

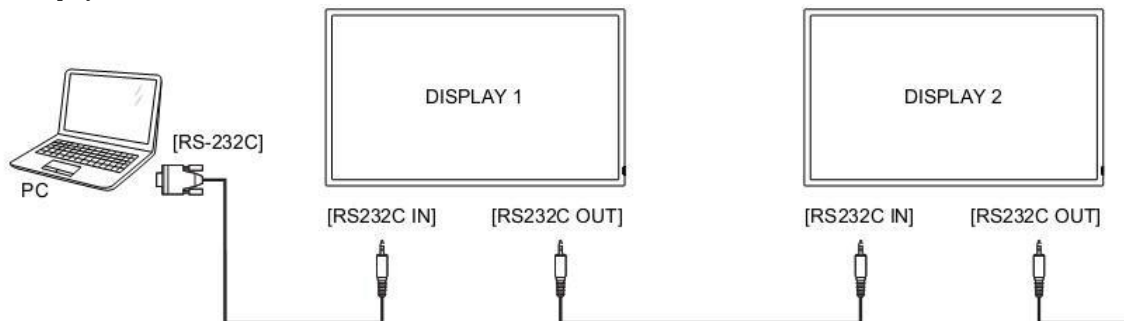
RS232 Command List

QD-75/QD-84/QD-98

1. INTRODUCTION

1.1 Purpose

The purpose of this document is to explain in detail the commands and steps that can be used to control a public display via RS232C.



1.2 Definitions, Abbreviations and Acronyms

PBS	Professional Business Solutions
RC	Remote Control
ACK	Acknowledge
NACK	Not Acknowledge
NAV	Not Available
ID	Identification
0xXX	Hexadecimal notation

2. COMMAND PACKET FORMAT

2.1 Physical Specifications

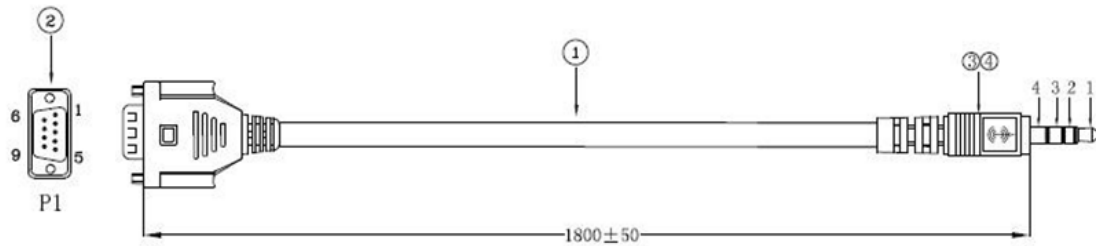
1. Baud Rate : 9600
2. Data bits: 8
3. Parity : None
4. Stop Bit : 1
5. Flow Control : None
6. The Pin Assignments for DB9 male connector:
Male D-Sub 9-Pin (outside view)



Pin #	Signal	Remark
1	NC	
2	RXD	Input to LCD Monitor
3	TXD	Output from LCD Monitor
4	NC	
5	GND	
6	NC	
7	NC	
8	NC	
9	NC	
frame	GND	

Digital Signage displays use RXD, TXD and GND pins for RS-232C control. For RS-232C cable, the reverse type cable should be used.

Pin assignment:



2.2 Communication Procedure

Control commands can be sent from a host controller via the RS232 connection. A new command should not be sent until the previous command is acknowledged. However, if a response is not received within 500 milliseconds a retry may be triggered. Every valid command receives an ACK. A command that is valid but not supported in the current implementation will be responded to with a NAV (Not Available). If the command buffer is corrupt (transmission errors) the command will be responded to with a NACK. The display operates according to the received command. If the command is a valid "Get" command, the display responds with the requested info. If the command is a valid "Set" command allowed, the display performs the requested operation.

Figure1 and Figure2 explain the mechanism of the Get and Set commands.

Note: For LAN control, the port number is 5000.

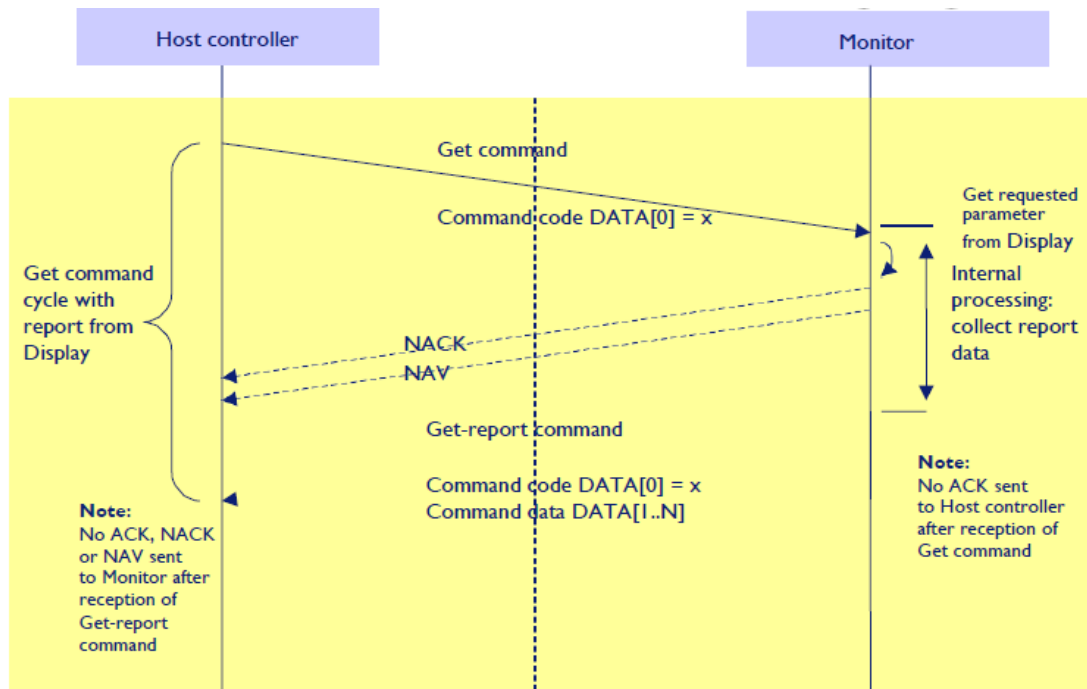


Figure 1: Explanation of mechanism of Get Command.

