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DDC/CI  
Command & VCP  
For  
NPG model (LCD)

Ver. 1 Rev. 4

October / 01 /2003

NEC-MITSUBISHI ELECTRIC VISUAL SYSTEMS  
Engineering Department

**CONFIDENTIAL****History**

| DDC/CI Command & VCP for NPG Design Model (LCD) |     |            |  |             |       |     |
|---|-----|------------|--|-------------|-------|-----|
| Development Department                          |     |            |  |             |       |     |
| Ver.  | Rev | Date       | Description  | ENG         | CHKD. | APP |
| 1   | 0   | 2002/05/22 | Draft 1<br>Separate this document from<br>“DDC/CI Command & VCP<br>For NPG model, Liteon<br>model, Compal model Ver. 1<br>Rev. 0 Draft 1”.   | K. Takamoto |       |     |
| 1   | 1   | 2002/07/18 | Draft 1<br>Add Vcp ( page_max 7Eh write<br>protect-DDC )<br>Add 15V as an applicable model   | K. Takamoto |       |     |
| 1   | 2   | 2002/10/21 | Draft 2<br>Add maximum length value in<br>Capabilities Request Reply   | I.Kenmochi  |       |     |
|   |     |            | Change VCP page data sample  | I.Kenmochi  |       |     |
|   |     |            | Change VCP support flag of<br>Power Mode (D6H)   | I.Kenmochi  |       |     |
|   |     |            | Add VCP command<br>Page0(FAH) Hours Running<br>“TOTAL”<br>Page0(FFH) Display Device On<br>Time   | I.Kenmochi  |       |     |
| 1   | 3   | 2003/04/01 | Add :<br>- 2003 models to “applicable<br>model”<br>- Command “MPU reset”<br>- 68h(Language): 3 language<br>- Appendix (1)<br>Change :<br>“2-3-4) Capabilities Request”<br>string sample. | T.Katagiri  |       |     |
|   |     |            | Add<br>- 8Dh : description   | T.Katagiri  |       |     |
| 1   | 4   | 2003/10/01 | Add<br>- B0h “Settings”  | T.Katagiri  |       |     |
|   |     |            |  |             |       |     |

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This Document describes command and Control op-code for DDC/CI that should be referred to when NPG design this function.

## **0. Applicable Models**

| Document Ver. | Applicable Models                                   |
|---------------|---|
| 1             | 2002 Model<br>NPG : 15VI, NL1503, 15V               |
| V1R3 -        | 2003 model<br>AS71V, AS71VM, AS51V, AS51VM,<br>PB17 |
|               |   |

# 1. System

## 1-1) System specification

System : I2C bus single master

Transfer rate : 100 k bit/s max.

Base protocol : DDC 2Bi

Monitor Slave address : 6E / 6F h

SCL : Serial clock Mini D-sub connector Pin#15

DVI connector Pin#6

SDA : Serial Data Mini D-sub connector Pin#12

DVI connector Pin#7

Requirement for MCU

Need a hard ware support for I2C Bus drive port.

## 1-2) Reference Specification standard Document

|   |                    |
|---|--------------------|
| VESA DDC/CI STANDARD Version 1                        | (August 14, 1998)  |
| VESA Monitor Command Set (MCCS )Standard Version1.0   | (September 11,'98) |
| ACCESS BUS Monitor Device Protocol Specification V3.0 | (September '95)    |
| VESA DDC/CI Implementation Guide Version 1P Draft 3   | (February 7, 02)   |

## 2. Command

### 2-1) Support Command

#### Command List

Following command set must be supported on “User Mode”.

| VESA standard command  | NEC-MITSUBISHI Custom commands   |
|--|--|
| 1) Get VCP<br>2) Set VCP<br>3) Save Current Setting<br>4) Capability Reply<br>5) Get Timing Report | 1) EEPROM read<br>2) Get VCPPage & VCPPage reply<br>3) Get Paged VCP & Paged VCP reply<br>4) Set paged VCP & paged VCP reply<br>5) Get Power Status & Reply<br>6) Asset Read Request & Reply<br>7) Asset Write Request |

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### 2-2) Command format

#### 2-2-1) User Command:

PC -> Monitor

S – [6E]a – [51]a – [Length]a – [Command]a – [Data(0-n)]a – - - [Checksum]a – P

S : Start Condition

[6E]: Monitor Slave address (w/ Destination)

[51]: Source

[Length]: (Byte size from next byte to before byte of checksum.) (\*1)

[Command]: Command (Refer to following section)

[Data] : Data

a : acknowledge (reply from monitor)

[Checksum]: checksum (\*2)

P : Stop Condition

Monitor -> PC

S – [6F]a – [6E]a – [Length]a – [Command]a – [Data(0-n)]a – - - [Checksum]n – P

S : Start Condition

[6F]: Monitor Slave address (w/ Destination) --- from PC

[6E]: Source

[Length]: (Byte size from next byte to before byte of checksum.) (\*1)

[Command]: Command (Refer to following section)

[Data] : Data / Status

a : acknowledge

n : Nack

[Checksum]: checksum (\*2)(\*3)

P : Stop Condition

(\*1) [Length] :

Bit7 of [Length] block is Protocol flag (P).

If Message is “Device Data stream” (P)=0

If Message is “Control/Status” (P)=1 -> (Length data + 80H)

(\*2) [Checksum] :

The message checksum shall be computed as the logical XOR of all previous bytes,

Including the message address.(ACCESS BUS Specification V3.0)

(\*3) Monitor -> PC

Note that the checksum is still computed by using the 0x50 virtual host address.



## 2-3) VESA Standard Command

2-3-1) VESA standard Command 1) Get VCP Feature

### Get VCP Feature

The get Virtual Control panel command instructs the monitor to send information about the selected control feature back to the host in a reply message. The VCP op-code informs the monitor which feature to return.



**S** – **[6E]**a – **[51]**a – **[82]**a – **[01]**a – **[CP]**a – **[CHK]**a – **P** →

Receive 01H as Get VCP Feature COMMAND

CP : VCP op code 00h – FFh

(Interval : 40m sec. ) --- Refer to “4-1) Interval Condition”

← **S** – **[6F]**a – **[6E]**a – **[88]**a – **[02]**a – **[RC]**a – **[CP]**a – **[TP]**a – **[MH]**a – **[ML]**a – **[SH]**a – **[SL]**a – **[CHK]**n – **P**

02 ; VCP Feature reply op code

RC ; Result Code 00h NoError  
01h Unsupported VCP Code (\*\*)

CP ; VCP op code from Feature request message

TP ; VCP type code 00h ; Set parameter  
01h ; Momentary

MH ; Maximum value High byte

ML ; Maximum value Low byte

SH ; Present value High byte

SL ; Present value Low byte

n : Nack (No ack)

(\*) The checksum is still computed by using the 0x50 virtual host address

(\*\*) If Monitor reply “Unsupported VCP Code” message, maximum value and present value are replied as follows.

**[MH][ML]=FFh, FFh [SH][SL]=00h,00h**

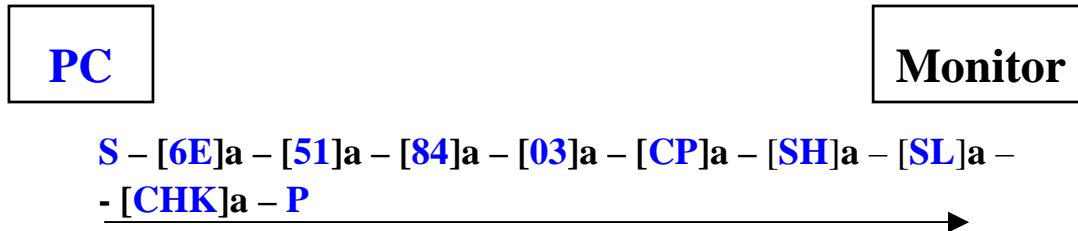
(Interval : 50m sec. ) --- Refer to “4-1) Interval Condition”

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2-3-2) VESA standard Command 2) Set VCP Feature

**Set VCP Feature**

The Set VCP Feature instructs the monitor to change the parameter specified by the minor op-code. If the host attempts to select a value that exceeds the permissible adjustment range the monitor selects the largest permissible value.



