Story of the PowerShot G1 X Mark II Development

you can

Canon

The pinnacle of Canon technology: PowerShot portability and DSLR-like performance.

It is much more than achieving one groundbreaking feature; Canon expands shooting capabilities.
An integrated lens compact camera can succeed in situations where an SLR or mirrorless camera may not.

The lens, sensor, and imaging processor, are all optimised and unrivaled technology was used to create the new flagship model.

f/2.0 (W) – f/3.9 (T), 24mm (W) - 120mm (T)[*1], min. focusing distance 5 cm.
A 1.5 type sensor[*2], DIGIC 6, comfortable handling, and a refined design.

A compact body that you can carry anywhere, a wide range of shooting modes with image quality approaching that of SLR, all in one camera.
With the birth of the PowerShot G1 X Mark II, Canon's philosophy and technology are embodied in one camera.

***1 35 mm film equivalent**
***2 Total pixels : Approx. 15.0 Megapixels Effective pixels : Approx. 12.8 Megapixels(3:2)**

Development & Planning

The planning and development of the PowerShot G1 X Mark II has been achieved through the efforts of a large team at Canon's Headquarters in Japan. Their words have been edited to provide a fascinating insight in to the development of this remarkable camera.

Photographers and survey results from users provided a vast amount of feedback, and Canon's engineers improved everything they could. A lot of requests were regarding macro performance, and the minimum focusing distance has been improved from 20 cm to 5 cm. Autofocus is also approximately twice as fast by improving the optics and sensor. Particularly difficult adjustments were necessary for the optics, but if these high ideals could not be achieved, this would not be a flagship model. The enthusiasm of the Canon engineers drove these developments, and, as a result, a shooting range that would not be possible with an SLR with just one interchangeable lens has been achieved.

Development Chief
Kanji Tsuji

Product Planning
Akiyoshi Ishii

Electronic Viewfinder and Dual Control Rings

Canon's R&D team was particularly conscious of the camera's viewfinder-based operation. Up until now the G series cameras have had an optical viewfinder. However, parallax and also vignetting of the field of view occurs due to the position of the lens barrel, so the optical viewfinder does not necessarily lead to great user satisfaction. The EVF (Electronic Viewfinder) was introduced to solve this: it offers 100% coverage, and it can display a variety of shooting information.

With composing the image through the EVF in mind, it is easier to shoot if the controls are centered around the lens. The Dual Control Rings are controls that were created for this purpose. The ring at the back is a "click ring" that can change exposure parameters, and Tv, Av values in click-stop increments, and the front ring moves smoothly, making it possible to achieve minute adjustments such as when focusing.

For focus in particular, in combination with EOS-like full time manual focus now included, operability approaching that of SLRs is achieved.

Even though it is an EVF, the optical design division paid great attention to detail during development, particularly emphasising the quality of the view through the viewfinder.

The Dual Control Rings were also a new departure, along with many new elements like this, contributing to the PowerShot G1 X Mark II. Initially, the technical obstacles of attaching two rings to the barrel could not be overcome, however, repeated trials were undertaken in cooperation with the design division to achieve a difference in operating feel between each ring.

Lens Technology

Many of Canon's optics divisions are concentrated in Utsunomiya. As optic designers for not only the SLR division, but others such as semiconductor exposure equipment and broadcast equipment, all work together in an environment where synergies occur easily. Information exchange happens regularly, and you can see the designs that different divisions create. The DSLR EF lens division in particular works in the same field of cameras, so sharing information and ideas is a real strength.

