



More Precision

confocalDT // Confocal chromatic measuring system





The new generation of confocal chromatic measuring systems

The confocalDT stands for high precision confocal chromatic measurement technology. The measuring system includes the fastest controller currently available, achieving high precision measurement results in displacement and distance measurement tasks, as well as thickness measurement of transparent objects. A large range of sensors and different controller interfaces open versatile fields of application, e.g. in the semiconductor industry, glass industry, medical engineering and plastics production.

System design

The confocalDT confocal chromatic measuring system includes a controller and a sensor connected via a fiber-optic cable. Due to a user-friendly web interface, the entire configuration process of controller and sensors is carried out without using any additional software.

The sensor range includes sensors with different sizes, measuring range and accuracy classes. As well as distance measurements in narrow bore holes and recesses, thickness measurements of transparent materials can also be performed.

Special features

The controller provides an excellent signal-to-noise ratio and enables high precision measurement. Fast surface compensation regulates the exposure times in order to achieve high signal stability. In contrast to systems using an oscillating lens, confocalDT is entirely wear-free. The sensors are designed for passive measurements and do not need any electrical components. They do not give off heat, which makes them suitable for use in temperature-sensitive environments.

The unique measuring principle enables high precision displacement and distance measurements – including on diffuse and reflecting surfaces. With transparent measurement objects, one-sided thickness measurement is possible.



The controller is configured via the web interface.
The settings can be performed fast and easily.

confocalDT

Sensor type		Measuring range	Measurement direction	Measurement mode	Page
confocalDT IFS2402	Miniature sensor ø4mm	400 μ m ... 2.5 mm		Distance measurement	8 - 9
confocalDT IFS2403	Hybrid sensor ø8mm	400 μ m ... 10 mm		Distance measurement Thickness measurement	10 - 11
confocalDT IFS2405	Robust universal sensor ø27 - 64 mm	0.3 mm ... 30 mm		Distance measurement Thickness measurement	12 - 13
confocalDT IFS2406 / IFS2407	Special sensors ø20 - 27 mm	0.3 mm ... 10 mm		Distance measurement Thickness measurement	14 - 15

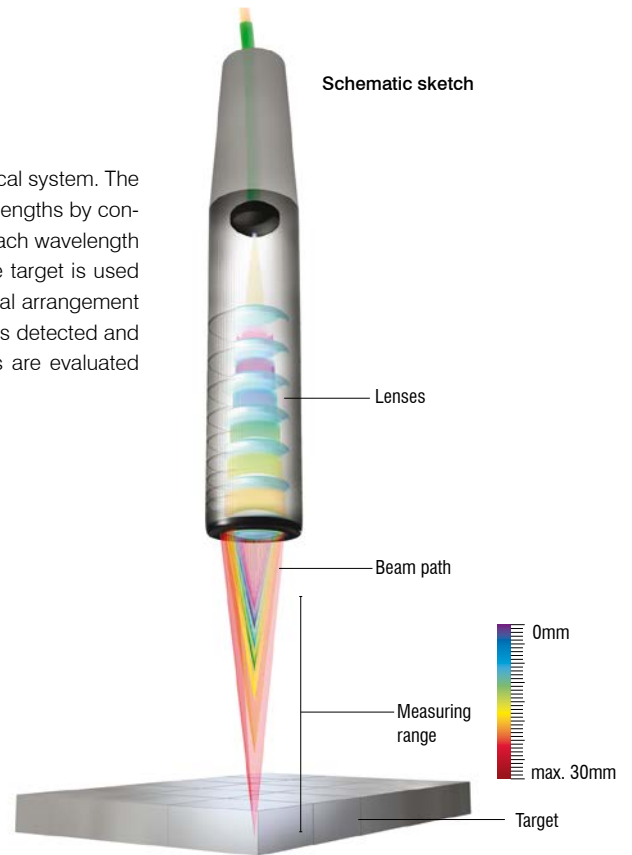
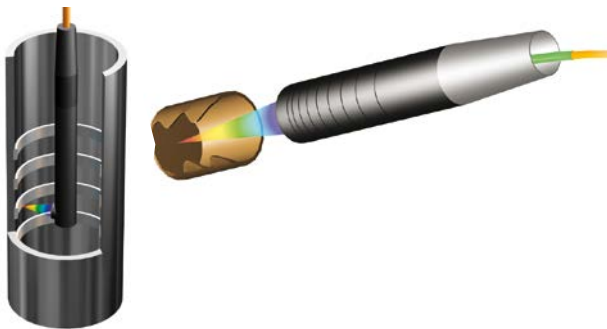
Controller type		Measurement channels	Measuring rate	Page
confocalDT IFC242x	Confocal controller for industrial applications	1 or 2	up to 6.5 kHz	16 - 17
confocalDT IFC2451	Universal confocal controller	1	up to 10 kHz	18 - 19
confocalDT IFC2461	High-performance controller	1	up to 25 kHz	20 - 21
confocalDT IFC2471 HS	Confocal high-speed controller	1	up to 70 kHz	22 - 23

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 light is dispersed into a monochromatic wavelengths 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 focused on the target is used for the measurement. The light reflected from this point is imaged by an optical arrangement onto a light sensitive sensor element, on which the associated spectral color is detected and evaluated. In the case of multi-peak measurements, several distance points are evaluated accordingly.

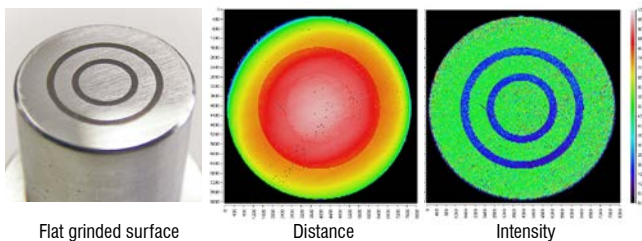
Cavity inspection

The axial beam path avoids most of the shadowing effects, enabling measurements even in sleeves and recesses. With the 90° models of the IFS2402 and IFS2403 mini-sensors, geometric characters can be measured inside holes and recesses.



