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Mr. Lamers,

In speaking with John Lohmeyer, it was suggested to me by him that Adtron submit a proposal to you to be included with the next mailings that were to go out.

To that end, and per my conversation with you, you will find attached a proposal for extensions to the SCSI command set to accomodate PCMCIA peripheral devices and the various PCMCIA card types that such a peripheral may be able to accept.

As can be seen from our proposal, a good number of the card types can be referenced as direct-access devices. There are others, such as modem and network cards, pager cards, A/D converter cards, encryption cards, printer interface cards, and so forth, that do not readily fit the direct-access device specification. These are addressed with the proposed extensions.

Thank you for your time and consideration. If you have an questions or comments, please feel free to contact me.

Sincerely,

Philip Joslin
Senior Software Engineer
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Commands for PCMCIA devices

The commands for PCMCIA devices shall be as shown in table 1.

Table 1 - Commands for PCMCIA devices

Command name	Operation Code	Type	Subclause
Card Information [1]	C0h	P	[2]
Copy	18h	O	8.2.3
Encryption [3][1]	-TBD-	P	[2]
Erase Zone [1]	E1h	P	[2]
Format Unit	04h	M	9.2.1
Inquiry	12h	M	8.2.5
Mode Select (6)	15h	O	8.2.8
Mode Select (10)	55h	O	8.2.9
Mode Sense (6)	1Ah	O	8.2.10
Mode Sense (10)	5Ah	O	8.2.11
Prevent-Allow Medium Removal	1Eh	O	9.2.4
Read (6)	08h	M	9.2.5
Read (10)	28h	M	9.2.6
Read Bytes (10) [1]	E2h	P	[2]
Read Capacity	25h	M	9.2.7
Release	17h	M	9.2.11
Request Sense	03h	M	8.2.14
Reserve	16h	M	9.2.12
Seek (6)	0Bh	O	9.2.15
Seek (10)	2Bh	O	9.2.15
Send Diagnostic	1Dh	M	8.2.15
Test Unit Ready	00h	M	8.2.16
Write (6)	0Ah	M	9.2.20
Write (10)	2Ah	M	9.2.21
Write Bytes (10) [1]	E3h	P	[2]

Key: M = Command implementation is mandatory.
O = Command implementation is optional.
P = Proposed additions specific to PCMCIA usage.
-TBD- = To Be Determined

Notes: [1] New command.
[2] See attached command description.
[3] Proposed optional. All other proposed command implementation would be of mandatory type.

CARD INFORMATION command

The CARD INFORMATION command requests that information regarding the composition of the currently inserted PCMCIA card be returned to the initiator.

Table 2 - CARD INFORMATION command

Bit / Byte	7	6	5	4	3	2	1	0
0	Operation Code (C0h)							
1	LUN			Reserved				
2	Reserved			VNDR	F/W	I/O	ATTR	COMM
3	(MSB)	Allocation Length						
4								(LSB)
5	Control							

The COMM, ATTR, and I/O bits are used to request that one or more Region Descriptor Blocks for common and/or attribute memory and/or I/O space be returned.

The F/W bit requests that one or more Region Descriptor Blocks for target firmware be returned. The F/W bit is optional. The VNDR bit is vendor specific and will request that one or more vendor unique Region Descriptor Blocks be returned. The VNDR bit is optional.

If all the select bits are zero, then only the Card Information Descriptor Block will be returned (i.e., the Region Descriptor Block Count field of the Card Information Descriptor Block will be zero).

CARD INFORMATION data

The CARD INFORMATION command will return a Card Information Descriptor Block (see table 3).

If there is no card plugged into the selected logical unit, then the PRES (card present) bit will be zero (0) and all other fields, except the Region Descriptor Block Count, will be undefined.

The RDY bit when set to one indicates that the card is ready to accept or yield data. The CHNG bit when set indicates that there has been a card change since the last CARD INFORMATION command. The POWR bit when set to one indicates that there is power to the card. The CWP bit when set to one indicates that the card is write protected.

The Battery field values are defined in table 4.

