip takes to change an output in response to an input. If REQ is an input then ACK is an output. Or if ACK is an input then REQ is an output. Typical turn-around time for the 53C90 is 40 nanoseconds.

3) The asynchronous transfer uses an interlocked handshake where a device cannot do the next thing until it receives positive acknowledgment that the other device received the last thing.

```
    First REQ goes true                         /* driven by Target */
    then ACK is permitted to go true            /* driven by Initiator */
    then REQ is permitted to go false
    then ACK is permitted to go false
```

Thus we have four "edges" propagating down the cable plus 4 turn-around delays. Asynchronous transfer requires 55 ns setup and no hold time (paragraph in 5.1.5.1 in SCSI-1 or SCSI-2) which gives an upper speed limit around 18 MB/s. A detailed analysis (assuming 53C90 family) shows that the setup time subtracts out. This is mostly because we are running at one-third the max rate, but also because setup for the next byte can begin anytime after ACK is received true or REQ is received false, depending on who is receiving. You can either take my word for it or draw the waveforms yourself. Thus, the asynchronous transfer reduces to:

```
(4 * 1.7 * 1) + (4 * 40ns) = 167 ns                 /* 1 foot cable */
                           = 6 MB/s

(4 * 5.25 * 6) + (4 * 40ns) = 286 ns                /* 6 meter cable */
                            = 3.5 MB/s

(4 * 5.25 * 25) + (4 * 40ns) = 685 ns               /* 25 meter cable */
                             = 1.5 MB/s
```

note: cables longer than 6 meters require external differential transceivers which add delay and degrade the performance even more than indicated here.

Our simulations say that under very best conditions (fast silicon, low temperature, high voltage, zero length cable) we can expect more than 8 MB/s asynchronously. In the lab, I routinely measure 5 MB/s on 8 foot cables. So, if you were writing the data manual for this, how would YOU spec it?

The framers of the SCSI spec threw in synchronous mode to boost the performance on long cables. In synchronous mode, the sending device is permitted to send the next byte without receiving acknowledgment that the receiver actually received the last byte. Kind of a ship and pray method. The acknowledgment is required to come back sometime, but we just don't have to wait for it (handwave the offset stuff and the ending boundary conditions). In this mode any external transceivers add a time shift, but not a delay. So if you negotiate for 5 MB/s, you get 5MB/s regardless how long the cable is and regardless whether you are single-ended or differential. But you can't go faster than 5.5 MB/s, except in SCSI-2. Synchronous mode does have a hold time (unlike asynch) but again, setup and hold times subtract out. In SCSI-1 synchronous mode, the speed limit comes from the combined ASSERTION PERIOD + NEGATION PERIOD which is 90ns + 90ns = 180ns = 5.5 MB/s. Our 53C90 family doesn't quite hit the max, but we do guarentee 5.0 MB/s. In SCSI-2, anything above 5.0 MB/s is considered to be FAST. Here the maximum transfer rate is explicitly limited to 100 ns or 10MB/s; you don't have to read between the lines to deduce it.

Interesting tid-bit: given a SCSI-2 FAST period of 100 ns and a cable delay of 131 ns on a 25 meter cable, you can actually stack 1.31 bytes in the 8-bit cable. In FAST and WIDE SCSI you can stack 5.24 bytes in this copper FIFO. Hummm...

====
QUESTION: What are the jumpers on my Conner drive?
ANSWER From: ekrieger@quasar.hacktic.nl (Eric Krieger)
Embellishment from: Henrik Stahl (f92-hst@nada.kth.se)
====

QUICK INSTALLATION GUIDE

SCSI

Most SCSI host adapters are compatible with Conner drives. Software drivers and installation instructions are provided with the host adapter.

The drives are shipped with SCSI ID set to 7. To select a different ID refer to the following:

Table A

ID	E-1	E-2	E-3
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

Table B

ID	E2	E3	E4
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

Parity is always ENABLED on the CP3200,CP30060,CP30080,CP30100, CP 30200, CP 3500, CP 3360, CP 30540 and CP 31370.

For the CP 340, jumper E-1 to disable parity.

All other models, jumper E-4 to disable parity.

SCSI drive parameters:

Model	Hds	Cyl	Sec	Table	LED
CP2020	2	642	32	A	n/a
CP340	4	788	26	B	1
CP3020	2	622	33	A	1
CP3040	2	1026	40	A	1
CP3180	6	832	33	A	1
CP3100	8	776	33	A	1
CP30060	2	1524	39	A	2

CP30080	4	1053	39	A	2
CP30100	4	1522	39	A	2
CP30200	4	2119	49	A	2
CP3200	8	1366	38	A	2
CP3360	8	1806	49	A	2
CP3540	12	1806	49	A	2
CP 30080E	2	1806	46	AA	C/E
CP 30170E	4	1806	46	AA	C/E
CP 30540	6	2249	59-89	AA	B
CP 31370	14	2094	59-95	AA	B

```
LED 1                LED 2
J-4  Pin 1 = +       J-1 Pin 3 = +
     Pin 2 = -           Pin 4 = -
```

On the CP 31370, jumper E5 enables termination. Default is termination on. It may be the same jumper for other models.