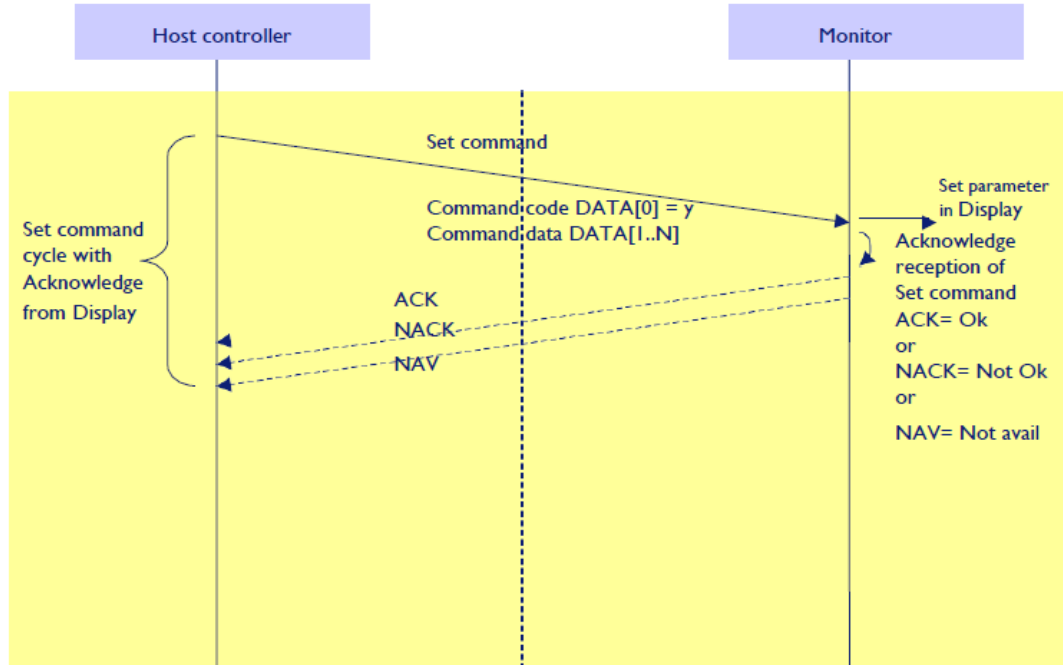


Figure 2: Explanation of mechanism of Set Command.

2.3 Command Format

The RS232 packet format:

Header	Monitor ID	Category	Code0	Code1	Length	Data Control	Data[0]	...	Data[N]	Checksum
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In detail:

Number of Field	Name of Field	Description
Byte 1	Header	Header = 0xA6
Byte 2	Monitor ID	Monitor ID Range : 1 ~ 255
Byte 3	Category	Category = 0x00 (fixed)
Byte 4	Code0 (Page)	Page = 0x00 (fixed)
Byte 5	Code1 (Function)	
Byte 6	Length	Length has to be calculated in the following way: Length = N + 3
Byte 7	Data Control	Data Control = 0x01 (fixed)
Byte 8 ~ Byte 44	Data[0] ~ Data[N]	This field can be also empty. If not empty then the range of Data Size, N = 0 to 36.
Last Byte	Checksum	Checksum. Range = 0 to 255 (0xFF). Algorithm: The EXCLUSIVE-OR (XOR) of all bytes in the message except the checksum itself. Checksum = [Header] XOR [Monitor ID] XOR ... DATA[0] ... XOR DATA[N]

MESSAGES - SYSTEM

2.4 Communication Control

This defines the feedback command from monitor to host controller when it receives the display command from the host controller, depending on the commands availability, the command reported back to host controller can be one of the ACK(0x00), NACK(0x03) or NAV(0x04.)

Note: there is no reply message when the wrong ID address is being used.

2.4.1 Message-Report

Number of Field	Name of Field	Description
Byte 1	Header	Header = 0x21
Byte 2	Monitor ID	Monitor ID Range : 1 ~ 255
Byte 3	Category	Category = 0x00 (fixed)
Byte 4	Code0 (Page)	Page = 0x00 (fixed)
Byte 5	Length	Length = 0x04
Byte 6	Data Control	Data Control = 0x01 (fixed)
Byte 7	Command	0x00(Communication Control)
Byte 8	Status	0x00: Completed Normal response. 0x01: Limit Over The packets was received normally, but the data value was over the upper limit. 0x02: Limit Over The packets was received normally, but the data value was over the lower limit. 0x03: Command canceled The packet is received normally but either the value of data is incorrect or request is not permitted for the current host value. 0x04: Parse Error Received not defined format data or check sum Error.
Byte 9	Checksum	Check Sum The total from Byte1 to Byte8 calculated by XOR

3 Platform and Version Labels , Model Number, FW Version, Build date

3.1 Platform and Version Labels

This command provides the SICP protocol version and the display Software version to the host controller.

3.1.1 Message-Get

Bytes	Bytes Description	Bits	Description
DATA[0]	0xA2 = Platform and Version Labels - Get		Request the SICP version.
DATA[1]	Which Label		0x00 = Get SICP implementation version 0x01 = Get the platform label 0x02 = Get the platform version (Ex: Eagle 1.2, Eagle 1.3, Phoenix 1.0, Himalaya, Andes...)

Example: Get version (Display address 01)

Header	Monitor ID	Category	Code0	Code1	Length	Data Control	Data[0]	Data[1]	Checksum
0xA6	0x01	0x00	0x00	0x00	0x04	0x01	0xA2	0x00	0x00

3.1.2 Message-Report

Bytes	Bytes Description	Bits	Description
DATA[0]	0xA2 = Platform and Version Label – Report		Request the internal Hardware version.
DATA[1] to DATA[N]	Character[0] to Character[N-1]		36 (0x24) characters maximum. No. of characters, N = 1 to 36 (0x24). The actual size determines the value of the message size byte.

3.1.3 Message-Get (Model Number, FW Version, Build date)

Bytes	Bytes Description	Bits	Description
DATA[0]	0xA1 = Get Model Number & FW version of device with Date		Request the Model Number and FW version of the device
DATA[1] to DATA[N]	Codes to request		0x00 = Model Number 0x01 = FW version 0x02 = Build Date

3.1.4 Message-Report (Model Number, FW Version, Build date)

Bytes	Bytes Description	Bits	Description
DATA[0]	0xA1 = Report - Model Number & FW version of device with Date		Request the Model number, FW version, FW build date
DATA[1] to DATA[N]	Character[0] to Character[N-1]		36 (0x24) characters maximum. No. of characters, N = 1 to 36 (0x24). The actual size determines the value of the message size byte.

4 MESSAGES - GENERAL

4.1 Power state

This command is used to set/get the power state as it is defined as below.

