

Radiance Pro™ Video Processor Owner's Manual



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This equipment has been tested and found to comply with the limits for a class B digital device, pursuant to Part 15 of the FCC rules, Canadian ICES-003, and CISPR 22. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Unauthorized modifications to this equipment may void Lumagen's limited warranty and the user's authority to operate this equipment.

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WARNINGS:

- Do not defeat the safety features of the power supply or power cord, such as, but not limited to, removing the ground pin connection.
- Do not open, insert objects into, or spill liquid into, this equipment.
- Do not block the cooling vents, and make sure there is adequate cooling around unit.
- Do not program an output resolution that exceeds the maximum specified refresh rate of the attached television, or projector.
- Improperly set gray-bar intensity may accelerate screen burn-in on CRT and plasma displays. Consult a home-theater specialist for help setting gray-bar intensity.

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Section 1 – Getting Started

Section 1 – Introduction

Thank you for purchasing a Lumagen® Radiance Pro™ video processor. The award winning Lumagen Radiance video processor family boasts the highest-performance video switching, processing, and calibration, available. This makes it ideal for premium quality high-definition home and commercial theater applications. Lumagen's Radiance series refines and enhances the video images presented by projectors, and flat-panel displays.

The Radiance family offers 10-bit front-end, and 12-bit back-end, processing, standard definition (SD) and high definition (HD) video de-interlacing, No-Ring™ scaling technology that does not add "Halos" around edges (unlike competing products). It supports 4k60 sources using HDMI 2.0, with HDCP 2.2, and uncompressed audio formats for Dolby-Digital TrueHD™ and DTS Master-Audio™ Bitstream formats.

Radiance processors can function as a central switching hub for the audio video system. The Radiance Pro family of video processors is modular and can be configured with 2 to 8 inputs, and 2 or 4 outputs.

Key Features

- Up to 8 inputs (444X) or 4 inputs (424X) with resolutions up to 4k60 HDMI 2.0a with HDCP 2.2
- Up to four outputs at resolutions up to 4k60 HDMI 2.0a with HDCP 2.2
 - The 444X models have up to four processed outputs
 - The 424X models have up to two processed outputs
- Inputs and some outputs can be upgraded to 18 GHz
- Proprietary Lumagen No-Ring™ scaling
- HDR Intensity Mapping for improved quality HDR sources on HDR, or SDR, displays
- Vertical Keystone correction
- Darbee Digital Visual Presence™ (DVP™) enhancement technology (for up to 1080p60 input rate)
- CMS (Color Management System) using a 4913-point 3D Look Up Table (3D LUT) RGB color palette
- 21-point parametric grayscale and Gamma
- 10-bit processing for deinterlacing plus a 12-bit calibration pipeline
- Support for both 2D and 3D anamorphic scaling *without* an anamorphic lens
- Convert common optional 3D formats to a required 3D format that is supported by the display
- Each input has 4 user configuration memories
- Each input user configuration memory has 8 resolution sub-memories (for HD inputs)
- Each resolution sub-memory is linked to one of 8 output configurations.
- 2:2, 3:2 and 3:3 pull-down for SD/HD film sources
- SD/HD video de-interlacing
- User programmable non-linear-stretch (NLS) mode
- 4:3, LBOX, 16:9, 1.85, 2.35, 2.40 and NLS input aspect ratios
- Programmable output aspect ratio from 1.10 to 2.50
- Large suite of test patterns
- Programmable input/output color-space
- Y/C-delay calibration
- CUE and ICP filtering
- Eight channel audio up to 192 kHz, DD True-HD™ 5.1, and DTS Master Audio™ Bitstream
- IR and RS232 control inputs (See Tech Tip 11 and 12 on the Lumagen.com support page)
- Internal USB-to-serial adaptor for command input or software updates.
- Wired IR format command input
- Universal, 100-240V, ~50/60Hz external 12 VDC 5 Amp power supply
- Optional rack mounting ears

Section 1 – Getting Started

Document Conventions and Menu Navigation

Commands are selected with the supplied infrared remote or the RS232 serial port. To prevent possible command conflict, only one of these methods of command should be used at a time. See the Serial RS232 Command Interface section for information on serial commands. The infrared remote control command notation is described below:

- Remote buttons are named as shown in a bold font. Example: **MENU**.
- For comma separated lists, press the buttons in the sequence shown.
- For parenthesized lists, select one button from the list.
- For square-bracketed lists, press the buttons as needed.
Example: For the list [**◀**, **▶**, **▲**, **▼**], press the arrow keys as needed.
- For menu commands press the **MENU** button. The **▲** and **▼** arrow keys are used to select the function. The **▶** arrow key (or **OK**) is used to enter sub-menus. This is shown as: **MENU** → **MenuItem** → **MenuItem**. Generally, the **◀** arrow key (or **EXIT**) steps up one menu level.
- Numerical entries are listed as **value**. For numerical entries, the **◀** arrow key acts as backspace.
- Some commands are activated immediately without the need to press **OK**. Other commands must be explicitly accepted by pressing **OK**. If needed, **OK** is listed as part of the command, and will complete the command and return the menu to one level higher in the menu system. Note that, at default settings, pressing **OK** when it is not required will bring up the Radiance Status Screen.
- For many commands, pressing **EXIT** cancels a partially completed command and returns to one level higher in the menu system. For advanced commands changes are completed from within the command and **EXIT** just returns to one level higher in the menu system.
- There are four independent configuration memory types for each input (**MEMA**, **MEMB**, **MEMC** and **MEMD**). The input setup and output resolution/timing can be set independently for each memory. To program an input memory, first select the input, then select the desired configuration memory and use the menu system to configure.
- Some menu commands are only available when their associated input is selected.
- Before changes are saved, they can be discarded by entering standby (**STBY**) mode.
- A Save must be performed after any changes or all changes will be discarded the next time the unit enters standby (**STBY**), or power is lost. To save press **MENU, ▲, OK, OK, OK**.

Unpacking

- Unpack the box.
- Save the box and packing materials in case you need to ship your Radiance.

Verify that your box contains the following items

- Lumagen Radiance video processor.
- Universal, 100-240V, ~50/60Hz, 12 VDC 5 Amp power supply
- Remote control.
- AAA Batteries (2).
- Owner's Manual.
- USB cable.
- If purchased with the Radiance Pro, the optional 19 inch rack-mount ears.

Remote Control Battery Installation

1. Locate the battery compartment on the back of the remote control.
2. Move the locking tab to open the door.
3. Remove the old batteries (if applicable).
4. Install two new AAA batteries, observing the battery polarity shown in the battery compartment.
5. Replace the battery compartment cover.

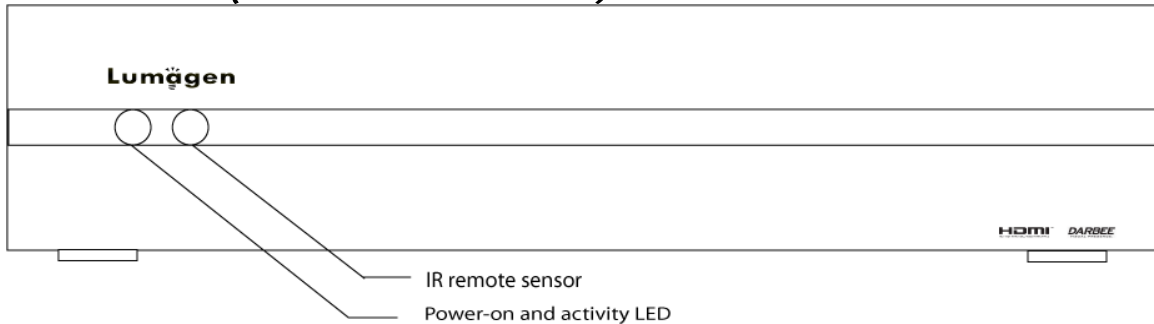
Installation Guidelines

- Disconnect wall power from all electronics before plugging in, or removing, HDMI cables
- Select a cool, well-ventilated, dry location.
- Install the Radiance on a flat, level surface such as a table, shelf, or in a 19" rack
- Verify that the cooling vents are clear of obstructions to provide adequate cooling.
- Use only the Lumagen approved power supply.
- Avoid sudden temperature changes, temperature extremes and excessive humidity.
- Unplug power to the Radiance before cleaning

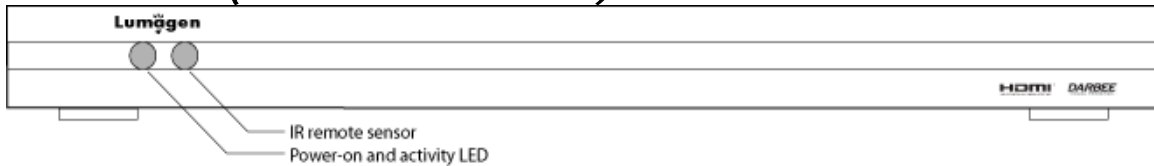
Section 2 – Overview

Section 2 – Overview

Front Panel (Radiance Pro 444X)



Front Panel (Radiance Pro 424X)

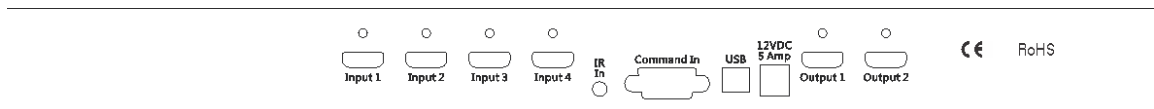


The front panel has a light-emitting-diode (LED) indicator, which is red when the unit is “standby” and, by default, is blue when the unit is “on.” Note: The blue “on” indicator can be disabled if preferred.

Rear Panel (Radiance Pro 444X)



Rear Panel (Radiance Pro 424X)

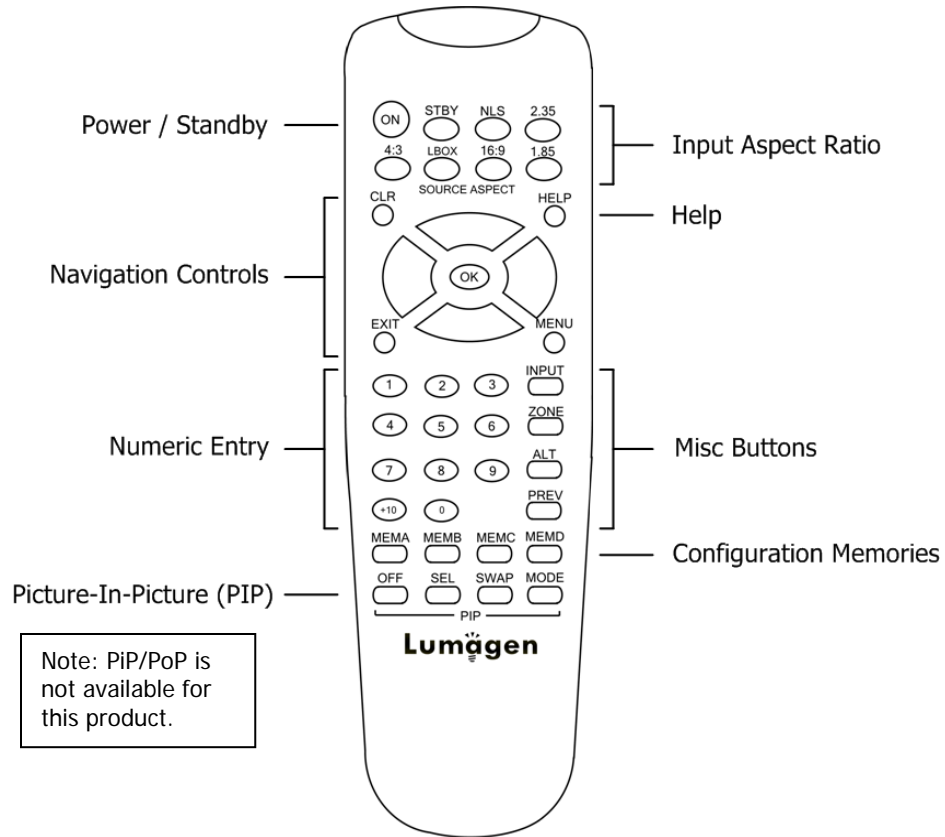


Rear panel connections are:

- Up to four HDMI 2.0 inputs (424X), or up to eight HDMI 2.0 inputs (444X), with HDCP 2.2
- Two HDMI 2.0 outputs (424X), or four HDMI 2.0 outputs (444X), with HDCP 2.2
- 18 GHz input and output options available
- IR format command input (See Tech Tip 9 on the Lumagen.com website)
- RS232 for commands and software update (See Tech Tip 6 & 11)
- USB port for updates and calibration. This uses an internal USB-to-Serial adapter
- Internal USB-to-serial adapter for commands and software update (See Tech Tip 6 & 11)
- Power Input (12 Volts DC, 5 Amp power supply)

Section 2 – Overview

Remote Control



Power / Standby

ON Power On
STBY Standby

Navigation Control

CLR Clear menu or partial commands
HELP Display context-sensitive help
EXIT Go back one menu level
OK Enter/Accept command, display info screen
▲ Menu navigation / zoom in
▼ Menu navigation / zoom out
◀ Menu navigation / input aspect
▶ Menu navigation / input aspect

Numeric Entry

1-9 Input 1 to 9
+10 Input 10 and greater

Picture-In-Picture (PIP)

OFF Not applicable
SEL Not applicable
SWAP Not applicable
MODE Not applicable

Input Aspect Ratio

4:3 4:3 (1.33) aspect ratio
LBOX Letterbox
16:9 16.9 (1.78) aspect ratio
1.85 1.85 aspect ratio
2.35 2.35 aspect ratio
NLS Non-Linear-Stretch

Misc Buttons

INPUT Precedes input # selection
ZONE <Radiance Pro 4449>
ALT Alternate info screens
PREV Previous output

Configuration Memories

MEMA Memory A
MEMB Memory B
MEMC Memory C
MEMD Memory D

Section 2 – Overview

Block Diagram

The function of the Radiance is to act as a video switch, process the selected video source, and then output video in the appropriate format and resolution. Input rates from standard definition up to 4k60 are supported. Video inputs are converted to progressive video, if necessary, and are then scaled to the video output resolution, which can be up to 4k60.