Receive 03H as Set VCP Feature COMMAND

CP ; VCP op code

SH ; High byte

SL ; Low byte

(Interval : 50m sec. ) --- Refer to “4-1) Interval Condition”

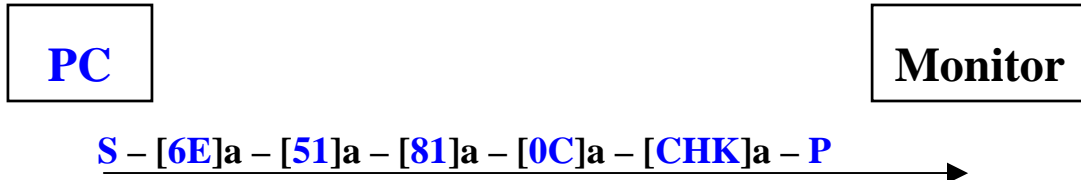
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2-3-3) VESA standard Command 3)      Save Current Settings

**Save Current Settings**

This command instructs the monitor to save all programmable values to nonvolatile Memory (User memory area).



Receive 0CH as Save current settings op code

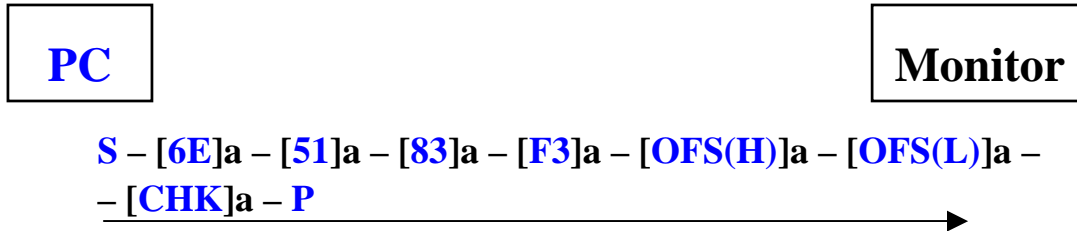
(Interval : 200m sec. )      --- Refer to “4-1) Interval Condition”

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2-3-4) VESA standard Command 4) Capabilities Request

**Capabilities Request**

A Capabilities Request message shall be issued by the computer to a device to instruct the addressed device to reply with a Capabilities Reply.



Receive F3H as Capabilities Request Command

OFS(H) : Offset value high byte (\*1)

OFS(L) : Offset value Low byte

(Interval : 40m sec. )

--- Refer to “4-1) Interval Condition”

**S** – **[6F]**a – **[6E]**a – **[LN]**a – **[E3]**a – **[OFS(H)]**a – **[OFS(L)]**a –  
 – **[Data(0)]**a – **[Data(1)]**a – **[Data(2)]**a - - - **[Data(n)]**a –  
 ← **[CHK]**n – **P**

E3 ; Capabilities reply op code

LN ; Length (Byte length + 80H)The maximum data length in a fragment is 32byte.

Data() : Capability strings data (ASCII code)

Support data

“vcp()”, ”type()”, ”mccs\_ver()”, ”asset\_eep()” and ”mpu\_ver()”

(No need to support “e\_edid\_sel() , now)

---- Refer to “VESA DDC/CI Implementation Guide)

Example: (

type(LCD) mccs\_ver(1.1)

vcp(04 08 10 12 14(01 02 04 06 07 08) 16 18 1A 62

68(01 02 03 05) A8 B4 B6 D6 E3 FA FF)

asset\_eep(20) mpu(1.00)

)

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“vcp()” : VCP data is an ASCII string of monitor control panel functions. All op-codes must be represented by two ASCII hexadecimal characters. Spaces between op-codes are optional.

The supported enumeration value of the non-continuous VCPs which have multiple supports should be described by following way. The VCPs which are required to show the capability of enumerate value are shown in the “Enum value in VCP()” of attached VCP table.

Ex.

VCP(10 12 14(01 02 04 05 08))

Above strings means “Contrast, Brightness and Select color preset(sRGB Native 5000K 6500K 9300K) are supported”.

If VCP Page is supported,

Ex.; vcp(10 12 14(01 05 06 08) 16 18 1A 50 92)

vcp\_p02(00 11 12 18)

(Space is not necessary beside with “(“ or “)” but necessary with each VCP codes.)

“type()”: The Monitor type information is defined by following strings.

Type(LCD) ; LCD monitor

“mccs\_ver()”: The supported MCCS version can be defined by following strings.

The monitor which uses the protocol in this document must support the version 1.1 or later.

Ex.; mccs\_ver(1.1)

“asset\_eep()” : The models that support commands “Asset read & reply” and “Asset Write Request” have this string.

“asset\_eep(length)” ex.: asset\_eep(20)

length : data length (min. 32byte, typ.:64byte)

in hexadecimal form

Need to reserve data area (min.32byte) for these commands.

Refer to “2-4-10 Asset read & reply” and “2-4-11 Asset Write Request”

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“ mpu\_ver()” : For soft ware version information.

Ex. mpu\_ver(1.00)

(Interval : 50m sec. ) --- Refer to “4-1) Interval Condition”

(\*) The checksum is still computed by using the 0x50 virtual host address

(\*1) : Offset for “Capability Request” and “Reply”  
Refer to follows “Access Bus Ver.3” – “Section 2”.

### 2.1.10.4.6. Capabilities Request

A Capabilities Request message shall be issued by the computer to a device to instruct the addressed device to reply with a Capabilities Reply.

The Capabilities Reply shall contain data starting at “offset”.

The Capabilities Request and Capabilities Reply messages form a protocol for transferring an arbitrary byte-string from the device to the computer, via a series of fragments. “Offset” shall be the index (from 0) into this string.

To simplify the device’s implementation of this protocol, “offset” shall be restricted to three values:

1. “send first” zero, indicating the computer wants to start over at the beginning;
2. “send again” the offset from the most recently transmitted Capabilities Request, indicating the computer did not receive a response and wants a retransmit;
3. “send next” the offset from the most recently received Capabilities Reply plus the number of bytes in the message fragment. (new offset = old offset + fragment length)  
(fragment length = message length – 3).

With these restrictions the computer can make three requests: start over, send current, and send next. See Capabilities Reply message for further details.

### 2.1.10.4.7. Capabilities Reply

A Capabilities Reply shall be used to reply to a Capabilities Request message with a fragment of

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data starting at “offset”.

The protocol is designed to be simple for the device to implement:

The device is free to choose the most convenient fragment size from one message to the next.

The only state information the device should need to maintain is the current offset and length of the most recently transmitted fragment.

On receiving a Capabilities Request message, the device shall examine the “offset” field:

1. If equal to zero, the device shall set the current offset to zero and send the fragment from offset zero (0).
2. If equal to the current offset, the device shall re-send the fragment from the current offset.
3. If equal to the “current offset” + “fragment length”, the device shall update the current offset (current offset := current offset + fragment length) and then look up (or calculates) the next fragment to send and sends it.
4. If the device has reached end-of-string, it shall send a fragment with the next offset but zero data bytes. This will indicate an end of string.
5. Otherwise, the device shall set the “current offset” to zero and send the fragment from offset 0.

Capability strings sample

```
(  
  type(LCD)  
  vcp(04 06 08 0E 10 12 14(01 02  
    04 06 07 08) 1E 20 30 3E 54 62  
    68(01 02 03 05) 8A 8C 9B 9C 9D  
    9E 9F A0 A8 B4 B6 E3)  
  vcp_p02(37 38 39 3B 41 47 64 65)  
  mccs_ver(1.1)  
  asset_eep(20)  
  mpu_ver(1.00)  
)
```

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2-3-5) VESA standard Command 5) Get Timing Report

**Get Timing Report**

This command instructs the monitor to return current horizontal and vertical timing information in a monitor timing report message to the host.



**S** – [**6E**]a – [**51**]a – [**81**]a – [**07**]a – [**CHK**]a – **P** →

Receive 07H as Get Timing Report COMMAND

(Interval : 40m sec. ) --- Refer to “4-1) Interval Condition”

← **S** – [**6F**]a – [**6E**]a – [**06**]a – [**4E**]a – [**SS**]a – [**HH**]a – [**HL**]a –  
– [**VH**]a – [**VL**]a – [**CHK**]n – **P**

4Eh ; Timing message op code

SS ; Timing Status byte

bit 7 = 1 Sync freq. Out of range

bit 6 = 1 Unstable count

bit 5 = 2 Reserved must be 0

bit 1 = 1 Positive horz sync

= 0 Negative horz sync

bit 0 = 1 Positive vert sync

= 0 Negative vert sync

HH ; High byte of Horizontal frequency (\*1)

HL ; Low Byte of Horizontal frequency (\*1)

VH ; High byte of Vertical frequency (\*1)

VL ; Low byte of Vertical frequency (\*1)

(Interval : 50m sec. ) --- Refer to “4-1) Interval Condition”

(\*) The checksum is still computed by using the 0x50 virtual host address



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- (\*1) For description of frequency data,  
refer to follows "AccessBus spec. Ver.3" – "Section 7".

