DPMS™ Standard

VESA®

Video Electronics Standards Association

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Display Power Management Signaling (DPMS) Standard

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Purpose

To standardize on a common definition and methodology in which the display controller sends a signal to the display that enables it to enter various power management states.

Summary

Government agencies and independent organizations worldwide are involved in setting limits or goals for power consumption in office equipment. Desktop computers are one of the primary targets for this effort. The display consumes a significant portion of the power used in a desktop computer system. These agencies would like to decrease energy use from computer displays specifically, in order to slow the growth in overall demand for electric power.

While these goals are laudable, it would be difficult to achieve widespread adoption and use of power management technology in displays without a standard interface between the display controller and the display.

This standard complements these initiatives by defining power management states as they relate to the display and providing a standard method for the display controller to signal to the display to enter into those states. This standard strictly covers the communication between the display controller and the display.

Intellectual Property

Trademarks

Patents

VESA proposals and standards documents are adopted by the Video Electronics Standards Association without regard to whether their adoption may involve patents on articles, materials, or processes. Such adoption does not assume any liability to any patent owner, nor does it assume any obligation whatever to parties adopting the proposals or standards document.

Support for this Specification

If you have a product which incorporates DPMS, you should ask the company that manufactured your product for assistance. If you are a display or controller manufacturer, VESA can assist you with any clarification you may require. All questions must be in writing to VESA, in order of preference by:

E-mail:	vesa-support@exodus.net
FAX:	408-435-8225
Mail to:	VESA 2150 N. First Street, Suite 440 San Jose, CA 95131-2029

Acknowledgments

This document was made possible by the joint efforts of the members of VESA Monitor Committee. In particular, the following individuals and their companies contributed with time and knowledge.

DPMS Work Group Leader

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Work Group Members

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Anders Frisk, ICL
Richard Atanus, NEC
Paul Doyle, Sony

Table of Contents

1.0 Introduction and Scope

The purpose of this document is to provide a standard for the hardware signaling of display power management states for use with a continuously refreshed display system employing horizontal and vertical synchronization signals and streamed video data. This document describes the use of these signals to define power management states based on the existing Advanced Power Management specification.

1.1 DPMS Architecture (PC example)

The following diagram illustrates how DPMS can fit into a PC power management architecture.

