Ultimate Exposure Guide For Sony F5/F55

Version 1.1

By Dennis Hingsberg

Demystify exposure on the Sony PMW F5 and F55 cameras, and get the absolute best results possible. Period.

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Table Of Contents

Author Bio

Preface

Exposure

- **Fundamentals**
- **Dynamic Range**
- **The Crux of S-LOG**
- **S-LOG vs RAW**

Standard & Hyper Gammas: Dynamic Ranges, Key Differences

Five Exposure Methods

- **Grey Card**
- **White Card**
- **Light Meter**
- **Zebras**
- **Monitor (WYSIWYG)**

Using the CineEI Mode

LUT/LOOKS Primer: Differences, Use, Cautions and Tips

Light Meters

- **Introduction**
- **Meter Basics**
- **Meter Modes**

Rating your camera ISO

Author Bio

Dennis Hingsberg, based out of Toronto works across Canada as a freelance Director of Photography and is also the CEO & President of his full service and award winning film production company StarCentral Media Inc.

Dennis has a diverse skillset ranging from Television Broadcast to Cinematic Film Production. He has worked on a variety of projects from cinematic style music videos, feature length and short films, to corporate and commercial work.

His work has appeared on TV, been distributed, and also screened in theatres across the country. He also provides regular consulting to DP's around the world on camera settings and post production workflows for achieving the highest quality images and most optimal results.

Regardless of the type of projects he's involved with his goal always remains the same - to produce the highest quality images possible. Period.

For more detailed and up to date information about Dennis Hingsberg please visit **www.hingsberg.com/index.php/about**.

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Preface

Since the advent of log based gamma curves on more mainstream cameras by Canon and Sony the internet has grown rampant with tips and information on how to best expose and work with these log based gammas. For some it has been difficult to understand how to get the best results when exposing for S-Log, while for some it has taken a considerable amount of time to perfect. Others new to S-Log or RAW are still learning the ins and outs of it.

Good exposure techniques continue to be a hot topic on the PXW-FS7 due to the extremely rich feature set and capabilities offered by the camera. The FS7 camera offers S-Log 3 and S-Log 2 gamma curves, 16-bit RAW recording (with external peripherals), Custom and CineEI modes, and both LUT and Sony Look Profile capabilities to work with.

This guide is dedicated to breaking everything down about exposure with this camera into its simplest and most practical form in ways that make sense and hopefully are easy to understand. It combines real-world situations and scenarios and avoids focusing on only the technical – although it's also there for those who want it.

What this guide is not: This guide will not teach you what all the other features available in the camera do or how to use them all. If you do need help on using the camera I highly recommend posting any questions on the Sony Large Sensor Camera community forums, DVINFO.net, or DVXUSER.com community forums where many others and myself avidly post answers to many common questions about camera operation.

I ask that you please do not distribute or share this guide with anyone. If you know someone who might be interested in getting a copy simply direct them to my website **www.hingsberg.com** where it can be purchased for a small cost. Also anyone who purchases the guide will automatically receive any subsequent revisions or updates made to the guide using your email address on file.

If you have any questions about anything in this guide please do not hesitate to email me directly at **info@starcentral.ca**. Also if you do happen to enjoy this guide please visit my cinema blog website @ **www.hingsberg.com** and post a comment or review on the **Exposure Guide** article located there. My blog also contains other articles and points of interest working with Sony and other professional cameras.

Exposure

Fundamentals

How to get the best exposure at best can be a subjective discussion, and the techniques for achieving it will probably vary depending who you ask. Answers will range based on people's individual background and working experience, preference, maybe what they read on the internet, or perhaps based on an engineer's perspective on "how something was designed to work".

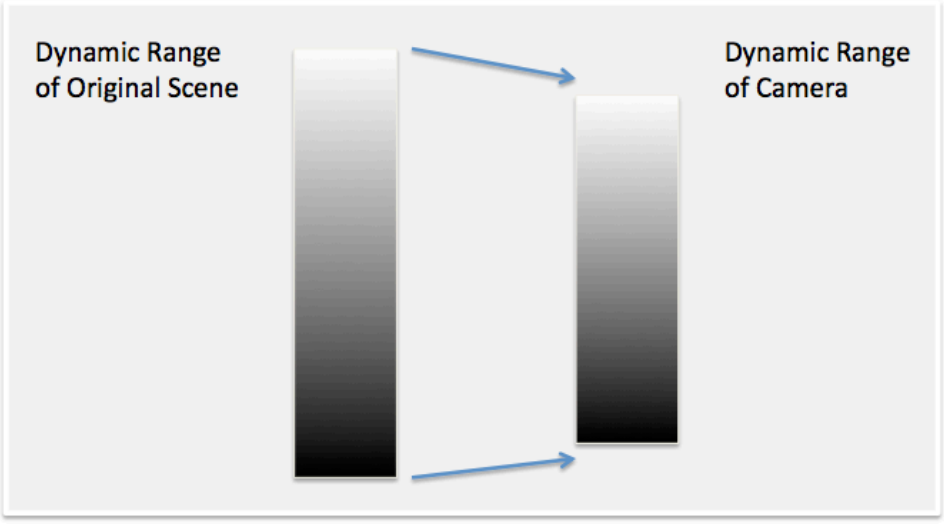
We've all heard a myriad of exposure tips ranging from; "expose to the right", "expose for middle grey", or "just use white and let everything else fall in place". What about "exposing by eye"? Sound familiar right?

Does any one of these methods work *best* and is there a single method we can rely on that will work *best* in the majority of shooting scenarios? Unfortunately I don't think that is the case as it's really going to depend on several factors ranging from; camera characteristics, scene elements, and some consideration for the *qualities* within the final image itself.

There are a variety of influences that can affect exposure and therefore getting a *good* image. They can work independently or in conjunction with each other. More specifically they are:

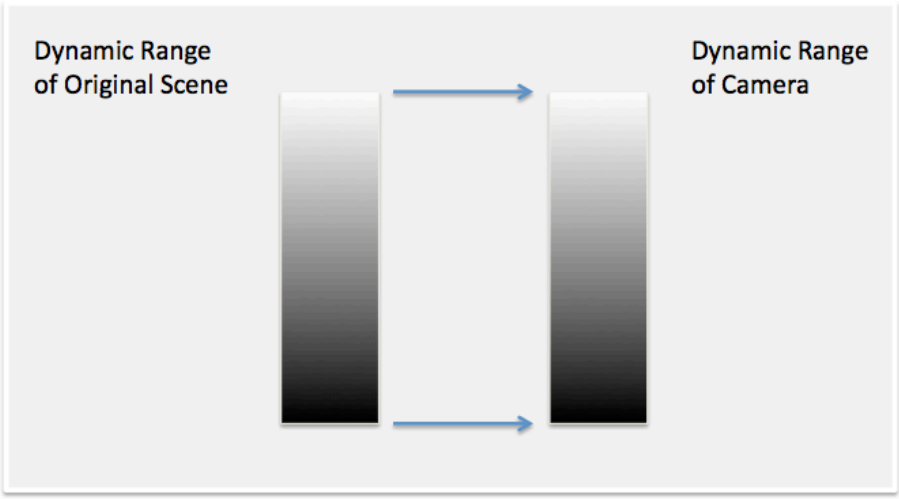
- Maximum dynamic range available by the camera.
- Overall scene contrast ratio determined by:
    - Variation in incident light.
    - Variation in reflectivity of objects within scene elements.
- Acceptable limits of noise when utilizing the full dynamic range of camera.
- Exposure setting.

Conceivably if we shoot a scene that has a dynamic range higher than our camera is capable of, it becomes difficult to maintain detail in both the shadows and highlights and clipping the highlights or crushing the blacks becomes more plausible. Setting a *good* exposure becomes increasingly difficult without making some compromises.



In a perfect world it would seem that all we need is a camera who's dynamic range is either equal to or even higher than the actual scene elements. Then we just make sure the exposure is spot on and we're all set. But even these scenarios will pose some unique problems.

