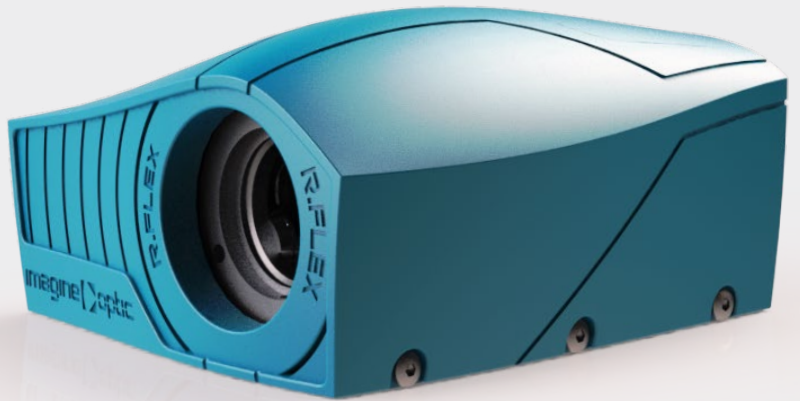


**COMPACT**  
AND SELF-ILLUMINATION

**METROLOGY TOOL**  
FOR LARGE OPTICS

**EASY TO USE**  
AND VERSATILE

**LARGE DYNAMIC**  
AND HIGH ACCURACY



The most practical and cost effective metrology tool for characterizing optical components such as large concave mirrors, lenses, complex optical systems, and beam expanders

## A UNIQUE SET OF ADVANTAGES

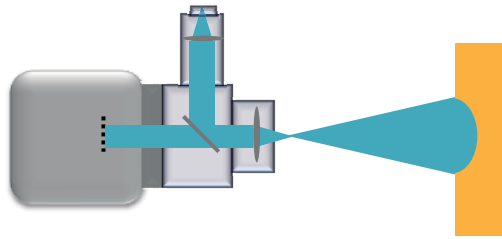
- Standard accuracy of  $\lambda/100$  rms and  $\lambda/200$  rms in double pass configurations
- Patented measurement technology of phase and intensity simultaneously and independently, and also large dynamic
- Insensitivity to vibrations and atmospheric turbulences
- Very low pupil distortion <3%
- Collimated exit beam or divergent exit beam with different focusing modules from F/1 to F/16
- Allows inspection with a desired wavelength
- Dismountable wavefront sensor for using as a stand-alone unit
- Numerous accessories (translation stages, reference mirrors, laser diodes...)

Delivered with WaveView metrology software

Contact us for more details: [contact@imagine-optic.com](mailto:contact@imagine-optic.com) or +33 (0) 1 64 86 15 60

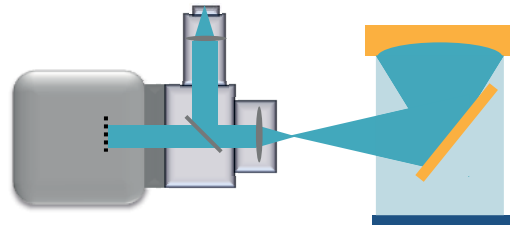
### Measuring large concave mirrors

HASO R-Flex has been optimized using proprietary designs that enable manufacturers to accurately measure large uncoated concave mirrors by positioning the unit to measure at the center of curvature.



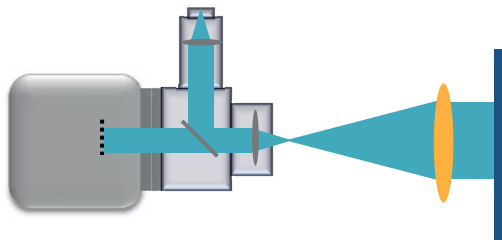
### Characterizing complex optical systems

Complex systems such as telescopes and collimators can be readily characterized by HASO R-Flex. The best focus point can be found using the wavefront error whereas, if the focus point is defined mechanically, optics can be aligned for that point.



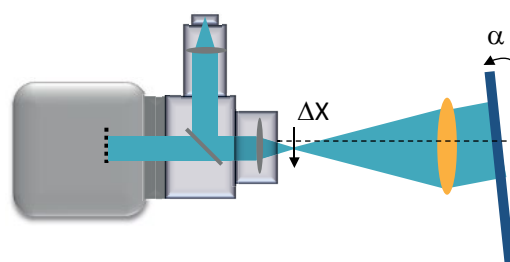
### Measuring lenses on-axis

Lenses of any diameter are easily measured with HASO R-Flex by using a coated or uncoated flat reference mirror to reflect the beam back to the wavefront sensor without adding any aberrations.



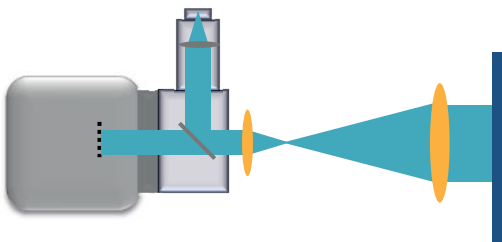
### Characterizing lenses in the field

By mounting your HASO R-Flex onto a translation stage and orienting your flat reference mirror correspondingly, you can measure lenses at any point in the field.



