Aspen Point of Sale Terminal

Technical Reference

Version 1.2
June 19, 2003

IBM Retail Store Solutions

Please note that not all of the features, functions, etc. are announced in all countries; and references in this document are not an indication that IBM will support these items in the future in every country. Consult with your IBM sales professional for assistance in identifying what is available in your country.

Document Information

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Review and Approval Process

This document will be reviewed, approved, and reissued whenever significant updates have been made. The document owner has approval authority for this document.

Version	Reviewers
V1.0	Kim Wood, Glenn Guy
V1.1	Kim Wood, Glenn Guy
V1.2	Kim Wood, Glenn Guy

Document Distribution and Change Notification

This document is available to all authorized RSS personnel and is located within the integrated project file.

Archival Requirements

None. This document is permanently in use and has no logical end or completion date. Old versions will be replaced and not archived.

Document Availability

The document is stored on the Aspen IPF.

Record Name	Where Kept	How Identified	Retention Period
Review Record.	Lotus notes email or marked up comments		Until next draft released
Approval Record.	Same as notification record	N/A	N/A
Notification Record.	PDT meeting minutes		Life of the IPF

Change History

Changes resulting in document revisions are summarized in this table in reverse chronological sequence. Revision bars (|) will highlight the text changed in the latest version.

Version	Date	Change Description
V1.0	3/25/03	DVT entry level
V1.1	4/17/03	✍ update content on VPD data (definition of type 11 records) ✍ fix mismatch between functional spec and this doc regarding OS levels supported ✍ add P3 memory map ✍ add page numbers
V1.2	6/19/03	misc changes

Related Documents

- Aspen functional spec
- Aspen ASIC spec
- 4694 functional spec
- SurePOS 700 (Yellowstone) functional spec
- I/O devices functional specs
- Industry PC architecture resources
- Vendor datasheets (Intel, etc.)

Overview

This document is a compilation of technical data for the Aspen family of POS terminals. It is written for the technical professional who has a need to understand the internal system and unique software interfaces.

ASPEN is designed to appear to a programmer as a standard PCI plug and play PC equivalent system that has several PCI devices pre-installed in the system. Unique aspects of Aspen are defined in the appropriate vendor datasheets or in this document.

Chipsets

For P3 models:

CPU	Via C3 1.2GHz/133Mhz FSB
Core chipset	Intel 815E northbridge Intel ICH2 southbridge Intel 82562EM Ethernet controller
Keyboard controller	SMSC LPC47M192 I/Ocontroller
AC97 codec	Realtek AL202

For P4 models:

CPU	Value - Intel Celeron (P4 type) 2.0GHz/400 MHz FSB Performance – Intel P4 2.4Ghz/533 MHz FSB
Core chipset	Intel 845GV north bridge Intel ICH4 south bridge Intel 82562EM Ethernet controller
Keyboard controller	SMSC LPC47M192 I/Ocontroller
AC97 codec	Realtek AL202

POS Riser card chipsets:

USB OHCI host controller	Ali M5273
POS interface IC	IBM Retail Store Solutions custom IC

Support/drivers

Note that customers should use drivers from the IBM Retail Store Solutions support web site and not pick up generic drivers from the manufacturer web sites.

IBM retail web site: www.pc.ibm.com/store

then click on "support"

Specific technical details on the chips used in Aspen can be found at the chip manufacturer's respective web sites.

VIA:	www.viatech.com
Intel:	www.intel.com
SMSC:	www.smsc.com
Ali	www.ali.com
Realtek:	www.realtek.com.tw

All of these chips are subject to change as cost and technology changes take place. It is IBM's intention to keep BIOS and I/O driver interfaces compatible where it is possible and technology allows it. Applications that write directly to hardware are not guaranteed to work with all versions of the hardware over time.

OS support

ASPEN is tested and certified (as appropriate) with IBM PCDOS 2000, Red Hat Linux 7.2 (2.4.4. kernel and above), Windows NT4-SP6, 2000 client-SP3, and XP SP1 and XPe. Testing in the IBM lab is performed using Microsoft Windows and Red Hat Linux Hardware Compatibility test suites as well as numerous third party test suites such as Winstone, Winbench, etc.

LAN, comm., and video drivers are tested with PC DOS2000, Red Hat Linux, and Windows NT/2000/XP and follow-ons. IBM uses these drivers "as is" from the component suppliers.

