



**TECHNICAL
PAPER**

PC Card Adapter Reference

November 1996



Order Number: 297719-001

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REVISION HISTORY

Number	Item
-001	Original version



1.0 INTRODUCTION

This technical paper will document products known in the industry as PC-Card adapters. PC Card Adapters enable desktop computing platforms to utilize a form factor known as the "PC Card." The PC Card, or PCMCIA card as it was previously called, was developed by a consortium of manufactures including the Japan Electronic Industry Development Association (JEIDA) and then later the Personal Computer Memory Card International Association (PCMCIA).

Reductions in component size and "standardized" flash interface software is spawning an opportunity for flash memory use in many mobile consumer products including digital cameras and voice recorders through the use of PC Cards. PC Card Adapters enable "desktop" systems to use PC Cards, and aid in the development of embedded/mobile products and applications.

PC Card Adapters are also known in the industry as "Reader/Writers," "PCMCIA Adapters" or "Card Readers." Although many names are used to describe this product, this technical paper will refer to them as "PC Card Adapters" exclusively.

Manufacturer contact information will be provided along with technical data pertaining to each PC Card Adapter model offered. This paper will also include a brief history of PCMCIA/JEIDA development and an overview of the PCMCIA architecture. Information on the Intel Series 100 Miniature Card is also provided.

The following pages reference an alphabetical listing of PC Card Adapter vendors and their related product lines. This list represents only a selection from the industry and will be updated as additional vendor information becomes available. Since this industry develops many new solutions each year, Intel recommends that designers contact vendors for their latest products, software support and current pricing information. Software and PC Card support for PC Card Adapters varies widely among manufacturers. Intel will continue to work with the industry to provide the widest variety of Intel PC Card support among the various software vendors and PC Card adapter manufacturers.

ACMA COMPUTERS INCORPORATED

47988 Fremont Boulevard
 Fremont, CA 94538

(Phone) 510/623-1212
 (Phone) 800/578-1888
 (Phone) 510/623-0818
 (BBS) 510/651-0629
 (Email) sales@acma.com
 (Web) www.acma.com

ACMA	TSE-100	TSE-200
Card Support		
Series 2	✓	✓
Series 2+	✓	✓
VS100	✓	✓
Miniature Card	✓	✓
Hardware Specifications		
No. Sockets Supported	2	2
Largest Card Support	Type III	Type III
Interface	ISA	ISA
Socket Mounting	Internal 3.5" Bay Mount	External Mounting
V _{CC} Support	5V	5V
V _{PP} Support	12V	12V
Controller Used	VG365	VG365
Boot Option Support	No	No
PCMCIA Release	2.1	2.1
Price Quantity 10	\$279.00	\$279.00
Bundled Software		
Software Vendor	SystemSoft CardWizard/CardWorks	SystemSoft CardWizard/CardWorks
Flash File System	SystemSoft FTL	SystemSoft FTL

NOTE:
 ACMA provides encryption software as an option. Call vendor for more information.



ADTRON

3050 South Country Club Dr. #24
Mesa, AZ 85210

(Phone) 602/926-9324
(FAX) 602/926-9359
(Email) sales@adtron.com
(Web) www.syspac.com/~adtron

ADTRON	Sddb	SDDC	SDDR/L ⁽³⁾	SDDP/M ⁽⁴⁾	SDDS
Card Support					
Series 2	✓	✓	✓	✓	✓
Series 2+	✓	✓	✓	✓	✓
VS100	Contact Mfg.	Contact Mfg.	Contact Mfg.	Contact Mfg.	Contact Mfg.
Miniature Card	Contact Mfg.	Contact Mfg.	Contact Mfg.	Contact Mfg.	Contact Mfg.
Hardware Specifications					
No. Sockets Supported	1	2	1	2	2
Largest Card Support	Type III	Type III	Type II	Type III	Type III
Interface	IDE Bus	ISA	(3)	PC-104 ⁽⁴⁾	SCSI
Socket Mounting	Internal	(2)	External	PC-104	Internal
V _{CC} Support	5V	5V	5V	5V	5V
V _{PP} Support	12V	12V	12V	12V	12V
Controller Used	Custom Xilinx	Intel 82365	Custom Xilinx	Cirrus 6720	Cirrus 6720
Boot Option Support	Yes	Yes	No	Yes	Call Vendor
PCMCIA Release	2.1	2.1	2.0	Call Vendor	Call Vendor
Price Quantity 10	\$165.00	\$150.00	\$265.00	\$195.00	\$195.00
Bundled Software					
Software Vendor	(1)	AMI	(3)	AMI	AMI
Flash File System	(1)	None	(3)	None	None

NOTES:

1. Development kit available. Proprietary software. Optional SCM flash file system for flash cards.
2. Three models available: dual sockets on ISA card, dual sockets on 3.5" bay, one socket on ISA card / one socket on cabled 3.5" bay.
3. SDDR = RS232/485, SDDL = Parallel port. DOS utility software for custom format and copy of flash cards included in developer's kit.
4. SDDP = 16-bit interface, SDDM = 8-bit interface.

