

Technologies Explained – Digital SLR

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Canon CMOS sensor

Designed by Canon and working in combination with the company's DIGIC processors, Canon's CMOS technology integrates advanced noise reduction circuitry at each pixel site delivering virtually noise-free images. In comparison with CCD technology, the lower power consumption characteristics of Canon's CMOS sensors also contribute to longer battery life.

Signal conversion in Canon's CMOS sensors is handled by individual amplifiers at each pixel site. Unnecessary charge transfer operations are avoided, vastly speeding up the process of getting signal to the image processor. Noise generation is reduced, power consumption is limited and faster frame rate potential is increased.

The architecture of the EOS-1D Mark IV sensor has been refined in order to derive maximum light efficiency and natural colour reproduction. Despite a smaller pixel size, optimised, more sensitive photodiodes, with higher signal to noise (S/N) ratios and larger capacities, allow more optical information to be gathered and transferred to the Dual "DIGIC 4" processors. This enables high ISO speeds, low noise, and a wide dynamic range to be achieved.

Additional features to reduce noise and support higher ISO speeds include:

- gapless microlenses, which have been moved closer to the photodiode to maximise the sensor's light-gathering ability
- the circuit for applying high gain suppresses noise from outside the sensor itself

AI Servo II

AI Servo AF uses a form of Artificial Intelligence (AI) to determine the speed and direction of moving subjects, then focuses the camera lens to a predicted position (Focus Prediction Function) in order to increase the probability of obtaining a sharp photograph.

Realising the importance of AI Servo in today's high speed cameras, the EOS-1D Mark IV autofocus system has been improved and is capable of accurately tracking a variety of subjects travelling at a variety of different speeds and distances. Tracking and focusing on macro subjects has been enabled through faster processing.

The following AF features have been improved with AI Servo II:

- **Stable lens drive:** In normal operation, the AI Servo algorithm makes calculations, and based on these results, instructs the lens to change focus position. Now, if the algorithm gets two results one after the other that are very different - for example, the subject changed direction rapidly and was not where the system expected it to be - this calculation is ignored and the system waits to instruct the lens until two results match. This means that errors generated no longer cause the lens to jump unexpectedly out of focus.
- **Secure focus tracking of a subject:** If an obstacle is detected or if the AF point is not kept over the subject, tracking continues based on the last known trajectory result immediately before the interruption.
- **Moderate lens drive:** If there is a radical change in focus distance, the lens is not driven straight to that value. It is slowly taken there based on past prediction results. This means that if a photographer drifts off the subject to the background for an extended period of time, the lens will not snap focus straight to the background. This in turn means that if the photographer gets the AF point back onto the subject that the lens is able to achieve sharp focus much more quickly.
- **Predictive control with quick response:** The system is now able to achieve predictive focus immediately as the subject starts moving and there is no delay before it can start tracking.

Dual “DIGIC 4” processors

Image information is processed by Canon’s Dual “DIGIC 4” processors, purpose-built to complement the 16.1 MP CMOS sensor. The power of Dual “DIGIC 4” enables more advanced processing algorithms to ensure precise, natural colours, accurate white balance and advanced noise reduction, as well as in-camera editing of EOS Movie clips filmed in full HD. The ultra-fast processing speeds raise the overall response rate of the camera operation and produce near-instant start-up times.

DIGIC chips work with a high speed DDR-SDRAM image buffer – reading, processing, compressing and writing image data fast enough to keep the buffer clear during long continuous shooting bursts. The buffer of the EOS-1D Mark IV’s Dual “DIGIC 4” processors has also been increased to support continuous bursts of up to 121 large JPEGs or 28 RAW files at 10fps, at full-resolution. In addition, as DIGIC 4 integrates all key processing functions, power consumption is kept to a minimum.

Working in tandem with Canon's CMOS sensor, DIGIC 4 removes the highly-noticeable colour noise, as well as reducing luminance noise without loss in detail, allowing for very clean, high ISO images. Even at ISO 6400, noise levels are similar to those of ISO 1600 from DIGIC III. The Dual "DIGIC 4" processors also support M-Raw and S-Raw image formats, commonly used by news desks, to maintain the benefit of Raw files whilst reducing file size.

Clear View II LCD

EOS-1D Mark IV's 3-inch LCD monitor has 920,000 dots (VGA resolution) with a viewing angle of 160°. Clear View II has been designed to combat glare by removing the air gap between the LCD's protective cover and the liquid crystal display. The air gap is filled with a photo-elastic material. This suppresses the reflections from the surface of the liquid crystal, caused by the sharp change in refractive index as light travels through the air gap.

EOS Movie

The EOS Movie function allows EOS-1D Mark IV users to record 1080p HD movies with full manual control and selectable frame rates.