Matching the scene dynamic range to the camera:



If we shoot a high contrast scene and approach the limits of the camera's maximum dynamic range, no matter how good the camera is we need to take the following points of consideration into account:

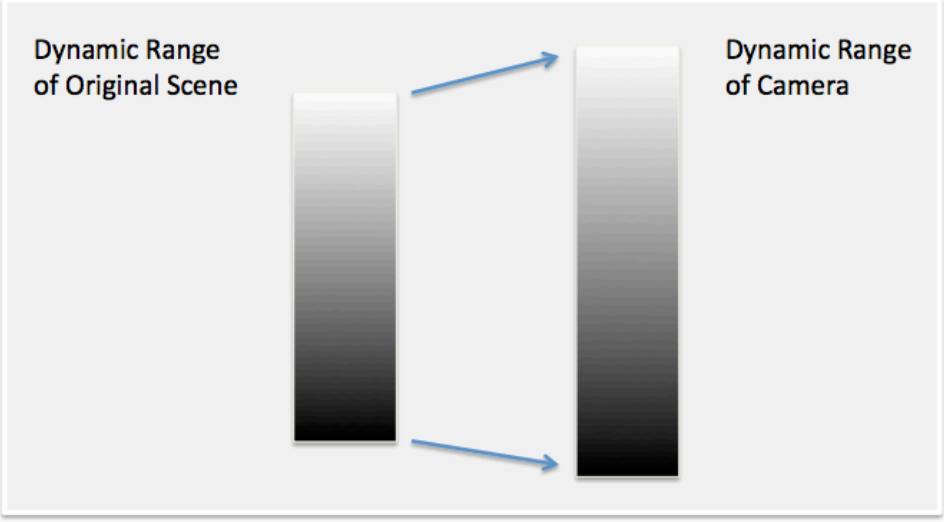
- Noise is more present at the lower tonal end. If the scene contains a small portion of dark elements it might not be a problem or noticeable, but if the scene contains large areas of dark elements the noise can become a concern.

- Scenes containing elements with very high reflectivity can actually cause the scene to exceed the dynamic range of the camera. This can lead to inaccurate exposure and/or clipping or crushing blacks on the signal if not factored in.

- It becomes far more likely to compress or clip part of the image depending on how the set exposure for the scene. Optimal exposure becomes more critical.

- We can no longer rate the camera lower than the native ISO without losing some range from the top end. Therefore we are limited in our ability to achieve higher effective signal-to-noise ratios if desired.

Exceeding the scene dynamic range with the camera:



When we shoot lower contrast scenes, or scenes which fit well within the range of the camera we can get very good results with our image. Working will within the camera's range offers the following benefits:

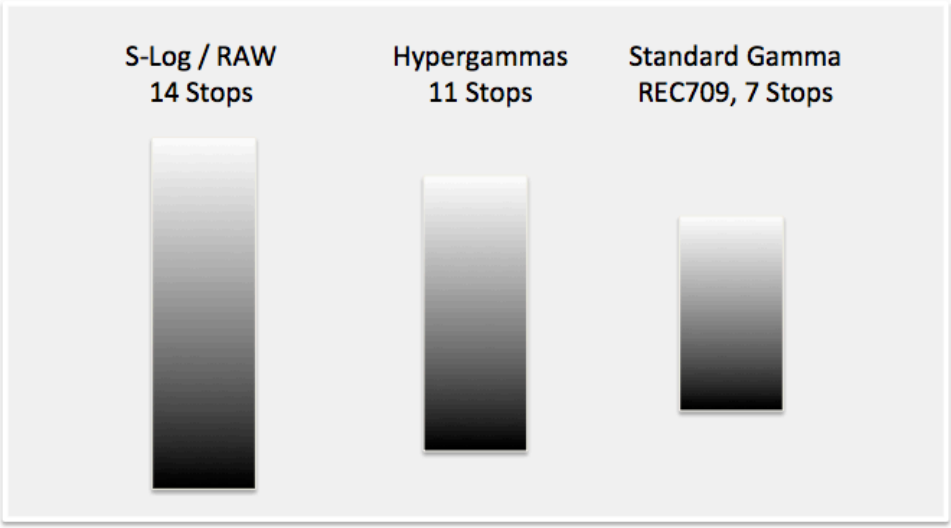
- Yields good representation of the overall tones throughout the scene
- Will result in the most pleasing look by the camera with a less "video" look
- The camera can be rated lower for an improved signal-to-noise ratio

Shooting within the capable range allows us to get good digital representation between the brightest and darkest tone – but it means consideration for the scene itself. Perhaps use of lights, lighting control, or filters for lenses to help work within the ranges of the camera.

Dynamic Range

The Sony F5 and F55 cameras offer a maximum dynamic range of 14 stops of exposure latitude when using the S-Log gamma mode or when recording in 16-bit linear RAW mode. RAW recording requires the AXS-R5 RAW recorder to enable external 4K/2K RAW recording.

Dynamic range for various modes:



The S-Log gamma modes offer 1300% dynamic range in order to achieve the full 14-stop dynamic range of the camera. 1300% dynamic ranges means the camera can capture brightness levels 14.4 times higher than 90% reflectance from a white card.

Dynamic range is reduced to approximately 11-12 stops in the hypergamma modes, and down to approximately 7 stops when using standard gamma modes.

Some hypergamma modes allow between 460% and 800% dynamic range depending on the curve selected allowing for some extra brightness levels above 90% reflectance white to be captured by the camera.

There is currently no HDR (High Dynamic Range) mode built into the cameras however the Sony RAW Viewer software does support exporting to the OpenEXR format. For more information please visit **www.openEXR.com**.

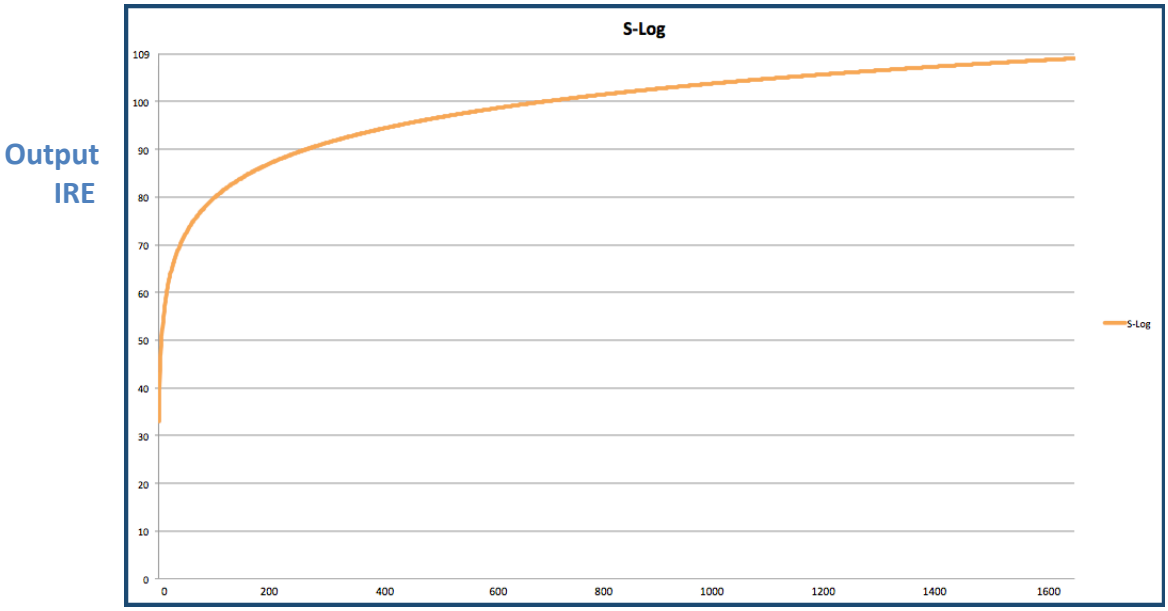
The Crux of S-LOG

The F5 and F55 cameras both offer S-Log gamma mode encoding which is a very powerful logarithmic gamma curve used to capture the full dynamic range available from the sensors in the cameras. One key attribute of S-Log is that it provides far smoother and more natural looking highlights when compared to regular video.

