



*3363 Optical Disk Drive
Hardware Reference
Library*

Technical Reference

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Second Edition (July 1987)

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- Move the computer away from the receiver
- Plug the computer into a different outlet so that the computer and receiver are on different branch circuits.

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How To Identify & Resolve Radio-TV Interference Problems.

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To comply with the limits for a Class B computing device of FCC Rules, shielded cables must be used when connecting this equipment to the adapter card in the system unit.

Caution: This product is equipped with a 3-wire power cord and plug for the user's safety. Use this power cord in conjunction with a properly grounded electrical outlet to avoid electrical shock.

Laser Safety

The 3363 Optical Disk Drive is certified to comply with the Laser Performance Standards set forth by the U.S. Department of Health Education and Welfare as a "Class 1 Laser Product" and with DHHS Rules 21 CFR Subchapter J in effect at time of manufacture. This means that this machine is part of a class of laser products that do not generate hazardous laser radiation; this is possible only because the laser beam is not accessible by the user during any operation.

The Class 3 laser in this machine operates at a wavelength of 830 nm and does, however, generate a ray of light or beam that if looked into can cause damage to the retina in the eye. Follow the servicing procedures as described in this manual without exception. Do not insert any objects through the cartridge opening that could deflect the beam out of the machine.

The drive is equipped with multiple interlocks that prevent power from being applied to the laser except when the drive is being used in normal operations.

DANGER

Do not attempt to override the interlocks and operate the laser with the drive disassembled. There are no drive service procedures that require drive disassembly.

When you follow the service procedures described in this manual no hazardous light radiation is generated. No operations by the user will result in laser radiation, because the laser beam is not accessible during normal machine operations.

CAUTION

Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

About This Manual

This manual contains advanced programming and technical information of special interest to:

- Hardware designers
- Software designers
- Programmers
- Engineers
- Others interested in the design and operation of IBM 3363 Optical Disk Drive internals.

It is divided into seven sections:

Section 1. Hardware Introduction: Description of drive unit hardware, including performance and specifications, drive electronic functions, and adapter card information.

Section 2. Optical Disk Media: Description of the disk and cartridge, performance and specifications, disk format, and demark.

Section 3. System Unit Communication With the Adapter and Drive: System I/O channel interface, read scenario, line diagram, line definitions, I/O port addresses, edge connectors, and pin identification.

Section 4. Programming: Introduction, BIOS interface, interrupts, and directory structure.

Section 5. Commands: Definitions of the commands.

Section 6. Status and Sense: Definitions of the status and sense bytes.

Section 7. Error Recovery Procedures: Error list, definitions, and recovery procedures.

Also included are a *Glossary*, an *Index*, and a *Reader's Comment Form*.

Related Publications

For maintenance and service information see the *Hardware Maintenance and Service* manual, SY32-7007-1, for the IBM 3363 Optical Disk Drive. Setup and operating instructions are in the IBM 3363 *Guide to Operations*, GC35-0104-1.

In addition, this book makes cross references to the:

- *Technical Reference Manual* for the IBM Personal Computer and IBM Personal System/2 computers to which the IBM 3363 is attached.
- *DOS 3.2 (or later) Technical Reference Manual* which contains additional programming information for IBM Personal Computer products.

To purchase manuals, contact an IBM authorized dealer, or your IBM Marketing Representative.

Summary of Amendments

The changes in this edition are primarily to provide additional information about the IBM 3363 when it is attached to an IBM Personal System/2.

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Section 1. Hardware Introduction

The IBM 3363 Optical Disk Drive attaches to the system units of most IBM Personal Computers and Models 30, 50, 60, and 80 of the IBM Personal Systems/2 (PS/2). Support is not provided for the IBM PC XT/370, PC/RT, Convertible, or PCjr^{®1}.

Attachment is by means of an adapter card and cable. Only one adapter card is permitted on the Personal Computer system units. However, depending on the model, up to four adapter cards can be installed in Personal System/2 system units.

The 3363 Optical Disk is available as an external stand-alone unit; complete with covers, power supply, and power cord, that is attached to the system unit. Optionally, the 3363 is also available as an internal unit and is installed as an integral part of a PS/2 system unit.

A 3363 Optical Disk Drive subsystem is defined as consisting of the following major components:

- Optical disk drive, electronics, and power supply (external drive)
- Optical disk drive adapter card
- Optical disk cartridge
- Power and signal interconnecting cables
- File System Driver (software package).

The optical disk drive contains both the mechanical assemblies and the drive electronics cards. The mechanical assemblies or the electronic cards are not individually replaceable as they are matched sets.

The 3363 Optical Disk Drive uses a laser for both writing and reading. The 3363 allows the one-time writing of data on a removable, single-sided, 130 mm optical disk.

The 3363 allows for the reading of data multiple times.

¹ All personal computer specified are trademarks of International Business Machines Corporation.

During a Write operation the laser changes the physical characteristics of the optical disk. During a Read operation the laser is used to detect changes in the physical characteristics of the optical disk.

The IBM 3363 Optical Disk Drive connects to the system unit through the required optical disk adapter card and a data/control signal cable and uses the personal computer's I/O bus.

The PC interface, controller, data buffer, error correction codes (ECC), run length code (RLC) encoding or decoding, and serializer/deserializer (SERDES) are all functions of the adapter card.

Performance and Specifications

The following table contains performance data, specifications, and environmental information for the IBM 3363 drive.

Average seek time (5700 tracks)	230 Milliseconds
Maximum seek time (5700 tracks)	270 Milliseconds
Average seek time (< 51 tracks)	45 Milliseconds
Average single track seek time	3.5 Milliseconds
Motor start and stop time	5 seconds
Error rate at end of life (Recoverable)	1 error in 10 to the 5th bits read
Error rate at end of life without prior use of Read - Verify (Unrecoverable)	1 error in 10 to the 9th bits read

Figure 1-1 (Part 1 of 2). IBM 3363 Performance, Specifications, and Environmental Information

Error rate at end of life with prior use of Read – Verify (Unrecoverable)	1 error in 10 to the 12th bits read
Seek error rate	1 error in 10 to the 6th seeks executed
Burst data rate at output of read amplifier	2.5 MB per second
Effective data rate from adapter card to system unit	171.7 Kilobytes per second
Rotation speed and direction	875 RPM counter clockwise
Latency	34.3 Milliseconds
Temperature range	<ul style="list-style-type: none"> • Operating: + 15.6°C to + 32.2°C (60°F to 90°F) • Shipping: -40°C to + 60°C (-40°F to 140°F) • Storage: + 0.6°C to + 60°C (33.08°F to 140°F)
Humidity range (see Note)	<ul style="list-style-type: none"> • Operating: 8% to 80% • Shipping: 5% to 100% • Storage: 5% to 80%
Wet bulb	<ul style="list-style-type: none"> • Operating: + 23.8°C (74.84°F) max. • Shipping: + 29.4° C (84.92°F) max. • Storage: + 29.4°C (84.92°F) max.
Drive orientation	The standalone drive should be operated with the media surface in the horizontal plane. The internal mount drive should be operated with the media surface in a vertical plane.
Physical specifications (standalone drive)	<ul style="list-style-type: none"> • Height: 138 mm (5.45 in.) • Width: 226 mm (8.7 in.) • Depth: 422.4 mm (16.6 in.) • Weight: 6.7 kg (14.8 pounds)
Physical specifications (internal drive)	<ul style="list-style-type: none"> • Height: 82.55 mm (3.25 in.) • Width: 146 mm (5.75 in.) • Depth: 203.2 mm (8.0 in.) • Weight: 2.4 kg (5.3 pounds)

Figure 1-1 (Part 2 of 2). IBM 3363 Performance, Specifications, and Environmental Information

Note: The packaged product should not be submitted to greater than 100% humidity for more than 96 hours.

Drive Electronics

The drive electronics control the following functions.

- Write Protect
- Optical Read
- Optical Write
- Sector Detection
- Track Counting
- Track Retrace
- Track Servo
- Disk Load and Unload Detection
- Seek Control
- Focus Servo
- Disk Motor Control
- Equalization
- Head Amplify
- Index Detection
- Laser Diode Control
- Linear Motor Control
- No Disk and Disk Upside Down Protection

Drive electronic functions are controlled by a logic board mounted on the drive unit. These functions are inherent in the logic board and are not programmable. The functions listed here are for general information only and are not explained in this book.

Electrical Power Specifications

The following voltages and power consumption rates are for the adapter card and drive.

Note: Power may be applied or removed in any sequence without drive damage or data destruction.

Frequency	47 to 63 Hz
Rated 115 vac Range	90 to 137 vac
Rated 230 vac Range	180 to 265 vac
Nominal Power Usage	<ul style="list-style-type: none">• 100 to 125 vac• 40 watts• 0.6 amperes
PC Adapter Card DC Current	<ul style="list-style-type: none">• Standby: 5V = 1.2 amperes• Maximum: 5V = 1.5 amperes
PS/2 Adapter Card DC Current	<ul style="list-style-type: none">• Standby: 5V = 0.9 amperes• Maximum: 5V = 1.2 amperes
Drive DC Current	<ul style="list-style-type: none">• Standby: 12V = 0.4 amperes 5V = 2.5 amperes• Start Up Current: 12V = 1.2 amperes 5V = 2.5 amperes• Maximum Operating Current: 12V = 2.0 amperes 5V = 3.0 amperes

Figure 1-2. Electrical Power Specifications

Adapter Card

The optical disk adapter card supports IBM 3363 drive units only. The IBM 3363 adapter card presents a high level command interface to software I/O drivers. Representative commands are Read, Write, Seek, Sense.

The adapter card controls seek verification and fine seek adjustments. In addition, it allows sector demarking and detects and reports demarked sectors on a read operation.

The adapter card is buffered on the I/O bus and uses the system board direct memory access (DMA) or programmed I/O for data transfers. An interrupt level is also used to indicate operation complete and status conditions requiring system unit attention.

The adapter card has the following functions:

- Data Buffer
- Demark Generation
- ECC Encode/Decode
- Modulation/Demodulation
- Serializer/Deserializer (SERDES)
- System Unit Device Control
- Demark Detection
- Drive Electronics Control
- ECC Scramble Buffer
- MFM Encode/Decode
- System Unit Interface
- Error Detection and Block (DCB) Buffer Correction

Section 2. Disk Cartridge and Media

The IBM 3363 Optical Disk Drive uses a single sided factory preformatted disk enclosed in a protective cartridge. The individual sectors of the optical disks can be written on once, until the cartridge is full. Thereafter, except for demarking, they can only be read. For more information about demarking, see the Glossary or "Demarking Sectors" on page 2-3.

Note: If a sector is over-written, the data on that sector becomes unreadable.

Disk Cartridge Assembly

Openings in the cartridge provide disk access for the Read/Write laser, disk sensing, drive hub, and Write Protect. A sliding cover protects the disk when the cartridge assembly is not in the drive.

Disk Format

The optical disk format consists of 17,100 tracks each containing 23 sectors of 795 bytes. Included in each sector is a 512 byte data field, an identification (ID) field and error correction and checking (ECC) data. The ID field is recorded when the disk is manufactured and contains the track and sector location of the record. The data field is for user data.

Performance and Specifications

The following table contains information about disk performance, specifications, environmental information, and disk space allocation.

User data/disk (512 byte sectors)	200,000,000 Bytes
User data per track	11,776 Bytes
Recording surfaces per disk	1
Tracks per surface	17,100
Sector size (user data)	512 Bytes
Sectors per track	23
Disk diameter	130 MM (5.12 in.)
Center hole	15 MM (.59 in.)
Pre-grooved recording area	65.28 MM to 120 MM (2.57 in. to 4.72 in.)
Track pitch (spiral)	1.60 Micrometer
Disk cartridge dimensions	135 MM wide, 9.2 MM high, 145 MM long (5.31 in. wide, .36 in. high, 5.71 in. long)
Temperature range	<ul style="list-style-type: none"> • Operating: +10°C to +51.6°C (50°F to 124°F) • Shipping: -40°C to +60°C (-40°F to 140°F) • Storage: +0.6°C to +60°C (33°F to 140°F)
Humidity range (see Note)	<ul style="list-style-type: none"> • Operating: 8% to 80% • Shipping: 5% to 100% • Storage: 5% to 80%

Figure 2-1. Media Performance, Specifications, and Environmental Information

Note: The packaged product should not be submitted to greater than 100% humidity for more than 96 hours.

Demarking Sectors

Demarking is used to mark a sector such that it can not be used for writing or reading. The laser demarks a sector by overwriting the data field of a sector with four pulse trains.

A demark is verified when the laser reads the target sector and confirms a demark is present in the data field. If the demark was unsuccessful, a retry is made with a Demark Recovery command. This command causes four additional pulse trains to be recorded.

Any Read command that detects any two of the 4 or 8 demark pulse trains will signal a demarked record.

Section 3. System Unit Communication With the Adapter Card and Drive

System I/O Channel Interface

For the IBM Personal Computer, IBM Personal Computer XT, XT/286, Portable, IBM Personal System/2 Model 30, and the IBM Personal Computer AT, the assignment of the interrupt and direct memory access (DMA) channels can be altered by changing the switches on the adapter card. IBM supplied basic input/output system (BIOS) requires the use of the standard assignments; interrupt level 5 and DMA channel 3. Alternate assignments are interrupt levels 2 or 6 and DMA level 2.

For the IBM Personal System/2, assignments are made by a diagnostic setup function. IBM supplied BIOS supports all allowed setup options.

For the IBM Personal Computer, IBM Personal Computer XT, and Personal System/2 Model 30 data transfer is performed by the Direct Memory Address (DMA) controls. For the IBM Personal Computer AT and XT/286 system units data transfer is performed by the use of the Programmed I/O. Both methods are supported by the adapter card BIOS. The BIOS determines the PC model and uses the appropriate data transfer function. The adapter card used with the IBM Personal Computers must have its address and function switches manually set for the PC model in which it is installed. The adapter card used with the IBM Personal System/2 computers other than PS/2 Model 30 must be configured by the diagnostic setup function. Refer to the *3363 Optical Disk Drive Guide to Operations* for information on how to set switches or run the diagnostic setup function.