4.1.1 Message-Get

Bytes	Bytes Description	Bits	Description
DATA[0]	0x19 = Power state - Get		Command requests the display to report its current power state

Example: (Display address 01)

Header	Monitor ID	Category	Code0	Code1	Length	Data Control	Data[0]	Checksum
0xA6	0x01	0x00	0x00	0x00	0x03	0x01	0x19	0xBC

4.1.2 Message-Report

Bytes	Bytes Description	Bits	Description
DATA[0]	0x19 = Power State - Report		Command reports Power state
DATA[1]	Power State		0x01 = Power Off 0x02 = On

Example: Power State On (Display address 01)

Header	Monitor ID	Category	Page	Length	Data Control	Data[0]	Data[1]	Checksum
0x21	0x01	0x00	0x00	0x04	0x01	0x19	0x02	0x3E

4.1.3 Message-Set

Bytes	Bytes Description	Bits	Description
DATA[0]	0x18 = Power state - Set		Command to change the Power state of the display
DATA[1]	Power state		0x01 = Power Off 0x02 = On

Example: Power State Deep Sleep (Display address 01)

Header	Monitor ID	Category	Code0	Code1	Length	Data Control	Data[0]	Data[1]	Checksum
0xA6	0x01	0x00	0x00	0x00	0x04	0x01	0x18	0x01	0xBB

4.2 Lock Functions for IR-Remote Control

The following commands separately are used to lock/unlock the Remote Control and Keypad.

4.2.1 Message-Get

Bytes	Bytes Description	Bits	Description
DATA[0]	0x1D = Get - Lock Status – IR – Remote Control		Get unlock all /lock all /lock all but power/lock all but volume/ Primary/Secondary status

Example: (Display address 01)

Header	Monitor ID	Category	Code0	Code1	Length	Data Control	Data[0]	Checksum
0xA6	0x01	0x00	0x00	0x00	0x03	0x01	0x1D	0xB8

4.2.2 Message-Report

Bytes	Bytes Description	Bits	Description
DATA[0]	0x1D = Report - Lock Status – IR – Remote Control		Report from display of lock/unlock state
DATA[1]	Status indicator byte for Remote Control		0x01 = Unlock 0x02 = Lock

Example: Lock Keyboard and unlocked Remote Control (Display address 01)

Header	Monitor ID	Category	Page	Length	Data Control	Data[0]	Data[1]	Checksum
0x21	0x01	0x00	0x00	0x04	0x01	0x1D	0x01	0x39

4.2.3 Message-Set

Bytes	Bytes Description	Bits	Description
DATA[0]	0x1C = Set - Lock State – IR – Remote Control		Set the lock/unlock state
DATA[1]	Status indicator byte for Remote Control		0x01 = Unlock 0x02 = Lock

Example: Unlock local remote control (Display address 01)

Header	Monitor ID	Category	Code0	Code1	Length	Data Control	Data[0]	Data[1]	Checksum
0xA6	0x01	0x00	0x00	0x00	0x04	0x01	0x1C	0x01	0xBF

4.3 Power state at Cold Start

Command is used to set the cold start power state, the cold start power state are updated and stored by this command.

4.3.1 Message-Get

Bytes	Bytes Description	Bits	Description
DATA[0]	0xA4 = Power at Cold Start - Get		Get Power state at Cold Start state

Example: (Display address 01)

Header	Monitor ID	Category	Code0	Code1	Length	Data Control	Data[0]	Checksum
0xA6	0x01	0x00	0x00	0x00	0x03	0x01	0xA4	0x01

4.3.2 Message-Report

Bytes	Bytes Description	Bits	Description
DATA[0]	0xA4 = Power at Cold Start – Report		Report from Power state at Cold Start state
DATA[1]	Power at Cold Start		0x00 = Power Off 0x01 = Forced On 0x02 = Last Status

Example: Report status of Forced On for power at cold start. (Display address 01)

Header	Monitor ID	Category	Page	Length	Data Control	Data[0]	Data[1]	Checksum
0x21	0x01	0x00	0x00	0x04	0x01	0xA4	0x01	0x80

4.3.3 Message-Set

Bytes	Bytes Description	Bits	Description
DATA[0]	0xA3 = Power at Cold Start - Set		Set Power state at Cold Start
DATA[1]	Power state at Cold Start		0x00 = Power Off 0x01 = Forced On 0x02 = Last Status

The value is stored and it is applied only when the display starts up from cold start power state the next time:
Power Off:

The monitor will be automatically switched to Power Off mode (even if the last status was on) whenever the mains power is turned on or resumed after the power interruption.

Forced On:

The monitor will be automatically switched to ON mode whenever the mains power is turned on or resumed after the power interruption.

Last Status:

The monitor will be automatically switched to the last status (either Power Off or On) whenever the mains power is turned on or resumed after the power interruption.

Example: Set Power state at cold start to last status (Display address 01)

Header	Monitor ID	Category	Code0	Code1	Length	Data Control	Data[0]	Data[1]	Checksum
0xA6	0x01	0x00	0x00	0x00	0x04	0x01	0xA3	0x02	0x03

5. MESSAGES - INPUT SOURCES

5.1 Input Source

This command is used to change the current input source.

5.1.1 Message-Set

Bytes	Bytes Description	Bits	Description
DATA[0]	0xAC = Input Source – Set		Command requests the display to set the current input source
DATA[1]	Input Source Type		0x01 = VIDEO 0x03 = COMPONENT 0x05 = VGA 0x06 = HDMI 2 0x0A = Display Port 0x0B= Card OPS 0x0C = USB 0x0D= HDMI 0x0E= DVI-D 0x0F = HDMI3
DATA[2]	Reserved		Reserved
DATA[3]	OSD Style		Source info. Display Style 0 = Reserved (V) 1 = Source label
DATA[4]	Reserved		Reserved

Example: Set on DVI-D (Display address 01)

Header	Monitor ID	Category	Code0	Code1	Length	Data Control	Data[0]	Data[1]	Data[2]	Data[3]
0xA6	0x01	0x00	0x00	0x00	0x07	0x01	0xAC	0x0E	0x00	0x00

Data[4]	Checksum
0x00	0x03

5.2 Current Source

5.2.1 Message-Get

Bytes	Bytes Description	Bits	Description
DATA[0]	0xAD = Current Source – Get		Command requests the display to report the current input source in use.