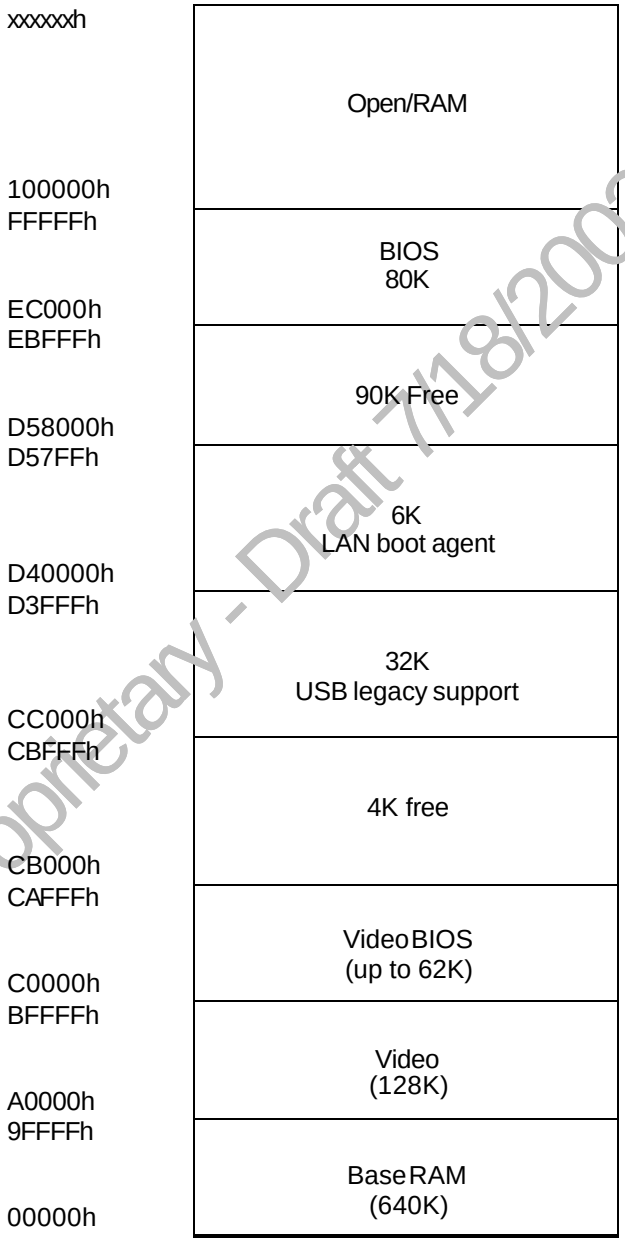
Note that no USB support (either PC or POS) is available for any DOS operating system.

ASPEN includes PXE 2.0 compatible network boot support in the system ROM. Other network boot protocols (such as IBM RPL or Novell) are not supported in ASPEN.

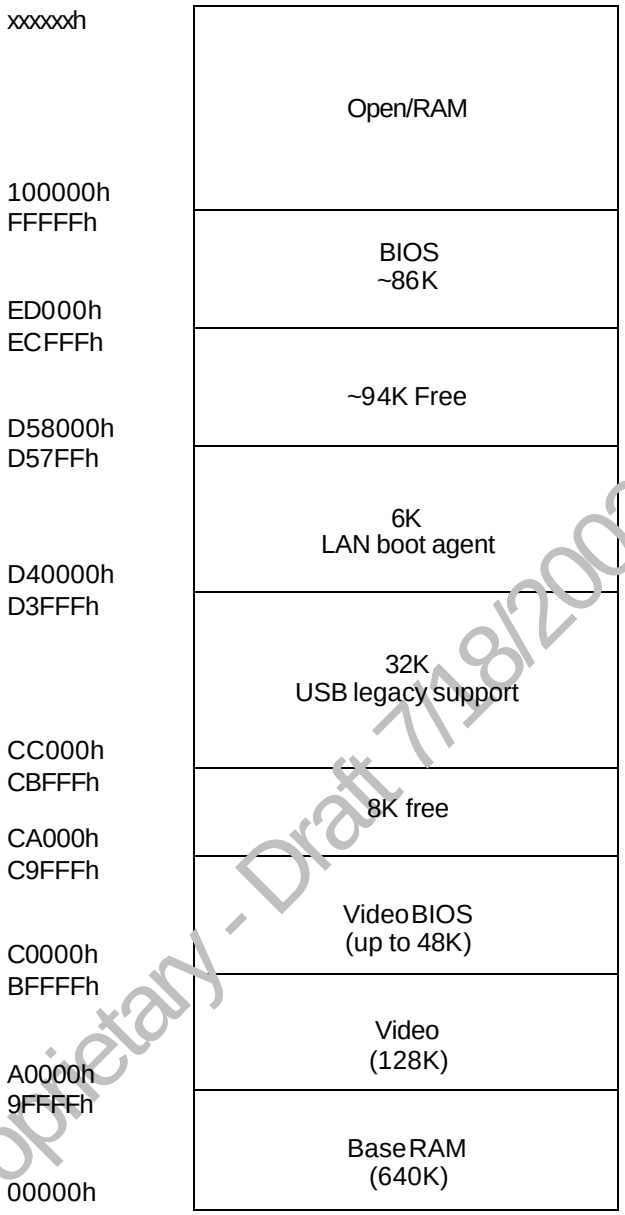
Memory Map

The system BIOS includes all the function calls provided by a PC. It is stored in a flash read only memory located on the planar board. Due to the increased amount of function in the base BIOS, the BIOS occupies much of the 64K segment between E000h and EFFFh (the specific amount varies between different BIOS versions**).**

The system **memory map** for the **P4** based planar is:



P3 memory map



BIOS updating, utility programs, and drivers

ASPEN uses flash memory to store the system BIOS, video BIOS, the LAN boot ROM, and the POS riser card ROM (POSROM). Flash memory has the advantage of permitting the firmware to be updated through software alone. Applying software updates to BIOS is a customer responsibility and is not covered by the IBM warranty or the typical IBM maintenance agreement.

