Technical Reference

UHD654-X-HR LCD Panel

External Commands

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Content

About external controls

In addition to using the display keypad or the remote control, you can control a display panel by using a serial (RS232/RS485) link to send ASCII commands and receive responses to those commands.

You can also use discrete infrared (IR) control codes to program a third-party remote control unit. For more information, see *Using discrete IR codes* (on page 23).

Sending communications over an RS232 or an Ethernet connection

Learn how to send messages from a control computer to a display panel over an RS232 or an Ethernet link.

The control computer or device must be running one of the following applications:

- An audio/video control system such as those manufactured by AMX, Extron, or Crestron
- The Video Wall Toolbox application

For more information on the Video Wall Toolbox application, see *Using the Video Wall Toolbox application* (on page 15).

Configuring the RS232 port

Learn how to configure the RS232 port.

1. Connect the control computer to the RS232 input on the display panel.

2. Do one of the following.

   - If you are using the Video Wall Toolbox application, to connect the control computer to the display panel, select the COM: port.

   For more information, see *Using the Video Wall Toolbox application* (on page 15).

   - If you are using an audio/video control system, complete the following to configure the RS232 port on the system.

     a. Select no parity, 8 data bits, 1 stop bit, and no flow control.

     b. Set the baud rate to 115200, so that it matches the RS232 port on the display panel.

Ethernet connection command and response format

If you are using the Video Wall Toolbox application, select the IP address of the display panel. If you are using an audio/video control system, configure the control system to the IP address of the display panel and send commands using the Telnet protocol.

Commands sent from an automation/control system or a control computer to the display panel must be sent in this format:

```
[STX] [IDT] [TYPE] [CMD] ([VALUE] or [REPLY]) [ETX]
```

Where:

- [STX] indicates the start of the data command (always 07).

- [IDT] is the display ID. Use hexadecimal values 01 to 19 inclusive to address a single display panel. Use 00 to broadcast a command to all display panels in a video wall.

- [TYPE] is the command type:

    - 00 = return to host (response from the LCD panel)

    - 01 = read/action

    - 02 = write

- [VALUE] is the parameter setting for the command.

- [REPLY] is the parameter setting for the command, acknowledged by the display panel in its response to a command.

- [ETX] indicates the end of the command data (always 08).

Examples: Serial commands and responses

The following are some examples of serial commands and their responses.

Description	Command sent to the display panel	Response received from the display panel
Turn off the display panel.	07 01 02 50 4F 57 00 08	07 01 00 50 4F 57 00 08
Turn on the display panel.	07 01 02 50 4F 57 01 08	07 01 00 50 4F 57 01 08
Request the display panel status	07 01 01 50 4F 57 08	07 01 00 50 4F 57 XX 08 (XX = 0 when off, or 1 when on)
Set the display panel contrast to 30 (1E hex).	07 01 02 43 4F 4E 1E 08	07 01 00 43 4F 4E 1E 08
Request the display panel use 4:3.	07 01 02 41 53 50 02 08	07 01 00 41 53 50 02 08
Reset the display settings on the display panel.	07 01 02 41 4C 4C 00 08	07 01 00 41 4C 4C 00 08
Request the serial number of the display panel.	07 01 01 53 45 52 08	07 01 00 53 45 52 S(0)…S(12) 08 (S(0)…S(12) = serial number in ASCII)
Request the firmware version of the display panel.	07 01 01 47 56 45 08	07 01 00 47 56 45 S(0)…S(5) 08 (S(0)…S(5) = firmware version in ASCII)

Serial command list

Learn the serial commands that work with a display panel.

Power control and input sources

Learn the commands for power control and input sources.

Main item	Control item	CMD	Type	Value (DEC)	Reply (HEX)	Content	CMD (HEX)
Power control and Input source	Power control	POW	W/R	0	00	Off (soft power)	50 4F 57*
				1	01	On (soft power)	
	Input source	MIN	W/R	13	0D	DisplayPort1	4D 49 4E
				16	10	DisplayPort2	
				14	0E	OPS	
				9	09	HDMI 1	
				10	0A	HDMI 2	

*Valid command on Power saving/ off mode (The setting of "Power Saving" must not be "Eco")

Display adjustment

Learn the commands for making adjustments to the display.