CHASE ADVANCED TECHNOLOGY

Salt's Mill, Victoria Road, Shipley
 West Yorkshire, BD18 3JD
 UNITED KINGDOM

(Phone) +44-1274-841316
 (FAX) +44-1274-841358
 (BBS) +44-1274-841317
 (Web) www.chase-at.com/chase/

CHASE	Cardport ISA	Cardport EX	Cardport Solo / Uno
Card Support			
Series 2	✓	Contact Mfg.	✓
Series 2+	✓	Contact Mfg.	✓
VS100	Contact Mfg.	Contact Mfg.	Contact Mfg.
Miniature Card	Contact Mfg.	Contact Mfg.	Contact Mfg.
Hardware Specifications			
No. Sockets Supported	2	1	1
Largest Card Support	Type III	Type III	Type III
Interface	ISA	Parallel	ISA
Socket Mounting	1 Slot on Bay, 1 Slot on Card	External	Solo-Drive Bay, Uno-Rear Slot
V _{CC} Support	5V	5V	5V
V _{PP} Support	12V	12V	12V
Controller Used	Cirrus 6720	Fujitsu MB86301	Ricoh 365
Boot Option Support	No	No	No
PCMCIA Release	PC Card 95	Contact Mfg.	PC Card 95
Price Quantity 10	\$199.00	Contact Mfg.	Solo \$99.00, Uno \$89.00
Bundled Software			
Software Vendor	SystemSoft 3.1	Chase Custom ⁽¹⁾	SystemSoft 3.1
Flash File System	Contact Mfg.	None	Contact Mfg.

NOTE:

1. Binary dump utilities provided. Supports memory and I/O cards.



CURTIS, INC.

 418 W. County Rd. D.
 St. Paul, MN 55112

 (Phone) 612/631-9512
 (FAX) 612/631-9508

CURTIS	PCCIR-SU	PCCIR-SU-B	PCCS2-I	PCCS2-I-B	PCCS2-E	PCCS2-EB
Card Support						
Series 2	✓	✓	✓	✓	✓	✓
Series 2+	✓	✓	✓	✓	✓	✓
VS100	Contact Mfg.	Contact Mfg.	Contact Mfg.	Contact Mfg.	Contact Mfg.	Contact Mfg.
Miniature Card	Contact Mfg.	Contact Mfg.	Contact Mfg.	Contact Mfg.	Contact Mfg.	Contact Mfg.
Hardware Specifications						
No. Sockets Supported	2	2	2	2	2	2
Largest Card Support	Type III	Type III	Type III	Type III	Type III	Type III
Interface	ISA	ISA	ISA	ISA	ISA	ISA
Socket Mounting	On Card	On Card	On Card	On Card	Bay Mount	Bay Mount
V _{CC} Support	5V ⁽¹⁾	5V ⁽¹⁾	5V	5V	5V	5V
V _{PP} Support	12V	12V	12V	12V	12V	12V
Controller Used	Cirrus 6720	Cirrus 6720	82365SL	82365SL	82365SL	82365SL
Boot Option Support	No	Yes ⁽²⁾	No	Yes	No	Yes
PCMCIA Release	2.1	2.1	2.1	2.1	2.1	2.1
Price Quantity 10	\$188.10	\$223.10	\$242.00	\$287.00	\$341.00	\$386.00
Bundled Software						
Software Vendor	SystemSoft	SystemSoft	SystemSoft	SystemSoft	SystemSoft	SystemSoft
Flash File System	FFS	FFS	FFS	FFS	FFS	FFS

NOTES:

All products built "rugged"

1. 3.3V optional.
2. ATA Bootable

ELAN DIGITAL SYSTEMS, LTD.

Elan House
 Little Park Farm Road
 Fareham, Hampshire PO15 SSJ
 UNITED KINGDOM

(Phone) +44-1489-579799
 (Phone) 800/541-ELAN
 (FAX) +44-1489-577516
 (BBS) +44-1489-578979

ELAN	J101	J102	J103	J104	J105	J106
Card Support						
Series 2	✓	✓	✓	✓	✓	✓
Series 2+	✓	✓	✓	✓	✓	✓
VS100	✓(2)	✓(2)	✓(2)	✓(2)	✓(2)	✓(2)
Miniature Card	✓(2)	✓(2)	✓(2)	✓(2)	✓(2)	✓(2)
Hardware Specifications						
No. Sockets Supported	1	1	1	1	1	2
Largest Card Support	Type II	Type II	Type III	Type III	Type III	Type III
Interface	ISA	ISA	ISA	ISA	ISA	ISA
Socket Mounting	3.5" Bay	External	3.5" Bay	External	ISA Card	Bay/ISA Card
V _{CC} Support	5V(1)	5V(1)	5V(1)	5V(1)	5V(1)	5V(1)
V _{PP} Support	12V	12V	12V	12V	12V	12V
Controller Used	Vadem 365	Vadem 365	Vadem 468	Vadem 468	Vadem 468	Vadem 468
Boot Option Support	No	No	Yes	Yes	Yes	Yes
PCMCIA Release	PC Card 95	PC Card 95	PC Card 95	PC Card 95	PC Card 95	PC Card 95
Price Quantity 10	Contact Mfg.	Contact Mfg.	Contact Mfg.	Contact Mfg.	Contact Mfg.	Contact Mfg.
Bundled Software						
Software Vendor	None(2)	None(2)	None(2)	None(2)	None(2)	None(2)
Flash File System	None(2)	None(2)	None(2)	None(2)	None(2)	None(2)

NOTES:

All products built to "industrial standards." J-series refer to standard reader hardware. JG-series refer to "copy station" hardware.

