



Application Note

ProLite LH3246HS-B1

ProLite LH4346HS-B1

ProLite LH4946HS-B1

ProLite LH5546HS-B1

RS232 SERIAL INTERFACE COMMUNICATION PROTOCOL

NOTE: The commands provided in this document are a standard set.

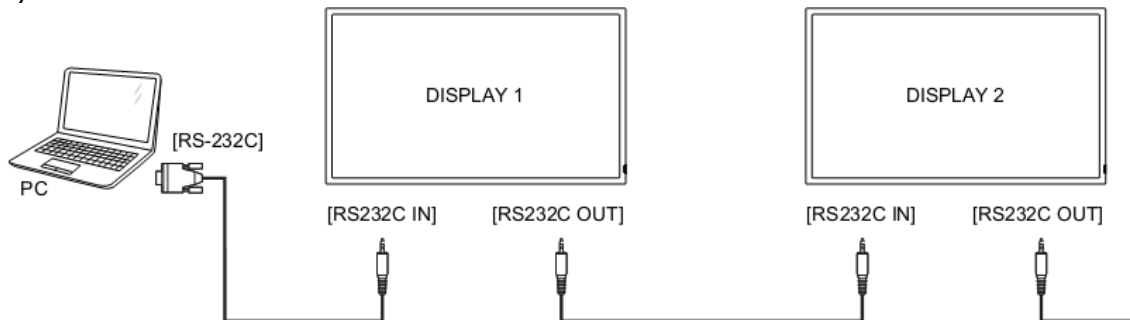
Functionality is guaranteed only of the commands/functions which are also available in the OSD Menu of the display.

Functionality of commands listed in this document but not available in the OSD Menu cannot be guaranteed

I. 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 display via RS232C.



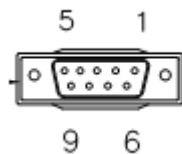
1.2 Definitions, Abbreviations and Acronyms

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

2. COMMAND PACKET FORMAT

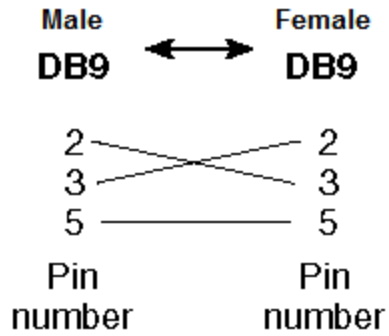
2.1 Physical Specifications

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 Female connector:
Female 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	

Note: A provided crossover cable (null modem) is needed for connection to the host controller:



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

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.

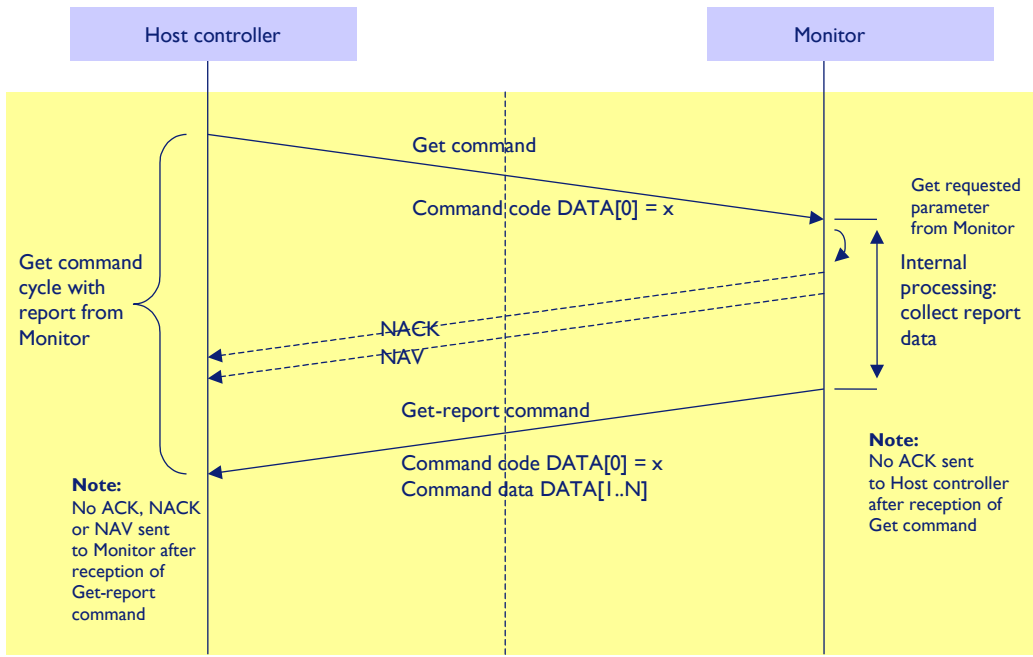


Figure 1: Explanation of mechanism of Get Command.

