### Ultimate Guide to CineEI on the PMW-F55 and PMW-F5.

#### **INTRODUCTION:**

This guide to Cine-EI is based on my own experience with the Sony PMW-F5 and F55. There are other methods of using LUT's and CineEI. The method I describe below, to the best of my knowledge, follows standard industry practice for working with a camera that uses EI gain and LUT's.

If you find the guide useful, please consider buying me a beer or a coffee. It took quite a while to prepare this guide and writing can be thirsty work.

In this guide I hope to help you get the very best from the Cine EI mode on Sony's PMW-F5 and PMW-F55 cameras. The cameras have two very distinct shooting mode, Cine EI and Custom Mode. In custom mode the camera behaves much like any other traditional video camera where what you see in the viewfinder is what's recorded on the cards. In custom mode you can change many of the cameras settings such as gamma, matrix, sharpness to create the look you are after in-camera. "Baking-in" the look of your image in camera is great for content that will go direct to air or for fast turn around productions. But a baked-in look can be difficult to alter in post production. In addition it is very hard to squeeze every last drop of picture information in to the recordings in this mode.

The other mode, Cine-EI, is primarily designed to allow you to record as much information about the scene as possible. The footage from the camera becoming in effect a "digital negative" that can then be developed in post and the final highly polished look of the film or video created. In addition the Cine-EI mode mimics the way a film camera works giving the cinematographer the ability to rate the camera at different ISO's to those specified by Sony. This can be used to alter the noise levels in the footage or to help deal with difficult lighting situations.

One further "non-standard" way to use Cine-EI is to use a LUT (Look Up Table) to create an in-camera look that can be baked in to the footage while you shoot. This offers an alternative to custom mode. Some users will find it easier to create a specific look for the camera using a LUT than they would by adjusting camera settings such as gamma and matrix.

MLUT's and LOOK's (both types of Look Up Tables) are only available in the Cine-EI mode.

#### LATITUDE AND SENSITIVITY.

The latitude and sensitivity of the F5/F55, like most cameras is primarily governed by the latitude and sensitivity of the sensor. The latitude of the sensor in these cameras is around 14 stops. Adding different amounts of conventional camera gain or using different ISO's does not alter the sensors actual sensitivity to light, only how much the signal from the sensor is amplified. Like turning up or down the volume on a radio, the sound level gets higher or lower, but the strength of the radio signal is just the same. Turn it up loud and not only does the music get louder but also any hiss or noise, the ratio of signal to noise does not change, they BOTH get louder. Turn it up too loud and it will distort. If you don't turn it up loud enough, you can't hear it, but the radio signal itself does not change. It's the same with the cameras sensor. It always has the same sensitivity, but with a conventional camera we can add or take away gain (volume control?) to make the pictures brighter or darker (louder?).

#### NATIVE ISO:

Sony's native ISO ratings for the cameras, 1250ISO for the F55 and 2000ISO for the F5 are values chosen by Sony that give a good trade off between sensitivity, noise and over/under exposure latitude. In general these native ISO's will give excellent results. But there may be situations where you want or need different performance. For example you might prefer to trade off a little bit of over exposure headroom for a better signal to noise ratio, giving a cleaner picture. Or you might need a very large amount of over exposure headroom to deal with a a scene with lots of bright highlights.

### The Cine EI mode allows you to change the effective ISO rating of the camera.

With film stocks the manufacturer will determine the sensitivity of the film and give it an Exposure Index which is normally the equivalent of the films measured ASA/ISO. It is possible for a skilled cinematographer to rate the film stock with a higher or lower ISO than the manufacturers rating to vary the look or compensate for filters and other factors. You then adjust the film developing and processing to give a correctly exposed looking image. This is a common tool used by cinematographers to modify the look of the film, but the film stock itself does not actually change it's base sensitivity, it's still the same film stock with the same base ASA/ISO.

Sony's Cine EI and EI modes on Red and Alexa are very similar. While it has many similarities to adding conventional video camera gain, the outcome and effect can be quite different. If you have not used it before it can be a little confusing, but once you understand the way it works it is very useful and a great way to shoot. Again, remember that the actual sensitivity of the sensor itself never changes.

