Setup: Installation

- This presentation applies to the Lumagen Radiance Pro software release 031023 and later, and a 4k projector or 4k TV

- Before starting it is recommended that you update to the latest release on the Lumagen support/updates/Radiance Pro page

- Radiance Pro HDMI connections
  - Use highest numbered output for Video to TV/Projector
  - Use Output 1 for audio to AVR/audio-processor
  - For faster switching, connect sources from most to least used on odd inputs ascending, then even descending
    - For the Radiance Pro 4446-18G this is 1, 3, 5, 7, 8, 6, 4, 2

- The Radiance Pro can be placed after the AVR/audio-processor. In this case the Radiance Pro 4240-18G is a good option.

Setup: Initialization

- Connect the Radiance Pro, turn it on, and select a bright 16:9 source image
- Do a Factory Reset
  - MENU 0999 for the factory reset
  - Alternately you can use the MENU → Save → Factory Reset menu
    - Select Reset ALL and press OK
  - Not required for incremental changes
- Unless noted, it is recommended you use default settings
- If you press the HELP button while in a menu, many menus show useful tips for that specific menu
- After any changes, including Factory Reset, do a Save
  - Any Lumagen remote: MENU → Up Arrow → OK → OK → OK
  - Radiance Pro remote: Press Save button at lower right, then press OK

Setup: Output Resolution

- If screen aspect ≥1.90 find out if projector chip is 4096 or 3840 wide. Note: 4k TVs are 3840x2160

  - JVC, and some Sony, projectors, have a 4096x2160 chip. Only use 4096 wide output if chip is 4096 wide

  - For ≥ 1.90 screen aspect, for a 4096 wide chip, using 4096x2160 output increases light by about 13.7%

  - Enter MENU 0873 for 9 GHz, or MENU 0874 for 18 GHz maximum output

  - To add 24 Hertz output

    - For 3840x2160 enter MENU 0872

    - For 4096x2160 enter MENU 0877

  - Save

Setup: Zoom to Screen Width

- Skip this step for a TV
- Make sure the projector is in 16:9 mode
- Select a source with a bright 16:9 image
- Select 16:9 Radiance Pro source aspect
- Use the projector zoom and horizontal lens shift to fit active image to width of screen plus a small amount of overscan
  - Do not worry about top and bottom for this adjustment

Setup: Adjust Image Height

- Skip this step for TVs
- Display the same 16:9 bright source, with the Radiance Pro source aspect selected as 16:9
- Use the projector vertical shift if needed to make sure image fills height of the screen
- Adjust height using MENU $\rightarrow$ Output $\rightarrow$ Styles $\rightarrow$ Style0 $\rightarrow$ Mask/Shrink $\rightarrow$ Shrink
  - Use up and down arrows to adjust the top active edge to the top of the screen plus a small overscan
  - Right arrow twice to get to the Bottom setting
  - Use up and down arrows to adjust the bottom active edge to the bottom of the screen plus a small overscan
- Press OK to accept. Then do a Save

Setup: Output Aspect

- Skip this step for TVs
- If screen has other than a 16:9 aspect ratio, set the Radiance Pro output aspect to match the screen aspect ratio
  - MENU → Output → Styles → Style0 → Aspect → Single Output Aspect
    - Enter output aspect in hundredths (e.g. 240 for 2.40)
- Press OK to accept
- Save

Setup: Output Color Format

- Output color format is SDR709 by default since this works well with all TVs and projectors
- To eliminate the need for the Radiance Pro to change output color formats between SDR and HDR it is often best to set the output colorspace to SDR2020
  - MENU → Output → CMSs → CMS0 → Colorspace
  - MENU → Output → CMSs → CMS1 → Colorspace
  - If the projector/TV handles Rec2020 well, set both to SDR2020, which is SDR Gamma 2.4 and Rec Bt.2020
  - Confirm projector/TV is in Rec 2020 colorspace
- Press OK to accept. Then do a Save

Setup: Auto Aspect

- ## Auto Aspect Setup (recommended settings)
  - MENU → Input → Options → Aspect Setup → Auto Aspect
    - Auto Aspect On/Off: On
    - Auto Aspect Control: Image
    - Sticky Aspect Override: On
    - NLS when applicable: Off
    - Letterbox Ctrl: Off
    - Merge 1.78/1.85: No
    - Merge 2.35 & 2.40: 2.40 (if you have a 2.40 screen)
    - Use Graphics Flag: 2.35 or 2.40 (if you have a Kaleidescape Strato)
    - Press OK and select either current input or All inputs
    - Press OK and select either current memory or All memories
    - Press OK to accept changes
    - Do a Save