Distribution of software updates, utility programs, news tips, technical info, etc is via the IBM Retail page on the Internet. The address for the site is:

http://www.pc.ibm.com/retail

Follow the support links to the ASPEN page.

All ASPEN utility programs will work with DOS and/or DOS boxes within Windows. If data is not transferred by LAN, customers will typically require either a USB floppy drive, a USB CDROM (if the CDROM is not installed in the unit), or a USB memory key for BIOS updating purposes. If CDROM use is desired, customers may be required to write their own CDROMs. Note that special actions must be performed in order to build a "bootable" CD ROM.

ASPEN utility programs are available that will:

- flash the system ROMs
- automatically configure the system configuration area (by writing CMOS bits based on a file with the correct info)
- Create the CMOS configuration file based on the contents of an ASPEN with the desired configuration information.

Drivers, etc. for ASPEN can also be found on this web site. Installation of drivers and driver updates is a customer responsibility.

While many different portions of the system ROM have their own level, there will be only one overall ROM level. This ROM level will be noted during POST as the IBM POS SYSTEM ROM LEVEL xxKTyyy. .

System configuration/setup

ASPEN contains a program within ROM that allows for both PC and POS options to be configured via a menu interface. Available options are different depending on model, features, and BIOS level. Use of this setup program requires the attachment of a PC compatible video display and keyboard (either USB or PS2 interface). (An alternative to using SETUP at the terminal is to use the utility configuration program described in the ***Utility Programs*** section above.)

RS-232 ports

There are 4 unpowered RS-232 ports. Two unpowered ports are integrated within the south bridge of the chipset, and the other two ports are attached via a dedicated PCI 2 channel async controller located on the riser card.

The RS-232 ports follow the PC 9 pin standard:

- TXD (transmit data, pin 3)
- RXD (receive data, pin 2)
- DSR (data set ready, pin 6)
- DTR (data terminal ready, pin 4);
- RTS (request to send, pin 7);
- CTS (clear to send, pin 8);
- CD (carrier detect, pin 1);
- RI (ring indicate, pin 9);
- Signal ground (pin 5);

The terms “transmit” and “receive” as defined above are viewed from the terminal out to the attached device. (The terminal appears as data terminal equipment or a DTE as defined by the RS-232 specification).

All RS-232 ports are 16550 (FIFO) compatible.

DOS application users must be aware that the PCI architecture prevents assigning the IRQ levels from these ports to different dedicated IRQ levels. Some old DOS applications depend on RS-232 ports being allocated to specific IRQ levels. This is not possible in the PCI architecture.

PC Printer port

All models have a bidirectional parallel printer port capable of working in EPP, ECP, or standard printer port mode.

Power Supply

(internal, not UPS)

Input Voltage	100-127VAC or 200-240VAC nominal universal input (no voltage selector switch)
Frequency	47-63 Hz
Power consumption	60W typical, 200W max.

AC Loads – internal power supply

None

DC Loads

Each port has a maximum continuous rating. There is also a total maximum rating from a combination of all ports.

24V printer ports	3.0A
38V printer ports	2.1A
24V/38V cash drawer ports	1.0A 150mS pulse
12V ports (RS-485)	1.0A/port
12V port (USB)	1.5A/port
5V RS-485	1.0A/port
5V PS2 keyboard/mouse	0.5A/port
5V in all USB ports	0.5A/port

Total 12V current available for all external loads is 5A max. Total 5V current available for all external loads is 5A max.

For systems with 38V and 24V printer ports, printers cannot be attached to both ports in the system at the same time.

Only one cash drawer may be activated at any instance in time.

UPS option

Note: The UPS is NOT AUTORANGING. Different units are required for low and high voltage countries. They are not convertible from one voltage range to the other.

Input

Input voltage	100-127 VAC OR 200-240 VAC
Input frequency ranges	Autosense 50 Hz +/- 3 Hz 60 Hz +/- 3 Hz

Output

Capacity	500VA/300W
Run Time	2.5 minutes minimum at full rated load
Output voltage in battery mode	113.5VAC +/-10% for low range; 220.0VAC +/-10% for high range.
Output voltage waveform	Stepped approximation to sine wave
Frequency (inverter output)	60 Hz +/- 3 Hz for line frequency > 55Hz 50 Hz +/- 3 Hz for line frequency < 55 Hz
Transfer time	<8ms typical, 10ms max, AC to battery

Batteries

Battery recharge time	8 hours typical, 16 hours maximum
Battery type	Sealed and leak-proof maintenance-free lead-acid with suspended electrolyte

Physical

Input socket	1 IEC 320 male
Number and type of output sockets	3 IEC 320 female (all 3 backed up)

Interface, Controls, and Indicators

Interface Port	Female DB-9 RS232

Note that the battery used in the UPS is a sealed lead acid battery. These batteries have a finite life and must be replaced on a regular basis (typically 1-3 years) in order for full standby capability to be maintained.