#### CONVENTIONAL VIDEO CAMERA GAIN.

Increasing conventional camera gain will reduce the cameras dynamic range as something that is recorded at maximum brightness (109%) at the native ISO would be pushed up above the peak recording level and into clipping if the conventional camera gain was increased because we can't record a signal larger than 109%. But as the true sensitivity of the sensor does not change, the darkest object the camera can actually detect remains the same. Dark objects may appear a bit brighter, but there is still a finite limit to how dark an object the camera can actually see and this is governed by the sensors noise floor and signal to noise ratio (how much noise there is in the image coming from the sensor).

Any very dark picture information will be hidden in the sensors noise. Adding gain will bring up both the noise and darkest picture information, so anything hidden in the noise at the native ISO (or 0db) will still be hidden in the noise at a higher gain or ISO as both the noise and small signal are amplified by the same amount.

Using negative conventional gain or going lower than the native ISO may also reduce dynamic range as picture information very close to black may be shifted down below black when you subtract gain or lower the ISO. At the same time there is a limit to how much light the sensor can deal with before the sensor itself overloads. So even though reducing the ISO or gain may make the picture darker, the sensor clipping/overload point remains the same, so there is no change to the upper dynamic range, just a reduction in recording level.

See also this article on gain and dynamic range.

As Sony's Slog2 and Slog3 are tailored to capture the cameras full 14 stop range this means that when shooting with Slog2 or Slog3 the gamma curve will only work as designed and deliver the maximum dynamic range when the camera is at it's native ISO. At any other **recording** ISO or gain level the dynamic range will be reduced. IE: If you were to use SLog2 or SLog3 with the camera in custom mode and not use the native ISO by adding gain or changing the ISO, you will not get the full 14 stop range that the camera is capable of delivering.

# EXPOSURE LEVELS FOR DIFFERENT GAMMA CURVES AND CONTRAST RANGES.

It's important to know (or better still understand) that different gamma curves with different contrast ranges will require different exposure levels. The TV system that we use today is currently based around a standard known as Rec-709. This standard specifies the contrast range that a TV set or monitor can show and which recording levels represent which display brightness levels. Most tradition TV cameras are also based on this standard. Rec-709 does have some serious restrictions, the brightness and contrast range is very limited as these standards are based around TV standards and technologies developed 50 years ago. To get around this issue most TV cameras use methods such as a "knee" to compress together some of the brighter part of the scene into a very small recording range.



A traditional TV camera with a limited dynamic range compresses only a small highlight range.

As you can see in the illustration above only a very small part of the recording "bucket" is used to hold a moderately large compressed highlight range. In addition a typical TV camera can't capture all of the range in many scenes anyway. The most important parts of the scene from black to white is captured more or less "as is". This leaves just a tiny bit of space above white to squeeze in a few highly compressed highlights. The signal from the TV camera is then passed directly to the TV and as the shadows, mid range and skin tones etc are all at more or less the same level as captured the bulk of scene looks OK on the TV/Monitor. Highlights may look a little "electronic" due to the very large amount of compression used.

But what happens if we want to record more of the scenes range? As the size of the recording "bucket", the codec etc, does not change, in order to capture a greater range and fit it in to the same space, we have to re-distribute how we record things.



Recording a greater dynamic range into the same sized bucket.

Above you can see that instead of just compressing a small part of the highlights we are now capturing the full dynamic range of the scene. To do this we have altered the levels that everything is recorded at. Blacks and shadows are a little lower, greys and mids are a fair bit lower and white is a lot lower. By bringing all these levels down we make room for the highlights and the really bright stuff to be recorded without being excessively compressed.

The problem with this though is that when you output the picture to a monitor or TV it looks odd. It will lack contrast as the really bright stuff is displayed at the same brightness as the conventional 709 highlights. White is now only as bright as faces would be with a conventional TV camera and Faces are only a little bit above the middle grey level.

This is how Slog works. By re-distributing the recording levels we can squeeze a much bigger dynamic range into the same size recording bucket. But it won't look quite right when viewed directly on a standard TV or monitor. It may look dark and certainly a bit washed out.

I hope you can also see from this that whenever the cameras gamma curve does not match that of the TV/Monitor the picture might not look quite right. Even when correctly exposed white may be at different levels, depending on the gamma being used, especially if the gamma curve has a greater range than the normal Rec-709 used in old school TV cameras.

