SCSI Implementation on 7110S

Amcodyne

Introduction

As the computer industry continues to rapidly expand into multiple markets and directions, speed and efficiency become increasingly important system considerations. And a system's performance is primarily dependent on its communications interface. Given the tremendous volume and design diversity of the computer equipment presently available, established interface standards such as the Storage Module Drive (SMD) and the ST412HP are unable to adequately meet the growing industry demands. Although design extensions of these interfaces are capable of supporting larger data files and transmission speeds, they cannot provide the device intelligence necessary for high-level multitasking, multiuser operations.

The SCSI Interface

The Small Computer Systems Interface (SCSI), through its architecture, lends itself well to a wide range of system configurations. A bus-oriented parallel interface, it allows peripheral device independence. Not only does it service much faster data transfer rates, SCSI is also relatively easy and inexpensive to implement.

The primary attribute of the SCSI interface lies in its employment of a host adapter. The optimum adapter design is capable of connecting a diverse variety of performance devices including disk and tape drives, modems and printers, as well as other storage and communications peripherals (see Figure 1). As an intelligent interface, SCSI permits peripheral device independence, thereby freeing more of the host's resources. This results not only in increased memory and program capacity, but additional system availability. The true performance of a SCSI interface depends, however, upon the effectiveness of the individual manufacturer's implementation.

SCSI Architecture

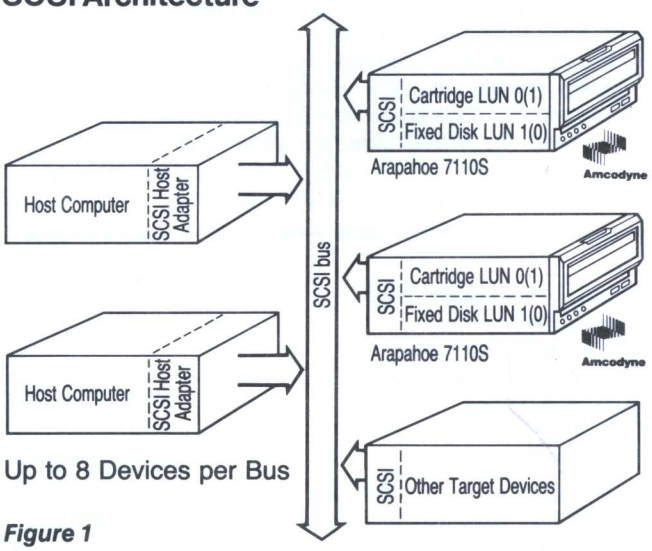

Figure 1

Amcodyne's Implementation

Amcodyne has implemented the SCSI interface on its Arapahoe Model 7110S 8-inch rigid disk drive. The fixed/removable drive contains 41.1 Mbytes of SCSI-defined formatted storage capacity. The removable disk cartridge feature facilitates easy data backup as well as the portability of extended data files. The SCSI interface itself is built-in, enhancing the overall performance of the drive. By incorporating the SCSI interface as an integral element of its design, the drive is capable of performing numerous unique and functional operations.

The SCSI interface employs a logical addressing approach which accesses and transfers data in a block format. This effectively increases system speed by allowing multi-block transfers to be conducted without regard to physical boundaries or limitations. The data seek function is implied, being embedded in the data transfer command. Consequently, the location of file data may be scattered throughout various tracks on the media, with cylinder, head and sector locations automatically verified before any read or write command is executed.

The command set specifications for SCSI, as proposed by the American National Standards Institute (ANSI), are fairly general by definition. ANSI defines only four commands as mandatory. Most of the remaining potential commands are considered either "Optional" or "Vendor Unique," leaving the specific implementation of the command set to the individual device manufacturer.

Amcodyne's SCSI set contains a total of 35 operational commands (see Table 1), as well as 10 messages (see Table 2), which furnish the user with comprehensive reporting on the status of the system. In addition to the four mandatory commands, an extensive set of "Optional" and "Vendor Unique" commands have been incorporated to provide some highly desirable interface capabilities. One of the more significant optional SCSI functions implemented by Amcodyne is the Disconnect/Reconnect/Arbitration feature. This disconnects the drive from the SCSI bus while it performs a seek operation or during the execution of a command which does not require the transfer of data. When the drive is ready to transfer information, it will arbitrate with the other peripherals for reconnection to the bus and access to the host device. This feature releases the drive to operate under its own internal intelligence system while the SCSI bus is free to perform other data transfer operations.