Setup: Auto Aspect

- ## Auto Aspect Setup (with additional details)
  - Set "Auto Aspect:" On
  - Set "Auto Aspect Control" to Image. If you have sources that correctly use the HDMI Info Frame feature, you can instead set it to "HDMI+image"
  - Lumagen recommends selecting "Sticky aspect override:" On. With this setting, for movies that change aspect ratio you can manually select an aspect, or disable Auto Aspect with the remote, to watch the movie as all anamorphic as Lumagen recommends
  - Lumagen recommends selecting "NLS when applicable:" Off. Some people want to always fill the screen. In this case set to On
  - Lumagen recommends selecting "Letterbox Ctrl:" Off. If you have a top-down masking screen, then "Bottom" may be best. If you have a Bottom-up masking screen, then "Top" may be best

Setup: Auto Aspect

- ## Auto Aspect Setup (details continued)
    - Lumagen recommends selecting "Merge 1.78/1.85:" No
    - If you have an anamorphic screen, we recommend "Merge 2.35 & 2.40" be set to 2.35 or 2.40. It is reasonable to leave this set to Off
    - If there is a Kaleidescape Strato, we recommend "Use Graphics Flag:" selected as 2.35, or 2.40, if the screen is 2.35, or 2.40. Then in the Strato LAN setup menu select OSD aspect as "2.35 Letterbox" and enable "Report Content Type Metadata." The Strato then sends the "graphics flag" when the OSD is showing. The Radiance Pro uses this to select the programmed OSD aspect ratio.
    - Press OK and select either current input or All inputs
    - Press OK and select either current memory or All memories
    - Press OK to accept
    - Do a Save

Setup: Source Aspect

- MENU → Input → Options → Aspect Setup → Options
  - Set Input Aspect Same: Yes
  - Input Aspects Used: Normal
  - Auto Aspect Speed: Instant
  - Auto Aspect Status: Hide
- For "Set Input Aspect Same:" Yes, selected manual aspect remains the same for all input resolutions
- For "Input Aspects used," Normal is default. If you want 2.1 source aspect auto detected, set to Extended
- For "Auto Aspect speed" Instant works well. If you use a "two-way" driver so the Radiance Pro controls masking you may want to increase the time to 0.5, 1.0, or 2.0 seconds
- The "Auto Aspect status" reports the new source aspect whenever the Radiance Pro auto Aspect detects a new source aspect. Lumagen recommends leaving this as Hide

Setup: HDR DTM

- Radiance Pro HDR Dynamic Tone Mapping (DTM) calculates the maximum intensity for each frame. It uses this information to change the transfer function on a scene-by-scene basis using parameters selected by the user

- "Adaptive" DTM (ADTM) in the Radiance Pro then adjusts the transfer-function for each frame to account for intra-scene intensity changes

- The Radiance Pro has zone-based scene analysis to further improve DTM

- The Radiance Pro outputs "HDR in an SDR container" and sends SDR Gamma 2.4 to the projector/TV

- The Radiance Pro DTM no longer uses the MaxCLL reported from sources for its DTM calculations

Setup: HDR DTM

- For historical reasons DTM Global Max Light is set to a multiple of the measured light output
  - MENU→Output→CMSs→CMS1→HDR Mapping→Max Light
  - Global Max light is also in HDR Setup Menu
    - This is a backdoor to Max Light in the CMS HDR Mapping menu
    - Access with the "HDR Setup" button on the "non-PiP" remote or left arrow on any Lumagen remote
  - Recommended starting point for Max Light
    - For 150 nits or less, set to 6x measured
    - For 150 to about 300 nits, set to 5x to 6x
    - For 300 for 500 nits, set to 3x to 5x
    - For 500 to 1000 nits, set to 1.5x to 3x
    - Above 1000 nits set to 1x to 1.5x
  - Save

Setup: HDR DTM

- To adjust Global Max Light a good scene is "The Meg" at 1:08:00 to 1:09:00

  - This scene has people on and around an overturned boat. Adjust to trade-off maximum brightness versus correct flesh tones.

