

# NIKON D90

## MOVIE WORLD

Make movies with your D-SLR? The more you think about it, the more it makes sense which is why Nikon is on to another winner with its D90. Paul Burrows is in the director's chair.

▲ Nikon's D90 looks very similar to the existing D80 in terms of size and styling, but under the skin is a whole new camera – sensor, processor and functions suite.

**CONVERGENCE IS A BUZZ WORD THAT'S** been around for a while as the various digital technologies – audio, video and photography – enable smarter mousetraps which can do the job of two or more analog-era components.

In imaging, convergence has largely been all about the development of cameras which record both stills and moving pictures... namely compacts and camcorders. As the camcorder world moved into high definition video there was the promise of better quality stills. And as digital compacts gained more processing power (and memory cards increased in capacity) there was the promise of longer recording times for video clips.

But both these approaches are still severely compromised – consumer-level camcorders because they're such alien things to use if you're a stills photographer and compact cameras because they really don't work for serious movie-making. And, of course, both are hampered by having very small sensors with very small pixels and all the image quality limitations that are the inevitable consequence. You have to move up to a semi-pro or even a pro-level camcorder to get the image quality and the controllability that most still photographers are used to, and these are expensive machines that you don't just carry around on a whim. So, then, how about a

D-SLR – with a comparatively big sensor – which can shoot HDV footage? Makes a lot of sense doesn't it? One camera – and a familiar feeling one at that – which shoots both 12 MP stills and 1280x720 pixels video, and accepts a huge selection of lenses from fish-eye to supertelephoto. And here it is – the Nikon D90, the world's first digital SLR with a video recording mode.

Nikon calls it "D-Movie" and it's a development of the live view function whereby the direct feed from the sensor is not only shown on the camera's monitor screen, but recorded as well. This is actually pretty easy to do so it won't be long before it's a standard in D-SLRs, but Nikon has the satisfaction of being first and notching up another important milestone in its SLR camera history.

### Lights, Camera, Action!

Because the movie mode is a derivative of live view, viewfinding can only be via the D90's LCD monitor and another limitation is that the maximum clip length is five minutes. That said, in movie-making terms five minutes is close to eternity and in reality the majority of scenes will always be a lot shorter... if only to avoid boring audiences senseless.

The D90 has the same high-resolution – 920,000 pixels – 7.62 cm TFT monitor screen



that's used in the D3, D700 and D300. This means it delivers a pretty good-looking picture and it has a viewing angle of up to 170 degrees. The process of switching the camera to movie mode couldn't be more straightforward. On the D90 live view is activated at the push of a button on the camera's back rather than the rather fiddly process on the likes of the D700. Then it's simply a case of framing and focusing the first shot (the latter by depressing the shutter release to the half-way position) and recording is commenced by pressing the 'OK' button. A blinking 'REC' indicator appears in the

**"AS WITH LIVE VIEW IN D-SLRs, THE FIRST REACTION TO HAVING A MOVIE MODE IS 'WHY?'. GIVE IT A BIT OF THOUGHT, THOUGH, AND THIS QUICKLY BECOMES 'WHY NOT?'"**

monitor screen, along with a time remaining counter. Sound is recorded via a tiny mono microphone that's built into the camera just above the model badge so it's pretty well out of the way in terms of accidentally being blocked by a finger or thumb. However, there isn't a provision for using a stereo accessory mic – attached to the hotshoe – which is an opportunity missed unfortunately. Nor is there any provision for manual audio level control; the D90 adjusts it automatically.

The limit on movie clip length is actually imposed by a maximum file size which is presumably related to the buffer memory's capacity. However, it's also likely that sensor heating up – which will increase the noise levels – is a restricting factor.

Obviously, in addition to focusing, the white balance and exposure can be preset prior to commencing recording, but only the multi-zone Matrix metering is available and, once shooting commences, neither autofocus nor manual aperture or shutter speed adjustment is possible. However, exposure compensation can be applied and the focusing adjusted manually. The AE lock is also active and the set 'Picture Mode' image processing parameters carry over into movie shooting. If a VR-series stabilised lens is fitted, the stabiliser is automatically engaged which is a nice touch. Recording is at 24 fps which is the movie film frame rate (full motion video records at 25 fps) and gives a more 'filmic' look.