Images recorded in S-Log however need to be graded in post production in order to have the levels restored to proper levels for viewing. Fortunately there are LUTs available in camera as well as in post production to make working with S-Log easier.

Due to the nature of compression that occurs with S-Log, as the brightness levels increase above 90% white those levels become far more compressed together. This can easily be seen in the slog curve plotted below.

As details in brightness increases above 90% the information is heavily compressed into standard video space:



Compressing the information above 90% white is the only way that it's possible to capture the maximum dynamic range of the camera which brings us to the real crux of S-Log – because there is so much compression at the top end of the curve there is little exposure latitude in S-Log mode, so accurate exposure becomes critical in order to gain the full benefits that S-Log has to offer.

For this reason in order to obtain the most optimal exposure, Sony has published specific information on proper exposure values for its S-Log curves.

Published values for accurate exposure when recording in S-Log 2 or S-Log 3 modes:

Sony S-Log 2 and S-Log 3 Exposure Chart					
	18% Grey		90% White		Clipping Point
	IRE	10-bit CV	IRE	10-bit CV	IRE
S-Log 2	32%	347	59%	582	108%
S-Log 3	41%	420	61%	598	94%

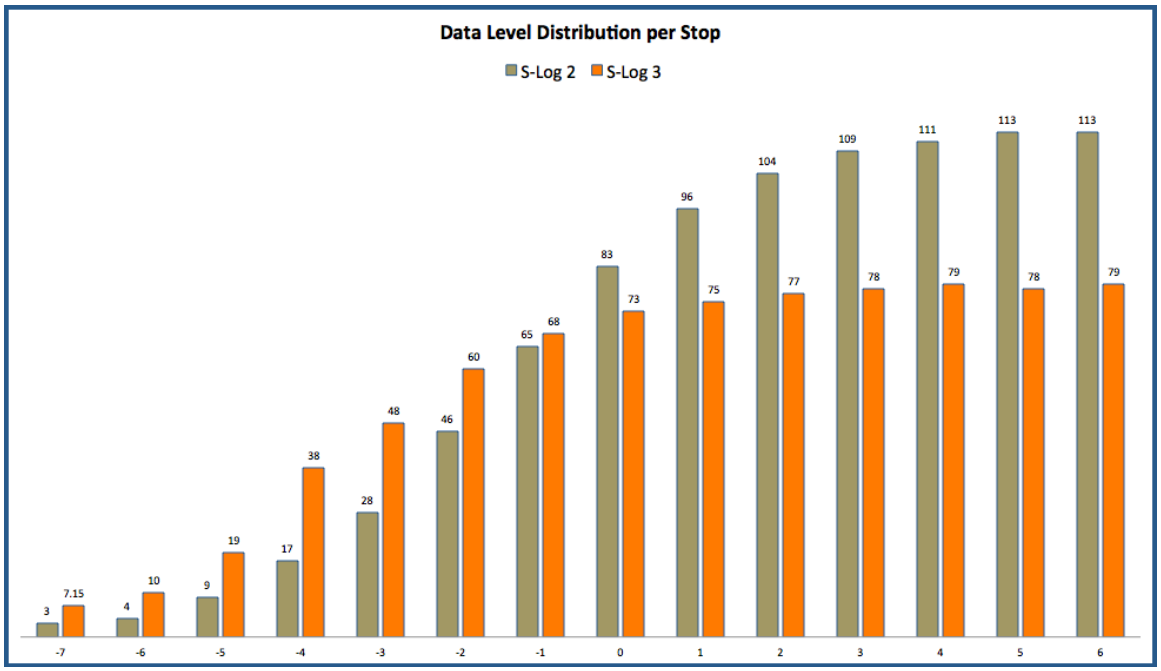
For example with S-Log 3 you would use an 18% grey card and get your exposure to read 41% IRE on your waveform monitor. Or if you don't have a grey card you can use a white card (which has 90% reflectance) and you would adjust your exposure to read 61% IRE on your waveform monitor. By now most people are already familiar with the proper exposure values for S-Log, but hopefully it's a little more apparent why the accuracy of exposure with S-Log is so important.

S-Log 3 vs S-Log 2

The F5 and F55 cameras have two versions of S-Log gamma curves available. They are S-Log 2 and S-Log 3. Both capture levels up to 14.4 times above 90% reflected white values compared to the original Sony S-Log which only captures 8.9 times above 90%.

A good characteristic of S-Log is that it provides a more even distribution of data allocation per stop which can be useful in post production for grading and color correction. The chart below gives us an idea of how much data is allocated towards each stop throughout the dynamic range of the camera for both S-Log 2 and S-Log 3.

Data Level Distribution per Stop for a 10-bit S-Log image:



The immediate difference seen is that S-Log 3 tends to allocate more data below middle grey whereas S-Log 2 tends to exponentially allocate slightly more data towards the highlights and midtones.

One really great advantage of using S-Log 3 over S-Log 2 is that it highly resembles the Cineon log curve which is also very close to the log curve gammas found on both Canon and ARRI. This allows for a wider range of compatibility in post production workflows and tools, including compatibility of 3rd party LUTs designed for ARRI or Canon.

Clipping points for S-Log:

One key difference between S-Log 3 and S-Log 2 is that they each have different white clipping points to be aware of. S-Log 2 clips at 108% IRE and S-Log 3 clips at 94% IRE.

The reason S-Log 3 clips at 94% IRE is because S-Log 3 can actually hold an additional 1.5 stops of dynamic range, quite possibly for use in the future when Sony releases cameras with higher dynamic range capabilities.

S-Log Clipping Points:

S-Log Clipping Points	
S-Log	**IRE**
S-Log 2	108%
S-Log 3	94%

Below is a table summary of exposure considerations when using S-Log:

Exposure Guide for S-Log			
	High Contrast	**Medium Contrast**	**Low Contrast**
Description	Outdoors, direct sun, harsh highlights, high reflective objects, low key lighting, scenes with little or no lighting control.	More controlled high contrast scenes, 8-12 stops of range in scene, lit scenes.	Overcast day, Flat Lighting, less than 8 stops.
Exposure	Set for accuracy to middle grey or white card.	Expose for grey or white, some latitude to rate camera lower.	Expose for grey or white, some latitude to rate camera lower.
Notes	Less latitude on exposure, high chance of clipping whites or crushing blacks.	More latitude on exposure, better signal-to-noise ratio.	More latitude on exposure, better signal-to-noise, consider using hypergamma.

TIPS for exposing for S-Log:

TIP 1: If you're dealing with a scene that has elements with high levels of reflectivity, highlights, or perhaps bright light sources in the frame it generally is better to slightly underexpose the image and adjust the levels in post to nominal levels. Of course the level of *pushing* the image back in post later can increase noise.

TIP 2: If you're dealing with lower contrast scenes in S-Log mode there is far more latitude in where you set your exposure level. For low contrast scenes I would typically suggest overexposing your scene by 1 to 2 stops. Later in post when levels are corrected it will result in a cleaner image with a better and higher signal-to-noise level.

TIP 3: Because the nature of S-Log is to capture reflectivity levels 14.4 times above values of 90% white, for low contrast scenes you will not really benefit from using S-Log and might consider using a Hypergamma instead which still provides an excellent amount of dynamic range.

TIP 4: You can record S-Log in RGB mode using the Sony SR codec which is free of chroma sampling found in YCbCr, and is better for most types of visual effects work.

TIP 5: For green screen work if you shoot in S-Log mode, you can overexpose your scene by 1 to 2 stops which when corrected later in post will improve the signal-to-noise ratio resulting in cleaner images and better results when pulling a key.

S-Log vs RAW

Understanding S-Log versus RAW is anything but simple. Some have suggested that a Log gamma encoded signal is far more efficient than the RAW format yet provides practically the same benefits of RAW. I feel that this is quite misleading and ignores some very important characteristics of the RAW format.

