

Technical Note

Truelight On-Set

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Summary

Truelight On-Set allows cinematographers and directors to set the look of their shows early in production; it provides the ability to colour-correct on set and share corrections back and forth with a post-production facility. Key to this ability is Truelight's calibration of displays and an understanding of the source images, whether from a digital camera or film transfer. Truelight On-Set is primarily used in two scenarios:

- On-set monitoring

For monitoring while shooting, the Truelight On-Set system applies a colour transform between the camera and monitors. Colour grades, set in pre-production or on previous shoots, can be applied and then further adjusted at the time of shooting.

- Dailies review

When footage is reviewed by a production on-location, colour correction performed by a colourist at a post-production house can be applied in the Truelight On-Set unit. The production can make further adjustments and send the new settings back to the facility.

In both scenarios, settings are logged with timecode and can be used to create the dailies deliverables and as the starting point for future colour correction.

Truelight provides several calibrated colour transforms. The first converts from the camera's colour space to the working colour space that will be used for colour correction. After colour correction is applied, a second transform is applied to convert from the working colour space to the reference display colour space – the colour space that will be used for delivery. When a display other than the reference display is used, e.g. previewing a digital cinema or film release on an LCD monitor, a transform is produced to emulate the reference display on the preview display.

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1 Introduction

For productions where the colour and tone of images play an important role, it is ideal to have the same tools used in a digital intermediate/mastering suite available on location and operated by a trained colourist overseen by the cinematographer and director. This is cost-prohibitive, so the work is usually conducted by a colourist at a post-production facility where the cost of equipment and labour can be spread across multiple productions. Unfortunately, the colourist is only left written or verbal notes from the cinematographer to guide the look of the project, and the colourist and cinematographer cannot always be sure that they are seeing the same thing on their respective monitors.

Truelight uses a colour management engine that can take images from one medium – video, film, HD camera data, CGI – and generate matching images in another medium. It has most commonly been used in post-production facilities to preview log film-out data on electronic displays, but is also used for video to film transfers, film to video transfers, matching displays, and more. On set, this colour management provides two important roles: the first is to make sure that displays used on location match the reference display used at the post-production facility (and in final exhibition); the second is to take “raw” or wide-latitude camera images and convert them into the colour space used for colour-correction.

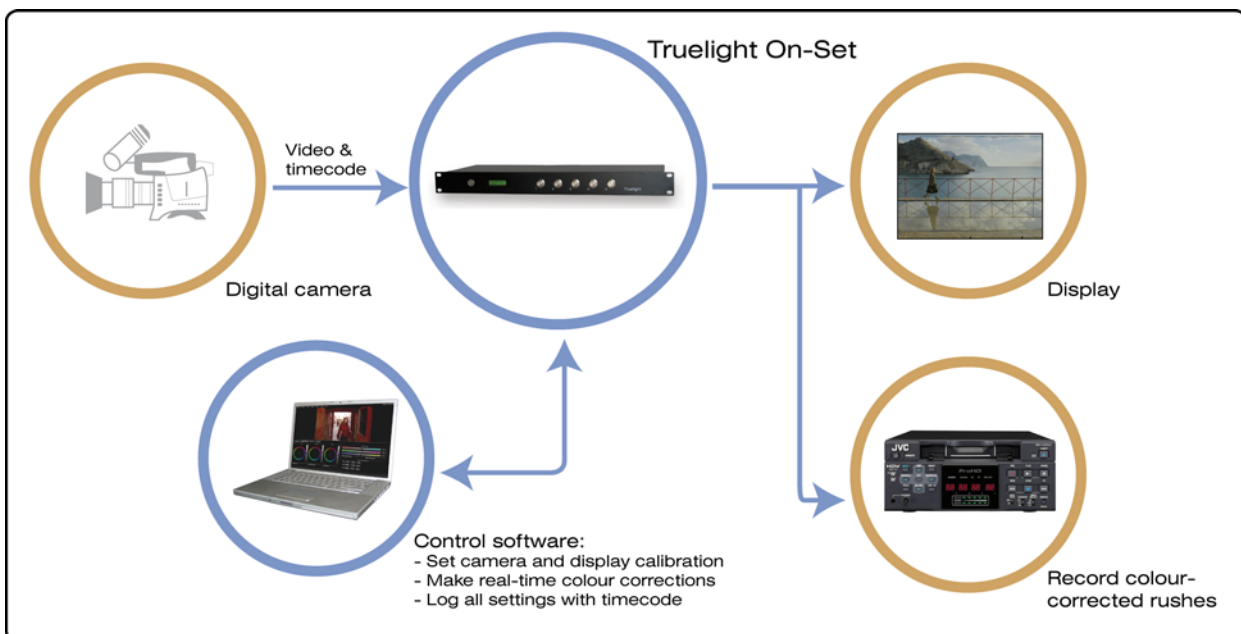
Truelight On-Set uses the American Society of Cinematographers Colour Decision List (ASC CDL) standard colour correction to make it compatible with a wide range of other devices, and to ensure that crew members can operate it without being overwhelmed by the huge range of options offered in a typical, high-end, colour corrector.

