

# **Application Note**

## **RS232 SERIAL INTERFACE COMMUNICATION PROTOCOL (SICP v1.6)**

### **Supported Models**

**BDL4230E/BDL4230ET/BDL4651VH/BDL4675XU/  
BDL4681XU/BDL4785SL/BDL5530EL/BDL5585XL/  
BDL6450AT/BDL6531E/BDL6551V**

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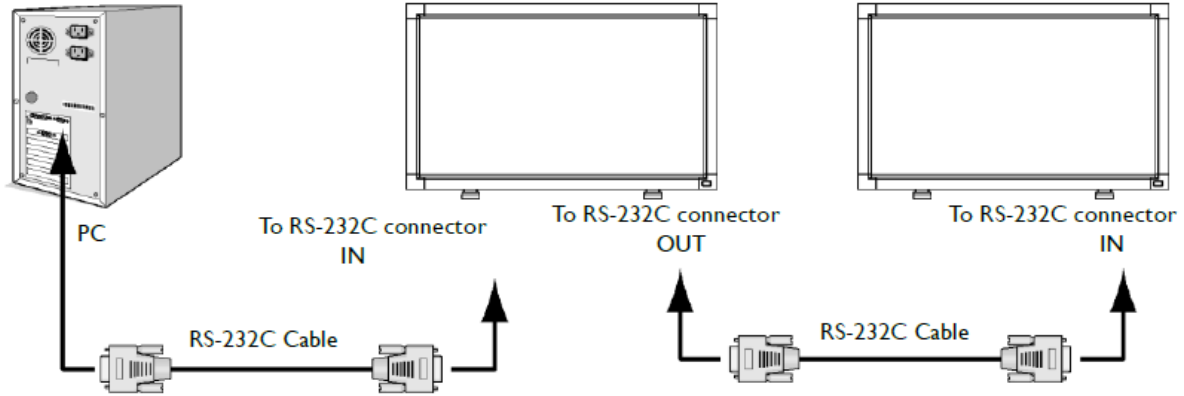
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## I. INTRODUCTION

### I.1 Purpose

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



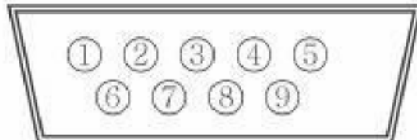
### I.2 Definitions, Abbreviations and Acronyms

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

## 2. COMMAND PACKET FORMAT

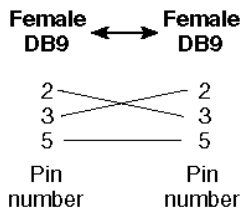
### 2.1 Physical Specifications

1. Baud Rate : 1200, 2400, 4800, 9600(default), 19200, 38400, 57600
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	

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



Philips 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.

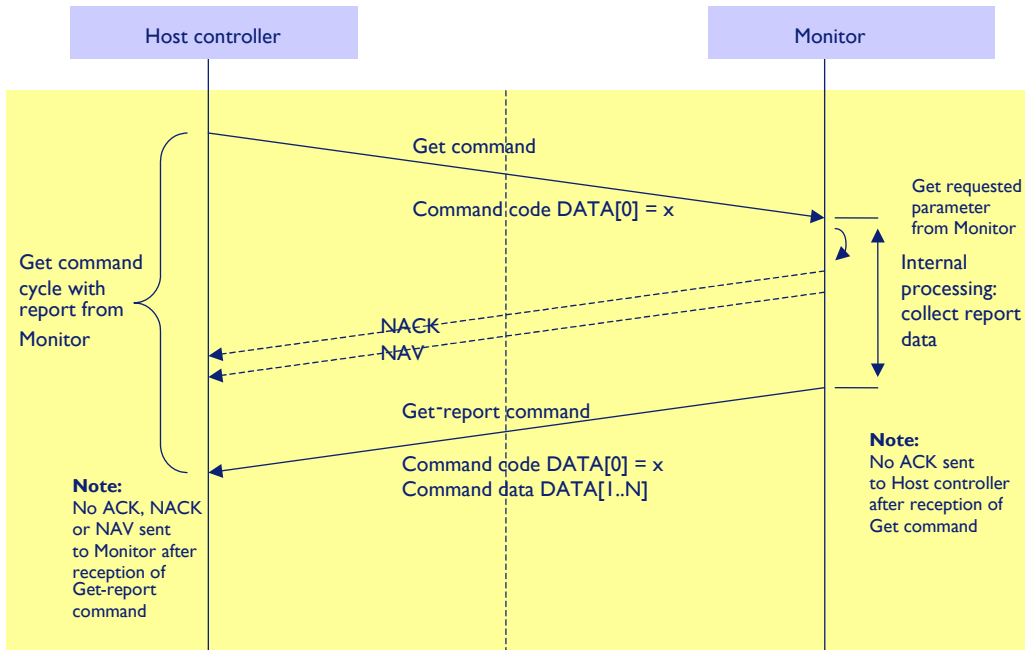


Figure 1: Explanation of mechanism of Get Command.