Main item	Control item	CMD	Type	Value (DEC)	Reply (HEX)	Content	CMD (HEX)
Display adjustment	Color	BRI	W/R	0~100	00~64	Backlight	42 52 49
		BRL	W/R	0~100	00~64	Brightness	42 52 4C
		BLC	W/R	0	00	Off (Backlight)	42 4C 43
				1	01	On (Backlightt)	
		CON	W/R	0~100	00~64	Contrast	43 4F 4E
		SHA	W/R	0~10	00~0A	Sharpness	53 48 41
		HUE	W/R	0~100	00~64	Hue	48 55 45

Main item	Control item	CMD	Type	Value (DEC)	Reply (HEX)	Content	CMD (HEX)
Display adjustment	Color	SAT	W/R	0~100	00~64	Saturation	53 41 54
		CCT	W/R	0~64	00~40	Color temperature (3200K~9600K)	43 43 54
		GAC	W/R	0	00	Off (Gamma)	47 41 43
				1	01	2.2 (Gamma)	
		USR	W/R	0~128	00~80	Red Gain (128~256)	55 53 52
		USG	W/R	0~128	00~80	Green Gain (128~256)	55 53 47
		USB	W/R	0~128	00~80	Blue Gain (128~256)	55 53 42
		UOR	W/R	0~100	00~64	Red Offset (-50~50)	55 4F 52
		UOG	W/R	0~100	00~64	Green Offset (-50~50)	55 4F 47
		UOB	W/R	0~100	00~64	Blue Offset (-50~50)	55 4F 42
		RXY	R	25 bytes	25 bytes	Read Luminance & Color Chromaticity for 9300K	52 58 59 (Note)
	Scheme selection	SCM	W/R	0	00	User	53 43 4D
				1	01	Sport	
				2	02	Game	
				3	03	Cinema	
				4	04	Vivid	

Note: The 25 Reply **Bytes are defined: bD1, bD2, bD3, …, bD25, where:**

- bD1 = High byte of RY*16, bD2 = Low byte of RY*16.

- bD3 = High byte of Rx*10000, bD4 = Low byte of Rx*10000.

- bD5 = High byte of Ry*10000, bD6 = Low byte of Ry*10000.

- bD7 = High byte of GY*16, bD8 = Low byte of GY*16.

- bD9 = High byte of Gx*10000, bD10 = Low byte of Gx*10000.

- bD11 = High byte of Gy*10000, bD12 = Low byte of Gy*10000.

- bD13 = High byte of BY*16, bD14 = Low byte of BY*16.

- bD15 = High byte of Bx*10000, bD16 = Low byte of Bx*10000.

- bD17 = High byte of By*10000, bD18 = Low byte of By*10000.

- bD19 = High byte of WY*16, bD20 = Low byte of WY*16.

- bD21 = High byte of Wx*10000, bD22 = Low byte of Wx*10000.

- bD23 = High byte of Wy*10000, bD24 = Low byte of Wy*10000.

- bD25 = checksum (bD1+bD2+...+bD25=0x00).

RY, GY, BY, and WY are the Luminance (cd/m2) of all pixel red, green, blue, and white respectively. (Rx, Ry), (Gx, Gy), (Bx, By), and (Wx, Wy) are the Color Chromaticity of all pixel red, green, blue, and white respectively.

Other controls

Learn the commands for making adjustments to the display.

In broadcast mode, the command that is used to auto sort the Monitor ID sequentially must have a Value Byte of 0x01.

In broadcast mode, the command that is used to auto arrange the Division X/Y must have a Value Byte of 0x11.

Main item	Control item	CMD	Type	Value (DEC)	Reply (HEX)	Content	CMD (HEX)
OSD	Transparency	OST	W/R	0~10	00~0A	OSD Transparency	4F 53 54
	H position	OSH	W/R	0~100	00~64	OSD H Position	4F 53 48
	V position	OSV	W/R	0~100	00~64	OSD V Position	4F 53 56
	OSD rotation	OSR	W/R	0	00	Landscape	4F 53 52
				1	01	Portrait	
	OSD timeout	OSO	W/R	5, 10, 20, 30, 60	05, 0A, 14, 1E, 3C	OSD Timeout (5, 10, 20, 30, 60 sec)	4F 53 4F
Main item	Control item	CMD	Type	Value (DEC)	Reply (HEX)	Content	CMD (HEX)

