Balancing Act

Setting an accurate white balance value does not have to be a matter of guesswork; thanks to the ExpoDisc tool it really is very straightforward. Simon Stafford explains.

Regular readers of my articles and books about photography will no doubt be familiar with my opinion on the importance of adopting a disciplined camera technique to ensure you get as much right in camera at the time of the original exposure, rather than relying on remedial actions with a computer at a subsequent stage.

All photographers shooting with digital cameras strive to achieve an accurate exposure of their subject but I wonder how many make the same effort to set an appropriate white balance value? I suspect most are content to rely on their camera's automation to sort out white balance – and why not it is valid function designed to assist the photographer. The complex algorithms developed by manufacturers and in-camera signal processing performed by the current crop of digital cameras mean that they are all capable of excellent results across a wide variety of colour temperature values. So why do the same manufacturers build-in alternative methods of selecting and applying a white balance value to your pictures? The answer is simple; there are compelling reasons for avoiding your camera's automatic white balance feature that's why!

I suggest, strongly, that selecting your camera's pre-set (custom) white balance feature offers several advantages for the following reasons:

1. Generally, the range of white balance values available via the automatic white balance feature is narrower than if you select a white balance manually.

2. Altering the composition of a scene by, of example, shifting the zoom ring on a lens can induce a change in the white balance value set by the automatic white balance feature, because the camera may 'see' a different ratio of colours reflected from the scene. The same problem can occur when you want to shoot a series of pictures with a view to 'stitching' them together to create a panoramic view. Altering the composition for each shot can result in them having a different white balance value, which will spoil the continuity of the panorama.

3. Setting a specific white balance value allows you to 'clean-up' any overall colour cast that may affect the scene you are shooting, which is essential when you shoot in the JPEG or TIFF file format because trying to remove colour anomalies in these files at a later stage can be fraught with difficulty.

4. Manual selection of a white balance results in predictable colour, and therefore repeatable results. This is analogous to choosing a particular film because you know how it will react in any given circumstances.

5. Selecting a specific white balance value means consistent colours, which aids the efficiency of your workflow when it comes to processing your images. This is especially important if you shoot in the RAW file format, as these will almost invariably require some degree of adjustment in your computer, and getting colour right in the camera means you have one less image attribute to worry about.

As an example of the different range of white balance values that cameras offer consider the Nikon D70s and D2X; the automatic white balance feature of both cameras extends from 3500K to 8000K, whereas setting it manually on the D70s provides values from 2700K to 9200K, and 2500K to 10,000K with the D2X. That extended range for the manually selected values is significant, especially in the case of the lower colour temperatures.

In light with a low colour temperature say around 4000K, or less, I have found the automatic white balance function of Nikon D-SLR cameras tends to set a colour temperature (Kelvin value) that is too high, which is probably due in part to the very low level of blue wavelength light present in such conditions. This becomes an important issue if you select the Auto white balance control, because the photosites on the camera's sensor that detect light in the blue wavelength range receive so little information. Consequently, left to make its own decisions the Auto white balance control will, typically, render a picture that appears to be overly warm (red/yellow). Hence Nikon suggest that for practical purposes the lowest colour temperature the Auto white balance can deal with is 3500K. However, the light from many incandescent light sources is, generally, in the range of 3000K to 3500K, for example a 100W domestic light bulb emits light with a colour temperature of about 2900K. Hopefully, this explains the first reason I give at the beginning of this article.

At this point it is also worth noting that Nikon's interpretation of colour temperature for some of the pre-determined values available on their digital cameras is a little curious. For example, the white balance value of 5200K for the Direct Sun setting, and 5400K for the Flash setting is rather on the low side. I say this because daylight film is usually balanced to around 5500K (see below), and most Nikon Speedlights emit light with a colour temperature between 5800K and 6000K. Hence, the problem is reversed in these instances and pictures can look too cool (blue), because in sunny conditions the ambient light will frequently have a colour temperature that is appreciably higher than 5200K; likewise light from a Speedlight flash will also have a colour temperature above 5400K. So, there are another two good reasons for using the pre-set (custom) white balance option!

Colour Temperature

The colour of light is often referred to as its ‘colour temperature’, which is expressed using the absolute centigrade scale in units of degrees Kelvin (K). It sounds counter intuitive but warm light (higher red wavelength content) has a low temperature and cool light (higher blue wavelength content) has a high temperature.

Why is this? Well, the colour temperature of a light source correlates to the colour of a ‘black body radiator’ (a theoretical object that re-emits 100% of the energy it absorbs) as it is heated; its colour changes from black, to red, orange, yellow, through to blue, as it gets hotter. The spectral output of a particular light source is said to approximate to a ‘black body’ at the same temperature, thus at low colour temperatures light contains a high proportion of red wavelengths, and conversely at a high colour temperature it comprises, predominantly, of blue wavelengths.