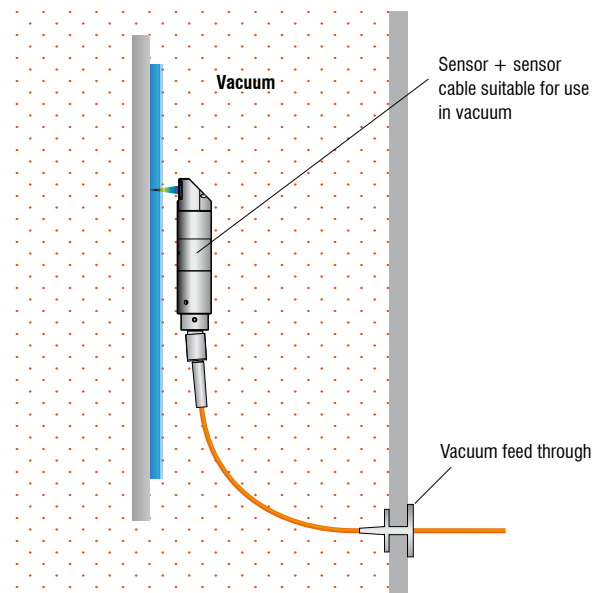
Use in sensitive environments

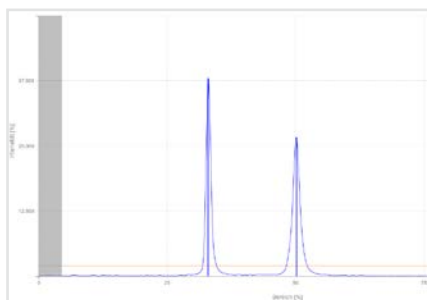
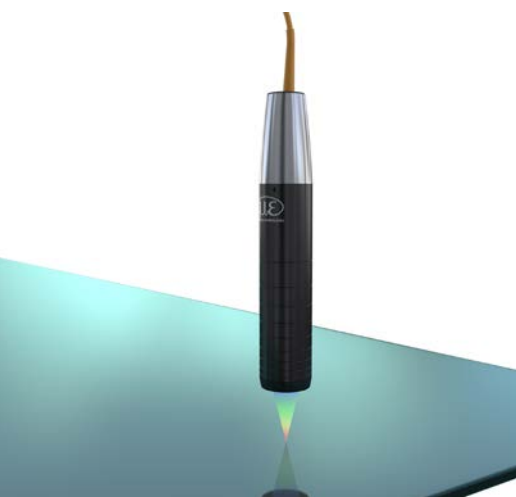
confocalDT sensors are suitable for use in sensitive environments. The sensors consist of passive components and do not give off heat. Particularly for use in vacuum applications, Micro-Epsilon offers sensors, cables and accessories which can be used according to their respective specification.



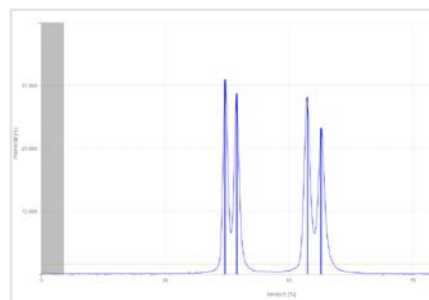
High measuring rates for dynamic measurement tasks

Controllers from Micro-Epsilon offer with 70 kHz the highest measuring rate in the world. However, it is important to adapt the exposure to the respective surface. Therefore, controllers from Micro-Epsilon operate based on a exposure control feature for the CCD line which uses the previous measuring cycle. Therefore, changes in surface color or reflectivity can be quickly compensated for which is why they hardly influence the measurement accuracy. Another option, in addition to distance measurement, is to perform measurements using signal intensity. Intensity evaluations help to display areas that cannot be detected using distance measurements.





Thickness measurement signal



Signal with multi-layer thickness measurements

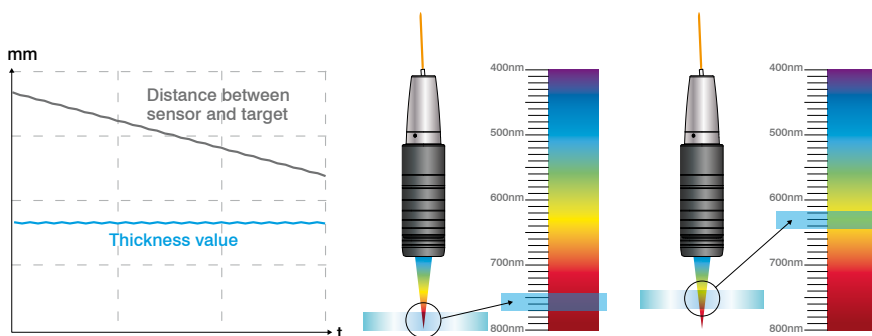
Thickness measurement of transparent materials

The unique measuring principle enables one-sided thickness measurement of transparent materials such as glass. The material thickness is detected to micrometer accuracy using just one single sensor. The controller provides a comprehensive materials database that is editable and expandable via the web interface. The evaluation of up to 6 peaks enables measurements of multi-layer objects such as laminated glass, where the suitable material can be selected for each layer.

Thickness calibration enables thickness measurements regardless of the distance

When measuring the thickness of transparent targets, the refraction index of the material depends on the focused wavelength. The refraction index changes with the distance between the sensor and the target. If the target is farther away from the sensor, the wavelengths used for thickness measurement are not the same as with a short distance from the sensor. Changing material thickness and a varying distance between the target and the sensor produce faulty measurement values.

The thickness calibration feature of Micro-Epsilon's confocal chromatic controllers eliminate this effect. The refractive indices (start of measuring range, midrange, end of measuring range) of different media are stored in the controller and can be individually adapted. For maximum measurement accuracy, simply choose the corresponding material so that distance-based errors are automatically compensated for. Thickness calibration is also possible with multi-layer targets, e.g. laminated glass.



The thickness value remains constant even with changing distances from the target.



