



Personal System/2®  
CD-ROM Drive  
Technical Reference

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CD-ROM Drive

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## Description

The IBM® Personal System/2® CD-ROM Drive is a read-only drive. This drive can read a 120 mm compact disc (CD) containing approximately 600MB (MB = 1,048,576 bytes) of information; the actual capacity is determined by the contents of the CD. The CD must conform to IEC Standard 908.

The drive conforms to the American National Standards Institute (ANSI) Small Computer System Interface (SCSI) Standard X3.131-1986. Because the CD-ROM drive is a SCSI device, it is used with a SCSI adapter. This adapter serves as the interface between the drive and the system, and between this drive and other SCSI devices connected to the same adapter. Up to seven SCSI devices, such as this CD-ROM drive, may be connected to a single SCSI adapter.

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## Programming Considerations

These SCSI commands are supported through standard IBM adapter commands:

- Inquiry
- Read Capacity
- Read Extended
- Request Sense.

The adapter command, Send Other SCSI Command, is used to issue the following SCSI commands to the drive.

Op Code (Hex)	Command
00	Test Unit Ready
01	Rezero Unit
15	Mode Select
16	Reserve
17	Release
1A	Mode Sense
1B	Start/Stop Unit
1E	Prevent/Allow Media Removal
C0	Audio Track Search
C1	Play Audio
C2	Still
C3	Set Stop Time
C4	Eject Disc Caddy
C6	Read Subcode Q Data and Playing Status
C7	Read Disc Information
C8	Read CD-ROM Mode

Figure 1. SCSI Commands Supported by CD-ROM Drive.



## Inquiry

The Inquiry command requests the CD-ROM drive to transfer the inquiry data block to the adapter.

The adapter allocates the required space in memory for the inquiry data block. The CD-ROM drive ends the transfer when the allocated number of bytes has been transferred, or when all of the available inquiry data has been transferred, whichever is less. The Inquiry command Allocation Length for the CD-ROM drive can be:

- 0** Specifies that no inquiry data can be transferred from the CD-ROM drive.
- XX** Specifies the number of bytes for transfer, up to the maximum of 98. The bytes are specified from the top of the inquiry data.

The inquiry data block information is as follows:

Byte	Hex Value	Description
00	05	SCSI device type
01	80	Device qualifier; 80 equals removable media
02	01	ISO, ECMA, and ANSI version
03	01	Response data format; 01 equals Common Command Set
04	5D	Additional length; 5D equals 93 additional bytes available
05 - 31		Additional inquiry data describing the brand, type, and model of drive
32 - 35		The revision level in ASCII
36 - 43		The month, day, and year of the drive microcode revision in ASCII

*Figure 2. Inquiry Data Block*

For more information about the inquiry data block, refer to the American National Standards Institute SCSI Standard.

## Read Capacity

The Read Capacity command is used by the adapter to request information regarding the capacity of the drive. This command returns the address of the last logical block and the size (data length) of each logical block.

## Read Extended

The Read Extended command requests the CD-ROM drive to transfer data from the CD to the adapter.

## Request Sense

The Request Sense command requests the CD-ROM drive to transfer the sense data to the adapter. The sense data is valid for a check-condition status returned on the prior command. This sense data is preserved by the drive for the adapter until retrieved by the Request Sense command, or until another command is received from the same adapter.

The adapter allocates the space, in bytes, for the sense data returned from the CD-ROM drive. The bytes are counted from the most-significant byte. The drive ends the transfer when the allocated number of bytes has been transferred, or when all available sense data has been transferred, whichever is less. The space allocated in the Request Sense command for the CD-ROM drive can be:

- 0** Specifies that four bytes of sense data can be transferred from the CD-ROM drive.
- XX** Specifies the number of bytes to transfer, up to the maximum of 18.

The CD-ROM drive uses the extended-sense-data block. The Error Class is 7 and the Error Code is 0. The sense key is located in the first four bits of byte 02 of the sense data. The additional sense codes are located in byte 12 of the sense data.

## Sense Keys

The sense keys associated with the Request Sense command are:

Sense Key (Hex Value)	Name	Description
0	No sense	No information to be transferred. The previous command completed correctly.
1	Recovered error	The Read or Read Extend command completed correctly after a retry operation of the CD-ROM.
2	Drive not ready	Indicates a CD has not been loaded.
3	Media error	CD defective.
4	Hardware error	Unrecoverable hardware error was detected while performing a command or self-test.
5	Invalid request	Designated command cannot be performed. For example, requesting a CD-ROM operation on an audio CD.
6	Unit Attention	Eject Disc Caddy was performed and the media was exchanged, or: <ul style="list-style-type: none"><li>• The drive was reset by power-on reset or bus device reset message.</li><li>• Mode Select command was issued and the block length in block description or the error recovery parameters were modified.</li></ul>
B	Canceled command	The drive abnormally ended the command. The adapter can recover by issuing the command again.

