

## DHM® R2100 - R2200 series

**Real-time measurements extended to 15 µm high steps keeping nanometer vertical resolution.**

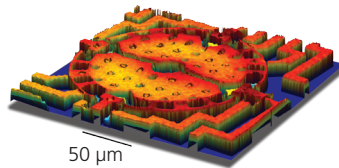
A new level is reached for real-time measurements in interference microscopy. The DHM R2000 family performs measurements at two wavelengths simultaneously. Its innovating optical schema is composed of two nested DHM with common object path and camera. This unique feature, offered by DHM's principle, provides a dual wavelength real-time measurement mode that allows:

- an increase of the measurement range to step heights of up to 15 µm, without any scanning or wavelength switch
- real-time measurements for both single and dual wavelengths modes and full frame phase and intensity images at video rate
- sub-nanometer resolution over the complete vertical range using mapping algorithms
- dual wavelength measurements providing the same tools, ease-of-use and insensitivity to vibrations as single wavelength

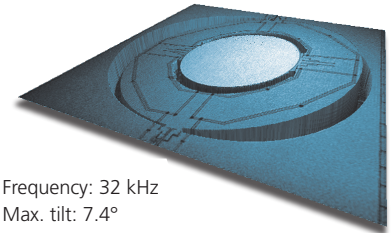
### Dual wavelength mode: keep the speed and ease-of-use

DHM R2000 family enables two interferences to take place simultaneously onto the same camera. Both are recorded on the same hologram and then independently reconstructed. They are combined at video rate to extend the measurement range to several microns as if the sample was imaged with a single wavelength, called synthetic wavelength, equivalent to the low frequency beating of the two monochromatic wavelengths. Working in dual wavelength mode is identical as in single wavelength. It keeps the same ease-of-use and facilities, such as sequences, roughness measurements, time monitoring,... Depending on your sample height, real-time measurements can be performed on either single monochromatic wavelengths data or on their synthetic combination. Switching between the measurement ranges is possible within a single acquisition as all the information is recorded simultaneously in the hologram and the measurements computed out of it.

The R2200 series integrates a third light source alternating with the second one. The DHM R2200 series thus comprises a second larger synthetic wavelengths that further extends the measurement range.



50 µm  
Height: 10 µm



Frequency: 32 kHz  
Max. tilt: 7.4°

### Mapping: keep the vertical resolution

The sub-nanometer vertical resolution of the monochromatic wavelength measurements can be kept over dual wavelength measurement ranges thanks to powerful mapping algorithms combining the synthetic and monochromatic wavelengths data. For short synthetic wavelengths mapping is performed out of a single acquisition. For longer synthetic wavelengths, a short synthetic wavelength measurement is also required for mapping. Alternate measurements in long and short dual wavelengths are therefor performed (acquisition time: 500 ms).

The simultaneous recording of data results in the fastest measurements over microns in interference microscopy. It avoids any artefacts due to acquisition time and thus ensures precision and robustness toward external vibrations. The real-time display of the measurements guaranties the ease-of-use and efficiency of DHM. The measurement range can further be increased to the millimeter range with the vertical coherence scanning module.

DHM R2101 and R2201 have a 4 µm short synthetic wavelength. The third source of the R2201 adds a 15 µm long synthetic wavelength. Both are compatible with the optional Lyncée Tec stroboscopic module in single wavelength. Other source combinations are available allowing higher measurement ranges without mapping or stroboscopic compatibility.



## Technical specifications

System	
Measurement techniques:	single and dual wavelength digital holographic microscopy in reflection and vertical coherence scanning
Image types:	intensity and quantitative phase contrast image (DHM mode), optical topography (vertical scanning)
Light sources:	up to three monochromatic laser sources
Sample stage:	manual or automated XYZ stages up to 300 × 300 × 12.5 mm travel range
Camera:	1392 × 1040 pixels, 8 bits
Available objectives:	standard, high NA, long working distance, water/oil immersion microscope objectives
Objective mounting:	6-position turret
Computer:	Dell workstation with latest Intel® processor, optimized and configured for DHM, with 19" SXGA monitor
Software:	Lyncée Tec proprietary Koala classic software based on C++ and .NET
Optional working mode:	stroboscopic mode

## Performance

Measurement mode:	Single wavelength	Short Dual wavelength	Long Dual Wavelength <sup>4</sup>	Vertical scanning
Accuracy <sup>1</sup> :	0.1 nm	0.1 nm (25 nm) <sup>5</sup>	0.1 nm (25 nm) <sup>5</sup>	0.5 μm
Vertical resolution <sup>2</sup> :	0.2 nm	0.2 nm (50 nm) <sup>5</sup>	0.2 nm (50 nm) <sup>5</sup>	1.0 μm
Repeatability <sup>3</sup> :	< 0.01 nm	< 0.01 nm (0.25 nm) <sup>5</sup>	< 0.01 nm (0.25 nm) <sup>5</sup>	< 0.05 μm
Vertical calibration:	determined by the wavelength, no mechanical movement calibration			
Vertical measuring range in single wavelength:	up to depth of field for smooth samples, up to 340 nm for sharp edge samples			
Vertical measuring range in dual wavelength:	up to depth of field for smooth samples, up to 2 μm (R2101) / 15 μm (R2201) for sharp edge samples			
Vertical measuring range in vertical scanning:	up to 10 mm, z-stage dependent			
Lateral resolution:	objective dependent, down to 300 nm with oil immersion objectives (1.4 NA)			
Field of view:	objective dependent, up to 4.4 mm			
Working distance:	objective dependent, from 0.3 to 18 mm			
Digital focusing range:	up to 50× depth of field (objective dependent)			
Grabbing time (1 hologram):	down to 1 μs in a single image grab			
Spatial sampling:	1024 × 1024 pixels (hologram)			
Acquisition rate:	30 fps (1024 × 1024 pixels) (optional up to 300 fps)			
Single wavelength reconstruction rate:	30 fps (1024 × 1024 pixels)			
Dual wavelength reconstruction rate:	20 fps (1024 × 1024 pixels)			
Vertical scanning acquisition time:	scanning speed: 6 μm/s, reconstruction time: 6 s			
Min. sample reflectivity:	less than 1%			
Sample illumination:	down to 1 μW/cm <sup>2</sup>			

## Power requirements

Input voltage:	85-260 VAC - 50/60 Hz
Power requirements (w/o computer):	max. 480 W

## Dimensions & weight

Microscope:	R2101 & R2201	R2101-L & R2201-L
Dimensions (L × W × H):	600 × 600 × 800 mm	900 × 900 × 850 mm
Weight:	45 kg	80 kg
Maximum sample size (L × W):	∞ × 415 mm	530 × 870 mm

<sup>1</sup> As demonstrated by taking the temporal standard deviation on 1 pixel over 30 measurements\*.

<sup>2</sup> Defined as twice the accuracy.

<sup>3</sup> As demonstrated by taking the one sigma Rq value of 30 repeatability measurements\* on SiC reference mirror.

<sup>4</sup> Only for DHM R2200 serie

<sup>5</sup> Without single wavelength mapping.

\*For single wavelength, 1 measurement is the average of 10 acquisitions.