Ultra-compact light spot

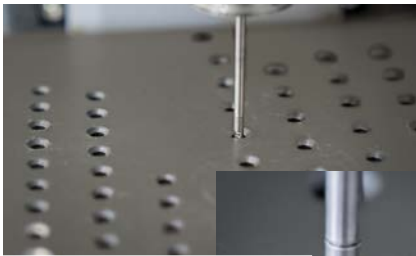
Confocal chromatic sensors from Micro-Epsilon are available with different aperture angles. Sensors with a large aperture angle or high numerical aperture (NA) generate a small light spot (X-Y resolution), which is precisely projected onto the CCD line. Therefore, the Z-resolution is increased as the color values barely overlap. 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, rough surfaces can be detected much more faster than with tactile measurements. In addition, the non-contact measuring principle is reactionless.



Recommended sensors:
IFS2405

Thickness measurement of displays and flat glass

When producing display glass, glass sheets with a homogenous 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 can also be used in fast processes.

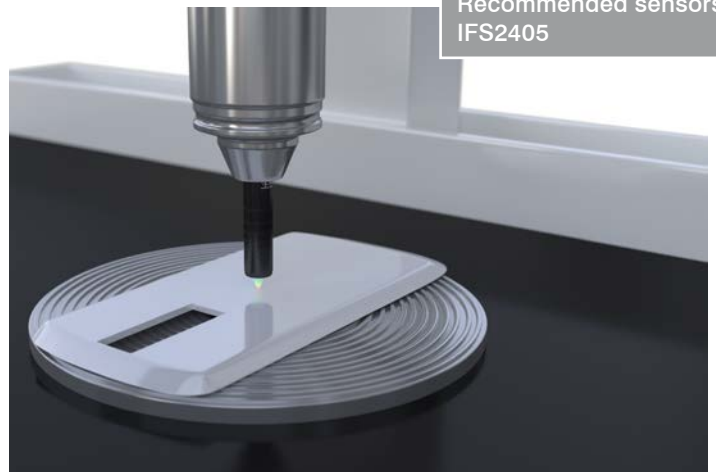


Recommended sensors:
IFS2402



Measurements in restricted installation space

Miniature sensors measure with a diameter of 4 mm 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:
IFS2405

Coordinate measuring machines

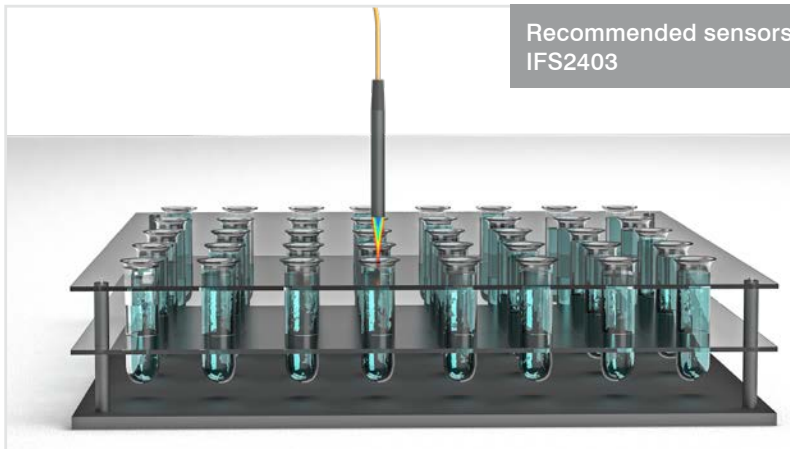
The large aperture angle or the high numerical aperture of confocal chromatic sensors enable high resolution and a small light spot size. As the sensors additionally tolerate a large tilt angle, they are used in coordinate measuring machines for geometry testing and roughness measurements.



Recommended sensors:
IFS2406

Wall thickness measurement of container glass

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



Recommended sensors:
IFS2403

Measurement in recesses

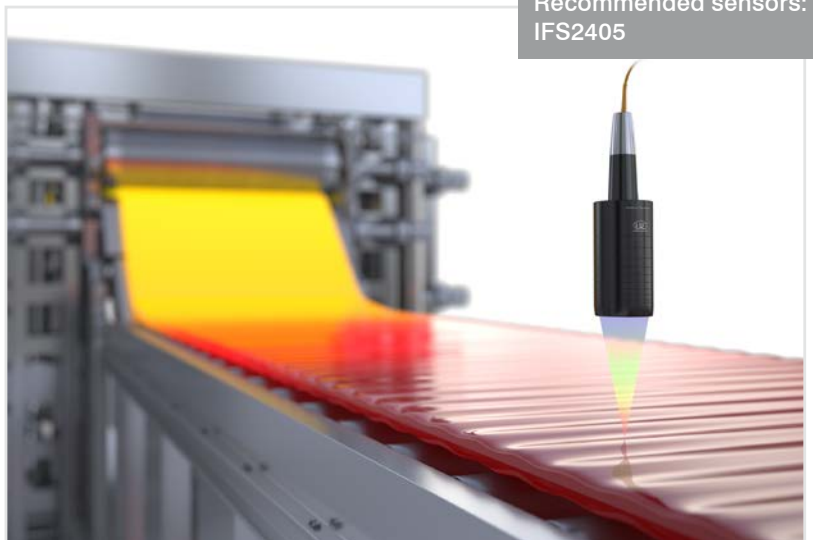
The narrow beam path enables the confocal sensors to measure in recesses. With the confocal measuring principle, measurements on liquids are possible, e.g. for precise filling level control in trays.



Recommended sensors:
IFS2406

Interior diameter inspection

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



Recommended sensors:
IFS2405

Measuring on hot glass

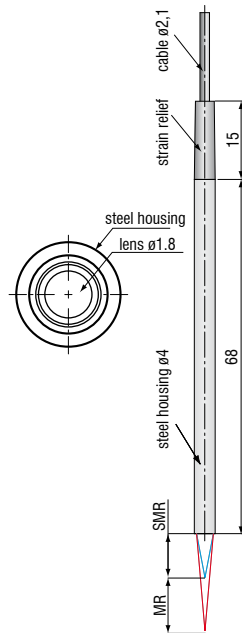
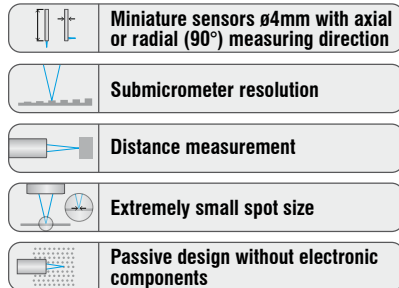
With a customer protection housing, confocal sensors can also measure on hot glass. The large offset distance allows for the sensor to be mounted from a safe distance to the hot glass.