Figure 3. Request Sense Command Sense Keys Table

## Additional Sense Data Codes

Code (Hex Value)	Name	Description
00	No sense	No error information.
04	Drive not ready	The drive is not ready; usually, the CD is missing, or the wrong CD is in the drive.
11	Unrecovered error	Unrecoverable data-read error.
12	No address mark	Header address of object block does not exist.
15	Seek positioning error	Seek operation did not complete within specified time limit.
17	Recovered error (with retries)	Read operation was completed with retries.
18	Recovered error (with ECC)	Data Read was completed using Error Correction Code (ECC).
20	Invalid command operation code	Improper operation code in Command Descriptor Block (CDB).
21	Invalid logical block address	Improper block address or subcode Q address in CDB; or, CD last position was exceeded.
24	Invalid field in CDB	Improper parameters in CDB.
25	Invalid LUN	A number other than 0 was specified as the device logical unit number (LUN).
26	Invalid field in parameter list	Improper values in parameter list received from adapter by command instruction.
28	Media Changed	Eject Disc Caddy was performed and the CD was changed.
29	Power-on, reset, or bus device reset	CD-ROM drive was reset by power-on, reset, or bus device reset.
2A	Mode select parameter change	Mode Select was issued, and the block length settings or error recovery settings were changed.

Figure 4 (Part 1 of 2). Additional Sense Data

<b>Code (Hex Value)</b>	<b>Name</b>	<b>Description</b>
30	Incompatible cartridge	Improper CD loaded in tray or Send Diagnostic command detected a failure.
42	Self-test diagnostics failure.	Improper CD loaded in tray or Send Diagnostic command detected a failure.
44	Internal controller error	CD-ROM drive detected an abnormality in the Interface process.
45	Select/Reselect failure	Process was stopped because an adapter cannot respond to multiple reselect operations.
47	SCSI interface parity error	Parity error was detected on the interface bus.
49	Inappropriate or invalid message	Incorrect message received in Data In/Out phases.
88	Not digital audio track	Search object address of Audio Track Search command is in CD-ROM data area.
89	Not CD-ROM data track	Read or Seek object block address of Read, Read Extended, or Seek Extended commands are on audio track.
8A	Not play audio state	Current operation status in CD-ROM is not in play on audio track.

*Figure 4 (Part 2 of 2). Additional Sense Data*

For more information about the Request Sense command and the extended sense data block, refer to the American National Standards Institute SCSI Standard.

## Send Other SCSI Command

This Subsystem Control Block (SCB) command is used to send SCSI commands, that are not supported by the adapter, directly to the CD-ROM drive. Messages are handled by the adapter, even when using this command.

The SCSI command is placed at the end of the SCB. The direction of data transfer is controlled by the read-option bit (RD) in the enable word. When this bit is set to 1, the adapter transfers data from the CD-ROM drive to the system. When this bit is set to 0, the adapter transfers data from the system to the CD-ROM drive.

If the system-buffer byte count specified in the SCB is 0, no data is transferred. Because device data can be altered by this command, the cache is automatically cleared of any data from the CD-ROM drive.

The following is the format of the SCB for Send Other SCSI Command:

Command Interface Register Bits																Remarks
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
0	0	1	0	0	1	0	0	ND	NS	0	1	1	1	1	1	Send Other SCSI Command Enable Word
RD ES RE PT 0 SS 1 0 0 0 0 0 0 0 0 0 0 CH																
<----- Reserved -----><-- SCSI CMD Length --->																
<----- Reserved ----->																
<----- Least Significant Word ----->																
<----- Most Significant Word ----->																
<----- Least Significant Word ----->																
<----- Most Significant Word ----->																
<----- Least Significant Word ----->																
<----- Most Significant Word ----->																
<----- Least Significant Word ----->																
<----- Most Significant Word ----->																
<-----1----- SCSI Command -----0----->																
<-----3----- SCSI Command -----2----->																
<-----5----- SCSI Command -----4----->																
<-----7----- SCSI Command -----6----->																
<-----9----- SCSI Command -----8----->																
<-----11----- SCSI Command -----10----->																
6 Bytes or																
10 Bytes or																
12 Bytes																

Figure 5. Send Other SCSI Command

## SCSI Commands

The SCSI commands used with the Send Other SCSI Command are:

### Test Unit Ready (Hex 00)

The Test Unit Ready command determines whether the CD-ROM drive is in the ready state or the idle state. When the drive is in the ready state (disc tray closed with a CD loaded correctly) with the drive powered on, the command returns a good status. If the drive is in the idle state (a state other than ready state), the command returns check-condition status. This is not a request for a self-test.