UPS interface

IBM RS232 Pin Assignments / Signal Levels

Signal Name	Status	UPS DB9 Pin No	Signal level [3]	Remark
On Battery	AC Normal	8 & 9 (CTS & RI)	GND or Negative	
	AC Fail		Positive	
Low Battery	Battery Normal	1 & 2 (CD &TXD)	GND	
	Battery Low		Positive	
Enable/Disable DC (Battery) Mode [1]	Enable DC Mode	4 & 6 (DTR &DSR)	Negative	Battery Mode enabled; negative level is present with an active RS232 interface
	Disable DC Mode		GND or Positive	Battery Mode disabled approx. 5 seconds after AC loss
2-position DIP switch [2]	Standalone Mode (DEFAULT)	Not applicable	Both positions OFF	Does not require active RS232 connection to enter Battery Mode
	Normal Mode		Both positions ON	Polarity of pins 4 & 6 determine whether unit is allowed to enter Battery Mode
Power for interface [4]		7 (RTS)		Active RS232 connection provides +12V
		3		No Connect (N/C)

UPS interface notes:

[1] When an active RS232 interface is present, this signal line is driven negative and the unit is allowed to enter Battery Mode upon AC loss. Conversely, the unit cannot enter battery mode if this signal line is at ground potential or driven positive when the settings for the DIP switch are for NORMAL mode.

[2] The DIP switch is a customer-accessible SELV switch pair located at the front panel which allows the UPS to be used as a standalone unit for which the ability to enter Battery Mode is not dependent on the presence of an active RS232 connection. With the DIP switch selected for "Standalone" operation by the user, Battery Mode is enabled even when there is no active RS232 connection from the POS terminal. Note that the DIP switch does not affect the function of Pins 1/2 and 8/9; i.e. even when the DIP switches are set for the "Standalone" position, the AC Fail and Low Battery signals still function properly.

[3] RS232 levels are the same as their binary equivalents. A positive signal will be presented to the software as a "1", while a zero or negative signal will be presented to the software as a "0".

[4] Unless the COM port connected to the interface is active (with RTS asserted), the definitions/functions of the other bits are undefined. Operation of the UPS will be the same as standalone mode.

DEFINITIONS:

Normal Mode: prevents the UPS from switching to battery if the POS terminal is powered off. This mode is intended to extend the life of the battery in stores where primary AC power is periodically removed, usually at the end of the day. This mode requires that a cable be attached between the UPS and the POS terminal for proper UPS operation.

Standalone Mode: in this mode the UPS ignores presence or absence of an active RS232 connection and always switches to battery if AC power is lost. This mode allows the UPS to operate in DC Mode without an RS232 connection to the POS terminal, similar to what would be the case with an off-the-shelf UPS in today's market.

Physical Characteristics

Mechanical

	Large	Large with UPS	Small
Width	442mm 17.4”	442mm 17.4”	320mm 12.6”
Depth	475mm 18.7”	475mm 18.7”	475mm 18.7”
Height	116mm 4.6”	116mm 4.6”	116mm 4.6”
Weight	11.8 kg 26 lbs	17.7 kg 39 lbs	10 kg 22 lbs

Cooling is provided via forced air cooling by a fan contained in the power supply. **Air vents must not be blocked and the vents must have 2” of clearance from cabinet walls, trash cans, papers, etc.**

Normal service access conditions for cable routing, attachment, etc. apply to the rear of the unit. The front of the unit must be accessible to the customer so that the power switch can be used.

Machine type/model, serial number, safety/regulatory labels, etc. are located on a label on the bottom of the unit. Machine type/model and serial number are also located behind the front door.

Environmental

- Gaseous- IBM Class G1
- Particulate- IBM Class P1
- Vibration and Shock- IBM Class V2
- Acoustical Levels- IBM Class 2C

Temperature

- Operating: +10^{0}C to 40^{0}C with 8% to 80% relative Humidity
- Shipping: -40^{0}C to +60^{0}C
- Storage: 0^{0}C to +60^{0}C.