Recommended sensors:
IFS2406

Thickness measurement on the star wheel

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



Mechanical tolerances ± 0.1 mm
 MR = measuring range
 SMR = start of measuring range
 Dimensions in mm.

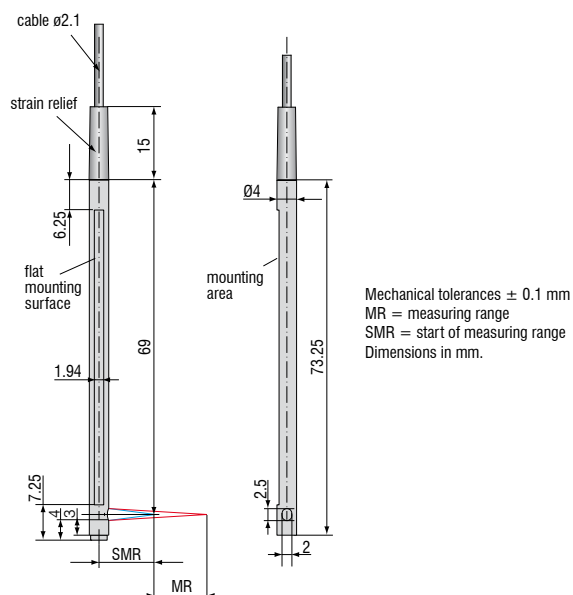
Sensor model (miniature)		IFS2402-0,4	IFS2402-1,5	IFS2402-4
Measuring range		400 μm	1.5 mm	2.5 mm
Start of measuring range	approx.	1.5 mm	0.9 mm	1.9 mm
Numerical aperture		0.25	0.20	0.10
Light spot diameter		10 μm	20 μm	20 μm
Linearity		≤ ± 0.3 μm	≤ ± 1.2 μm	≤ ± 2 μm
Resolution ¹⁾		16 nm	60 nm	100 nm
Weight		15 g		
Max. tilt ²⁾		± 8°	± 5°	± 3°
Protection class		IP64, front operated		
Temperature range	Operation	+5 ... +70 °C		
	Storage	-30 ... +70 °C		
Connection		integral cable 2 m; option up to 50 m; bending radius: static 30 mm; dynamic 40 mm		
Shock		15 g, 6 ms		
Vibration		2 g / 10 Hz ... 500 Hz		

FSO = Full Scale Output

All data at constant ambient temperature (25 ± 2 °C) against optical flat; specifications can change when measuring different materials.

¹⁾ Average from 512 values

²⁾ Maximum sensor tilt angle that produces a usable signal on a reflecting surface, near to the midrange



Sensor model (miniature)	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⁾
Numerical aperture	0.20	0.10
Light spot diameter	20 μ m	20 μ m
Linearity	$\leq \pm 1.2 \mu$ m	$\leq \pm 2 \mu$ m
Resolution ²⁾	60 nm	100 nm
Weight	15 g	
Max. tilt ³⁾	$\pm 5^\circ$	$\pm 3^\circ$
Protection class	IP40	
Temperature range	Operation	+5 ... +70 °C
	Storage	-30 ... +70 °C
Connection	integral cable 2 m; option up to 50 m; bending radius: static 30 mm; dynamic 40 mm	
Shock	15 g, 6 ms	
Vibration	2g / 10 Hz ... 500 Hz	

FSO = Full Scale Output

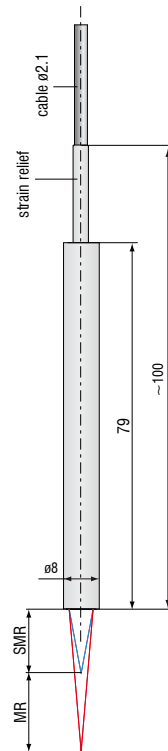
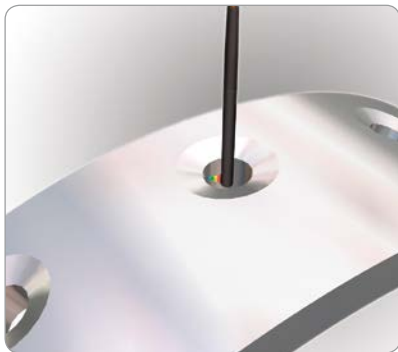
All data at constant ambient temperature (25 ± 2 °C) against optical flat; specifications can change when measuring different materials.

¹⁾ Start of measuring range measured from sensor axis.

²⁾ Average from 512 values

³⁾ Maximum sensor tilt angle that produces a usable signal on a reflecting surface, near to the midrange

- Hybrid sensors ø8mm with axial or radial (90°) measuring direction
- Submicrometer resolution
- One-sided thickness measurement
- Distance measurement
- Extremely small spot size
- Passive design without electronic components



Mechanical tolerances ± 0.1 mm
MR = measuring range
SMR = start of measuring range
Dimensions in mm.

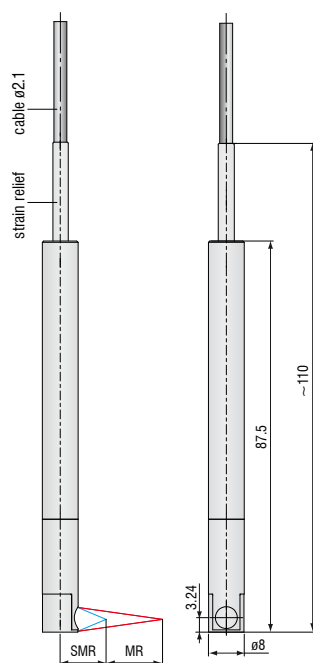
Sensor model		IFS 2403-0,4	IFS 2403-1,5	IFS 2403-4	IFS 2403-10
Measuring range		400 μm	1.5 mm	4 mm	10 mm
Start of measuring range	approx.	2.5 mm	8.0 mm	14.7 mm	11 mm
Numerical aperture		0.5	0.3	0.15	0.15
Light spot diameter		9 μm	15 μm	28 μm	56 μm
Linearity (displacement and distance measurement)		≤ ± 0.3 μm	≤ ± 1.2 μm	≤ ± 3 μm	≤ ± 20 μm
Linearity (thickness measurement)		≤ ± 0.6 μm	≤ ± 2.4 μm	≤ ± 6 μm	≤ ± 40 μm
Resolution ¹⁾		16 nm	60 nm	100 nm	250 nm
Weight		25 g			
Max. tilt ²⁾		± 20°	± 16°	± 6°	± 6°
Protection class		IP64, front operated			
Temperature range	Operation	+5 ... +70 °C			
	Storage	-30 ... +70 °C			
Connection		integral cable 2 m; option up to 50 m; bending radius: static 30 mm; dynamic 40 mm			
Shock		15 g, 6 ms			
Vibration		2 g / 10 Hz ... 500 Hz			

