

HASO™ R-Flex

Compact Auto-Illuminated Wavefront Sensor

The most advanced turnkey solution
for wavefront sensing and analysis.

Characterize:

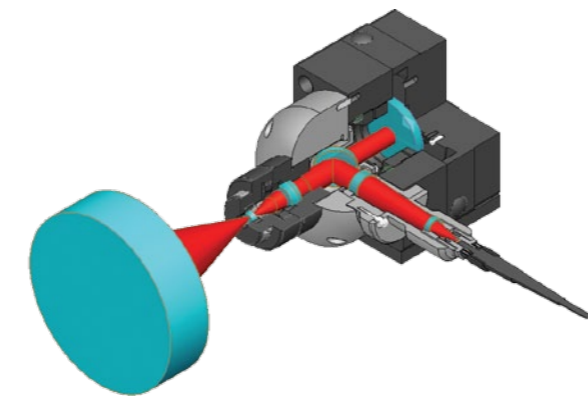
- large concave mirrors
- lenses on-axis
- lenses in the field/off-axis
- complex optical systems
- beam expanders
- external sources



Imagine Optic™

imagine-optic.com

HASOTM R-Flex



- Analyze the transmitted wavefront of optical systems
- Perform precision characterization of optical surfaces
- Increase the N/A for direct wavefront measurement

HASO R-Flex unites Imagine Optic's patented HASO Shack-Hartmann wavefront sensors with an auto-collimator and a focusing module to provide users with a versatile and turnkey solution for precision characterization of optical systems and surfaces. It's standard accuracy of $\lambda/100$, $\lambda/200$ in double pass configurations, and insensitivity to vibrations or atmospheric turbulence enable users to perform measurements that meet the most stringent requirements for reliable, repeatable results. Even more, accuracy can be further increased if the measured aberration is close to the diffraction limit.

Because different users have different needs, the $f/\#$ of HASO R-Flex can be adapted to each user's requirements by choosing the focusing module best suited for the task at hand. As the sample $f/\#$ defines the best focusing module, Imagine Optic offers factory models that are available from $f/\#=2$ to $f/\#=30$ to ensure maximum resolution, whereas custom models for special needs can equally be delivered. Please see the back cover for a list of standard focusing units.

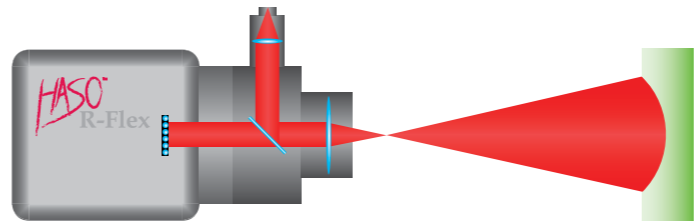
Characterizing large optical components or complex systems is performed easily as the exit beam is divergeant, thereby allowing users to set to focal spot to any point. When set at the the center of concave mirrors, surface defects can be measured and analyzed.

HASO R-Flex is delivered with HASOv3 wavefront measurement and analysis software that runs under Windows XP and 7 (version B for x64). It displays aberrations in real-time so that users can immediately see the effects of various positioning or alignment adjustments. It's small footprint allows to it be easily mounted onto translation stages so samples can be measured on-axis or at any point in the field.

To speak with a sales engineer, learn more or to find a distributor in your region, please visit www.imagine-optic.com/find.

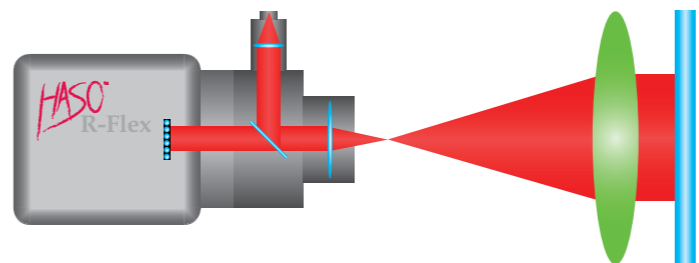
Measuring large concave mirrors

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.



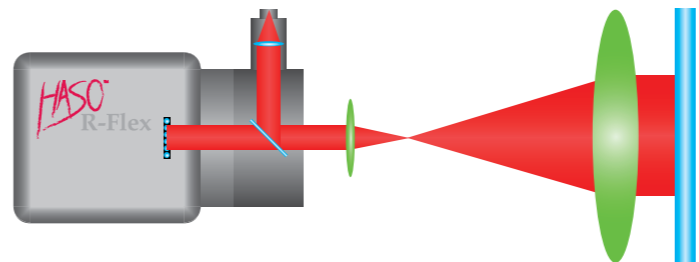
Measuring lenses on-axis

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.



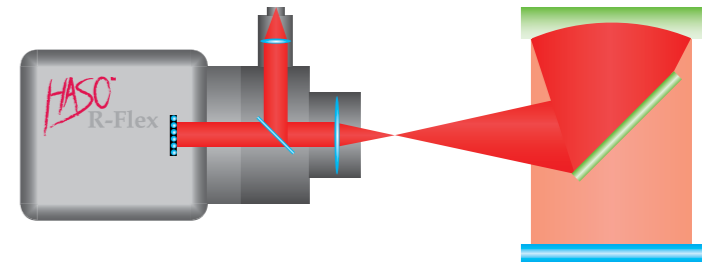
Characterizing & aligning beam expanders

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.