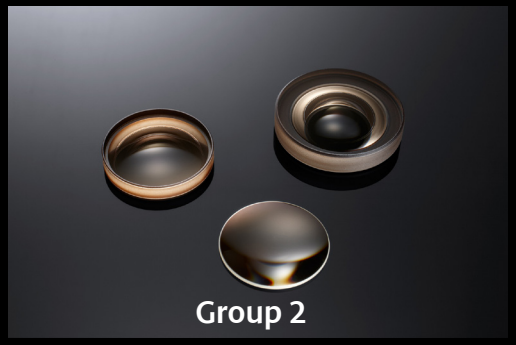
The integrated lens barrier

As there were strong demands from G1 X users for this, we looked into the possibility of an integrated lens barrier from the start of development.

Six lens group construction


Group 1


Group 4


Group 2


Group 5


Group 3


Group 6

The remarkable challenge of combining sensitivity with a high level of lens control required repeated discussions with the lens barrel design division. In order to achieve mass production, there was also close coordination with the factory. This coordination was a major factor in attaining this difficult goal.

Within the lens barrel, the mechanical parts do a great job of controlling the high level of sensitivity required. As existing methods of construction could not achieve the required precision, making these adjustments was an extremely difficult job. In cooperation with the algorithm development division, we were able to achieve lens control by adopting an original new method, combined with new manufacturing methods at the factory. Manufacturing the G1 X Mark II's lens barrel required many more processes than before, and, with the introduction of new equipment, etc., mass production that maintains precision to the micron level was achieved.

Minimum focusing distance

As the sensor gets bigger, the lens located at the very rear needs to become larger. This rear lens is also used for focusing, so has to move with speed and precision. On the large sensor of the G1 X Mark II, using the inner focus method is extremely effective.

To suppress any irregularity in performance, movement of the lens group is securely controlled within the lens barrel, and can to shoot beautifully from distant views up to close range. Additionally, as an inner focus lens group moves a shorter distance, it was possible to significantly improve autofocus speed.