====
QUESTION: What are the jumpers for my Wangtek 5150 drive?
ANSWER From: Terry Kennedy (terry@spcvxa.spc.edu)
====

First, the disclaimer: This is not an official representation of Wangtek or of my employer. This is info I've discovered by reading publicly available reference material. When changing jumpers, always observe proper anti-static precautions and be sure you have the current configuration written down so you have a known starting point.

Ok. Here's the complete scoop on Wangtek 5150ES drives:

The current part number for a "generic" 5150ES is:

33685-201 (black faceplate)
33685-202 (beige faceplate)

These are referred to as the "ACA version" of the drive.

There are _many_ other part numbers for 5150ES drives. If you have one that isn't one of the above, it doesn't mean you have an old or an out of rev drive, it just means it's a special version created for a distributor or OEM, or with different default jumper settings.

You can order the Wangtek 5150ES OEM Manual from Wangtek. It is part number 63045-001 Revision D.

There are 5 possible logic boards. Here are the jumper options for each:

Logic assembly #33678

(J10)
0 - SCSI unit LSB
1 - SCSI unit
2 - SCSI unit MSB
K - not documented

J32 - Diagnostic test connector, default is not installed
E1, F1 - SCSI termination power. E1 in = power from drive and to cable,

```
         E1 out - power from cable. F1 = terminator power fuse, 1.5A FB.
         Default is IN.
E2 - Chassis ground. E2 in jumpers logic to chassis ground. E2 out isolates
     through a .33 uFD capacitor. Default is IN.
E5 - Master oscillator enable. Test only. Must be IN.
E20 - Factory test. Must be OUT.
RP1, RP2, RP3 - SIP terminators. Default is IN, remove for no termination.
```

Logic assembly #30559

```
HDR1 - Factory testing. Setting depends on drive. Don't touch.
HDR2 - Factory testing. Defaults are pins 15-16, 17-18, 19-20. Don't touch.
HDR3 pin 1 - A-B enables buffered mode. B-C disables. Can be overridden by
             SCSI Mode Select.
HDR3 pin 2, 3 - Default data format. Set to B-C for a 5150ES.
HDR3 pin 4 - parity enable. A-B enables, B-C disables.

(J10)
0 - SCSI unit LSB
1 - SCSI unit
2 - SCSI unit MSB
K - not documented

E1 - SCSI termination power. E1 in = power from drive and to cable,
     E1 out - power from cable.
E2 - Chassis ground. E2 in jumpers logic to chassis ground. E2 out isolates
     through a .33 uFD capacitor. Default is IN.
E3 - Master oscillator enable. Test only. Must be IN.
E4 - Write test mode. Test only. Must be OUT.
E5 - Write oscillator enable. Test only. Must be IN.
E6 - Disable HDR2. Test only. Must be IN.
E7 - Microcontroller clock select. In for a 5150ES.
E8 - Write precomp select. Set on a per-drive basis. Don't touch.
E9 - RAM size. Don't touch.
E10 - Erase frequency. Don't touch.
RP2, RP3 - DIP and SIP terminators. Default is IN, remove for no termination.
```

Logic assembly #30600

```
HDR1 - Factory testing. Setting depends on drive. Don't touch.
HDR2 - Write precomp select. Set on a per-drive basis. Don't touch.
HDR3 pin 1, 2, 3 - SCSI device address. 1 is LSB, 3 is MSB. A-B=1, B-C=0
HDR3 pin 4 - Parity enable. IA-B is enabled.
HDR3 pin 5, 6 - Default data format. B-C for a 5150ES.
HDR3 pin 7 - Buffered mode select. A-B is enabled.
HDR3 pin 8 - Reserved. Must be OUT.
HDR4 - Write frequency select. Don't touch.
E1 - SCSI termination power. E1 in = power from drive and to cable,
     E1 out - power from cable.
E2 - Chassis ground. E2 in jumpers logic to chassis ground. E2 out isolates
     through a .33 uFD capacitor. Default is IN.
E3 - Hard/soft reset. IN enables hard reset.
E4 - Write precomp select. Don't touch.
E5 - Clock speed. Don't touch.
E6 - Tape hole test. Don't touch.
```