Byte	7	6	5	4	3	2	1	0	Remarks
0	0	0	0	0	0	0	0	0	Command Code
1	0	0	0	0	0	0	0	0	
2	0	0	0	0	0	0	0	0	Flag and Link Control
3	0	0	0	0	0	0	0	0	
4	0	0	0	0	0	0	0	0	
5	0	0	0	0	0	0	F	L	

Figure 6. Test Unit Ready Command

### Rezero Unit (Hex 01)

The Rezero Unit command requests the CD-ROM drive to turn off the laser, stop the rotation of the spindle motor, and return the read-head to the start position. This command can be performed when the drive is in the ready state. When the Disconnect process is allowed, the CD-ROM drive performs the Disconnect or Reconnect process using the following criteria:

- Disconnect at the start of the Rezero Unit command
- Reconnect after completing the Rezero Unit command.

Byte	7	6	5	4	3	2	1	0	Remarks
0	0	0	0	0	0	0	0	1	Command Code
1	0	0	0	0	0	0	0	0	
2	0	0	0	0	0	0	0	0	Flag and Link Control
3	0	0	0	0	0	0	0	0	
4	0	0	0	0	0	0	0	0	
5	0	0	0	0	0	0	F	L	

Figure 7. Rezero Unit Command

## Mode Select (Hex 15)

The Mode Select command allows the adapter to specify peripheral device parameters to the CD-ROM drive. The parameter list length specifies the number of bytes in the mode select parameter list that will be transferred from the adapter to the CD-ROM drive.

Byte	7	6	5	4	3	2	1	0	Remarks
0	0	0	0	1	0	1	0	1	Command Code
1	0	0	0	1	0	0	0	0	Parameter Flag
2	0	0	0	0	0	0	0	0	
3	0	0	0	0	0	0	0	0	
4	<-----PL----->								Parameter List Length
5	0	0	0	0	0	0	F	L	Flag and Link Control

Figure 8. Mode Select Command

The mode-select parameter list consists of a 4-byte header, 0- or 8-byte block descriptor, and 0 to multipage descriptors. The Parameter List Length specifies the number of bytes transferred from the adapter to the CD-ROM drive. If the parameter length is 00, the command completes normally, with no change to the parameter settings.

Byte	7	6	5	4	3	2	1	0	Remarks
0	0	0	0	0	0	0	0	0	
1	<-----MT----->								Media Type = 00
2	0	0	0	0	0	0	0	0	
3	<-----BDL----->								Block Descriptor Length = 08 or 00

Figure 9. Mode Select Parameter List

The block descriptors specify the data length (block size) of each block of data transferred to the adapter during Read or Read Extended command. The three block lengths specified by the CD-ROM drive are as follows:

2048 (hex 800)

2336 (hex 920)

2340 (hex 924).



Byte	7	6	5	4	3	2	1	0	Remarks
0	0	0	0	0	0	0	0	0	
1	0	0	0	0	0	0	0	0	
2	0	0	0	0	0	0	0	0	
3	0	0	0	0	0	0	0	0	
4	0	0	0	0	0	0	0	0	
5	<-----MSB----->								Block Length
6	<----->								
7	<-----LSB----->								

Figure 10. Block Descriptors

Page descriptors, byte 00, specify the Page Code in the CCS. Pages supported by the CD-ROM drive are:

Page	Description
01	Error recovery parameters
02	Disconnect or reconnect control parameters.

Page descriptors, byte 01, specify the byte number of the parameter following byte 02, containing the parameter for each page, of the page descriptors. The CD-ROM drive supports the following:

Page	Page length
01	06 hex
02	0A hex.

Byte	7	6	5	4	3	2	1	0	Remarks
0	0	0	<-----PC----->						Page Code
1	<-----PL----->								Page Length
2	<-----PP----->								Page Parameter

Figure 11. Page Descriptors

The page descriptors, byte 02, error recovery parameters are as follows:

#### Disable Correction (DC) Bit 0

Value	Description
0	Enables CD-ROM ECC correction.
1	Disables CD-ROM ECC correction.

### **Disable Transfer on Error (DT) Bit 1**

<b>Value</b>	<b>Description</b>
0	Data is transferred to the adapter if a recovered error occurs.
1	Data transfer is stopped when a recovered error occurs and a check condition is reported.

### **Post Error (PE) Bit 2**

<b>Value</b>	<b>Description</b>
0	A check condition is not reported if a recovered error occurs.
1	A recovered error will cause a check condition.

### **Early Enable correction (EC) Bit 3**

<b>Value</b>	<b>Description</b>
0	A retry operation is performed prior to attempting ECC correction when an error occurs.
1	ECC correction is performed prior to attempting a retry operation when an error occurs.

### **Read Continuous (RC) Bit 4**

<b>Value</b>	<b>Description</b>
0	Enables data transfer speed to vary during data transfer to the adapter, by the recovery operation.
1	Data is transferred to the adapter without performing the recovery operation. If an error occurs, the data speed varies.