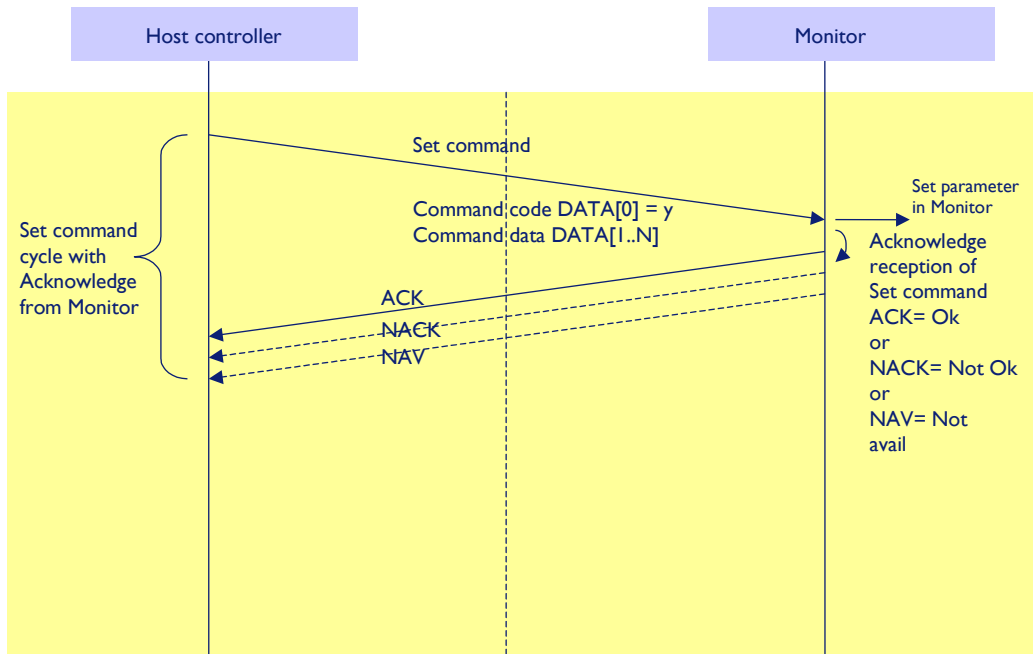


Figure 2: Explanation of mechanism of Set Command.

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, 0 = broadcast.
Byte 3	Category	Category = 0x00 (fixed)
Byte 4	Code0 (Page)	Reserve
Byte 5	Code1 (Function)	Reserve
Byte 6	Length	Length of message plus checksum code. Calculate the length from Control byte to Checksum byte.
Byte 7	Data Control	Data Control = 0x01 (fixed)
Byte 8	Data[0]	Command code.
Byte 9~Byte9+(N-1)	Data[1]~Data[N]	Data. This field can be also empty.
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
Byte3	Category	0x00
Byte4	Page	0x00
Byte5	MsgLen	Length of message plus checksum code. Calculate the length from Control byte to Checksum byte.
Byte6	Control	0x01
Byte7	Data[0]	Copy the received Command code.
Byte8~Byte8+(N-1)	Data[1]~Data[N]	Returned data associated with command code.
Byte 8+N	Checksum	XOR of all byte in reply/report packet(except checksum itself).

Example ACK reply: (Display address 01)

Header	Monitor ID	Category	Page	Length	Control	Data[0]	Data[1]	Checksum	Description
0x21	0x01	0x00	0x00	0x04	0x01	0x00	0x00	0x25	Command is well executed.

Example NACK reply: (Display address 01)

Header	Monitor ID	Category	Page	Length	Control	Data[0]	Data[1]	Checksum	Description
0x21	0x01	0x00	0x00	0x04	0x01	0x00	0x03	0x26	No this command code-Data(0), the system will reply "NACK".