#### THE CORRECT EXPOSURE LEVELS FOR SLOG-2 and SLOG-3.

Before we go any further lets just look at the correct exposure levels for SLog-2 and SLog-3. As these gamma curves have a very large dynamic range the recording levels that they use are different to the levels used by the normal 709 gamma curve used for conventional TV. As a result when correctly exposed, Slog looks dark and low contrast on a conventional monitor or in the viewfinder. The table below has the correct levels for middle grey and 90% reflectance white for the different types of Slog.

Input reflection	0% Black	(IRE0%)	18% Gre	y (IRE20%)	90% White	e (IRE100%)
Output	IRE	CV	IRE	CV	IRE	CV
S-Log3	3.5%	95	41%	420	61%	598
S-Log2	3.0%	90	32%	347	59%	582
S-Log	3.0%	90	38%	394	65%	636

Correct exposure levels for Sony's Slog.

The white level in particular is a lot lower than we would normally use for TV gamma. This is done to make extra space above white to fit in the extended range that the camera is capable of capturing, all those bright highlights, bright sky and clouds and other things that cameras with a smaller dynamic range struggle to capture.

Let's now take a look at how to set the correct starting point exposure for SLog-3. You can use a light meter if you wish, but if you do want to use a light meter I would first suggest you check the calibration of the light meter by using the grey card method below and comparing the what the light meter tells you with the results you get with a grey or white card.

The most accurate method is to use a good quality grey card and a waveform display. For the screen shots seen here I used a Lastolite EzyBalance Calibration Card. This is a pop up grey card/white card that fits in a pocket but expands to about 30cm/1ft across giving a decent sized target. It has middle grey on one side and 90% reflectance white on the other. With the MLUT's off, set the exposure so that the grey card is exposed at the appropriate level (see table above).

Note: To get the waveform to display you must have BOTH the SDI SUB and Viewfinder MLUT's OFF or BOTH ON. The waveform is turned on and off under the "VF" - "Display ON/OFF" - "Video Signal Monitor" settings of the main menu. Sadly the cameras built in waveform display is not the best so it may help to use an external monitor with a better waveform display.



Grey should be 41%

If you don't have access to a better waveform display you can use a 90% reflectance white card and zebras. By setting up the Zebras with a narrow aperture window of around 3% you can get a very accurate exposure assessment for various shades of white. For SLog-3 set the Zebras to 3% aperture and the level at 61%. Sadly the zebras don't go below 60%. For Slog-2 using 60% will be accurate enough, a 1% error is not going to do any real harm. You can use exactly the same method for S-Log2 just by using the SLog-2 levels detailed in the chart above.

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Zebra1 Level		61%	50%	107%
Zebra1 Aperture Le	evel	3%	1%	20%
Zebra2 Level		100%	52%	109%

Setting up the Zebras to measure S-Log3 exposure of white card (90% reflectance white card).



The image above shows the use of both the Zebras and Waveform to establish the correct exposure level for S-Log3 when using a 90% reflectance white card or similar target. Please note that very often a piece of white paper or a white car etc will be a little bit brighter than a calibrated 90% white card. If using typical bleached white printer paper I suggest you add around 4% to the white values in the above chart to prevent under exposure.

#### SO HOW DOES CINE-EI WORK?



Cine-EI (Exposure Index) works differently to conventional camera gain. It's operation is similar in other cameras that use Cine-EI or EI gain such as the F5, F55, F3, F65, Red or Alexa. You enable Cine-EI mode in the camera menus Base Settings page. On the F5 and F55 it works in YPbPr, RGB and RAW modes.

**IMPORTANT:** In the Cine-EI mode the ISO of the recordings remains fixed at the cameras native ISO (unless baking in a LUT, more on that later). By always recording at the cameras native ISO you will always have 14 stops of dynamic range.

#### YOU NEED TO USE A LUT:

**Important:** For Cine-EI mode to work as expected you should monitor your pictures in the viewfinder or via the SDI/HDMI output through one of the cameras built in MLUT's (Look Up Table), LOOK's or User3D LUT's. So make sure you have the MLUT's turned on. If you don't have a LUT then it won't work as expected because the EI gain is applied to the cameras LUT's. At this stage just set the MLUT's to on for the Sub&HDMI output and the Viewfinder out.

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For CineEI to work correctly you MUST turn on the LUT's for the Viewfinder and/or Sub&HDMI output.