Main item	Control item	CMD	Type	Value (DEC)	Reply (HEX)	Content	CMD (HEX)
EDID	HDMI1	EH1	W/R	0	00	1080P	45 48 31
				1	01	4K30Hz	
				2	02	4K60Hz	
	HDMI2	EH2	W/R	0	00	1080P	45 48 32
				1	01	4K30Hz	
				2	02	4K60Hz	
	OPS	EH5	W/R	0	00	1080P	45 48 35
				1	01	4K30Hz	
				2	02	4K60Hz	
	DisplayPort1	ED1	W/R	0	00	1080P	45 44 31
				1	01	4K30Hz	
				2	02	4K60Hz	
	DisplayPort2	ED2	W/R	0	00	1080P	45 44 32
				1	01	4K30Hz	
				2	02	4K60Hz	
Multi source	Multi source views adjust	PSC	W/R	0	00	OFF	50 53 43
				1	01	PIP small	
				2	02	PIP medium	
				3	03	PIP large	
				4	04	Dual view	
				7	07	Quad view	
	PIP Source selection	PIN	W/R	(refer to MIN)	(refer to MIN)	Select the input source of sub window 1 (refer to MIN)	50 49 4E
		PIO	W/R	(refer to MIN)	(refer to MIN)	Select the input source of sub window 2 (refer to MIN)	50 49 4F
		PIP	W/R	(refer to MIN)	(refer to MIN)	Select the input source of sub window 3 (refer to MIN)	50 49 50
	PIP position	PPO	W/R	0	00	PIP Position Bottom-left	50 50 4F
				1	01	PIP Position Bottom-right	
				2	02	PIP Position Top-left	
				3	03	PIP Position Top-right	

Multi Source	PIP / Main swap	SWA	W	0	00	Swap main and PIP	53 57 41

Main item	Control item	CMD	Type	Value (DEC)	Reply (HEX)	Content	CMD (HEX)
Other Control	Scaling	ASP	W/R	0	00	Native	41 53 50
				1	01	Full screen	
				2	02	4 : 3	
				3	03	Letterbox	
		PAS	W/R	1	01	Full Screen	50 41 53
				2	02	4 : 3	
				3	03	Letterbox	
		ZOM	W/R	0~10	00~0A	Adjust over scan ratio	5A 4F 4D
	Baud rate adjustment	BRA	W/R	0	00	115200	42 52 41
				1	01	38400	
				2	02	19200	
	Power saving selection	WFS	W/R	0	00	Eco	57 46 53
				1	01	Normal	
				2	02	Never sleep	
	Auto scan	ATS	W/R	0	00	Off	41 54 53
				1	01	Main	
				2	02	Multi	
				3	03	All	
	IRFM	IRF	W/R	0	00	Off	49 52 46
				1	01	On	
	Smart light control	SLC	W/R	0	00	Off	53 4C 43
				1	01	Consistency	
				2	02	Video Wall	
	Power LED	LED	W/R	0	00	Off	4C 45 44
				1	01	On	
	DisplayPort 1 version	DPM	W/R	0	00	DP 1.1	44 50 4D
				1	01	DP 1.2	
	DisplayPort 2 version	DPN	W/R	0	00	DP 1.1	44 50 4E
				1	01	DP 1.2	

Main item	Control item	CMD	Type	Value (DEC)	Reply (HEX)	Content	CMD (HEX)

Other Control	RGB Color Range	HCR	W/R	0	00	Auto Detect	48 43 52
				1	01	Full Range	
				2	02	Limited Range	
	Backlight Limit Control	BLL	W/R	12~100	19~64	Adjust Backlight Limit	42 4C 4C
	Remote Control	RCU	W	0	00	MENU Key	52 43 55
				1	01	INFO key	
				2	02	UP key	
				3	03	DOWN key	
				4	04	LEFT key	
				5	05	RIGHT key	
				6	06	ENTER key	
				7	07	EXIT key	
				10	0A	HDMI1 key	
				11	0B	HDMI2 key	
				12	0C	DISPLAYPORT1 key	
				18	12	SOURCE key	
				19	13	P-SOURCE key	
				20	14	PIP key	
				21	15	P-POSITION key	
				22	16	SWAP key	
				23	17	SCALING key	
				26	1A	BRIGHT key	
				27	1B	CONTRAST key	
				33	21	OPS key	
				34	22	DISPLAYPORT2 key	
		ALL	W	0	00	Reset all	41 4C 4C