7.6.1. Timing Report

The timing message reports the current Horizontal and Vertical synchronization frequencies. The monitor transmits this message to the host in reply to a Get Timing Information message or optionally whenever it detects a change in video mode.

The status byte returns sync polarity and whether the report is valid. The monitor sets bit 7 if the sync frequencies are not supported. Bit 6 is set if the monitor cannot accurately determine what the sync frequencies are. It may also return unstable count (bit 6) during mode changes if the monitor has not yet locked to the new sync rates. Unstable count may be temporary condition. The host should resend the request timing command after a 1 second delay to give the monitor time to lock to the new signals..

Horizontal and Vertical sync rates are reported in the frequency domain as 16 bit values. Horizontal sync is reported in 10hz increments from .01khz-655.35khz Vertical sync is reported in .01hz increments from .01-655.35hz.

2-4) NMV Custom Command for User/Factory

2-4-1) NMV Custom Command 1) Common Data entry

**Common Data entry**

This command instructs the monitor to save common data in all Timings. To nonvolatile Memory (Factory & User memory area).



**S** – [**6E**]**a** – [**51**]**a** – [**82**]**a** – [**C0**]**a** – [**05**]**a** – [**CHK**]**a** – **P** →

Receive C0H as Factory message COMMAND  
Receive 05H as Common Data Entry COMMAND

(Interval : 60m sec. ) --- Refer to “4-1) Interval Condition”

**S** – [**6F**]**a** – [**51**]**a** – [**83**]**a** – [**C1**]**a** – [**05**]**a** – [**STTS**]**a** – [**CHK**]**n** – **P** ←

STTS: 1 Byte data

|       |    |          |
|-------|----|----------|
| Bit 0 | 0: | Complete |
|       | 1: | NG       |

(\*) The checksum is still computed by using the 0x50 virtual host address

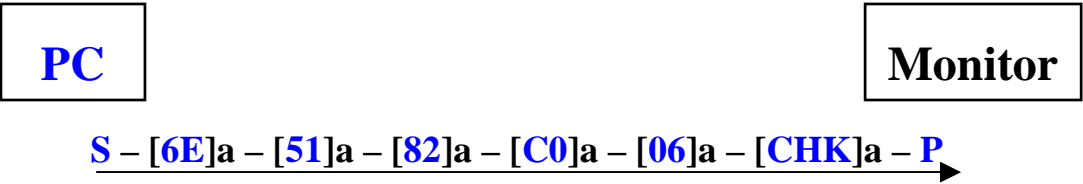
(Interval : 50m sec. ) --- Refer to “4-1) Interval Condition”

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2-4-2) NMV Custom Command 2)      Timing Data entry

**Timing Data entry**

This command instructs the monitor to save data for each Timings to nonvolatile Memory (Factory & User memory area).



Receive C0H as Factory message COMMAND  
Receive 06H as Common Data Entry COMMAND

(Interval : 40m sec. .)      --- Refer to “4-1) Interval Condition”

S - [6F]a - [51]a - [83]a - [C1]a - [06]a - [STTS]a - [CHK]n - P ←

STTS:    1 Byte data

|       |    |          |
|-------|----|----------|
| Bit 0 | 0: | Complete |
|       | 1: | NG       |

(\*) The checksum is still computed by using the 0x50 virtual host address

(Interval : 50m sec. .)      --- Refer to “4-1) Interval Condition”

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2-4-3) NMV Custom Command 3) EEPROM read

**EEPROM read**

This command instructs the monitor to read and send data on addresses that PC appoint .



**S** – [**6E**]a – [**51**]a – [**LN**]a – [**C0**]a – [**09**]a – [**NL**]a – [**AH**]a –  
– [**AL**]a – [**CHK**]a – **P**

Receive C0H as Factory message COMMAND

Receive 09H as EEPROM Read COMMAND

NL: Read Byte Number

AH: Start address to read. (High)

AL: Start address to read. (Low)

(Interval : 40m sec. ) --- Refer to “4-1) Interval Condition”

**S** – [**6F**]a – [**51**]a – [**LN**]a – [**C1**]a – [**09**]a –  
– [**Data(0)**]a – [**Data(1)**]a – [**Data(2)**]a - - - [**Data(n)**]a –  
– [**CHK**]n – **P**

Send C1H as Factory message COMMAND

Send 09H as EEPROM Read COMMAND

(\*) The checksum is still computed by using the 0x50 virtual host address

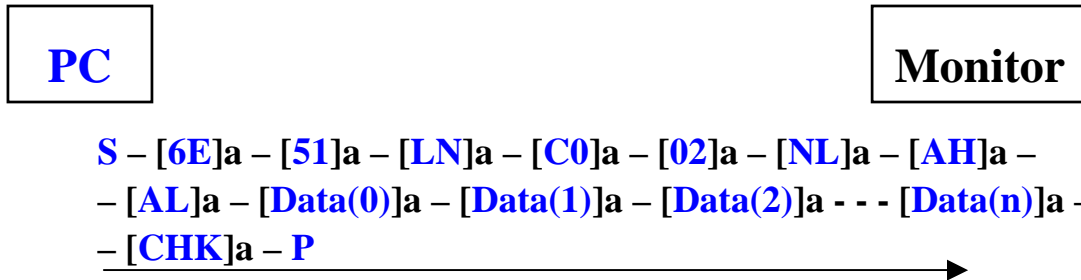
(Interval : 50m sec. ) --- Refer to “4-1) Interval Condition”

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2-4-4) NMV Custom Command 4) EEPROM write

**EEPROM write**

This command instructs the monitor to Write data on addresses that PC appoint .



Receive C0H as Factory message COMMAND

Receive 02H as EEPROM Write COMMAND

NL: Write Byte Number

AH: Start address to write. (High)

AL: Start address to write. (Low)

Data(n) : n=31d max. (32byte max.)

(Interval : 40m sec. ) --- Refer to “4-1) Interval Condition”

← S - [6F]a - [51]a - [83]a - [C1]a - [02]a - [RC]a - [CHK]n - P

Send C1H as Factory message COMMAND

Send 02H as EEPROM Write COMMAND

RC: 0 --- No check sum error

1 --- Check sum error found

(Send a result code (RC: 0/1) of checking “check sum” for last “EEPROM write” operation.)

(\*) The checksum is still computed by using the 0x50 virtual host address

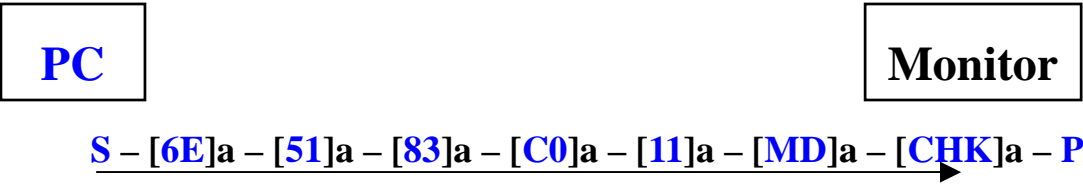
(Interval : 50m sec. ) --- Refer to “4-1) Interval Condition”

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2-4-5) NMV Custom Command 5) Mode Change Request

Mode Change Request

This command instructs the monitor to change a mode status (User mode / Factory mode / others )



Receive C0H as Factory message COMMAND  
Receive 11H as Mode change request COMMAND  
MD: Mode ID 00: User Mode  
03: Factory Mode

(Interval : 40m sec. ) --- Refer to “4-1) Interval Condition”

S - [6F]a - [51]a - [83]a - [C1]a - [11]a - [MD]a - [CHK]n - P

Send C1H as Factory message COMMAND  
Send 11H as Mode change request COMMAND

(\*) The checksum is still computed by using the 0x50 virtual host address

(Interval : 50m sec. ) --- Refer to “4-1) Interval Condition”

