

External Control

- 1. Application
- 2. Connectors and wiring
 - 2.1. RS-232C Remote control
 - 2.2. LAN control
- 3. Communication Parameter
 - 3.1. RS-232C Remote control
 - 3.1.1. Communication timing
 - 3.2. LAN control
 - 3.2.1. Communication timing
- 4. Communication Format
 - 4.1. Header block format (fixed length)
 - 4.1.1. Header format
 - 4.2. Message block format
 - 4.2.1. Get current parameter
 - 4.2.2. Get Parameter reply
 - 4.2.3. Set parameter
 - 4.2.4. Set Parameter reply
 - 4.2.5. Command
 - 4.2.6. Command reply
 - 4.3. Check code
 - 4.3.1. Formatted and calculate.
 - 4.4. Delimiter
- 5. Message type
 - 5.1. Get current Parameter from a monitor
 - 5.1.1. Get current parameter format
 - 5.2. "Get parameter" reply
 - 5.2.1. Get parameter reply format
 - 5.3. Set parameter
 - 5.3.1. Set parameter format
 - 5.4. "Set parameter" reply
 - 5.4.1. Set parameter reply format
 - 5.5. Commands
 - 5.5.1. Save Current Settings
 - 5.5.2. Get Timing Report and Timing reply
 - 5.5.3. NULL Message
- 6. Typical procedure example
 - 6.1. How to change the "Backlight" setting.
 - 6.2. How to read the measurement value of the built-in temperature sensors.
- 7. CTL commands
 - 7.1. System Command
 - 7.1.1. CTL-0C. Save Current Settings
 - 7.1.2. CTL-07. Get Timing Report and Timing reply
 - 7.2. Power control procedure

- 7.2.1. CTL-01D6. Power status read
 - 7.2.2. CTL-C203-D6. Power control
- 7.3. Serial No. & Model Name Read
 - 7.3.1. CTL-C216. Serial No. Read
 - 7.3.2. CTL-C217. Model Name Read
- 7.4. Capabilities Request
 - 7.4.1. CTL-F3. Capabilities Request
- 7.5. MAC Address Read Request & Reply
 - 7.5.1. CTL-C220. MAC Address Read Request
- 7.6. Direct TV Channel Read & Write
 - 7.6.1. CTL-C22C. Direct TV Channel Read Request
 - 7.6.2. CTL-C22D. Direct TV Channel Write Request
- 7.7. Remote Control Data Code sending format via RS-232C
 - 7.7.1. CTL-C210. Remote Control Data Code sending format via RS-232C
- 7.8. Firmware Version Command
 - 7.8.1. CTL-CA02. Firmware Version Read Request
 - 7.8.2. CTL-CA04-03. Input Name of Designated Terminal Read Request
 - 7.8.3. CTL-CA04-04. Input Name of Designated Terminal Write Request
 - 7.8.4. CTL-CA04-05. Input Name of Designated Terminal Reset Request
- 8. OSD menu and contrast table for each command

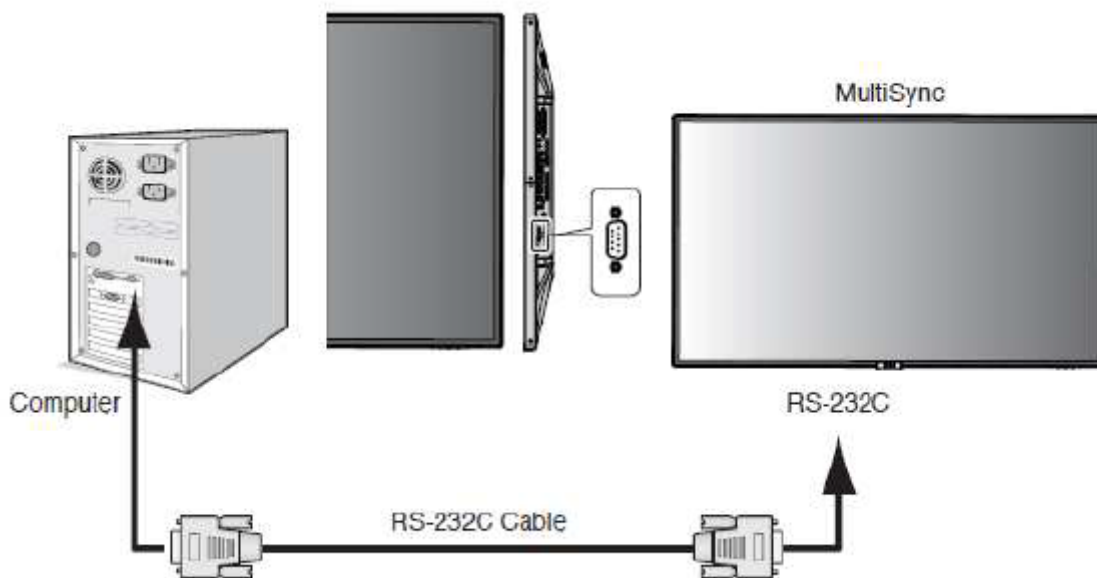
1. Application

This document defines the communications method for control of the NEC LCD monitor, when using an external controller.

2. Connectors and wiring

2.1. RS-232C Remote control

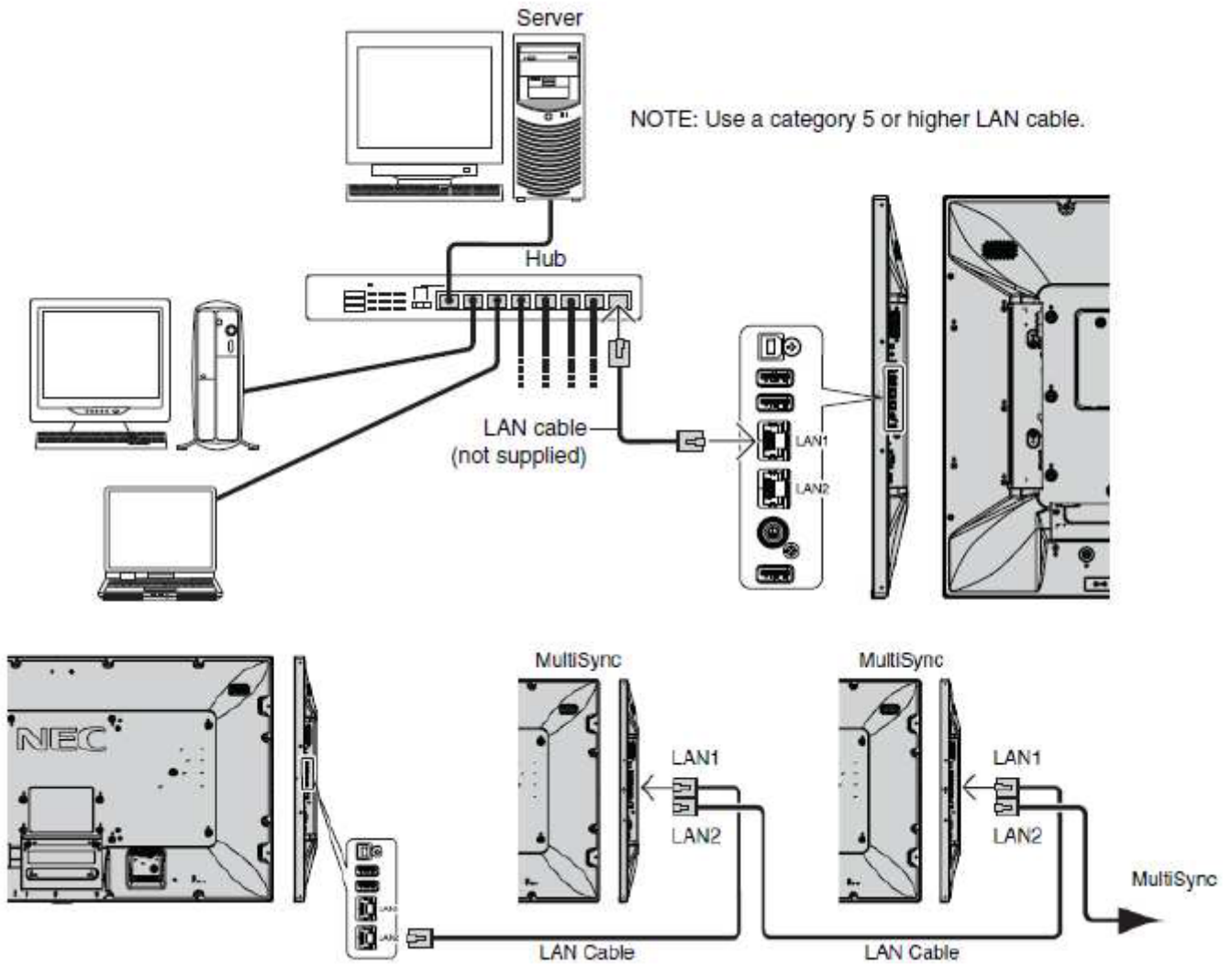
- | | |
|---------------|--|
| (1) Connector | 9-pin D-Sub |
| (2) Cable | Cross (reversed) cable or null modem cable |



(Please refer "Controlling the LCD monitor via RS-232C Remote control" on User's manual.)

2.2. LAN control

- | | |
|---------------|--------------------------------|
| (1) Connector | RJ-45 10/100 BASE-T |
| (2) Cable | Category 5 or higher LAN cable |



(Please refer "Controlling the LCD monitor via LAN control" on User's manual.)

3. Communication Parameter

3.1. RS-232C Remote control

(1) Communication system	Asynchronous
(2) Interface	RS-232C
(3) Baud rate	9600bps
(4) Data length	8bits
(5) Parity	None
(6) Stop bit	1 bit
(7) Communication code	ASCII

3.1.1. Communication timing

The controller should wait for a packet interval before next command is sent.
The packet interval needs to be longer than 600msec for the LCD monitor.