Main item	Control item	CMD	Type	Value (DEC)	Reply (HEX)	Content	CMD (HEX)
Other Control	Remote control	KLC	W/R	0	00	Unlock keys	4B 4C 43
				1	01	Lock keys	
		SER	R	13 Bytes	13 Bytes	Read serial number	53 45 52
		MNA	R	13 Bytes	13 Bytes	Read model name	4D 4E 41
		GVE	R	6 Bytes	6 Bytes	Read firmware version	47 56 45
		RTV	R	0~255	00~FF	Read RS232 table version	52 54 56
		RTT	R	0~255	00~FF	Read the temperature of the internal thermal sensor (-128~+127).	52 54 54
		RSF	R	0~255	00~FF	Read the Fan 1 speed (RPM=30xReply Value).	52 53 46
			W	0/0~255	00/00~FF	Read the Fan 1 speed (RPM=30xReply Value.	
			W	1/0~255	01/00~FF	Read the Fan 2 speed (RPM=30xReply Value.	
	Configuration Presets	PSS	W	0~127	00~7F	XX-th-Preset Configurations Save	50 53 53
		PSR	W	0~127	00~7F	XX-th-Preset Configurations Recall	50 53 52
		PSH	W	0~127	00~7F	Check if XX-th-Configurations is valid (return 1) or not (return 0)	50 53 48
	Multi-display	SID	W	0	00	Show Monitor ID	53 49 44
		CID	W	1~100	01~64	Change Monitor ID	43 49 44
		VWS	W/R	0	00	Video wall switch off	56 57 53
				1	01	Video wall switch on	
		VWF	W/R	0	00	Video wall framless off	56 57 46
				1	01	Video wall framless on	

		MAT	W/R	X: 1~10 Y: 1~10	X: 01~0A Y: 01~0A	Matrix X, Y value High quarter is X: 7 ~ 4 bit Low quarter is Y: 3 ~ 0 bit	4D 41 54
		DIV	W/R	X: 1~10 Y: 1~10	X: 01~0A Y: 01~0A	Divisions X, Y value High quarter is X : 7 ~ 4 bit Low quarter is Y : 3 ~ 0 bit	44 49 56

Main item	Control item	CMD	Type	Value (DEC)	Reply (HEX)	Content	CMD (HEX)
Other control	Multi-display	POD	W/R	0~30	00~1E	Integral part of Power On Delay (0, 1, **2, …, 30 sec).**	50 4F 44
		POE	W/R	0~19	00~13	Fractional part of Power On Delay (0, 0.05, **0.10, …, 0.95** sec).	50 4F 45
	Self diagnosis	OTT	R	4 bytes	4 bytes	Accumulated operation time (minutes)	4F 54 54 (Note 1)
		OTS	R	4 bytes	4 bytes	Operation time (minutes)	4F 54 53 (Note 1)
		ERR	R	4 bytes	4 bytes	Error code	45 52 52 (Note 2)
		LMT	R	8 bytes	8 bytes	The maximum temperature and the corresponding accumulated operation time (minutes)	4C 4D 54 (Note 3)
		LM1	R	8 bytes	8 bytes	The 1st error log	4C 4D 31 (Note 4)
		LM2	R	8 bytes	8 bytes	The 2nd error log	4C 4D 32 (Note 4)
		LM3	R	8 bytes	8 bytes	The 3rd error log	4C 4D 33 (Note 4)
		LM4	R	8 bytes	8 bytes	The 4th error log	4C 4D 34 (Note 4)
		LM5	R	8 bytes	8 bytes	The 5th error log	4C 4D 35 (Note 4)
		LM6	R	8 bytes	8 bytes	The 6th error log	4C 4D 36 (Note 4)
		LM7	R	8 bytes	8 bytes	The 7th error log	4C 4D 37 (Note 4)
		LM8	R	8 bytes	8 bytes	The 8th error log	4C 4D 38 (Note 4)
		LM9	R	8 bytes	8 bytes	The 9th error log	4C 4D 39 (Note 4)
		LMA	R	8 bytes	8 bytes	The 10th error log	4C 4D 41 (Note 4)

Note 1: The 4 Reply Bytes are defined: bD1, bD2, bD3, bD4. Where bD1~bD4 combine a 32-bits value and bD1 is the lowest byte.

