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Monitor Control Command Set

VESA Monitor Control Command Set

(MCCS) Standard Version 3

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Purpose

The purpose of this standard is to define a universal set of commands used to control the screen settings of displays which can be used within any communication protocol established between the host and display. This standard also defines requirements for compliance of the MCCS VCP codes.

Summary

This document describes the standardized list of commands and controls to be used in identifying and controlling the display by means of an application running on the host. The list of commands and controls is kept to a minimum, while supporting the control of virtually all parameters related to the screen settings in the display. It does not describe how these commands are packaged in a particular interface protocol.

Further, the document assumes the interface supporting the display can issue an unsolicited attention call (interrupt) to alert the host that something has happened outside the control of the host. The targeted display devices are displays attached to the video output of PCs and workstations; however, it is not restricted to this area.

Version 3 has several purposes, included the correction of some known errors, clarification of the use of certain VCP codes, new definitions for some VCP codes and the introduction of new VCP codes. This proposal also withdraws support for two VCP codes (C7h and CBh) which have not achieved their intended purpose. In addition, a set of compliance requirements are introduced for all of the defined VCP codes except for the DPVL support group.

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History

MCCS Version 1, September 11, 1998

The original MCCS standard

MCCS Version 2, October 17, 2003

A major update, in particular to provide support for flat panel displays and the VESA DPVL (Digital Packet Video Link) standard. It extends the scope and range of controls for television functions and introduces commands to permit individual control of multiple windows on a display. Many of the existing VCP codes have expanded functionality and/or clearer definitions. To ensure that the requirements of compatibility and an intuitive user interface can be readily achieved, support for 2 commands (see Section 5) is a compliance requirement for MCCS Version 2.

Additionally, new classes of VCP codes associated with asset management, secondary displays (for information, status, etc) and remote program calls to the display processor are introduced. It is expected that these will become important to the industry over time.

MCCS Version 2, Revision 1 May 28, 2005

A revision and update that reflects industry experience with the version 2 standard and also adds support for new functionality that is being introduced in products.

Additionally, includes significant effort to improve the clarity and usability of the standard.

MCCS Version 3, July 27, 2006

A revision and update that reflects industry experience with the Version 2, Revision 1 standard and also adds support for new functionality that is being introduced in products. It also introduces compliance requirements for each VCP code.

1 OVERVIEW

1.1 Summary

This standard describes the standardized list of control commands that may be used to control a display by means of an application running on the host. This concept is referred to a 'virtual control panel' or VCP and individual commands are referred to as 'VCP codes'

The list of commands and controls is kept to a minimum while supporting the control of all common parameters related to the image settings on the display and other common features.

This standard does not specify how particular commands are implemented with a particular interface protocol nor does this document describe the way a particular protocol queries and changes the settings of the controls, see appropriate interface standard for these details e.g. VESA DDC/CI standard.

This standard also contains the requirements and procedures to achieve and verify compliance for each VCP code: see section 10 for details.

A companion document will be maintained, called MCCS_UP.pdf. This will include such things as correction of known errors, extensions of VCP code value definitions and new VCP codes proposed for inclusion in the next MCCS revision.

1.1 Background

Due to the emergence of bidirectional communication interfaces (Analog Interface or DVI using an I^2C base, USB, etc) on hosts (PCs and workstations), it has become possible to control the settings of the display by means of an application running on the host.

Historically, displays have provided hardware control panels (on screen display or OSD) to accomplish these adjustments. Using the computer in addition, or instead of, to these manual controls increases user convenience and provides the opportunity for a standardized user interface regardless of the manufacturer of a particular display.

Although there are different communication paths, the basic content of the information communicated can be standardized offering everyone the same experience in accomplishing the same goal.

The scope of MCCS is not limited to traditional 'computer ⇔ monitor' applications. Digital television products have suitable bidirectional communication paths (I^2C based) built into DVI and HDMI interface. Additionally some VCP codes are designed specifically for television applications.

In general, this standard will use the term 'host' to refer to the image source (PC, workstation, set-top-box, etc) and the term 'display' which may be any device that receives a signal from the source and converts that signal to a visible image (e.g. computer monitor, television, etc)

The following drawing illustrates the basic architectural model – note that the 'video data' and 'timing data' are the generalized common element of all video interfaces. The bidirectional communication between a host and display may be part of a standard video interface (e.g. DDC/CI) or an external interface (e.g. USB)

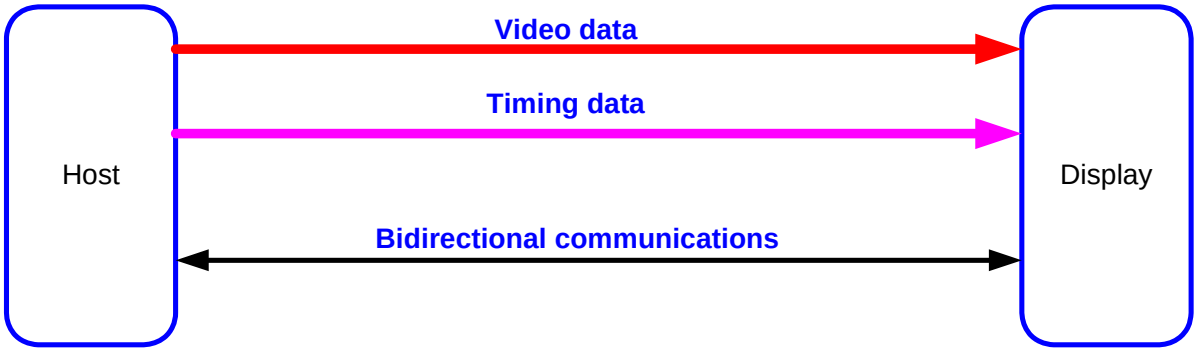


Figure 1-1: Basic Architectural Model

1.2 Standard Objectives

The standard aims to provide for a standard list of display controls and commands, which can be used irrespective of the specific interface used to support the necessary communications between the host and the display.

The VCP code list is chosen to be the minimum list necessary to support virtually all parameters related to the display product set-up and operation. A number of VCP codes are reserved for manufacturers to use where they have design features not covered by the standard VCP codes – these codes must be considered proprietary since, generally, the purpose of individual VCP codes will only be known to the manufacturer and accessing these VCP codes may have unknown effects.

1.3 Terminology Conventions

1.3.1 Keywords

Table 1-1: Keyword Conventions

May	A keyword that indicates a choice with no expressed or implied preference.
Must	A keyword that indicates a mandatory requirement for compliance with this standard.
Should	A keyword that indicates a choice with a strong, expressed preference – equivalent to "is strongly recommended"
Required	A keyword that indicates a mandatory element required for compliance with this standard

1.3.2 VCP Code Type

The 'Type' column in Table 8-2, Table 8-4, Table 8-6, Table 8-8, Table 8-10, Table 8-12 and Table 8-14 refer to the permissible action(s) with each VCP code:

WO : Write only
RO : Read only
R / W : Read or Write

1.3.3 VCP Code Function

The 'Function' column in Table 8-2, Table 8-4, Table 8-6, Table 8-8, Table 8-10, Table 8-12 and Table 8-14 refer to the permissible action(s) with each VCP code:

C : Continuous
NC : Non-continuous
T : Table

1.3.4 VCP Code Compliance

The 'Compliance' column in Table 8-2, Table 8-4, Table 8-6, Table 8-8, Table 8-10, Table 8-12 and Table 8-14 provides a reference to the appropriate compliance procedure.

1.3.5 Use of 'Horizontal', 'Top' and 'Bottom'

In Table 8-2, Table 8-4, Table 8-6, Table 8-8, Table 8-10, Table 8-12 and Table 8-14, 'horizontal' refers to the axis of the display parallel to the local horizon (usually the floor, ceiling or work surface) when the display is in its normal, intended orientation.

In Table 8-2, Table 8-4, Table 8-6, Table 8-8, Table 8-10, Table 8-12 and Table 8-14, 'top' refers to the first image line addressed at the start of each frame regardless of the display orientation. Similarly 'bottom' refers to the last image line addressed in each frame.

1.3.6 Data Byte Designations

For consistency with the DDC/CI standard, the designations SH and SL will be used to indicate the high order and low order bytes respectively on both read and write operations involving two data bytes. For example: GetMax or GetCurrent: SH-SL

Read operations involving four data bytes (e.g. GetVCPFeature) will designate the four data bytes as MH-ML-SH-SL.

Other read and write operations (e.g. GetTable and SetTable) will designate the data bytes sequentially as byte0-byte1-byte2-byte3- ….-byteN.

In summary, except in the case of 'table' operations, write commands (host → display) involve two data bytes (designated SH and SL) and read commands (display → host) involve four data bytes (designated MH, ML, SH and SL), Each 'table' command defines the number of data bytes associated with write and read operations (designated byte0, byte1, byte2, … byteN).

If using a communications interface other than DDC/CI then these terms should be appropriately mapped to the protocol being used.

1.4 Reference Documents

Table 1-2: Reference Documents

Document	Version / Revision	Date
VESA Enhanced Display Data Channel (E-DDC) Standard	Version 1.1	March 2004
VESA Enhanced Extended Display Identification (E-EDID) Standard	Release A, Rev. 1	Feb. 2000
VESA Display Power Management Signaling (DPMS) Standard	Version 1.0, Rev.1.0	Aug. 1993
VESA Display Power Management (DPM) standard	Release A	March 2003
VESA Display Data Channel Command Interface (DDC/CI) Standard	Version 1, Rev. 1	Oct. 2004
VESA Digital Packet Video Link (DPVL) standard	Version 1	April 2004
VESA Flat Panel Display Measurement (FPDM) standard	Version 2.0	June 2001
VESA MCCS Update Document		Latest
VESA Video Timing Block Extension Data (VTB-EXT) standard	Release A	Nov.2003
VESA Display Information Extension Block (DI-EXT) standard	Release A	Aug. 2001
Access Bus Specification	Version 3.0	Sept. 1995
VESA Discrete Monitor Timing (DMT) standard	Revision 10	Oct. 2004
CEA-861C, A DTV profile for Uncompressed High Speed Digital Interfaces	Revision C	Sept. 2005
VESA Glossary of Terms		Latest

2 Co-Existence of Local and Remote Adjustment Options

If a display has the facility to be adjusted both in the conventional manner (hardware/firmware OSD) with user controls on the display bezel (usually) - known as "local adjustment" - and also over an interface (e.g. DVI with DDC/CI) using the MCCS command set - known as 'remote adjustment' - then there is a possibility that the 'local adjustment' and 'remote adjustment' options may lose synchronization causing user confusion and loss of confidence.

The following implementation recommendations provide ways to avoid this situation:

2.1 Remote Adjustment Always Takes Priority

Whenever the software based adjustment system is active, the hardware based adjustment system is disabled without user intervention.

- If the hardware based system is active and the software based system is activated, then the hardware based adjustment system should be closed.
- If the software based system is active and the user attempts to activate the hardware based system then the user should only get a message indicating that the software based system is active.

2.2 Remote and Local Adjustment May be Active Simultaneously

If it is desired that the local and remote adjustment options can be used interactively then particular care must be used to ensure that the local and remote adjustment options remain synchronized and in particular regarding the current control values. The VCP codes 02h and 52h are designed to allow this synchronization to be maintained without user intervention or knowledge.

3 Functional Characteristics

Display devices enable the user of an application to view the results of the actions taken. The primary purpose of a display device is to present to the user the image supplied by the host system. Display devices typically include a number of user controls, the details vary from model to model and also between technologies. However, many allow the user to set luminance, contrast, picture size, position, and color balance. In addition, displays frequently have a number of internal settings that are changed to optimize operation with different video display formats. Some display devices have other features, e.g. audio, which may also be controlled using VCP codes.

It is desirable for the host system to be able to control these settings directly, as well as to be able to read data regarding the current set-up of the display.

3.1 Operational Model

Note: The terminology used in this section (Table 3-1) contained in " ", is generalized and not specific to any particular communications channel. Refer to the specification/standard for the particular communications channel being used for precise terminology.

The controls are characterized as being continuous, non-continuous or table controls.

- Continuous controls allow for all values between zero and a maximum value, generally these values may be either read or written.
- The non-continuous controls only supported a limited number of values and may be read only, write only or read and write.
- Table commands support the transfer of blocks of data and may be read only, write only or read and write.

The communication between the host and the display consists of VCP codes and associated data along with the particular protocol overhead of the interface being used.

To enable the host to issue requests, the display has to be able to specify the supported VCP codes and associated data such as:

- For continuous controls: the maximum value supported by the display (the minimum value is zero by definition)
- For non-continuous control: the specific values supported by the display

Note: See individual VCP code definitions for details.

Note: Requests are issued by the host and may be followed by a data transfer. Some requests need further specification, in those cases the parameters are indicated in the brackets in Table 3-1

Table 3-1: Generalized Host Requests

Control	Description
"GetSupportedControls"	This request from the host must cause the display to respond with a "capability string" that defines supported VCP codes.
"GetMax" (VCP Code)	Requests the possible range of values of the VCP codes supported by the display device. The display responds with either the maximum possible value (in case of a continuous control) or the maximum number of different values of the control (in case of a non-continuous control).
"GetPossible" (VCP Code)	Requests the possible values of the non-continuous VCP

Control	Description
	codes supported by the display. The display responds with the supported values for the specified non-continuous VCP code.
"GetCurrent" (VCP Code)	Requests the current value of the specified VCP code. The display responds with the current value of the specified VCP code.
"SetCurrent" (VCP Code)	Sets the current values of the virtual controls supported by the display device. The display must overwrite the currently stored value of the specified VCP code with the new value supplied.
"GetEDID"	This request is issued by the host to get the EDID information (in the binary format specified in the E-EDID standard) of the display.
"ControlControlRelation" (VCP Code)	This request asks for the identification of any other VCP codes affected by the alteration of the control indicated by the VCP code. Required for cases where there is interaction between controls.
"GetTable" (VCP Code)	Requests that a block of data, specified by the control code, is transferred to the host
"SetTable" (VCP Code)	Transfers a block of data to the display, storage location is defined in the definition of the control code.

3.2 Implementation of MCCS on Different Interfaces

Since MCCS aims to provide for a standard list of controls to be used on any bidirectional interface between the host and the monitor, the selection of the VCP codes needs some caution.

Depending on the interface used, duplication of functionality may occur, providing the host with multiple ways to control the same thing. It is recommended that the usage of the MCCS VCP codes be chosen such that duplication is prevented.

For instance, if the interface used already provides a way to control the power mode of the monitor outside the implementation of MCCS on that interface, then it is recommended to disable the support of the 'Display Powermode' VCP code within the implementation of MCCS.

4 Display VCP Codes

In Section 8 all the controls are listed, specifying their name, code and definition. They are organized in functional groups defined in Section 4.2; Section 11 contains cross-reference charts for all VCP Codes.

Note: All VCP codes between 00h and DFh inclusive that are not defined here are reserved for future use and may become active in future revisions of this standard. VCP codes between E0h and FFh are reserved for manufacturer use to enable support for a capability not defined in the standard.

4.1 VCP Codes That Return More Than 2 Bytes

Some VCP codes - e.g. ACh (Horizontal Frequency) and C8h (Display Controller Type) - return more than 2 bytes and are not 'table' type commands. The organization of the returned bytes is defined in the DDC/CI standard (see Get VCP Feature & VCP Feature Reply), but is included here for completeness.

The four bytes available for return are labeled MH, ML, SH and SL. If only 3 bytes (as the examples) are returned then the MH byte must be set = 00h. MH and ML are the two high bytes, SH and SL are the two low bytes.

For table commands, the number of bytes written or read depends on the particular VCP code but in all cases the first byte transmitted is designated "byte 0", the second byte transmitted is designated "byte 1", etc

4.2 Control Grouping

Controls are grouped by area of applicability into:

4.2.1 Preset Operations (see Section 8.1)

This group relates to the selection from a number of preset options

4.2.2 Image Adjustment (see Section 8.2)

This group relates to the adjustment of the displayed image excluding geometric adjustments

e.g. luminance and color

4.2.3 Display Control (see Section 8.3)

This group covers items relating to information and overall control of the display

e.g. the number of hours that display has been in use and the OSD (On Screen Display) language.

4.2.4 Geometry (see Section 8.4)

This group provides support for image geometry and spatial adjustments.

4.2.5 Miscellaneous Functions (see Section 8.5)

This group covers items not included elsewhere.

4.2.6 Audio Functions (see Section 8.6)

This group covers items relating to the audio (input and output) of the display device.

4.2.7 DPVL Functions (see Section 8.7)

This group is for the commands required to support the VESA DPVL standard.

4.2.8 Manufacturer Specific (see Section 8.8)

This group is reserved for manufacturer specific codes.

Note: In some cases a VCP code does not fit exactly into one of these groups. In this case they have been classified according to their typical usage.

4.3 Control Function

4.3.1 Continuous Controls

Continuous controls are controls that accept any value from zero to a maximum value specific for each control. All continuous controls are read and write enabled. Indicated by C in the 'function' column.

4.3.2 Non-continuous Controls

The non-continuous controls accept only specific values. The valid values of these controls do not need to be continuous in value. Non-continuous controls can be "read and write", "read-only" or "write-only". Indicated by NC in the 'function' column.

4.3.3 Table Controls

These controls are typically associated with a block of data where only the overall structure is explicitly defined and not the contents. Table controls can be "read and write", "read only" or "write only". Indicated by T in the 'function' column.

4.3.4 Manufacturer-specific Controls.

The 32 control codes E0h through FFh have been allocated to allow manufacturers to issue their own specific controls either where the defined VCP codes do not provide a required function or where the added function is considered proprietary.

Caution: Use of these codes has the risk of causing incompatibility and / or unpredictable behavior.

For example: Consider the case when two display manufacturers choose to use the same 'manufacturer VCP code' for different functions (or different implementations of the same function) but the user chooses not to use the specific software support supplied or recommended for his particular display – he may use a general purpose MCCS support application, native support built into the operating system or a MCCS support application intended for a different display model. In this case, the resulting behavior is unpredictable, ranging from no support for the function which uses a 'manufacturer VCP code' to incorrect control and adjustment of the function. In all cases this will likely result in an annoyed user and a service call, in extreme cases it may result in a situation where the user cannot return the display to normal operation.

It is recommended that these codes are used with caution and only when strictly necessary.

5 Required VCP Codes

MCCS Version 2 and MCCS Version 2 Revision 1, require that the VCP code DFh, 'VCP Version' and VCP code 02h, 'New control value', are supported. MCCS Version 3 leaves the required VCP Codes unchanged.

- Support of DFh (VCP Version) allows application code to correctly interpret responses from the display and provide an intuitive user interface.
  - Use of this VCP code enables correct forward and backward compatibility between the display and any host code seeking to remotely control the display.
    - The host code must ensure that it does not try to utilize features or functions that are not supported at the reported display MCCS version and revision level.
    - Higher revision levels of the MCCS standard indicate that backward compatible change(s) have been made so if the display supports a higher revision level than the host code, the host code must handle all supported display VCP Codes defined at its version and revision level.
    - Higher version levels indicate that some degree of incompatibility has been introduced. However, the host codes should attempt to decode the capability string and handle all possible VCP Codes.
- Support of 02h (New control Value) enables a simple way to maintain synchronization between a software display control application and the hardware/firmware based control in the display.
  - See section 2 for a discussion of the issues involved and section 13.2 for a recommended implementation.

Additionally, all unassigned VCP codes are reserved for future use and MCCS compliant products must not use them. If an undefined function is required then one of the VCP codes reserved as 'manufacturer's specific codes' must be used - the sole exception being when the VESA Display Systems Committee has decided to include a new VCP code function in the MCCS update document (see section 1.1) and indicated the VCP code that is proposed for a future MCCS standard revision.

6 Capability String Format & Terminology

The capability string delineates display information and supported VCP codes. The following format is recommended to obtain display industry consistency. The following abbreviations are used, more complete definitions can be found in section 7 of the Access Bus Specification except for window() Which is introduced here.

Table 6-1: Capability String Abbreviations

prot()	Used to specify the protocol class
type()	Identifies type of display
cmds()	An ASCII string listing supported VCP codes
vcp()	A list of the supported VCP codes in ASCII. Also contains a list of the supported values for each non-continuous VCP code
model()	The display model number (may be alpha-numeric)
mccs_ver()	Specifies the supported version and revision of the MCCS standard.
window()	Specifies the VCP codes that are supported within a window
vcpname()	Allows a display to specify an alternative name to be used for a control

The capability string header may contain information about the display for prot(), type(), model(), cmds(), vcp(), mccs_ver(x.x), window()

Note: If the host receives a capability string with non-standard abbreviations then the non-standard portions of the capability string should be ignored.

Example:

prot(display) type(lcd) model(xxxxxx) cmds(xxxxxx) vcp(02 04 10 12 DC(00 01 02 03 07) DF)mccs_ver(x.x) window(10) vcpname(10(Brightness))

The above string explicitly states that New Control Value, Factory Restore, Luminance, Contrast, Display Application Presets and VCP Version are supported VCP codes but that only Luminance adjustments are supported within a window. It also lists the non-continuous values that are supported by the 'Display Application' VCP code. The vcpname string indicates that 'Brightness' should be used instead of Luminance when referring to adjustments using VCP code 10h.

VCP 02h : New Control Value

VCP 04h : Factory Restore

VCP 10h : Luminance

VCP 12h : Contrast

VCP DCh : Select Display Application

Display Application presets available using VCP DCh

- 00h : Standard / default mode
- 01h : Productivity (office applications)
- 02h : Mixed (e.g. internet browsing)
- 03h : Movie
- 07h : Professional (no signal processing in display)

VCP DFh : VCP Version

Each display input source should have its own capability string, i.e. LCD analog and digital inputs should have independent unique capability strings since there will be, generally, a different set of VCP codes supported on each input.

VCP codes with bit mapped functions must not report the bits in the capability string, the host must read the individual VCP code to get the details of the supported function set.

When the window() string reports support of non-continuous VCP codes then it is the responsibility of the software application to determine the actual values supported.

6.1 Capability String Compliance

Section 10.5 contains the compliance procedure for the capability string.

7 Functional Grouping of VCP Codes

This section provides a number of tree structures, each covers the VCP Codes that may affect a specific area of the display operation.

For example: A restore function may clear a window or change one or more of the attributes of the image within that window.

Notes:

- Some VCP Codes appear in several trees.
- VCP Codes have been placed in tree(s) based on the common perception of the effect of the VCP Code and not necessarily a technically accurate interpretation.
- Some trees reference other tree(s)