FSO = Full Scale Output

All data at constant ambient temperature ($25 \pm 2^\circ\text{C}$) against optical flat; specifications can change when measuring different materials.

¹⁾ Average from 512 values

²⁾ Maximum sensor tilt angle that produces a usable signal on a reflecting surface, near to the midrange



Mechanical tolerances $\pm 0.1 \text{ mm}$
 MR = measuring range
 SMR = start of measuring range
 Dimensions in mm.

Sensor model		IFS 2403/90-1,5	IFS 2403/90-4	IFS 2403/90-10
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⁾
Numerical aperture		0.3	0.15	0.15
Light spot diameter		15 μm	28 μm	56 μm
Linearity (displacement and distance measurement)		≤ ± 1.2 μm	≤ ± 3 μm	≤ ± 20 μm
Linearity (thickness measurement)		≤ ± 2.4 μm	≤ ± 6 μm	≤ ± 40 μm
Resolution ²⁾		60 nm	100 nm	250 nm
Weight		25 g		
Max. tilt ³⁾		± 16°	± 6°	± 6°
Protection class		IP40		
Temperature range	Operation	+5 ... +70 °C		
	Storage	-30 ... +70 °C		
Connection		integral cable 2 m; option up to 50 m; bending radius: static 30 mm; dynamic 40 mm		
Shock		15 g, 6 ms		
Vibration		2 g / 10 Hz ... 500 Hz		

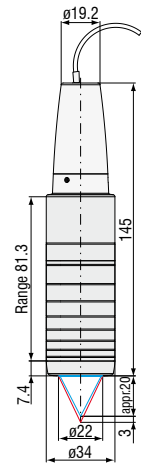
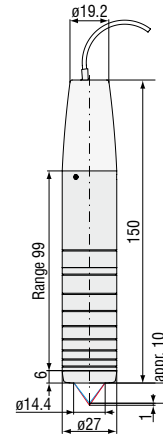
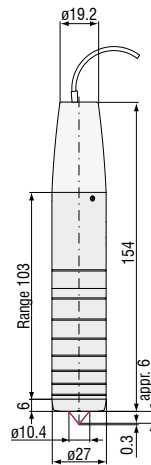
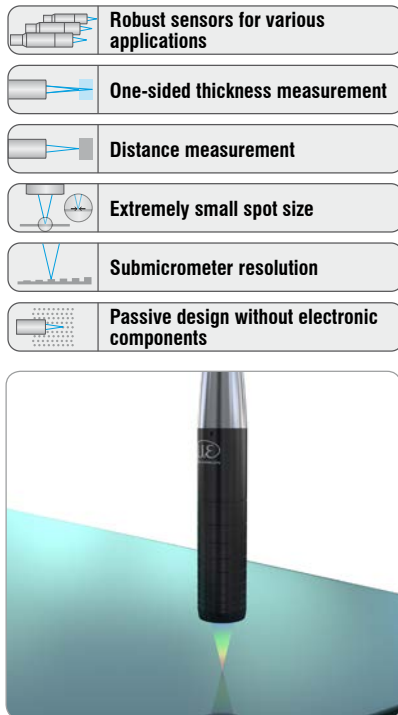
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All data at constant ambient temperature ($25 \pm 2^\circ\text{C}$) against optical flat; specifications can change when measuring different materials.

¹⁾ Start of measuring range measured from sensor axis

²⁾ Average from 512 values

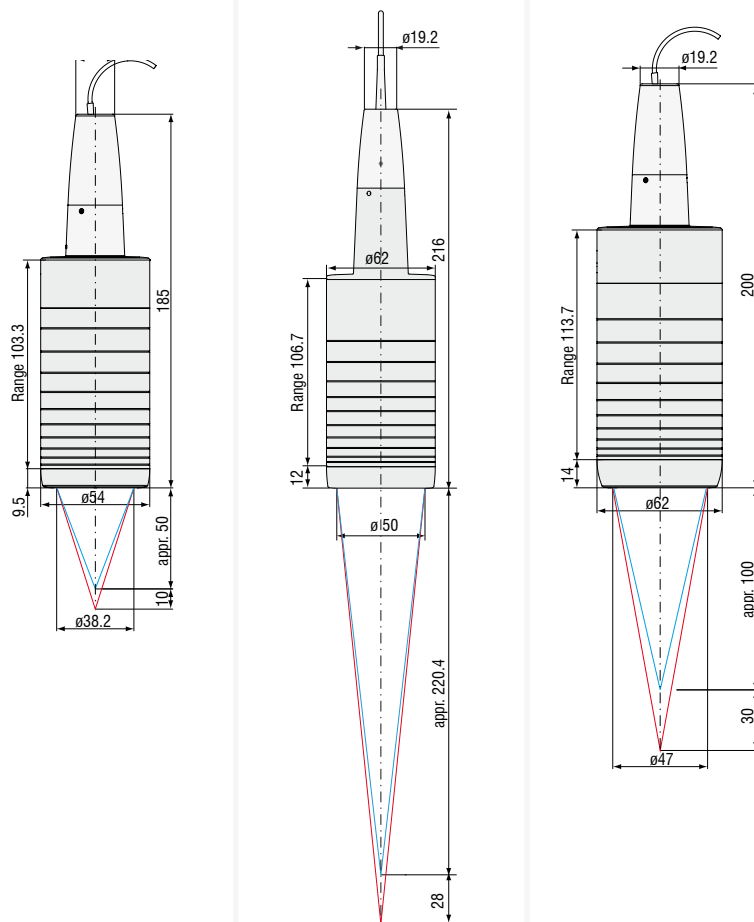
³⁾ Maximum sensor tilt angle that produces a usable signal on a reflecting surface, near to the midrange