In the '720p' high-definition mode, the actual image aspect ratio is 16:9 widescreen and so the top and bottom sections of the monitor image are greyed out to ensure accurate framing.

### Planning Ahead

Despite the control limitations, the D90's 'D-Movie' mode actually works very well, but better results will be achieved with a bit of pre-planning – for example, if the focus or exposure needs to be adjusted with scene changes. But this is the key to better-looking videos anyway.

Initial focusing is via the live view mode's contrast detection system so it takes a second or two, but the focusing zone can be moved anywhere around the frame – even to the extreme edges – and visual confirmation is provided by it turning from red to green (plus an audible signal if the beeper is turned on). There's also a face detection function which speeds things up when shooting people. The five minute countdown resets after recording stops so, in reality, the only limitation on length is memory capacity and that's not really a problem now that 8.0, 16 and 32 GB SDHC

types are here (yes, the D90 uses the smaller format card). The capacity to shoot with different lenses is obviously a big plus as is the way that focusing can be used much more effectively as a creative tool given the shallower depth-of-field that's available in this format (versus the average consumer camcorder

with their tiny, tiny sensors). We tried shooting with the LCD monitor screen bathed in direct sunlight and it wasn't especially difficult to see what was going on. Usefully, though, there's a back-of-the-camera adjustment for monitor brightness (which by-passes the menu-based set-up), achieved by using the up/down components of the D90's multi-controller. In-camera playback is accompanied by the soundtrack (with adjustable levels) and includes fast forward/rewind functions plus frame-by-frame advance or reverse.

Obviously it's early days for D-SLR movie recording and the big problem at this stage appears to be the sound quality which exhibits quite a bit of hiss plus the mic picks up even the smallest amount of camera handling noise. Of course, this can all be worked on post-camera, but the simplest solution would appear to be to allow the fitting of an accessory microphone (i.e. add an audio input). There is, of course, an HDMI output so the high-definition video can be viewed on an HDTV (with the option of auto or manual format setting).

### Styling And Design

What else is new on the D90? Well, just about everything if it's compared to the D80, including the bodyshell, sensor and image processor. It's essentially an enthusiast-level model, but it's not hard to see professionals buying it for the movie feature and, at other times, using it as a back-up body. It lacks nothing of importance as far as these users are concerned, although the different card format from the pro-level Nikon D-SLRs (which are all CompactFlash) may be a bit of an inconvenience.

The D90 has exactly the same dimensions as its predecessor and while the styling is reasonably similar, it's a little cleaner and crisper overall. It has a GRP bodyshell over a diecast aluminium chassis with a conventional monochrome LCD read-out panel on one side of the top plate and a main mode dial on the other. However, as is now common on D-SLRs, the LCD monitor screen also serves



▲ Live view is activated by simply pressing the 'Lv' button on the camera's rear panel. This also readies the D90 for recording movies which are started and stopped by pressing the 'OK' button.



▲ The D90 accepts SD/SDHC memory cards and is the highest spec Nikon D-SLR to do so to date. However, with this format now matching CompactFlash cards for capacity and speed it's certainly not a problem.



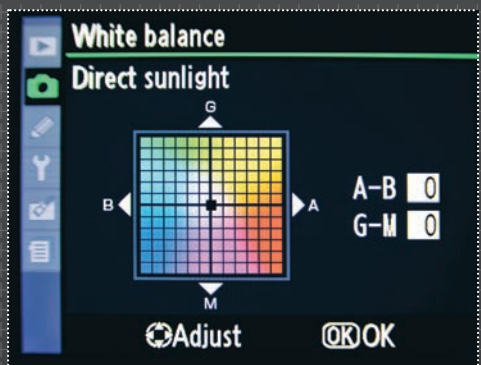
▲ The D90 has both front and rear input dials which are used in conjunction with the various function buttons for changing settings.



▲ These are not ordinary subject programs. No, they're 'Advanced Scene Modes' which not only optimise the exposure settings but also the digital imaging processing parameters.



▲ Nikon's menu systems are logically arranged and extremely efficient to use.