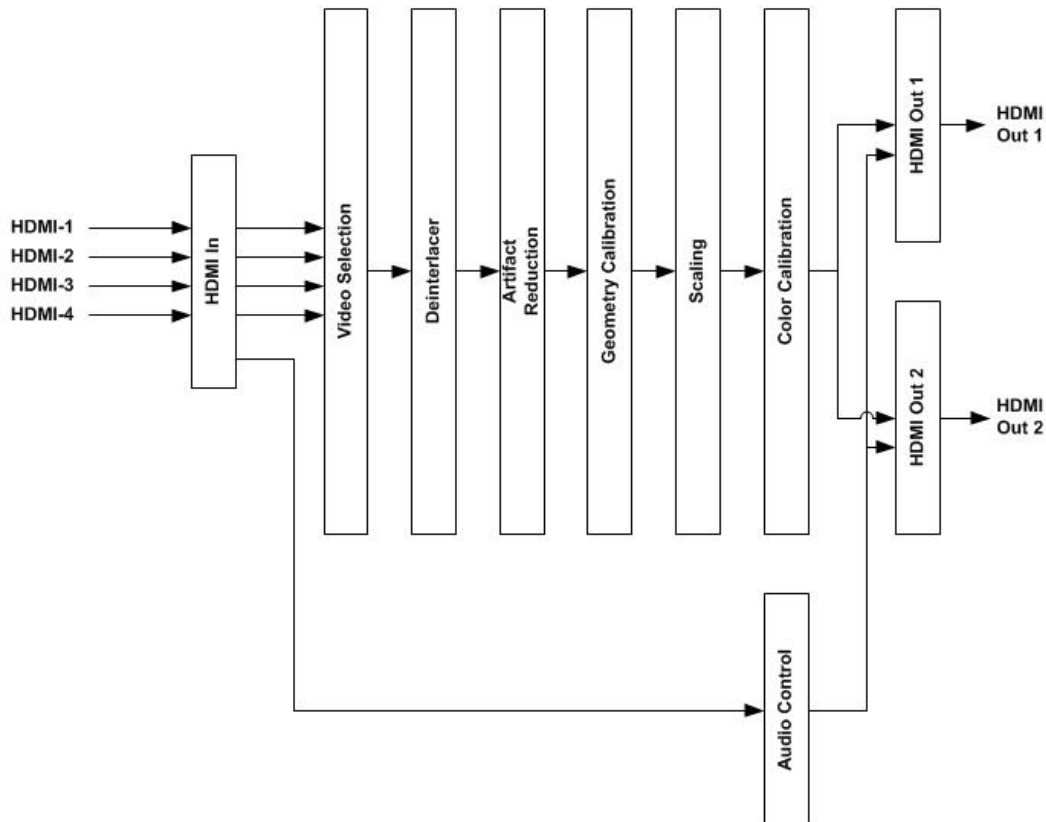
Interlaced video has been in use for more than 60 years and is still a common video format. It displays half of the lines of picture information each sixtieth (or fiftieth) of a second. Each half of the image is called a field and displays either all the even lines, or all the odd lines. So, an entire image, called a frame, takes a thirtieth (or twenty-fifth) of a second to display on the screen. An “i” suffix on the resolution specification is used to indicate interlaced formats.

In contrast, progressive video presents each frame as a whole. A “p” suffix on the resolution specification is used to indicate progressive formats. Converting interlaced video to progressive video is referred to as “deinterlacing.”

The Radiance is comprised the following major functional sections:

- Video/Audio input selection
- Video deinterlacing (if required)
- Video processing and scaling
- Video/Audio output

The functional blocks are shown below. Note that the number of HDMI inputs and outputs can vary. The Radiance Pro 4242 four-input, two-output, configuration is shown.



Commands can be sent to the Radiance by infrared remote or via the serial RS232 port. The RS232 port, or the USB port, can be used for software updates. Setup is done with the on-screen menu. User functions (e.g. select input) use direct commands to make macro programming simpler.

Section 2 – Overview

Configuration Memories

To understand how the Radiance functions, it is important to note that setup and calibration parameters are split into “input memories” and “output configurations.” Input memories control the video source setup. Output configurations control the display setup and calibration. The Output configurations are specified by selecting a Config, CMS and Style for input, input memory, input resolution, HDR/SDR, and 2D/3D mode.

Each Radiance Pro input has four input memories (**MEMA**, **MEMB**, **MEMC** and **MEMD**). Each input memory has sub-memories for the various possible input formats. These are automatically selected based on the input resolution and vertical-rate. The “Other” entry represents the other possible input resolutions and vertical rates not specified specifically. Each input resolution and vertical rate has 7 sub-memories which can be selected on a per-input and per-input-memory basis. For example, as shown in the block diagram below, there can be 8 different input configurations for 480i/p sources shared among all inputs and all memories.

Each input sub-memory can be independently linked to any one of the 8 Output **Mode** configurations, 8 **CMS** memories, and 8 **Style** memories. These store setup data for the video display setup and calibration. In the factory default condition all input sub-memories are linked to **Auto** output select, **CMS 0** (for SDR sources), **CMS 1** (for HDR/Rec2020 sources), and **Style 0**.

To change these linkages use the **Output Setup** menu. Settings can be changed for each input sub-memory. Makes sure to “Save” any changes you want to keep (**MENU** → **Save** → **OK** → **OK** → **OK**).

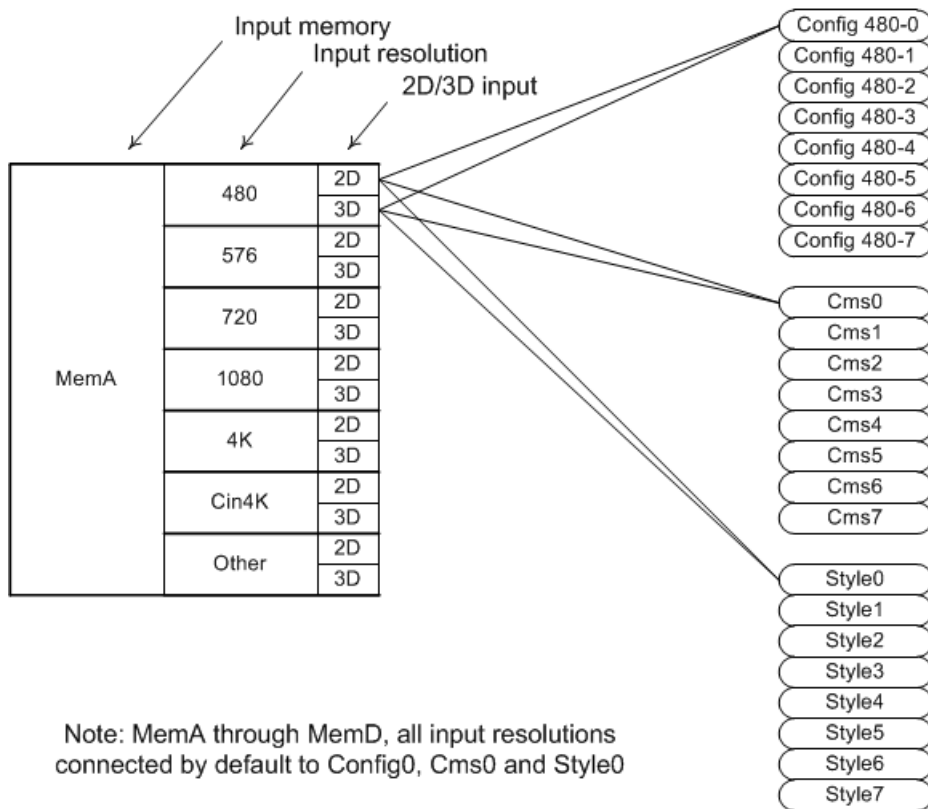
NOTE:

By default, for a Rec 709 source, all sub-memories point to Auto output mode CMS0 and Style0. For a HDR/Rec2020 source, all sub-memories point to Auto output mode, CMS1 and Style0. For the majority of systems the default configuration does not need to be changed.

NOTE:

Changes must be Saved to make them permanent. If changes are not Saved the Radiance Pro will revert to the previously Saved settings when turned off.

Input memory to output configuration block diagram



Section 3 – Quick Start Guide

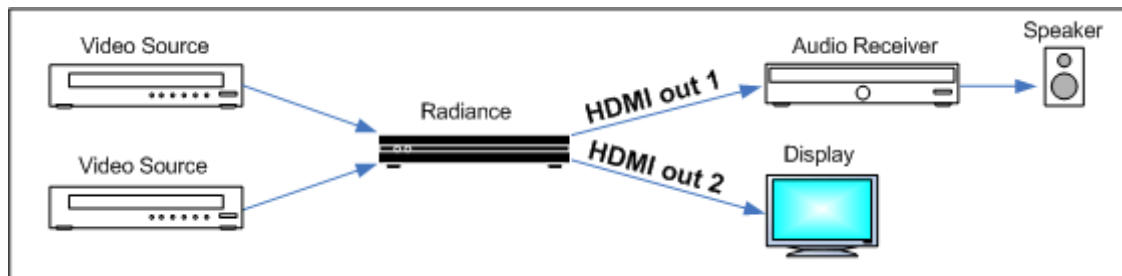
Section 3 – Quick Start Guide

Installation Instructions

1. Install two AAA batteries in the Lumagen Remote Control.
2. Disconnect all power in the system before connecting any A/V cabling to minimize the chance of damaging equipment.
3. Connect audio/video sources as appropriate.

NOTE:

The default configuration is to connect Radiance Pro HDMI Output 1 to the audio receiver, and HDMI Output 2 (424X) or Output 4 (444X) to the primary TV or projector. Lumagen recommends that the Radiance be used as the switching device for ease of operation, fastest video switching, and best video quality.



Default connections for Radiance Pro 4242 with AVR plus display/projector

4. Connect the Radiance outputs. If using only one Radiance output, connect the display to the highest numbered output. Then change the highest numbered output to both audio and video and enable the appropriate audio modes manually (See Direct Commands section for MENU 0943 and MENU 0944) to and do a Save. If using an AVR, or audio PrePro, connect it to Radiance Output 1 the display/projector to Output 2 (424X), or Output 2 or 4 (444X).

NOTE:

For HDMI connections on the Radiance Pro output use 6 to 10 foot (2 to 3 meters) passive 18 GHz HDMI cables if long enough. For Radiance Pro outputs requiring lengths over 10 feet (3 meters) Lumagen recommends using a certified 18 Ghz active wired or fiber HDMI cables.

5. Reconnect power. Plug the DC power cord from the Radiance power supply into the DC power jack on the back of the Radiance. Then connect the power cord to the Radiance power supply and plug it into a wall outlet.
6. Turn the other equipment on and use the Radiance remote control to turn the Radiance on.
7. Select the desired Radiance input using the Radiance remote control. The video inputs are numbered from 1 to 8. To select an input press the "Input" button and then press the corresponding number button on the remote. Make sure the selected source device is outputting active video.
8. You should now have an image on your display/projector. The Radiance automatically selects the appropriate output resolution and frame rate for HDMI/DVI displays/projectors (including 24p when supported), when connected according to these instructions.
9. The default output aspect ratio is 16:9 (i.e. 1.78:1). No output aspect ratio selection is needed for 16:9 displays or projectors. For other output aspect ratios, please see the User Manual for information on how to set the output aspect ratio. For 2.35 anamorphic screens the Radiance Pro can control the aspect ratio without the use of an anamorphic lens. See Tech Tip 16 for information on how to set up the Radiance Pro for a 2.35 screen.

Section 5 – Basic Commands

Section 4 – System Configuration Examples

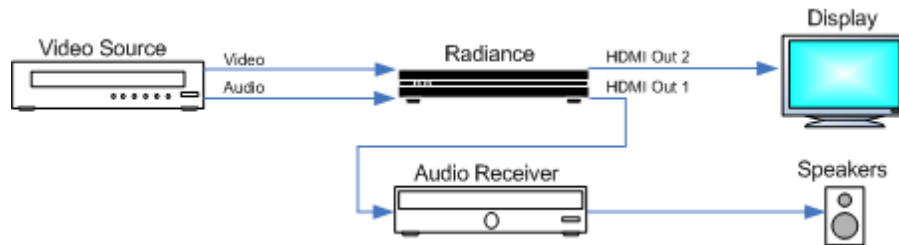
The most common configurations using the Radiance are shown below. Note, that HDMI outputs 1 and 2 are shown (424X). For the Radiance Pro 444X, Use Output 1 for the Receiver and Output 4 for the TV/projector.

1. Receiver after Radiance.

The default configuration is to connect all the video sources to the inputs of the Radiance Pro and connect the receiver, or preamp, to HDMI Out 1, and the display/projector to Radiance HDMI Out 2 (424X) or Output 4 (444X). Only after all audio and video connections have been made, connect to power and turn everything on. The Radiance automatically detects the video EDID from output 2 (424X) or Output 4 (444X), and the audio EDID from output 1 and reports the appropriate EDID modes back to all source devices.

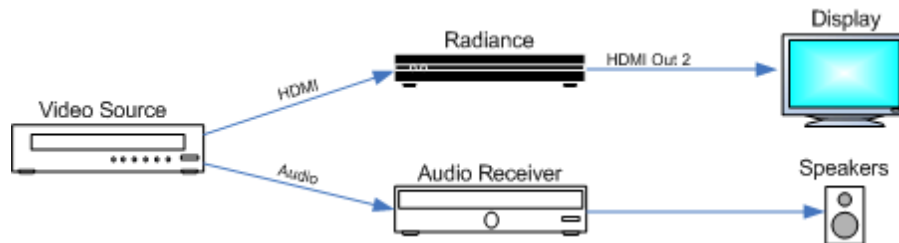
By default, Output 1 is set to "Audio Only". With this setting, Output 1 will output audio with blank 1080i video. By default, the other outputs are set to "Video Only". With this setting, they will output video without audio. In the "Output Setup" menu, you can change the settings for each output to "Audio Only", "Video Only", "Both Audio and Video", or "No Audio or Video".

This configuration can improve switching delays by using the Radiance Pro's input switching and guarantees that the receiver does not degrade the video. It also minimizes the work needed to configure the Radiance, for the TV/projector output, because audio is off by default.