Logic assembly #30552

```
  HDR1 - Factory testing. Setting depends on drive. Don't touch.
  HDR2 - Write precomp select. Set on a per-drive basis. Don't touch.
  HDR3 pin 1, 2, 3 - SCSI device address. 1 is LSB, 3 is MSB. [Note - HDR3
                    pins 1-3 are duplicated at another location on the board]
  HDR3 pin 4 - Parity enable. IN is enabled.
  HDR3 pin 5, 6, 7, 8 - Default data format. 5,5 B-C, 7-8 A-B for a 5150ES.
  HDR4 - Write frequency select. Don't touch.
  E1 - SCSI termination power. E1 in = power from drive and to cable,
       E1 out - power from cable.
  E2 - Chassis ground. E2 in jumpers logic to chassis ground. E2 out isolates
       through a .33 uFD capacitor. Default is IN.
  E3 - Hard/soft reset. IN enables hard reset.
  E4 - Write precomp select. Don't touch.
  E5 - Clock speed. Don't touch.
  E6 - Tape hole test. Don't touch.

  Logic assembly #30427
  ---------------------

  HDR1 - Factory testing. Setting depends on drive. Don't touch.
  HDR2 - Write precomp select. Set on a per-drive basis. Don't touch.
  HDR3 pin 1, 2, 3 - SCSI device address. 1 is LSB, 3 is MSB. A-B=1, B-C=0
  HDR3 pin 4 - Parity enable. IA-B is enabled.
  HDR3 pin 5, 6, 7, 8 - Default data format. 5,5 B-C, 7-8 A-B for a 5150ES.
  E1, E3 - Factory test. Must be IN.
  E2 - SCSI termination power. E2 in = power from drive and to cable,
       E2 out - power from cable.
  E4 - Chassis ground. E4 in jumpers logic to chassis ground. E4 out isolates
       through a .33 uFD capacitor. Default is IN.
```

Firmware - There are many flavors of firmware. I have seen the following parts:

  24115-xxx
  24144-xxx
  21158-xxx

the -xxx suffix changes as the firmware is updated. According to the folks I spoke to at Wangtek, the standard firmware is the 21158. The latest version as of this writing is 21158-007. All of these will work with the Adaptec and GTAK.

The firmware options (as returned by a SCSI Identify) are on the end of the product string, which is "WANGTEK 5150ES SCSI ES41C560 AFD QFA STD" for the 21158-007 firmware. The 3-letter codes have the following meaning:

```
  AFD - Automatic Format Detection - the drive will recognize the format (such
        as QIC-24, QIC-120, or QIC-150) that the tape was written in.

  QFA - Quick File Access - the ability to rapidly locate a tape block, and
        to implement the "position to block" and "report block" SCSI commands.
        This is compatible with the Tandberg implementation.

  STD - Standard feature set.
```

====
QUESTION: How do I configure my HP DDS DAT tape drive?
ANSWER From: Alan Strassberg (alan@lmsc.lockheed.com)
====

The HP DDS Configuration Guide (postscript) can be found:
http://www.impediment.com/hp/hp_2.ps

====
QUESTION: What is CAM?
ANSWER From: ctjones@bnr.ca (Clifton Jones)
====

Common Access Method.

It is a proposed ANSI standard to make it easier to program SCSI applications by encapsulating the SCSI functions into a standardized calling convention.

ANSWER From: landis@sugs.tware.com (Hale Landis)
====

You may be able to get the CAM spec(s) from the SCSI BBS

====
QUESTION: What is FPT (Termination)?
ANSWER From: jvincent@bnr.ca (John Vincent)
====

FPT is actually really simple, I wish I had thought of it. What it does is use diode clamps to eliminate over and undershoot. The "trick" is that instead of clamping to +5 and GND they clamp to the output of two regulated voltages. This allows the clamping diodes to turn on earlier and is therefore better at eliminating overshoot and undershoot. The block diagram for a FPTed signal is below. The resistor value is probably in the 110 Ohm range. The actual output voltages of the regulators may not be exaclty as I have shown them but ideally they are matched to the diode characteristics so that conduction occurs when the signal voltage is greater than 3.0 V or less than 0.5 V.

```
          +-----------*--- TERMPWR
          |           |
      ____|____       |
     |         |      |
     | Vreg 1  |---------------------------------* 2.8 V
     |_________|      |                          |
          |           |                          |
        -----         |                          |
         ---          |                          \
          -           |                          /    term resistor
                      |                          \    (110 Ohms)
                      |                          /
                  ____|____                      |
                 |         |                     |
                 | Vreg 2  |-*--------* 2.4 V    |
                 |_________| |        |          |
                             |      --+--        |
                             |       / \         |
                       +-------+    /___\        |
                       |              |          |              terminated
```

```
                 |                 *----------*------------- signal
                 |                 |
                 |                 |
                 |               --+--
                 |                / \
                 |               /___\   Both diodes are fast silicon
                 |                 |     switching diodes (.6 V drop)
             ____|_____            |
            |          |           |
            | Vreg 3   |----------*  0.8 Volts
            |__________|
```

The diagram shows the circuit for terminating one signal. In a complete FPT there would be 36 diodes and 18 110 Ohm resistors plus the regulator chips. Using the values shown, transients would be clamped at 0.2V and 3.0V.