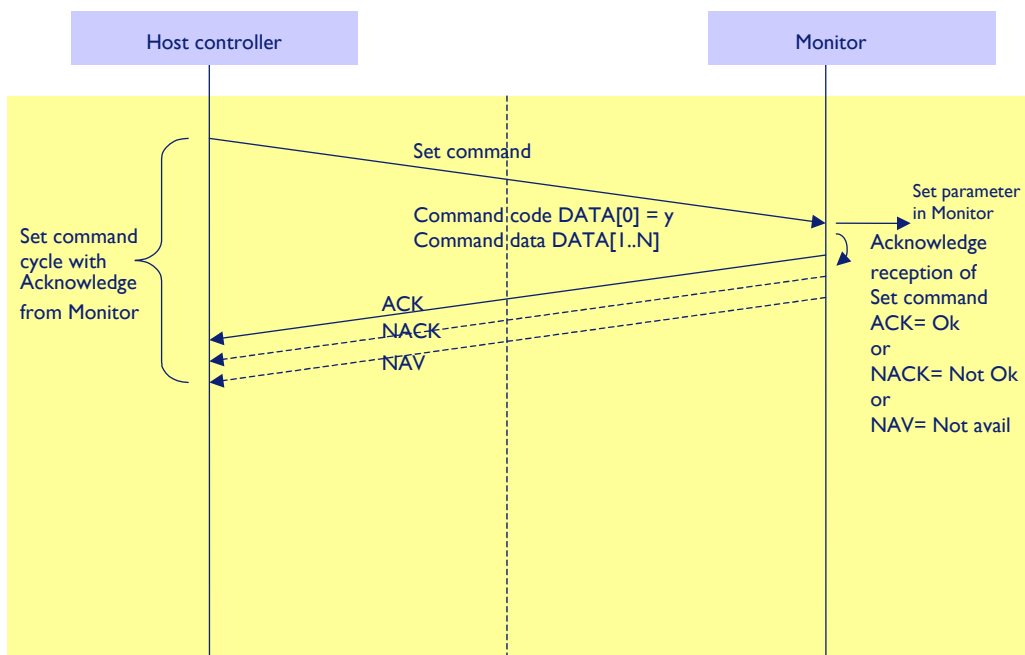


Figure 2: Explanation of mechanism of Set Command.

## 2.3 Command Format

The RS232 packet format:

<b>MsgSize</b>	<b>Control</b>	<b>Data[0]</b>	<b>Data[1]</b>	...	<b>Data[N]</b>	<b>Checksum</b>
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*Every field of packet format consists of one byte – MsgSize = 1 byte, etc.*

In detail:

Number of Field	Name of Field	Description
Byte 1:	MsgSize	Message Size has to be calculated in the following way: MsgSize + Control + Data(0) + ... + Data(N) + Checksum Range = 3 to 40 (0x3 to 0x28).
Byte 2:	Control (first case)	Message Control.  Bit 7..0: Monitor ID [Display Address range from 0 to 255]
Byte 2:	Control for Broadcast commands	Message Control.  Bit 7..0: Monitor ID [Display Address range from 0 to 256]  <b>Reserved for RS232 chaining:</b> all zeroes means all devices in the chain.
Byte 3 to Byte 39:	Data[0] to Data[N]	Data. This field can be also empty. If not empty then the range of Data Size, N = 0 to 36 (0x24).
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 = [MSG-SIZE] XOR [CONTROL] XOR DATA[0] ... XOR DATA[N]

Note 1: It is the responsibility of the host control software (or the external RS-232 controller device box) to avoid situations where multiple sets are responding with ACKs or Reports. It can control this aspect when addressing multiple monitors by setting Control. Bit 7 to 0.



## 3. MESSAGES - SYSTEM

### 3.1 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, NACK or NAV.

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

#### 3.1.1 Message-Report

Bytes	Bytes Description	Bits	Description
DATA[0]	<b>0x00 = Communication Control - Report</b>		Generic report message after Get or Set message
DATA[1]	Communication Control		0x06 = Acknowledge (ACK) 0x15 = Not Acknowledge (NACK) 0x18 = Not Available (NAV). Command not available, not relevant or cannot execute

*Example ACK reply: (Display address 01)*

MsgSize	Control	Data (0)	Data (1)	Checksum	Description
0x05	0x01	0x00	0x06	0x02	Command is well executed.

*Example NACK reply: (Display address 01)*

MsgSize	Control	Data (0)	Data (1)	Checksum	Description
0x05	0x01	0x17	0x01	0x12	No this command code-Data(0), the system will reply "NACK".

*Example NAV reply: (Display address 01)*

MsgSize	Control	Data (0)	Data (1)	Checksum	Description
0x05	0x01	0x18	0x01	0x1E	Checksum error, the system will reply "NAV".