Example: (Display address 01)

Header	Monitor ID	Category	Code0	Code1	Length	Data Control	Data[0]	Checksum
0xA6	0x01	0x00	0x00	0x00	0x03	0x01	0xAD	0x08

5.2.2 Message-Report

Bytes	Bytes Description	Bits	Description
DATA[0]	0xAD = Current Source – Report		Command reports to the host controller the current input source in use by the display.
DATA[1]	Input Source Type/Number		0x01 = VIDEO 0x03 = COMPONENT 0x05 = VGA 0x06 = HDMI 2 0x0A = Display Port 0x0B= Card OPS 0x0C = USB 0x0D= HDMI 0x0E= DVI-D 0x0F = HDMI3
DATA[2]	Reserved		Reserved
DATA[3]	OSD Style		Source info. Display Style 0 = Reserved (V) 1 = Source label
DATA[4]	Reserved		Reserved

Example: Current Input Source: DVI-D (Display address 01)

Header	Monitor ID	Category	Page	Length	Data Control	Data[0]	Data[1]	Data[2]	Data[3]
0x21	0x01	0x00	0x00	0x07	0x01	0xAD	0x0E	0x00	0x00

Data[4]	Checksum
0x00	0x85

6. MESSAGES - VIDEO

6.1 Video Parameters

The following commands are used to get/set video parameters as it is defined below.

6.1.1 Message-Get

Bytes	Bytes Description	Bits	Description
DATA[0]	0x33 = Video Parameters – Get		Command requests the display to report its current video parameters.

Example: (Display address 01)

Header	Monitor ID	Category	Code0	Code1	Length	Data Control	Data[0]	Checksum
0xA6	0x01	0x00	0x00	0x00	0x03	0x01	0x33	0x96

6.1.2 Message-Report

Bytes	Bytes Description	Bits	Description
DATA[0]	0x33 = Video Parameters – Report		Command reports to the host controller the current video parameters of the display.
DATA[1]	Brightness.		0 to 100% (0x00~0x64) of the user selectable range of the display.
DATA[2]	Color.		0 to 100% (0x00~0x64) of the user selectable range of the display.
DATA[3]	Contrast.		0 to 100% (0x00~0x64) of the user selectable range of the display.
DATA[4]	Sharpness.		0 to 100% (0x00~0x64) of the user selectable range of the display.
DATA[5]	Tint (Hue)		0 to 100% (0x00~0x64) of the user selectable range of the display.
DATA[6]	Black Level		0 to 100% (0x00~0x64) of the user selectable range of the display.
DATA[7]	Gamma Selection		0x01= Native, 0x02 = S gamma, 0x03 = 2.2, 0x04 = 2.4,

Example: All video parameters are set to 55 % (0x37) and Gamma Curve is set to 2.2 (Display address 01)

Header	Monitor ID	Category	Page	Length	Data Control	Data[0]	Data[1]	Data[2]	Data[3]	Data[4]
0x21	0x01	0x00	0x00	0x0A	0x01	0x33	0x37	0x37	0x37	0x37

Data[5]	Data[6]	Data[7]	Checksum
0x37	0x37	0x03	0x1B

6.1.3 Message-Set

Bytes	Bytes Description	Bits	Description
DATA[0]	0x32 = Video Parameters – Set		Command to change the current video parameters
DATA[1]	Brightness.		0 to 100% (0x00~0x64) of the user selectable range of the display.
DATA[2]	Color.		0 to 100% (0x00~0x64) of the user selectable range of the display.
DATA[3]	Contrast.		0 to 100% (0x00~0x64) of the user selectable range of the display.
DATA[4]	Sharpness.		0 to 100% (0x00~0x64) of the user selectable range of the display.
DATA[5]	Tint (Hue)		0 to 100% (0x00~0x64) of the user selectable range of the display.
DATA[6]	Black Level		0 to 100% (0x00~0x64) of the user selectable range of the display.
DATA[7]	Gamma Selection		0x01= Native, 0x02 = S gamma, 0x03 = 2.2, 0x04 = 2.4,

Example: Set all video parameters to 0x37 (55 %) (Display address 01)

Header	Monitor ID	Catego	Code0	Code1	Length	Data control	Data[0]	Data[1]	Data[2]	Data[3]
0xA6	0x01	0x00	0x00	0x00	0x0A	0x01	0x32	0x37	0x37	0x37

Data[4]	Data[5]	Data[6]	Data[7]	Checksum
0x37	0x37	0x37	0x03	0x9D

6.2 Color Temperature

6.2.1 Message-Get

Bytes	Bytes Description	Bits	Description
DATA[0]	0x35 = Color Temperature – Get		Command requests the display to report its current color temperature.

Example: (Display address 01)

Header	Monitor ID	Category	Code0	Code1	Length	Data Control	Data[0]	Checksum
0xA6	0x01	0x00	0x00	0x00	0x03	0x01	0x35	0x90

6.2.2 Message-Report

Bytes	Bytes Description	Bits	Description
DATA[0]	0x35 = Color Temperature – Report		Command reports to the host controller the current color temperature of the display.
DATA[1]	Color temperature		0x00 = User 1 0x01 = Nature 0x03 = 10000K 0x04 = 9300K 0x05 = 7500K 0x06 = 6500K 0x09 = 5000K 0x0A = 4000K 0x0D = 3000K

Example: The current color temperature is set to Nature (Display address 01)

Header	Monitor ID	Category	Page	Length	Data Control	Data[0]	Data[1]	Checksum
0x21	0x01	0x00	0x00	0x04	0x01	0x35	0x01	0x11

6.2.3 Message-Set

Bytes	Bytes Description	Bits	Description
DATA[0]	0x34 = Color Temperature – Report		Command reports to the host controller the current color temperature of the display.
DATA[1]	Color temperature		0x00 = User 1 0x01 = Nature 0x03 = 10000K 0x04 = 9300K 0x05 = 7500K 0x06 = 6500K 0x09 = 5000K 0x0A = 4000K 0x0D = 3000K

Example: The current color temperature is set to Nature (Display address 01)

Header	Monitor ID	Category	Code0	Code1	Length	Data Control	Data[0]	Data[1]	Checksum
0xA6	0x01	0x00	0x00	0x00	0x04	0x01	0x34	0x01	0x97

6.3 Color Parameter

6.3.1 Message-Get

The following commands are used to get/set the color parameters for **color temperature**.

Bytes	Bytes Description	Bits	Description
DATA[0]	0x37 = Color Parameters – Get		Command requests the display to report its current color parameters.

Example: (Display address 01)

Header	Monitor ID	Category	Code0	Code1	Length	Data Control	Data[0]	Checksum
0xA6	0x01	0x00	0x00	0x00	0x03	0x01	0x37	0x92

6.3.2 Message-Report

Bytes	Bytes Description	Bits	Description
DATA[0]	0x37 = Color Parameters – Report		Command reports to the host controller the current video parameters of the display.
DATA[1]	Red color gain value		0 to 255 (0x00~0xFF) of the user selectable range of the display.
DATA[2]	Green color gain value		0 to 255 (0x00~0xFF) of the user selectable range of the display.
DATA[3]	Blue color gain value		0 to 255 (0x00~0xFF) of the user selectable range of the display.