For the purposes of this guide as it relates to exposure, there are some specific characteristics to pay attention to but first let's take a look at the major differences between S-Log and RAW:

Major differences between S-Log and RAW:

S-LOG Characteristics
S-Log is *not* a file format. It is a gamma curve and how the signal from the sensor is encoded into YCrCb or RGB color space. It then undergoes compression using a codec such as MPEG, XAVC, or the Sony SR Codec. It is therefore *processed*.
S-Log uses a logarithmic gamma curve which provides a more uniform distribution of the data per stop throughout the overall dynamic range available by the camera.
S-Log can only be recorded with a maximum bit depth of 10-bits internally on the F5 and F55 providing a total of 1,024 levels of grey.
S-Log uses a traditional video format to record the image information and heavily compresses the top end of the highlights into regular video space.

RAW Characteristics
RAW *is* a file format. It contains data straight off the sensor which has not been de-bayered yet, does not have a traditional gamma applied to it, nor has been encoded into any specific color space. It is considered *unprocessed*.
RAW does not use a logarithmic curve to encode the image from the sensor, it is linear based. The nature of recording a linear based gamma is that data is not evenly distributed per stop throughout the entire dynamic range. Instead data doubles with each increase in stop starting from the darkest tones to the brightest.
RAW on the F5 and F55 (requires the AXS-R5 RAW recorder) is recorded with a bit depth of 16-bits which provides an impressive 65,536 total levels of grey to represent the image data.
RAW is based on RGB data which provides better quality for various types of work in post production.
The RAW format offers very little compression from the original sensor image data.

To summarize, RAW is a file format which incorporates a linear gamma. On the F5 and F55 camera's it can be recorded with 16-bit precision (requires the AXS-R5 RAW recorder) which offers nearly 63 times the amount of data over any of the built-in 10-bit formats which can record and encode using the S-Log gamma.

Images recorded in RAW are *processed* later in post using software such as Sony RAW Viewer, Davinci Resolve, or can also be supported directly on the timeline of various NLE software. When RAW images are processed in post they are de-bayered and can be encoded into a variety of supported gamma curves at which point grading and color correction can be applied.

Although the RAW format offers an unprecedented 65,536 levels of grey to work with compared with only the 1,024 levels found with XAVC or SR File (Sony SR Codec) the distribution of data throughout the entire dynamic range of the camera are very different.

In the chart below we see the direct relationship between S-Log and Linear gamma.

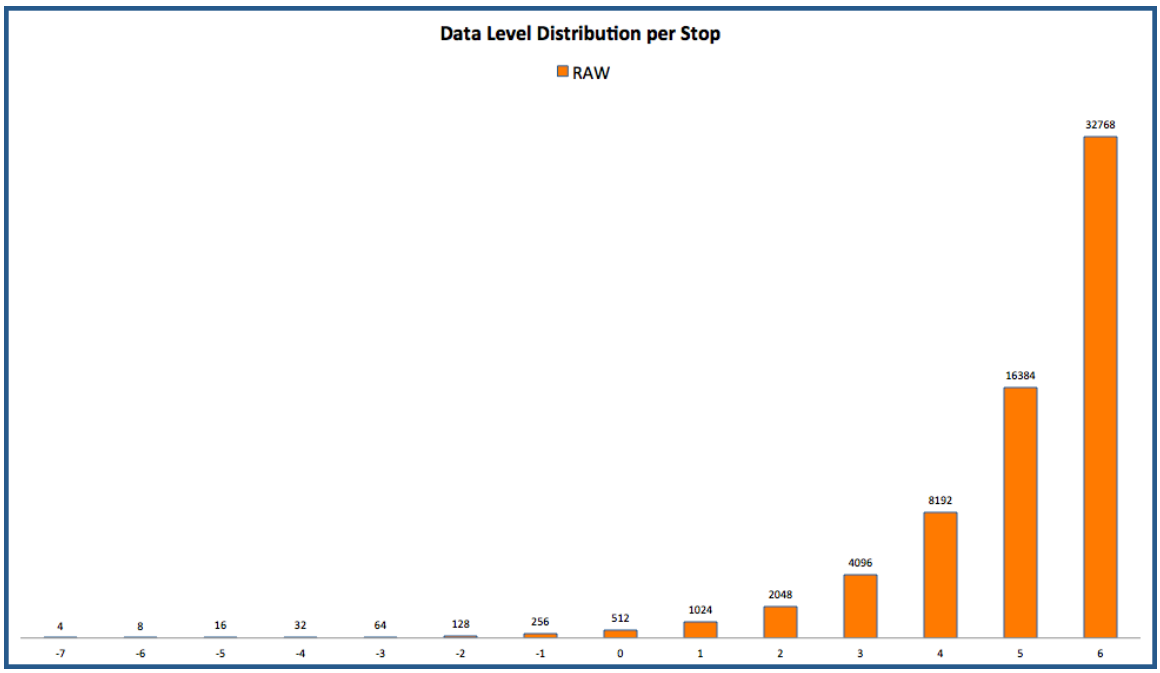
S-Log and Linear Gamma Curves:

As we saw in the previous section because S-Log uses a traditional based video format to record it's signal, it's subject to heavy compression in the highlights and exposure needs to be accurate in order to get the full dynamic range potential of the camera.

With RAW on the other hand, half of the full amount of available data is allocated to the brightest stop on the camera and from there each subsequent stop down from there will contain half the amount of data as the one preceding it.

Here is a chart to help visualize how data is distributed in the RAW format:

Data Level Distribution per Stop for 16-bit RAW image:



Below are the same data values summarized in table form:

Detailed Summary of RAW Data Allocation:

Data Distribution for 16-bit Linear Gamma	
Stop	**RAW Data Levels**
+6	32,768
+5	16,384
+4	8,912
+3	4,096
+2	2,048
+1	1,024
0	512
-1	256
-2	128
-3	64
-4	32
-5	16
-6	8
-7	4

With RAW the first six stops of dynamic range get the majority of the data levels available. Around middle grey we have around 500 levels above it to the next stop, and around 250 levels below. Compare this to S-Log where on average most stops at middle grey and above have around 100 levels.

The data values suggested here are purely theoretical and would suggest that Sony (or other manufacturers) use a *purely* linear based gamma which is likely *not* the case. Since there is so much data available that is biased and skewed towards the bright tones it is likely that some small amount of curving is applied particularly towards the lower end so that there is more data available to represent the darker tones below middle grey.

In terms of exposure, unlike S-Log where you really need to watch your underlying exposure level in order to preserve dynamic range and highlight detail, with RAW you have much more exposure latitude and exposure can be much more forgiving.

With RAW it can actually be favourable to keep the "*image to the right*" or in other words slightly biased towards the highlights and then in post adjust your exposure to the desired level. Of course if you want consistent exposure from shot to shot, or scene to scene then it makes sense to work with a good reference point like middle grey or a white card.

Below is a table summary of exposure considerations when using RAW:

Exposure Guide for RAW			
	High Contrast	**Medium Contrast**	**Low Contrast**
Description	Outdoors, direct sun, harsh highlights, high reflective objects, low key lighting, scenes with little or no lighting control.	More controlled high contrast scenes, 8-12 stops of range in scene, lit scenes.	Overcast day, Flat Lighting, less than 8 stops.
Exposure	Expose for highlights or just under clipping point and adjust exposure in post.	Expose for middle grey or white card, or overexpose by one or two stops and adjust levels in post.	Overexpose by one or two stops and adjust levels in post.
Notes	Maximum use of data available.	Better signal-to-noise ratio.	Better signal-to-noise ratio.

Summary of S-LOG vs RAW:

S-Log and RAW Chart			
	S-Log		**RAW**
Bit-Depth	10-bit	8-bit	16-bit
Levels of Grey	1,024	256	65,536
Gamma	Logarithmic		Linear
Notes	Offers more even distribution of data throughout the entire tonal range. Small bias towards highlights.		Less even distribution of data throughout tonal range. Data allocation increases towards highlights.