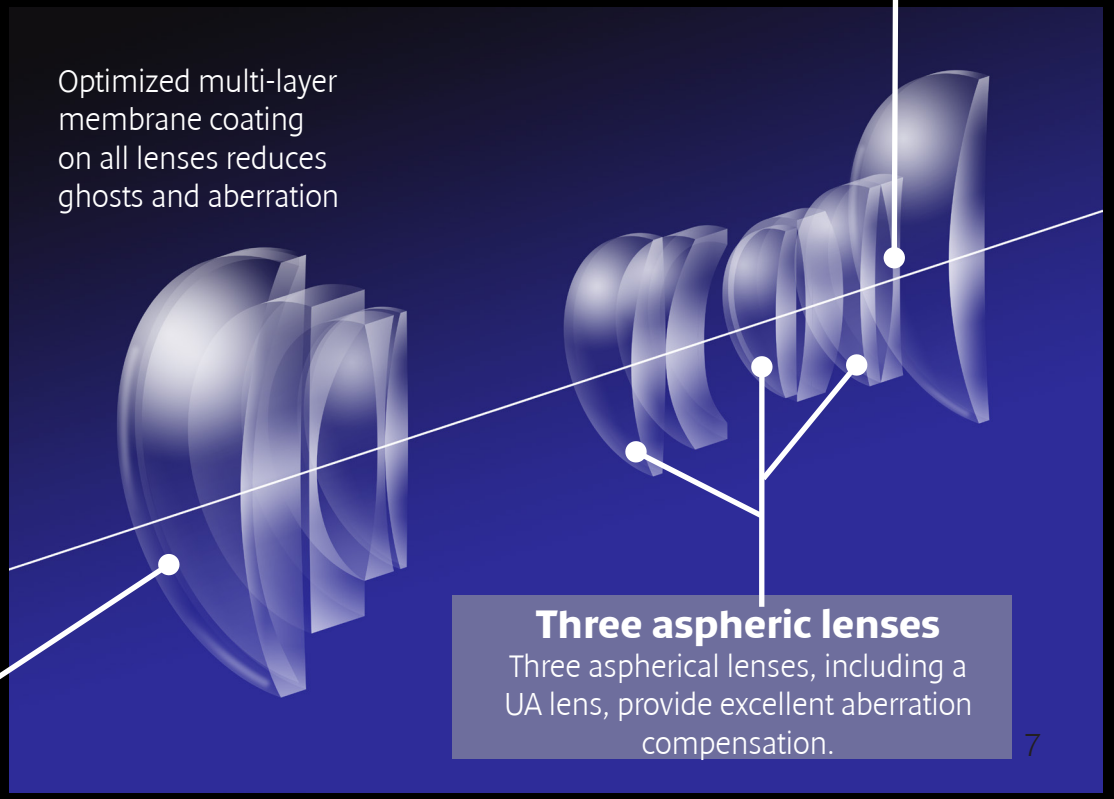
Improved lens in a compact body

The PowerShot G1 X Mark II uses a six-group zoom lens construction (total of 11 groups), the most for a Canon compact camera. The G1 X had a four-group zoom lens construction. The six-group construction gives more freedom for the lens distribution, and significantly greater variation of design. By drawing out the best of everything from the shape, glass material, distribution, to the coating for each of the individual 14 elements, an all around improvement in specifications was achieved.

By adding two more lens groups, there is a significant increase in precision required to control the lens position, and in the level of difficulty for manufacturing. However, six groups offer greater freedom of design, and an increase in magnification even in a restricted space. As a result, significantly more simulations were tested on the computer, and a six group construction of lens elements is used in this flagship model.

Inner focus
Although the G1 X used a rear focusing system, the G1 X mark II employs an inner focusing system which contributes to minimal lens movement, faster AF speed, a compact form, and improved macro shooting performance.

Optimized multi-layer membrane coating on all lenses reduces ghosts and aberration



Three aspheric lenses
Three aspherical lenses, including a UA lens, provide excellent aberration compensation.

Large diameter thin lenses
High-refraction glass materials result in a shorter zoom stroke.

Smooth background blur, known as bokeh.

F2.8

Beautiful background blur, known as ‘bokeh’ and pronounced bo-kay, is achieved with large format sensors. This effect was the area of development with the most emphasis. Various experiments were repeatedly carried out from the earliest stage of development, along with repeated discussions about including a larger aperture lens. As a result, f/numbers of f/2.0 (W) – f/3.9 (T) are achieved to take advantage of the G1 X Mark II’s 1.5 type larger format sensor.

A 9-blade diaphragm also contributes to beautiful background blur, as the aperture itself is nearer to a perfectly circular shape. Also, by using nine blades, as each blade is smaller, so the outer diameter size of the lens barrel is kept to a minimum.

F5.6

Shooting at close distance

A lot of feedback was concerned with the macro shooting distance on the G1 X. It is a real achievement to offer a minimum focusing distance of 5 cm on the G1 X Mark II. For macro shooting, the possibilities are now much greater, and users can enjoy shooting all types of scenes in close up.

F11

Size and performance balance

High specifications are not the only goal with the G1 X Mark II, but also a high capacity for expression that can be enjoyed on a daily basis. As a result, the optimum balance between size and performance has been achieved and a variety of photo styles in a wide range of scenes are possible with this camera.

Sensor and image processing

The PowerShot G1 X Mark II is equipped with the newer DIGIC 6 image processor. Image quality is improved for image clarity and noise reduction performance. The noise reduction process for shooting still images has been revised, compared to DIGIC 5, resulting in still image shooting 2.4x faster. Thanks to advances in noise reduction performance for shooting movies, approximately 9x as much information is processed compared to DIGIC 5. Texture and noise are precisely isolated, making it possible to reduce noise at ISO 1600 equivalent to levels comparable with ISO 400 using DIGIC 5. Full HD 30p and MP4 recording are also possible.

An additional benefit of this sensor is the ability to record 3:2 or 4:3 aspect ratios with the same focal length, supporting the needs of SLR users.