[Editor(GF)]:
Some errors in the above diagram were corrected as suggested by
Wietze van Winden (wietze@ittpub.nl)

====
QUESTION: What is Active Termination?
ANSWER From: eric@telebit.com (Eric Smith)
        and brent@auspex.com (Brent R. Largent)
====

An active terminator actually has one or more voltage regulators to produce the termination voltage, rather than using resistor voltage dividers.

This is a passive terminator:

```
TERMPWR     ------/\/\/\/------+------/\/\/\/-----  GND
                               |
                               |
                           SCSI signal
```

Notice that the termination voltage is varies with the voltage on the TERMPWR line. One voltage divider (two resistors) is used for each SCSI signal.

An active terminator looks more like this (supply filter caps omitted):

```
           2.85 Volt Regulator
               +------------+    +2.85V   110 Ohms
TERMPWR   -----| in     out |------+------/\/\/\/-------SCSI signal
               |    gnd     |      |
               +------------+      |
                     |             +------/\/\/\/-------SCSI signal
                     |             |
GND  ----------------+             |
                                   +------/\/\/\/-------SCSI signal
                                   |
                                  etc.
```

Assuming that the TERMPWR voltage doesn't drop below the desired termination voltage (plus the regulator's minimum drop), the SCSI signals will always be terminated to the correct voltage level.

Several vendors have started making SCSI active terminator chips,
which contain the regulator and the resistors including Dallas
Semiconductor, Unitrode Integrated Circuits and Motorola

====
QUESTION: Why Is Active Termination Better?
ANSWER brent@auspex.com (Brent R. Largent)
====

Typical passive terminators (resistors) allow signals to fluctuate directly in relation to the TERM Power Voltage. Usually terminating resistors will suffice over short distances, like 2-3 feet, but for longer distances active termination is a real advantage.

Active termination provide the following advantages:
- Helps reduce noise.
- A logic bit can be used to effectively disconnect the termination.
- Regulated termination voltage.
- SCSI-2 spec. recommends active termination on both ends of the scsi bus.
- Improved resistance tolerences (from 1% to about 3%)

[Editor(GF):
- Reduces current drawn from TERMPWR line.

In FPT form:
- Provides signal overshoot/undershoot clamping on all signal lines.]

====
QUESTION: How can I tell whether an unmarked terminator is active or passive?
ANSWER From: Gary Field (gfield@grcelect.ultranet.com)
====
If you have an Ohm-meter of one kind or another, measure the resistance from the TERMPWR pin to an adjacent GROUND pin. Reverse the probes and take another reading.

If the reading is about 30.5 Ohms, with the probes both ways, you have a passive single-ended terminator.

If the reading is about 45 Ohms, with the probes both ways, you have a passive differential terminator.

Active terminators should read much higher and give very different readings with the probes interchanged.

====
QUESTION: Where can I buy terminators ?
ANSWER From: Rodney Brown (RBrown@cocam.com.au)
Info taken from Usenet postings by:
John Zatler (JPZ@Popmail.mcs.com)
Steve Schreppler (schrep@oasys.dt.navy.mil)
Dave Nadler (nadler@ug.eds.com)
====

DataMate / Methode

Methode Electronics, Inc.
dataMate Division
7444 West Wilson Avenue

Chicago, IL 60656
(708) 867-9600
(800) 323-6858
(708) 867-3149 FAX

Brief description of terminators available.

Passive, Active, SLICK (Elaboration of FPT)) in:
Centronics 50 pin (SCSI-1)
Male 3 row D-Sub (Old Sun)
Male 50 position .050" Centres (SCSI-2 HD)
Male 68 position .050" Centres (SCSI-3 P cable)
Male & Female for ribbon cables
Male/Female for pass through between device and ribbon cable

Newark Electronics stocks the DataMate product line
Newark's address info

```
Newark Electronics              (International orders)
4801 N. Ravenswood Ave.         500 N. Pulaski St.
Chicago IL 60640-4496           Chicago IL 60624-1019
(312)-784-5100, (FAX (312)-638-7652, TLX 6718690 NEWARK U).
```

====
QUESTION: What is Plug and Play SCSI?
ANSWER From: leefi@microsoft.com (Lee Fisher) (Updated Dec 7 1993)
====

Plug and Play is the name of a technology that lets PC hardware and attached devices work together automatically. A user can simply attach a new device ("plug it in") and begin working ("begin playing"). This should be possible even while the computer is running, without restarting it. Plug and Play technology is implemented in hardware, in operating systems such as Microsoft Windows, and in supporting software such as drivers and BIOS.