▲ All the white balance presets (and the auto control) allow for manual fine-tuning in both the blue-to-amber and green-to-magenta colour ranges.



▲ The D90 has now no fewer than eight image review pages, including one which displays both luminance and RGB channel histograms.



▲ A number of functions can be directly accessed via the 'Shooting Information' display, including the assignment of various controls. The 'Fn' button on the camera's front can be set up as short-cut to virtually any of the D90's functions.

as the shooting information display, but with bigger read-outs and the option of switching between black-on-white or the reverse (with auto brightness adjustment too). The monitor screen is protected by a clip-on cover which is a feature unique to Nikon and provides a welcome line of defence against scratches or more substantial impacts. The D90 is powered by the same 1500 mAh EL-EN3e rechargeable lithium-ion power pack as the D700 and D300, and of course, the D80. It also accepts the same optional battery grip as this model – the MD-D80 – which takes two Li-ion packs or six AA-size batteries. As noted earlier, a significant change is the switch to the SD/SDHC memory card format, but any dimensional advantages from this have probably been offset by the bigger monitor screen. The rear panel layout pretty well follows the arrangement Nikon has been using for a while now, but, compared to the D80, the multi-controller has the 'OK' button located in its centre which is the same as on all models since the D3. There's also an 'Info' button which activates the shooting status display and, when pressed again, gains access to the 'Quick Settings' submenu which provides shortcuts to various functions. These include the 'Picture Control' settings, long exposure and high ISO noise reduction, the 'Active D-Lighting' functions and assignment of the 'Fn' and AE/AF lock buttons' operations. It would be quite nice to be able to user-assign the 'Quick Settings' submenu to include the functions that are most often needed mid-shoot, but there is a 'Recent Settings' menu which provides quicker access to the last 15 adjustments made. And the 'Fn' button – located on the camera's front,

adjacent to the handgrip – can be assigned to just about anything for immediate access.

The menu system itself is quick and efficient to use following a 'click right' process to progress from the main page tabs through to the submenus and the settings... with the 'OK' button serving as the enter key and pressing the 'menu' button to go back a step. It works very intuitively and is arguably the best designed system in the business.

## Pixels And Processing

The D90 has a new CMOS-type sensor with an imaging area of 23.6x15.8 mm (i.e. Nikon's 'DX' format or 'APS-C') and a total pixel count of 12.9 million. The sensor is matched with one of Nikon's 'Expeed' processors which is its latest generation of device, designed to enable features such as face detection and the 'Active D-Lighting' process as well as enhanced noise reduction, colour reproduction and shooting speeds. Built-in sensor cleaning – another important development over the D80 – is provided by ultrasonic vibration of the low-pass filter (LPF). Cleaning is performed automatically when the camera is switched on and off or it can be manually initiated.

The native sensitivity is equivalent to ISO 200 and can be increased to ISO 3200 with a one stop 'boost' either side of this range (i.e. to ISO 100 and 6400).

The maximum image size is 4288x2848 pixels which represents a file size of around 6.0 MB for a maximum quality JPEG and 11 MB for a RAW image (depending, of course, on the actual content of the image). There's a choice of two smaller-sized JPEGs and three

▼ The rear panel is dominated by a 7.62 cm LCD monitor screen with a resolution of 920,000 pixels. It can also serve as the camera/capture status display with automatically variable brightness.



▲ The 'Shooting Information' display can be switched between black-on-white and white-on-black read-outs.



▲ A mono microphone is built into the front of the camera, but it has a severely limited dynamic range and there appears to be no way of connecting an external mic.



▲ Movie clips are limited to five minutes in length (at high definition), but the counter (top right) resets at the end of each clip so, theoretically, there's no real limit on the length of a complete 'production'.



▲ The D90 has a loudspeaker built into the base of the handgrip for in-camera playback of movie clips.

levels of compression which Nikon tags 'fine' (at approximately 1:4 compression), 'normal' (1:8) and 'basic' (1:16). The NEF RAW files are captured and processed at 12-bits (versus, incidentally, 14-bits for the Canon EOS 40D and 50D models). RAW+JPEG capture is possible with all the available JPEG image sizes. The maximum continuous shooting speed is quoted as 4.5 fps and there's a low speed mode which can be set between 1.0 fps and 4.0 fps.

