

Optimizing for Low Video Noise

(excerpted from “A Guide To The Panasonic AU-EVA1 Camera”)

“Noise” in a video signal is a random variation in the color and intensity of each pixel. This random variation is very small compared to a strong signal (i.e., a bright part of the image), but becomes relatively more apparent as the signal level decreases (i.e., in dark parts of the image). In general, a properly-exposed image will show much less noise than an underexposed image!

Depending on the settings of the camera, noise can be minimal, or quite invasive (just try 25,600 ISO for an example). A small amount of noise is usually present in all scenes, but there are steps you can take to minimize the appearance of the noise. By taking advantage of the various menu settings, as well as employing proper lighting, you can reduce the appearance of some of the image noise.

The most important determining factor for how much noise is in the image is the electronic gain level (or ISO). In general, the higher the gain, or the higher the ISO, the more noise will be in the image. Now, sometimes it's easier to just crank up the gain or raise the ISO to get a shot in challenging lighting — but just understand that doing so can raise the noise level slightly, moderately, or even significantly, depending on how much gain you add (or how high you push the ISO). If you need the picture brighter, adding light to the scene will do much more for the quality of your picture than gain ever would, because adding too much gain can cause the image to get very noisy, muddy and soft. Adding light will give you a cleaner picture and adequate light can help to suppress noise that might otherwise have been there. Underexposing video leads to increased noise in the signal; giving the camera proper exposure will clean up the signal nicely. A camera is a light-gathering device, so giving it enough light will help it perform its best. A camera feeds on light – feed it, and it will reward you with gorgeous imagery; starve it and you may not be as pleased by its results. The AU-EVA1 offers a unique Dual Native ISO feature. You can set the base ISO at either 800, or 2500 ISO. If you're going to need more than about 1250 ISO, it's generally probably better to set the base ISO to 2500 and then gain down from there. If you set the base ISO at 800 and then gain up, you'll be increasing noise and grain more than if you'd started at the native ISO of 2500 and stepped down a bit.

As for menu settings, there are a few that can help. The first and most obvious is the CAMERA SETTINGS>NR menu. This is a dedicated Noise

Reduction menu. You can set the noise reduction to one of four choices: off, Normal 1 (mild), Normal 2 (medium), or SMOOTH (maximum). The Noise Reduction can be applied to each base ISO separately, so you can assign a certain level of noise reduction to the ISO800 base, and a different level to the ISO2500 base. Noise reduction can be quite effective, but keep in mind that a side effect of noise reduction can be the loss of fine detail in the image. Generally the least amount of noise reduction is better, but if you're seeing more noise than you prefer, you can definitely use the Noise Reduction settings to clean some of it up. The nice thing about the NR menu is that its settings will work even when shooting V-Log; generally the image controls menus are disabled when shooting V-Log.

If you're not shooting V-Log, there are some more menu options that can have a significant impact on the visibility of noise in the image. In the SCENE FILE SETTINGS>DETAIL menu, you'll find the master detail control (SW OFF). If the Detail circuit is switched on, it can contribute to the perception of noise. Lowering the MASTER LEVEL menu setting can mask the visibility of noise. It doesn't really change the presence of noise itself, but the higher detail level settings will actually accentuate the edges of the noise, and can even draw edge-enhancement outlines around the noise, making it much more noticeable. The lower you set your detail level, the less visible the noise will be (but, of course, the softer the image will look, too).

Hand in hand with the detail level control is the CORING control. Coring is designed to suppress edge enhancement on noise. What this means is, the higher you turn up CORING, the less visible noise you'll see in your picture, but it really depends on your overall MASTER LEVEL settings. If the MASTER LEVEL is very low, then there will be little to no visible edge enhancement happening on the noise, so there won't be much of anything for CORING to do. So when you have the MASTER LEVEL really low then you really won't see much if any effect on noise from CORING no matter what you set it to. But the higher you set the MASTER LEVEL of detail, the more effect CORING will have in suppressing the visibility of the noise. Just be aware: CORING can't tell the difference between fine high-frequency image detail and general noise though, so setting CORING up to a high level may reduce the apparent sharpness of high-frequency detail too. You can also rein in the visibility of the overall DETAIL by setting the SCENE FILE SETTINGS>DETAIL>FREQUENCY menu to a lower setting. The higher that's set, the more visible the edge enhancement will be, and if the edge enhancement is outlining the noise, the obviously a higher setting will make the noise more visible.

Also, the SKIN DETAIL function can help smooth out noise in skin tones. It works just like CORING but only on colors that it perceives to be skin tones (the general idea being to smooth out skin blemishes.) If you're aiming to minimize noise as much as possible, enabling SKIN DETAIL may help. There are different options for skin detail; each option establishes a different range of tones that the skin detail function will work within to soften edge enhancement. These different ranges are individually selectable and can be combined to create the widest range of skin softening.

Another way to really clean up the noise is to shoot in 1920x1080 FHD instead of UHD or 4K. When in FHD mode, the camera averages four pixels together to create each HD pixel, and the noise gets averaged out in the process. FHD mode is cleaner than UHD or 4K footage in terms of noise performance because of this; you can get away with about 6dB of gain in FHD and still have comparable noise performance to UHD/4K at 0dB of gain.

Also, remember to Automatic Black Balance frequently. Black Balancing may help the camcorder's sensor to sort out, minimize, and mask noise in the darker regions.