MICRO-EPSILON

More Precision.

confocalDT // Confocal chromatic sensor system

Confocal chromatic displacement and thickness measurements
confocalDT

Highest precision in confocal chromatic displacement and thickness measurements

The confocalDT product range stands for the highest precision and dynamics in confocal chromatic measurement technology. The measuring system includes the fastest controller currently available, enabling high precision measurement results in displacement and distance measurement tasks, as well as thickness measurement of transparent objects. A large number of sensors and different interfaces can be used in versatile measurement tasks, e.g., in the semiconductor industry, glass industry, medical engineering and machine building.

Fast surface compensation

For distance and thickness measurements

Overview
confocalDT

Sensor type		Measuring range	Measurement direction	Measurement mode	Page
confocalDT IFS2402	Confocal chromatic miniature sensors ø4 mm	1.5 mm ... 3.5 mm		Distance measurement	8 - 9
confocalDT IFS2403	Confocal chromatic hybrid sensors ø8 mm	0.4 mm ... 10 mm		Distance measurement Thickness measurement	10 - 11
confocalDT IFS2404	Confocal chromatic sensors ø12 mm	2 mm		Distance measurement Thickness measurement	12
confocalDT IFS2405	Precise confocal sensors ø27 - 64 mm	0.3 mm ... 30 mm		Distance measurement Thickness measurement	13 - 15
confocalDT IFS2406	Confocal chromatic sensors for displacement & thickness measurements ø20 - 27 mm	2.5 mm ... 10 mm		Distance measurement Thickness measurement	16 - 17
confocalDT IFS2407	High precision sensors for displacement & thickness measurements ø12 - 54 mm	0.1 mm ... 3 mm		Distance measurement Thickness measurement	18 - 19

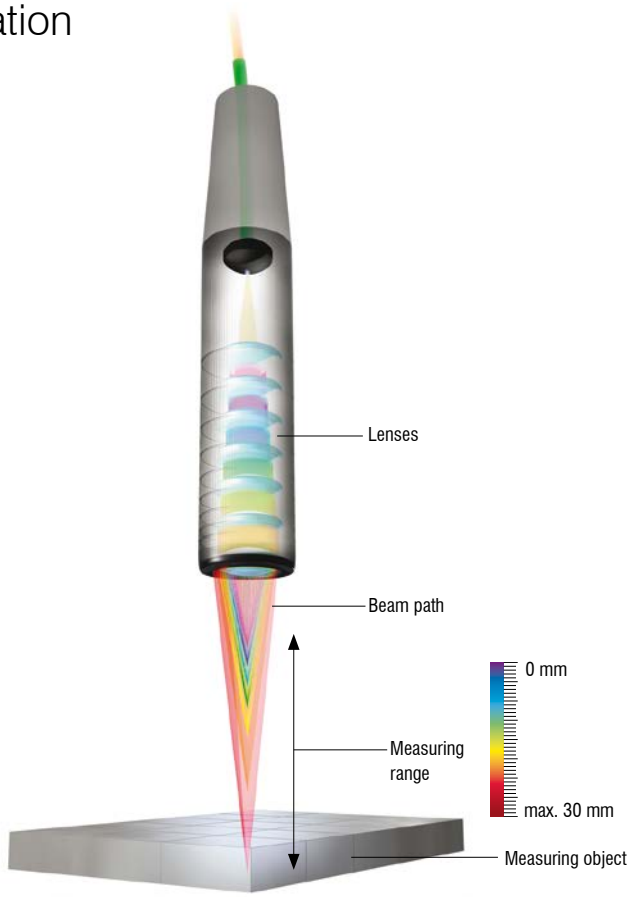
Each sensor can be operated with every confocalDT controller.

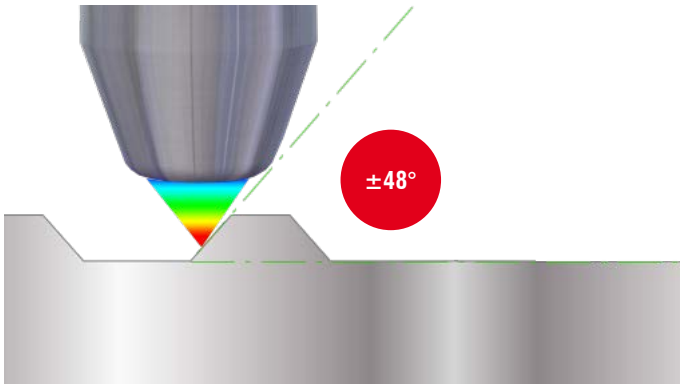
Controller type		Channels	Measuring rate	Page
confocalDT IFC242x	Confocal controller for industrial applications	1 or 2	up to 6.5 kHz	20 - 21
confocalDT IFC246x	Light-intensive controller for high speed measurements	1 or 2	up to 30 kHz	22 - 23
confocalDT IFC2471 HS	Confocal high-speed controller	1	up to 70 kHz	24 - 25

Measuring principle and fields of application
confocalDT

The confocal chromatic measuring principle

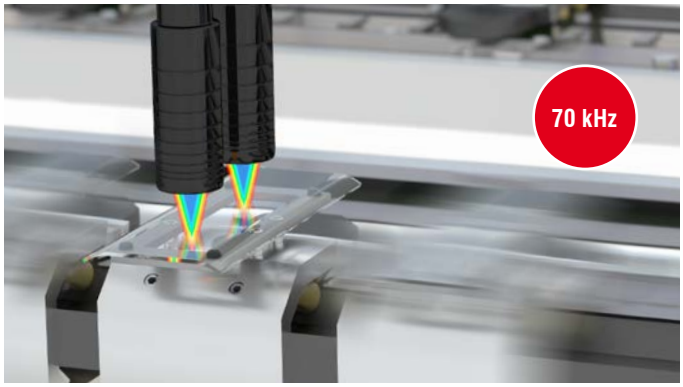
Polychromatic white light is focused onto the target surface by a multilens optical system. The lenses are arranged so that the white light is dispersed into monochromatic wavelengths by controlled chromatic aberration. To each wavelength, a specific distance is assigned by factory calibration. Only the wavelength which is exactly focused on the target is used for the measurement. An optical arrangement images the light reflected onto a light sensitive sensor element, on which the corresponding spectral color is detected and evaluated. In the case of multi-peak measurements, several distance points are evaluated accordingly.





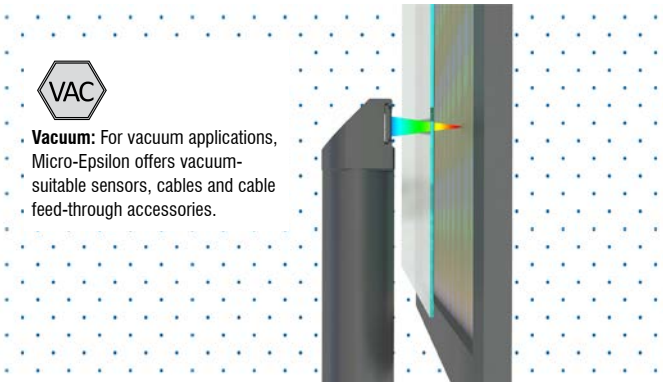
Large measuring angle

The confocalDT IFS sensors tolerate a large measuring angle up to 48°. Therefore, curved and structured surfaces can be detected reliably to generate stable signals.



Fastest measuring rates for dynamic measurement tasks

IFC2471HS controllers offer with 70 kHz the highest measuring rate in the world. However, it is important to adapt the exposure to the respective surface. Therefore, the confocalDT controller dynamically regulates the exposure of the CCD line. This exposure control compensates for color and reflectivity changes of the measuring object in order to increase the measurement accuracy at high measuring rates.

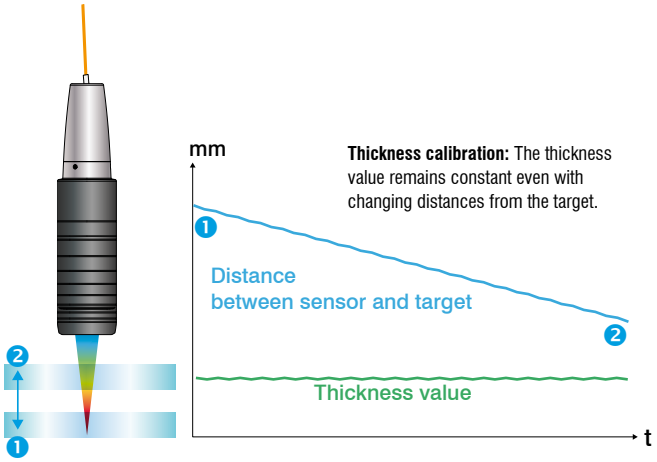


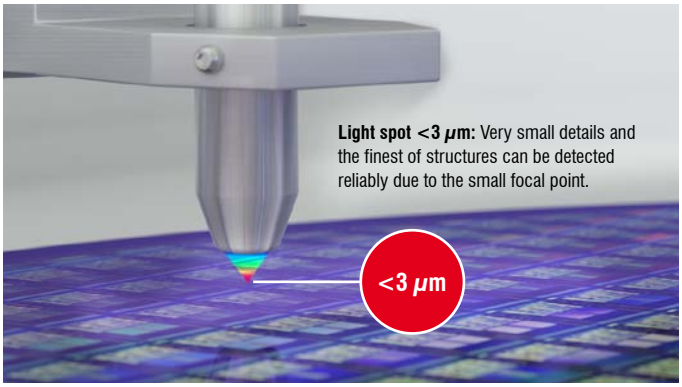
Ready for vacuum

The confocalDT sensors consist of passive components and do not emit heat. Particularly for use in vacuum applications, Micro-Epsilon offers sensors, cables and accessories which can be used according to their respective specification.

Compact sensors for restricted installation spaces

The compact design with diameters from 4 mm enables integration in restricted spaces. With the 90° models, the required installation depth is again significantly reduced.



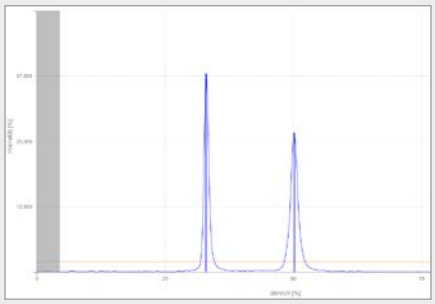


Thickness calibration for precise thickness measurements regardless of distance

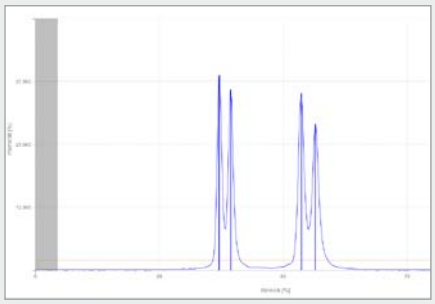
Changing material thickness and a varying distance between the target and the sensor produce faulty measurement values. Therefore, confocalDT controllers from Micro-Epsilon offer a thickness calibration feature. The refractive indices (start of measuring range, mid of measuring range, end of measuring range) of different materials are stored in the controller and can be individually adapted. By selecting the respective target material, the distance-dependent error is automatically compensated for which enables to achieve the highest possible measurement accuracy.

The world's smallest light spot for high lateral resolution

The confocalDT sensors from Micro-Epsilon are available with different aperture angles. Sensors with a large aperture angle or high numerical aperture (NA) generate a small light spot (X-Y resolution) and high Z resolution. The light spot size remains almost constant over the entire measuring range which enables to measure even finest details such as IC pins on PCBs, bonding wire or surface roughness. Due to the high measuring rate, roughness can be detected much more faster than with tactile measurements. In addition, the non-contact measuring principle is reactionless.



Thickness measurement signal

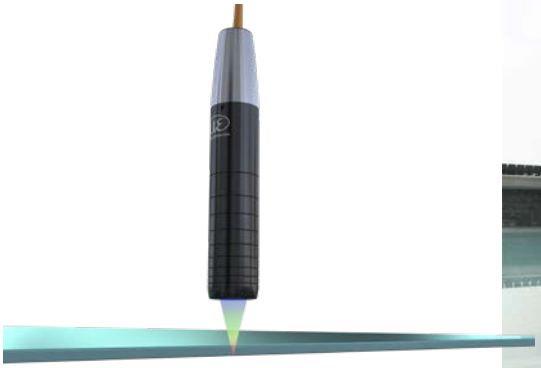


Signal with multi-layer thickness measurements (max. 6 peaks)

Thickness measurement of transparent materials in the micron range

The confocalDT sensors enable thickness measurements of transparent materials. The material thickness is detected to micrometer accuracy using just one single sensor. Thanks to the integrated multi-layer measurement, the thickness of materials such as laminated glass can be evaluated.