### **Transfer Block (TB) Bit 5**

<b>Value</b>	<b>Description</b>
0	When a recovered or unrecovered error occurs, the data in that block is not transferred to the adapter.
1	When a recovered or unrecovered error occurs, the data in that block is transferred to the adapter.

## Retry Count (RTC)

The retry count specifies the number of retry operations in the recovery operation when an error occurs. The number of retry operations can be set from 0 to 254. The default value is five times.

Byte	7	6	5	4	3	2	1	0	Remarks
0	0	0	<----- PC ----->						Page Code = 01
1	<----- PL ----->								Page Length = 06
2	0	0	TB	RC	EC	PE	DT	DC	
3	<----- RTC ----->								
4	0	0	0	0	0	0	0	0	
5	0	0	0	0	0	0	0	0	
6	0	0	0	0	0	0	0	0	
7	1	1	1	1	1	1	1	1	

Figure 12. Page 01 Error Recovery Parameters

The page 02 disconnect or reconnect parameters are as follows.

Byte	7	6	5	4	3	2	1	0	Remarks
0	0	0	<----- PC ----->						Page Code = 02
1	<----- PL ----->								Page Length = 0A
2	<----- BF ----->								Buffer Full Ratio
3	0	0	0	0	0	0	0	0	
4	0	0	0	0	0	0	0	0	
5	0	0	0	0	0	0	0	0	
6	0	0	0	0	0	0	0	0	
7	0	0	0	0	0	0	0	0	
8	0	0	0	0	0	0	0	0	
9	0	0	0	0	0	0	0	0	
10	0	0	0	0	0	0	0	0	
11	0	0	0	0	0	0	0	0	

Figure 13. Page 02 Disconnect or Reconnect Control Parameters

The CD-ROM drive buffer full ratio defaults to a value of 92 hex and indicates the data buffer is full when performing a Read or a Read Extend command. The data buffers can hold 28 blocks of data. The drive is disconnected from the bus when these data buffers are emptied. The relationship between the buffer full ratio and the number of blocks transferred is as follows:

Buffer Full Ratio (hex)	Number of Blocks	Buffer Full Ratio (hex)	Number of Blocks
00	*	63 - 76	13
01 - 09	1	77 - 80	14
0A - 12	2	81 - 89	15
13 - 18	3	8A - 92	16
1C - 24	4	93 - 9B	17
25 - 2D	5	9C - A4	18
2E - 36	6	A5 - AD	19
37 - 40	7	AE - B6	20
41 - 49	8	B7 - C0	21
4A - 52	9	C1 - C9	22
53 - 5B	10	CA - D2	23
5C - 64	11	D3 - DB	24
65 - 6D	12	DC - FF	25

\* A buffer full ratio of zero indicates that the CD-ROM will not disconnect during the data-in phase.

Figure 14. Buffer Full Ratio

### Reserve (Hex 16)

The Reserve command is used to reserve SCSI devices.

The Reserve and Release commands provide the ability to resolve contentions in multiple-adapter systems.

Byte	7	6	5	4	3	2	1	0	Remarks
0	0	0	0	1	0	1	1	0	Command Code
1	0	0	0	0	0	0	0	0	
2	0	0	0	0	0	0	0	0	
3	0	0	0	0	0	0	0	0	
4	0	0	0	0	0	0	0	0	
5	0	0	0	0	0	0	F	L	Flag and Link Control

Figure 15. Reserve Command

## Release (Hex 17)

The Release command is used to release SCSI devices that had been reserved previously by the adapter.

Byte	7	6	5	4	3	2	1	0	Remarks
0	0	0	0	1	0	1	1	1	Command Code
1	0	0	0	0	0	0	0	0	
2	0	0	0	0	0	0	0	0	
3	0	0	0	0	0	0	0	0	
4	0	0	0	0	0	0	0	0	
5	0	0	0	0	0	0	F	L	Flag and Link Control

Figure 16. Release Command

## Mode Sense (Hex 1A)

The Mode Sense command is used by the CD-ROM drive to report peripheral device parameters to the adapter. This command is complementary to, and is used with the Mode Select command to support media that might contain multiple block lengths.

The Page Control field and Page Code fields specify the kinds of page parameters in the mode-sense data block transferred from the CD-ROM drive after the command phase. When the Page Code is hex 3F, the current values of page 01 and 02 are transferred. When Page Code is 01 or 02, only the current value of the page specified is transferred.