Example NAV reply: (Display address 01)

Header	Monitor ID	Category	Page	Length	Control	Data[0]	Data[1]	Checksum	Description
0x21	0x01	0x00	0x00	0x04	0x01	0x00	0x04	0x21	1.Checksum error, the system will reply "NAV". 2.No this parameter-Data(1), the system will reply "NAV".

3. MESSAGES - GENERAL

3.1 Platform and Version Labels

This command provides the model name of platform 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 label version.
DATA[1]	Label		0x00 = Get the FW version 0x01 = Get model name of the platform.

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 label 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.

3.2 **Power state**

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

3.2.1 **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

3.2.2 **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	Control	Data[0]	Data[1]	Checksum
0x21	0x01	0x00	0x00	0x04	0x01	0x19	0x02	0x3E

3.2.3 **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

3.3 User Input Control

The following commands are used to lock/unlock the Remote Control and the Local Keyboard functionality corresponding.

3.3.1 Message-Get

Bytes	Bytes Description	Bits	Description
DATA[0]	0xID = User Input Control – Get		Get the lock/unlock state

Example: (Display address 01)

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

3.3.2 Message-Report

Bytes	Bytes Description	Bits	Description
DATA[0]	0xID = User Input Control – Report		Report from display of lock/unlock state
DATA[1]	Bit meaning: 0 = locked 1 = unlocked	Bit 7..2	Not used
		Bit 1	Local Keyboard
		Bit 0	Remote Control

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

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

3.3.3 Message-Set

Bytes	Bytes Description	Bits	Description
DATA[0]	0xIC = User Input Control – Set		Set the lock/unlock state
DATA[1]	Bit meaning: 0 = locked 1 = unlocked	Bit 7..2	Not used.
		Bit 1	Local Keyboard
		Bit 0	Remote Control

Example: Unlock local Keyboard and unlock 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	0xIC	0x03	0xBD

3.4 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.

3.4.1 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

3.4.2 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	0xnn

3.4.3 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 state at Cold Start		0x00 = Power Off 0x01 = Forced On 0x02 = Last Status

Example: Current Power state at Cold Start state: Last Status (Display address 01)

Header	Monitor ID	Category	Page	Length	Control	Data[0]	Data[1]	Checksum
0x21	0x01	0x00	0x00	0x04	0x01	0xA4	0x02	0xnn

4. MESSAGES - INPUT SOURCES

4.1 Input Source

This command is used to change the current input source.

4.1.1 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 0x01 = S-VIDEO 0x03 = COMPONENT 0x03 = CVI 2 (not applicable) 0x05 = VGA 0x05 = HDMI2 0x07 = Card DVI-D 0x07 = Display Port 0x08 = Card OPS 0x08 = USB 0x09 = HDMI 0x09 = DVI-D 0x0A = Network
DATA[2]	Input Source Number		0x00 = VIDEO 0x01 = S-VIDEO 0x00 = COMPONENT 0x01 = CVI 2 (not applicable) 0x00 = VGA 0x01 = HDMI2 0x00 = Card DVI-D 0x01 = Display Port 0x00 = Card OPS 0x01 = USB 0x00 = HDMI 0x01 = DVI-D 0x00 = Network
DATA[3]	OSD Style Reserved	Bit7	Not used.
		Bit6	Do not switch. Source is made current. set is updated with the details of this source; however, source change is performed. ↑ = Do not switch. 0 = Switch
		Bit2-0	Source info. Display Style 0 = Reserved ↑ = Source label
DATA[4]	Delay time for source change		Unit : 100 ms

Example: Wait 1000ms (10*100ms), Set on DVI-D (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	0xAC	0x09	0x01	0x00	0x0A	0x0F

4.2 Current Source

4.2.1 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

4.2.2 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		0x00 = Reserved for smartcard 0x01 = Reserved for smartcard 0x02 = Reserved for smartcard 0x03 = Reserved for smartcard 0xFD = Input Source (normal state) 0xFE = Reserved for smartcard
DATA[2]	Input Source Number		<u>For Input Source Type: 0x00, 0x01, 0x02, 0x03</u> 0x01...0x63 = Channel Number (only for smartcard) For Input Source Type: 0xFD 0x01 = VIDEO 0x02 = S-VIDEO 0x06 = COMPONENT 0x08 = VGA 0x09 = HSMI2 0x0A = HDMI 0x0B = DVI-D 0x0D = Display Port 0x0E = Card OPS 0x0F = USB 0x10 = Network 0xFF = Unknown