Note 2: The 4 Reply Bytes are defined: bD1, bD2, bD3, bD4

Where

- bD1:

    - The maximum temperature value. (-128~127)

    - bit0: Fan1 error

    - bit1: Fan2 error

    - bit2: Overheat

    - bit3: EEPROM error

    - bit4: Reserved

    - bit5: HDMI error

    - bit6: MCU error

    - bit 7: Net2Uart error

- bD2:

    - bit0: Reserved

    - bit1: Fan speed sensor error

    - bit2: Thermal sensor error

    - bit3: Reserved

    - bit4: Backlight error

    - bit5~7: Reserved

- bD3, bD4: Reserved.

Note 3: The 8 Reply Bytes are defined: bD1, bD2, … , bD8

Where

- bD1: The maximum temperature value. (-128~127)

- bD2~bD3: Reserved.

- bD5~bD8: combine a 32-bits value (the corresponding accumulated operation time in minutes) and bD5 is the lowest byte.

Note 4: The 8 Reply Bytes are defined: bD1, bD2, … , bD8

Where

- bD1~bD4 are the 4-bytes error code and are defined in Note 2.

- bD5~bD8 combine a 32-bits value (the corresponding accumulated operation time in minutes) and bD5 is the lowest byte.

Using the Video Wall Toolbox application

The Video Wall Toolbox application can be used to configure and control a single display panel or a video wall.

The application provides an alternative to using the remote control unit or built-in keypad. It presents all of the controls in the on-screen display (OSD) menus as a graphical user interface.

To use the Video Wall Toolbox application, the control computer must be running Windows 7 or later.

Installing the Video Wall Toolbox application

Learn how to install and set up the Video Wall Toolbox application on the control computer.

1. Download the Video Wall Toolbox application from *https://www.christiedigital.com/*.

2. Connect the control computer to a display panel or video wall.

   For detailed instructions on connecting a control computer to a video wall using an RS232 or an Ethernet connection, refer to the user manual for the product.

3. Verify that the baud rate for the RS232 connection on the control computer matches the baud rate of the display panel.

   The default baud rate is 115200.

4. Launch the Video Wall Toolbox application.

5. To specify the size of the video wall, in the Video Wall Size fields, enter the number of columns and rows in your video wall.
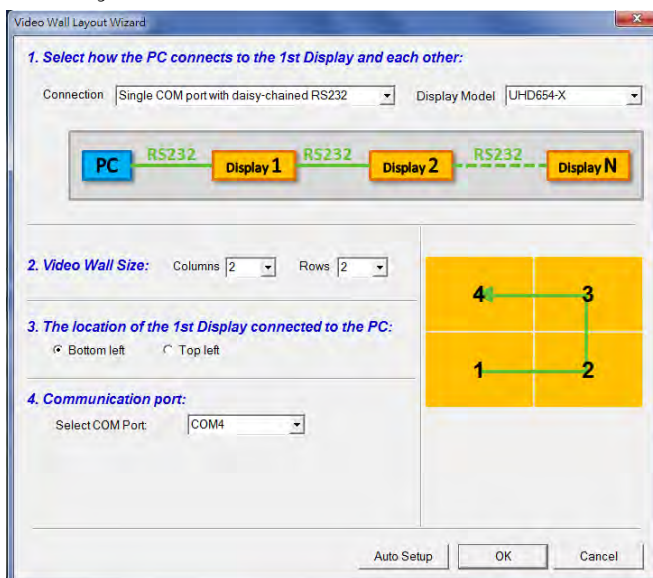
6. Specify the location of the first display panel that is connected to the display computer.

7. To connect the display panel or video wall to the control computer, in the Select COM Port list, select an option.

8. To automatically assign Monitor IDs to all the display panels in a video wall, select Auto Setup.

Understanding functions of the Video Wall Toolbox application

Learn the differences between the functions of the Video Wall Adjustment screen, the Color Adjustment screen, and the Remote Control screen.