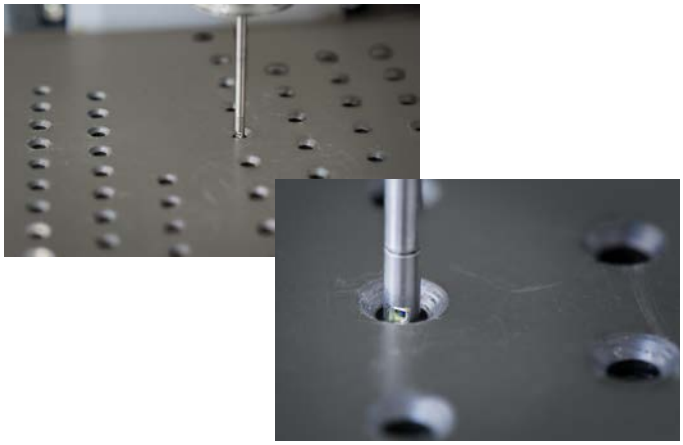
Applications
confocalDT

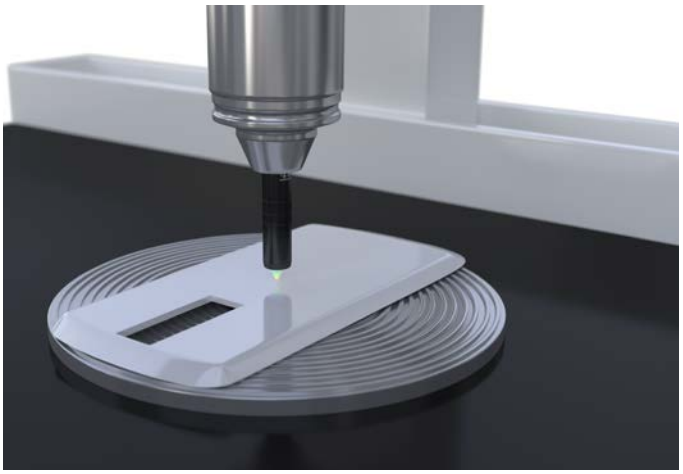


Thickness measurement of displays and flat glass

For the production of display glass, glass sheets with a homogeneous thickness profile are required. To monitor the thickness, confocal chromatic sensors from Micro-Epsilon are used for non-contact, one-sided thickness measurement. Due to their high measuring rate, the sensors are also applied in high speed processes.

Recommended sensors: IFS2405





Restricted installation space

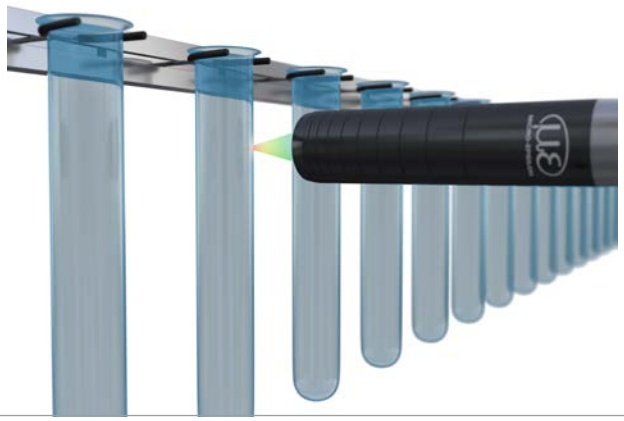
Miniature sensors with a diameter of 4 mm measure in confined installation spaces, e.g., for the inspection of boreholes. Furthermore, the 90° version of these sensors enables to measure the finest interior contours.

Recommended sensors: IFS2402

Coordinate measuring machines

The large aperture angle and the high numerical aperture of confocal chromatic sensors enable high resolution with a small light spot size. As the sensors also tolerate a large tilt angle, they are used in coordinate measuring machines for geometry testing and roughness measurements.

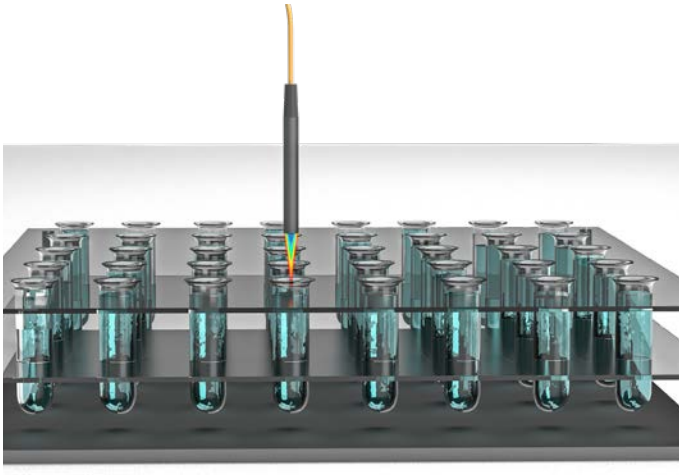
Recommended sensors: IFS2405 / IFS2407



Wall thickness measurement of container glass

Wall thickness distribution is a crucial quality criterion for container glass. In order to determine the glass thickness of the bottom and the walls, confocal chromatic sensors from Micro-Epsilon are used. Measurements are performed without contact and at a high measuring rate.

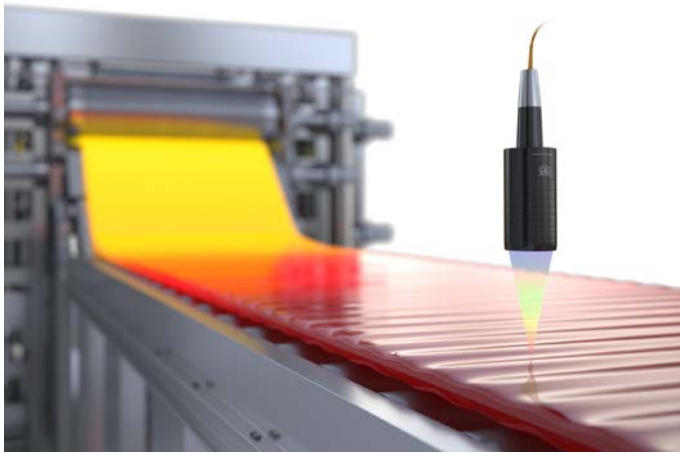
Recommended sensors: IFS2406



Measurement in recesses

Their narrow beam path enables the confocal sensors to measure in recesses. With the confocal measuring principle, also measurements on liquids are possible, e.g., for precise filling level control in trays.

Recommended sensors: IFS2403 / IFS2404



Hot glass measurments

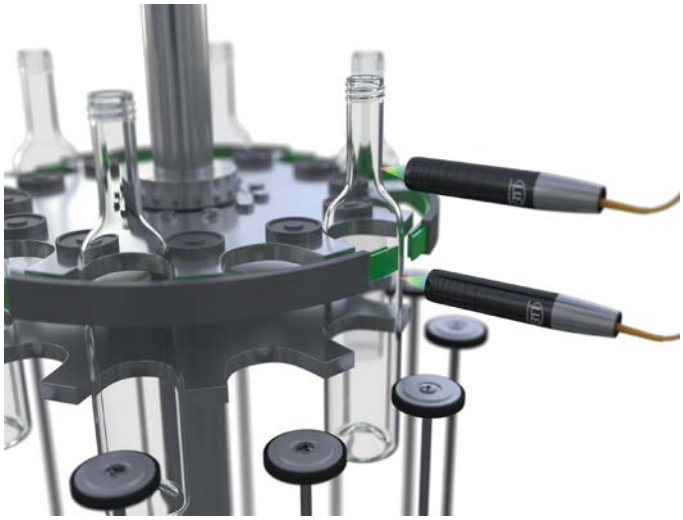
Protected with a housing provided by the customer, confocal sensors can also measure on hot glass. The large offset distance allows for the sensor to be mounted from a safe distance to the hot glass.

Recommended sensors: IFS2405

Interior diameter inspection

High precision diameter inspection of bores and cylinders using 90° sensor models.

Recommended sensors: IFS2406



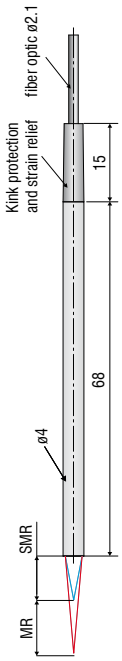
Thickness measurement on the star wheel

Fast dual-channel thickness measurement of glass bottles in industrial production processes.

Recommended sensors: IFS2406

Confocal chromatic miniature sensors
confocalDT IFS2402

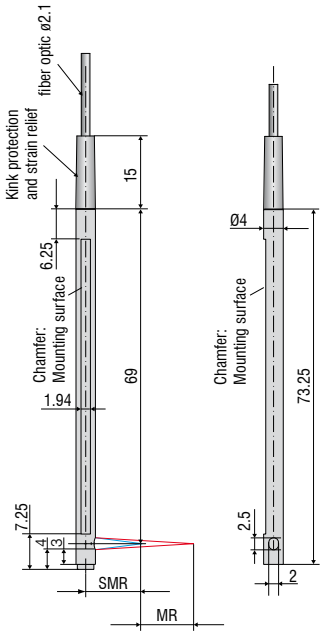
- Miniature sensors Ø4 mm with axial or radial beam path
- Submicron resolution
- For precise distance measurements
- Small light spot



MR = Measuring range
SMR = Start of measuring range
Dimensions in mm, not to scale

Model		IFS2402-0,5	IFS2402-1,5	IFS2402-4
Measuring range		0.5 mm	1.5 mm	3.5 mm
Start of measuring range	approx.	1.7 mm	0.9 mm	1.9 mm
Resolution	static [1]	16 nm	60 nm	100 nm
	dynamic [2]	48 nm	192 nm	480 nm
Linearity [3]	Displacement and distance	< ±0.2 µm	< ±1.2 µm	< ±3 µm
Light spot diameter		10 µm	20 µm	20 µm
Max. measuring angle [4]		±18°	±5°	±3°
Numerical aperture (NA)		0.40	0.20	0.10
Connector		integrated optical fiber 2 m with E2000/APC connector; extension up to 50 m; bending radius: static 30 mm; dynamic 40 mm		
Mounting		Clamping, mounting adapter (see accessories)		
Temperature range	Storage	-20… +70 °C		
	Operation	+5 … +70 °C		
Shock (DIN EN 60068-2-27)		15 g / 6 ms in XY axis, 1000 shocks each		
Vibration (DIN EN 60068-2-6)		2 g / 20 … 500 Hz in XY axis, 10 cycles each		
Protection class (DIN EN 60529)		IP64, front operated		
Material		Stainless steel housing, glass lenses		
Weight		approx. 186 g (incl. optical fiber)		

[1] Average from 512 values at 1 kHz, near to the mid of the measuring range onto optical flat
[2] RMS noise relates to mid of measuring range (1 kHz)
[3] All data at constant ambient temperature (25 ±1 °C) against optical flat; specifications can change when measuring different objects.
[4] Maximum measuring angle of the sensor that produces a usable signal on reflecting surfaces. The accuracy decreases when approaching the limit values.

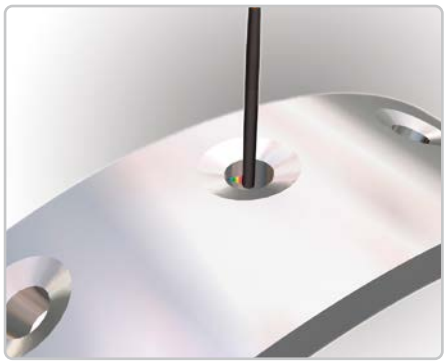


MR = Measuring range
SMR = Start of measuring range
Dimensions in mm, not to scale

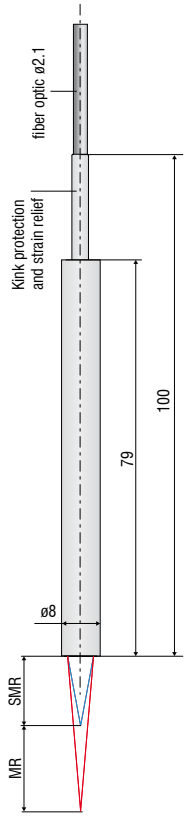
Model		IFS2402/90-1,5	IFS2402/90-4
Measuring range		1.5 mm	2.5 mm
Start of measuring range	approx.	2.5 mm [1]	2.5 mm [1]
Resolution	static [2]	60 nm	100 nm
	dynamic [3]	192 nm	480 nm
Linearity [4]	Displacement and distance	< ±1.2 µm	< ±3 µm
Light spot diameter		20 µm	20 µm
Max. measuring angle [5]		±5°	±3°
Numerical aperture		0.20	0.10
Connector		integrated optical fiber 2 m with E2000/APC connector; extension up to 50 m; bending radius: static 30 mm, dynamic 40 mm	
Mounting		Clamping, mounting adapter (see accessories)	
Temperature range	Storage	-20 … +70 °C	
	Operation	+5 … +70 °C	
Shock (DIN EN 60068-2-27)		15 g / 6 ms in XY axis, 1000 shocks each	
Vibration (DIN EN 60068-2-6)		2 g / 20 … 500 Hz in XY axis, 10 cycles each	
Protection class (DIN EN 60529)		IP40	
Material		Stainless steel housing, glass lenses	
Weight		approx. 186 g (incl. optical fiber)	

[1] Start of measuring range measured from sensor axis
[2] Average from 512 values at 1 kHz, near to the mid of the measuring range onto optical flat
[3] RMS noise relates to mid of measuring range (1 kHz)
[4] All data at constant ambient temperature (25 ±1 °C) against optical flat; specifications can change when measuring different objects.
[5] Maximum measuring angle of the sensor that produces a usable signal on reflecting surfaces. The accuracy decreases when approaching the limit values.