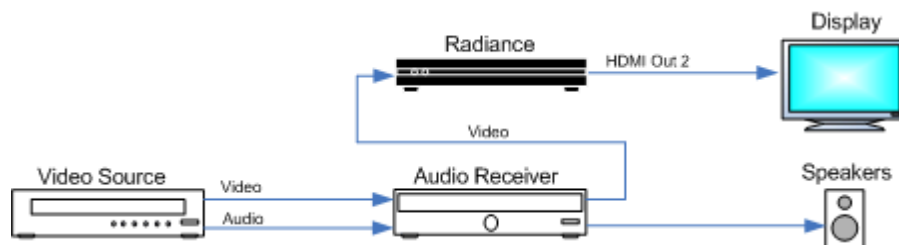
2. Audio and Video routed separately.

Route the audio and video separately to the Radiance and a receiver. Connect the TV/projector to Output 2 (424X) or Output 4 (444X). This output has its audio turned off by default and so is correct by default for this case.



3. Receiver in front of Radiance.

Use an AVR in front of the Radiance to switch the video sources. Note that some AVR's add artifacts to the video. So turn off all video processing in the AVR. Connect the TV/projector to Output 2 (424X) or Output 4 (444X). This output has its audio turned off by default and so is correct by default for this case.



Section 5 – Basic Commands

Section 5 – Basic Commands

Power

Turn power on by pressing the **ON** button. Place the Radiance in standby-mode by pressing **STBY**.

Input Selection

Press the **INPUT** button and then press the corresponding input number button on the remote.

Shortcut:

If the menu or status is not displayed on the screen, a new input can be selected by pressing the corresponding number button on the remote.

Configuration Memory Selection

Each input has four configuration memories. These are referred to as memory “A”, “B”, “C” and “D”. To select one of these memories press **MEMA**, **MEMB**, **MEMC**, or **MEMD**, respectively. Note, RS232 codes are provided to directly access these memories. Each input memory has eight input “sub-memories” that are automatically selected based on the input resolution and 2D/3D input video format.

Each configuration memory, and sub-memory, is independent of the other memories. To allow the memories to be used for mode selection (e.g. day/night), by default, the memory type remains unchanged when a new input is selected. (i.e. If input 2 memory B is active, pressing “**INPUT, 3**” selects input 3 memory B).

Input Aspect Ratio Selection

The input source aspect ratio can be selected by pressing one of the **4:3**, **LBOX**, **16:9**, **1.85**, or **2.35** aspect buttons. To use the **NLS** feature, press “**4:3, NLS**”, “**16:9, NLS**”, or “**1.85, NLS**”.

- Use **4:3** for standard definition full-screen material.
- Use **LBOX** for “letterbox” standard definition material, such as analog-television movies shown with black bars above and below the image.
- Use **16:9** for material labeled as “Enhanced for 16:9 televisions”.
- Use **1.85** for material labeled as “Aspect ratio 1.85”.
- Use **'Alt' 1.85** for material that is “Aspect ratio 1.85 letterboxed in a 16:9 (1.78) window”.
- Use **2.35** for material labeled as “Aspect ratio 2.35”.
- Use **'Alt' 2.35** for material labeled as “Aspect ratio 2.40”.
- Use **NLS** to apply a horizontal non-linear stretch, to stretch 4:3 to 16:9, or 16:9 or 1.85 to 2.35 or 2.40.

NOTE:

Make sure the “display aspect ratio” setting is 16:9 in the setup menu of all video sources (e.g. Blu-ray players or set top boxes), even if your display is not 16:9.

Image Zoom

After the input aspect ratio has been selected, the image can be zoomed in to better fit the screen. The zoom function uses the **▲** and **▼** arrow buttons. When the menu is off, by default, the **▲** arrow button zooms in by about 15% and the **▼** arrow button zooms out by about 15%. The Zoom amount can be changed to 5% steps.

Status Screen

Pressing “**OK**” when the menu is off displays an on-screen information message as shown in the example below.

Radiance Pro	Info Pg 1	(for Pg 2 press Ok)	
SW Rev.xxxxxx	Serial:xxxxxxx		
	Input 1A	Out1	Out2
Mode:	480i	1080p	1080p
Rate:	59.94Hz	59.94Hz	59.94Hz-2D
Format:	YCbCr 422	RGB	RGB-SDR709
HDCP:	On	1.x	2.x

Pressing “**OK**” when the information screen is displayed, will display a second status screen as shown in the example below.

Section 5 – Basic Commands

Radiance Pro		Info Pg 2
Audio:HDMI1		
In asp=1.78	Out asp=1.78	Zoom=0%
X scaler: Off	AdjInHres: 1920	OutHRes:1920
Y scaler: Off	AdjInVres: 1080	OutVRes:1080
Genlock: off	CIkN:1	PT:1
Deinterlacing:NA		ChipTemp: 72C

On-Screen Help

Pressing, “**HELP**” when the menu is displayed, displays on-screen help information for the currently highlighted menu item for many of the menu options.

Quick Keys

Provides a menu to use for basic remotes that have limited buttons, The ‘Quick Keys’ menu has buttons for input aspect ratio (4:3, LBOX, 16:9, 1.85, 2.35, NLS), set zoom (Zoom+, Zoom-) and select the user memory (MemA, MemB, MemC, MemD). The “Quick Keys” menu duplicates the function of pressing the corresponding buttons on the Lumagen remote. There are also buttons to control 3D (off, SbyS, TopB).

MENU → Quick Keys → (4:3, LBOX, 16:9, 1.85, 2.35, NLS, Zoom+, Zoom-, MemA, MemB, MemC, MemD, '3D'Off, '3D'Sbys, '3D'TopB)

Section 6 – Video Output Menu

Section 6 – Video Output Menu

By default the output is set to “Auto 2” (424X) or “Auto 4” (444X). “Auto 2” means the Radiance automatically reads the video EDID for the devices connected to Output 2, and automatically selects the appropriate output resolution.

For “Auto” modes the output vertical rate is selected based on the input vertical rate. For example, input formats 480i60, 720p60, and 1080i60 automatically select a vertical output rate of 60 Hertz. Input formats 576i50, 720p50, and 1080i50 automatically select a vertical output rate of 50 Hz. For a 24p input formats, a 24p output vertical rate is selected if the display supports a 24p vertical rate, otherwise a 60 Hz output rate is selected.

Video Output Select Menu

The *Video Output Setup Menu* is used to select output settings (*Mode*, *CMS*, and *Style*) based on the input number, input memory, and input video mode. The *Video Output Select Menu* does not affect the audio settings. See the *Audio Configuration* section for information on configuring audio modes.

NOTE:

Use of the Video Output Setup Menu is not needed for typical systems

Once selected, the parameters for the *Mode*, *CMS*, and *Style* are changed using the **MENU → Output → Ok → (Custom Modes, CMS's, Styles)** menu.

To select the output settings based on which input is selected and the input video mode, press **MENU → Output Setup → Ok**. This will display the Input Conditions and Output Selections.

Input Conditions	
Input: 1A Mode: Other, 2D, Rec601	
Output Selections	
Mode: Custom0(Auto 4)	
CMS: CMS0	
Style: Style0	
Out Enables: ABBV (1-4)	

Press “OK” again to display the *Video Output Select Menu*. Highlight the ‘2D’ or ‘3D’ row and press “Ok” to edit.

In Condition			Video Output Selection						
In	Mode		3D Mode	601/709 CMS	HDR/2020 CMS	Enable Style	1 2 3 4		
*2D:	1A	1080p24	-	Custom0	CMS0	CMS1	Style0	A B B V	
				(Auto 4)					
3D:	1A	1080p24	-	Auto 4	Auto	CMS0	CMS1	Style0	A B B V

Next highlight the input condition entry that you want to edit.

Press the ▲ and ▼ buttons to set the input number, input memory, and input mode.

NOTE:

For any of the three input conditions you can press the number “4” button which then selects ‘All’ as the condition. This allows you to apply the output setup to multiple input conditions.

When making settings that apply to multiple input conditions you can leave any of the output settings unchanged by selecting the ‘---’ option for that output setting. The Video Output has selections for “A” audio only, “V” video only, “N” audio and video off, “-” unmodified, and “B” both audio and video.

2D In Condition			2D Video Output Selection					
In#	Mem	Mode	Mode	601/709 CMS	HDR/2020 CMS	Enable Style	1 2 3 4	
1	A	1080p24	->	Custom0	CMS0	CMS1	Style0	A B B V
				(Auto 4)				
				(Input to edit output settings of)				
				Press '4' for 'All', '5' to see current				
				<> Select, ^v Change, OK to set, Exit quits				

Section 6 – Video Output Menu

Custom Output Mode

Custom Modes store settings for the timing of HDMI video mode that drives the display. There are menus to select standard HDMI modes or custom timings for HDMI modes *NOTE: By default the Radiance Pro automatically selects the appropriate output modes based on the EDID reported by the TV/projector on the primary video output.*

Output Mode – Direct Commands

Note that these direct commands are meant as temporary overrides, not as permanent selections and affect only the current input, input resolution and input memory. The *Output Setup* menu should be used to program the output modes if the *Auto* output mode is not being used. The direct commands to select output resolution are:

480p60: **MENU 0 2 1 OK** 720p60: **MENU 0 2 4 OK** 1080p24: **MENU 0 2 0 OK**
1080p60: **MENU 0 2 7 OK** 4k24: **MENU 0 2 3 OK** 4k50: **MENU 0 2 5 OK**
4k60: **MENU 0 2 9 OK**

Select Mode

Select the output mode from a list. If after selecting you lose the picture, press “Exit” or wait 15 seconds for the output to revert to the previous mode. Setting the mode to “Auto X” will get data from the display about its preferred mode. Select which output gets priority by choosing one of the Auto modes. The command is:

MENU → Output → Custom Modes → [Custom] → Select Mode

Mode Timing

After selecting a Custom Output Mode, its timing can be modified on a pixel basis. Do not change the timing using this menu unless it is really needed. Warning: Some digital displays lose picture if timing is changed by even a single pixel. The command is:

MENU → Output → Custom Modes → [Custom] → Mode Timing

Output Label

You can change the output mode labels. Use the ◀ and ▶ buttons to highlight a letter. Use the ▲ and ▼ buttons to change the letter. Capital letters, small letters, numbers, symbols, and blank are available. The command is:

MENU → Output → Custom Modes → [Custom] → Label → Ok

CMS Menu

The Color Management System (CMS) stores settings used to calibrate the color of the display. There are menus to calibrate the position of the primary/secondary color points, calibrate grayscale tracking, calibrate the gamma curve, and compensate for red/green push errors.

Gamma Factor

The Gamma Factor adjusts the gamma of the video output up or down. Since the Radiance is in the middle of the video chain, its default goal is to not affect the image Gamma and so the default Radiance gamma is 1.00. Changing the Gamma Factor allows the Radiance a “coarse correction” control for display Gamma. It should be set to (Desired_Gamma / Measured_Gamma). The command is:

MENU → Output → CMS's → [CMS] → Gamma Factor → Ok

Color Gamut

Allows primary and secondary color point calibration, or calibration of 4913-points throughout the RGB color cube, using a 3D color lookup table (3D LUT) Color Management System (CMS). A color probe, appropriate calibration software, and proper training is necessary for correct adjustment. The command is:

MENU → Output → CMS's → [CMS] → Color Gamut

Section 6 – Video Output Menu

Colorspace

Select the output **Colorspace**. The choices are Auto, HDR2020, SDR2020, SDR709, and SDR601. Auto sets the output color space to match the input colorspace. When HDR Intensity Mapping is active, for non-HDR TVs/Projectors, or to output SDR to a HDR TVs/projector, select SDR2020. SDR601 is generally not used since the Pro converts SD sources to Rec 709 on input. The command is:

MENU → Output → CMS's → [CMS] → Colorspace

Grayscale and Gamma

Allows the parametric adjustment of 2, 5, 11, 12 or 21 color temperature points to adjust the grayscale and gamma for the display. The command is:

MENU → Output → CMS's → [CMS] → Gray/Gamma

Color Decoder

Used to correct color decoder errors in the display that have red and/or green push. This adjustment should generally not be used in conjunction with Color Gamut. The command is:

MENU → Output → CMS's → [CMS] → Color Decoder

Black Level

Used to set the black level for the display. Normally the "Brightness" or "Black Level" control in the display is used to set the black level. However, some displays cannot be set accurately. This command allows for accurate calibration when the display controls are not adequate. It is recommended that the Radiance Contrast Pattern 2 (dark contrast) be used to set the display's black level. This command is also useful when a second black level is desired (using a second output CMS) for a "day" or "night" mode. The command is:

MENU → Output → CMS's → [CMS] → Black → Ok

White Level

Sets the white level for the display. Normally the "Contrast" control on the display is used to set the white level. It is recommended that the Radiance Contrast Pattern 1 (White and Black squares pattern) be used to set the display's white level. The command is:

MENU → Output → CMS's → [CMS] → White → Ok

HDR Intensity Mapping Initial Setup

HDR Intensity Mapping can map a HDR source on to a SDR, or HDR, display, but does not apply to SDR sources, and is disabled by default. To enable it go to the **CMS's → [CMS] → HDR Mapping** menu. Note that by default the **CMS1** output configuration memory is automatically selected for HDR sources.

NOTE:

A key concept to understand for HDR sources, and HDR Intensity Mapping, is that the important thing is to have a correct image on the screen and not the format of intermediate calculations. So, data manipulation in the pipeline does not always have to be strictly "HDR." Just as P3 movies are put into a Rec 2020 "container" for UHD HDR, it is possible to put the HDR Gamma into a "SDR Container" as long this is accounted for such that the on screen image is correct. This is important to understand because two of the three recommended practices below do exactly this, but the end result is the correct image on the screen. We try to use the word "adapt" instead of "convert" when discussing the HDR verses SDR settings, since it is *not* somehow converting the HDR to SDR, but just putting the HDR data into a "SDR container."

The **Display Max Light** is set in this CMS menu. You can increase or decrease the **Display Max Light** using the arrow keys in 100 nit steps or use the number keys to enter a value from 30 to 990 nits. Changing the **Display Max Light** adjusts the source to display light ratio, and is similar to changing the "multiple" used to compensate for screen size in calibration software.