7.1 Image Adjustments

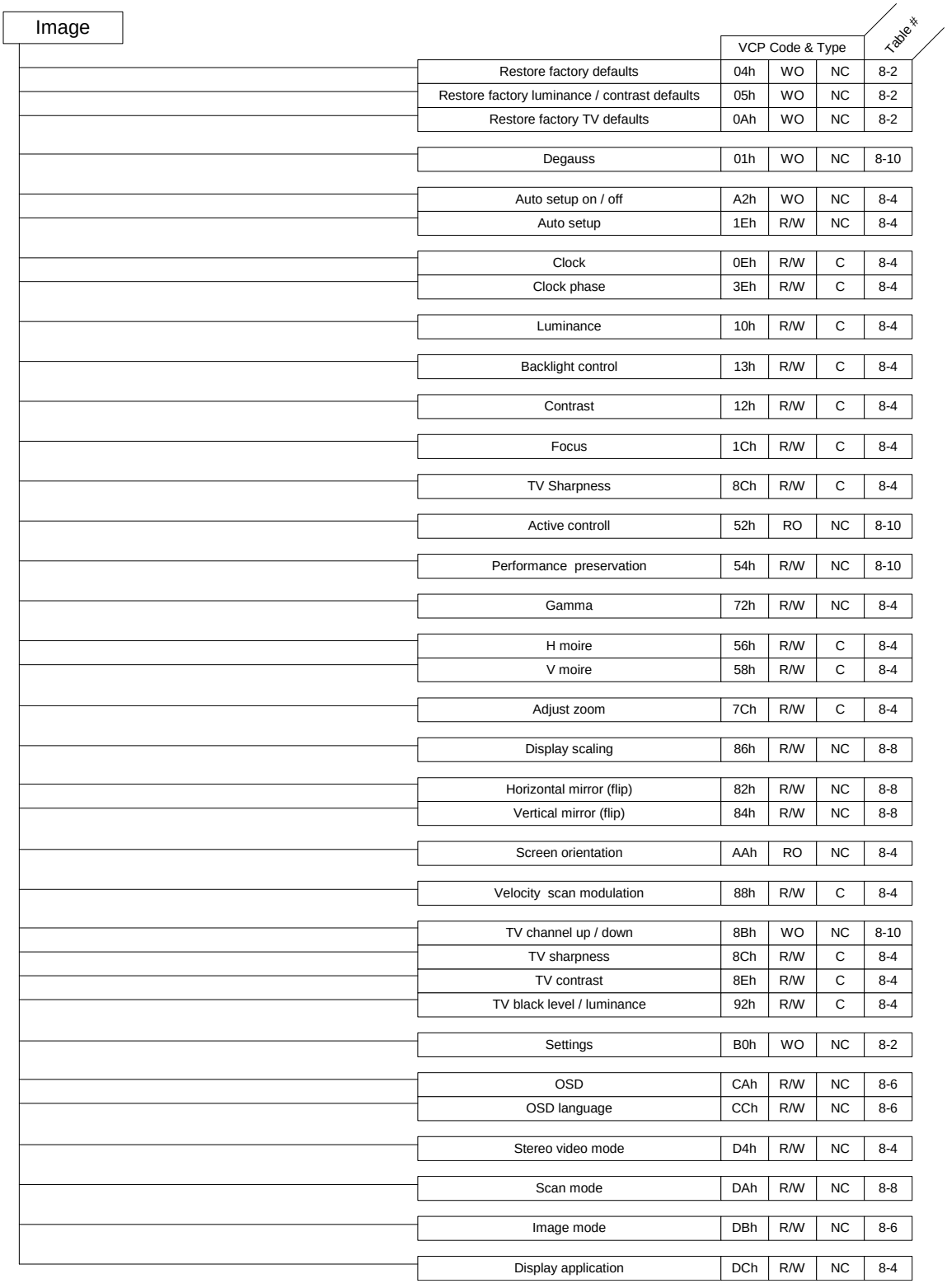


Figure 7-1: Image Adjustment VCP Code Tree

7.2 Color Adjustments

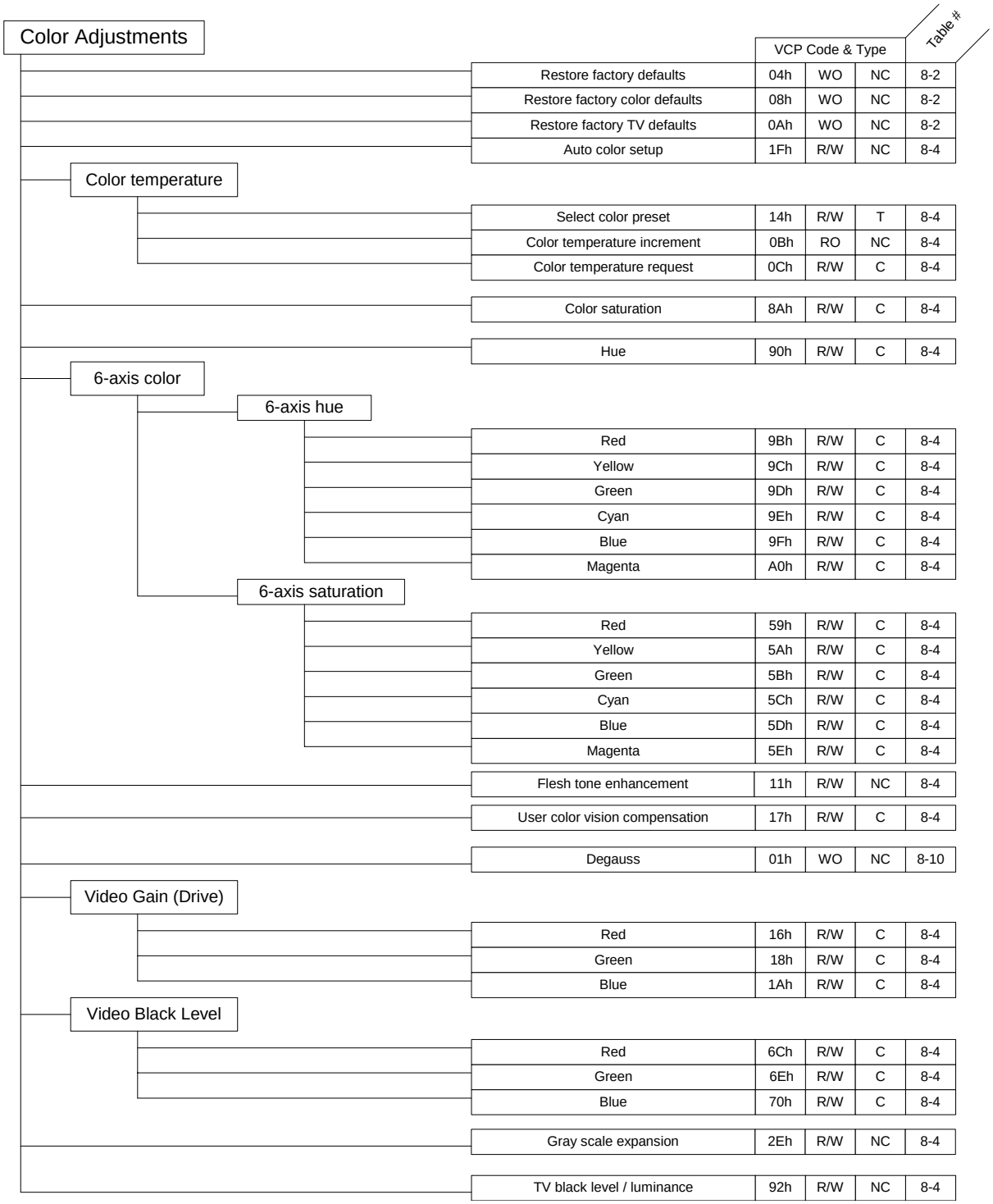
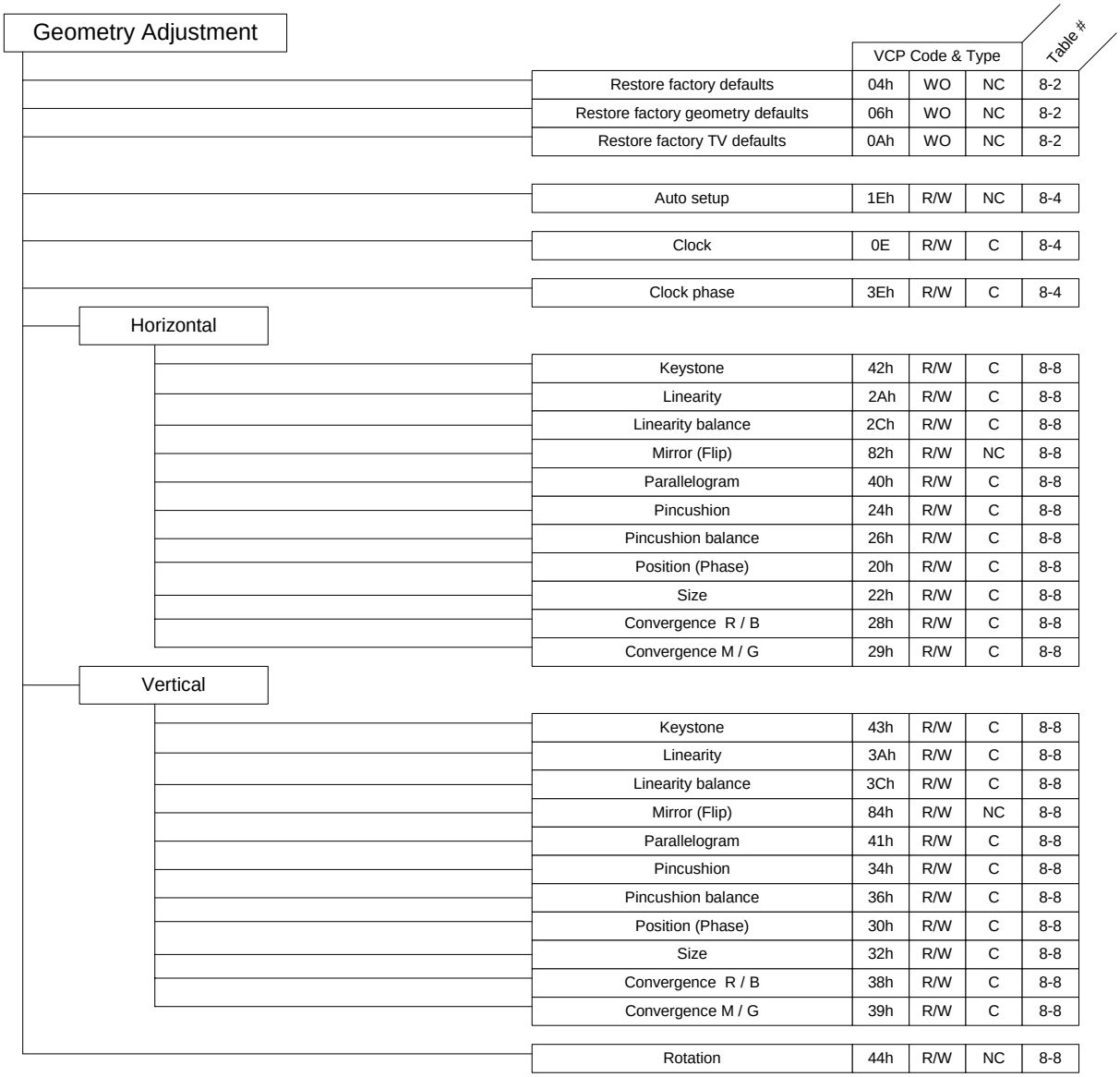


Figure 7-2: Color Adjustment VCP Code Tree

7.3 Image Geometry Adjustment



	VCP Code & Type			Table #
Restore factory defaults	04h	WO	NC	8-2
Restore factory geometry defaults	06h	WO	NC	8-2
Restore factory TV defaults	0Ah	WO	NC	8-2
Auto setup	1Eh	R/W	NC	8-4
Clock	0E	R/W	C	8-4
Clock phase	3Eh	R/W	C	8-4
Keystone	42h	R/W	C	8-8
Linearity	2Ah	R/W	C	8-8
Linearity balance	2Ch	R/W	C	8-8
Mirror (Flip)	82h	R/W	NC	8-8
Parallelogram	40h	R/W	C	8-8
Pincushion	24h	R/W	C	8-8
Pincushion balance	26h	R/W	C	8-8
Position (Phase)	20h	R/W	C	8-8
Size	22h	R/W	C	8-8
Convergence R / B	28h	R/W	C	8-8
Convergence M / G	29h	R/W	C	8-8
Keystone	43h	R/W	C	8-8
Linearity	3Ah	R/W	C	8-8
Linearity balance	3Ch	R/W	C	8-8
Mirror (Flip)	84h	R/W	NC	8-8
Parallelogram	41h	R/W	C	8-8
Pincushion	34h	R/W	C	8-8
Pincushion balance	36h	R/W	C	8-8
Position (Phase)	30h	R/W	C	8-8
Size	32h	R/W	C	8-8
Convergence R / B	38h	R/W	C	8-8
Convergence M / G	39h	R/W	C	8-8
Rotation	44h	R/W	NC	8-8

Figure 7-3: Image Geometry Adjustment VCP Code Tree

7.4 Audio Adjustments

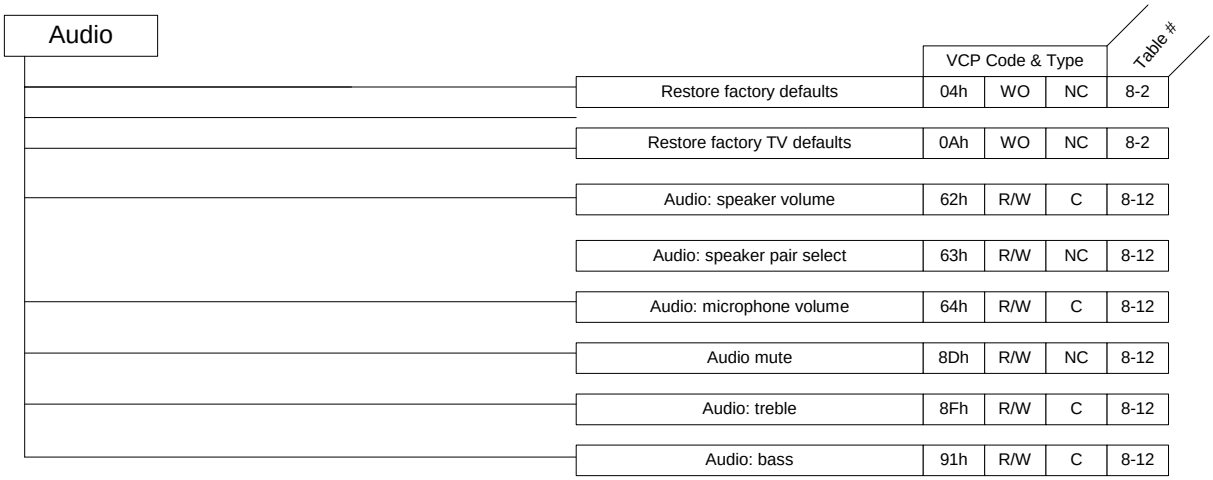


Figure 7-4: Audio Adjustment VCP Code Tree

7.5 Windows Operation

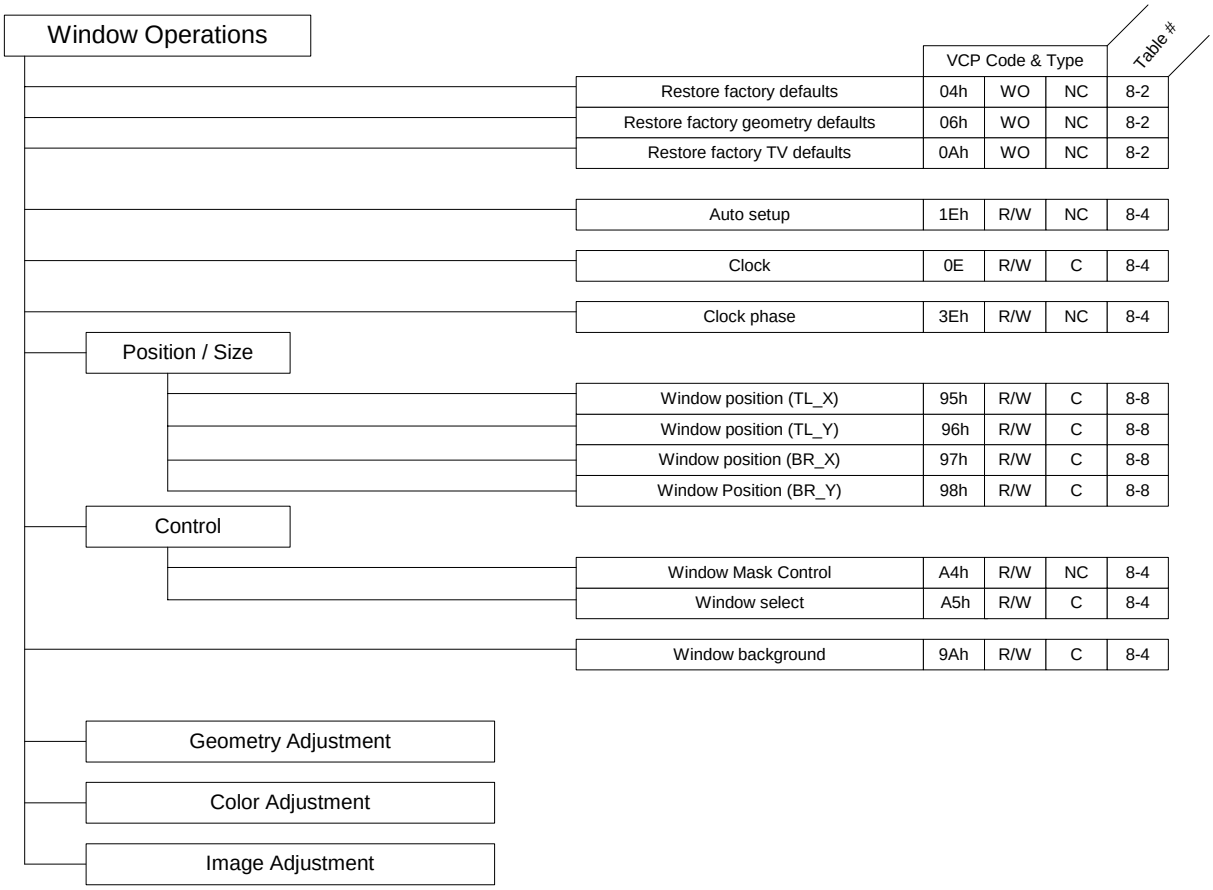


Figure 7-5: Windows Operation VCP Codes Tree

7.6 DPVL Support

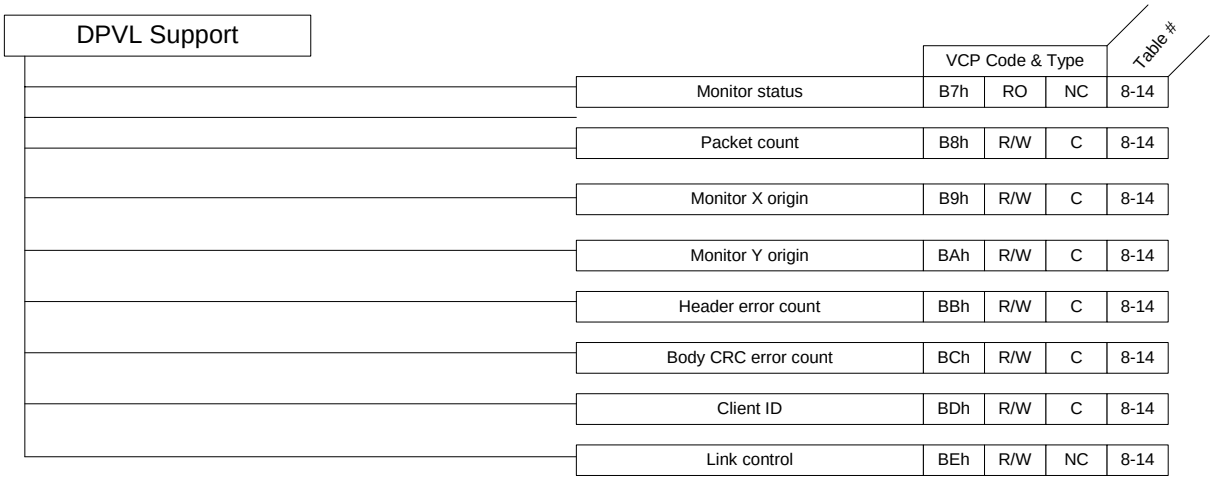


Figure 7-6: DPVL Support VCP Code Tree

8 VCP Code Definitions

The following tables of this section define the VCP Code functions and usage. The compliance column of the tables contains a reference to the appropriate compliance procedure for each VCP Code.

8.1 Preset Operations VCP Codes

Table 8-1: Preset Functions VCP Code Cross-reference

VCP Code Name	Code	Compliance
Restore Factory Color Defaults	08h	10.8
Restore Factory Defaults	04h	10.8
Restore Factory Geometry Defaults	06h	10.8
Restore Factory Luminance / Contrast Defaults	05h	10.8
Restore Factory TV Defaults	0Ah	10.8
Settings	B0h	10.8

Table 8-2: Preset Operations VCP Codes

Code	VCP Code Name	Type	Function	Description	Compliance
04h	Restore Factory Defaults	WO	NC	Restore all factory presets including luminance / contrast, geometry, color and TV defaults. Any non-zero value causes defaults to be restored. A value of zero must be ignored	10.8
05h	Restore Factory Luminance / Contrast Defaults	WO	NC	Restores factory defaults for luminance and contrast adjustments. Any non-zero value causes defaults to be restored. A value of zero must be ignored.	10.8
06h	Restore Factory Geometry Defaults	WO	NC	Restore factory defaults for geometry adjustments. Any non-zero value causes defaults to be restored. A value of zero must be ignored.	10.8
08h	Restore Factory Color Defaults	WO	NC	Restore factory defaults for color settings. Any non-zero value causes defaults to be restored. A value of zero must be ignored.	10.8
0Ah	Restore Factory TV Defaults	WO	NC	Restore factory defaults for TV functions. Any non-zero value causes defaults to be restored. A value of zero must be ignored.	10.8
B0h	Settings	WO	NC	Store / Restore the user saved values for current mode. **Byte: SL** 01h – Store current settings in the monitor. 02h – Restore factory defaults for current mode. If no factory defaults then restore user values for current mode. All other values are reserved and must be ignored.	10.8

8.2 Image Adjustment VCP Codes

Table 8-3: Image Adjustment VCP Code Cross-reference

VCP Code Name	Code	Compliance
6 Axis Hue Control: Blue	9Fh	10.10
6 Axis Hue Control: Cyan	9Eh	10.10
6 Axis Hue Control: Green	9Dh	10.10
6 Axis Hue Control: Magenta	A0h	10.10
6 Axis Hue Control: Red	9Bh	10.10
6 Axis Hue Control: Yellow	9Ch	10.10
6 Axis Saturation Control: Blue	5Dh	10.10
6 Axis Saturation Control: Cyan	5Ch	10.10
6 Axis Saturation Control: Green	5Bh	10.10
6 Axis Saturation Control: Magenta	5Eh	10.10
6 Axis Saturation Control: Red	59h	10.10
6 Axis Saturation Control: Yellow	5Ah	10.10
Adjust Zoom	7Ch	10.6
Auto Color Setup	1Fh	10.9
Auto Setup	1Eh	10.9
Auto setup On / Off	A2h	10.12.6
Backlight Control	13h	10.6
Block LUT Operation	75h	10.11.4
Clock	0Eh	10.6
Clock Phase	3Eh	10.6
Color Saturation	8Ah	10.6
Color Temperature Increment	0Bh	10.11
Color Temperature Request	0Ch	10.6
Contrast	12h	10.6
Display Application	DCh	10.7
Flesh Tone Enhancement	11h	10.7
Focus	1Ch	10.6
Gamma	72h	10.6
Gray Scale Expansion	2Eh	10.7
Horizontal Moiré	56h	10.6
Hue	90h	10.6
Luminance	10h	10.6
LUT Size	73h	10.11.4
Screen Orientation	AAh	10.11
Select Color Preset	14h	10.7
Sharpness	87h	10.6
Single Point LUT Operation	74h	10.11.4
Stereo Video Mode	D4h	10.7
TV-Black Level / Luminance	92h	10.6
TV-Contrast	8Eh	10.6
TV-Sharpness	8Ch	10.6
User Color Vision Compensation	17h	10.6

VCP Code Name	Code	Compliance
Velocity Scan Modulation	88h	10.6
Vertical Moiré	58h	10.6
Video Black Level: Blue	70h	10.6
Video Black Level: Green	6Eh	10.6
Video Black Level: Red	6Ch	10.6
Video Gain (Drive): Blue	1Ah	10.6
Video Gain (Drive): Green	18h	10.6
Video Gain (Drive): Red	16h	10.6
Window Background	9Ah	10.6
Window Control On / Off	A4h	10.11.4
Window Select	A5h	10.6

Table 8-4: Image Adjustment VCP Codes

Code	VCP Code Name	Type	Function	Description	Compliance
0Bh	Color Temperature Increment	RO	NC	Allows the display to specify the minimum increment in which it can adjust the color temperature. This will be used in conjunction with VCP code 0Ch, Color temperature request. Values of 0 and > 5000 are invalid and must be ignored.	10.11
0Ch	Color Temperature Request	R/W	C	Allows a specified color temperature (in K) to be requested. If display is unable to achieve requested color temperature, then it should move to the closest possible temperature. A value of 0 must be treated as a request for a color temperature of 3000 K. Values greater than 0 must be used as a multiplier of the color temperature increment (read using VCP 0Bh) and the result added to the base value of 3000 K Example: If VCP 0Bh returns a value of 50 K and VCP code 0Ch sends a value of 50 (decimal) then the display must interpret this as a request to adjust the color temperature to 5500 K (3000 + (50 * 50)) K = 5500 K **Notes**: 1) Applications using this function are recommended to read the actual color temperature after using this command and taking appropriate action. 2) This control is only recommended if the display can produce a continuously (at defined increment, see VCP code 0Bh) variable color temperature.	10.6
0Eh	Clock	R/W	C	Increasing (decreasing) this value will increase (decrease) the video sampling clock frequency	10.6
10h	Luminance	R/W	C	Increasing (decreasing) this value will increase (decrease) the Luminance of the image.	10.6

<table>
<tr><th colspan="6">Table 8-4: Image Adjustment VCP Codes</th></tr>
<tr><th>Code</th><th>VCP Code Name</th><th>Type</th><th>Function</th><th>Description</th><th>Compliance</th></tr>
<tr><td>11h</td><td>Flesh Tone Enhancement</td><td>R/W</td><td>NC</td><td>Data size: Write = 2 bytes / Read = 4 bytes
This control allows for selection of contrast enhancement algorithms. A possible value is selected by setting the corresponding bit = 1.
On a write a bit set = 1 in the SH-SL bytes must select the required level of enhancement.
<u>Note:</u> setting more than one bit = 1 is invalid and must be ignored by the display.
On a read the MH -ML bytes contain the flags corresponding to those functions that are supported by the display. The SH-SL bytes contain the bit field with the appropriate bit set to indicate the current status of the display.
The following table defines the SH byte, and the MH byte for read operations only.
<table>
<tr><th>Byte: SH / MH</th><th></th></tr>
<tr><td>Bit 7</td><td>No enhancement,</td></tr>
<tr><td>Bit 6</td><td>Enhancement 1: Enhancement except for automatically detected regions of “skin tone”</td></tr>
<tr><td>Bit 5</td><td>Enhancement 2: Enhancement including “skin tone” regions</td></tr>
<tr><td>Bit 4</td><td>Demo mode: Enhancement is applied to part of the displayed image only</td></tr>
<tr><td>Bit 3</td><td>User mode</td></tr>
<tr><td>Bits 2 → 0</td><td>Reserved, do not use</td></tr>
</table>
The following table defines the SL byte, and the ML byte for read operations only.
<table>
<tr><th>Byte: SL / ML</th><th></th></tr>
<tr><td>Bits 7 → 0</td><td>Reserved, do not use</td></tr>
</table></td><td>10.7</td></tr>
<tr><td>12h</td><td>Contrast</td><td>R/W</td><td>C</td><td>Increasing (decreasing) this value will increase (decrease) the Contrast of the image.
<u>Notes</u>:
1) The actual range of contrast over which this control applies is defined by the manufacturer.
2) Care should be taken to avoid the situation where the contrast ratio approaches 0 … this may be non-recoverable since user will not be able to see the image.</td><td>10.6</td></tr>
</table>

<table>
<tr><th colspan="6">Table 8-4: Image Adjustment VCP Codes</th></tr>
<tr><th>Code</th><th>VCP Code Name</th><th>Type</th><th>Function</th><th>Description</th><th>Compliance</th></tr>
<tr><td>13h</td><td>Backlight Control</td><td>R/W</td><td>C</td><td>Increasing (decreasing) this value in the SL byte will increase (decrease) the specified Backlight Control value.
The SH byte defines whether operation should be performed as a white adjustment or as a red / green or blue backlight adjustment when theses are separate light sources (e.g. LED’s)
On a read the MH-Ml bytes contain the flags corresponding to those functions supported by the display. The SH-SL bytes contain the bit field with the appropriate bit set to indicate the current status of the display.
The following table defines the SH byte, and the MH byte for read operations only.
<table><tr><th>Byte: SH / MH</th><th></th></tr><tr><td>00h</td><td>A white adjustment</td></tr><tr><td>01h</td><td>A red adjustment</td></tr><tr><td>02h</td><td>A green adjustment</td></tr><tr><td>03h</td><td>A blue adjustment</td></tr><tr><td>≥ 04h</td><td>Reserved, must be ignored</td></tr></table><u>Note:</u> The adjustment range (0 → 255) will be mapped to the actual adjustment range defined by the display manufacturer. A value of 0 corresponds to the lowest value and 255 the highest value.</td><td>10.6</td></tr>
<tr><td>14h</td><td>Select Color Preset</td><td>R/W</td><td>NC</td><td>Select a specified color temperature. This is a 2 byte value, the MH byte defines the tolerance associated with any preset … this is fixed by the display manufacturer. If no tolerance level is specified, the presets must be interpreted as relative values supporting a scale which can move to warmer (lower color temperature) or cooler (higher color temperature).
<table><tr><th>Byte: MH</th><th></th></tr><tr><td>00h</td><td>No tolerance is specified, treat as relative scale.</td></tr><tr><td>01h</td><td>A tolerance of 1% is specified</td></tr><tr><td>02h</td><td>A tolerance of 2% is specified</td></tr><tr><td>03h</td><td>⇓</td></tr><tr><td>09h</td><td>A tolerance of 9% is specified</td></tr><tr><td>0AH</td><td>A tolerance of 10% is specified</td></tr><tr><td>≥ 0Bh</td><td>Reserved, must be ignored</td></tr></table><table><tr><th>Byte:</th></tr></table></td><td>10.7</td></tr>
</table>

