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Color Correcting a Monitor for Optimum Reproduction when Shot by a Studio Camera.

A number of variables come into play when a studio camera is used to shoot video off a TV monitor. The purpose of this guideline is limited to a quick set-up procedure to provide acceptable results.

It is assumed that the camera being used has been properly color balanced for the existing studio lighting using a log chart as well as a color chart and/or a flesh tone chart. A flat color spectrum for the studio lighting will simplify color balance and improve overall performance.

The remaining goal is to color pre-correct a given studio monitor or video display in the studio camera field of view so as to obtain good quality pictures off the monitor. It is important to make sure that the monitor being shot be free from studio lighting reflections at the camera to monitor shooting angle. Light reflections off the monitor will cause a shift in black level that cannot be corrected by modifications to the monitor video input.

We will assume that the monitor is set to a default or preset operating mode that can display high quality pictures. However, when the monitor is seen through the studio camera, the resulting picture is not acceptable. Hence we want to pre-correct the video monitor video input.

Studio Monitor Pre-Correction.

Please note, the test signals we specify are appropriate for the NTSC color system. For any other system you may use equivalent test signals with their appropriate signal levels. The signal levels referenced in our procedures need to be changed to the appropriate values associated with the test signals actually being used.

Feed your studio display a monochromatic (black and white) linear stairstep test video signal via the Color Corrector (we assume a 100 IRE units peak-to-peak luminance signal, which includes 7.5 IRE's of setup).

Set all controls on the Color Corrector to the center detent positions, set the SOURCE switch to PANEL, and the ON/BYP switch to ON.

Focus the studio camera on the studio monitor. On a waveform monitor, look at the RED, BLUE, GREEN video signals from the camera. On the Color Corrector, individualy adjust the Pedestal control for each color so as to bring the black step of the stairstep signal to 7.5 IRE's for each color. (Note, if you can't bring them to 7.5 IRE's, your studio monitor has excessive reflection of studio lighting).
Next, check the level of the white step for each color, they should be at 100 IRE's. If they are all within 10 or 15 IRE's of 100, adjust the Color Corrector Gain control for each color to bring the white step for each color to 100 IRE units. (Note: a digital signal has very little head room before it clips. To avoid clipping, if any of the colors' white step is less than 85 IRE's prior to pre-correction with the Color Corrector, it is desirable to adjust the monitor individual color gain controls or the monitor's contrast control to bring the white bar level of the lowest level color to at least 85 IRE's prior to using the Color Corrector Red, Blue, Green Gains to equalize the three colors to 100 IRE's).

Looking at the Luminance signal from the camera on your waveform monitor, select a Gamma on the Color Corrector that most closely results in a linear stairstep response. For Gamma selection it is actually a little easier to use a linear ramp instead of the strairstep signal, but either signal will provide acceptable results. (Note: It is possible to further improve stairstep linearity, if so desired, by slightly modifying the best matching Gamma curve, although it is usually not necessary to have a perfectly linear video response. This can be done by slightly increasing Luminance Pedestal setting and lowering Luminance Gain in the Color Corrector. Only Model HD-950M has a Luminance Gain control, but one can achieve the same effect in other Models by equally decreasing RED, BLUE, GREEN Gains. If this technique of modifying the Gamma is used, a complementary setback of the Monitor Brightness Control and an increase in Contrast should be made at the Studio Monitor itself to ensure that the Stairstep signal excursion from the Studio Camera for Luminance as well as the Red, Blue, Green signals will be from 0 to 100 IRE units).

Next you will want to look at chroma output. If your Color Corrector has pre-sets, it is suggested that you save the settings achieved above to one of the stores. Color Bars should be fed to the Studio monitor through the Color Corrector. Start out by keeping the settings obtained in the previous process. Look at the Studio Camera output on a component waveform monitor. Look at the Blue signal color bars. Adjust the Chroma Gain control to make all the blue bars the same peak level and

peak to peak level. Under those condtions, the Red and Green bars should also end up with the same peak and peak to peak levels. This concludes the basic studio monitor pre-correction. It is advised that these Color Corrector settings be stored into memory for safe keeping and recall on demand.

The final step, which is optional, consists in applying some subjective adjustments while looking at the camera output on a video monitor. Minor adjustments can be made to the pre-corrected signal to satisfy some colorist preferences. This may involve increasing color saturation, increasing contrast, or slightly tinting the final picture.
These mods can easily be done any time and on the fly, based on specific video sources. These are probably most easily done operating in the DELTA mode, preloading the DELTA mode with the appropriate objective pre-sets for a specific monitor. (See the Manual under STORE SELECTION for Delta Model Operation). After subjective adjustments have been finalized it may be useful to store the final color corrector settings in a separate memory location.

Alternate Method for Monitor Pre-Correction.

Some colorists and engineers prefer to just use color bars to pre-correct a studio display being shot by the studio camera. This can normally be effective as long as the monitor does not require a substantial gamma pre-correction.

The method of pre-correction using a color bar test signal is as follows.

Feed standard (SMPTE) 75% color bars from a color bar generator to the studio monitor via the Color Corrector. Set all controls on the Color Corrector to the center detent positions, set the SOURCE switch to PANEL, and the ON/BYP switch to ON.

Focus the studio camera on the studio monitor. Look at the camera output on a Waveform Monitor, a Vectorscope, and the camera video monitor. On the Waveform Monitor, check that the luminance video signal levels for the white bar and the black level are correct. If not, adjust them using the Luminance Gain and Luminance Pedestal controls on the Color Corrector. (See previous section if your Color Corrector does not have a luminance gain control).

On the Waveform Monitor, look at the Blue signal. Adjust the blue signal set-up position with respect to blanking to the correct level (7.5 IRE units) by using the Color Corrector Blue Pedestal control. Using the Color Corrector Blue Gain control, adjust the peak to peak level of the blue bars to 75 IRE units (about 0.53v pp). Perform the same operations for the red bars and the green bars using the appropriate Red and Green controls.

The above adjustments will need to be re-iterated a few times to minimize any crosstalk among the primary colors. Keeping an eye on a Vectorscope display of the color bars will help you see any color imbalance in the black level or amplitude of the individual color bars (vector dots falling in places other than the defined locations). The final fine adjustment of Red, Blue, Green Pedestals and Gains may be easier to do by just looking at the Vectorscope display and try to make all vectors fall in their proper places. If your Color Corrector has memory pre-sets available store the settings determined above into memory.

Finally, looking at the camera output on a studio monitor, additional subjective tweeking of the Color Corrector settings may be made. Changes in Gamma setting may also be tried to see if it provides improved picture quality. An objective determination of the appropriate Gamma can be made using either a linear black to white ramp test signal, or a linear stairsteps test signal. See the previous Pre-Correction method for that procedure.

Always save the final Color Corrector settings into a unique memory location for future recall.