Image Degradation Diagnosis and Filter/Sensor Cleaning

Although DataRay does not recommend cleaning the beam profiling camera sensors due to the delicacy of the parts, cleaning may become necessary if dirt is interfering with the quality of laser beam profiling measurements. If the user decides to clean the sensor, we recommend extreme caution as user-damaged sensors are not covered by the camera's three-year warranty.

There are three different places that image degradation can occur. First, the optics preceding the DataRay beam profiling camera (source optics) can have flaws (e.g. dirt on preceding lenses, problems with the source output). These source optic problems must be addressed by the user as each setup varies. Second, the ND filter covering the sensor may be dirty or scratched. Dirty ND filters can be cleaned, but scratched or damaged ND filters must be replaced. Lastly, the sensor itself can be dusty or damaged. A dusty sensor can be cleaned, while a damaged sensor must be replaced. If the problem lies in the source optics or a dirty ND filter, then a diffraction pattern should be seen (see Figure 1). If the problem lies with a dirty sensor, then small dark spots will be seen (see Figure 2). Scratched sensors will generally show a dark line running across the image.

Diffraction Pattern

If a diffraction pattern is seen, then the problem most likely lies in the source optics or the ND filter attached to the DataRay beam profiling camera. Distinguish between them as follows

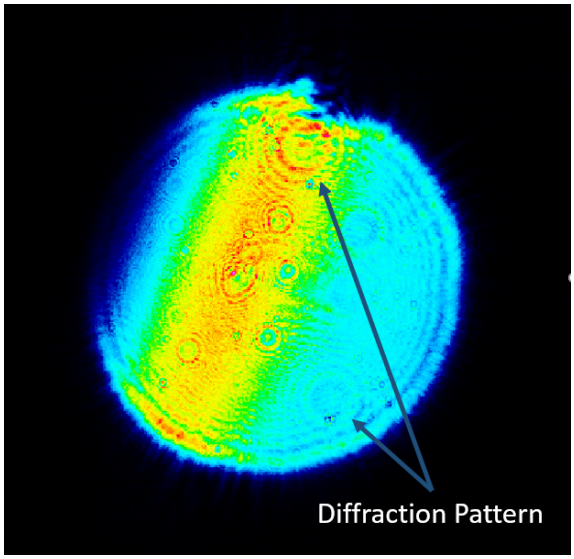


Figure 1

Source Optics: Move your source so that the source's motion can be seen on the DataRay beam profiling software. If the diffraction spots move with the source, then the issue is the source optics. Solutions to this problem are not addressed in this blog post as they are user specific.

ND Filter: If the diffraction pattern does not move when the source moves, the most likely explanation is dust or other marks on the ND filter or sampling/attenuation optics. If the problem is dust, then the filter can be cleaned with an oil free air-duster. However, if the problem is finger prints, the ND filter or sampling attenuation optic must be physically cleaned.

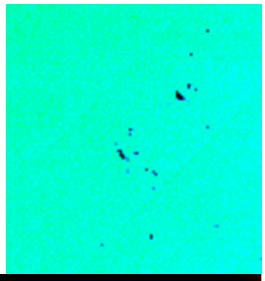
To clean the filter of dust, first try only air-dusting the front surface of the filter. If this does not work, carefully unscrew the ND filter from the profiling camera. Next with an oil free air-duster, blow off both sides of the ND filter (see air-duster section under the Black Spots heading).

To clean finger prints from the ND filter or sampling attenuation optics, first remove the filter by carefully unscrewing it from the DataRay profiling camera. Next, clean the filter by rubbing it down with a small amount of laboratory grade methanol on a lint-free cloth. We use cloth cleaning wipes. After wiping down the filter, blow off the filter with an oil free air-duster. If the mark is particularly stubborn, two alternate

methods can be tried. The first is an alcohol wash with a cotton bud followed by an edge to edge blow-dry. Secondly, since some marks are not alcohol soluble but rather water-soluble, the marks must be rubbed off with a water-dampened, lint-free cloth.