3.2. LAN control

(1) Communication system	TCP/IP (Internet protocol suite)
(2) Interface	Ethernet (CSMA/CD)
(3) Communication layer	Transport layer (TCP) * Using the payload of TCP segment.
(4) IP address	(Default) 192.168.0.10 * If you need to change, Please refer "Network settings" on User's manual.
(5) Port No.	7142 (Fixed)

【Note】

The monitor will disconnect the connection if no packet data is received for 15 minutes.
And the controller (PC) has to re-connect to control the monitor again, after 15 minutes or more.

3.2.1. Communication timing

The controller should wait for a packet interval before next command is sent.
The packet interval needs to be longer than 600msec for the LCD monitor.

4. Communication Format

There are two types of external control commands: VCP and CTL.

The command consists of four parts: Header, Message, Check code, and Delimiter.

The contents of Message vary depending on the type of command.

Header	Message	Check Code	Delimiter
--------	---------	------------	-----------

Follow the instructions below for more information on each.

Messages and other common components of the VCP command are described in this chapter.

■ Detailed description of message for VCP command

- See the part [4.2. Message block format](#)

■ Detailed description of message for CTL command

- See the part [7. CTL commands](#)

4.1. Header block format (fixed length)

| **Header** | Message | Check Code | Delimiter |

4.1.1. Header format

SOH	Reserved '0'	Destination	Source	Message Type	Message Length
1st	2nd	3rd	4th	5th	6th-7th

1st) SOH: Start of Header
ASCII SOH (01h)

2nd) Reserved: Reserved for future extensions.
On this monitor, it must be ASCII '0' (30h).

3rd) Destination: Destination equipment ID. (Receiver)
Specify a commands receiver's address.
This value must match the "MONITOR ID" or "GROUP ID" set in the OSD.
On the reply, the monitor sets '0' (30h), always.

4th) Source: Source equipment ID. (Sender)
Specify a sender address.
The controller must be '0' (30h).
On the reply, the monitor sets the own MONITOR ID in here.

5th) Message Type: (Case sensitive.)
Refer to section 4.2 "Message block format" for more details.
ASCII 'A' (41h): Command.
ASCII 'B' (42h): Command reply.
ASCII 'C' (43h): Get current parameter from a monitor.
ASCII 'D' (44h): "Get parameter" reply.
ASCII 'E' (45h): Set parameter.
ASCII 'F' (46h): "Set parameter" reply.

6th -7th) Message Length:
Specify the length of the message (that follows the header) from STX to ETX.
This length includes STX and ETX.
The byte data must be encoded to ASCII characters.

Ex.)
The byte data 3Ah must be encoded to ASCII characters '3' and 'A' (33h and 41h).
The byte data 0Bh must be encoded to ASCII characters '0' and 'B' (30h and 42h).

"MONITOR ID", "GROUP ID" to "Destination Address" conversion table is as follows,

Monitor ID	Destination Address	Monitor ID	Destination Address	Monitor ID	Destination Address	Monitor ID	Destination Address
1	41h('A')	26	5Ah('Z')	51	73h	76	8ch
2	42h('B')	27	5Bh	52	74h	77	8Dh
3	43h('C')	28	5Ch	53	75h	78	8Eh
4	44h('D')	29	5Dh	54	76h	79	8Fh
5	45h('E')	30	5Eh	55	77h	80	90h
6	46h('F')	31	5Fh	56	78h	81	91h
7	47h('G')	32	60h	57	79h	82	92h
8	48h('H')	33	61h	58	7Ah	83	93h
9	49h('I')	34	62h	59	7Bh	84	94h
10	4Ah('J')	35	63h	60	7Ch	85	95h
11	4Bh('K')	36	64h	61	7Dh	86	96h
12	4Ch('L')	37	65h	62	7Eh	87	97h
13	4Dh('M')	38	66h	63	7Fh	88	98h
14	4Eh('N')	39	67h	64	80h	89	99h
15	4Fh('O')	40	68h	65	81h	90	9Ah
16	50h('P')	41	69h	66	82h	91	9Bh
17	51h('Q')	42	6Ah	67	83h	92	9Ch
18	52h('R')	43	6Bh	68	84h	93	9Dh
19	53h('S')	44	6Ch	69	85h	94	9Eh
20	54h('T')	45	6Dh	70	86h	95	9Fh
21	55h('U')	46	6Eh	71	87h	96	A0h
22	56h('V')	47	6Fh	72	88h	97	A1h
23	57h('W')	48	70h	73	89h	98	A2h
24	58h('X')	49	71h	74	8Ah	99	A3h
25	59h('Y')	50	72h	75	8Bh	100	A4h
ALL	2Ah('*')						

Group ID	Destination Address	Group ID	Destination Address	Group ID	Destination Address	Group ID	Destination Address
A	31h('1')	D	34h('4')	G	37h('7')	J	3Ah(':')
B	32h('2')	E	35h('5')	H	38h('8')		
C	33h('3')	F	36h('6')	I	39h('9')		

Ex.) If you want to control a monitor that has the "ID No." as '1', specify a destination address 'A'(41h).

If you want to control all of the monitors which are connected by a daisy chain, specify a destination address ' * '(2Ah).

4.2. Message block format

| Header | **Message** | Check Code | Delimiter |

“Message block format” is allied to the “Message Type” in the “Header”.

Refer to the section 4.1 “Header block format” for more detail.

4.2.1. Get current parameter

The controller sends this message when you want to get the status of the monitor. For the status that you want to get, specify the “OP code page” and “OP code”, refer to chapter 8.

“Message format” of the “Get current parameter” is as follows.

4.2.1.1. Get current parameter format

STX	OP Code Page		OP Code		ETX
	Hi	Lo	Hi	Lo	

Refer to section 5.1 “Get current parameter from a monitor.” for more details.

4.2.2. Get Parameter reply

The monitor will reply with the status of the requested item specified by the controller in the “Get parameter message”.

“Message format” of the “Get parameter reply” is as follows.

4.2.2.1. Get Parameter reply format

STX	Result		OP Code Page		OP code		Type		Max value			Current Value			ETX
	Hi	Lo	Hi	Lo	Hi	Lo	Hi	Lo	MSB	...	LSB	MSB	...	LSB	

Refer to section 5.2 “Get parameter reply” for more details.

4.2.3. Set parameter

The controller sends this message to change a setting of the monitor.

Message format of the "Set parameter" is as follows.

4.2.3.1. Set parameter format

STX	OP Code Page		OP code		Set value			ETX
	Hi	Lo	Hi	Lo	MSB	...	LSB	

Refer to section 5.3 "Set parameter" for more details.

4.2.4. Set Parameter reply

The monitor replies with this message for a confirmation of the "Set parameter message". Message format of the "Set parameter reply" is as follows.

4.2.4.1. Set parameter reply format

STX	Result		OP Code Page		OP code		Type		Max value			Requested Setting Value			ETX
	Hi	Lo	Hi	Lo	Hi	Lo	Hi	Lo	MSB	...	LSB	MSB	...	LSB	

Refer to section 5.4 "Set parameter reply" for more details.

4.2.5. Command

"Command message" format depends on each command.

Usually, this "command message" is used for some non-slider controls and some special operations, such as "Save current settings", "Get timing report", "Power control", "Schedule", etc.

Refer to section 5.5 "Commands message" for more details.

4.2.6. Command reply

The monitor replies to a query from the controller. "Command reply message" format depends on each command.

Refer to section 5.5 "Commands message" for more details.

4.3. Check code

| Header | Message | **Check code** | Delimiter |

4.3.1. Formatted and calculate.

Use the figure below to learn how check code is formatted and calculated.

First, place the check code format after ETX in the command.

Therefore, place the Check code at the position of 'D9' in the figure below.

Header						Message					
SOH	Resv.	Dest	Src	Type	Length	STX	Data	-	-	ETX	Check code
D0	D1	D2	D3	D4	D5	D6	D7	-	-	D8	D9

Next, as an example of calculating Check code, sum the values listed above each column from 'D1' to 'D16' in the figure below.

Therefore, we calculate the total value from '30' (30h) to '03' (03h) in the figure below.

As a result of the calculation, the check code of the command in the figure below is '77'(77h), so set it to Check code.

※ Check code may be described as Block Check Code (BCC) in the command details described below.

Header						Message										Check code (BCC)	Delimiter	
SOH	Resv.	Dest	Src	Type	Length	STX	OP Code	Page	OP Code	Set Value			ETX					
01h	30h	41h	30h	45h	30h	41h	02h	30h	30h	31h	30h	30h	30h	36h	34h	03h	77h	0Dh
D0	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14	D15	D16	D17	D18

Check code (BCC) D17 = D1 xor D2 xor D3 xor ... xor D14 xor D15 xor D16
 = 30h xor 41h xor 30h xor 45h xor 30h xor 41h xor 02h xor 30h xor
 30h xor 31h xor 30h xor 30h xor 30h xor 36h xor 34h xor 03h
 = 77h

4.4. Delimiter

| Header | Message | Check code | **Delimiter** |

Delimiter does not have the formats and calculations described so far.

Specify 'CR'(0Dh) in ASCII for the Command Delimiter.

5. Message type

5.1. Get current Parameter from a monitor

5.1.1. Get current parameter format

STX	OP Code Page		OP Code		ETX
	Hi	Lo	Hi	Lo	
1st	2nd - 3rd		4th - 5th		6th

Send this message when you want to get the status of a monitor.

For the status that you want to get, specify the "OP code page" the "OP code", refer to chapter 8.