With **HDR Intensity Mapping** control parameters at default use the **Display Max Light** as a coarse "brightness" control. When outputting HDR source in HDR mode (CMS **Colorspace** = HDR2020 and **Gamma to 3D LUT** = HDR or Auto), typical **Display Max Light** settings range from about 3000 to 9900. For SDR output mode (CMS **Colorspace** = SDR2020), typical **Display Max Light** settings are in the range of 100 to 500 for a projector, or 200 to 800 for a current TVs. The **Display Max Light** setting is higher for HDR output because the display's internal Tone Mapping is already reducing the HDR input to match the display's actual light output leaving

Section 6 – Video Output Menu

much less range for the **HDR Intensity Mapping** to work with. Higher **Display Max Light** settings allow less control. So, for HDR output the amount of control available with **HDR Intensity Mapping** is reduced versus using **Gamma to 3D LUT = SDR** along with SDR output mode (**Colorspace = SDR2020**).

The EOTF of the **HDR Intensity Mapping** output to the 3D LUT is selected as “**Gamma to 3D LUT**.” This selection is active even when **HDR Intensity Mapping** is disabled. The *Auto* mode selects HDR EOTF to the 3D LUT if the CMS output **Colorspace** is selected as HDR2020, and SDR EOTF otherwise. If you want to calibrate the 3D/1D LUTs to change the source’s HDR EOTF, to SDR EOTF, you must select the **Gamma to 3D LUT** as HDR.

For a SDR display, or HDR display if you want to use SDR output mode, you can calibrate the 3D/1D LUTs to SDR Rec 2020 specifications, and let the HDR Intensity Mapping “adapt” the HDR EOTF to SDR EOTF. In this case set the CMS **Gamma to 3D LUT = SDR**, and the CMS **Colorspace = SDR2020** (if an HDR display) or SDR709 for a SDR only display. Even if **HDR Intensity Mapping** is off, this EOTF adaptation will still be applied for an HDR source if “**Gamma to 3D LUT**” is selected as SDR (or Auto mode if the **Colorspace** is set to SDR2020).

See the **Calibration** section for more information on HDR calibration.

The valid combinations for the CMS memory **Gamma to 3D LUT** and **Colorspace** for HDR sources are shown in the following table.

Gamma to 3D LUT	Colorspace	Test Pattern Mode	3D/1D LUT calibration
HDR or Auto	HDR2020	HDR	Optional. Bt.2084 in and out. Rec 2020 Gamut
HDR	SDR2020	HDR	Required. Bt.2084 in to Bt.1886 out. Rec 2020 Gamut
SDR or Auto	SDR2020	SDR	Optional. Bt.1886 in and out. Rec 2020 Gamut

HDR Intensity Mapping control parameters are selected in Input Menu under **Input → Options → HDR Mapping** (if no menu or OSD is displayed the ◀ key bring this menu on screen). See the **Video Input Menu** and **Calibration** sections for more information. The command is:

MENU → Output → CMS’s → [CMS] → HDR Mapping

CMS Label

You can change the CMS memory labels. Use the ◀ and ▶ buttons to highlight a letter. Use the ▲ and ▼ buttons to change the letter. Capital letters, small letters, numbers, symbols, and blank are available. The command is:

MENU → Output → CMS’s → [CMS] → Label

Styles Menu

The Style memory stores settings for the HDMI format used to drive the display. There are menus to set the HDMI format, size, position, aspect ratio, and gray-bars for the image on the display. These output styles (Style0 through Style7) can be selected for use in the Output Setup menu.

HDMI Output Type

You can specify the digital output range as “RGB-PC level” (e.g. for 8-bit 0 to 255) or “RGB-Video level” (e.g. for 8-bit 16 to 235). “YCbCr 422” is the recommended output format. For the HDMI RGB output, setting the level as *video* allows blacker-than-black and whiter-than-white levels to be output from the Radiance. The Dual Output mode uses two connections to the display with the 12 LSB’s on Output 1 and the 24 MSB’s on Output 2. The command is:

MENU → Output → Styles → [Style] → HDMI Format → Type → (Auto, RGB/Level=Vid, RGB/Level=PC, RGB/36bpp Dual Out/Level=Vid, RGB/36bpp Dual Out/Level=Vid YCbCr444, YCbCr422)

Note that for some modes (4k60 using 9 GHz output cards) the mode may not be programmable. For reference the 4k60 output mode using 9 GHz I/O cards is always 4:2:0, 8-bit.

Rate Match

Some material may be sourced at 24.00/60.00 Hertz refresh rates instead of the standard 23.98/59.94 Hertz rates. It is desirable to slightly alter the output rate to match the input rate as long as the display works with these

Section 6 – Video Output Menu

different rates. The default setting is 'Yes.' If the output mode is set to "Auto", this setting is ignored and rate matching is used if needed. The command is:

MENU → Output → Styles → [Styles] → HDMI Format → Rate Match → (No, Yes)

Color Format

Sets the outputs color format. It should be set to Auto except to correct for a color format error in the display. Normally Bt.601 is use for SD/ED modes and Bt.709 is used for HD modes. Use the Auto format unless there is an issue that requires a manual selection. The command is:

MENU → Output → Styles → [Style] → HDMI Format → Color Format → (Auto, Bt.601, Bt.709)

Dither

Some fixed pixel displays show contouring on images that have gradients because the physical pixel depth of each pixel is limited. The dither control can be used to enhance the resolution of the display and reduce contouring. Dither position sets the bit size of the pixel for dithering. Orientation controls the frame-to-frame randomization and can be fixed or dynamic. Masking can be turned on to clear the lowest bits after the dither addition. The command is:

MENU → Output → Styles → [Style] → HDMI Format → Dither

Mask

Allows you to "blank" the edges of the video image on the output without changing its position or scaling. This is useful to blank bad pixel data from the source that shows on screen, when you want to keep the "pixel perfect" setup (i.e. no scaling). The command is:

MENU → Output → Styles → [Styles] → Mask/Shrink → Mask

Shrink

Adjust the image size to fit inside a screen masking system. This command is useful for rear-screen and flat-panel displays when the manufacturer uses too much "overscan". The command is:

MENU → Output → Styles → [Styles] → Mask/Shrink → Shrink

Keystone

Adjust for a projector vertical placement offset. Note: Use only if the projector does not have enough optical keystone adjustment. The command is:

MENU → Output → Styles → [Styles] → Mask/Shrink → Keystone

Gray Level

Sets the gray level of borders created by the shrink or output mask commands. The gray level is adjustable from black to white in sixteen steps. The command is:

MENU → Output → Styles → [Styles] → Mask/Shrink → Gray Level

Screen Aspect Ratio

Select the screen aspect ratio. The screen aspect ratio range is 1.10 to 2.50 and is entered in units of hundredths (e.g. 16:9 is entered as **178**). If you have a normal fixed aspect display, select the "Single output aspect" which is the default setting. If you have a movable anamorphic lens or a projector with programmable lens-shift and focus that you are using, select "Output aspect per input aspect."

For the "Output aspect per input aspect" mode, there is a special case when you use NLS. When the input aspect is 4.3+NLS the output aspect assigned to the 16:9 entry is used. When the input aspect is LBOX+NLS, 16:9+NLS, or 1.85+NLS the output aspect assigned to the 2.35 entry is used. The command is:

MENU 0 6 (Single output aspect, Output aspect per input aspect)
or **MENU → Output → Styles → [Style] → Aspect Ratio → (Single output aspect, Output aspect per input aspect)**

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Graybar Intensity

Some degree of burn-in will occur on any susceptible display, such as a CRT or plasma TV. This command can help minimize it by allowing the intensity of the graybars to be adjusted. Set to "0" for black. The command is:

MENU → Output → Styles → [Style] → Graybar → (Sides, Top/bottom)

Soft Edge

Rounds off the outside edges of the video, which gives movies a bit more of a theater look and can mitigate overscan issues at the edges of the screen. It can make the edges of a projected image less visible on the screen masking. The command is:

MENU → Output → Styles → [Styles] → Soft Edge

Style Label

You can change the Style memory labels. Use the ◀ and ▶ buttons to highlight a letter. Use the ▲ and ▼ buttons to change the letter. Capital letters, small letters, numbers, symbols, and blank are available. The command is:

MENU → Output → Styles → [Styles] → Label

Misc. Output Settings

3D Output Options

By default, when set to "Auto", the display's 3D capability is automatically detected using its EDID information. However, some 3D displays do not properly report their 3D capability in their EDID. This command allows the 3D output capability to be manually set. The command is

MENU → Output → 3D Options → Output List → (Auto, Yes, No)

Copy Output Settings

This command copies the current output Mode/CMS/Style settings to the selected output Mode/CMS/Style. The command is:

MENU → Output → Copy → OK

Section 7 – Video Input Menu

Section 7 – Video Input Menu

The Video Input Menu is used to configure independent setting for each input, input memory, and input resolution. Often no changes are needed using the Input Menu.

Input Setup Menu

The *Input Setup Menu* is used to select input settings based on the input resolution and vertical rate. For each Input, Input Memory, and Input Resolution, there are 8 input configuration memories. The *Video Input Select Menu* does not affect the audio settings. See the *Audio Configuration* section for information on configuring audio modes. "4k" is 3840 pixels wide. "Cin4k" refers to Cinema 4k and is 4096 pixels wide.

First highlight the '2D' or '3D' row and press "Ok" to edit.

Input Condition			->	Input Config Selection
In	Mode			Config
*2D	1A	1080	->	1080-0
3D	1A	1080	->	1080-0
^ Selects 2D or 3D setup, press OK to edit				

Next highlight the input condition entry that you want to edit.

2D Input Condition			->	2D Input Config Selection
In#	Mem	Mode		Config
1	A	1080	->	1080-0
(Input to edit output settings of)				
<> Select, ^v Change, OK to set, Exit quits				

The ◀ and ▶ buttons change the active column. The ▲ and ▼ buttons select the input number, input memory, and input mode. In each Input Condition column one of the selections is "All."

Shortcut:

You can press the number "4" button to select "All" as the condition for any column of the Input Condition. This applies the setup to multiple input, input memories, or input resolutions.

In Configs Setup

The *Base Input Resolutions* are 480, 576, 720, 1080, 4K, Cin4K, Other. The *4K* mode is automatically selected for sources that send 3840x2160, and the *Cin4K* mode is automatically selected for sources that send 4096x2160. Each *Base Input Resolutions* has 8 user programmable configuration memories 0 to 7.

For each input sub-memory adjustments include *Picture*, *Size*, *Control*, and *Enhance*.

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Input Picture Controls

HDR Intensity Mapping Control

HDR Intensity Mapping is part of HDR *Tone Mapping* which adapts HDR sources to smaller color Gamut, lower intensity, displays. While the color mapping portion of Tone Mapping is done by calibrating the 3D LUT for the Rec 2020 color space, the intensity portion of tone mapping can be accomplished using the Radiance Pro's **HDR Intensity Mapping** feature. See the **Calibration** and **Output CMS HDR Mapping** sections for more information.

Note:

HDR Intensity Mapping must be enabled, and the Display Maximum Brightness set, in the Output CMS menu under HDR Mapping.

Note:

These HDR Intensity Mapping controls are specific to the active Input, and Input Memory. So you need to set your preferences for each Input and Input Memory.

Note:

HDR Intensity Mapping must be disabled during 3D/1D LUT calibration.

The default HDR Intensity Mapping parameters were chosen to provide reasonable base settings. You can change the parameters to suit your personal preferences and adjust for differences in source material. Since parameters interact with each other, you should spend time trying different settings for each control to see how each one affects the image and is affected by the other controls.

As with SDR setup, before making adjustments you should use the *Contrast2* test pattern (see Tech Tip 5) to make sure the black level is set correctly. See the **Calibration** Section for more details.

Note:

HDR Intensity Mapping has very little effect on dark scenes. So pick a scene with both dark and bright areas (e.g. the new Magnificent 7 at 16:00), and/or a scene with a very bright object (e.g. the muzzle flash in Mad Max Fury Road at 38:13 paused on the frame with the flash). Pause the scene and make the HDR Intensity Mapping adjustments. For the first scene you adjust, it is recommended you change Display Max Light (leaving "Ratio" at 0), as a coarse "brightness" setting. Later use the Ratio parameter to adjust for differences between sources.

The **View** control allows you to temporarily disable **HDR Intensity Mapping**, temporarily put the screen in a split-screen mode with **HDR Intensity Map** processing on the right, or reset **HDR Intensity Mapping** parameters to default.

The **Ratio** parameter adjusts the HDR source to *Display Max Light* ratio. Since the source to display intensity ratio is the primary factor in the **HDR Intensity Mapping** transfer function, **Ratio** has the largest effect on the transfer function. **Ratio** has a range of -15 to 15 (default = 0).

The **Shape** parameter controls how smoothly the transfer function changes from the lower intensity range (where the goal is to "match nit-for-nit") to the higher intensities. The **Shape** control range is 0 to 7 (default = 3). A smaller curve (lower setting) increases the size of the "nit-for-nit" range, and a smoother curve (higher setting) reduces the rate of change in input-to-output slope. Note that the effect of the **Shape** control changes based on **Display Max Light**, **Transition** and **Clip** parameters.

The **Clip** parameter specifies if the highest source intensities will be clipped or not. The range for the **Clip** control is 0 to 7 (default = 0). When **Clip** = 0 (no clipping), the input to output slope for higher intensities is reduced so that changes in the source level have some effect on the output level for the entire source input range. As an example, you might choose to not clip any of the source range to make sure all specular highlights have some level of modulation. With clipping the tradeoff is that the specular highlights above the clipping level may look "blockier," but it allows the content below the **Clip** level to better approximate the source level. The **Clip** control allows you to tradeoff these effects to match your personal preference.

The **Transition** parameter controls the percentage of the range that HDR Intensity Mapping tries to match "nit for nit." It has a more direct effect on the "nit for nit" range than the **Shape** parameter, but reducing **Transition**, or increasing **Shape**, both have the effect of reducing the "nit for nit" range. So they are very interactive. The **Transition** control can be set from 0 to 7 (default = 3).