- 3V operation available by adapter, all sockets are keyed for 5V.
- J-series compatible with industry-standard PCMCIA-compliant software "stack" and FTL flash file system. Elan proprietary software (JC/JW-copy) compatible only with "365"-compatible chipsets (i.e., Vadem 468). Contact manufacturer for current card support details.



ELAN DIGITAL SYSTEMS, LTD. (Continued)

ELAN	J108	J109	JG08-3	JG16-3	JG32-3
Card Support					
Series 2	✓	✓	✓	✓	✓
Series 2+	✓	✓	✓	✓	✓
VS100	✓(2)	✓(2)	✓(2)	✓(2)	✓(2)
Miniature Card	✓(2)	✓(2)	✓(2)	✓(2)	✓(2)
Hardware Specifications					
No. Sockets Supported	2	2	8	16	32
Largest Card Support	Type III	Type III	Type III	Type III	Type III
Interface	ISA	ISA	ISA	ISA	ISA
Socket Mounting	3.5" Drive Bay	External	Ext. Tower	Ext. Tower	Ext. Tower
V _{CC} Support	5V(1)	5V(1)	5V(1)	5V(1)	5V(1)
V _{PP} Support	12V	12V	12V	12V	12V
Controller Used	Vadem 468	Vadem 468	Vadem 468	Vadem 468	Vadem 468
Boot Option Support	Yes	Yes	Yes	Yes	Yes
PCMCIA Release	PC Card 95	PC Card 95	PC Card 95	PC Card 95	PC Card 95
Price Quantity 10	Contact Mfg.	Contact Mfg.	Contact Mfg.	Contact Mfg.	Contact Mfg.
Bundled Software					
Software Vendor	None(2)	None(2)	JC-Copy	JC-Copy	JC-Copy
Flash File System	None(2)	None(2)	None	None	None

NOTES:

All products built to "industrial standards." J-series refer to standard reader hardware. JG-series refer to "copy station" hardware.

1. 3V operation available by adapter, all sockets are keyed for 5V.
2. J-series compatible with industry standard PCMCIA compliant software "stack" and FTL flash file system. Elan proprietary software (JC/JW-copy) compatible only with "365"-compatible chipsets (i.e., Vadem 468). Contact manufacturer for current card support details.

GREYSTONE

130-A Knowles Drive
Los Gatos, CA 95030

(Phone) 408/866-4739
(Phone) 800/600-5710
(FAX) 408/866-8328
(BBS) 408/866-6938
(Email) grystone@ix.netcom.com

GREYSTONE	TA50	PC30	GS-110	GS-120	GS220	GS-440
Card Support						
Series 2	✓		✓	✓	✓	✓
Series 2+	✓	✓	✓	✓	✓	✓
VS100	✓		Contact Mfg.	Contact Mfg.	Contact Mfg.	Contact Mfg.
Miniature Card	✓	Contact Mfg.	Contact Mfg.	Contact Mfg.	Contact Mfg.	Contact Mfg.
Hardware Specifications						
No. Sockets Supported	1	1	1	2	2	4
Largest Card Support	Type III	Type III	Type III	Type III	Type III	Type III
Interface	PCMCIA ⁽¹⁾	PCMCIA ⁽²⁾	ISA	ISA	ISA	ISA
Socket Mounting	External	External	On ISA card	On ISA card	5.25 Bay	5.25 Bay
V _{CC} Support	(1)	3V Only ⁽²⁾	5V	5V	5V	5V
V _{PP} Support	(1)	(2)	12V	12V	12V	12V
Controller Used	N/A	N/A	Cirrus 6720	Cirrus 6720	Cirrus 6720	Cirrus 6720
Boot Option Support	No	No	No	No	No	No
PCMCIA Release	2.1	2.1	2.1	2.1	2.1	2.1
Price Quantity 10	\$49.00	\$79.00	\$85.00	\$99.00	\$149.00	\$298.00
Bundled Software						
Software Vendor	N/A	N/A	SystemSoft	SystemSoft	SystemSoft	SystemSoft
Flash File System	N/A	N/A	SystemSoft	SystemSoft	SystemSoft	SystemSoft

NOTES:

1. The TA50 is a PCMCIA "pass through" adapter allowing larger type cards to be used with existing PCMCIA slots.
2. The PC 30 is a "pass through" adapter. It converts 5V from existing PCMCIA slot to 3V at the external slot.