Example: All color parameters are set to 255 (0xFF) (Display address 01)

Header	Monitor ID	Category	Page	Length	Data Control	Data[0]	Data[1]	Data[2]	Data[3]	Checksum
0x21	0x01	0x00	0x00	0x06	0x01	0x37	0xFF	0xFF	0xFF	0xEF

6.3.3 Message-Set

Bytes	Bytes Description	Bits	Description
DATA[0]	0x36 = Color Parameters – Report		Command reports to the host controller the current video parameters of the display.
DATA[1]	Red color gain value		0 to 255 (0x00~0xFF) of the user selectable range of the display.
DATA[2]	Green color gain value		0 to 255 (0x00~0xFF) of the user selectable range of the display.
DATA[3]	Blue color gain value		0 to 255 (0x00~0xFF) of the user selectable range of the display.

Example: All color parameters are set to 255 (0xFF) (Display address 01)

Header	Monitor ID	Category	Code0	Code1	Length	Data Control	Data[0]	Data[1]	Data[2]	Data[3]	Checksum
0xA6	0x01	0x00	0x00	0x00	0x06	0x01	0x36	0xFF	0xFF	0xFF	0x69

6.4 Picture Format

This command is used to control the display screen format.

6.4.1 Message-Get

Bytes	Bytes Description	Bits	Description
DATA[0]	0x3B = Picture Format – Get		Command requests the display to report its current picture format

Example: (Display address 01)

Header	Monitor ID	Category	Code0	Code1	Length	Data Control	Data[0]	Checksum
0xA6	0x01	0x00	0x00	0x00	0x03	0x01	0x3B	0x9E

6.4.2 Message-Report

Bytes	Bytes Description	Bits	Description
DATA[0]	0x3B = Picture Format – Report		Command report to the host controller the current picture format of the display.
DATA[1]	Picture Format*	Bit 7..4	Not used.
		Bit 3..0	Picture Format. 0x00 = Normal 0x01 = Custom 0x02 = Real 0x03 = Full 0x04 = 21:9

* For further explanations, please see section 6.2.3 – Message-Set.

Example: Current Picture Format is Widescreen (Full) on Full Display (Display address 01)

Header	Monitor ID	Category	Page	Length	Data Control	Data[0]	Data[1]	Checksum
0x21	0x01	0x00	0x00	0x04	0x01	0x3B	0x03	0x1D

6.4.3 Message-Set

Bytes	Bytes Description	Bits	Description
DATA[0]	0x3A = Picture Format – Set		Command requests the display to set the specified picture format
DATA[1]	Picture Format	Bit 7..4	Not used.
		Bit 3..0	Picture Format. 0x00 = Normal 0x01 = Custom 0x02 = Real 0x03 = Full 0x04 = 21:9

* For further explanations, please see section 6.2.3 – Message-Set.

Example: Set Picture Format to Widescreen (Full) on Full Display (Display address 01)

Header	Monitor ID	Category	Code0	Code1	Length	Data Control	Data[0]	Data[1]	Checksum
0xA6	0x01	0x00	0x00	0x00	0x04	0x01	0x3A	0x03	0x9B

6.5 Picture-in-Picture (PIP)

This command is used to control PIP on/off with different locations.

6.5.1 Message-Get

Bytes	Bytes Description	Bits	Description
DATA[0]	0x3D = Picture-in-Picture – Get		Command requests the display to get the specified PIP setting.

Example: Get PIP setting (Display address 01)

Header	Monitor ID	Category	Code0	Code1	Length	Data Control	Data[0]	Checksum
0xA6	0x01	0x00	0x00	0x00	0x03	0x01	0x3D	0x98

6.5.2 Message-Report

Bytes	Bytes Description	Bits	Description
DATA[0]	0x3D = Picture-in-Picture – Report		Command reports to the host controller the current PIP settings.
DATA[1]	Picture-in-Picture	Bit 7..1 Bit 0	(reserved, default 0) PIP on/off 0 = off 1 = on Note: The size of the PIP window is platform-dependent. If the size is other than half-screen (i.e. Picture-by-Picture), DATA [2].Bit1.0 may be used to specify the window position.
DATA[2]	Additional PIP parameters	Bit 7..3 Bit 2..0	(reserved, default 0) Position of the PIP window: 0x00 = 00 = position 0 (typically bottom-left) 0x01 = 01 = position 1 (typically top-left) 0x02 = 10 = position 2 (typically top-right) 0x03 = 11 = position 3 (typically bottom-right) 0x04 = Others.
DATA[3]			(reserved, default 0)
DATA[4]			(reserved, default 0)

Example: Current PIP setting is enabling and located at position 2 (Display address 01)

Header	Monitor ID	Category	Page	Length	Data Control	Data[0]	Data[1]	Data[2]
0x21	0x01	0x00	0x00	0x07	0x01	0x3D	0x01	0x02

Data[3]	Data[4]	Checksum
0x00	0x00	0x18

6.5.3 Message-Set

Bytes	Bytes Description	Bits	Description
DATA[0]	0x3C = Picture-in-Picture – Set		Command requests the display to set the specified PIP settings.
DATA[1]	Picture-in-Picture	Bit 7..1	(reserved, default 0)
		Bit 0	PIP on/off 0 = off 1 = on Note: The size of the PIP window is platform-dependent. If the size is other than half-screen (i.e. Picture-by-Picture), DATA[2].Bit1.0 may be used to specify the window position.
DATA[2]	Additional PIP parameters	Bit 7..2	(reserved, default 0)
		Bit 1..0	Position of the PIP window: 0x00 = 00 = position 0 (typically bottom-left) 0x01 = 01 = position 1 (typically top-left) 0x02 = 10 = position 2 (typically top-right) 0x03 = 11 = position 3 (typically bottom-right)
DATA[3]			(reserved, default 0)
DATA[4]			(reserved, default 0)

Example: Set PIP ON, top-right (Display address 01)

Header	Monitor ID	Category	Code0	Code1	Length	Data Control	Data[0]	Data[1]	Data[2]
0xA6	0x01	0x00	0x00	0x00	0x07	0x01	0x3C	0x01	0x02

Data[3]	Data[4]	Checksum
0x00	0x00	0x9E

6.6 PIP Source

This command is used to control the PIP source settings for each display quadrant on the screen.
Example: If display resolution is 4K2K, user can select input source for each Full HD quadrant.

Q 1 (main)	Q 2
Q 3	Q 4

PIP Set/Get can only change input source for Q2, Q3, and Q4 individually by following the commands below.

6.6.1 Message-Get

Bytes	Bytes Description	Bits	Description
DATA[0]	0x85 = PIP Source – Get		Command requests the display to report its current PIP source setting.

This command is used to get the source for the PIP window when PIP feature is activated.

