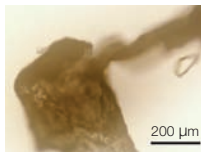
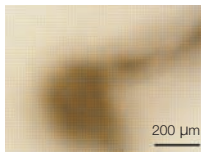


Supersonic Wave Filter (SSWF): Dust Reduction System.



Piece of dandruff on image sensor



Area affected by dust on image sensor

The problem of dust in D-SLR cameras:

Most digital SLR camera owners are thrilled by the sheer brilliance of the photos they make thanks to the high quality of their equipment. Their camera system represents an investment they expect to enjoy for years to come. But they might be in for a surprise. The discovery of tiny dark spots in their images could be the effect of dust on the image sensor.

Every time lenses are changed there is a chance that dust may enter the camera. Yet even if utmost care is taken during this process, the mechanical parts such as shutter or quick-return mirror might still generate dust contamination due to friction occurring during their movement. At the same time, they ever so slightly move the air inside the camera body, which is enough to whirl the miniscule dust particles around. This is not as critical with film SLRs as the dust disappears as the film is wound on, but in D-SLRs the image sensor always remains in the same place. Even with dust particles no bigger than 0.1mm (100 microns) and invisible to the human eye, once they land on the image sensor's surface they can degrade the quality of all the images taken hereafter. And it is usually a difficult task to remove the dust, which may often require sending the camera in for servicing.



The solution:

Olympus is the pioneer of dust-free D-SLR photography. It was the first manufacturer to face this annoying problem by developing a unique and innovative solution to defeat it – the Supersonic Wave Filter (SSWF). It forms the main part of the Dust Reduction System, the one that keeps the image sensor free from contaminants. This system was introduced together with Olympus' first digital SLR, the E-1 in 2003, and has been incorporated to wide acclaim in all seven Olympus D-SLRs since. Recently, the dust reduction system was perfected even further. Now, this second generation SSWF is even more effective. To accommodate the greater need for dust removal due to the higher pixel density of 10 Megapixel image sensors, the vibration frequency of the SSWF was increased and the main frame reinforced. At the same time, the size of the system is reduced leading to a decrease in the volume of parts around the mount box, allowing further size reductions in camera bodies. Now some other manufacturers are beginning to recognise the problem and are incorporating dust protection systems in their models. However, Olympus remains the initiator of dust-free D-SLR photography and is the only manufacturer with a proven track record in eliminating the problem of dust.



Dust problems on the image



Supersonic Wave Filter



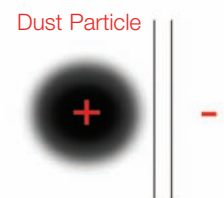
Dust free image

Two types of dust

There are two main types of dust that have the potential to damage photos: Dust particles that adhere through electric force and dust particles that adhere through intermolecular force.

(1) Dust particles adhering through electrostatic charges

Most of the contamination to be found on the image sensor surface is caused by dust particles as small as just one micron (0.001mm) adhering to it through electrical charges. By examining dust particles and the surface of the Supersonic Wave Filter under a microscope, it was discovered that the particles themselves have electricity and carry a positive electric charge, while the image sensor is negatively charged. This makes them gravitate to each other. The same phenomenon can be observed on the surface of LCD and CRT monitor screens. This type of dust can easily be removed by the SSWF.



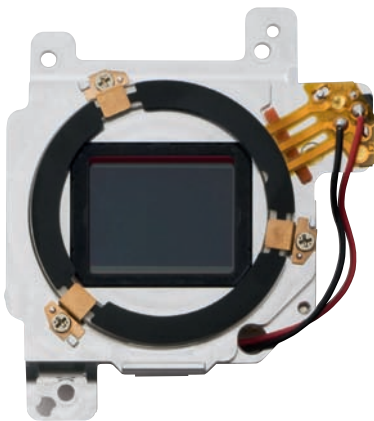
(2) Dust particles adhering through intermolecular force

The intermolecular force is weaker than electrostatic charges. However, it still attracts microscopic-sized dust to the image sensor even with infinitesimal force. While earthing the camera can help reduce the problem of static dust it does not avoid intermolecular attraction. But the ultrasonic vibrations of the SSWF can solve this problem. If dust or flour is drizzled into the camera, it still adheres to the surface of earthed metal. This kind of dust is attracted by intermolecular force. Liquid also adheres to the image sensor by intermolecular force and such molecules adhere strongly due to their ability to get closer to the adhesion surface, making it harder for dust reduction systems to remove the dust completely. In such instances, wiping the optical element, such as the Low Pass and Infrared filters, in front of the image sensor with cleaning fluid is effective. However, there is little or no possibility of liquid adhesion to the SSWF during regular use.