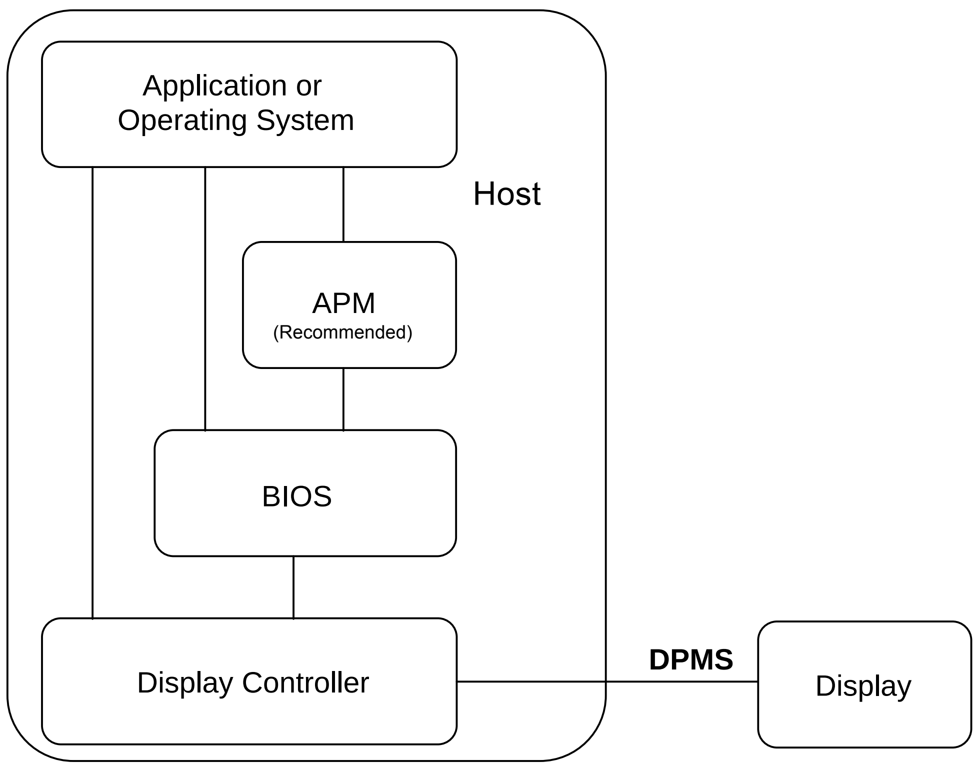

Figure 1. DPMS Architecture
(PC Example)

1.2 Activation Criteria and Power Consumption Requirements

This document does not specify criteria for entering into the various power management states, nor does it specify absolute levels of power consumption. The signaling method has been defined independently of the criteria and power levels as these requirements may change over time or with market needs.

1.3 Computer Systems Supported

DPMS is intended to be independent of computer platform and operating system.

1.4 Synchronization Formats Supported

This standard applies to all synchronization (sync) formats: separate horizontal and vertical sync, composite sync, and sync on green.

1.5 Programming Interface

This standard defines a hardware signaling method between the display controller and the display. No programming interface is defined within this document.

2.0 Terms and Definitions

2.1 Advanced Power Management (APM)

APM is a specification created by Microsoft and Intel that provides an environment for power management of personal computers by the system BIOS, operating system or applications. In the context of this document, the power management states have been identified as follows:

APM State	Power Savings	Recovery Time
On	None	Not Applicable
Stand-by	Minimal	Short recovery
Suspend	Substantial	Longer recovery allowed
Off	Maximum	System dependent

Table 2. APM State Summary

NOTE: Absolute power savings and recovery times are not defined by APM, similarly, DPMS has adopted the same guidelines. Actual parameters may be determined by regional or customer requirements.

It is expected that after a user defined or default idle period, the host system will initiate power management, although other criteria are allowed.

The definitions for “On”, “Stand-by,” “Suspend” and “Off” States used in this specification adhere as closely as possible to the definitions in the APM specification. While these definitions were developed primarily for use in portable computing, the need for power management has crossed over into the desktop arena and the terminology also applies well in this environment.

2.2 Synchronization Signals

The basis of the DPMS standard is the condition of the synchronization signals to the display. Two conditions are defined: pulses and no pulses

2.2.1 Pulses

Pulses for the Horizontal sync signal are defined as greater than 10 kHz repetition frequency. Pulses for the Vertical sync signal are defined as greater than 40 Hz repetition frequency.

It is recommended that to optimize recovery time from Stand-by or Suspend state the synchronization signals be maintained at the same frequency and duty cycle as last used in the On State.

2.2.2 No Pulses

No pulses is defined as less than 10 Hz repetition frequency with less than 25% duty cycle.

2.2 Blanked Video

Blanked video is defined as the condition for which the video signal contains no picture information. This signal may or may not contain set-up.

2.3 Display Controller

The chip, board and/or system component from which the display receives the video signals to be displayed, including the synchronization signals.

2.4 Display

Any device that displays the output from the display controller. This may include CRT, flat panel, or any other type of continuous refresh display device.

2.5 Host System

The device that includes the central processing unit, operating system, application software and display controller.

3.0 Display Power Management States

Transitions between states shall not require any manual display adjustment unless otherwise noted. There is no restriction on any combination of state transitions. It is recommended that the display wait for a minimum of 5 seconds before transition from On to avoid unintentionally entering a power saving state during display resolution and timing mode changes.

3.1 On

This refers to the state of the display when it is in full operation.

3.2 Stand-By

This defines an optional operating state of minimal power reduction with the shortest recovery time.

3.3 Suspend

This refers to a level of power management in which substantial power reduction is achieved by the display. The display can have a longer recovery time from this state than from the Stand-by state.

3.4 Off

This indicates that the display is consuming the lowest level of power and is non-operational. Recovery from this state may optionally require the user to manually power on the monitor.