Byte	7	6	5	4	3	2	1	0	Remarks
0	0	0	0	1	1	0	1	0	Command Code
1	0	0	0	0	0	0	0	0	
2	<PCF> <-----PC----->								Page Control Field and Page Code
3	0	0	0	0	0	0	0	0	
4	<-----AL----->								Allocation Length
5	0	0	0	0	0	0	F	L	Flag and Link Control

Figure 17. Mode Sense Command

Page Control Field is as follows:

Byte	Description
00	Transfers the page parameter set by the Mode Select command to the adapter.
01	The adapter transfers the page parameters that can be set by the Mode Select command.
10	Transfers initial value of the page parameter to the adapter.
11	Not used by CD-ROM drive.

The mode-sense data block consists of:

		Mode Sense Header								
Byte		7	6	5	4	3	2	1	0	Remarks
0		<----->								Sense Data Length
1		0	0	0	0	0	0	0	0	00
2		1	0	0	0	0	0	0	0	80
3		<----->								08 Block Descriptor Length
		Block Descriptors								
Byte		7	6	5	4	3	2	1	0	Remarks
0		0	0	0	0	0	0	0	0	
1		0	0	0	0	0	0	0	0	
2		0	0	0	0	0	0	0	0	
3		0	0	0	0	0	0	0	0	
4		0	0	0	0	0	0	0	0	00
5		<-----MSB----->								Block Length
6		<----->								
7		<-----LSB----->								
		Page Descriptors								
Byte		7	6	5	4	3	2	1	0	Remarks
0		0	0	<-----PC----->						01/02 Page Code
1		<-----PL----->								Page Length
2		<-----PP----->								Page Parameter

Figure 18. Mode Sense Data Block

### Start/Stop Unit (Hex 1B)

The Start/Stop Unit command causes the CD-ROM drive to disable or enable the logical unit. When the immediate bit is set to 1, the status is returned as soon as the operation is initiated. When this bit is set to 0, the status is returned after the operation is completed.

The start and stop actions are controlled by the start bit. When the start bit is set to 1, the CD-ROM drive is placed in setup state. When the start bit is set to 0, the drive is placed in stop state.

Byte	7	6	5	4	3	2	1	0	Remarks
0	0	0	0	1	1	0	1	1	1B Operation Code
1	0	0	0	0	0	0	0	IM	Immediate bit
2	0	0	0	0	0	0	0	0	00
3	0	0	0	0	0	0	0	0	00
4	0	0	0	0	0	0	0	ST	Start bit
5	0	0	0	0	0	0	F	0	Flag and Link Control

Figure 19. Start/Stop Unit Command

### Prevent/Allow Media Removal (Hex 1E)

The Prevent/Allow Media Removal command requests the CD-ROM drive to prevent or allow the removal of the media in the CD-ROM drive. When the prevent bit is set to 1, the eject button on the front of the CD-ROM drive is locked. When the bit is set to 0, the eject button will function. Also, the eject button can be unlocked by turning off the power to the drive.

Byte	7	6	5	4	3	2	1	0	Remarks
0	0	0	0	1	1	1	1	0	Command Code
1	0	0	0	0	0	0	0	0	00
2	0	0	0	0	0	0	0	0	00
3	0	0	0	0	0	0	0	0	00
4	0	0	0	0	0	0	0	PV	Prevent bit
5	0	0	0	0	0	0	F	L	Flag and Link Control

Figure 20. Prevent/Allow Media Removal Command

## Audio Track Search (Hex C0)

The Audio Track Search command searches the CD subcode Q address specified in the Search Object Address field.

The Search Object Address field (bytes 2 through 5) definition varies according to the Type bits (byte 9, bits 7 and 6) specified.

### Byte 0 Command Code

Byte	7	6	5	4	3	2	1	0	Remarks
	1	1	0	0	0	0	0	0	Command Code
1	0	0	0	0	0	0	0	Pl	Play Mode
2	<---- High Byte ---->								Search Object Address
3	<----->								
4	<----->								
5	<---- Low Byte ---->								
6	0	0	0	0	0	0	0	0	
7	0	0	0	0	0	0	0	0	
8	0	0	0	0	0	0	0	0	
9	<TY>	0	0	0	0	F	L		Type, Flag, and Link Control

Figure 21. Auto Track Search Command

The play bit specifies whether pause or automatic playback begins after the search is completed.

### Value Description

- 0** The pause operation starts after the search is completed. When the Play Audio command is issued, playback starts at the search object address.
- 1** Playback in the stereo mode automatically starts at the search object address after the search is completed. The playback mode can be changed by issuing the Play Audio command *after* playback has started. If the Play Audio command is not issued, the mode returns the initial set value and the track at the search object address.

Information relating to play or other status can be determined by using the Read Subcode Q and Playing Status command.



When the Disconnect process is enabled, the CD-ROM drive initiates the Disconnect or Reconnect process at the following criteria:

- Disconnect at the start of the search operation.
- Reconnect after completing the search operation for the specified address.

The type bits specify how the Search Object Address field (bytes 2 through 5) is used.