- * 1st byte) STX: Start of Message
ASCII STX (02h)

- * 2nd-3rd bytes) OP code page: Operation code page.
Specify the "OP code page" for the control which you want to get the status.
Refer to chapter 8 for each item.
OP code page data must be encoded to ASCII characters.
Ex.)
The byte data 02h must be encoded to ASCII characters '0' and '2' (30h and 32h).
OP code page 02h -> OP code page (Hi) = ASCII '0' (30h)
 OP code page (Lo) = ASCII '2' (32h)
Refer to chapter 8.

- * 4th-5th bytes) OP code: Operation code
Refer to "VcpTable" for each item.
OP code data must be encoded to ASCII characters.
Ex.)
The byte data 3Ah must be encoded to ASCII characters '3' and 'A' (33h and 41h).
OP code 3Ah -> OP code (Hi) = ASCII '3' (33h)
 OP code (Lo) = ASCII 'A' (41h)
Refer to chapter 8.

- * 6th byte) ETX: End of Message
ASCII ETX (03h)

5.2. "Get parameter" reply

5.2.1. Get parameter reply format

STX	Result		OP Code Page		OP code		Type		Max value			Current Value			ETX
	Hi	Lo	Hi	Lo	Hi	Lo	Hi	Lo	MSB	...	LSB	MSB	...	LSB	
1st	2nd-3rd		4th-5th		6th-7th		8th-9th		10th- 13th			14th - 17th			18th

The monitor replies with a current value and the status of the requested item (operation code).

- * 1st byte) STX: Start of Message
ASCII STX (02h)
- * 2nd-3rd bytes) Result:Result code.
These bytes indicate a result of the requested commands as follows.
00h: No Error.
01h: Unsupported operation with this monitor or unsupported operation under current condition.
This result code from the monitor is encoded to ASCII characters.
Ex.)
The byte data 01h is encoded to ASCII character '0' and '1' (30h and 31h).
- * 4th-5th bytes) OP code page: Operation code page.
These bytes indicate a replying item's OP code page.
This returned value from the monitor is encoded to ASCII characters.
Ex.)
The byte data 02h is encoded to ASCII character '0' and '2' (30h and 32h).
Refer to the "VcpTable".
- * 6th-7th bytes) OP code: Operation code
These bytes indicate a replying item's OP code.
This returned value from the monitor is encoded to ASCII characters.
Refer to the "VcpTable".
Ex.)
The byte data 1Ah is encoded to ASCII character '1' and 'A' (31h and 41h).
- * 8th-9th bytes) Type: Operation type code
00h: Set parameter
01h: Momentary
Like the Auto Setup function which automatically changes the parameter.
This returned value from the monitor is encoded to ASCII characters.
Ex.)
The byte data 01h is encoded to ASCII character '0' and '1' (30h and 31h).
- * 10th-13th bytes) Max. value: Maximum value which monitor can accept. (16bits)
This returned value from the monitor is encoded to ASCII characters.
Ex.)
'0', '1', '2' and '3' means 0123h (291)
- * 14th-17th bytes) Current Value: (16bits)
This returned value from the monitor is encoded to ASCII characters.
Ex.)
'0', '1', '2' and '3' means 0123h (291)
- * 18th byte) ETX: End of Message
ASCII ETX (03h)

5.3. Set parameter

5.3.1. Set parameter format

STX	OP Code Page		OP code		Set value				ETX
	Hi	Lo	Hi	Lo	MSB			LSB	
1st	2nd-3rd		4th-5th		6th-9th				10th

Send this message to change monitor's adjustment and so on.

The controller requests a monitor to change value.

- * 1st byte) STX: Start of Message
ASCII STX (02h)
- * 2nd-3rd bytes) OP code page: Operation code page
This OP code page data must be encoded to ASCII characters.
Ex.) The byte data 02h must be encoded to ASCII '0' and '2' (30h and 32h).
Refer to the "VcpTable".
- * 4th-5th bytes) OP code: Operation code
This OP code data must be encoded to ASCII characters.
Ex.) OP code 1Ah -> OP code (Hi) = ASCII '1' (31h)
 OP code (Lo) = ASCII 'A' (41h)
Refer to the "VcpTable".
- * 6th-9th bytes) Set value: (16bit)
This data must be encoded to ASCII characters.
Ex.) 0123h -> 1st(MSB) = ASCII '0' (30h)
 2nd = ASCII '1' (31h)
 3rd = ASCII '2' (32h)
 4th(LSB) = ASCII '3' (33h)
- * 10th byte) ETX: End of Message
ASCII ETX (03h)

5.4. "Set parameter" reply

5.4.1. Set parameter reply format

STX	Result		OP Code Page		OP code		Type		Max value			Requested Setting Value			ETX
	Hi	Lo	Hi	Lo	Hi	Lo	Hi	Lo	MSB	...	LSB	MSB	...	LSB	
1st	2nd-3rd		4th-5th		6th-7th		8th-9th		10th-13th			14th-17th			18th

The Monitor echoes back the parameter and status of the requested operation code.

- * 1st byte) STX: Start of Message
ASCII STX (02h)
- * 2nd-3rd bytes) Result code
ASCII '0' '0' (30h, 30h): No Error.
ASCII '0' '1' (30h, 31h): Unsupported operation with this monitor or unsupported operation under current condition.
- * 4th-5th bytes) OP code page: Echoes back the Operation code page for confirmation.
Reply data from the monitor is encoded to ASCII characters.
Ex.)
OP code page 02h -> OP code page = ASCII '0' and '2' (30h and 32h)
Refer to "VcpTable".
- * 6th-7th bytes) OP code: Echoes back the Operation code for confirmation.
Reply data from the monitor is encoded to ASCII characters.
Ex.)
OP code 1Ah -> OP code (Hi) = ASCII '1' (31h)
 OP code (Lo) = ASCII 'A' (41h)
Refer to "VcpTable".
- * 8th-9th bytes) Type: Operation type code
ASCII '0' '0' (30h, 30h): Set parameter
ASCII '0' '1' (30h, 31h): Momentary
Like Auto Setup function, that automatically changes the parameter.
- * 10th-13th bytes) Max. value: Maximum value that monitor can accept. (16bits)
Reply data from the monitor is encoded to ASCII characters.
Ex.) '0' '1' '2' '3' means 0123h (291)
- * 14th-17th bytes) Requested setting Value: Echoes back the parameter for confirmation. (16bits)
Reply data from the monitor is encoded to ASCII characters.
Ex.) '0' '1' '2' '3' means 0123h (291)
- * 18th byte) ETX: End of Message
ASCII ETX (03h)

5.5. Commands

"Command message format" depends on each command.

5.5.1. Save Current Settings

The controller requests for the monitor to store the adjusted value.

5.5.1.1. Format

STX	Command Code		ETX
	'0'	'C'	

Send "OC"(30h, 43h) as Save current settings command.

Complete "Save Current setting" command packet as follows.

```
ASCII : 01h-30h-41h-30h-41h-30h-34h-02h-30h-43h-03h-CHK-0Dh
        SOH-'0'-'A'-'0'-'A'-'0'-'4'-STX-'0'-'C'-ETX-CHK-CR
The monitor replies the packet for confirmation as follows.
        SOH-'0'-'0'-'A'-'B'-'0'-'6'-STX-'0'-'0'-'0'-'C'-ETX-CHK- CR
```

5.5.2. Get Timing Report and Timing reply

The controller requests the monitor to report the displayed image timing.

STX	Command Code		ETX
	'0'	'7'	

Send "07"(30h, 37h) as Get Timing Report command.

Complete "Get Timing Report" command packet as follows.

```
ASCII : 01h-30h-41h-30h-41h-30h-34h-02h-30h-37h-03h-CHK-0Dh
        SOH-'0'-'A'-'0'-'A'-'0'-'4'-STX-'0'-'7'-ETX-CHK-CR
```

The monitor replies status as the following format.

STX	Command		SS		H Freq.				V Freq.				ETX
	'4'	'E'	Hi	Lo	MSB			LSB	MSB			LSB	

* SS: Timing status byte

Bit 7 = 1 : Sync Frequency is out of range.

Bit 6 = 1 : Unstable count

Bit 5-2 Reserved (Don't care)

Bit 1 1:Positive Horizontal sync polarity.
0:Negative Horizontal sync polarity.

Bit 0 1:Positive Vertical sync polarity.
0:Negative Vertical sync polarity.

* H Freq: Horizontal Frequency in unit 0.01kHz

* V Freq: Vertical Frequency in unit 0.01Hz

Ex.) When H Freq is '1'2'A'9' (31h, 32h, 41h, 39h), it means 47.77kHz.

5.5.3. NULL Message

5.5.3.1. Format

STX	Command Code		ETX
	'B'	'E'	

The NULL message returned from the monitor is used in the following cases.

- * A timeout error has occurred. (The default timeout is 10sec.)
- * The monitor receives an unsupported message type.
- * The monitor detects a packet BCC (Block Check Code) error.
- * To tell the controller that the monitor does not have any answer to give to the host (not ready or not expected)
- * Following operations need a certain time for to execute, so the monitor will return this message when another message is received during execution.
 - Power ON, Power OFF, Auto Setup, Input, PIP Input, Auto Setup and Factory reset.
- * Complete "NULL Message" command packet as follows.
01h-30h-30h-41h-42h-30h-34h-02h-42h-45h-03h-CHK-0Dh
SOH-'0'-'0'-'A'-'B'-'0'-'4'-STX-'B'-'E'-ETX-CHK-CR

6. Typical procedure example

The following is a sample of procedures to control the monitor, these are examples of "Get parameter", "Set parameter" and "Save current settings".