INTERMART SYSTEMS

 131-D Albright Way
 Los Gatos, CA 95030

 (Phone) 408/379-0770
 (FAX) 408/379-3666
 (Web) www.intermartsys.com

INTERMART	PCD10	PCD15	PCD15B
Card Support			
Series 2			
Series 2+	✓	✓	✓
VS100	✓	✓	✓
Miniature Card	✓	✓	✓
Hardware Specifications			
No. Sockets Supported	1	2	2
Largest Card Support	Type III	Type II/III	Type II/III
Interface	SCSI	SCSI	SCSI
Socket Mounting	External	Internal Bay	External
V _{CC} Support	3.3V/5V	3.3V/5V	3.3V/5V
V _{PP} Support	—	—	—
Controller Used	Cirrus 371	Cirrus 371	Cirrus 371
Boot Option Support	Yes	Yes	Yes
PCMCIA Release	2.1	2.1	2.1
Price Quantity 10 ⁽¹⁾	\$350.00	\$500.00	\$350.00
Bundled Software			
Software Vendor	(2)	(2)	(2)
Flash File System	(2)	(2)	(2)

NOTES:

Operates with SCSI-2 interface. Products support data transfer rates up to 4 Mbytes/second, hot swap card interchange and recognition. PCD15 and PCD15B support UNIX OS.

1. Contact Intermart for current pricing information
2. Shipped with Macintosh S/W drivers. All units support standard PCMCIA software suites purchased separately.

MPL AG ELEKTRONIK UNTERNEHMEN

Tafernstr. 20
 5405 Dattwil:
 Switzerland

(Phone) +41-56-493-3080
 (FAX) +41-56-493-3020
 (Email) info@mpl.ch
 (Web) www.mpl.ch/mpl

MPL AG	MS-MCDISK-D	MS-MCRW-D	MS-MCDISK-E	MS-MCRW-E
Card Support				
Series 2	✓	✓	✓	✓
Series 2+	✓	✓	✓	✓
VS100	Contact Mfg.	Contact Mfg.	Contact Mfg.	Contact Mfg.
Miniature Card	Contact Mfg.	Contact Mfg.	Contact Mfg.	Contact Mfg.
Hardware Specifications				
No. Sockets Supported	(1)	(2)	2	2
Largest Card Support	Type III+	Type III+	Type III	Type III
Interface	SCSI	RS-232	SCSI	RS-232
Socket Mounting	External	External	Open Frame	Open Frame
V _{CC} Support	5V	5V	5V	5V
V _{PP} Support	12V	12V	12V	12V
Controller Used	Contact Mfg.	Contact Mfg.	Contact Mfg.	Contact Mfg.
Boot Option Support	No	No	No	No
PCMCIA Release	2.1	2.1	2.1	2.1
Price Quantity 10	Contact Mfg.	Contact Mfg.	Contact Mfg.	Contact Mfg.
Bundled Software				
Software Vendor	(3)	(3)	(3)	(3)
Flash File System	(3)	(3)	(3)	(3)

NOTES:

- MS-MCDISK-D1 has two Type III slots, MCDISK-D2 has single Type III+ (14.2 mm) slot, MS-MCDISK-D3 has single Type II slot.
- MS-MCRW-D5 includes real-time clock.
- Card/socket services built in. Contact manufacturer for software information.



PREMAX ELECTRONICS

17702 Mitchell North
Irvine, CA 92174

(Phone) 714/851-8242
(Phone) 714/851-8249
(BBS) 714/851-1527
(Web) www.premax.com

PREMAX	PC-300	PC-260
Card Support		
Series 2	✓	✓
Series 2+	✓	✓
VS100	Contact Mfg.	Contact Mfg.
Miniature Card	Contact Mfg.	Contact Mfg.
Hardware Specifications		
No. Sockets Supported	2	2
Largest Card Support	Type III	Type III
Interface	ISA	ISA
Socket Mounting	Bay	Bay
V _{CC} Support	5V	5V
V _{PP} Support	12V	12V
Controller Used	DB86072	DB86072
Boot Option Support	No	No
PCMCIA Release	2.1	2.1
Price Quantity 10	\$199.00	\$199.00
Bundled Software		
Software Vendor	SystemSoft	SystemSoft
Flash File System	SystemSoft FTL	SystemSoft FTL



QUATECH

662 Wolf Ledges Parkway
Akron, OH 44311

(Phone) 216/434-3154
(Phone) 800/553-1170
(FAX) 216/434-1409
(BBS) 216/434-2481

QUATECH	PCD2-F	PCD2-B
Card Support		
Series 2	✓	✓
Series 2+	✓	✓
VS100	Contact Mfg.	Contact Mfg.
Miniature Card	Contact Mfg.	Contact Mfg.
Hardware Specifications		
No. Sockets Supported	2	2
Largest Card Support	Type III	Type III
Interface	ISA	ISA
Socket Mounting	Bay	ISA Card
V _{CC} Support	5V	5V
V _{PP} Support	12V	12V
Controller Used	82356	82356
Boot Option Support	Yes	Yes
PCMCIA Release	2.1	2.1
Price Quantity 10	\$199.00	\$199.00
Bundled Software		
Software Vendor	SystemSoft	SystemSoft
Flash File System	SystemSoft FTL	SystemSoft FTL