Black Spots

If you see small black spots on the image that do not move with the source image, or when you rotate the filter, then this is dust on the chip. A small amount of dust is inevitable, so avoid cleaning the sensor unless the dust is interfering with measurements. We reiterate that user-damaged sensors are not covered by the warranty. However, to clean the sensor first carefully remove the ND filter or sampling/attenuation optics. With the filter removed, the ambient illumination of the imager typically shows the dust spots (see Figure 2). Avoid touching the surface of the sensor chip at any time during the cleaning process. Ultimately, the sensor surface will be blown off with an oil free air-duster, but first a couple of important things must be noted:



Bond Wires connect the sensor to the rest of the electronics; they are extremely small and delicate (see Figure 3). Should they be damaged, the sensor cannot be repaired. Avoid blowing directly on the fragile bond wires by instead blowing off the chip at an angle (air-dusters addressed below). The ambient light on the sensor should show when the dust spots have been removed.

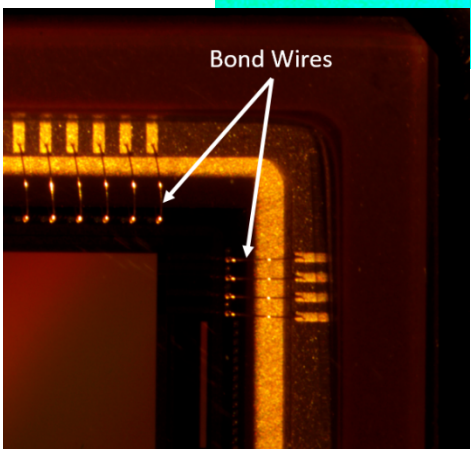


Figure 3

Air-Dusters often spray a visible film when they are used at an angle (see Figure 4). Always make sure that the air-duster is completely vertical and upright when blowing off the sensor. The film will irreparably contaminate the sensor surface. We recommend doing a test blow away from the sensor with the air-duster to make sure the duster isn't blowing oil. When blowing off the sensor with the air-duster, the air stream should make approximately a 30-degree angle with the sensor surface. Either hold the sensor at an angle or angle the plastic nozzle attached to the duster (but leave the air-duster can upright, see Figure 5). Avoid touching the surface of the sensor. We use the Dust-Off and Dust Destroyer brand products which are available at both Amazon & Staples in the USA.

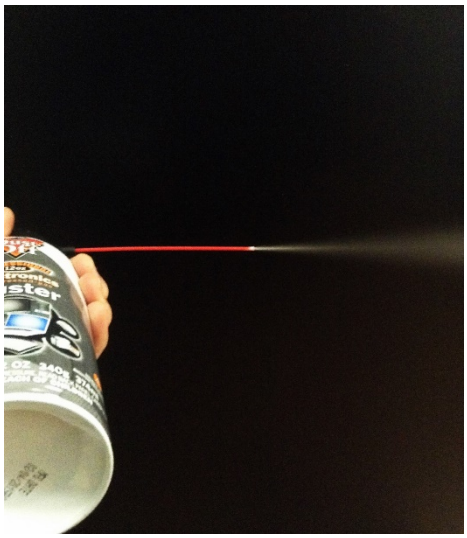


Figure 4: Incorrect way to hold air-duster. Note oil being blown from container, because the canister is non-vertical.

Sensor Replacement

Most cameras have user-replaceable imager chips. User-damaged chips are not covered under warranty, but can still be replaced. Often times, replacing the sensor is more cost effective than buying

a new camera. Additionally, most sensors are field replaceable (instructions available), which can save on RMA shipping time.

For questions on sensor cleaning not addressed in this document feel free to contact us. For more information on image sensor replacement contact your local Rep/Distributor.

Figure 5: Correct vertical orientation of air-duster bottle. Air is blown at an angle by bending the attached plastic nozzle.