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You can turn the MLUT's on and off by pressing the CAMERA button until you see the MLUT controls, then use the hotkeys to turn the MLUT's on and off.

#### EXPOSING VIA THE LUT/LOOK.

At the cameras native ISO (2000 on F5, 1250 on F55), when shooting via a LUT you should adjust your exposure so that the picture in the viewfinder looks correctly exposed. If the LUT is correctly exposed then so too will the S-log. As a point of reference, middle grey for Rec-709 and the 709(800) LUT should be at, or close to 42%.

This is really quite simple, generally speaking when using a LUT, if it looks right, it probably is right. However it is worth noting that different LUT's may have slightly different optimum exposure levels. For example the 709(800) LUT is designed to be a very close match to the 709 gamma curve used in the majority of monitors, so this particular LUT is really simple to use because if the picture looks normal on the monitor then your exposure will also be normal.



Grey should be 42%. 90% will be 90%.



Correct exposure of the 709(800) LUT using a 90% white card, white will be 90%. You can use zebras at 90% to check this level.

The above images show the correct exposure levels for the 709(800) LUT. Middle grey should be 42% and 90% white is... well 90%. Very simple and you can easily use zebras to check the white level by setting them to 90%. As middle grey is where it normally is on a TV or monitor and white is also where you would expect to see it, when using the 709(800) LUT, if the picture looks right in the viewfinder then it generally is right. This means that the 709(800) LUT is particularly well suited to being used to set exposure as a correctly exposed scene will look "normal" on a 709 TV or monitor.

Many of the other LUT's and Looks however capture a contrast range that far exceeds the Rec-709 standard used in most monitors. So you may need to adjust your exposure levels slightly to allow for this.

The LC709-TypeA Look is very popular as a LUT for the PMW-F5 and F55 as it closely mimics the images you get from an Arri Alexa ("type A" = type Arri).

The "LC" part of the Look's name means Low Contrast and this also means big dynamic range. Whenever you take a big dynamic range (lots of shades) and show it on a display with a limited dynamic range (limited shades) all the shades in the image get squeezed together to fit into the monitors limited range and as a result the contrast gets reduced. This also means that middle grey and white are also squeezed closer together. With conventional 709 middle grey would be 42% and white around 80-90%, but with a high dynamic range/low Contrast gamma curve white gets squeezed closer to grey to make room for the extra dynamic range. This means that middle grey will remain close to 42% but white reduces to around 72%. So for the LC709 Looks in the F5/F55 optimum exposure is to have middle grey at 42% and white at 72%. Don't worry too much if you don't hit those exact numbers, a little bit either way does little harm.



#### **RECOMMENDED LUT EXPOSURE LEVELS.**

Here are some white levels for some of the built in LUT's. The G40 or G33 part of the HG LUT's is the recommended value for middle grey. Use these levels for the zebras if you want to check the correct exposure of a 90% reflectance white card. I have also include an approximate zebra value for a piece of typical white printer paper.

709(800) = Middle Grey 42%. 90% Reflectance white 90%, white paper 92%.

HG8009(G40) = Middle Grey 40%. 90% Reflectance white 83%, white paper 86%.

HG8009(G33) = Middle Grey 33%. 90% Reflectance white 75%, white paper 80%.

The "LC709" LOOK's = Middle Grey 42%. 90% Reflectance white 72%, white paper 77%.

**DONT PANIC if you don't get these precise levels!** I'm giving them to you here so you have a good starting point. A little bit either way will not hurt. Again, generally speaking if it looks right in the viewfinder or on your monitor screen, it is probably close enough not to worry about it.

If you ever need to confirm the correct levels for any given LUT or Look it's really easy. Put the camera in to CineEI. Turn OFF the MLUT's (remember you can turn LUT's on and off from the cameras side information screen by

pressing the CAMERA menu button until you see the LUT options at the bottom of the display). With the MLUT's OFF use a grey card or white card (or maybe your calibrated light meter) to set the exposure for the Slog curve you have chosen.

Once you have established the correct exposure for the SLog, without adjusting anything else, turn on the MLUT's, ensure the camera is at the native ISO and choose the LUT or LOOK that you want to check. Now you can measure the grey and white point for the LUT/Look you have chosen and see on the monitor or in the viewfinder what the correct exposure looks like via the LUT. It probably won't be vastly different from normal 709 in most cases, especially middle grey this tends to stay very close to 42%, but it's useful to do this check if you are at all unsure.