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The **Gamma** parameter modifies the effect of the “Gamma Factor” in the CMS menu. Increasing **Gamma** increases the resulting Gamma, and can help make the image appear to have a higher contrast ratio. Selecting a negative number for **Gamma** can increase the brightness of dark areas if they are too dark. The range for the **Gamma** control is -10 to 10 (default = 0).

The **HDR Intensity Mapping Black** control adjusts the black level before the **HDR Intensity mapping** in the pipeline (the CMS memory **Black** is in the 1D LUT that is after the 3D LUT). Reducing the **Black** level may improve the perceived contrast ratio of the image, or if reduced too much may “crush” portions of the image near black. The range for the **HDR Intensity Mapping Black** control is -7 to 7 (default = 0).

The **HDR Mapping** parameter command is:

MENU → Input → Options → HDR Mapping → OK

You can also access the input **HDR Mapping** parameters by pressing the ◀ key, if the Menu, or Info Screen, is not on-screen. Once in this menu press OK to accept changes or **EXIT** to discard changes.

Black and White Levels

To set the input’s black-level (also referred to as brightness) and white-level (also referred to as contrast) using the Lumagen controls, use a test pattern generator or select a PLUGE pattern from a test pattern disc. Note that the input memory black and contrast are intended to compensate for variations in video source levels, not to calibrate the display. The command is:

MENU → Input → In Configs → [Resolution] → [#] → Picture → (Black, White)

Colorspace

Since all inputs are HDMI by default the appropriate color space is automatically selected (“Auto” mode) for standard-definition “Bt.601,” high-definition “Bt.709,” or UHD “Rec 2020.” The “Auto” mode is generally best, but some upscaling sources do not convert the color format to Bt.709 as they should and so “Bt.601” would be manually selected for these if they are programmed to output HD formats. The command is:

MENU → Input → In Configs → [Resolution] → [#] → Picture → Colorspace

Color Decoder

NOTE:

Set the display’s Color and Hue to their default values.

Normally not used if the Color-Gamut is calibrated using the Radiance CMS system, unless the source has an error in its color decoder. Use Radiance internal color-bar pattern, a test pattern generator, or a test disc test pattern, to set color, Hue, color, and Hue offsets, if necessary. The command is:

MENU → Input → In Configs → [Resolution] → [#] → Picture → Color Decoder

Y/C Delay

Adjust the horizontal Chroma timing in relation to Luma. Range is +/- 1.9375 pixels in 1/16 steps. It is suggested that you use a Y/C-delay calibration image from a test pattern generator or test disc to calibrate the Y/C-delay. The C_B and C_R channels are adjusted independently. The command is:

MENU → Input → In Configs → [Resolution] → [#] → Picture → YC Delay

CUE Filter

This filter can minimize Chroma issues for sources with a Chroma up-sample error. The command is:

MENU → Input → In Configs → [Resolution] → [#] → Picture → CUE Filter

Input Sizing

Input sizing can be used to compensate for active image size differences between sources.

Note:

*The input size command does not affect the output size or position.
Rather, it affects which input pixels are captured for processing.*

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Use the **Crop TopLeft** command to select the top-left-most active input pixel. Use the **Crop BotRight** command to select the bottom-right-most active pixel. Select the scanline using the ▲ and ▼ arrows, and the pixel using the ◀ and ▶ arrows. The command is:

MENU → Input → In Configs → [Resolution] → [#] → Size → [Aspect Ratio] → (Crop TopLeft, Crop BotRight)

Vertical Shift

The vertical shift moves the image up and down without changing the *Input Sizing* settings. There are 15 vertical settings that are shared between all input memories. Select the vertical shift setting and then the shift value. The command is:

MENU → Input → In Configs → [Resolution] → [#] → Size → [Aspect Ratio] → Vert Shift

Non-linear Stretch

Non-linear-stretch (NLS) is used to horizontally stretch a 4:3 aspect ratio source to fit a 16:9 aspect-ratio display or to stretch a 16:9/1.85 source to fit a 2.35 aspect-ratio display. The image is stretched by a constant amount in the center section, and by an increasing amount approaching the left and right edges. This eliminates the black sidebars normally seen when viewing smaller aspect material on a higher aspect display. To use non-linear stretch press the “4:3”, “16:9” or “1.85” button and then press the “NLS” button.

The goal is to stretch the image to fill the screen in a way that looks as natural as possible. The Lumagen NLS command is very flexible and allows the image to be adjusted to user preferences to achieve this goal. The NLS adjustments are center width, center stretch, top cropping and bottom cropping. The center section of the image is stretched by a constant ratio from 0% to 24%. The width of the center section can be set from 15% to 70% of the display width. By programming the center section width and stretch amount, the amount of non-linear stretch in the left and right sections can be optimized. In addition, the top and bottom cropping can be set from 0 to 12%. Increasing the amount of cropping reduces the amount of stretch near the left and right edges of the image. When setting the cropping parameters, check the satellite/cable-box menu to insure that critical information remains visible.

Some 4:3 sources fill the entire source image (e.g. DVD 16:9 movies), but other sources place a 4:3 image in the center of a 16:9 image (e.g. HDTV with up-scaled SD source). This latter case is seen as a “pillar-boxed” image with black bars on the left and right. The “PILLARBOXED” parameter must be enabled for this case. The Radiance Pro will then crop the pillbox bars and stretch the active 4:3 image.

For a 16:9 display, when 4:3 NLS is enabled, the image will fill the screen with a 4:3 (1.33) source for any output aspect ratio up to 1.85. If the output aspect ratio is greater than 1.85, software limits the maximum width to the equivalent of 1.78 and adds left and right sidebars.

For a 2.35 display, when 16:9 NLS is enabled, the image will fill the screen with a 16:9 or 1.85 source for any output aspect ratio up to 2.40. If the output aspect ratio is greater than 2.40, software limits the maximum width to the equivalent of 2.40 and adds left and right sidebars.

Select the parameter to adjust using the ▲ and ▼ arrows, and change the value of the selected parameter using the ◀ and ▶ arrows. The command is:

MENU → Input → In Configs → [Resolution] → [#] → Size → [Aspect Ratio] → NLStretch

Input Masking

The masking command allows you to cover up the sides of the video source. It is different than cropping in that the video is not stretched to fill the screen. It can be used for pass-through modes, where you do not want the Radiance to scale the picture, to cover up some video noise on top/bottom/side of the picture. Another situation is to cover up and change the gray level of the black bars added by a video source, surrounding a letterboxed image.

When you select the command you must first select which mask number you wish to use. There are 15 available masks that can be shared among different input memories. After selecting the mask number, you can adjust how much the mask covers the 4 sides of the input. The last step is to alter the gray level for the 4 sides. If an input mask is on, its gray level takes precedence over the gray level of the aspect bar. The aspect bar gray level can be adjusted under **Output→Configs→[Config]→Other→Graybar**. If aspect bars are requested (via differing input and output aspects) the masking is added to the aspect bar width. The command is:

MENU → Input → In Configs → [Resolution] → [#] → Size → [Aspect Ratio] → Masking

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Letter Box Zoom

By default the LBOX and 2.35 input aspect ratio button zoom the image to fill the height of the output. For example for a 16:9 output aspect ratio, pressing the 2.35 will zoom the 2.35 letter box image to the height of the screen and crop the left and right edges to fit the screen. If the *Output Aspect Per Input Aspect* feature is used this may not be the correct behavior. The Letter Box Zoom command can disable the Zoom for these input aspect ratio selections. The command is:

MENU → Input → In Configs → [Resolution] → [#] → Size → [Aspect Ratio] → LBox Zoom

Deinterlace

Deinterlacing converts interlaced sources to progressive. Depending on the source type, the deinterlacer can bias the algorithms to either film or video to obtain the best picture. The command is:

MENU → Input → In Configs → [Resolution] → [#] → Control → Deinterlace → Mode

Deinterlacing Field Flip

Some source devices do not follow conventions for the order of video fields. This can be seen as excessive combing in the video. While generally not required, this command allows the input fields to be swapped so these out-of-spec sources can be properly deinterlaced. The command is:

MENU → Input → In Configs → [Resolution] → [#] → Control → Deinterlace → Field

Reinterlace

Converts 480p and 576p sources back to interlaced so the Radiance can do the deinterlacing. This can provide dramatic improvements to a picture that has been poorly deinterlaced, prior to coming into the Radiance. Reinterlacing also allows for taking in 480p/576p movies and going out at 24/48/72Hz.

With this command you can "allow" or "disallow" quick remote key control for a particular resolution as well as turn it on/off. If "Reinterlace <> Keys" are set to 'allow' the left/right arrow buttons on the remote can then be used to control reinterlacing. The left arrow toggles reinterlacing on/off and the right arrow toggles the field order. Depending on how the picture was deinterlaced, the field order may or may not be important, but it can be quickly toggled to see if there is any difference. The command is:

MENU → Input → In Configs → [Resolution] → [#] → Control → Reinterlace

Input Enhancement Controls

Darbee

With Factory Settings the ► button is a short cut to bring up the Darbee menu. The Darbee DVP support sources up to 1080p60. See the Darbee DVP™ Section for more information. The command is:

MENU → Input → In Configs → [Resolution] → [#] → Enhance → Darbee

Copy Enhancement Settings

You can copy the local enhancement settings to other resolutions and memories. The command is:

MENU → Input → In Configs → [Resolution] → [#] → Enhance → Copy

Input Options

Often the HDMI Input setup features are not required. However, for special cases or non-conforming sources, they are available to optimize each input. If required input setup should occur after the output setup is complete.

Physical to Virtual Input Mapping

If desired the input selection for HDMI sources can be assigned to different physical HDMI inputs. This "Virtual Input" feature can be useful if a receiver or HDMI switcher is used to switch several HDMI sources to a single input on the Radiance. Using Virtual Inputs different settings and calibrations for several virtual HDMI inputs can be stored for the same physical HDMI input. The command is:

MENU → Input → Options → HDMI Setup → Physical In

Section 7 – Video Input Menu

Video EDID Display Information for HDMI inputs

EDID is information that can be read over DVI/ HDMI cables to influence how source devices deliver video, which helps produce an optimal picture. There are 4 settings for the Lumagen EDID interface. The default setting enables all of the display modes the Radiance supports. The User defined setting allows the user to individually select which capabilities will be advertised to the source. You can scroll through the list of capabilities with the up/down arrows and toggle advertising the feature with the left/right arrows. With the Passback setting, the Radiance will read the EDID from the display/AVR connected to the selected output and pass that back to the source. The command is:

MENU → Input → Options → HDMI Setup → Video EDID → (Interlaced, Rec202, HDR)

HDCP 2.2, or HDCP 1.X, Input Mode Selection

The Radiance Pro accepts HDCP 2.2 sources. As required by the HDCP 2.2 License Agreement, a HDCP 2.2 capable source is required to output using HDCP 2.2 encryption if the downstream device supports HDCP 2.2. This is an issue if the output of the Radiance Pro is connected to a HDCP 1.X TV, or projector, since the Radiance Pro will then be required to disable video, because the TV, or projector, is not HDCP 2.2.

Generally if a HDCP 2.2 capable set top box or UHD Bluray player sees a HDCP 1.X device on its output, it will downgrade the video resolution and output as HDCP 1.X. This command allows the user to tell the Radiance Pro to report only HDCP 1.X capability back to the source so at least a downgraded video format will be output from the set top box or UHD Bluray player for 4k sources, and the Radiance Pro can output the HDCP 1.X video to the HDCP 1.X TV, or projector. The command is:

MENU → Input → Options → HDMI Setup → HDCP

HDMI Video Type

By default the HDMI input format is detected automatically using the *HDMI Info Frame*. For DVI sources, the Auto mode selects RGB format. For sources that do not report their format correctly, the input format can be selected manually. Set to "Auto" for YCbCr 420. The command is:

MENU → Input → Options → HDMI Setup → Type → (Auto, YCbCr 444, YCbCr 422, RGB)

Input Level

This command specifies if RGB HDMI inputs use video levels or PC levels. The input video level should be set to match the expected range of the video source. A mismatch can cause the image to be too dark or too bright. The command is only applicable for the RGB input format. The command is:

MENU → Input → HDMI Setup → Level → (Video, PC)

Auto Aspect Selection

For HDMI sources (not DVI), aspect information may be sent from the source. Enabling HDMI Auto-Aspect allows the source to select the input aspect ratio using the HDMI Info Frame aspect ratio information. The Radiance Pro can also automatically detect the input aspect ratio by analyzing the image to see if it fills the height of the source raster. Options for Auto Aspect are Off (default), HDMI (only), or HDMI plus Image based auto aspect.

Since the image based auto aspect analyzes the video, it is possible in rare cases that one aspect ratio might be mistaken for another. If the user manually selects an aspect ratio, by default, that aspect ratio will be used until the next aspect ratio change is detected by the Radiance Pro. If enabled the Sticky Aspect Override feature will disable the image based aspect ratio detection new aspect will be used until the input is reselected, the **Input** button is pressed, or a memory (e.g. **MEMA**) button is pressed.

Some users prefer that, for example, 16:9 sources use the NLS function to always stretch the image to fill an anamorphic screen. If the *NLS when applicable* feature is enabled, when the Radiance Pro detects 4:3, 16:9, or 1.85 as the source aspect, the NLS features is automatically applied.

The user can also select whether the automatic aspect ratio detection applies Letterbox Zoom to letterboxed sources, or not. See the Letterbox Zoom section for more information on letterbox zoom. The command is:

MENU → Input → Options → Aspect Setup → Auto Aspect

Input Aspect Selection Mode

By default the input aspect ratio can be unique for each input resolution. When a control system is used to control the input aspect ratio it may be desirable to have a common aspect ratio for a given configuration

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memory and allow the control system to select it without regard to the input resolution. This command controls whether the input aspect is common to all input resolutions for a given configuration memory, or if each input resolution has a unique aspect ratio. The command is:

MENU → Input → Options → Aspect Setup → Aspect Set

Genlock

Genlock is used to provide a constant video delay from input to output, and to avoid an occasional dropped or repeated frame. Unlike older Radiance models Genlock in the Radiance Pro is designed to not increase switching delays much. So it can be on for Set top boxes and not significantly increase channel change time.