Personal Computer System I/O Channel Interface

The following block diagram shows data flow between a Personal Computer system unit, optical disk adapter card, and the disk drive electronics. For a description of the lines, see "Personal Computer Line Definitions" on page 3-3. For a description of the Personal System/2 lines, see "Personal System/2 System I/O Channel Interface" on page 3-2. For additional information refer to the system unit Technical Reference manual.

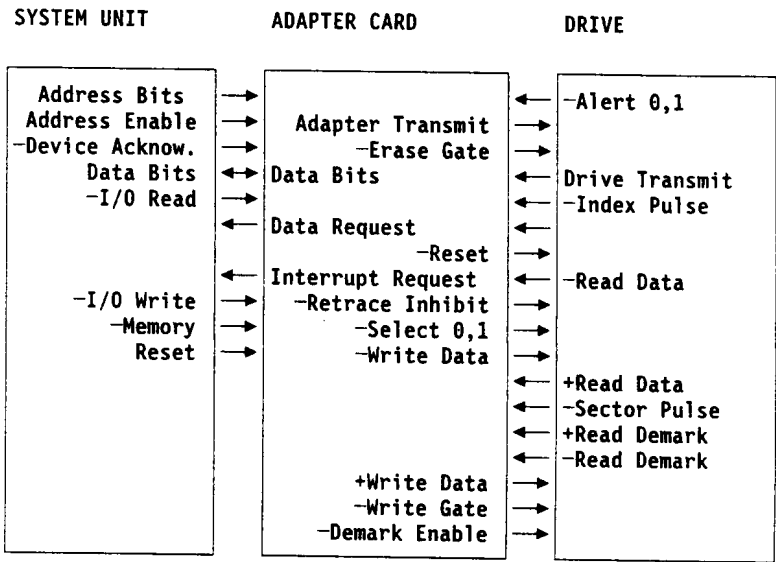


Figure 3-1. I/O Channel PC Interface Block Diagram

Personal System/2 System I/O Channel Interface

The following block diagram shows data flow between a Personal Computer system unit, optical disk adapter card, and the disk drive electronics. For a description of the lines, see "Personal System/2 Line Definitions" on page 3-5. For a description of the Personal Computer lines, see "Personal Computer System I/O Channel Interface." For additional

information refer to the system unit Technical Reference manual.

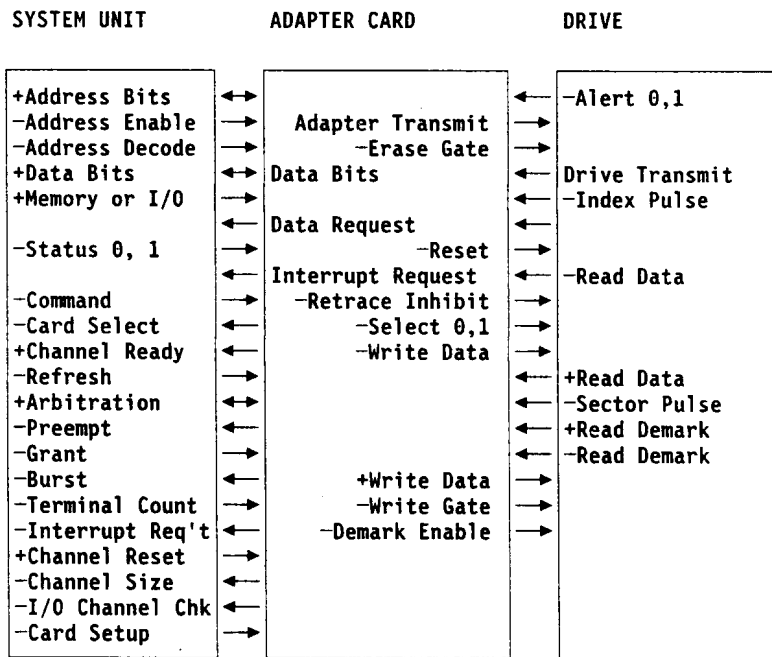


Figure 3-2. I/O Channel PS/2 Interface Block Diagram

Personal Computer Line Definitions

Adapter Card

Adapter Card Transmit: Control information is transferred serially on this line from the adapter card to the drive.

-Alert 0,1: This signal indicates drive 0 or 1 requires service. The -Alert signal is cleared by reading drive sense. Each drive has one -Alert output line, and the adapter card has an input for each drive.

-Demark Enable: This line enables the demark of the specified sector(s). The demark pattern on the write data lines is written on the specified sector(s) when this line and the -Write Gate line are low.

Drive Transmit: Status information is transferred serially on this line from the drive to the adapter card.

-Index Pulse: Indicates the beginning of a track is present.

-Read Data and + Read Data: The read data lines are differential pair signal lines containing data read from the optical disk.

+ Read Demark and -Read Demark: These are differential pair signal lines containing the demark signal read from the optical disk.

-Reset: This line, ANDed with the -Select line, is used to initialize the drive microprocessor and logic in the selected drive.

-Retrace Inhibit: This line, ANDed with the -Select line, to inhibit the automatic retrace in the drive which is initiated by the detection of the Index Mark.

-Sector Pulse: Indicates the beginning of a sector is present.

-Select 0,1: These signals are used to enable data transfers, index pulse, sector pulse, write gate, reset, and retrace inhibit between the adapter card and the selected drive. Each drive has one -Select input line and the adapter card has an output for each drive.

+ Write Data and -Write Data: The write data lines are differential pair signal lines from the adapter card containing data to be written on the optical disk.

-Write Gate: This line enables data to be written on the disk when low and read from the disk when high.

The system unit to adapter card I/O interface is described in the *Technical Reference Manual* for the PC system unit.

Personal System/2 Line Definitions

Adapter Card

- + **Address Bits:** Address bus signal lines 0 to 23 that allow access to 16M of memory.
- + **Data Bits:** Data bus bits 0 to 15 for the microprocessor, memory, and I/O devices.
- Address Decode:** Address decode latch used to latch valid address and memory decodes from the microprocessor.
- Address Enable:** Used to signal the adapter to decode the address bus.
- + **Memory or I/O:** Status byte 2; used with status bytes 0 and 1 to indicate the kind of bus cycle in progress. It also distinguishes between memory and I/O operations.
- Status 0, 1:** Used by the system microprocessor to control data transfers. S0 selects Read operations, S1 selects Write operations.
- Command:** Used to define when data is valid on the bus.
- Card Select:** This line is used when the system addresses an enabled memory or I/O adapter.
- + **Channel Ready:** Used by memory and I/O devices to lengthen their cycles.
- + **Arbitration:** Arbitration bus priority levels 0 through 3 used with multidevice systems.
- Preempt:** Used to grant momentary control of the bus to a requesting master.

- Arbitration Grant:** Used to define ownership of the bus to the requesting device with the highest priority.
- Burst:** Indicates that the active master requires burst usage of the bus.
- Terminal Count:** Used to indicate a terminating device.
- Interrupt Request:** Used to signal the system microprocessor that an I/O device needs attention.
- + **Channel Reset:** Used to reset the system logic.
- Channel Size:** Used by the 16-bit memory or I/O device to indicate that the device being addressed is capable handling 16-bit data.
- Card Setup:** Multiple lines, one for each expansion slot, used to select and enable adapters.
- I/O Channel Check:** Provides the system with error information about memory or devices on the I/O channel.
- Refresh:** Used by the system microprocessor to indicate that a refresh cycle is in progress.

The system unit to adapter card I/O interface is described in the *Technical Reference Manual* for the PS/2 system unit.

Adapter Card Pin Assignments

Pin assignments for the drive electronics interface on the rear of the adapter card are shown below. Pin 1 is located top left, looking toward the rear of the system unit.

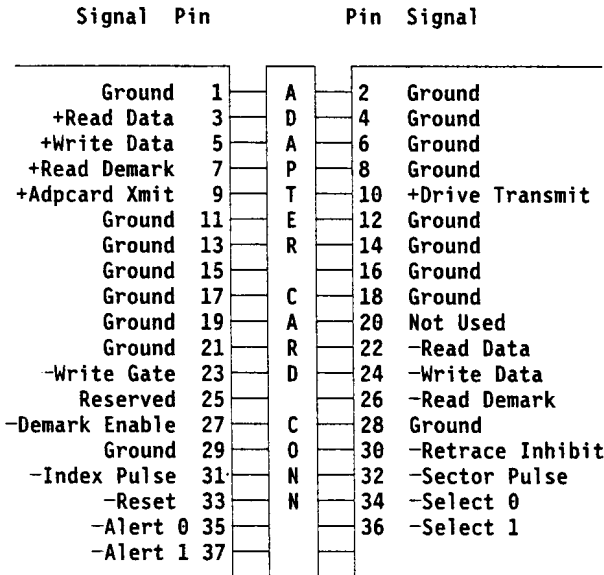


Figure 3-3. Adapter Card External Cable Connector

I/O Port Addresses

The 3363 optical disk address is sent to the adapter card. The I/O read signal and the I/O write signal are supported. The adapter supports four Read/Write ports. The following table defines the four read and write ports.

R/W	Port Address		Function
	PC (Note)	PS/2 (Note)	
Read Write	X'0258'	X'xx58'	Read Status (from adapter card to system unit). Write commands (from the system unit to the adapter card).
Read Write	X'0259' X'0259'	X'xx59' X'xx59'	Reserved. Reset adapter card electronics, microcode, and drive(s).
Read Write	X'025A' X'025A'	X'xx5A' X'xx5A'	Transfers 1 byte of data when using programmed I/O protocol. (Reserved all other models)
Read Write	X'025B' X'025B'	X'xx5B' X'xx5B'	Reserved. Set interrupt and DMA.

Figure 3-4. Read/Write Port Definitions

Note: PC addresses supported by the hardware denoted as xx are 02. PS/2 addresses supported by the hardware denoted as xx are 02, 06, 0A, and 0E.

Read to I/O address (Read Status) X'xx58': Results in the transfer of one byte of status from the optical disk adapter card to the system unit.

Write to I/O address X'xx58': A 6 byte control block containing a command for execution by the adapter card and the drive is sent using this port. Six "OUT" instructions are required to transfer the control bytes.

Read to I/O address X'xx59': Reserved. Do not use.

Write to I/O address X'xx59' (Reset): Resets the optical disk adapter card electronics and microcode. Also sets the operating values to the default state. A Selective Drive Reset is issued to each of the attached drives.

Read to I/O address X'xx5A': Transfers one byte of data from the adapter to the processor when using Programmed I/O protocol. This address is reserved in all other models. Do not use.

Write to I/O address X'xx5A': Transfers one byte of data from the processor to the adapter card when using Programmed I/O protocol. This address is reserved in all other models. Do not use.

Read to I/O address X'xx5B': Reserved. Do not use.

Write to I/O address X'xx5B' (Set Interrupt and DMA):
Transfers one control byte to the adapter card to set the Interrupt and DMA conditions as follows. The least significant bit is D0.

D0—DMA Enable—When set to 1, the adapter card is allowed to do DMA transfers. The DMA Request line is enabled. This bit must be set for any data transfer including Programmed I/O.

D1—Interrupt Enable—When set to 1, the adapter card is allowed to interrupt the system unit. If the Interrupt Enable bit is a 1, the Interrupt line is enabled. Interrupts occur at the start of each sector if in Program I/O mode, and at the completion of the operation for both DMA and Programmed I/O modes.

D2-D7—Set to 0.

Read Operation

The application program allocates a data input area and issues a GET to the host operating system.

The host operating system support creates a command parameter list. The list contains the following:

- Device address
- Command
- Address of the data area in the system unit memory
- Track and sector address
- Block count.

Data transfers are done with DMA or Programmed I/O depending on the model of the IBM PC's System Unit.

The BIOS sends the validated command to the adapter card.

The adapter card command causes the drive actuator mechanism to move to the required track. The adapter card waits until the addressed sector is positioned under the read head and then verifies the track and sector ID.

The adapter card conducts the transfer of data from the proper sectors into the adapter card buffer. The adapter card then causes the decode and corrects for errors. The data is then transferred to the processor by the DMA or Programmed I/O.

After the total data transfer is complete, the controller sets the status register with the completion codes for the request.

The BIOS then reads the adapter card status. If the status byte indicates no errors, the transfer is complete and the busy status bit is reset. If an error occurs, the BIOS issues a Read Sense command and passes the sense information to the device driver for error recovery action.

Section 4. Programming

This section describes the directory structure, basic input/output system (BIOS) interface, and disk operating system (DOS) interrupt extensions (DOS INT21) along with general programming information for the IBM 3363 Optical Disk Drive.

The following overview diagram assumes the existence of the 3363, the INT21 router support, the file system driver functions, and the 3363 driver (BIOS) support.

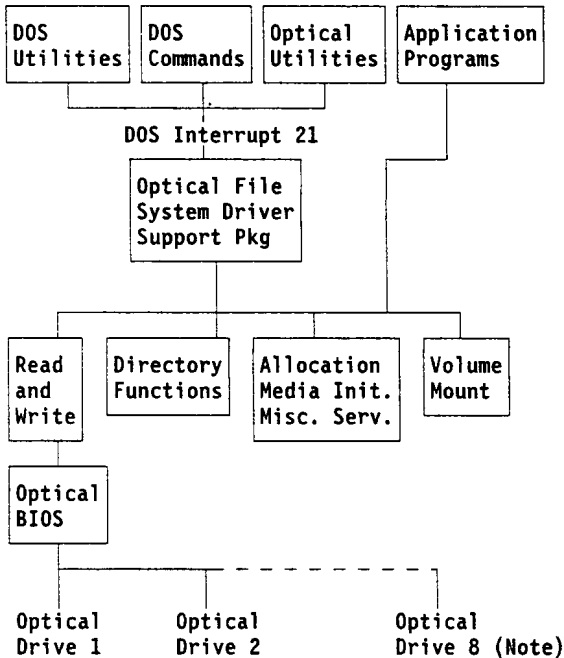


Figure 4-1. Overview of File Driver Structure.

Note: Optical drives 3 through 8 are available on only certain models of PS/2.

File Driver Diagram Definitions

Optical BIOS: Controls Input/Output (I/O) operations to the physical optical device.