  - Access with the "HDR Setup button" on the "non-PiP" remote or left arrow on any Lumagen remote. Make changes. Press OK.

- For the "dark scene" Max Light you can use "The Revenant" at 0:19:58

  - Adjust the "Low Ratio" in the HDR Setup menu. This adjusts the effective "dark scene max light" which is shown as the "Low" value in parenthesis when Low Ratio is selected

  - The trapper son's tunic and tree bark should have good detail, but background should be dark. When done press OK

- Save

Setup: Audio EDID

- Connect the audio processor
- By default, with the audio processor on Output 1, the Radiance Pro will pass-back the Audio portion of the EDID to the sources
- For improved startup it is often good to manually set the audio EDID:
  - MENU 0745 for 2 channel 44.1 and 2 channel 48
  - MENU 0746 for 2 channel 44.1, 2 channel 48 and DD5.1
  - MENU 0747 for common formats, but no ATMOS, and no DTX X
  - MENU 0748 for common formats with ATMOS and DTX X
- Save

HDMI Cable choices

- HDMI cables can make or break the installation
- Radiance Pro outputs have fast 4k edge rates, and cable equalization.
  - Due to transmission line physics, it is edge rate, not data rate, that is the primary factor in required cable quality
- Passive HDMI cables should be at least 2 meters long and no more than 5 meters long. Typically 3 meter is optimal for cable attenuation
- All HDMI cables should be 18 GHz Certified. Passive 48 GHz HDMI are now the recommended speed grade
- Avoid Baluns at 4k. We have reports of issues with these (including without a Radiance Pro). AV Pro CAT Baluns have worked when a Balun was required
- Avoid using active cables on source outputs as often sources do not have enough HDMI Output Standby Power to reliably drive active cables
- Avoid "8k active cables" for 4k systems. To work at 48 GHz, they need to have faster buffers, which can cause issues in an 18 GHz system

Advanced settings

- The following slides discuss advanced topics
  - Adjusting black level
  - Adjusting white level
  - Color calibration using color calibration software and color probes
- For well designed projectors and TVs the black and white levels are likely correct with factory settings
- Color calibration should be left to professionals unless you have experience doing calibration

Calibrating Black Level

- Calibrating the Black Level is the most important calibration step
- No special training or equipment needed
- Select reasonable TV/Projector settings including appropriate lamp/backlight level
- Turn off dynamic features (iris, contrast, etc.)
- There are two steps (do this before 1D/3D LUT)
  - Calibrate Optical Black
  - Calibrate Digital Black
- Calibrate Black Level for SDR (CMS0)
- Calibrate Black Level for HDR (CMS1). This should be the same as for SDR and can often use same setting
- Save

Calibrating Optical Black Level

- View the Reference VidBlack pattern
  - MENU → Other → Test Patterns → Reference
  - Use ➤ to select Contrast1 pattern and press digit 1 repeatedly to step (backwards through patterns) to "VidBlack" pattern (pattern 10) is displayed. This is a full raster black field (except one pixel to keep lasers on)
  - After selecting the VidBlack pattern you can hide the menu text by pressing the digit 2
- Raise TV/Projector Brightness until the black field is visible
- Reduce TV/Projector Brightness until a down-click does not make black darker. Press OK when satisfied
- Press CLR to exit pattern mode. Then do a Save

Calibrating Digital Black Level

- View Adjustable Contrast 2 pattern
  - MENU → Other → Test Pattern → Adjustable
  - Use ➤ to select Contrast pattern group. Then press digit 4 to step to Contrast 2 pattern
  - After selecting the pattern, you can hide the OSD text by pressing the digit 2
- Press MENU then OK for Black Adjust
- Adjust so 1% to 4% bars just right of center are visible, but -1% to -4% bars to left of center look the same as Black (center bar)
- Typically, CMS0 and CMS1 Black will be the same
- Press OK to accept, then CLR to exit. Do a Save
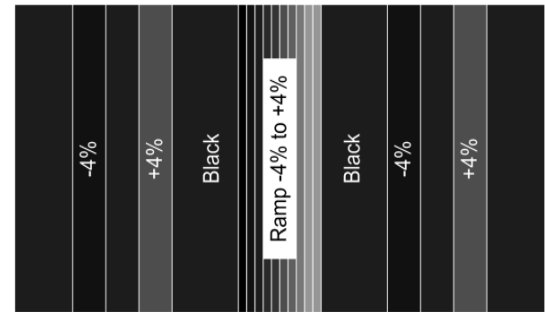
Calibrating White Level

- ## White level is calibrated using SDR output mode

  - Adjust TV/projector Contrast control using Test Pattern → Adjustable → Contrast1 pattern so 96% vertical bars are visible

  - If there are color differences between 96% and 100% white, reduce TV/projector Contrast

  - There is debate about levels "above White." These are not supposed to happen in sources (but sometimes do). They will never happen for "HDR output in an SDR container."