With Plug and Play technology, users can easily add new capabilities to their PCs, such as sound or fax, without having to concern themselves with technical details or encountering problems. For users of mobile PCs (who are frequently changing their configurations with docking stations, intermittent network connections, etc.) Plug and Play technology will easily manage their changing hardware configuration. For all users, Plug and Play will reduce the time wasted on technical problems and increase their productivity and satisfaction with PCs.

The Plug and Play technology is defined in a series of specifications covering the major component pieces. There are specifications for BIOS, ISA cards, PCI, SCSI, IDE CD-ROM, PCMCIA, drivers, and Microchannel. In a nutshell, each hardware device must be able to be uniquely identified, it must state the services it provides and the resources which it requires, it must identify the driver which supports it, and finally it must allow software to configure it.

The first Plug and Play compliant products are available now, as are development kits for drivers and hardware. Twenty different Plug and Play products were shown at Comdex in November 1993.

Specifications:

The Plug and Play specifications are now available via anonymous ftp at ftp.microsoft.com in the \drg\plug-and-play subdirectory. The files are compressed in .zip format, and are in Microsoft Word format.)

```
  Plug and Play ISA files (.\pnpisa\*)

    errata.zip   Clarifications and corrections to pnpisa.doc
    isolat.zip   MS-DOS testing tool to isloate ISA PnP hardware
    pnpdos.zip   Plug and Play device driver interface specification
    pnpisa.zip   Hardware spec for PnP ISA enhancement
    vhdlzi.zip   Hardware spec for PnP ISA enhancement

  Plug and Play SCSI files (.\scsi_ide\*):

    pnpscsi.zip  Plug and Play SCSI specification proposal
    scam.zip     SCAM (SCSI Comnfigured Auto-Magically) specification

  Plug and Play BIOS files (.\bios\*):

    apmv11.zip   Advanced Power management spec v.1
    vios.zip     Plug and Play BIOS spec
    escd1.zip    Spec for optional method of storing config info for PnP BIOS
```

PlayList@Microsoft.COM alias:

There is an alias, PlayList@Microsoft.COM, which you can email and get on a Microsoft mailing list related to Plug and Play, where the Hardware Vendor Relations Group (HVRG) will mail out new specifications, announcements, information on workshops, Windows Hardwware Engineering Conference (WinHEC), etc...

Compuserve PlugPlay forum:

There is a forum on Compuserve, GO PLUGPLAY. This forum is the method for support, discussions and dialogs about Plug and Play. In addition, the forum's library contains all of the current specification.

Intel Plug and Play kits:

If you are interested in Intel's two Plug and Play kits, either "Plug and Play Kit for MS-DOS and Windows" or "Plug and Play BIOS Enhancements Kit", FAX your name and company information to Intel at 1.503.696.1307, and Intel will send you the information.

====
QUESTION: Where can I get drivers (ASPI and other) for the WD7000 FASST2
          host adapter?
ANSWER From: Gary Field (gfield@grcelect.ultranet.com)
====

Western Digital stopped producing WD7000 FASST2 cards some time in 1990. Future Domain bought the rights to produce them and as of early 1994 they still do. Columbia Data Products Inc. of Altamonte Springs, Florida still provides driver support for the card.
Their SST IV driver package provides support for many types of SCSI devices including disks, tapes, and CDROM. Also included in this package is an ASPI manager driver (equivalent to the Adaptec ASPI4DOS.SYS). I have personally tested this ASPI manager and it works with GNU tar w/ASPI and the Corel CDROM driver, so most other ASPI stuff should work too. Versions of SSTASPI.SYS prior to Oct 1993 do NOT work with the above mentioned programs so be sure

to check the file date. There are other useful programs in the package as well. For instance I find the TAPEUTIL program very handy for duplicating tapes. The price of this package is $99 or $85 as an upgrade of a previous version. A pre-requisite to run this software is that the adapter card must have a BIOS ROM version of 3.36 or newer. I don't think cards manufactured before 1989 or so are compatible.

```
Columbia Data Products Inc.
1070 B Rainer Dr
Altamonte Springs, FL 32714 (407) 869-6700 (main number)
                            (407) 862-4725 (fax)
http://www.cdp.com          (Columbia home web page)
cdp@cdp.com                 (Columbia e-mail)
```

[Update to above information 1/20/97][Editor(GF)]

From: "Alan L. Welsh" <snapback@ix.netcom.com>
Subject: Western Digital 7000-Fasst SCSI Cards and CDP's SST software
Alan L. Welsh, President
Columbia Data Products, Inc.

We don't usually recommend that users purchase the upgrade for the 7000 software today. Development has ceased, Windows 95 is not supported except in DOS mode, and today I would rather recommend a popular currently manufactured Local-bus SCSI board and not an ISA 7000 board. However, there are still some companies that we do support that have standardized on 7000s and need to keep them in service for years to come. So please buy the software, sell the board, use it as-is, or buy a new board.
http://www.cdp.com cdp@cdp.com

HISTORY OF THE WD-7000 SCSI HOST ADAPTER AND COLUMBIA DATA PRODUCTS, INC.