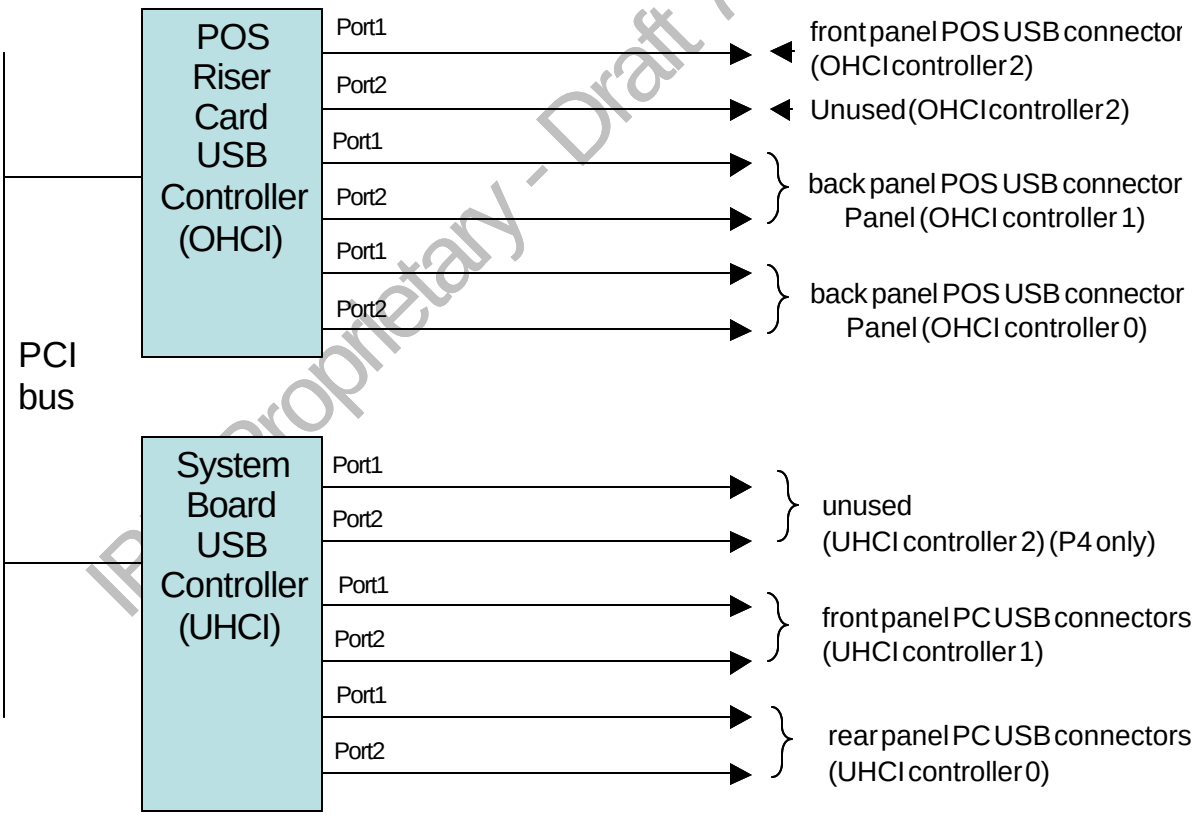
Electromagnetic Compatibility (EMC)

- EMI radiated/conducted (USA/Canada) - FCC/DOC Class A
- EMI radiated (EMEA) - EC CE mark (meets CISPR-22A emission limits)
- EMI conducted (EMEA) - meets CISPR-22B emission limits
- EMI radiated/conducted (Japan) - Japan VCCI Class 1
- EMI radiated/conducted (Korea) - Korea MOC Class A
- ESD Class 2 (reference IBM C-S 2-0001-005) (similar to EN61000-4-2)

POS unique functions – software interface

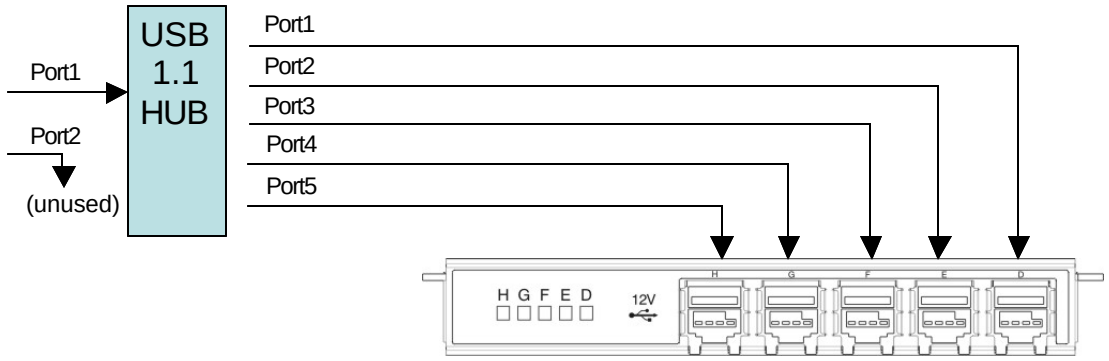
From a programmer point of view, ASPEN appears as a PCI based PC system unit with the usual PC peripherals. Most of this POS unique function is packaged on the PCI riser card. POS unique function that is provided in the system unit:

- A unique motherboard that implements the ATX riser architecture for the POS riser card
- 2 PCI feature card slots
- 128K of NVRAM
- a ROM that hooks the system ROM during POST to provide additional function and information
- an interface to the RS-485 subsystem, if the system is equipped with RS-485 ports.. This interface is similar, but not the same as the 4694. IBM provided drivers and operating systems isolate these changes from the application.
- An interface to the POS USB subsystem. This interface is similar, but not the same as existing SurePOS 700 units. IBM provided drivers and operating systems isolate these changes from the application.