Thanks to the large size of the integrated CMOS sensor (28.1x18.7mm), photographers have greater ability to control depth of field. The exposure of the movie can be controlled in Manual mode, allowing full control of shutter speeds and apertures. It is possible to select frame rates from: 30 (29.97), 25, and 24 (23.976), with 60 (59.94) and 50 available at resolutions of 720p. Program mode also allows photographers to easily shoot HD video without worrying about exposure settings– ideal when needing to capture split-second action as it unfolds.

Picture Styles

Picture Style presets simplify in-camera control over image qualities. Picture Style presets can be likened to different film types – each one offering a different colour response. Within each selectable preset, photographers have control over sharpness, contrast, colour tone and saturation. The camera's factory default configuration is set to deliver immediately-usable JPEG images without need for additional menu settings. Picture Style presets applied to a Raw image can be revised with Canon's Digital Photo Professional software.

The six presets are:

1. Standard – for crisp, vivid images that don't require post-processing
2. Portrait – optimises colour tone and saturation and weakens sharpening to achieve attractive skin tones
3. Landscape – for punchier greens and blues with stronger sharpening to give a crisp edge to mountain, tree and building outlines
4. Neutral – ideal for post-processing
5. Faithful – adjusts colour to match the subject colour when shot under a colour temperature of 5200K
6. Monochrome – for black and white shooting with a range of filter effects (yellow, orange, red and green) and toning effects (sepia, blue, purple and green)

With the EOS-1D Mark IV, the Picture Style presets feature greater sharpening (for all presets excluding Faithful and Neutral), giving the photographer press-ready files straight from the camera.

Auto Lighting Optimizer

The Auto Lighting Optimizer (ALO) automatically corrects the image brightness and contrast for images suffering from underexposure, low contrast, or backlit situations, assisted by face detection technology. With DIGIC 4's low-noise image processing and corrective algorithm, the correction is performed without affecting the natural gradation. Standard, Low, Strong, or Disable settings can be set and applied to the image.

With the EOS-1D Mark IV, the Auto Lighting Optimizer now works with manual exposure and bulb shooting. The correction is based on the exposure set by the user and is especially effective for backlit conditions when the subject looks dark. Typically, if the exposure is brightened for the subject, the background becomes overexposed. However, with the Auto Lighting Optimizer set and the picture taken so that the background is not overexposed, both the subject and background can be favorably exposed.

EOS Integrated Cleaning System

The EOS Integrated Cleaning System combats sensor dust in three important ways:

Reduce, Repel and Remove.

1. **Reduce** - Internal camera mechanisms are designed to minimise dust generation. The redesigned body cap prevents dust generation through wear on the cap itself
2. **Repel** - Anti-static technologies, including a special fluorine coating, are applied to the low-pass filter covering the front of the sensor so as not to attract dust
3. **Remove** - A Self-Cleaning Sensor Unit uses hi-frequency vibrations to shake dust from the infrared filter for a period of approximately one second after each start up. For instant shooting after power up, this feature is disabled immediately as the shutter release is depressed

Canon has also developed an internal Dust Delete Data system, which can map the position of visible dust on the sensor. This can then be deleted automatically after the shoot with the latest Digital Photo Professional software.

Software

Digital Photo Professional Software

Digital Photo Professional software provides high speed, high quality processing of lossless RAW images. Processing with Digital Photo Professional allows real-time display and immediate application of image adjustments, giving control over RAW image variables such as white balance, dynamic range, exposure compensation, noise reduction and colour tone – plus the ability to view Auto Focus points on an image. The Lens Aberration correction tool allows precise correction of different types of distortion caused by certain cameras. Images can be recorded in camera with sRGB or Adobe RGB colour space.

Digital Photo Professional supports sRGB, Adobe RGB, ColorMatch RGB, Apple RGB and Wide Gamut RGB colour spaces. ICC (International Colour Consortium) profiles can be attached to TIFF or JPEG images when converted from RAW. This allows faithful reproduction of colours in software applications that support ICC profiles, such as Adobe Photoshop. For improved efficiency, a set of image adjustments can be saved as a recipe and applied.

EOS Utility

The latest version of EOS Utility provides essential support for Live View remote shooting, camera configuration and image transfers. Tightly integrated with Digital Photo Professional, EOS Utility can be configured to monitor 'hot' folders, automatically renaming and moving incoming images to a structured file system. Users can also tag their images with EXIF data, including copyright information.

Picture Style Editor

Picture Style Editor allows photographers to create individual Picture Styles that meet their personal requirements. Each Picture Style contains detailed information on how specific colours should be represented within an image. Once new Picture Styles have been created, they can be uploaded directly into the camera and applied to JPEG or RAW images. When working with RAW files in DPP, both personal Picture Styles and predetermined Picture Styles can all be adjusted.