**Type Description**

**00** Search Object Address field specifies the logical block address.

**Bytes**

2 <--- Logical Block Address (High Byte) --->  
 3 <--- Logical Block Address ----->  
 4 <--- Logical Block Address ----->  
 5 <--- Logical Block Address (Low Byte) ---->

**01** Search Object Address field specifies the CD absolute time.

**Bytes**

2 <----- CD Absolute Time (AM IN) ----->  
 3 <----- CD Absolute Time (ASEC) ----->  
 4 <----- CD Absolute Time (AFRAME) ----->  
 5 0 0 0 0 0 0 0 0

**10** Search Object Address field specifies the CD standard track number.

**Bytes**

2 <----- CD Standard Track Number ----->  
 3 0 0 0 0 0 0 0 0  
 4 0 0 0 0 0 0 0 0  
 5 0 0 0 0 0 0 0 0

**11** Reserved

## Play Audio (Hex C1)

The Play Audio command sets the play mode and starts playback of the audio track. The Playback Completion Address field specifies the subcode Q address where playback is to end. The CD-ROM drive ends the audio-track playback when the subcode Q address is greater than or equal to the specified address. The Playback Completion Address field definition varies according to the Type field.

Byte	7	6	5	4	3	2	1	0	Remarks
	1	1	0	0	0	0	0	1	Command Code
1	0	0	0	0	0	0	0	<-PL-->	Play Mode
2	<---- High Byte ---->								Playback Completion Address
3	<----->								
4	<----->								
5	<---- Low Byte ---->								
6	0	0	0	0	0	0	0	0	
7	0	0	0	0	0	0	0	0	
8	0	0	0	0	0	0	0	0	
9	<TY>	0	0	0	0	F	L		Type, Flag, and Link Control

Figure 22. Play Audio Command

Play mode bits specify the play mode in audio track playback as follows:

Value	Description
000	Play with muting on.
001	Play left (L) channel only.
010	Play right (R) channel only.
011	Play stereo (left and right channels).
100	Previously set play mode not changed.
XXX	Reserved.

The Type bits specify how the Playback Completion Address field (bytes 2 through 5) is used.

**Value Description**

**00** Playback Completion Address field specifies the logical block address.

**Bytes**

2 <--- Logical Block Address (High Byte) --->  
 3 <--- Logical Block Address ----->  
 4 <--- Logical Block Address ----->  
 5 <--- Logical Block Address (Low Byte) ---->

**01** Playback Completion Address field specifies the CD absolute time.

**Bytes**

2 <----- CD Absolute Time (AM IN) ----->  
 3 <----- CD Absolute Time (ASEC) ----->  
 4 <----- CD Absolute Time (AFRAME) ----->  
 5 0 0 0 0 0 0 0 0

**10** Playback Completion Address field specifies the CD standard track number.

**Bytes**

2 <----- CD Standard Track Number ----->  
 3 0 0 0 0 0 0 0 0  
 4 0 0 0 0 0 0 0 0  
 5 0 0 0 0 0 0 0 0

**11** Playback Completion Address field data becomes invalid and does not affect the previously set playback completion address.

**Bytes**

2 0 0 0 0 0 0 0 0  
 3 0 0 0 0 0 0 0 0  
 4 0 0 0 0 0 0 0 0  
 5 0 0 0 0 0 0 0 0

## Still (Hex C2)

The Still command temporarily interrupts audio track playback and starts the still operation (that is, turns on muting and continues to search for the same subcode Q address) with the CD subcode Q address stored immediately before this command was issued as the object address.

This command is valid only when audio-track playback is in progress after the completion of the Audio Track Search command (Play bit = 1) or Play Audio command. If this command is issued on any other occasion, a check-condition status is returned to the adapter. The still status is released by the Play Audio command, and the Audio Track playback resumes from the Subcode Q Address (SQA) position stored before the start of the still operation. The still status also is released by a new command, such as Audio Track Search or Read. When the CD-ROM drive is not in the ready state, a check-condition status is reported.

Byte	7	6	5	4	3	2	1	0	Remarks
0	1	1	0	0	0	0	1	0	Command Code
1	0	0	0	0	0	0	0	0	
2	0	0	0	0	0	0	0	0	
3	0	0	0	0	0	0	0	0	
4	0	0	0	0	0	0	0	0	
5	0	0	0	0	0	0	0	0	
6	0	0	0	0	0	0	0	0	
7	0	0	0	0	0	0	0	0	
8	0	0	0	0	0	0	0	0	
9	0	0	0	0	0	0	F	L	Flag and Link Control

Figure 23. Still Command

### Set Stop Time (Hex C3)

The Set Stop Time command specifies the wait time required to shift to stop status after the completion of the following operations:

- Data read
- Data seek
- Audio track playback
- Setup.

The setting time is coded as binary-coded decimal (BCD) data.