Read/Write Support:

- Transforms logical addresses within a file into absolute track and sector addresses.
- Interfaces to BIOS level support.
- Provides error recovery support.
- Manages implicit space allocation on drive.
- Includes buffer and cache management functions.

Directory Functions: Directory management functions manage the optical disk directory structure. Including:

- Creation of the directory structure on disk initialization.
- Creation of subdirectories.
- Modification of directory structures as entries are made into subdirectories.
- Searches directory entries for file name and file version requests.

Note: For additional information on horizontal and vertical search see "Search Versions" on page 4-15.

Directory functions are used by allocation, disk initialization, volume mount, the optical disk utilities, and the DOS processor routines.

Miscellaneous Services, Allocation, and Disk Initialization:

Miscellaneous services are routines that provide access to and update of internal control blocks and internal buffers.

The function of allocation is to manage available disk space. The functions are used by the DOS processor and volume mount.

The function of disk initialization is to initialize a new optical disk. Initialization includes the following functions:

- Builds the root directory and its anchor.
- Defines the diagnostic track.
- Writes the optical disk label record.
- Writes the disk description record that describes the disk and initialization parameters.

Volume Mount:

- Builds a volume control block that describes the mounted disk and serves as an anchor for other volume related control blocks.
- Builds the control blocks for the root directory and points to it from the volume control block.
- Determines the free space on the volume and records it in the volume control block.

DOS Utilities: External DOS utilities such as Attrib, Print, Sort, etc..

DOS Commands: Internal DOS commands such as Dir, Vol, etc..

Optical Commands: Commands that exploit the optical disk device characteristics.

File System Driver Initialization: Initialization functions for the file system driver.

Optical File System Driver Processor Functions: The DOS processor consists of a set of routines that process the DOS Interrupt 21 function codes. These routines receive control from the router via the file system driver interface.

Directory Structure

The structure of root directories and subdirectories are the same. All directories have a directory header and a directory segment. Any directory can have multiple headers and multiple segments.

In the following charts, "Offset" means the number of bytes from the beginning of the table, and "Length" means how many bytes are taken up by the ODSDCB (optical disk self describing control block).

Anchor blocks are used to expand the number of elements supported by the root directory. The ODSDCB contains the main pointer to the directory anchor base location. It is the starting base location (track and sector address) to move through the directory structure.

The anchor base is a single track entry, pointed to by the ODSDCB. Each directory entry in the anchor base has an identifier of "A." The anchor base is used to obtain the directory anchor pointer. The following table gives the anchor base entry definition.

Offset	Length	Field Name	Content
0	1	DHRPFID	The directory header format ID. This field is set to "A" for the anchor base.
1	1	DHRPSAD	Sector address of the previous anchor base element. This field is set to 0 if there is no previous element.
2	2	DHRPTAD	Always 0.
4	2	DHRSEGAD	Track address of the directory anchor pointer.
6	1FA		Reserved.

Figure 4-2. Anchor Base Entry Definition

The following table gives the anchor base pointer entry definition.

Offset	Length	Field Name	Content
0	1	DHRPFID	The directory header format ID. This field is set to "P" for the directory anchor pointer.
1	1	DHRPSAD	Sector address of the previous anchor pointer track. If there is no previous anchor pointer, this field is set to 0.
2	2	DHRPTAD	Track address of the previous anchor pointer track. If there is no previous anchor pointer, this field is set to 0.
4	2	DHRSEGAD	Track address of the root directory header.
6	1FA		Reserved.

Figure 4-3. Anchor Base Pointer Entry Definition

Directory Control Block

The optical disk self describing control block (ODSDCB) contains the disk definition. It is written on track 1 in the first useable sector and is read during volume mount. The ODSDCB is used to build the optical disk directory control block (ODDCB).

Offset	Length	Field Name	Description
0	6	ODSFID	Identification (Value = "ODSDCB")
6	1	ODSSPT	Number of sectors per track.
7	1		Reserved.
8	2	ODSTRK	Number of tracks per cylinder.
A	2	ODSCYL	Number of cylinders per volume.
C	2	ODSSSZ	Size of the sector (in bytes).
E	4	ODSTOTS	Total number of sectors per drive.
12	1	ODSDAU	The number of sectors per demand allocation unit. There must be an integer number of demand allocation units per track.
13	1	ODSSAU	File system driver allocation unit size.
14	1	ODSNOH	The number of heads.
15	1	ODSMED	Media type: 0 = Write Once.
16	2	ODSMLNG	Length of the anchor base (in tracks).
18	2	ODSDIAGT	Number of tracks in the diagnostic area.
1A	A	ODSVOLID	The volume label.
24	1		Reserved.
25	2	ODSVERNO	Version of ODSDCB = "01."
27	2	ODSFSDL	Version of file system driver = "01."
29	2	ODSMAHT	Track address of the anchor base.
2B	2	ODSDIAGL	Location of the diagnostic area (track address).
2D	4	ODSDTS	Unique disk identifier.
31	1CF		Reserved.

Figure 4-4. Optical Disk Self Describing Control Block

Directory Header

The directory header is common to the root directory and all subdirectories. The root directory header is located via the directory anchor pointer. Headers for subdirectories are located via the subdirectory entries in the root directory or in other subdirectories.

Directory headers have an identifier of "H." The maximum number of directory headers depends on whether the directory headers are subdirectories or root directories. The maximum number of directory headers for one subdirectory varies, depending on where the subdirectory is described. The maximum number of root directory headers is 12,167.

The structure of the directory header is a contiguous string of entries, physically composed of a set of areas that may not be physically contiguous.

A directory header contains the following:

- A pointer to the directory segment controlled by the header.
- A summary index for the previous directory segment. This contains information about the directory segment entries controlled by the previous directory header entry. The first directory header does not have that information.

The following table defines the directory header entry.

Offset	Length	Field Name	Content
0	1	DHRPFID	Directory header format ID. This field is set to "H."
1	1	DHRPSAD	Sector address of the previous directory header element. If this field is not valid, DHRPTAD is set to 0.
2	2	DHRPTAD	Track address of the previous directory header element. If this field is set to 0, there is no previous entry.

Figure 4-5 (Part 1 of 2). Directory Header Entry

Offset	Length	Field Name	Content
4	2	DHRSEGAD	Track address of the directory segment associated with this directory header element.
6	2	DHRBTADI	Base track address associated with the index entries in DHRIDXEN.
8	1F8	DHRIDXEN	Directory index entries for the previous directory segment. Each entry is 12 bytes long and there are a maximum of 42 entries in the index. The index is present in all directory header elements except the first.

Figure 4-5 (Part 2 of 2). Directory Header Entry

The directory index entry (DHRIDXEN) format is described in the following table.

Offset	Length	Field Name	Content
0	8	IDXNAME	The eight byte file or subdirectory name. It is justified to the left and padded with blanks.
8	3	IDXEXT	The three byte file extension name. It is justified to the left and padded with blanks. This field combined with the IDXNAME makes up the index key.
B	1	IDXSPTR	The relative sector pointer for the file. (See DHRBTADI on page 4-8.)

Figure 4-6. Directory Index Entry

The end of the index list (if less than 42 entries) is represented by X'FFFFFF' in the track/sector entry.

Directory Entries

The Directory Segment

A directory segment entry contains the directory information for a file and is common to both the root directory and subdirectories. The directory segment is composed of 46 entries, of which, four are reserved for system use. The other 42 can contain entries that describe files or subdirectories. A file or subdirectory can use more than one entry depending on the size of the file. The directory segment entry contains the following types of information.

- The type of directory entry: Since a file may require more physical directory sectors to contain the file history, the directory entry type has the information required about physical mapping.
- Common file information: Information common to all file versions.
- Unique file version information: File attributes and extent information.

Directory records are written sequentially, in chronological order, beginning with the oldest. The types of records are as follows.

- X'80': The only physical directory sector that describes the file.
- X'81': The first physical directory sector of multiple directory sectors for this file. This record points to the next directory for this file.
- X'82': This is an intermediate physical directory sector for a file. This file contains multiple physical directory sectors. This record may point to another X'82' type record or to a X'83'.
- X'83': The last physical directory sector for a file.
- X'84': Subdirectory pointer record.

There are extent directory entries that contain extended extent information for large files. These use the following record types.

- X'02': An intermediate physical extent sector for a file. There are multiple physical extent sectors for this file. This record may point to another X'02' type record or to a X'03' type record.
- X'03': The last physical extent sector for a file. There are two or more directory extents for this type of file.

The directory segment is divided into the following sections.

- **General Header:** This is the header for each directory entry. The general header record exists for each sector of a directory entry. The header contains a chain for multiple physical directory sectors.
- **Common File Header:** Header for the most recent directory entry sector. The common file header describes the data that is most common to all file versions. Data in the file version header is valid only for a directory type record of X'80' or X'81'.
- **File Version Header:** Header for each file version. The file version header contains the data that is unique to each file version. The first version header describes the latest or current file level.

Directory contents are written contiguously. The general header record is followed by the common file header, which is followed by the file version header containing the extent information for the file.

A directory sector contains as many file versions as will fit in the sector. When a new file version is created, a test is made to determine if the new version (with all its extent definitions) will fit in the existing directory sector. If the new file version fits, the existing versions in the directory sector are moved down and the new version is added after the common file header entry. If the new file version fits (without its extent definitions) a type X'02' and/or type X'03' is created. The updated directory sector is then written out, and the existing directory block is demarked.

If the new version will not fit into the directory sector, the old directory header is marked as a type X'82' (if it is an intermediate record), or a type X'83' (if there is no last record), and written out. The updated directory sector is then

written out and the existing directory sector directory block is demarked.

If the new version causes an overflow of the directory sector, the old directory header is marked as a type X'82' (if it is an intermediate record), or a type X'83', (if there is no last record), and written out. The new version is defined in a new type X'81' record (first record of multiple directory sectors). This ensures that a minimum number of directory blocks are used.

The directory header is described in the following table.

Offset	Length	Field Name	Description
0	1	DIRBLKID	Directory entry identifier = S
1	1	DIRBLKTP	Physical directory record type: X'80': Single directory sector file. X'81': First record of a multi-sector file. X'82': Middle record of a multi-sector file. X'83': Last record of a multi-sector file. X'84': Subdirectory pointer record. X'02': Middle record of a multi-extent file. X'03': Last record of a multi-extent file.
2	2	DIRBLKFT	Track address of the next record for the file. If this is the only record or the last record, this is a 0.
4	1	DIRBLKFS	Sector address of the next record for the file. If this is the only record or the last record, this is a 0.
5	1		Reserved
6	2	DIRSPACE	The last byte used in this directory sector.
8	2	DIRVERCT	The number of versions in this sector.

Figure 4-7. Directory Header

The common file header is described in the following table.

Offset	Length	Field Name	Description
0	8	FILENAME	Filename
8	3	FNEXTAME	File extension name.
B	1		Reserved
C	2	ACTVERNO	Version number for active version. If this is a 0, there is no active version.
E	2	CTVERNO	Count of version numbers used for this file.
10	2	TOTVERS	Total number of versions currently in the file.

Figure 4-8. Common File Header

The file version header is described in the following table.

Offset	Length	Field Name	Description
0	2	VERNO	Version number. This is an absolute number running from X'00' to X'FFFF'.
2	1	FLAGS	The file attribute flags in hexadecimal. X'01': Read only file. X'02': Hidden file. X'04': System file. X'08': Volume label. X'10': Subdirectory. X'20': Archive bit.
3	1	EXTYPE	Extent record type. X'00': Extent information in this record. X'01': Extent information is pointed to by this record.
4	2	TIME	The time this version was created. The time is specified in standard DOS format with the least significant byte first.

Figure 4-9 (Part 1 of 2). File Version Header

Offset	Length	Field Name	Description
6	2	DATE	The date this version was created. The date is specified in standard DOS format with the least significant byte first.
8	4	SIZE	The file size of this version in bytes. The size is specified with the first word containing the low order part of the size.
C	2	EXTCNT	The number of extents in this version. If EXTYPE = X'00', EXTCNT and EXTENTS apply.
E	5n	EXTENTS	The extent definition for this version, where n = the number of extents in this version. *Bytes 1 – 3: Absolute track, sector. *Bytes 4 – 5: Number of contiguous sectors.
C	2	EXTRK	The track address of the extent record. If EXTYPE = X'01', EXTRK and EXTSECT apply.
E	2	EXTSECT	The sector address of the extent record.
<p>* The following special value is defined for bytes 1 – 3 of EXTENTS.</p> <p>X'FFFFFF' = The number of sectors specified in bytes 4 – 5 are not allocated, as they have not been written. This happens when a user writes noncontiguous records. For example, a user may write record 1 then record 100. Records 2 – 99 will be defined as not allocated since these records were not written.</p>			

Figure 4-9 (Part 2 of 2). File Version Header

The following figure illustrates the overall directory structure. The numbers represent the maximum number of elements that can exist in the structure if no directory sectors are demarked due to errors.

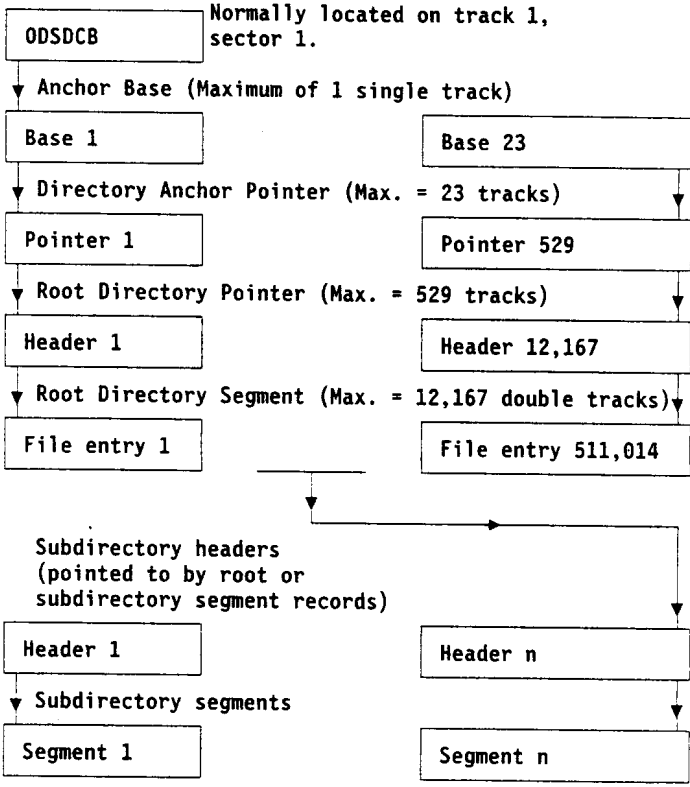


Figure 4-10. Directory Structure

DOS Interrupt 21 Interface

Using Extended DOS Functions

Extended function calls require input to be passed to the function call in registers. After setting the proper register, enter the function number in AH and issue interrupt type 21H.