Example: Current Input Source: HDMI (Display address 01)

Header	Monitor ID	Category	Page	Length	Control	Data[0]	Data[1]	Data[2]	Checksum
0x21	0x01	0x00	0x00	0x05	0x01	0xAD	0xFD	0x0A	0x7E

4.3 Auto Signal Detecting

4.3.1 Message-Get

Bytes	Bytes Description	Bits	Description
DATA[0]	0xAF = Auto Signal Detecting – Get		Command requests the display to report its current Auto Signal Detecting status

Example: (Display address 01)

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

4.3.2 Message-Report

Bytes	Bytes Description	Bits	Description
DATA[0]	0xAF = Auto Signal Detecting – Report		Command reports Auto Signal Detecting Setting
DATA[1]	On / Off		0x00 = Off 0x01 = On

Example: Current Display settings: Off and On (Display address 01)

Header	Monitor ID	Category	Page	Length	Control	Data[0]	Data[1]	Checksum
0x21	0x01	0x00	0x00	0x04	0x01	0xAF	0x01	0x8B

4.3.3 Message-Set

Bytes	Bytes Description	Bits	Description
DATA[0]	0xAE = Auto Signal Detecting – Set		Command to change the Auto Signal Detecting setting of the display
DATA[1]	On / Off		0x00 = Off 0x01 = On

Example: Set the Display to the following: Auto Signal Detecting On (Display address 01)

Header	Monitor ID	Category	Code0	Code1	Length	Data Control	Data[0]	Data[1]	Checksum
0xA6	0x01	0x00	0x00	0x00	0x04	0x01	0xAE	0x01	0x0D

5.2 Picture Format

This command is used to control the display screen format.

5.2.1 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

5.2.2 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 = 4:3 0x01 = Custom 0x02 = Unscaled 0x03 = Wide Screen 0x04 = Movie expand 16:9 0x05 = Auto

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

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

5.2.3 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 = 4:3 0x01 = Custom 0x02 = Unscaled 0x03 = Wide Screen 0x04 = Movie expand 16:9 0x05 = Auto

The display shall respond with NAV if it receives a Picture Format that is not relevant to its Display Aspect Ratio.

The display shall ignore the [Picture Format - Set] if it receives a Picture Format that it cannot execute.

Example: Set Picture Format to Widescreen 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

5.3 Color Temperature

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

5.3.1 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	0xnn

5.3.2 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 = Custom 0x03 = Cool (10000K) 0x04 = Normal (9300K) 0x06 = Warm (6500K)

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

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

5.3.3 Message-Set

Bytes	Bytes Description	Bits	Description
DATA[0]	0x34 = Color Temperature – Set		Command to change the current color parameters
DATA[1]	Color Temperature		0x00 = Custom 0x03 = Cool (10000K) 0x04 = Normal (9300K) 0x06 = Warm (6500K)

Example: The current color temperature is set to Normal (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	0x04	0xnn

5.4 Color Temperature Parameters

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

5.4.1 Message-Get

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	0xnn

5.4.2 Message-Report

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

Example: All color parameters are set to 128 (0x80) (Display address 01)

Header	Monitor ID	Category	Page	Length	Control	Data[0]	Data[1]	Data[2]	Data[3]	Checksum
0x21	0x01	0x00	0x00	0x09	0x01	0x37	0x80	0x80	0x80	0xnn

5.4.3 Message-Set

Bytes	Bytes Description	Bits	Description
DATA[0]	0x36 = Color Parameters – Set		Command to change the current color parameters
DATA[1]	Red color gain value		0 to 255 of the user selectable range of the display.
DATA[2]	Green color gain value		0 to 255 of the user selectable range of the display.
DATA[3]	Blue color gain value		0 to 255 of the user selectable range of the display.