Sensor model		IFS2405-0.3	IFS 2405-1	IFS 2405-3
Measuring range		0.3 mm	1 mm	3 mm
Start of measuring range	approx.	6 mm	10 mm	20 mm
Numerical aperture		0.60	0.55	0.45
Light spot diameter		6 μm	8 μm	9 μm
Linearity (displacement and distance measurement)		≤ ± 0.15 μm	≤ ± 0.25 μm	≤ ± 0.75 μm
Linearity (thickness measurement)		≤ ± 0.3 μm	≤ ± 0.5 μm	≤ ± 1.5 μm
Resolution ¹⁾		10 nm	28 nm	36 nm
Weight		140 g	125 g	225 g
Max. tilt ²⁾		± 34°	± 30°	± 24°
Protection class		IP65, front operated		
Temperature range	Operation	+5 ... +70 °C		
	Storage	-20 ... +70 °C		
Connection		pluggable sensor cable via FC socket, standard length 3 m; extension up to 50 m; bending radius: static 30 mm; dynamic 40 mm		
Shock		15 g, 6 ms		
Vibration		2g / 10 Hz ... 500 Hz		

FSO = Full Scale Output

All data at constant ambient temperature ($25 \pm 2^\circ\text{C}$) against optical flat; specifications can change when measuring different materials.¹⁾ Average from 512 values at 1 kHz, near to the midrange²⁾ Maximum sensor tilt angle that produces a usable signal on a reflecting surface, near to the midrange



Sensor model		IFS 2405-10	IFS 2405-28	IFS 2405-30
Measuring range		10 mm	28 mm	30 mm
Start of measuring range	approx.	50 mm	220 mm	100 mm
Numerical aperture		0.30	0.10	0.20
Light spot diameter		16 μm	60 μm	50 μm
Linearity (displacement and distance measurement)		≤ ± 2.5 μm	≤ ± 7 μm	≤ ± 7.5 μm
Linearity (thickness measurement)		≤ ± 5 μm	≤ ± 14 μm	≤ ±15 μm
Resolution ¹⁾		60 nm	250 nm	180 nm
Weight		500 g	750 g	730 g
Max. tilt ²⁾		± 17°	± 5°	± 9°
Protection class		IP65, front operated		
Temperature range	Operation	+5 ... +70 °C		
	Storage	-20 ... +70 °C		
Connection		pluggable sensor cable via FC socket, standard length 3 m; extension up to 50 m; bending radius: static 30 mm; dynamic 40 mm		
Shock		15 g, 6 ms		
Vibration		2 g / 10 Hz ... 500 Hz		

FSO = Full Scale Output

All data at constant ambient temperature ($25 \pm 2^\circ\text{C}$) against optical flat; specifications can change when measuring different materials.

¹⁾ Average from 512 values at 1 kHz, near to the midrange

²⁾ Maximum sensor tilt angle that produces a usable signal on a reflecting surface, near to the midrange



**Sensors with axial
or radial beam path**



One-sided thickness measurement



Distance measurement



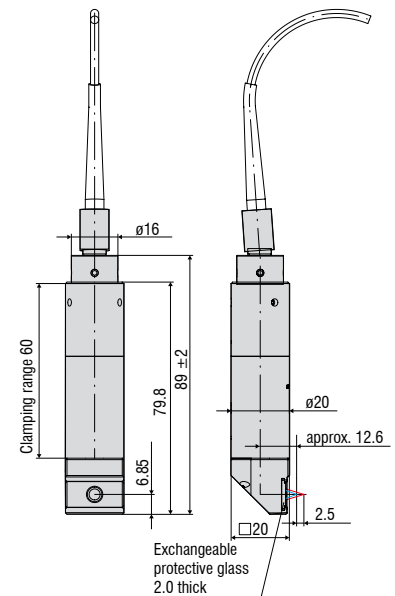
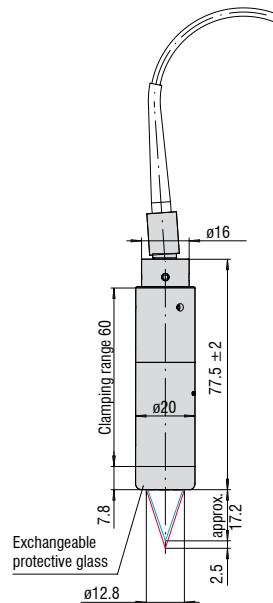
Extremely small spot size



Submicrometer resolution



Optional for vacuum applications



Sensor model	IFS 2406-2,5/VAC(003)	IFS 2406/90-2,5/VAC(001)
Measuring range	2.5 mm	2.5 mm
Start of measuring range approx.	17.2 mm	12.6 mm ¹⁾
Numerical aperture	0.30	0.30
Light spot diameter	10 µm	10 µm
Linearity (displacement and distance measurement)	≤ ± 0.75 µm	≤ ± 0.75 µm
Linearity (thickness measurement)	≤ ± 1.5 µm	≤ ± 1.5 µm
Resolution ²⁾	24 nm	24 nm
Weight	105 g	130 g
Max. tilt ³⁾	± 16°	± 16°
Protection class	IP40, vacuum capable	
Operating temperature	+5 ... +70 °C	
Storage temperature	-20 ... +70 °C	
Connection	pluggable sensor cable via FC socket, standard length 3 m; extension up to 50 m; bending radius: static 30 mm; dynamic 40 mm	
Shock	15 g, 6 ms	
Vibration	2 g / 10 Hz ... 500 Hz	