Table 8-4: Image Adjustment VCP Codes

Code	VCP Code Name	Type	Function	Description	Compliance
				SL If MH byte ≠ 00h: Reserved, must be ignored If MH byte = 00h: 00h: Reserved, must be ignored 01h: sRGB 02h: Display native 03h: 4000 K 04h: 5000 K 05H: 6500 K 06h: 7500 K 07h: 8200 K 08h: 9300 K 09h: 10000 K 0Ah: 11500 K 0Bh: User 1 0Ch: User 2 0Dh: User 3 ≥ 0Eh: Reserved, must be ignored **Note**: In all cases a read operation must return the nominal color temperature and tolerance associated with the value. Example: If tolerance is specified as 5% and preset 09h is selected then color temperature is specified as 10000 K ± 5%.	
16h	Video Gain (Drive): Red	R/W	C	Increasing (decreasing) this value will increase (decrease) the luminance of red pixels. The value returned must be an indication of the actual red gain at the current color temperature and not be normalized.	10.6
17h	User Color Vision Compensation	R/W	C	Increasing (decreasing) this value will increase (decrease) the degree of compensation. **Note**: This is intended to help user suffering from the form of color deficiency in which red colors are poorly seen.	10.6
18h	Video Gain (Drive): Green	R/W	C	Increasing (decreasing) this value will increase (decrease) the luminance of green pixels. The value returned must be an indication of the actual green gain at the current color temperature and not be normalized.	10.6
1Ah	Video Gain (Drive): Blue	R/W	C	Increasing (decreasing) this value will increase (decrease) the luminance of blue pixels. The value returned must be an indication of the actual blue gain at the current color temperature and not be normalized.	10.6

Table 8-4: Image Adjustment VCP Codes

<table>
<tr><th>Code</th><th>VCP Code Name</th><th>Type</th><th>Function</th><th>Description</th><th>Compliance</th></tr>
<tr><td>1Ch</td><td>Focus</td><td>R/W</td><td>C</td><td>Increasing (decreasing) this value will adjust the focus of the image.</td><td>10.6</td></tr>
<tr><td>1Eh</td><td>Auto Setup</td><td>R/W</td><td>NC</td><td>Perform auto setup function (H/V position, clock, clock phase, A/D converter, etc)
<table><tr><th>Byte: SL</th><th></th></tr><tr><td>00h</td><td>Auto setup is not active</td></tr><tr><td>01h</td><td>Perform / performing auto setup</td></tr><tr><td>02h</td><td>Enable continuous / periodic auto setup</td></tr><tr><td>≥ 03h</td><td>Reserved, must be ignored</td></tr></table><u>Note:</u> A value of ‘02h’ (when supported) must cause the display to either continuously or periodically (event or timer driven) perform an auto setup. Cancel by writing a value of either ‘01h’ or ‘00h’.</td><td>10.9</td></tr>
<tr><td>1Fh</td><td>Auto Color Setup</td><td>R/W</td><td>NC</td><td>Perform auto color setup function (R / G / B gain and offset, A/D setup, etc.)
<table><tr><th>Byte: SL</th><th></th></tr><tr><td>00h</td><td>Auto color setup is not active</td></tr><tr><td>01h</td><td>Perform / performing auto color setup</td></tr><tr><td>02h</td><td>Enable continuous / periodic auto color setup</td></tr><tr><td>≥ 03h</td><td>Reserved, must be ignored</td></tr></table><u>Note:</u> A value of ‘02h’ (when supported) must cause the display to either continuously or periodically (event or timer driven) perform an auto color setup. Cancel by writing a value of either ‘01h’ or ‘00h’.</td><td>10.9</td></tr>
<tr><td>2Eh</td><td>Gray Scale Expansion</td><td>R/W</td><td>NC</td><td>Expands the gray scale either in the near white region or the near black region (or both).
<table><tr><th>Byte: SH</th><th>Near white region</th></tr><tr><td>00h</td><td>No white region expansion</td></tr><tr><td>01h</td><td>First level of expansion</td></tr><tr><td>02h</td><td>Second level of expansion</td></tr><tr><td>03h</td><td>Third level of expansion</td></tr><tr><td>≥ 04h</td><td>Reserved, must be ignored</td></tr></table><table><tr><th>Byte: SL</th><th>Near black region</th></tr><tr><td>00h</td><td>No black region expansion</td></tr><tr><td>01h</td><td>First level of expansion</td></tr><tr><td>02h</td><td>Second level of expansion</td></tr><tr><td>03h</td><td>Third level of expansion</td></tr><tr><td>≥ 04h</td><td>Reserved, must be ignored</td></tr></table></td><td>10.7</td></tr>
<tr><td>3Eh</td><td>Clock Phase</td><td>R/W</td><td>C</td><td>Increasing (decreasing) this value will increase (decrease) the phase shift of the sampling clock.</td><td>10.6</td></tr>
</table>

Table 8-4: Image Adjustment VCP Codes

Code	VCP Code Name	Type	Function	Description	Compliance
56h	Horizontal Moiré	R/W	C	Increasing (decreasing) this value controls the horizontal picture moiré cancellation.	10.6
58h	Vertical Moiré	R/W	C	Increasing (decreasing) this value controls the vertical picture moiré cancellation.	10.6
59h	6 Axis Saturation Control: Red	R/W	C	Adjust the red saturation for 6-axis color **Byte: SL** > 7Fh — Causes an increase in red saturation 7Fh — The nominal (default) value < 7Fh — Causes a decrease in red saturation If set = 7fh then display must make no change to the red saturation of the incoming signal. If set ≠ 7Fh, then writing a value = 7Fh must cause the display to return to its nominal (default) setting for red saturation. The ± 7Fh range must be linearly mapped to the actual adjustment range.	10.10
5Ah	6 Axis Saturation Control: Yellow	R/W	C	Adjust the yellow saturation for 6-axis color **Byte: SL** > 7Fh — Causes an increase in yellow saturation 7Fh — The nominal (default) value < 7Fh — Causes a decrease in yellow saturation If set = 7fh then display must make no change to the yellow saturation of the incoming signal. If set ≠ 7Fh, then writing a value = 7Fh must cause the display to return to its nominal (default) setting for yellow saturation. The ± 7Fh range must be linearly mapped to the actual adjustment range.	10.10
5Bh	6 Axis Saturation Control: Green	R/W	C	Adjust the green saturation for 6-axis color **Byte: SL** > 7Fh — Causes an increase in green saturation 7Fh — The nominal (default) value < 7Fh — Causes a decrease in green saturation If set = 7fh then display must make no change to the green saturation of the incoming signal. If set ≠ 7Fh, then writing a value = 7Fh must cause the display to return to its nominal (default) setting for	10.10

<table>
<tr><th colspan="6">Table 8-4: Image Adjustment VCP Codes</th></tr>
<tr><th>Code</th><th>VCP Code Name</th><th>Type</th><th>Function</th><th>Description</th><th>Compliance</th></tr>
<tr><td></td><td></td><td></td><td></td><td>green saturation.
The ± 7Fh range must be linearly mapped to the actual adjustment range.</td><td></td></tr>
<tr><td>5Ch</td><td>6 Axis Saturation Control: Cyan</td><td>R/W</td><td>C</td><td>Adjust the cyan saturation for 6-axis color

<table><tr><th>Byte: SL</th><th></th></tr><tr><td>> 7Fh</td><td>Causes an increase in cyan saturation</td></tr><tr><td>7Fh</td><td>The nominal (default) value</td></tr><tr><td>< 7Fh</td><td>Causes a decrease in cyan saturation</td></tr></table>
If set = 7fh then display must make no change to the cyan saturation of the incoming signal.
If set ≠ 7Fh, then writing a value = 7Fh must cause the display to return to its nominal (default) setting for cyan saturation.
The ± 7Fh range must be linearly mapped to the actual adjustment range.</td><td>10.10</td></tr>
<tr><td>5Dh</td><td>6 Axis Saturation Control: Blue</td><td>R/W</td><td>C</td><td>Adjust the blue saturation for 6-axis color

<table><tr><th>Byte: SL</th><th></th></tr><tr><td>> 7Fh</td><td>Causes an increase in blue saturation</td></tr><tr><td>7Fh</td><td>The nominal (default) value</td></tr><tr><td>< 7Fh</td><td>Causes a decrease in blue saturation</td></tr></table>
If set = 7fh then display must make no change to the blue saturation of the incoming signal.
If set ≠ 7Fh, then writing a value = 7Fh must cause the display to return to its nominal (default) setting for blue saturation.
The ± 7Fh range must be linearly mapped to the actual adjustment range.</td><td>10.10</td></tr>
<tr><td>5Eh</td><td>6 Axis Saturation Control: Magenta</td><td>R/W</td><td>C</td><td>Adjust the magenta saturation for 6-axis color

<table><tr><th>Byte: SL</th><th></th></tr><tr><td>> 7Fh</td><td>Causes an increase in magenta saturation</td></tr><tr><td>7Fh</td><td>The nominal (default) value</td></tr><tr><td>< 7Fh</td><td>Causes a decrease in magenta saturation</td></tr></table>
If set = 7fh then display must make no change to the magenta saturation of the incoming signal.
If set ≠ 7Fh, then writing a value = 7Fh must cause the display to return to its nominal (default) setting for</td><td>10.10</td></tr>
</table>

<table>
<tr><th colspan="6">Table 8-4: Image Adjustment VCP Codes</th></tr>
<tr><th>Code</th><th>VCP Code Name</th><th>Type</th><th>Function</th><th>Description</th><th>Compliance</th></tr>
<tr><td></td><td></td><td></td><td></td><td>magenta saturation.
The ± 7Fh range must be linearly mapped to the actual adjustment range.</td><td></td></tr>
<tr><td>6Ch</td><td>Video Black Level: Red</td><td>R/W</td><td>C</td><td>Increasing (decreasing) this value will increase (decrease) the black level of the red video.</td><td>10.6</td></tr>
<tr><td>6Eh</td><td>Video Black Level: Green</td><td>R/W</td><td>C</td><td>Increasing (decreasing) this value will increase (decrease) the black level of the green video.</td><td>10.6</td></tr>
<tr><td>70h</td><td>Video Black Level: Blue</td><td>R/W</td><td>C</td><td>Increasing (decreasing) this value will increase (decrease) the black level of the blue video.</td><td>10.6</td></tr>
<tr><td>72h</td><td>Gamma</td><td>R/W</td><td>NC</td><td>This VCP code has two distinct modes, it may be used to select an absolute (within a defined tolerance) value for gamma or it may be used to select a value of gamma relative to the default gamma of the display.
The SL byte defines whether the operation should be performed as a white adjustment or as a red / green or blue sub-channel adjustment or if the display should disable all gamma correction.
<table><tr><th>Byte: SL</th><th></th></tr><tr><td>00h</td><td>A white absolute adjustment</td></tr><tr><td>01h</td><td>A red absolute adjustment</td></tr><tr><td>02h</td><td>A green absolute adjustment</td></tr><tr><td>03h</td><td>A blue absolute adjustment</td></tr><tr><td>04h</td><td>A white relative adjustment</td></tr><tr><td>05h</td><td>Disable all gamma correction in the display</td></tr><tr><td>≥ 06h</td><td>Reserved, must be ignored</td></tr></table><u>Note</u>:
If a white absolute or relative adjustment is sent to a display with separate red, green and blue sub-channel adjustment capability then the three sub-channels must be adjusted together.
<u>For absolute adjustments:</u>
The SH byte defines the actual operation value as follows:
The decimal value of the desired gamma is divided by 100 and then added to a base value of 1.
Examples:
A value of 0 results in a gamma of 1 (linear) {0/100+1=1}
A value of 120 results in a gamma of 2.20 {120/100+1=2.20}
<u>Capability string format:</u>
The format of capability string reporting for this VCP is very important, it must be in the following format for displays supporting absolute gamma adjustment:

1st #: Accuracy of gamma setting as a percentage of</td><td>10.6</td></tr>
</table>

Table 8-4: Image Adjustment VCP Codes

Code	VCP Code Name	Type	Function	Description	Compliance

requested gamma value (range 00h (ideal) → 0Ah (accuracy is equal to or worse than {requested gamma ± 10%}. A value > 0Ah and < FFh indicates that there is no tolerance specified. The value of FFh is reserved.

2nd#: The native gamma (default) of the display, expressed as the decimal value associated with a particular gamma value
e.g. a native gamma of 2.2 would be represented by a decimal value of 120

3rd #:and above:

3rd #	Definition of 3rd #	4th # & above
FFh	Full range of absolute gamma adjustment is supported	Not applicable
FEh	Full range of absolute gamma adjustment is supported AND display has ability to bypass gamma correction.	Not applicable
FDh	Limited range of absolute gamma adjustment is supported	4th and 5th #'s define the lower and upper range limits respectively
FCh	Limited range of absolute gamma adjustment is supported AND display has ability to bypass gamma correction.	4th and 5th #'s define the lower and upper range limits respectively
FBh	Specific absolute gamma preset(s) follow	4th # and above are absolute gamma presets expressed as the decimal value associated with a particular gamma value
FAh	Specific absolute gamma preset(s) follow AND display has ability to bypass gamma correction.	4th # and above are absolute gamma presets expressed as the decimal value associated with a particular gamma value
≤ F9h	Reserved	

<table>
<tr><th colspan="6">Table 8-4: Image Adjustment VCP Codes</th></tr>
<tr><th>Code</th><th>VCP Code Name</th><th>Type</th><th>Function</th><th>Description</th><th>Compliance</th></tr>
<tr><td></td><td></td><td></td><td></td><td>
Example 1:
72(05 78 FB 50 64 78 8C) indicates that the display has a default gamma of 2.2 and presets of 1.8, 2.0, 2.2 and 2.4 with an accuracy at each preset of ± 5%
Example 2:
72(02 96 FE 50 A0) indicates that the display has a default gamma of 2.5 and is capable of adjusting the gamma within the range of 1.8 to 2.6 with an accuracy of ± 2%
For relative adjustments:
The SL byte is as previously defined.
The SH byte defines the actual operation value:
<table>
<tr><th>Byte: SH</th><th></th></tr>
<tr><td>00h</td><td>Display default gamma</td></tr>
<tr><td>01h</td><td>Default gamma – 0.1</td></tr>
<tr><td>02h</td><td>Default gamma – 0.2</td></tr>
<tr><td>⇓</td><td>⇓</td></tr>
<tr><td>09h</td><td>Default gamma – 0.9</td></tr>
<tr><td>0Ah</td><td>Default gamma – 1.0</td></tr>
<tr><td></td><td></td></tr>
<tr><td>11h</td><td>Default gamma + 0.1</td></tr>
<tr><td>12h</td><td>Default gamma + 0.2</td></tr>
<tr><td>⇓</td><td>⇓</td></tr>
<tr><td>19h</td><td>Default gamma + 0.9</td></tr>
<tr><td>1Ah</td><td>Default gamma + 1.0</td></tr>
<tr><td>20h</td><td>Disable all gamma correction in the display.</td></tr>
<tr><td>≥21h</td><td>Reserved, must be ignored</td></tr>
</table>
Capability string format:
The format of capability string reporting for this VCP is very important, it must be of the following format for displays supporting relative gamma adjustment:
1st #: Set = FFh to specify relative adjustment
2nd#: The native gamma (default) of the display, expressed as the decimal value associated with a particular gamma value
e.g. a native gamma of 2.2 would be represented by a decimal value of 120.
3rd #:and above:
<table>
<tr><th>3rd #</th><th>Definition of 3rd #</th><th>4th # & above</th></tr>
<tr><td>FFh</td><td>Full range of relative gamma adjustment is supported</td><td>Not applicable</td></tr>
</table>
</td><td></td></tr>
</table>

Table 8-4: Image Adjustment VCP Codes

Code	VCP Code Name	Type	Function	Description	Compliance
				FEh — Full range of relative gamma adjustment is supported AND display has ability to bypass gamma correction. — Not applicable FDh — Limited range of relative gamma adjustment is supported — 4th and 5th #'s define the lower and upper range limits respectively. **Note**: Undefined values in range have no meaning and must be ignored. FCh — Limited range of relative gamma adjustment is supported AND display has ability to bypass gamma correction. — 4th and 5th #'s define the lower and upper range limits respectively. **Note:** Undefined values in range have no meaning and must be ignored. FBh — Specific relative gamma preset(s) follow — 4th # and above are relative gamma represented by the appropriate value for the SL byte as defined above. FAh — Specific relative gamma preset(s) follow AND display has ability to bypass gamma correction. — 4th # and above are relative gamma represented by the appropriate value for the SL byte as defined above. ≤ F9h — Reserved Example 3: 72(FF 00 01 03 05 07 09 11 13 15 17 19) indicates that the display can make relative adjustments of ± 0.1, ± 0.3, ± 0.5, ± 0.7 and ± 0.9. Example 4: 72(FF 01 FE 05 15) indicates that the display can make relative adjustments up to ± 0.5 in increments of 0.1	
73h	LUT Size	RO	T	Provides the size (number of entries and number of bits / entry) for the Red / Green and Blue LUT in the display	10.11.4

<table>
<tr><th colspan="6">Table 8-4: Image Adjustment VCP Codes</th></tr>
<tr><th>Code</th><th>VCP Code Name</th><th>Type</th><th>Function</th><th>Description</th><th>Compliance</th></tr>
<tr><td></td><td></td><td></td><td></td><td>
<table>
<tr><th>Byte</th><th>Definition</th></tr>
<tr><td>0 + 1</td><td>Number of Red LUT entries</td></tr>
<tr><td>2 + 3</td><td>Number of Green LUT entries</td></tr>
<tr><td>4 + 5</td><td>Number of Blue LUT entries</td></tr>
<tr><td>6</td><td>Number of bits / entry in Red LUT</td></tr>
<tr><td>7</td><td>Number of bits / entry in Green LUT</td></tr>
<tr><td>8</td><td>Number of bits / entry in Blue LUT</td></tr>
</table>
<u>Note:</u>
Support for this command is a pre-requisite for support of commands 74h and 75h.
</td><td></td></tr>
</table>

<table>
<tr><th colspan="6">Table 8-4: Image Adjustment VCP Codes</th></tr>
<tr><th>Code</th><th>VCP Code Name</th><th>Type</th><th>Function</th><th>Description</th><th>Compliance</th></tr>
<tr><td>74h</td><td>Single Point LUT Operation</td><td>R/W</td><td>T</td><td>Allows a single point within a display's color LUT (look up table) to be loaded.
Write Operation
<table>
<tr><th>Byte</th><th>Definition</th></tr>
<tr><td>0</td><td>Value = 1 (write operation)</td></tr>
<tr><td>1 + 2</td><td>Offset into the LUT</td></tr>
<tr><td>3 + 4</td><td>Red LUT value to be loaded</td></tr>
<tr><td>5 + 6</td><td>Green LUT value to be loaded</td></tr>
<tr><td>7 + 8</td><td>Blue LUT value to be loaded</td></tr>
</table>
Read Operation
<table>
<tr><th>Byte</th><th>Definition</th></tr>
<tr><td>0</td><td>Value = 2 (read operation)</td></tr>
<tr><td>1 + 2</td><td>Offset into the LUT</td></tr>
</table>
<table>
<tr><th>Byte</th><th>Definition</th></tr>
<tr><td>0 + 1</td><td>Red LUT value read</td></tr>
<tr><td>2 + 3</td><td>Green LUT value read</td></tr>
<tr><td>4 + 5</td><td>Blue LUT value read</td></tr>
</table>
<u>Notes:</u>
1. If display LUT cannot store 16 bit values then least significant bits must be discarded
2. Support of VCP 73h, LUT Size, is a pre-requisite for this VCP</td><td>10.11.4</td></tr>
</table>

<table>
<tr><th colspan="6">Table 8-4: Image Adjustment VCP Codes</th></tr>
<tr><th>Code</th><th>VCP Code Name</th><th>Type</th><th>Function</th><th>Description</th><th>Compliance</th></tr>
<tr><td>75h</td><td>Block LUT Operation</td><td>R/W</td><td>T</td><td>Provides an efficient method for loading multiple values into a display's LUT
Write Operation
<table>
<tr><th>Byte</th><th>Definition</th></tr>
<tr><td>0</td><td>Value = 1 (write operation)</td></tr>
<tr><td>1</td><td>Red / Green or Blue LUT follows
Value = 1 : Red LUT data
Value = 2 : Green LUT data
Value = 3 : Blue LUT data</td></tr>
<tr><td>2 + 3</td><td>Number of values to be read</td></tr>
<tr><td>4 + 5</td><td>Offset into Red or Green or Blue LUT</td></tr>
<tr><td>6 + 7</td><td>1st R or G or B LUT value to be loaded</td></tr>
<tr><td>8 + 9</td><td>2ndR or G or B LUT value to be loaded</td></tr>
<tr><td>10 + 11</td><td>3rd R or G or B LUT value to be loaded</td></tr>
<tr><td></td><td>etc</td></tr>
</table>
Read Operation
<table>
<tr><th>Byte</th><th>Definition</th></tr>
<tr><td>0</td><td>Value = 2 (read operation)</td></tr>
<tr><td>1</td><td>Red / Green or Blue LUT follows
Value = 1 : Red LUT data
Value = 2 : Green LUT data
Value = 3 : Blue LUT data</td></tr>
<tr><td>2 + 3</td><td>Number of values to be read</td></tr>
<tr><td>4 + 5</td><td>Offset into Red or Green or Blue LUT</td></tr>
</table>
<table>
<tr><th>Byte</th><th>Definition</th></tr>
<tr><td>0 + 1</td><td>1st Red or Green or Blue LUT contents</td></tr>
<tr><td>2 + 3</td><td>2nd Red or Green or Blue LUT contents</td></tr>
<tr><td>4 + 5</td><td>3rd Red or Green or Blue LUT contents</td></tr>
<tr><td></td><td>etc</td></tr>
</table>
<u>Notes:</u>
1. If display LUT cannot store 16 bit values then least significant bits must be discarded
2. Support of VCP 73h, LUT Size, is a pre-requisite for this VCP</td><td>10.11.4</td></tr>
<tr><td>7Ch</td><td>Adjust Zoom</td><td>R/W</td><td>C</td><td>Increasing (decreasing) this value will increase (decrease) the zoom function of the projection lens.</td><td>10.6</td></tr>
<tr><td>87h</td><td>Sharpness</td><td>R/W</td><td>C</td><td>Allows one of a range of algorithms to be selected to suit the type of image being displayed and/or personal preference.
Increasing (decreasing) the value must increase (decrease) the edge sharpness of image features.</td><td>10.6</td></tr>
</table>

Table 8-4: Image Adjustment VCP Codes					
Code	**VCP Code Name**	**Type**	**Function**	**Description**	**Compliance**
88h	Velocity Scan Modulation	R/W	C	Increasing (decreasing) this value will increase (decrease) the velocity modulation of the horizontal scan as a function of a change in the luminance level.	10.6
8Ah	Color Saturation	R/W	C	Increasing this control increases the amplitude of the color difference components of the video signal. The result is an increase in the amount of pure color relative to white in the video. This control applies to the currently active interface.	10.6
8Ch	TV-Sharpness	R/W	C	Increasing this control increases the amplitude of the high frequency components of the video signal. This allows fine details to be accentuated. This control does not affect the RGB input, only the TV video inputs.	10.6
8Eh	TV-Contrast	R/W	C	Increasing (decreasing) this control increases (decreases) the ratio between whites and blacks in the video. This control does not affect the RGB input, only the TV video inputs.	10.6
90h	Hue	R/W	C	Also known as 'tint' Increasing (decreasing) this control increases (decreases) the wavelength of the color component of the video signal. The result is a shift towards red (blue) in the hue of all colors. This control applies to the currently active interface.	10.6
92h	TV-Black Level / Luminance	R/W	C	Increasing this control increases the black level of the video, resulting in an increase of the luminance level of the video. A value of zero represents the darkest level possible. This control does not affect the RGB input, only the TV video inputs.	10.6
9Ah	Window Background	R/W	C	Changes the contrast ratio between the area of the window and the rest of the desktop Lower (higher) values will cause the desktop luminance to decrease (increase) **Notes:** 1. This VCP code should be used in conjunction with VCP 99h 2. This command structure is not recommended for new designs, see VCP A5h for alternate.	10.6

Table 8-4: Image Adjustment VCP Codes

Code	VCP Code Name	Type	Function	Description	Compliance
9Bh	6 Axis Hue Control: Red	R/W	C	Adjust the red hue for 6-axis color **Byte: SL** > 7Fh — Causes an increase in red hue 7Fh — The nominal (default) value < 7Fh — Causes a decrease in red hue If set = 7fh then display must make no change to the red hue of the incoming signal. If set ≠ 7Fh, then writing a value = 7Fh must cause the display to return to its nominal (default) setting for red hue. The ± 7Fh range must be linearly mapped to the actual adjustment range.	10.10
9Ch	6 Axis Hue Control: Yellow	R/W	C	Adjust the yellow hue for 6-axis color **Byte: SL** > 7Fh — Causes an increase in yellow hue 7Fh — The nominal (default) value < 7Fh — Causes a decrease in yellow hue If set = 7fh then display must make no change to the yellow hue of the incoming signal. If set ≠ 7Fh, then writing a value = 7Fh must cause the display to return to its nominal (default) setting for yellow hue. The ± 7Fh range must be linearly mapped to the actual adjustment range.	10.10
9Dh	6 Axis Hue Control: Green	R/W	C	Adjust the green hue for 6-axis color **Byte: SL** > 7Fh — Causes an increase in green hue 7Fh — The nominal (default) value < 7Fh — Causes a decrease in green hue If set = 7fh then display must make no change to the green hue of the incoming signal. If set ≠ 7Fh, then writing a value = 7Fh must cause the display to return to its nominal (default) setting for green hue. The ± 7Fh range must be linearly mapped to the actual adjustment range.	10.10

Table 8-4: Image Adjustment VCP Codes

Code	VCP Code Name	Type	Function	Description	Compliance
9Eh	6 Axis Hue Control: Cyan	R/W	C	Adjust the cyan hue for 6-axis color **Byte: SL** > 7Fh: Causes an increase in cyan hue 7Fh: The nominal (default) value < 7Fh: Causes a decrease in cyan hue If set = 7fh then display must make no change to the cyan hue of the incoming signal. If set ≠ 7Fh, then writing a value = 7Fh must cause the display to return to its nominal (default) setting for cyan hue. The ± 7Fh range must be linearly mapped to the actual adjustment range.	10.10
9Fh	6 Axis Hue Control: Blue	R/W	C	Adjust the blue hue for 6-axis color **Byte: SL** > 7Fh: Causes an increase in blue hue 7Fh: The nominal (default) value < 7Fh: Causes a decrease in blue hue If set = 7fh then display must make no change to the blue hue of the incoming signal. If set ≠ 7Fh, then writing a value = 7Fh must cause the display to return to its nominal (default) setting for blue hue. The ± 7Fh range must be linearly mapped to the actual adjustment range.	10.10
A0h	6 Axis Hue Control: Magenta	R/W	C	Adjust the magenta hue for 6-axis color **Byte: SL** > 7Fh: Causes an increase in magenta hue 7Fh: The nominal (default) value < 7Fh: Causes a decrease in magenta hue If set = 7fh then display must make no change to the magenta hue of the incoming signal. If set ≠ 7Fh, then writing a value = 7Fh must cause the display to return to its nominal (default) setting for magenta hue. The ± 7Fh range must be linearly mapped to the actual adjustment range.	10.10