Final Considerations

We have a myriad of options and considerations when it comes to setting exposure depending on the nature of the scene and its elements, plus combine that with the latitude offered between the various shooting modes on the F5 and F55 cameras and it can be enough to make our head spin! But hopefully with the information contained within the EXPOSURE section of this guide it will be helpful for you to make decisions that will result in the absolute best images possible.

Recording Format Considerations:

Recording Format Selection Guide			
Low	**Good**	**Better**	**Best**
Standard gamma	Hyper gamma	S-Log 2 / S-Log 3	RAW
7 stops dynamic range	11 stops dynamic range	14 stops dynamic range	14 stops dynamic range
REC709 look, low dynamic range, quick turn around.	More dynamic range, quick turn around.	Highest dynamic range, needs post production, LUTs can bake in a look for fast turn around.	Highest dynamic range, requires post production, higher flexibility offered for grading.
Limited dynamic range below 800% will yield more clippy looking images if strong highlights present.	800% dynamic range offers a strong balance between standard gammas and S-Log.	"Thin negative" can produce great images with careful exposure - but is limited mainly due to lower bit-depth of the camera (10-bit).	"Thick negative" offers more *unprocessed* sensor data and more data information (12-bit and 16-bit).

STANDARD & HYPER GAMMAS

An 18% grey card once properly exposed will sit at different levels on a waveform monitor depending on the particular gamma curve selected. This is true for all standard or hyper gammas, S-Log, and also LUTs or LOOKS loaded into the camera.

In standard REC709 middle grey sits just around 42% IRE. Each hypergamma has a unique value mapped for middle grey, and the mapped middle grey value is actually built right into the name of each hypergamma curve. See the chart below.

Hypergamma Chart:

Hypergamma Chart	
Hypergamma	**Description**
HG1 - 3250G36	Legal Signal. Good for low-light: slightly brighter mid-tones.
HG2 - 4600G30	Legal Signal. Slight improved dynamic range.
HG3 - 3259G40	Good for low-light: slightly brighter mid-tones.
HG4 - 4609G33	Slight improved dynamic range.
HG7 - 8009G40	High 800% dynamic range. Better for low-light.
HG8 - 8009G33	High 800% dynamic range. Better for sunny day

For example with **HG7 - 8009G40** the **800** means the gamma curve has a 800% dynamic range, the **9** means it records up to 109% IRE, and the **G40** means a grey card should be exposed at 40% grey on a waveform monitor.

On the F5 and F55 cameras the HG7 and HG8 hypergammas are high dynamic range curves that give you the highest dynamic range possible without having to record in S-Log mode. These hypergammas offer 800% dynamic range which can provide up to 11 stops of dynamic range. This is the same dynamic range as was provided by the original S-Log 1 mode.

TIP 1: To understand what "325%" dynamic range means in the real world using HG3 as an example, divide this number by 90% and this is the level of brightness that can be captured above 90% white. So 325% dynamic range means the gamma curve can capture brightness levels up to 3.6 times brighter than 90% white. The higher this number, the more levels of brightness values that can be recorded and hence a softer and more natural looking production of tones in the extreme highlights region.

Exposing Hypergamma curves

Selecting a hypergamma curve allows you to record images with a "baked in" look and still have some flexibility in post production for color correction or grading if desired. The dynamic range of hypergammas are between 11 and 12 stops and you don't need to worry about removing the look of S-Log in post, so most of the time the footage can be handed straight over to the editor who can make some subtle adjustments if needed.

When setting your exposure for hypergammas there are two options to consider:

- Using the specific middle grey value mapped for each gamma curve.
- Placing middle grey anywhere on the gamma curve you like.

If setting your exposure using the middle grey values mapped for each gamma curve the gamma curves with lower middle grey values such as HG4 or HG8 (which have a grey value mapped to 33% IRE) tend to be better for brighter lit scenes, such as a sunny day or a scene with high-key lighting. Conversely gamma curves with higher middle grey values such as HG3 and HG7 (which have middle grey mapped to 40% IRE) are better for lower light situations, such as scenes with low-key lighting or scenes with large pools of dark shadows or elements in them.

One caution is that when you use a hypergamma with a low middle grey value the tendency can be to end up overexposing the image because with such a low middle grey value an image may look dim or dark on the viewfinder or external monitor. The same is true with hypergammas that have a higher middle grey value, they can make images appear too bright on a viewfinder or external monitor, so the tendency can be to end up underexposing the images. The key in preventing over or under exposure is to use a grey card and a waveform monitor to see exactly where your middle grey value is on the waveform monitor.

Otherwise you can place middle grey anywhere on the gamma curve you like depending on the scene which will allow you to allocate more of the dynamic range towards either the shadows or the highlights. So by setting your exposure with middle grey higher on the gamma curve, more data will be allocated the shadows but you will lose some range from your highlights. If you set your exposure with middle grey lower on the curve more data will be allocated to the highlights, and therefore less data in the shadows.

Standard Gammas:

The Standard gammas on the F5 and F55 are limited to around 7 stops of dynamic range. They give you a perfectly legal signal with blacks at 0% and white clipping at 100%. These gammas will tend to give you a "video look" straight out of the camera and do not offer a lot of room in grading without easily destroying the image. They can however be good for low contrast scenes and very quick turn around of files.

Standard Gamma Chart:

Standard Gamma Chart	
Standard gamma	**Description**
STD1	DVW camcorder equivalent. Has lowest slope near black (for low noise and black-crushing).
STD2	x4. Somewhere between Std1 and Std3
STD3	x3.5
STD4	240M
STD5	Rec709 is the most commonly used gamma; it's the default HDTV standard gamma.
STD6	x5.0

Five Exposure Methods

- Grey card
- White card
- Light Meter
- Zebras
- Monitor (WYSIWYG)

There are a variety of methods you can use to set your exposure on the F5 and F55 cameras and I believe that different types of work or shooting situations may call for different methods of determining exposure, so having a few different methods in your back pocket can't really hurt.

Although there might by other exposure methods or tools available, amongst some of the methods I use most often for determining exposure, they are as follows:

Grey card

Place an 18% grey card under the lighting exactly where the subject will be standing, and with the grey card facing the camera adjust the lighting, lens, camera settings, or add/remove ND filters to get the desired middle grey value on the waveform monitor.

I do carry a grey card around in my lens cases but often I might just decide where I will place the skin level on the waveform monitor and work with that. Once I set my exposure using grey or the skin level typically I am letting everything else *fall in place* but still keeping an eye on my levels above and below middle grey for other scene elements.

White card

Similar to using a grey card, you can place a white card or white piece of paper under the direct lighting where the subject will be positioned, or in the scene itself if there is no subject, and with the white card facing the camera make appropriate adjustments until you get the white level value where you want it on the waveform monitor.

A white card will reflect 90% of light but where you place it on the waveform monitor will depend on many factors. If you are using S-Log you should use the values in the tables defined on page 11 in the S-Log 2 and S-Log 3 Exposure Chart. For example for S-Log 2 a white card with 90% reflectance should sit at 59% IRE on the waveform monitor.

If you plan to use any other gammas, LUTs, or built-in LOOKS you should not necessarily set the white card on your waveform monitor to 90% since each of these can be mapped to different underlying values.

For example LC-709 has 90% white mapped to 73% IRE, and LC-709A has 90% white mapped to 71% IRE. So by placing white at different levels then it was *designed* it can push the rest of your tones to areas of the curve that may have undesirable effects. (More on this in the LUT/Looks section of the guide.)

Example Gamma & LUT mappings:

Example Gamma & LUT mappings		
	Reflectance	
Gamma/LUT	**18% grey**	**90% white**
REC709(800)	44% IRE	90% IRE
S-Log 2	32% IRE	59% IRE
S-Log 3	41% IRE	61% IRE
LC-709	40% IRE	73% IRE
LC-709TypeA	40% IRE	71% IRE
HG7	40% IRE	82% IRE

If you do want to use a white card for gauging exposure while using a LUT, LOOK, or even a hypergamma, I suggest mapping out your own values for 90% white so you are fully aware of where they sit on the scale.