Confocal chromatic hybrid sensors
confocalDT IFS2403



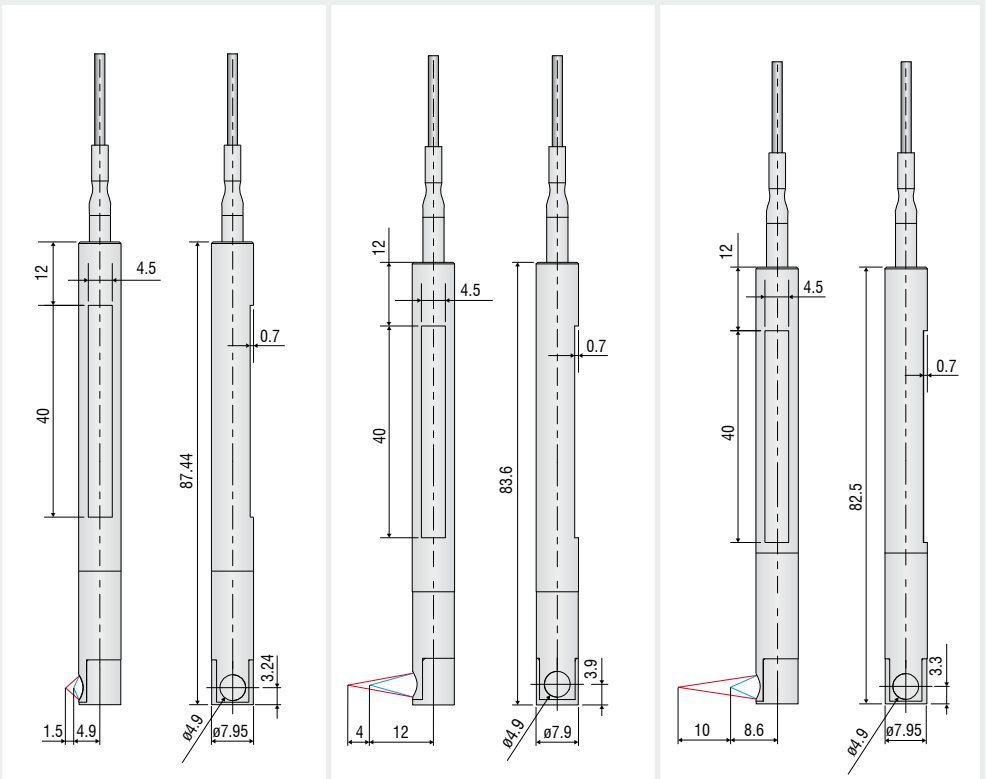
- Hybrid sensors ø8 mm with axial or radial beam path
- Submicron resolution
- For one-sided thickness measurements
- For precise distance measurements
- Small light spot



MR = Measuring range
SMR = Start of measuring range
Dimensions in mm, not to scale

Model		IFS2403-0,4	IFS2403-1,5	IFS2403-4	IFS2403-10
Measuring range		0.4 mm	1.5 mm	4 mm	10 mm
Start of measuring range	approx.	2.5 mm	8 mm	14.7 mm	11 mm
Resolution	static [1]	16 nm	60 nm	100 nm	250 nm
	dynamic [2]	47 nm	186 nm	460 nm	1250 nm
Linearity [3]	Displacement and distance	< ±0.3 µm	< ±1.2 µm	< ±3 µm	< ±8 µm
	Thickness	< ±0.6 µm	< ±2.4 µm	< ±6 µm	< ±16 µm
Light spot diameter		9 µm	15 µm	28 µm	56 µm
Max. measuring angle [4]		±20°	±16°	±6°	±6°
Numerical aperture (NA)		0.50	0.30	0.15	0.15
Min. target thickness [5]		0.06 mm	0.23 mm	0.6 mm	1.5 mm
Connector		integrated optical fiber 2 m with E2000/APC connector; extension up to 50 m; bending radius: static 30 mm, dynamic 40 mm			
Mounting		Clamping, mounting adapter (see accessories)			
Temperature range	Storage	-20 … +70 °C			
	Operation	+5 … +70 °C			
Shock (DIN EN 60068-2-27)		15 g / 6 ms in XY axis, 1000 shocks each			
Vibration (DIN EN 60068-2-6)		2 g / 20 … 500 Hz in XY axis, 10 cycles each			
Protection class (DIN EN 60529)		IP64 (front)			
Material		Stainless steel housing, glass lenses			
Weight		approx. 200 g (incl. optical fiber)			

[1] Average from 512 values at 1 kHz, near to the mid of the measuring range onto optical flat
[2] RMS noise relates to mid of measuring range (1 kHz)
[3] All data at constant ambient temperature (25 ±1 °C) against optical flat; specifications can change when measuring different objects.
[4] Maximum measuring angle of the sensor that produces a usable signal on reflecting surfaces. The accuracy decreases when approaching the limit values.
[5] Glass sheet with refractive index n = 1.5 in midrange



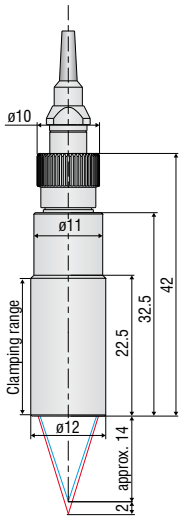
Dimensions in mm,
not to scale.

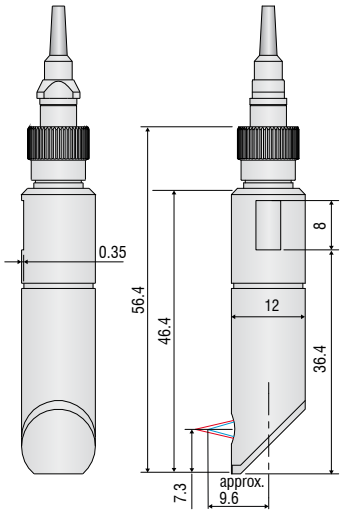
Model		IFS2403/90-1,5	IFS2403/90-4	IFS2403/90-10
Measuring range		1.5 mm	4 mm	10 mm
Start of measuring range	approx.	4.9 mm [1]	12 mm [1]	8.6 mm [1]
Resolution	static [2]	60 nm	100 nm	250 nm
	dynamic [3]	186 nm	460 nm	1250 nm
Linearity [4]	Displacement and distance	< ±1.2 µm	< ±3 µm	< ±8 µm
	Thickness	< ±2.4 µm	< ±6 µm	< ±16 µm
Light spot diameter		15 µm	28 µm	56 µm
Max. measuring angle [5]		±16°	±6°	±6°
Numerical aperture (NA)		0.30	0.15	0.15
Min. target thickness [6]		0.23 mm	0.6 mm	1.5 mm
Connector		integrated optical fiber 2 m with E2000/APC connector; extension up to 50 m; bending radius: static 30 mm, dynamic 40 mm		
Mounting		Clamping, mounting adapter (see accessories)		
Temperature range	Storage	-20 … +70 °C		
	Operation	+5 … +70 °C		
Shock (DIN EN 60068-2-27)		15 g / 6 ms in XY axis, 1000 shocks each		
Vibration (DIN EN 60068-2-6)		2 g / 20 … 500 Hz in XY axis, 10 cycles each		
Protection class (DIN EN 60529)		IP64 (front)		
Material		Stainless steel housing, glass lenses		
Weight		approx. 200 g (incl. optical fiber)		

[1] Start of measuring range measured from sensor axis
[2] Average from 512 values at 1 kHz, near to the mid of the measuring range onto optical flat
[3] RMS noise relates to mid of measuring range (1 kHz)
[4] All data at constant ambient temperature (25 ±1 °C) against optical flat; specifications can change when measuring different objects.
[5] Maximum measuring angle of the sensor that produces a usable signal on reflecting surfaces. The accuracy decreases when approaching the limit values.
[6] Glass sheet with refractive index n = 1.5 in midrange

Confocal chromatic sensors
confocalDT IFS2404

- Compact sensors ø12 mm
- Submicron resolution
- For one-sided thickness measurements
- For precise distance measurements
- Small light spot



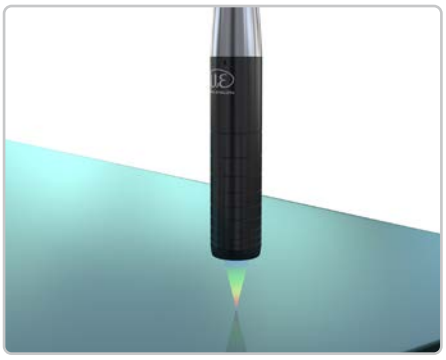


Dimensions in mm,
not to scale.

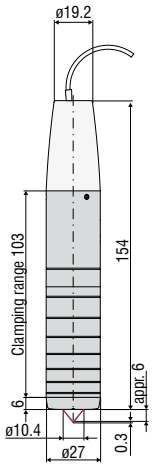
Model		IFS2404-2	IFS2404/90-2
Measuring range		2 mm	2 mm
Start of measuring range	approx.	14 mm	9.6 mm [1]
Resolution	static [2]	40 nm	40 nm
	dynamic [3]	125 nm	125 nm
Linearity [4]	Displacement and distance	< ±1 µm	< ±1 µm
	Thickness	< ±2 µm	< ±2 µm
Light spot diameter		10 µm	10 µm
Max. tilt angle [5]		±12°	±12°
Numerical aperture (NA)		0.25	0.25
Min. target thickness [6]		0.1 mm	0.1 mm
Connector		pluggable optical fiber via FC socket, type C2404-x; standard length 2 m; extension up to 50 m; bending radius: static 30 mm, dynamic 40 mm	
Mounting		Clamping, mounting adapter (see accessories)	
Temperature range	Storage	-20 … +70 °C	
	Operation	+5 … +70 °C	
Shock (DIN EN 60068-2-27)		15 g / 6 ms in XY axis, 1000 shocks each	
Vibration (DIN EN 60068-2-6)		2 g / 20 … 500 Hz in XY axis, 10 cycles each	
Protection class (DIN EN 60529)		IP65 (front)	
Material		Stainless steel housing, glass lenses	
Weight [7]		approx. 20 g	approx. 30 g

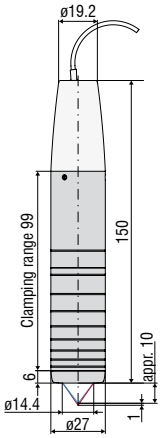
[1] Start of measuring range measured from sensor axis
[2] Average from 512 values at 1 kHz, near to the mid of the measuring range onto optical flat
[3] RMS noise relates to mid of measuring range (1 kHz)
[4] All data at constant ambient temperature (25 ±1 °C) against optical flat; specifications can change when measuring different objects.
[5] Maximum measuring angle of the sensor that produces a usable signal on reflecting surfaces. The accuracy decreases when approaching the limit values.
[6] Glass sheet with refractive index n = 1.5 throughout the entire measuring range. In the mid of the measuring range, also thinner layers can be measured.
[7] Sensor weight without optical fiber

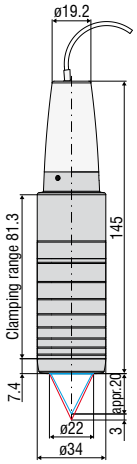
Confocal sensors with high precision
confocalDT IFS2405



- Robust universal sensors for versatile applications
- Submicron resolution
- For one-sided thickness measurements
- For precise distance measurements
- Very small light spot
- Large tilt angle





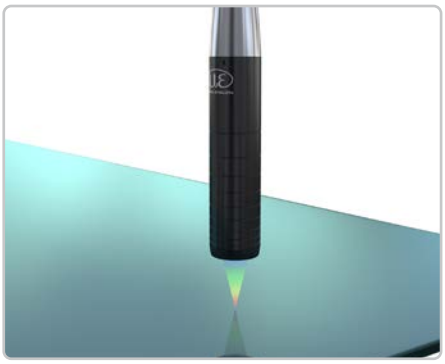


Dimensions in mm, not to scale.