Card Function will be one of the PCMCIA standard defined values as found in table 5.

The CIS field values are defined in table 6. These values indicate the location of the CIS (Card Information Structure) on the PCMCIA card.

The voltage field values indicate the card voltages and programming capabilities OF THE LOGICAL UNIT DRIVE and not of the card. The OtherVolt field is currently undefined.

Table 3 - Card Information Descriptor Block

Bit Byte	7	6	5	4	3	2	1	0
0	CWP	Battery		POWR	PRES	CHNG	RDY	0
1	Reserved							
2	Card Function							
3	Reserved						CIS	
4	Card Manufacturer Code							
5								
6	Manufacturer Card Rev Info							
7								
8	Reserved							
9	Reserved							
10	Reserved			OtherVolt	12V	5V	3.3V	
11	Reserved							
12	(MSB) Region Descriptor Block Count							
13								(LSB)

Table 4 - Battery codes

Bits 6,5	Battery Level
00b	Battery dead or removed
01b	Battery low
10b	Battery dead or removed
11b	Battery good

Table 5 - Card Function codes

Code	Card Function
0	Multi-Function
1	Memory
2	Serial Port
3	Parallel
4	Fixed Disk
5	Video Adapter
6	NetworkLAN Adapter
7	AIMS
08h..FFh	Reserved

Table 6 - Program codes

Bits 1,0	CIS Location
00b	No CIS found
01b	CIS in common memory
10b	CIS in attribute memory
11b	Reserved

The Region Descriptor Block Count, if non-zero, indicates how many additional information blocks will be sent by the target to the initiator up to the Allocation Length specified by the initiator. Each Region Descriptor Block (see table 7) will contain information regarding the individual makeup of the regions within the PCMCIA card found in the logical unit. A region is defined as a contiquous set of like devices within the PCMCIA card.

Table 7 - Region Descriptor Block

Bit Byte	7	6	5	4	3	2	1	0
0	Device Type							
1	Reserved							
2	WP Mode		Reserved			Region Type		
3	Reserved							
4	(MSB)							
5				Region Size (in bytes) or Number of I/O Ports for an I/O Region				
6								
7								(LSB)
8	(MSB)							
9				Starting Physical (Linear) Base Address for Region or Starting Port Number for an I/O Region				
10								
11								(LSB)
12	(MSB)							
13				Number of Erase Zones				
14								
15								(LSB)
16	(MSB)							
17				Erase Zone Size (in bytes)				
18								
19								(LSB)
20 - - - 35				JEDEC Specification				
36 - - - 39				Reserved				

The Device Type will be one of the PCMCIA standard defined values as found in table 8.

Table 8 - Device Type codes

Code	Device Type
0	No device
1	Masked ROM
2	OTP
3	UV EPROM
4	EEPROM
5	Flash EPROM
6	Static RAM
7	Dynamic RAM
08h..0Ch	Reserved
0Dh	Function Specific
0Eh	Extended type (reserved for future use)
0Fh..FFh	Reserved

The WP (Write Protect) Mode will be one of the values as found in table 9. This applies to the specified region only.

Table 9 - WP Mode

Bits 7,6	Write Protect Mode
00b	Write protected per card WP switch
01b	Always write protected
10b	Never write protected
11b	Reserved

The Region Type will be one of the values as found in table 10.

Table 10 - Region Type codes

Code	Region Type
0	Common memory
1	Attribute memory
2	Reserved
3	I/O
4	Firmware
5	Vendor specific
6-15	Reserved

Erase Zone Size refers to the size, in bytes, of each erase zone.

The JEDEC specification is as defined in the PCMCIA standard.

ENCRYPTION command

The ENCRYPTION command will enable or disable encryption/decryption of data to/from the target.

Table 11 - ENCRYPTION command

Bit / Byte	7	6	5	4	3	2	1	0
0	Operation Code (TBD)							
1	LUN				Reserved			ENAB
2	Encryption Type							
3	(MSB)							
4	Encryption Key Descriptor Length							(LSB)
5	Control							

The ENAB bit when set to one will enable encryption on the given logical unit. When the bit is zero then encryption will be disabled.