Another advantage of the Radiance Pro Genlock is that the input to output video delay is the same within a few milliseconds independent of the input and output mode. For example, with Genlock on the input to output delay for 1080i in to 4k60 out is almost the same as for 24p in to 24p out.

By default Genlock is off. Genlock can be set to off for all input rates, on for only 24p and 25p input rates, or on for all input rates. The command is:

MENU → Input → Options → Genlock → (Off, Auto24, Auto)

Scale Bias

Scaling is normally on to adjust the source to exactly fit the output resolution. If the scale bias is set to "On", scaling is enabled unless the input and output resolution match exactly. Scaling is disabled/enabled independently for horizontal and vertical. If the scale bias is set to "Off" scaling is disabled if the input and output resolutions are close. This is useful when using the Radiance Pro to control aspect ratio for an anamorphic screen. This case uses *Output Shrink* and since it is difficult to match the input and output exactly for the 2.35 input to 2.35 output aspect case, turning Scale Bias to off will insure scaling is disabled when possible, providing the best possible image quality. The second page of the Status screen indicates whether scaling is active (Press **OK** on the remote twice when no Menu is displayed). The command is:

MENU → Input → Options → Scale Bias

Game Mode

Minimizes video processing latency for playing video games. Interlaced sources 480i/576i/1080i are treated as 240p/288p/540p, respectively. Deinterlacing is not available in Game Mode. Typically game mode is enabled for a specific input memory that is then selected while playing games. For games that have a vertical rate that matches the Radiance output vertical rate, turning "Genlock" on can further minimize video latency. Game mode is not intended for video/film program material, such as television shows. The command is:

MENU → Input → Options → Control → Game Mode

Input Label

Each input configuration memory can be named. Follow the on-screen directions. The ◀ and ▶ arrows select which input to change and then which character to change. The ▲ and ▼ arrows change the selected character. The command is:

MENU → Input → Label

Copy Input Settings

This command can be used to copy input setting from one input and one input memory to another input and input memory, or all input for one memory, or all input for all four input memories. Copying an input memory to another input memory, copies each resolution sub-memory to the respective resolution sub-memory of the other input(s). The command is:

MENU → Input → Copy

Section 8 – Audio Configuration

Section 8 – Audio Configuration

The Radiance video processor supports the HDMI 2.0 audio formats. This means that Dolby Digital TrueHD™ and DTS Master-Audio™ Bitstream formats are available.

By default the audio EDID from the device on HDMI Output 1 is passed back to all source devices. If the audio processor is not connected to Output 1, or to help with any power-on order or EDID issues, the Audio EDID reported back to sources can be manually selected as follows:

MENU 0943 Report all HDMI audio modes in EDID back to sources (feature toggle)

MENU 0944 Report basic HDMI audio modes (2-Ch PCM and DD 5.1) back to sources (feature toggle)

Audio Mute Control

Audio is muted when changes are detected on the input. Some audio receivers need to be muted longer in these situations to avoid unintended noise. Range 0.0 to 7.5 seconds. The command is:

MENU → Global → Audio → Mute Control

Section 9 - Calibration

Section 9 - Calibration

Whether you use a TV or a projector, your theater system needs to be calibrated to provide the best possible image quality. To brighten the image in the show room, most display manufacturers intentionally change the display calibration away from industry standards to make them brighter. Unfortunately most displays do not have the controls necessary to undo these errors, and some with calibration controls are not mathematically correct, making proper calibration impossible without an external calibration device such as the Radiance Pro.

Correcting these intentional errors, and other unintentional errors, so you “See what the director intended™,” is a primary function of the Radiance Pro.

It is recommended that a professional calibrator be hired to perform the calibration. An experienced professional calibrator has the necessary tools and experience to extract the best performance from your theater. However, you can improve your picture without hiring a professional. You will need to learn how to use the Lumagen test patterns. Then you need to spend time learning how various calibration controls interact and how they affect image quality, with the most important step being proper adjustment of the Black Level in the TV's, or projector's, menu.

To understand Radiance calibration, it is important to note that setup and calibration parameters are split into “input memories” and “output configurations.” Input memories are for source specific setup and adjustment. Output configurations are for display setup and calibration.

Lumagen recommends using the internal Radiance test patterns to calibrate the output configuration. This will insure that any variance between sources does not affect the calibration. Note that Radiance Pro test patterns are in Source-Gamma space for all source formats.

Calibration training is beyond the scope of this document. Training classes for calibration are provided by THX and by the Imaging Science Foundation. We recommend you take one of these courses if you are interested in learning about calibration. The recommended Lumagen calibration sequence for Rec.709 is discussed in TechTip 2 on the Lumagen support “Manuals and Tech Tips” page at <http://www.lumagen.com/testindex.php?module=manuals>. Note that Tech Tip 2 is for SDR calibration and does not have information specific to HDR. Please read this and other Tech Tips for information on setup and calibration.

The Radiance Pro calibration pipeline, consists of Color/Hue controls (generally not used), and a 3D LUT (Look-Up-Table) which is followed by a 1D grayscale/Gamma LUT.

It is best to calibrate your display using automated calibration software because the Radiance Pro's 17x17x17 (4913) point 3D LUT used for Gamut calibration has too many points to calibrate manually. Companies such as Light Illusion, SpectraCal, and Chromapure, provide calibration software and workflows for automated display calibration using the Radiance Pro.

Supporting HDR and Rec 2020 color Gamut increases the complexity of calibrations. However, once calibrated using the Radiance Pro video processor, your theater can take advantage of the latest UHD movies including support for the HDR and Rec 2020 standards. It is even possible to watch HDR/Rec2020 sources on non-HDR displays (to the best ability of the display for brightness and color Gamut). With proper calibration, your Radiance Pro will be able to drive your Rec 709 TV or projector to its full capabilities to allow a wider color Gamut, with HDR EOTF, and less image noise than Rec 709 sources, such as Bluray.

The **HDR** standard supports display brightness up to 10000 Nits, and the Rec 2020 color standard has a much larger color Gamut than Rec 709. Since, at this time, no TV or projector can perform to these standards, *Tone Mapping* that can adapt the source to the display is a critical aspect of HDR and Rec 2020 viewing. Calibrating using the Radiance Pro 3D LUT implements the color portion of Tone Mapping. The Radiance Pro **HDR Intensity Mapping** implements the intensity portion of Tone Mapping. See the **HDR Intensity Mapping Control** section for additional information on how HDR sources are adapted for viewing on TVs and projectors.

The Radiance Pro uses the source's HDR/Rec2020 Info Frame flags to select either a Rec709 CMS memory (default is CMS0) or a HDR/Rec2020 CMS memory (default is CMS1). Which CMS memory is selected for each of these cases can be changed using the **Output Setup** menu.

For Non-HDR displays viewing HDR source material, the Radiance Pro output HDR Info-Frame is not relevant. So display setup consists of making sure the optimal display mode and settings are selected for HDR sources (a wide Gamut, bright output mode, that still has excellent black levels).

Section 9 - Calibration

For a non-HDR display you need to select the "Yes" options for HDR and Rec 2020 in **MENU → Global → Video** and do a Save. If you have a HDR display you may still want to set these to "Yes" as it can help with Power-On order dependencies. Lumagen is seeing some HDR players not re-read the EDID/HDR information when Hotplug is toggled, as they are supposed to do. This makes them power-on order dependent. By manually enabling HDR and Rec 2020 the HDR display can be off or even disconnected and the Radiance Pro will still report HDR and Rec 2020 back to the video sources.

The HDR Intensity Mapping has output conversion curves for HDR EOTF (Electro Optical Transfer Function) display mode and SDR EOTF (for showing HDR on SDR displays). That is, for SDR output mode, the **HDR Intensity Mapping** modifies the data so the image adapts the EOTF of the source so the image looks as correct as possible on the SDR display. The CMS Colorspace can be selected as HDR output mode or for SDR output mode. The CMS **Colorspace** selection, along with the **Gamma to 3D LUT** is then used by **HDR Intensity Mapping** to select the appropriate output EOTF. Additional information on selecting the **Gamma to 3D LUT** and **Colorspace** can be found in the **Output CMS HDR Mapping** section.

For SDR calibration (CMS0 at default settings) the process has not changed. First you need to set the display to neutral settings, choose a reasonable color Gamut mode, and set the black and white levels using the display controls. For your calibration software you should choose the SDR Gamma and Rec 709 color primaries as usual. At default settings in the Radiance Pro CMS0 is automatically chosen for all SDR, non-Rec2020, sources and the SDR Rec 709 calibration is loaded into CMS0.

HDR Calibration

This section covers some of the calibration steps unique to HDR calibration.

NOTE:

During calibration HDR Intensity Mapping must be turned off.

NOTE:

Lumagen strongly recommends using 4:2:2 for the color format for HDR (and SDR) for both input and output when not limited by the I/O speed (e.g. 4k60 on a 9 GHz card). The 4:2:2 HDMI format allows 12-bit pixel depth, including for 4k60 if you are using 18 GHz I/O.

As with SDR calibration, setting the black level correctly is the first and most important step in calibration. Use the *Contrast2* test pattern (see Tech Tip 5) when adjusting the Black level. An incorrectly set black level will make the image look "washed out" even with a HDR source. The recommended practice is, with the Radiance controls at default, reduce the display's Brightness (black) control until the black background becomes as black as it can reasonably be. Then if necessary increase (or reduce), the **Black** level in the CMS memory until the +1% to +4% bars to the right of the center black bar are visible, and the -1% to -4% bars to the left of the center black bar are not visible, as compared to the center Black bar. Sometimes the -1% and +1% are either both visible, or both not visible. It is most important that the -1% bar is not visible as compared to the center Black bar.

Typically the calibration software makes two sets of measurements, one in the display mode that will be used for SDR/Rec709 material and one in the display mode that will be used for HDR/Rec2020 material. Alternately it is possible to use a single bright mode with a large Gamut for both HDR and SDR sources. After initial measurements the calibration software creates a 1D LUT, and a 3D LUT for SDR/Rec709, plus a separate 1D LUT and 3D LUT for HDR/Rec2020. See your calibration software company's workflow documentation for details.

For HDR calibration there are three distinct calibration procedures to choose from. Two of these are for a SDR display (or a HDR display in SDR mode), and one for HDR displays using HDR output mode. The default is CMS1 for HDR and/or Rec 2020 sources.

HDR Calibration for a SDR Display (or HDR display in SDR mode)

HDR calibration using SDR display mode (**Colorspace** = SDR2020) is similar to SDR Rec 709, except you choose Rec 2020 primary points for the calibration. The first step is to put the display into a nominal state, in a reasonable SDR wide-Gamut Rec 2020 color mode, and set the black background level using the display controls. Use the Contrast2 test pattern in the Radiance Pro to adjust the black level before calibration.

There are two options for HDR to SDR output mode calibration.

One method for HDR to SDR output is to use **Colorspace** = SDR and **Gamma to 3D LUT** = SDR. This tells the **HDR Intensity Mapping** to adapt the HDR EOTF so the image looks correct on an SDR display. Then

Section 9 - Calibration

you do the 3D LUT calibration choosing a normal SDR Gamma except tell the calibration software to use Rec 2020 primaries.

Hint: To calibrate **CMS1** in SDR mode as required for this method, change the **Output Setup** menu to select CMS1 for SDR input modes. Then calibrate CMS1 to SDR Rec 2020 using the Radiance Pro SDR Test Pattern Mode. After calibration is complete, go back to the **Output Setup** menu and reselect CMS0 for SDR sources. Do a Save after this change.

The second option for SDR output is to use **Colorspace** = SDR and **Gamma to 3D LUT** = HDR. For this method the calibration software generates the 3D/1D LUT to adapt the HDR EOTF of the source to look correct on the SDR EOTF display. If possible set up the calibration software so that this calibration works as if the source is 3000 nits to perhaps 5000 nits, maximum instead of the normal HDR 10000 nit limit. Reducing the expected brightness will allow you to set the Display Max Light at perhaps 2000 to 5000 nits, which in turn allows more room for the HDR Intensity Mapping to improve the image.

For either of these SDR output methods, you may want to use the calibration software "roll-off" the Rec 2020 Gamut so that as the display approaches its Gamut limits there is no hard clip at Gamut extents.

Hint: One change to consider for either of the SDR output options above is to set the SDR display Gamma to its highest setting before doing the calibration. If the display has a 1D LUT for grayscale calibration, you can even calibrate the display's 1D LUT to increase the display's Gamma to 3, or even 4. Depending on the internal precision of the display this *may* have lower noise near black viewing HDR material. The reason is that after calibration using the Radiance Pro 1D and 3D LUTs is completed the resulting image Gamma is still correct, but the HDMI interface from the Radiance Pro to the display is at a higher Gamma. Just as the higher HDR Gamma helps reduce noise near black, this can help preserve the benefit of the higher Gamma used for HDR sources. This is because the HDMI interface to the display will be at a higher Gamma which can potentially provide additional precision near black.

HDR Calibration using a HDR Display

For an HDR display, the first step is to put the display into a nominal state, in a reasonable HDR wide-Gamut Rec 2020 color mode, and set the black background level using the display controls. Use the Contrast2 test pattern in the Radiance Pro to adjust the black level before calibration.

Each HDR display has its own HDR Tone Mapping. We are seeing some displays have significant clipping, and a less than ideal mapping. This can make calibration more difficult, and you may find you prefer one of the above SDR output mode options.

If the output is in HDR mode, the **Display Max Light** needs to be set to match the expected level of the HDR source, rather than the display's actual brightness, to account for the display's internal Tone Mapping. If possible set up the calibration software so that this calibration works well as if the source maximum is set to 3000 nits to perhaps 5000 nits, instead of the normal HDR 10000 nit limit. Reducing the expected brightness will allow you to set the **Display Max Light** to a lower value, perhaps in the range of 2000 to 5000 nits. In turn this allows more room for the HDR Intensity Mapping to improve the image. Calibration software has roll-off parameters for Gamut and intensity.

HDR Calibration Summary

The best choice of calibration software parameters will be different for different displays. So you will likely need to experiment with different settings.