Example: Get PIP source setting (Display address 01)

Header	Monitor ID	Category	Code0	Code1	Length	Data Control	Data[0]	Checksum
0xA6	0x01	0x00	0x00	0x00	0x03	0x01	0x85	0x20

6.6.2 Message-Report

Bytes	Bytes Description	Bits	Description
DATA[0]	0x85 = PIP Source – Get		Command requests the display to report its current PIP source setting.
DATA[1]	Source Type		0xFD = Input Source (normal state) 0xFE = Reserved for smartcard
DATA[2]	Q2 Source Number		0x01 = VIDEO 0x03 = COMPONENT 0x05 = VGA 0x06 = HDMI2 0x0A = DisplayPort 0x0B = CardOPS 0x0C = USB 0x0D = HDMI1 0x0E = DVI-D 0x0F = HDMI3
DATA[3]	Q3 Source Number		0x01 = VIDEO 0x03 = COMPONENT 0x05 = VGA 0x06 = HDMI2 0x0A = DisplayPort 0x0B = CardOPS 0x0C = USB 0x0D = HDMI1 0x0E = DVI-D 0x0F = HDMI3
DATA[4]	Q4 Source Number		0x01 = VIDEO 0x03 = COMPONENT 0x05 = VGA 0x06 = HDMI2 0x0A = DisplayPort 0x0B = CardOPS 0x0C = USB 0x0D = HDMI1 0x0E = DVI-D 0x0F = HDMI3

Example: Get PIP source report (Display address 01, Q2 Video, Q3 VGA, Q4 DVI-D)

Header	Monitor ID	Category	Page	Length	Data Control	Data[0]	Data[1]	Data[2]	Data[3]	Data[4]	Checksum
0x21	0x01	0x00	0x00	0x07	0x01	0x85	0xFD	0x01	0x05	0x0E	0x54

6.6.3 Message-Set

This is the PIP source selection command

Bytes	Bytes Description	Bits	Description
DATA[0]	0x84 = PIP Source – Set		Command requests the display to set the specified PIP source.
DATA[1]	Source Type		0xFD = Input Source (normal state) 0xFE = Reserved for smartcard
DATA[2]	Q2 Source Number		0x01 = VIDEO 0x03 = COMPONENT 0x05 = VGA 0x06 = HDMI2 0x0A = DisplayPort 0x0B = CardOPS 0x0C = USB 0x0D = HDMI1 0x0E = DVI-D 0x0F = HDMI3
DATA[3]	Q3 Source Number		0x01 = VIDEO 0x03 = COMPONENT 0x05 = VGA 0x06 = HDMI2 0x0A = DisplayPort 0x0B = CardOPS 0x0C = USB 0x0D = HDMI1 0x0E = DVI-D 0x0F = HDMI3
DATA[4]	Q4 Source Number		0x01 = VIDEO 0x03 = COMPONENT 0x05 = VGA 0x06 = HDMI2 0x0A = DisplayPort 0x0B = CardOPS 0x0C = USB 0x0D = HDMI1 0x0E = DVI-D 0x0F = HDMI3

This command is used to select the source for the PIP window before the PIP feature is activated.

Example: Set source PIP (Display address 01, Q2 Video, Q3 VGA, Q4 DVI-D)

Header	Monitor ID	Category	Code0	Code1	Length	Data Control	Data[0]	Data[1]	Data[2]	Data[3]	Data[4]	Checksum
0xA6	0x01	0x00	0x00	0x00	0x07	0x01	0x84	0xFD	0x01	0x05	0x0E	0xD2

7. MESSAGES - AUDIO

7.1 Volume

This command is used to set/get the Volume as it is defined as below.

7.1.1 Message-Get

Bytes	Bytes Description	Bits	Description
DATA[0]	0x45 = Volume – Get		Command requests the display to report its current Volume level

The interface to set Software must be such that they also modify the variables representing these current parameters.

To mute the display, send Volume = 0. This command does not overwrite the system mute status of the display.

Example: (Display address 01)

Header	Monitor ID	Category	Code0	Code1	Length	Data Control	Data[0]	Checksum
0xA6	0x01	0x00	0x00	0x00	0x03	0x01	0x45	0xE0

7.1.2 Message-Report

Bytes	Bytes Description	Bits	Description
DATA[0]	0x45 = Volume – Report		Command reports current Volume level
DATA[1]	Volume.		0 to 100% (0x00~0x64) of the user selectable range of the display.

Example: Current Display settings: Volume: 77% (0x4D) (Display address 01)

Header	Monitor ID	Category	Page	Length	Data Control	Data[0]	Data[1]	Checksum
0x21	0x01	0x00	0x00	0x04	0x01	0x45	0x4D	0x2D

7.1.3 Message-Set

Bytes	Bytes Description	Bits	Description
DATA[0]	0x44 = Volume – Set		
DATA[1]	Volume.		0 to 100% (0x00~0x64) of the user selectable range of the display.

Example: Set the Display Volume to 77% (0x4D) (Display address 01)

Header	Monitor ID	Category	Code0	Code1	Length	Data Control	Data[0]	Data[1]	Checksum
0xA6	0x01	0x00	0x00	0x00	0x04	0x01	0x44	0x4D	0xAB

7.2 Volume Limits

This command is used to set the volume limit (minimum, maximum and switch on volume).

7.2.1 Message-Set

Bytes	Bytes Description	Bits	Description
DATA[0]	0xB8 = Volume Limits- Set		The 3 values must conform to the rule : Min <= Switch On <= Max
DATA[1]	Minimum Volume		0 to 100% (0x00~0x64) of the user selectable range of the display.
DATA[2]	Maximum Volume		0 to 100% (0x00~0x64) of the user selectable range of the display.
DATA[3]	Switch On Volume		0 to 100% (0x00~0x64) of the user selectable range of the display.

Example: Set the Display to the following: 10% (0x0A), 77% (0x4D), 50% (0x32) (Display address 01)

Header	Monitor ID	Category	Code0	Code1	Length	Data Control	Data[0]	Data[1]	Data[2]	Data[3]	Checksum
0xA6	0x01	0x00	0x00	0x00	0x06	0x01	0xB8	0x0A	0x4D	0x32	0x6D

7.3 Audio Parameters

This command is used to set/get the audio parameters as it is defined as below.

7.3.1 Message-Get

Bytes	Bytes Description	Bits	Description
DATA[0]	0x43 = Audio Parameters – Get		Command requests the display to report its current audio parameters

Example: (Display address 01)

Header	Monitor ID	Category	Code0	Code1	Length	Data Control	Data[0]	Checksum
0xA6	0x01	0x00	0x00	0x00	0x03	0x01	0x43	0xE6

7.3.2 Message-Report

Bytes	Bytes Description	Bits	Description
DATA[0]	0x43 = Audio Parameters – Report		Command reports Audio Parameters
DATA[1]	Treble.		0 to 100% (0x00~0x64) of the user selectable range of the display.
DATA[2]	Bass.		0 to 100% (0x00~0x64) of the user selectable range of the display.

