

Glass-**SFR** *inspex*

Windshield Quality Control for
Perfect Image Recognition



LAVISION

FOCUS ON IMAGING



The Future in Clear View - Optimizing Image Quality for Autonomous Driving

To ensure the necessary windshield quality for future ADAS systems of higher levels, the current interior camera technologies require innovative measurement technology. Glass windshield designs are one of the essential optical elements for autonomous driving. The ADAS image quality can be as good as necessary, but the windshield distortion is even more critical. Therefore, glass windshield designs influence the imaging performance of the entire camera-based ADAS system. Crucial are the constructive condition and the installation position.

LaVisions **Glass-SFR inspex** provides comprehensive measurements of optical glass quality for safe autonomous driving with ADAS camera systems. Optical transmission parameters like contrast reduction or optical power (diopter) at the ADAS camera area of the windshield are carried out by image quality evaluation using innovative analysis techniques.

Future ADAS camera systems and their lenses will be designed for longer distances of 60 m and more. Especially for the viewing area of the camera field in the windshield, the camera working ranges at a hyperfocal distance require new, extended test criteria. Testing the optical refractive power of glass windshields alone is not sufficient. Therefore, a qualitative optical analysis of the SFR (Spatial Frequency Response) or MTF (Modulation Transfer Function) is required to evaluate the transmission optics or image quality.

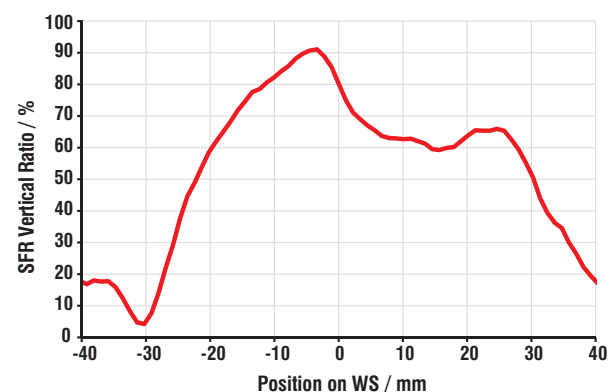
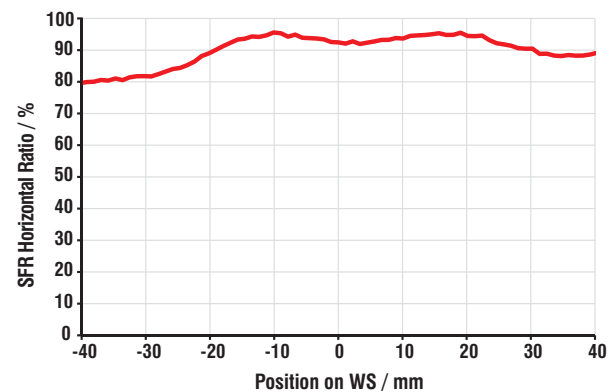
Spatial Frequency Response

To determine realistic object distances, the **Glass-SFR inspex** system is used to measure the effects of the windshield on the image quality of the ADAS camera systems.

Therefore, the glass is placed in front of the high-resolution autofocus camera system at the correct angle. Then, the images of the illuminated target are recorded through the windshield.

Precise comparison measurements of the SFR / MTF are received by the image analysis of object's edge contrasts following the ISO 12233. This analysis quantifies the optical influence of the windshield on the ADAS image quality.

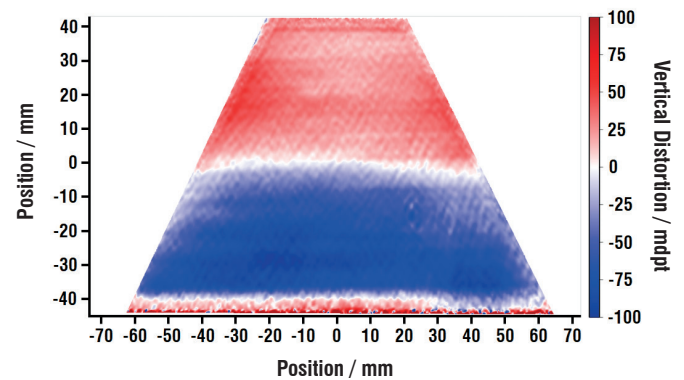
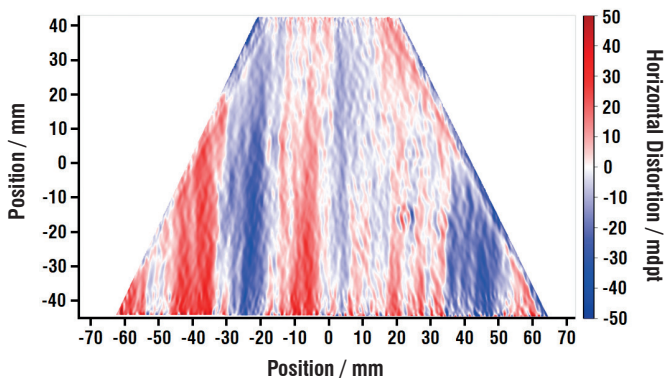
	Optical Power	SFR / MTF
Measurement	High resolution 2D distribution	Pointwise
Measuring range	± 600 mdpt	0% - 100%
Measuring precision	$< \pm 3\%$, < 1 mdpt	$< \pm 2\%$
Recording speed	8 images/s (transient mode)	