2 System configuration

Truelight On-Set incorporates hardware and software that can be integrated with cameras, tape decks, and other equipment in a variety of ways. The Truelight On-Set unit is the primary processing unit that applies colour transforms to an SDI video signal. Control software runs on a laptop, communicating with the unit via Ethernet. Truelight software is also used with a Truelight Monitor Probe or Projector Probe to calibrate displays.

2.1 On-set monitoring

For monitoring while shooting, Truelight On-Set provides an accurate emulation of the final output, e.g. film projection, digital cinema, or video. This is especially important for digital cameras that record in a “raw” or extended range mode, which offer the most flexibility in post but yield very flat or off-colour images that are not representative of the final look.



The Truelight On-Set unit is connected between the camera and monitors. Colour grades, set in pre-production or on previous shoots, can be applied and then further adjusted at the time of shooting. It is best to use preset colour corrections rather than making important colour decisions during shooting because you see images differently on a display in a dim or dark surround environment than you do in a well-lit environment. Most sets are too bright to match the calibrated viewing environment of a theatre or video mastering suite. Even if the monitor is in a tent or dark area of the set, it takes the eye several minutes to adjust to the darker surrounds so any colour decisions are skewed by the effect of being adapted to a brighter surround.

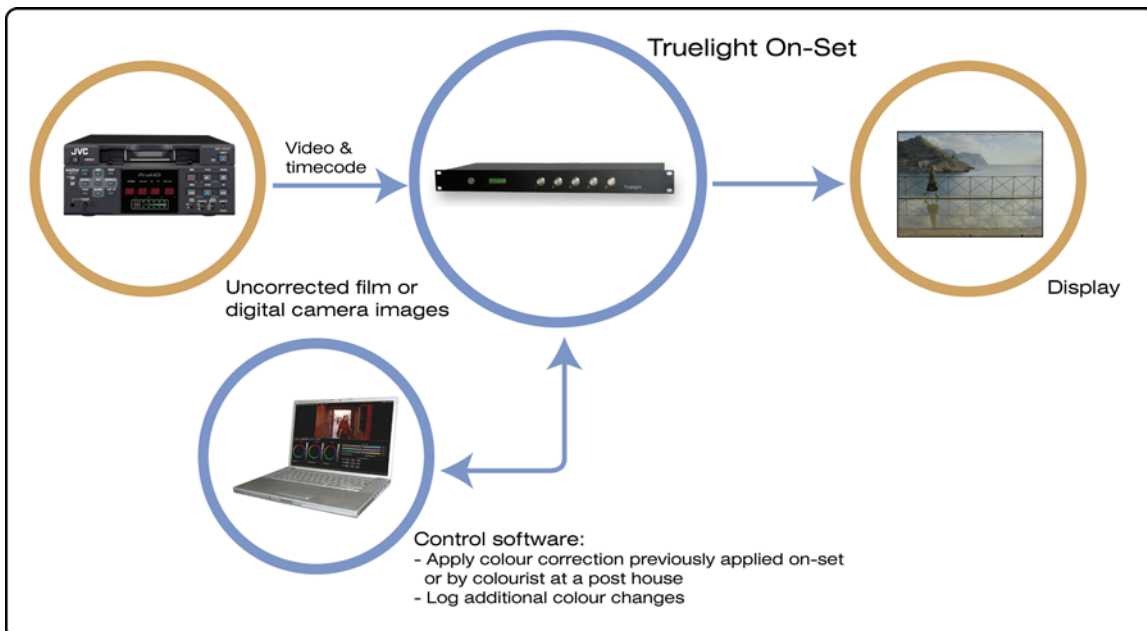
The on-set monitoring scenario works best with digital cameras because video taps used for monitoring on film cameras typically do not have enough dynamic range or image quality to accurately represent

what the film will look like once processed. Colour corrections can be done to video-tap images to show others on set what the intention of the look is, but the settings will not be relevant to post-production.