6.1. How to change the "Backlight" setting.

6.1.1. Step 1. The controller requests the Monitor to reply with the current backlight setting and capability to support this operation.

(Get parameter)

Header	Message	Check code	Delimiter
SOH-'0'-Monitor ID -'0'-'C'-'0'-'6'	STX-'0'-'0'-'1'-'0'-ETX	BCC	CR

Header

```
SOH (01h) : Start of Header.  
'0' (30h) : Reserved.  
Monitor ID: Specify the Monitor ID from which you want to get a value.  
            Ex.) If Monitor ID is '1', specify 'A'.  
'0' (30h) : Message sender is the controller.  
'C' (43h) : Message type is "Get parameter command".  
'0'-'6' (30h, 36h) : Message length is 6 bytes.
```

Message

```
'0'-'0'(30h, 30h) : Operation code page number is 0.  
'1'-'0'(31h, 30h) : Operation code is 10h (in the OP code page 0).  
ETX (03h)       : End of Message
```

Check code

```
BCC           : Block Check Code  
              Refer to the section 4.3 "Check code" for a BCC calculation.
```

Delimiter

```
CR (0Dh)     : End of packet
```

6.1.2. Step 2. The monitor replies with current Backlight setting and capability to support this operation.

Header	Message	Check code	Delimiter
SOH-'0'-'0'-Monitor ID -'D'-'1'-'2'	STX-'0'-'0'-'0'-'0'-'1'-'0'-'0'-'0' -'0'-'0'-'6'-'4'-'0'-'0'-'3'-'2'-ETX	BCC	CR

Header

SOH (01h) : Start of Header
 '0' (30h) : Reserved
 '0' (30h) : Message receiver is the controller.
 Monitor ID: Indicate a replying Monitor ID.
 Ex.) When this byte is set to 'A', the replying Monitor ID is '1'.
 'D' (44h) : Message Type is "Get parameter reply".
 '1'-'2' (31h, 32h) : Message length is 18 bytes.

Message

'0'-'0'(30h, 30h) : Result code. No error.
 '0'-'0'(30h, 30h) : Operation code page number is 0.
 '1'-'0'(31h, 30h) : Operation code is 10h (in the page 0).
 '0'-'0'(30h, 30h) : This operation is "Set parameter" type.
 '0'-'0'-'6'-'4'(30h, 30h, 36h, 34h)
 : Backlight max value is 100(0064h).
 '0'-'0'-'3'-'2'(30h, 30h, 33h, 32h)
 : Current Backlight setting is 50(0032h) .
 ETX (03h) : End of Message

Check code

BCC : Block Check Code
 Refer to the section 4.3 "Check code" for a BCC calculation.

Delimiter

CR (0Dh) : End of packet

6.1.3. Step 3. The controller request the monitor to change the Backlight setting

Header	Message	Check code	Delimiter
SOH-'0'-Monitor ID -'0'-'E'-'0'-'A'	STX-'0'-'0'-'1'-'0' -'0'-'0'-'5'-'0'-ETX	BCC	CR

Header

SOH (01h) : Start of Header
'0' (30h) : Reserved
Monitor ID: Specify the Monitor ID of which you want to change a setting.
Ex.) If Monitor ID is '1', specify 'A'.
'0' (30h) : Message sender is the controller.
'E' (45h) : Message Type is "Set parameter command".
'0'-'A' (30h, 41h) : Message length is 10 bytes.

Message

'0'-'0'(30h, 30h) : Operation code page number is 0.
'1'-'0'(31h, 30h) : Operation code is 10h (in the page 0).
'0'-'0'-'5'-'0'(30h, 30h, 35h, 30h)
: Set Backlight setting 80(0050h).
ETX (03h) : End of Message

Check code

BCC : Block Check Code
Refer to the section 4.3 "Check code" for a BCC calculation.

Delimiter

CR (0Dh) : End of packet

6.1.4. Step 4. The monitor replies with a message for confirmation.

Header	Message	Check code	Delimiter
SOH-'0'-'0'-Monitor ID -'F'-'1'-'2'	STX-'0'-'0'-'0'-'0'-'1'-'0'-'0'-'0' -'0'-'0'-'6'-'4'-'0'-'0'-'5'-'0'-ETX	BCC	CR

Header

SOH (01h) : Start of Header
 '0' (30h) : Reserved
 '0' (30h) : Message receiver is the controller.
 Monitor ID: Indicate a replying Monitor ID.
 Ex.) When this byte is set to 'A', the replying Monitor ID is '1'.
 'F' (46h) : Message Type is "Set parameter reply".
 '1'-'2' (31h, 32h) : Message length is 18 bytes.

Message

'0'-'0'(30h, 30h) : Result code. No error.
 '0'-'0'(30h, 30h) : Operation code page number is 0.
 '1'-'0'(31h, 30h) : Operation code is 10h (in the page 0).
 '0'-'0'(30h, 30h) : This operation is "Set parameter" type.
 '0'-'0'-'6'-'4'(30h, 30h, 36h, 34h)
 : Backlight max value is 100(0064h).
 '0'-'0'-'5'-'0'(30h, 30h, 35h, 30h)
 : Current Backlight setting is 80(0050h) .
 ETX (03h) : End of Message

Check code

BCC : Block Check Code
 Refer to the section 4.3 "Check code" for a BCC calculation.

Delimiter

CR (0Dh) : End of packet

Repeat Step 1 and Step 2, if you need to check the Backlight setting. (Recommended)

6.1.5. Step 5. Request the monitor to store the Backlight setting. (Save Current Settings Command)

Header	Message	Check code	Delimiter
SOH-'0'-Monitor ID -'0'-'A'-'0'-'4'	STX-'0'-'C'-ETX	BCC	CR

Header

SOH (01h) : Start of Header
'0' (30h) : Reserved
Monitor ID: Specify the Monitor ID which you want to store the setting.
Ex.) If Monitor ID is '1', specify 'A'.
'0' (30h) : Message sender is the controller.
'A' (41h) : Message type is "Command".
'0'-'4' (30h, 34h) : Message length is 4 bytes.

Message

'0'-'C' (30h, 43h) : Command code is 0Ch as "Save current settings".
ETX (03h) : End of Message

Check code

BCC : Block Check Code
Refer to the section 4.3 "Check code" for a BCC calculation.

Delimiter

CR (0Dh) : End of packet

6.2. How to read the measurement value of the built-in temperature sensors.

If the display has a built-in temperature sensor, the controller uses these sensors through external control. You can monitor the internal temperature.

The temperature read procedure is shown below as an example of how to use it.

6.2.1. Step 1. Select a temperature sensor which you want to read.

Header	Message	Check code	Delimiter
SOH-'0'-Monitor ID -'0'-'E'-'0'-'A'	STX-'0'-'2'-'7'-'8' -'0'-'0'-'0'-'1'-ETX	BCC	CR

Header

SOH (01h) : Start of Header
'0' (30h) : Reserved
Monitor ID: Specify the Monitor ID which you want to get a value.
Ex.) If Monitor ID is '1', specify 'A'.
'0' (30h) : Message sender is the controller.
'E' (45h) : Message Type is "Set parameter command".
'0'-'A' (30h, 41h) : Message length is 10 bytes

Message

'0'-'2'(30h, 32h) : Operation code page number is 2.
'7'-'8'(37h, 38h) : Operation code is 78h (in the page 2).
'0'-'0'-'0'-'1'(30h, 30h, 30h, 31h)
: Select the temperature sensor #1 (01h).
ETX (03h) : End of Message

Check code

BCC : Block Check Code
Refer to the section 4.3 "Check code" for a BCC calculation.

Delimiter

CR (0Dh) : End of packet

6.2.2. Step 2. The monitor replies for confirmation.

Header	Message	Check code	Delimiter
SOH-'0'-'0'-Monitor ID -'F'-'1'-'2'	STX-'0'-'0'-'0'-'2'-'7'-'8'-'0'-'0' -'0'-'0'-'0'-'3'-'0'-'0'-'0'-'1'-ETX	BCC	CR

Header

SOH (01h) : Start of Header
 '0' (30h) : Reserved
 '0' (30h) : Message receiver is the controller.
 Monitor ID: Indicates a replying Monitor ID.
 Ex.) When this byte is set to 'A', the replying Monitor ID is '1'.
 'F' (46h) : Message Type is "Set parameter reply".
 '1'-'2' (31h, 32h) : Message length is 18 bytes.

Message

'0'-'0'(30h, 30h) : Result code. No error.
 '0'-'2'(30h, 32h) : Operation code page number is 2.
 '7'-'8'(37h, 38h) : Operation code is 78h (in the page 2).
 '0'-'0'(30h, 30h) : This operation is "Set parameter" type.
 '0'-'0'-'0'-'3'(30h, 30h, 30h, 33h)
 : Number of temperature sensors are 3 (0003h).
 '0'-'0'-'0'-'1'(30h, 30h, 30h, 31h)
 : temperature sensor is #1.
 ETX (03h) : End of Message

Check code

BCC : Block Check Code
 Refer to the section 4.3 "Check code" for a BCC calculation.

Delimiter

CR (0Dh) : End of packet

6.2.3. Step 3. The controller requests the monitor to send the temperature from the selected sensor.

Header	Message	Check code	Delimiter
SOH-'0'-Monitor ID -'0'-'C'-'0'-'6'	STX-'0'-'2'-'7'-'9'-ETX	BCC	CR

Header

SOH (01h) : Start of Header
'0' (30h) : Reserved
Monitor ID: Specify the Monitor ID which you want to get a value.
Ex.) If Monitor ID is '1', specify 'A'.
'0' (30h) : Message sender is the controller.
'C' (43h) : Message Type is "Get parameter".
'0'-'6' (30h, 36h) : Message length is 6 bytes.