Light Meter

This is by far my preferred method for setting exposure for practically any type of work.

Once you go through the process of rating your camera's ISO yourself it is possible to know your middle grey without using a grey card and the camera itself to look at a waveform monitor to adjust your values. It does take some trust and experience to get this level of confidence using a light meter to set your exposure - but it provides many benefits if working with crews or even on your own. For example you can work on lighting setups and lighting adjustments before a camera is even in place or turned on. I also find light meters very useful for scouting locations and taking ambient readings so I know the lighting levels ahead of time and can plan accordingly.

There are a lot of people who don't like using light meters and find reasons why they don't work or get into debates over reflectance vs incident metering but essentially what the meter is telling you is what f-stop to set on your taking lens in order to place middle grey at the right level for your camera. The best part about using a meter is it can help you get very consistent lighting from shot to shot plus maintain any lighting ratios you've established.

Since a light meter measures the light falling onto it (incident mode) whereas your camera measures the light reflected from it you do have to use some judgment to know when you might compensate accordingly for the scene or subject you are lighting. ie. Light skin / darker skin, a very dark wall or a scene with a snow covered ground. You may open up or close down your iris additionally to what your meter tells you based on the actual subject and/or scene.

For shooting S-Log on Sony cameras (which for the most part have never had built-in waveform monitors or really great exposure tools) I have found using a light meter extremely accurate, consistent, and could not imagine myself shooting without one.

Zebras

If shooting using the S-Log modes you can use zebra stripes set to 60-70% making sure that only your highlights hit these values keeping in mind that approximately 60% IRE on the S-Log scale is actually 90% IRE and you probably want to avoid clipping any highlights.

I find zebras can work really well for limited setups or run and gunning but it can also create inconsistent exposures if you work on multiple camera setups per day, shooting a variety of scenes, make frequent lens changes, etc. So it's method that definitely has some advantages in terms of quick shooting but you need to factor in the possible effects on the final footage.

One way I might use zebras is if I'm shooting a scene that has lots of bright tones making up the scene, then I toggle zebras on and off to see if I'm hitting any really high values to ensure that I stay below clipping or at least am aware of what I might let go into clipping.

Monitor (WYSIWYG)

Some camera operators have managed to get comfortable using their monitors to judge exposure and knowing how what they see on screen translates to what's being recorded underneath. Needless to say this comes with experience and enough of a feedback loop to give you that confidence.

Even working with S-Log over time you eventually get immune to how washed out it looks and can learn to start working with it. With S-Log it's a bit *riskier* because of the narrow exposure latitude but with hypergammas or the ability to use monitoring LUTs in-camera on top of S-Log it is not impossible to shoot what just *looks good*.

By using the 709(800%) LUT you can *almost quite* accurately judge exposure off a monitor but of course be if you're planning this be sure to toggle the LUT on and off at least a few times and look at the underlying values on a waveform monitor to see where in fact your tones are landing.

CINE EI Mode

The CineEI mode on the F5 and F55 disables much of the internal processing from within the camera including matrix, detail settings, noise reduction, and provides for the most unadulterated image to be captured from the sensor which can be highly desired for material which may undergo extensive post processing (ie. VFX, Color Correction, Color Grading) and overall enables the widest creative possibilities in post.

One of the main operating features of the CineEI mode is that it allows you to rate the camera's ISO differently than you will actually be recording. It means for example you can overexpose or underexpose your image but on your monitor have the image unaffected and look like it is exposed normal.

It can be easy to get confused with this concept or why you might even resort to using it, so here are a few examples and explanations:

Overexpose (Rating the camera lower):

If you overexpose your image by 1 stop it means all your scene information is brighter including the detail in any darker related tones. This could be useful in green screen applications, or in low-key lighting situations where you might have large areas of darkness, blacks and shadows.

Since you over exposed your image by using more lighting or by opening your lens iris, in post when you restore these levels back down you will effectively INCREASE the signal-to-noise ratio of the camera and DECREASE the noise. (The higher the signal-to-noise ratio the cleaner and more noise free the image becomes.) This can make pulling a key easier and also if you are looking for rich blacks and detail in your shadows can also be a good technique to employ.

CAUTION: The downside of rating the camera lower is you will lose some of the range at the high end. However since the camera can provide an overall dynamic range of 14 stops most of the time it might not be an issue to lose some of your dynamic range.

TIP: To overexpose your image by 1 stop your camera must be in the CineEI mode, and on the F55 select ISO640, and on the F5 select ISO1000. Under the **MONITOR LUT** menu ensure that **MLUT** is set to **OFF** for **SDI(Main)&INTERNAL Rec**. Set the **SDI(Sub)&HDMI MLUT** to **ON**, and set the **Viewfinder MLUT** to **ON**. From the LUT menu I suggest you select the REC709(800) LUT since it provides the most "normalized" look while preserving the underlying mapped values.

Underexpose (Rating the camera higher):

On the opposite end of it, there could be times where you want to work with underexposing your image. Perhaps you want to give yourself more headroom in the brighter tones than are regularly available by the camera.

Maybe it's a very sunny day, or a landscape scene in the arctic where both the snow covered ground and rich blue cloudy skies have higher reflectance values and you want to allocate more data towards them.

CAUTION: When underexposing an image any shadow areas or lower midtones present in the overall scene will be pushed further down towards the bottom of the range where there is generally less data available and is also closer to the noise floor of the camera. If you attempt to *push* the image in post you will DECREASE the effective signal-to-noise ratio and therefore INCREASE the noise.

TIP: To underexpose your image by 1 stop your camera must be in the CineEI mode, and on the F55 you would select ISO2500, and on the F5 select ISO4000. Under the **MONITOR LUT** menu ensure that **MLUT** is set to **OFF** for **SDI(Main)&INTERNAL Rec**. Set the **SDI(Sub)&HDMI MLUT** to **ON**, and set the **Viewfinder MLUT** to **ON**. From the LUT menu I suggest you select the REC709(800) LUT since it provides the most "normalized" look while preserving the underlying mapped values.

Setting Exposure

This part can get a little confusing. We rate the camera lower or higher to affect the underlying exposure being recorded, but then how is it we go about setting our exposure properly?

The quick answer is you expose exactly as you would normally using your monitor, waveform monitor, zebras, etc.. or whatever your preferred method of setting exposure is. The CineEI mode takes care of the rest!

As you adjust your EI ISO the camera is actually applying the gain to what you see on the waveform monitor, not what is being recorded. So it stands to reason that the CineEI mode will only work with a LUT enabled on the camera, so you will have to chose a LUT to enable and work with.

For all simplicity sakes if you don't want to get caught up in why exposing with different LUTs can take some rocket science to get your head around I strongly suggest you use the 709(800%) LUT built right into the camera. With this LUT you can work with 45% IRE on your waveform monitor as 18% middle grey, and 90% IRE on your waveform monitor as your 90% reflectance from a white card. So if you prefer exposing Caucasian skin at 60%-65% then this is still what you set your waveform monitor too.

Interesting Related Bits

You actually don't need CineEI mode to over or under expose your images. You can do it in the Custom mode by just overexposing or underexposing your shot, however the image in your monitor will also be affected and appear brighter or darker. But if your workflow can support this then it's an alternative option if you don't want to use CineEI mode.

Prior to firmware release version 5.0 Noise Reduction was disabled in CineEI mode and not available. Since firmware release 5.0 it has become possible to enable Noise Reduction in the camera and select from Low, Mid, and High level settings.

If you chose not to enable any Noise Reduction in CineEI mode it can be practical and useful to rate the camera at least 1 stop lower to improve the noise level. In general noise is often more noticeable in mid and dark tones, so I recommend having good lighting levels on even your shadows and darker tones for the best results.

The base ISO for both cameras will stay the same when in CineEI mode regardless of the index setting. For the F5 the base ISO is 2000ISO, and for the F55 the base ISO is 1250ISO. This is important to know because it means you are somewhat *stuck* with working at these base ISO's on your shoot. ie. If you are outdoors you will undoubtingly need ND filters to get the base exposure you want to work with.