Note: Also see Compatible, Noncompatible, and Not Applicable DOS Commands on page 5-2.

IOCTL READ

OPDIOSRD – X'44'

Purpose: Handles specific requests based on the subfunction code passed to the input/output control (IOCTL) function. It also handles requests that obtain information from the optical disk directory.

Search Versions

The IOCTL Read function handles specific requests based upon the subfunction code which is passed to the IOCTL function. IOCTL Read handles search requests which obtain information from the optical directory.

Search Versions are subfunction code 01 and have three request codes.

- 01 = Search Directory Horizontal First (searches horizontally across the filename and filetype for the first directory entry).
- 02 = Search Directory Horizontal Next (searches horizontally across the filename and filetype for the next directory entry).
- 03 = Search Directory Vertical (searches vertically within the same filename and filetype, looking for versions).

Request code 01, Search Directory Horizontal First, performs the first horizontal directory search for a particular search criteria. This request code must be performed prior to doing a request code 02 or 03.

Request code 02, Search Directory Horizontal Next, performs a horizontal directory search for the next file which satisfies the search criteria. This makes use of search first and search next to perform the function. The work area in the parameter list is used for the search next entries.

Request code 03, Search Directory Vertical, performs a directory search for the next file version within the most recent file returned by request code 01, Search Directory Horizontal. An additional portion of the work area pointed to by the parameter list is used for the search next vertical entries.

On Entry	Register Contents
AH	X'44'
DS:DX	Pointer to work buffer (defined below)
BL	Drive number (0 = default, 1 = A, 2 = B, etc)
AL	X'04'

The first byte of the area addressed by the buffer contains the subfunction code. The definition of the buffer area is as follows.

WORK BUFFER

0	Subfunction Code = 01	Status Extension
2	Request Code (01/02/03)	Attributes (R)
4	File state (R)	Reserved
6	Count of Versions	(R)
8	Absolute Version Number	(R)
A	Relative Version Number	
C	Address of the Search Name	(DW)
10	Length of the Search Name	
12	Pointer to Secondary Workarea at X'1E'	(DW)
16	File Size in Bytes	(DW)
1A	File Modification Time	
1C	File Modification Date	
1E	Start of Secondary Workarea (X'22' bytes long)	

(R) = Value returned
(DW) = Double word

Figure 4-11. Work Buffer

Where:

- Subfunction Code = 01: The subfunction code for Search Versions
- Status Extension: A field to be used to return code processing which are extensions to normal extended DOS error codes.
- Request Code: Identifies the particular request code of a Search Version
 1. 01/02 - Horizontal Directory Search First/Next - Works exactly like Search First/Search Next except it will

return the latest version of a file regardless of whether or not it is active.

2. 03 - Vertical Directory Search - Given that one has performed a horizontal directory search and is positioned at a directory, then this request code may be called to get specific version information.
- Attributes - The attribute byte is both an input and output field. As input, it specifies the attribute selection mask. As output, it returns the attribute value for the specific file hit.
 - File State -
 1. 00 = Active file
 2. 01 = Inactive file
 - Count of Versions - The count of the number of versions is returned for each hit while doing a horizontal directory search.
 - Absolute Version Number - The absolute version number of the file returned. This field is updated for both horizontal and vertical directory searches.
 - Relative Version Number - The relative version number which will be used as the reference point for the next version to be returned. This value would normally be initialized to zero for the first invocation of the Search Vertical (03) request code. This field is undefined for the Search Horizontal (01/02) request codes.
 - The rest of the fields (X'C' - X'1D') are self-explanatory.
 - The secondary work area is for the use of the file system driver and should not be modified by the caller.

If an error is detected by the file system driver, the carry flag will be set on return. To determine the type of error, DOS function X'59' must be performed.

IOCTL WRITE

OPDIOCWD – X'44'

Purpose: Handles specific requests based on the subfunction code passed to the IOCTL write function. It also handles requests that modify information on the optical disk.

On Entry	Register Contents
AH	X'44'
DS:DX	Pointer to work buffer (defined below)
BL	Drive number (0 = default, 1 = A, 2 = B, etc)
AL	X'05'

The IOCTL Write function handles specific requests based upon the subfunction code which is passed to the IOCTL write function. IOCTL write handles requests which modify the optical device media.

1. **Eradicate File Version:** This function deletes the latest version or all versions of a file. If the file is Opened (any version of the file), then the request will be rejected.
2. **Media Initialization:** This initializes the media characteristics on a new optical disk.
3. **Copy Logical File:** This function does a logical copy from a source file to a target file. There is no physical data movement, but the target file receives a directory entry with the same data extents as the source file.

Eradicate File Version

This function deletes the specified version from a file. If the file is opened (any version of the file), then the request will be rejected.

WORK BUFFER

0	Subfunction = 01	Request Type Code
2	Reserved	
4	Address of the File Name	(DW)
8	Length of the File Name	

Valid request type codes are:

01 = Reserved

02 = Latest Version Request

03 = All Versions Request

Figure 4-12. Eradicate Work Buffer

Media Initialization

This function initializes the media characteristics on a new optical disk cartridge.

WORK BUFFER

0	Subfunction = 02	Reserved = 00
2	Media Initialization Time	
4	Media Initialization Date	
6	ODSSPT (=23)	Reserved
8	ODSTRK (=1)	
A	ODSCYL (=17000)	
C	ODSSSZ (=512)	
E	ODSTOTS (=393300)	
12	ODSDAU (=1)	ODSSAU (=1)
14	ODSNOH (=1)	ODSMED (=1)
16	ODSMLNG (=1)	
18	ODSDIAGL (=1)	
1A	Volume Label (11 Bytes)(Blank No Label)	

Figure 4-13. Media Initialization Work Buffer

Copy Logical File

This function does a logical copy from a source file to a target file. There is no physical data movement, but the target file receives a directory entry with the same extants as the source file.

WORK BUFFER

0	Subfunction = 03	Reserved = 00
2	Pointer to Source File ASCIIZ String	
4	Reserved	
6	Pointer to Target File ASCIIZ String	
8	Reserved	

Note: The ASCIIZ string must be null (00) terminated.

Figure 4-14. Copy Logical File Work Buffer

Optical Disk Check

Purpose: Optical disk check is used to verify that the drive is actually an optical disk before optical only operations are performed.

On Entry	Register Contents
AH	0
DL	Drive number (1 = A, 2 = B, 3 = C, etc)

On Return	Register Contents
AL	0 = Optical drive, else not optical

Remarks: The call is made like a BIOS call, but the actual operation is performed by the file system driver.

The call is made to the routine by using the pointer located at address X'(40:B0)'.

Open a File (Interrupt 21, Function Code X'3D')

When the Int 21, function = 3D is used as the interface to the optical disk drive, then the ASCII string value for the filename and extent may be extended with version information of the format:

{path} filename { .ext } { [n.] }

Note: { } denotes optional parameters

Where:

- &d** Drive letter
- path** File path
- filename** File name. No wild card specifications can be used.
- ext** Extension. No wild card specifications can be used.
- (...)** File version. If omitted, then the latest file version.
- [n]** Absolute version number (always an integer)
- [.]** Latest version (the default)

Refer to the *Disk Operating System 3.0 (or later) Technical Reference* manual for more information on Interrupt 21, function 3D.

Section 5. Commands

This section describes the IBM Personal Computer DOS commands for the IBM 3363 Optical Disk Drive. Not all commands are applicable or compatible with this device.

Note: Verify that commands used with your application programs are compatible.

Compatible DOS Commands

The following commands work with the 3363 Optical Disk.

ATTRIB	BACKUP	CHDIR
COMP	COPY	DEL
DIR	ERASE	FIND
MKDIR	PRINT	REPLACE
RESTORE	RENAME	RMDIR
SORT	TYPE	VERIFY
VOL	XCOPY	

Figure 5-1. Compatible DOS commands

New Commands

There are two new commands used with the 3363 Optical Disk Drive.

- Backup, Update, and Retrieve with Terse (BURT3363)
- Optical Disk Utilities (UTIL3363).

The BURT3363 command is used to backup, archive, and restore files. The Optical Disk Utilities provide optical disk management functions. These utilities have four options:

- The OPINIT option replaces the DOS format command.
- The PROMOTE option allows management of file versions.
- The ERADICATE option controls the physical erasure of a file.
- The VLIST option displays file version information.

Nonsupported DOS Commands

Other DOS commands are specific to other types of storage devices, such as diskette drives, and there is no equivalent function for the 3363. The following commands will not work with the optical disk drive.

ASSIGN	CHKDSK	DISKCOMP
DISKCOPY	FDISK	FORMAT
JOIN	LABEL	RECOVER
SUBST	SYS	TREE

Figure 5-2. Nonsupported DOS commands

Warning: The LABEL and JOIN commands will have very unpredictable results when executed against a 3363 drive. The command may appear to execute properly when issued, yet an error may occur after command execution. In other cases, the command may result in the drive being left in an unpredictable state. Since none of the preceding commands are supported by the 3363, care should be taken never to execute the commands against a 3363 drive.

Not Applicable DOS Commands

Some DOS commands don't interact with the optical disk. The following commands work whether or not the optical disk drive is installed.

BREAK	CLS	COMMAND
CTTY	DATE	EXE2BIN
GRAFTABL	GRAPHICS	KEYPxx
MODE	MORE	PATH
PROMPT	SELECT	SET
SHARE	TIME	VER

Figure 5-3. Not applicable DOS commands

Non – Intercepted DOS Commands

<p>X'03' – AUXILIARY INPUT X'04' – AUXILIARY OUTPUT X'05' – PRINTER OUTPUT X'18' – RESERVED BY DOS X'19' – CURRENT DISK</p> <p>X'1D' – RESERVED BY DOS X'1E' – RESERVED BY DOS</p> <p>X'1F' – RESERVED BY DOS X'20' – RESERVED BY DOS X'25' – SET INTERRUPT VECTOR</p> <p>X'26' – CREATE NEW PROGRAM SEGMENT X'29' – PARSE FILENAME X'2A' – GET DATE X'2B' – SET DATE X'2C' – GET TIME</p> <p>X'2D' – SET TIME X'2F' – GET DISK TRANSFER ADDRESS</p> <p>X'30' – GET DOS VERSION NUMBER X'32' – RESERVED BY DOS</p>	<p>X'33' – CTRL/BREAK CHECK X'34' – RESERVED BY DOS X'35' – GET VECTOR X'37' – RESERVED BY DOS X'38' – COUNTRY DEPENDENT INFO</p> <p>X'45' – DUPLICATE A FILE HANDLE X'46' – FORCE A FILE HANDLE DUPLICATE X'48' – ALLOCATE MEMORY X'49' – FREE ALLOCATED MEMORY X'4A' – MODIFY ALLOCATED MEMORY BLOCKS</p> <p>X'50' – RESERVED BY DOS</p> <p>X'51' – RESERVED BY DOS X'52' – RESERVED BY DOS X'53' – RESERVED BY DOS X'54' – GET VERIFY SETTING</p> <p>X'55' – RESERVED BY DOS X'58' – USED INTERNALLY BY DOS</p> <p>X'5C' – LOCK/UNLOCK X'60' – RESERVED BY DOS X'61' – RESERVED BY DOS X'68' – COMMIT FILE</p>
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Figure 5-4. Non – intercepted DOS commands

Intercepted DOS Commands

X'00' – PROGRAM END	X'31' – END BUT STAY RESIDENT
X'01' – CONSOLE INPUT CHAR	X'36' – ALLOCATION TABLE
X'02' – CONSOLE OUTPUT CHAR	X'39' – MKDIR
X'06' – CONSOLE CHAR IN OR OUT	X'3A' – RMDIR
X'07' – CONSOLE INPUT CHAR	X'3B' – CHDIR
X'08' – CONSOLE INPUT CHAR	X'3C' – CREATE
X'09' – CONSOLE PRINT STRING	X'3D' – OPEN (Also see 4-24)
X'0A' – BUFFERED CONSOLE INPUT	X'3E' – CLOSE
X'0B' – CONSOLE INPUT CHECK	X'3F' – READ
X'0C' – SINGLE OR MULTIPLE INPUT	X'40' – WRITE
X'0D' – DISK SYSTEM RESET	X'41' – ERASE
X'0E' – SET DEFAULT DRIVE	X'42' – 'LSEEK'
X'0F' – OPEN FCB	X'43' – CHMOD
X'10' – CLOSE FCB	X'44' – IOCTL, (Also see page 4-15)
X'11' – SEARCH FIRST (FCB)	X'47' – GET DIRECTORY STRING
X'12' – SEARCH NEXT (FCB)	X'4B' – PROGRAM LOAD
X'13' – DELETE FCB	X'4C' – PROGRAM END
X'14' – SEQUENTIAL READ	X'4D' – GET PROCESS RETURN CODE
X'15' – SEQUENTIAL WRITE	X'4E' – SEARCH FIRST
X'16' – FILE CREATE (FCB)	X'4F' – SEARCH NEXT
X'17' – RENAME (FCB)	X'56' – RENAME
X'1A' – SET DTA	X'57' – GET/SET FILE TIME/DATE
X'1B' – ALLOCATION TABLE	X'59' – GET EXTENDED ERROR
X'1C' – ALLOCATION TABLE	X'5A' – CREATE TEMPORARY
X'21' – RANDOM READ	X'5B' – NONDESTRUCTIVE CREATE
X'22' – RANDOM WRITE	X'5D' – NETWORK SERVER
X'23' – FILE SIZE	X'5E' – NETWORK CONTROL
X'24' – SET RANDOM RECORD	X'5F' – NETWORK REDIRECTION
X'27' – RANDOM BLOCK READ	X'62' – GET PSP
X'28' – RANDOM BLOCK WRITE	
X'2E' – SET VERIFY SWITCH	

Figure 5-5. Intercepted DOS commands

BIOS Programming Conventions

The BIOS is accessed with a far "call" indirect instruction to X'04B0' (40:B0). An identifier verifies the optical disk BIOS is present and not some other adapter or code. The characters **OPTIC ,0** followed by a blank are located three bytes beyond the entry point of the BIOS. When the File System Driver is installed, then the characters **File System Driver, 0** are located three bytes beyond the entry point of the BIOS.