Example: Current Display settings: Treble:80% (0x50) , Bass:80% (0x50) (Display address 01)

Header	Monitor ID	Category	Page	Length	Data Control	Data[0]	Data[1]	Data[2]	Checksum
0x21	0x01	0x00	0x00	0x05	0x01	0x43	0x50	0x50	0x67

7.3.3 Message-Set

Bytes	Bytes Description	Bits	Description
DATA[0]	0x42 = Audio Parameters – Set		Command to change the Audio Parameters of the display
DATA[1]	Treble.		0 to 100% (0x00~0x64) of the user selectable range of the display.
DATA[2]	Bass.		0 to 100% (0x00~0x64) of the user selectable range of the display.

The interface to set Software must be such that they modify the variables representing these current parameters

Example: Set the Display to the following: Treble:77% (0x4D) , Bass:77% (0x4D) (Display address 01)

Header	Monitor ID	Category	Code0	Code1	Length	Data Control	Data[0]	Data[1]	Data[2]	Checksum
0xA6	0x01	0x00	0x00	0x00	0x05	0x01	0x42	0x4D	0x4D	0xE1

8. MISCELLANEOUS

8.1 Operating Hours

The command is used to record the working hours of the display.

8.1.1 Message-Get

Bytes	Bytes Description	Bits	Description
DATA[0]	0x0F = Misc Info - Get		Command requests the display to report from miscellaneous information parameters
DATA[1]	Item		0x02 = Operating Hours (All other values are reserved)

Example: (Display address 01)

Header	Monitor ID	Category	Code0	Code1	Length	Data Control	Data[0]	Data[1]	Checksum
0xA6	0x01	0x00	0x00	0x00	0x04	0x01	0x0F	0x02	0xAF

8.1.2 Message-Report

Bytes	Bytes Description	Bits	Description
DATA[0]	0x0F = Misc Info – Report		Command reports current Operating Hours
DATA[1] to DATA[2]	Operating Hours		DATA[1] and DATA[2] form the MSByte and LSByte, respectively, of the 16-bit-wide Operational Hours value.

Example: Current Display Operation Hours counter value (Display address 01)

Header	Monitor ID	Category	Page	Length	Data Control	Data[0]	Data[1]	Data[2]	Checksum
0x21	0x01	0x00	0x00	0x05	0x01	0x0F	0x4D	0x00	0x66

8.2 Auto Adjust

This command works for VGA (host controller) video auto adjust.

8.2.1 Message-Set

Bytes	Bytes Description	Bits	Description
DATA[0]	0x70 = Video Alignment – Set		Command requests the display to make auto adjustment on VGA Input source.
DATA[1]	Item		0x40 = Auto Adjust (* All other values are reserved *)
DATA[2]			(reserved, default 0)

Example: (Display address 01)

Header	Monitor ID	Category	Code0	Code1	Length	Data Control	Data[0]	Data[1]	Data[2]	Checksum
0xA6	0x01	0x00	0x00	0x00	0x05	0x01	0x70	0x40	0x00	0x93

8.3 Serial Code

8.3.1 Message-Get

Bytes	Bytes Description	Bits	Description
DATA[0]	0x15 = Serial Code Get		Command requests the display to report its Serial Code Number (Production code) 16 digits

Example: (Display address 01)

Header	Monitor ID	Category	Code0	Code1	Length	Data Control	Data[0]	Checksum
0xA6	0x01	0x00	0x00	0x00	0x03	0x01	0x15	0xB0

8.3.2 Message-Report

Bytes	Bytes Description	Bits	Description
DATA[0]	0x15 = Serial Code – Report		Command reports Serial Code
DATA[1]	1 st Character		Character acc. ASCII character map (HEX)
DATA[2]	2 nd Character		
DATA[3]	3 rd Character		
DATA[16]	16 th Character		Character acc. ASCII character map (HEX)

8.4 Tiling

The command is used to set/get the tiling status as it is defined as below.

8.4.1 Message-Get

Bytes	Bytes Description	Bits	Description
DATA[0]	0x23 = Tiling – Get		Command requests the display to report Tiling status.

Example: (Display address 01)

Header	Monitor ID	Category	Code0	Code1	Length	Data Control	Data[0]	Checksum
0xA6	0x01	0x00	0x00	0x00	0x03	0x01	0x23	0x86

8.4.2 Message-Report

Bytes	Bytes Description	Bits	Description
DATA[0]	0x23 = Tiling – Report		Command reports Tiling Setting
DATA[1]	Enable		0x00 = No 0x01 = Yes
DATA[2]	Frame comp.		0x00 = No 0x01 = Yes
DATA[3]	Position		0x01 = position 1 0x02 = position 2 till See Note 1
DATA[4]	V monitors, H monitors		0x00 = don't care 0x01 = V monitors =1 H monitors =1 0x02 = V monitors =1 H monitors =2 till See Note 2

Note 1:

(1) For Zero Bezel models, the maximum Position value is 150 (hexadecimal value is 0x96).

(2) For other models, the maximum Position value is 25 (hexadecimal value is 0x19).

(3) The Position is counted from left to right, then up to down in the Tiling Wall.

Example: See Figure 3 for the hexadecimal Position value in a 4x3 (H Monitors x V Monitors) Tiling Wall.

Example: See Figure 4 for the hexadecimal Position value in a 5x5 (H Monitors x V Monitors) Tiling Wall.

Example: See Figure 5 for the hexadecimal Position value in a 15x10 (H Monitors x V Monitors) Tiling Wall

Note 2:

(1) For Zero Bezel models, the maximum H Monitors are 15 and the maximum V Monitors are 10. The formulas for DATA [4], V Monitors, and H Monitors are as follows:

H Monitors = MOD (Data [4], 15) (Data [4] ÷ 15, take the remainder)

V Monitors = INT (Data [4], 15) + 1 (Data [4] ÷ 15, take the quotient and plus one)

Data [4] = (V Monitors – 1) x 15 + H Monitors

Example: If H Monitors = 12 and V Monitors = 6, the Data [4] value will be (6–1) x 15 + 12 = 87

(2) For other models, the maximum H Monitors and V Monitors are 5, and the formulas for DATA [4], V Monitors, and H Monitors are as follows:

H Monitors = MOD (Data [4], 5) (Data [4] ÷ 5, take the remainder)

V Monitors = INT (Data [4], 5) + 1 (Data [4] ÷ 5, take the quotient and plus one)

Data [4] = (V Monitors – 1) x 5 + H Monitors

Example: If H Monitors = 4 and V Monitors = 3, the Data [4] value will be (3–1) x 5 + 4 = 14.