Message

'0'-'2' (30h, 32h) : Operation code page number is 2.
'7'-'9' (37h, 39h) : Operation code is 79h (in the OP code page 2).
ETX (03h) : End of Message

Check code

BCC : Block Check Code
Refer to the section 4.3 "Check code" for a BCC calculation.

Delimiter

CR (0Dh) : End of packet

6.2.4. Step 4. The monitor replies a temperature of selected sensor.

Header	Message	Check code	Delimiter
SOH-'0'-'0'-Monitor ID -'D'-'1'-'2'	STX-'0'-'0'-'0'-'2'-'7'-'9'-'0'-'0' -'F'-'F'-'F'-'F'-'0'-'0'-'3'-'2'-ETX	BCC	CR

Header

SOH (01h) : Start of Header
 '0' (30h) : Reserved
 '0' (30h) : Message receiver is the controller.
 Monitor ID: Indicate a replying Monitor ID.
 Ex.) When this byte is set to 'A', the replying Monitor ID is '1'.
 'D' (44h) : Message Type is "Get parameter reply".
 '1'-'2' (31h, 32h) : Message length is 18 bytes.

Message

'0'-'0'(30h, 30h) : Result code. No error.
 '0'-'2'(30h, 32h) : Operation code page number is 2.
 '7'-'9'(37h, 39h) : Operation code is 79h (in the page 2).
 '0'-'0'(30h, 30h) : This operation is "Set parameter" type.
 'F'-'F'-'F'-'F'(46h, 46h, 46h, 46h)
 : Maximum value.
 '0'-'0'-'3'-'2'(30h, 30h, 33h, 32h)
 : The temperature is 25 degrees Celsius.
 ETX (03h) : End of Message

Readout value is 2's complement.

Temperature [Celsius]	Readout value	
	Binary	Hexadecimal
+125.0	0000 0000 1111 1010	00FAh
+ 25.0	0000 0000 0011 0010	0032h
+ 0.5	0000 0000 0000 0001	0001h
0	0000 0000 0000 0000	0000h
- 0.5	1111 1111 1111 1111	FFFFh
- 25.0	1111 1111 1100 1110	FFCEh
- 55.0	1111 1111 1001 0010	FF92h

Check code

BCC : Block Check Code
 Refer to the section 4.3 "Check code" for a BCC calculation.

Delimiter

CR (0Dh) : End of packet

7. CTL commands

7.1. System Command

7.1.1. CTL-0C. Save Current Settings

【 Function 】

This command is used in order to store the adjusted value.

【 Command 】

```
[ASC]SOH-'0'-ID-'0'-'A'-'0'-'4'-STX "Data " ETX BCC 0DH  
[HEX]01H 30H ID 30H 41H 30H 34H 02H (D01~02) 03H BCC 0DH
```

Data	Contents

D01~02	Message "0C"(30H 43H) : Save Current Settings

【 ACK 】

```
[DAT]SOH-'0'-'0'-ID-'B'-'0'-'6'-STX "Data " 03H BCC 0DH  
[HEX]01H 30H 30H ID 42H 30H 36H 02H (D01~04) 03H BCC 0DH
```

Data	Contents

D01~04	Message "000C"(30H 30H 30H 43H) : Save Current Settings

【 Note 】

7.1.2. CTL-07. Get Timing Report and Timing reply

【 Function 】

This command is used in order to report the displayed image timing.

【 Command 】

```
[ASC]SOH-'0'-ID-'0'-'A'-'0'-'4'-STX "Data " ETX BCC 0DH  
[HEX]01H 30H ID 30H 41H 30H 34H 02H (D01~02) 03H BCC 0DH
```

Data	Contents

D01~02	Message "07"(30H 37H) : Get Timing Report command.

【 ACK 】

```
[DAT]SOH-'0'-'0'-ID-'B'-'0'-'E'-STX "Data " 03H BCC 0DH  
[HEX]01H 30H 30H ID 42H 30H 45H 02H (D01~02 D03~04 D05~08 D09~12) 03H BCC 0DH
```

Data	Contents

D01~02	Message "4E"(34H 45H) : Command
D03~04	SS Bit 7 = 1: Sync Frequency is out of range. (or No signal.) Bit 6 = 1: Unstable count Bit 5-2 Reserved (Don't care) Bit 1 1:Positive Horizontal sync polarity. 0:Negative Horizontal sync polarity. Bit 0 1:Positive Vertical sync polarity. 0:Negative Vertical sync polarity.
D05~08	H Freq: Horizontal Frequency in unit 0.01kHz
D09~12	V Freq: Vertical Frequency in unit 0.01Hz Ex.) When H Freq is '1' '2' 'A' '9' (31h, 32h, 41h, 39h), it means 47.77kHz.

【 Note 】

7.2. Power control procedure

7.2.1. CTL-01D6. Power status read

【 Function 】

This command is used in order to read a current power status.

【 Command 】

```
[ASC]SOH-'0'-ID-'0'-'A'-'0'-'6'-STX "Data " ETX BCC 0DH  
[HEX]01H 30H ID 30H 41H 30H 36H 02H (D01~04) 03H BCC 0DH
```

Data	Contents
D01~04	Message "01D6"(30H,31H,44H,36H) : Get power status command

【 ACK 】

```
[DAT]SOH-'0'-'0'-ID-'B'-'1'-'2'-STX "Data " ETX BCC 0DH  
[HEX]01H 30H 30H ID 42H 31H 32H 02H (D01~02 D03~04 D05~06 D07~08 D09~12 D13~16) 03H BCC 0DH
```

Data	Contents
D01~02	Reserved data "02"(30H,32H)
D03~04	Result code "00"(30H,30H) : No Error "01"(30H,31H) : Unsupported
D05~06	Display power mode code "D6"(44H,36H) :
D07~08	Parameter type "00"(30H,30H): Set parameter
D09~12	Max "0004"(30H,30H,30H,34H) : Power mode is 4 types.
D13~16	Current power mode "0001"(30H,30H,30H,31H) : ON "0002"(30H,30H,30H,32H) : Stand-by (power save) "0003"(30H,30H,30H,33H) : Reserved "0004"(30H,30H,30H,34H) : OFF (same as IR power off)

【 Note 】

7.2.2. CTL-C203-D6. Power control

【 Function 】

This command is used in order to control monitor power.

【 Command 】

```
[ASC]SOH-'0'-ID-'0'-'A'-'0'-'C'-STX "Data          " ETX BCC 0DH  
[HEX]01H 30H ID 30H 41H 30H 43H 02H (D01~06) (D07~10) 03H BCC 0DH
```

Data	Contents

D01~06	Message "C203D6"(43H 32H 30H 33H 44H 36H) : power control command
D07~10	Power mode "0001"(30H 30H 30H 31H) : ON "0002"(30H 30H 30H 32H) : Do not set "0003"(30H 30H 30H 33H) : Do not set "0004"(30H 30H 30H 34H) : OFF (same as IR power off)

【 ACK 】

```
[DAT]SOH-'0'-'0'-ID-'B'-'0'-'E'-STX "Data          " ETX BCC 0DH  
[HEX]01H 30H 30H ID 42H 30H 45H 02H (D01~02) (D03~08) (D09~12) 03H BCC 0DH
```

Data	Contents

D01~02	Result code "00"(30H 30H) : No Error
D03~08	Message "C203D6"(43H 32H 30H 33H 44H 36H) : power control reply command
D09~12	Power mode "0001"(30H 30H 30H 31H) : ON "0002"(30H 30H 30H 32H) : Do not set "0003"(30H 30H 30H 33H) : Do not set "0004"(30H 30H 30H 34H) : OFF (same as IR power off)

【 Note 】

7.3. Serial No. & Model Name Read

7.3.1. CTL-C216. Serial No. Read

【 Function 】

This command is used in order to read a serial number.

【 Command 】

```
[ASC]SOH-'0'-ID-'0'-'A'-'0'-'6'-STX "Data " ETX BCC 0DH  
[HEX]01H 30H ID 30H 41H 30H 36H 02H (D01~04) 03H BCC 0DH
```

Data	Contents

D01~04	Message "C216"(43H 32H 31H 36H) : Serial No. command

【 ACK 】

```
[DAT]SOH-'0'-'0'-ID-'B'- N - N -STX "Data " ETX BCC 0DH  
[HEX]01H 30H 30H ID 42H LEN LEN 02H (D01~04) (D05~XX) 03H BCC 0DH
```

Data	Contents

D01~04	Message "C316"(43H 33H 31H 36H) : Serial No. reply command
D05~XX	Serial Number(XX Max=30) * The byte data 20h is encoded as ASCII characters '2' and '0' (32h and 30h). Ex.) For example when receiving Serial Number data 33h 31h 33h 32h 33h 33h 33h 34h Step1: Serial Number data is encoded as character string. Example: 33h 31h 33h 32h 33h 33h 33h 34h -> '3','1','3','2','3','3','3','4' Step2: Decode pairs of ASCII characters to hexadecimal values. Example: '3','1','3','2','3','3','3','4' -> 31h , 32h , 33h , 34h Step3: Byte data represents the ASCII string data. Example: 31h 32h 33h 34h -> "1234" Result: Serial Number is "1234". Note: No null termination character is sent.

【 Note 】

7.3.2. CTL-C217. Model Name Read

【 Function 】

This command is used in order to read the Model Name.

