FAQ: To Cut or Not to Cut UV Light in Color Profiling?

The new EFI™ ES-2000 handheld spectrophotometer included in Fiery® Color Profiler Suite v4, supports UV-cut or non-UV-cut measurements in a single device. This means that users can profile any paper with one instrument and predict how colors printed on optically brightened paper will look under different light conditions. This document answers to common questions about optical brighteners in paper stock.

What is UV?

The human eye can see visible light wavelengths from 400 nanometers (violet) to 780 nanometers (red). Wavelengths shorter than 400 nm are in the ultraviolet, or UV spectrum. Wavelengths longer than 780 nanometers (nm) fall into the infrared (IR) portion of the spectrum. The eye cannot see UV or IR wavelengths — but UV light can influence the appearance of printed material. This is because UV light causes certain chemicals that are sometimes used in printing substrates to fluoresce, or "glow." These chemicals are called optical brightening agents (OBAs) and, if they are present in a paper, it is best to make color measurements used for printer profiles with a device that filters out the brightening effect. This is done with a UV filter in the measuring instrument.

What happens if a paper has optical brighteners?

Optical brightening agents are most effective in making the paper look brighter and whiter when viewed in an environment such as daylight, which has a significant amount of UV light. If the paper profile assumes there will be UV in the viewing light source, but the print is then viewed in a light source with a low amount of UV, the printed colors will appear too yellow. If the profile does not take the brighteners into account, and the print is viewed in UV light conditions, the printed colors can appear too blue.

What is UV cut?

UV cut means that the spectrophotometer actually cuts the UV wavelengths out of the measurements it makes. It does this by using a filter that eliminates UV wavelengths, starting at about 400 nm. This is generally accepted as the correct type of measurement to use when profiling papers with high OBAs, especially if they will be viewed in lighting that has no UV component.

What is non-UV cut?

Non-UV cut means that the spectrophotometer will include UV wavelengths in the measurements. This is the correct type of measurement to use when profiling papers without OBAs.

Why do I want to filter out the UV rays with optically brightened paper?

When measuring colors to make an ICC profile, filtering out the UV portion of the visible spectrum means that OBAs do not fluoresce and cause the measurement device to record more energy than is optically visible in the violet-blue end of the spectrum. If the UV is not filtered out, the device gives color measurements at that end of the spectrum that can make prints look too blue when viewed in a light source such as traditional D50, which has a low amount of UV illumination.

Is it okay to profile papers without OBAs with a UV cut?

For papers without OBAs, or those with a low OBA load, it is better not to measure with a UV-cut instrument when viewed in UV-lighting conditions. This is because the filter used to cut the UV wavelengths is not precise enough to cut only the UV. The filter also cuts a small degree of visible light from the blue-violet end of the spectrum. This means that the profile for a paper that is not optically brightened can cause prints to look too yellow.

What does the ES-1000 have?

The ES-1000 was available in two versions.

- UV-cut: A UV filter incorporated into the instrument allowed measurement of the sample without fluorescent emission.
- Non-UV-cut: This version included UV wavelengths in the measurements it made.

How does the new EFI ES-2000 spectrophotometer deal with this issue?

The new EFI ES-2000 device provides UV or non-UV measurements to Color Profiler Suite v4, to enable profiling for any type of substrate in any viewing condition. The ES-2000 covers all measurement needs in one device. For calibration and re-calibration, the ES-2000 correlates with the current ES-1000 UV and non-UV devices to maintain and update existing calibrations.

How does this issue relate to M0, M1 and M2 measurements?

ISO 13655:2009 defines three measuring conditions: M0, M1, and M2.M0 is the technical term for the measuring condition that uses an illuminant that contains UV wavelengths which will excite OBAs in the paper, if present. M0 is correlated with the standard “Illuminant A", which is the traditional unfiltered tungsten light used in the original CIE experiments.

The second measuring condition per ISO 13655 is M1. M1 also uses an illuminant that contains UV wavelengths and so like M0 can be used to make UV-included measurements. The difference between M0 and M1 is that M1 corresponds to the standard illuminant “D50” rather than “Illuminant A”. M1 gives the ability to use spectrophotometers of different makes and models since the D50 illuminant is well defined. M0 has not historically been precisely correlated to “Illuminant A” on all measuring devices.

ISO 13655 further defines a measuring condition without a UV component that can be used for making "UV-Cut" measurements. This illuminant is known as M2 and is the right choice to use when profiling a paper with a high OBA load that may be viewed in non-UV containing light. Like M0 it corresponds to “Illuminant A”.

Historically, commercial printers and publishers have always had print buyers sign off on jobs in a standard light booth with lamps that illuminated prints in light with the color temperature of 5000° Kelvin (K) or 6500° K depending on geography. In the 1980s, color temperature definition moved from the Kelvin to the daylight scale and light booths were manufactured to comply with D50 or D65 white points on that scale. D50 and D65 are the points on the daylight scale that corresponds to a correlated color temperature of 5000 and 6500°K respectively in the viewing light.

What measurement is generally recommended?

The general rule of thumb for the type of measurement to use depends on the viewing conditions and the type of paper. When the print will be evaluated and approved under lighting that has a UV component, UV-included measurement is often recommended — even for a stock with OBAs. This way, prints will not appear too yellow when viewed in lighting with UV wavelengths. Refer to the table below to understand what measuring method get the best results for a particular combination of paper and viewing environment.

Summary

The table below summarizes the optimum use of the current ES-1000 UV and ES-1000 non-UV devices, and shows how a single ES-2000 device can be used for accurate color profiling in both environments.

Device	Measurement	Best for profiling	Impact	Recommended Viewing environment
ES-1000 UV cut	Eliminates UV	High-OBA paper	Cutting UV prevents prints from looking too blue in non-UV illumination	• D50 per ISO 3664:2000 • Commercial lighting
ES-1000 non-UV cut	Includes UV	Low-OBA paper	Not cutting UV prevents prints from looking too yellow in UV-containing illumination	• D50 per ISO 3664:2009 • Office Fluorescent
ES-2000	M0 includes UV M1 includes UV M2 eliminates UV	All		All

This table shows the viewing results for all possible combinations of measurements and viewing environments.

Paper	Measurement	Viewing Environment	Result
High–OBA paper	Includes UV	UV lighting (Outdoors & office)	Good
	UV cut	UV lighting	Appears too yellow
	Includes UV	D50 (ISO 3664:2009)	Good
	UV cut	D50 (ISO 3664:2009)	Appears too yellow
Low-OBA paper	Includes UV	UV lighting	Good
	UV cut	UV lighting	Can appear slightly yellow
	Includes UV	D50 (ISO 3664:2009)	Good
	UV cut	D50 (ISO 3664:2009)	Can appear slightly yellow