Technote 1105

AppleVision Displays

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CONTENTS

This Technote describes some of the design features and characteristics of the AppleVision series of displays. It outlines information that is of interest to developers who may want to create cards and drivers for use with the AppleVision 1710, 1710AV, 850 and 850AV displays.

In October 1997, this Technote was revised to include information about the AppleVision 750 and 750 AV displays.

Guidelines for Card Developers

AppleVision displays support a number of possible resolutions and timing modes varying across a range of settings (rather than a discrete selection of modes and resolutions). As such, developers of display cards and drivers intending to be compatible with AppleVision monitors must adhere to the guidelines for implementing the `cscGetConnection` and `cscGetModeTiming` calls as documented in Chapter 11 of *Designing PCI Cards and Drivers* .

In general, software that adheres to the guidelines specified in *Designing PCI Cards and Drivers* (aka "Cards and Drivers") will be compatible with AppleVision displays. Guidelines of particular importance for compatibility with AppleVision displays are discussed below.

Never Cache Sense Codes

AppleVision monitors support the type 6 extended sense codes as described in the HW 30 - Sense Lines technote and on page 1-5 of the Display Device Driver Guide. In reading these sense codes from AppleVision displays, software should provide special support for the `cscGetConnection` call. Here, developers should always return the current sense information read from the display. This information should never be cached as it may be changed by the Display Manager over the ADB connection at any time--the sense information must be read on every call to `cscGetConnection`.

Report All Available Timing Modes

Video drivers should always report all of the timing modes that are supported by their graphics card including those timing modes supported by the card that are not apparently valid for the connected display. The Display Manager will calculate the intersection of the modes supported by the video driver and the modes supported by the display to determine the actual set of possible display modes.

Other Guidelines

- You do not need to add new functional `sResources`.
- Some drivers use the `kAllModesValid` or `kAllModesSafe` calls from `scsGetConnection`, rather than implementing `cscGetModeTiming` for all timings. If you add a group of invalid modes, you should not mark them as valid in the `cscGetConnection` call.
- If your video card supports additional standard timings that do not have constants in `Video.h`, contact Apple Developer Support at devsupport@apple.com.
- Support tagging. Tagging is part of the `cscGetConnection` call. It is documented in Chapter 11 of *Designing PCI Cards and Drivers* .
- Trim duplicate timings. If your card has different display modes with the same timing and same number of pixels, you should trim all but one of the display modes for each timing mode.
- Trim display modes that your hardware cannot support. For example, if your video card does not have enough VRAM to support a display mode, trim that display mode rather than marking it invalid. Such a display mode is not one that you would want an AppleVision display to enable.
- Implement `cscGetConnection` and `cscGetModeTiming` for all timing modes. You should mark any timing mode that is not supported by the sense code as invalid and unsafe. When you do this, the display may override the decision.
- Allow the display to switch to invalid timing modes. Some invalid timing modes may be validated by the display, and you should allow the switch, even though you may be unaware of their validity.
- If you do not recognize a sense code, mark all timing modes invalid and program the hardware with the Apple 13" timing modes. This allows a smart display to come in as an unknown timing mode and enable the modes it supports.
- If possible, framebuffer card vendors should test a configuration with two of their cards (in addition to built-in video and any other framebuffers) and at least one AppleVision display in that configuration. The AppleVision display must be driven by one of their two cards. They should be sure that Monitors and Sound correctly associates the AppleVision display with the correct video card and that the appropriate timings are available in the resolution panel (as opposed to just 640x480 @ 67 Hz).
- When AppleVision displays are first powered up they always return the RGB 13" Type 6 sense code. Video drivers should avoid switching resolutions at any time during the boot process (even if the sense code appears to be invalid). The Display Manager will tell the video driver to switch to the correct mode at Finder launch time.

NuBus Guidelines

- If your video card is intended to work on systems that were released before the Display Manager was introduced, you need to check for the Display Manager before enabling invalid timings. Otherwise, the user will see the invalid timings in the Monitors control panel.
- Do not trim invalid functional sResources. If your video card does not have a programmable ROM, you will need to put the trimmed sResources back in when you patch your driver. These timing modes may be enabled by the display.

  See Also: the "Graphics Drivers" chapter in *Designing PCI Cards and Drivers*.

Available Display Modes

This section discusses information regarding the resolution, timing, and operational modes available for AppleVision displays.