**If you can, use a LUT, not a LOOK.** That's my recommendation, not a hard and fast rule but if you're new to CineEI, LUT's and Looks please read on as to why I say this. Otherwise skip on to Baking-in the LUT/LOOK.

I recommend that for exposure evaluation you should normally try to use one of the cameras built in MLUT's not the LOOK's. Especially if you are new to LUT's and Looks. This is because the LUT's behave differently to the Looks when you use a high or low EI.

I found that when you lower the EI gain, below native, the output level of the LOOK lowers, so that depending on the EI, the clipping, peak level and middle grey values are different. For example on my PMW-F5 at 500 EI the LC709TypeA LUT has a peak output (clipping) level of just 90% while at 2000 ISO it's 98%. This also means that middle grey of the LOOK will shift down slightly as you lower the EI. This means that for consistent exposure at different low EI's you may need to offset your exposure very slightly (it is only very slight). It also means that at Native EI if the waveform shows peak levels at 90% you are not overexposed or clipped, but at low EI's 90% will mean clipped Slog, so beware of this peak level offset with the LOOK's.

When you raise the EI of the LOOKS, the input clipping point of the Look profile changes. For each stop of EI you add the LOOK will clip one stop earlier than the underlying Slog. For example set the LC709TypeA LUT to 8000 ISO (on my PMW-F5) and the LOOK itself hard clips 2 stops before the actual SLog3 clips. So your LOOK will make it appear that your Slog is clipped up to 2 stops before it actually is and the dynamic range and contrast range of the LOOK varies depending on the EI, so again beware.

So, the Looks may give the impression that the Slog is clipped if you use a high ISO and will give the impression that you are not using your full available range at a low ISO. I suspect this is a limitation of 3D LUT tables which only work over a fixed 0 to1 input and output range.

What about the 1D LUT's? Well the built in LUT's don't cover the full range of the Slog curves so you will never see all of your dynamic range at all at once. However I feel their behaviour at low and high EI's is a little bit more intuitive than the level shifts and early clipping of the LOOKs.

The 1D LUT's will always go to 109%. So there are no middle grey shifts for the LUT, no need to compensate at any ISO. In addition if you see any clipping below 109% then it means your SLog is clipping, for example if you set the camera to 500 ISO (on an F5), when you see the 709(800) LUT clipping at 105% it's because the Slog is also clipping.

At High ISO's you won't see the top end of the SLog's exposure range anyway because the 1D LUT's range is less than Slog's range, but the LUT itself does not clip, instead highlights just go up above 109% where you can't see them and this in my opinion is more intuitive behaviour than the clipped LOOK's that don't ever quite reach 100% and clip at lower than 100% even when the Slog itself isn't clipped.

At the end of the day use the ones that work best for you, just be aware of the limitations of both and that the LUT's and LOOKs behave very differently. I suggest you test and try both before making any firm decisions, but my recommendation is to use the LUT's rather than the LOOK's when judging exposure.

#### Using the built in MLUT's?

There are 5 built in MLUT's: P1 709(800), P2 HG8009G40, P3 HG8009G33, P4 Slog2, P5 Slog3. You can only select the Slog2 LUT when the camera is set to SLog2 in the base settings, the same for the SLog3 LUT. You can also create your own 1D LUT's in Sony's Raw Viewer software and user 3D LOOK's in most grading suites but that's a whole other subject that I'm not going to cover right here (see this article for user 3D Look creation or go to the additional LUT creation section at the bottom of this document), for now lets just consider the built in LUT's.

All 3 of the other built in LUTs have an 800% exposure range. The camera itself has a 1300% exposure range when your shooting in CineEI, Raw, SLog2 or SLog3 (1300% more than standard gamma). So if you want to see your full exposure range then you should select SLog as your LUT or turn the LUT's off. However the pictures will be flat looking and lack contrast, which makes accurate focussing harder and you must set your exposure using the SLog levels given above, so in addition Slog 2 will look dark. Note that if you press the "camera" button by the side LCD screen 2 times you can use the hot keys around the LCD to change LUT and turn the LUT's on and off.