*Example NAV reply: (Display address 01)*

MsgSize	Control	Data (0)	Data (1)	Checksum	Description
0x05	0x01	0x18	0x04	0x18	No this parameter-Data(1), the system will reply "NAV".

*Example NAV reply: (Display address 01)*

MsgSize	Control	Data (0)	Data (1)	Checksum	Description
0x05	0x01	0x18	0x01	0x1D	Command is correct, while system is already in stand-by mode, so reply "NAV".

*Example No reply: (Display address 01- not active ID)*

MsgSize	Control	Data (0)	Data (1)	Checksum	Description
0x05	0x01	0x18	0x01	0x1D	Command is correct, while system would NOT reply any message due to it's not active.

*Example No reply: (Display address 00- Broadcast ID)*

MsgSize	Control	Data (0)	Data (1)	Checksum	Description
0x05	0x00	0x18	0x01	0x1C	Command is correct, all systems would NOT reply any message due to "Daisy Chain"'s limitation- Collision might occur.

## 3.2 Platform and Version Labels

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

### 3.2.1 Message-Get

Bytes	Bytes Description	Bits	Description
DATA[0]	<b>0xA2 = Platform and Version Labels - Get</b>		Request the SICP version
DATA[1]	Which Label		0x00 = Get SICP implementation version 0x01 = Get the software label and version information of the platform.

*Example: Get SICP version (Display address 01)*

MsgSize	Control	Data (0)	Data (1)	Checksum
0x05	0x01	0xA2	0x00	0xA6

### 3.2.2 Message-Report

Bytes	Bytes Description	Bits	Description
DATA[0]	<b>0xA2 = Platform and Version Label – Report</b>		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.

## 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]	<b>0x19 = Power state - Get</b>		Command requests the display to report its current power state

*Example: (Display address 01)*

MsgSize	Control	Data (0)	Checksum
0x04	0x01	0x19	0x1C

#### 4.1.2 Message-Report

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

*Example: Power State On (Display address 01)*

MsgSize	Control	Data (0)	Data (1)	Checksum
0x05	0x01	0x19	0x02	0x1F

#### 4.1.3 Message-Set

Bytes	Bytes Description	Bits	Description
DATA[0]	<b>0x18 = Power state - Set</b>		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)*

MsgSize	Control	Data (0)	Data (1)	Checksum
0x05	0x01	0x18	0x01	0x1D

## 4.2 User Input Control

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

### 4.2.1 Message-Get

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

Example: (Display address 01)

MsgSize	Control	Data (0)	Checksum
0x04	0x01	0xID	0x18

### 4.2.2 Message-Report

Bytes	Bytes Description	Bits	Description
DATA[0]	<b>0xID = User Input Control – Report</b>		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)

MsgSize	Control	Data (0)	Data (1)	Checksum
0x05	0x01	0xID	0x01	0x18

### 4.2.3 Message-Set

Bytes	Bytes Description	Bits	Description
DATA[0]	<b>0xIC = User Input Control – Set</b>		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)

MsgSize	Control	Data (0)	Data (1)	Checksum
0x05	0x01	0xIC	0x03	0x1B

## 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]	<b>0xA4 = Power state at Cold Start- Get</b>		Command requests the display to report its current power state at Cold Start

Example: (Display address 01)

MsgSize	Control	Data (0)	Checksum
0x04	0x01	0xA4	0xA1

### 4.3.2 Message-Report

Bytes	Bytes Description	Bits	Description
DATA[0]	<b>0xA4 = Power State at Cold Start - Report</b>		Command reports Power state at Cold Start
DATA[1]	Power State at Cold Start		0x00 = Power Off 0x01 = Forced On 0x02 = Last Status

Example: Power State at Cold Start of display is Forced On (Display address 01)

MsgSize	Control	Data (0)	Data (1)	Checksum
0x05	0x01	0xA4	0x01	0xA1

### 4.3.3 Message-Set

Bytes	Bytes Description	Bits	Description
DATA[0]	<b>0xA3 = Power state at Cold Start - Set</b>		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)

MsgSize	Control	Data (0)	Data (1)	Checksum
0x05	0x01	0xA3	0x02	0xA5

## 5. MESSAGE – 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]	<b>0xAC = Input Source – Set</b>		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 0x07 = Card DVI-D (not applicable) 0x07 = Display Port 0x08 = Card OPS 0x09 = HDMI 0x09 = DVI-D
DATA[2]	Input Source Number		0x00 = VIDEO 0x01 = S-VIDEO 0x00 = COMPONENT 0x01 = CVI 2 (not applicable) 0x00 = VGA 0x00 = HDMI 0x01 = DVI-D 0x00 = Card DVI-D (not applicable) 0x01 = Display Port 0x00 = Card OPS
DATA[3]	OSD Style	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. 1 = Do not switch. 0 = Switch
		Bit2.0	Source info. Display Style 0 = Reserved 1 = Source label
DATA[4]	Mute Style	Bit 7	(Reserved, value is 0)
		Bit 6	(Reserved, value is 0)
		Bit 5	(Reserved, value is 0)
		Bit 4	(Reserved, value is 0)
		Bit 3	(Reserved, value is 0)
		Bit 2	(Reserved, value is 0)
		Bit 1	(Reserved, value is 0)
		Bit 0	(Reserved, value is 0)