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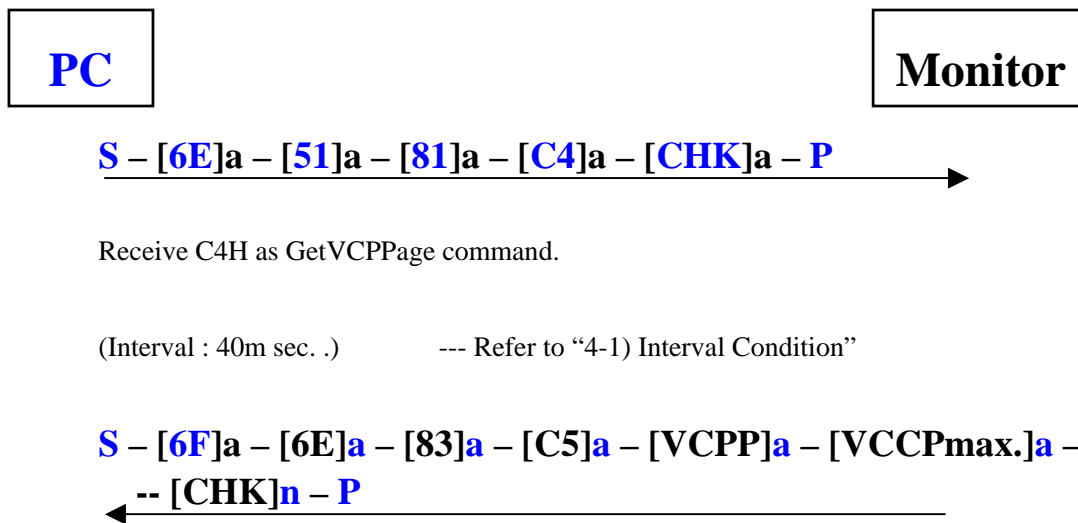
2-4-6) NMV Custom Command 6)      Get VCPPPage & VCP Page reply

### **Get VCP Page & Reply**

Monitor send “VCP Page” information to Host PC.

“VCP Page” is the feature that expands a standard VCP.

This command will be standardized in a feature.



Send C5H as Extension command for Get VCP Page Reply.

VCPP : Current VCP Page Value (from 00h to FFh)

VCCPmax. : Maximum Value of VCP Page value. (from 00h to FFh)

(\*) The checksum is still computed by using the 0x50 virtual host address

If VCPP is not supported, then this command is not returned to host.

The factory mode page(actual MAX page) is hidden if it is in factory mode.

So the max page is changed by the adjustment mode setting.

The maximum page means the factory adjustment items's page for NMV models, and it can not be described in the Capabilities strings which shows the page structure.

The vcp page should be changed in monitor side according to the adjustment mode (User or Factory)

**Note : VCP EXPANSION**

To expand VCP, we will adopt Page system.

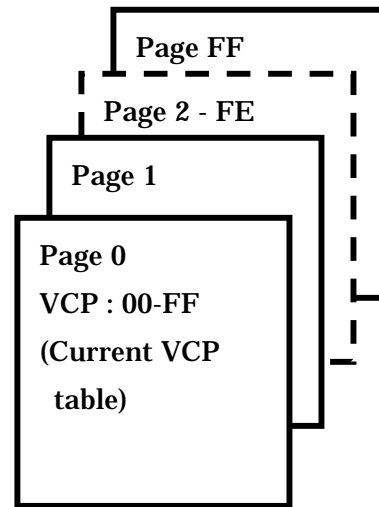
Page assign

Page 0 : Current VCP table of VESA.

Page 1 : Expanded VCP table of VESA.

Page 2-FFh : NMV specificity.

Page max.(last page) : VCP table for factory mode use .



Additional command for VCP expansion.

Get VCPPage & VCP Page reply

Send current VCP page and max. value of VCP page to Host.

Get paged VCP & paged VCP reply.

It is “Get VCP & reply “ with page indication.

Set paged VCP & paged VCP reply.

It is “Set VCP & reply “ with page indication.

No paged “Get VCP” and “Set VCP” have a same mean “Get VCP Page” and ”Set VCP Page” with “VCP page 0”.

When Monitor Received “GetVCP” or “Set VCP” without page information, monitor should change a current page to “Page 0”

If VCP Page is supported,

Ex.; ~~vcp(page0(10 12 14(01 05 06 08) 16 18 1A 50 92) page2(00 11 12 18))~~

Ex.; vcp(10 12 14(01 05 06 08) 16 18 1A 50 92) vcp\_p2(00 11 12 18))

(Space is not necessary beside with “(“ or “)” but necessary with each VCP codes.)

Page Max. Number.

| Spec. version | Page max. number |
|---------------|------------------|
| Ver. 1        | ---              |
| Ver. 2        | Page 3           |



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2-4-7) NMV Custom Command 7) Get Paged VCP &amp; Paged VCP reply

**Get Paged VCP & Reply**

Monitor send “Paged VCP” Data to Host PC.

This command will be standardized in a feature.



**S** – [**6E**]**a** – [**51**]**a** – [**83**]**a** – [**C6**]**a** – [**VCPP**]**a** – [**CP**]**a** –  
 -- [**CHK**]**a** – **P**

Receive C6H as Extension command for Get paged VCP.

VCP : VCP Page Value (00h-FFh)

CP : VCP op-code

(Interval : 40m sec. .) --- Refer to “4-1) Interval Condition”

**S** – [**6F**]**a** – [**6E**]**a** – [**89**]**a** – [**C7**]**a** – [**RC**]**a** – [**VCCP**]**a** –  
 – [**CP**]**a** – [**TP**]**a** – [**MH**]**a** – [**ML**]**a** – [**SH**]**a** – [**SL**]**a** –  
 -- [**CHK**]**n** – **P**

Send C7H as Paged VCP Reply code.

RC ; Result Code      00h      NoError  
                                  01h      Unsupported VCP Code

VCP : Current VCP Page Value (from 00h to FFh)

CP ; VCP op code from Feature request message

TP ; VCP type code    00h ; Set parameter  
                                  01h ; Momentary

MH ; Maximum value High byte

ML ; Maximum value Low byte

SH ; Present value High byte

SL ; Present value Low byte

(\*) The checksum is still computed by using the 0x50 virtual host address

If VCPP is not supported , then this command is not returned to host.

(Interval : 50m sec. .) --- Refer to “4-1) Interval Condition”

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2-4-8) NMV Custom Command 8) Set Paged VCP &amp; Paged VCP reply

**Set Paged VCP & Reply**

Monitor receive "Set Paged VCP" as expanded Set VCP.

This command will be standardized in a feature.



**S** – [**6E**]a – [**51**]a – [**85**]a – [**C8**]a – [**VCPP**]a – [**CP**]a –  
 – [**SH**]a – [**SL**]a – [**CHK**]a – **P**

Receive C8H as Extension command for Set paged VCP.

VCPP : VCP Page Value (00h-FFh)

CP : VCP op-code

SH ; High byte

SL ; Low byte

(Interval : 40m sec. .) --- Refer to "4-1) Interval Condition"

**S** – [**6F**]a – [**6E**]a – [**89**]a – [**C7**]a – [**RC**]a – [**VCCP**]a –  
 – [**CP**]a – [**TP**]a – [**MH**]a – [**ML**]a – [**SH**]a – [**SL**]a –  
 -- [**CHK**]n – **P**

Send C7H as Paged VCP Reply code.

|      |             |     |                      |
|------|-------------|-----|----------------------|
| RC ; | Result Code | 00h | NoError              |
|      |             | 01h | Unsupported VCP Code |

VCPP : Current VCP Page Value (from 00h to FFh)

CP ; VCP op code from Feature request message

|      |               |       |               |
|------|---------------|-------|---------------|
| TP ; | VCP type code | 00h ; | Set parameter |
|      |               | 01h ; | Momentary     |

MH ; Maximum value High byte

ML ; Maximum value Low byte

SH ; Present value High byte

SL ; Present value Low byte

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(\*) The checksum is still computed by using the 0x50 virtual host address

If VCPP is not supported , then this command is not returned to host.

It is only for the confirmation of setting data by Set paged VCP.

If application read data after sending this command, it can obtain a feedback from monitor.