Example: All color parameters are set to 128 (0x80) (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	0x09	0x01	0x36	0x80	0x80	0x80	0xnn

6. MESSAGES - AUDIO

6.1 Volume

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

6.1.1 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

6.1.2 Message-Report

Bytes	Bytes Description	Bits	Description
DATA[0]	0x45 = Volume – Report		Command reports current Volume level
DATA[1]	Volume.		0 to 60 of the user selectable range of the display.

Example: Current Display settings: Volume:50 (0x32) (Display address 01)

Header	Monitor ID	Category	Page	Length	Control	Data[0]	Data[1]	Checksum
0x21	0x01	0x00	0x00	0x04	0x01	0x45	0x32	0x52

6.1.3 Message-Set

Bytes	Bytes Description	Bits	Description
DATA[0]	0x44 = Volume – Set		
DATA[1]	Volume.		0 to 60 of the user selectable range of the display.

Example: Set the Display Volume to 20 (0x14) (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	0x14	0xF2

6.2 Volume Limits

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

6.2.1 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 60 of the user selectable range of the display.
DATA[2]	Maximum Volume		0 to 60 of the user selectable range of the display.
DATA[3]	Switch On Volume		0 to 60 of the user selectable range of the display.

Example: Set the Display to the following: 20 (0x14), 60 (0x3C), 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	0x14	0x3C	0x32	0x02

7.1 Audio Parameters

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

9.1.4 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

9.1.5 Message-Report

Bytes	Bytes Description	Bits	Description
DATA[0]	0x43 = Audio Parameters – Report		Command reports Audio Parameters
DATA[1]	Treble.		-8 to 8(0x2A ~ 0x3A) of the user selectable range of the display.
DATA[2]	Bass.		-8 to 8(0x2A ~ 0x3A) of the user selectable range of the display.

Example: Current Display settings: Treble:0 (0x32) , Bass:0 (0x32) (Display address 01)

Header	Monitor ID	Category	Page	Length	Control	Data[0]	Data[1]	Data[2]	Checksum
0x21	0x01	0x00	0x00	0x05	0x01	0x43	0x32	0x32	0x67

9.1.6 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.		-8 to 8(0x2A ~ 0x3A) of the user selectable range of the display.
DATA[2]	Bass.		-8 to 8(0x2A ~ 0x3A) 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:0 (0x32) , Bass:0 (0x32) (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	0x32	0x32	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]	Subcommand		0x01 = Current source status. 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 / Current source status.		Operating Hours: DATA[1] and DATA[2] form the MSByte and LSByte, respectively, of the 16-bit-wide Operational Hours value. Current source status. DATA[1]: 0x00 DATA[2]: 0x01 = signal loss / 0x02 = signal stable.

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

Header	Monitor ID	Category	Page	Length	Control	Data[0]	Data[1]	Data[2]	Checksum
0x21	0x01	0x00	0x00	0x05	0x01	0x0F	0x00	0x0A	0x21

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]	Subcommand		0x40 = Auto Adjust (* All other values are reserved *)
DATA[2]	Reserved		(reserved, fixed 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) 14 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[14]	14 th Character		Character acc. ASCII character map (HEX)

Example: Current Display settings: Serial Code = HA1A0917123456 (Display address 01)

Header	Monitor ID	Category	Page	Length	Control	Data[0]	Data[1]	Data[2]	Data[3]	Data[4]
0x21	0x01	0x00	0x00	0x11	0x01	0x15	0x48	0x41	0x31	0x41
Data[5]	Data[6]	Data[7]	Data[8]	Data[9]	Data[10]	Data [11]	Data[12]	Data[13]	Data[14]	Checksum
0x30	0x39	0x31	0x37	0x31	0x32	0x33	0x34	0x35	0x36	0xnn

8.4 Temperature Sensors

8.4.1 Message-Get

Bytes	Bytes Description	Bits	Description
DATA[0]	0x2F = Temperature Sensor – Get		Command requests the display to report its value of the temperature sensors ($\pm 3^{\circ}\text{C}$).

Example: (Display address 01)

Header	Monitor ID	Category	Code0	Code1	Length	Data Control	Data[0]	Checksum
0xA6	0x01	0x00	0x00	0x00	0x03	0x01	0x2F	0xnn

8.4.2 Message-Report

Bytes	Bytes Description	Bits	Description
DATA[0]	0x2F = Temperature Sensor – Report		Command reports Temperature sensor value
DATA[1]	Temperature Sensor 1		0-100 in Celsius degrees represented in hex.