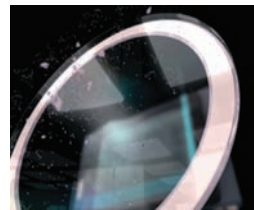


How the SSWF works:

The SSWF is automatically activated every time the camera is turned on, generating ultrasonic vibrations at more than 35,000 times per second or more, that shake off dust on its surface. It can also be invoked manually via the camera menu. The removed dust is then captured on an adhesive absorber at the bottom of the filter. In most instances, its operation is generally indicated by the blinking of a blue LED on the top of the Olympus camera body.



Every D-SLR is susceptible to dust



The SSWF shakes it off



To guarantee clear images

(1) Ultrasonic dust removal

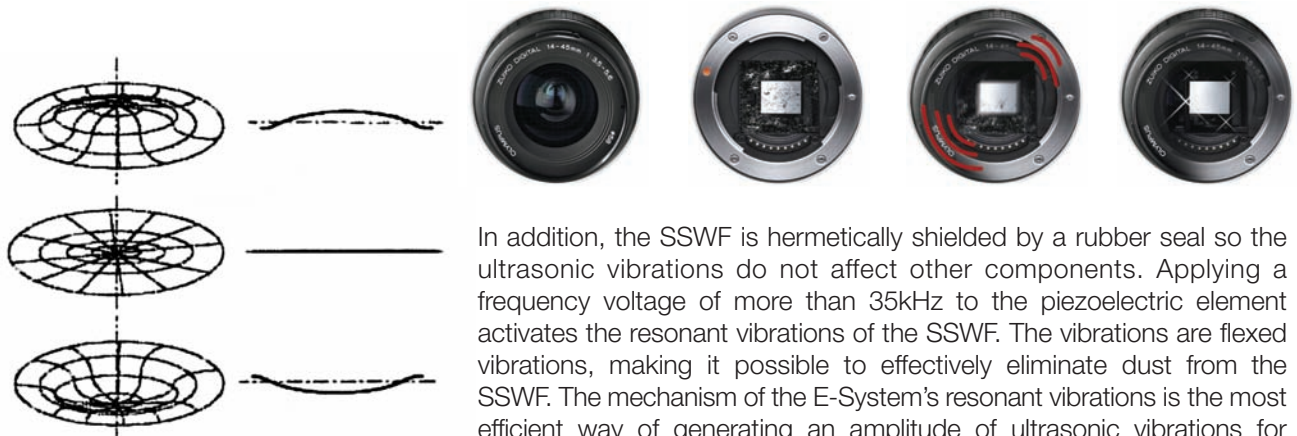
Through the ultrasonic vibrations, any dust particles that have adhered to the surface of the SSWF are instantly removed. They are then captured on an adhesive dust absorber at the bottom of the filter. The material used for the filter was very carefully chosen, as it needed to be free from any kind of reflection. The SSWF consists of a discoid plate and a piezoelectric element.

(2) Preventing dust from reaching the image sensor

The Dust Reduction System prevents dust from settling on the image sensor by hermetically sealing the space between the SSWF and the image sensor surface. This is achieved by applying a special rubber seal between the image sensor and Low Pass Filter as well as the Low Pass Filter and SSWF.

(3) Preventing dust from appearing in the image

Due to the space between the sensor surface and the SSWF, dust is not projected clearly therefore it does not block the light and won't appear in the image.



In addition, the SSWF is hermetically shielded by a rubber seal so the ultrasonic vibrations do not affect other components. Applying a frequency voltage of more than 35kHz to the piezoelectric element activates the resonant vibrations of the SSWF. The vibrations are flexed vibrations, making it possible to effectively eliminate dust from the SSWF. The mechanism of the E-System's resonant vibrations is the most efficient way of generating an amplitude of ultrasonic vibrations for eliminating dust particles.