

## Manually Tunable Lens ML-20-37



The curvature of the lens can be manually changed from convex to flat to concave by rotating the outer ring attached to the lens. The focal length is accordingly tuned to a desired value.

The following table gives the specification of our standard manual lens. Lens aperture, thickness and tuning range can be adapted in the framework of a customization project.

### Mechanical specifications

Optical aperture <sup>1</sup>	20	mm
External diameter	37 (39 including gears)	mm
Thickness	13.2	mm
Weight	13.7 (without adapter) / 25.2 (with adapter)	g
Max torque	80 (at gear teeth)	mNm
Full tuning angle	337	°

### Optical specifications

Lens type	from plano-convex to plano-concave	
Optical power tuning range (BFL <sup>2</sup> )	-18 to +18	Dpt
Focal tuning range (BFL)	-55 to infinity to +55	mm
Focus resolution	Depends on motorization	
Optical liquid		
Refractive index @20°C	1.38	
Abbe number V	65	
Transmission spectrum	See Figure 2	
Wavefront error (@525 nm, 5mm CA)	0.95 (across tuning range) 0.19 (at 0 dpt)	λ RMS
Polarization	preserving	
Temperature drift	TBD	Dpt/°C

### Environmental specifications

Operating temperature	10 to 40	°C
Storage temperature	-20 to +75	°C
Humidity	30-50 (non-condensating)	% R.H.
Lifetime (#random cycles)	5 mio	#

Standard Product	Tuning range	AR Coating	C-mount adapter
ML-20-37-VIS-36D	-18 to +18 dpt	400nm -700nm	no
ML-20-37-VIS-36D-C	-18 to +18 dpt	400nm -700nm	yes

<sup>1</sup> Recommended useful aperture is 80% of clear aperture

<sup>2</sup> Back-focal length

## Mechanical mounting

Figure 1 shows the dimensions of the ML-20-37 lens. The back-focal range is measured from the mating surface of the housing of the OEM lens. This surface lies 5.4 mm behind the outermost surface of the C-mount adapter. The ring is used to set the focal range to the desired value.