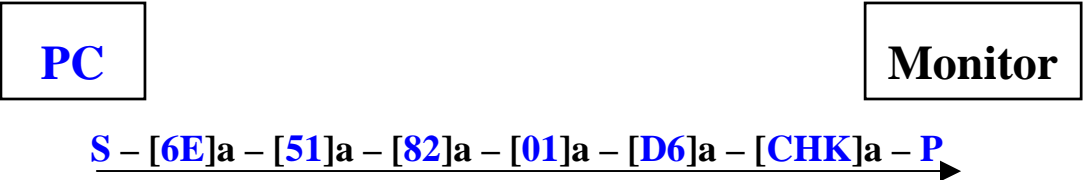
It can be canceled (if it is not required) by sending the commands which write data to monitor.

(Interval : 50m sec. )                      --- Refer to “4-1) Interval Condition”

2-4-9) NMV Custom Command 9)      Get Power Status & reply

**Get Power Status & Reply**

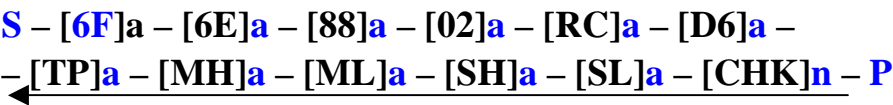
This is a detail description for VCP “D6: Display Power mode”.



Receive 01H as Get VCP Feature command.

D6h :      VCP op-code of Display power mode

(Interval : 40m sec. .)      --- Refer to “4-1) Interval Condition”



Send 02H as VCP Feature Reply op-code.

|       |                                   |          |                      |                        |
|-------|-----------------------------------|----------|----------------------|------------------------|
| RC ;  | Result Code                       | 00h      | NoError              |                        |
|       |                                   | 01h      | Unsupported VCP Code |                        |
| D6h ; | VCP op code of Display power mode |          |                      |                        |
| TP ;  | VCP type code                     | 00h ;    | Set parameter        | (should be this value) |
|       |                                   | 01h ;    | Momentary            |                        |
| MH ;  | Maximum value High byte           |          | (should be 00h)      |                        |
| ML ;  | Maximum value Low byte            |          | (should be 04h)      |                        |
| SH ;  | Present value High byte           |          | (should be 00h)      |                        |
| SL ;  | Present value Low byte            | (value ; | 1 : ON               |                        |
|       |                                   |          | 2 : Stand_By         |                        |
|       |                                   |          | 3 : Susupend         |                        |
|       |                                   |          | 4 : Off)             |                        |

(\*) The checksum is still computed by using the 0x50 virtual host address

(Interval : 50m sec. .)      --- Refer to “4-1) Interval Condition”

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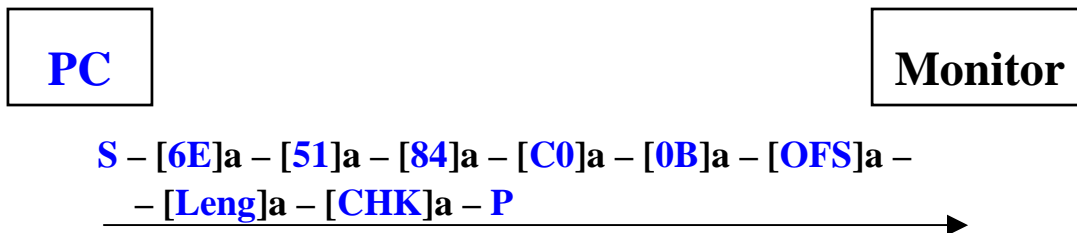
2-4-10) NMV Custom Command 10) Asset Read Request &amp; reply

**Asset Read request & Reply**

Monitor send an Asset Management Data set (min.32byte, typ.64byte) to Host PC.

So, monitor need to have reserved area (min.32byte) in EEPROM.

This “Asset Management Data ” is another data set for EDID.



Receive 0BH as Asset read request command.

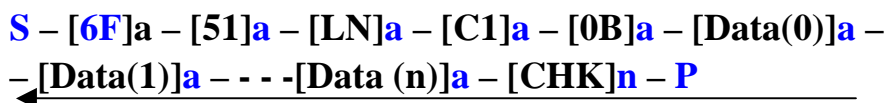
OFS : Offset address to read the data. (Top address on reserved define “00h”)

Leng : Length of the Data.

Note;The maximum data length which can be read from monitor at once  
 is 32Byte.

(Interval : 40m sec. ) --- Refer to “4-1) Interval Condition”

If monitor receive the offset or data length value which exceed the length declared in the capabilities strings, then it ignores the request and return the null packet.



Send 0BH as Asset Read Reply .

LN ; Length (Byte length + 80H)

(\*) The checksum is still computed by using the 0x50 virtual host address

(Interval : 50m sec. ) --- Refer to “4-1) Interval Condition”

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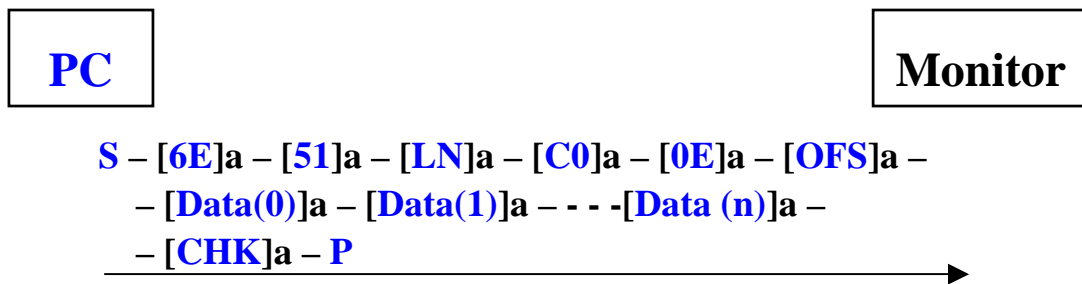
2-4-11) NMV Custom Command 11) Asset Write Request &amp; reply

**Asset Write request**

Monitor writes an Asset Management Data set (min.32byte, typ.64byte) that received from Host to EEPROM .

So, monitor need to have reserved area (min.32byte) in EEPROM.

This “Asset Management Data ” is another data set for EDID.



Receive 0EH as Asset read request command.

OFS : Offset address to write the data. (Top address on reserved define “00h”)

If monitor receive the data more than the length declared in the capabilities strings, then it ignores the data.

Note;The maximum data length which can be written to monitor at once is 32Byte.

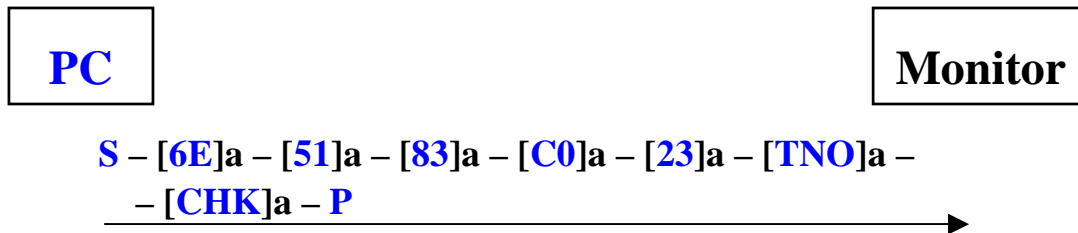
(Interval : 50m sec. .) --- Refer to “4-1) Interval Condition”

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2-4-12) NMV Custom Command 12) WB Table Read

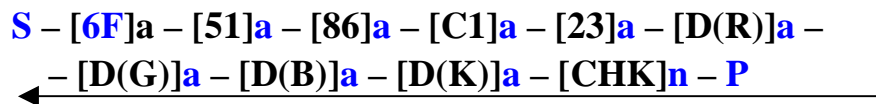
**White Balance Table Read**

When Monitor receives “CO” – which shows Factory Mode, and command “23”,  
Monitor replies value of Red, Green, Blue and Color Temperature.



TNO : Table No.