Sensor
Norio Negishi

Imaging processor
Kenji Takahashi

A new lens, 1.5 type sensor, and DIGIC 6 working together

No matter how advanced the imaging processor's image processing is, if the data received through the optics and sensor is not good, beautiful image quality simply won't be there. The three elements of lens, sensor and imaging processor are extremely important for image creation and ultimate quality.

As each of the three elements, lens, sensor and processor are all developed and manufactured by Canon, significant merits are achieved. Sharing within Canon deep insights and technical information has meant that it is possible to provide the best sensor designed to match the lens. In turn, the sensor has been tuned optimally for the lens and DIGIC 6.

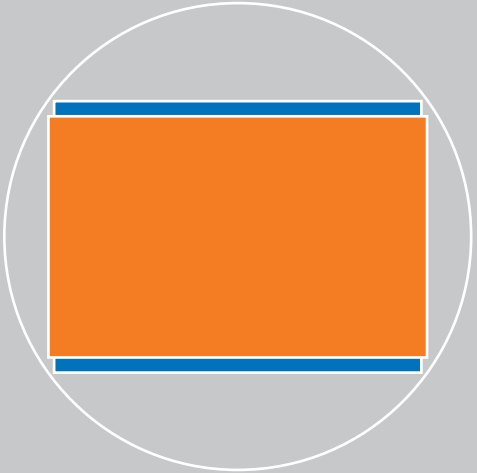
Noise reduction settings on the G1 X Mark II are extremely precise. Noise reduction consists of making minute adjustments according to shooting conditions, and this camera is tuned so precisely that it is difficult to compare to other cameras. With just a tripod, for example, shoot beautiful starry skies with Star Mode, and take full advantage of the enhanced noise reduction performance for extremely clear photos.

Comparing the G1 X Mark II to an SLR or mirrorless camera

The PowerShot G1 X Mark II is a compact digital camera with a fixed integrated lens. This means that many aspects of performance can be optimised for this lens. Sharpness, distortion, lens zooming position, sensor can all be optimised for the integrated lens. This kind of optimisation is not found in cameras with interchangeable lenses, especially those with lenses of f/2.0 or larger.

Record Raw in 3:2 like a DSLR

With multi-aspect ratio options on many cameras, 4:3 images are trimmed to create 3:2 images. This time however, the area of the 1.5 type sensor is used more effectively, so true 24mm effective wide angle images can be shot in both 4:3 and 3:2.



When the recording aspects are 3:2 and 16:9 on G1 X Mark II, the 3:2 area is recorded as RAW

When the recording aspects are 4:3, 1;1, and 4:5 on the G1 X Mark II, the 4:3 area is recorded as RAW

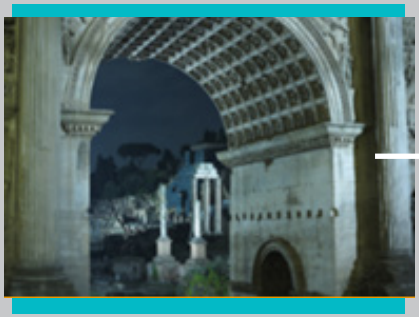
PowerShot G1 X

PowerShot G1 X 3: 2

The image of 3:2 for existing model is the same data as the one which is cut both top and bottom of the image of 4:3.

PowerShot G1 X Mark II

PowerShot G1X Mark II 3: 2



Record the areas to the left and right that couldn't be seen in 4:3 images where the top and bottom are slightly cut off