All commands other than Seek, Adapter Reset, and Selective Drive Reset are completed before BIOS returns to the caller. If an error is detected, BIOS returns the status information and adapter sense information in the registers. Refer to the following diagram for individual commands.

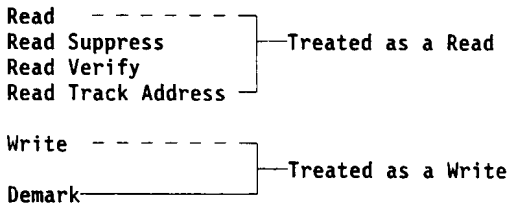


Figure 5-6. Combining Commands.

The adapter card supports the overlap of a Seek command and other processing. The user should not issue a Seek command to a drive until the previous Seek command is completed. If a Seek is issued to a drive that is executing a Seek command, the command is ignored and an invalid command error is generated by the adapter card. The user should issue a Read Sense command to the drive to confirm it is ready to accept commands prior to issuing the Seek command, or implement a control mechanism to insure that a second Seek is not issued to a drive that is executing a previous Seek command.

Command Issued	If the adapter card is busy, the status byte response is:	If the drive is busy, the sense byte response is:
* Read	Bit 0 = 1	Bit 0 = 0
* Write	Bit 0 = 1	Bit 0 = 0
Read Status	⁽¹⁾ Status Byte	⁽¹⁾ Status Byte
Reset	⁽²⁾ None	⁽²⁾ None
* Selective Drive Reset	Bit 0 = 1	⁽³⁾ None
* Seek	Bit 0 = 1	Bit 0 = 0
* Read Sense	Bit 0 = 1	⁽⁴⁾ None
* Execute Diagnostics	special case. Bit 0 = 1	special case

Figure 5-7. Sense/Status Responses

* = BIOS always reads status and tests for not busy (bit 0 = 0) before issuing those commands that are marked with an asterisk (*).

⁽¹⁾ = Bits 1 and 5 are not valid unless interrupt pending Bit 7 = 1.

⁽²⁾ = The adapter card and drive will not be busy to this command.

⁽³⁾ = The selected drive will not be busy to this command.

⁽⁴⁾ = The drive sense will include all other current states.

Command Registers

Commands are passed in the following registers:

AH command code

AL block count (block count = number of sectors specified by a command)

CX track address

DH sector address

DL drive address

ES:BX pointer to Read/Write data area.

If Read/Write data is transferred, it is located at the address that was loaded into ES:BX. The carry flag is set with any return code except 0. The read/write data area may not cross a 64K byte boundary on IBM Personal Computers using DMA protocol.

BIOS Interface

The BIOS Interface commands are listed in numeric (hexadecimal) order as follows and described in subsequent text.

- (AH) X'20' — Selective Drive Reset
- (AH) X'21' — Read Sense
- (AH) X'22' — Read Attribute Data
- (AH) X'23' — Read Verify Normal ECC Correction
- (AH) X'24' — Sector Recovery (Backup 1 Sector)
- (AH) X'25' — Sector Recovery (Backup 2 Sectors)
- (AH) X'26' — No Retry
- (AH) X'27' — No Retry with Sector Recovery (Backup 1 Sector)
- (AH) X'28' — No Retry with Sector Recovery (Backup 2 Sectors)
- (AH) X'29' — Read Normal
- (AH) X'2A' — Sector Recovery (Backup 1 Sector)
- (AH) X'2B' — Sector Recovery (Backup 2 Sectors)
- (AH) X'2C' — No ECC Correction
- (AH) X'2D' — No ECC Correction with Sector Recovery (Backup 1 Sector)
- (AH) X'2E' — No ECC Correction with Sector Recovery (Backup 2 Sectors)
- (AH) X'2F' — No Retry
- (AH) X'30' — No Retry with Sector Recovery (Backup 1 Sector)
- (AH) X'31' — No Retry with Sector Recovery (Backup 2 Sectors)
- (AH) X'32' — Write Normal
- (AH) X'33' — Seek Normal
- (AH) X'34' — Test
- (AH) X'35' — Run Diagnostics
- (AH) X'36' — Read Suppress Normal
- (AH) X'37' — Sector Recovery (Backup 1 Sector)
- (AH) X'38' — Sector Recovery (Backup 2 Sectors)
- (AH) X'39' — Normal (No Error Recovery or Retry)
- (AH) X'3A' — Demark Recovery
- (AH) X'3B' — Sector Recovery (Backup 1 Sector)
- (AH) X'3D' — Sector Recovery (Backup 2 Sectors)

- (AH) X'3E' — Demark Recovery with Sector Recovery (Backup 2 Sectors)
- (AH) X'3F' — Read Track Address
- (AH) X'40' — Adapter Reset
- (AH) X'41' — Read Adapter Status
- (AH) X'42' — Read Scan Command
- (AH) X'43' — Sector Recovery (Backup 1 Sector)
- (AH) X'44' — Sector Recovery (Backup 2 Sectors).

Return Codes

The following is a list of return codes and their indications. They indicate a probable hardware or software error.

Return Code	Indication
X'00'	Successful
X'01'	Invalid command (detected by BIOS)
X'02'	Invalid drive address (detected by BIOS)
X'03'	Invalid track address (detected by BIOS). Track address was greater than 17099; valid range is 0 to 17099.
X'04'	Invalid sector address (valid range is 0 to 22)
X'05'	Invalid block count (exceeded block count limits; see specific command where error occurred)
X'07'	Adapter busy (command not issued)
X'08'	Interrupt timeout (adapter did not respond within specified time)
X'09'	DMA boundary (attempt to cross 64K boundary limit)
X'0A'	Sense failed (sense issued but no sense returned)
X'0B'	Command failed (command issued but failed; Sense issued by BIOS)
X'0C'	Maximum track overflow (command issued requested more sectors than were available to end of disk)

Figure 5-8. Return Code List

Note: For all return codes, except X'00', an error was detected, nothing was sent to the device, and the return code was presented by BIOS.

Drive Commands

(AH) X'20' — Selective Drive Reset

Purpose: Selective Drive Reset repeats the drive initialization process. The selected drive and microprocessor are reset and restarted at the initial power on entry point.

On Entry	Register Contents
AH	Command Code
DL	Drive Address 0 through 7 (value verified)

On Return	Register Contents
AH	Return code: 0 = successful operation. If unsuccessful, carry flag is set. If AH = X'0B' (command failed), then a sense command was issued by BIOS. Six bytes of sense data will be returned in BX, CX, and DX: BH = byte 0; BL = byte 1 CH = byte 2; CL = byte 3 DH = byte 4; DL = byte 5 If AH = X'0A' the sense issued by BIOS failed and the sense data returned is invalid.
AL	Adapter status

Remarks: Control is returned immediately after execution of the command. A Selective Drive Reset takes approximately six seconds to complete. During this time, a command may be issued to another drive; the caller can do other work, wait, or perform a sense loop looking for a drive ready to receive commands.

(AH) X'21' — Read Sense

Purpose: Transfers adapter and drive sense bytes to the system unit.

On Entry	Register Contents
AH	Command Code
DL	Drive Address 0 through 7 (value verified)

On Return	Register Contents
AH	<p>Return code: 0 = successful operation. If unsuccessful, carry flag is set. If AH = X'0B' (command failed), then a sense command was issued by BIOS. Six bytes of sense data will be returned in BX, CX, and DX:</p> <p>BH = byte 0; BL = byte 1 CH = byte 2; CL = byte 3 DH = byte 4; DL = byte 5</p> <p>If AH = X'0A' the sense issued by BIOS failed and the sense data returned is invalid.</p>
AL	Adapter status

(AH) X'22' — Read Attribute Data

Purpose: Transfers adapter and drive attribute data to the system unit. *Note: Read attribute is a form of Read Sense.*

On Entry	Register Contents
AH	Command Code
DL	Drive Address 0 through 7 (value verified)

On Return	Register Contents
AH	<p>Return code: 0 = successful operation. If unsuccessful, carry flag is set. If AH = X'0A' the command failed. The sense command is not reissued. Four bytes returned in BX and CX.</p> <p>BH = byte 0; BL = byte 1 CH = byte 2; CL = byte 3</p> <p>If AH = X'0A' the sense issued by BIOS failed and the sense data returned is invalid.</p>
AL	Adapter status

Read Verify Commands

(AH) X'23' — Normal ECC Correction

Purpose: Verifies written data.

On Entry	Register Contents
AH	Command Code
DL	Drive Address 0 through 7 (value verified)
DH	Sector Address 0 – 22 (value verified)
CX	Track Address 0 – 17099 (value verified)
AL	Block Count 1 – 128 (value verified)

On Return	Register Contents
AH	<p>Return code: 0 = successful operation. If unsuccessful, carry flag is set. If AH = X'0B' (command failed), then a sense command was issued by BIOS. Six bytes of sense data will be returned in BX, CX, and DX:</p> <p style="padding-left: 40px;">BH = byte 0; BL = byte 1 CH = byte 2; CL = byte 3 DH = byte 4; DL = byte 5</p> <p>If AH = X'0A' the sense issued by BIOS failed and the sense data returned is invalid.</p>
AL	Adapter status

Remarks: Read Verify transfers the contents of the specified sector(s) to the drive buffer performing error checking. The Read is performed at a lower clipping level and with a more strict ECC error criteria. No data is transferred to the processor.

When an ECC error occurs, one retry is attempted by the adapter rereading the data from the optical disk.

Maximum block count is 128.

(AH) X'24' — Sector Recovery (Backup 1 Sector)

Remarks: Normal ECC correction: When an ECC error occurs, one retry is attempted by the adapter rereading the data from the optical disk.

This command is used when a sector not found error is detected. It allows the drive to read the previous sector ID and then time through to the desired sector.

A Seek is issued to the target track minus 1 and orientation is to the target sector minus 1. The target sector minus 1 data field is timed through, and the target sector is read.

The block count must be set to 1.

(AH) X'25' — Sector Recovery (Backup 2 Sectors)

Remarks: Normal ECC correction: When an ECC error occurs, one retry is attempted by the adapter rereading the data from the optical disk.

This command is used when sector not found on the previous sector X'25' close occurs.

All orientation is to the target sector minus 2. The data field of the target sector, minus 2, is timed through. The target sector minus 1 sector mark field and data field are timed through. The sector mark field of the target sector is timed through to arrive at the target sector data field.

The block count must be set to 1.

(AH) X'26' — No Retry

Remarks: Normal ECC correction: No retry is attempted when an ECC error occurs.

Orientation to a particular sector is done using the track and sector information from the sector ID field of the target sector.

Maximum block count is 128.

(AH) X'27' — No Retry with Sector Recovery (Backup 1 Sector)

Remarks: Normal ECC correction: No retry is attempted when an ECC error occurs.

A Seek is issued to the target track minus 1, and orientation is to the target sector minus 1. The target sector minus 1 data field is timed through. The sector mark field of the target sector is timed through, and the target sector is read.

The block count must be set to 1.

(AH) X'28' — No Retry with Sector Recovery (Backup 2 Sectors)

Remarks: Normal ECC correction: No retry is attempted when an ECC error occurs.

All orientation is to the target sector minus 2. The data field of the target sector minus 2 is timed through. The target sector minus 1 sector mark field and data field are timed through. The sector mark field of the target sector is timed through to arrive at the target sector data field.

The block count must be set to 1.

Read Commands

(AH) X'29' — Normal

Purpose: Transfer the contents of a specified sector(s) to system unit storage.

On Entry	Register Contents
AH	Command Code
DL	Drive Address 0 through 7 (value verified)
DH	Sector Address 0 – 22 (value verified)
CX	Track Address 0 – 17099 (value verified)
AL	Block Count 1 – 128 (value verified)
ES:BX	Pointer to user Read/Write data area

On Return	Register Contents
AH	Return code: 0 = successful operation. If unsuccessful, carry flag is set. If AH = X'0B' (command failed), then a sense command was issued by BIOS. Six bytes of sense data will be returned in BX, CX, and DX: BH = byte 0; BL = byte 1 CH = byte 2; CL = byte 3 DH = byte 4; DL = byte 5 If AH = X'0A' the sense issued by BIOS failed and the sense data returned is invalid.
AL	Adapter status

Remarks: Normal ECC correction: one retry is attempted when an ECC error occurs by rereading the data from the optical disk.

Orientation to a particular sector is done using the track and sector information from the sector ID field on the target sector.

Maximum block count is 128.

(AH) X'2A' — Sector Recovery (Backup 1 Sector)

Remarks: Normal ECC correction: one retry is attempted when an ECC error occurs by rereading the data from the optical disk.

A Seek is issued to the target track minus 1 and orientation is to the target sector minus 1. The target sector minus 1 data field is timed through. The sector mark field of the target sector is timed through, and the target sector is read.

The block count must be set to 1.

(AH) X'2B' — Sector Recovery (Backup 2 Sectors)

Remarks: Normal ECC correction: When an ECC error occurs, one retry is attempted by rereading the data from the optical disk.

All orientation is to the target sector minus 2. The data field of the target sector minus 2 is timed through. The target sector minus 1 sector mark field and data field is timed through. The sector mark field of the target sector is timed through to arrive at the target sector data field.

The block count must be set to 1.

(AH) X'2C' — No ECC Correction

Remarks: No ECC correction: This command is preset for test of the device and is not normally used.

Orientation to a particular sector is done using the track and sector information from the sector ID field of the target sector.

Maximum block count is 128.