(Interval : 40m sec. .) --- Refer to “4-1) Interval Condition”



D(R) : Red Value ( 0x00-0xff )

D(G) : Green Value ( 0x00-0xff )

D(B) : Blue Value ( 0x00-0xff )

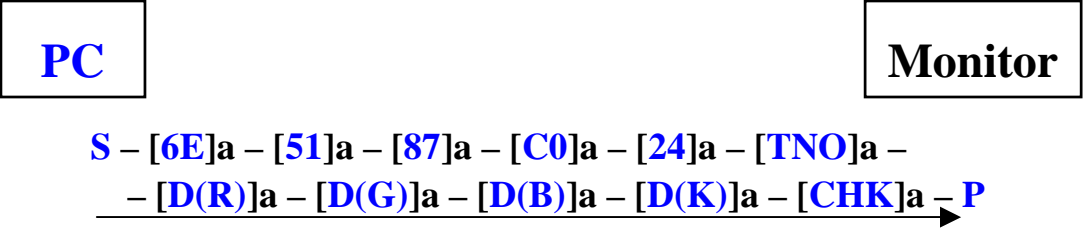
D(K) : Color Temperature Value in Kelvin ( Actual Value / 100 )

(Interval : 50m sec. .) --- Refer to “4-1) Interval Condition”

2-4-13) NMV Custom Command 13) WB Table Write

**White Balance Table Write**

When Monitor receives “CO” – which shows Factory Mode, and command “24”,  
Monitor replies value of Red, Green, Blue and Color Temperature.



TNO : Table No.

D(R) : Red Value ( 0x00-0xff )

D(G) : Green Value ( 0x00-0xff )

D(B) : Blue Value ( 0x00-0xff )

D(K) : Color Temperature Value in Kelvin ( Actual Value / 100 )

(Interval : 50m sec. )                    --- Refer to “4-1) Interval Condition”

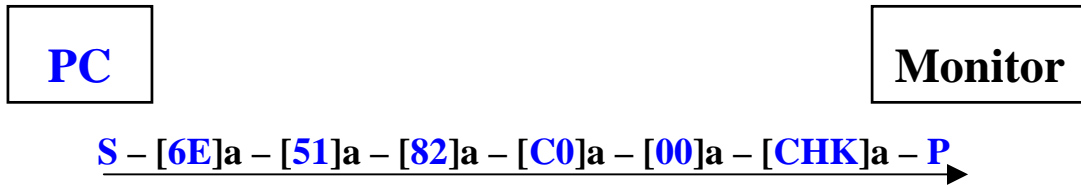


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2-4-14) NMV Custom Command 13) MPU Reset

**MPU Reset**

When Monitor receives this command, MPU should make reset itself (= Make Program Counter to “0”) or MPU should reflect all adjusted data on auto alignment to RAM memory area and to actual image settings.



(Interval : 50m sec. .)

--- Refer to “4-1) Interval Condition”

This command is enable at factory mode only

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## 3. Op-Code

3-1) **VCP OP-Code List (1)****---Page\_0**

| No  | Op Code name        | Need to support (*1) | Description  |
|-----|---------------------|----------------------|--|
| 00H | Degauss             | No                   |  |
| 01H | Degauss             | No                   |  |
| 04H | ALL Reset           | Yes                  | Factory Preset (All Reset)<br>Value : 0 – 0001h<br>Set VCP data value :<br>0 : No operate<br>Not 0 : Reset Operate<br>refer to 4-6)<br>Type Code : 01 (Momentary)  |
| 06H | Geometry Reset      | Yes                  | Restore the geometry data<br>0 : No operate<br>Not 0 : Operate<br>refer to 4-6)<br>Type Code : 01 (Momentary)  |
| 08H | Color Reset         | Yes                  | Color Reset<br>Value : 0 – 0001h<br>Set VCP data value :<br>0 : No operate<br>Not 0 : Reset Operate<br>refer to 4-6)<br>Type Code : 01 (Momentary)   |
| 0EH | Clock               | Yes                  | Clock<br>Value : 0 – (max value: 0001h-FFFFh)<br>Set VCP data value :<br>0 < ----- > Max.Value   |
| 10H | Brightness          | Yes                  | Brightness<br>Value : 0 – (max value: 0001h-FFFFh)<br>Set VCP data value :<br>0 < ----- > Max.Value<br>(Dark) (Bright)<br>refer to 4-7)  |
| 12H | Contrast            | Yes                  | Contrast<br>Value : 0 – (max value: 0001h-FFFFh)<br>Set VCP data value :<br>0 < ----- > Max.Value<br>(Low) (High)<br>refer to 4-7)   |
| 14H | Select Color preset | Yes                  | Color No. select<br>Value : 0001h – (max value: 0001h-FFFFh)<br>Set VCP data value :<br>00: No Operate<br>01: sRGB<br>02: Native<br>03: 4000K<br>04: 5000K<br>05: 6500K<br>06: 7500K<br>07: 8200K<br>08: 9300K |

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| No  | Op Code name                  | Need to support (*1) | Description  |
|-----|-------------------------------|----------------------|--|
|     |                               |                      | 09: 10000K<br>0A: 11500K<br>0B: User1<br>0C: User2<br>0C: User3<br><br>Note) In order to check from PC which enumerate values are available in Monitor side, Monitor should describe the VCP() in it's capabilities strings as follows;<br>VCP(14(01 02 04 06 07 08))<br>refer to 4-7) |
| 16H | Red Gain                      | Yes                  | Red video Gain. Select Color No. before control.<br>Value : 0 – (max value: 0001h-FFFFh)<br>Set VCP data value :<br>0 < ----- > Max.Value<br>(Dark)      (Bright)<br><br>Note: Send a data of selected color No.<br>refer to 4-7)  |
| 18H | Green Gain                    | Yes                  | Green video Gain. Select Color No. before control.<br>Same as “Red Gain”<br>refer to 4-7)  |
| 1AH | Blue Gain                     | Yes                  | Blue video Gain. Select Color No. before control.<br>Same as “Red Gain”<br>refer to 4-7)   |
| 1EH | Auto Set Up                   | Yes                  | Execute the auto adjustment function<br>- H. Position, V. Position<br>- Clock, Clock Phase<br>- Contrast<br>Data 0: No operate<br>Data 1-FF: Operate<br><br>Type Code : 01 (Momentary)   |
| 20H | Horizontal Position           | Yes                  | Horizontal Position<br>Value : 0 – (max value: 0001h-FFFFh)<br>Set VCP data value :<br>0 < ----- > Max.Value<br>(to Left)    (to right)  |
| 22H | Horizontal Size               | No                   |  |
| 24H | Horizontal Pincushion         | No                   |  |
| 26H | Horizontal Pincushion Balance | No                   |  |
| 28H | Horizontal Misconvergence     | No                   |  |
| 2AH | Horizontal Linearity          | No                   |  |
| 30H | Vertical Position             | Yes                  | Vertical Position<br>Value : 0 – (max value: 0001h-FFFFh)<br>Set VCP data value :<br>0 < ----- > Max.Value<br>(to downward)    (to upward )  |

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| No  | Op Code name                   | Need to support (*1) | Description   |
|-----|--------------------------------|----------------------|---|
| 32H | Vertical Size                  | No                   |   |
| 38H | Vertical Misconvergence        | No                   |   |
| 3AH | Vertical Linearity             | No                   |   |
| 3CH | Vertical Linearity-Balance     | No                   |   |
| 3EH | Clock Phase                    | Yes                  | Clock Phase<br>Value : 0 – (max value: 0001h-FFFFh)<br>Set VCP data value :<br>0 < ----- > Max.Value  |
| 40H | Key-Balance                    | No                   |   |
| 42H | Trapezoidal                    | No                   |   |
| 43H | Trapezoidal (Vertical)         | No                   |   |
| 44H | Tilt (Rotation)                | No                   |   |
| 46H | Top corner                     | No                   |   |
| 48H | Top corner balance             | No                   |   |
| 4AH | Bottom corner                  | No                   |   |
| 4CH | Bottom corner Balance          | No                   |   |
| 54H | Color-Temperature              | Yes                  | Color-Temperature<br>Value : 0 – 0056h (max value: 0056h)<br>Set VCP data value :<br>0 < --- > 0056h<br>(5000K) (9300K) step : 50K<br>If “Color temperature” became meaningless by user changing R/G/B gain, return data value “FF”.              |
| 56H | Horizontal Moiré               | No                   |   |
| 58H | Vertical Moiré                 | No                   |   |
| 62H | Audio Speaker Volume Adjust    | Yes                  | Audio Speaker Volume<br>Value : 0 – (max value: 0001h-FFFFh)<br>Set VCP data value :<br>0 < ----- > Max.Value<br>( to low ) ( to high )   |
| 64H | Audio Microphone Volume Adjust | No                   |   |
| 68H | Language select                | Yes                  | OSD Language select<br>Value : 0 – (max value: 0001h-FFFFh)<br>Set VCP data value :<br>0: no effect<br>1: English<br>2: German<br>3: French<br>4: Spanish<br>5: Japanese<br>6 : Italian<br>7 : Swedish<br>8 : Dutch<br>9 : Russian<br>A : FINLAND |