Screen Resolutions

AppleVision 750 displays are adjusted at the factory for the following standard modes:

Mode	Pixel Resolution	Vertical Refresh	Horizontal Scan
VGA	640 x 480	60 Hz	31.5 kHz
Macintosh	640 x 480	66.67 Hz	34.97 kHz
VESA	800 x 600	60.31 Hz	37.9 kHz
VESA	800 x 600	75 Hz	46.9 kHz
Macintosh	832 x 624	74.55 Hz	49.7 kHz
Macintosh	1024 x 768	74.93 Hz	60.24 kHz
Macintosh	1152 x 870	75 Hz	68.7 kHz
VESA	1024 x 768	60 Hz	48.4 kHz
VESA	1280 x 1024	60 Hz	64.3 kHz
VESA	1280 x 1024	75.03 Hz	79.98 kHz

AppleVision 850 displays are adjusted at the factory for the following standard modes:

Mode	Pixel Resolution	Vertical Refresh	Horizontal Scan
VGA	640 x 480	60 Hz	31.469 kHz
Macintosh	640 x 480	67 Hz	35.036 kHz
VESA	640 x 480	72 Hz	37.861 kHz
VESA	640 x 480	75 Hz	37.500 kHz
VESA	640 x 480	85 Hz	43.269 kHz
VESA	800 x 600	56 Hz	35.160 kHz
VESA	800 x 600	60 Hz	37.879 kHz
VESA	800 x 600	72 Hz	48.077 kHz
VESA	800 x 600	75 Hz	46.875 kHz
VESA	800 x 600	85 Hz	53.674 kHz

Macintosh	832 x 624	75 Hz	49.700 kHz
IBM	1024 x 768	87 Hz interlaced	35.522 kHz interlaced
VESA	1024 x 768	60 Hz	48.363 kHz
VESA	1024 x 768	70 Hz	56.476 kHz
VESA	1024 x 768	75 Hz	60.023 kHz
VESA	1024 x 768	85 Hz	68.677 kHz
Macintosh	1152 x 870	75 Hz	68.700 kHz
VESA	1280 x 1024	75 Hz	79.976 kHz
VESA	1280 x 1024	85 Hz	91.146 kHz
VESA	1600 x 1200	75 Hz	93.750 kHz

AppleVision 1710 displays are adjusted at the factory for the following standard modes:

Mode	Pixel Resolution	Vertical Refresh	Horizontal Scan
VGA	640 x 480	60 Hz	31.5 kHz
Macintosh	640 x 480	66.67 Hz	34.97 kHz
VESA	800 x 600	60 Hz	37.9 kHz
VESA	800 x 600	75 Hz	46.9 kHz
Macintosh	832 x 624	74.55 Hz	49.700 kHz
Macintosh	1024 x 768	74.93 Hz	60.24 kHz
VESA	1024 x 768	60 Hz	48.4 kHz
VESA	1280 x 1024	60 Hz	64.3 kHz
VESA	1280 x 1024	75.03 Hz	79.98 kHz

Note:
AppleVision displays are not limited to the modes described by the above table: these new displays support any possible resolution that falls within the given timing range (see below).

Timing Modes

AppleVision displays are not limited to the timing modes listed in the above table. AppleVision 850 displays will synchronize over timing ranges 48-120 Hz for vertical refresh, and 30-94 kHz for horizontal scan; and, AppleVision 1710 and 750 displays will synchronize over timing ranges 40-120 Hz for vertical refresh, and 30-80 kHz for horizontal scan.

Operating Modes

AppleVision displays have a feature that allows them to work in two different modes, depending on whether or not the AppleVision software is present. These modes are Remote and Local.

When the display is first powered up, it is in Local mode. If it is connected to a PC-compatible computer, it remains in Local mode. If it is connected to a Macintosh computer, but the Macintosh AppleVision software is not installed, it also remains in Local mode. If the display is connected to a Macintosh computer with the AppleVision software installed, the software puts the display into Remote mode by sending a series of ADB messages to the display. The display then remains in Remote mode.

In Local mode, the computer does not control the display. When the user presses control buttons on the front

of the display, the display handles these actions and makes the required changes to its settings. In addition, when one of the video front panel buttons is pressed, the on-screen display (OSD) appears to provide visual feedback on the changes being made.

Remote mode allows the Monitors and Sound control panel to control the settings of the display. In addition, the OSD does not appear on the screen. Instead, when any front panel buttons are pressed, the information about which button was pressed is sent to the Macintosh over the ADB cable. The Display Manager sends instructions to the display for changing its settings.

Display Data Channel (DDC) Support

The AppleVision 1710, 750 and 850 displays implement both DDC1 and DDC2B standards (for cross platform compatibility) through a scheme compatible with the older Macintosh sense-code-detection mechanism as described in the following documents:

Technote HW08, "Color Monitor Connections"

Technote HW30, "Sense Lines"

Further information regarding the DDC standard is available from:

Video Electronics and Standards Association (VESA)
2150 North First Street, Suite 440
San Jose, CA. 95131-2029
Phone: (408) 435-0333
Fax: (408)435-8225
<http://www.vesa.org>
ftp.vesa.org

Operational Requirements

This section provides information regarding environmental and power requirements for operation of an AppleVision monitor.