SCM MICRO SYSTEMS

 131 Albright Way #B
 Los Gatos, CA 95030

 (Phone) 408/370-4888
 (Fax) 408/370-4880
 (BBS) 408/370-4881
 (Email) pccard@scmmicro.com
 (Web) www.scmmicro.com

SCM	Lite SBI-C1	Premium Combo SBI-FC1D1	Classic Combo SBI-FD1	Classic SBI-D1	Classic X2 SBI-D2W95	Premium SBI-C1D1
Card Support						
Series 2	✓	✓	✓	✓	✓	✓
Series 2+	✓	✓	✓	✓	✓	✓
VS100	✓	✓	✓	✓	✓	✓
Miniature Card	✓	✓	✓	✓	✓	✓
Hardware Specifications						
No. Sockets Supported	1	2	1	1	2	2
Largest Card Support	III	III	III	III	III	III
Interface	ISA	ISA	ISA	ISA	ISA	ISA
Socket Mounting	(2)	(3)	(4)	Bay	Bay	(6)
V _{CC} Support	5V	5V	5V	5V	5V	5V
V _{PP} Support	12V	12V	12V	12V	12V	12V
Controller Used	Vadem 465	Vadem 365	Vadem 465	Vadem 465	Vadem 469	Vadem 365
Boot Option Support	Yes	Yes	Yes	Yes	No	Yes
PCMCIA Release	2.1	2.1	2.1	2.1	2.1	2.1
Price Quantity 10	\$71.00	\$239.00	\$159.00	\$95.00	\$119.00	\$183.00
Bundled Software						
Software Vendor	SystemSoft ⁽¹⁾	SystemSoft ⁽¹⁾	SystemSoft ⁽¹⁾	SystemSoft ⁽¹⁾	SystemSoft ⁽¹⁾	SystemSoft ⁽¹⁾
Flash File System	SCM FTL	SCM FTL	SCM FTL	SCM FTL	SCM FTL ⁽⁵⁾	SCM FTL

NOTES:

- Operates under DOS, Windows, Windows95, Win NT and OS/2 Warp. SystemSoft Card and Socket Service suite includes versions 3.1 and CardWizard.
- Socket mounted on internal ISA PCB and is accessed at the rear of system.
- One socket is internal on ISA card (rear access). The other socket is bay mount and includes 3.5" floppy drive.
- Socket is bay mounted and includes a 3.5" floppy drive.
- Software includes SwapFTL from SCM Microsystems
- One socket is internal on ISA card (rear access). The other socket is bay mount (w/o floppy).

SCM MICRO SYSTEMS (Continued)

SCM	Classis X2 SBI-D2P	Lite X2 SBI-C2P				
Card Support						
Series 2	✓	✓				
Series 2+	✓	✓				
VS100	✓	✓				
Miniature Card	✓	✓				
Hardware Specifications						
No. Sockets Supported	2	2				
Largest Card Support	III	III				
Interface	ISA	ISA				
Socket Mounting	Bay	ISA Card ⁽³⁾				
V _{CC} Support	5V (3.3V Optional)	5V (3.3V Optional)				
V _{PP} Support	12V	12V				
Controller Used	Vadem 469	Vadem 469				
Boot Option Support	No	No				
PCMCIA Release	2.1	2.1				
Price Quantity 10	\$119.00	\$95.00				
Bundled Software						
Software Vendor	SystemSoft (1)	SystemSoft (1)				
Flash File System	SCM FTL ⁽²⁾	SCM FTL ⁽²⁾				

NOTES:

1. Operates under DOS, Windows, Windows95, Win NT and OS/2 Warp. SystemSoft Card and Socket Service suite includes versions 3.1 and CardWizard.
2. Includes WIZFTL flash support utility.
3. Socket access at rear of ISA card.



STEELE CREEK TECHNOLOGIES

 14035 Appling Lane
 Charlotte, NC 28278

 (Phone) 704/588-1780
 (FAX) 704/588-1780
 (Email) 70372.366@compuserve.com

STEELE CREEK	CL680F	CL682F	CL683F	CL680F-I ⁽²⁾
Card Support				
Series 2	✓	✓	✓	
Series 2+	Contact Mfg.	Contact Mfg.	Contact Mfg.	N/A
VS100	Contact Mfg.	Contact Mfg.	Contact Mfg.	N/A
Miniature Card	Contact Mfg.	Contact Mfg.	Contact Mfg.	N/A
Hardware Specifications				
No. Sockets Supported	1	2	1	N/A
Largest Card Support	II	II	III	N/A
Interface	Parallel	Parallel	Parallel	ISA
Socket Mounting	External	External	External	N/A
V _{CC} Support	5V	5V	5V	N/A
V _{PP} Support	12V	12V	12V	N/A
Controller Used	Proprietary	Proprietary	Proprietary	N/A
Boot Option Support	No	No	No	N/A
PCMCIA Release	Contact Mfg.	Contact Mfg.	Contact Mfg.	N/A
Price Quantity 10	Contact Mfg.	Contact Mfg.	Contact Mfg.	Contact Mfg.
Bundled Software				
Software Vendor	(1)	(1)	(1)	N/A
Flash File System	(1)	(1)	(1)	N/A

NOTES:

1. Manufacturer Socket Services provided. Flash file system (FLASHMGR) supplied by manufacturer, and is provided to copy individual files using the FAT file system format.
2. The CL680F-I in an internal parallel port expansion PCB which will allow parallel PC Card Adapter units to be housed inside a PC case. The interface PCB provides two connector access to the parallel port, both internally as well as externally.