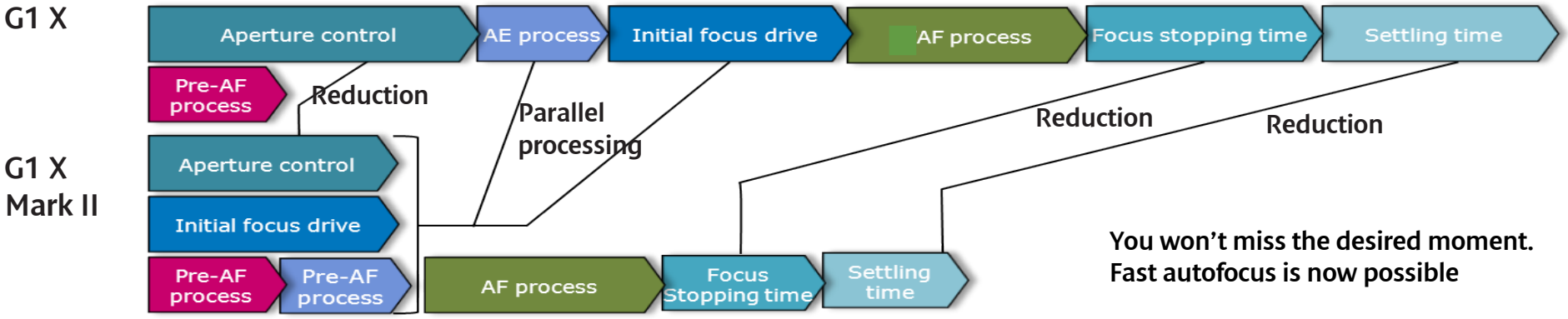
AF speed and continuous shooting

The frame rate of the sensor that imports the data for AF has been improved, so the reading speed is faster. In combination with the improvements in optics, a focus speed almost twice that of the G1 X is now possible.

DIGIC 6 and movies

Noise reduction has improved dramatically for movies as well, giving more options for shooting in low light. DIGIC 6 can process approximately 9x as much information as DIGIC 5, so texture and noise isolation precision, and noise reduction performance are both improved. The f/number is even brighter, to offer smooth out of focus backgrounds, and easier shooting in even lower lighting conditions.

The focus process was rationalised and streamlined, achieving a great reduction in shooting time lag.



You won't miss the desired moment. Fast autofocus is now possible

HDR shooting

HDR shoots multiple photos and creates one image by superimposing them over a wide dynamic range, and to do this, the PowerShot G1 X Mark II uses a huge amount of image processing power. Similar processing was possible with DIGIC 5, but with DIGIC 6 the processing time is even faster. Five types of effects are available – just like the EOS 5D Mark III.

HDR Mode effects

Art Standard

Art Bold

Art Vivid

Art Embossed

Natural

*

Design concepts

The G series up until now have been the high-end models of the PowerShot range, with suitable quality and ease of operation.

However, with the PowerShot G1 X Mark II, there was a desire to bring in new users to enjoy it, while still maintaining the tradition of the G series. Overall it probably looks as though it is quite simple, but a simple design was not the only aim, and emphasis was placed on the giving the lens presence, as well as extreme precision.

Currently there is a trend towards designing premium compact cameras like classic cameras. However, Canon has kept its distance from this trend. As a result, the design is not pretentious, and it also does not look like a so-called compact camera, and achieves a great balance between traditional and new.

Ergonomically, strong emphasis is placed on handling and in particular, the operation and material quality of the Dual Control Rings. For example, the click ring has a wide knurled pattern so you can grip the base of the lens and rotate it firmly. Only the front edge of the second smooth ring is knurled, and the space between the rings keeps their operation separate. Many prototypes were made to reflect the minute detail of understanding ergonomics: the feeling when rotated, and the feel of the engraved knurled pattern. The best of each prototype was selected and never before have so many prototypes been created during development, to give the balance and operational handling of a camera designed to allow the master craftsman photographer to put all their effort in to shooting.

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Design
Yuji Kondoh

Design
Miyabi Orihashi

The PowerShot G1 X Mark II Enhanced Grip Edition (available in Europe, Middle East and Africa) features a large ergonomic grip for excellent handling.

Some images in this document show the smaller grip version, not available in Europe, Middle East and Africa. These are marked with *

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