*Example: Set on DVI-D with Source label displaying on OSD (Display address 01)*

MsgSize	Control	Data (0)	Data (1)	Data (2)	Data (3)	Data (4)	Checksum
0x08	0x01	0xAC	0x09	0x01	0x01	0x00	0xAC

## 5.2 Current Source

### 5.2.1 Message-Get

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

Example: (Display address 01)

MsgSize	Control	Data (0)	Checksum
0x04	0x01	0xAD	0xA8

### 5.2.2 Message-Report

Bytes	Bytes Description	Bits	Description
DATA[0]	<b>0xAD = Current Source – Report</b>		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 0x07 = CVI 2 (not applicable) 0x08 = VGA 0x0A = HDMI 0x0B = DVI-D 0x0C = Card DVI-D (not applicable) 0x0D = Display Port 0x0E = Card OPS

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

MsgSize	Control	Data (0)	Data (1)	Data (2)	Checksum
0x06	0x01	0xAD	0xFD	0x01	0x56

## 5.3 Auto Signal Detecting

### 5.3.1 Message-Get

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

Example: (Display address 01)

MsgSize	Control	Data (0)	Checksum
0x04	0x01	0xAF	0xAA

### 5.3.2 Message-Report

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

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

MsgSize	Control	Data (0)	Data (1)	Checksum
0x05	0x01	0xAF	0x00	0xAB
0x05	0x01	0xAF	0x01	0xAA

### 5.3.3 Message-Set

Bytes	Bytes Description	Bits	Description
DATA[0]	<b>0xAE = Auto Signal Detecting – Set</b>		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 Off (Display address 01)

MsgSize	Control	Data (0)	Data (1)	Checksum
0x05	0x01	0xAE	0x00	0xAA



## 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]	<b>0x33 = Video Parameters – Get</b>		Command requests the display to report its current video parameters.

*Example: (Display address 01)*

MsgSize	Control	Data (0)	Checksum
0x04	0x01	0x33	0x36

#### 6.1.2 Message-Report

Bytes	Bytes Description	Bits	Description
DATA[0]	<b>0x33 = Video Parameters – Report</b>		Command reports to the host controller the current video parameters of the display.
DATA[1]	Brightness.		0 to 100 (%) of the user selectable range of the display.
DATA[2]	Colour.		0 to 100 (%) of the user selectable range of the display.
DATA[3]	Contrast.		0 to 100 (%) of the user selectable range of the display.
DATA[4]	Sharpness.		0 to 100 (%) of the user selectable range of the display.
DATA[5]	Tint (Hue)		0 to 100 (%) of the user selectable range of the display.

*Example: All video parameters are set to 55 % (0x37) (Display address 01)*

MsgSize	Control	Data (0)	Data (1)	Data (2)	Data (3)	Data (4)	Data (5)	Checksum
0x09	0x01	0x33	0x37	0x37	0x37	0x37	0x37	0x0C

#### 6.1.3 Message-Set

Bytes	Bytes Description	Bits	Description
DATA[0]	<b>0x32 = Video Parameters – Set</b>		Command to change the current video parameters
DATA[1]	Brightness.		0 to 100 (%) of the user selectable range of the display.
DATA[2]	Colour.		0 to 100 (%) of the user selectable range of the display.
DATA[3]	Contrast.		0 to 100 (%) of the user selectable range of the display.
DATA[4]	Sharpness.		0 to 100 (%) of the user selectable range of the display.
DATA[5]	Tint (Hue)		0 to 100 (%) of the user selectable range of the display.

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

MsgSize	Control	Data (0)	Data (1)	Data (2)	Data (3)	Data (4)	Data (5)	Checksum
0x09	0x01	0x32	0x37	0x37	0x37	0x37	0x37	0x0D

## 6.2 Picture Format

This command is used to control the display screen format.