2.0 PCMCIA HISTORY

PC Card Technology began in 1985 with the Japan Electronic Industry Development Association (JEIDA). By 1990, JEIDA had released four specifications.

PCMCIA was formed with an agreement among a group of about 25 companies, including Intel, on the need for memory card standardization. The market need for I/O capabilities within the same form factor in addition to memory cards was later recognized for the mobile computing market. Today, many products embrace the JEIDA /PCMCIA standard including flash memory cards, fax/modems, sound, SCSI, video, LAN adapters, and the list of products continues to grow. JEIDA and PCMCIA continue to set pace with industry trends such as lower voltage and higher performance PC Cards, and has quickly become the preferred interface within the mobile computing and consumer electronic markets. The following brief history will trace the PCMCIA Standard through its various changes.

PCMCIA Standard Release 1.0 (JEIDA 4.0) – June 1990

- Release of 68-pin standard for Type I and Type II PC Memory Cards defined.
- Memory cards only
- Metaformat (CIS) defined

PCMCIA Release 1.0 (JEIDA 4.0) defines a physical 68-pin interface with type I and type II PC Card form factors with a thickness of 3.3 mm and 5.0 mm respectively. This release only supported **memory cards**. I/O support was not introduced until the next revision of the specification.

This release defines the “Metaformat” needed for interoperability and compatibility between PC Cards. The Card Information Structure (CIS) within the Metaformat is stored within a card’s nonvolatile memory space and contains detailed information about the card, including allowable configurations, operating voltage and other items which allow the card to be set up and operate with the correct system resources. In short, the CIS identifies the PC Card to the PCMCIA aware software and helps to configure the hardware controller.

PCMCIA Standard Release 2.0 (JEIDA 4.1) – September 1991

- I/O card support added
- Dual voltage memory card support defined
- CIS enhanced
- XIP support added
- API (Application Programming Interface)

PCMCIA Release 2.0 (JEIDA 4.1) defines an I/O interface for the same 68-pin connector as used by memory cards in Release 1.0. Support for dual-voltage memory cards was added as was the definition for the cards environmental requirements and testing methods. The CIS was enhanced to support newly added features.

Support for eXecute In Place (XIP) was added which allows code to be executed directly from the card rather than copying files to and executing from system memory.

A software application programming interface (API) introduced Socket Services, a software layer which provides a “common interface” to the Host Bus Adapter (HBA). The HBA is the hardware controller which “bridges” the PC Card socket(s) to the host system bus. Socket Services are written to support the HBA and provide a common interface to the application software. Without Socket Services, application programmers would be required to understand and write code for each unique HBA implementation. Socket Services hides the hardware details from the programmer, and provides a common set of functions used to communicate with the hardware.

PCMCIA Standard Release 2.01 and 2.1 (JEIDA 4.2) – November 1992 and July 1993

- ATA specification defined
- Type III card support added
- AIMS specification added
- Card Services specification introduced and enhanced
- Electrical and physical sections of the standard updated
- CIS enhancements made

The ATA Standard describes the operation of mass storage PC Cards utilizing the ANSI AT Attachment for Disk Drives. PC Cards implemented as ATA drives include small form-factor disk drives and flash cards



used to emulate a disk drive. A new card thickness, Type III (10.5 mm) was also defined to accommodate larger PC Card form factors such as rotating media ATA drives.

AIMS (Auto-Indexing Mass Storage) supports functions such as imaging and multimedia. The specification describes the signal interface and register set required by the AIMS card.

Card Services is introduced as an additional software layer above Socket Services to control system resources between multiple PC Cards in a system. Card Services holds a database of all system resources available for assignment and controls such resources to the PC Cards as requested. Card Services is responsible for notifying the client drivers of any card insertion or removals, as well as any other status change events.

The Card and Socket Services specification were enhanced with Release 2.1 (4.2) to form a complete and robust software architecture and API necessary for compatible implementations.

Electrical and physical sections of the standard were also updated within this release. Within the electrical section, pin 58 was change from “RFU” (Reserved for Future Use) to “Reset” and pin 59 was changed from “RFU” to “Wait.” Enhancements were also made to the CIS.

PC Card Standard – February 1995

- Improved CIS compatibility and enhancements including the requirement of a CIS on all PC Cards
- Flash Translation Layer (FTL) Media Storage Format defined
- Low voltage only operation (3.3V) defined
- Hardware DMA defined
- Multiple-function card support
- Industry-standard power management interface (APM)
- CardBus interface

The most recent specification developed by PCMCIA as of the writing of this paper is the *PC Card Standard*. This latest revision adds information to improve PC Card compatibility by requiring a CIS on every PC Card, and by extending the amount of information within the CIS. Guidelines were added to help

developers implement the standard, and define a “common” media storage format such as FTL (Flash Translation Layer) used on flash memory cards.