- The Video Wall Adjustment screen provides the same controls as the Multi-Display Control menu on a display panel.

- The Color Adjustment screen provides the same image quality controls as the Image Settings menu on a display panel.
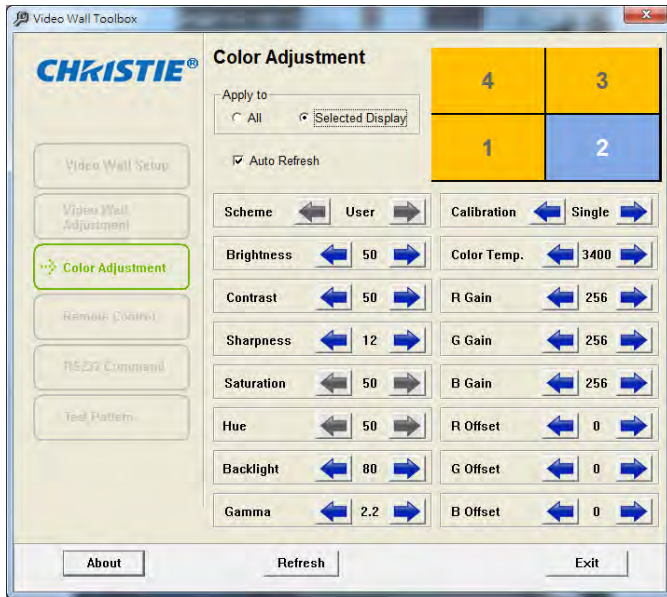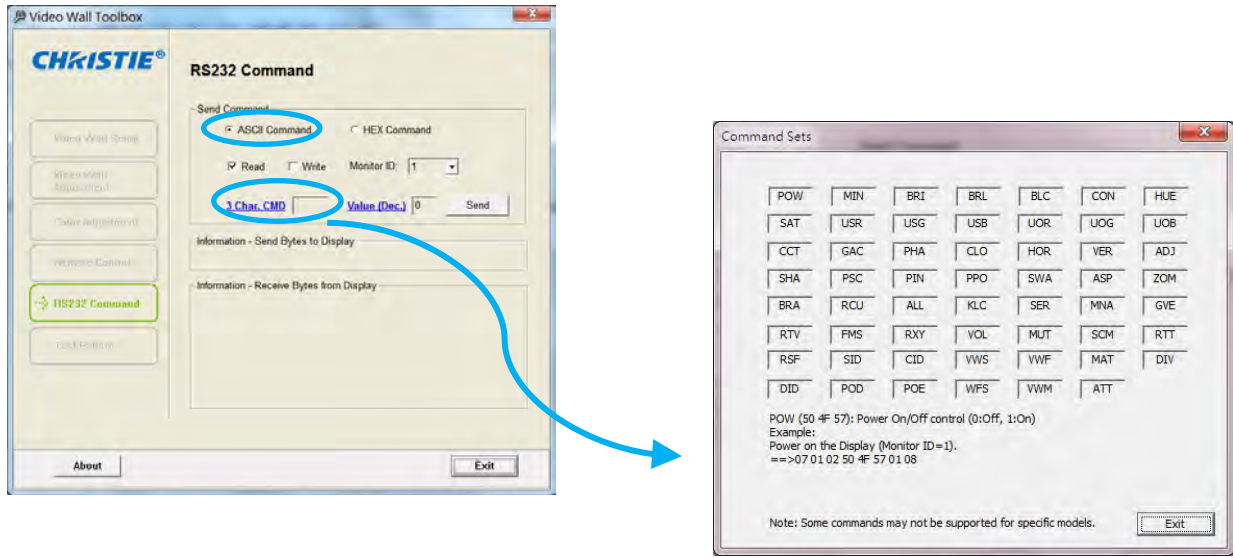
- The Remote Control screen provides the same functionality as the hand-held remote control.
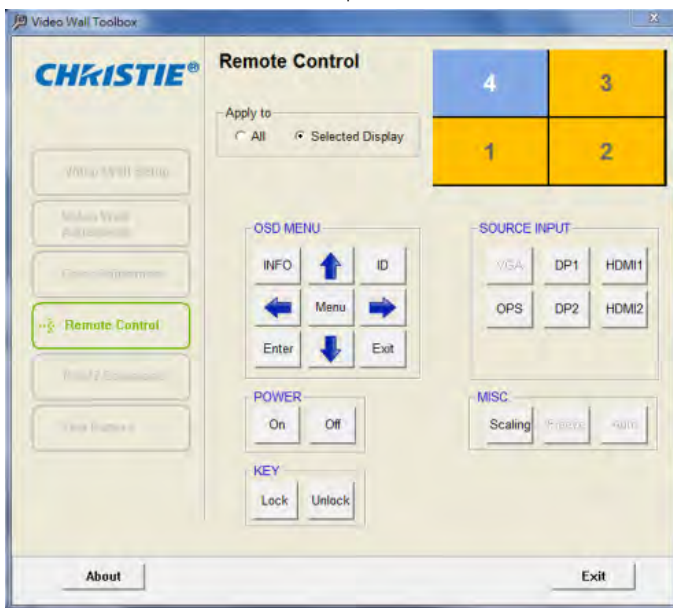
Entering RS232 commands in ASCII format