(AH) X'2D' — No ECC Correction With Sector Recovery (Backup 1 Sector)

Remarks: No ECC correction: This command is preset for test of the device and is not normally used.

A Seek is issued to the target track minus 1 and orientation is to the target sector minus 1. The target sector minus 1 data field is timed through. The sector mark field of the target sector is timed through, and the target sector is read.

The block count must be set to 1.

(AH) X'2E' — No ECC Correction with Sector Recovery (Backup 2 Sectors)

Remarks: No ECC correction: This command is preset for test of the device and is not normally used.

All orientation is to the target sector minus 2. The data field of the target sector minus 2 is timed through. The target sector minus 1 sector mark field and data field are timed through. The sector mark field of the target sector is timed through to arrive at the target sector data field.

The block count must be set to 1.

(AH) X'2F' — No Retry

Remarks: Normal ECC correction: No retry is attempted when an ECC error occurs.

Orientation to a particular sector is done using the track and sector information from the sector ID field of the target sector.

Maximum block count is 128.

(AH) X'30' — No Retry with Sector Recovery (Backup 1 Sector)

Remarks: Normal ECC correction: No retry is attempted when an ECC error occurs.

A Seek is issued to the target track minus 1 and orientation is to the target sector minus 1. The target sector minus 1 data field is timed through. The sector mark field of the target sector is timed through and the target sector is read.

The block count must be set to 1.

(AH) X'31' — No Retry with Sector Recovery (Backup 2 Sectors)

Remarks: Normal ECC correction: No retry is attempted when an ECC error occurs.

All orientation is to the target sector minus 2. The data field of the target sector minus 2 is timed through. The target sector minus 1 sector mark field is timed through. The sector mark field of the target sector is timed through to arrive at the target sector data field.

The block count must be set to 1.

Write Command

(AH) X'32' — Normal

Purpose: Transfers contents of system unit storage to the specified sector(s) of the optical disk.

On Entry	Register Contents
AH	Command Code
DL	Drive Address 0 through 7 (value verified)
DH	Sector address 0 – 22 (value verified)
CX	Track address 0 – 17099 (value verified)
AL	Block count 1 – 128 (value verified)
ES:BX	Pointer to user Read/Write data area

On Return	Register Contents
AH	Return code: 0 = successful operation. If unsuccessful, carry flag is set. If AH = X'0B' (command failed), then a sense command was issued by BIOS. Six bytes of sense data will be returned in BX, CX, and DX: BH = byte 0; BL = byte 1 CH = byte 2; CL = byte 3 DH = byte 4; DL = byte 5 If AH = X'0A' the sense issued by BIOS failed and the sense data returned is invalid.
AL	Adapter status

Remarks: 512 byte blocks of data are transferred to the specified sector(s).

Maximum block count is 128.

Seek Commands

(AH) X'33' — Normal

Purpose: Move actuator to specified track.

On Entry	Register Contents
AH	Command Code
DL	Drive Address 0 through 7 (value verified)
CX	Track address 0 – 17099 (value verified)

On Return	Register Contents
AH	<p>Return code: 0 = successful operation. If unsuccessful, carry flag is set. If AH = X'0B' (command failed), then a sense command was issued by BIOS. Six bytes of sense data will be returned in BX, CX, and DX:</p> <p>BH = byte 0; BL = byte 1 CH = byte 2; CL = byte 3 DH = byte 4; DL = byte 5</p> <p>If AH = X'0A' the sense issued by BIOS failed and the sense data returned is invalid.</p>
AL	Adapter status

Remarks: The adapter card supports the overlap between drives of a Seek command. Do not issue a Seek command to a drive until the previous Seek command has been completed. If a Seek is issued to a drive that is executing a Seek command, the command is ignored and an invalid command error is issued by the adapter card. Issue a Read Sense command to the drive to confirm it is ready to accept commands before issuing the Seek command, or implement a control mechanism to ensure a second Seek is not executing. This command is performed the normal 10 times by the adapter card and drive.

Note: Both Read and Write commands include an implied Seek; specific issuance of a Seek command is normally not done.

(AH) X'34' — Test

Remarks: Test Seek. This command is performed one time by the adapter card and drive.

Diagnostic Command

(AH) X'35' — Run Diagnostic Command

Purpose: Execute adapter card and drive Diagnostic command. *Note: This command is used during the POST (Power On Self Test) and is not normally needed by a user.*

On Entry	Register Contents
AH	Command Code
DL	Drive Address 0 through 7 (value verified)

On Return	Register Contents
AH	Return code: 0 = successful operation. If unsuccessful, carry flag is set. If AH = X'0B' (command failed), then a sense command was issued by BIOS. Six bytes of sense data will be returned in BX, CX, and DX: BH = byte 0; BL = byte 1 CH = byte 2; CL = byte 3 DH = byte 4; DL = byte 5 If AH = X'0A' the sense issued by BIOS failed and the sense data returned is invalid.
AL	Adapter status

Remarks: Executing the Run Diagnostic command causes the adapter card diagnostics to run, then the specified drive diagnostic to run, if the specified drive is ready and an optical cartridge is loaded. No data is written to the optical cartridge during the execution of this command.

Read Suppress Commands

(AH) X'36' — Normal

Purpose: Transfer the contents of the specified sector(s) to system unit storage without regard to errors and include ECC data.

On Entry	Register Contents
AH	Command Code
DL	Drive Address 0 through 7 (value verified)
DH	Sector Address 0 – 22 (value verified)
CX	Track Address 0 – 17099 (value verified)
AL	Block Count 1 – 128 (value verified)
ES:BX	Pointer to user Read/Write data area.

On Return	Register Contents
AH	Return code: 0 = successful operation. If unsuccessful, carry flag is set. If AH = X'0B' (command failed), then a sense command was issued by BIOS. Six bytes of sense data will be returned in BX, CX, and DX: BH = byte 0; BL = byte 1 CH = byte 2; CL = byte 3 DH = byte 4; DL = byte 5 If AH = X'0A' the sense issued by BIOS failed and the sense data returned is invalid.
AL	Adapter status

Remarks: Transfers 795 bytes of data including ECC data to the processor.

Orientation to a particular sector is done using the track and sector information from the sector ID field of the target sector.

Maximum block count is 82.

(AH) X'37' — Sector Recovery (Backup 1 Sector)

Remarks: Transfers 795 bytes of data including the ECC check code to the processor.

A Seek is issued to the target track minus 1, and orientation is to the target sector minus 1. The target sector minus 1 data field is timed through. The sector mark field of the target sector is timed through, and the target sector is read.

The block count must be set to 1.

(AH) X'38' — Sector Recovery (Backup 2 Sectors)

Remarks: Transfers 795 bytes of data including the ECC check code to the processor.

All orientation is to the target sector minus 2. The data field of the target sector minus 2 is timed through. The target sector minus 1 sector mark field and data field are timed through. The sector mark field of the target sector is timed through to arrive at the target sector data field.

The block count must be set to 1.

Demark Commands

Commands are provided to perform demark, demark recovery and sector recovery. Any Read command that detects any two of the four or eight demark pulse trains will signal a demarked record.

(AH) X'39' — Normal

Purpose: Demarks the specified sector(s).

On Entry	Register Contents
AH	Command Code
DL	Drive Address 0 through 7 (value verified)
DH	Sector Address 0 – 22 (value verified)
CX	Track Address 0 – 17099 (value verified)
AL	Block Count 1 – 128 (value verified)

On Return	Register Contents
AH	Return code: 0 = successful operation. If unsuccessful, carry flag is set. If AH = X'0B' (command failed), then a sense command was issued by BIOS. Six bytes of sense data will be returned in BX, CX, and DX: BH = byte 0; BL = byte 1 CH = byte 2; CL = byte 3 DH = byte 4; DL = byte 5 If AH = X'0A' the sense issued by BIOS failed and the sense data returned is invalid.
AL	Adapter status

Remarks: A sector will be demarked by recording pulse trains over the data field of a sector.

Orientation to a particular sector is done with track and sector information from the sector ID field of the target sector.

Maximum block count is 128.

(AH) X'3A' — Demark Recovery

Remarks: If a Demark is unsuccessful (detected by reading, or read verifying, the target sector and confirming a demark is present), a retry is provided by the Demark Recovery command. This command writes an additional demark pattern on the sector ID field. Eight demark pulse trains are recorded on the optical disk.

Maximum block count is 128.

(AH) X'3B' — Sector Recovery (Backup 1 Sector)

Remarks: Transfers 795 bytes of data including the ECC check code to the processor.

A Seek is issued to the target track minus 1 with retrace off, and orientation is to the target sector minus 1. The target sector minus 1 data field is timed through. The sector mark field of the target sector is timed through, and the target sector is demarked.

The block count must be set to 1.

Remarks: If a Demark is unsuccessful (detected by reading a demark in the target sector), a retry is provided by the demark recovery command. This command writes additional demark patterns.

A Seek is issued to the target track minus 1 with retrace off. Orientation is to the target sector minus 1. The target sector minus 1 data field is timed through. The sector mark field of the target sector is timed through, and the target sector is demarked.

The block count must be set to 1.

(AH) X'3D' — Sector Recovery (Backup 2 Sectors)

Remarks: All orientation is to the target sector minus 2. The data field of the target sector minus 2 is timed through. The target sector minus 1 sector mark field and data field are timed through. The sector mark field of the target sector is timed through to arrive at the target sector data field.

The block count must be set to 1.

(AH) X'3E' — Demark Recovery with Sector Recovery (Backup 2 Sectors)

Remarks: If a Demark is unsuccessful (detected by reading a demark in the target sector), a retry is provided by the demark recovery command. This command writes additional demark patterns.

All orientation is to the target sector minus 2. The data field of the target sector minus 2 is timed through. The target sector minus 1 sector mark field and data field are timed through. The sector mark field of the target sector is timed through to arrive at the target sector data field.

The block count must be set to 1.

Miscellaneous Commands

(AH) X'3F' — Read Track Address

Purpose: Transfers the track address of the track where the actuator is currently positioned.

On Entry	Register Contents
AH	Command Code
DL	Drive Address 0 through 7 (value verified)

On Return	Register Contents
AH	Return code: 0 = successful operation. If unsuccessful, carry flag is set. If AH = X'0B' (command failed), then a sense command was issued by BIOS. Six bytes of sense data will be returned in BX, CX, and DX: BH = byte 0; BL = byte 1 CH = byte 2; CL = byte 3 DH = byte 4; DL = byte 5 If AH = X'0A' the sense issued by BIOS failed and the sense data returned is invalid.
AL	Adapter status
CX	Track address

Remarks: Two bytes of track address are returned to the caller in CX.

(AH) X'40' — Adapter Reset

Purpose: Resets the optical disk adapter card electronics and microcode. Also sets the operating values to the default state. A Selective Drive Reset is issued to each of the attached optical disk drives.

On Entry	Register Contents
AH	Command Code
DL	Drive Address 0 through 7 (value verified)

Remarks: Control is returned immediately after the command executes. An Adapter Reset takes approximately 12 seconds. During this time, the caller can do other work, wait, or perform a sense loop looking for a drive ready to receive commands. Registers are undefined.

(AH) X'41' — Read Adapter Status

Purpose: Transfers the adapter status byte from the optical disk adapter to the processor.

On Entry	Register Contents
AH	Command Code
DL	Drive Address 0 through 7 (value verified)

On Return	Register Contents
AH	Return code: 0 = successful operation.
AL	Adapter status

(AH) X'42' — Read Scan

Purpose: Scans the optical disk to locate the next available sector that can be used. No data transferred to or from the system unit.

On Entry	Register Contents
AH	Command Code
DL	Drive Address 0 through 7 (value verified)
DH	Sector address 0 – 22 (value verified)
CX	Track address 0 – 17099 (value verified)
AL	Block count 1 – 128 (value verified)

On Return	Register Contents										
AH	<p>Return code: 0 = unsuccessful operation. No unwritten or non-demarcated sector was found.</p> <p>Return code: Not 0 = successful operation if AH = X'0B' then an available sector was located if sense byte 1, bit 5 is set to 1. A count is returned in the sense byte that gives the number of sectors to the available sector, relative to the starting sector.</p> <p>Return code: Not 0 = unsuccessful operation if AH is not = X'0B' then normal error recovery procedures apply (invalid track). For example:</p> <p>if sector 0 = data, sector 1 = demarcated, sector 2 = data, and sector 3 = available; then the readscan starting sector count returned in CL after a read scan is:</p> <table style="margin-left: 40px;"> <tr> <td>Start Read Scan at</td> <td>Start Sector Count is</td> </tr> <tr> <td>0</td> <td>3</td> </tr> <tr> <td>1</td> <td>2</td> </tr> <tr> <td>2</td> <td>1</td> </tr> <tr> <td>3</td> <td>0</td> </tr> </table>	Start Read Scan at	Start Sector Count is	0	3	1	2	2	1	3	0
Start Read Scan at	Start Sector Count is										
0	3										
1	2										
2	1										
3	0										
AL	Adapter status										

Remarks: This command is used to find 'sector-not-found' or 'data-not-recorded' errors in the specified sectors; these are null sectors.

(AH) X'43' — Sector Recovery (Backup 1 Sector)

Purpose: A Seek is issued to the target track minus 1 and orientation is to the target sector minus 1. The target sector minus 1 data field is timed through, the target sector mark field is timed through, and the target sector is read and the TTS contained in the data field is verified. The block count must be set to 1.

(AH) X'44' — Sector Recovery (Backup 2 Sectors)

Purpose: A Seek is issued to the target track minus 2 and orientation is to the target sector minus 2. The target sector minus 2 data field, the target sector minus 1 mark field, and the target sector minus 1 data field are timed through to arrive at the target sector data field. The block count must be set to 1.

Section 6. Status and Sense

This section describes the status and sense bytes.

Status Register (Status Byte)

At the end of all commands from the system unit, the adapter card returns a completion status byte to the system unit (with or without an error). Normally, when a Read Adapter Status command is issued, all zeros are returned. These lines are reset by the BIOS at the completion of a DMA or non-DMA command as part of the clean up process.

The least significant bit is 0.

The following shows the format for the Status Byte.

Bit	7	6	5	4	3	2	1	0
Byte	p	i	d	m	0	0	e	b

Bit 0 If the adapter card is busy, this bit is set to 1 and the adapter card will not accept commands.