The JPEG image processing options begin with the 'Picture Control' presets that are now pretty well standard across the Nikon D-SLR range. The D90 has a choice of six – actually two more than either the D700 or D3 – which are labelled 'Standard', 'Neutral', 'Vivid', 'Monochrome', 'Portrait' and 'Landscape' (the latter two being the extras). These provide preset combinations of sharpness, contrast, brightness, colour saturation and colour hue which can subsequently be fine-tuned. However, the contrast and brightness parameters are out of bounds if the 'Active D-Lighting' function is operational (more about this shortly). A total of nine 'slots' are provided for saving (and renaming) the edited 'Picture Controls' or for saving new ones created in Nikon's Capture NX2 software. There's a 'Quick Adjust' option which allows a number of the processing parameters to be adjusted together; for example, the saturation, sharpness and contrast in the 'Vivid' mode. The monochrome 'Picture Control' has adjustments for contrast and brightness plus the traditional B&W contrast control filters (yellow, orange, red and green) and a host of toning effects (nine colours each with seven levels).

## Dynamic Solutions

'Active D-Lighting' is Nikon's approach to dealing with the problem of digital capture's limited dynamic range and the function is gradually increasing in sophistication as more is learned about how to process the image.

On the D90 this can be done on-the-fly – i.e. at the time of capture – or subsequently in its 'Retouch Menu'. The image is analysed for brightness and contrast (hence these elements are locked out of the 'Picture Control' processing) and then an appropriate amount of underexposure is applied to ensure more

highlight detail is retained while the shadows are selectively lightened to preserve more detail in these areas. The D90 has an auto mode, plus low, normal, high and extra high (new on this model) settings. The function can also be switched off as the additional processing will slow things down and, of course, some users will prefer to sort all this out post-camera using Photoshop Levels or Curves. The D90 provides the option of applying the 'Active D-Lighting' processing post-capture (but still in-camera) which preserves the original file and makes a copy. This, in fact, is how all the Retouch Menu editing functions work and the D90 boasts an even longer list than ever before resulting in two menu pages. Among the more interesting new additions is 'Straighten' (plus/minus five degrees), 'Distortion Control' (which uses lens data to make corrections) and 'Fisheye' (which, of course, dramatically does the opposite with up to ten levels of effect). There's also a 'Quick Retouch' option which allows for some colour and contrast adjustments to be made in a hurry and, while not new, the RAW image processing is worth a mention as it allows for just about any capture-related setting to be applied to the JPEG copy.

▼ Test images exhibit excellent colour and contrast with a surprisingly wide dynamic range even without Nikon's 'Advanced D-Lighting' processing. Noise levels increase noticeably from ISO 800 onwards.



## Making A Scene

On the camera side, the D90 steps down a rung or two from the D300 and D700, although it still employs the 'Scene Recognition System' processing to optimise the focusing, exposure and white balance.

It has an 11-point autofocus system which comprises one central cross-type array surrounded by a combination of vertical and horizontal line arrays. These points can be manually selected and there's 'Dynamic Area' and '3D Tracking' modes to automatically switch points in the event that the subject or the camera moves (i.e. after recomposing the shot). The switching between single-shot and continuous AF operation can be performed either manually or automatically, the latter with a predictive function to compensate for shutter lag.

Metering is based on the 420-pixel version of Nikon's '3D Colour Matrix II' system which is also the heart of the scene recognition processing, the white balance control and the i-TTL flash metering. The alternative metering methods are centre-weighted average (with a variable diameter centre zone) and a spot measurement which accounts for 2.0 percent of the total frame

area and can allied with the selected focusing point. Being a non-pro camera, the D90 has a set of subject programs to supplement the standard compliment of exposure modes. Nikon actually calls these "Advanced Scene Modes" as they not

facility, although it's harder to work out what's going to happen with a Nikon D-SLR than with Canon's easy-to-understand plus/minus exposure scale-based displayed. Still, looking at the playback information will reveal exactly how

## "WHAT ELSE IS NEW ON THE D90? WELL, JUST ABOUT EVERYTHING IF IT'S COMPARED TO THE D80, INCLUDING THE BODYSHELL, SENSOR AND IMAGE PROCESSOR."

only optimise the exposure to suit the subject, but also the 'Picture Control' parameters and the 'Active D-Lighting' processing. The Auto ISO control is also activated, automatically increasing the sensitivity to ensure a high enough shutter speed is set to avoid camera shake problems (and noise reduction is automatically applied accordingly). The shutter speed range is 30 seconds to 1/4000 second and the shutter assembly itself has been tested to 100,000 cycles... not in the pro camera league, obviously, but still good.