Learn how to send and receive RS232 commands using the Video Wall Toolbox application.

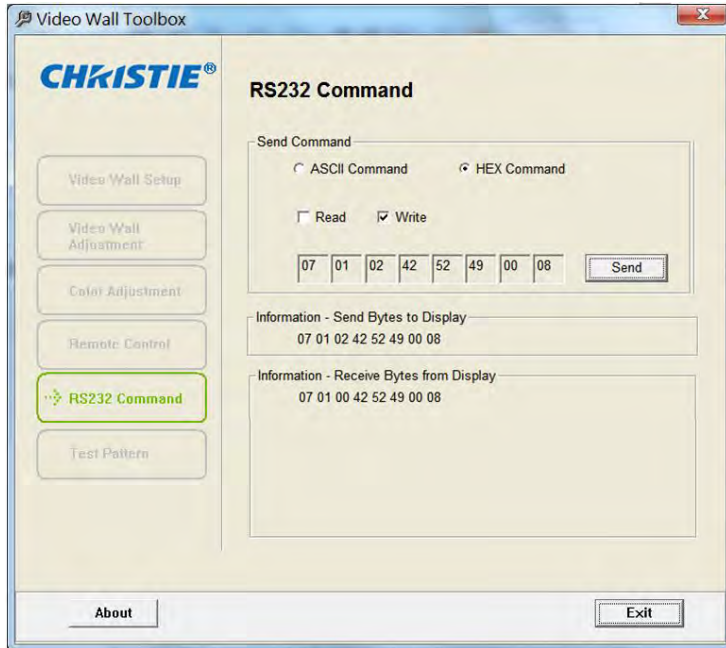Use the RS232 Command screen to manually enter supported RS232 commands in ASCII format.

1. On the RS232 Command screen, under Send Command, select ASCII Command.

2. To select a command type, select Read or Write.

3. To select a command destination, from the Monitor ID list, select a display panel.

4. If you are entering a Read command, do one of the following.

   - To manually enter a valid three-character command from the *Serial Command List* (on page 6), in the 3 Char CMD field, type a command.

   - To choose a three-character command from a list of commands, click 3 Char CMD. When you hover your mouse pointer over a command, a brief description of the command and an example in hexadecimal format appear at the bottom of the window. Click a command to select it.

5. If you are entering a Write command, do one of the following.

   - To enter a decimal parameter value to send with the command, in the Value (Dec.) field, enter a value.

   - To change the parameter entry mode to Value (Hex) and enter a hexadecimal value, click Value (Dec.).

6. Click Send.

   If the command is successfully executed, the command and the response from the target display panel appear in the window.

Entering RS232 commands in hexadecimal format

Learn how to send and receive RS232 commands using the Video Wall Toolbox application.

1. On the RS232 Command screen, under Send Command, select HEX Command.

2. To select a command type, select Read or Write.

3. Click the far-left text box then enter 07.

4. In the second text box, enter the Monitor ID.

5. In the third text box, enter 01 for a Read command, or 02 for a Write command.

6. In the next three text boxes, enter the command.

    If you are entering a Write command, enter a parameter value to send with the command.

7. In the far-right text box, enter 08.

8. Click Send.

    If the command is successfully executed, the command and the response from the target display panel appear in the window.