Generally, during its manufacture most film is balanced to either daylight under a clear sky at mid-day (5500K), or the light emitted by a tungsten photoflood lamp (3400K). If the temperature of the ambient light you are shooting under differs from these values your photographs will take on a colour cast, which you have to counter by using colour correction filters.

Digital cameras are far more versatile and most allow you to set a specific colour temperature (white balance) in addition to their automatic white balance capabilities, so when you view the image in the camera, or computer, the colours are matched to your chosen white balance value. Assuming this value corresponds to the colour temperature of the prevailing light the scene will be rendered without any colour casts. Of course you can use the white balance feature creatively by setting an alternative value, which does not correspond to the prevailing light and thereby induce a colour shift deliberately.

Using the Pre-set White Balance

You will need to consult the instruction book for your own camera for precise details on how to use its pre-set white balance function, as there can be slight differences in the procedure depending on the model in use but in essence there are three steps:

- Set up a test target in the same light as the subject
- Configure the camera to make a pre-set white balance measurement
- Make a test exposure during which the camera assesses the colour temperature of the light, and sets an appropriate white balance value.

The instructions contained in the manuals to Nikon D-SLR cameras suggest that the test target can be either a neutral grey, or white object, such as a piece of card. Using an 18% grey card intended for photographic purposes (it is designed to reflect 18% on the light that falls on it) makes sense, as it will help to improve the accuracy of both exposure and white balance setting, provided you know how to use such a card appropriately. A white card test target can get you in to all sorts of trouble! First, if you measure from a white card it is more difficult to get an accurate exposure, particularly if you use one of the automatic exposure modes, as the camera will tend to under expose, which will affect the white balance reading. Second, some manufacturers incorporate 'brighteners' (pigments) that boost the apparent whiteness of their card but such additives can affect white balance measurement.

Using a piece of card as a test target can be unreliable and at the very best is inconvenient. Thankfully there is an alternative – the ExpoDisc. This simple device, which is available as a circular device in a variety of popular filter diameters that attach to the front of your lens just like a filter except you just push it in to place, so there is no risk of it binding to the lens (it has three sprung pins that engage in the thread of the filter ring), or a 100 x 100mm square flat plate for slot-type filter systems. If you keep a UV or other filter permanently attached to your lens the ExpoDisc can be mounted on it, directly, as well. Each Expodisc is supplied with comprehensive set of instructions and further information and technical details are available at www.expodisc.com.

Apart from replacing the need to use a piece card to obtain a white balance value the ExpoDisc also converts your camera's TTL meter, which normally reads reflected light, into an incident light metering system (i.e. it measures the light falling on your subject). In many instances, particularly with subjects that have a predominance of very light or very dark tones, this method of metering will provide a more accurate reading of the prevailing light level. In other words you can obtain an accurate white balance and exposure value at the same time but the versatility of the Expodisc does not stop there; you can use it to shoot a grey reference frame in the same lighting as your subject, and then use this subsequently for setting the grey point in an image manipulation software such as Adobe Photoshop. Brilliant!

The ExpoDisc works by combining a layer of micro-prisms to disrupt the light passing through it, followed by a compensating filter, which enhances the color distribution in the visible spectrum while eliminating any UV and near IR transmission to produce a colour neutral light transmittance, and finally a diffusion panel that ensures the light that exits the Expodisc has a uniform distribution.

The device is manufactured to very stringent standards; its accuracy to $1/12^{th}$ of an f/stop is four times tighter than the tolerance of the TTL metering systems used in most cameras. Each Expodisc is supplied with an individual quality

control certificate that states its precise density and colour transmittance characteristics for red, green, and blue light, and is designed so that 18% of the light it receives is passed to the camera's TTL meter. This makes it ideal for those photographers who employ the Zone system for exposure control as 18% reflectance represents the mid-point of Zone V (the mid-grey point on a geometric scale between pure white and black). I know from my discussions with engineers at Nikon that the company uses its own standard and methodology to calibrate the metering systems in its cameras, and whilst I am not privy to the precise details I would suggest (based on my own tests) that they use a standard with a reflectance value slightly lower than 18%. However, using the Expodisc to calibrate your own digital camera's meter is simplicity itself. Start by establishing the exposure value for the 18% transmittance of the Expodisc and then make an exposure of a grey frame. Check the histogram and look at where the peak occurs (it will probably be slightly left of centre) now take a series of additional grey frame exposures at increments of 1/3-stop and pick the one where the histogram peak is centred. The deviation from the 18% transmittance exposure represents the amount by which you will need to adjust your exposure. Having tested my own cameras I find I need to open the exposure consistently by 1/3-stop over the 18% transmittance value suggested by the Expodisc.

During the past few months that I have used the Expodisc I have tested it under a wide variety of conditions and been very impressed by its performance; simple and quick to use, it provides consistently accurate results for both exposure and white balance under ambient lighting. So much so that it now has a permanent place in my camera bag.

I would like to express my thanks to Hardy Haase at Flaghead Photographic Limited (www.flaghead.co.uk) UK distributors of Expodisc products for his assistance in preparing this article.

December 2005