If you use MLUT's P1, P2 orP3 then the viewfinder pictures will have near "normal" contrast. Your exposure levels will be more normal looking (although P3 should have middle grey at 33% so should look a touch darker than normal) but you won't be seeing the full recorded range, only 800% out of the possible 1300% is displayed, so some things might look clipped in the viewfinder while the actual recording is not. I suggest switching the LUT's off momentarily to check this, or connect a second monitor to the Main SDI to monitor the non LUT output. Do note that if using Slog2/Slog3 as a LUT and at a positive EI ISO you won't see your full recording range. You will still see up to a stop more than the 800% LUT's but at high EI's the Slog2 or Slog3 LUT will clip slightly before the camera recordings. At low EI's the Slog LUT's will clip at the same time as the camera, but the level of the clipping point on any waveform display via the LUT output will be lower and this can be a little confusing. Unfortunately if you turn off the LUT's you can't get the cameras built in waveform display. This is where an external monitor with waveform the main HDSDI output.

**Personally I prefer to use the 709(800) LUT for exposure** as the restricted range matches that of most consumer TV's etc so I feel this gives me a better idea of how the image may end up looking on a consumers TV. The slightly restricted range will help highlight any contrast issue that may cause problems in post. It's often easier to solve these issues when shooting rather than leaving it to later. Also I find my Slog exposure more accurate as the LUT's restricted range means you are more likely to expose within finer limits. In addition as noted above I fell the LUT's behaviour is more predictable and intuitive at high and low EI's than the LOOK's.

#### BAKING IN THE LUT/LOOK.

When shooting using a high or low EI, the EI gain is added or subtracted from the LUT or LOOK, this makes the picture in the viewfinder or monitor fed via the LUT brighter or darker depending on the EI used. In Cine-EI mode you want the camera to always actually record the raw and S-Log2/S-log3 at the cameras native ISO (1250 ISO for F55 or 2000 ISO for F5). So normally you want to leave the LUT's OFF for the internal recording. Just in case you missed that very important point: normally you want to leave the LUT's OFF for the internal recording!

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Normally in CineEI you need to ensure that the LUT is OFF for the Main&Internal so that there is no LUT added to the SxS recordings.

Just about the **only** exceptions to this might be when shooting raw or when you want to deliberately record with the LUT/Look baked in to your SxS recordings. By "baked-in" I mean with the gamma, contrast and color of the LUT/Look permanently recorded as part of the recording. You can't remove this LUT/look later if it's "baked-in".

No matter what the LUT/Look settings, if you're recording raw on the R5 raw recorder the <u>raw is always recorded at the native ISO</u>. But the internal SxS recordings are different. It is possible, if you choose, to apply a LUT/LOOK to the SxS recordings by setting the "Main&Internal" MLUT to ON. The gain of the recorded LUT/LOOK will be altered according to the CineEI gain settings. This might be useful to provide an easy to work with proxy file for editing, with the LUT/LOOK baked-in while shooting raw. Or as a way create an in-camera look or style for material that won't be graded. Using a baked-in LUT/LOOK for a production that won't be graded or only have minimal grading is an interesting alternative to using Custom Mode that should be considered for fast turn-around productions.

In most cases however you will probably not have a LUT applied to your primary recordings. If shooting in S-Log2 or S-Log3 you must set MLUT - OFF for "Main&Internal" See the image above. With "Main&Internal MLUT OFF" the internal recordings, without LUT, will be SLog2 or Slog3 and at the cameras native ISO.

You can tell what it is that the camera is actually recording by looking in the viewfinder. At the center right side of the display there is an indication of what is being recorded on the cards. Normally for Cine-EI this should say either SLog2 or Slog3. If it indicates something else, then you are baking the LUT in to the internal recordings.





#### CHANGING THE EI.

#### Latitude Indication.

At the native ISO you have 6 stops of over exposure latitude. This is how much headroom your shot has. Your over exposure latitude is indicated on the cameras side LCD panel as highlight latitude.

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is 2000 (native F5 ISO)

#### **REDUCING THE EI.**

So what happens when you halve the EI gain to 1000EI? 1 stop of ISO will subtracted from the LUT. As a result the picture you see via the LUT becomes one stop darker (a good thing to know is that 1 stop of exposure is the same as 6db of gain or a doubling or halving of the ISO). So the picture in the viewfinder gets darker. But also remember that the camera will still be recording at the native ISO (unless baking-in the LUT).