If the camera or recording device outputs timecode, Truelight On-Set can log the settings used during each take. A colour-corrected version of the dailies can also be recorded on set and used as the basis for the dailies that are distributed to editorial and other departments. Colour-corrected dailies can also be created later at a post-production facility using the settings logged on set.

2.2 Dailies review

Truelight On-Set is also used to make colour adjustments when reviewing dailies on location. One of the main advantages of colour correcting during dailies review is that it can be done in a small theatre, trailer or other area with controlled lighting, giving the eyes a chance to adapt to a proper viewing environment.



Productions shooting film can also work on an actual film transfer; if care is taken to make the daily film transfers colorimetrically similar to the final film scan then decisions made with Truelight On-Set can be used as the starting point for future colour correction. One disadvantage of using Truelight On-Set during dailies review is that some productions send copies of the footage to other parties before the cinematographer and/or director are able to review it. To remedy this, the production may choose to delay other deliverables until the colour is approved or they may decide to only use the colour corrections later, e.g. for preview screenings and the final colour correction. They may also supply feedback to the colourist to use for the dailies from the next day.

In this scenario, raw digital camera footage or flat film transfers are played back from a video device that outputs timecode (e.g. a VTR or DDR). The signal is routed through the Truelight On-Set unit, which applies colour corrections from either a selection of presets, settings logged by a colourist at a post-production facility, or settings logged when using the box during shooting.

2.3 Transfer between set and post-production

In both the on-set monitoring and dailies review scenarios, if timecode is provided by the camera, tape-deck, or DDR, then the colour correction settings can be logged for each shot. When recording, the current settings are saved for each take. When playing back, previously saved settings are applied and any additional adjustments can be saved to a new log file.

In the dailies review scenario, a colourist can create settings with Truelight On-Set at the post-production facility or with any colour corrector that exports to the ASC CDL standard.

Colour decisions are logged in an Avid Log Edit (ALE) file according to ASC recommendations. The ALE exported by Truelight On-Set can be used in an editing system like the Avid. When a final edit decision list (EDL) is exported, it has ASC CDL numbers included. When the EDL is then imported into the colour corrector used for final colour mastering, the colour decisions made with Truelight On-Set are applied as a basic colour grade for each shot.

ASC CDL colour corrections can also be used by visual effects facilities to ensure that their shots match the desired colour applied to other scenes.

3 Colour transforms

The Truelight On-Set unit applies two colour cube transforms, one on the input side before colour correction, the other on the output side after colour correction. Both transforms can be configured with the Truelight control software.

