

Section I

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## The Allure of the X-Pro1

### Large-Format APS-C Sensor Selected for High Image Quality

People think that the physics of image sensors implies that the bigger they are, the closer they are to the desired image quality, but a larger size also has implications for body design that result in poor handling and other problems. The APS-C size was adopted for the X-Pro1 as representing the best balance between these competing factors. Its area is more than ten times that of the 1/2.33-inch sensors used in most compact digital cameras; at this size, each pixel can perform its role of reliably capturing the light from the lens and passing it to the image engine as a high-quality, low-noise signal.



### The Plusses and Minuses of Moiré and Optical Low-Pass Filters

Digital cameras that use large sensors provide sharp images thanks to increased pixel pitch. Unfortunately, moiré is more likely in close-ups of cloth and in shots of other subjects featuring regular geometric patterns. To counter this, most cameras use optical low-pass filters, a filter placed between the lens and the sensor to reduce the occurrence of moiré by defocusing fine details. Optical low-pass filters prevent lenses achieving their full potential, no matter how good their resolution.



Moiré

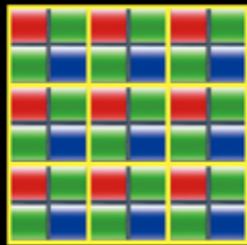


No moiré

### New Dimensions in Detail Inspired by the Design of Photographic Film

Color filters attached to the image sensor are arranged in a regular array, causing moiré due to mutual interference in shots of objects featuring regular patterns. At FUJIFILM our attention was drawn to the fact that moiré does not occur in pictures taken with silver-nitrate film. Film grain is distributed randomly, preventing interference with regular patterns. Our attempt to replicate this random distribution is the “new color-filter array”, which is decidedly “film camera” in its inspiration. By removing the source of moiré, we also removed the need for a low-pass filter, with the result that the X-Pro1 offers a level of fidelity far beyond that of other image sensors with the same number of pixels.

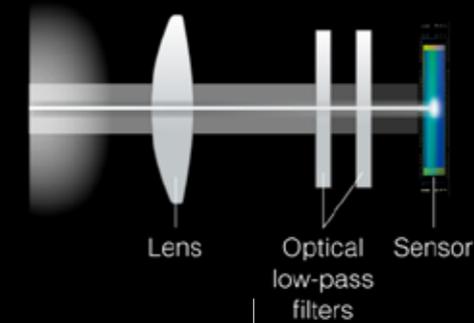
#### [ Conventional Color Filter Array ]



The repeating arrangement of the 2x2 pixel sets tends to generate moiré and false colors when shooting stripes and other regular patterns.

Traditional optical low-pass filters inhibit moiré and false colors but consequently lead to a loss in resolution.

Lens with optical low-pass filters



#### [ Newly-Developed Color Filter Array ]

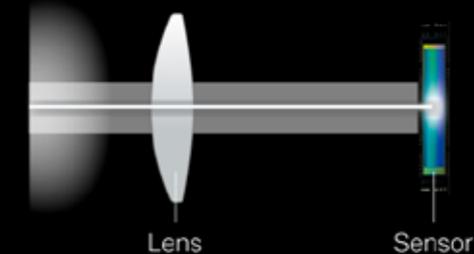


The high aperiodicity (randomness) of the arrangement of pixels in 6x6 sets reduces the occurrence of moiré. Also the presence of an R, B and B pixel in every vertical and horizontal pixel series minimizes the generation of false colors and delivers higher color reproduction fidelity.

Inspired by the natural random arrangement of the fine grains of silver halide in film, the new filter changes the rules of digital photography. Without using an optical low-pass filter,

moiré and false colors are eliminated, but high resolution is maintained.

X-Pro1 No optical low-pass filter



### In Search of Superior Image Quality and Ease of Use

With its all-new lenses, lens mount, and sensor, the X-Pro1 represents the pursuit of top image quality and ease of use unhindered by existing concepts and standards. The design of “XF” X-system lenses is true to the following concepts:

- Optical fidelity is maintained from the center to the edges of the image for sharp detail in every corner of the frame .
- Maximum aperture is as fast as possible for greater expressive power.
- Compact and easy to carry

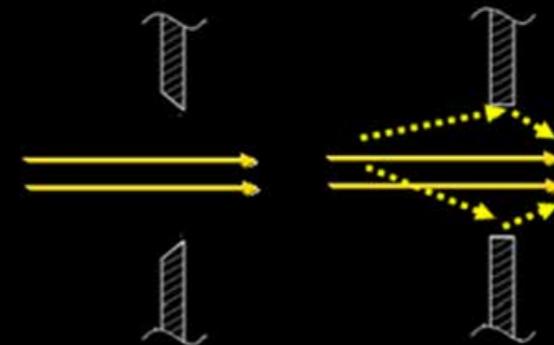


### Aperture Diaphragm Blades Designed with Image Quality in Mind

Typically, each of the blades in a multi-bladed aperture has the same rounding, so that when aperture is stopped down, out-of-focus light sources are blurred into polygonal shapes that make it hard to get good bokeh. XF lenses feature a “rounded aperture” design in which the blades are carefully adjusted to create a nearly circular aperture at all f-stops. Molds are used for blades that, unlike blades produced by the more common press manufacturing process, can be virtually any shape in cross-section, minimizing flare and ghosting caused by lens-internal reflections.