Low voltage only operation (3.3V) was defined along with a low voltage connector (see Figure 1). Two electrical signals were also redefined, VS1 and VS2. Pin 43 was changed from “RFSH” (input) to VS1 (output), and pin 57 was changed from “RFU” to “VS2” (output).

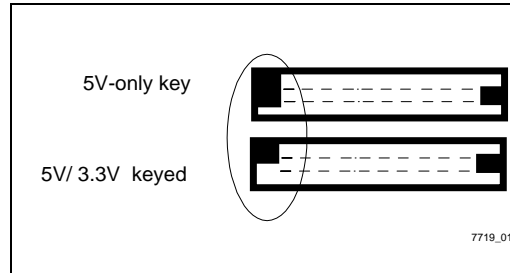


Figure 1. Socket End View

The newly introduced CardBus PC Card Interface provides a high-performance 32-bit-bus master capability while preserving backward compatibility to the 16-bit PC Card architecture. The CardBus PC Card system programming environment extends the existing 16-bit PC Card software model as required to support the new features of the CardBus PC Card. As the CardBus definition is beyond the scope of this document, the reader is referred to the PCMCIA *PC Card Standard* for more information.

Other features such as Hardware DMA, Multi-Function Card Support and the industry-standard Power Management interface (APM) has also been defined within this *PC Card Standard* release. Refer to the *PC Card Standard* for more information on these and other related topics.

3.0 PCMCIA ARCHITECTURE

PCMCIA defines various layers of software support. Embedded systems may require minimal software overhead where a more robust consumer host system may require a larger investment in driver support. PCMCIA encompasses only a portion of the hardware and software interface between the PC Card sockets and the host system. “Higher level” system software is supported outside the realm of the *PC Card Standard*, and is generally supported by system software vendors.

3.1 Hardware and Socket Support

The lowest level within the PCMCIA architecture includes the hardware Host Bus Adapter (HBA) “sockets” and Socket Services software. The HBA “bridges” the host system bus with the PC Card socket(s) while Socket Services provides a standardized interface to communicate between the HBA and higher software drivers. Examples of Socket Service support includes HBA configuration for I/O or memory and socket voltage control. There can be multiple instances of Socket Services for multiple HBA’s in a system.

3.2 Card Services

Card Services resides above Socket Services, and arbitrates PC Card sockets for system resources among multiple clients. “Clients” are drivers or programs that access PC cards via Card Services, and may be resident, transient device drivers, system utilities or application programs. There may be only one Card Services implementation in a host system among many possible Socket Services. Card Services provides access to the hardware through the Socket Services interface, and is intended to be the sole client of all Socket Services present. All Socket Services status reporting is routed to this single Card Services layer, where it is then routed back to the interested client.

The following is an example of what may happen during a card insertion or desertion event:

Example

When a card is inserted into a PC socket, the Host Bus Adapter notifies Card Services (via Socket Services) that a change as occurred. “Client drivers” monitoring insertion events register with Card Services to service the newly inserted card if recognized. If a client is not available, then the newly inserted card may not be supported. After a client driver “registers” itself with Card Services and system resources have been identified, the HBA is configured for the type of card inserted (memory or I/O) via Socket Services. After the HBA is programmed for the newly inserted PC Card, Card and Socket Services perform a different role and are used by the client driver to access the PC Card and monitor card events.

If the HBA detects that the card has been removed or changed, an interrupt is generated that returns Card and Socket services back into the configuration mode to determine the source and type of status change. Card Services then notifies the client driver, and the client then processes the event as necessary.

There are other software models known as “Monolithic” which may not utilize Card and/or Socket Services. These models may interface directly to the hardware and boast a smaller memory footprint, useful in embedded applications where memory is at a premium.

3.3 MTDs

Special programming algorithms may also be required to write or erase “memory devices” such as flash memory cards. Card Services hides such details of what is required to write or erase memory devices (algorithms) from the client drivers through the use of Memory Technology Drivers (MTDs). MTDs may be embedded within, or register with Card Services at run-time. In short, MTDs implement the specific programming algorithms required to access memory devices. When PC Cards are inserted, MTDs monitoring insertion events register with Card Services to support access to a memory device region through the Card Services read, write, copy and erase service routines. Card Services may also provide “default” MTDs that support simple memory accesses without any algorithmic operation. Figure 2 shows a fundamental block diagram of how MTD’s, Card and Socket Services relate with other system software components.

4.0 SERIES 100 MINIATURE CARD

The Intel Series 100 Flash Memory Miniature Card is a simple array of flash devices housed in a small “Miniature Card” form factor measuring only 38 mm × 33 mm × 3.5 mm. The Series 100 Miniature Card may be utilized by PCMCIA PC Card Adapter hardware by using a “PC Card to Miniature Card adapter.” This adapter converts the unique Series 100 Miniature Card pinout and socket style to the standard 68-pin PC Card form factor. Additional information on the Intel Series 100 Flash Memory Miniature Card may be found in the *Series 100 Flash Memory Miniature Card Datasheet*, order number 290581.