Analysis of the SFR of an ADAS camera area at a windshield by a vertical scan.

Optical Power

Additionally, the **Glass-SFR inspex** is capable of a precise 2D diopter analysis of the ADAS camera area at the windshield. The full-field imaging technique accurately measures the optical power of local distortions in milli-diopters with the highest spatial resolution. The system uses a structured background pattern and the digital image correlation (DIC) technique for this application.



Analysis of the optical power of an ADAS camera area at a windshield.

Key Benefits

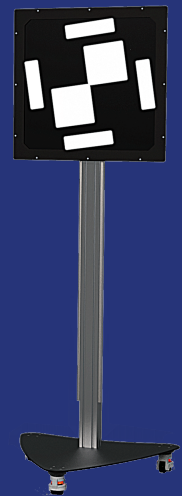
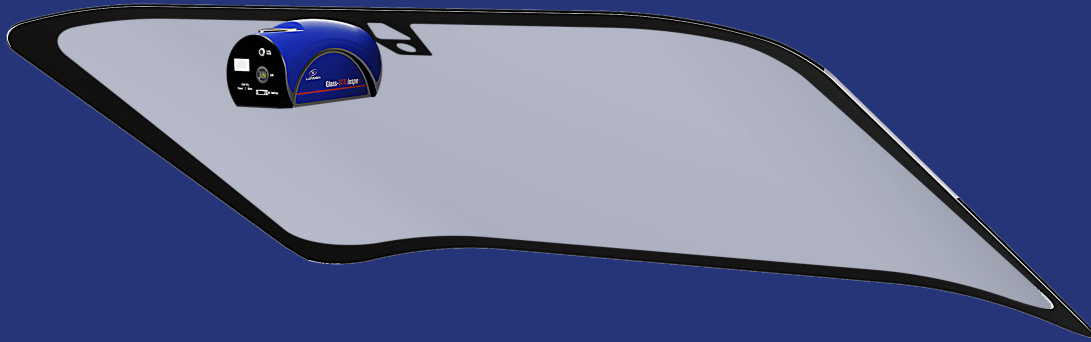
LaVision's modular, camera-based measurement system, **Glass-SFR inspex**, supports various users, such as R&D and ADAS camera system developers, OEMs of vehicles, as well as the automotive glass industry, in the quality control and evaluation of windshields in the laboratory or in the process with the following benefits:

- ▶ Glass quality control in terms of influences on ADAS imaging systems.
- ▶ High-resolution glass SFR / MTF measurement according to ISO 12233.
- ▶ Real test conditions for customized ADAS camera lenses
- ▶ Optional: high spatial resolution optical power analysis maps, precision < 1 mdpt.
- ▶ Innovative measurement technology, with advanced image processing hardware and intelligent, cutting-edge image processing software.
- ▶ Over 30 years of experience cooperating with the world's leading aerospace and automotive companies, universities, and well-known research institutes.



Glass-SFR *inspex*

Evaluate the Windshield-Induced
Contrast Reduction



LaVisionUK Ltd

2 Minton Place / Victoria Road
Bicester / Oxon / OX26 6QB / United Kingdom
E-Mail: sales@lvisionuk.com
www.lvisionUK.com
Phone: +44-(0)-870-997-6532
Fax: +44-(0)-870-762-6252

LaVision GmbH

Anna-Vandenhoeck-Ring 19
37081 Göttingen / Germany
E-Mail: info@lvision.com
www.lvision.com
Tel.: +49-(0)5 51-9004-0
Fax: +49-(0)551-9004-100

LaVision Inc.

211 W. Michigan Ave. / Suite 100
Ypsilanti, MI 48197 / USA
E-Mail: sales@lvisioninc.com
www.lvision.com
Phone: (734) 485 - 0913
Fax: (240) 465 - 4306