### 6.2.1 Message-Get

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

Example: (Display address 01)

MsgSize	Control	Data (0)	Checksum
0x04	0x01	0x3B	0x3E

### 6.2.2 Message-Report

Bytes	Bytes Description	Bits	Description
DATA[0]	<b>0x3B = Picture Format – Report</b>		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 0x05 = Dynamic

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

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

MsgSize	Control	Data (0)	Data (0)	Checksum
0x05	0x01	0x3B	0x03	0x3C

### 6.2.3 Message-Set

Bytes	Bytes Description	Bits	Description
DATA[0]	<b>0x3A = Picture Format – Set</b>		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 0x05 = Dynamic

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)

MsgSize	Control	Data (0)	Data (0)	Checksum
0x05	0x01	0x3A	0x03	0x3D

<b>Picture Format</b>	<b>Description</b>
0x00	Normal
0x01	Custom
0x02	Real
0x03	Full
0x04	21:9
0x05	Dynamic

## 6.3 Picture-in-Picture (PIP)

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

### 6.3.1 Message-Set

Bytes	Bytes Description	Bits	Description
DATA[0]	<b>0x3C = Picture-in-Picture – Set</b>		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].Bit 1.0 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)

MsgSize	Control	Data (0)	Data (1)	Data (2)	Data (3)	Data (4)	Checksum
0x08	0x01	0x3C	0x01	0x02	0x00	0x00	0x36

### 6.3.2 PIP Source

This is the PIP source selection command

Bytes	Bytes Description	Bits	Description
DATA[0]	<b>0x84 = PIP Source – Set</b>		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]	Source Number		0x01 = VIDEO 0x03 = S-VIDEO 0x06 = COMPONENT 0x08 = VGA 0x0A = HDMI 0x0B = DVI-D 0x0C = Card DVI-D (not applicable) 0x0D = Display Port 0x0E = Card OPS

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

Example: Set source PIP to VIDEO (Display address 01)

MsgSize	Control	Data (0)	Data (1)	Data (2)	Checksum
0x06	0x01	0x84	0xFD	0x01	0x7F

## 7. MESSAGES - AUDIO

### 7.1 Audio Parameters

This command is used to set/get the audio parameters as it is defined as below, and is applicable to BDL4785SL, BDL5585XL, and BDL6450AT only.

#### 7.1.1 Message-Get

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

*Example: (Display address 01)*

MsgSize	Control	Data (0)	Checksum
0x04	0x01	0x43	0x46

#### 7.1.2 Message-Report

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

*Example: Current Display settings: Treble:80% (0x50) , Bass:93% (0x5D) (Display address 01)*

MsgSize	Control	Data (0)	Data (1)	Data (2)	Checksum
0x06	0x01	0x43	0x50	0x5D	0x49

#### 7.1.3 Message-Set

Bytes	Bytes Description	Bits	Description
DATA[0]	<b>0x42 = Audio Parameters – Set</b>		Command to change the Audio Parameters of the display
DATA[1]	Treble.		0 to 100 (%) of the user selectable range of the display.
DATA[2]	Bass.		0 to 100 (%) 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)*

MsgSize	Control	Data (0)	Data (1)	Data (2)	Checksum
0x06	0x01	0x42	0x4D	0x4D	0x45

## 7.2 Volume

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

### 7.2.1 Message-Get

Bytes	Bytes Description	Bits	Description
DATA[0]	<b>0x45 = Volume – Get</b>		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)*

MsgSize	Control	Data (0)	Checksum
0x04	0x01	0x45	0x40

### 7.2.2 Message-Report

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

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

MsgSize	Control	Data (0)	Data (1)	Checksum
0x05	0x01	0x45	0x4D	0x0C

### 7.2.3 Message-Set

Bytes	Bytes Description	Bits	Description
DATA[0]	<b>0x44 = Volume – Set</b>		
DATA[1]	Volume.		0 to 100 (%) of the user selectable range of the display.

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

MsgSize	Control	Data (0)	Data (1)	Checksum
0x05	0x01	0x44	0x4D	0x0D

## 7.3 Volume Limits

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

### 7.3.1 Message-Set

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

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

MsgSize	Control	Data (0)	Data (1)	Data (2)	Data (3)	Checksum
0x07	0x01	0xB8	0x0A	0x4D	0x32	0xCB

## 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]	<b>0x0F = Misc Info - Get</b>		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)*

MsgSize	Control	Data (0)	Data (1)	Checksum
0x05	0x01	0x0F	0x02	0x09

#### 8.1.2 Message-Report

Bytes	Bytes Description	Bits	Description
DATA[0]	<b>0x0F = Misc Info – Report</b>		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)*

MsgSize	Control	Data (0)	Data (1)	Data (2)	Checksum
0x06	0x01	0x0F	0x4D	0x00	0x45



## 8.2 Power Saving Mode

This command is used for dimming back light power consumption control. Different levels of power consumptions can be achieved by using this command.

### 8.2.1 Message-Set

Bytes	Bytes Description	Bits	Description
DATA[0]	<b>0xDD = SmartPower – Set</b>		Command requests the display to set the specified Power Saving Mode.
DATA[1]	Level of SmartPower control		For the currently-defined Type = 0: 0x00 = OFF (no special action, default mode) 0x01 = Low (defined to be same as OFF) 0x02 = Medium 0x03 = High (highest power-saving mode)

Example: Set the Display to Medium SmartPower Level (Display address 01)

MsgSize	Control	Data (0)	Data (1)	Checksum
0x05	0x01	0xDD	0x02	0xDB

Note1: This command controls the level of power-saving when the display is active-on.