AppleVision 750 Environmental and Power Requirements

Temperature	10° to 40° C (50° to 104° F) -- operating 0° to 60° C (32° to 140° F) -- storage -40° to 60° C (-4° to 140° F) -- shipping
Relative humidity	10% to 80% non condensing -- operating 5% to 90% non condensing -- storage 5% to 90% non condensing -- shipping
Operating altitude	0 to 10,000 feet (0 to 3048 meters)
Shipping altitude	0 to 35,000 feet (0 to 10,670 meters)
AC input range	100-240 volts AC, auto select
AC input Frequency range	50-60 Hz, single phase

AppleVision 850 Environmental and Power Requirements

Temperature	10° to 40° C (50° to 104° F) -- operating 0° to 60° C (32° to 140° F) -- storage -40° to 60° C (-4° to 140° F) -- shipping
Relative humidity	20% to 95% non condensing -- operating 5% to 95% non condensing -- storage 5% to 95% non condensing -- shipping
Operating altitude	0 to 10,000 feet (0 to 3048 meters)
Shipping altitude	0 to 35,000 feet (0 to 10,670 meters)
AC input range	90-264 volts AC, auto select
AC input Frequency range	47-63 Hz, single phase

AppleVision 1710 Environmental and Power Requirements

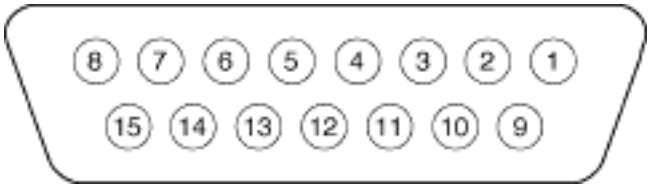
Temperature	10° to 40° C (50° to 104° F) -- operating 0° to 60° C (32° to 140° F) -- storage -40° to 60° C (-4° to 140° F) -- shipping
Relative humidity	10% to 80% non condensing -- operating 5% to 90% non condensing -- storage 5% to 95% non condensing -- shipping
Operating altitude	0 to 10,000 feet (0 to 3048 meters)
Shipping altitude	0 to 35,000 feet (0 to 10,670 meters)
AC input range	90-264 volts AC, auto select
AC input Frequency range	47-63 Hz, single phase

Hardware Interfaces

This section describes the hardware interface for the AppleVision 1710, 750 and 850 Displays. Both displays provide an interface for the video connector and the ADB ports and connector. The AppleVision 1710AV, 750AV and 850AV displays also provide an interface for the sound input port and the sound output port.

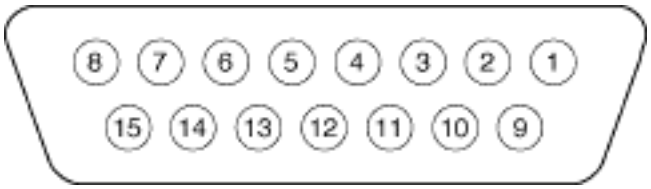
Video Port and Connector

The video port connection is made through a standard DB-15 connector. AppleVision 850, 750 and 1710 displays define pin 8 in different ways as shown in the following tables:



AppleVision 850 Connector Pin Assignments

Pin	Output Signal	Pin	Output Signal
1	Red video ground	9	Blue video
2	Red video	10	ID 3 or DDC SDA
3	Not used	11	Vertical Sync return
4	ID 1 or DDC return	12	Vertical Sync
5	Green video	13	Blue video ground
6	Green video ground	14	Horizontal Sync return
7	ID 2 or DDC SCL	15	Horizontal Sync
8	DDC 5V	Shell	Shield ground



AppleVision 1710 and 750 Connector Pin Assignments

Pin	Output Signal	Pin	Output Signal
1	Red video ground	9	Blue video
2	Red video	10	ID 3 or DDC SDA
3	Not used	11	Vertical Sync return
4	ID 1 or DDC return	12	Vertical Sync
5	Green video	13	Blue video ground
6	Green video ground	14	Horizontal Sync return
7	ID 2 or DDC SCL	15	Horizontal Sync
8	Not Used	Shell	Shield ground

Abbreviations used in the above tables:

- ID -- Identification
- DDC -- Display Data Channel
- SCL -- Serial Clock
- SDA -- Serial Data

Note:
In the past, graphics drivers sensed the type of display attached to the video card by means of three sense lines on the video cable (ID 1, ID 2, and ID 3). These lines were encoded to produce a hardware sense code algorithm. This has changed for AppleVision displays and while the display is operating in local mode, these sense lines may return different sense codes depending on the display's current resolution and timing configuration.