【 Command 】

```
[ASC]SOH-'0'-ID-'0'-'A'-'0'-'6'-STX "Data " ETX BCC 0DH  
[HEX]01H 30H ID 30H 41H 30H 36H 02H (D01~04) 03H BCC 0DH
```

Data	Contents
D01~04	Message "C217"(43H 32H 31H 37H) : Model Name command

【 ACK 】

```
[DAT]SOH-'0'-'0'-ID-'B'- N - N -STX "Data " ETX BCC 0DH  
[HEX]01H 30H 30H ID 42H LEN LEN 02H (D01~04) (D05~XX) 03H BCC 0DH
```

Data	Contents
D01~04	Message "C317"(43H 33H 31H 37H) : Model Name reply Command
D05~XX	Model name(XX Max=36) * The byte data 20h is encoded as ASCII characters '2' and '0' (32h and 30h). Ex.) For example when receiving Model Name data 35h 30h 33h 34h 33h 30h 33h 33h Step1: Model Name data is encoded character string. Example: 35h 30h 33h 34h 33h 30h 33h 33h -> '5','0','3','4','3','0','3','3' Step2: Decode pairs of ASCII characters to hexadecimal values. Example: '5','0','3','4','3','0','3','3' -> 50h , 34h , 30h , 33h Step3: Byte data represents the ASCII string data. Example: 50h 34h 30h 33h -> "P403" Result: Model Name is "P403". Note: No null termination character is sent.

【 Note 】

7.4. Capabilities Request

7.4.1. CTL-F3. Capabilities Request

【 Function 】

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

【 Command 】

```
[ASC]SOH-'0'-ID-'0'-'A'-'0'-'8'-STX "Data          " ETX BCC 0DH
[HEX]01H 30H ID 30H 41H 30H 38H 02H (D01~02) (D03~06) 03H BCC 0DH
```

Data	Contents
D01~02	Message "F3"(46H,33H) : Capabilities Control command
D03~06	Offset

【 ACK 】

```
[DAT]SOH-'0'-'0'-ID-'B'- N - N -STX "Data          " ETX BCC 0DH
[HEX]01H 30H 30H ID 42H LEN LEN 02H (D01~02) (D03~06) (D07~XX) 03H BCC 0DH
```

Data	Contents
D01~02	Message "E3"(45H,33H) : Capabilities Control Reply command
D03~06	Offset
D07~XX	Capability strings data(XX Max=32) "prot()" "cmds()" "vcp()" "type()" "mccs_ver()" "asset_eep()" "mpu_ver()" "model()" "c_tmp_ofst()" "mswhql()"

【 Note 】

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.

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

```
(  
prot(monitor)  
type(LCD)  
cmds(01 02 03 07 0C F3)  
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)  
vcp_p10(10 11)  
mccs_ver(2.0)  
model(S401)  
mswhql(1)  
asset_eep(20)  
mpu_ver(1.0.00)  
)
```

(※1)Capability strings data

"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) vcp_p10(10 11)

(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(2.0)

"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”

"mpu_ver()"

For software version information.
Ex. mpu_ver(1.0.00)

"prot()"

The highest level definition of a device's family category.
Monitor device is defined as follows.
Ex. prot(monitor)

"cmds()"

The cmds entry contains a list of supported monitor device protocol commands.
Supported command is shown by op-code.

01: Get VCP
02: VCP feature reply
03: Set VCP
07: Get Timing Report
0C: Save Current Setting
C2: NECDS Special Command
C4: GetVCPPage
C6: GetPagedVCP
C8: SetPagedVCP
F3: Capability Reply
Ex. cmds(01 02 03 07 0C C2 C4 C6 C8 F3)

"model()"

The model entries model name.
Ex. model(P551)

"mswhql()"

The mswhql should entry “1” in according to Windows requirement.
Ex. mswhql(1)

"gamma_table()"

Table size & each color data offset of gamma
size(C00) : table size of gamma data
r_ofs(0) : data offset of Red gamma data
g_ofs(400) : data offset of Green gamma data
b_ofs(800) : data offset of Blue gamma data
this value wrote by hexadecimal
Ex : data size = 3072 (C00h) word,
red = 0 (0h), green = 1024(400h), blue = 2048(800h)
Ex. gamma_table(size(C00)r_ofs(0)g_ofs(400)b_ofs(800))

"c_tmp_ofst()"

The color temperature offset data.
Ex.c_tmp_ofst(A28h)

7.5. MAC Address Read Request & Reply

7.5.1. CTL-C220. MAC Address Read Request

【 Function 】

This command is used in order to read the MAC Address.

【 Command 】

```
[ASC]SOH-'0'-ID-'0'-'A'-'0'-'8'-STX "Data          " ETX BCC 0DH  
[HEX]01H 30H ID 30H 41H 31H 30H 02H (D01~04) (D05~06) 03H BCC 0DH
```

Data	Contents
D01~04	Message "C220"(43H 32H 32H 40H) : MAC Address Read Request command
D05~06	Select device "00"(30H 30H) :fixed

【 ACK 】

```
[DAT]SOH-'0'-'0'-ID-'B'- N - N -STX "Data          " ETX BCC 0DH  
[HEX]01H 30H 30H ID 42H LEN LEN 02H (D01~04) (D05~06) (D07~XX) 03H BCC 0DH
```

Data	Contents
D01~04	Message "C320"(43H 33H 32H 30H) : MAC Address Read Request reply command
D05~06	Select device "00"(30H 30H) :fixed
D07~XX	MAC Address(XX Max=12)

【 Note 】

7.6. Direct TV Channel Read & Write

7.6.1. CTL-C22C. Direct TV Channel Read Request

【 Function 】

This command is used in order to read the Direct TV Channel.

【 Command 】

```
[ASC]SOH-'0'-ID-'0'-'A'-'0'-'6'-STX "Data " ETX BCC 0DH  
[HEX]01H 30H ID 30H 41H 30H 36H 02H (D01~04) 03H BCC 0DH
```

Data	Contents

D01~04	Message "C22C"(43H 32H 32H 43H) : Direct TV Channel read request command

【 ACK 】

```
[DAT]SOH-'0'-'0'-ID-'B'-'1'-'2'-STX "Data " ETX BCC 0DH  
[HEX]01H 30H 30H ID 42H 31H 32H 02H (D01~04) (D05~08) (D09~12) (D13~16) 03H BCC 0DH
```

Data	Contents

D01~04	Message "C32C"(43H 33H 32H 43H) : Direct TV Channel read request reply command
D05~08	Major Channel High(H)(L)
D09~12	Major Channel Low (H)(L)
D13~16	Minor Channel (H)(L)

【 Note 】

This function is available model as follows.
E328_TV / E438_TV / E498_TV / E558_TV / E658_TV

7.6.2. CTL-C22D. Direct TV Channel Write Request

【 Function 】

This command is used in order to write Direct TV Channel.

【 Command 】

```
[ASC]SOH-'0'-ID-'0'-'A'-'1'-'2'-STX "Data" ETX BCC 0DH  
[HEX]01H 30H ID 30H 41H 31H 32H 02H (D01~04) (D05~08) (D09~12) (D13~16) 03H BCC 0DH
```

Data	Contents

D01~04	Message "C22D"(43H 32H 32H 44H) : Direct TV Channel write request command
D05~08	Major Channel High(H)(L)
D09~12	Major Channel Low (H)(L)
D13~16	Minor Channel (H)(L)

【 ACK 】

```
[DAT]SOH-'0'-'0'-ID-'B'-'1'-'2'-STX "Data" ETX BCC 0DH  
[HEX]01H 30H 30H ID 42H 31H 32H 02H (D01~04) (D05~08) (D09~12) (D13~16) 03H BCC 0DH
```

Data	Contents

D01~04	Message "C32D"(43H 33H 32H 4DH) : Direct TV Channel write request reply command
D05~08	Major Channel High(H)(L)
D09~12	Major Channel Low (H)(L)
D13~16	Minor Channel (H)(L)

【 Note 】

This function is available model as follows.
E328_TV / E438_TV / E498_TV / E558_TV / E658_TV

7.7. Remote Control Data Code sending format via RS-232C

7.7.1. CTL-C210. Remote Control Data Code sending format via RS-232C

【 Function 】

This command is used in order to send the Remote Control Data Code.

【 Command 】

```
[ASC]SOH-'0'-ID-'0'-'A'-'0'-'C'-STX "Data" ETX BCC 0DH  
[HEX]01H 30H ID 30H 41H 30H 43H 02H (D01~04) (D05~06) (D07~08) (D09~10) 03H BCC 0DH
```

Data	Contents
D01~04	Message "C210"(43H 32H 31H 30H) : Remote Control Data Code command
D05~06	remote control data code upper byte(High) "00"(30H 30H)
D07~08	remote control data code upper byte(Low) "1D"(31H 44H) : PICTURE "29"(32H 39H) : ASPECT "43"(34H 33H) : SOUND "08"(30H 38H) : 1 "09"(30H 39H) : 2 "0A"(30H 41H) : 3 "0B"(30H 42H) : 4 "0C"(30H 43H) : 5 "0D"(30H 44H) : 6 "0E"(30H 45H) : 7 "0F"(30H 46H) : 8 "10"(31H 30H) : 9 "44"(34H 34H) : DASH "12"(31H 32H) : 0 "19"(31H 39H) : INFO "20"(32H 30H) : MENU "1F"(31H 46H) : EXIT "15"(31H 35H) : UP "14"(31H 34H) : DOWN "21"(32H 31H) : LEFT "22"(32H 32H) : RIGHT "23"(32H 33H) : OK "17"(31H 37H) : VOL + "16"(31H 36H) : VOL - "33"(33H 33H) : CH + "32"(33H 32H) : CH - "1B"(31H 42H) : MUTE "27"(32H 37H) : FREEZE "2C"(32H 43H) : CC "1A"(31H 41H) : MTS
D09~10	repeat times(HL)

【 ACK 】

```
[DAT]SOH-'0'-'0'-ID-'B'-'0'-'A'-STX "Data" ETX BCC 0DH  
[HEX]01H 30H 30H ID 42H 30H 38H 02H (D01~04) (D05~06) (D07~08) 03H BCC 0DH
```

Data	Contents
D01~04	Message "C310"(43H 33H 31H 30H) : Remote Control Data Code reply command

D05~06	remote control data code upper byte(High) "00"(30H 30H)
D07~08	remote control data code upper byte(Low) Omitted because it is the same as the transmitted data.