<table>
<tr><th colspan="6">Table 8-4: Image Adjustment VCP Codes</th></tr>
<tr><th>Code</th><th>VCP Code Name</th><th>Type</th><th>Function</th><th>Description</th><th>Compliance</th></tr>
<tr><td>A2h</td><td>Auto Setup On / Off</td><td>WO</td><td>NC</td><td>Turn on / off the auto setup function (periodic or event driven).
<table><tr><th>Byte: SL</th><th></th></tr><tr><td>00h</td><td>Reserved, must be ignored</td></tr><tr><td>01h</td><td>Turn auto setup “off”</td></tr><tr><td>02h</td><td>Turn auto setup ‘on’</td></tr><tr><td>≥ 03h</td><td>Reserved, must be ignored</td></tr></table></td><td>10.11.4</td></tr>
<tr><td>A4h</td><td>Window Mask Control</td><td>R/W</td><td>T</td><td>Data size: Write / Read = 10 bytes
This code has two sets of functions:
- To retain compatibility with applications using VCP codes 95h → 98h to set the (x,y) coordinates of a window.
It also provides a way to set all the window coordinates simultaneously – this is recommended for new designs.
For legacy operations:
The bits of byte 0 allow each window to be masked from the user e.g. while it is being resized.
The bits of byte 1 allow each window to be turned to an active or inactive state … note that only an active window will be visible to the user, assuming it has not been masked.
For new implementations:
Byte 2 and 3 provide the top left x coordinate of the window.
Byte 4 and 5 provide the top left y coordinates of the window.
Byte 6 and 7 provide the bottom right x coordinate of the window.
Byte 8 and 9 provide the bottom right y coordinates of the window.
<table><tr><th>Byte 0</th><th></th><th></th></tr><tr><td>Bit 0</td><td>Set = 0</td><td>Window controls have no effect on the displayed image.</td></tr><tr><td></td><td>Set = 1</td><td>Window controls affect the displayed image (full image area)</td></tr><tr><td>Bit 1</td><td>Set = 0</td><td>Window controls have no effect on the displayed image (window 1)</td></tr><tr><td></td><td>Set = 1</td><td>Window controls affect the displayed image (window 1)</td></tr><tr><td>⇓</td><td>⇓</td><td>⇓</td></tr><tr><td>Bit 7</td><td>Set = 0</td><td>Window controls have no effect on the displayed image (window</td></tr></table></td><td>10.11.4</td></tr>
</table>

Table 8-4: Image Adjustment VCP Codes

Code	VCP Code Name	Type	Function	Description	Compliance
				7)	
				Set = 1 — Window controls affect the displayed image (window 7)	
				Byte 1	
				Bit 0 — Set = 0 — Reserved, do not use	
				Bit 1 — Set = 0 — Window # 1 is inactive	
				Bit 1 — Set = 1 — Window # 1 is active	
				⇓ ⇓ ⇓	
				Bit 7 — Set = 0 — Window # 7 is inactive	
				Bit 7 — Set = 1 — Window # 7 is active	
				Byte 2 — High order bits of top left x coordinate	
				Byte 3 — Low order bits of top left x coordinate	
				Byte 4 — High order bits of top left y coordinate	
				Byte 5 — Low order bits of top left y coordinate	
				Byte 6 — High order bits of bottom right x coordinate	
				Byte 7 — Low order bits of bottom right x coordinate	
				Byte 8 — High order bits of bottom right y coordinate	
				Byte 9 — Low order bits of bottom right y coordinate	
				Note: This command structure is recommended, in conjunction with VCP A5h, for all new designs.	

<table>
<tr><th colspan="6">Table 8-4: Image Adjustment VCP Codes</th></tr>
<tr><th>Code</th><th>VCP Code Name</th><th>Type</th><th>Function</th><th>Description</th><th>Compliance</th></tr>
<tr><td>A5h</td><td>Window Select</td><td>R/W</td><td>C</td><td>Change the selected window (as defined by 95h – 98h).
When a window is selected then all commands that the display controller supports for window operations are valid, this may include but is not limited to: luminance, contrast, R/G/B gain, 6-axis color, sharpness, etc.
<table>
<tr><th>Byte: SL</th><th></th></tr>
<tr><td>00h</td><td>Full display image area is selected except for area(s) of active windows</td></tr>
<tr><td>01h</td><td>Window 1 is selected</td></tr>
<tr><td>02h</td><td>Window 2 is selected</td></tr>
<tr><td>03h</td><td>Window 3 is selected</td></tr>
<tr><td>04h</td><td>Window 4 is selected</td></tr>
<tr><td>05h</td><td>Window 5 is selected</td></tr>
<tr><td>06h</td><td>Window 6 is selected</td></tr>
<tr><td>07h</td><td>Window 7 is selected</td></tr>
<tr><td>≥ 08h</td><td>Reserved, must be ignored</td></tr>
</table>
<u>Notes</u>:
If this command is not supported then the ‘full image area’ must be the default.
This command structure is recommended, in conjunction with VCP A4h, for all new designs
The last window to be addressed is assumed to the top ‘layer’ of the displayed image.</td><td>10.6</td></tr>
</table>

<table>
<tr><th colspan="6">Table 8-4: Image Adjustment VCP Codes</th></tr>
<tr><th>Code</th><th>VCP Code Name</th><th>Type</th><th>Function</th><th>Description</th><th>Compliance</th></tr>
<tr><td>AAh</td><td>Screen Orientation</td><td>RO</td><td>NC</td><td>Indicates the orientation of the screen.
<table>
<tr><th>Byte: SL</th><th></th><th></th></tr>
<tr><td>00h</td><td>Reserved</td><td>Shall be ignored</td></tr>
<tr><td>01h</td><td>0 degrees</td><td>The normal landscape mode</td></tr>
<tr><td>02h</td><td>90 degrees</td><td>Portrait mode achieved by clockwise rotation of the display 90 degrees.</td></tr>
<tr><td>03h</td><td>180 degrees</td><td>Landscape mode achieved by rotation of the display 180 degrees.</td></tr>
<tr><td>04h</td><td>270 degrees</td><td>Portrait mode achieved by clockwise rotation of the display 270 degrees.</td></tr>
<tr><td>05h → FEh</td><td>Reserved</td><td>Shall be ignored</td></tr>
<tr><td>FFh</td><td>Not applicable</td><td>Indicates that the display cannot supply the current orientation</td></tr>
</table>
<u>Note:</u> “Clockwise rotation” when viewing the display from user’s viewpoint.</td><td>10.11</td></tr>
<tr><td>D4h</td><td>Stereo Video Mode</td><td>R/W</td><td>NC</td><td>Used to select the video mode with respect to 2D or 3D video.
<table>
<tr><th>Byte: SL</th><th></th></tr>
<tr><td>Bit 7</td><td>Reserved, must be ignored</td></tr>
<tr><td>Bit 6</td><td>Enable Field-Sequential Right Eye First</td></tr>
<tr><td>Bit 5</td><td>Enable Field-Sequential Left Eye First</td></tr>
<tr><td>Bit 4</td><td>Enable 2-Way Interleaved Right Eye First</td></tr>
<tr><td>Bit 3</td><td>Enable 2-Way Interleaved Left Eye First</td></tr>
<tr><td>Bit 2</td><td>Enable 4-Way Interleaved, Display Stereo Buffer 0 (even scan lines)</td></tr>
<tr><td>Bit 1</td><td>Enable 4-Way Interleaved, Display Stereo Buffer 1 (odd scan lines)</td></tr>
<tr><td>Bit 0</td><td>Enable Side-by-Side Interleaved</td></tr>
</table>
<u>Note:</u> It is permissible, during a read operation, for a display to indicate support for 2 or more stereo modes</td><td>10.7</td></tr>
</table>

<table>
<tr><th colspan="6">Table 8-4: Image Adjustment VCP Codes</th></tr>
<tr><th>Code</th><th>VCP Code Name</th><th>Type</th><th>Function</th><th>Description</th><th>Compliance</th></tr>
<tr><td>DCh</td><td>Display Application</td><td>R/W</td><td>NC</td><td>Permits the selection of a preset optimized by manufacturer for an application type or the selection of a user defined setting.

<table><tr><th>Byte: SL</th><th></th></tr><tr><td>00h</td><td>Stand / default mode</td></tr><tr><td>01h</td><td>Productivity (e.g. office applications)</td></tr><tr><td>02h</td><td>Mixed (e.g. internet with mix of text and images)</td></tr><tr><td>03h</td><td>Movie</td></tr><tr><td>04h</td><td>User defined</td></tr><tr><td>05h</td><td>Games (e.g. games console / PC game)</td></tr><tr><td>06h</td><td>Sports (e.g. fast action)</td></tr><tr><td>07h</td><td>Professional (all signal processing disabled)</td></tr><tr><td>08h</td><td>Standard / default mode with intermediate power consumption</td></tr><tr><td>09h</td><td>Standard / default mode with low power consumption</td></tr><tr><td>0Ah</td><td>Demonstration (used for high visual impact in retail etc)</td></tr><tr><td>0Bh - EFh</td><td>Reserved, must be ignored</td></tr><tr><td>F0h</td><td>Dynamic contrast</td></tr><tr><td>≥ F1h</td><td>Reserved, must be ignored</td></tr></table><u>Note</u>: The condition(s) associated with options 00h → 0Ah (inclusive) are defined by the display manufacturer and may include all or some of luminance, contrast, gamma settings, etc.</td><td>10.7</td></tr>
</table>

8.3 Display Control VCP Codes

Table 8-5: Display Control VCP Code Cross-Reference

VCP Code Name	Code	Compliance
Display Controller Type	C8h	10.11
Display Firmware Level	C9h	10.11
Display Usage Time	C6h	10.11
Horizontal Frequency	ACh	10.11
Image Mode	DBh	10.7
OSD	CAh	10.7
OSD Language	CCh	10.7
Power Mode	D6h	10.7
Source Color Coding	B5h	10.11.4
Source Timing Mode	B4h	10.12.2
VCP Version	DFh	10.11
Vertical Frequency	AEh	10.11

Table 8-6: Display Control VCP Codes

Code	VCP Code Name	Type	Function	Description	Compliance
ACh	Horizontal Frequency	RO	C	Horizontal synchronization signal frequency in Hz as determined by the display. MH = ML = SH = SL = FFh: Indicates that the display cannot determine the frequency or it is out of range. Example: A reported value of 01h, 21h, 10h indicates a Hz frequency of 74.0KHz (nominal for 1920 x 1200 @ 60Hz reduced blanking)	10.11
AEh	Vertical Frequency	RO	C	Vertical synchronization signal frequency in 0.01Hz as determined by the display. MH = ML = SH = SL = FFh: Indicates that the display cannot determine the frequency or it is out of range. Example: A reported value of 17h, 7Ah indicates a Hz frequency of 60.1Hz.	10.11
B4h	Source Timing Mode	R/W	T	Indicates the timing mode being sent by the host. This command has a 5 byte data structure: Byte 0: flags for DMT timing modes Byte 1: flags for DTV timing modes Bytes 2 – 4: CVT descriptor bytes **Note:** Only one Timing Mode must be indicated, any combination with more than a single Timing Mode identified is invalid and must be ignored. **Note:** 'RB' in following table indicates 'reduced blanking' as defined by the VESA CVT standard **Byte 0** | **VESA DMT Standard entry**	10.12.2

				00h	Reserved, must be ignored	
				01h	640 x 350 @ 85 Hz	
				02h	640 x 400 @ 85 Hz	
				03h	720 x 400 @ 85 Hz	
				04h	640 X 480 @ 60 Hz	
				05h	640 X 480 @ 72 Hz	
				06h	640 X 480 @ 75 Hz	
				07h	640 X 480 @ 85 Hz	
				08h	800 x 600 @ 56 Hz	
				09h	800 X 600 @ 60 Hz	
				0Ah	800 x 600 @ 72 Hz	
				0Bh	800 x 600 @ 75 Hz	
				0Ch	800 x 600 @ 85 Hz	
				0Dh	848 x 480 @ 60 Hz	
				0Eh	1024 x 768 @ 43 Hz interlaced	
				0Fh	1024 x 768 @ 60 Hz	
				10h	1024 x 768 @ 70 Hz	
				11h	1024 x 768 @ 75 Hz	
				12h	1024 x 768 @ 85 Hz	
				13h	1152 x 864 @ 75 Hz	
				14h	1280 x 768 @ 60 Hz - RB	
				15h	1280 x 768 @ 60 Hz	
				16h	1280 x 768 @ 75 Hz	
				17h	1280 x 768 @ 85 Hz	
				18h	1280 x 960 @ 60 Hz	
				19h	1280 x 960 @ 85 Hz	
				1Ah	1280 x 1024 @ 60 Hz	
				1Bh	1280 x 1024 @ 75 Hz	
				1Ch	1280 x 1024 @ 85 Hz	
				1Dh	1360 x 768 @ 60 Hz	
				1Eh	1400 x 1050 @ 60 Hz - RB	
				1Fh	1400 x 1050 @ 60 Hz	
				20h	1400 x 1050 @ 75 Hz	
				21h	1400 x 1050 @ 85 Hz	
				22h	1440 x 900 @ 60 Hz - RB	
				23h	1440 x 900 @ 60 Hz	
				24h	1440 x 900 @ 75 Hz	
				25h	1440 x 900 @ 85 Hz	
				26h	1600 x 1200 @ 60 Hz	
				27h	1600 x 1200 @ 65 Hz	
				28h	1600 x 1200 @ 70 Hz	
				29h	1600 x 1200 @ 75 Hz	
				2Ah	1600 x 1200 @ 85 Hz	
				2Bh	1680 x 1050 @ 60 Hz - RB	
				2Ch	1680 x 1050 @ 60 Hz	
				2Dh	1680 x 1050 @ 75 Hz	

2Eh	1680 x 1050 @ 85 Hz
2Fh	1792 x 1344 @ 60 Hz
30h	1792 x 1344 @ 75 Hz
31h	1856 x 1392 @ 60 Hz
32h	1856 x 1392 @ 75 Hz
33h	1920 x 1200 @ 60 Hz – RB
34h	1920 x 1200 @ 60 Hz
35h	1920 x 1200 @ 75 Hz
36h	1920 x 1200 @ 85 Hz
37h	1920 x 1440 @ 60 Hz
38h	1920 x 1440 @ 75 Hz
≥ 39h	Reserved, must be ignored

Note: The aspect ratio (AR) identified in the following table is the physical aspect ratio of the image.

Byte 1	DTV Standards (ref. CEA 861-c)
00h	Reserved, must be ignored
01h	640 x 400p @ 59.94/60 Hz 4:3 AR
02h	720 x 480p @ 59.94/60 Hz 4:3 AR
03h	720 x 480p @ 59.94/60 Hz 16:9 AR
04h	1280 x 720p @ 59.94/60 Hz 16:9 AR
05h	1920 x 1080i @ 59.94/60 Hz 16:9 AR
06h	720(1440) x 480i @ 59.94/60 Hz 4:3 AR
07h	720(1440) x 480i @ 59.94/60 Hz 16:9 AR
08h	720(1440) x 240p @ 59.94/60 Hz 4:3 AR
09h	720(1440) x 240p @ 59.94/60 Hz 16:9 AR
0Ah	(2880) x 480i @ 59.94/60 Hz 4:3 AR
0Bh	(2880) x 480i @ 59.94/60 Hz 16:9 AR
0Ch	(2880) x 240p @ 59.94/60 Hz 4:3 AR
0Dh	(2880) x 240p @ 59.94/60 Hz 16:9 AR
0Eh	1440 x 480p @ 59.94/60 Hz 4:3 AR
0Fh	1440 x 480p @ 59.94/60 Hz 16:9 AR
10h	1920 x 1080p @ 59.94/60 Hz 16:9 AR
11h	720 x 576p @ 50 Hz 4:3 AR
12h	720 x 576p @ 50 Hz 16:9 AR
13h	1280 x 720p @ 50 Hz 16:9 AR
14h	1920 x 1080i @ 50 Hz 16:9 AR
15h	720(1440) x 576i @ 50 Hz 4:3 AR
16h	720(1440) x 576i @ 50 Hz 16:9 AR
17h	720(1440) x 288p @ 50 Hz 4:3 AR
18h	720(1440) x 288p @ 50 Hz 16:9 AR
19h	(2880) x 576i @ 50 Hz 4:3 AR
1Ah	(2880) x 576i @ 50 Hz 16:9 AR
1Bh	(2880) x 288p @ 50 Hz 4:3 AR
1Ch	(2880) x 288p @ 50 Hz 16:9 AR
1Dh	1440 x 576p @ 50 Hz 4:3 AR
1Eh	1440 x 576p @ 50 Hz 16:9 AR

1Fh	1920 x 1080p @ 50 Hz 16:9 AR
20h	1920 x 1080p @ 23.97/24 Hz 16:9 AR
21h	1920 x 1080p @ 25 Hz 16:9 AR
22h	1920 x 1080p @ 29.97/30 Hz 16:9 AR
23h	2880 x 480p @ 59.94/60 Hz 4:3 AR
24h	2880 x 480p @ 59.94/60 Hz 16:9 AR
25h	2880 x 576p @ 50 Hz 4:3 AR
26h	2880 x 576p @ 50 Hz 16:9 AR
27h	1920 x 1080i @ 50 Hz 16:9 AR
28h	1920 x 1080i @100 Hz 16:9 AR
29h	1280 x 720p @100 Hz 16:9 AR
2Ah	720 x 576p @100 Hz 4:3 AR
2Bh	720 x 576p @100 Hz 16:9 AR
2Ch	720(1440) x 576i @100 Hz 4:3 AR
2Dh	720(1440) x 576i @100 Hz 16:9 AR
2Eh	1920 x 1080i @119.88 / 120 Hz 16:9 AR
2Fh	1280 x 720p @119.88 / 120 Hz 16:9 AR
30h	720 x 480p @119.88 / 120 Hz 4:3 AR
31h	720 x 480p @119.88 / 120 Hz 16:9 AR
32h	720(1440) x 480i @119.88 / 120 Hz 4:3 AR
33h	720(1440) x 480i @119.88 / 120 Hz 16:9 AR
34h	720 x 576p @ 200 Hz 4:3 AR
35h	720 x 576p @ 200 Hz 16:9 AR
36h	720(1440) x 576i @ 200 Hz 4:3 AR
37h	720(1440) x 576i @ 200 Hz 16:9 AR
38h	720 x 480p @ 239.76 / 240 Hz 4:3 AR
39h	720 x 480p @ 239.76 / 240 Hz 16:9 AR
3Ah	720(1440) x 480i @ 239.76 / 240 Hz 4:3 AR
3Bh	720(1440) x 480i @ 239.76 / 240 Hz 16:9 AR
≥ 3Ch	Reserved, must be ignored

The following describes the contents of the 3 byte CVT descriptor, this is correct at the time of writing but for complete description and to verify accuracy the user should verify using the latest revision of the VESA VTB-EXT standard.

If the CVT descriptor is not being used then the three bytes must be set to 00h.

Byte: 2	
Bits 7 → 0	The lower 8 bits of VSize VSize = (# of vertical active lines / 2) – 1)
Byte 3	
Bits 7 → 4	The upper 4 bits of VSize
Bits 3 → 2	Aspect ratio 00 : 4:3

<table>
<tr><td></td><td></td><td></td><td></td><td><table>
<tr><td></td><td>01 : 16:9
10 : 16:10
11 : Reserved</td></tr>
<tr><td>Bits 1 → 0</td><td>Reserved, set to 00</td></tr>
<tr><td>Byte 4</td><td></td></tr>
<tr><td>Bit 7</td><td>Reserved, set to 0</td></tr>
<tr><td>Bits 6 → 5</td><td>Preferred refresh rate
00 : 50 Hz
01 : 60 Hz
10 : 75 Hz
11 : 85 Hz
<u>Note:</u> 60Hz may indicate either standard or reduced blanking. If both are supported then reduced blanking is preferred.</td></tr>
<tr><td>Bits 4 → 0</td><td>Supported refresh rates (standard blanking unless otherwise stated)
Bit 4 set to 1 : 50 Hz supported
Bit 3 set to 1 : 60 Hz supported,
Bit 2 set to 1 : 75 Hz supported
Bit 1 set to 1 : 85 Hz supported
Bit 0 set to 1 : 60 Hz reduced blanking (per CVT standard) is supported</td></tr>
</table></td><td></td></tr>
<tr><td>B5h</td><td>Source Color Coding</td><td>WO</td><td>NC</td><td>Allows the host to specify the color coding method that is being used.

<table>
<tr><td>Byte: SH</td><td></td></tr>
<tr><td>00h</td><td>Default value</td></tr>
<tr><td>01 → FFh</td><td>Reserved, must be ignored</td></tr>
<tr><td>Byte: SL</td><td></td></tr>
<tr><td>00h</td><td>RGB 4:4:4</td></tr>
<tr><td>01h</td><td>YCbCr / YPbPr 4:4:4</td></tr>
<tr><td>02h</td><td>YCbCr / YPbPr 4:2:2</td></tr>
<tr><td>≥ 03h</td><td>Reserved, must be ignored</td></tr>
</table></td><td>10.11.4</td></tr>
<tr><td>C0h</td><td>Display Usage Time</td><td>RO</td><td>C</td><td>Returns the current value (in hours) of ‘active power on’ time accumulated by the display in the ML, SH and SL bytes. The MH byte must be set to 00h.
‘Active power on’ time is defined as the period when the emissive elements(s) of the display – cathodes for a CRT, fluorescent lamps for a LCD, etc – are active.</td><td>10.11</td></tr>
</table>

<table>
<tr>
<td>C8h</td>
<td>Display Controller Type</td>
<td>RO</td>
<td>NC</td>
<td>This VCP code will provide the host with knowledge of the controller type being used by a particular display which will enable a table based approach (by applications) to what features may be available on attached display.

SL byte : Indicates controller manufacturer

ML and SH bytes : Provide a numeric indication of controller type

<u>Notes:</u>
1. Each controller manufacturer supporting this command is required to publish and maintain an equivalence table between the actual product identifier (alpha-numeric marketing identifier) and the simple numerical value here.
2. A host application would use the combination of data from MH, ML and SH bytes to uniquely identify a particular controller.

<table>
<tr><th>SL byte</th><th></th></tr>
<tr><td>01h</td><td>Conexant</td></tr>
<tr><td>02h</td><td>Genesis Microchip</td></tr>
<tr><td>03h</td><td>Macronix</td></tr>
<tr><td>04h</td><td>MRT (Media Reality Technologies)</td></tr>
<tr><td>05h</td><td>Mstar Semiconductor</td></tr>
<tr><td>06h</td><td>Myson</td></tr>
<tr><td>07h</td><td>Philips</td></tr>
<tr><td>08h</td><td>PixelWorks</td></tr>
<tr><td>09h</td><td>RealTek Semiconductor</td></tr>
<tr><td>0Ah</td><td>Sage</td></tr>
<tr><td>0Bh</td><td>Silicon Image</td></tr>
<tr><td>0Ch</td><td>SmartASIC</td></tr>
<tr><td>0Dh</td><td>STMicroelectronics</td></tr>
<tr><td>0Eh</td><td>Topro</td></tr>
<tr><td>0Fh</td><td>Trumpion</td></tr>
<tr><td>10h</td><td>Welltrend</td></tr>
<tr><td>11h</td><td>Samsung</td></tr>
<tr><td>12h</td><td>Novatek Microelectrtonics</td></tr>
<tr><td>13h</td><td>STK</td></tr>
<tr><td>14h → FEh</td><td>Reserved, must be ignored</td></tr>
<tr><td>FFh</td><td>Not defined – a manufacturer designed controller</td></tr>
</table>
Please check the MCCS_UP.pdf document on the VESA website for any extensions to this list.</td>
<td>10.11</td>
</tr>
<tr>
<td>C9h</td>
<td>Display Firmware Level</td>
<td>RO</td>
<td>C</td>
<td>This VCP code results in two bytes of data being sent by the display.
SH byte: defines the firmware version number
SL byte: defines the firmware revision number
e.g. 03h, 05h defines a firmware level of 3.5</td>
<td>10.11</td>
</tr>
</table>

<table>
<tr><td>CAh</td><td>OSD</td><td>R/W</td><td>NC</td><td>Indicates the current state of the display OSD

<table><tr><th>Byte: SL</th><th></th></tr><tr><td>00h</td><td>Reserved, must be ignored</td></tr><tr><td>01h</td><td>OSD is disabled</td></tr><tr><td>02h</td><td>OSD is enabled</td></tr><tr><td>7Fh → FEh</td><td>Reserved, must be ignored</td></tr><tr><td>FFh</td><td>Indicates that the display cannot supply this information.</td></tr></table></td><td>10.7</td></tr>
<tr><td>CCh</td><td>OSD Language</td><td>R/W</td><td>NC</td><td>Allows the display OSD language to be selected.