CineEI Exposure Index Chart:

Exposure Index Chart				
The 'E' value represents the highlight latitude in stops				
Sony F5		**Sony F55**		
CineEI ISO	**Base ISO**	**CineEI ISO**	**Base ISO**	**Description**
500EI: 4.0E	2000ISO	**320EI: 4.0E**	1250ISO	2 Stops overexposed
640EI: 4.3E	2000ISO	**400EI: 4.3E**	1250ISO	1.7 Stops overexposed
800EI: 4.7E	2000ISO	**500EI: 4.7E**	1250ISO	1.3 Stops overexposed
1000EI: 5.0E	2000ISO	**640EI: 5.0E**	1250ISO	1 Stop overexposed
1250EI: 5.3E	2000ISO	**800EI: 5.3E**	1250ISO	.7 Stops overexposed
1600EI: 5.7E	2000ISO	**1000EI: 5.7E**	1250ISO	.3 Stops overexposed
2000EI: 6.0E	2000ISO	**1250EI: 6.0E**	1250ISO	No exposure change from base ISO
2500EI: 6.3E	2000ISO	**1600EI: 6.3E**	1250ISO	.3 Stops underexposed
3200EI: 6.7E	2000ISO	**2000EI: 6.7E**	1250ISO	.7 Stops underexposed
4000EI: 7.0E	2000ISO	**2500EI: 7.0E**	1250ISO	1 Stop underexposed
5000EI: 7.3E	2000ISO	**3200EI: 7.3E**	1250ISO	1 .3 Stops underexposed
6400EI: 7.7E	2000ISO	**4000EI: 7.7E**	1250ISO	1.7 Stops underexposed
8000EI: 8.0E	2000ISO	**5000EI: 8.0E**	1250ISO	2 Stops underexposed

As of firmware update v4.1 (June 2014) Sony made it possible to actually burn in the LUT to the footage being recorded. I have found this handy for quick turn around of footage and had lots of great success with Sony's LC709-A LUT which emulates the look of the ARRI Alexa in REC709 mode.

In order to burn the LUT straight into the footage under the **MONITOR LUT** menu set the **SDI(Main)&Internal Rec** to **ON**. This is *WYSIWYG* recording. The image and exposure levels you see in your monitor is exactly as it will be recorded. There is no

way to reverse or undo this later in post so be cautious about this one particular setting.

Quick guide on burning in the LUT or not:

Quick guide on burning in the LUT or not	
Desired Outcome	**Description**
Burn the camera LUT to the footage (WYSIWYG)	**SDI(Main)&INTERNAL REC** is set to **ON**
Do not burn the camera LUT to footage (CineEI)	**SDI(Main)&INTERNAL REC** is set to **OFF**

LUT/LOOKS Primer

Introduction:

LUTs can only be enabled on the F5 and F55 cameras when the camera is in CineEI mode. The camera supports 1D and 3D LUTs of either 17 or 33 lattices which can be created in Resolve or the Sony RAW viewer and uploaded into the camera. The ability to load 3D Luts into these cameras also opens up support for a variety of third party LUTs such as VisionColor's film emulation LUTs which simulate many very popular film stocks from Kodak, Fuji, and others.

In general LUTs are designed to transpose gamma values and color information from all three RGB channels and manipulate overall color information. 1D LUTs are limited in their ability and can only control gamma values for each RGB channel. Whereas 3D LUTs allow for additional image color manipulation such as changes to hue and color saturation. For example a 3D LUT can desaturate color from only the highlights region of the image if desired.

Uses:

LUTs have several practical uses from on-set monitoring, applying to dailies, and post-production. This is especially true if recording in S-Log mode. To elaborate:

- **ON-SET MONITORING**: It could be desirable when recording in S-Log to add a LUT in-camera in order to provide a more pleasing look specific project or crew members. ie. Producer, Directors, Makeup Artist, etc.

- **DAILIES**: If creating proxy files for editing or creating dailies for a production adding a LUT in post can give an approximate look of what the footage might look like after grading.

- **POST-PRODUCTION**: LUTs are useful for converting from one gamma curve to another, and the use of 3D LUTs in motion picture film is what dramatically revolutionized the Digital Intermediate process of scanning film to digital for post work and printing back to film. More recently in the web-verse LUTs have also become popular for applying film stock emulations to footage.

LUTs *can* also be used for the purposes of creative grading but they are not really a replacement for proper color correction and grading in post, as some footage may need specific correction that not all footage needs – so using a LUT is not a "one click fix all" solution.

For more information on film emulation LUTs visit **www.cinetiny.com/FELUT**

Sony's implementation of LUTs:

When the camera is in CineEI mode you need to select a monitoring LUT since the way CineEI mode works is by adjusting the gain of the viewing LUT and does not affect the underlying signal being recorded.

The F5 and F55 cameras have three categories of Monitoring LUTs:

- **LUT**: Allows you to use one of the five built in preset LUTs (P1 through P5) or you can select the User LUT (1D only).
- **LOOK PROFILE 3D LUT**: Sony's default Look Profiles including; LC-709, LC-709TypeA, SLog2-709, Cine+709. These are built into the camera and you can not change them. For more details please see Sony's Look Profiles Summary document.
- **USER 3D LUT**: Allows you to select one of four user 3D LUTs loaded into the camera.

Camera menu LUT summary table:

Camera menu LUT summary table			
	LUT	**Look Profile 3D LUT**	**User 3D LUT**
Menu Options	P1: 709 (800%) P2: HG8009G40 P3: HG8009G33 P4: S-Log2 P5: S-Log3 U1 through U6 for user assignable LUTs	1: LC-709 2: LC-709TypeA 3: Slog2-709 4: Cine+709	User 3D-1 User 3D-2 User 3D-3 User 3D-4
Notes	Preset LUTs for use for RAW or to SXS	Sony's "look" profiles. 3D LUTs. Can not be adjusted in-camera. They are also available for download as CUBE files from Sony's website.	User loadable 3D LUTs. You can create LUTs using Davinci Resolve, Sony RAW Viewer, and other software.

Starting with the **LUT** presets, these are great for monitoring while shooting in RAW or S-Log. Particularly P1: 709(800%), as it allows you to expose using *normal* REC709 levels. You can also use the other preset gammas knowing their grey value mappings.

The **Look profiles** were created by Sony to provide an easier starting point for color grading. The same four looks that are built into the camera are also available as downloadable LUTs from Sony's website. 3D LUT profiles 1 through 3 are 33x33x33 cubes, while 4: Cine+709 is a 65x65x65 cube.

User 3D LUTs allow you to upload your own 3D LUTs you can create in Davinci Resolve or other software. The camera supports 17 or 33 lattice cube files only.

Using LUTs for Exposure:

Remembering that a LUT is a mere Look Up Table transposing specific tonal values to new values *primarily* for the purpose of monitoring, it would be prudent if basing your exposure on a LUT to know exactly how its values are mapped to underlying tonal values. Specifically knowing the mapped values for reflectance values 18% grey and 90% white since you would likely use one of both of these to help you set exposure.

Knowing the mapped values for some of the preset LUTs are a little more intuitive because we are already familiar with the values for S-Log, Hypergammas, etc.. but be a little cautious when using Sony's "Look Profiles" or even other LUTs downloaded from the internet.

As seen in the example gamma chart both the 18% middle grey and 90% white values can range from gamma curve to gamma curve, LUT to LUT, or Sony Look Profile:

Example Gamma & LUT mappings:

Example Gamma & LUT mappings

	Reflectance	
Gamma/LUT	**18% grey**	**90% white**
REC709(800)	44% IRE	90% IRE
S-Log 2	32% IRE	59% IRE
S-Log 3	41% IRE	61% IRE
LC-709	40% IRE	73% IRE
LC-709TypeA	40% IRE	71% IRE
HG7	40% IRE	82% IRE

For example if you were using the Sony Look Profile LC-709TypeA and set your white card to 90% IRE on the waveform monitor instead of 71% IRE, you would cause a discrepancy of around 20% IRE in your underlying recorded footage. Hence your entire tonal range including middle grey would be shifted up possibly causing clipping to occur and recall that in S-Log mode values over 90% IRE account for much of S-Log's ability to achieve 1300% dynamic range so this level of overexposure completely negates the benefit of recording in S-Log.