【 Note 】

7.8. Firmware Version Command

7.8.1. CTL-CA02. Firmware Version Read Request

【 Function 】

This command is used in order to read Firmware Version.

【 Command 】

```
[ASC]SOH-'0'-ID-'0'-'A'-'0'-'8'-STX "Data          " ETX BCC 0DH  
[HEX]01H 30H ID 30H 41H 30H 38H 02H (D01~04) (D05~06) 03H BCC 0DH
```

Data	Contents

D01~04	Message "CA02"(43H 41H 30H 32H) : Firmware Version Read Command
D05~06	Firmware Type "00"(30H 30H) : F/W Revision

【 ACK 】

```
[DAT]SOH-'0'-'0'-ID-'B'-'1'-'2'-STX "Data          " ETX BCC 0DH  
[HEX]01H 30H 30H ID 42H 31H 32H 02H (D01~04) (D05~06) (D07~08) (D09~16) 03H BCC 0DH
```

Data	Contents

D01~04	Message "CB02"(43H 42H 30H 31H) : Firmware Version Read reply command
D05~06	Result code "00"(30H 30H) : No Error "01"(30H 31H) : Error
D07~08	Firmware Type "00"(30H 30H) : Firmware revision
D09~16	Firmware Version String D09 : R D10 : Major Version "0"(30H) ~ "9"(39H) D11 : Period 2EH (fixed) D12 : Minor (Basic) Version1 "0"(30H) ~ "9"(39H) D13 : Minor (Basic) Version2 "0"(30H) ~ "9"(39H) D14 : Minor (Basic) Version3 "0"(30H) ~ "9"(39H) D15 : Branch Version1 "A"(41H) ~ "Z"(5AH) D16 : Branch Version2 "A"(41H) ~ "Z"(5AH)

【 Note 】

The version information section is an ASCII character string.

7.8.2. CTL-CA04-03. Input Name of Designated Terminal Read Request

【 Function 】

This command is used in order to read Input Name of Designated Terminal.

【 Command 】

```
[ASC]SOH-'0'-ID-'0'-'A'-'0'-'A'-STX "Data" ETX BCC 0DH  
[HEX]01H 30H ID 30H 41H 30H 41H 02H (D01~04) (D05~06) (D07~08) 03H BCC 0DH
```

Data	Contents
D01~04	Message "CA04"(43H 41H 30H 34H) : Input Name command
D05~06	Index "03"(30H 33H) : Designated Terminal Read
D07~08	Input Terminal "00"(30H 30H) : No mean "01"(30H 31H) : VGA(RGB) "05"(30H 35H) : AV "09"(30H 39H) : Tuner "0C"(30H 43H) : VGA(YPbPr) "11"(31H 31H) : HDMI1 "12"(31H 32H) : HDMI2 "82"(38H 32H) : HDMI3 "87"(38H 37H) : MP(Media player)

【 ACK 】

```
[DAT]SOH-'0'-'0'-ID-'B'- N - N -STX "Data" ETX BCC 0DH  
[HEX]01H 30H 30H ID 42H LEN LEN 02H (D01~04) (D05~06) (D07~08) (D09~10) (D11~XX) 03H BCC 0DH
```

Data	Contents
D01~04	Message "CB04"(43H 42H 30H 34H) : Input Name reply command
D05~06	Index "03"(30H 33H) : Designated Terminal Read
D07~08	Result code "00"(30H 30H) : No Error "01"(30H 31H) : Error
D09~10	Input Terminal Omitted because it is the same as the transmitted data.
D11~XX	Input Name XX = Max 39 Max length of actual Input Name 14 characters

【 Note 】

7.8.3. CTL-CA04-04. Input Name of Designated Terminal Write Request

【 Function 】

This command is used in order to write Input Name of Designated Terminal.

【 Command 】

```
[ASC]SOH-'0'-ID-'0'-'A'- N - N -STX "Data " ETX BCC 0DH  
[HEX]01H 30H ID 30H 41H LEN LEN 02H (D01~04) (D05~06) (D07~08) (D09~XX) 03H BCC 0DH
```

Data	Contents
D01~04	Message "CA04"(43H 41H 30H 34H) : Input Name command
D05~06	Index "04"(30H 34H) : Designated Terminal Write
D07~08	Input Terminal "00"(30H 30H) : No mean "01"(30H 31H) : VGA(RGB) "05"(30H 35H) : AV "09"(30H 39H) : Tuner "0C"(30H 43H) : VGA(YPbPr) "11"(31H 31H) : HDMI1 "12"(31H 32H) : HDMI2 "82"(38H 32H) : HDMI3 "87"(38H 37H) : MP(Media player)
D09~XX	Input Name XX = Max 37 Max length of actual Input Name 14 characters

【 ACK 】

```
[DAT]SOH-'0'-'0'-ID-'B'-'0'-'A'-STX "Data " ETX BCC 0DH  
[HEX]01H 30H 30H ID 42H 30H 41H 02H (D01~04) (D05~06) (D07~08) 03H BCC 0DH
```

Data	Contents
D01~04	Message "CB04"(43H 42H 30H 34H) : Input Name reply command
D05~06	Index "04"(30H 34H) : Designated Terminal Write
D07~08	Result code "00"(30H 30H) : No Error "01"(30H 31H) : Error

【 Note 】

7.8.4. CTL-CA04-05. Input Name of Designated Terminal Reset Request

【 Function 】

This command is used in order to reset Input Name of Designated Terminal.

【 Command 】

```
[ASC]SOH-'0'-ID-'0'-'A'-'0'-'A'-STX "Data" ETX BCC 0DH  
[HEX]01H 30H ID 30H 41H 30H 41H 02H (D01~04) (D05~06) (D07~08) 03H BCC 0DH
```

Data	Contents

D01~04	Message "CA04"(43H 41H 30H 34H) : Input Name command
D05~06	Index "05"(30H 35H) : Designated Terminal Reset
D07~08	Input Terminal "00"(30H 30H) : ALL Terminal "00"(30H 30H) : No mean "01"(30H 31H) : VGA(RGB) "05"(30H 35H) : AV "09"(30H 39H) : Tuner "0C"(30H 43H) : VGA(YPbPr) "11"(31H 31H) : HDMI1 "12"(31H 32H) : HDMI2 "82"(38H 32H) : HDMI3 "87"(38H 37H) : MP(Media player)

【 ACK 】

```
[DAT]SOH-'0'-'0'-ID-'B'-'0'-'A'-STX "Data" ETX BCC 0DH  
[HEX]01H 30H 30H ID 42H 30H 41H 02H (D01~04) (D05~06) (D07~08) 03H BCC 0DH
```

Data	Contents

D01~04	Message "CB04"(43H 42H 30H 34H) : Input Name reply
D05~06	Index "05"(30H 35H) : Designated Terminal Reset
D07~08	Result code "00"(30H 30H) : No Error "01"(30H 31H) : Error

【 Note 】

8. OSD menu and contrast table for each command

A table of settings that exist in the OSD menu of the monitor versus each command.

Some commands that do not exist in the OSD menu are listed in the "Other" section of the comparison table.

【VCP command format】

VCP - "OP code page" - "OP code"

Ex.) VCP-00-60
 OP code page: 00
 OP code: 60

OSD		Command	Parameter
Video	Picture Mode		VCP-02-1A 0003H : HIGHBRIGHT 0004H : Standard 0008H : CUSTOM1 0017H : Dynamic 0018H : Energy Saving 001BH : HDR Video 001DH : CONFERENCING
	Advanced Video	Aspect Ratio	VCP-02-70 0001H : NORMAL 0002H : FULL 0004H : ZOOM 0007H : OFF(dot by dot)
		Overscan	VCP-02-E3 0001H : Under Scan 0002H : Over Scan 0003H : Auto
		Dimming Setting	VCP-11-4E 0001H : OFF 0002H : Dynamic Backlight 0003H : Local Dimming (*3)
		Color Temperature	VCP-00-0C 0023H : Warm 003FH : Normal 005AH : Cool
		Color Temperature	VCP-00-14 <u>VCP-00-14</u> 0002H : Display native (NATIVE) 000BH : User1(CUSTOM)
		R	VCP-00-16 0000H - 0064H (Dark) - (Bright)
		G	VCP-00-18 0000H - 0064H

			(Dark) - (Bright)
	B	VCP-00-1A	0000H - 0064H (Dark) - (Bright)
Noise Reduction		VCP-02-20 VCP-02-26	<u>VCP-02-20</u> 0000H : OFF 0001H : Low 0002H : Mid 0003H : High <u>VCP-02-26</u> 0000H : OFF 0001H : Low 0002H : Mid 0003H : High
Adaptive Contrast		VCP-02-8D	0001H : OFF 0002H : LOW 0003H : MIDDLE 0004H : HIGH
Gamma		VCP-02-68	0001H : NATIVE 0004H : 2.2 0008H : 2.4 0010H : HDR-Hybrid Log 0011H : HDR-ST2084(PQ)
Ambient Light Sensing		VCP-10-C8	0001H : OFF 0002H : MODE1
Color Enhance		VCP-11-EC	0001H : Off 0002H : Vivid 0003H : Wide
HDR Mode		VCP-11-E5	0004H : Low 0005H : Mid 0006H : High
Backlight / Brightness		VCP-00-10	0000H - 0064H (Dark) - (Bright)
Contrast		VCP-00-12	0000H - 0064H (Low) - (High)
Video Black Level		VCP-00-92	0000H - 0064H (To Dark) - (To Bright)
Sharpness		VCP-00-87 VCP-00-8C	<u>VCP-00-87</u> 0000H - 0064H (Dull) - (Sharp)

