GfK Imaging Summit 2009 in Nürnberg

Press Release

LINOS
A member of the Qioptiq Group

Lenses for High Resolution Digital Backs in Professional Photography

Rodenstock lenses for professional photo studios and labs are highly appreciated because of their excellent image quality worldwide. With two new lens series, specially adapted to the characteristics of high resolution digital backs for professional technical cameras, the image quality could be improved further to an unrivalled high level never seen before: So both series **HR Digaron-S** and **HR Digaron-W** really set a new lens standard.

HR Digaron-S

The lens series HR Digaron-S with focal lengths from 23 mm to 180 mm and an image circle diameter of 70 mm (80 mm for focal length 180 mm) can be used with all sensor sizes from 24 x 36 mm up to 36 x 56 mm and 40 x 54 mm.

With sensor sizes up to 33 x 44 mm, this image circle provides a large movement zone for parallel shifts to compensate for converging verticals as well as for swing and tilt of the lens to widen depth of field without additional stopping down (which would result in blur due to diffraction) to an extent as it is known from conventional professional large format studio cameras. (For comparing image circles or shifts with those from the familiar large format photography, they have to be converted according to the ratio of the respective format diagonals, e. g. to be devided by 3.6 for comparing 24 x 36 mm with 4 x 5".)

With the sensor size 37 x 49 mm the movement zone is a bit smaller, but it is still sufficient for landscape and most product photos. Even with the largest sensor sizes 36 x 56 mm and 40 x 54 mm the room to move is 2 mm to 3 mm. This does not allow larger perspective control; however, it ensures exemplary sharpness and uniform illumination up to the corners without vignetting.

Already with fully opened aperture an exceptional high resolution is achieved (optimum at f/4 to f/5.6) with more than 80 lp/mm even at the margin. This is very close to the diffraction limit and predestines this lens series for high resolution sensors with a pixel pitch down to approx. 5 µm. Such an excellent performance is owed to an unusual complex lens design (with up to 15 lens elements!) and last, but not least, owed to the correction of the aberrations caused by the sensor's protection glass thickness and to the almost perfectly flattened field. Such a glass thickness correction has never been applied before by any manufacturer to a photographic lens (only to microscope lenses).

HR Digaron-W

The lens series HR Digaron-W with focal lengths of 40 mm, 50 mm, 70 mm and 90 mm – more lenses are in preparation – has been developed to make large movements (parallel shift, lens swing and tilt) available even for the largest sensors. Those movements are required especially for architectural and

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industrial photography as well as for product shots from a very oblique angle. An image circle diameter of 90 mm at the focal lengths 40 mm and 50 mm, of 100 mm at the focal length 70 mm and of 125 mm at the focal length 90 mm leave nothing to be desired. Furthermore, the resolution provided by these lenses is close to the diffraction limit and barely second to the HR Digaron-S. Therefore, this lens series makes it possible for the first time to visualize the phantastic resolution of the largest sensors (40x54 mm) with 60 megapixels in combination with wide shifts and tilts for the correction of converging verticals and for extending the depth of field without excessive stopping down.

All lenses of the series HR Digaron-W have an exemplarily flattened field as well, and the sensor glass thickness has been taken into consideration in the optical design of the models with 40 mm, 50 mm and 70 mm focal length, too.

The lens series HR Digaron-W, originally intended for the larger sensors, can also be advantageous to smaller sensors, when panoramas (e.g. landscapes, townscapes, large interiors) shall be produced by “stitching”, which means a composing of two or more overlapping photos via imaging software. For this purpose, the camera must have a device for sliding the digital back in certain steps; the alingment of the camera must not be changed from shot to shot. By this way, with a 24x36 mm sensor, a panorama of up to 86x24 mm (with a horizontal sensor) or up to 82x36 mm (with a vertical sensor) could be realized within the image circle of 90 mm diameter of the 40 mm or 50 mm lens. The total pixel count of those panoramas would be the 2.4 fold or the 3.4 fold of the sensors pixel count respectively. Taken with the HR Digaron-W, the resulting panoramas would create an overwhelming impression for the viewer.