With the EI reduced to 1000EI from the native 2000EI the High Latitude decreases to 5.0E or +5 stops.

As you can see from the side panel indication, the cameras highlight latitude decreases by 1 stop.

#### Why does this happen and what's happening to my pictures?

First of all lets take a look at the scene, as seen in the cameras viewfinder when we are at the native EI (This would be 1250 on the F55 and 2000ISO on an F5) and then with the EI changed one stop down so it becomes 500EI on F55 or 1000EI on the F5. The native ISO on the left, the one stop lower EI on the right.



2000EI and 1000EI as seen in the viewfinder of an F5 with NO exposure change.

So, in the viewfinder, when we lower our El by one stop (halving the El) the picture becomes darker by 1 stop. Note that if you were using the waveform display or histogram the indicated levels would also become lower. The waveform, histogram and zebras all measure the output from the LUT or the image seen in the viewfinder. So as this becomes one stop darker, they would also read 1 stop darker/lower. If using an external monitor with a waveform display connected to the SDI SUB out (SDI's 3&4) or HDMI and the LUT is enabled for "Sub&HDMI" this too would get darker and the levels decrease by one stop.

What do you do when you have a dark picture? Well most people would normally compensate for a dark looking image by opening the iris to compensate. As we have gone one stop darker with the EI gain, to return the viewfinder image back to the same brightness as it was at the native EI you would open the iris by one stop.

If using a light meter you would start with the meter set at 2000/1250 ISO and set your exposure according to the what the meter tells you. Then you reduce your EI gain on the camera (the viewfinder image gets darker). Now you also change your ISO on the light meter to the new EI ISO. The light meter will then tell you to open the iris by one stop.

So now, after reducing the EI by one stop and then compensating by opening the iris by 1 stop, the viewfinder image is the same brightness as it was when we started.

#### But what's happening to my recordings?

Remember the recordings, whether on the SxS card (assuming the Main&Internal LUT is OFF) or RAW always happens at the cameras native **ISO (2000 on the F5 and 1250 on the F55), no matter what the EI is set** to. As a result, because we opened the iris by 1 stop to compensate for the dark viewfinder or new light meter reading the recording will have become 1 stop brighter. Look at the image below to see what we see in the viewfinder alongside what is actually being recorded. The EI offset exposure as seen in the viewfinder (left hand side) looks normal, while the actual native ISO recording (right hand side) is 1 stop brighter.



At 1000EI the Viewfinder image on the left is 1 stop darker than the actual recorded image (on the right) which is recorded at the native 2000 ISO (F5).

#### How does this help us, what are the benefits?

When I take this brighter recorded image in to post production I will have to bring the levels back down to normal as part of the grading process. As I will be reducing my levels in post production by around 1 stop (6db) any noise in the picture will also be reduced by 6db. The end result is a picture with 6db less noise than if I had shot at the native ISO. Another benefit may be that as the scene was exposed brighter I will be able to see more shadow information.

#### Is there a down side to using a low EI?

Because the actual recorded exposure is brighter by one stop I have one stop less headroom. However the F5 and F55 have an abundance of headroom so the loss of one stop is often not going to cause a problem. I find that going between 1 and 1.5 EI stops down rarely results in highlight issues. But when shooting very high contrast scenes and using a low EI it is worth toggling the LUT on and off to check for clipping in the SLog image. This can be done from the side panel of the camera by pressing the "Camera" button until you see the MLUT controls on the side display and turning the MLUT on or off.

#### What is happening to my exposure range?

What you are doing is moving the mid point of your exposure range up in the case of a lower EI. This allows the camera to see deeper into the shadows but reduces the over exposure latitude. The reverse is also possible. If you use a higher EI you shift your mid point down. This gives you more headroom for dealing with very bright highlights, but you won't see as far into the shadows and the final pictures will be a little noisier as in post production the overall levels will have to be brought up to compensate for the darker overall recordings.

Cine-El allows us to shift our exposure mid point up and down. Lowering the El gain gives you a darker VF image so you tend to overexpose the actual recording which reduces over exposure headroom but increases under exposure range (and improves the signal to noise ratio). Adding El gain gives a brighter Viewfinder image which makes you underexpose the recordings, which gives you more headroom but with less underexposure range (and a worse signal to noise ratio).



Cine EI moves the exposure mid point up and down.