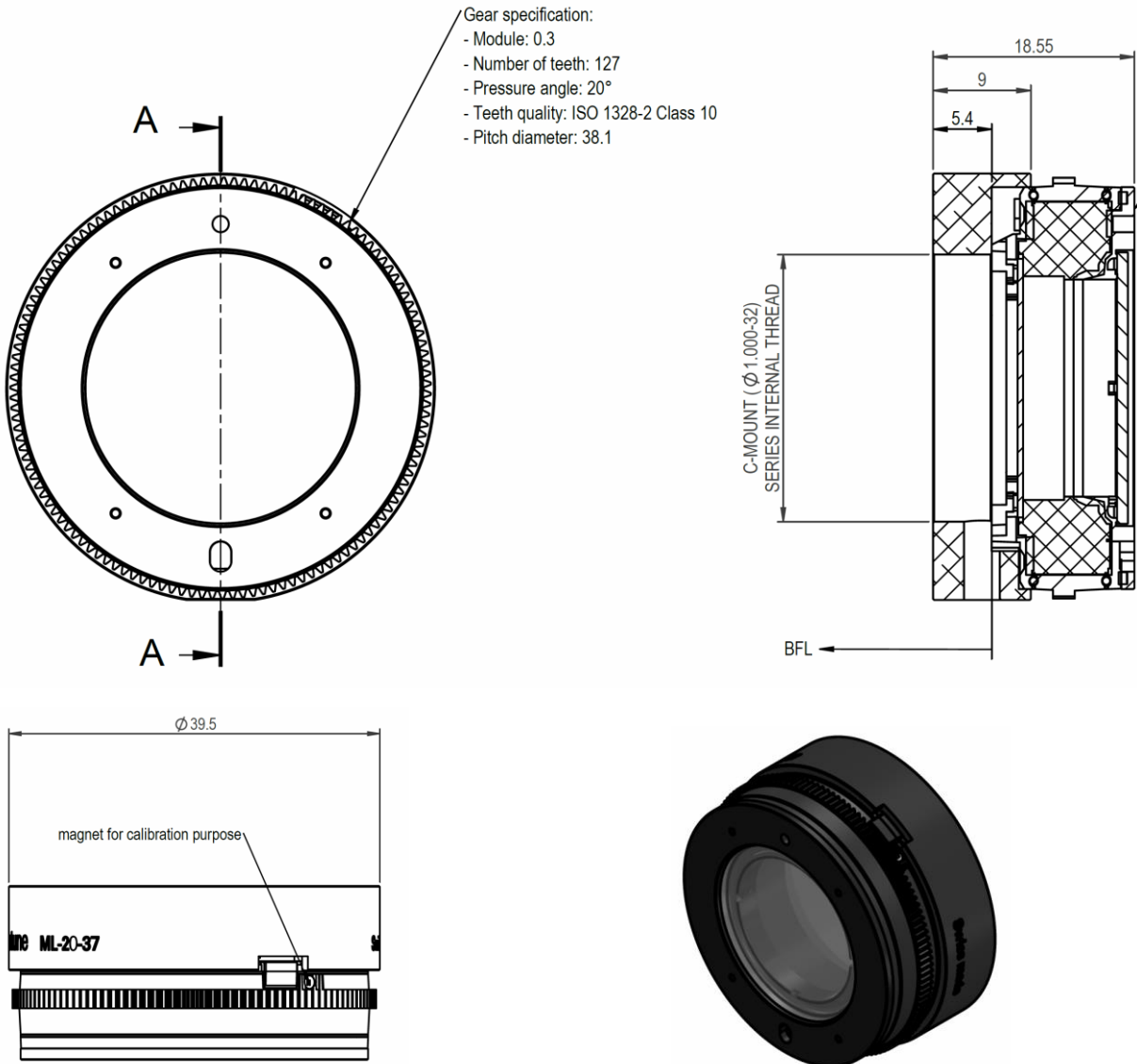


Figure 1: Mechanical layout of ML-20-37-VIS-36D-C (unit: mm)

## Motorization

The ML-20-37 can be motorized using either a direct drive or a worm gear. The magnet can be used for calibration purposes.

## Transmission

Both the optical fluid and the membrane material are highly transparent in the range of 400 to 2500 nm. As the membrane is elastic it cannot be coated using standard processes, hence a reflection of 3 – 4 % is to be expected.

Cover glasses can be coated as desired. Figure 2 shows the transmission spectrum for the standard broad-band VIS coating.

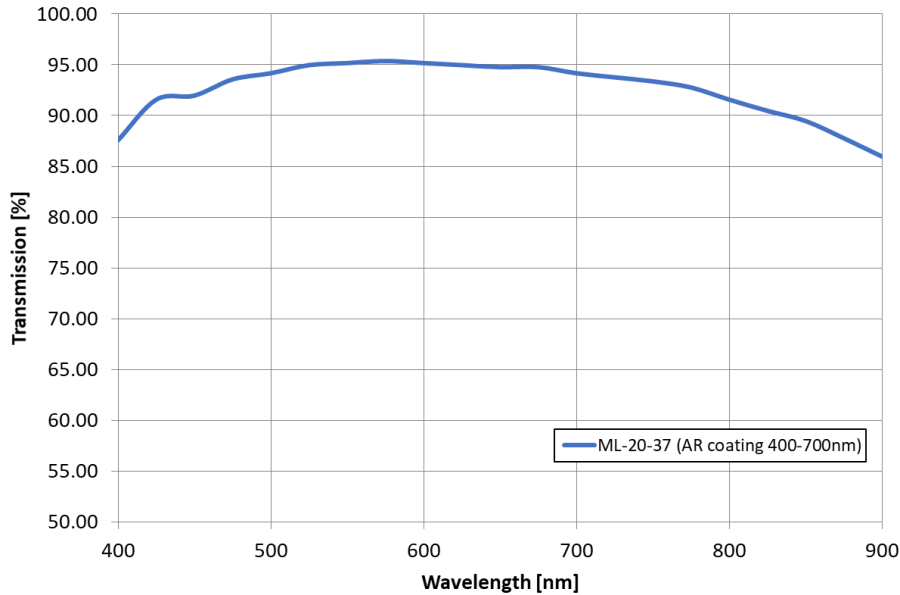


Figure 2: Transmission spectrum of the ML-20-37 with standard VIS coating.