			<u>VCP-00-8C</u> 0000H - 0064H (Dull) - (Sharp)
	Color	VCP-00-8A VCP-02-1F	<u>VCP-00-8A</u> 0000H - 0064H (Pale) - (To Deep) <u>VCP-02-1F</u> 0000H - 0064H (Pale) - (To Deep)
	Tint	VCP-00-90	0000H - 0064H (To Purplish) - (To Greenish)
	Reset Video Settings	VCP-02-CB	0001H : All(=Factory Reset) 0002H : Picture 0003H : Adjust 0004H : Audio 0010H : Network
Audio	Sound Mode	Sound Mode	VCP-10-B2 0001H : Standard 0002H : Movie 0003H : Music 0005H : Custom
		120Hz	N/A ---
		500Hz	N/A ---
		1.5kHz	N/A ---
		5kHz	N/A ---
		10kHz	N/A ---
	Balance	VCP-00-93	0000H - 0064H (To Left) - (To Right)
	Surround	VCP-02-34	0001H : Off 0002H : Low
	Internal Speakers	VCP-11-BA	0000H : No mean 0001H : OFF 0002H : ON 0003H : AUTO
	Digital Output	N/A	---
Audio Input	VCP-02-2E	0001H : Audio1 (Audio In) 0002H : Audio2 (AV) 0004H : HDMI1	

			0006H : Option (TV) 000AH : HDMI2 000BH : HDMI3 000DH : MP
	Audio Delay	VCP-10-CB	0000H - 0064H (Small) - (Large)
	Audio Source (MTS)	VCP-02-2C	0000H : No mean 0001H : main 0002H : sub 0003H : main+sub 0004H : stereo 0005H : mono 0006H : dual 0007H : SAP
	Visually Impaired	N/A	---
	Menu Speech (TTS)	Menu Speech (TTS)	N/A
		Volume	N/A
		Speed	N/A
		Pitch	N/A
	Audio Language	VCP-10-B3	0002H : English 0003H : French 000AH : Spanish
	Reset Audio Settings	VCP-02-31 VCP-02-CB	<u>VCP-02-31</u> 0001H : Reset <u>VCP-02-CB</u> 0001H : All(=Factory Reset) 0002H : Picture 0003H : Adjust 0004H : Audio 0010H : Network
Channels	Auto Channel Scan		N/A
	Add / Skip Channels		N/A
	Favorite Channels		N/A
	Channel Labels		N/A
	Time Zone		N/A
Setup	OSD Settings	Language	VCP-00-68 0001H : English 0002H : German (*2) 0003H : French

				0004H : Spanish 0005H : Japanese (*2) 0006H : Italian (*2) 0009H : Russian (*2) 000EH : Chinese (*2) 000FH : Czech (*2)	
	Transparency		VCP-02-B8	0001H : Off(Opaque) 0002H : 30% 0003H : 50% 0004H : 70%	
	Information OSD		VCP-02-3D	0000H : Off 0005H : On	
Parental Controls	Enter Password □□□□	Block Unrated TV		N/A	---
		US	Movie Ratings	N/A	---
			US TV Ratings Lock	N/A	---
		Canadian	Canadian English	N/A	---
			Canadian French	N/A	---
		Change Password	Enter New Password	N/A	---
			Confirm New Password	N/A	---
		RRT5		N/A	---
		Reset RRT5		N/A	---
		Closed Caption	Caption Display		VCP-10-84

	Analog Captions	VCP-10-84	0000H : No mean 0001H : Off 0002H : CC1 0003H : CC2 0004H : CC3 0005H : CC4 0006H : TT1 0007H : TT2 0008H : TT3 0009H : TT4
	Digital Captions	VCP-10-A1	0000H : No mean 0001H : OFF 0002H : service1 0003H : service2 0004H : service3 0005H : service4 0006H : service5 0007H : service6
	Digital CC Settings	Style	N/A
		Size	N/A
		Font	N/A
		Text Color	N/A
		Text Opacity	N/A
		Background Color	N/A
		Background Opacity	N/A
		Edge Effect	N/A
	Edge Color	N/A	---
Power save settings	Energy Mode	N/A	---
	Power Save	N/A	---
	Quick Start	VCP-11-EA	0001H : DISABLE 0002H : ENABLE
	Auto Power Down	N/A	---
Auto Input Change	Auto Input Change	VCP-02-40	0000H : FIRST DETECT 0002H : NONE 0004H : CUSTOM DETECT
	Input 1	VCP-10-2E	0001H : VGA 0005H : Video1(AV) 000CH :

			DVD/HD1(VGA(YPbPr)) 0011H : HDMI1 0012H : HDMI2 0082H : HDMI3
	Input 2	VCP-10-2F	0001H : VGA 0005H : Video1(AV) 000CH : DVD/HD1(VGA(YPbPr)) 0011H : HDMI1 0012H : HDMI2 0082H : HDMI3
	Input 3	VCP-10-30	0001H : VGA 0005H : Video1(AV) 000CH : DVD/HD1(VGA(YPbPr)) 0011H : HDMI1 0012H : HDMI2 0082H : HDMI3
HDMI Settings	CEC	CEC	VCP-11-76 0001H : OFF 0002H : MODE1(ON)
		Auto Turn Off	VCP-11-77 0001H : NO 0002H : YES
		Audio Receiver	VCP-11-78 0001H : DISABLE 0002H : ENABLE
		Device list	VCP-11-79 0001H : NO 0002H : YES
	EDID	VCP-10-AA	0001H : EDID1 0002H : EDID2 0003H : EDID3
	Video Range	VCP-10-40	0001H : EXPANDED SIGNAL 0002H : RAW SIGNAL 0003H : AUTO
	HPD Delay	N/A	---
	VGA Options	VGA Mode	VCP-10-8E
Auto Adjust		VCP-00-1E	0001H : Execute
H.Position		VCP-00-20	0000H - 0064H (Left Side) - (Right Side)
V.Position		VCP-00-30	0000H - 0064H (Bottom Side) - (Top Side)

	Clock	VCP-00-0E	0000H - 0064H	
	Phase	VCP-00-3E	0000H - 0064H	
	H.Resolution	VCP-02-50	0000H - FFFFH (Low) - (High)	
	V.Resolution	VCP-02-51	0000H - FFFFH (Low) - (High)	
	Reset VGA Options	VCP-02-CB	0001H : All(=Factory Reset) 0002H : Picture 0003H : Adjust 0004H : Audio 0010H : Network	
Other settings	Input Labels	CTL-CA04-03 CTL-CA04-04 CTL-CA04-05	---	
	Key Lock Settings	VCP-00-FB	0000H : Unlock 0001H : Mode2 0002H : Mode1	
	IR Lock Settings	VCP-02-3F	0001H : Normal 0004H : Mode2 0005H : Mode1	
	Power supply	VCP-11-75	0001H : ON 0003H : OFF	
	LED Indicator	VCP-02-BE	0001H : ON 0002H : OFF	
	Mute Settings	VCP-11-E9	0001H : AUDIO 0002H : VIDEO 0003H : AUDIO&VIDEO	
	Thermal Management	Warning Message	VCP-11-ED	0000H : No mean 0001H : Warning Message Hide 0002H : Warning Message Display
		Shutdown	VCP-10-8A	0001H : OFF 0002H : ON
		Signal Information	N/A	---
Monitor Information	CTL-C217 CTL-CA02 CTL-C216	---		

			VCP-02-78 VCP-02-79	
	Factory Reset		VCP-02-CB	0001H : All(=Factory Reset) 0002H : Picture 0003H : Adjust 0004H : Audio 0010H : Network
Control Settings	Control Interface		VCP-10-3E	0001H : RS-232C 0002H : LAN
	Network Settings	DHCP	N/A	---
		IP ADDRESS:	N/A	---
		SUBNET MASK:	N/A	---
		DEFAULT GATEWAY:	N/A	---
		DNS PRIMARY:	N/A	---
		DNS SECONDARY:	N/A	---
		MAC ADDRESS:	N/A	---
		SAVE	N/A	---
	Monitor ID		VCP-02-3E	0001H - 0064H
Reset Network Settings		VCP-02-CB	0001H : All(=Factory Reset) 0002H : Picture 0003H : Adjust 0004H : Audio 0010H : Network	
Media Player	USB Demo Mode		N/A	---
	UnPlug USB Device		N/A	---
	Caution Window		N/A	---
Schedule	Sleep Timer		N/A	---
	Current Time settings		N/A	---
	Schedule settings	Power On	N/A	---
			N/A	---
		Power Off	N/A	---
			N/A	---
Input Select				
Input Select	TV		VCP-00-60	0000H : No mean 0001H : VGA(RGB)

HDMI1	0005H : Video1(AV)
HDMI2	0009H : Tuner1(TV) (*1)
HDMI3	000CH : DVD/HD1 (VGA(YPbPr))
VGA(RGB)	0011H : HDMI1
VGA(YPbPr)	0012H : HDMI2
AV	0082H : HDMI3
Media Player	0087H : MP(Media Player)

(*1) E328_TV / E438_TV / E498_TV / E558_TV / E658_TV model supported

(*2) E328_TV / E438_TV / E498_TV / E558_TV / E658_TV model not supported

(*3) E328_TV / E328_PD / E328_JP model not supported