<table><tr><th>Byte: SL</th><th></th></tr><tr><td>00h</td><td>Reserved, must be ignored</td></tr><tr><td>01h</td><td>Chinese (traditional / Hantai)</td></tr><tr><td>02h</td><td>English</td></tr><tr><td>03h</td><td>French</td></tr><tr><td>04h</td><td>German</td></tr><tr><td>05h</td><td>Italian</td></tr><tr><td>06h</td><td>Japanese</td></tr><tr><td>07h</td><td>Korean</td></tr><tr><td>08h</td><td>Portuguese (Portugal)</td></tr><tr><td>09h</td><td>Russian</td></tr><tr><td>0Ah</td><td>Spanish</td></tr><tr><td>0Bh</td><td>Swedish</td></tr><tr><td>0Ch</td><td>Turkish</td></tr><tr><td>0Dh</td><td>Chinese (simplified / Kantai)</td></tr><tr><td>0Eh</td><td>Portuguese (Brazil)</td></tr><tr><td>0Fh</td><td>Arabic</td></tr><tr><td>10h</td><td>Bulgarian</td></tr><tr><td>11h</td><td>Croatian</td></tr><tr><td>12h</td><td>Czech</td></tr><tr><td>13h</td><td>Danish</td></tr><tr><td>14h</td><td>Dutch</td></tr><tr><td>15h</td><td>Estonian</td></tr><tr><td>16h</td><td>Finnish</td></tr><tr><td>17h</td><td>Greek</td></tr><tr><td>18h</td><td>Hebrew</td></tr><tr><td>19h</td><td>Hindi</td></tr><tr><td>1Ah</td><td>Hungarian</td></tr><tr><td>1Bh</td><td>Latvian</td></tr><tr><td>1Ch</td><td>Lithuanian</td></tr><tr><td>1Dh</td><td>Norwegian</td></tr><tr><td>1Eh</td><td>Polish</td></tr><tr><td>1Fh</td><td>Romanian</td></tr><tr><td>20h</td><td>Serbian</td></tr><tr><td>21h</td><td>Slovak</td></tr><tr><td>22h</td><td>Slovenian</td></tr></table></td><td>10.7</td></tr>
</table>

<table>
<tr><td></td><td></td><td></td><td></td><td>
<table>
<tr><td>23h</td><td>Thai</td></tr>
<tr><td>24h</td><td>Ukrainian</td></tr>
<tr><td>25h</td><td>Vietnamese</td></tr>
<tr><td>≥ 26h</td><td>Reserved, must be ignored</td></tr>
</table>
</td><td></td></tr>
<tr><td>D6h</td><td>Power Mode</td><td>R/W</td><td>NC</td><td>
Power Mode – DPM & DPMS standards are supported along with other power function(s).

<table>
<tr><th>SL byte</th><th>DPM</th><th>DPMS</th></tr>
<tr><td>00h</td><td colspan="2">Reserved, must be ignored</td></tr>
<tr><td>01h</td><td>On</td><td>On</td></tr>
<tr><td>02h</td><td>Off</td><td>Standby</td></tr>
<tr><td>03h</td><td>Off</td><td>Suspend</td></tr>
<tr><td>04h</td><td>Off</td><td>Off</td></tr>
<tr><td colspan="3">Item(s) below are not part of the DPM or DPMS standards</td></tr>
<tr><td>05h</td><td colspan="2">Power off the display – functionally equivalent to turning off power using the “power button”</td></tr>
<tr><td>≤ 06h</td><td colspan="2">Reserved, must be ignored</td></tr>
</table>

<u>Note 1</u>: Following a MCCS command with a value of 01h → 04h, the display must respond to the appropriate DPM (or DPMS) protocols.
<u>Note 2:</u> Following a MCCS command with a value of 05h, user intervention at the display (pressing / toggling the power switch) may be required to restore operation.
</td><td>10.7</td></tr>
<tr><td>DBh</td><td>Image Mode</td><td>R/W</td><td>NC</td><td>
Controls aspects of the displayed image.
<u>Note:</u> This VCP code is intended for use with TV applications.

<table>
<tr><th>Byte: SL</th><th>Name</th><th>Description</th></tr>
<tr><td>00h</td><td>-</td><td>No effect</td></tr>
<tr><td>01h</td><td>Full mode</td><td>Linear expansion (compression) of the image on horizontal axis.</td></tr>
<tr><td>02h</td><td>Zoom mode</td><td>Linear expansion (compression) of the image on horizontal and vertical axes.</td></tr>
<tr><td>03h</td><td>Squeeze mode</td><td>Display all of image content on visible screen. May result in unused areas of visible screen … bars at top, bottom, or sides .</td></tr>
<tr><td>04h</td><td>Variable</td><td>Display all of image content by applying non-linear expansion (compression) to the horizontal axis.</td></tr>
<tr><td>≥ 05h</td><td>-</td><td>Reserved, must be ignored</td></tr>
</table>
<u>Note:</u> a more complete description of these modes may be found in the VESA DI-EXT standard.
</td><td>10.7</td></tr>
</table>

DFh	VCP Version	RO	NC	Defines the version number of the MCCS standard recognized by the display. SH byte: defines the MCCS version number SL byte: defines the MCCS revision number e.g. 03h 00h defines a MCCS level of 3.0 (this standard) **Note: Support of this code is a mandatory requirement for compliance with MCCS standard Version 2 and higher.**	10.11

8.4 Geometry VCP Codes

See section 11 for drawings to assist with interpretation of these VCP Codes.

Table 8-7: Geometry VCP Codes Cross-reference

VCP Code Name	Code	Compliance
Bottom Corner Flare	4Ah	10.6
Bottom Corner Hook	4Ch	10.6
Display Scaling	86h	10.7
Horizontal Convergence R / B	28h	10.6
Horizontal Convergence M / G	29h	10.6
Horizontal Keystone	42h	10.6
Horizontal linearity	2Ah	10.6
Horizontal Linearity Balance	2Ch	10.6
Horizontal Mirror (Flip)	82h	10.7
Horizontal Parallelogram	40h	10.6
Horizontal Pincushion	24h	10.6
Horizontal Pincushion Balance	26h	10.6
Horizontal Position (Phase)	20h	10.6
Horizontal Size	22h	10.6
Rotation	44h	10.6
Scan Mode	DAh	10.7
Top Corner Flare	46h	10.6
Top Corner Hook	48h	10.6
Vertical Convergence R / B	38h	10.6
Vertical Convergence M / G	39h	10.6
Vertical Keystone	43h	10.6
Vertical Linearity	3Ah	10.6
Vertical Linearity Balance	3Ch	10.6
Vertical Mirror (Flip)	84h	10.7
Vertical Parallelogram	41h	10.6
Vertical Pincushion	34h	10.6
Vertical Pincushion Balance	36h	10.6
Vertical Position (Phase)	30h	10.6
Vertical Size	32h	10.6
Window Position (TL_X)	95h	10.6
Window Position (TL_Y)	96h	10.6
Window Position (BR_X)	97h	10.6
Window Position (BR_Y)	98h	10.6

Table 8-8: Geometry VCP Codes					
Code	**VCP Code Name**	**Type**	**Function**	**Description**	**Com-pliance**
20h	Horizontal Position (Phase)	R/W	C	Increasing (decreasing) this value moves the image toward the right (left) side of the display.	10.6
22h	Horizontal Size	R/W	C	Increasing (decreasing) this value will increase (decrease) the width of the image.	10.6
24h	Horizontal Pincushion	R/W	C	Increasing (decreasing) this value will cause the right and left sides of the image to become more (less) convex.	10.6
26h	Horizontal Pincushion Balance	R/W	C	Increasing (decreasing) this value will move the center section of the image toward the right (left) side of the display.	10.6
28h	Horizontal Convergence R/B	R/W	C	Increasing (decreasing) this value will shift the red pixels to the right (left) across the image and the blue pixels left (right) across the image with respect to the green pixels.	10.6
29h	Horizontal Convergence M/G	R/W	C	Increasing (decreasing) this value will shift the magenta pixels to the right (left) across the image and the green pixels left (right) across the image with respect to the magenta pixels.	10.6
2Ah	Horizontal Linearity	R/W	C	Increasing (decreasing) this value will increase (decrease) the density of pixels in the image center.	10.6
2Ch	Horizontal Linearity Balance	R/W	C	Increasing (decreasing) this value shifts the density of pixels from the left (right) side to the right (left) side of the image.	10.6
30h	Vertical Position {Phase}	R/W	C	Increasing (decreasing) this value moves the image toward the top (bottom) edge of the display.	10.6
32h	Vertical Size	R/W	C	Increasing (decreasing) this value will increase (decrease) the height of the image	10.6
34h	Vertical Pincushion	R/W	C	Increasing (decreasing) this value will cause the top and bottom edges of the image to become more (less) convex.	10.6
36h	Vertical Pincushion Balance	R/W	C	Increasing (decreasing) this value will move the center section of the image toward the top (bottom) edge of the display.	10.6
38h	Vertical Convergence R/B	R/W	C	Increasing (decreasing) this value shifts the red pixels up (down) across the image and the blue pixels down (up) across the image with respect to the green pixels.	10.6
39h	Vertical Convergence M/G	R/W	C	Increasing (decreasing) this value will shift the magenta pixels up (down) across the image and the green pixels down (up) across the image with respect to the magenta pixels.	10.6
3Ah	Vertical Linearity	R/W	C	Increasing (decreasing) this value will increase (decrease) the density of scan lines in the image center.	10.6
3Ch	Vertical Linearity Balance	R/W	C	Increasing (decreasing) this value shifts the density of scan lines from the top (bottom) end to the bottom (top) end of the image.	10.6
40h	Horizontal Parallelogram	R/W	C	Increasing (decreasing) this value shifts the top section of the image to the right (left) with respect to the bottom section of the image.	10.6

Table 8-8: Geometry VCP Codes

Code	VCP Code Name	Type	Function	Description	Compliance
41h	Vertical Parallelogram	R/W	C	Increasing (decreasing) this value shifts the top section of the image to the right (left) with respect to the bottom section of the image.	10.6
42h	Horizontal Keystone	R/W	C	Increasing (decreasing) this value will increase (decrease) the horizontal size at the top of the image with respect to the horizontal size at the bottom of the image.	10.6
43h	Vertical Keystone	R/W	C	Increasing (decreasing) this value will increase (decrease) the vertical size at the left of the image with respect to the vertical size at the right of the image.	10.6
44h	Rotation	R/W	C	Increasing (decreasing) this value rotates the image (counter) clockwise about the center point of the screen.	10.6
46h	Top Corner Flare	R/W	C	Increasing (decreasing) this value will increase (decrease) the distance between the left and right sides at the top of the image.	10.6
48h	Top Corner Hook	R/W	C	Increasing (decreasing) this value moves the top of the image to the right (left).	10.6
4Ah	Bottom Corner Flare	R/W	C	Increasing (decreasing) this value will increase (decrease) the distance between the left and right sides at the bottom of the image.	10.6
4Ch	Bottom Corner Hook	R/W	C	Increasing (decreasing) this value moves the bottom of the image to the right (left).	10.6
82h	Horizontal Mirror (Flip)	R/W	NC	This VCP code allows the image to be mirrored horizontally. **Byte: SL** 00h – Normal mode 01h – Mirrored horizontally mode ≥ 02h – Reserved, must be ignored	10.7
84h	Vertical Mirror (Flip)	R/W	NC	This VCP code allows the image to be mirrored vertically. **Byte: SL** 00h – Normal mode 01h – Mirrored vertically mode ≥ 02h – Reserved, must be ignored	10.7

Table 8-8: Geometry VCP Codes

<table>
<tr><th>Code</th><th>VCP Code Name</th><th>Type</th><th>Function</th><th>Description</th><th>Com-pliance</th></tr>
<tr><td>86h</td><td>Display Scaling</td><td>R/W</td><td>NC</td><td>Changing this value will affect the scaling (input versus output) function of the display.
<u>Note:</u> This VCP code can be used to scale up or down to the maximum screen size.
Controls values 02h → 06h are primarily intended for use with computer displays and controls values 07h → 0Ah are primarily intended for use with TV applications.
<table>
<tr><th>Byte: SL</th><th>Name</th><th>Description</th></tr>
<tr><td>00h</td><td>-</td><td>Reserved, must be ignored</td></tr>
<tr><td>01h</td><td>No scaling</td><td>No effect, 1:1 relationship</td></tr>
<tr><td>02h</td><td>Max Image</td><td>Scale to maximum image size with no aspect (AR) ratio distortion</td></tr>
<tr><td>03h</td><td>Max Vt 1</td><td>Scale to maximum vertical image size with no AR distortion</td></tr>
<tr><td>04h</td><td>Max Hz 1</td><td>Scale to maximum horizontal image size with no AR distortion</td></tr>
<tr><td>05h</td><td>Max Vt 2</td><td>Scale to maximum vertical image size with AR distortion</td></tr>
<tr><td>06h</td><td>Max Hz 2</td><td>Scale to maximum horizontal image size with AR distortion</td></tr>
<tr><td>07h</td><td>Full mode</td><td>Linear expansion (compression) of the image on horizontal axis.</td></tr>
<tr><td>08h</td><td>Zoom mode</td><td>Linear expansion (compression) of the image on horizontal and vertical axes.</td></tr>
<tr><td>09h</td><td>Squeeze mode</td><td>Display all of image content on visible screen. May result in unused areas of visible screen … bars at top, bottom, or sides.</td></tr>
<tr><td>0Ah</td><td>Variable</td><td>Display all of image content by applying non-linear expansion (compression) to the horizontal axis.</td></tr>
<tr><td>≥ 0Bh</td><td>-</td><td>Reserved, must be ignored</td></tr>
</table>
<u>Note:</u> A more complete description of modes 07h → 0Ah may be found in the VESA DI-EXT standard.</td><td>10.7</td></tr>
<tr><td>95h</td><td>Window Position (TL_X)</td><td>R/W</td><td>C</td><td>Defines the top left X pixel of an area of the image. Specified in co-ordinates of incoming image before any scaling etc in the display.</td><td>10.6</td></tr>
<tr><td>96h</td><td>Window Position (TL_Y)</td><td>R/W</td><td>C</td><td>Defines the top left Y pixel of an area of the image. Specified in co-ordinates of incoming image before any scaling etc in the display.</td><td>10.6</td></tr>
</table>

Table 8-8: Geometry VCP Codes

Code	VCP Code Name	Type	Function	Description	Com-pliance
97h	Window Position (BR_X)	R/W	C	Defines the bottom right X pixel of an area of the image. Specified in co-ordinates of the incoming image before any scaling etc in the display.	10.6
98h	Window Position (BR_Y)	R/W	C	Defines the bottom right Y pixel of an area of the image. Specified in co-ordinates of the incoming image before any processing (e.g. scaling) in the display.	10.6
DAh	Scan Mode	R/W	NC	Controls the scan characteristics. **Note:** This VCP code is intended for use with TV applications. **Byte: SL** 00h – Normal operation (no overscan or underscan) 01h – Underscan 02h – Overscan ≥ 03h – Reserved, must be ignored	10.7

8.5 Miscellaneous Functions VCP Codes

Table 8-9: Miscellaneous Function VCP Code Cross-reference

VCP Code Name	Code	Compliance
Active Control	52h	10.11
Ambient Light Sensor	66h	10.7
Application Enable Key	C6h	10.7
Asset Tag	D2h	10.11.4
Auxiliary Display Data	CFh	10.11.4
Auxiliary Display Size	CEh	10.11
Auxiliary Power Output	D7h	10.7
Degauss	01h	10.11.4
Display Descriptor Length	C2h	10.11
Display Technology Type	B6h	10.11
EDID Operation	78h	10.11.4
Enable Display of 'Display Descriptor'	C4h	10.7
Flat Panel Sub-Pixel Layout	B2h	10.11
Input Source	60h	10.11.4
New Control Value	02h	10.7
Output Select	D0h	10.11.4
Performance Preservation	54h	10.7
Remote Procedure Call	76h	10.11.4
Soft Controls	03h	10.7
Status Indicators	CDh	10.7
TV-Channel Up / Down	8Bh	10.11.4
Transmit Display Descriptor	C3h	10.11.4
Scratch Pad	DEh	10.7

Table 8-10: Miscellaneous Functions VCP Codes

Code	VCP Code Name	Type	Function	Description	Com-pliance
01h	Degauss	WO	NC	Causes a CRT display to perform a degauss cycle. Any value not equal to zero causes a single cycle of the degauss operation. **Note:** A value of 0 must be ignored.	10.11.5

Table 8-10: Miscellaneous Functions VCP Codes

Code	VCP Code Name	Type	Function	Description	Com-pliance
02h	New Control Value	R/W	NC	Used to indicate that a display's user control(s) (excluding power control) has been used to change a control value. **Byte: SL** 00h — Reserved, must be ignored 01h — No new control value(s) 02h — One or more new control value(s) has been saved 03h → FEh — Reserved, must be ignored FFh — No user controls are present All changes made using the controls on the display must be reported even if these values have not been saved. The new control value must be reported to a host request for the current control value (i.e. a "GetVCP" command) A value = 02h must only be reset to a value = 01h by a host write operation and not by the display **Support of this code is a mandatory requirement for compliance with MCCS standard Version 2 and higher** **Note: A recommended implementation of this VCP code in conjunction with VCP code 52h is outlined in Section 13.2**	10.7
03h	Soft Controls	R/W	NC	Allows display controls to be used as soft keys **Byte: SL** 00h — No button active 01h — Button 1 active 02h — Button 2 active 03h — Button 3 active 04h — Button 4 active 05h — Button 5 active 06h — Button 6 active 07h — Button 7 active 08h → FEh — Reserved, must be ignored FFh — No controls present **Notes:** 1. A 'button active' value should only be reset to 00h by host write operation and not by the display 2. This command and associated activity must not be affected by disabling the OSD (if present), see VCP CAh	10.7

Table 8-10: Miscellaneous Functions VCP Codes					
Code	**VCP Code Name**	**Type**	**Function**	**Description**	**Com-pliance**
52h	Active Control	RO	NC	This VCP code may be used to obtain the VCP codes stored in a "FIFO stack" if the recommendations outlined in section 13.2 have been implemented. A read must cause the VCP code to be removed from the "FIFO stack". The last entry in the "stack" must be 00h indicating that no further VCP codes are present on the stack i.e. the VCP codes for all adjustments made have been read by the host. **Note:** When the host sets the New Control Value (VCP code 02h) equal to 01h, then the display must clear the stack. Examples: If luminance has been changed then return value of 10h If red gain has been changed then return value of 16h.	10.11

Table 8-10: Miscellaneous Functions VCP Codes

<table>
<tr><th>Code</th><th>VCP Code Name</th><th>Type</th><th>Function</th><th>Description</th><th>Com-pliance</th></tr>
<tr><td>54h</td><td>Performance Preservation</td><td>R/W</td><td>NC</td><td>Data size: Write = 2 bytes / Read = 4 bytes
This command provides the capability to control up to 16 features aimed at maintaining the performance of a display.
e.g. Features designed to minimize image burn-in
The terms used here are generic, specific implementation details are left to the manufacturer.
A possible value is selected by setting the corresponding bit = 1.
<u>Note:</u> Setting more than one bit = 1 in either byte is invalid and must be ignored by the display.
On a read the MH-ML bytes contain the flags corresponding to those functions that are supported by the display. The SH/SL bytes contain the bit field with the appropriate bit(s) set to indicate the current status of the display.
The following table defines the SH and SL bytes, and the MH and ML bytes for read operations only.
<table>
<tr><th>Byte: SH / MH</th><th></th></tr>
<tr><td>Bit 7</td><td>Image “orbiting” mode</td></tr>
<tr><td>Bit 6</td><td>Low luminance mode with “active” video mode</td></tr>
<tr><td>Bit 5</td><td>Slow luminance reduction when a static image is detected mode</td></tr>
<tr><td>Bit 4</td><td>Slow luminance reduction when no user activity is detected mode</td></tr>
<tr><td>Bits 3 → 0</td><td>Reserved, must be ignored</td></tr>
<tr><th>Byte: SL / ML</th><th></th></tr>
<tr><td>Bit 7</td><td>A white vertical bar (or line) moving slowly horizontally across the screen on a black background.</td></tr>
<tr><td>Bit 6</td><td>A white image filling the display area.</td></tr>
<tr><td>Bit 5</td><td>A black vertical bar (or line) moving slowly horizontally across the screen on a black background.</td></tr>
<tr><td>Bit 4</td><td>Reverse video … the displayed image is the inverse color of the source image.</td></tr>
<tr><td>Bit 3</td><td>Display is active but video is blanked.</td></tr>
<tr><td>Bit 2</td><td>A grayscale pattern moving slowly horizontally across the screen.</td></tr>
<tr><td>Bits 1 → 0</td><td>Reserved, must be ignored</td></tr>
</table>
</td><td>10.7</td></tr>
</table>

Table 8-10: Miscellaneous Functions VCP Codes

<table>
<tr><th>Code</th><th>VCP Code Name</th><th>Type</th><th>Function</th><th>Description</th><th>Com-pliance</th></tr>
<tr><td>60h</td><td>Input Source</td><td>R/W</td><td>T</td><td>Data size: Write = 4 bytes / Read = 8 bytes
A possible value is selected by setting the corresponding bit = 1.
<u>Note</u>: Setting more than one bit = 1 is invalid and must be ignored by the display.
Used to select the active video source.
<table>
<tr><th>Byte 0</th><th></th></tr>
<tr><td>Bit 7</td><td>Analog Video (R/G/B) # 1</td></tr>
<tr><td>Bit 6</td><td>Analog Video (R/G/B) # 2</td></tr>
<tr><td>Bit 5</td><td>Digital Video (TMDS) # 1</td></tr>
<tr><td>Bit 4</td><td>Digital Video (TMDS) # 2</td></tr>
<tr><td>Bit 3</td><td>Composite Video # 1</td></tr>
<tr><td>Bit 2</td><td>Composite Video # 2</td></tr>
<tr><td>Bit 1</td><td>S-video # 1</td></tr>
<tr><td>Bit 0</td><td>S-video # 2</td></tr>
<tr><th>Byte 1</th><th></th></tr>
<tr><td>Bit 7</td><td>Tuner – Analog # 1</td></tr>
<tr><td>Bit 6</td><td>Tuner – Analog # 2</td></tr>
<tr><td>Bit 5</td><td>Tuner – Digital # 1</td></tr>
<tr><td>Bit 4</td><td>Tuner – Digital # 2</td></tr>
<tr><td>Bit 3</td><td>Component Video (YPrPb / YCrCb) # 1</td></tr>
<tr><td>Bit 2</td><td>Component Video (YPrPb / YCrCb) # 2</td></tr>
<tr><td>Bit 1</td><td>Component Video (YPrPb / YCrCb) # 3</td></tr>
<tr><td>Bit 0</td><td>Reserved, must be ignored</td></tr>
<tr><th>Byte 2</th><th></th></tr>
<tr><td>Bit 7</td><td>Digital Video (DisplayPort) # 1</td></tr>
<tr><td>Bit 6</td><td>Digital Video (DisplayPort) # 2</td></tr>
<tr><td>Bits 5 → 0</td><td>Reserved, must be ignored</td></tr>
<tr><th>Byte 3</th><th></th></tr>
<tr><td>Bits 7 → 0</td><td>Reserved, must be ignored</td></tr>
</table></td><td>10.11.4</td></tr>
<tr><td>66h</td><td>Ambient Light Sensor</td><td>R/W</td><td>NC</td><td>Used to control the action of an ambient light sensor
<table>
<tr><th>Byte: SL</th><th>Definitions</th></tr>
<tr><td>00h</td><td>Reserved, must be ignored</td></tr>
<tr><td>01h</td><td>Ambient light sensor is disabled</td></tr>
<tr><td>02h</td><td>Ambient light sensor is enabled</td></tr>
<tr><td>≥ 03h</td><td>Reserved, must be ignored</td></tr>
</table></td><td>10.7</td></tr>
</table>

<table>
<tr><th colspan="6">Table 8-10: Miscellaneous Functions VCP Codes</th></tr>
<tr><th>Code</th><th>VCP Code Name</th><th>Type</th><th>Function</th><th>Description</th><th>Com-pliance</th></tr>
<tr><td>76h</td><td>Remote Procedure Call</td><td>WO</td><td>T</td><td>Allows initiation of a routine / macro resident in the display. Only one RPC is defined at this time:

<table><tr><th>Byte</th><th>Definition</th></tr><tr><td>0</td><td>Defines the operation (see below)</td></tr><tr><td>1 + 2</td><td>Offset into the LUT</td></tr><tr><td>3 + 4</td><td>1st Red LUT value</td></tr><tr><td>5 + 6</td><td>1st Green LUT value</td></tr><tr><td>7 + 8</td><td>1st Blue LUT value</td></tr><tr><td>9 + 10</td><td>Increment to next LUT entry</td></tr><tr><td>11 + 12</td><td>2nd Red LUT value</td></tr><tr><td>13 + 14</td><td>2nd Green LUT value</td></tr><tr><td>15 + 16</td><td>2nd Blue LUT value</td></tr><tr><td>17 + 18</td><td>Increment to next LUT entry</td></tr><tr><td>19 + 20</td><td>etc</td></tr></table>
<table><tr><th>Byte 0</th><th>Operation Definitions</th></tr><tr><td>00h</td><td>Reserved, must be ignored</td></tr><tr><td>01h</td><td>Indicates that a spline curve routine must be applied to the data (supplied in byte 1 and higher)) and the resulting data used to derive a full set of values for the display color LUT which must then be loaded.</td></tr><tr><td>02h → DFh</td><td>Reserved, must be ignored</td></tr><tr><td>E0h → FFh</td><td>Reserved for manufacturer specific operations</td></tr></table></td><td>10.11.4</td></tr>
<tr><td>78h</td><td>EDID Operation</td><td>RO</td><td>T</td><td>This command allows a selected block (128 bytes) of EDID to be read.