Bit 1 When set to 1, this bit indicates an error occurred for all commands except Read Verify and Execute Diagnostics.

If any of the following adapter card sense bits are set to a 1, this bit will be set to a 1.

Byte 0	Bits 0, 1, 2, 3, 4, 5, 6, 7
Byte 1	Bits 4, 5, 6

For a Read Verify command, the following adapter card sense bits set this bit to 1.

Byte 0	Bits 0, 1, 3, 4, 5, 6, 7
Byte 1	Bits 3, 4, 5, 6

For the Execute Diagnostics command, the following adapter card sense bits set this bit to 1.

Byte 0	Bits 0, 1
Byte 1	Bits 0, 1, 2, 3, 4, 5

For the Read Scan command, the following adapter card sense bits set this bit to 1.

Byte 0	Bits 0, 1, 2, 4, 5
Byte 1	Bits 5, 6

Bits 2 and 3 These bits are set to 0.

Bit 4 This bit indicates that DMA transfers have been enabled by a Write to the Interrupt and DMA Enable register at I/O address X'xx5B'.

Bit 5 Specifies drive 0 or drive 1.

Bit 6 This bit indicates that interrupts have been enabled by a Write to the Interrupt and DMA Enable register at I/O address X'xx5B'.

Bit 7 This is the Interrupt Pending bit. It is set on command completion with or without an error. If Interrupts are enabled, the Interrupt Request 5 line goes high. This bit is cleared by an I/O Status Read at address X'xx58'.

Note: Addresses supported by the hardware denoted as xx are 02, 06, 0A, and 0E.

Adapter Card Sense

These bits are reset on the next I/O device command transfer. The following table shows the IBM 3363 Optical Disk Drive adapter card sense bytes. Zero (0) is the least significant bit.

Bit	Byte 0	Byte 1	Byte 2	Byte 3
0	Drive Error	Adapter Card RAM/ROM Error	s	S0
1	Drive Not Responding	Demark Function Error	u	S1
2	Seek Error	ECC Error – E1	t	S2
3	ID Mismatch	ECC Error – E2	q	S3
4	Sector Not Found	ECC Error – E3	p	S4
5	Data Area Not Recorded	Invalid Command	v	S5
6	Data Area Not Readable	Illegal Disk Address	a	S6
7	Demarked Sector	Reserved	r	0

Note: The drive electronics sense bytes that are transferred to the adapter card are shown at “Drive Electronics Sense” on page 6-11

The byte 3 bits are defined as follows.

Bit	Definition
a	Retry option on data error
p	Recovery modifier
q	Sector recovery
r	Seek test
s	Reserved
t	Sense attributes
u	Demark recovery
v	No ECC correction

Byte 3 contains the contents of the control field in the DCB of the last command sent to the drive.

Byte 4, bits S0 (LSB) through S6 (MSB) contains the number of sectors successfully processed prior to an error during execution of a Read, Read-Verify, Read-Suppress, Read-Scan, Demark or Write command.

Note: A maximum of 128 sectors for 512 byte sectors, and a maximum of 82 for 795 byte sectors.

S7 is always set to 0.

The ECC Error bits E1 through E3 for the Read command and the Execute Diagnostics command are defined in the following table.

E3	E2	E1	Read Command	Execute Diagnostics
0	0	0	No Error	No Error
0	0	1	Single Error	Data Buffer Error
0	1	0	Double Error	Error Detection and Correction Error
0	1	1	Triple Error	Scramble Buffer Error
1	0	0	Uncorrectable Error	Mod/Demod Error
1	0	1	Not valid	Sector Read/Write Control Error

When decoding the code words in a sector; single, double, or triple errors indicate the maximum number of symbols found in error in a single code word. One or two errors are always controllable, three are not. On a Read-Verify command, more than a single error in a code word turns on the error bit (bit 1) in the status byte. This is to allow for media degradation at end of life and still be readable.

Adapter Card Sense Bit Definitions

For additional recovery actions refer to Section 7. Error Recovery Procedures.

Adapter Card RAM/ROM Error: The adapter card has detected a data error during the RAM diagnostic test or a program Checksum error during the ROM diagnostic test.

Suggested recovery action: None; this information is used by the diagnostics to help identify failing components.

Data Area Not Readable: Data is present in the sector but is not readable after the adapter card has attempted the Read on two revolutions of the disk. This is most likely due to writing the same sector more than once.

Suggested recovery action: Retry the command once.

Data Area Not Recorded: A Read command is issued to a sector that has not been previously written. The adapter card has attempted to perform the Read on two revolutions of the disk.

Suggested recovery action: This is a normal response if the Read is issued to determine the next available sector. Do not attempt a retry.

Demark Function Error: An error is detected during the execution of the Demark Function Test diagnostic.

Suggested recovery action: None; this information is used by the diagnostics to help identify failing components.

Demarked Sector: A Read has been attempted on a demarked sector by Read, Read-Verify, or Read-Suppress commands.

Suggested recovery action: None.

Drive Error: The drive has detected an error during a command operation other than a diagnostic operation. This bit is also set if the processor issues a Write or Demark to a write protected disk. The following drive sense bits set this bit.

Byte 0	Bits 2, 3
Byte 1	Bits 0, 1, 2, 3, 4, 5, 7

Suggested recovery action: Refer to "Drive Electronics Sense Bit Definitions" on page 6-12.

For a diagnostic command: If the following drive sense bits are set to 1, this bit will be set to 1.

Byte 0	Bit 1
Byte 1	Bits 0, 1, 2, 3, 4, 5

Suggested recovery action: Refer to "Drive Electronics Sense Bit Definitions" on page 6-12.

Drive Not Responding: The adapter card attempts to send a command to the drive over the serial interface and the drive does not return the two bytes of status, indicating the drive does not recognize its address and the command.

Suggested recovery action: Reset drive and retry operation once. If error still exists, signal I/O error.

ECC Error E1, E2, E3: The adapter card detects an ECC error or diagnostic error. On a Read, E1, E2, and E3 indicate no error, single error, double error, triple error, or uncorrectable error conditions. If the adapter card encounters an ECC uncorrectable error during a Read command, the adapter card

transfers the contents of the data buffer to system unit storage with as much of the data corrected as possible.

Suggested recovery action: Refer to "ECC Errors" on page 7-8.

For an Execute Diagnostics command, E1, E2, and E3 indicate no error, data buffer error, error detection and correction error, scramble buffer error, sector read/write control error, or mod/demod error conditions in the adapter card hardware.

Suggested recovery action: None; this information is used by diagnostics to identify failing components.

ID Mismatch: There is a mismatch between the track and sector number in the Sector ID Field and the track and sector number in the data field. This is most likely caused by writing the sector multiple times.

Suggested recovery action: Retry the command once.

Illegal Disk Address: The adapter card detects a track or sector address, from the system unit, that is beyond the maximum range in the device control block (DCB). This includes the effect of the block count field. *Note: Block count = the number of sectors specified by a command.*

00000 to 17099 for the track address
00 to 22 for the sector address

Suggested recovery action: Retry the command once.

Invalid Command: The adapter card receives an invalid command from the system unit.

Suggested recovery action: Retry the command once.

S0 – S6: These bits contain the number of sectors processed prior to the error (status byte 1 = 1) during the execution of a Read, Demark, Read – Verify, or Write command.

Note: 128 maximum for 512 byte sectors, 82 for 795 byte sectors for the PC.

Sector Not Found: The Sector 0 index mark has been passed twice without finding the target sector ID.

Suggested recovery action: See “Sector Not Found Errors” on page 7-2.

Seek Error: A 1.5 second Seek timeout more than 10 Seek retries have occurred without finding the target sector.

Suggested recovery action: Retry the command once.

Adapter Card and Drive Attributes

The following data is transferred to the processor from the controller when the Sense command is issued to the controller with the attribute bit on in the control byte. The controller sends four bytes of data. The first two bytes are controller attributes and the second two are drive attributes. Refer to "Drive Electronics Sense" on page 6-11 for bytes 3 and 4. The following table shows the 3363 adapter card attributes. D0 is the least significant bit.

Bit	Byte 1	Byte 2
D0	W-O Controller	CEC1 Engineering Change
D1	0 Reserved	CEC2 Engineering Change
D2	0 Reserved	CEC3 Engineering Change
D3	0 Reserved	CEC4 Engineering Change
D4	130 MM Controller	0 Reserved
D5	0 Reserved	0 Reserved
D6	0 Reserved	0 Reserved
D7	0 Reserved	0 Reserved

Adapter Card and Drive Attribute Definitions

W-O Controller: This bit is set to zero.

130 MM Controller: This bit is set to zero.

CEC1 -- CEC4: Contains the least significant digit of the EC level of the controller microcode. The range is 0 through F.

Drive Electronics Sense

These bits are reset on completion of a sense status command to the drive electronics. The following table shows the 3363 drive electronics sense bytes. D0 is the least significant bit.

Bit	Byte 1	Byte 2
D0	Ready to Accept Commands	Invalid Command
D1	Seek Complete or RAM/ROM Error	Track Jumped
D2	Disk Description DD1	Write Fault
D3	Disk Description DD2	Focus Not OK
D4	Reserved	Laser Out
D5	Drive DR0	Motor Sync Error
D6	Reserved for DR1	Write Protect
D7	Reserved for DR2	Disk Changed

Note: The Drive DR1 bit defines the drive responding to a command.

The Disk Description DD1 and DD2 bits are defined as follows.

DD2	DD1	Disk Type
0	0	Normal
1	1	No Disk

Drive Electronics Sense Bit Definitions

For additional recovery actions see Section 7. Error Recovery Procedures.

Disk Changed: A different disk or the same disk has been put into the drive. This bit is set to 0 by Power On Reset, Reset, or Selective Drive Reset.

Suggested recovery action: None; notify the user that the disk has been changed. See "Disk Changed Error" on page 7-7.

Disk Description DD1, DD2: The No Disk state indicates there is no disk in the drive or the disk is in upside down.

Suggested recovery action: On No Disk or Disk Upside Down, the system unit notifies the operator and retries the command after action is taken to correct the problem.

Drive DR1: Indicates which drive is responding with the status.

Laser Focus Error: Focus error means the laser beam is not in focus on the disk. After focus is turned on and if focus is not ok after three retries, the error is reported.

Suggested recovery action: Reset drive and retry the operation once. If not successful, signal I/O error.

Interrupt: If interrupts are disabled, the ninth bit in the serial transfer of a sense byte interrupts the adapter card.

Invalid Command: The drive has received an invalid command from the adapter card.

Suggested recovery action: Retry the command once.

Laser Out: The laser diode is not functioning properly.

Suggested recovery action: Reset drive and retry the operation once. If not successful, signal I/O error.

Motor Sync Error: The drive motor is not at the correct speed or the drive is out of synchronization.

Suggested recovery action: Reset drive and retry the operation once. If not successful, signal I/O error.

Ready to Accept Commands: The drive is ready to accept commands from the adapter card.

Seek Complete or RAM/ROM Error: On the Seek command, the drive has completed a track Seek operation.

Suggested recovery action: None.

When executing the Run Diagnostics command, the drive electronics has detected a data error in the RAM, or a check sum error in the ROM program store.

Suggested recovery action: None. This information is used by the IBM diagnostics to help identify failing components.

Track Jumped: On all Write and Demark commands, the drive electronics has detected an abnormal track crossing. An abnormal track crossing is defined as a track crossing detected under all conditions except Drive Not Ready, Seeking, or Retracing. The detection of a Track Jumped will:

- Prevent Laser Write Power from being turned on.
- Turn Laser Write Power to off, if on.

Suggested recovery action: Refer to "Track Jumped Error" on page 7-10.

When executing a Run Diagnostic command, the drive electronics set this bit on by failing to detect a jump forced by the Write Fault diagnostic.

Suggested recovery action: None. This information is used by the IBM diagnostics to help identify failing components.

Write Fault: Write Fault can be set by any of the following conditions.

- Focus Not Ok, Motor Sync error, Laser Out, Write-Protect, or a Track Jump has occurred with -Write Gate enabled.
- -Write Gate has been enabled to a drive containing a write protected disk.
- A track jump forced by the execution of the Write Fault diagnostic has been detected.

Suggested recovery action: Refer to "Write Fault Errors" on page 7-8.

Write Protect: The disk in the drive is write protected.

Suggested recovery action: No recovery action is required unless there is a Write Fault on a Write or Demark Sector command. See "Write Protect Error" on page 7-6.

Section 7. Error Recovery Procedures

The following information describes the subsystem recovery action for specific errors.

Write Error Detection

Write errors are detected during a write operation by issuing a Read Verify command after a Write command. The Read Verify command reads the data with a higher clipping level and more stringent ECC criteria. A Read Verify that results in a double error, triple error, or an uncorrectable ECC error indicates the sector should be demarked. The control program performs retry actions. Data records with single error correctable ECC errors are not considered to be defective.

If a double, triple or uncorrectable ECC error is encountered after retries are attempted, the system unit issues a Demark Sector command for the sector in error.

The system unit then issues a Write to the next sequential sector to store the data and then updates the next available directory slot pointer. This process is repeated until the sector is successfully written.

Note: These instructions assume that a Read Verify command is always issued by the device driver following the Write of a sector.

Sector Not Found Errors

Write or Demark Sector Command: Retry the command once. If the error occurs again, issue the Demark command to the target sector with the q bit on the control byte. The adapter card will:

1. Orient to the target track minus 1 and target sector minus 1.
2. Time through the data field of the target sector minus 1.
3. Time through the sector mark field of the target sector.
4. Demark the data field of the target sector.

If the Demark Sector command fails with a Sector Not Found indication, reissue the Demark Sector command with both the p and q bit on in the control byte. The adapter card will:

1. Orient to the target track minus 1 and target sector minus 2.
2. Time through the data field of the target sector minus 2.
3. Time through the sector mark field and the data field of the target sector minus 1.
4. Time through the sector mark field of the target sector.
5. Demark the data field of the target sector.

This command sequence offers recovery if two consecutive defective sector marks cause a sector to not be found. If this recovery action fails, a permanent error signal will be sent to the system unit.