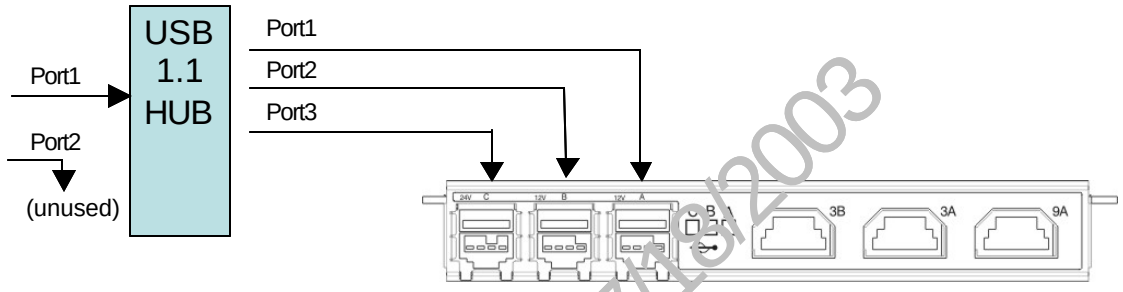


SurePOS 700 72x/74x/78x POS USB port configuration

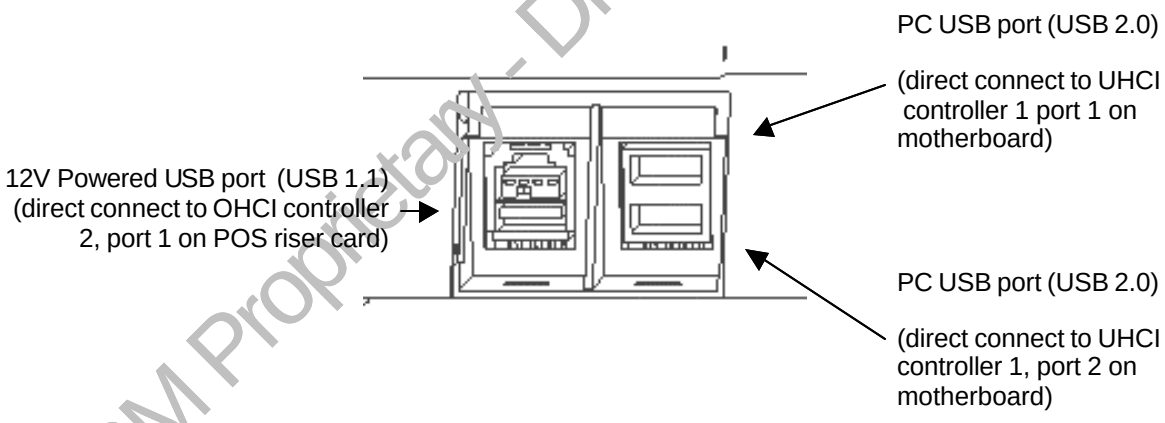
All USB connector card



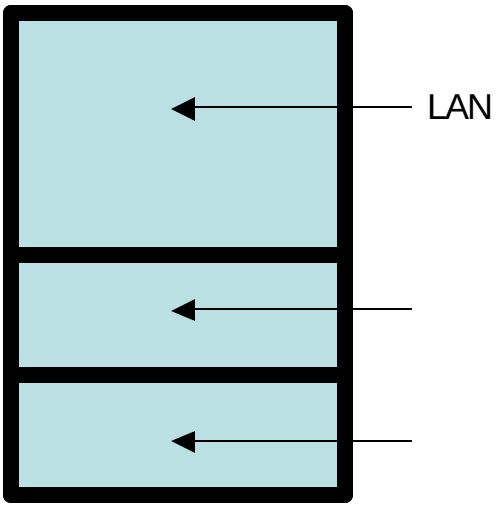
USB/SIO/cash drawer card



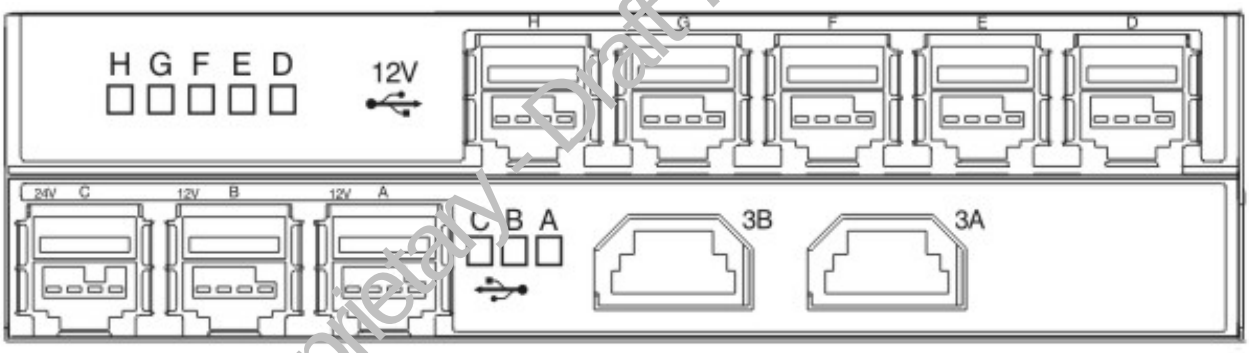
NOTE: noassumptionshouldbemadeastowhichOHCIcontroller(0or1)isconnectedtowhichbackpanel