Starting in early 1987, Western Digital (WD) manufactured virtually all of the 100,000+ 7000 SCSI boards, except for a few hundred that were made by Future Domain. The first few thousand, known as 7000-ASC boards went out with no software and only a ROMBIOS that was actually written by John Sponger of WD. In the summer of 1987, Columbia Data Products (CDP) completed and shipped its first ROMBIOS for the card that enabled it to boot and operate in DOS. At that same time CDP also completed a DOS ram-resident driver so that DOS would recognize and operate the card without the slowness of the ROMBIOS, a DASD driver so that DOS could access additional drive letters and to break the (then) 32 meg barrier, and partitioning software to perform the FDISK function for SCSI.

It was CDP's goal at that time to develop and provide SCSI software that would enable: any SCSI host adapter, to run any SCSI peripheral, on any operating system, in any PC-based bus. Since at that time WD had 80% of the hard drive controller market, CDP chose WD as the most logical choice to strategically market with, and so CDP supported their cards almost exclusively. During that following year, CDP continued to develop the software for the 7000 host adapters, enabling it to run faster than any other board of its time, including Adaptec's new 1540, whose hardware was actually faster.

In the fall of 1988, CDP exclusively licensed its SCSI software suite, called SST to WD. The WD 7000-asc SCSI host adapter was renamed 7000-FASST. WD was the first OEM to ship software with all SCSI boards distributed as part of the package. CDP's SST software was well received, even though SCSI was still a relatively small market. CDP was paid a royalty for each card shipped and CDP provided complete software support and limited hardware support throughout the world.

By 1991 CDP had developed support for all SCSI peripherals known, all PC operating systems such as Unix, Xenix, Windows, Dos, Netware, and even AIX, although never officially released, and a SCSI toolkit utility package. All of the 7000-FASST's shipped had multiboot capability that allowed all of these operating systems to simultaneously coexist on a single hard drive so that one OS can be selectively booted each session.

CDP's exclusive was ending with WD, and CDP was porting the software to 25 of the most popular SCSI host adapters. Unfortunately, most of software had to be rearchitected and rewritten to embrace not only all the new adapters but also the new SCSI software standards such as CAM, LADDR, ASPI, INT-4b, as well as CDP's own standard since 1987, SDLP. During the next few years WD was losing a considerable amount of money and sold many of their product lines, which included selling the SCSI board business to Future Domain. Future Domain did very little sales of the 7000 as they had competing product lines and didn't understand the value of a bus mastering SCSI board. (Bus mastering gives the card the ability to move data to and from the card and system memory directly without the CPU's involvement, making it as fast as the peripherals driving it, even on an old slow 80286!) The bus mastering 1542 product line from Adaptec is still being produced today, very popular, and is based on the same basic design as the 7000. From a pricing standpoint, the prices for this class of product has declined less than 50% in ten years. This is only amazing if you compare the price of 1MB of memory at $300 in 1987 to that of today.

CDP has continued to develop and support for the 7000-FASST continuously, even though the board hasn't been manufactured for quite a number of years. Our last major revision of our SST-IV software was done in late 1993, although there have been some minor revisions since then. To enable CDP to continue to develop software and support the board, CDP has been selling upgrades to the large installed user base for years. Without this revenue, development and support would have ceased long ago. There are no plans to continue development at this time, as SCSI is moving from the ISA bus to Local Bus. Although Window-95 development and support was considered, the potential upgrade business wouldn't have covered the cost of development.

In 1994 CDP entered the server backup software market, shipping the first version of Snapback in March of that year. Many of our customers for years had been begging us to write our own backup software and were complaining that "restoring" their servers sometimes took days with the current backup products. For SCSI software development purposes only, CDP had been backing up and restoring hard drives containing multiple operating systems for years. CDP adapted and then rewrote this software in this first release to provide the ability to backup and restore any hard drive that contained any operating system, from DOS. CDP later wrote a device driver in Netware, that could make the backup tape look, act and perform like a hard drive from a Netware workstation. This enabled direct file retrieval and use through Netware from the backup tape, making it appear to a workstation to be just another drive letter. Since all the directories and FATs are cached, the tape is almost as fast as a hard drive. Another feature, resize, allows a Netware server's hard drive to be replaced with a larger one in an hour instead of a day's labor.

At fall COMDEX 1996, CDP released its latest version, Snapback Live! that backs up a live image of a Netware file server's hard drive, capturing all open files in the process, without impacting system performance. Watch your Computer magazine for Snapback reviews in 1997, as well as a version for NT. Innovating backup software has now become CDP’s new life--from an innovative SCSI software company.