The Encryption Type field values and Encryption Key Descriptor are yet to be determined.

ERASE ZONE (10) command

The ERASE ZONE (10) command will erase the specified zone(s) of the the card medium. As used here, erased means that a set value will be written throughout the card zone(s).

Table 12 - ERASE ZONE (10) command

Bit / Byte	7	6	5	4	3	2	1	0
0	Operation Code (E1h)							
1	LUN				Reserved			
2	(MSB)							
3								
4				Physical (Linear) Address of First Zone to be Erased				
5								(LSB)
6	(MSB)							
7				Number of Zones to Erase				(LSB)
8	Reserved					Region Select		
9	Control							

The Physical Address is the base address of the region in which the zone is found plus the zone number * zone size. For example, if the region base address were 00108000h and the zone size were 8000h bytes, then the address to erase zone 0 would be 00108000h, and the address to erase zone 3 of that region would be 00120000h.

The region base address must previously have been returned through a CARD INFORMATION command.

The Region Select field is used to select the region type (see table 14).

READ BYTES (10) command

The READ BYTES (10) command requests that the target transfer data to the initiator. The most recent data value(s) written in the addressed physical location shall be returned.

Table 13 - READ BYTES (10) command

Bit / Byte	7	6	5	4	3	2	1	0
0	Operation Code (E2h)							
1	LUN			0	Region Select			
2	(MSB)							
3				Physical (Linear) Address or Port Number for I/O Region				
4								
5								(LSB)
6	BWIDE	DMODE		Reserved				X1K
7	(MSB)							
8				Transfer Count (in bytes)				(LSB)
9	Control							

The Region Select field is used to select the region type from which data is to be read. The field values are defined in table 14.

Table 14 - Region select codes

Code	Region Select
0	Common memory
1	Attribute memory -- even bytes
2	Attribute memory -- all
3	I/O
4	Firmware
5	Vendor specific
6-15	Reserved

If Region Select is set to zero, then the Transfer Count represents the number of contiguous bytes to be read from card common memory and transferred to the initiator.

If Region Select is set to one, then the Transfer Count represents the number of even bytes to be read from card attribute memory and transferred to the initiator. This implies that the Physical Address for attribute memory will always be even and that the data returned will represent only valid attribute data (every other byte). An odd physical address will result in a CHECK CONDITION status and the sense key set to ILLEGAL REQUEST.

If Region Select is set to two, then only half the number of valid attribute bytes will be returned. All odd bytes returned will be undefined data (usually FFh). The Physical Address for this access shall also be even or a CHECK CONDITION will result.

If Region Select is set to three, then the Transfer Count represents the number of bytes to be read from card I/O space and transferred to the initiator.

If Region Select is set to four, then the Transfer Count represents the number of contiguous bytes to be read from the drive firmware and transferred to the initiator. Implementation of this select value is optional. If this value is

selected and is not supported by the device, then the command will be terminated with a CHECK CONDITION status and the sense key shall be set to ILLEGAL REQUEST.

If Region Select is set to five, then the Transfer Count represents the number of contiguous bytes to be read from vendor specific space on the card and transferred to the initiator. Implementation of this select value is optional. If this value is selected and is not supported by the device, then the command will be terminated with a CHECK CONDITION status and the sense key shall be set to ILLEGAL REQUEST.

If BWIDE is set to one, then all transfers WITHIN the LUN will be byte-wide (i.e., 8-bit I/O and memory accesses). Otherwise all accesses will be 16-bit wide. If the LUN does not support the specified width for the selected region, a CHECK CONDITION will result and the sense key shall be set to ILLEGAL REQUEST.

The DMODE field indicates how the data source address WITHIN the LUN will be treated following each transfer. The field values are defined in table 16. If the LUN does not support the specified mode for the selected region, a CHECK CONDITION will result and the sense key shall be set to ILLEGAL REQUEST.