Other problems exposing when using LUTs:

As you adjust the EI gain above or below the camera's native ISO value, the behaviour of the monitoring LUTs are impacted in such a way that they too will start to shift slightly.

So depending on the amount of EI gain set, the values listed in the example gamma & LUT mappings are no longer correct so even if you thought you were using proper values on a LUT'd image you may not be, and the underlying values yet again can be off from where you expect.

Using High/Low key function:

The High/Low key function is a really great feature built into the camera that allows you to temporarily examine the brightest and darkest parts of your image which otherwise may look blown, or too dark in your VF or monitor when you shoot scenes that have a high dynamic range. This is because LUTs or even your viewfinder are not able to display the full 14 stops that the sensor can actually record.

How the feature works is you map the function to one of the assignable buttons on the camera, and the first time you press it you are in High Key mode. Here the brightest parts of the image are lowered a few stops so you can see if in fact you are clipping the image or not. When you press the button again you go into Low Key mode and now you can look at shadows or dark areas of the image to see how it looks.

Pressing the assignable button again exits the mode.

Final conclusion on LUTs:

LUTs are absolutely fantastic to have as an option on these cameras for the purposes of monitoring images which otherwise may not be suitable for viewing by clients, producers, directors, makeup artists, etc..

LUTs can also be convenient for applying a "quick grade" for fast turn around of footage (LC709TypeA is my favourite) – however it can not be stressed enough that for the many reasons outlined in this section of this guide, that when it comes to exposure it's always best to observe your underlying exposure values being recorded with the LUT off, and then turning the monitoring LUT back on and making due with however it looks - or have another LUT designed that is more suitable for display monitoring while properly preserving the underlying values being recorded.

Light Meters

A light meter has become my tool of choice for setting my exposure and I've found that working with S-Log or RAW it works very well since after all light meters are designed to work *around* 18% middle grey. Using a light meter my crew or I can create repeatable lighting setups without any talent present or stand-ins, or even having a camera in place yet and turned on. It allows me to work more efficient, accurate, and consistent with my exposure.

Before you decide to go ahead and use a light meter for setting exposure in digital cinematography, I highly suggest that you go through the process of "rating the ISO" of your camera (next section in the Guide) which goes through the process to calibrate your specific light meter to your specific camera. Rating the ISO of your camera takes into consideration any specific camera settings, lenses, and possibly other nuances when performing the calibration and let's you work out any kinks. Remember the concept behind using a light meter is to synchronize the light meter to the camera in order to give you consistent and repeatable middle grey. So rating the camera ISO is a very critical step.

My other recommendation if you are going to use a light meter with any digital camera is that you absolutely know exactly where middle grey is placed for the particular gamma curve, monitoring LUT, or "Sony Look" being used. Remember the idea for a given gamma curve or S-Log curve is that later in post it will be restored accordingly to a new or *proper* middle grey value. You can of course chose to place your reference grey point where ever you like, for example raising it in order to improve the latitude in the shadow regions of the scene or lowering it in order to increase the highlight latitude.

Once your light meter is probably calibrated to your camera, it will give you the ability to take a meter reading and know exactly what f-stop you need to set your lens iris to in order to place 18% middle grey at the right IRE level for any particular gamma curve.

Meter Basics:

By default a "cine" based light meter works with a default of 180 degree shutter which is why on a cine meter you only select the frame rate and not the shutter speed. So for 24fps 180 shutter angle the frame rate is 1/48th and of course your camera and meter should always be set to the identical frame rate and shutter speed.

If your meter is not a "cine" meter then don't sweat it. You can simply set the shutter speed on the light meter to double what the frame rate of the camera is set to. So if the camera is set to 24fps then you would set the shutter speed on the light meter to 1/48th. Or if you shoot PAL and have the camera frame rate set to 25fps you would set the shutter speed on the light meter to 1/50th.

Meter Modes:

Light meters allow you work in either incident or reflected light modes. Incident light mode is what I use most and measures light *falling* onto scene elements whereas reflected light is more similar to how a camera sees the light reflected onto subjects and measures the light *reflected* from the subject or the scene.

One issue with using a light meter in reflected light mode is that this mode is designed to take a meter reading based for average lit scenes. Since scene elements can consist of light colors or elements with high specularity it can cause the meter to give a false higher light reading level, and thus in effect cause underexposure.

Incident based metering is a little more accurate but also has similar considerations. Since incident metering measures the amount of light falling onto a subject, meter reads are not influenced by the subject's reflectance but you may still need to take into account any reflectivity of scene elements when lighting them.

More advanced light meters may have a spot meter function which uses reflected light as its basis for metering, however in spot meter mode the meter measures reflectance using a very tight viewing angle around 1° which provides a higher degree of accuracy metering scene elements or subjects with high degrees of reflectivity.

Rating your camera ISO

In the digital world there are a variety of different standards established for manufacturers to rate the effective ISO of digital imaging sensors. It is fair to say that in many cases the sensitivity response will vary from camera to camera and from manufacturer to manufacturer.

Rating the ISO of your camera is therefore critical if you want to ensure that your camera and light meter are “synchronized” and ready to work properly together.

Also if you are using a newer digital light meter that can load camera profiles downloaded from the internet I strongly avoid using any of these profiles in your meter until you’ve performed your own camera ISO rating and work out any kinks with how to get everything working together properly.

Steps to perform your own camera ISO rating:

Aside from the camera and a light meter, you will also need a grey card, waveform monitor and an even lighting source such as a soft box or other soft light source that will produce an even spread of light across your grey card.

Before you begin I recommend setting the camera in the lowest ISO setting possible, disabling any internal ND filters, and double checking your shutter speed/angle setting. Particularly check the “Shutter” setting ON/OFF in the CAMERA menu and make sure it is set to ON.

On your light meter, if it has any DIP switch settings consult the owners manual and ensure that the meter itself is restored to the appropriate settings, or factory defaults before you being. For the most part you want to operate the light meter in incident light metering mode.

1. Evenly light a 18% grey card. Set the camera to 24p, 1/48th (or 180 degree shutter), 0db gain. Pick a gamma curve where you know it's middle grey placement on the gamma curve. I suggest S-Log 2 since we know middle grey is mapped to 32%. Adjust your lens iris until you get 32% on a waveform monitor. You may need to adjust your lighting intensity so that you can set your lens iris to an even stop value such as f4 or f5.6, etc..

2. On your light meter, if it is a cine meter select 24fps. If it is a regular light meter chose 1/48th shutter speed. Set the ISO on the light meter to the same ISO value as the camera ISO is set to. On the F5 the lowest ISO is 2000ISO, and on the F55 the lowest ISO setting is 1250ISO.

3. Make sure you are in incident metering mode, not reflective or spot. Note that more than likely for your particular light meter you need to have the lumisphere up in order to take an incident meter read.

4. Take a light meter reading.

5. If the f-stop on the light meter matches that which is set on the camera lens iris you all set and ready to go! But if the f-stop values between your light meter and lens iris do not match, we'll proceed to the next steps.

6. Most meters let you hold down a "mode" button so that you can adjust the light meter ISO without losing meter read you just took. Adjust the ISO on the light meter until the f-stop on the light meter matches what you set your taking lens to.

7. Once the light meter and lens iris match f-stop values, the ISO value on your light meter is the new value that you have rated the camera ISO as.

By using this new ISO value on your light meter, it will ensure that each and every time when you take a reading with your light meter that setting your lens iris to the same f-stop as the meter says, will ensure perfect exposure for a 18% middle grey card.

If you're new camera ISO rating is different then what the camera is set to, you will need to remember this difference, and if changing the base ISO of the camera then also put the new ISO into the light meter using that same difference.

When conducting my own ISO rating for the Sony F5 and F55 cameras, I've found them to be one stop lower than the ISO set on the camera.

Notes