For more information, contact us at:
http://www.cdp.com OR cdp@cdp.com

====
QUESTION: What if I have a SCSI drive larger than a gigabyte (1024MB) ?
ANSWER From: Gary Field (gfield@grcelect.ultranet.com)
====
The IBM PC/AT BIOS Int 13h disk interface was specified in about 1986 when a large disk drive was about 60 MB. IBM decided that disks wouldn’t have more than 1024 cylinders and only allocated 10 bits for the CYL parameter to the INT 13h interface. By 1989, this was already a problem. When vendors began to support SCSI drives under INT 13h, they needed to come up with a translation algorithm between the CYL, HEAD, SECT parameters of INT 13h and the linear block numbers used by SCSI devices. Various vendors chose to map the two such that each INT 13h "cylinder" contained 1 MB.
In other words they emulated a drive with 32 heads and 63 sectors per track.
At the time, large drives were at about 300 MB, so this worked OK. Once drives larger than 1024 MB arrived, a problem developed. They couldn’t provide cylinder values greater than 1023! Changing algorithms became necessary.
This is painful since any disk formatted with the old algorithm can’t be read using the new algorithm.
By the way, different vendors chose different mappings, so drives formatted with one adapter can’t necessarily be moved to a different one.
Adaptec’s newer adapters (e.g. the 154xC and the 154xCF) provide a BIOS control to select the old algorithm or the new one, and they also provide BIOS PROMs for the 154xB that will use the new algorithm.
There is an absolute limit of 16 M sectors which means 8 GB assuming 512 byte sectors. Also DOS only allows 2 GB per partition.
The day when this presents another problem is not too far away (1995?)
Hopefully, we’ll all be running more sophisticated O/Ses that bypass this limitation by then.

====
QUESTION: My SCSI bus works, but is not reliable. What should I look at?
ANSWER From: Gary Field (gfield@grcelect.ultranet.com)
====
If you still have problems after you’re sure that you have all the ID and termination and cable issues resolved, it’s time to dig a little deeper.
If you get your SCSI bus to the point where it basically works, but it isn’t reliable I have found that the gremlin can be the TERMPWR voltage.

With your system fully powered up, and both terminators attached, measure the TERMPWR voltage at the far end of your bus. It needs to be between 4.25 and 5.25 Volts. Many vendors start with the system’s +5 VDC and add a regular silicon rectifier diode and fuse in series. Silicon rectifiers have an inherent voltage drop of .6 to 1.0 Volts depending on the current through them. Schottky barrier rectifiers are much better for this application. I always use a 1N5817 myself. If the diode on the host adapter is a 1N400x type, change it to a 1N5817. If you add up the drop across the diode and the fuse and 15 feet of ribbon cable and the connector contact resistances, many times you’ll find yourself below 4.0 Volts. When using passive terminators, this can shift the signal threshold and decrease the signal to noise ratio on the bus. If you aren’t able to get relief with these methods, sometimes you can solve the problem by having several devices supply TERMPWR to the bus.

Sometimes the voltage is high enough, but there is too much noise on the TERMPWR line. This can cause really strange problems! If you can see more than about 200 mV of noise on TERMPWR, add a .1 uF and 10 uF capacitor from TERMPWR to one of the adjacent GROUND lines. You need to have the bus as active as you can get it when measuring the noise. I have actually seen over 1 Volt of noise in some severe cases.

Another way you can help to solve TERMPWR problems is to use active terminators. These don't draw as much current from the TERMPWR source and they also have a built in regulator which can operate on lower voltage than the standard passive terminators. The regulator also tends to reduce the noise.

====
QUESTION: Where can I find information about programming using the ASPI
          interface from DOS and Windows?
ANSWER From: Gary Field (gfield@grcelect.ultranet.com)
====

The Adaptec BBS has some documents about ASPI. They also have a WWW server. See the FAQ Question "How can I contact Adaptec?" for phone numbers and URL information etc.

ftp://ftp.adaptec.com/pub/BBS/adaptec/aspi*

Dr Dobb's Journal March 1994 issue pg 154, has an article called "The Advanced SCSI Programming Interface" by Brian Sawert. Example code in C and x86 assembly language is included. The code can be obtained via anonymous ftp from: ftp.mv.com: /pub/ddj/1994.03/aspi.zip.

====
QUESTION: How to replace Macintosh internal HD and terminate the SCSI chain
           properly?
Answer From: Jie Yuan PhD (Jie.Yuan@UC.Edu)
====

The factory installed Macintosh internal HD should be terminated. Make sure the terminator/resitor-package is installed in the drive before using it. Most vendors will install the terminator for you if you tell them it is for use in Macintosh as the system disk. Manufacturers usually have toll free numbers for SCSI termination, ID, and such.
If you don't already have the terminator, they may send you one for free.
BTW, Macintosh SCSI chain starts at the system disk (ID=0), and ends at the control board (ID=7). ID numbers from 1-6 should be used for any other divices on the chain.