  - Setting max brightness at 100% white (i.e. cannot see 104% vertical bars) can increase contrast ratio

  - Make sure 100% White does not clip Red, Green, or Blue. The 96% and 100% should look to be the same color, and only vary in intensity. Or use a color probe to check 100% white for D65
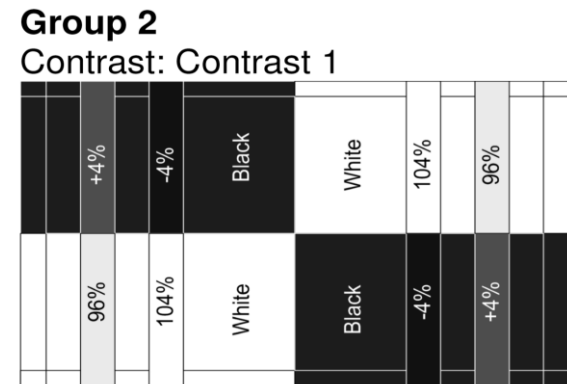
Calibrating for HDR Content

- "HDR" source CMS calibration steps are shown on next page (assumes Factory Default Settings)

- Radiance Pro HDR calibration is done with SDR Gamma = 2.4. The calibration process is very similar to SDR Rec 709. Use SDR patterns, and SDR Rec 2020 targets

- Use *Colorspace* = SDR2020 (or SDR709 or P3 with "auto-convert" disabled), and *Gamma to 3D LUT* = SDR

- Note: In general, for calibration, turn "2020 <--> 601/709" Off in the Output → CMSs → CMS0 → Colorspace menu

- Process is to do a 1D/3D LUT calibration to Gamma = 2.4 and target Rec 2020 primaries (or Rec 709 or P3) using SDR calibration software

Calibrating HDR and SDR

- Turn off all sources. Active sources can create interrupts which lengthen draw time.
- This information assumes one calibration in CMS0 (in SDR in and out mode), that is then copied to CMS1
- Set CMS0 Colorspace = SDR2020, 2020 < -- > 601/709 = Off, HDR Flag = Off
- In the calibration software select Rec 2020 targets, and Gamma = 2.4
- Calibrate Black as described previously
- Calibrate "Contrast" using Adjustable → Contrast1. No need for >100% white since tone mapping limits output to 100% white, but make sure 100% white has a low dE to D65
- Check Gamma against 2.4 curve. Use Radiance Pro Gamma_Factor, or Projector Gamma, as course correction for Gamma
- Select 21-point Grayscale mode in color calibration software
- Use "SDR" pattern mode to calibrate CMS0 1D LUT and, if desired/needed, 3D LUT
- After 1D/3D LUT calibration, check Grayscale and adjust as necessary
- Enable Auto Convert (2020 < -- > 601/709 = On), and then copy CMS0 to CMS1
- Enable HDR Mapping in CMS1 and adjust "Max Light"
- One calibration can be used for SDR and HDR if projector light is about 110 nits or less
- Hint: For an SDR Rec 709 calibration in CMS0 if Colorspace = SDR2020 you can leave "Auto Convert" on. Run the calibration as a standard Rec 709 calibration. The Auto Convert is mapped out since the projector is in 2020 mode, and points are correct for 709
- Calibration software saves its changes. Save any manual adjustments

Conclusion

- Whether you are a dealer, or end user, if you have questions on completing your setup, HDR, calibration, or other questions concerning the Radiance Pro, please contact Lumagen support at:
  - Phone: 503-574-2211
  - Or email lumagen.com support
- Hours are USA Pacific time 9 to 5, M - F
  - Support is often available in the evening and on weekends
  - If you think you will need off-hours support, please contact us during business hours so we can try to arrange a time