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| No      | Op Code name                | Need to support (*1)  | Description  |
|---------|-----------------------------|-----------------------|--|
|         |                             |                       | B : DENMARK<br>C : PORUTUGAL   |
| 6AH     | CLEAR TYPE                  | No                    |  |
| 6CH     | Red Video Black level       | No                    |  |
| 6EH     | Green Video Black level     | No                    |  |
| 70H     | Blue Video Black level      | No                    |  |
| 8AH     | TV Color Saturation         | Yes                   | 6 Axis color control SATURATION<br>Value : 0 – (max value: 0001h-FFFFh)<br>Set VCP data value :<br>0 < ----- > Max.Value<br>( to low ) ( to high ) |
| 8BH     | TV Channel Up/Down          | No                    |  |
| 8CH     | TV Sharpness                | Yes                   | Sharpness<br>Value : 0 – (max value: 0001h-FFFFh)<br>Set VCP data value :<br>0 < ----- > Max.Value<br>( to low ) ( to high )                       |
| 8DH     | TV Audio Mute               | Yes<br>(Factory only) | Mute the TV audio volume.<br>0 : No operate (Mute Off)<br>1 : No operate (Mute Off)<br>2 : Operate (Mute ON)                                       |
| 8FH     | TV Audio Control            | No                    |  |
| 90H     | TV HUE(Tint)                | No                    |  |
| 91H     | TV Audio                    | No                    |  |
| 92H     | TV Black Level              | No                    |  |
| 93H     | TV Audio Control            | No                    |  |
| 95H (*) | Window position (TL_X)      | No                    |  |
| 96H (*) | Window position (TL_Y)      | No                    |  |
| 97H (*) | Window position (BR_X)      | No                    |  |
| 98H (*) | Window position (BR_Y)      | No                    |  |
| 99H     | Window Control On/Off       | No                    |  |
| 9Ah     | Window Background           | No                    |  |
| 9BH     | 6 Axis color control RED    | Yes                   | 6 Axis color control RED<br>Value : 0 – (max value: 0001h-FFFFh)<br>Set VCP data value :<br>0 < ----- > Max.Value<br>( to low ) ( to high )        |
| 9Ch     | 6 Axis color control YELLOW | Yes                   | 6 Axis color control YELLOW<br>Value : 0 – (max value: 0001h-FFFFh)<br>Set VCP data value :  |

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| No  | Op Code name                 | Need to support (*1) | Description   |
|-----|------------------------------|----------------------|---|
|     |                              |                      | 0 < ---- > Max.Value<br>( to low ) ( to high )  |
| 9DH | 6 Axis color control GREEN   | Yes                  | 6 Axis color control GREEN<br>Value : 0 – (max value: 0001h-FFFFh)<br>Set VCP data value :<br>0 < ---- > Max.Value<br>( to low ) ( to high )  |
| 9EH | 6 Axis color control CYAN    | Yes                  | 6 Axis color control CYAN<br>Value : 0 – (max value: 0001h-FFFFh)<br>Set VCP data value :<br>0 < ---- > Max.Value<br>( to low ) ( to high )   |
| 9FH | 6 Axis color control BLUE    | Yes                  | 6 Axis color control BLUE<br>Value : 0 – (max value: 0001h-FFFFh)<br>Set VCP data value :<br>0 < ---- > Max.Value<br>( to low ) ( to high )   |
| A0H | 6 Axis color control MAGENDA | Yes                  | 6 Axis color control MAGENDA<br>Value : 0 – (max value: 0001h-FFFFh)<br>Set VCP data value :<br>0 < ---- > Max.Value<br>( to low ) ( to high )  |
| A2H | Auto Setup On/Off            | No                   |   |
| A8H | Sync type                    | Yes                  | Read Only<br>0 : None selected<br>1 : Separate<br>2 : Composite<br>3 : Sync On Green<br>Type Code : 01 (Momentary)  |
| AAH | Screen Orientation           | No                   |   |
| B2H | LCD Pattern                  | No                   |   |
| B4H | RGB odering                  | Yes                  | Read Only<br>0 : No mean<br>1 : RGB<br>2 : BGR<br>Type Code : 01 (Momentary)  |
| B0H | Settings                     | Yes                  | "Store / Restore the user saved values for current mode. (Write only)<br><br>1. Store current settings in the monitor.<br>2. Restore factory defaults for current mode.<br>If no factory defaults then restore user values for current mode.<br><br>0 and other values : shall be ignored." |
| B6H | Monitor Type                 | Yes                  | Monitor Type.<br>Use the vcpname() strings for more definition of monitor type<br>0 : No mean<br>1 : CRT (shadowmask)<br>2 : CRT(Aperture Grill)  |

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| No  | Op Code name  | Need to support (*1) | Description                            |
|-----|---------------|----------------------|--|
|     |               |                      | 3 : TFT<br>4 : Projector<br>5 : Plasma |
| D6H | Power Mode    | Yes                  |  |
| DCH | Display Mode  | No                   |  |
| DFH | (VCP Version) | No                   | No need support now.                   |

(\*1) : We will decide in another meeting which VCP will be supported in each model.

**CONFIDENTIAL****3-2) VCP OP-Code List (2) NMV specific controls****---Page\_0**

| No  | Op Code name              | User Mode(*1) | Description  |
|-----|---------------------------|---------------|--|
| E3H | Control Lock              | Yes           | User Key Control Enable/Disable switch.<br>Value : 0 - 0001h<br>Set VCP data value :<br>0: Allow Key control<br>Not 0: Prohibit a User Key Control |
| FAH | Hours Running<br>"TOTAL"  | Yes           | Read Only<br>Total operate Time – "ON" + "OFF" Time (Unit : 30min.----need to transfer to 30min.step value)<br>Type Code : 01 (Momentary)          |
| FFH | Display Device On<br>Time | Yes           | Read Only<br>"ON" Time (Unit : 30min.----need to transfer to 30min.step value)<br>Type Code : 01 (Momentary)                                       |

(\*1) : We will decide in another meeting which VCP will be supported in each model.



**CONFIDENTIAL****3-3) VCP OP-Code List (3)****---Page\_1**

| No | Op Code name | Support       |              | Description |
|----|--------------|---------------|--------------|-------------|
|    |              | User Mode(*1) | Factory mode |             |
|    |              |               |              |             |

(\*1) : We will decide in another meeting which VCP will be supported in each model.

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## 3-4) VCP OP-Code List (4) NMV specific controls

---Page\_2

| No          | Op Code name                        | User Mode(*1) | Description  |
|-------------|-------------------------------------|---------------|--|
| (P2)<br>37H | Contrast AUTO                       | Yes           | Auto adjustment of CONTRAST<br>0 : No operate<br>Not 0 : Operate<br><b>Type Code : 01 (Momentary)</b>  |
| (P2)<br>38H | OSD position<br>Horizontal          | Yes           | Horizontal OSD position<br>Value : 0 – (max value: 0001h-FFFFh)<br>Set VCP data value :<br>0 < ----- > Max.Value<br><b>( to left ) ( to right )</b>                            |
| (P2)<br>39H | OSD position<br>Vertical            | Yes           | Vertical OSD position<br>Value : 0 – (max value: 0001h-FFFFh)<br>Set VCP data value :<br>0 < ----- > Max.Value<br><b>( to bottom ) ( to top )</b>                              |
| (P2)<br>3BH | Default Color<br>Setting Changed    | Yes           | Show the factory default color setting is changed or not for selected color.<br>0 : Default Setting<br>1 : Not Default Setting ( CUSTOM )<br><b>Type Code : 01 (Momentary)</b> |
| (P2)<br>41H | OSD Rotation                        | Yes           | OSD Rotation<br>0 : Landscape<br>1 : Portrait<br><b>Type Code : 01 (Momentary)</b>   |
| (P2)<br>47H | Hours Running<br>“TOTAL”            | YES           | Read Only<br>Total operate Time – “ON” + “OFF” Time (Unit : 30min.----need to transfer to 30min.step value)<br><b>Type Code : 01 (Momentary)</b>                               |
| (P2)<br>64H | Hours Running<br>“ON” ( On Time )   | YES           | Read Only<br>“ON” Time (Unit : 30min.----need to transfer to 30min.step value)<br><b>Type Code : 01 (Momentary)</b>  |
| (P2)<br>65H | Hours Running<br>“OFF” ( Off Time ) | YES           | Read Only<br>“OFF” Time (Unit : 30min.----need to transfer to 30min.step value)<br><b>Type Code : 01 (Momentary)</b>   |
|             |                                     |               |  |

(\*1) : We will decide in another meeting which VCP will be supported in each model.