Once calibration has been completed, enable **HDR Intensity Mapping**, and set the CMS HDR **Display Max Light**. You should try several **Display Max Light** values using it as a coarse "brightness" control to see which gives the best HDR image with default **HDR Mapping** parameters. Then use the **HDR Mapping** parameter input menu to adjust the response to your preference.

At this time HDR calibration is evolving as calibrators discover the best trade-offs. So calibrators will need to experiment to learn what techniques work best. We are working with calibration software companies to refine the HDR calibration workflow.

Section 10 - Miscellaneous Commands

Section 10 – Miscellaneous Commands

System Settings

Menu Mode

The menu mode controls what settings can be changed in the menu. In Locked Mode nothing can be changed; in the User Mode, Service Mode (temporary) or Service Mode (permanent). The default setting is User Mode, which allows access to all the basic controls. The Service Mode allows access to all controls including the color gamut controls. The configuration can be locked to prevent unintended changes. When locked, input selection functions normally, but setup parameters are fixed. The command is:

MENU → Other → Menu control → Menu Mode → (Locked, User mode, Service mode temporary, Service mode permanent)

Timeouts

In the “Normal” setting the menu and test patterns will timeout in approximately three minutes. The “Slow” setting extends the timeout by x10. Test patterns also have a setting for “Never” timeout. The command is:

MENU 0 9 0 5 (Normal, Slow) Ok

Or

MENU → Other → Menu control → Timeouts → (Normal, Slow, Never)

OSD Enable

On-Screen-Display (OSD) shown after each user command. Shows the selected input, input aspect ratio, and zoom. The command is:

MENU → Other → Menu control → OSD enable → (On, Off)

Input Reselect

By default, when the currently active input is reselected the input will be reinitialized and the input number will be displayed. This can be turned off so reselecting the active input has no affect. The command is:

MENU → Other → Menu control → In Reselect → (On, Off)

Menu Placement

In the “Standard” placement the menu is in the center of the screen. Choose “Center open” to move the menu so that the center of the screen is open for display calibration measurements. The command is:

MENU → Other → Menu control → Menu Options → Menu placement → (Std, Cntr Open)

Input Menu

Enables pop up list of inputs to select from when “Input” button is pressed on the remote. The command is:

MENU → Other → Menu control → Menu Options → Input Menu → (Off, On)

Menu Size

Sets the size of the menu. The command is:

MENU → Other → Menu control → Menu Options → Menu Size → (Small,Med,Large,Full)

Initial Power State

When power is connected, the unit will turn “on” automatically, or go to “standby-mode”. The command is:

MENU → Other → OnOff Setup → Auto On → (Standby, Turn On)

Initial Input Selection

Sets which input and input memory is selected when the unit is turned on, either after power has been removed or the unit has been put into standby. The command is:

MENU → Other → OnOff Setup → Input Select → (After Power Removed, After Standby)

Section 10 - Miscellaneous Commands

On/Off Message

A programmable string can be sent to another device via the RS-232 connector to turn the device on or off. The command is:

MENU → Other → OnOff Setup → (On Message, Off Message)

Message Control

Sets the RS-232 parameters that are used for sending a power on/off message to another device. The command is:

MENU → Other → OnOff Setup → Message Ctl

Test Patterns

The Radiance Pro can generate test patterns in the video modes that will be used for your display. The input colorspace (Rec.709 or Rec.2020), HDR (On, Off) output mode (480p60 through 2160p60), 3D type (Off, SbyS, TopB, FrmP), CMS, and Style can be selected. You can calibrate your display without the need to switch to a particular video source and having it generate a specific video mode. You must select "Ref w/Mode" or "Adj w/Mode" to generate patterns with your test mode settings.

Warning:

Some test patterns can burn plasma and CRT displays if left on for more than a few seconds.

The Radiance Pro has large selection of test patterns. Similar test patterns are organized into "Test Pattern Groups." Reference test patterns are only affected by the Radiance Pro output PC/Video level setting and are the same as the patterns produced by a video test pattern generator. Adjustable patterns allow viewing the effect of the Radiance Pro output color management settings. The Warm Up test pattern displays a 20 IRE to 50 IRE gray screen. See Radiance Tech Tip 5 for more information. The command is:

MENU → Other → Test Pattern → Pattern → (Reference, Adjustable, Warm up)

◀ and ▶ arrows step to the previous or next Test Pattern Group.

▲ and ▼ arrows can adjust the intensity of many test patterns from 0 to 100 IRE.

"HELP" Pressing the HELP button brings up a Help Menu.

"4" Pressing the number 4 steps through the patterns within the current Test Pattern Group.

"Prev" Toggle between the source and the pattern.

"OK" Exit the test pattern command but leave the pattern on-screen. You can then adjust various parameters to judge their effect on the pattern.

"ALT" Jump back into the pattern command.

Note: "PREV" and "Alt" functions are only valid if you leave the pattern on-screen by pressing "Ok."

Remote Control Arrow Buttons

This command changes the default usage of the arrow buttons on the remote. By default the Up/Down arrow buttons control zoom, the left arrow displays the **HDR Mapping** parameter menu, and the right arrow displays the **Darbee** menu. The default behavior can be changed. The command is:

MENU → Other → I/O Setup → Remote Ctl → (Up/Down arrows, Rt/Left arrows)

LED Setup

Controls the operation of the Blue LED on the front panel. The LED can be set to "Blue" to be a power on indicator or set to "Dark" so that it is off when the Radiance is operating. The command is:

MENU → Other → I/O Setup → LED Setup → (Blue, Dark)

RS-232 Setup

With echo on the Radiance will echo all characters sent to it. With echo off the Radiance will only send a message at power on/off. With echo set to off with status, the power on/off messages are changed to status responses. See Tech Tip 11 for delimiter usage and more details. The command is:

MENU → Other → I/O Setup → RS-232 Setup → (Echo, Delimiters, Report change) → (On, Off)

Section 10 - Miscellaneous Commands

Auto Input Select

When enabled, this list can be used to auto switch to an active input when the current video source is turned off. The priority 1 input is the first input tried when the current video source is turned off. HDMI inputs can be auto selected when turned on by setting "Select when On" to "Y". Disable auto selection by deleting all entries in the list. The command is:

MENU → Other → I/O Setup → Auto Select

Zoom Step

Sets the size of the Zoom step to 5% or 15%. The command is:

MENU → Other → Zoom step → (5%, 15%)

Configuration Memory Usage

By default, when a configuration memory (A-D) is chosen the selection applies to all inputs. For example if input 1A is active, then input 2 is selected followed by selecting "MemB," if input 1 is again selected, it would use configuration memory 1B. This is called the "Common" configuration memory mode. Generally this mode is used when specific day and night calibrations are desired and used for all inputs.

You can set the memory usage to be "Per Input." That is the configuration memory selection is independent for each input. In this mode, using the example above, starting with input 1A, changing to input 2, pressing "MemB" and finally selecting input 1, results in using configuration memory 1A. The command is:

MENU → Other → Memory Usage → (Common, Per Input)

Fan Control

The target FPGA ("Chip") temperature can be selected as well as the minimum fan speed. It is recommended that the target FPGA Chip temperature is selected as 84C, which is the default. Temperatures up to 94C can be selected, and for most systems work fine, but system speed is rated at 85C.

The minimum fan speed helps maintain a more consistent FPGA temperature. The minimum fan speed defaults to 4.

The FPGA temperature is shown in the menu and on the Info Screen page 2. The command is:

MENU → Other → Fan Control

Quick Keys

There is an easily assessable, top-level, menu called "Quick Keys", which gives access to functions that are normally selected using buttons on the Lumagen remote. This menu can be used with programmable remotes that have limited buttons. You can use the arrow buttons on the remote to highlight one of the functions and press "Ok" to execute the function. Alternately you can use a number button on the remote to highlight one of the functions and then press "Ok" to execute the function. (0)4:3, (1)LBOX, (2)16:9, (3)1.85, (4)2.35, (5)NLS, (6)Zoom+, (7)Zoom-, (8)MemA, (9)MemB, (n/a)MemC, (n/a)MemD, (n/a)3D Off, (n/a)3D SbyS, (n/a)3D TopB. The command is:

MENU → Quick Keys → (function) → Ok

Saving the Configuration

Save

NOTE:

If a Save command is not executed after making changes, the changes will be discarded when the unit is put in standby mode, or power is interrupted.

Permanently save the current configuration. Note that, once saved, the configuration is retained even if the unit is disconnected from power. The configuration from the previous save is retained to allow one level of save-undo. You can use the Radiance Configuration Utility found on the Lumagen.com support page to download a configuration file to your PC. The command is:

MENU → Save → Save → OK → OK

Section 10 - Miscellaneous Commands

Undo

Revert to the configuration over-written by the last **SAVE** command. Repeating the Save Undo command toggles between the last two saved configurations. The command is:

MENU → Save → Undo → OK

Restore from Internal Backup memory

During calibration, the video technician can save the resulting Lumagen configuration to a special configuration memory. This command restores that configuration. A **SAVE** is required to make the restore permanent. The command is:

MENU → Save → Restore Backup → OK

Load Factory Settings

Set all parameters to factory defaults. A **SAVE** is required to make this "Factory Reset" permanent. The command is:

MENU 0 9 9 9

Or **MENU → Save → FactoryReset → OK**

Section 11 – 3D Support

Section 11 – 3D Support

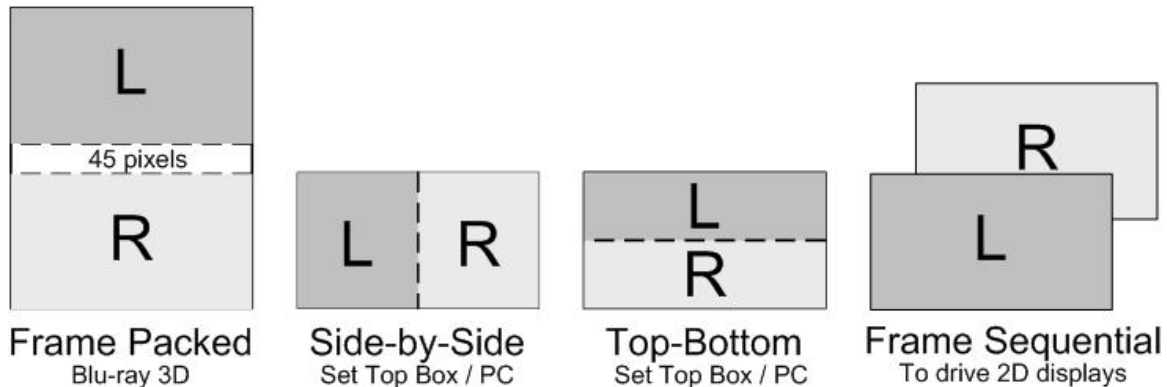
The Radiance supports HDMI 1.4 “3D”. This includes 3D video source switching, 3D processing, 3D scaling, 3D aspect ratio control, and a number of 3D format conversions. The Radiance can stretch 3D images for a 2.35 screen. The Radiance can accept HDMI 1.4 “3D” material and output either the left-eye or right-eye image, for dual projector 3D systems that use passive 3D glasses. The Radiance can also be used to display 3D on many 2D displays, such as a CRT display or projector.

If HDMI Output 1 on the Radiance is connected to a non-3D AVR the Radiance can automatically turn off video on that output when selecting a 3D video source. Most non-3D AVR's get confused if you try to send them a 3D video signal.

Any HDMI cable, with good electrical characteristics, will work for displaying HDMI 1.4 3D video on 3D displays.

3D Types

The Radiance can receive all the commonly used 3D types. The Radiance has options to convert 3D types, which are not supported by your 3D display, to a format supported by the display. For example the Radiance automatically converts optional 3D formats into required 3D formats. For CRT displays all supported 3D formats are converted to 3D Frame Sequential. This allows 2D CRT displays/projectors to display 3D images.



Frame Packed

The 1080p24 3D frame-packed mode consists of a frame that contains a full resolution left eye image, 45-pixel active buffer, and a full resolution right eye image. Bluray movies use this 3D type and are stored on the disk at 1920x2205/24.

Side-by-Side

Consists of a frame that contains Side-By-Side sub-frames for the left eye and right eye images. Set top boxes and PC's use this 3D type.

Top-Bottom

Consists of a frame that contains Top-Bottom sub-frames for the left eye and right eye image. Set top boxes and PC's use this 3D type.

Frame Sequential

Consists of individual frames of left eye and right eye images that are transmitted sequentially. Some 2D CRT and other 2D digital displays can be driven with this 3D type in order to display 3D images. For this case, an external IR Glass Driver is needed to drive the 3D active glasses.

Section 11 – 3D Support

Separate Left and Right

The Radiance can accept HDMI 1.4 “3D” video and output either the left-eye or right-eye image for a dual projector 3D system that uses passive 3D glasses. This 3D system configuration uses two Radiance video processors.

3D Output Settings

The Radiance has support for all of the commonly used 3D video sources. If you connect a HDMI 1.4a compliant 3D video source and compliant 3D display, to the Radiance, you should automatically get a 3D image, using the Radiance default settings.

The Radiance has settings that you can use to display 3D video, using non-compliant 3D video sources and displays. The Radiance has settings to optimize the video on your 3D display. The Radiance also has settings to display 3D video on some 2D displays (See section titled “3D Support for 2D Displays” for further details).

3D Output Setup Menu

You can select the 3D output settings based on the input number, input memory, and input video mode. For any of the three input conditions you can select ‘All’ to apply the output setup to multiple input conditions. When making settings that apply to multiple input conditions you can leave any of the output settings unchanged by selecting the ‘---’ option for that output setting. Press “4” for ‘All’ and press “5” to see the current settings. The command is:

MENU → Output → 3D Options → 3D → Ok

3D Output Mode = Auto

By default the output is set to “Auto 2,1.” The selection “Auto 2,1” means the Radiance automatically reads the EDID for the devices connected to both outputs, giving priority to Output 2, and automatically selects the appropriate output resolution. That is, if an active device is connected to output 2, the EDID from that device is read to determine the optimal video output resolution and the Radiance automatically selects the specified resolution. If no device is connected to output 2, or the device connected to output 2 is turned off, the Radiance uses the EDID from the device connected to Output 1 and sets the output resolution appropriately. Output 1 can have priority by selecting “Auto 1,2” from the *Video Output Select Menu*.