4.0 Display Power Management Summary

State	Signals			DPMS Compliance Requirement	Power Savings	Recovery Time
	Horizontal	Vertical	Video			
On	Pulses	Pulses	Active	Mandatory	None	Not Applicable
Stand-by	No Pulses	Pulses	Blanked	Optional	Minimal	Short
Suspend	Pulses	No Pulses	Blanked	Mandatory	Substantial	Longer
Off	No Pulses	No Pulses	Blanked	Mandatory	Maximum	System Dependent

NOTE 1: See Section 2. for "Terms and Definitions" of signals.

NOTE 2: It is recommended that the display wait for a minimum of 5 seconds before transition from On to avoid unintentionally entering into a power saving state during display resolution and timing mode changes. Transition from any power saving state can be instantaneous.

NOTE 3: Recovery from Off state may optionally require the user to manually power on the monitor.

Appendix A: Override Capability (optional)

An optional override capability is also defined. This is not a power management state. Its intention is to provide display manufacturers a suggested method to override the DPMS function during the design, test, burn-in, manufacturing or diagnostic processes if desired.

To initiate Override, both the horizontal and the vertical sync signals shall be in the no pulses condition when the display is manually powered on. This condition should be maintained during the entire time Override is required. As soon as pulses are detected on either synchronization signal, the display shall enter DPMS operation.

Appendix B: Pseudo Stand-by State

If a quicker recovery to the On State is desired than the one offered by the Suspend State, and the monitor is not designed to react to the optional DPMS Stand-by signaling, it is beneficial that the display controller continue to supply normal On State Horizontal and Vertical sync signals for the pseudo Stand-by State but with blanked video. This is similar to existing screen saver technology.

This pseudo Stand-by State can be set by software to replace the optional DPMS Stand-by State.

Appendix C: Related Documents/Other Organizations

Microsoft/Intel Advanced Power Management (APM)

Intel Corporation	Microsoft Corporation
2200 Mission College Blvd.	One Microsoft Way
Santa Clara, CA 95051	Redmond, WA 98052-6399

U.S. Environmental Protection Agency (EPA)
Energy Star Computers Program
US EPA (6202J)
Washington, D.C. 20460
Contact: Brian Johnson

Nutek
Department of Energy Efficiency
S-117 86 Stockholm, Sweden
Contact: Olof Molinder

Appendix D: Questions and Answers

This appendix documents some of the major decisions and tradeoffs that were made by the VESA Monitor Committee in developing this standard.

Q. Why did VESA develop the Display Power Management Signaling Standard?

A. Trends in energy use and load profiles for computers and electronic equipment are of growing concern not only to utility demand forecasters, but also to standard setting and enforcement organizations, facility managers, "shared savings" contractors, and energy analysts and policy makers. (1) The European Community (EC) has stated their intention to decrease their dependency on Nuclear Energy plants causing equipment manufacturers to design power reduction into their products.

Experts agree that opportunities exist for equipment manufacturers to design-in energy efficiency in both hardware and software. This would result in a reduction of load growth of energy equipment. (1).

Today, many governmental agencies and independent organizations are involved in setting limits or goals in power consumption. VESA, as a standards setting organization, decided to take a leading role in setting a standard in implementing seamless, automatic, power management states which would complement the current manual system of the end-user powering down their system.

Q. What were the goals of the work group?

A. The goals were simple: They were to provide a methodology that would be:

1. User Friendly
2. Seamless and Automatic
3. Simple to implement and relatively quick to market
4. Technology independent
5. Able to work with the three different sync formats: Separate Sync, Sync on Green and Composite Sync
6. Follow the Microsoft/Intel Advanced Power Management (APM) levels of power management states

Q. The standard does not provide any power consumption levels or activation and recovery time periods. Why?

A. The goal was to provide just the signaling methodology that would initiate the power management states, yet still provide individual manufacturers a way to differentiate their products. In addition, as other governmental and independent organizations had already set these, VESA did not want to conflict with any published, and possibly changing, requirements. VESA wanted a universal standard that would complement, and not conflict, with any other country, agency or organization requirements.