**CONFIDENTIAL****3-5) VCP OP-Code List (5) NMV specific controls---Page\_max. (max=3)**

| No        | Op Code name  | Support        |              | Description  |
|-----------|---------------|----------------|--------------|--|
|           |               | User Mode(*1)  | Factory mode |  |
| Pm<br>7EH | Write protect | YES<br>If need | (*2)         | Write Protection Control for DDC2B device<br>Value : 0 – 0001h<br>Set VCP data value :<br>0 : Write Protect<br>1 : <b>Write Enable</b> |

(\*1) : We will decide in another meeting which VCP will be supported in each model.

(\*2) : If need , these VCP can be used in Factory Mode for alignment on Production line.

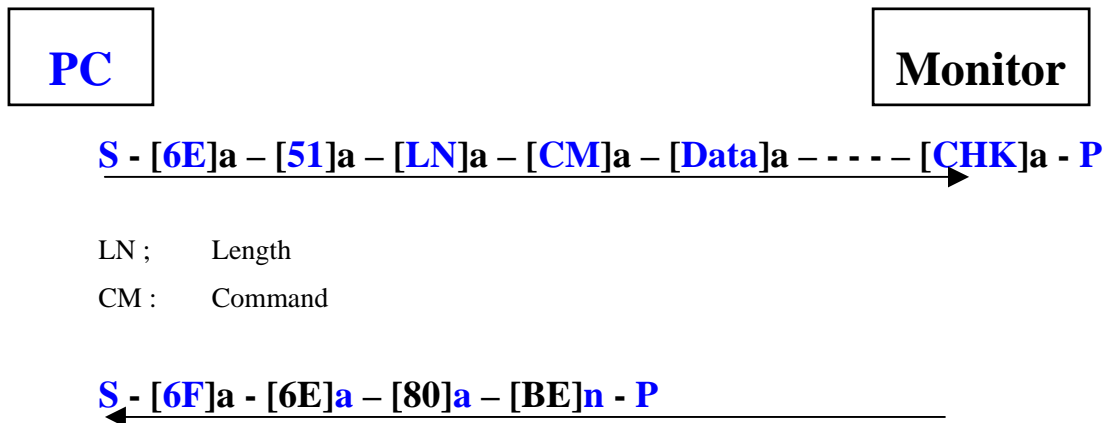
## 4. others

### 4-1) Interval Condition

Monitor must be ready to reply within 40msec., after received each command.

If PC send reply request before Monitor have ready to reply, Monitor must reply a “Null Message”.

### 4-2) Null message



The NULL message is used in the following cases:

- To detect that the display is DDC2Bi capable (by reading it at 0x6F I2C slave address)
- To tell the host that the display does not have any answer to give to the host (not ready or not expected)
- The “Enable Application Report” has not been sent before using Application Messages

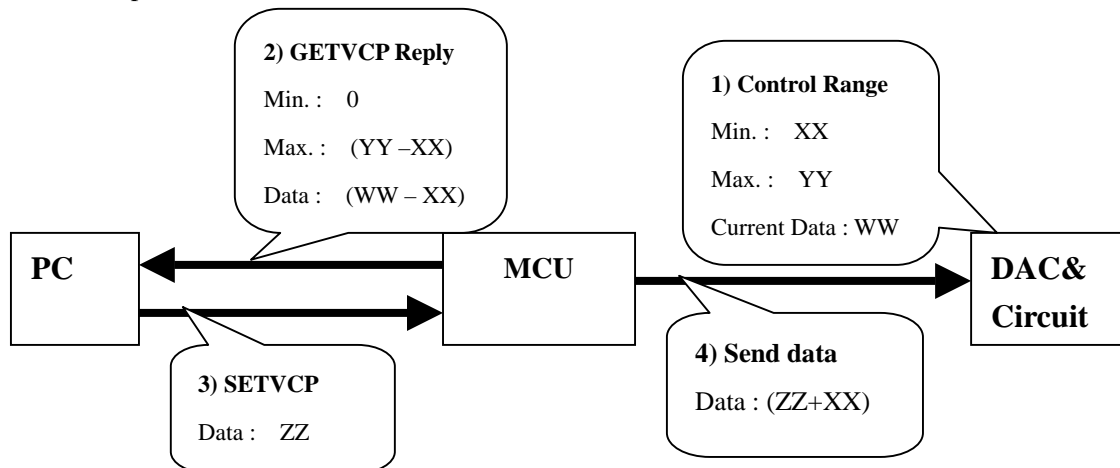
Refer to “DDC/CI Implementation Guide” – “6.Communication error recovery”

#### 4-3) Data value shifting (Data offset)

On DDC/CI communication, minimum range data is always “0”.

If adjust item has “not zero value” as minimum data, it need to offset between actual control data value and sending data on DDC/CI communication.

[For Example.]



On above Figure, supposing as follows.

Control range of circuit :      Min. “XX” ,  
Max. “YY” ( 0 =< XX < YY)

Current Data value :                   “WW” (XX =< WW =< YY)

When Monitor receives a “Get VCP” command, MCU send data to PC as follows.

Range Max. data : (YY-XX)

Min. : "0"

Current data : (WW-XX)

When Monitor receive a “Set VCP” command and data ”ZZ”, MCU send data to circuit as follows.

Set data : (ZZ+XX)

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### 4-4) Protection from illegal access

To protect from illegal access for the monitor, make a limit for operation of command and VCP, by User .

#### Command

If monitor received unsupported command or unknown command, monitor should ignore it and should not have mis-operation.

Refer to “2-1) Support commands”.

#### Vcp

If monitor receive “GETVCP” with Vcp that is not supported, monitor must reply a “No support message”.

Refer to ”2-3-1) GET VCP feature”

If monitor receive “SETVCP” with Vcp that is not supported, monitor must not operate by the command.

If monitor received “SetVCP” or “SetPagedVCP” for unsupported VCP or unknown VCP, monitor should ignore it and should not have mis-operation.

### 4-5) OSD

If monitor receive any command while appearing OSD menu, OSD menu must be closed on user mode.

### 4-6) Reset command

“Reset” command code (VCP: 04h,06h,08h) support follows item’s restore, in NMV OWN/OEM models.

04h (All Reset): All Items that “Factory preset” or “all reset” functions support.

06h (Geometry reset): All items that “tag3 reset “

08h (Color reset): All Items that “tag 5 reset” support.

### 4-7) Showing the unsupported VCPs by using VCP reply.

#### 4-7-1) sRGB

If color mode is sRGB mode, then Certain color related controls should be inhibited and VCP reply should show the no support. It is applied to User mode at least.

And if Host send “SetVCP”/”SetPagedVCP” to monitor, monitor should ignore it.

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Contrast/Bright(10h,12h),  
Color Temperature(54h)

**4-7-2)**

4-7-3) R/G/B Gain & Color temperature

"R/G/B gain" and "Color temperature control" have a exclusive relationship.  
So, if user changed R/G/B gain, color temperature become meaningless.

On this condition, if monitor received "GET VCP(VCP 54H)",  
reply a data "FF" to Host PC.

After this, if monitor received "SET VCP(VCP 54H)", cancel a data set of current R/G/B gain  
and follow the "SET VCP(VCP 54H)".

## 5. Standard Test Environment for DDC/CI

## H/W

|             |   |
|-------------|---|
| PC:         | PC-AT compatible with AGP   |
| Video Card: | Matrox G200,G400,G450 or G550<br>nVidia   Ge-Force2mx, Ge-Force 3 |

## S/W

|                   |  |
|-------------------|--|
| OS:               | Windows 2000 or Windows XP   |
| Video Driver:     | Latest (for matrox)<br>Windows XP pre installed. ( for nVidia )                |
| Monitor Driver:   | NMV  |
| Appreciation s/w: | NMV      1) NaViSet<br>2) EEPROM Editor<br>3) VESA DDC Test<br>4) NMV DDC Test |



## Appendix