<table><tr><th>Byte 0</th><th>EDID block number</th></tr><tr><td>00h</td><td>Base EDID</td></tr><tr><td>01h</td><td>First extension block</td></tr><tr><td>02h</td><td>Second extension block</td></tr><tr><td>03h</td><td>Third extension block</td></tr><tr><td>04h → FFh</td><td>Etc.</td></tr></table>
<u>Note:</u> After receipt of the 128 bytes, users are advised to create a new checksum and verify that it matches the checksum in the last byte of the EDID block.</td><td>10.11.4</td></tr>
</table>

Table 8-10: Miscellaneous Functions VCP Codes

Code	VCP Code Name	Type	Function	Description	Compliance
8Bh	TV-Channel Up / Down	WO	NC	Used to increment / decrement between TV-channels, the exact behavior is implementation specific (e.g. increment / decrement to next numeric channel or increment / decrement to next channel with a signal). **Byte: SL** 00h: Reserved, must be ignored 01h: Increment channel 02h: Decrement channel ≥ 03h: Reserved, must be ignored	10.11.4
B2h	Flat Panel Sub-Pixel Layout	RO	NC	Indicates the type of LCD sub-pixel structure. **Byte: SL** 00h: Sub-pixel layout is not defined 01h: Red / Green / Blue vertical stripe 02h: Red / Green / Blue horizontal stripe 03h: Blue / Green / Red vertical stripe 04h: Blue/ Green / Red horizontal stripe 05h: Quad-pixel, a 2 x 2 sub-pixel structure with red at top left, blue at bottom right and green at top right and bottom left 06h: Quad-pixel, a 2 x 2 sub-pixel structure with red at bottom left, blue at top right and green at top left and bottom right 07h: Delta (triad) 08h: Mosaic with interleaved sub-pixels of different colors ≥ 09h: Reserved, must be ignored	10.11
B6h	Display Technology Type	RO	NC	Indicates the base technology type. **Byte: SL** 00h: Reserved, must be ignored 01h: CRT (shadow mask) 02h: CRT (aperture grill) 03h: LCD (active matrix) 04h: LCoS 05h: Plasma 06h: OLED 07h: EL 08h: Dynamic MEM e.g. DLP 09h: Static MEM e.g. iMOD ≥ 0Ah: Reserved, must be ignored	10.11
C2h	Display Descriptor Length	RO	C	Returns the length (in bytes) of non-volatile storage in the display available for writing a display descriptor – the maximum descriptor length is 256 bytes See VCP code C3h.	10.11

<table>
<tr><th colspan="6">Table 8-10: Miscellaneous Functions VCP Codes</th></tr>
<tr><th>Code</th><th>VCP Code Name</th><th>Type</th><th>Function</th><th>Description</th><th>Com-pliance</th></tr>
<tr><td>C3h</td><td>Transmit Display Descriptor</td><td>R/W</td><td>T</td><td>Allows a display descriptor (up to maximum length defined by the display (see code C2h) to be written (read) to (from) non-volatile storage in the display.
The data must conform to ISO 8859-2 (Latin 1) code set (ASCII code).
If an attempt is made to write beyond the maximum storage length, the descriptor must be truncated with the excess bytes being discarded.</td><td>10.11.4</td></tr>
<tr><td>C4h</td><td>Enable Display of ‘Display Descriptor’</td><td>R/W</td><td>NC</td><td>If enabled, the display descriptor written to the display using VCP code C3h must be displayed when no video is being received. The duration for which it is displayed is left to individual manufacturers.
<table><tr><th>Byte: SL</th><th></th></tr><tr><td>00h</td><td>Reserved, must be ignored</td></tr><tr><td>01h</td><td>Display is enabled</td></tr><tr><td>02h</td><td>Display is disabled</td></tr><tr><td>≥ 03h</td><td>Reserved, must be ignored</td></tr></table></td><td>10.7</td></tr>
<tr><td>C6h</td><td>Application Enable Key</td><td>RO</td><td>NC</td><td>A 2 byte value used to allow an application to only operate with known products. The display manufacturer and application author agree to a code such that application will only run when a valid code is present in the display.</td><td>10.7</td></tr>
<tr><td>CDh</td><td>Status Indicators</td><td>R/W</td><td>NC</td><td>This command provides the capability to control up to 16 LED (or similar) indicators which may be used to indicate aspects of the system status. The capability string must report the functions supported by the display and these must be mapped to the 16 bits of the command in the sequence reported in the capability string starting with the most significant bit of the first byte.
Meaning of values reported in the capability string:
<table><tr><th>Byte: SH</th><th></th><th>Mapping #</th></tr><tr><td>Bit 7</td><td>Host power is ‘on’</td><td>1</td></tr><tr><td>Bit 6</td><td>Hard drive is active</td><td>2</td></tr><tr><td>Bit 5</td><td>New e-mail received</td><td>3</td></tr><tr><td>Bit 4</td><td>New voicemail received</td><td>4</td></tr><tr><td>Bit 3</td><td>Appointment reminder</td><td>5</td></tr><tr><td>Bit 2</td><td>Phone is busy</td><td>6</td></tr><tr><td>Bit 1</td><td>Speaker phone function active</td><td>7</td></tr><tr><td>Bit 0</td><td>Battery is charging</td><td>8</td></tr><tr><td>Byte: SL</td><td></td><td></td></tr><tr><td>Bit 7</td><td>LAN is active</td><td>9</td></tr><tr><td>Bits 6 → 0</td><td>Reserved, must be ignored</td><td>10 → 16</td></tr></table>In all cases writing a “1” to the indicator must turn it ‘on’ and writing a “0” to the indicator must turn it ‘off’.</td><td>10.7</td></tr>
</table>

Table 8-10: Miscellaneous Functions VCP Codes

Code	VCP Code Name	Type	Function	Description	Com-pliance
CEh	Auxiliary Display Size	RO	NC	An 'auxiliary display' is a small alpha-numeric display associated with the primary display and able to be accessed via the primary display. This command returns a 1 byte value that defines the number of characters and the number of rows available. The format is: **Byte: SL** Bits 7 → 6: The number of rows + 1 Bits 5 → 0: The number of characters / row + 1 i.e. The maximum auxiliary display size is 5 rows each with 65 characters	10.11
CFh	Auxiliary Display Data	WO	T	An 'auxiliary display' is a small alpha-numeric display associated with the primary display and able to be accessed via the primary display. This command transmits a number of bytes of alpha-numeric data to be displayed on the auxiliary display. The data must conform to ISO 8859-2 (Latin 1) code set (ASCII code). The auxiliary display will be written from the top left position, moving to right along each line and then starting at left end of the next line.	10.11.4
D0h	Output Select	R/W	T	Data size: Write = 4 bytes / Read = 8 bytes A possible value is selected by setting the corresponding bit = 1. **Note:** Setting more than one bit = 1 is invalid and must be ignored by the display. Used to select the active video output. **Byte 0** Bit 7: Analog Video (R/G/B) # 1 Bit 6: Analog Video (R/G/B) # 2 Bit 5: Digital Video (TMDS) # 1 Bit 4: Digital Video (TMDS) # 2 Bit 3: Composite Video # 1 Bit 2: Composite Video # 2 Bit 1: S-video # 1 Bit 0: S-video # 2 **Byte 1** Bit 7: Tuner – Analog # 1 Bit 6: Tuner – Analog # 2 Bit 5: Tuner – Digital # 1 Bit 4: Tuner – Digital # 2 Bit 3: Component Video (YPrPb / YCrCb) # 1 Bit 2: Component Video (YPrPb / YCrCb) # 2	10.11.4

Table 8-10: Miscellaneous Functions VCP Codes

Code	VCP Code Name	Type	Function	Description	Com-pliance
				Bit 1 — Component Video (YPrPb / YCrCb) # 3 Bit 0 — Reserved, must be ignored **Byte 2** Bit 7 — Digital Video (DisplayPort) # 1 Bit 6 — Digital Video (DisplayPort) # 2 Bits 5 → 0 — Reserved, must be ignored **Byte 3** Bits 7 → 0 — Reserved, must be ignored	
D2h	Asset Tag	R/W	T	Data length: Read / write = 16 bytes This VCP codes allows an Asset Tag to be written to a display or read from a display. It also allows for control by the display manufacturer of which applications may write an asset tag. Read operation: No key required, the 16 bytes returned by the display may contain any value in bytes 0 and 1. The key should not be returned. Write operation: A successful write operation requires that bytes 0 and 1 contain the correct key, if they do not then the display must take no action. **Byte** / **Definition** 0 — MSB of key 1 — LSB of key 2 — MSB of asset tag 3 — ↑ 4 — | 5 — | 6 — | 7 — | 8 — | 9 — | 10 — | 11 — | 12 — | 13 — | 14 — ↓ 15 — LSB of asset tag Data must be stored in ASCII (code page # 437) starting in byte 2 (MSB of the asset tag). If the stored asset tag is < 14 characters then the asset tag must be terminated with the ASCII character A0h and, if required, the remainder of the	10.11.4

<table>
<tr><th colspan="6">Table 8-10: Miscellaneous Functions VCP Codes</th></tr>
<tr><th>Code</th><th>VCP Code Name</th><th>Type</th><th>Function</th><th>Description</th><th>Com-pliance</th></tr>
<tr><td></td><td></td><td></td><td></td><td>asset tag bytes packed with ASCII character 20h.
The 2 byte key may be a simple a “secret” number or be derived by taking certain required elements of the base EDID and manipulating the values of those elements by a mathematical formula – the formula used for a particular display (or family of displays) should only be released by the display manufacturer to users they trust..
<u>Note:</u> When shipped from the manufacturing location, the data field must be set=00h unless an asset tag has been stored to meet a customer requirement.</td><td></td></tr>
<tr><td>D7h</td><td>Auxiliary Power Output</td><td>R/W</td><td>NC</td><td>Controls output of an auxiliary power output from a display to a host device.

<table><tr><th>Byte: SL</th><th></th></tr><tr><td>00h</td><td>Reserved, must be ignored</td></tr><tr><td>01h</td><td>Disable auxiliary output power</td></tr><tr><td>02h</td><td>Enable auxiliary output power</td></tr><tr><td>≥ 03h</td><td>Reserved, must be ignored</td></tr></table></td><td>10.7</td></tr>
<tr><td>DEh</td><td>Scratch Pad</td><td>R/W</td><td>NC</td><td>Provides 2 bytes of volatile storage for use of software application(s) … leading to more efficient operation.
<u>Notes:</u>
1. The display must set these bytes = 00h following a power-on or power off/on cycle.
2. Aside from the actions of note 1, the display must not take any action with these bytes.</td><td>10.7</td></tr>
</table>

8.6 Audio Function VCP Codes

Table 8-11: Audio Function VCP Code Cross-reference

VCP Code Name	Code	Compliance
Audio: Balance L / R	93h	10.7
Audio: Bass	91h	10.7
Audio: Microphone Volume	64h	10.6
Audio: Processor Mode	94h	10.7
Audio: Speaker Volume	62h	10.7
Audio: Treble	8Fh	10.7
Audio: Mute	8Dh	10.7
Speaker Select	63h	10.7

Table 8-12: Audio Function VCP Codes

Code	VCP Code Name	Type	Function	Description	Compliance
62h	Audio: Speaker Volume	R/W	NC	Allows the volume to be adjusted. **Byte: SL** 00h — Fixed (default) level 01h → FEh — Volume level FFh — Mute **Note:** The level will increase from a minimum at a value = 01h to a maximum at a value = FEh	10.7
63h	Speaker Select	R/W	NC	Allows a "pair" (may be physically more than two speakers) of speakers to be selected. **Byte: SL** 00h — Front L / R 01h — Side L / R 02h — Rear L / R 03h — Center / Sub woofer 04h → FFH — Reserved, must be ignored.	10.7
64h	Audio: Microphone Volume	R/W	C	Increasing (decreasing) this value will increase (decrease) the microphone gain.	10.6
8Dh	Audio Mute	R/W	NC	Provides for the audio to be muted or unmuted. **Byte: SL** 00h — Reserved, must be ignored 01h — Mute the audio 02h — Unmute the audio ≥ 03h — Reserved, must be ignored	10.7

Table 8-12: Audio Function VCP Codes

<table>
<tr><th>Code</th><th>VCP Code Name</th><th>Type</th><th>Function</th><th>Description</th><th>Com-pliance</th></tr>
<tr><td>8Fh</td><td>Audio Treble</td><td>R/W</td><td>NC</td><td>Allows control of the high frequency component of the audio.
<table><tr><th>Byte: SL</th><th></th></tr><tr><td>00h</td><td>Reserved, must be ignored</td></tr><tr><td>01h → 7Fh</td><td>Cut the treble</td></tr><tr><td>80h</td><td>Neutral … no effect</td></tr><tr><td>81h → FFh</td><td>Boost the treble</td></tr></table><u>Notes:</u>
• As value is reduced below 80h, the treble content will be increasingly cut
• As value is increased above 80h, the treble content will be increasingly boosted</td><td>10.7</td></tr>
<tr><td>91h</td><td>Audio Bass</td><td>R/W</td><td>NC</td><td>Allows control of the low frequency component of the audio.
<table><tr><th>Byte: SL</th><th></th></tr><tr><td>00h</td><td>Reserved, must be ignored</td></tr><tr><td>01h → 7Fh</td><td>Cut the bass</td></tr><tr><td>80h</td><td>Neutral … no effect</td></tr><tr><td>81h → FFh</td><td>Boost the bass</td></tr></table><u>Notes:</u>
• As value is reduced below 80h, the bass content will be increasingly cut
• As value is increased above 80h, the bass content will be increasingly boosted</td><td>10.7</td></tr>
<tr><td>93h</td><td>Audio Balance L / R</td><td>R/W</td><td>NC</td><td>This control affects the left – right balance of audio output. Increasing (decreasing) the value will cause the balance to move to the right (left).
<table><tr><th>Byte: SL</th><th></th></tr><tr><td>00h</td><td>Reserved, must be ignored</td></tr><tr><td>01h → 7Fh</td><td>Left (L) channel dominates</td></tr><tr><td>80h</td><td>Centered</td></tr><tr><td>81h → FEh</td><td>Center / Sub woofer</td></tr><tr><td>FFh</td><td>Reserved, must be ignored</td></tr></table><u>Notes:</u>
• As value is reduced below 80h, the left channel will be increasingly dominant
• As value is increased above 80h, the right channel will become increasingly dominant.</td><td>10.7</td></tr>
<tr><td>94h</td><td>Audio Processor Mode</td><td>R/W</td><td>NC</td><td>This control allows one of several audio processing modes to be selected.
<table><tr><th>Byte: SL</th><th>Name</th><th>Definition</th></tr><tr><td>00h</td><td colspan="2">Audio processing is not supported.</td></tr><tr><td>01h</td><td>Mono</td><td>Both display audio channels use the left audio channel</td></tr><tr><td>02h</td><td>Stereo</td><td>Incoming left and right audio channels feed separate display</td></tr></table></td><td>10.7</td></tr>
</table>

Table 8-12: Audio Function VCP Codes

Code	VCP Code Name	Type	Function	Description			Com-pliance
						output audio channels.	
				03h	Stereo expanded	As defined by the manufacturer.	
				04h → 10h	Reserved	Must be ignored	
				11h	SRS 2.0	SRS stereo	
				12h	SRS 2.1	SRS stereo + subwoofer	
				13h	SRS 3.1	SRS stereo + subwoofer + center	
				14h	SRS 4.1	SRS stereo + subwoofer + rear	
				15h	SRS 5.1	SRS stereo + subwoofer + rear + center	
				16h	SRS 6.1	SRS stereo + subwoofer + side	
				17h	SRS 7.1	SRS stereo + subwoofer + side + center	
				18h → 20h	Reserved	Must be ignored	
				21h	Dolby 2.0	Dolby stereo	
				22h	Dolby 2.1	Dolby stereo + subwoofer	
				23h	Dolby 3.1	Dolby stereo + subwoofer + center	
				24h	Dolby 4.1	Dolby stereo + subwoofer + rear	
				25h	Dolby 5.1	Dolby stereo + subwoofer + rear + center	
				26h	Dolby 6.1	Dolby stereo + subwoofer + side	
				27h	Dolby 7.1	Dolby stereo + subwoofer + side + center	
				28h → 30h	Reserved	Must be ignored	
				31h	THX 2.0	THX stereo	
				32h	THX 2.1	THX stereo + subwoofer	
				33h	THX 3.1	THX stereo + subwoofer + center	
				34h	THX 4.1	THX stereo + subwoofer + rear	
				35h	THX 5.1	THX stereo + subwoofer + rear + center	
				36h	THX 6.1	THX stereo + subwoofer + side	
				37h	THX 7.1	THX stereo + subwoofer + side + center	
				≥ 38h	Reserved	Shall be ignored	

8.7 DPVL Support VCP Codes

Table 8-13: DPVL Support Cross-reference

VCP Code Name	Code	Compliance
Body CRC Error Count	BCh	n/a
Client ID	BDh	n/a
Header Error Count	BBh	n/a
Link Control	BEh	n/a
Monitor Status	B7h	n/a
Monitor X Origin	B9h	n/a
Monitor Y Origin	Bah	n/a
Packet Count	B8h	n/a

Notes:

1. All DPVL data values are 2 bytes
2. See the DPVL standard for details of the meaning and usage of each of these VCP codes.
3. Compliance procedures for DPVL VCP Codes is beyond the scope of the current standard

Table 8-14: DPVL Support VCP Codes

<table>
<tr><th>Code</th><th>VCP Code Name</th><th>Type</th><th>Function</th><th>Description</th><th>Com-pliance</th></tr>
<tr><td>B7h</td><td>Monitor Status</td><td>RO</td><td>NC</td><td>Video mode and status of a DPVL capable monitor.
<table>
<tr><th>Byte: SL</th><th>Value</th><th>Definition</th></tr>
<tr><td>Bits 7 → 3</td><td></td><td>Reserved, set = 0</td></tr>
<tr><td rowspan="2">Bit 2</td><td>= 0</td><td>No error detected in the last header received</td></tr>
<tr><td>= 1</td><td>Error detected in the last header received</td></tr>
<tr><td rowspan="2">Bit 1</td><td>= 0</td><td>Monitor is able to receive the next packet</td></tr>
<tr><td>= 1</td><td>Monitor is unable to accept another packet</td></tr>
<tr><td rowspan="2">Bit 0</td><td>= 0</td><td>Raster scan mode</td></tr>
<tr><td>= 1</td><td>DPVL mode</td></tr>
</table></td><td>n/a</td></tr>
<tr><td>B8h</td><td>Packet Count</td><td>R/W</td><td>C</td><td>Counter for the DPVL packets received (valid and invalid ones). This value counts from 0000h to FFFFh and then rolls over to 0000h.
The host can reset the value to 0000h.</td><td>n/a</td></tr>
<tr><td>B9h</td><td>Monitor X Origin</td><td>R/W</td><td>C</td><td>The X origin of the monitor in the virtual screen. The support of this command indicates the multi-display support of the display. If a display supports this command, the monitor must also support Monitor Y Origin command.
“0000h” to “FFFFh” or 0 to 65535</td><td>n/a</td></tr>
</table>

<table>
<tr><th colspan="6">Table 8-14: DPVL Support VCP Codes</th></tr>
<tr><th>Code</th><th>VCP Code Name</th><th>Type</th><th>Function</th><th>Description</th><th>Com-pliance</th></tr>
<tr><td>BAh</td><td>Monitor Y Origin</td><td>R/W</td><td>C</td><td>The Y origin of the display in the virtual screen. The support of this command indicates the multi-display support of the display. If a display supports this command, the monitor must also support Monitor X Origin command.
“0000h” to “FFFFh” or 0 to 65535</td><td>n/a</td></tr>
<tr><td>BBh</td><td>Header Error Count</td><td>R/W</td><td>C</td><td>Error Counter for the DPVL header. The counter value saturates at FFFFh. Host can reset to 0000h.</td><td>n/a</td></tr>
<tr><td>BCh</td><td>Body CRC Error Count</td><td>R/W</td><td>C</td><td>CRC error Counter for the DPVL body (containing video data). The counter value saturates at FFFFh. The Host can reset to 0000h</td><td>n/a</td></tr>
<tr><td>BDh</td><td>Client ID</td><td>R/W</td><td>C</td><td>Assigned identification number for the monitor.
Valid range is 0000h to FFFEh, FFFFh is reserved for broadcast.</td><td>n/a</td></tr>
<tr><td>BEh</td><td>Link Control</td><td>R/W</td><td>NC</td><td>Indicates the status of the DVI link.
<table>
<tr><th>Byte: SL</th><th>Value</th><th>Definition</th></tr>
<tr><td>Bits 7 → 1</td><td></td><td>Reserved, set = 0</td></tr>
<tr><td rowspan="2">Bit 0</td><td>= 0</td><td>Link shutdown is disabled</td></tr>
<tr><td>= 1</td><td>Link shutdown is enabled</td></tr>
</table></td><td>n/a</td></tr>
</table>

8.8 Manufacturer Specific VCP Codes

Table 8-15: Manufacturer Specific VCP Codes				
Code	**VCP Code Name**	**Type**	**Function**	**Description**
E0h	Manufacturer Specific	TBD	TBD	May be defined by display manufacturer
E1h	Manufacturer Specific	TBD	TBD	May be defined by display manufacturer
E2h	Manufacturer Specific	TBD	TBD	May be defined by display manufacturer
E3h	Manufacturer Specific	TBD	TBD	May be defined by display manufacturer
E4h	Manufacturer Specific	TBD	TBD	May be defined by display manufacturer
E5h	Manufacturer Specific	TBD	TBD	May be defined by display manufacturer
E6h	Manufacturer Specific	TBD	TBD	May be defined by display manufacturer
E7h	Manufacturer Specific	TBD	TBD	May be defined by display manufacturer
E8h	Manufacturer Specific	TBD	TBD	May be defined by display manufacturer
E9h	Manufacturer Specific	TBD	TBD	May be defined by display manufacturer
EAh	Manufacturer Specific	TBD	TBD	May be defined by display manufacturer
EBh	Manufacturer Specific	TBD	TBD	May be defined by display manufacturer
ECh	Manufacturer Specific	TBD	TBD	May be defined by display manufacturer
EDh	Manufacturer Specific	TBD	TBD	May be defined by display manufacturer
EEh	Manufacturer Specific	TBD	TBD	May be defined by display manufacturer
EFh	Manufacturer Specific	TBD	TBD	May be defined by display manufacturer
F0h	Manufacturer Specific	TBD	TBD	May be defined by display manufacturer
F1h	Manufacturer Specific	TBD	TBD	May be defined by display manufacturer
F2h	Manufacturer Specific	TBD	TBD	May be defined by display manufacturer
F3h	Manufacturer Specific	TBD	TBD	May be defined by display manufacturer
F4h	Manufacturer Specific	TBD	TBD	May be defined by display manufacturer
F5h	Manufacturer Specific	TBD	TBD	May be defined by display manufacturer
F6h	Manufacturer Specific	TBD	TBD	May be defined by display manufacturer
F7h	Manufacturer Specific	TBD	TBD	May be defined by display manufacturer
F8h	Manufacturer Specific	TBD	TBD	May be defined by display manufacturer
F9h	Manufacturer Specific	TBD	TBD	May be defined by display manufacturer
FAh	Manufacturer Specific	TBD	TBD	May be defined by display manufacturer
FBh	Manufacturer Specific	TBD	TBD	May be defined by display manufacturer
FCh	Manufacturer Specific	TBD	TBD	May be defined by display manufacturer
FDh	Manufacturer Specific	TBD	TBD	May be defined by display manufacturer
FEh	Manufacturer Specific	TBD	TBD	May be defined by display manufacturer
FFh	Manufacturer Specific	TBD	TBD	May be defined by display manufacturer

9 Compliance

9.1 Overview

This section specifies the requirements and procedures to ensure that a display is compliant with VESA's MCCS Version 3.

Compliance may either be by visual assessment with a suitably trained and qualified operator or by instrumentation at varying levels up to and including a fully automatic implementation. The test patterns required at each stage of the compliance procedures will vary depending on the characteristics of the assessment / measurement system being used. This standard does not address the issue of suitable patterns. However, the VESA FPDM-2 standard (Flat Panel Display Measurements) should be used as both a guide to good metrology practice and a source of many suitable test patterns.

The appropriate compliance procedures depends on the VCP Codes supported by a particular display but a compliant display requires that all appropriate compliance procedures are performed with a 'Compliant' result at each stage of the compliance procedures for all supported VCP codes.

The test procedures assume that a software tool is available that can exercise the VCP Codes. It is the responsibility of the organization conducting the compliance procedure to verify that any software tool(s) and detailed compliance procedures are in conformance with the requirements of this standard.

9.2 Compliance of Manufacturer VCP Codes

Manufacturer VCP codes can be considered to have two sub-classes:

- Those that are public and extend the scope of the MCCS VCP code set in a manner that the manufacturer wishes to promote and have used, and
- Those that are private and perform functions that the manufacturer does not wish the end user to access.

All public manufacturer VCP codes (see Table 8-15) that are declared in the capability string must also be required to pass a test for compliance with the product design specification. The procedure(s) used to ensure the compliance of the manufacturer VCP Codes is(are) the responsibility of the display manufacturer.

Private manufacturer VCP codes are outside the scope of this compliance procedure.

9.3 Summary of Compliance

The appropriate compliance procedures depends on the VCP Codes supported by a particular display but a compliant display requires that all appropriate compliance procedures are performed with a 'Compliant' result at every stage.

9.4 Compliance Testing – General Points

1. VESA MCCS Standard 3.0 requires that VCP Codes 02h (New Control Value) and DFh (VCP Version) must be implemented. Compliance requires that theses are supported, correctly reported in the Capability String and pass the appropriate compliance procedures.
2. Read and parse the Capability String to determine the VCP Codes that the display claims to support, this list must define the basic display feature set for compliance tests.
3. Verify that all elements of the display feature set (except Manufacturer Specific and DPVL Support VCP Codes) meet the requirements of the appropriate compliance test procedure.
4. Verify that unassigned VCP Codes (reserved) are not used by the display - use of these VCP Codes must result in non-compliance, except where the MCCS_UP.pdf document (www.vesa.org) has been used to

indicate a new definition(s). In this case a display is considered compliant if it does not use VCP Codes that are unassigned in either the MCCS standard or the MCCS_UP document.

5. The compliance test procedures defined are segregated into several sub-groups. In some cases a common compliance procedure for several of the VCP Codes of the sub-group is defined, in other cases there are specific compliance procedures for individual VCP Codes.

6. In some cases, the maximum or minimum value may set the display into an unfavorable mode which renders it inoperable to the casual user (e.g. no image is visible). Minimum and maximum values should be designed to avoid this problem.

10 Compliance Procedures

10.1 Introduction

This section gives a compliance procedure for each of the groups of VCP Codes that a display may support.

Note: Support for some VCP Codes is a requirement for compliance but most are optional allowing design flexibility.

10.2 Organization of Compliance Procedures

Wherever possible a compliance procedure is written to cover a group of VCP codes with common characteristics, however, this is not possible in all cases and there are some compliance procedures that are only appropriate for a specific VCP code. The follow table summarizes the purpose and scope of the various compliance procedures.

Table 10-1: Compliance Procedures Purpose and Scope

VCP Group Description	Scope	Procedure(s)
Mandatory	New control value (02h) VCP version (DFh)	10.3 10.4
Capability String	All	10.5
Continuous "C"	All VCP codes of function "C" not identified explicitly	10.6
Non-continuous "NC"	All VCP codes of function "NC" not identified explicitly	10.7
Presets	Preset VCP codes defined in 8.1	10.8
Auto set-up	Auto Set-up (1Eh) and Auto Color Set-up (1Fh)	10.9
6 Axis Color	Saturation Hue	10.10.1 10.10.2
Read Only "RO"	Hz and Vt frequency (ACh and AEh) Display usage time (C0h) Others of type 'RO' Display Controller Type, (C8h) Display Firmware Level, (C9h) Flat Panel Sub-Pixel layout, (B2h) Display technology Type, (B6h) Application Enable Key, (C6h) Auxiliary Display Size, (CEh)	10.11.1 10.11.2 10.11.3 10.11.4
Write only "WO"	Degauss (01h)	10.11.5

VCP Group Description	Scope	Procedure(s)
Table “T”	Input source & output select (60h & D0h)	10.12.1
	Source timing mode (B4h)	10.12.2
	EDID operation (78h)	10.12.3
	Auxiliary display data (CFh)	10.12.4
	Transmit display descriptor (C3h)	10.12.5
	Asset tag (D2h)	10.12.6
	LUT size (73h)	10.12.7
	Single point LUT operation (74h)	10.12.8
	Block LUT (75h)	10.12.9
	Remote procedure call (76h)	10.12.10
	TV-channel up/down (8Bh)	10.12.11
	Auto set-up on/off (A2h)	10.12.12
	Display enable key (C7h)	10.12.13

10.3 Compliance Procedure for VCP Code 02h – New Control Value

This VCP Code is used to determine if a display control has been used, this control allows for the synchronization of display hardware/firmware and a software utility.