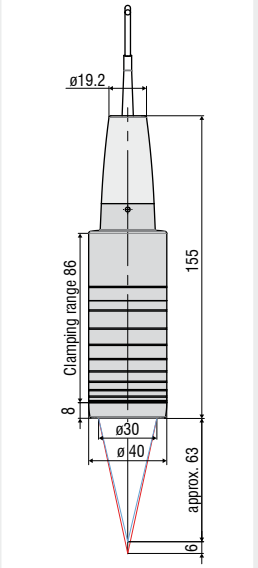
Model		IFS2405-0,3	IFS2405-1	IFS2405-3
Measuring range		0.3 mm	1 mm	3 mm
Start of measuring range	approx.	6 mm	10 mm	20 mm
Resolution	static [1]	4 nm	8 nm	15 nm
	dynamic [2]	18 nm	38 nm	80 nm
Linearity [3]	Displacement and distance	< ±0.1 µm	< ±0.25 µm	< ±0.75 µm
	Thickness	< ±0.2 µm	< ±0.5 µm	< ±1.5 µm
Light spot diameter		6 µm	8 µm	9 µm
Max. measuring angle [4]		±34°	±30°	±24°
Numerical aperture (NA)		0.60	0.55	0.45
Min. target thickness [5]		0.015 mm	0.05 mm	0.15 mm
Connector		pluggable optical fiber via FC socket, standard length 3 m; extension up to 50 m; bending radius: static 30 mm; dynamic 40 mm		
Mounting		Clamping, mounting adapter (see accessories)		
Temperature range	Storage	-20 … +70 °C		
	Operation	+5 … +70 °C		
Shock (DIN EN 60068-2-27)		15 g / 6 ms in XY axis, 1000 shocks each		
Vibration (DIN EN 60068-2-6)		2 g / 20 … 500 Hz in XY axis, 10 cycles each		
Protection class (DIN EN 60529)		IP64 (front)		
Material		Aluminum housing, glass lenses		
Weight [6]		approx. 140 g	approx. 125 g	approx. 225 g

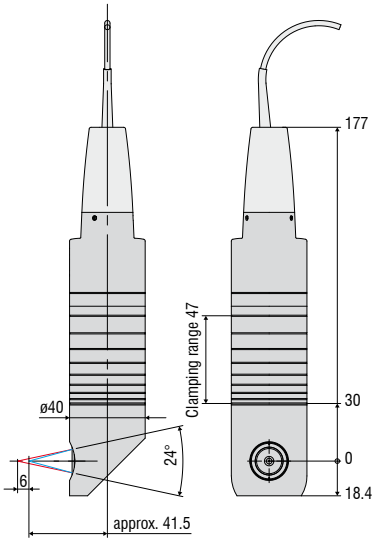
[1] Average from 512 values at 1 kHz, near to the mid of the measuring range onto optical flat
[2] RMS noise relates to mid of measuring range (1 kHz)
[3] All data at constant ambient temperature (25 ±1 °C) against optical flat; specifications can change when measuring different objects.
[4] Maximum measuring angle of the sensor that produces a usable signal on reflecting surfaces. The accuracy decreases when approaching the limit values.
[5] Glass sheet with refractive index n = 1.5 throughout the entire measuring range. In the mid of the measuring range, also thinner layers can be measured.
[6] Sensor weight without optical fiber

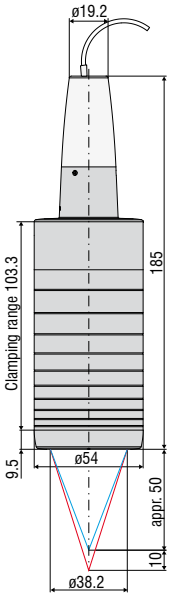
Confocal sensors with high precision
confocalDT IFS2405



- Robust universal sensors for versatile applications
- Submicron resolution
- For one-sided thickness measurements
- For precise distance measurements
- Very small light spot
- Large tilt angle



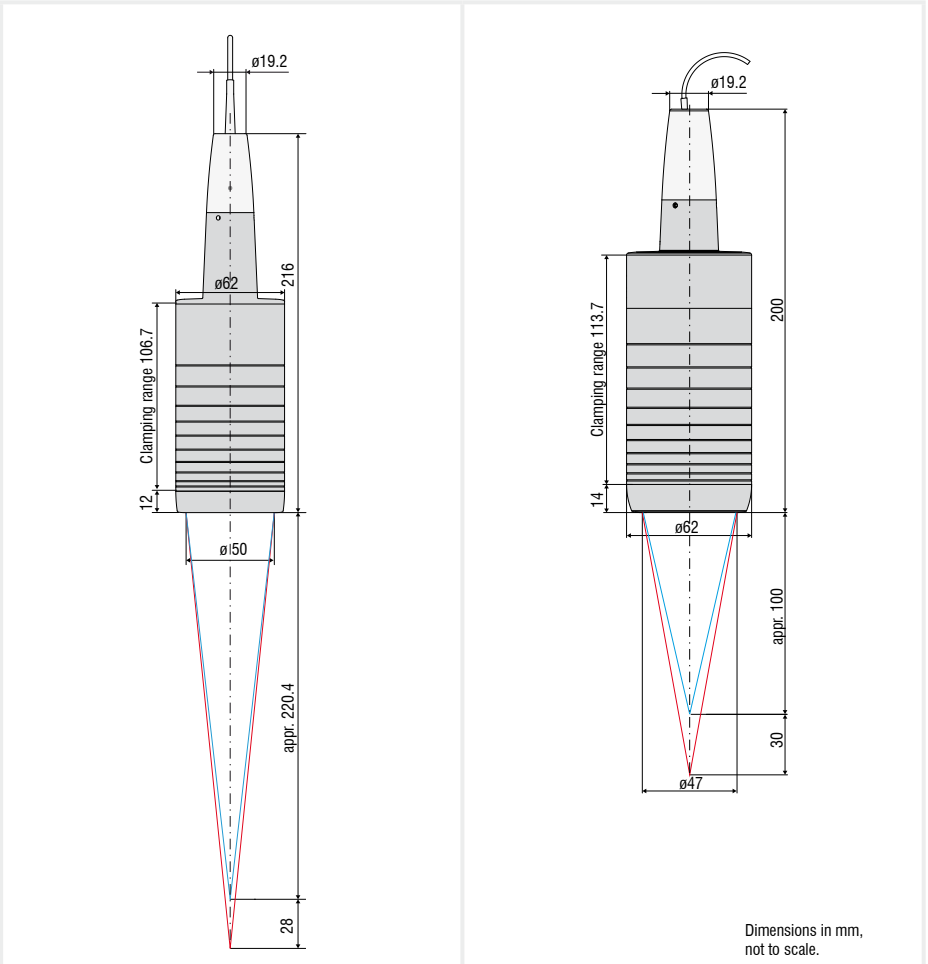




Dimensions in mm, not to scale.

Model		IFS2405-6	IFS2405/90-6	IFS2405-10
Measuring range		6 mm	6 mm	10 mm
Start of measuring range	approx.	63 mm	41 mm [1]	50 mm
Resolution	static [2]	34 nm	34 nm	36 nm
	dynamic [3]	190 nm	190 nm	204 nm
Linearity [4]	Displacement and distance	< ±1.5 µm	< ±1.5 µm	< ±2 µm
	Thickness	< ±3 µm	< ±3 µm	< ±4 µm
Light spot diameter		31 µm	31 µm	16 µm
Max. measuring angle [5]		±10°	±10°	±17°
Numerical aperture (NA)		0.22	0.22	0.30
Min. target thickness [6]		0.3 mm	0.3 mm	0.5 mm
Connector		pluggable optical fiber via FC socket, standard length 3 m; extension up to 50 m; bending radius: static 30 mm; dynamic 40 mm		
Mounting		Clamping, mounting adapter (see accessories)		
Temperature range	Storage	-20 … +70 °C		
	Operation	+5 … +70 °C		
Shock (DIN EN 60068-2-27)		15 g / 6 ms in XY axis, 1000 shocks each		
Vibration (DIN EN 60068-2-6)		2 g / 20 … 500 Hz in XY axis, 10 cycles each		
Protection class (DIN EN 60529)		IP64 (front)		
Material		Aluminum housing, glass lenses		
Weight [7]		approx. 260 g	approx. 315 g	approx. 500 g

[1] Start of measuring range measured from sensor axis
[2] Average from 512 values at 1 kHz, near to the mid of the measuring range onto optical flat
[3] RMS noise relates to mid of measuring range (1 kHz)
[4] All data at constant ambient temperature (25 ±1 °C) against optical flat; specifications can change when measuring different objects.
[5] Maximum measuring angle of the sensor that produces a usable signal on reflecting surfaces. The accuracy decreases when approaching the limit values.
[6] Glass sheet with refractive index n = 1.5 throughout the entire measuring range. In the mid of the measuring range, also thinner layers can be measured.
[7] Sensor weight without optical fiber



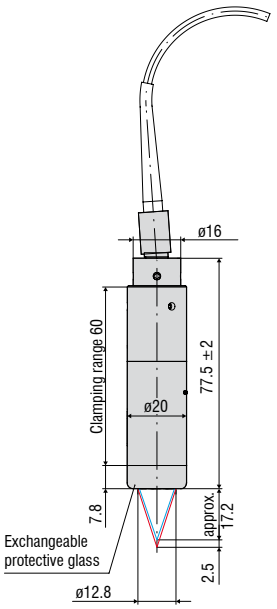
Dimensions in mm,
not to scale.

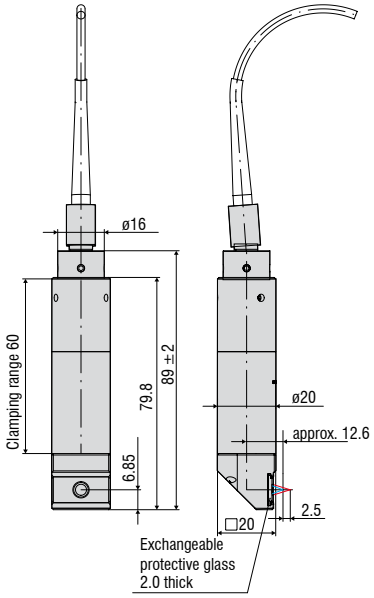
Model		IFS2405-28	IFS2405-30
Measuring range		28 mm	30 mm
Start of measuring range	approx.	220 mm	100 mm
Resolution	static [1]	130 nm	93 nm
	dynamic [2]	747 nm	530 nm
Linearity [3]	Displacement and distance	< ±7 µm	< ±6 µm
	Thickness	< ±14 µm	< ±12 µm
Light spot diameter		60 µm	50 µm
Max. measuring angle [4]		±5°	±9°
Numerical aperture (NA)		0.10	0.20
Min. target thickness [5]		2.2 mm	1.5 mm
Connector		pluggable optical fiber via FC socket, standard length 3 m; extension up to 50 m; bending radius: static 30 mm; dynamic 40 mm	
Mounting		Clamping, mounting adapter (see accessories)	
Temperature range	Storage	-20 … +70 °C	
	Operation	+5 … +70 °C	
Shock (DIN EN 60068-2-27)		15 g / 6 ms in XY axis, 1000 shocks each	
Vibration (DIN EN 60068-2-6)		2 g / 20 … 500 Hz in XY axis, 10 cycles each	
Protection class (DIN EN 60529)		IP64 (front)	
Material		Aluminum housing, glass lenses	
Weight [6]		approx. 750 g	approx. 730 g

[1] Average from 512 values at 1 kHz, near to the mid of the measuring range onto optical flat
[2] RMS noise relates to mid of measuring range (1 kHz)
[3] All data at constant ambient temperature (25 ±1 °C) against optical flat; specifications can change when measuring different objects.
[4] Maximum measuring angle of the sensor that produces a usable signal on reflecting surfaces. The accuracy decreases when approaching the limit values.
[5] Glass sheet with refractive index n = 1.5 throughout the entire measuring range. In the mid of the measuring range, also thinner layers can be measured.
[6] Sensor weight without optical fiber

Confocal chromatic sensors for displacement and thickness
confocalDT IFS2406

- Sensors with axial or radial beam path
- Submicron resolution
- For one-sided thickness measurements
- For precise distance measurements
- Very small light spot
- Suitable for VAC areas

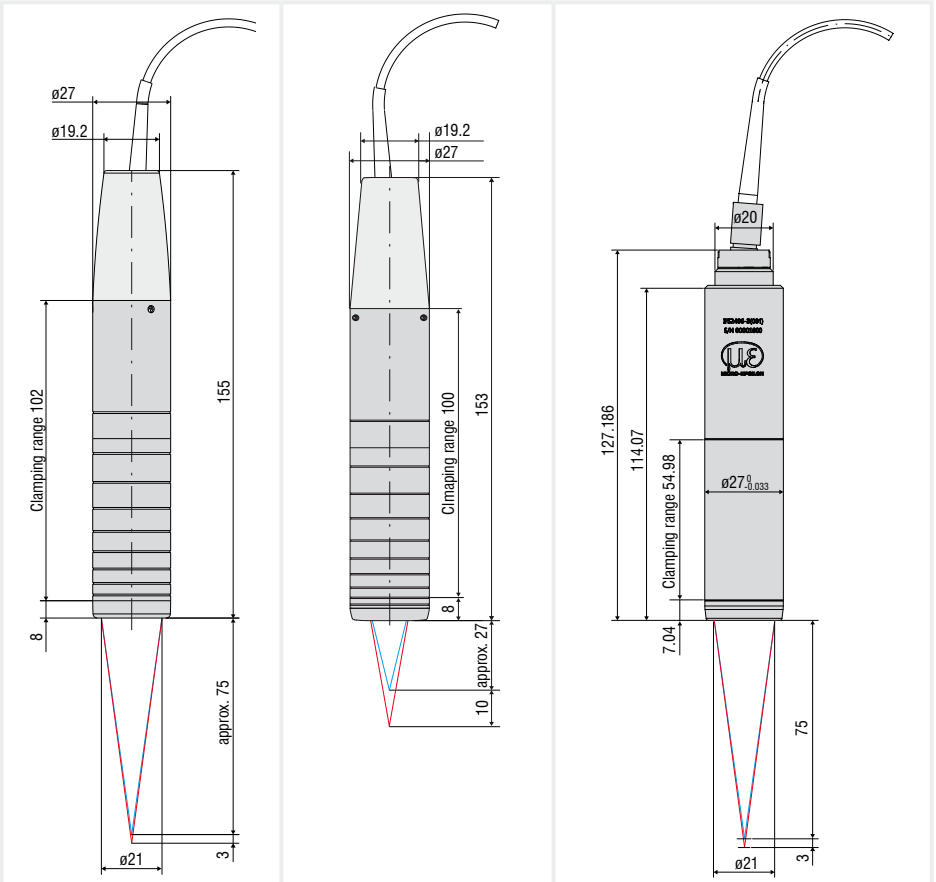




Dimensions in mm, not to scale.

Model		IFS2406-2,5/VAC(003)	IFS2406/90-2,5/VAC(001)
Measuring range		2.5 mm	2.5 mm
Start of measuring range	approx.	17.2 mm	12.6 mm [1]
Resolution	static [2]	18 nm	18 nm
	dynamic [3]	97 nm	97 nm
Linearity [4]	Displacement and distance	< ±0.75 µm	< ±0.75 µm
	Thickness	< ±1.5 µm	< ±1.5 µm
Light spot diameter		10 µm	10 µm
Max. measuring angle [5]		±16°	±16°
Numerical aperture (NA)		0.30	0.30
Min. target thickness [6]		0.125 mm	0.125 mm
Connector		pluggable optical fiber via FC socket, type C240x-x (01); standard length 3 m; extension up to 50 m; bending radius: static 30 mm, dynamic 40 mm	
Mounting		Clamping, mounting adapter (see accessories)	
Temperature range	Storage	-20 … +70 °C	
	Operation	+5 … +70 °C	
Shock (DIN EN 60068-2-27)		15 g / 6 ms in XY axis, 1000 shocks each	
Vibration (DIN EN 60068-2-6)		2 g / 20 … 500 Hz in XY axis, 10 cycles each	
Protection class (DIN EN 60529)		IP40 (vacuum compatible)	
Material		Stainless steel housing, glass lenses	
Weight [7]		approx. 105 g	approx. 130 g

[1] Start of measuring range measured from sensor axis
[2] Average from 512 values at 1 kHz, near to the mid of the measuring range onto optical flat
[3] RMS noise relates to mid of measuring range (1 kHz)
[4] All data at constant ambient temperature (25 ±1 °C) against optical flat; specifications can change when measuring different objects.
[5] Maximum measuring angle of the sensor that produces a usable signal on reflecting surfaces. The accuracy decreases when approaching the limit values.
[6] Glass sheet with refractive index n = 1.5 throughout the entire measuring range. In the mid of the measuring range, also thinner layers can be measured.
[7] Sensor weight without optical fiber

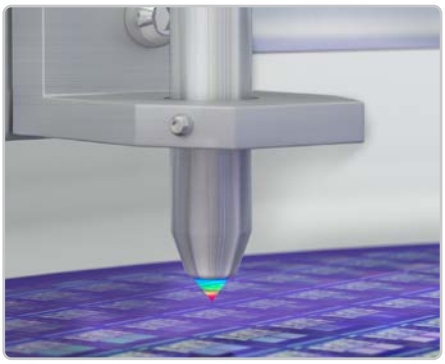


Dimensions in mm,
not to scale.

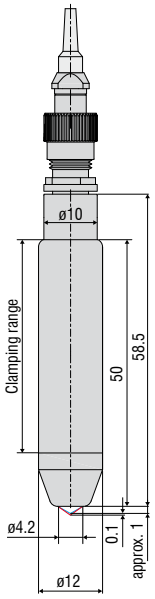
Model		IFS2406-3	IFS2406-10	IFS2406-3/VAC(001)
Measuring range		3 mm	10 mm	3 mm
Start of measuring range	approx.	75 mm	27 mm	75 mm
Resolution	static [1]	32 nm	38 nm	50 nm
	dynamic [2]	168 nm	207 nm	168 nm
Linearity [3]	Displacement and distance	< ±1.5 µm	< ±2 µm	< ±1.5 µm
	Thickness	< ±3 µm	< ±4 µm	< ±3 µm
Light spot diameter		35 µm	15 µm	35 µm
Max. measuring angle [4]		±6.5°	±13.5°	±6.5°
Numerical aperture (NA)		0.14	0.25	0.14
Min. target thickness [5]		0.15 mm	0.5 mm	0.15 mm
Connector		pluggable optical fiber via FC socket, type C240x-x (01); standard length 3 m; extension up to 50 m; bending radius: static 30 mm, dynamic 40 mm		pluggable optical fiber via FC socket, type C240x-x/VAC(01); standard length 3 m; extension up to 50 m; bending radius: static 30 mm, dynamic 40 mm
Mounting		Clamping, mounting adapter (see accessories)		
Temperature range	Storage	-20 … +70 °C		
	Operation	+5 … +70 °C		
Shock (DIN EN 60068-2-27)		15 g / 6 ms in XY axis, 1000 shocks each		
Vibration (DIN EN 60068-2-6)		2 g / 20 … 500 Hz in XY axis, 10 cycles each		
Protection class (DIN EN 60529)		IP65 (front)		IP40 (vacuum compatible)
Material		Aluminum housing, glass lenses		Stainless steel housing (1.4305), glass lenses
Weight [6]		approx. 99 g	approx. 128 g	approx. 250 g

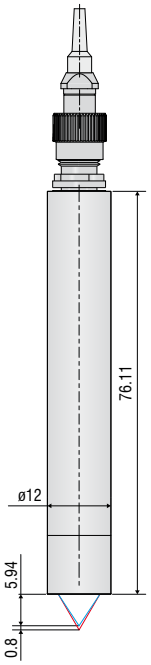
[1] Average from 512 values at 1 kHz, near to the mid of the measuring range onto optical flat
[2] RMS noise relates to mid of measuring range (1 kHz)
[3] All data at constant ambient temperature (25 ±1 °C) against optical flat; specifications can change when measuring different objects.
[4] Maximum measuring angle of the sensor that produces a usable signal on reflecting surfaces. The accuracy decreases when approaching the limit values.
[5] Glass sheet with refractive index n = 1.5 throughout the entire measuring range. In the mid of the measuring range, also thinner layers can be measured.
[6] Sensor weight without optical fiber

High precision sensors for displacement and thickness measurements
confocalDT IFS2407



- Compact sensors from ø12 mm
- Submicron resolution
- For one-sided thickness measurements
- For precise distance measurements
- Very small light spot
- Large tilt angle

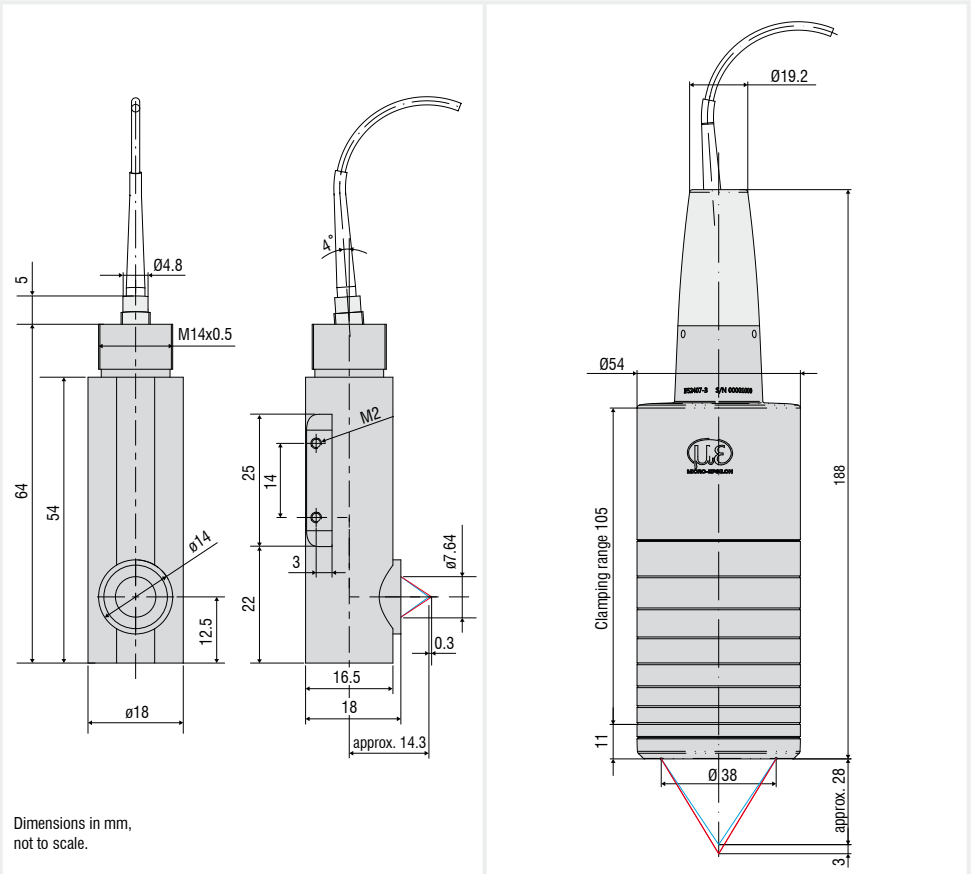




Dimensions in mm, not to scale.

Model		IFS2407-0,1	IFS2407-0,1(001)	IFS2407-0,8
Measuring range		0.1 mm	0.1 mm	0.8 mm
Start of measuring range	approx.	1 mm	1 mm	5.9 mm
Resolution	static [1]	3 nm	3 nm	24 nm
	dynamic [2]	6 nm	6 nm	75 nm
Linearity [3]	Displacement and distance	< ±0.05 µm	< ±0.05 µm	< ±0.2 µm
	Thickness	< ±0.1 µm	< ±0.1 µm	< ±0.4 µm
Light spot diameter		3 µm	4 µm	6 µm
Max. measuring angle [4]		±48°	±48°	±30°
Numerical aperture (NA)		0.80	0.70	0.50
Min. target thickness [5]		0.005 mm	0.005 mm	0.04 mm
Connector		pluggable optical fiber via FC socket, standard length 3 m; extension up to 50 m; bending radius: static 30 mm; dynamic 40 mm		
Mounting		Clamping, mounting adapter (see accessories)		
Temperature range	Storage	-20 … +70 °C		
	Operation	+5 … +70 °C		
Shock (DIN EN 60068-2-27)		15 g / 6 ms in XY axis, 1000 shocks each		
Vibration (DIN EN 60068-2-6)		2 g / 20 … 500 Hz in XY axis, 10 cycles each		
Protection class (DIN EN 60529)		IP65 (front)		
Material		Stainless steel housing, glass lenses		
Weight [6]		approx. 36 g	approx. 36 g	approx. 40 g
Special features		Sensor with high numerical aperture	Light-intensive sensor	-

[1] Average from 512 values at 1 kHz, near to the mid of the measuring range onto optical flat
[2] RMS noise relates to mid of measuring range (1 kHz)
[3] All data at constant ambient temperature (25 ±1 °C) against optical flat; specifications can change when measuring different objects.
[4] Maximum measuring angle of the sensor that produces a usable signal on reflecting surfaces. The accuracy decreases when approaching the limit values.
[5] Glass sheet with refractive index n = 1.5 throughout the entire measuring range. In the mid of the measuring range, also thinner layers can be measured.
[6] Sensor weight without optical fiber



Dimensions in mm,
not to scale.

Model		IFS2407/90-0,3	IFS2407-3
Measuring range		0.3 mm	3 mm
Start of measuring range	approx.	5.3 mm	28 mm
Resolution	static [1]	6 nm	13 nm
	dynamic [2]	20 nm	63 nm
Linearity [3]	Displacement and distance	< ±0.15 µm	< ±0.5 µm
	Thickness	< ±0.3 µm	< ±1 µm
Light spot diameter		6 µm	9 µm
Max. measuring angle [4]		±27°	±30°
Numerical aperture (NA)		0.50	0.53
Min. target thickness [5]		0.015 mm	0.15 mm
Connector		pluggable optical fiber via FC socket, type C2407-x; standard length 3 m; extension up to 50 m; bending radius: static 30 mm, dynamic 40 mm	pluggable optical fiber via FC socket, standard length 3 m; extension up to 50 m; bending radius: static 30 mm, dynamic 40 mm
Mounting		Mounting holes (2x M2)	Clamping, mounting adapter (see accessories)
Temperature range	Storage	-20 … +70 °C	
	Operation	+5 … +70 °C	
Shock (DIN EN 60068-2-27)		15 g / 6 ms in XY axis, 1000 shocks each	
Vibration (DIN EN 60068-2-6)		2 g / 20 … 500 Hz in XY axis, 10 cycles each	
Protection class (DIN EN 60529)		IP65 (front)	
Material		Stainless steel housing, glass lenses	Aluminum housing, glass lenses
Weight [6]		approx. 30 g	approx. 550 g

[1] Average from 512 values at 1 kHz, near to the mid of the measuring range onto optical flat
[2] RMS noise relates to mid of measuring range (1 kHz)
[3] All data at constant ambient temperature (25 ±1 °C) against optical flat; specifications can change when measuring different objects.
[4] Maximum measuring angle of the sensor that produces a usable signal on reflecting surfaces. The accuracy decreases when approaching the limit values.
[5] Glass sheet with refractive index n = 1.5 throughout the entire measuring range. In the mid of the measuring range, also thinner layers can be measured.
[6] Sensor weight without optical fiber

The new confocal controller for industrial applications
confocalDT IFC242x

- Measuring rate up to 6.5 kHz
- Ethernet / EtherCAT / RS422 / PROFINET / Ethernet/IP / Analog
- Fast surface compensation
- Configuration via web interface
- Submicron resolution
- Thickness measurement of multi-layer materials
- Synchronous two-sided thickness measurement
- Robust design with passive cooling

The confocalDT 2421/22 controllers set the industrial standard in precise, confocal measurement technology.

Available as either a single- or a dual-channel version, these measuring systems are a low cost solution especially for serial applications. The active exposure regulation of the CCD line enables accurate, fast surface compensation on changing surfaces.

The controller can be operated with any IFS sensor and is available as a standard version for distance measurements or as a multi-peak version for multi-layer thickness measurements. Using a special calculation function, the confocalDT 2422 dual-channel version evaluates both channels. Measurement acquisition is synchronous and can be carried out while exploiting the full measuring rate for both channels.

Due to a user-friendly web interface, no additional software is necessary to configure the controller and the sensors. Data output is via Ethernet, EtherCAT, RS422 or analog output.

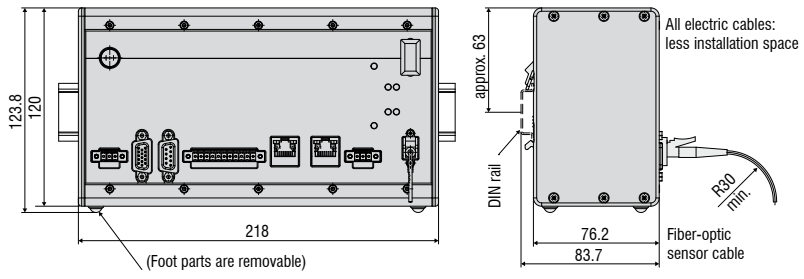
Settings are made via the web interface. For thickness measurements, materials are stored in an expandable materials database.

Two sensors can be directly connected to a confocal IFC2422 controller.

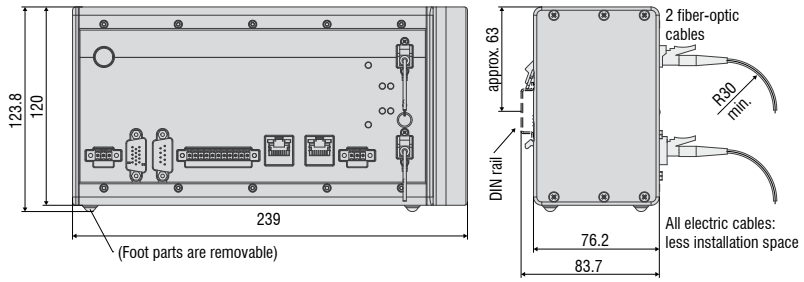
Model		IFC2421	IFC2421MP	IFC2422	IFC2422MP
Resolution	Ethernet/EtherCAT	1 nm			
	RS422	18 bit			
	Analog	16 bits (teachable)			
Measuring rate		continuously adjustable from 100 Hz to 6.5 kHz			
Linearity		typ. < ±0.025 % FSO (depends on sensor)			
Multi-layer measurement		1 layer	5 layers	1 layer	5 layers
Light source		internal white LED			
No. of characteristic curves		up to 20 characteristic curves for different sensors per channel, selection via table in the menu			
Permissible ambient light [1]		30,000 lx			
Synchronization		yes			
Supply voltage		24 VDC ±15 %			
Power consumption		approx. 10 W			
Signal input		sync-in / trig-in; 2x encoders (A+, A-, B+, B-, index)			
Digital interface		Ethernet; EtherCAT; RS422; PROFINET [2]; EtherNet/IP [2]			
Analog output		Current: 4 … 20 mA; voltage: 0 ... 10 V (16 bit D/A converter)			
Switching output		Error1-Out, Error2-Out			
Digital output		sync-out			
Connector	Optical	pluggable optical fiber via E2000 socket, length 2 m ... 50 m, min. bending radius 30 mm			
	Electrical	3-pin supply terminal strip; encoder connection (15-pin, HD-sub socket, max. cable length 3 m, 30 m with external encoder supply); RS422 connection socket (9-pin, Sub-D, max. cable length 30 m); 3-pin output terminal strip (max. cable length 30 m); 11-pin I/O terminal strip (max. cable length 30 m); RJ45 socket for Ethernet (out) / EtherCAT (in/out) (max. cable length 100 m)			
Mounting		free-standing, DIN rail mounting			
Temperature range	Storage	-20 … +70 °C			
	Operation	+5 ... +50 °C			
Shock (DIN EN 60068-2-27)		15 g / 6 ms in XYZ axis, 1000 shocks each			
Vibration (DIN EN 60068-2-6)		2 g / 20 … 500 Hz in XYZ axis, 10 cycles each			
Protection class (DIN EN 60529)		IP40			
Material		Aluminum			
Weight		approx. 1.8 kg		approx. 2.25 kg	
Compatibility		compatible with all confocalDT sensors			
No. of measurement channels [2]		1		2	
Control and indicator elements		Multifunction button (two adjustable functions and reset to factory setting after 10 s); 5x LEDs for intensity, range, status and supply voltage			

FSO = Full Scale Output
[1] Illuminant: light bulb
[2] Connection via interface module (see accessories)
[3] No loss of intensity and linearity due to two synchronous measurement channels

IFC2421 Controller



IFC2422 Controller



Light-intensive controller for high speed measurements
confocalDT IFC246x

- Measuring rate up to 30 kHz
- Ethernet / EtherCAT / RS422 / PROFINET / Ethernet/IP / Analog
- Fast surface compensation and high light intensity
- Configuration via web interface
- Submicron resolution
- Thickness measurement of multi-layer materials
- Synchronous two-sided thickness measurement
- Robust design with passive cooling

The confocalDT 2465 and 2466 controllers enable fast, high-precision distance and thickness measurements up to 30 kHz. They are available as a single- or dual-channel variant. In addition, the MP models measure the thickness of up to 5 transparent layers at once. The controllers are characterized by high luminous intensity which enables very fast and reliable measurements even on dark surfaces.

The controller can be operated with any IFS sensor and is available as a standard version for distance measurements or as a multi-peak version for multi-layer thickness measurements. Using a special calculation function, the confocalDT 2466 dual-channel version evaluates both channels. Measurement acquisition is synchronous and can be carried out while exploiting the full measuring rate for both channels.

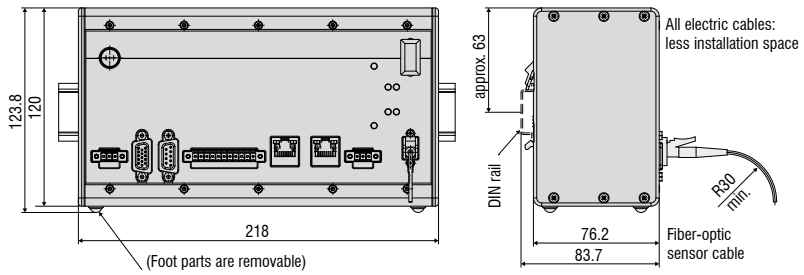
Due to a user-friendly web interface, no additional software is necessary to configure the controller and the sensors. Data output is via Ethernet, EtherCAT, RS422 or analog output. Optionally available interface modules enable the data to be output also via PROFINET or EtherNet/IP.

Settings are made via the web interface. For thickness measurements, materials are stored in an expandable materials database.

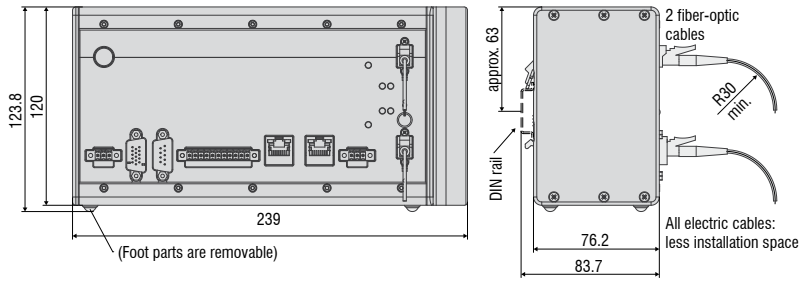
Model		IFC2465	IFC2465MP	IFC2466	IFC2466MP
Resolution	Ethernet/EtherCAT	1 nm			
	RS422	18 bit			
	Analog	16 bits (teachable)			
Measuring rate		continuously adjustable from 100 Hz to 30 kHz			
Linearity		typ. < ±0.025 % FSO (depends on sensor)			
Multi-layer measurement		1 layer	5 layers	1 layer	5 layers
Light source		internal white LED			
No. of characteristic curves		up to 20 characteristic curves for different sensors per channel, selection via table in the menu			
Permissible ambient light [1]		30,000 lx			
Synchronization		yes			
Supply voltage		24 VDC ±15 %			
Power consumption		approx. 10 W			
Signal input		sync-in / trig-in; 2x encoders (A+, A-, B+, B-, index)			
Digital interface		Ethernet / EtherCAT / RS422 / PROFINET [2] / EtherNet/IP [2]			
Analog output		Current: 4 … 20 mA; voltage: 0 ... 10 V (16 bit D/A converter)			
Switching output		Error1-Out, Error2-Out			
Digital output		sync-out			
Connector	Optical	pluggable optical fiber via E2000 socket, length 2 m ... 50 m, min. bending radius 30 mm			
	Electrical	3-pin supply terminal strip; encoder connection (15-pin, HD-sub socket, max. cable length 3 m, 30 m with external encoder supply); RS422 connection socket (9-pin, Sub-D, max. cable length 30 m); 3-pin output terminal strip (max. cable length 30 m); 11-pin I/O terminal strip (max. cable length 30 m); RJ45 socket for Ethernet (out) / EtherCAT (in/out) (max. cable length 100 m)			
Mounting		free-standing, DIN rail mounting			
Temperature range	Storage	-20 … +70 °C			
	Operation	+5 ... +50 °C			
Shock (DIN EN 60068-2-27)		15 g / 6 ms in XYZ axis, 1000 shocks each			
Vibration (DIN EN 60068-2-6)		2 g / 20 … 500 Hz in XYZ axis, 10 cycles each			
Protection class (DIN EN 60529)		IP40			
Material		Aluminum			
Weight		approx. 1.8 kg		approx. 2.25 kg	
Compatibility		compatible with all confocalDT sensors			
No. of measurement channels [3]		1		2	
Control and indicator elements		Multifunction button (two adjustable functions and reset to factory setting after 10 s); 5x LEDs for intensity, range, status and supply voltage			

FSO = Full Scale Output
[1] Illuminant: light bulb
[2] Connection via interface module (see accessories)
[3] No loss of intensity and linearity due to two synchronous measurement channels

IFC2465 Controller



IFC2466 Controller



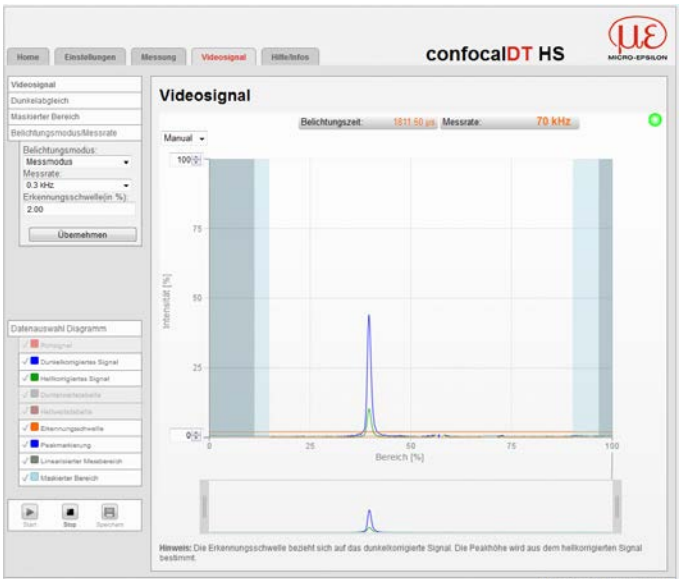
Confocal high-speed controller up to 70 kHz
confocalDT IFC2471 HS

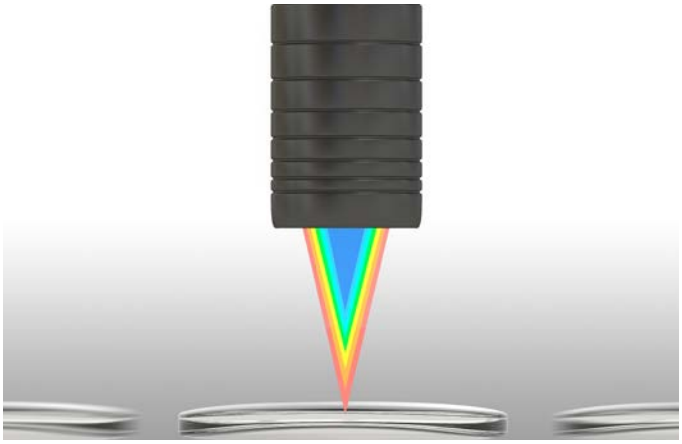
- Fastest controller in the world: Measuring rate up to 70 kHz
- Ethernet / EtherCAT / RS422 / PROFINET / Ethernet/IP / Analog
- Fast surface compensation
- Configuration via web interface
- Submicron resolution
- Thickness measurement of multi-layer materials
- Robust design with passive cooling

The confocalDT 2471 HS controllers are used for fast distance and thickness measurements of highly reflecting and specular surfaces. The controllers are equipped with enhanced optical components enabling measuring rates up to 70 kHz on reflecting surfaces without having to use an external light source. The confocalDT HS controllers are one of the fastest confocal measuring systems in the world. The active exposure regulation of the CCD line enables accurate, fast surface compensation on changing surfaces during dynamic measurement processes.

The controller can be operated with any IFS sensor and is available as a standard version for distance and thickness measurements or as a multi-peak version for multi-layer measurements.

Due to a user-friendly web interface, no additional software is necessary to configure the controller and the sensors. Data output is via Ethernet, EtherCAT, RS422 or analog output.

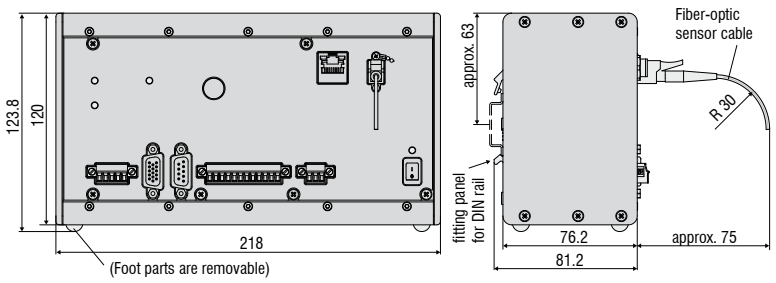




Model		IFC2471LED	IFC2471MP LED
Resolution	Ethernet/EtherCAT	1 nm	
	RS422	18 bit	
	Analog	16 bits (teachable)	
Measuring rate		continuously adjustable from 100 Hz to 70 kHz	
Linearity		typ. < ±0.025 % FSO (depends on sensor)	
Multi-layer measurement		1 layer	5 layers
Light source		internal white LED	
No. of characteristic curves		storage of up to 20 calibration tables for different sensors per channel, menu selection	
Permissible ambient light [1]		30,000 lx	
Synchronization		yes	
Supply voltage		24 VDC ±15 %	
Power consumption		approx. 10 W	
Signal input		sync-in / trig-in; 3x encoders (A, B, index)	
Digital interface		Ethernet; EtherCAT; RS422; PROFINET [2]; EtherNet/IP [2]	
Analog output		Current: 4 … 20 mA; voltage: 0 ... 10 V / -10 … +10 V (16 bit D/A converter)	
Switching output		Error1-Out, Error2-Out	
Digital output		sync-out	
Connector	Optical	pluggable optical fiber via E2000 socket, length 2 m ... 50 m, min. bending radius 30 mm	
	Electrical	3-pin supply terminal strip; encoder connection (15-pin, HD-sub socket, max. cable length 3 m); RS422 connection socket (9-pin, Sub-D, max. cable length 30 m); 3-pin output terminal strip (max. cable length 30 m); 12-pin I/O terminal strip (max. cable length 30 m); RJ45 socket for Ethernet /(EtherCAT (max. cable length 100 m)	
Mounting		free-standing, DIN rail mounting	
Temperature range	Storage	-20 … +70 °C	
	Operation	+5 ... +50 °C	
Shock (DIN EN 60068-2-27)		15 g / 6 ms in XYZ axis, 1000 shocks each	
Vibration (DIN EN 60068-2-6)		2 g / 20 … 500 Hz in XYZ axis, 10 cycles each	
Protection class (DIN EN 60529)		IP40	
Material		Aluminum	
Weight		approx. 2.2 kg	
Compatibility		compatible with all confocalDT sensors	
No. of measurement channels		1	
Control and indicator elements		ON/OFF multifunction button (as well as dark alignment and reset to factory setting after 10 s); 4x LEDs for intensity, range, status, supply voltage	
Special features		particularly light-intensive and high measuring rate	

FSO = Full Scale Output
[1] Illuminant: light bulb
[2] Connection via interface module (see accessories)

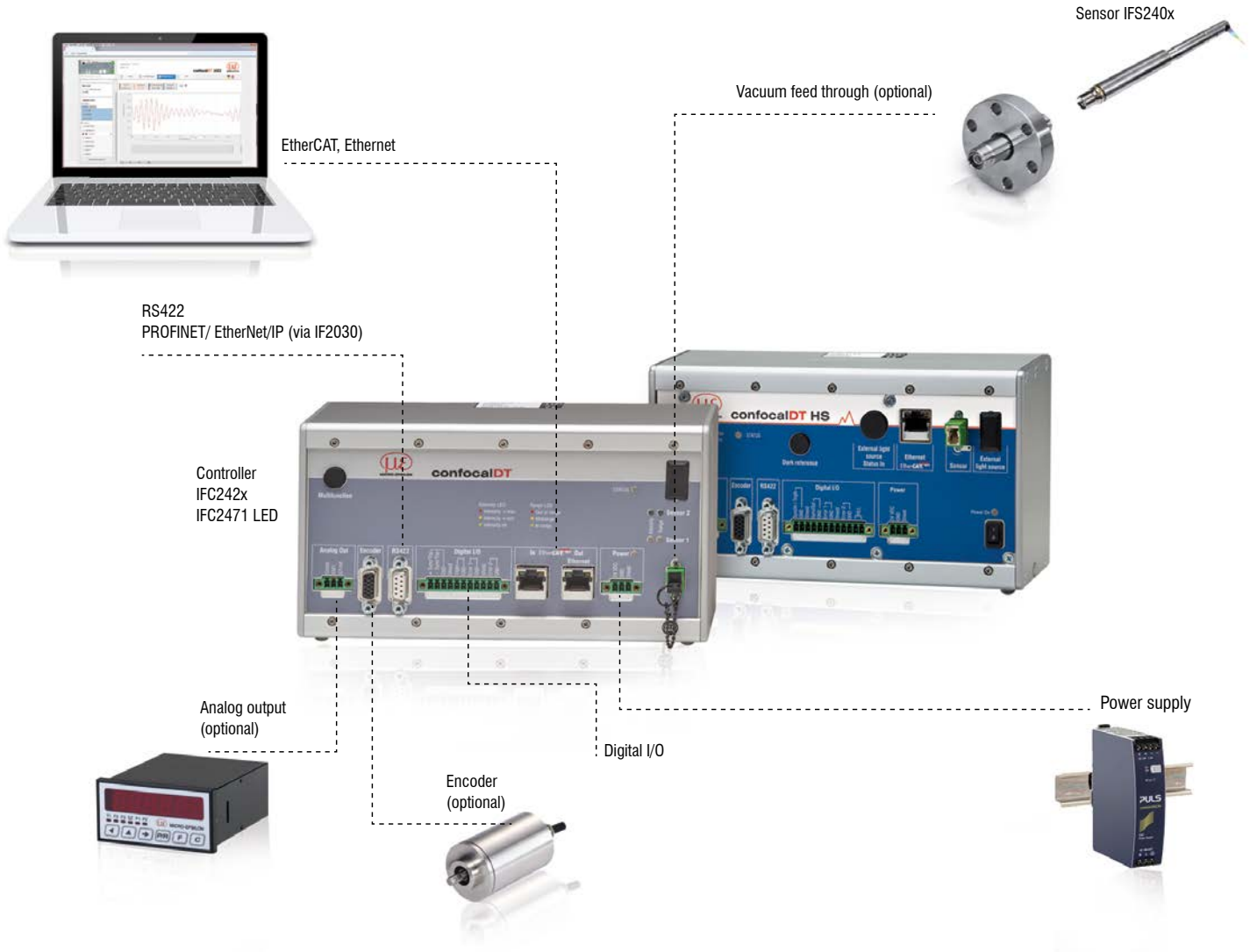
Controller IFC2471 LED



System design
confocalDT

The confocalDT system consists of:

- Sensor IFS240x
- Controller IFC24xx
- Fiber optic cable C24xx



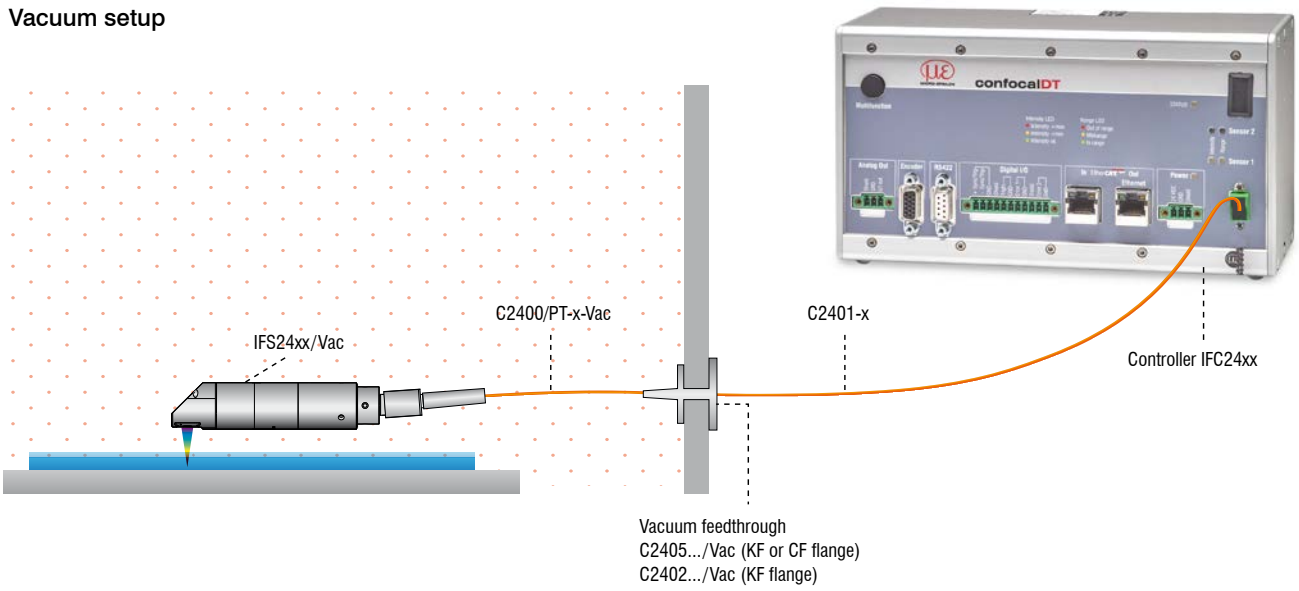
Customer-specific modifications

Application examples are often found where the standard versions of the sensors and the controllers are performing at their limits. To facilitate such special tasks, it is possible to customize the sensor design and to adjust the controller accordingly. Common requests for modifications include changes in design, mounting options, customized cable lengths and modified measuring ranges.

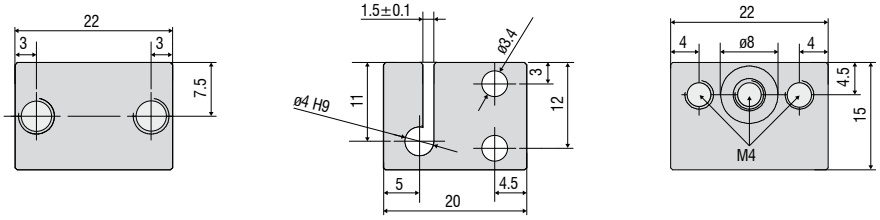
Possible modifications

- Sensors with connector
- Cable length
- Vacuum suitability up to UHV
- Specific lengths
- Customer-specific mounting options
- Optical filter for ambient light compensation
- Housing material
- Measuring range / Offset distance

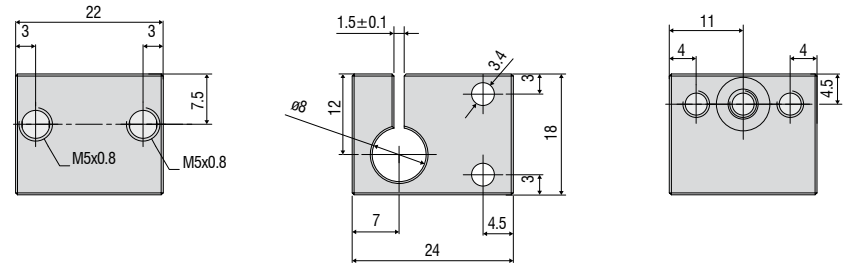
Vacuum setup



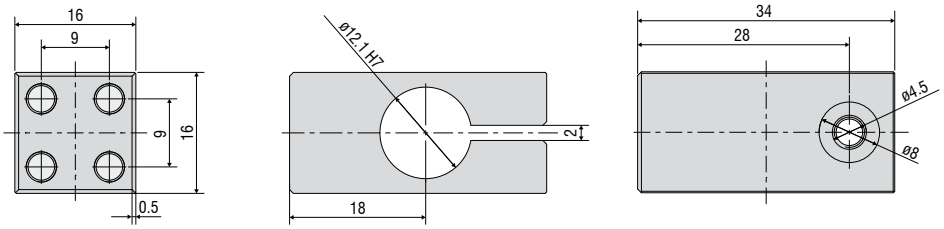
Accessories: mounting adapter
MA2402 for sensors 2402



Accessories: mounting adapter
MA2403 for sensors 2403

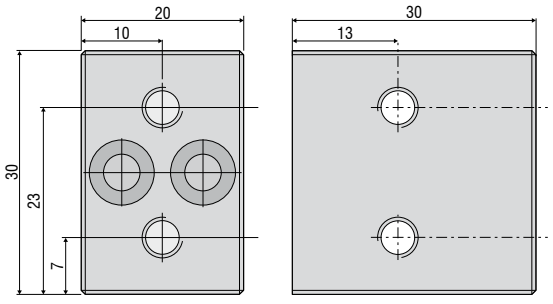


Accessories: mounting adapter
MA2404-12 for sensors IFS2404-2 / IFS2404/90-2 / IFS2407-0,1

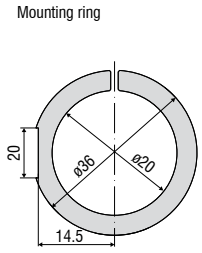


Accessories: mounting adapter
MA2400 for sensors IFS2405 / IFS2406 / IFS2407 (consisting of a mounting block and a mounting ring)

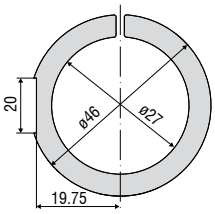
Mounting block



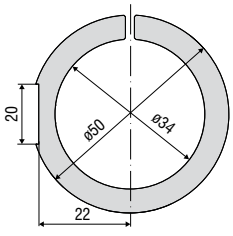
Mounting ring



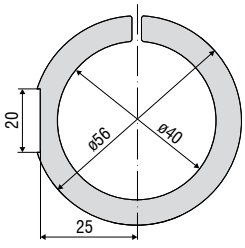
MA 2406-20
for sensors
IFS2406-2,5
IFS2406/90-2,5



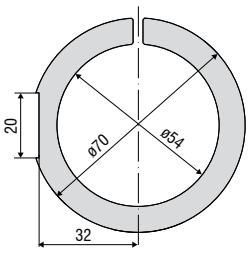
MA 2400-27
for sensors
IFS2405-0,3 / -1
IFS2406-3 / -10



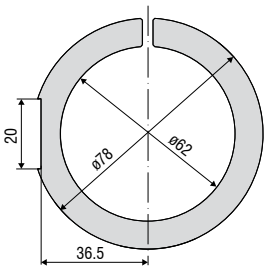
MA 2405-34
for sensors
IFS2405-3



MA 2405-40
for sensors
IFS 2405-6



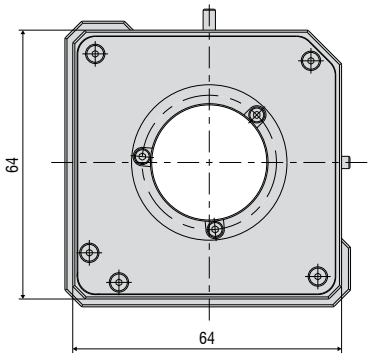
MA 2405-54
for sensors
IFS2405-10 / IFS2407-3

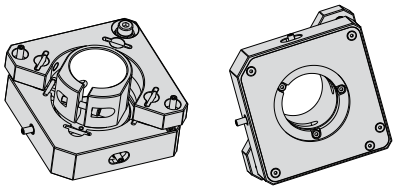


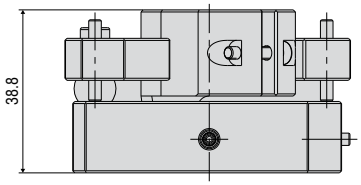
MA 2405-62
for sensors
IFS2405-28 / -30

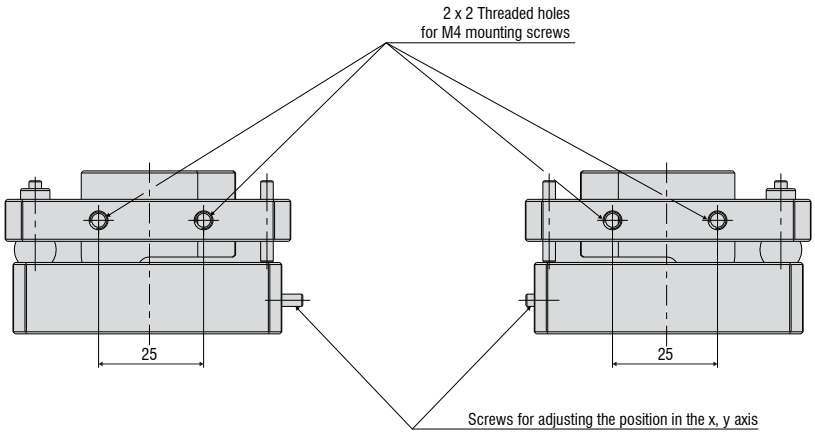
Adjustable mounting adapter

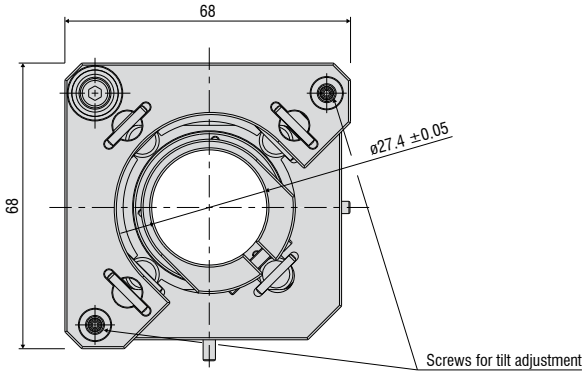
The adjustable JMA mounting adapter simplifies the alignment and fine adjustment of confocal sensors. You can integrate the sensors with the adapter directly into the machine and then align them directly on site. This corrects, e.g, minor deviations caused by mounting and compensates for tilted measuring objects. With two-sided thickness measurements, the mounting adapter supports the fine alignment of the two measuring points.







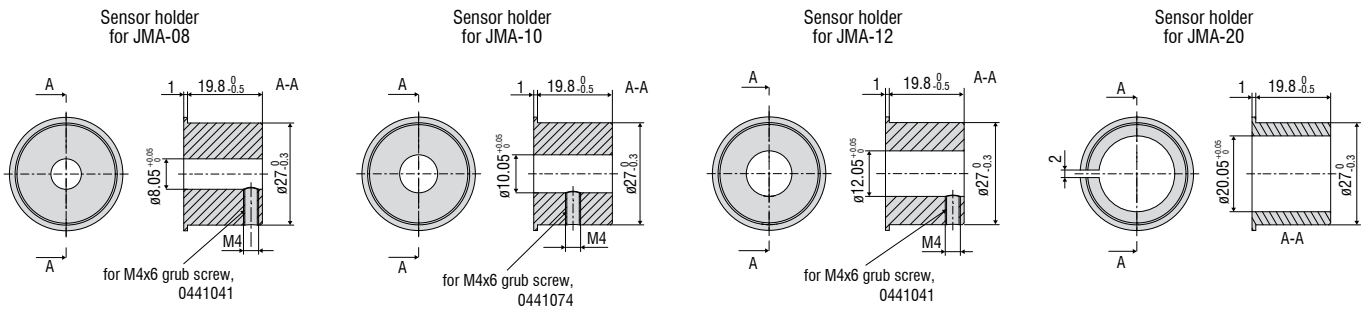




Scope of supply

- Adjustable mounting adapter
- Sensor holder for smaller diameters (not with JMA-27)
- Screwdriver for positioning
- Assembly instructions

Sensor holder for smaller diameters



Accessories
confocalDT

Software

IFD24xx-Tool	Software demo tool included

Accessories light source

IFL2422/LED	Lamp module for IFC2422 and IFC2466
IFL24x1/LED	Lamp module for IFC2421, IFC2465 and IFC2471

Cable extension for sensors

CE2402 cable with 2x E2000/APC connectors

CE2402-x	Extension for optical fiber (3 m, 10 m, 13 m, 30 m, 50 m)
CE2402/PT3-x	Extension for optical fiber with protection tube for mechanical stress (3 m, 10 m, customer-specific length up to 50 m)

Cable for IFS2404 sensors

C2404-x	Optical fiber with FC/APC and E2000/APC connectors Fiber core diameter 20 µm (2 m)

Cables for IFS2405/IFS2406/2407-0,1 sensors

C2401 cable with FC/APC and E2000/APC connectors

C2401-x	Optical fiber (3 m, 5 m, 10 m, customer-specific length up to 50 m)
C2401/PT3-x	Optical fiber with protection tube for mechanical stress (3 m, 5 m, 10 m, customer-specific length up to 50 m)
C2401-x(01)	Optical fiber core diameter 26 µm (3 m, 5 m, 15 m)
C2401-x(10)	Drag-chain suitable optical fiber (3 m, 5 m, 10 m)

C2400 cable with 2x FC/APC connectors

C2400-x	Optical fiber (3 m, 5 m, 10 m, customer-specific length up to 50 m)
C2400/PT-x	Optical fiber with protection tube for mechanical stress (3 m, 5 m, 10 m, customer-specific length up to 50 m)
C2400/PT-x-Vac	Optical fiber with protection tube suitable for use in vacuum (3 m, 5 m, 10 m, customer-specific length up to 50 m)

Cable for IFS2407/90-0,3 sensors

C2407-x	Optical fiber with DIN connector and E2000/APC (2 m, 5 m)

Vacuum feedthrough

C2402/Vac/KF16	Vacuum feed through with optical fiber, 1 channel, vacuum side FC/APC non-vacuum side E2000/APC, clamping flange KF 16
C2405/Vac/1/KF16	Vacuum feed through on both sides FC/APC socket, 1 channel, clamping flange type KF 16
C2405/Vac/1/CF16	Vacuum feed through on both sides FC/APC socket, 1 channel, flange type CF 16
C2405/Vac/6/CF63	Vacuum feed through FC/APC socket, 6 channels, flange type CF 63

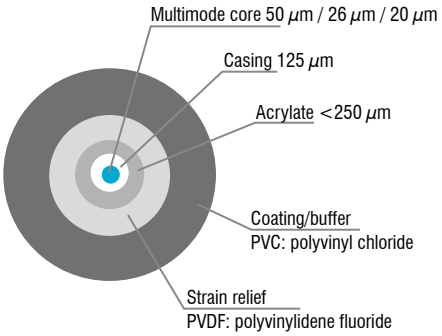
Other accessories

SC2471-x/USB/IND	Connector cable IFC2461/71, 3 m, 10 m, 20 m
SC2471-x/IF2008	Connector cable IFC2461/71-IF2008, 3 m, 10 m, 20 m
PS2020	Power supply 24 V / 2.5 A
EC2471-3/OE	Encoder cable, 3 m
IF2030/PNET	Interface module for PROFINET connection
IF2030/ENETIP	Interface module for EtherNet/IP connection

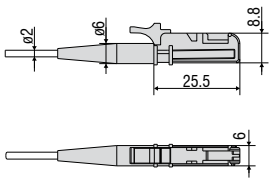
Optical fiber

Temperature range: -50 °C to 90 °C

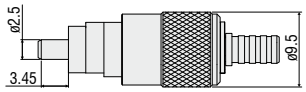
Bending radius: 30/40 mm



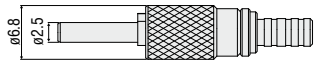
E2000/APC Standard connector



FC/APC Standard connector



DIN Connector



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Sensors and systems for displacement, distance and position

Sensors and measurement devices for non-contact temperature measurement

Measuring and inspection systems for metal strips, plastics and rubber

Optical micrometers and fiber optics, measuring and test amplifiers

Color recognition sensors, LED analyzers and inline color spectrometers

3D measurement technology for dimensional testing and surface inspection

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