## Wavefront quality

*In principle, Optotune's focus tunable lenses exhibit a spherical lens shape. Results are summarized in*

Figure 3. With the lens lying horizontally (optical axis vertical), the RMS wavefront error of the ML-20-37 (measured at 525 nm) is  $0.95\lambda$  and  $0.19\lambda$  over the full tuning range and at 0 dpt, respectively.

Coming soon

Figure 3: Typical wavefront measurement of the ML-20-37 at 525 nm, defocus, tilt & sphere excluded.

## Optical layout

Figure 4 contains the information needed to model the ML-20-37 lens for simulation. A precise ZEMAX model can be downloaded from our website. As the cover glass is moved up and down, the membrane deflection changes continuously.

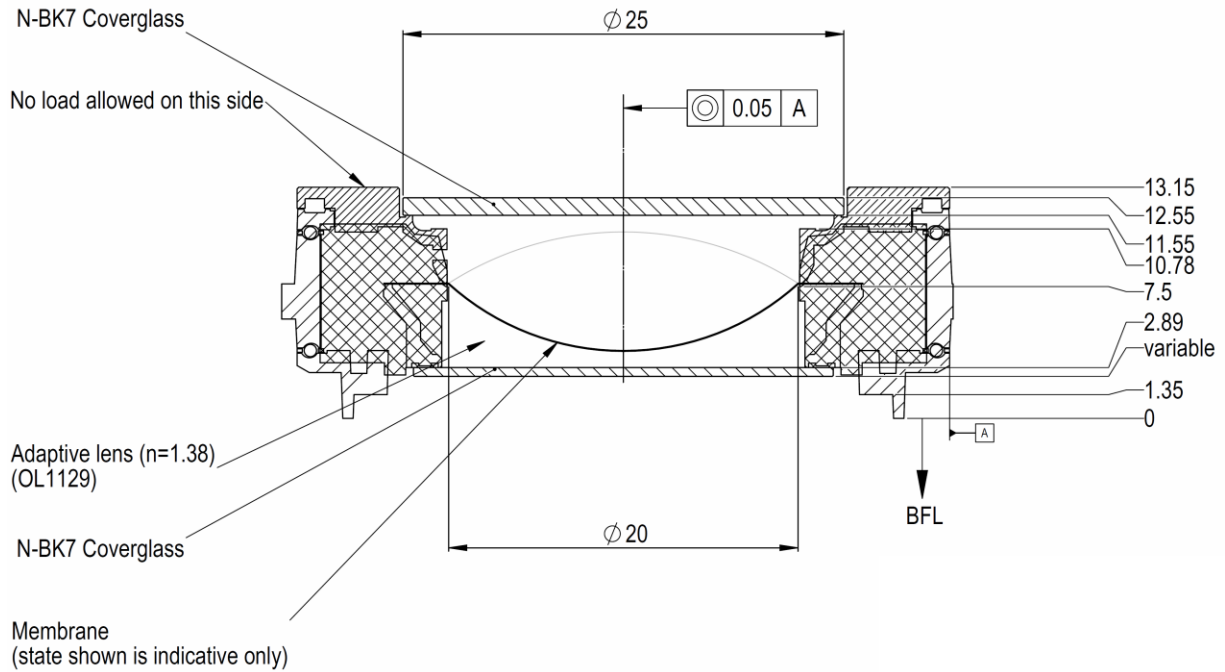


Figure 4: Optical layout of the ML-20-37

## Mounting possibilities

As depicted there exists different mechanical mounting possibilities of the C-mount version. For mounting recommendations of the version without C-mount adapter, please contact Optotune.



Figure 5: Mounting possibilities for the ML-20-37-C.

(a) ML-20-37-VIS-LD-C shown with a standard 1/2" optical post mount with M4 screw.

(b) ML-20-37-VIS-LD-C mounted to a 30 mm to 60 mm Cage Plate Adapter ([LCP02/M](#)) with the help of a C-mount to SM1 adapter ring ([SM1A39](#))

## Safety and compliance

The product fulfills the RoHS and REACH compliance standards. The customer is solely responsible to comply with all relevant safety regulations for integration and operation.

For more information on optical and mechanical parameters, please contact [sales@optotune.com](mailto:sales@optotune.com).