For 'buttonless' displays, use compliance procedure 10.3.1. For displays with user controls to access the conventional OSD, use compliance procedure 10.3.2

10.3.1 Buttonless Display – Verify Read and Write Operation of VCP Code 02h

The following compliance procedure verifies that the display accurately reports the absence of buttons or other manual controls to set adjustments via the conventional OSD.

Table 10-2: Compliance Procedure (buttonless) for VCP Code 02h

Stage #	Action	Result
1	Set the display to 'factory default'	n/a
2	Read the current value at VCP Code 02h	If value read = FFh: Compliant If value read ≠ FFh: Not compliant
3	Write any value other than FFh to VCP Code 02h	n/a
4	Read the current value at VCP Code 02h	If value read = FFh: Compliant If value read ≠ FFh: Not compliant
5	Determination of compliance	All stage results are 'Compliant': VCP Code 02h is compliant

10.3.2 Display with Manual Controls – Verify Read and Write of VCP Code 02h

The following test verifies that the display supports the ability to read and write to VCP code 02h for synchronization between hardware and software adjustments made to the display.

Table 10-3: Compliance Procedure for VCP Code 02h

Stage #	Action	Result
1	Set the display to 'factory default'	n/a
2	Write a value of 01h to VCP Code 02h	If value read = FFh: Compliant If value read ≠ FFh: Not compliant
3	Read the current value at VCP Code 02h	If value read = 01h: Compliant and continue to stage 4 If value read ≠ 01h: Not compliant
4	Activate first user control function with user display controls and OSD	n/a
5	Read the current value at VCP Code 02h	If value read > 01h AND < FFh: Compliant and continue to stage 6 If value read = 00h, 01h OR FFh: Not compliant
6	Repeat stages 4 and 5 with all other user control functions with user display controls and OSD	n/a
7	Determination of compliance	All stage results are 'Compliant': VCP Code 02h is compliant

Caution: This procedure will verify the basic operation but does not verify that the operation will perform correctly in real-time. The requirement is that there is no discernable lag in synchronization to a user.

10.4 Compliance Procedure for VCP Code DFh – VCP Version

Table 10-4: Compliance Procedure for VCP Code DFh

Stage #	Action	Result
1	Read the current value at VCP Code DFh	If value read matches the MCCS version and revision levels intended for this display design, then Compliant. If value read does not match either or both the MCCS version and revision level intended for this design then Not Compliant.

10.5 Compliance Procedure for Capability String

The supported VCP codes reported in the capability string must match the supported codes listed in the design specification for the display.

Table 10-5: Compliance Procedure for Capability String

Stage #	Action	Result
1	Verify the Capability String format matches the requirements of section 6.	If the Capability string matches the requirements of section 6, then Compliant. If the Capability string does not match the requirements of section 6, then Not Compliant.
2	Read and parse the Capability String	n/a
3	Verify that support for the required VCP codes is reported.	If VCP Codes 02h, New Control Value and DFh, VCP Version are supported then, Compliant If either or both VCP Codes 02h, New Control Value and DFh, VCP Version are not supported then, Not Compliant
4	Verify that all VCP Codes in range 00h →DFh inclusive reported as supported are defined by the MCCS standard.	If all supported VCP Codes are defined, then Compliant. If one or more supported VCP Codes are not defined (i.e. are unassigned and reserved) then, Not Compliant.
5	Compare supported VCP Codes in Capability String with the list of supported VCP Codes from the display design specification.	If Capability String and design specification list of supported VCP codes match exactly then, Compliant. If Capability String and design specification list of supported VCP codes do not match then, Not Compliant. If options within a supported VCP code do not match in the Capability string and the design specification then, Not Compliant.
6	All "public" VCP Codes in E0h → FFh range	If the "vcpname" field(s) (see VESA DDC/CI Standard version 1.1, section 6.7.3) is present with an appropriate [1] name, then Compliant. If the "vcpname" field(s) (see VESA DDC/CI Standard version 1.1, section 6.7.3) is not present or contains a meaningless name, then Not Compliant.
7 [2]	All "public" VCP Codes in E0h → FFh range	If the operation of the VCP Code(s) is in compliance with the product engineering specification, then Compliant. If the operation of the VCP Code(s) is not in compliance with the product engineering specification, then not Compliant.

[1] An 'appropriate name' is one that is descriptive of the function performed.
[2] Depending on the nature of the function, an existing compliance test procedure or a new, VCP Code specific, procedure may be required. Determination, and development when appropriate, of the correct procedure is the responsibility of the testing organization.

10.6 Compliance Procedure for Controls with a Continuous Range of Adjustment

Many VCP Codes are of function "C" meaning that the valid values constitute a continuous range from 0 (the minimum value) to a defined maximum of ≤ 65535 (FFFFh).

Some VCP Codes will have a granularity which does not permit individual increments in step 5 (Table 10-6) to be visible. In these cases, the compliance requirement is for a smooth transition from the minimum condition to the maximum condition.

Table 10-6: Compliance Procedure for Continuous Range VCP Codes

Stage #	Action	Result
1	Use GetVCP command to obtain the maximum supported value.	n/a
2	Compare reported maximum value to design specification maximum value for this VCP Code.	If reported and design specification maximum values are equal then, Compliant. If reported and design specification maximum values are not equal then, Not Compliant.
3	Set the display to factory default condition.	n/a
4	Use SetVCP to write a value of 00h to the current VCP Code	Ensure that the appropriate display characteristic changed to minimum condition.
5	Use SetVCP to increment the adjustment value of the current VCP Code by 1.	Ensure that there is a visibly smooth change in the appropriate characteristic.
6	Repeat stage 5 until VCP Code is at maximum value	Ensure that appropriate display characteristic is at maximum condition.
7	Determine whether display is Compliant or Not Compliant	If stages 4 → 6 produce a smooth transition of the appropriate display characteristic from the minimum condition to the maximum condition then, Compliant If stages 4 → 6 do not produce a smooth transition of the appropriate display characteristic from the minimum condition to the maximum condition then, Not Compliant

10.7 Compliance Procedure for Controls with a Non-Continuous Range of Adjustment

Several VCP Codes are of function "NC" meaning that only a limited number of values are valid. The maximum number of valid values is defined in this standard but individual display designers may choose to implement a sub-set and report accordingly in the Capability String.

Table 10-7: Compliance Procedure for Non-Continuous Range VCP Codes

Stage #	Action	Result
1	Obtain the list of supported values form the Capability String.	n/a
2	Compare reported supported values to design specification supported values for this VCP Code.	If reported and design specification supported values are equal then, Compliant. If reported and design specification supported values are not equal then, Not Compliant.
3	Set the display to factory default condition.	n/a
4	Use SetVCP to write the first supported value (lowest numerical value) to the current VCP Code	Ensure that the appropriate display characteristic changed accordingly.
5	Use SetVCP to write the next supported value (moving from lowest to highest numerical value) to the current VCP Code	Ensure that the appropriate display characteristic changed accordingly.
6	Repeat stage 5 until all supported values for this VCP Code have been exercised.	Ensure that the appropriate display characteristic changed accordingly.
7	Determine whether display is Compliant or Not Compliant	If stages 4 $\rightarrow$ 6 produce changes in the appropriate display characteristic for each supported value then, Compliant If stages 4 $\rightarrow$ 6 do not produce changes in the appropriate display characteristic for each supported value then, Not Compliant

10.8 Compliance Procedure for Preset VCP Codes

There are a number of VCP Codes associated with presetting some or all adjustments to known (factory) defaults, these are write only commands defined in 8.1.

Note: The exact operation of each Preset VCP Code is defined by the display designer.

Table 10-8: Compliance Procedure for Preset VCP Codes

Stage #	Action	Result
1	Obtain, from the display design specification, the VCP Code(s) that the current Preset VCP Code is intended to affect and the associated default values.	n/a
2	Set all supported VCP Codes to their maximum value	n/a
3	Issue the current Preset VCP Code	n/a
4	Read the new value of all VCP Codes set to maximum value in stage 2	If the VCP Code(s) intended to be affected by current preset is (are) at default value then, Compliant. If the VCP Code(s) intended to be affected by current preset is(are) at not at default value then, Not Compliant. If the VCP Code(s) not intended to be affected by the current preset VCP Code is (are) not at maximum value the, Not Compliant.

10.9 Compliance Procedures for Auto Set-up and Auto Color Set-up VCP Codes

There are two auto set-up VCP Codes, (1Eh, Auto Set-up and 1Fh, Auto Color Set-up) which require a special compliance procedure.

Note: There may be an interaction between these tests and VCP Code A2h, Auto setup On/Off.

Table 10-9: Compliance Procedure for Auto Set-up VCP Codes

Stage #	Action	Result
1	Set display to factory defaults.	n/a
2	If VCP code A2h (Auto Set-up On/Off) is supported then set it "ON" (write a value of 02h).	n/a
3	Write a value of 01h to VCP code 1Eh	If auto set-up is performed then, Compliant If auto set-up is not performed then, Not Compliant
4	Write a value of 02h to VCP Code 1Eh	If auto set-up is performed then, Compliant If auto set-up is not performed then, Not Compliant
5	• If display uses a timer, then wait for time period defined by the display specification OR • If display operation is triggered by a mode change then force a mode change	If auto set-up is performed after the defined period then, Compliant If auto set-up is not performed after the defined period then, Not Compliant
6	Write a value of 00h to VCP Code 1Eh	If auto set-up is performed then, Not Compliant
7	• If display uses a timer, then wait for time period defined by the display specification OR • If display operation is triggered by a mode change then force a mode change	If auto set-up is performed after the defined period then, Not Compliant
8	Write a value > 02h to the VCP Code 1Eh	If auto set-up is performed after the defined period then, Not Compliant
9	Repeat stage 8 with a different value	If auto set-up is performed after the defined period then, Not Compliant
10	Repeat stages 3 $\rightarrow$ 9 substituting VCP code 1Fh for 1Eh at each stage.	n/a

10.10 Compliance for 6-axis Color Adjustments

The 6-axis color saturation and hue adjustment VCP codes require separate compliance procedure since they allow adjustment about a mid-point.

10.10.1 Compliance for 6-axis Saturation VCP Codes

Table 10-10: Compliance Procedure for 6-axis Color Saturation Adjustment VCP Codes

Stage #	Action	Result
1	Set display to factory defaults.	n/a
2	Write a value of 00h to the current 6-axis Color Saturation VCP Code	If the current color moves to the minimum supported color saturation then, Compliant. If the current color does not move to the minimum supported color saturation then, Not Compliant.
3	Write a value of FFh to the current 6-axis Color Saturation VCP Code	If the current color moves to the maximum supported color saturation then, Compliant. If the current color does not move to the maximum supported color saturation then, Not Compliant.
4	Write a value of 7Fh to the current 6-axis Color Saturation VCP Code	If the current color moves to the default color saturation then, Compliant. If the current color does not move to the default color saturation then, Not Compliant.
5	Repeat stages 1 → 5 for other 6-axis Color Saturation VCP Codes	n/a

10.10.2 Compliance for 6-axis Hue VCP Codes

Table 10-11: Compliance Procedure for 6-axis Color Hue VCP Codes

Stage #	Action	Result
1	Set display to factory defaults.	n/a
2	Write a value of 00h to the current 6-axis Color Hue VCP Code	If the current color moves to the minimum supported color hue then, Compliant. If the current color does not move to the minimum supported color hue then, Not Compliant.
3	Write a value of FFh to the current 6-axis Color Saturation VCP Code	If the current color moves to the maximum supported color hue then, Compliant. If the current color does not move to the maximum supported color hue then, Not Compliant.
4	Write a value of 7Fh to the current 6-axis Color Saturation VCP Code	If the current color moves to the default color hue then, Compliant. If the current color does not move to the default color hue then, Not Compliant.
5	Repeat stages 1 → 5 for other 6-axis Color Hue VCP Codes	n/a

10.11 Compliance for Read only VCP Codes

There are a number of read only VCP Codes which require special compliance procedures.

10.11.1 Compliance Procedure for Horizontal and Vertical Frequency VCP Codes

Table 10-12: Compliance Procedure for Horizontal and Vertical Frequency VCP Codes

Stage #	Action	Result
1	Set display timing to a known condition	n/a
2	Read the Horizontal Frequency VCP Code	If the returned Horizontal Frequency matches the display input horizontal frequency to ± 0.5 % then, Compliant. If the returned Horizontal Frequency does not match the display input horizontal frequency to ± 0.5 % then, Not Compliant.
3	Read the Vertical Frequency VCP Code	If the returned Vertical Frequency matches the display input vertical frequency to ± 0.5 Hz then, Compliant. If the returned Vertical Frequency does not match the display input vertical frequency to ± 0.5 Hz then, Not Compliant.

10.11.2 Compliance Procedure for Display Usage Time VCP Code

Table 10-13: Compliance Procedure for Display Usage Time VCP Code

Stage #	Action	Result
1	Read the current display usage time at VCP Code C0h	Note the reported time
2	Leave the display active for a minimum of 2 hours. **Note**: It will be necessary to disable any automatic shut-down timer in the host for this procedure	n/a
3	Read the current time at VCP Code C0h	If the time reported in stage 1 + delay time is correctly reported in stage 3 then, Compliant If the time reported in stage 1 + delay time is not correctly reported in stage 3 then, Not Compliant

10.11.3 Compliance Procedure for Miscellaneous Read Only VCP Codes

Table 10-14: Compliance Procedure for Other Read only VCP Codes

Stage #	Action	Result
1	Read the current value at the current VCP Code	If reported value matches the display specification then, Compliant. If reported value does not match the display specification then, Not Compliant.

10.11.4Compliance for Write Only VCP Codes

Table 10-15: Compliance Procedure for Write Only VCP Codes

Stage #	Action	Result
1	Write a valid value to the display	If the display reacted appropriately then Compliant If the display did not react appropriately then Not Compliant
2	Write an invalid value to the display	If the display ignored the command then Compliant If the display did not ignore the command then Not Compliant
3	Repeat stage 1 with a different valid value	If the display reacted appropriately then Compliant If the display did not react appropriately then Not Compliant

10.11.5 Compliance Procedure for Degauss VCP Code

Table 10-16: Compliance Procedure for Degauss VCP Codes

Stage #	Action	Result
1	Write a value > 00h	If a degauss cycle was performed then, Compliant. If a degauss cycle was not performed then, Not Compliant
2	Write a value of 00h	If a degauss cycle was performed then, Not Compliant. If a degauss cycle was not performed then, Compliant
3	Repeat stage 1 with a different value > 00h	If a degauss cycle was performed then, Compliant. If a degauss cycle was not performed then, Not Compliant

10.12 Compliance for Table VCP Codes

10.12.1 Compliance Procedure for Input Source and Output Select VCP Codes

Note: It is possible that a display will only support Input Source or the Output Select VCP Code, in that case only steps 1 and 2 or 3 and 4 (respectively) of Table 10-17 must be used.

Table 10-17: Compliance Procedure for Input Source and Output Select VCP Codes

Stage #	Action	Result
1	Write the appropriate value to select each supported Input Source	If the correct input was selected then, Compliant If an incorrect input was selected then, Not Compliant
2	Write the appropriate values for Input Sources that are not supported	If there is no change to the previously selected input then, Compliant If there is a change to the previously selected input then, Not Compliant
3	Write the appropriate value to select each supported Output	If the correct output was selected then, Compliant If an incorrect output was selected then, Not Compliant
4	Write the appropriate values for Output that are not supported	If there is no change to the previously selected output then, Compliant If there is a change to the previously selected output then, Not Compliant

10.12.2 Compliance Procedure for Source Timing Mode VCP Codes

Table 10-18: Compliance Procedure for Source Timing Mode VCP Code

Stage #	Action	Result
1	Determine the VESA DMT and DTV timing modes supported by the display.	n/a
2	Select 3 supported timing modes from the VESA DMT and DTV lists. If possible, these must each have different pixel formats and refresh rates.	n/a
3	Write the appropriate value for the first timing mode	n/a
4	Read the current value of timing mode stored by the display	If the value read matches the value written then, Compliant If the value read does not match the value written then, Not Compliant
5	Repeat stages 3 & 4 for other timing modes selected in stage 2	n/a

10.12.3 Compliance Procedure for EDID Operation

Table 10-19: Compliance Procedure for EDID Operation VCP Code

Stage #	Action	Result
1	Determine the full EDID structure – base EDID and any extension blocks – that are part of the display design. Determine the intended content of base EDID and any EDID extensions that are present.	n/a
2	Read base EDID	If the received contents match the design contents determined in step 1 then, Compliant If the received contents do not match the design contents determined in step 1 then, Not Compliant
3	Read first EDID extension	If the received contents match the design contents determined in step 1 then, Compliant If the received contents do not match the design contents determined in step 1 then, Not Compliant
4	Repeat stage 3 as required for all further EDID extensions	If the received contents match the design contents determined in step 1 then, Compliant If the received contents do not match the design contents determined in step 1 then, Not Compliant

10.12.4 Compliance Procedure for Auxiliary Display Data VCP Code

Table 10-20: Compliance Procedure for Auxiliary Display Data VCP Code

Stage #	Action	Result
1	Determine the design size of the auxiliary display.	n/a
2	Write an ASCII string of the appropriate length to fill the auxiliary display. **Note:** String content must be non-repetitive.	If the data send is correctly displayed then, Compliant If the data send is not correctly displayed then, Not Compliant
3	Write an ASCII string of the appropriate length to fill the auxiliary display + 2 bytes. Note: String content must be non-repetitive and different from data in stage 2	If the latest data sent that corresponds to the display length is correctly displayed then, Compliant If the latest data sent that corresponds to the display length is not correctly displayed then, Not Compliant

10.12.5 Compliance Procedure for Transmit Display Descriptor VCP Code

Table 10-21: Compliance Procedure for Transmit Display Descriptor VCP Code

Stage #	Action	Result
1	Determine the design length of the display descriptor storage.	n/a
2	Write an ASCII string of the appropriate length to fill the display descriptor storage. **Note:** String content must be non-repetitive.	n/a
3	Read the Display Descriptor VCP Code	If the data read matches the data written in stage 2 then, Compliant If the data read does not match the data written in stage 2 then, Not Compliant.
4	Write an ASCII string of the appropriate length to fill the display descriptor storage + 2 bytes **Note:** String content must be non-repetitive and different from data in stage 2	n/a
5	Read the Display Descriptor VCP Code	If the data read matches the data written in stage 4 without the last 2 bytes then, Compliant If the data read does not match the data written in stage 4 without the last 2 bytes then, Not Compliant

10.12.6 Compliance Procedure for Asset Tag VCP Code

Table 10-22: Compliance Procedure for Asset Tag VCP Code

Stage #	Action	Result
1	Determine the appropriate key.	n/a
2	Read the asset tag	If key is not present in bytes 0 and 1 then, Compliant If key is present in bytes 0 and 1 then, Not Compliant
3	Write the key and a test pattern that must completely fill the asset tag. Data should be non-repetitive.	n/a
4	Read the asset tag	If key is not present in bytes 0 and 1 then, Compliant If key is present in bytes 0 and 1 then, Not Compliant If the asset tag data matches the data written in stage 3 then, Compliant If the asset tag data does not match the data written in stage 3 then, Not Compliant

10.12.7 Compliance Procedure for LUT Size VCP Code

Table 10-23: Compliance Procedure for LUT Size VCP Code

Stage #	Action	Result
1	Determine the display LUT size (number of entries and bits / entry) from the design specification.	n/a
2	Read the LUT Size	If the reported values for Red, Green and Blue LUTS match the design specification then, Compliant. If the reported values for Red, Green and Blue LUTS do not match the design specification then, Not Compliant.

10.12.8 Compliance Procedure for Single Point LUT Operation VCP Code

Table 10-24: Compliance Procedure for Single Point LUT VCP Code

Stage #	Action	Result
1	Verify that display reports support for the LUT Size VCP Code (73h)	If display report supports for LUT Size VCP Code then, Compliant. If display does not report support for LUT Size VCP Code then, Not Compliant.
2	Read the current contents of selected Red, Green and Blue LUT entries (2 for each LUT). **Note**: LUT entries must be at different offsets	n/a
3	Write a new Red LUT value to the first selected location. **Note:** Data must be chosen to be significantly different to data read from selected location in stage 2	If a display change is visible then, Compliant. If a display change is not visible then, Not Compliant
4	Repeat stage 3 for a second Red LUT entry and for each Green and Blue LUT entries. **Note:** Data values writer to each LUT entry must be different	n/a
5	Read the current contents selected Red, Green and Blue LUT entries.	n/a
6	Compare the data read at stage 5 with that at stage 2	If data read at stage 5 matches the data read at stage 2 then, Compliant If data read at stage 5 does not match the data read at stage 2 then, Not Compliant

10.12.9 Compliance Procedure for Block LUT Operation VCP

Table 10-25: Compliance Procedure for Block LUT VCP Code

Stage #	Action	Result
1	Verify that display reports support for the LUT Size VCP Code (73h)	If display report supports for LUT Size VCP Code then, Compliant. If display does not report support for LUT Size VCP Code then, Not Compliant.
2	Read the current values of the Red, Green and Blue LUT entries	n/a
3	Write a new set of data to the Red LUT **Note:** Data must be chosen to be significantly different to data read from in stage 2	If a display change is visible then, Compliant. If a display change is not visible then, Not Compliant
4	Repeat stage 3 for the Green and Blue LUTs. **Note:** All LUTs must be written with different data.	n/a
5	Read the current values of the Red, Green and Blue LUT entries	n/a
6	Compare the data read at stage 5 with that at stage 2	If data read at stage 6 is different to data read at stage 2 then, Compliant If data read at stage 6 is not different to data read at stage 2 then, Not Compliant If data read at stage 6 matches the data written at stages 3 and 4 then, Compliant If data read at stage 6 does not match the data written at stages 3 and 4 then, Not Compliant.

10.12.10 Compliance Procedure for Code Remote Procedure Call VCP Code

Table 10-26: Compliance Procedure for Remote Procedure Call VCP Code

Stage #	Action	Result
1	Determine the current contents of the Red, green and Blue LUTs.	n/a
2	Select six LUT offset locations to be used to generate a new set of LUT data. The data selected for these six locations must be significantly different to the values determined in step 1	n/a
3	Write the data from stage 2 along with a value of 01h in byte 0	If the display characteristic change appropriately for the data then, Compliant. If the display characteristic do not change appropriately for the data then, Not Compliant.
4	Write a new set of data, selected to be significantly different from that used in stage 2, with a value > 01h	If the display characteristic do not change then, Compliant. If the display characteristic change then, Not Compliant.
5	Repeat stage 4 but with byte 0 set to a value of 01h	If the display characteristic change appropriately for the data then, Compliant. If the display characteristic do not change appropriately for the data then, Not Compliant.

10.12.11 Compliance procedure for TV-channel Up/Down VCP Code

Table 10-27: Compliance Procedure for TV-channel Up/Down VCP Code

Stage #	Action	Result
1	Determine initial channel number	n/a
2	Write a value of 01h	If channel number was incremented by 1 then, Compliant. If channel number was not incremented by 1 then, Not Compliant.
3	Repeat stage 2 twice more	If channel number was incremented by 1 each time then, Compliant. If channel number was not incremented by 1 each time then, Not Compliant.
4	Write a value of 02h, three times	If channel number is equal to initial channel number determined in step 1 then, Compliant If channel number is not equal to initial channel number determined in step 1 then, Not Compliant

10.12.12 Compliance Procedure for Auto Set-up On/Off VCP Code

Table 10-28: Compliance Procedure for Auto Setup On/Off VCP Code

Stage #	Action	Result
1	Write a value of 02h (auto setup on)	n/a
2	Write a value of 01h to 1Eh, Auto Set-up, VCP Code	If Auto Set-up is performed then, Compliant If Auto Set-up is not performed then, Not Compliant
3	Write a value of 01h (auto setup off)	n/a
4	Write a value of 01h to 1Eh, Auto Set-up, VCP Code	If Auto Set-up is performed then, Not Compliant If Auto Set-up is not performed then, Compliant

10.12.13 Compliance Procedure for Display Enable Key, VCP Code

Table 10-29: Compliance Procedure for Display Enable Key, VCP Code

Stage #	Action	Result
1	Obtain the display specification or the display manufacturer, the correct display security value and duration of delays before activation.	n/a
2	Write the correct display security value	n/a
3	Wait for the activation period	n/a
4	Ensure correct operation of the display	If the display operates correctly then, Compliant If the display does not operate correctly then, Not Compliant
5	Wait for the activation period	n/a
6	Ensure correct operation of the display	If the display operates correctly then, Not Compliant If the display does not operate correctly then, Compliant
7	Write the correct display security value	n/a
8	Write an incorrect display security value	n/a
9	Wait for the activation period	n/a
10	Ensure correct operation of the display	If the display operates correctly then, Not Compliant If the display does not operate correctly then, Compliant

11 VCP Code Index

Notes:

1. All unassigned codes are reserved for future use. To ensure predictable operation and interoperability any required control functions not assigned a specific VCP code must be implemented using a manufacturer's specific VCP code in range of E0h to FFh.
2. In the event of a conflict between these index tables and the VCP Code tables in section 8, the VCP codes defined in section 8 must be deemed to be correct.