Generating a test pattern

Learn how to generate a test pattern on a display panel or a video wall using the Video Wall Toolbox application.
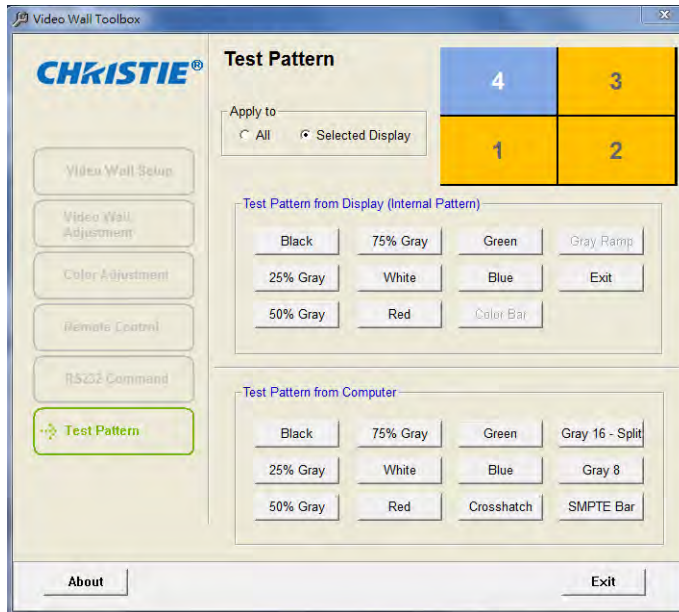
1. To select whether to display a test pattern across a video wall or on just one display panel, under Apply To, select All or Selected Display.

2. If you chose Selected Display, select the Monitor ID for the target display panel.

3. Do one of the following.

   - To generate an internal test pattern from a display panel, under Test Pattern from Display select a test pattern.

   - To generate an external test pattern from the control computer, under Test Pattern from Computer, select a test pattern.

Using discrete IR codes

A display panel can accept commands in the form of infrared (IR) signals that conform to NEC.

Each button on a display panel remote control has an IR control code associated with it. You can use these codes to program a third-party, universal, remote control unit that can work with the display panel. Generally, these third-party products come with a computer software application that supports this. For more information, see the documentation provided with the third-party remote control unit.

IR command protocol

The following are characteristics that IR control codes possess.

- Each code consists of the following.

  - A leader pulse—A modulated pulse of 9 ms followed by a non-modulated pulse of 4.5 ms.

  - 16 address bits (custom code)—Eight bits for the address followed by the logical inverse of the address. The custom code for the display is 16559 decimal (0x40AF, binary 01000000 10101111).

  - 16 data bits—Eight bits for the command followed by the logical inverse of the command.

  - An end pulse—A modulated pulse of 0.56 ms, similar to the modulated pulse in the 0 and 1 bits. The end of the modulated pulse constitutes the end of the data transmission.

- The carrier frequency is 38 kHz, with the modulated pulses having a 33% duty cycle.

- Commands are sent at a maximum rate of 9 Hz.

To illustrate, below is the NEC control code for the POWER button on the display panel remote control unit.

Hex	40	AF	1C	E3
Binary	010000000	10101111	00011100	11100011
Function	Cust. Code Byte 1	Cust. Code Byte 2	Command	Command (logical inverse)

IR control code list

Learn the IR control codes.

Customer code	Data code	Function
40AF	04FB	INFO
40AF	1CE3	POWER
40AF	08F7	DISPLAY PORT1

Customer code	Data code	Function
40AF	09F6	HDMI1
40AF	0AF5	PIP POSITION
40AF	0BF4	DISPLAY PORT2
40AF	0CF3	HDMI2
40AF	1AE5	PIP
40AF	15EA	OPS
40AF	11EE	SWAP
40AF	13EC	PIP SOURCE
40AF	02FD	UP ARROW
40AF	01FE	LEFT ARROW
40AF	0EF1	MENU
40AF	03FC	RIGHT ARROW
40AF	19E6	DOWN ARROW
40AF	12ED	ENTER
40AF	05FA	EXIT
40AF	14EB	SCALING
40AF	17E8	BRIGHT
40AF	18E7	CONTRAST
40AF	1EE1	AUTO
40AF	0FF0	SOURCE

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