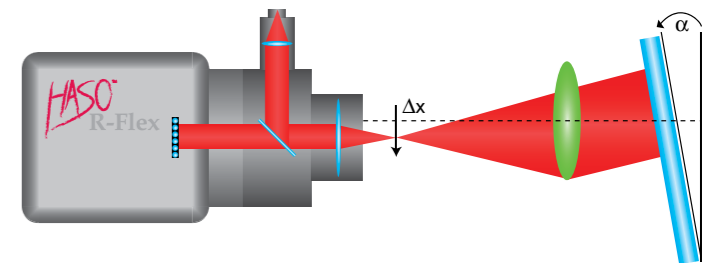
Characterizing complex optical systems

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.



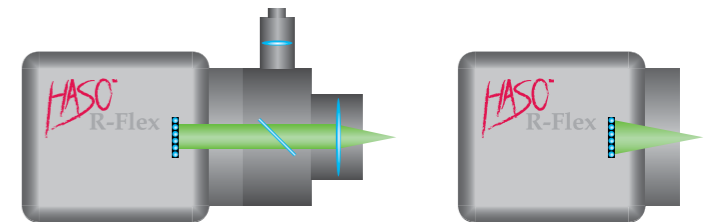
Characterizing lenses in the field

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.



Working with external sources

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



Green elements indicate the characterized components.

HASO R-Flex 32	Pupil size (mm ²)	Sensitivity rms	Relative Accuracy rms	Sampling points	Weight	Size(w/h/d)
		4.9 x 6.1	3 nm ¹	4 nm ¹	32 x 40	0.7 Kg
Focusing Modules	Focal length (mm) ²	f-number	WFE (nm) rms ³	Working distance (mm) ⁴	Pupil imaging ⁵	Pupil distortion
MOD32-2	9	2.0	20	1.2	NO	1.0%
MOD32-4	19	4.0	150	-2.3	YES	3.0%
MOD32-6.4	31	6.4	60	1.9	YES	1.5%
MOD32-10	45	10.0	40	-1.0	YES	0.7%
MOD32-12.5	60	12.5	30	11.5	YES	0.3%
MOD32-16	75	16.0	20	21.7	YES	0.2%
MOD32-24	117	24.0	20	29.0	YES	0.2%
MOD32-30	150	30.0	20	144.5	YES	0.2%

HASO R-Flex 76	Pupil size (mm ²)	Sensitivity rms	Relative Accuracy	Sampling points	Weight	Size(w/h/d)
		8.7 x 11.4	3	4	76 x 100	1.6 Kg
Focusing Modules	Focal length (mm) ²	f-number	WFE (nm) rms ³	Working distance (mm) ⁴	Pupil imaging ⁵	Pupil distortion
MOD76-3	26	3.0	30	10	NO	1.5%
MOD76-8.7	75	8.7	100	9	YES	1.8%
MOD76-13.4	115	13.4	80	30	YES	1.5%
MOD76-17	146	17.0	60	65	YES	1.0%

HASO R-Flex 128	Pupil size (mm ²)	Sensitivity rms	Relative Accuracy	Sampling points	Weight	Size(w/h/d)
		14.6 x 14.6	3	4	128 x 128	1.6 Kg
Focusing Modules	Focal length (mm) ²	f-number	WFE (nm) rms ³	Working distance (mm) ⁴	Pupil imaging ⁵	Pupil distortion
MOD128-2	26	2.0	60	10	NO	4.0%
MOD128-5.1	75	5.1	150	9	YES	3.5%
MOD128-7.9	115	7.9	100	30	YES	2.5%
MOD128-10	146	10.0	80	65	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 mechanics (if negative, the focalization spot is inside the mechanics). 5: YES means that the microlenses are imaged at infinity by the module.

Accessories (sold separately)

Translation stages	Whether you choose the ΘXΘY for easy 2-way rotation on the X and Y axis for angular alignment or our 5-axis translation stage that provides 2-way rotation on the X and Y axis as well as 3-way rotation along the X, Y and Z axis, these units are the perfect complement to HASO R-Flex.
Software add-ons	HASO R-Flex is delivered with HASOv3 software. We provide several optional modules including MTF (Modulation Transfer Function) and PSF (Point Spread Function) that enable you to increase HASO R-Flex's functionality.
Auto-collimation & reference mirrors	To complete your metrology system, we can provide you with a Ø 20mm spherical reference mirror with an optical quality of λ/20 P/V for calibrating your HASO R-Flex as well as an orientable auto-collimation flat mirror for double-pass measurement configurations.
Additional laser diodes	For those who want to use their HASO R-Flex at different wavelengths, we can provide you with additional mono-wavelength laser diodes to further expand the versatility of your system.



HASO R-Flex comes complete with a laser diode, frame grabber, cables and HASOv3 software.