Note2: Exactly how this feature is implemented, or whether it can be done at all, depends on the platform. It is possible that the picture-quality might be compromised as a trade-off.

## 8.3 Auto Adjust

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

### 8.3.1 Message-Set

Bytes	Bytes Description	Bits	Description
DATA[0]	<b>0x70 = Video Alignment – Set</b>		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)

MsgSize	Control	Data (0)	Data (1)	Data (2)	Checksum
0x06	0x01	0x70	0x40	0x00	0x37

## 8.4 Temperature Sensors

### 8.4.1 Message-Get

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

Example: (Display address 01)

MsgSize	Control	Data (0)	Checksum
0x04	0x01	0x2F	0x2A

### 8.4.2 Message-Report

Bytes	Bytes Description	Bits	Description
DATA[0]	<b>0x2F = Temperature Sensor – Report</b>		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 =  $28^{\circ}\text{C}$  (Display address 01)

MsgSize	Control	Data (0)	Data (1)	Checksum
0x05	0x01	0x2F	0x1C	0x37

## 8.5 Serial Code

### 8.5.1 Message-Get

Bytes	Bytes Description	Bits	Description
DATA[0]	<b>0x15 = Serial Code Get</b>		Command requests the display to report its Serial Code Number (Production code) 14 digits

Example: (Display address 01)

MsgSize	Control	Data (0)	Checksum
0x04	0x01	0x15	0x10

### 8.5.2 Message-Report

Bytes	Bytes Description	Bits	Description
DATA[0]	<b>0x15 = Serial Code – Report</b>		Command reports Serial Code
DATA[1]	1 <sup>st</sup> Character		Character acc. ASCII character map (HEX)
DATA[2]	2 <sup>nd</sup> Character		
DATA[3]	3 <sup>rd</sup> Character		
DATA[14]	14 <sup>th</sup> Character		Character acc. ASCII character map (HEX)

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

MsgSize	Control	Data (0)	Data (1)	Data (2)	Data (3)	Data (4)	Data (5)	Data (6)	Data (7)
0x12	0x01	0x15	0x48	0x41	0x31	0x41	0x30	0x39	0x31

Data (8)	Data (9)	Data (10)	Data (11)	Data (12)	Data (13)	Data (14)	Checksum
0x37	0x31	0x32	0x33	0x34	0x35	0x36	0x77

## 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]	<b>0x23 = Tiling – Get</b>		Command requests the display to report Tiling status.

Example: (Display address 01)

MsgSize	Control	Data (0)	Checksum
0x04	0x01	0x23	0x26

### 8.6.2 Message-Report

Bytes	Bytes Description	Bits	Description
DATA[0]	<b>0x23 = Tiling – Report</b>		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) For BDL4675XU/BDL4681XU/BDL5585XL, the maximum Position value is 150 (hexadecimal value is 0x96).
  - (2) For BDL4230E/BDL4230ET/BDL6551V/BDL6531E/BDL6450AT/BDL4651VH/BDL5530EL/BDL4785SL/BDL5585XL, 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 BDL4675XU/BDL4681XU/BDL5585XL, 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:  

$$H\ Monitors = MOD(Data[4], 15) \quad (Data[4] \div 15, \text{ take the remainder})$$

$$V\ Monitors = INT(Data[4], 15) + 1 \quad (Data[4] \div 15, \text{ take the quotient and plus one})$$

$$Data[4] = (V\ Monitors - 1) \times 15 + H\ Monitors$$
 Example: If H Monitors = 12 and V Monitors = 6, the Data[4] value will be  $(6-1) \times 15 + 12 = 87$
- (2) For BDL4230E/BDL4230ET/BDL6551V/BDL6531E/BDL6450AT/BDL4651VH/BDL5530EL/BDL4785SL/BDL5585XL, the maximum H Monitors and V Monitors are 5, and the formulas for DATA[4], V Monitors, and H Monitors are as follows:  

$$H\ Monitors = MOD(Data[4], 5) \quad (Data[4] \div 5, \text{ take the remainder})$$

$$V\ Monitors = INT(Data[4], 5) + 1 \quad (Data[4] \div 5, \text{ take the quotient and plus one})$$

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

Example for BDL4675XU, 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:  $(2-1) \times 15 + 3 = 18$  (hex value: 0x12)

MsgSize	Control	Data[0]	Data (1)	Data (2)	Data (3)	Data (4)	Checksum
0x08	0x01	0x23	0x01	0x00	0x02	0x12	0x3B

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:  $(2-1) \times 5 + 3 = 8$

MsgSize	Control	Data[0]	Data (1)	Data (2)	Data (3)	Data (4)	Checksum
0x08	0x01	0x23	0x01	0x00	0x02	0x08	0x21

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

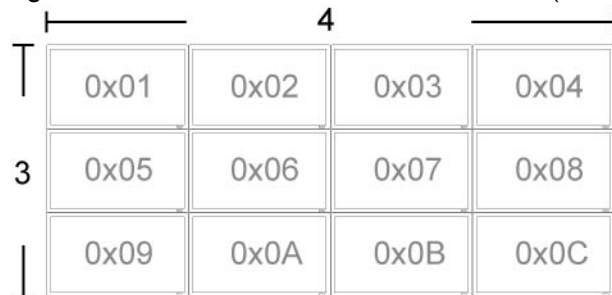


Figure 4. The hexadecimal Position value in a 5x5 (H Monitors x V Monitors) Tiling Wall.