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QUESTION: Will attaching a SCSI-1 device to my SCSI-2 bus hurt its performance?
ANSWER From: Gary Field (gfield@grcelect.ultranet.com)
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Attaching a SCSI-1 device to a system with a SCSI-2 host adapter and several SCSI-2 devices already attached will not hurt over-all performance significantly unless it doesn't handle disconnect/reconnect well. This assumes that the host adapter keeps track of protocol options seperately for each target device. Some people have the idea that attaching a SCSI-1 device to a SCSI-2 bus will cause the entire bus to run at SCSI-1 speeds. This is not true.

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QUESTION: Can I connect a SCSI-3 disk to my SCSI-1 host adapter?
          Can I connect a SCSI-2 CDROM to a SCSI-3 host adapter?
          Can I connect a Narrow SCSI2 disk to a WIDE SCSI3 host adapter?

ANSWER From: Gary Field (gfield@grcelect.ultranet.com)
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Questions of this nature really cannot be answered in a useful way. There are so many aspects and options to each of the SCSI standards, you need to be much more specific about what devices and adapters you're interested in connecting. Most of the time the best thing to do is just try it! Most combinations will work, but if you're considering a purchase and looking for a guarantee from "The Net", forget it.

The issue is further complicated by the fact that vendors like to latch onto the latest acronyms before they even know what's involved. For example SCSI3 is not approved yet, but vendors are already saying their devices are SCSI3 compatible. Since there is no standards compliance testing organization, they can pretty much say what they want.

If you buy a high end host adapter (probably called SCSI3 :-)) from a reputable vendor, and it has enough control over the various options (like synch xfer rate 5,10,20 xfers/s and the ability to disable WIDE or FAST/Ultra negotiation), and you carefully think out what devices you connect to it (all WIDE devices nearest the host adapter end of the bus etc.), and you are careful to properly terminate not only both ends, but both halves (upper byte and lower byte) of the bus, and none of the older devices you might already have (like a Panasonic CDROM) do anything stupid (like not handle the WIDE negotiation message without hanging) then it will all work fine. :-)

Even though a host adapter may be called SCSI3 doesn't mean it can enable or disable each optional feature, yet this is vital for supporting older devices.

To make matters worse, you won't know which older devices do some of the stupid things unless you know someone who's been bitten already. Your best bet is to look for good deals on name brand devices and adapters and before you buy, ask in comp.periphs.scsi whether anyone has tried the combination you're considering. It's also important to buy from a well known vendor with reasonable return policies.

If you're looking at buying a Vendorxyz spiffydisk which claims to be SCSI-3 compatible and you have a Seagate ST-01 host adapter and you want to know if anyone else has tried this combination, then that's exactly what you should ask.

In general, most SCSI devices and adapters made less than 4 years apart will probably work together, but without specific information about exactly which devices there's no assurance of it. There's also the potential for poor performance even if it does work.

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QUESTION: Can I connect a WIDE device to my narrow SCSI host adapter?
QUESTION: Can I connect a narrow device to my WIDE SCSI host adapter?
ANSWER FROM: Gary Field (gfield@grcelect.ultranet.com)
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Yes, you just need an appropriate adapter. Most WIDE devices use the 68 pin "P" connector so you need a 68 pin to 50 pin adapter. You do need to make sure that both the upper byte and lower byte of the bus will be properly terminated though. Some adapters provide a place for terminators, others do not. If the wiring adapter is placed right at the SCSI host adapter, you can usually configure the host adapter's on-board terminators to only terminate the high byte. You need to be clear on what type of connectors are present where you want to do the conversion. You also need to plan your bus so that all the WIDE devices will be at one end and all the narrow devices will be at the other end. Certain host adapters with auto-termination make the assumption that when the low byte is terminated the high byte is also. When using WIDE/narrow adapters this assumption is not valid.

Such adapters are available from:

Technical Cable Concepts
1790 E. McFadden Ave.
Unit 103/104
Santa Ana, CA 92705
TEL: (714) 835-1081
FAX: (714) 835-1595
http://www.techcable.com/

MegaHaus
2201 Pine Drive
Dickinson, TX 77539
E-Mail megahaus@phoenix.net
Order Line 800-786-1157
Fax Line (281)534-6580
Main Line (281)534-3919
http://www.megahaus.com/

Dalco Electronics
P.O. Box 550
275 South Pioneer Blvd.
Springboro, OH 45066-1180
http://www.dalco.com/

Attention other vendors: If you want to be listed here send your contact info to: Gary Field (gfield@grcelect.ultranet.com)

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End.
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email: gfield@zk3.dec.com   http://www.ultranet.com/~gfield TZ=EST5EDT
Press RESET to continue. */