For “Auto” modes the output vertical rate is selected based on the input vertical rate. For example, input formats 480i60, 720p60, 1080i60 automatically select a vertical output rate of 60 Hertz. Input formats 576i50, 720p50, and 1080i50 automatically select a vertical output rate of 50 Hz. For a 1080p24 input format a 24 Hz output vertical rate is selected if the display supports a 24 Hz output vertical rate, otherwise a 60 Hz rate is selected.

If the priority output is connected to a 3D device, and the secondary output’s device is not 3D, when a 3D source is detected the Radiance automatically disables video to the 2D output.

For analog displays and digital displays, that do not properly support EDID, the output mode must be selected.

3D Output Mode = Specific Format

The Radiance will convert all 3D input formats to the specified 3D output format. For example all 3D input modes can be converted to a 1080p60 side-by-side output mode.

3D Output Type = Auto

The Radiance has support for all of the commonly used 3D Types (Frame Packed, Side-by-Side, Top-Bottom, and Frame Sequential). When the output ‘Type’ is set to ‘Auto’ the Radiance will convert all 3D modes and types to HDMI 1.4a mandatory 3D format.

3D Output Type = Specific 3D Type

The Radiance will convert all 3D input types to the specified 3D output type. i.e. All 3D input types can be converted to 3D Frame Sequential to drive a CRT display/projector.

Section 11 – 3D Support

3D EDID Configuration

By default the display's 3D capability is automatically detected using its EDID information. However, some 3D displays do not properly report their 3D capability in their EDID. This command allows the 3D output capability to be manually enabled (or disabled). The command is

MENU → Output → 3D Options → (Out1, Out2) → (Auto, Yes, No)

3D Setup Procedures

Normal Setup

For most new 3D video sources and displays, just connect the source and display to the Radiance. You will get a 3D image, with the Radiance default settings of 3D output 'Mode=Auto' and 3D 'Type=Auto'.

1. If starting with a unit in an unknown state, press "**MENU 0999**" to restore factory default settings and save the new settings by pressing "**MENU → Save → Save → OK → OK**".
2. Connect the *Radiance* outputs. If using only one *Radiance* output, use Output 1 if the *Radiance* needs to pass audio, or Output 2 if not. If using an AVR, or audio Pre/Pro, connect it to *Radiance* Output 1 and the display to Output 2.
3. Connect a video source that supports 3D to a HDMI input on the Radiance.
4. Turn on power to the display and video source.
5. You should now have a 3D image on your display.

Display Optimization

To get the best quality 3D image, on some displays, it is necessary to convert some or all of the 3D video modes to a specific 3D output mode. Research the display specifications, to determine the optimum 3D modes and types for your display.

For example; If a display shows 720p 3D video as a letterboxed image. You can set the Radiance to convert 720p 3D video to 1080p60 Side-by-Side 3D video, which is shown full screen on the display.

1. Set the appropriate Radiance output to "3D Capable" by pressing "**MENU → Output → 3D Options → Ok → (Out1/Out2) → Yes → Ok**".
2. For example; to set the Radiance 3D output to "1080p60" "Side-by-Side", press "**MENU → Output → Output Setup → 3D → Ok → Mode → 1080p60 → Type → SbyS → Ok**". Note: You need to select a 3D output mode before you can select a specific 3D output type.
3. Save the new settings by pressing "**MENU → Save → Save → OK → OK**".

Setup for Non-Compliant Displays

The Radiance also has settings to display 3D video on non-compliant displays.

1. If starting with a unit in an unknown state, press "**MENU 0999**" to restore factory default settings.
2. Connect the *Radiance* outputs. If using only one *Radiance* output, use Output 1 if the *Radiance* needs to pass audio, or Output 2 if not. If using an AVR, or audio Pre/Pro, connect it to *Radiance* Output 1 and the display to Output 2.
3. Connect a video source that supports 3D to a HDMI input on the Radiance.
4. Turn on power to the display, Radiance and video source.
5. Set the appropriate Radiance output to "3D Capable" by pressing "**MENU → Output → Output Setup → Ok → (Out1/Out2) → Yes → Ok**".
6. Save the new settings by pressing "**MENU → Save → Save → OK → OK**".

Section 11 – 3D Support

Setup for Non-Compliant 3D Video Sources

The Radiance also has settings to display 3D video using 3D video from non-compliant video sources. It is only necessary to manually set the 3D input mode on the Radiance if the video source doesn't transmit that it's displaying a 3D mode.

1. If starting with a unit in an unknown state, press **"MENU 0999"** to restore factory default settings.
2. Connect the *Radiance* outputs. If using only one *Radiance* output, use Output 1 if the *Radiance* needs to pass audio, or Output 2 if not. If using an AVR, or audio Pre/Pro, connect it to *Radiance* Output 1 and the display to Output 2.
3. Connect a video source that supports 3D to a HDMI input on the Radiance.
4. Turn on power to the display, Radiance and video source.
5. The Quick Key Menu has settings to set the Radiance input to 2D, 3D Side-by-Side, or 3D Top Bottom mode, press **"MENU → Quick Keys → (3D Off, 3D SbyS, 3D TopB) → Ok"**.
6. The direct commands to set the Radiance input to 2D, 3D Side-by-Side, or 3D Top-Bottom is:

2D	"MENU 030"
3D Side-by-Side	"MENU 031"
3D Top-Bottom	"MENU 032"

7. This setting isn't saved. Use the Quick Key Menu or a direct command to set the 3D input mode on the Radiance, when using a non-compliant 3D video source.

Section 12 – Darbee Video Enhancement

Section 12 – Darbee Visual Presence™

The Darbee Visual Presence (DVP™) feature can improve the perceived visual quality of an image. It does this by adding definition and contrast to the image. Darbee DVP can be used with the other Radiance video enhancements, especially the edge enhancement “Sharpness” control, to further enhance the image.

NOTE:

Darbee DVP is supported for input rates up to 1080p60.

By default, the Darbee video enhancement is turned on at a normal level. You can experiment with the gain setting to find the appropriate level, for your video source and display. Many users find that “HD” mode with a “Gain” setting in the range of 25, to 55, provide the best overall results.

NOTE:

The Darbee video processing is automatically turned off when a Radiance test pattern is displayed. When using an external test pattern, turn off DVP by setting “Enabled” to “No” in the Darbee menu.

Darbee menu

There are two ways to access the Darbee menu as shown below:

- That is, press the right-arrow while menu is not displayed. **NOTE:** *This is the default behavior, but this can be changed to a different function.*

Or **MENU → Input → In Configs → [resolution] → [#] → Enhance → Darbee → Ok**

Darbee menu control



Press ➤, or ◀, arrow buttons as needed to select the setting to modify. Press the up and down arrow buttons to change the selected setting. Press the **EXIT** button to leave the Darbee menu.

Gain

The gain control range is from 0 to 120. Most people prefer a gain from 25 to 55 but the optimum setting varies for different video sources, displays, and based on personal preference. A gain setting of 0 effectively turns Darbee off, and has the same effect as setting “Enabled” to “Off”.

Mode

- **HD** The “High Def” mode can be used for watching high definition video. It has the least aggressive processing and is virtually free from processing artifacts. This is also a good general-purpose mode to use for all types of video content.
- **Full** The “Full-Pop” mode can be used for watching low-resolution or lower-quality video. It has the most aggressive processing and isn’t appropriate to use for watching high definition video or games. You may notice more image artifacts than Game Mode.
- **Game** The “Game” mode can be used for playing video games. It is also a good mode to use for watching Computer Generated Imagery (CGI) and other clean video sources.

Enabled

Set “Enabled” to “Yes” or “No” to turn the Darbee video enhancement on or off. Use this control to compare an image with and without the Darbee video processing.

View

Set “View” to “Full” for normal viewing with Darbee processing. Set “View” to “Split” to display a split-screen image, with Darbee processing on the right half of the screen. The split-screen can be used to demonstrate or evaluate Darbee DVP processing.

Section 13 – Direct Commands

Section 13 – Radiance Pro Direct Commands

For rarely used commands, or commands that are not in the Menu system yet, here are some Direct Commands that can speed configuration. Direct Commands are entered using the Lumagen remote control or RS232 interface. Make sure to do a Save after any changes.

Miscellaneous Direct Commands

MENU 0727	Erase Configuration Memory: In Service Mode enter command, answer question, remove power. More aggressive than Factory Reset. No Save needed. Cannot be undone.
MENU 0811	Set current input to report HDCP 1.X back to sources
MENU 0819	Set all inputs/memories to report HDCP 1.X back to sources
MENU 0821	Set current input to report HDCP 2.2 back to sources
MENU 0827	Set output aspect to 2.35 (no Anamorphic-lens). This command implements all steps of the “Fixed 2.35 Output Aspect” section of Tech Tip 16
MENU 0829	Set all inputs/memories to report HDCP 2.2 back to sources
MENU 0860	Globally turn Darbee processing off
MENU 0861	Globally turn Darbee processing on
MENU 0871	Set output as 4k24, 4k25, 1080p50, 1080p60 based on input rate
MENU 0872	Set output as 4k24, 4k25, 4k50, 4k60 based on input rate
MENU 0875	Set HDMI output format as 4:2:2 on all styles (as appropriate)
MENU 0910	Temporary Service Mode (see <i>Other</i> menu which also has Permanent Service Mode)
MENU 0927	Disable/Enable the “Show Info Page on RS232 <cr> (carriage return) character
MENU 0940	Reinterlacing off
MENU 0941	Reinterlacing on
MENU 0943	Report all HDMI audio modes in EDID back to sources (feature toggle)
MENU 0944	Report basic HDMI audio modes (2-Ch PCM and DD 5.1) back to sources (feature toggle)
MENU 0995	Disable IR commands. Repeat to re-enable IR commands (this is the only IR command accepted when IR commands are disabled). This command cannot be Saved
MENU 0999	Load Factory Settings (temporary Factory Reset unless Saved)
ALT PREV	Restart the Radiance Pro outputs. Use if TV/Projector has trouble locking on the signal

Output Resolution Direct Commands

The following output mode commands are intended for temporary testing only and affect only the current input, input memory and input resolution. Use the **Output Setup** Menu to program the output mode, or modes, if the “Auto” setting is not being used (or use MENU 0871 or MENU 0872 above).

480p:	MENU 021	Progressive with 480 active scanlines
720p:	MENU 024	Progressive with 720 active scanlines
1080i:	MENU 028	Interlaced with 1080 active scanlines
1080p24:	MENU 020	Progressive with 1080 active scanlines
1080p:	MENU 027	Progressive with 1080 active scanlines
4k24:	MENU 023	Progressive with 2160 active scanlines
4k50:	MENU 025	Progressive with 2160 active scanlines
4k60:	MENU 029	Progressive with 2160 active scanlines

Menu Shortcuts

See **Radiance Tech Tip 13 “Direct Commands and Menu Shortcuts”** which contains a list of commands. This Tech Tip is available for download at <http://www.lumagen.com>.

IR Command List

See **Radiance Tech Tip 12 “IR Command Interface”** which contains a complete list of IR commands. This Tech Tip is available for download at <http://www.lumagen.com>.

RS-232 ASCII Command List

See **Radiance Tech Tip 11 “RS232 Command Interface”** which contains a complete list of RS232 commands. This Tech Tip is available for download at <http://www.lumagen.com>.

Section 14 – Specifications

Section 14 – Specifications

Inputs

- Up to four HDMI 2.0 with HDCP 2.2 at up to 4k60 (Radiance Pro 424X)
- Up to eight HDMI 2.0 with HDCP 2.2 at up to 4k60 (Radiance Pro 444X)
- Inputs can be upgraded to 18 GHz (4k60, 4:2:2, 12-bit)

Processing

- Input resolutions up to 4k60 HDMI 2.0 with HDCP 2.2
- Proprietary Lumagen No-Ring™ scaling
- HDR Intensity Mapping for improve quality HDR sources on HDR, or SDR, displays
- Vertical Keystone correction
- Darbee Digital Visual Presence™ (DVP™) enhancement technology (up to 1080p60 input)
- Full CMS (Color Management System) using a 4913-point 3D linear-gamma RGB color palette
- 21-point parametric grayscale and Gamma
- 10-bit processing for deinterlacing plus a 12-bit calibration pipeline
- Support for HDMI® 1.4 “3D” including anamorphic lens scaling
- Convert common optional 3D formats to a required 3D format that is supported by the display
- Each input has 4 user configuration memories
- Each input user configuration memory has 8 resolution sub-memories (for HD inputs)
- Each resolution sub-memory is linked to one of 8 output configurations.
- 2:2, 3:2 and 3:3 pull-down for SD/HD film sources
- Per-pixel SD/HD video de-interlacing
- User programmable non-linear-stretch (NLS) mode
- 4:3, LBOX, 16:9, 1.85, 2.35, 2.40 and NLS input aspect ratios
- Programmable output aspect ratio from 1.10 to 2.50
- Extensive support for anamorphic without need for an anamorphic lens
- Large suite of test patterns
- Programmable input/output color-space
- Y/C-delay calibration
- CUE and ICP filtering
- Eight channel audio up to 192 kHz, DD True-HD™ 5.1, and DTS Master Audio™ Bitstream

Outputs

- Output resolution up to 4k60 HDMI 2.0 with HDCP 2.2
- Up to two HDMI outputs for Radiance Pro 424X.
- Up to four HDMI outputs for Radiance Pro 444X.
- 18 GHz output upgrade available.
- Eight channel audio at 192 kHz
- Supports DD True-HD™, and DTS Master Audio™ Bitstream formats
- Each HDMI output can provide “stand-by” power to an external device of +5V at 250 mA total including the display and any devices that scavenge power from the HDMI output.

Miscellaneous

- IR and RS232 control inputs (See Tech Tip 11 and 12 on the Lumagen.com support page)
- Internal USB-to-serial adaptor for calibration or software updates
- Wired IR format command input
- Universal, 100-240V, ~50/60Hz external 12 VDC 5 Amp power supply
- Dimension 17" W x 9.5" D x 1.75" H (1U case) or 3.5" H (2U case)
- Optional rack mounting ears

ROHS



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