ADB Port and Connector

The ADB port is only used in conjunction with Mac OS compatible computers and provides facilities for

operation of the display in the remote operating mode allowing for software configuration of the display over the ADB connection. The ADB connection is used to transfer both audio and video control data between the Mac OS compatible computer and the display. The AppleVision 1710, 750 and the 850 displays have an ADB port on both side panels. These ports allow you to connect a mouse or keyboard directly to the display.

ADB Connector Pin Assignments

Pin	Signal Name	Description
1	ADB	Bidirectional data bus for input and output; transfers audio (AV display only) and video control data between the CPU and the display
2	POWER ON	Enables power to be turned on from the keyboard
3	+5VDC	+5 V power
4	GND	Logic Ground
Shield	None	Chassis Ground

Note:
For multiple monitor support, a shielded ADB splitter (part number 590-0448) is available.

Sound Ports and Adapter

The sound ports are found only on the AppleVision 1710AV, 750AV and on the 850AV Displays. The sound output port is used for headphones or external speakers. The sound input port accepts sound inputs from a microphone or any appropriate sound source. These ports are both stereo ports, but they use single ministereo audio connectors. You must make sure that the connector you use for audio input or output is compatible with your sound equipment. For example, if you are connecting to a device that uses dual (RCA-type) connectors for stereo sound, use a "Y" adapter to connect the stereo ports of the sound source or speakers to the display's single-connector stereo port. Figure 2-4 shows the sound adapter configuration.

The AppleVision 1710AV, 750AV and 850AV Displays also have the following sound ports:

- A sound input port, on the left panel, allows you to connect an external microphone or other sound source to the display
- A sound output port, on the right panel, allows you to connect speakers or headphones to the display

Compatibility Requirements

This section provides information regarding what Apple computers are compatible with the AppleVision display, video cards, and versions of the Mac OS that support AppleVision displays.

CPU configurations supporting the AppleVision display

The following Apple CPUs are compatible with AppleVision displays:

- PCI based CPU's including
    - 7200/90/100/120
    - 7500/100/120
    - 7600/120
    - 8500/120/132/150
    - 9500/120/132/150
    - 7300/8600/9600/5500/6500

  All PCI based machines shiping a the time of this document's publication are supported.

- PowerMac CPU's including
    - 8100/80/100/110
    - 8100/80/100/110AV
    - 7100/66/80, the 6100/66
    - 6100/60AV
    - 6200
    - 6300 models

- PowerBooks CPU's including
    - 280/280c/2300 (with Mini Dock/Duo Dock II)
    - 520/520c
    - 540/540c
    - 5xx/PowerMac Upgrade
    - 5300
    - 1400
    - 3400 series

- Quadra CPU's including
    - Quadra 605
    - Quadra 610
    - Quadra 630
    - Quadra 630/PowerMac Upgrade
    - Centris 650
    - Quadra 650
    - Quadra 650/PowerMac Upgrade
    - Quadra 950
    - Quadra 900
    - Quadra 950/PowerMac Upgrade
    - Quadra 660AV
    - Quadra 840AV

- Apple DOS Compatible CPU's
    - Quadra 610/DOS
    - 6100/DOS
    - 640 DOS
    - 90MHz 586
    - 100MHz Pentium
    - 166 MHz Pentium PC cards for PCI CPUs

Video Card Compatibility

In addition to the on-board video provided by the CPUs listed in Table 1-4, plug-in video cards, such as the NuBus 24AC video card, also support AppleVision displays.

Apple video cards 8.24, 8.24GC, and 4.8 do not support the AppleVision displays. In addition, plug-in video cards that do follow the new guidelines defined in the "Graphics Drivers" section of *Designing PCI Cards and Drivers* for Macintosh Computers do not support the displays.

Operating System Compatibility

You should use System 7.5 or later with the AppleVision display. If you run earlier versions of the operating system, QuickTime delays the loading of the AppleVision INIT. You may have renamed AppleVision INIT with a name that begins with a letter later than Q (QuickTime). This means that the INIT installs after QuickTime, and QuickTime moves the AppleVision components, delaying booting.

Further References

- "Graphics Drivers" chapter in (ftp://ftp.apple.com/devworld/Technical_Documentation/PCI_Information/Designing_PCI_Cards_-_Driv.sit) *Designing PCI Cards and Drivers* .
- Display Device Driver Guide
- Technote HW08, "Color Monitor Connections"
- Technote HW30, "Sense Lines"

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