# Digital Infrared

Our eyes are sensitive to a limited band of wavelengths in the electromagnetic spectrum (between 400nm, the blue end and 700nm, the red end) which is known as "visible light". Technically Infrared covers a vast range of wavelengths beyond the deepest reds of the spectrum (700nm) up to microwaves (100000+nm). In practise only a small band of this huge range (between 700nm and 1200nm) is used to expose photographic film. This small band is generally split in to two sections known as "near" and "far" infrared. The "far" range is mostly heat and is used in thermal imaging cameras. The bit we are interested in lies between 700nm and 900nm - the bit that our camera can see or "near infrared" (NIR)!!

It turns out that all CCDs in digital cameras are sensitive to light up to about 900nm, which means they are able to capture NIR images. Normally it is the light from the visible spectrum that we capture, either on film or on a digital CCD. By using an appropriate filter, we can block out most or all of the visible light and allow our camera to capture just the NIR wavelengths.

*Upper Thames at Cricklade*
*Canon Powershot G1*
*1/13 second F2 Wratten 88a*

*Rockley near Marlborough Witls.*
*Nikon Coolpix 850*
1/2 sec f8 Wratten 87

There are a confusing array of filters on the market, some of which will be readily available and some which are quite rare (and correspondingly expensive). IR filters are designed to cut out light at specific wavelengths. The confusion arises because of the different numbers/names given to IR filters by various manufacturers. There are a number of sites on the web that give “spectral sensitivity curves” for many of the filters on the market. These may seem complicated, but in fact all they show is a graph of the wavelengths of light that any particular filter allows through. Most filter manufacturers offer a range of filters that “cut off” at different wavelengths. In most cases the change isn’t instant i.e. a filter does not let everything through at 750nm and nothing at 749 nm. What actually happens is that 100% of light at wavelengths of 720nm may be blocked, 50% at 750nm is blocked and nothing is blocked at 800nm. This gradual change can be plotted on a graph as a curve and these are the curves that you find on the web.

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The Kodak Wratten Series is used as a standard way of describing the characteristics of all photographic filters. When it comes to filters for IR photography this is still the case and it is often useful to relate the different names and numbers quoted by various manufacturers back to the Wratten Series. The following table gives a list of filters for NIR photography, with their Wratten equivalents and the points at which they allow 0% transmission and 50% transmission. (note: none of these filters allow 100% of light through at any wavelengths)

| | Other Manufacturer Equivalent | | | 0% transmission for | 50% transmission for |
|---|---|---|---|---|---|
| Wratten Designation | B+W | Heliopan | Hoya | wavelengths shorter than | wavelengths shorter than |
| Wratten 70 | | RG665 | | 645nm | 675nm |
| Wratten 89B | 092 | RG695 | R72 | 680nm | 720nm |
| Wratten 88 | | | | 700nm | 735nm |
| Wratten 88A | | RG715 | | 720nm | 750nm |
| Wratten 87 | | RG780 | | 740nm | 795nm |
| Wratten 87C | 093 | RG830 | | 790nm | 850nm |
| Wratten 87B | | RG850 | | 820nm | 930nm |
| Wratten 87A | 094 | RG1000 | RM90 | 880nm | 1050nm |

So this all sounds pretty easy - lets all go and buy a filter and get on with it eh? - Unfortunately there is one big fly in the ointment. Many of the newer 3 megapixel digital cameras have an innocent little thing called a "hot mirror" between the lens and the CCD. This is effectively a small filter that improves the quality (apparently) of visible light images by CUTTING OUT the NIR wavelengths. There is very little you can do about this I'm afraid. Dismantling your camera and removing the hot mirror will not only invalidate your warranty, but may prevent you from taking visible light images entirely! Interestingly there is a company in The States that will charge you around £300 to “convert” your DSLR to an “IR only” camera by removing the hot mirror and replacing it with an appropriate Wratten equivalent.

What happens with one of these newer cameras is that the “hot mirror” may (for example) cut out all wavelengths longer than 720nm. You then put a filter in front of the lens that cuts out all wavelengths shorter than 700nm. As you can see there isn’t much left to be allowed through and your camera is unlikely to allow the 3 hour exposure times you will need.

So if you are keen to try this out and your current camera has a hot mirror then you need to do what I did and search the second hand market for an alternative. Many of the older 2 Megapixel cameras will give fantastic NIR results - I bought a Nikon Coolpix 800 for £250 and have just ordered a Canon Sureshot G1 3.3 megapixel camera which is also IR capable. The best way to test is of course to buy a filter and take it with you before you buy. Alternatively a search for “Digital Infrared Photography” on the web will direct you to numerous galleries of digital IR work. Many of the photographers exhibiting this way give details of the camera and filters they use to get the results they exhibit.

*Bole Hill Quarry,The Peak District.*
*Canon Powershot G1*
1 sec f2 Wratten 89b



 

If you already own a camera try pointing it at the business end of a TV remote and pressing a button. If you can see a really bright light on the end of the remote then your camera may well be able to capture NIR images. A note of caution though: my Coolpix 995 did register a dim light on the TV remote but is useless for capturing NIR images, its hot mirror cuts out most of the NIR light and even 8 second exposures wide open aren't long enough!

So what's the big advantage of taking these pictures digitally? Well the filters mentioned above cut out all visible light and as such you can't see through them. When using film you need to compose your shot, then attach the filter and then hope! With a digital camera you attach the filter and bingo, a beautiful infrared image appears on the LCD screen.

When it comes to making your first exposure, choose a bright sunny day, preferably with some interesting cloud formations. One of the beauties of this type of photography is the wonderful way that skies are rendered. Blue skies will go completely black and this enhances the appearance of any clouds present. The sun is necessary, because foliage will only appear that familiar bright colour when it is actually reflecting IR from the sun. You can get great effects near water, which will also go deep black where it reflects blue sky, and any foliage just under the surface will show through as dazzling white. Photographing people can also be interesting, although the results may look more like something from a horror movie than a classic portrait.

*Ogbourne Downs, Wiltshire*
*Nikon Coolpix 850*
1 sec f11 Wratten 87

*Old Mill, The River Wye, The Peak District*
*Canon Powershot G1*
1/2 sec f2.2 Wratten 89b

Once you've captured your shots you may find that they need some enhancement in Photoshop. I convert mine to LAB colour and then delete the a and b channels to give me a monochrome image. I then apply "Auto Levels" which considerably boosts the contrast and then apply a moderate amount of Unsharp Masking to the edges only using the “Smart_Sharpen” command in a separate channel.

You may also want to experiment with “Diffuse Glow” from the Distort submenu in the Filter menu and perhaps add some noise via the Noise submenu. In this way it is possible to mimic the effects that were obtained from traditional IR film.

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*Fairbrook, The Peak District*
*Canon Powershot G1*
1/2 sec f2.5 Wratten 89b

*Sevenhampton Church, Wiltshire*
*Canon Powershot G1*
1/2 sec f4 Wratten 88a

*Standing Stones, Avebury, Wiltshire*
*Nikon Coolpix 850*
1/2 sec f11 Wratten 87

*Bole Hill Quarry, The Peak District*
*Canon Powershot G1*
1 sec f2.8 Wratten 89b

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