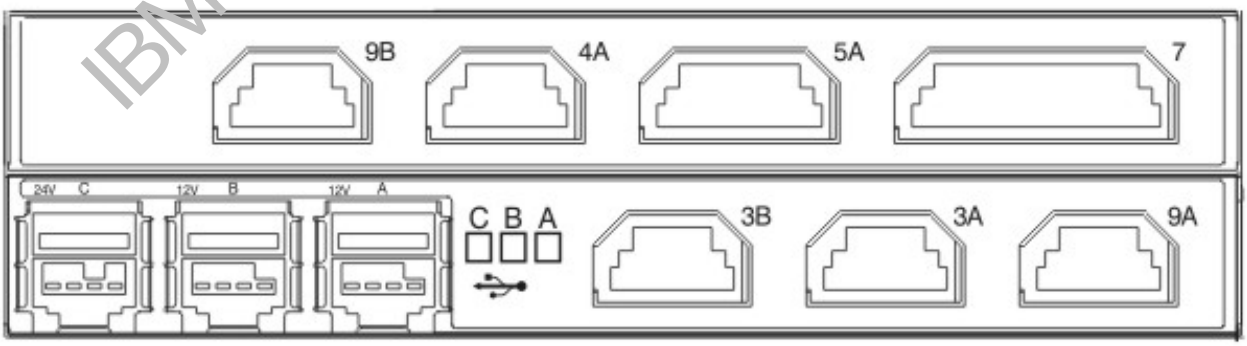
SurePOS 700 74x/78x front panel USB port configuration



SurePOS 700 72X/74x/78x rear panel LAN/USB connector
USB port configuration



USB tailgate detail



SIO tailgate detail

Vital Product Data

Vital product data in Aspen will stored in SMBIOS data structures. Those VPD attributes that are predefined in SMBIOS, will be stored as defined in the SMBIOS specification. The table defines the specific unique Aspen information that is available, along with responsibilities for creation, etc.

ALL OS, driver, application usage of this data must be via the SMBIOS calls defined in the SMBIOS specification.

Data field	Data source	Primary data storage area	SMBIOS build source	SMBIOS record type	Data type	Field length	Starting address
Machine type/model (1)	Box manufacturing	Riser card EEROM	Option ROM during POST	1	ASCII string	7	05h
System serial number (2)	Box manufacturing	Riser card EEROM	Option ROM during POST	1	ASCII string	7	07h
System build date	Box manufacturing	Riser card EEPROM	Option ROM during POST	11 (5)	ASCII string	6	05h
Motherboard revision level	Motherboard manufacturing	Motherboard EEPROM	Option ROM during POST	2	ASCII string	2	06h
BIOS level (4)	BIOS	Motherboard system ROM	System ROM during POST	0	ASCII string	7	05h
LAN MAC address	Box manufacturing	Motherboard EEROM	System ROM during POST	1	Binary string	6	12h
UPS installed (2)	User via riser card setup screen	Riser card EEROM	Option ROM during POST	11 (5)	ASCII string	11	0Ch
Footprint type (2)	User via riser card setup screen	Riser card EEROM	Option ROM during POST	11 (5)	ASCII string	15	18h
Cash Drawer Voltage	Riser card source code	None	Option ROM during POST	11 (5)	ASCII string	19	3Bh
Riser code level	Riser card source code	Riser card code ROM	Option ROM during POST	11 (5)	ASCII string	4	4Fh
Riser code board level	Riser card source code	Riser card EEROM	Option ROM during POST	11 (5)	ASCII string	6	55h

Data field	Data source	Primary data storage area	SMBIOS build source	SMBIOS record type	Data type	Field length	Starting address
Connector panel configuration	Connector panel manufacturing	Connector card EEROM	Option ROM during POST	11 (5)	ASCII strings	See type11 table	35h

Aspen VPD table notes:

- no data strings have dashes, embedded spaces, etc.
- all ASCII data fields of fixed length are padded right with spaces if required
- Date fields are in the format mmddyy unless otherwise noted

Note 1 Machine type model is one of three values:
4800 – 72X
4800 – 74X
4800 – 78X

Note 2 Diagnostics must allow/require for CE to update this field if riser card is replaced.

Note 3 See connector card data structure specification

Note 4 Format is: XXKTZZZ
where:
XX = 80 for P3 planar
81 for P4 planar
ZZZ = numeric string from 100 to 999 indicating BIOS level.

Note 5 **OEM type 11 is SMBIOS data structure definition:**

Offset	Name	Length	Value	Description
00h	Type	1 byte	11h	OEM strings indicator
01h	Length	1 byte	05h	Length of structure
02h	Handle	1 word		
04h	Count	1 byte	varies	Number of strings in this structure
05h	System build date	25 bytes	varies	System build date (mmddyy) programmed by factory, "000000" means field updated part "System Build Date: 101003"
1Fh	UPS Installed	11 bytes	varies	"UPS Present" or "No UPS "
2Bh	Footprint Type	15 bytes	varies	"Small Footprint" or "Large Footprint"
3B	Cash Drawer Voltage	19 bytes	varies	Reflects cash drawer voltage and automatic/hardwired jumper setting. One of: "CD Voltage: Auto/24" "CD Voltage: Auto/38" "CD Voltage: Hard/24" "CD Voltage: Hard/38"
4Fh	Riser code level	5 bytes	varies	Riser card ROM level
55h	Riser card version	6 bytes	varies	Riser card type/EC level
5Ch	Connector panel 0 description	varies, max of 127 bytes	varies	Describes the lower connector panel (see connector panel data structure definition)
DCh	Connector panel 1 description	varies, max of 127 bytes	varies	Describes the upper connector panel (see connector panel data structure definition)