On a Write command, the data associated with the failed Write command will be written on the next available sector after the defective sector is demarked.

Read Command: Retry the command once. If the error occurs again, reissue the Read command to the target sector with the q bit on the control byte. The adapter card will:

1. Orient to the target track minus 1 and target sector minus 1.
2. Time through the data field of the target sector field minus 1.
3. Time through the sector mark of the target sector.
4. Read the data field of the target sector.

If the Read command fails with a Sector Not Found indication, reissue the Read command with both the p and q bit on in the control byte. The adapter card will:

1. Orient to the target track minus 1 and target sector minus 2.
2. Time through the data field of the target sector minus 2.
3. Time through the sector mark field and the data field of the target sector minus 1.
4. Time through the sector mark field of the target sector.
5. Read the data field of the target sector.

This command sequence offers recovery if two consecutive defective sector marks cause a sector to not be found. If this recovery action fails, a permanent error signal is sent to the system unit.

The adapter card confirms the correct sector is read by verifying track and sector address information from the data area, and then transfers the data to the system unit.

Read Suppress Command: Retry the command once. If the error occurs again, reissue the Read Suppress command to the target sector with the q bit on the control byte. The adapter card will:

1. Orient to the target track minus 1 and target sector minus 1.

2. Time through the data field of the target sector minus 1.
3. Time through the sector mark field of the target sector.
4. Read the data field of the target sector.

If the Read Suppress command fails with a Sector Not Found indication, reissue the Read Suppress command with both the p and q bit on in the control byte. The adapter card will:

1. Orient to the target track minus 1 and target sector minus 2.
2. Time through the data field of the target sector minus 2.
3. Time through the sector mark field and the data field of the target sector minus 1.
4. Time through the sector mark field of the target sector.
5. Read the data field of the target sector.

This offers recovery if two consecutive defective sector marks cause a sector to not be found. If this recovery action fails, a permanent error signal is sent to the system unit.

The adapter card then transfers the entire contents of the data area of the sector to the system unit.

Read Verify Command: Retry the command once. If the error occurs again, issue the Demark command to the target sector with the q bit on in the control byte. The adapter card will:

1. Orient to the target track minus 1 and target sector minus 1.
2. Time through the data field of the target sector minus 1.
3. Time through the sector mark field of the target sector and Demark the data field of the target sector.

If the Demark Sector command fails with a Sector Not Found indication, reissue the Demark Sector

command with both the p and q bit on in the control byte. The adapter card will:

1. Orient to the target track minus 1 and target sector minus 2.
2. Time through the data field of the target sector minus 2.
3. Time through the sector mark field and the data field of the target sector minus 1.
4. Time through the sector mark field of the target sector and Demark the data field of the target sector. This will offer recovery if two consecutive defective sector marks cause a sector to not be found. If this recovery action fails, a permanent error signal will be sent to the system unit.

If the Demark Sector command is issued to confirm the successful write of data and the Read Verify completes with error, the system unit rewrites the data to the next available sector after demarking the defective sector.

Write Protect Error

A Write Protect error occurs when a write is attempted while the write protect tab is activated. This error is detected when the system unit examines the sense data returned on completion in error of either a Write command or a Demark Sector command and finding the Write Fault and Write Protect bits turned on.

The optical disk drive detects a Write Fault error when the adapter card attempts to enable the Write Gate to a drive containing a write protected disk. The drive electronics do not permit a Write operation to take place on this disk. An error will be reported to the adapter card. The error sense reported by the adapter card to the system unit will be:

- Adapter Card sense with Drive Error (byte 1, bit 0).
- Drive sense with Write Fault (byte 2, bit 4).
- Write Protect (byte 2, bit 2).

All of the above are set to 1.

The system unit examines the sense and the command that failed and issues a message to the operator that the disk is write protected.

Note: Read Only disks are manufactured with the write protect on.

Disk Changed Error

The Disk Changed indication, provided by the drive, prevents the inadvertent destruction of data stored on an Optical Disk if the disk is changed by the operator and the system is not aware of the change. The system must maintain pointers to the next available directory sector and data sector on a particular disk. At the time of the first Open on a disk, an audit is completed of the directory and data areas to locate the next available sectors and the pointers are initialized to these locations for later use in allocating space on the disk. These pointers must always agree with the disk that is mounted on the drive. If not, the directory and data areas could be destroyed.

The Disk Changed indication is sent to the adapter card by the drive when a cartridge is unloaded and the same or another cartridge is reloaded. The drive accomplishes this by activating the Alert line (if Select is enabled). When the adapter card issues any command after the cartridge is changed, the drive returns sense with the Disk Changed bit on. The adapter card retains this sense indicator for presentation on the next command issued to this drive by the system unit. The next command to this drive will not be executed (except for the sense command) and status byte will indicate an error (bit 1 = 1). The subsequent adapter card sense indicates a drive error (byte 1, bit 0 = 1) and drive sense indicates Disk Changed (byte 2, bit 7 = 1). Upon detecting this condition, the system unit notifies the operator to re-insert the disk cartridge, or if appropriate, cause the initialization of the disk allocation parameters before any I/O is executed against this drive.

Disk Unload Request

The operator removes the disk cartridge by pressing the disk unload button. When the unload button is pressed, the drive motor is turned off when the operating command is completed. When disk rotation has stopped (approximately 5 seconds), the cartridge is released from the drive and the operator can remove the optical disk cartridge.

ECC Errors

Read Command: Retry the operation once. If the error occurs again, a permanent error is signaled.

Read Verify Command: Do not attempt a retry. The target sector will be Demarked and the data written to another sector.

Write Fault Errors

Write Command:

- If Write Protect on:

The system unit has made an attempt to issue a Write command to a write protected disk. See "Write Protect Error" on page 7-6.

- If Motor Sync error:

Do a selective drive reset.

- If a Laser Out, Focus Not Ok, or Track Jumped error is detected:

Do a Read Verify operation on the sector being written at the time of the error.

If the Read Verify operation completes without error, the sector being written at the time of the error was written successfully and normal processing can continue.

If the Read Verify command completes with error, if Focus Not Ok, Motor Sync error, or Laser Out occurs: A permanent I/O error signals the system unit to inform the operator there may be a defective sector on the disk.

If an ECC error is reported, the sector is demarked and the data rewritten. However, if Focus Not Ok, Motor Sync Error, Laser Out, or a Track Jumped is detected on the Demark or Write, a permanent I/O error signal is sent to the system unit. The system unit sends a message to the operator that the disk may have a defective sector.

Demark Sector Command:

- If Write Protect on:

The system unit has made an attempt to issue a Write command to a write protected disk. See "Write Protect Error" on page 7-6.

- If Motor Sync error:

Do a selective drive reset.

- If Laser Out, Focus Not Ok, or Track Jumped error:

Do a Read Verify operation on the sector being demarked at the time of the error. If a demarked sector is reported; then ok. Otherwise, issue the Demarked Sector command to the target sector.

If a Write Fault error is detected on the demarked sector, a permanent I/O error signal is sent to the system unit. This informs the user there may be a partially written sector on the disk which can not be corrected because of a hardware failure.

Otherwise issue a Read Verify command to target sector.

If a demarked sector is detected, Demarked sector has been successful. Otherwise, a permanent I/O error signal will be sent to the system unit. This is to inform the user there may be a partially written sector on the disk which can not be corrected because of a hardware failure.

Track Jumped Error

If a Write or a Demark Sector command, go to the Write Fault error processing section.

If a Read, Read Verify or Read Suppress Command, reset the drive and retry the command once.

Laser Errors

Laser Out: The laser diode does not emit read laser power with the -Write Gate line disabled when the drive starts.

The laser diode emits write laser power with the -Write Gate line disabled.

The laser diode does not emit write laser power with the -Write Gate line enabled. This condition sets the Write Fault bit to a 1. Suggested recovery action:

Reset drive and retry the operation once. If not successful, signal a drive error.

Focus Not Ok: Focus Not Ok means the laser beam is not in focus on the media. After focus is turned on and is not ok after 3 retries, the error is reported. Suggested recovery action:

Reset drive and retry the operation once. If not successful, signal I/O error.

Motor Sync Error

The drive motor is not at the correct speed or the drive is out of synchronization. Suggested recovery action:

Reset drive and retry the operation once. If not successful, signal I/O error.

Glossary of Terms and Abbreviations

This section gives the meaning of selected terms used in this manual.

active version. An active version refers to a file level which is "visible" to existing DOS commands and applications. A file may or may not have an active version; however, if it exists there can only be one active version.

ASCIIZ. American National Standard Code for information exchange with an additional byte value of 0.

BIOS. An acronym for basic input/output system.

bit. Synonym for binary digit.

block. (1) A string of sectors, records, words, or characters formed for technical or logic reasons to be treated as an entity. (2) A set of things, such as words, characters, or digits, treated as a unit.

block count. Block count is equivalent to the number of sectors specified by a command for processing.

bus. One or more conductors used for transmitting signals or power.

byte. (1) A sequence of adjacent binary digits that are operated upon as a unit. (2) A binary character operated upon as a unit. (3) The binary representation of a character.

channel. A path, along which signals can be sent; for example, data channel, output channel.

configuration. The devices and programs that make up a system, subsystem, or network.

demark. The demark consists of 4 pulse trains written into the data area of the failing sector. These pulse trains are detectable by the hardware and render the sector unusable.

device driver. A device driver is a memory image file or an .EXE file that contains all the code needed to implement the device.

direct memory access (DMA). A method of transferring data between main storage and I/O devices that does not require processor intervention.

disable. To stop the operation of a circuit or device.

DMA. Direct memory access.

ECC. Error checking and correction.

edge connector. A terminal block with a number of contacts attached to the edge of a printed-circuit board.

enable. To initiate the operation of a circuit or device.

end of block (EOB). A code that marks the end of a block of data.

end of file (EOF). An internal label, immediately following the last record of a file, signaling the end of that file. It may include control totals for comparison with counts accumulated during processing.

EOB. End of block.

EOF. End of file.

EOT. End of transmission.

error checking and correction (ECC). The detection and correction of all single bit errors, plus the detection of double bit, and some multiple bit errors.

FCC. Federal Communications Commission.

field. (1) In a record, a specified area used for a particular category of data. (2) In a data base, the smallest unit of data that can be referred to.

flag. (1) Any of various types of indicators used for identification. (2) A character that signals the occurrence of some condition, such as the end of a word. (3) Deprecated term for mark.

format. The arrangement or layout of data on a data medium.

hardware. (1) Physical equipment used in data processing, as opposed to programs, procedures, rules, and associated documentation. (2) Contrast with software.

inhibited. (1) Pertaining to a state of a processing unit in which certain types of interruptions are not allowed to occur. (2) Pertaining to the state in which a transmission control unit or an audio response unit cannot accept incoming calls on a line.

initialize. To set counters, switches, addresses, or contents of storage to 0 or other starting values at the beginning of, or at prescribed points in, the operation of a computer routine.

input/output (I/O). (1) Pertaining to a device or to a channel that may be involved in an input process and, at a different time, in an output process. (2) Pertaining to a device whose parts can be performing an input process and an output process

at the same time. (3) Pertaining to either input or output, or both.

instruction. In a programming language, a meaningful expression that specifies one operation and identifies its operands, if any.

interrupt. (1) A suspension of a process, such as the execution of a computer program, caused by an event external to that process, and performed in such a way that the process can be resumed. (2) Synonymous with interruption.

I/O. Input/output.

laser. Light amplification by stimulated emission of radiation.

least significant bit (LSB). The rightmost bit. See also low-order position.

light emitting diode (LED). A semiconductor device that gives off visible or infrared light when activated.

load. In programming, to enter data into storage or working registers.

low-order position. The rightmost position in a string of characters. See also least significant bit.

LSB. Least significant bit

machine code. The machine language used for entering text and program instructions onto the recording medium or into storage and which is subsequently used for processing and printout.

machine language. (1) A language used directly by a machine. (2) Deprecated term for computer instruction code.

mark. A symbol or symbols that indicate the beginning or end of a field, word, an item of data, or of a data set such as a file, record, or block.

Mb. 1,048,576 bytes.

memory. Term for main storage.

MSB. Most significant bit

microcode. (1) One or more microinstructions. (2) A code, representing the instructions of an instruction set, implemented in a part of storage that is not program – addressable.

most significant bit (MSB). The leftmost (non-zero) digit. See also high-order position.

ODDCB. Optical disk directory control block.

ODSDCB. Optical disk self describing control block.

offline. Pertaining to the operation of a functional unit without the continual control of a computer.

output. Pertaining to a device, process, or channel involved in an output process, or to the data or states involved in an output process.

port. An access point for data entry or exit.

POST. Power On Self Test; a test of subsystem functions done when power is turned on.

power supply. A device that produces the power needed to operate electronic equipment.

Programmed I/O. A data transfer protocol where the address of the logic, the command to be performed, and the addresses are designated by the I/O instruction.

pulse train. A series of pulses with similar characteristics.

recoverable error. An error condition that allows continued execution of a program.

regular version. A regular version refers to a specific file level. A regular version may also be an active version. A file may have a maximum of 64K regular versions.

retry. To resend the current block of data (from the last EOB or ETB) a prescribed number of times, or until it is entered correctly or accepted.

RF. Radio frequency.

RLC. Run length code.

sector. That part of a track or band on a storage disk that can be accessed by the magnetic head (or laser) in the course of a predetermined rotational displacement of the particular device.

serializer/deserializer (SERDES). A device that serializes output from, and deserializes input to, a business machine.

track. (1) The path or one of the sets of paths, parallel to the reference edge on a data medium, associated with a single reading or writing component as the data medium moves past the component. (2) The portion of a moving data medium such as a drum or disk that is accessible to a given reading head position.

unrecoverable error. An error that makes recovery impossible without the use of recovery techniques external to the computer program or run.

version number. A unique version number is associated with each version of a name space. These numbers are implicitly assigned when a new version of a name space is created, and is

associated with that version for the duration of that version's existence. Version numbers are assigned in ascending increments of one, where the higher the version number the later that particular version was assigned. New version numbers are assigned when Copy, Promote, Rename commands are issued or when a new or updated file is closed.

write. To make a permanent or transient recording of data in a storage device or on a data medium.

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