Table 11-1 : VCP Code Numeric Index

Code	VCP Code Name	**Preset** Table 8-2	**Image** Table 8-4	**Control** Table 8-6	**Geometry** Table 8-8	**Misc.** Table 8-10	**Audio** Table 8-12	**DPVL** Table 8-14	**Manuf.** Table 8-15
00h									
01h	Degauss					√			
02h	New Control Value					√			
03h	Soft Controls					√			
04h	Restore Factory Defaults	√							
05h	Restore Factory Luminance/ Contrast Defaults	√							
06h	Restore Factory Geometry Defaults	√							
07h									
08h	Restore Factory Color Defaults	√							
09h									
0Ah	Restore Factory TV Defaults	√							
0Bh	Color Temperature Increment		√						
0Ch	Color Temperature Request		√						
0Dh									
0Eh	Clock		√						
0Fh									
10h	Luminance		√						
11h	Flesh Tone Enhancement		√						
12h	Contrast		√						
13h	Backlight Control		√						
14h	Select Color Preset		√						
15h									
16h	Video Gain (Drive): Red		√						
17h	User Color Vision Compensation		√						
18h	Video Gain (Drive): Green		√						
19h									
1Ah	Video Gain (Drive): Blue		√						
1Bh									
1Ch	Focus		√						

Table 11-1 : VCP Code Numeric Index									
Code	**VCP Code Name**	**Preset** Table 8-2	**Image** Table 8-4	**Control** Table 8-6	**Geometry** Table 8-8	**Misc.** Table 8-10	**Audio** Table 8-12	**DPVL** Table 8-14	**Manuf.** Table 8-15
1Dh									
1Eh	Auto Setup		√						
1Fh	Auto Color Setup		√						
20h	Horizontal Position (Phase)				√				
21h									
22h	Horizontal Size				√				
23h									
24h	Horizontal Pincushion				√				
25h									
26h	Horizontal Pincushion Balance				√				
27h									
28h	Horizontal Convergence R / B				√				
29h	Horizontal Convergence M / G				√				
2Ah	Horizontal Linearity				√				
2Bh									
2Ch	Horizontal Linearity Balance				√				
2Dh									
2Eh	Gray Scale Expansion		√						
2Fh									
30h	Vertical Position (Phase)				√				
31h									
32h	Vertical Size				√				
33h									
34h	Vertical Pincushion				√				
35h									
36h	Vertical Pincushion Balance				√				
37h									
38h	Vertical Convergence R/B				√				
39h	Vertical Convergence M/G				√				
3Ah	Vertical Linearity				√				
3Bh									
3Ch	Vertical Linearity Balance				√				
3Dh									
3Eh	Clock Phase		√						
3Fh									
40h	Horizontal Parallelogram				√				
41h	Vertical Parallelogram				√				
42h	Horizontal Keystone				√				
43h	Vertical Keystone				√				

Table 11-1 : VCP Code Numeric Index									
Code	**VCP Code Name**	**Preset** Table 8-2	**Image** Table 8-4	**Control** Table 8-6	**Geometry** Table 8-8	**Misc.** Table 8-10	**Audio** Table 8-12	**DPVL** Table 8-14	**Manuf.** Table 8-15
44h	Rotation				√				
45h									
46h	Top Corner Flare				√				
47h									
48h	Top Corner Hook				√				
49h									
4Ah	Bottom Corner Flare				√				
4Bh									
4Ch	Bottom Corner Hook				√				
4Dh									
4Eh									
4Fh									
50h									
51h									
52h	Active Control					√			
53h									
54h	Performance Preservation					√			
55h									
56h	H Moiré		√						
57h									
58h	V Moiré		√						
59h	6 Axis Saturation Control: Red		√						
5Ah	6 Axis Saturation Control: Yellow		√						
5Bh	6 Axis Saturation Control: Green		√						
5Ch	6 Axis Saturation Control: Cyan		√						
5Dh	6 Axis Saturation Control: Blue		√						
5Eh	6 Axis Saturation Control: Magenta		√						
5Fh									
60h	Input Source					√			
61h									
62h	Audio: Speaker Volume						√		
63h	Audio: Speaker Pair Select						√		
64h	Audio: Microphone Volume						√		
65h									
66h	Ambient Light Sensor					√			
67h									
68h									
69h									
6Ah									

Table 11-1 : VCP Code Numeric Index									
Code	**VCP Code Name**	**Preset** Table 8-2	**Image** Table 8-4	**Control** Table 8-6	**Geometry** Table 8-8	**Misc.** Table 8-10	**Audio** Table 8-12	**DPVL** Table 8-14	**Manuf.** Table 8-15
6Bh									
6Ch	Video Black Level: Red		√						
6Dh									
6Eh	Video Black Level: Green		√						
6Fh									
70h	Video Black Level: Blue		√						
71h									
72h	Gamma		√						
73h	LUT Size		√						
74h	Single Point LUT Operation		√						
75h	Block LUT Operation		√						
76h	Remote Procedure Call					√			
77h									
78h	EDID Operation					√			
79h									
7Ah									
7Bh									
7Ch	Adjust Zoom		√						
7Dh									
7Eh									
7Fh									
80h									
81h									
82h	Horizontal Mirror (Flip)				√				
83h									
84h	Vertical Mirror (Flip)				√				
85h									
86h	Display Scaling				√				
87h	Sharpness		√						
88h	Velocity Scan Modulation		√						
89h									
8Ah	Color Saturation		√						
8Bh	TV Channel Up / Down					√			
8Ch	TV Sharpness		√						
8Dh	Audio Mute						√		
8Eh	TV Contrast		√						
8Fh	Audio Treble						√		
90h	Hue		√						
91h	Audio Bass						√		

Table 11-1 : VCP Code Numeric Index									
Code	**VCP Code Name**	**Preset** Table 8-2	**Image** Table 8-4	**Control** Table 8-6	**Geometry** Table 8-8	**Misc.** Table 8-10	**Audio** Table 8-12	**DPVL** Table 8-14	**Manuf.** Table 8-15
92h	TV Black Level / Luminance		√						
93h	Audio Balance L / R						√		
94h	Audio Processor Mode:						√		
95h	Window Position (TL_X)				√				
96h	Window Position (TL_Y)				√				
97h	Window Position (BR_X)				√				
98h	Window Position (BR_X)				√				
99h									
9Ah	Window Background		√						
9Bh	6 Axis Color Control: Red		√						
9Ch	6 Axis Color Control: Yellow		√						
9Dh	6 Axis Color Control: Green		√						
9Eh	6 Axis Color Control: Cyan		√						
9Fh	6 Axis Color Control: Blue		√						
A0h	6 Axis Color Control: Magenta		√						
A1h									
A2h	Auto Setup On / Off		√						
A3h									
A4h	Window Mask Control		√						
A5h	Window Select		√						
A6h									
A7h									
A8h									
A9h									
AAh	Screen Orientation		√						
ABh									
ACh	Horizontal Frequency			√					
ADh									
AEh	Vertical Frequency			√					
AFh									
B0h	Settings	√							
B1h									
B2h	Flat Panel Sub-Pixel Layout					√			
B3h									
B4h	Source Timing Mode			√					
B5h	Source Color Coding			√					
B6h	Display Technology Type					√			
B7h	DPVL : Display status							√	
B8h	DPVL : Packet count							√	

Table 11-1 : VCP Code Numeric Index									
Code	**VCP Code Name**	**Preset** Table 8-2	**Image** Table 8-4	**Control** Table 8-6	**Geometry** Table 8-8	**Misc.** Table 8-10	**Audio** Table 8-12	**DPVL** Table 8-14	**Manuf.** Table 8-15
B9h	DPVL : Display X origin							√	
BAh	DPVL : Display Y origin							√	
BBh	DPVL : Header CRC error count							√	
BCh	DPVL : Body CRC error count							√	
BDh	DPVL : Client ID							√	
BEh	DPVL : Link control							√	
BFh									
C0h	Display Usage Time			√					
C1h									
C2h	Display Descriptor Length					√			
C3h	Transmit Display Descriptor					√			
C4h	Enable Display of 'Display Descriptor'					√			
C5h									
C6h	Application Enable Key					√			
C7h									
C8h	Display Controller Type			√					
C9h	Display Firmware Level			√					
CAh	OSD			√					
CBh									
CCh	OSD Language			√					
CDh	Status Indicators					√			
CEh	Auxiliary Display Size					√			
CFh	Auxiliary Display Data					√			
D0h	Output Selection					√			
D1h									
D2h	Asset Tag					√			
D3h									
D4h	Stereo Video Mode		√						
D5h									
D6h	Power Mode			√					
D7h	Auxiliary Power Output					√			
D8h									
D9h									
DAh	Scan Mode				√				
DBh	Image Mode			√					
DCh	Display Application		√						
DDh									
DEh	Scratch Pad					√			

Table 11-1 : VCP Code Numeric Index									
Code	**VCP Code Name**	**Preset** Table 8-2	**Image** Table 8-4	**Control** Table 8-6	**Geometry** Table 8-8	**Misc.** Table 8-10	**Audio** Table 8-12	**DPVL** Table 8-14	**Manuf.** Table 8-15
DFh	VCP Version			√					
E0h	Manufacturer Specific								√
E1h	Manufacturer Specific								√
E2h	Manufacturer Specific								√
E3h	Manufacturer Specific								√
E4h	Manufacturer Specific								√
E5h	Manufacturer Specific								√
E6h	Manufacturer Specific								√
E7h	Manufacturer Specific								√
E8h	Manufacturer Specific								√
E9h	Manufacturer Specific								√
EAh	Manufacturer Specific								√
EBh	Manufacturer Specific								√
ECh	Manufacturer Specific								√
EDh	Manufacturer Specific								√
EEh	Manufacturer Specific								√
EFh	Manufacturer Specific								√
F0h	Manufacturer Specific								√
F1h	Manufacturer Specific								√
F2h	Manufacturer Specific								√
F3h	Manufacturer Specific								√
F4h	Manufacturer Specific								√
F5h	Manufacturer Specific								√
F6h	Manufacturer Specific								√
F7h	Manufacturer Specific								√
F8h	Manufacturer Specific								√
F9h	Manufacturer Specific								√
FAh	Manufacturer Specific								√
FBh	Manufacturer Specific								√
FCh	Manufacturer Specific								√
FDh	Manufacturer Specific								√
FEh	Manufacturer Specific								√
FFh	Manufacturer Specific								√

12 Appendix A: Drawings of Display Geometry

The drawings in this section are for information only and intended to aid in the interpretation of the function of VCP codes in section 8.4

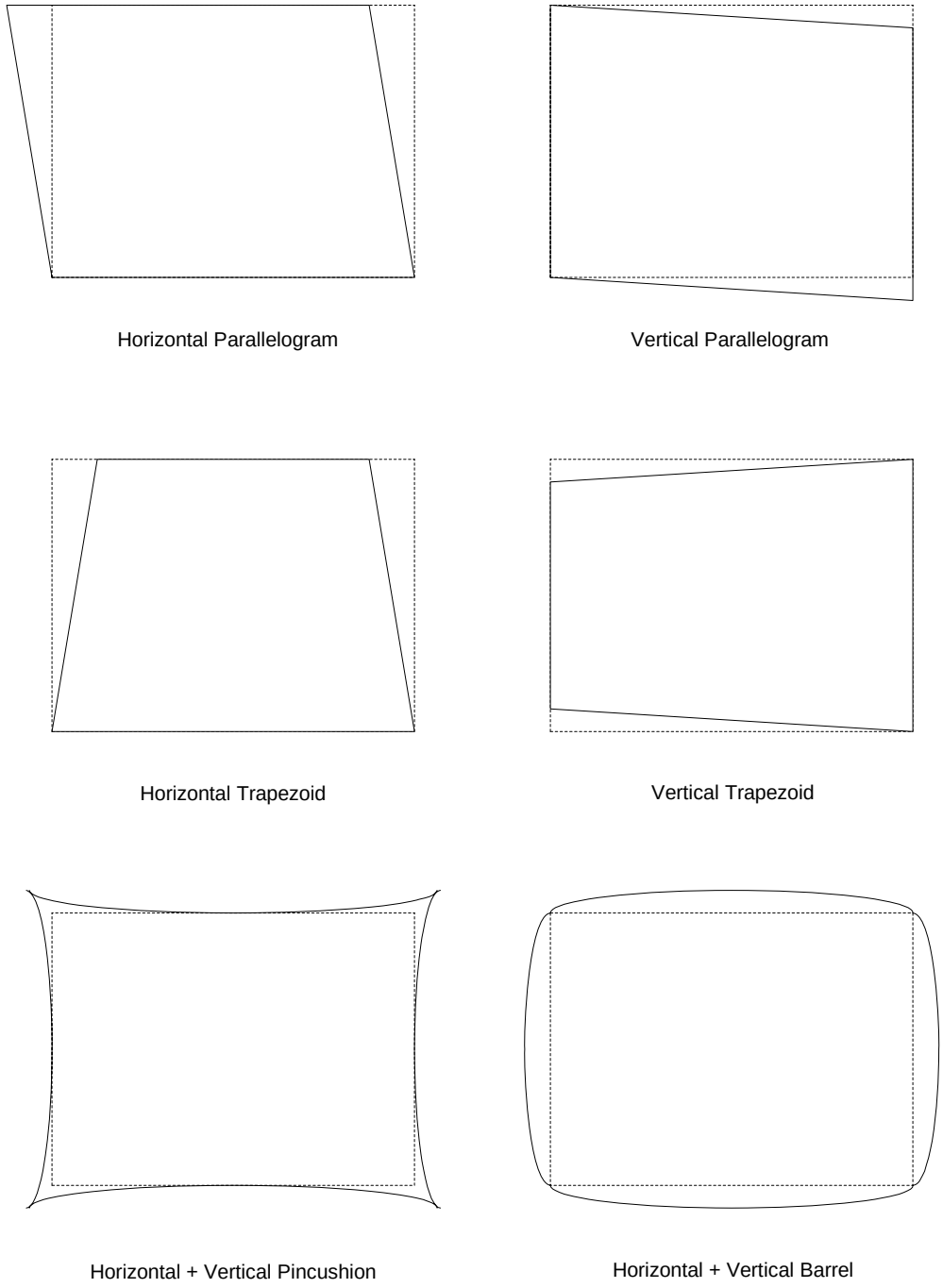
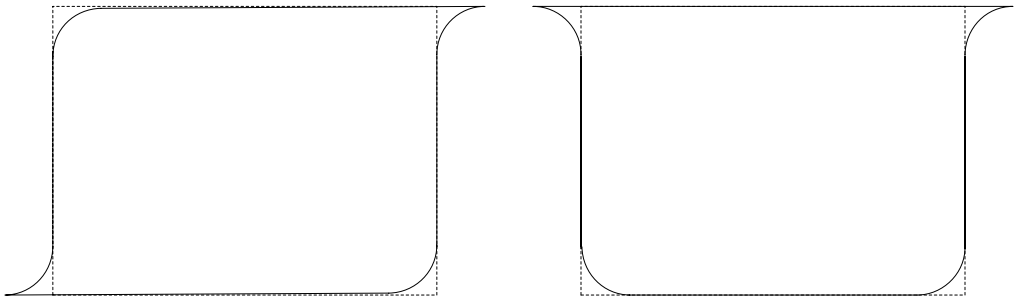
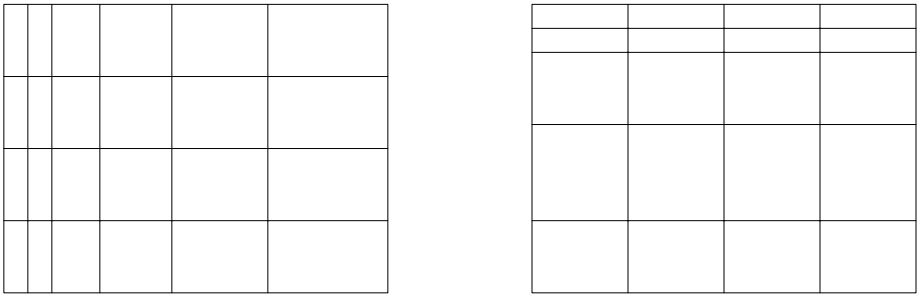


Figure 12-1: Parallelogram, Trapezoid, Pincushion & Barrel Distortion



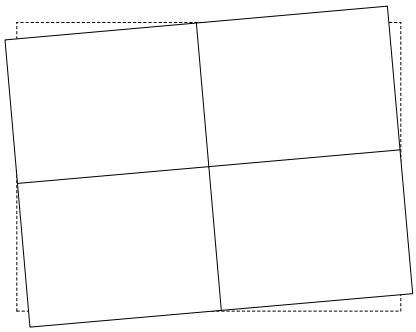
Top + Bottom Hook

Top + Bottom Flare



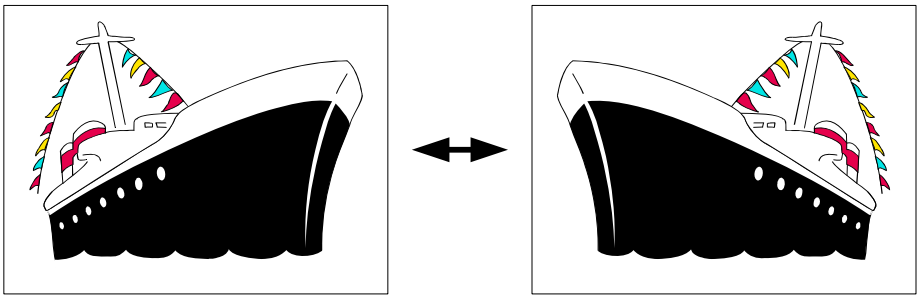
Horizontal Linearity

Vertical Linearity

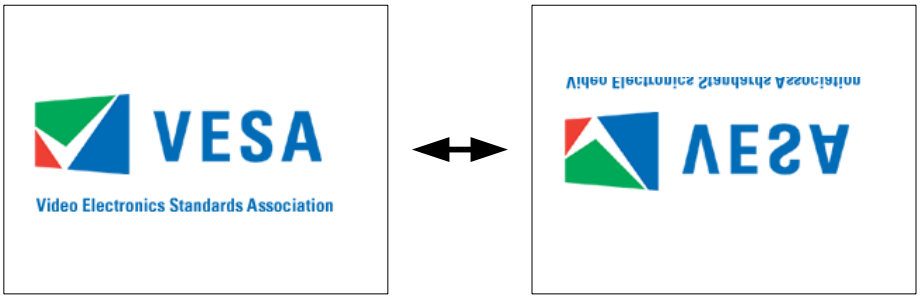


Rotation

Figure 12-2: Hook, Flare, Linearity & Rotation Distortion



Horizontal Mirror (Flip)



Vertical Mirror (Flip)

Figure 12-3: Mirroring / Flip

13 Appendix B: Implementation Guidance

Note: This section is for information and is not part of the MCCS standard.

13.1 Support for Multiple Window Operation.

Note: The range of commands available to operate on a window may be different (usually a sub-set) from those available for full screen operation.

13.1.1 Window Position VCP Codes (95h → 98h)

It is important to recognize that the defined X and Y coordinates apply before any scaling that takes place in the display … the display must make appropriate adjustments if scaling is active.

13.1.2 Window Mask Control VCP Code (A4h)

This control has two functions:

It allows the effects of changes to be masked until all values have been updated. This permits intermediate effects on the image which may result in objectionable effects to be selected. It also allows for each window to be set active or inactive

13.1.3 Window Select VCP Code (A5h)

This control allows up to seven windows plus the background (full image area) to be selected.

If the selected window is not masked 'off' by the appropriate bit in Window Control (VCP code A4h), then changes will have immediate effect.

13.1.4 Picture in Picture (PIP)

A PIP size and location may be defined using window commands and the appropriate input signal selected for the signal that is required to be inserted here. For example:

Set A4h ⇒ 00h	Mask all windows
Set A5h ⇒ 01h	Select window 1
Set 95h ⇒ 00h	Top left X value = 0
Set 96h ⇒ 00h	Top left Y value = 0
Set 97h ⇒ 03h, 20h	Bottom right X value = 800
Set 98h ⇒ 01h, C2h	Bottom right Y value = 450
Set 60h ⇒ 07h	Select S-video # 1 as input source
Set A4h ⇒ C0h	Unmask the background and window # 1

This will result in a PIP window at the top left of the image with 800 x 450 pixels.

Note: The display must scale the PIP input signal to match the defined window.

13.2 Keeping Local and Remote Operations in Synchronization

Reference the discussion in Section 2.

This section outlines a recommended implementation and the following logical flow chart shows the operation of the host and display and how these interact.

If several control values have been changed then display must implement a ‘FIFO (First In, First Out) stack’ with the VCP codes of all changed controls and with the last entry set to 00h. The host must perform successive reads until it receives a value of 00h, it will then reset the New Control Value to 01h.

Notes:

“The display should ensure that only a single instance of a particular VCP code is placed on the ‘stack’. In particular, if the same VCP code is used several times to make an adjustment, this should not result in multiple instance of that VCP code on the ‘stack’.” (i.e. several adjustments of the same feature before the software application has read the “stack” should not result in multiple instances of the associated VCP code)

The software application should read entries on the ‘stack’ using VCP code 52h, a value of 00h indicates that there are no more entries on the ‘stack’. The application should reset the ‘New Control value’ to 01h.

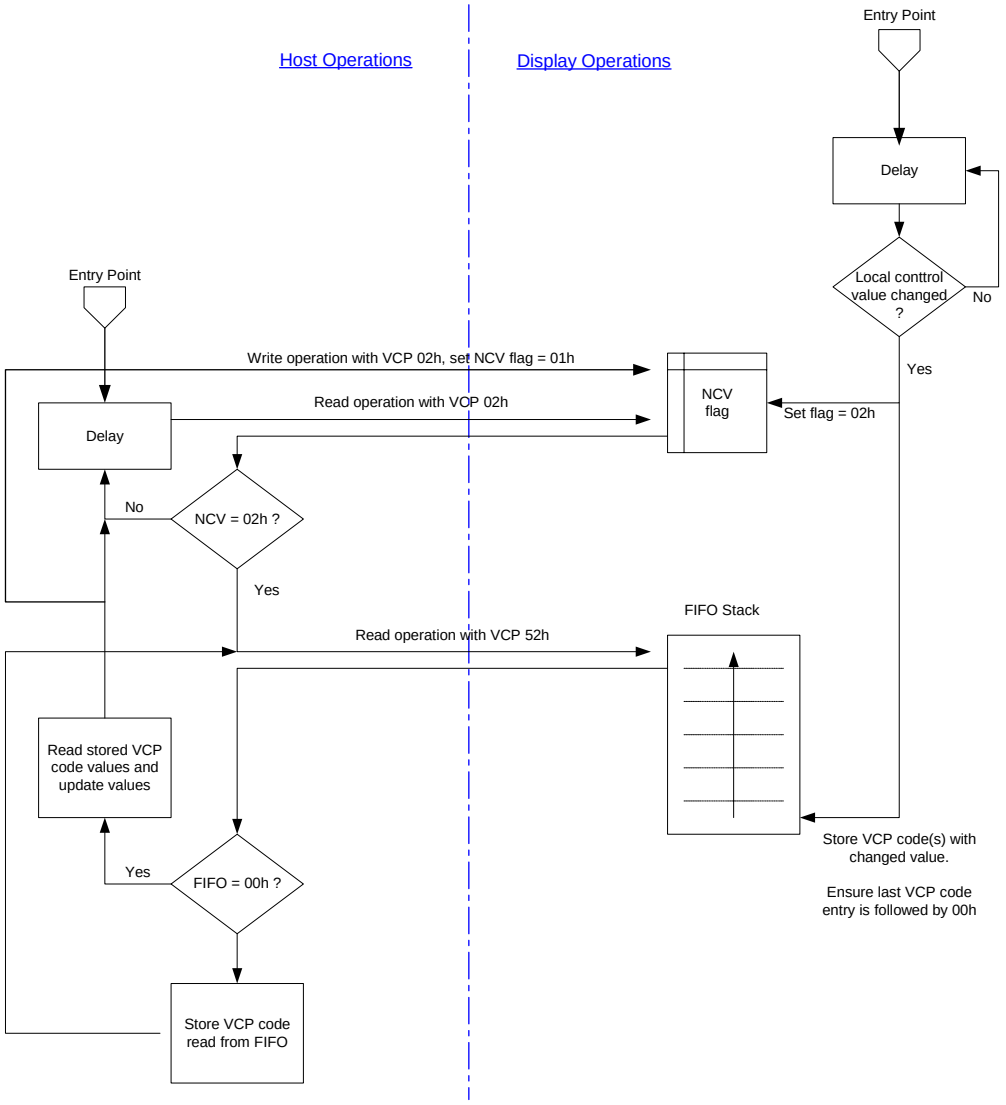


Figure 13-1: Local and Remote Synchronization

14 Appendix C: Glossary of Abbreviations, Acronyms and Terms

Table 14-1: Glossary

Term	Definition
C	Continuous – indicates that the associated VCP code has a continuous range of adjustment
CRC	Cyclic Redundancy Check – a technique applied to protect the integrity of data transmission
CRT	Cathode Ray Tube – a class of display technology
Display Controller	Generic term used to indicate the function (usually provided by an integrated circuit and / or firmware) that controls all the functions of the display.
DPM	Display Power Management – a VESA standard for display power management
DPMS	Display Power Management Signaling – an old VESA display power management standard
DPVL	Digital Packet Video Link – a VESA standard
EL	Electroluminescent – a class of display technology
FED	Field Emission Device – a class of display technology
LCD	Liquid Crystal Display – a class of display technology
LCoS	Liquid Crystal on Silicon – a class of display technology
LUT	Look Up Table – a block of data containing reference data. In the context of display, most often used with reference to the modification of the video transfer characteristics.
MEM	Micro Electro-Mechanical: a class of devices that combine mechanical and electronic elements. A class of display technology
NC	Not Continuous – indicates that the associated VCP codes only has a few valid values
OLED	Organic Light Emitting Diode – a class of display technology
Orbiting	A technique applied to some displays, especially Plasma, which causes the image to periodically move by small amounts. Purpose is to minimize the visual effects of image burn-in.
OSD	On Screen Display – a small (usually) icon and/or text based user interface to allow adjustment of display parameters
Plasma	Plasma – a class of display technology
RO	Read only – the associated VCP code does not permit the value to be changed (written)
R / W	Read / Write – the associated VCP code permits the value to be both read and written
T	Table – a class of VCP codes which handle large blocks of data
TFT	Thin Film Transistor – often used as a short form of TFT-LCD
TFT-LCD	Thin Film Transistor – Liquid Crystal Display – a class of display technology
VCP	Virtual Control Panel
WO	Write Only – the associated VCP code does not permit the value to be read

15 Appendix D: Main Contribution History

Table 15-1: Main Contributors to MCCS Version 2

Don Chambers	Cables-to-Go	
Tamuka Ishida	EIZO NANAO	
Yuichiro Wada	Fujitsu	
John Frederick	Hewlett-Packard	
Bob Myers	Hewlett-Packard	
Youichi Igarashi	Hitachi	
Kai Schleupen	IBM	
Hiroshi Yamashita	International Display Technology	
Hironobu Yasui	Mitsubishi Electric Corp.	
Jack Hosek	NEC-Mitsubishi.	
Kazuaki Takamoto	NEC Mitsubishi Electric Visual Systems	
Hideki Tanizoe	NEC Mitsubishi Electric Visual Systems	
Yoshihisa Kudou	NEC Viewtechnology	
Seiji Kobayashi	Plus Vision	
George Wiley	Qualcomm	
Bryan Speece	Portrait Displays	
Ian Miller	Samsung Information Systems America	Workgroup leader
Steve Hasegawa	Sony Electronics	
Doug Gorny	Three-Five Systems	
Alain d'Hautecourt	ViewSonic	

Table 15-2: Main Contributors to MCCS version 2 Revision 1

Bryan Speece	Entech Taiwan	
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Glen Adler	Philips	
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Scott Anderson	Portrait Displays	
Ian Miller	Samsung Information Systems America	Task Group Chair & Editor
Paul Doyle	Sony	
Jim Webb	Tech Source	
Alain d'Hautecourt	ViewSonic	Task Group Vice-chair & Secretary