The standard auto exposure modes are backed by the AE lock, up to +/-5.0 EV compensation – in either 1/3- or 1/2-stop increments –and auto bracketing which can be applied over two or three frames. The adjustment range is +/-0.3 EV up to +/-2.0 EV and it can be combined with the compensation

much exposure adjustment has been applied to each frame. The D90 actually offers a swag of bracketing options – exposure, flash, exposure *and* flash (handy for getting the amount of fill-in right), white balance and something called "ADL bracket" which allows for two shots to be taken, one with Active D-Lighting processing (as specified in the menu), the other without.

On the subject of flash, the D90 has Nikon's i-TTL flash control which uses the 420-pixel Matrix metering and preflash monitoring for the accurate balancing of flash and daylight. The camera's built-in flash also serves as the commander unit for a wireless TTL flash set up with one or more compatible accessory Speedlights – again using imperceptible preflashes to communicate. The big appeal of having the built-in flash act as the commander is that one less accessory unit is needed.

The D90's unit has a metric guide number of 17 (at ISO 200) and the 'on board' modes comprise red-eye reduction (via a built-in lamp, not preflashing), auto, slow speed sync and first/second curtain sync. Additionally, it can be switched to manual operation and the output varied all the way down to 1/100th of full power. Obviously this is useful for both fill-in and close-up purposes. Flash compensation can be applied over a range of -3.0 EV to +1.0 EV and there's also a modelling function which fires off a strobe sequence so it's possible to determine – with varying degrees of success it must be said – where there's likely to be a problem with shadows or hotspots.

### Balances And Checks

The basic complement of auto white balance and six presets is supplement by fine-tuning, manual colour temperature setting and a custom measurement. Fine-tuning can be performed in both the blue-to-amber and green-to-magenta colour ranges (separately or together) and can be applied to all the presets, the AWB and the custom setting.

The manual colour temperature range is from 2500 degrees Kelvin to 10,000 degrees which pretty well covers any type of lighting encountered in the real world from candles to bright blue skies. As just noted, there's also a WB bracketing function, again over two or three frames with adjustments of plus/minus one, two or three steps amber-to-blue. These steps actually correspond to plus/minus five, ten or 15 mireds respectively.

The white balance settings can be previewed in the D90's live view mode as can the application exposure compensation. Live view is another facility that's continually being refined with successive models and, on the D90, its implementation is possibly the easiest yet of any Nikon D-SLR.

Push-button on-and-off, a very easy zooming function (to assist with manual focusing) and the choice of three autofocus modes all help expand the useability. As noted earlier, autofocus in live view is performed via a contrast detection system (as opposed to the conventional phase-difference detection method) so it's marginally slower in its acquisition of the subject, but the D90 has a face-detection mode (up to five), a wide-area mode (with a fully moveable zone) and a normal-area mode (which is designed for tripod shooting and allows for a more selective aim). A 4x4 grid display can be superimposed to assist with levelling.

The live view image represents 100 percent subject coverage versus the optical viewfinder's 96 percent, but Nikon has made some improvements here too. For instance, a 'BW' indicator appears when the camera is in the monochrome Picture Mode. It's actually superimposed on the image area so it can't be missed, as are warnings for low battery power and "No card". A grid can also be superimposed.

Nikon has also added to the image replay options, giving the D90 a 72-image thumbnail display – made feasible by the size and resolution of the LCD monitor – to join the conventional four-up and nine-up screens. Zooming playback

▼ The top deck layout is very conventional and retains a monochrome camera status display.



is possible, now up to a massive 27x and the number of 'Pictmotion' slide show modes has been increased to five choices of both background music and image transitions.