Example: Current Temp Sensor read out: Sensor 1 = 28°C (Display address 01)

Header	Monitor ID	Category	Page	Length	Control	Data[0]	Data[1]	Checksum
0x21	0x01	0x00	0x00	0x04	0x01	0x2F	0x1C	0xnn

8.6 Tiling

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

8.6.1 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	0xnn

8.6.2 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 ... 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 ... See Note 2

Note 1:

(1) The maximum Position value is 100 (hexadecimal value is 0x64).

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

Example: See Figure 1 for the hexadecimal Position value in a 4x3 (H Monitors x V Monitors) Tiling Wall.

Example: See Figure 2 for the hexadecimal Position value in a 5x5 (H Monitors x V Monitors) Tiling Wall.

Note 2:

(1) The maximum H Monitors are 10 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], 10) (Data[4] ÷ 10, take the remainder)

V Monitors = INT(Data[4], 10) + 1 (Data[4] ÷ 10, take the quotient and plus one)

Data[4] = (V Monitors – 1) × 10 + H Monitors

Example: If H Monitors = 10 and V Monitors = 6, the Data[4] value will be (6–1) × 10 + 10 = 60

Example 1:

Set the display as follows:

Tiling enabled: Yes

Frame comp.: No

Position: 2

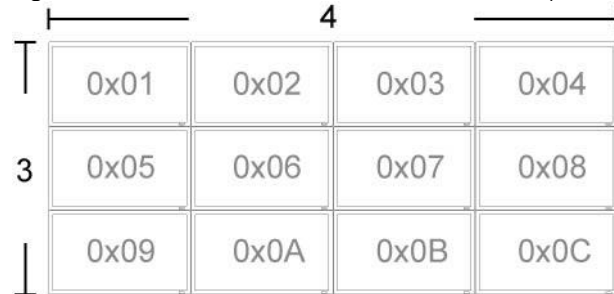
H Monitors: 4

V Monitors: 3

Data[4] value will be: $(3-1) \times 10 + 4 = 24$ (hex value: 0x18)

Header	Monitor ID	Category	Page	Length	Control	Data[0]	Data[1]	Data[2]	Data[3]	Data[4]	Checksum
0x21	0x01	0x00	0x00	0x07	0x01	0x23	0x01	0x00	0x02	0x18	0xnn

Figure 1. The hexadecimal Position value in a 4x3 (H Monitors x V Monitors) Tiling Wall.



8.6.3 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 ... 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 ... See Note 2 at 8.6.2

Example 1:

Set the display as follows:

Tiling enabled: Yes

Frame comp.: No

Position: 2

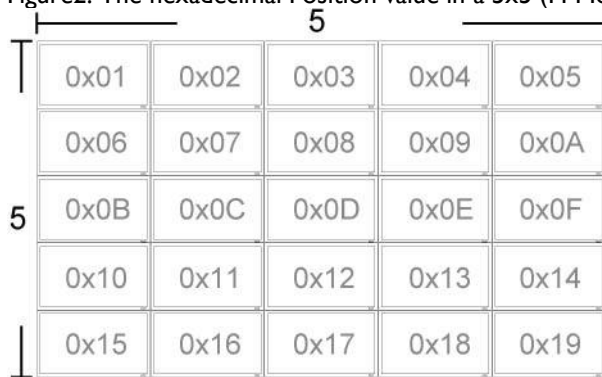
H Monitors: 5

V Monitors: 5

Data[4] value will be $(5-1) \times 10 + 5 = 45$ (hex value: 0x2D)

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	0x00	0x02	0x2D	0xnn

Figure2. The hexadecimal Position value in a 5x5 (H Monitors x V Monitors) Tiling Wall.



Example 2:

Set the display as follows:

Tiling enabled: Yes

Frame comp., Position, H Monitors, V Monitors: Keep as before

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	0xnn

9.1 Backlight Level

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

9.1.1 Message-Get

Bytes	Bytes Description	Bits	Description
DATA[0]	0x31 = Backlight level – Get		Command requests the display to report its current Backlight level.