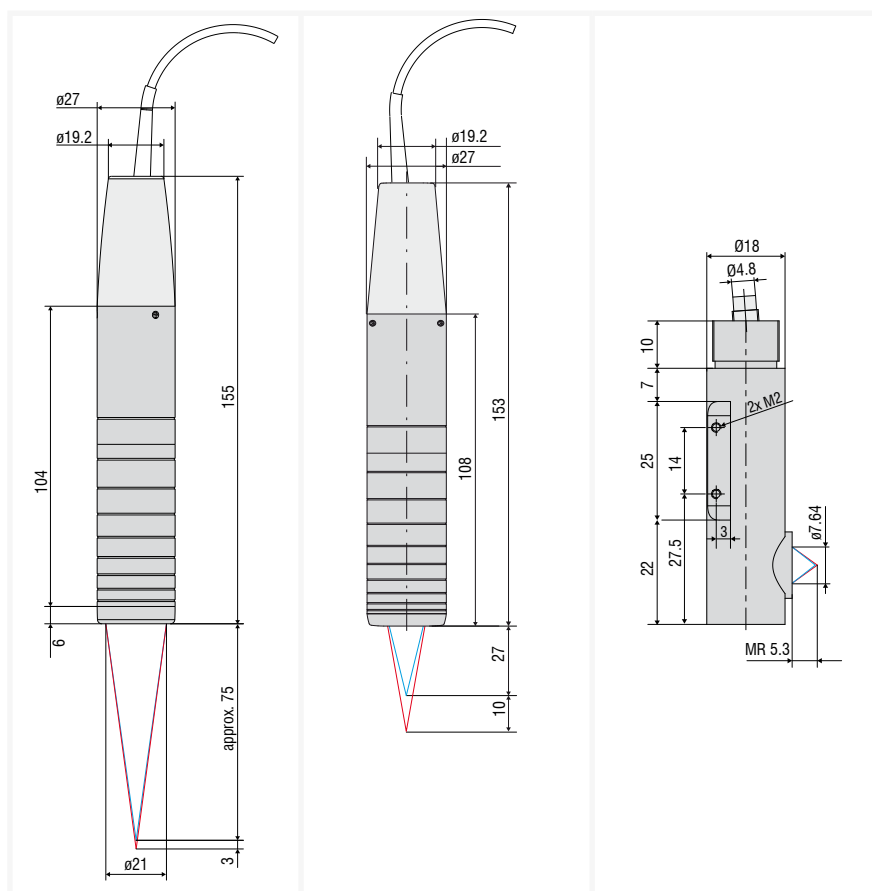
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All data at constant ambient temperature (25 ± 2 °C) against optical flat; specifications can change when measuring different materials.

¹⁾ Start of measuring range measured from sensor axis

²⁾ Average from 512 values at 1 kHz, near to the center of the measuring range

³⁾ Maximum sensor tilt angle that produces a usable signal on a reflecting surface, near to the midrange



Sensor model	IFS 2406-3	IFS 2406-10	IFS2407/90-0,3
Measuring range	3 mm	10 mm	0.3 mm
Start of measuring range, approx	75 mm	27 mm	5.3 mm
Numerical aperture	0.14	0.25	0.50
Light spot diameter	35 μm	15 μm	6 μm
Linearity (displacement and distance measurement)	$\leq \pm 1.5 \mu\text{m}$	$\leq \pm 2.5 \mu\text{m}$	$\leq \pm 0.15 \mu\text{m}$
Linearity (thickness measurement)	$\leq \pm 3 \mu\text{m}$	$\leq \pm 5 \mu\text{m}$	$\leq \pm 0.3 \mu\text{m}$
Resolution ¹⁾	50 nm	60 nm	10 nm
Weight	99 g	128 g	30 g
Max. tilt ²⁾	$\pm 6.5^\circ$	$\pm 13.5^\circ$	$\pm 27^\circ$
Protection class	IP65, front operated		
Operating temperature	+5 ... +70 °C		
Storage temperature	-20 ... +70 °C		
Connection	pluggable sensor cable via FC socket, standard length 3 m; extension up to 50 m; bending radius: static 30 mm; dynamic 40 mm		pluggable C2404 sensor cable, standard length 2 m; bending radius: static 30 mm; dynamic 40 mm
Shock	15 g, 6 ms		
Vibration	2g / 10 Hz ... 500 Hz		

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¹⁾ Average from 512 values at 1 kHz, near to the midrange

²⁾ Maximum sensor tilt angle that produces a usable signal on a reflecting surface, near to the midrange



	Measuring rate up to 6.5kHz
	Interfaces: Ethernet / EtherCAT / RS422 / Analog
	Fast surface compensation
	Configuration via web interface
	Submicrometer resolution
	Multi-layer thickness measurement
	Synchronous two-sided thickness measurement
	Robust design with passive cooling

The confocalDT 2421 and 2422 sets the industrial standard in precise, confocal measurement technology.

Available as either a single- or a dual-channel version, these measuring systems enable a low cost solution especially for high volume applications. The active exposure regulation feature in the CCD line enables accurate, fast surface compensation on difficult 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, the entire configuration process of controller and sensors is carried out without using any additional software. Data output is via Ethernet, EtherCAT, RS422 or analog output.



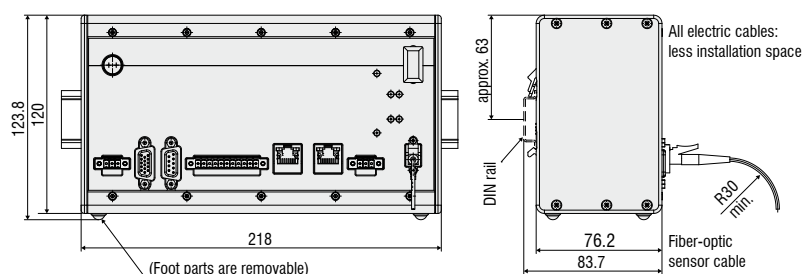
All settings are performed in the web interface. For thickness measurements, materials are stored in an expandable materials database.



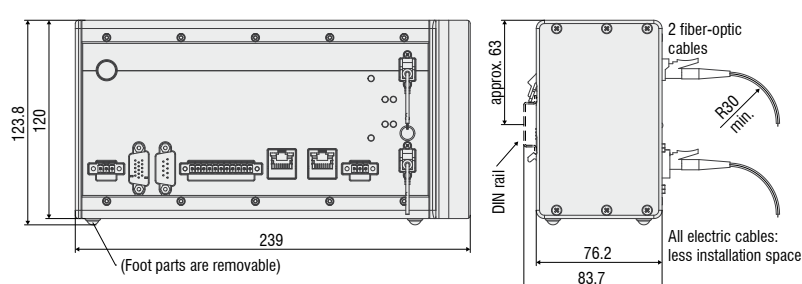
Two sensors can be directly connected to a confocal IFC2422 controller.