#### **Post Production.**

When shooting raw information about the EI gain is stored in the clips metadata. The idea is that this metadata can be used by the grading or editing software to adjust the clips exposure level in the edit or grading application so that it looks correctly exposed (or at least exposed as you saw it in the viewfinder via the LUT). The metadata information is recorded alongside the XAVC or SSTP footage when shooting SLog2/3. However, currently few edit applications or grading applications use this metadata to offset the exposure, so S-Log2/3 material may look dark/bright when imported into your edit application and you may need to add a correction to return the exposure to a "normal" level. As the footage is log you should use log corrections to get the very best results. As an alternative you can use a correction LUT to move the exposure up and down like the ones for SLog2 available here, created by cameraman and DP Ben Turley. <u>http://www.turley.tv</u>. Sony's Raw Viewer software does correctly read the Slog2/3 metadata and will automatically add any required offsets. If shooting raw the majority of grading and editing applications will correctly read the metadata in the raw footage and apply the correct exposure offset, so raw normally looks correctly exposed.

### See also this article for more information on El gain and raw on the F5 and F55.

If shooting raw then you may choose to add the S-Log2/3 LUT to your internal SxS recordings. This will then add the EI-gain to the internal SxS recordings, so they will become brighter/darker as if applying actual gain while only the raw recordings remain at the native ISO. This may be useful if you wish to use the SxS recordings as a proxy file for the edit and would like the proxy files to look similar to the way the final footage will look after grading and correction for the EI offset.

#### **CINE-EI SUMMARY:**

CineEI allows you to "rate" the camera at different ISO.

You MUST use a LUT for CineEI to work as designed.

A low EI number will result in a brighter exposure which will improve the signal to noise ratio giving a cleaner picture or allow you to see more shadow detail. However you will loose some over exposure headroom.

A high EI number will result in a darker exposure which will improve the over exposure headroom but decrease the under exposure range. The signal to noise ratio is worse so the final picture may end up with more noise.

A 1D LUT will not clip and appear to overexpose as readily as a 3D LOOK when using a low EI, so a 1D LUT may be preferable.

When viewing via a 709 LUT you expose using normal 709 exposure levels. Basically if it looks right in the viewfinder or on the monitor (via the 709 LUT) it almost certainly is right.

When I shoot with my F5 I normally rate the camera as 800EI. I find that 5 stops of over exposure range is plenty for most situations and I prefer the decrease in noise in the final pictures. I rate the F55 similarly at 640EI. But please, test and experiment for yourself.

## QUICK GUIDE TO CREATING YOUR OWN LOOK's (Using DaVinci Resolve).

It's very easy to create your own 3D LUT for the Sony PMW-F5 or PMW-F55 using DaVinci Resolve or just about any grading software with LUT export capability. The LUT should be a 17x17x17 or 33x33x33 .cube LUT. This is what Resolve creates by default and .cube LUT's are the most common types of LUT in use today.

First simply shoot some test Slog3 clips at the cameras native ISO. You must use Slog3 if you want to use User 3D LOOK's in the camera. In addition you should also use the same color space for the test shot as you will when you want to use the LUT. I recommend shooting a variety of clips so that you can asses how the LUT will work in different lighting situations.

Import and grade the clips from the test shoot in Resolve creating the look that you are after for your production or as you wish your footage to appear in the viewfinder of the camera. Then once your happy with the look of the graded clip, right click on the clip in the timeline and "Export LUT". Resolve will then create and save a .cube LUT.

Then place the .cube LUT file created by the grading software on an SD card in the PMWF55\_F5 folder. You may need to create the following folder structure on the SD card. So first you have a PRIVATE folder, in that there is a SONY folder and so on.

PRIVATE : SONY : PRO : CAMERA : PMWF55\_F5

Put the SD card in the camera, then go to the "File" menu and go to "Monitor 3D LUT" and select "Load SD Card". The camera will offer you a 1 to 4 destination memory selection, choose 1,2,3 or 4, this is the location where the LUT will be saved. You should then be presented with a list of all the LUT's on the SD card. Select your chosen LUT to save it from the SD card to the camera.

Once loaded in to the camera when you choose 3D User LUT's you can select between user LUT memory 1,2,3 or 4. Your LUT will be in the memory you selected when you copied the LUT from the SD card to the camera.