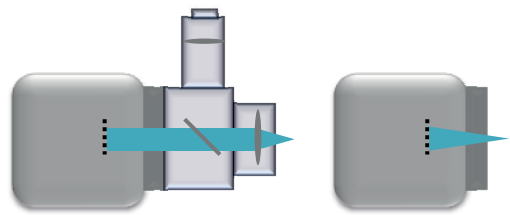
### Characterizing & aligning beam expanders

HASO R-Flex's modularity is particularly useful as its focusing unit dismounts quickly and therefore a collimated beam can be used as an illumination source to characterize the beam expander adding any aberrations.



### Working with external sources

High N/A external sources can be accurately measured because the optical head can be completely characterized (left image). Dismount it, and you can use the wavefront sensor as a stand-alone unit (right image).



## HASO3 R-Flex 32

HASO3 R-Flex 32	Pupil size (mm <sup>2</sup> )	Sensitivity rms (nm) <sup>1</sup>	Relative Accuracy rms (nm) <sup>1</sup>	Sampling points	Weight (kg)	Size WxHxD(mm <sup>3</sup> )
	4.9 x 6.1	3	4	32 x 40	0.7	98 x 70 x 114
Focusing Modules	Focal length (mm) <sup>2</sup>	F-number	WFE rms (nm) <sup>3</sup>	Working distance (mm) <sup>4</sup>	Pupil imaging <sup>5</sup>	Pupil distortion
MOD32-1	4.5	1	150	0.6	NO*	1.0%
MOD32-2	9	2	30	1.2	NO*	1.0%
MOD32-4	19	4	150	-2.3	YES	3.0%
MOD32-6	31	6.4	60	5.5	YES	1.5%
MOD32-9	45	10	40	2	YES	0.7%
MOD32-16	75	16	20	73	YES	0.2%
*AFO-x1	allows pupil imaging on MOD32-1 and MOD32-2					

## HASO4 R-Flex 50

HASO4 R-Flex 50	Pupil size (mm <sup>2</sup> )	Sensitivity rms (nm) <sup>1</sup>	Relative Accuracy rms (nm) <sup>1</sup>	Sampling points	Weight (kg)	Size WxHxD (mm <sup>3</sup> )
	5.2 x 7.0	3	4	50 x 68	0.5	110 x 60 x 122
Focusing Modules	Focal length (mm) <sup>2</sup>	F-number	WFE rms (nm) <sup>3</sup>	Working distance (mm) <sup>4</sup>	Pupil imaging <sup>5</sup>	Pupil distortion
MOD50-1	4.5	1	150	0.6	NO*	1.0%
MOD50-2	9	2	30	1.2	NO*	1.0%
MOD50-4	19	3.8	150	-2.3	YES	3.0%
MOD50-6	31	6.2	60	5.5	YES	1.5%
MOD50-9	45	9	60	2	YES	0.7%
MOD50-15	75	15	50	73	YES	0.2%
*AFO-x1	allows pupil imaging on MOD50-1 and MOD50-2					

## HASO3 R-Flex 128

HASO3 R-Flex 128	Pupil size (mm <sup>2</sup> )	Sensitivity rms (nm) <sup>1</sup>	Relative Accuracy rms (nm) <sup>1</sup>	Sampling points	Weight (kg)	Size WxHxD(mm <sup>3</sup> )
	14.6 x 14.6	3	4	128 x 128	1.6	80 x 194 x 270
Focusing Modules	Focal length (mm) <sup>2</sup>	F-number	WFE rms (nm) <sup>3</sup>	Working distance (mm) <sup>4</sup>	Pupil imaging <sup>5</sup>	Pupil distortion
MOD128-1 <sup>6</sup>	13	1	150	0.6	YES	1.0%
MOD128-2 <sup>6</sup>	26	2	60	1.2	YES	1.0%
MOD128-5.1	75	5.1	150	33	YES	3.5%
MOD128-7.9	115	7.9	100	54	YES	2.5%
MOD128-10	146	10	80	90	YES	2.0%

(1) can be divided by 2 if the optical system under test is characterized by double-pass method

(2) focal length of the module

(3) WFE is the wavefront error at the output of the module for the largest included round pupil.

(4) distance between the focalization point and the first optics (alignment holes must be removed)

(5) YES means that the microlenses are imaged at infinity by the module.

(6) These modules consist of the association of a x3 beam expander and MOD32-1 or MOD32-2.

## Accessories

### Translation stage

Our  $\Theta X \Theta Y$  rotation stage for angular alignment or 5-axis stage that provides 2-way rotation about X and Y axes as well as 3-way translation along the X, Y and Z axes is the perfect complement to HASO R-Flex.

### Software add-on

HASO R-Flex is delivered with WaveView software. We provide optional software modules including MTF (Modulation Transfer Function) and PSF (Point Spread Function) that enable you to increase HASO R-Flex's functionality.

### Reference mirror

To complete your metrology system, we can provide a spherical reference mirror ( $\varnothing 20\text{mm}$  useful pupil,  $< 10\text{ nm rms}$  surface error with respect to a perfect sphere,  $R=15\text{mm}$ ,  $NA \sim 0.73$ ) for calibrating your HASO R-Flex in double-pass measurement configuration.

### Additional diode lasers

For those who want to use their HASO R-Flex at different wavelengths, we can provide additional single-wavelength diode lasers to further expand the versatility of your system.

## HASO3 R-Flex 128

For high-resolution measurements, HASO3 R-Flex128 gives more than 12000 sub-pupils.



## Focusing module

Standard and customized objective modules with pupil imaging are available.