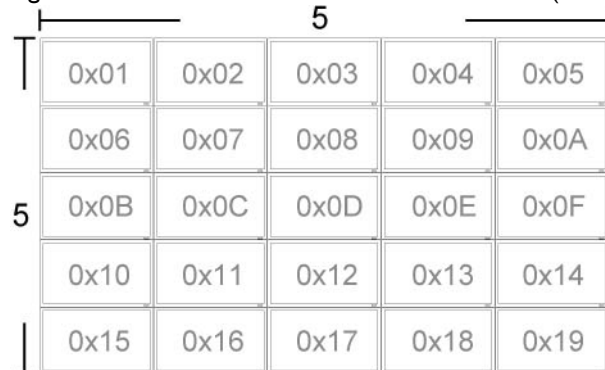
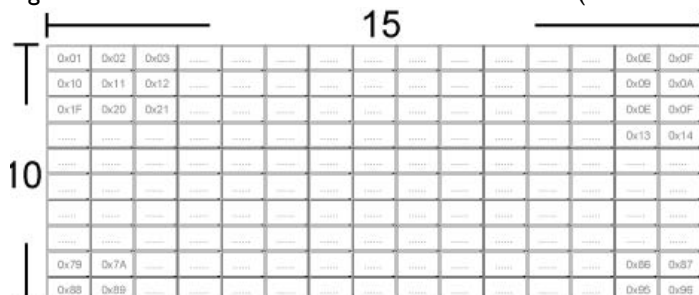


Figure 5. The hexadecimal Position value in a 15x10 (H Monitors x V Monitors) Tiling Wall.



## 8.6.3 Message-Set

Bytes	Bytes Description	Bits	Description
DATA[0]	<b>0x22 = Tiling – Set</b>		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 for BDL4675XU, 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  $(2-1) \times 15 + 3 = 18$  (hex value: 0x12)

MsgSize	Control	Data[0]	Data (1)	Data (2)	Data (3)	Data (4)	Checksum
0x08	0x01	0x22	0x01	0x00	0x02	0x12	0x3A

Example for BDL4675XU, Display address 01

Set the display as follows:

Tiling enabled: Yes

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

MsgSize	Control	Data[0]	Data (1)	Data (2)	Data (3)	Data (4)	Checksum
0x08	0x01	0x22	0x01	0x02	0x00	0x00	0x28

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

MsgSize	Control	Data[0]	Data (1)	Data (2)	Data (3)	Data (4)	Checksum
0x08	0x01	0x22	0x01	0x00	0x02	0x08	0x20

Example for BDL4230E, Display address 01

Set the display as follows:

Tiling enabled: Yes

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

MsgSize	Control	Data[0]	Data (1)	Data (2)	Data (3)	Data (4)	Checksum
0x08	0x01	0x22	0x01	0x02	0x00	0x00	0x28

## 8.7 Light Sensor

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

### 8.7.1 Message-Get

Bytes	Bytes Description	Bits	Description
DATA[0]	<b>0x25 = Light Sensor – Get</b>		Command requests the display to report its current light sensor status

*Example: (Display address 01)*

MsgSize	Control	Data (0)	Checksum
0x04	0x01	0x25	0x20

### 8.7.2 Message-Report

Bytes	Bytes Description	Bits	Description
DATA[0]	<b>0x25 = Light Sensor – Report</b>		Command reports Light Sensor Setting
DATA[1]	On / Off		0x00 = Off 0x01 = On

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

MsgSize	Control	Data (0)	Data (1)	Checksum
0x05	0x01	0x25	0x00	0x21
0x05	0x01	0x25	0x01	0x20

### 8.7.3 Message-Set

Bytes	Bytes Description	Bits	Description
DATA[0]	<b>0x24 = Light Sensor – Set</b>		Command to change the Light Sensor setting of the display
DATA[1]	On / Off		0x00 = Off 0x01 = On

*Example: Set the Display to the following: Light Sensor Off (Display address 01)*

MsgSize	Control	Data (0)	Data (1)	Checksum
0x05	0x01	0x24	0x00	0x20

## 8.8 OSD Rotating

The command is used to set/get the OSD menu direction as it is defined as below.