The latest version of the SMBIOS spec can be found at

http://www.dmtf.org/standards/bios.php or the reader should go to the DMTF homepage at http://www.dmtf.org

Connector card data structure

Each I/O connector memory area is structured as follows:

Byte offset	Length	contents	definition
00h	2	DBDBh	Starting header (required)
02h	2	Varies	Board type (ASCII string….A0 – Z9) DO NOT USE THIS FIELD TO DETERMINE CONNECTOR CONTENT AND STRUCTURE
04h	1	Varies	binary count of number of connectors
05h	# of connectors x 8 bytes/ connector	Varies	Unique connector info
# of connectors x 8 + 05h	1	Varies	Length of ASCII string that follows
# of connectors x 8 + 06h	Determined by value above	Varies	ASCII string that defines connector panel type…free form data (typically contain 1-2 characters that define the panel…01, 02, etc.)

Each connector entry is 8 bytes long, currently only 2 bytes are defined. The remaining bytes are undefined and will be set to 00h. The structure of each field is defined below:

Byte offset	length	contents	Definition
00h	1	varies	Connector type 01h = SIO 02h = PC USB 03h = POS USB 04h = cash drawer 05h = RS232 06h = audio FFh = custom, details in ASCII string field for connector card
01h	1		Specific connector type (see table)
02h-07h	6	00h	Currentlyundefined

Connector type definition (byte offset 1 in connector definition)
Note that FFh in any position implies a unique connector, detail info is contained in the ASCII text field.

for SIO:

- 00h = “4A” (12V display)
- 01h = “4B” (12V display)
- 02h = “5A” (keyboard)
- 03h = “5B” (keyboard)
- 04h = “9” (12V display, scanner, etc.)
- 05h = “7” 38V printer port
- 06h = “7” 24V printer port
- 07h = “17” scanner port

for PC USB:

- 00h = standard PC USB 1.1
- 01h = standard PC USB 2.0

for POS USB:

- 00h = POS USB 1.1 12V
- 01h = POS USB 1.1 24V
- 02h = POS USB 2.0 12V
- 03h = POS USB 2.0 24V

for cash drawer:

- 00h = standard IBM cash drawer port (auto volt select)
- 01h = RJ45 type 24V cash drawer port

for RS232:

- 00h = 9 pin D (standard PC pinout)
- 01h = 15 pin D (unpowered)
- 02h = 15 pin D (12V power only…IBM POS pinout)
- 03h = 15 pin D (5V power only…IBM POS pinout)
- 04h = 15 pin D (12V and 5V power…IBM POS pinout)
- 05h = 15 pin D powered with custom pinout/voltage (details in ASCII field)
- 06h = 25 pin D

for audio:

- 00h = mic in
- 01h = line in
- 02h = line out
- 03h = line/headphone out
- 04h = speaker out

Riser card option EEROM data structure

Aspen contains a riser card where the bulk of POS I/O function is located. Also on this card is an EEROM that contains many default values used by the system as well as unique manufacturing data stored at the time of manufacture. Access to this EEROM is via the Aspen ASIC (see the documentation for details on how to access this data).

Below is a memory map of the EEPROM. Note that this data is subject to change at any time. **As noted earlier, only SMBIOS data structures should be used by software to query Aspen data.**

offset	length	type	**function**
000h	0Bh	binary	**ASIC defaults**
00Bh	04h	ASCIII string	**Machine type ('4800')**
00Fh	03h	ASCII string	**Model**
012h	07h	ASCII string	**System serial number (format is xxyyyyy, ie 4512345)**
019h	06h	ASCII string	**System build date**
01Fh	02h	Word	**UPS status (bit 4 =1 if installed), footprint type (bits 3-0)** **0000 = small** **0001 = large** **(Bits 15-5 currently reserved, set to 0)**
021h	06h	ASCII string	**Riser card PCB level**
027h	1C8h		Free…filled with 0's
01EFh	10h	binary	**Mfg unique data**
01FFh	**01h**	**binary**	**Checksum**

Aspen riser card

Aspen contains a riser card that provides the circuitry for much of the POS function, as well as providing two PCI feature slots.

Functions of the riser card:

- 2 PCI 2.2 (entry) or PCI 2.3 (mid/high) compatible 32 bit feature card slots
- OHCI compatible 6 port USB host controller for interfacing with the POS USB ports
- SIO subsystem for SIO based POS devices
- 128K bytes of NVRAM
- configuration EEPROM
- dump switch support

A custom IC (Aspen ASIC) is located on this card, and is used for interfacing with NVRAM, SIO, and dump switch logic. Details of the chip are provided in the Aspen ASIC specification.

Aspen riser card block diagram: