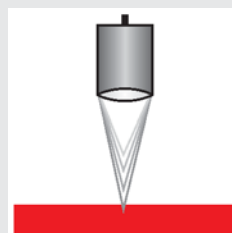




More Precision.

optoNCDT 2401

Confocal chromatic displacement sensors



optoNCDT 2401 Confocal displacement measurement system



- Constant extreme small measuring spot
- Measure any target matt, specular and liquid
- Submicrometer accuracy

The confocal measurement principle

Polychromatic white light is focused onto the target surface by a multi-lens optical system. The lenses are arranged so that the white light is dispersed into a monochromatic light by controlled chromatic aberration. A specific distance to the target is assigned to each wavelength by a factory calibration. Only the wavelength which is exactly focussed on the target is used for the measurement. This light reflected from the target surface is passed through a confocal aperture onto a spectrometer which detects and processes the spectral changes.

System set-up

The confocal chromatic measurement system, optoNCDT 2401, consists of a controller and a sensor. A fiber optical cable, which can be of almost any length, connects the two components. This system has no moving components and is therefore wear free. It can also be used in ATEX/EX environments.

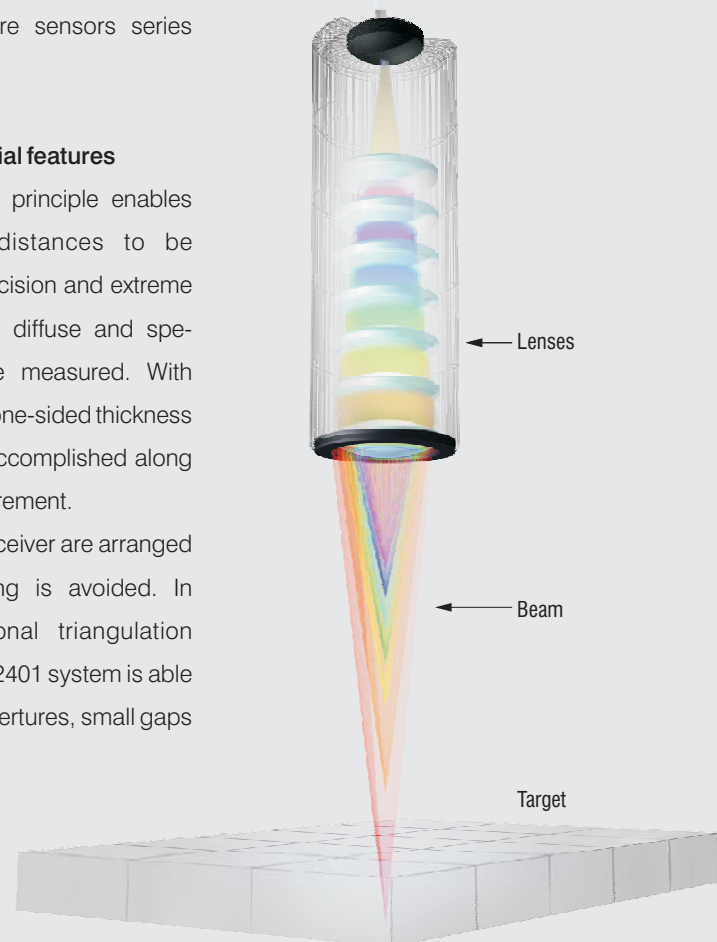
The system consists of a LED based controller a fiber optical cable and one of the sensor heads of the series 2400/2401 or the world first miniature sensors series 2402.

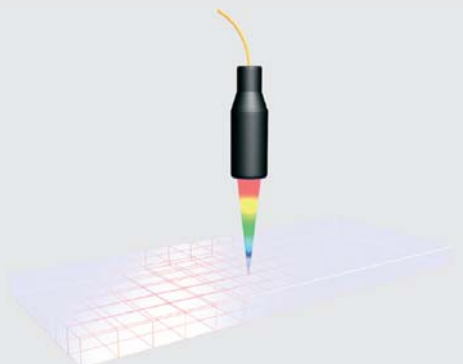
Performance and special features

This unique measuring principle enables displacements and distances to be measured with high precision and extreme spatial resolution. Both diffuse and specular surfaces can be measured. With transparent materials a one-sided thickness measurement can be accomplished along with the distance measurement.

Since the emitter and receiver are arranged in one axis, shadowing is avoided. In contrast to conventional triangulation sensors the optoNCDT 2401 system is able to measure in narrow apertures, small gaps and cavities.

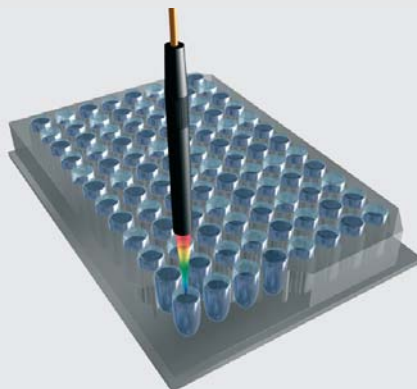
Measuring principle





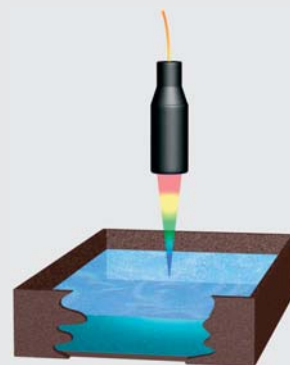
Thickness measurement against transparent materials

The unique measurement principle enables a one-sided thickness measurement on transparent materials such as glass and plastic. Just one sensor measures the thickness with micrometer accuracy.



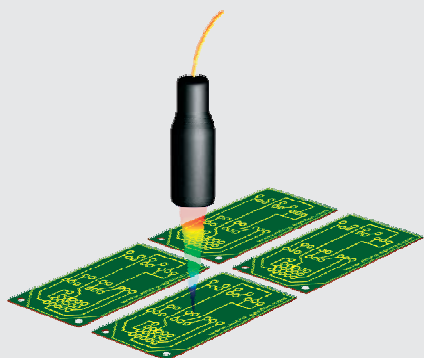
Liquid level control

Miniaturised confocal sensors check fill level in medical trays and microtiter plates, even if the surface is curved.



Profiling of specular surfaces

The confocal measurement principle enables measurements against high reflecting surfaces (glass, mirror), as well as liquids.



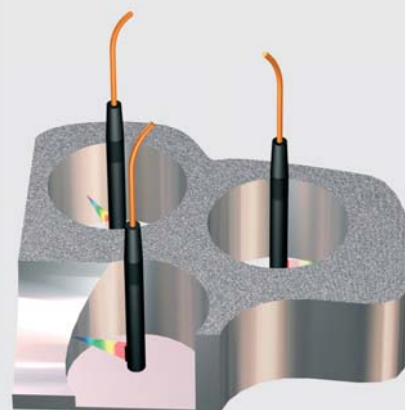
Surface scan

The extreme spatial resolution in x-axis and the submicron accuracy in the z-axis make it a perfect sensor for surface scans e. g. checking for presence on electronic boards.



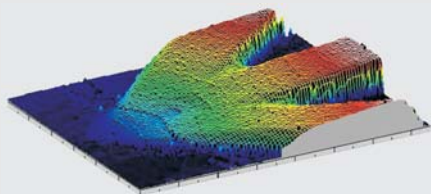
Cavity inspection

The 90°-version of the miniaturised sensors detects grooves or inner wall features.



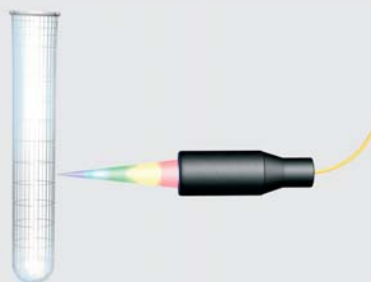
Confocal miniature sensors

Special miniature sensors with a diameter of 4 mm measure in confined installation spaces, e.g. in drilled holes and recesses. Furthermore, the 90° version of these sensors enables the inspection of very small inner diameters.



Extreme resolution

The confocal sensors facilitate optical measurements in the submicrometer resolution in x and y-axis. In this way, the smallest structural changes or displacements can be measured down to microscopic levels.



Wall thickness of transparent tubes

Due to one-sided thickness measurement, a single sensor is able to measure the thickness of glass, plastic tubes or any transparent coatings.



Thickness measurement in confined space

Two synchronised sensors acquire the base thickness inside sleeves.

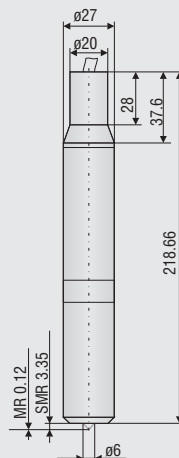
optoNCDT 2400/2401 Confocal displacement sensors



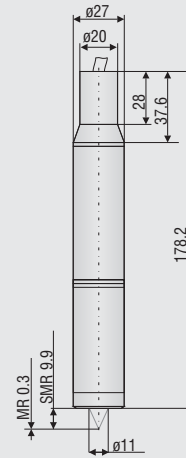
- Compact sensors with large stand off distance
- One-sided thickness measurement of any transparent material
- Detect machined marks and surface roughness
- For ATEX / EX proof environments

The confocal sensors of the series 2400 and 2401 are applicable for distance and one-sided thickness measurement. The large tilt angle and the relative long stand off distance allow the use in many application fields. Measuring distance on shiny and transparent objects, one-sided thickness measurement; this sensor is ideal for precision measurement against any diffuse and specular materials e.g. film, liquid, glass, metal, polymer and many more.

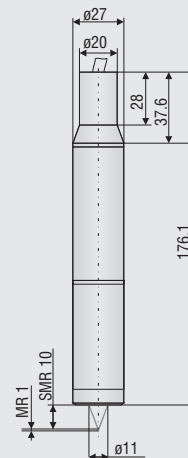
IFS 2401-0.12



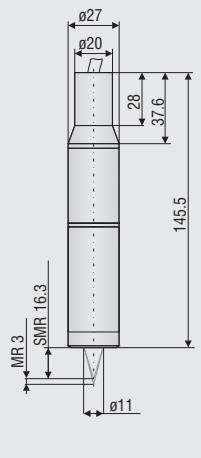
IFS 2401-0.4



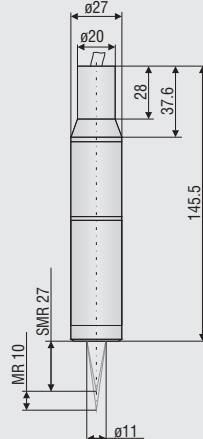
IFS 2401-1



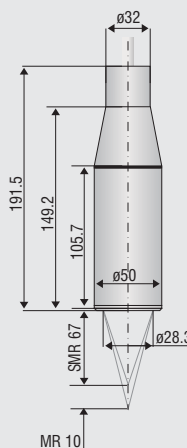
IFS 2401-3



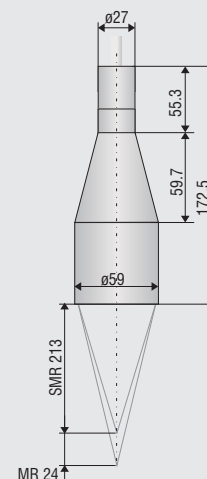
IFS 2401-10



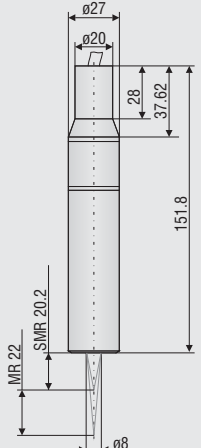
IFS 2400-10



IFS 2400-24



IFS 2401-25



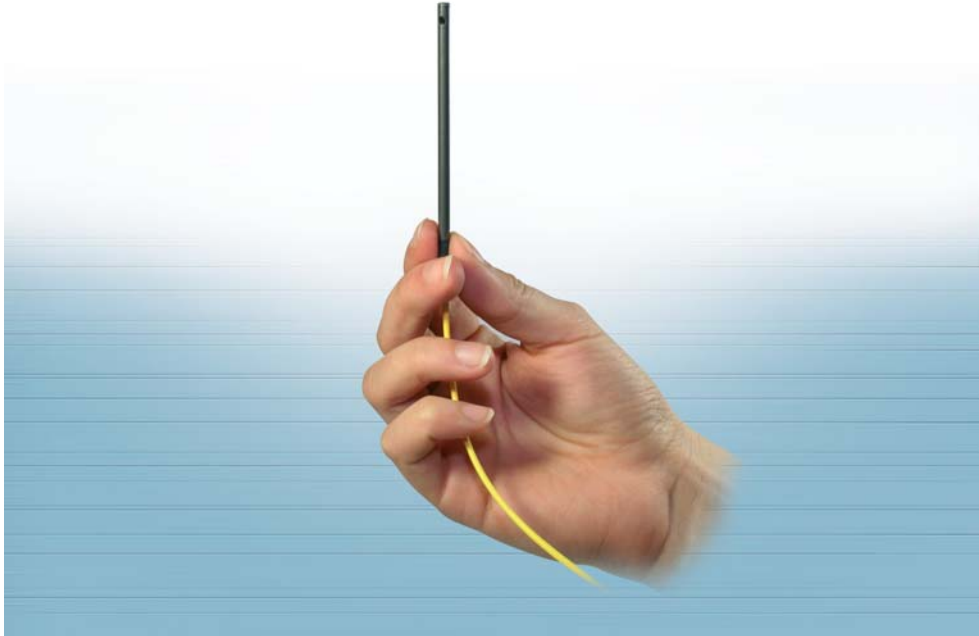
MR = Measuring Range SMR = Start of Measuring Range Dimensions in mm.

Controller	IFC2401							
Sensor model (standard)	IFS 2401-0.12	IFS 2401-0.4	IFS 2401-1	IFS 2401-3	IFS 2401-10	IFS 2400-10	IFS 2400-24	IFS 2401-25
Measuring range	120 μm	300 μm	1 mm	3 mm	10 mm	8.5 mm	24 mm	22 mm
Start of measuring range approx.	3.35 mm	9.9 mm	10 mm	16.3 mm	27 mm	67 mm	213 mm	20.2 mm
Spot diameter	7 μm	10 μm	10 μm	25 μm	50 μm	50 μm	100 μm	100 μm
Linearity	0.12 μm	0.3 μm	0.5 μm	1.5 μm	5 μm	5 μm	12 μm	11 μm
	0.1 % FSO		0.05 % FSO					
Resolution	$\sim 0.005 \mu\text{m}$	0.012 μm	0.04 μm	0.12 μm	0.4 μm	0.4 μm	$\sim 1 \mu\text{m}$	$\sim 0.9 \mu\text{m}$
	0.004 % FSO							
Weight	sensor	0.20 kg	0.22 kg	0.22 kg	0.16 kg	0.19 kg	0.68 kg	0.52 kg
	sensor+MA 2400	0.38 kg	0.40 kg	0.40 kg	0.34 kg	0.37 kg	0.90 kg	0.76 kg
Max. tilt	$\pm 43^\circ$	$\pm 28^\circ$	$\pm 27^\circ$	$\pm 22^\circ$	$\pm 14^\circ$	$\pm 14^\circ$	$\pm 5^\circ$	$\pm 8.5^\circ$
Repeatability	0.01 % FSO							
Measuring rate	100 Hz ... 2000 Hz (adjustable)							
Ambient light	30.000 lx							
Light source	LED							
Protection class (sensor/controller)	IP 40							
Temperature stability (sensor)	0.01 % FSO / $^\circ\text{C}$							
Operation temperature	$+10^\circ\text{C}$... $+50^\circ\text{C}$							
Storage temperature	-30°C ... $+70^\circ\text{C}$							
Output	2x 0 - 10 V / RS 232 / RS 422 / USB 2.0							
Supply	24 VDC							
Sensor cable (fiber optic cable)	standard 3 m option up to 50 m							
dimensions	(W x H x D): 111.5 x 168 x 138 mm							
Controller features	touch keys, trigger function, synchronisation, storage of 20 configurations (for sensors with different ranges) LED indicators, DIN rail mount, digital interfaces free analysis, configuration and acquisition software							
Electromagnetic compatibility (EMC)	EN 50081-1 and EN 50082-2							

FSO = Full Scale Output

All data based on constant ambient temperature during measurement against an 'optical flat' glass target in direct reflection.

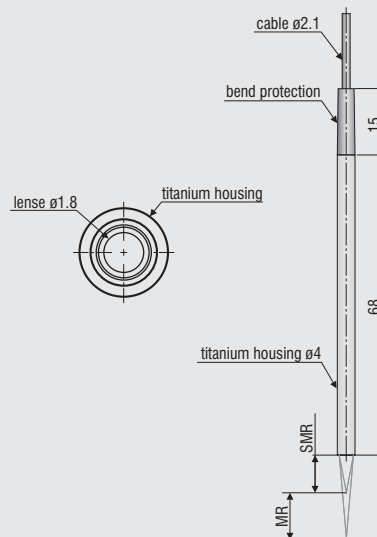
optoNCDT 2402 Confocal miniature sensors



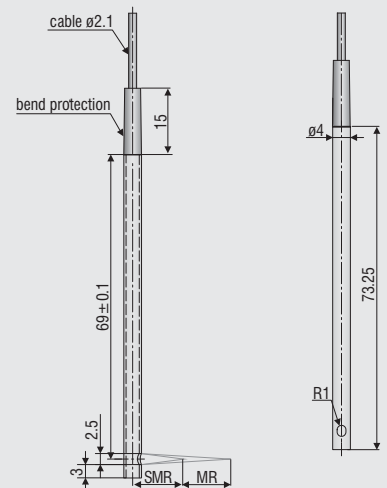
- Miniature sensors \varnothing 4 mm
- Measure inside bores and cavities
- Robust housing (titanium)
- Axial or radial measuring direction
- Smallest confocal sensor worldwide

The miniaturised series optoNCDT 2402 offers all advantages of the confocal measurement principle, with only 4 mm outer diameter. Due to a unique and patented lens design, this compact sensor allows measuring in narrow cavities and bores. Sensors with axial measuring direction and sensors with 90° beam exit are available, which can measure radially in small cavities and bores.

IFS 2402-0.4/1.5/4/10



IFS 2402/90-1.5/4/10



MR = Measuring Range SMR = Start of Measuring Range Dimensions in mm.

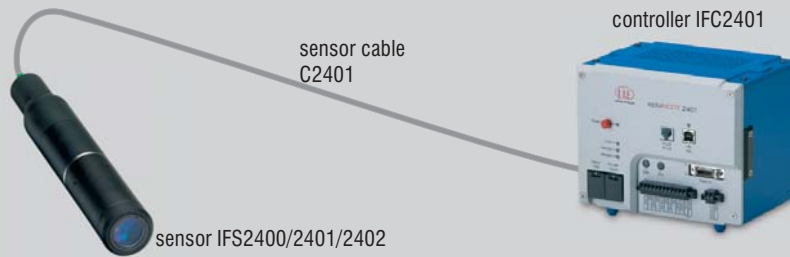
Controller		IFC2401						
Sensor model (miniature version)		IFS 2402-0.4	IFS 2402-1.5	IFS 2402/90-1.5	IFS 2402-4	IFS 2402/90-4	IFS 2402-10	IFS 2402/90-10
Measuring range		400 μm	1.5 mm	1.5 mm	3.5 mm	2.5 mm	6.5 mm	6.5 mm
Start of measuring range	approx.	1.5 mm	0.9 mm	2.5 mm ¹⁾	1.9 mm	2.5 mm ¹⁾	2.5 mm	3.5 mm ¹⁾
Spot diameter		10 μm	20 μm	20 μm	20 μm	20 μm	100 μm	100 μm
Linearity		~0.3 μm	1.2 μm	1.2 μm	~3 μm	2 μm	13 μm	13 μm
		0.08 % FSO					0.2 % FSO	
Resolution		0.016 μm	0.06 μm	0.06 μm	0.14 μm	0.1 μm	~0.7 μm	~0.7 μm
		0.004 % FSO					0.01 % FSO	
Weight		50 g						
Max. tilt		± 8°	± 5°	± 5°	± 3°	± 3°	± 1.5°	± 1.5°
Repeatability		0.01 % FSO						
Measuring rate		100 Hz ... 2000 Hz (adjustable)						
Ambient light		30.000 lx						
Light source		LED						
Protection class (sensor/controller)		IP 40						
Operation temperature		+10 °C ... +50 °C						
Storage temperature		-30 °C ... +70 °C						
Output		2x 0 - 10 V / RS 232 / RS 422 / USB 2.0						
Supply		24 VDC						
Sensor cable (fiber optic cable)		integral cable 2 m option up to 50 m						
dimensions		(W x H x D): 111.5 x 168 x 138 mm						
Controller features		touch keys, trigger function, synchronisation, storage of 20 configurations (for sensors with different ranges) LED indicators, DIN rail mount, digital interfaces free analysis, configuration and aquisition software						
Electromagnetic compatibility (EMC)		EN 50081-1 and EN 50082-2						

FSO = Full Scale Output

¹⁾ Start of measuring range measured from sensor axis

All data based on constant ambient temperature during measurement against an 'optical flat' glass target in direct reflection.

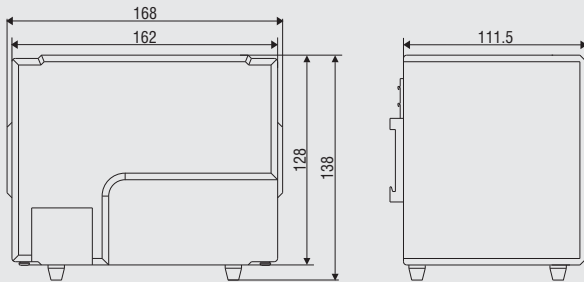
System configuration



A measurement system IFS2401 consists of the IFS240x sensor, a C2401-x optical cable and the IFC2401 controller. The sensor is calibrated to the corresponding controller. Up to 20 different sensor characteristics can be stored in one controller.

Dimensions Controller IFC2401

Dimensions in mm, not to scale.



Accessories: cable (only 2400 and 2401)

C2401-3 fiber optic cable, length 3 m

C2401-10 fiber optic cable, length 10 m

C2401-xx fiber optic cable, custom length up to 50 m

C2401/PT-3 armored cable, length 3 m

C2401/PT-10 armored cable, length 10 m

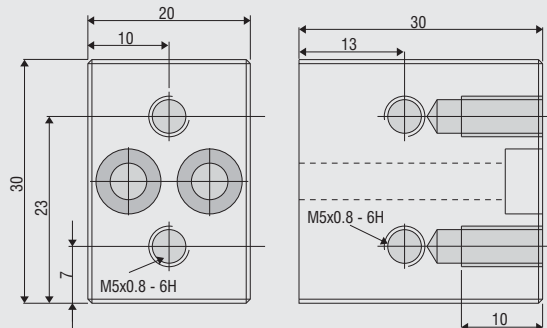
C2401/PT-xx armored cable, custom length up to 50 m

Vacuum suited cable bushing and also sensors for vacuum applications on request.

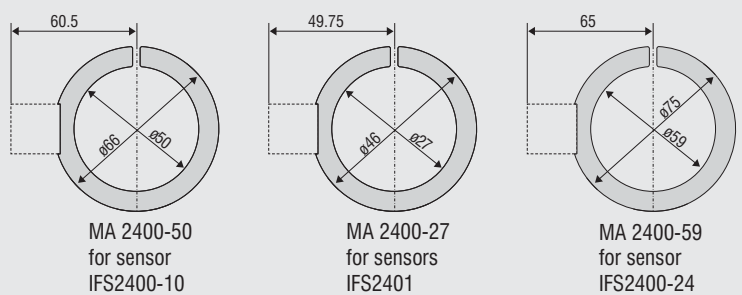
Accessories: mounting adapter

MA2400 for sensors 2400/2401 - consisting of a mounting block and a mounting ring

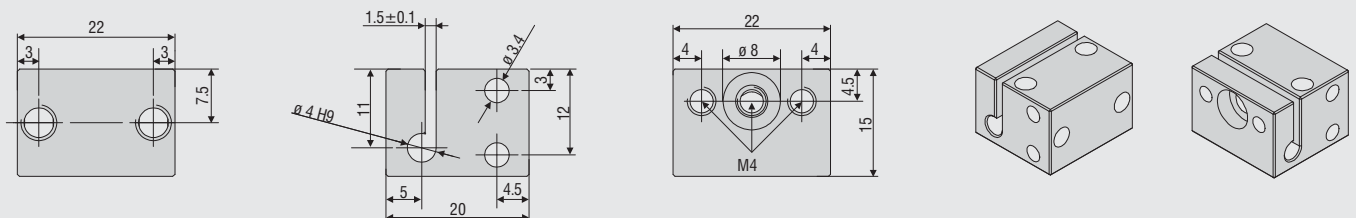
mounting block



mounting ring



MA2402 for sensors 2402



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