Byte	7	6	5	4	3	2	1	0	Remarks
0	1	1	0	0	0	0	1	0	Command Code
1	0	0	0	<---ST---				0	Setting Time (ST) minutes
2	<---ST---								Setting Time (ST) seconds
3	0	0	0	0	0	0	0	0	
4	0	0	0	0	0	0	0	0	
5	0	0	0	0	0	0	0	0	
6	0	0	0	0	0	0	0	0	
7	0	0	0	0	0	0	0	0	
8	0	0	0	0	0	0	0	0	
9	0	0	0	0	0	0	F	L	Flag and Link Control

Figure 24. Set Stop Time Command

## Eject Disc Caddy (Hex C4)

The Eject Disc Caddy command ejects the CD caddy from the front panel of the CD-ROM drive.

This command is always performed regardless of the status of the Prevent/Allow Medium Removal command. Because this command takes time to perform, the status that is returned to the adapter can be specified with the Immed bit.

### Immed

#### Bit Description

- 0** Returns the status when command is complete.
- 1** Returns the status when the command is issued.

Byte	7	6	5	4	3	2	1	0	Remarks
0	1	1	0	0	0	1	0	0	Command Code
1	0	0	0	0	0	0	0	IM	Immed bit
2	0	0	0	0	0	0	0	0	
3	0	0	0	0	0	0	0	0	
4	0	0	0	0	0	0	0	0	
5	0	0	0	0	0	0	0	0	
6	0	0	0	0	0	0	0	0	
7	0	0	0	0	0	0	0	0	
8	0	0	0	0	0	0	0	0	
9	0	0	0	0	0	0	F	L	Flag and Link Control

Figure 25. Eject Disc Caddy Command

## Read Subcode Q Data and Playing Status (Hex C6).

This command transfers the CD subcode Q address and the current playing status from the CD to the adapter.

The transfer length (byte 1, bits 4 through 0) specifies the number of bytes to be transferred from the CD-ROM drive to the adapter.

### Byte Description

**00** Does not perform data transfer and immediately completes normally.

**01 to 09** Specifies byte number counted from MSB of the data.

**10 or greater** All 10-bytes of data

Byte	7	6	5	4	3	2	1	0	Remarks
0	1	1	0	0	0	1	1	0	C6 Operation Code
1	0	0	0	<---TBN---			0	0	Transfer Length
2	0	0	0	0	0	0	0	0	00
3	0	0	0	0	0	0	0	0	00
4	0	0	0	0	0	0	0	0	00
5	0	0	0	0	0	0	0	0	00
6	0	0	0	0	0	0	0	0	00
7	0	0	0	0	0	0	0	0	00
8	0	0	0	0	0	0	0	0	00
9	0	0	0	0	0	0	F	L	Flag and Link Control

Figure 26. Read Subcode Q Data and Playing Status Command

The format and contents of transferred data are:

### Byte Description

**00** Shows current playback status, defined as follows:

- Bit 00 The Audio Track Playback is in progress following the completion of the Audio Track Search command (Play bit = 1) or the Play Audio command.
- Bit 01 The still operation is in progress following the completion of the Still command.
- Bit 02 The pause operation is in progress following the completion of the Audio Track Search command (Play bit = 0).
- Bit 03 Audio track playback completion status.

**01 to 09** Transfers CD SQA data loaded from a compact disc. Data is assured only during audio track playback.

Byte	7 6 5 4 3 2 1 0	Remarks
0	<----->	Playback status
1	<-----SQA----->	Control
2	<-----SQA----->	TNO
3	<-----SQA----->	X
4	<-----SQA----->	MIN
5	<-----SQA----->	SEC
6	<-----SQA----->	FRAME
7	<-----SQA----->	AMIN
8	<-----SQA----->	ASEC
9	<-----SQA----->	AFRAME

Figure 27. Format of Transferred Playback Status and SQA

The format of subcode Q address data, byte 01, Control Flag is as follows:

Bit	3	2	1	0	Content
0	0	X	0		Two audio channels without pre-emphasis
0	0	X	1		Two audio channels with pre-emphasis
1	0	X	0		Four audio channels without pre-emphasis
1	0	X	1		Four audio channels with pre-emphasis
0	1	X	0		Data track
0	1	X	1		Reserved
1	1	X	X		Reserved
X	X	0	X		Digital copy prohibited
X	X	1	X		Digital copy permitted

Figure 28. Read Subcode Q Address Data Control Flag



The format of Subcode Q Address data, bytes 02 through 09, are as follows:

Byte	Subcode Q Address Data
02	BCD data indicating the track number on the CD
03	BCD data indicating the chapter number on the CD
04 MIN	BCD data indicating the number of minutes which elapsed from the beginning of the current track.
05 SEC	BCD data indicating the number of seconds which elapsed from the beginning of the current track.
06 FRAME	BCD data indicating the number of frames which elapsed from the beginning of the current track.
07 AMIN	BCD data indicating the number of minutes which elapsed from the beginning of the disc.
08 ASEC	BCD data indicating the number of seconds which elapsed from the beginning of the disc.
09 AFRAME	BCD data indicating the number of frames which elapsed from the beginning of the disc.

