

XRE Lens

Near-Eye Display Test Solution with Electronic Focus



Applications

- Measurement of near-eye displays (NEDs) and extended reality (XR) devices: augmented (AR), mixed (MR), and virtual reality (VR) headsets
- Test and measurement of luminance, chromaticity, contrast, modulation transfer function (MTF), image distortion, image sticking, and x,y image position
- Characterization and quality control for devices in R&D and production

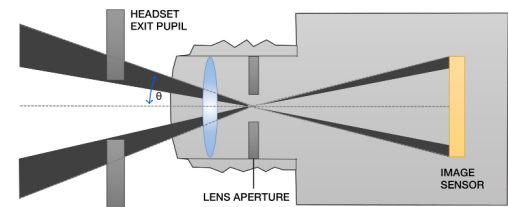
Benefits

- Electronic focus
- Fold-mirror option to enable 'periscope' measurement
- High-resolution measurements with up to $\pm 35^\circ$ FOV
- Distortion correction to normalize images before testing
- Spatial positions reported in degrees ($^\circ$) via software
- Pairs with high-resolution ProMetric® Imaging Colorimeters and Photometers
- Easy-to-use measurement control and analysis software

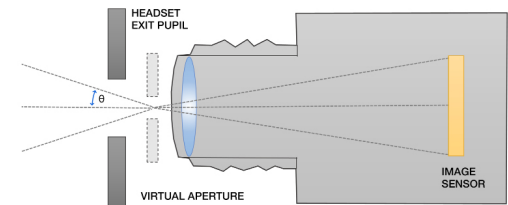
Specially designed lens and configuration options for near-eye display testing within extended reality (XR) headsets

The Radiant Vision Systems XRE lens has a unique optical design specially engineered for measuring near-eye displays (NEDs), such as those integrated into virtual (VR), mixed (MR), and augmented reality (AR) headsets. The patent-pending lens design simulates the size, position, and field of view of the human eye. Unlike alternatives, where an aperture is located inside the lens, the entrance pupil of the XRE lens is located in front of the lens. This enables the positioning of the imaging system's entrance pupil within NED headsets to view head-mounted displays (HMDs) at the same location as the human eye. With the entrance pupil in front of the lens, the connected imaging system can capture a wide field of view (FOV) of the display (up to $\pm 35^\circ$) without occlusion by hardware. The effective aperture size of 3.3 mm matches the size of a human entrance pupil, allowing displays to be measured under the same conditions as they are viewed by a user.

The XRE lens mounts directly to a Radiant high-resolution ProMetric® Y-series Imaging Photometer or I-series Colorimeter. Radiant TrueTest™ Software provides the leading display test algorithms and a specialized test suite for XR display analysis within the TT-ARVR™ Software module, including: modulation transfer function (MTF) to evaluate image clarity based on Line Pairs, Slant Edge Contrast (ISO 12233), or Line Spread Function (LSF); Distortion; Focus Uniformity; reporting the horizontal, vertical, and diagonal device FOV; and giving spatial x,y positions in degrees ($^\circ$). Extensive data analysis functions are supported, including isometric plots, cross-section graphs, radar plots, bitmaps and CIE color plots.



Aperture location inside of standard lens results in image occlusion.



Entrance pupil in front of lens enables imaging the full display field of view.



Key Features

- Electronic focus to adjust focal settings via software
- Entrance pupil positioned in front of lens to simulate human eye entrance pupil
- Effective aperture size (3.3 mm) to simulate human eye pupil size
- Field of view up to $\pm 35^\circ$ (70° total)

Specifications

Parameter	XRE Lens		
Primary Application	Light and color measurement for near-eye displays (NED) in headsets		
Effective Aperture	3.3 mm*		
Focus	Electronic		
Focus Distance**	Range 0.5 m to infinity		
Minimum Inter-Pupillary Distance	63 mm		
Fold Length of Optional Fold Mirror	173 mm		
Luminance - Minimum	0.01 cd/m ²		
Luminance - Maximum***	10,000 cd/m ² (Y-series); 1,000,000 cd/m ² (I-series)		
Measurement Capabilities****	Luminance, Radiance, CIE Chromaticity Coordinates, Correlated Color Temperature (CCT)		
Units****	cd/m ² , nit, W/sr/m ² , foot-lambert, CIE (x, y) and (u', v'), Kelvin (CCT)		
Paired with Camera	ProMetric I29	ProMetric Y45	ProMetric Y61, I61
Approximate Field of View (Horizontal)	$\pm 35^\circ$	$\pm 35^\circ$	$\pm 35^\circ$
Approximate Field of View (Vertical)	$\pm 35^\circ$	$\pm 28^\circ$	$\pm 35^\circ$
Resolution	0.017° / sensor pixel	0.010° / sensor pixel	0.012° / sensor pixel

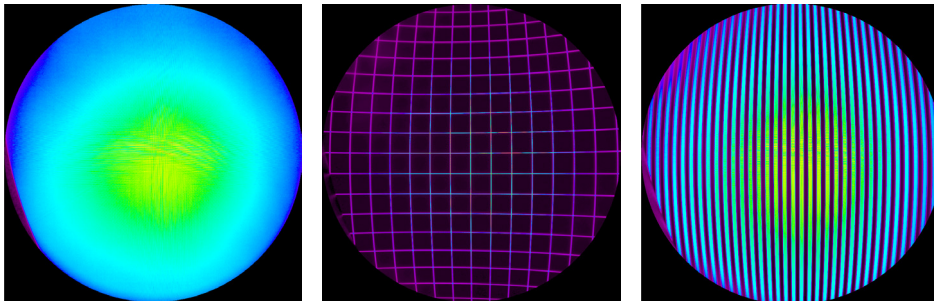
Specifications subject to change without notice.

* Contact Radiant for relevant drawings.

** Measured from front of lens.

*** Maximum luminance is for 1 ms. For higher luminance for Y-series cameras, contact info@radiantvs.com.

**** Color measurement available with I-series cameras only.



Images of XR display test patterns captured by the XRE Lens inside a VR headset. Patterns from left to right: ANSI Brightness, Distortion Line Grid, and MTF Line Pair. Images shown in false-color scale for luminance (cd/m²) within Radiant's TT-ARVR™ Software for XR display testing.

XRE Lens Options



Non-folded XRE lens, shown with ProMetric Y-series imaging photometer



XRE lens with fold mirror, shown with ProMetric I-series imaging colorimeter

Designed for positioning the camera entrance pupil at the eye position within XR headsets.

System Recommendations

- High-resolution ProMetric Imaging Photometer (Y61) or Colorimeter (I29 or I61) for maximum-FOV imaging
- TT-ARVR Software module