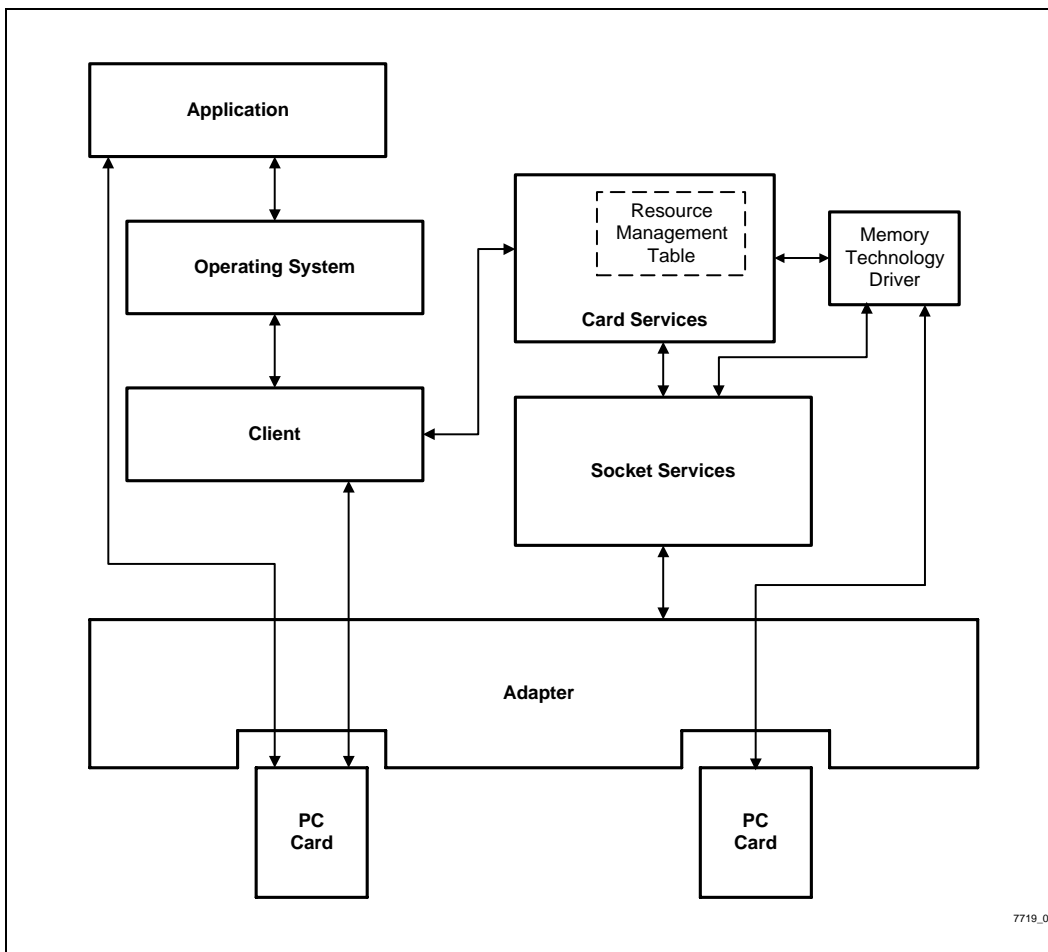


Figure 2. Block Diagram

5.0 SUMMARY

PC Card Adapters enable desktop platforms to utilize PCMCIA “PC Cards.” The PCMCIA software model includes Socket Services, Card Services and Memory Technology Drivers used to interface client applications to PC Cards and control system resources. The intent of this model is to provide a truly “plug and play” environment where PC Cards may be installed on any system with a minimum of user intervention, and freely exchanged without the need to power the system down or terminate software. It is beyond the scope of this document to provide every possible hardware/software scenario, and the reader is advised to review the latest PCMCIA PC Card specification for more information.

PC Card adapters are very useful for developing embedded applications utilizing PC Cards on standard “desktop” platforms. Each PC Card adapter is unique and offers diversity in hardware controllers and interface options. Software and hardware engineers should carefully analyze project requirements and utilize this guide to help provide the proper PC Card adapter as required.

APPENDIX A ADDITIONAL INFORMATION

RELATED INTEL INFORMATION(1,2)

Order Number	Document
297665	<i>Flash File System Selection Guide</i>
290581	<i>Series 100 Flash Memory Miniature Card Datasheet</i>
FaxBack* Document 2235	<i>PC Card Flash Card Software Architecture</i>
Contact Intel/Distribution Sales Office	<i>Understanding the FTL Specification</i>

NOTES:

1. Please call the Intel Literature Center at (800) 548-4725 to request Intel documentation. International customers should contact their local Intel or distribution sales office.
2. Visit Intel's World Wide Web home page at <http://www.Intel.com> for technical documentation and tools.