Set the display as follows:

Tiling enabled: Yes

Frame comp.: No

Position: 2

H Monitors: 3

V monitors: 2

Data [4] value will be: $(2-1) \times 15 + 3 = 18$ (hex value: 0x12)

Header	Monitor ID	Category	Page	Length	Data Control	Data[0]	Data[1]	Data[2]	Data[3]	Data[4]	Checksum
0x21	0x01	0x00	0x00	0x07	0x01	0x23	0x01	0x00	0x02	0x12	0x14

Example for BDL4230E, Display address 01

Set the display as follows:

Tiling enabled: Yes

Frame comp.: No

Position: 2

H Monitors: 3

V monitors: 2

Data [4] value will be: $(2-1) \times 5 + 3 = 8$

Header	Monitor ID	Category	Page	Length	Data Control	Data[0]	Data[1]	Data[2]	Data[3]	Data[4]	Checksum
0x21	0x01	0x00	0x00	0x07	0x01	0x23	0x01	0x00	0x02	0x08	0x0E

Figure 3. The hexadecimal Position value in a 4x3 (H Monitors x V Monitors) Tiling Wall.

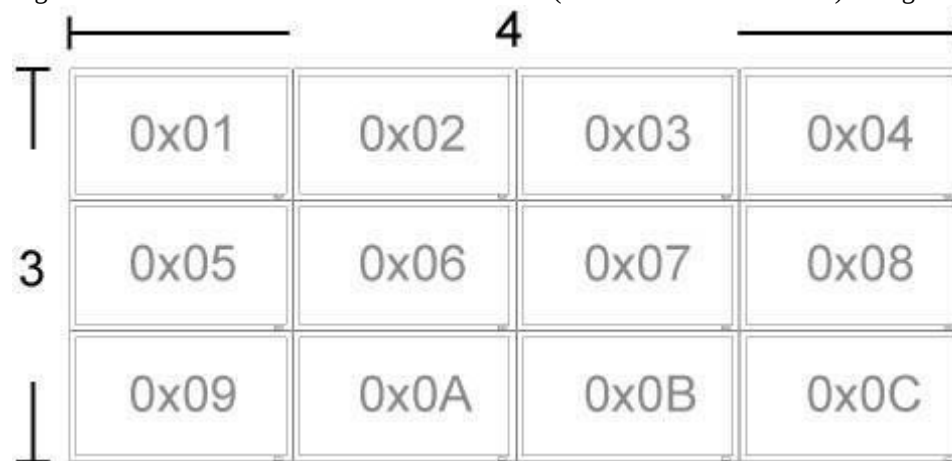


Figure 4. The hexadecimal Position value in a 5x5 (H Monitors x V Monitors) Tiling Wall.

5					
5	0x01	0x02	0x03	0x04	0x05
	0x06	0x07	0x08	0x09	0x0A
	0x0B	0x0C	0x0D	0x0E	0x0F
	0x10	0x11	0x12	0x13	0x14
	0x15	0x16	0x17	0x18	0x19

Figure 5. The hexadecimal Position value in a 15x10 (H Monitors x V Monitors) Tiling Wall.

15														
10	0x01	0x02	0x03	.....	.....	.....	.....	.....	.....	.....	.....	.....	0x0E	0x0F
	0x10	0x11	0x12	.....	.....	.....	.....	.....	.....	.....	.....	.....	0x09	0x0A
	0x1F	0x20	0x21	.....	.....	.....	.....	.....	.....	.....	.....	.....	0x0E	0x0F
	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0x13	0x14
														
														
														
														
														
														
	0x79	0x7A	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0x86	0x87
	0x88	0x89	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0x95	0x96

8.4.3 Message-Set

Bytes	Bytes Description	Bits	Description
DATA[0]	0x22 = Tiling – Set		Command reports Tiling Setting
DATA[1]	Enable		0x00 = No 0x01 = Yes
DATA[2]	Frame comp.		0x00 = No 0x01 = Yes 0x02 = don't overwrite (keep previous value)
DATA[3]	Position		0x00 = don't overwrite (keep previous value) 0x01 = position 1 0x02 = position 2 till See Note 1 at 8.6.2
DATA[4]	V monitors, H monitors		0x00 = don't overwrite (keep previous value) 0x01 = V monitors =1 H monitors =1 0x02 = V monitors =1 H monitors =2 till See Note 2 at 8.6.2

Example: Set the Display to the following: Tiling Enabled Yes, Frame comp. No, Position 2, V Monitors=2, H monitors = 3 (Display address 01)

Header	Monitor ID	Category	Code0	Code1	Length	Data Control	Data[0]	Data[1]	Data[2]	Data[3]	Data[4]	Checksum
0xA6	0x01	0x00	0x00	0x00	0x07	0x01	0x22	0x00	0x00	0x02	0x08	0x89

Example: Set the Display to the following: Tiling Enabled: Yes, Frame comp.: keep as before, Position: Keep as before, V Monitors, H monitors: keep as before (Display address 01)

Header	Monitor ID	Category	Code0	Code1	Length	Data Control	Data[0]	Data[1]	Data[2]	Data[3]	Data[4]	Checksum
0xA6	0x01	0x00	0x00	0x00	0x07	0x01	0x22	0x01	0x02	0x00	0x00	0x80

9. Command summary

Command name	Set Command	Get Command	Command Code	Remarks
Communication Control		V	0x00	Generic report
Platform and version labels		V	0xA2	
model num. & F/W ver. & Build date get		V	0xA1	
Power state get		V	0x19	
Power state set	V		0x18	
User Input Control get		V	0x1D	
User Input Control set	V		0x1C	
Power state at cold start get		V	0xA4	
Power state at cold start set	V		0xA3	
Current Source get		V	0xAD	
Input Source set	V		0xAC	
Video parameters get		V	0x33	Brightness, etc.
Video parameters set	V		0x32	
Color temperature get		V	0x35	
Color temperature set	V		0x34	
Color parameters get		V	0x37	
Color parameters set	V		0x36	
Picture Format get		V	0x3B	
Picture Format set	V		0x3A	
Picture-in-picture get		V	0x3D	
Picture-in-picture set	V		0x3C	
PIP source get		V	0x85	
PIP source set	V		0x84	
Volume get		V	0x45	
Volume set	V		0x44	
Volume limits	V		0xB8	
Audio parameters get		V	0x43	
Audio parameters set	V		0x42	
Miscellaneous info		V	0x0F	Operating hours
Auto Adjust	V		0x70	VGA only
Serial code get		V	0x15	
Tiling get		V	0x23	
Tiling set	V		0x22	