The X1K bit acts as a transfer count multiplier. If the X1K bit is set to one, the actual number of bytes transferred will be Transfer Count * 1024. Otherwise, if the bit is zero, the number of bytes transferred will be Transfer Count. Implementation of the X1K bit is optional. If this bit is set and is not supported by the device, then the command will be terminated with a CHECK CONDITION status and the sense key shall be set to ILLEGAL REQUEST.

WRITE BYTES (10) command

The WRITE BYTES (10) command requests that the target write the data transferred from the initiator to the medium.

Table 15 - WRITE BYTES (10) command

Bit / Byte	7	6	5	4	3	2	1	0
0	Operation Code (E3h)							
1	LUN			0	Region Select			
2	(MSB)							
3			Physical (Linear) Address or Port Number for I/O Region					
4								
5								(LSB)
6	BWIDE	DMODE		Reserved			WPO	X1K
7	(MSB)							
8			Transfer Count (in bytes) or Immediate Data					(LSB)
9	Control							

The Region Select field is used to select the region type to which data is to be written. The field values are defined in table 14.

If Region Select is set to zero, then the Transfer Count represents the number of contiguous bytes to be transferred from the initiator and written to card common memory.

If Region Select is set to one, then the Transfer Count represents the number of bytes to be transferred from the initiator and written to even bytes in card attribute memory. The Physical Address for attribute memory will always be even. An odd physical address will result in a CHECK CONDITION status and the sense key set to ILLEGAL REQUEST.

If Region Select is set to two, then only half the number of Transfer Count will be written to card attribute memory. Even number bytes will be taken from the byte data transferred from the initiator (odd bytes will be ignored). The initiator must still provide Transfer Count number of bytes. The Physical Address for this access shall also be even or a CHECK CONDITION will result.

If Region Select is set to three, then the Transfer Count represents the number of bytes to be transferred from the initiator and written to card I/O space.

If Region Select is set to four, then the Transfer Count represents the number of contiguous bytes to be transferred from the initiator and written to the drive firmware. Implementation of this select value is optional. If this value is selected and is not supported by the device, then the command will be terminated with a CHECK CONDITION status and the sense key shall be set to ILLEGAL REQUEST.

If Region Select is set to five, then the Transfer Count represents the number of contiguous bytes to be transferred from the initiator and written to vendor specific space in the card. Implementation of this select value is optional.

If this value is selected and is not supported by the device, then the command will be terminated with a CHECK CONDITION status and the sense key shall be set to ILLEGAL REQUEST.

If BWIDE is set to one, then all transfers WITHIN the LUN will be byte-wide (i.e., 8-bit I/O and memory accesses). Otherwise all accesses will be 16-bit wide. If the LUN does not support the specified width for the selected region, a CHECK CONDITION will result and the sense key shall be set to ILLEGAL REQUEST.

The DMODE field indicates how the data destination address WITHIN the LUN will be treated following each transfer. The field values are defined in table 16. If the LUN does not support the specified mode for the selected region, a CHECK CONDITION will result and the sense key shall be set to ILLEGAL REQUEST.

Table 16 - DMODE codes

Bits 6,5	DMODE action
00b	No increment, no decrement
01b	Increment address
10b	Decrement address (NOT applicable to READ BYTES command)
11b	Indicates that the Transfer Count field holds data. Data will be 8-bits (in LSB) if BWIDE is 1 and will be 16-bits if BWIDE is 0. No data phase will follow the command. (NOT applicable to READ BYTES command)

The X1K bit acts as a transfer count multiplier. If the X1K bit is set to one, the actual number of bytes transferred will be Transfer Count * 1024. Otherwise, if the bit is zero, the number of bytes transferred will be Transfer Count.

Implementation of the X1K bit is optional. If this bit is set and is not supported by the device, then the command will be terminated with a CHECK CONDITION status and the sense key shall be set to ILLEGAL REQUEST.

The WPO bit is the write protect override bit. If this bit is set to one then data will be written to the card regardless of the state of the write protect switch setting on the card itself and if the card is not always write protected (see table 9).