### Read Disc Information (Hex C7)

The Read Disc Information command transfers the CD table of contents to the adapter during the Data In phase performed following the Command phase. Four bytes of data are transferred. The field information to be transferred can be selected by the type byte 1, bits 1 and 0.

Byte	7	6	5	4	3	2	1	0	Remarks
0	1	1	0	0	0	1	1	1	C7 Operation Code
1	0	0	0	0	0	0	<TY>		Type
2	<-----TNO----->								Track Number (Type=10)
3	0	0	0	0	0	0	0	0	00
4	0	0	0	0	0	0	0	0	00
5	0	0	0	0	0	0	0	0	00
6	0	0	0	0	0	0	0	0	00
7	0	0	0	0	0	0	0	0	00
8	0	0	0	0	0	0	0	0	00
9	0	0	0	0	0	0	F	L	Flag and Link Control

Figure 29. Read Disc Information Command

The content and data format varies with the value as follows:

**Value      Description**

**00**      Transfers the minimum and maximum track numbers on the CD

**Bytes**

```
0      <----- minimum TNO on track ----->
1      <----- maximum TNO on track ----->
2      0   0   0   0   0   0   0   0
3      0   0   0   0   0   0   0   0
```

**01**      Transfers the last location (lead-out area start position) of the program area on the CD

**Bytes**

```
0      <----- lead-out area SQA (AMIN) ----->
1      <----- lead-out area SQA (ASEC) ----->
2      <----- lead-out area SQA (AFRAME) ----->
3      0   0   0   0   0   0   0   0
```

**10**      Transfers the track information of the track specified by the track number parameter in byte 02

**Bytes**

```
0      <----- start point of track (AMIN) ----->
1      <----- start point of track (ASEC) ----->
2      <----- start point of track (AFRAME) ----->
3      <----- control of specified track ----->
```

The information (byte 03) on control of specified music is as follows:

    Specified music is an audio track (binary 0000 00X0).

    Specified music is a data track (binary 0000 01X0).

**11**      Reserved.

## Read CD-ROM Mode (Hex C8)

The Read CD-ROM Mode command transfers CD-ROM mode data from the CD-ROM drive to the adapter. This command must be preceded by a Seek command.

Byte	7	6	5	4	3	2	1	0	Remarks
0	1	1	0	0	1	0	0	0	Operation Code
1	0	0	0	0	0	0	0	0	
2	0	0	0	0	0	0	0	0	
3	0	0	0	0	0	0	0	0	
4	0	0	0	0	0	0	0	0	
5	0	0	0	0	0	0	0	0	
6	0	0	0	0	0	0	0	0	
7	0	0	0	0	0	0	0	0	
8	0	0	0	0	0	0	0	0	
9	0	0	0	0	0	0	F	L	Flag and Link Control

Figure 30. Read CD-ROM Mode Command

## Connector

A 50-pin connector on the rear of the CD-ROM drive is used to attach a SCSI signal cable. The pins correspond to the SCSI standard.

The following table shows the signals and pin assignments for the CD-ROM drive connector.

Pin	Signal	Pin	Signal
1	Ground	26	-Data Bits(0)
2	Ground	27	-Data Bits(1)
3	Ground	28	-Data Bits(2)
4	Ground	29	-Data Bits(3)
5	Ground	30	-Data Bits(4)
6	Ground	31	-Data Bits(5)
7	Ground	32	-Data Bits(6)
8	Ground	33	-Data Bits(7)
9	Ground	34	-Data Bits(P)
10	Ground	35	Ground
11	Ground	36	Ground
12	Ground	37	Ground
13	Not Connected	38	+ Terminal Power
14	Ground	39	Ground
15	Ground	40	Ground
16	Ground	41	-Attention
17	Ground	42	Ground
18	Ground	43	-Busy
19	Ground	44	-Acknowledge
20	Ground	45	-Restart
21	Ground	46	-Message
22	Ground	47	-Select
23	Ground	48	Data/-Control
24	Ground	49	-Request
25	Ground	50	Output/-Input

Figure 31. SCSI Connector Pin Assignments

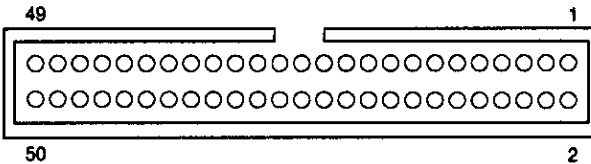


Figure 32. CD-ROM Drive SCSI Signal Connector