Example: (Display address 01)

Header	Monitor ID	Category	Code0	Code1	Length	Data Control	Data[0]	Checksum
0xA6	0x01	0x00	0x00	0x00	0x03	0x01	0x31	0xnn

9.1.2 Message-Report

Bytes	Bytes Description	Bits	Description
DATA[0]	0x31 = Backlight level – Report		Command reports current Backlight level
DATA[1]	Backlight value		0 to 100 of the user selectable range of the display.

Example: Backlight:90 (0x5A) (Display address 01)

Header	Monitor ID	Category	Page	Length	Control	Data[0]	Data[1]	Checksum
0x21	0x01	0x00	0x00	0x04	0x01	0x31	0x5A	0xnn

9.1.3 Message-Set

Bytes	Bytes Description	Bits	Description
DATA[0]	0x30 = Backlight level – Set		Command to change the Backlight level of the display.
DATA[1]	Backlight value		0 to 100 of the user selectable range of the display.

Example: Set Backlight:90 (0x5A) (Display address 01)

Header	Monitor ID	Category	Code0	Code1	Length	Data Control	Data[0]	Data[1]	Checksum
0xA6	0x01	0x00	0x00	0x00	0x04	0x01	0x42	0x5A	0xnn

9.3 Factory Reset

The command is used to reset all you customized settings to the factory defaults.

9.3.1 Message-Set

Bytes	Bytes Description	Bits	Description
DATA[0]	0xFE = Factory Reset		Command to do the Factory Reset of the display

Example: Set Factory Settings (Display address 01)

Header	Monitor ID	Category	Code0	Code1	Length	Data Control	Data[0]	Checksum
0xA6	0x01	0x00	0x00	0x00	0x03	0x01	0xFE	0x5B

9.4 IR Remote Command

The command is used to send IR Key to Control display.

9.4.1 Message-Set

Bytes	Bytes Description	Bits	Description
DATA[0]	0xFD = IR Remote Command		Command to simulate the IR Remote to send IR Key to display
DATA[1]	IR KEY		0xA0: Power 0xA1: Menu 0xA2: Input 0xA3: Vol_Up 0xA4: Vol_Down 0xA5: Mute 0xA6: Cursor_Up 0xA7: Cursor_Down 0xA8: Cursor_Left 0xA9: Cursor_Right 0xB1: OK 0xB2: Return 0xC1: Red 0xC2: Green 0xC3: Yellow 0xC4: Blue 0xD1: Format 0xD2: Info 0x00: Btn_0 0x01: Btn_1 0x02: Btn_2 0x03: Btn_3 0x04: Btn_4 0x05: Btn_5 0x06: Btn_6 0x07: Btn_7 0x08: Btn_8 0x09: Btn_9

Example: Send Power Key (Display address 01)

Header	Monitor ID	Category	Code0	Code1	Length	Data Control	Data[0]	Data[1]	Checksum
0xA6	0x01	0x00	0x00	0x00	0x04	0x01	0xFD	0xA0	0xFF

10. Command summary

Command name	Set Command	Get Command	Command Code	Remarks
Communication Control	√	√	0x00	Generic report
Platform and version labels		√	0xA2	
Power state get		√	0x19	
Power state set	√		0x18	
User Input Control get		√	0x1D	
User Input Control set	√		0x1C	
Power at cold start set	√		0xA3	
Power at cold start get		√	0xA4	
Input Source	√		0xAC	
Current Source		√	0xAD	
Auto Signal Detecting Get		√	0xAF	
Auto Signal Detecting Set	√		0xAE	
Video parameters get		√	0x33	Brightness, etc.
Video parameters set	√		0x32	
Color Temperature Get		√	0x35	
Color Temperature Set	√		0x34	
Color Parameters Get		√	0x37	
Color Parameters Set	√		0x36	
Picture Format get		√	0x3B	
Picture Format set	√		0x3A	
Volume get		√	0x45	
Volume set	√		0x44	
Volume limits	√		0xB8	
Audio parameters get		√	0x43	
Audio parameters set	√		0x42	
Miscellaneous info		√	0x0F	Signal status Operating hours
Auto Adjust	√		0x70	VGA only
Serial Code Get		√	0x15	
Temperature Get		√	0x2F	
Tiling Get		√	0x23	
Tiling Set	√		0x22	
Backlight Level Get		√	0x31	
Backlight Level Set	√		0x30	
Factory Reset	√		0xFE	
IR Remote Control	√		0xFD	