More common features of both lens series

The HR Digaron-S and the HR Digaron-W lenses provide the best available resolution of current production-line photographic lenses with an oversized image circle for camera movements. Correction of all significant aberrations (including astigmatism, koma and color fringes) was impoved to the highest possible standards, and it includes the above mentioned sensor glass thickness correction and an almost perfect field flattening. The MTF curves (MTF = modulation transfer function) certify unsurpassed imaging quality even with wide open apertures. It is no longer necessary to stop down more than for the appropriate depth of field, and this ensures the lowest blur due to diffraction.

But larger working apertures have even more benefits: With ambient light, they allow faster shutter speeds for freezing any motion in the motif, and with electronic flash they do not request expensive high energy flash generators.

Photographers who are afraid of insufficient depth of field with large apertures can be calmed down: On a small digital sensor (e.g. 24x36 mm) the depth of field is exactly the same as on a large format sheet film (e.g. 4x5") with an f-number that is the f-number for the sheet film devided by the format factor (3.6 in this case). Thus, when f-stop 22 would be sufficient for 4x5", an f-stop 22/3.6 = 6.1 would also be sufficient for 24x36 mm. This means that the large aperture fortunately avoids diffraction without reducing the depth of field.

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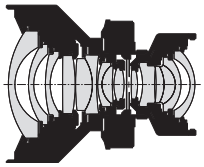
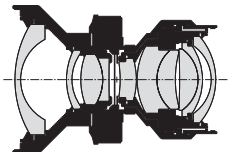
HR Digaron-S
23 mm f/5.6

HR Digaron-W
40 mm f/4





Both lens series HR Digaron-S and HR Digaron-W have got a specially optimized anti-reflection multi-coating on the surface of the last lens element to keep ghost and flare to the lowest level. This is very important because the higher reflectance of the sensor's protection glass (compared to conventional film) results in a higher intensity of light coming from the protection glass and falling onto the last surface of the lens. When this light is reflected once more backwards to the sensor, the resulting gost and flare ruins the contrast.

Because of the small sensor formats, the focal lengths of all lenses must be much shorter than those for large sheet film formats (the focal lengths are proportional to the format factor just as the f-numbers were for identical depth of field and identical diffraction). But shorter focal lengths also result in shorter back focal lengths, and this can be a problem with wide-angle lenses: The rear lens barrel may be so close to the sensor that they collide when the lens is tilted, or that it touches the frame of the rear camera standard (which holds the digital back) when the lens is shifted. Therefore, all wide-angle lenses of both lens series HR Digaron-S and HR Digaron-W have been designed as retro-focus lenses with a longer back focal length.This also extends the flange focal length and makes it possible to use flat lens boards instead of recessed ones for much better handling (setting aperture and shutter speed).

Luckily, the longer back focal length of the retro-focus lens design has one more very positive effect. The large angle of incidence of the light rays at the margin of the sensor is reduced, and this eliminates a big problem when the sensor has a microlens array in front of its pixel plane: Large angles of incidence lead to a severe vignetting because the microlenses cannot concentrate such light rays inside the light sensitive pixel area. But because of a longer back focal length the retro-focus wide-angle lenses of the HR Digaron-S and HR Digaron-W series do not suffer from dark image corners as known from other wide-angle lenses in combination with sensors with microlens arrays.

Finally, the new "barrel-in-barrel" lens alignment feature must be mentioned. High performance lenses, especially those with a very complex design, are more sensitive than normal lenses to a poor alignment of the axes of the front and the rear lens assembly. This alignment is influenced by tolerances of the shutter (a third party product). Therefore, all those HR Digaron-S and HR Digaron-W lenses have got a rear lens assembly with an adjustable inner barrel to allow a precise alignment of its optical axis with that of the front assembly after both lens assemblies have been screwed into the shutter. ■

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