### 8.8.1 Message-Get

Bytes	Bytes Description	Bits	Description
DATA[0]	<b>0x27 = OSD Rotating – Get</b>		Command requests the display to report its current OSD rotating status

Example: (Display address 01)

MsgSize	Control	Data (0)	Checksum
0x04	0x01	0x27	0x22

### 8.8.2 Message-Report

Bytes	Bytes Description	Bits	Description
DATA[0]	<b>0x27 = OSD Rotating – Report</b>		Command reports OSD Rotating Setting
DATA[1]	On / Off		0x00 = Off 0x01 = On

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

MsgSize	Control	Data (0)	Data (1)	Checksum
0x05	0x01	0x27	0x00	0x23
0x05	0x01	0x27	0x01	0x22

### 8.8.3 Message-Set

Bytes	Bytes Description	Bits	Description
DATA[0]	<b>0x26 = OSD Rotating – Set</b>		Command to change the OSD Rotating setting of the display
DATA[1]	On / Off		0x00 = Off 0x01 = On

Example: Set the Display to the following: OSD Rotating Off (Display address 01)

MsgSize	Control	Data (0)	Data (1)	Checksum
0x05	0x01	0x26	0x00	0x22



## 8.9 MEMC Effect

The command is used to set/get the MEMC effects as it is defined as below, and is applicable to BDL4785SL and BDL5530EL only.

### 8.9.1 Message-Get

Bytes	Bytes Description	Bits	Description
DATA[0]	<b>0x29 = MEMC Effect – Get</b>		Command requests the display to report its current MEMC effect status

Example: (Display address 01)

MsgSize	Control	Data (0)	Checksum
0x04	0x01	0x29	0x2C

### 8.9.2 Message-Report

Bytes	Bytes Description	Bits	Description
DATA[0]	<b>0x29 = MEMC Effect – Report</b>		Command reports the MEMC effect level
DATA[1]	Off/Low/Medium/High		0x00 = Off 0x01 = Low 0x02 = Medium 0x03 = High

Example: Current Display MEMC settings: Off (Display address 01)

MsgSize	Control	Data (0)	Data (1)	Checksum
0x05	0x01	0x29	0x00	0x2D

### 8.9.3 Message-Set

Bytes	Bytes Description	Bits	Description
DATA[0]	<b>0x28 = MEMC Effect – Set</b>		Command to set the MEMC level of the display for various picture motion performance
DATA[1]	Off/Low/Medium/High		0x00 = Off 0x01 = Low 0x02 = Medium 0x03 = High

Example: Set the Display to the following: MEMC Effect Off (Display address 01)

MsgSize	Control	Data (0)	Data (1)	Checksum
0x05	0x01	0x28	0x00	0x2C

## 8.10 Touch Feature

The command is used to set/get the Touch Feature as it is defined as below, and is applicable to BDL4230ET and BDL6450AT only.

### 8.10.1 Message-Get

Bytes	Bytes Description	Bits	Description
DATA[0]	<b>0x1F = Touch Feature – Get</b>		Command requests the display to report its current Touch Feature status

Example: (Display address 01)

MsgSize	Control	Data (0)	Checksum
0x04	0x01	0x1F	0x1A

### 8.10.2 Message-Report

Bytes	Bytes Description	Bits	Description
DATA[0]	<b>0x1F = Touch Feature – Report</b>		Command reports the Touch Feature enabled or disabled
DATA[1]	On / Off		0x00 = Off 0x01 = On

Example: Current Display Touch Feature settings: Off (Display address 01)

MsgSize	Control	Data (0)	Data (1)	Checksum
0x05	0x01	0x1F	0x00	0x1B

### 8.10.3 Message-Set

Bytes	Bytes Description	Bits	Description
DATA[0]	<b>0x1E = Touch Feature – Set</b>		Command to set the Touch Feature of the display enabled or disabled
DATA[1]	On /Off		0x00 = Off 0x01 = On

Example: Set the Display to the following: Touch Feature Off (Display address 01)

MsgSize	Control	Data (0)	Data (1)	Checksum
0x05	0x01	0x1E	0x00	0x1A

## 9. 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 state at cold start get		√	0xA4	
Power state at cold start set	√		0xA3	
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	
Picture Format get		√	0x3B	
Picture Format set	√		0x3A	
Picture-in-picture	√		0x3C	
PIP source	√		0x84	
Audio parameters get		√	0x43	
Audio parameters set	√		0x42	
Volume get		√	0x45	
Volume set	√		0x44	
Volume limits	√		0xB8	
Miscellaneous info		√	0x0F	Operating hours
Smart power	√		0xDD	Dimming backlight
Auto Adjust	√		0x70	VGA only
Temperature Get		√	0x2F	
Serial Code Get		√	0x15	
Tiling Get		√	0x23	
Tiling Set	√		0x22	
Light Sensor Get		√	0x25	
Light Sensor Set	√		0x24	
OSD Rotating Get		√	0x27	
OSD Rotating Set	√		0x26	
MEMC Effect Get		√	0x29	
MEMC Effect Set	√		0x28	
Touch Feature Get		√	0x1F	
Touch Feature Set	√		0x1E	



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