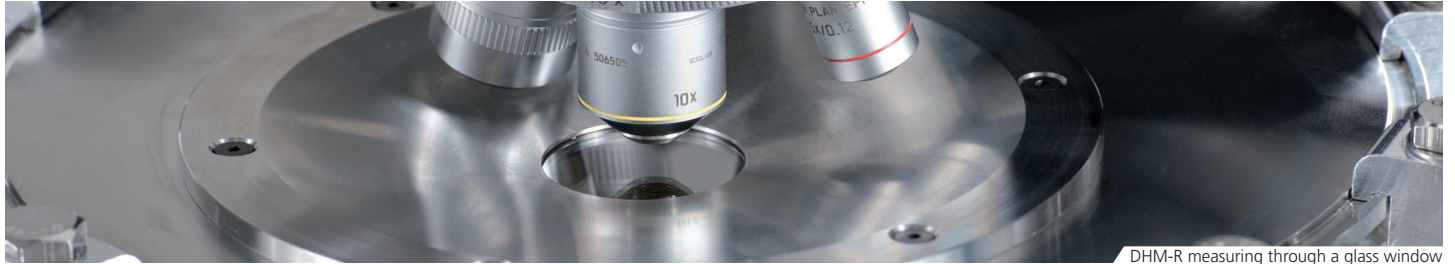


## DHM<sup>®</sup> - R series

Reflection configured Digital Holographic Microscope (DHM<sup>®</sup>), a non-scanning and non-contact method for static and dynamic 3D topography as well as vibration characterization.



DHM-R measuring through a glass window

Unrivaled Speed

### 3D profilometry at unrivaled speed

DHM<sup>®</sup> measures the 3D topography map of a surface with a single acquisition, without any scanning mechanism required. It provides unbeatably fast acquisition, at camera rate of up to 1000 fps, enabling:

- Study of the 3D dynamic behavior of deformable samples
- Fast screen and analysis of large surfaces
- Routine inspections with high productivity
- Capture of 3D topographies on the production line, without stopping the sample

### MEMS analysis, up to 25 MHz

The optional stroboscopic unit synchronizes the DHM<sup>®</sup> measurements with the excitation signal of a MEMS device. The analysis of this unique set of data provides:

- Time-sequence of 3D topographies
- Frequency resonances and responses
- Vibration amplitude with resolution of 5pm for out-of-plane and 1nm for in-plane displacements
- Characterization of complex motions and sample geometries, including in presence of holes

### Measure in controlled environmental conditions

The unique optical configuration of DHM<sup>®</sup> enables the user to measure with optimal optical quality:

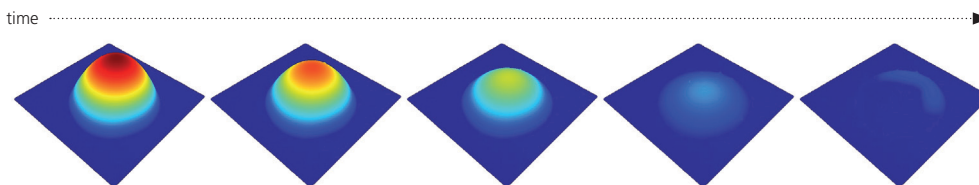
- Through glass and immersion liquids
- Inside environmental and vacuum chambers, under controlled temperature, humidity, pressure or gas composition

### Measure topography of transparent patterns

The optional DHM<sup>®</sup> Reflectometry analysis software enables the measurement of:

- Topography of transparent structures
- Thicknesses and refractive index values of structured multi-layers with thicknesses ranging from 10 nanometers to tens of microns
- Topography of soft materials and liquids

Innovation



Time sequence of 3D topographies, limited by camera rate: evaporation of a liquid drop

### DHM<sup>®</sup>

The Digital Holographic Microscopy (DHM<sup>®</sup>) is a patented technology. It records, with a digital camera, holograms produced by the interference between the beam reflected by the sample, and a reference beam generated inside of the microscope. The holograms are processed numerically to reconstruct a 3D optical map of the specimen.

The vertical calibration of DHM<sup>®</sup> is intrinsically defined by the laser wavelength. It provides high accuracy and reproducible data and measures with interferometric resolution, i.e. a subnanometric vertical resolution, and a lateral resolution limited by the choice of microscope objective.

Thanks to advanced numerical processing of the recorded hologram, sharp focus can be performed simultaneously or after measurement, as a post-processing without manually adjusting the height of the sample.



Three configurations of Reflection DHM® are available, differentiated by the number of wavelengths.