There is now a total of eight image review pages, displaying various combinations of image and data, including histograms (brightness and RGB channels), a highlight warning and – new to the D90 – GPS data. This is acquired by an optional GPS unit which adds latitude, longitude, altitude and co-ordinated universal time to the Exif data. Even the movie clip files can be displayed with a brightness histogram for the opening frame.

## Speed And Performance

Nikon's 'Expeed' processors aren't so-named for nothing. The D90 is claimed to be capable of continuous shooting at up to 4.5 fps... and that's exactly what it does.

We fired off a sequence of 21 JPEG/large/fine frames (before the buffer was full) in 4.66 seconds which represents a shooting speed of 4.506 fps... virtually spot on. Next we just kept on shooting so the buffer was then operating on a one-in-one-out procedure, stopping at 50 frames which, of course, is much longer than will ever be needed in real life. Even then, though, the D90's shooting speed was still 3.125 fps.

Incidentally, these test files were around 6.45 MB in size so slightly bigger than Nikon's quoted standard size.

With RAW capture the buffer was actually full at ten frames and the clock stopped at 2.503 seconds, giving a shooting speed of 3.99 fps... still pretty respectable.

The D90's CMOS sensor is new to the ranks of Nikon D-SLRs, but the Expeed processing for colour reproduction and noise reduction has already earned its stripes in the D3, D700 and D300. The D90's image quality continues the good work – the test pictures exhibited exceptionally accurate colours, nicely smooth tonal gradations and excellent detailing overall. The Standard 'Picture Control' mode delivers a good balance of saturation and neutrality, but both the Vivid and Landscape modes add some very pleasing 'punch' to the primary colours. Once again, it's interesting to note that the dynamic range is actually pretty good even before 'Active D-Lighting' gets to work so, if maximum shooting speed is needed, it's still possible to get a good balance of detailing in the highlights and shadows (with some careful metering).

Fine detailing is very well defined at the lower ISO values, but noise does start to become evident at ISO 800 and beyond. The noise processing algorithms to a good job, but it is

at the expense of some definition in textures and micro details. The 420-pixel Matrix metering appears to be no less competent than its 1005-pixel cousin and the AF is generally quick and reliable, but it's not quite in the same league as the 51-point system.

Nevertheless, the D90 is still a hugely competent camera that will deliver sufficient imaging performance in many applications. As noted earlier, the movie clips look absolutely fabulous especially if the vision is going to be married with a separate soundtrack – music for instance – later on.

## The Verdict

The D90 continues Nikon's dream run in the D-SLR market since the launch of the D3 and D300. With these models and the D700 the brand has clawed back both reputation and market share, and the D90 is only going to keep this momentum going.

Beyond the pioneering movie mode it's still a thoroughly competent mid-range D-SLR which is comfortable to handle, intuitive to use and delivers excellent results. The pricing is keen too, given this camera's range of capabilities and its specifications level. Best of all though, it shows that the level of original and innovative thinking that went into the D3 wasn't just a flash in the pan.

## VITAL STATISTICS NIKON D90 \$1549 body only

**Type:** Enthusiast level digital SLR with Nikon F (D-type) bayonet lens mount

**Focusing:** Automatic via 11-point wide-area system using phase-detection type CCD sensor with a central cross-type array. Focus points may be selected manually or automatically. One-shot and continuous modes both with a predictive function. Sensitivity range is EV -1 - 19 (ISO 100). AF assist provided by built-in illuminator. Contrast detection autofocus provided in live view mode.

**Metering:** 420-pixel RGB '3D Color Matrix II', centre-weighted average (with variable diameter weighting – 6.0mm, 8.0mm or 10mm), spot (3.5mm/2.0%), and i-TTL flash via 420-pixel sensor. Metering ranges are; 3D Color Matrix II and C/W average = EV 0 up to 20, spot = EV 2 up to 20 (f1.4/ISO 100).

**Exposure Modes:** Continuously-variable program with shift, shutter-priority auto, aperture-priority auto, metered manual, i-TTL auto flash and manual flash. Plus subject modes for portraits, landscapes, close-ups, sports actions, night portraits and flash-off situations.