XF lens circular diaphragm



Molded (XF lens)

Press manufactured

### Aperture Ring Supports 1/3 EV Stops for Flexible Exposure

Aperture is adjusted using a ring on the lens barrel, just as in traditional cameras, and can be fine-tuned in increments as small as 1/3 EV for photographers who pay close attention to slight differences in exposure or depth of field. Increments are etched close together, reducing the amount the ring must be rotated to change aperture with each stop: for each 1/3 stop, the ring is rotated four degrees. Full steps are delineated by a stronger “click” than 1/3 stops, a design that makes it easy for photographers to directly feel changes to aperture through their fingertips.



### Size, Weight, and Feel All Targeted for Top Image Quality and Free Expression

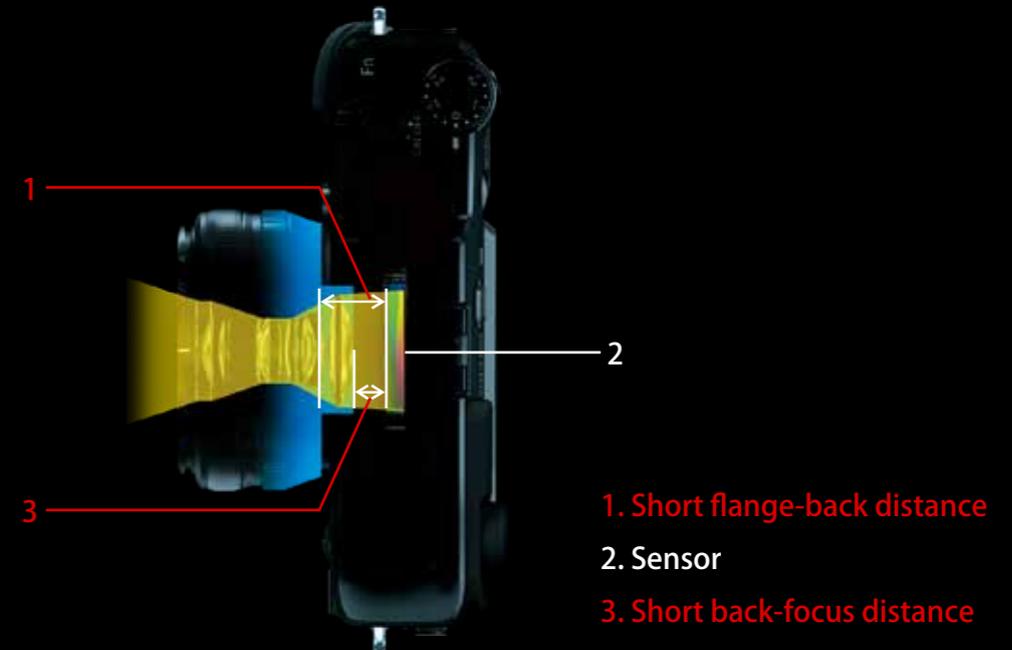
XF lenses are of course designed to deliver superlative image quality, but more than this, with their aluminum barrels and exteriors, they have been designed with appearance, quality, and feel in mind. The more the camera is used, the clearer the intentions of the designers with respect to such points as how the camera feels in the hand during framing and focusing, and this no doubt is what makes it a true professional photographic tool.



### Unique X Mount Newly Developed to Increase Lens Optical Fidelity

The X-Pro1 acknowledges no restraint in pursuit of high image quality. Central to this pursuit is the “X mount”.

Take, for example, single-lens reflex cameras, which require a large flange-back distance due to the presence of a mirror assembly between the sensor and the lens. This makes it difficult to design wide-angle lenses that preserve adequate optical fidelity at the edges of the frame. In contrast, the X mount, with a flange-back distance of 17.7 mm, makes reduced flange-back distance its first priority. In addition, a wide opening allows the lens to be set back another 7.5 mm or so. This reduces the lens back-focus distance, preventing loss of peripheral illumination and ensuring high resolution right to the edges of the frame. This ingenious mount design also allows the rear lens element to be made larger, reducing the overall size of the lens.



### Down to the Last Anti-Flex Screw, Mount Design Spares Nothing in Pursuit of Thinness

The X mount is extremely thin, having been kept to a thickness of about 2.5 mm to reduce the flange-back distance. The number of screws used to ensure mount strength has consequently been increased to six from the more usual four. They are positioned to keep the both edges of each bayonet slot in place, combining thinness and strength while maintaining focus precision.



### **New Shutter System Combines Reduced Shutter Lag with High Frame Rate**

The focal-plane shutters in mirrorless cameras typically operate in the following sequence:

1. The front curtain opens.
2. The camera captures the live view image.
3. The front curtain closes briefly when shutter button is pressed.
4. The front curtain opens to create the exposure.
5. The rear curtain closes.
6. The front and rear curtains are charged and the process repeats from Step 1.

While the X-Pro1 uses this sequence in single-frame advance mode, during burst shooting Steps 1 to 3 are omitted after the first shot, increasing the frame rate.



### **Lenses' Full Potential Realized by Electronically Transmitting All Lens Data to the Camera**

Mount control usually includes mechanical processes such as autofocus and aperture adjustment. The ten signal pins in the X mount connect the lens drive to the camera body, where it is controlled electronically. This simple and reliable method makes it easy to optimize image quality. Another feature of the X mount is that it gives the camera body access to high-level optical data from lenses of all types. This information is used to optimize image processing for high resolution, even illumination, and reduced chromatic aberration.