



LA VISION

WE COUNT ON PHOTONS

Hybrid Camera Endoscope System for UV

Target to engines

LaVision offers a new kind of UV endoscope that benefits from included diffractive optics, which allows improving the image quality such as brightness and chromatic performance in an outstanding manner compared to classical optics.

The target setup of the **Hybrid Camera Endoscope** is the application to minimum invasive in-cylinder measurements in engines. Many UV-emission based techniques are known like

- ▶ fuel LIF
- ▶ air-fuel ratio with FARLIF
- ▶ liquid-vapor separation with exciplex LIF
- ▶ spray patternation on the direct injection system
- ▶ planar spray sizing with combined Mie/LIF
- ▶ flame front diagnostics via OH self emission or OH-LIF

Why is it called „hybrid“?

The word hybrid stresses the fact, that the entire device is a combination of a classical endoscope objective with refractive lenses and a single diffractive optical element (DOE) to compensate for lens aberrations, which are hard to correct with classical optics in the UV.

What is „diffractive optics“?

Lenses achieve their optical properties by refraction on curved surfaces and the dispersion of the glass material. In contrast to that diffractive optics consist of a computed phase pattern on a flat plate, similar to a phase hologram, to introduce an optical element into the endoscope. The so-called phase function is calculated from the desired optical properties of the entire system and can compensate lens aberrations and dispersion.

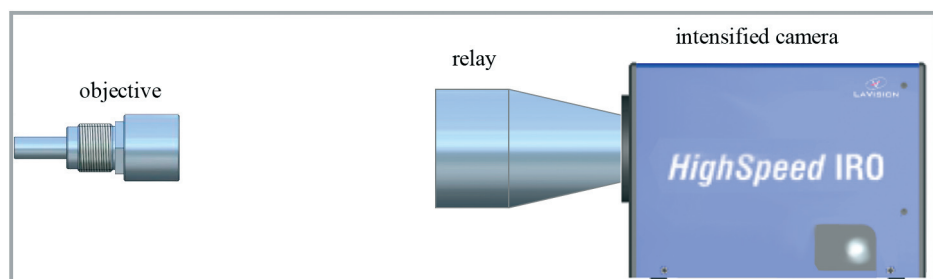
Why integrating „diffractive optics“?

In the new endoscope system an element is integrated, that redirects light via diffraction on grating-like microscopic structures. The presented design profits of the inherent property of strong negative dispersion of diffractive optics and an aspheric phase function, so a very effective correction of lens aberrations could be realized. This enables the high lens speed and light efficiency with a minimum number of elements and a small front endoscope.

Setup

The endoscope system consists of 2 parts

- ▶ The objective is close to the measurement plane and mounted into the engine's body
- ▶ The relay is mounted to the stationary (intensified) camera and contains the diffractive optics element



Components of the Hybrid Endoscope System.

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Engine Setup

The endoscope's objective is compact enough to be mounted easily into an engine*). The engine and the camera are not mechanically coupled to avoid vibrations transferred to the in most cases heavy intensified camera. The endoscope specifications are given for a vibration amplitude of ± 0.5 mm in all 3 directions, without a significant loss of performance.

Related products

- ▶ laser endoscopes
- ▶ laser articulated arms
- ▶ camera filter sets
- ▶ intensified CCD cameras

*) Pressure sealing not included

Specifications

Optical data

optimized wavelength ¹⁾	280-340 nm
usable wavelength ²⁾	265-400 nm
viewing direction	0° (straight)
cone angle of view	>50°
object field diameter	42 mm
image field diameter	16 mm
quadratic object field	30 mm × 30 mm
quadratic image field	13 mm × 13 mm
optimized working distance	35 mm
vignette, center/edge	better than 2:1 (inside 38 mm object diameter)
resolution ³⁾	at least 100×100 pixel in 30×30 mm object size with 40% contrast square wave response
coating	antireflective UV broadband coating
effective f-number	4.5-6

¹⁾ chromatically corrected for entire range

²⁾ with reduced spectral bandwidth and/or resolution

³⁾ for a polychromatic light source with a constant emission spectrum over the optimized range

Dimensions of overall system

- ▶ relay length 93 mm
- ▶ distance relay - objective 170-220 mm
- ▶ relay diameter 60 mm

Dimensions of objective

- ▶ total length 75 mm
- ▶ end tube diameter 10 mm
- ▶ free aperture 8 mm
- ▶ end tube length 24 mm
- ▶ mounting thread M22×1.5

Data provided by LaVision is believed to be true. However, no responsibility is assumed for possible inaccuracies or omissions. All data are subject to change without notice.

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Ordering information

part number	Description
1108850	Hybrid Camera Endoscope

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