Q. Why was Horizontal and Vertical Sync formats used as the methodology?

A. All monitors currently do some level of detection on their sync lines and all host systems provide sync signals to monitors. This was the logical approach for the proposal, providing a simple method to implement thereby shortening the time to market.

Q. Do the monitors necessarily have to have the four states?

A. As long as the display is not damaged while receiving the applied signals, they will be compliant with the proposal. The manufacturer may choose to combine states, but must implement at least one reduced power consumption state. This allows the proposal to offer flexibility without losing its effectiveness.

Q. The Stand-by state does not seem to offer much power consumption savings. Why did VESA include it in its implementation?

A. In simple CRT-based displays, it is true that the Stand-by state offers minimal power consumption reduction. However, stand-alone displays based on Flat Panel technology offer significant power reduction in this state by turning off the backlight. As the backlight also has the shortest life span of the FPD, the Stand-by state offered even more benefits. Also, as monitors develop with additional features like multimedia, manufacturers may use the Stand-by state for additional savings that may not be easily evident today. It was important that host system manufacturers have the ability to develop one platform that would be technology independent.

Q. Why did we select the methodology outlined in the table for the activation of the Stand-by State and the Suspend state?

A. Since the Suspend state is a more critical power saving state than Stand-by, we used the absence of the Vertical Sync signal because many monitors designs depend on the Horizontal Sync Signal.

Q. Why didn't you use blank video as the activation signal for Stand-by State?

A. In an application like a privacy screen mode, the video is blanked to prevent a casual observer from viewing confidential data. In systems in which the signal cable is very long, and in applications where the screen data is very minimal, the monitor may perceive blank video and prematurely enter into the various states of power management.

Blank video is very difficult to detect in just H and V signals. To effectively institute blank video signaling, it would require detectors along the R, G, B signals as well as Horizontal and Vertical. This would be a costly solution for monitors. In a Flat Panel Display, the complexity is increased even more.

Q. Why isn't "No Pulses" defined as 0 Hz?

A. After talking with some of the top names in the video chip business, it was determined that some current existing chips were not able to go all the way down to 0 Hz. However, they were able to drop down to less than 6 Hz. It was important that VESA provide guard bands in all specifications to allow for any fluctuations. VESA did not want to preclude any known vendor from being able to implement the DPMS standard as quickly as possible.

While this is applicable to today's technology, it is fully expected that all future video chips and display controllers will be able to achieve 0 Hz. The ability to achieve 0 Hz will result in lower power consumption levels by displays. This is especially important as expectations by governmental and independent organizations are expected for lower power consumption levels.

Q. Are there other ways of possibly implementing power management states?

A. Certainly. However, in order to be effective, the implementation must be widespread and be cognizant of the end-user. VESA achieved a user-friendly, and relatively simple implementation. Time-to-market was essential so that manufacturers could quickly develop products and end-users could take advantage of this significant feature. The VESA implementation is strengthened because it is backed by the major players in the system, monitor, graphics controller, and software companies.

Q. Will the existing installed base of monitors which were not designed to be DPMS compliant fail when receiving the DPMS signaling?

A. Most monitors will not fail upon receiving the DPMS signaling. If an older monitor is prone to failure when the video cable is disconnected when the power is on, it is possible that this monitor may be susceptible to failure upon receiving the power management signal. This would be an extremely rare and isolated occurrence.

Q. VESA, through DPMS, has clearly outlined the signaling for power management. Will they standardize the way display controllers implement the signaling management?

A. VESA has already published a proposal for BIOS extensions for power management. This proposal is called the VBE/PM (VESA BIOS Extensions / Power Management). Standardization of the BIOS extensions will assure widespread implementation of DPMS for the industry.

Q. How quickly do you expect the DPMS to be implemented in computer manufacturers equipment?

A. Products have already been announced at the U.S. Environmental Protection Agency's announcement at the White House in June. In addition, VESA-compliant products appeared at the PC Expo show in New York this summer. And although VESA does not want to pre-announce any of its members products, further announcements of DPMS-compliant products will happen this fall.

Appendix E: Revision History

Revision 1.0	Added VESA logo. Replaced AOL reference with vesa-support@exodus.net in the Support for this Specification section. Added Appendix E.