Amcodyne has also incorporated a full-track FIFO buffer into its design. The buffer, in conjunction with the logical address scheme, facilitates the execution of some important "Vendor Unique" commands. Operation of the FIFO buffer is self-adjusting, allowing the concurrent overlapping of data transfers to and from the buffer. It also permits data transfers, with seek, over physical track boundaries.

By using the full-track FIFO buffer and eliminating host intervention, data transfers between disk drive volumes are optimized. For example, a complete volume-to-volume

Table 1
Commands Implemented by 7110S

Command	OP	SCSI Code (ANSI)
Test Unit Ready	00	O
Rezero Unit	01	O
Request Syndrome	02	V
Request Sense	03	M
Format Unit	04	M
Format Good Track	06	V
Read	08	M
Write	0A	M
Seek	0B	O
Assign Alt. Track	0E	V
Inquiry	12	E
Reserve Unit	16	O
Release Unit	17	O
Mode Sense	1A	O
Start/Stop Drive	1B	O
Copy	A0	V
Copy with Verify	A1	V
Self Test	E0	V
Write Long	E1	V
Seek Test	E3	V
Read Long	E8	V
Controller Test	ED	V
Data Test	EF	V
Special Spin	F1	V
Execute Exerciser	F2	V
Read First ID	F3	V
Seek Physical	F4	V
Get Rentry Count	F5	V
Get Defect Map	F6	V
Verify Track (Ph)	F7	V
Format Track (Ph)	F8	V
Read Start/Stop Switch	F9	V
Force Strobe	FA	V
Set Max Rentry	FD	V
Write Defect Map	FE	V

E = Extended O = Optional
M = Mandatory V = Vender

Table 2
Messages

Message	Code
Op Complete	00
Restore Pointers	03
Disconnect	04
Initiator Detected Error	05
Abort	06
Message Reject	07
No Operation	08
Message Parity Error	09
Bus Device Reset	0C
Identify	80-FF

copy, with Error Correcting Code (ECC) verification, can be performed between the drive's fixed disk and removable cartridge in less than two minutes.

Another important aspect of the integral drive-interface relationship is the extensive set of diagnostics unique to Amcodyne's design. The level of internal defect management is configured by the host and is transparent to the user. Command retries, or recoveries, and an 11-bit internal error correction function are automatic. If desired, both operations may also be disabled by the host. Moreover, the resident diagnostic commands permit the drive to be interrogated more specifically to locate the source of any potential problem.

A certain degree of application flexibility is furnished by the drive's adjustable parameters. Readily accessible switches on the front of the drive allow four of the interface parameters to be user-defined. The data block size is adjustable to 256, 512, 1024 or 2048 bytes. A parity check may be either enabled or disabled, as desired, while the Logical Unit Number (LUN) can define either the fixed disk or the removable cartridge as LUN 0 and the other as LUN 1. SCSI IDs 0-7 are included as user-defined parameters.

Conclusion

The SCSI interface offers a high degree of utility in a multitude of system environments. Data transfer rates are greatly improved by SCSI while device independence allows the host computer to accommodate more tasks and peripherals. In addition, SCSI installation is relatively easy and inexpensive to implement, with a host adapter representing only about ¼ of the investment of a controller device.

Amcodyne's SCSI interface, built into its 8-inch fixed/removable disk drive, enhances the typical industry implementation. Utilizing 35 commands and 10 messages, the Arapahoe Model 7110S provides a comprehensive set of disk drive operations. Disconnect/Reconnect/Arbitration capability, a full-track FIFO buffer, efficient media copying and transparent defect management all combine to create an intelligent and useful SCSI interface. The user-selectable parameters also allow some applications customization. By uniting such highly desirable disk drive features, Amcodyne's SCSI interface meets the emerging industry needs with both versatility and functionality.

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