3.1 Output/display transform

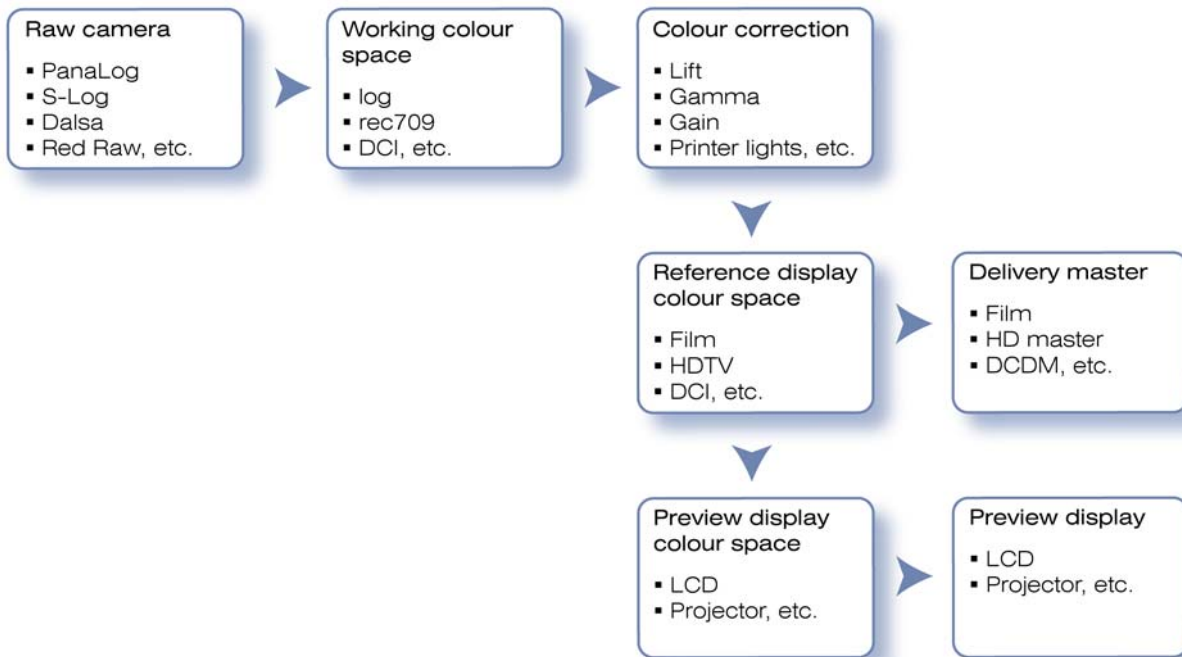
The most important colour transform Truelight On-Set provides is the display transform to make the on-set display look as close as possible to the reference display that will be used for final colour grading and delivery. Without this any colour decisions made on set are likely to not be representative of the final look, and correction would have to be completely re-created in post-production.

Truelight's display calibration software uses a Truelight Monitor Probe or Projector Probe to take measurements of the display, ensuring it is on the desired aim. It also profiles how the monitor reproduces colour and tone-scale so that any differences between the measured monitor and the ideal reference monitor can be compensated for.

Every display device has inherent limitations that cannot be overcome, and often the displays used on set can only show a subset of the colour and dynamic range of the reference monitor. For instance an LCD display may only have a 900:1 sequential contrast ratio, but a digital cinema reference projector may have a contrast in excess of 2000:1, and have a wider colour gamut. Truelight creates a transform that approximates the reference display so that the overall impression images are as similar as possible. Even with different contrast ranges and colour gamuts, users often find that after a Truelight calibration the different displays look quite similar when viewed separately, but the differences are more noticeable when viewed side-by-side. It is important to be aware of the limitations of the display devices used with Truelight On-Set, but they should not prevent the ability to perform meaningful colour correction.

Although modern LCDs, plasma displays, and prosumer projectors are limited in terms of their contrast range and colour fidelity, they tend to have consistent image reproduction even when moved from one location to another. This is not true of CRTs, which should be recalibrated every time they are moved and tend to drift out of calibration over time even when left untouched. The advantage of the other displays over a CRT then is that a calibration can be done before the monitor is taken on location and it should not be necessary to have a probe on set. If a digital projector is used for dailies review, however, it is recommended to have at least a light meter to check the projector's brightness as the lamp ages.

This diagram shows an overview of the workflow and some of the possible options within each stage:



3.2 Input/camera transform

When shooting with digital cameras in raw or wide-latitude recording mode it is often necessary to convert images into the colour space used for colour correction. Colour correctors are designed for working in a limited set of colour spaces, e.g. video gamma space or log film space. Although data in other colour spaces can be used, the controls respond in unexpected ways and a great deal of effort may be put into just getting the images into a usable state. A typical example is a digital camera that records truly linear data. In a linear image the vast majority of the image information is reserved for highlights with shadows and midtones compressed at the bottom range. Pulling out the image information with typical lift/gamma/gain and printer light controls is difficult, and small changes to the controls affect large changes in the image. It is better to use a transform to pull out the midtones and compress the highlights prior to colour correction.

Colour corrections made on set only produce the same results in post-production if the same camera transform is used in both situations. The transforms used by Truelight On-Set can be applied in the same way as a typical Truelight display transform: in a Truelight SDI unit, a Baselight colour corrector, or software packages such as Shake and Nuke. Truelight On-Set can also mimic conversions that may be done inside the colour corrector, e.g. a linear-to-log conversion as published in Cineon documents. If colour correction is performed on the camera data directly, the input transform in the Truelight On-Set unit can be bypassed.

For more information on how Truelight is used with digital camera images, see **FilmLight** Technical Note, *Truelight 3.0 Commands*, available from the **FilmLight** web site.