- **R1000 models** are configured with a single wavelength and are the ideal tool for measuring smooth surfaces and vibrations.
- **R2100 models** are configured for measuring simultaneously at two wavelengths for achieving measurement of complex or discontinuous structures.
- **R2200 models** are R2100 with a third source to extend measurement capability, in particular for measuring transparent patterns

## Technical specifications

System			
DHM models	R1000	R2100	R2200
Number of laser sources	1	2	3
Operating wavelength ( $\pm 1.0$ nm)	666 nm	666 nm, 794 nm	666 nm, 794 nm, 680 nm
Laser wavelength stability	0.01°/K at 666 nm		
Sample stage	Manual or motorized XYZ stages up to 300 mm x 300 mm x 38 mm travel range		
Objectives	Magnification 1.25x to 100x, standard, high NA, long working distance, water/oil immersion		
Objective turret	6 positions		
Computer	Dell workstation with latest multicore Intel® processor, high performance graphic card, optimized and configured for DHM with screen min 21inch and mouse		
Software	Proprietary Koala software based on C++ and .NET Additional optional software modules available for advanced analysis		
Data compatibility	Measurement data recorded in bin format, exportable in .txt format, recorded and reconstructed images exportable in .tif format or .txt array		

Performance			
Measurement mode	Single wavelength at 666 nm	Short synthetic wavelength at 4.2 $\mu$ m	Long synthetic wavelength at 24 $\mu$ m
DHM models	R1000, R2100, R2200	R2100, R2200	R2200
Accuracy <sup>1</sup> [nm]	0.15	0.15 / 3.0 *	20
Vertical resolution <sup>2</sup> [nm]	0.30	0.30 / 6.0 *	40
Repeatability <sup>3</sup> [nm]	0.01	0.01 / 0.1 *	0.5
Vertical measuring range	up to 200 $\mu$ m	up to 200 $\mu$ m	up to 200 $\mu$ m
Max. height of steps with sharp edges	up to 333 nm <sup>4</sup>	up to 2.1 $\mu$ m <sup>4</sup>	up to 12 $\mu$ m <sup>4</sup>
Surface type	Smooth surfaces	Complex or discontinuous structures	Complex or discontinuous structures
Vertical calibration	Determined by interferometric optical filter, $\pm 0.1$ nm		
Acquisition time	Standard: 500 $\mu$ s (optional 10 $\mu$ s)		
Acquisition rate	Standard: 30 fps (1024 x 1024 pixels). (optional up to 1000 fps).		
Reconstruction rate	Up to 25 fps 1024 x 1024 pixels hologram (data analysis dependent ). (optional up to 60 fps )		
Lateral resolution	Objective dependent, down to 300 nm **		
Field of view	Objective dependent, from 66 $\mu$ m x 66 $\mu$ m up to 5 mm x 5 mm **		
Working distance	Objective dependent, from 0.3 to 18 mm **		
Digital focusing range	Up to 50x depth of field (objective dependent)		
Min. sample reflectivity	Less than 1%		
Sample illumination	Down to 1 $\mu$ W/cm <sup>2</sup>		
Stroboscopic unit	Compatibility with single and short synthetic wavelength		

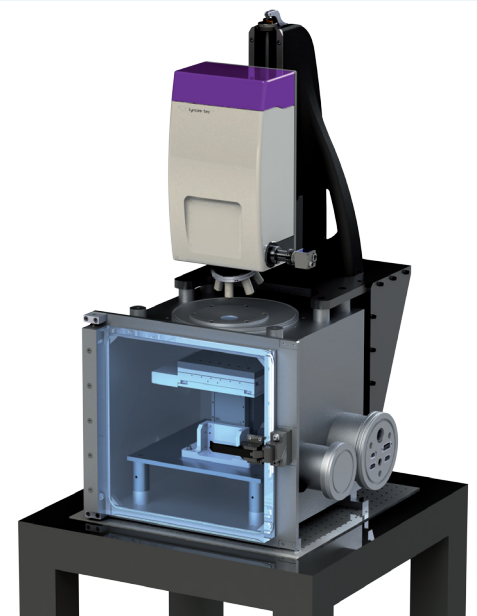
Power requirements	
Input voltage	85-260 VAC – 50/60 Hz
Power requirements	max. 250 W

Dimensions & weight	
Dimensions (L x W x H)	600 x 600 x 800 mm
Weight	48kg

- 1 As demonstrated by taking the temporal standard deviation on 1 pixel over 30 measurements  
 2 Defined as twice the accuracy  
 3 As demonstrated by taking the one sigma Rq value of 30 repeatability measurements without sample  
 4 Depends on the laser source(s) and operating wavelength(s)  
 \* With / Without single wavelength mapping  
 \*\* Objectives specifications on [www.lynceetec.com/microscope-objectives](http://www.lynceetec.com/microscope-objectives)

### DHM® systems are compatible with a large choice of options

- Objectives with extra-LWD, cover-glass correction, for immersion, etc.
- Motorized stage for automation and stitching
- Remote TCP/IP module for automation and remote control of DHM
- Stroboscopic unit for MEMS analysis
- Environmental chamber for measuring under controlled conditions



Reflection DHM® mounted on a vacuum chamber