**Shutter:** Electronically-controlled, vertical travel, focal plane type, 30-1/4000 second plus 'B'. Flash sync to 1/200 second. Exposure compensation up to +/-5.0 EV in 1/3 or 1/2 stop increments.

**Viewfinder:** Coverage = 96% vertical/horizontal. Magnification = 0.94x (50mm lens at infinity). LCD displays and LED focus point indicators. Standard focusing screen has AF zones and on-demand grid lines. Eyepiece strength adjustment provided.

**Flash:** Built-in with a metric guide number of 17 (ISO 200). Auto, fill-in, red-eye reduction, front/rear sync, slow speed sync and wireless control modes. Flash compensation up to -3.0/+1.0 EV in 1/3 or 1/2 stop increments.

External flash units connect via hotshoe.

**Additional Features:** Auto exposure bracketing (two or three frames), depth-of-field preview, AE lock, flash compensation, all exposure adjustments in 1/3 or 1/2 stops; variable delay self-timer (two to 20 seconds), multiple exposures (up to three), exposure delay mode, monochrome LCD read-out panels with built-in illumination, audible signals, remote control terminal, 41 custom functions.

### DIGITAL SECTION

**Sensor:** 12.9 million pixels CMOS with 23.6x15.8 mm imaging area. Sensitivity equivalent to ISO 200-3200 (extendable to ISO 100 and 6400).

**Focal Length Increase:** 1.5x.

**Formats/Resolution:** Three JPEG compression settings and lossless compressed RAW files. Three JPEG resolution settings; 4288x2848, 3216x2136 and 2144x1424 pixels. RAW images are captured at 4288x2848 pixels in 36-bit colour. RAW+JPEG capture is possible (all JPEG compression levels).

**Recording Media:** One SD/SDHC memory card slot.

**Continuous Shooting:** Up to 20 frames at 4.5 fps in JPEG/large/fine mode, up to nine frames in RAW mode. Low speed continuous shooting mode can be set from 1.0 to 4.0 fps. Movie clips captured at 24 fps and 1280x720, 640x424 or 320x216 pixels with audio. Motion JPEG compression and AVI format.

**White Balance:** TTL measurements using 420-pixel RGB metering sensor. Auto/manual control with six presets and one custom setting. White balance fine-tuning available for AWB and all presets (blue-to-amber and green-to-magenta) plus manual colour temperature setting (2500-10000 degrees Kelvin) and white balance bracketing (up to three frames).

**Interfaces:** USB 2.0, video (PAL/NTSC) and HDMI.

**Additional Digital Features:** HD video clip recording (up to five minutes), live view mode (with full AF), live view with level indicator, 7.62 cm LCD monitor (920,000 pixels resolution) with histogram displays (brightness or RGB channels) and highlight alert; LCD monitor cover, 'Active D-Lighting' for contrast control, six 'Picture Control' modes (standard, neutral, vivid, portrait, landscape and monochrome) with fine-tuning (colour saturation, sharpness, contrast, brightness and hue), nine user-defined 'Picture Control' modes, sRGB and Adobe RGB colour spaces, long exposure noise reduction, high ISO noise reduction, Auto ISO function, image comments input (up to 36 characters), auto image orientation, adjustable image display time, auto playback, thumbnail display (four, nine or 72), playback zoom, in-camera editing functions (D-Lighting, straighten, distortion, fish-eye effects, red-eye correction, trim, B&W, filter effects, colour balance, image resizing, image overlay and RAW-to-JPEG conversion). May be fitted with optional GP-1 GPS data recording unit.

**Power:** One 7.4 volt, 1500 mAh rechargeable lithium-ion battery pack (EN-EL3e type). Optional MB-D80 battery grip accepts two EN-EL3e type packs or six AA-size batteries.

**Dimensions (WxHxD):** Camera body only = 132x103x77 mm.

**Weight:** Camera body only = 620 grams (without battery pack).

**Price:** Body only = \$1549. With AFS 18-105mm VR zoom = \$1849.

**Distributor:** Nikon Australia Pty Ltd, telephone 1300 366 499 or visit [www.nikon.com.au](http://www.nikon.com.au)