Controller		IFC2421	IFC2421MP	IFC2422	IFC2422MP
Multi peak measurement		2 peaks	6 peaks	2 peaks	6 peaks
Measurement channels		1	1	2	2
Light source		internal white LED			
Measuring rate		continuously adjustable from 100 Hz to 6.5 kHz			
Resolution	Ethernet/EtherCAT	1 nm			
	RS422	18 bit			
	analog	16 bit (teachable)			
Storage		up to 20 calibration tables for different sensors per channel, menu selection			
Controller inputs/outputs		Sync-In/Trig-In, Sync-Out Error1-Out, Error2-Out encoder (2x A, Ȧ, B, Ḃ, index) EtherCAT/Ethernet RS422 analog: current, voltage (16bit D/A converter)			
EtherCAT					
Operating elements, controller display		multifunction button (dark alignment and reset to factory setting after 10 sec) 5x LED for intensity, range, status, supply voltage			
Supply voltage, power consumption		24 VDC ± 15 %, approx. 10 W			
Material		aluminum case for DIN rail mounting			
Protection class		IP40			
Temperature range	Operation	+5 ... +50 °C			
	Storage	-20 ... +70 °C			
Permissible ambient light		30,000 lx			
Shock		15 g, 6 ms			
Vibration		2 g / 10 Hz ... 500 Hz			
Connection	Cable (optical fiber)	2 ... 50 m			
	Connector	E2000			
	EtherCAT, Ethernet	CAT5E; cable length < 100 m			
Max. cable lengths (all cables are shielded)	Supply, RS422, Sync./error	< 30 m			
	analog	< 30 m			
	Encoder	< 3 m			

Controller IFC2421



Controller IFC2422





- Measuring rate up to 10kHz**
- Interfaces: Ethernet / EtherCAT / RS422 / Analog**
- Fast surface compensation**
- Configuration via web interface**
- Submicrometer resolution**
- Multi-layer thickness measurement**
- Robust design with passive cooling**

The universal confocalDT IFC2451 controllers are used for various industrial measurement tasks. Due to their excellent signal-to-noise ratio, these controllers achieve measuring rates of 10kHz with white light LEDs.

The active exposure regulation feature for the CCD line enables accurate, fast surface compensation on changing surfaces during dynamic measurement processes.

Due to a user-friendly web interface, the entire configuration process of controller and sensors is carried out without using any additional software. Data output is via Ethernet, EtherCAT, RS422 or analog output.

confocalDT 2451/2471 systems are used for complex distance and thickness measurements and can be used with any IFS sensor. Furthermore, up to 6 peaks are provided which allows the thickness of transparent, multi-layer objects to be measured. Optical signals are transferred between sensor and controller via optical fibers.



The web interface can be accessed via Ethernet and provides set up and configuration options for controller and sensors. For thickness measurements, materials are stored in an expandable materials database.

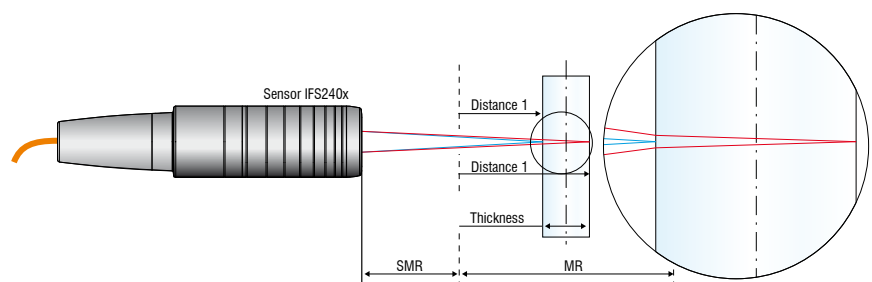
confocalDT 2451

Material database

Material name	Description	Refractive index n_d at 486nm	Refractive index n_d at 660nm	Refractive index n_d at 660nm	Active value n_d	Device
Vacuum, Air	Vacuum, Luft (refractive coefficient, approximately)	1.000000	1.000000	1.000000		
Water	Water	1.337121	1.333544	1.331152		
Ethanol	Ethanol (ethyl alcohol)	1.361400	1.361400	1.361400		
Acrylic	Acrylfarz, Plexiglas, Acryl (acrylic resin, adhesive, lacquer)	1.497300	1.491668	1.488100		
PMMA	Polymethylmethacrylat (Plexiglas, Acrylglas (acrylic glass))	1.497161	1.491756	1.488200		
PMMA	Polymethylmethacrylat, ein Kunststoff (a plastic)	1.524300	1.524300	1.524300		
PS	Polystyrol, Polystyren, ein Kunststoff (a plastic)	1.602729	1.590891	1.585949		
PC	Polycarbonat, Makrolon, Lexan, ein Kunststoff (a plastic)	1.589439	1.585470	1.578664		
Fused Silica	Quarzglas, Silica (silica)	1.453126	1.450864	1.450267		

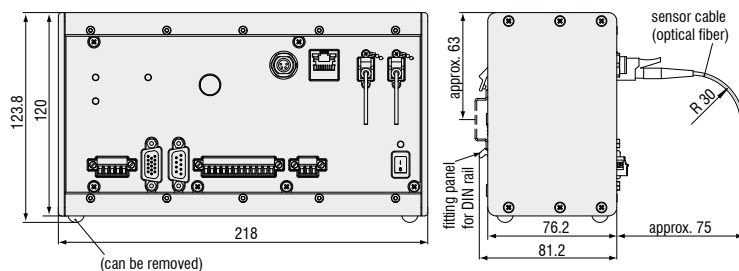
EtherCAT
Conformance tested

EtherCAT Conformance tested: IFC2451



Controller		IFC2451	IFC2451MP
Multi peak measurement		2 peaks	up to 6 peaks
Light source		internal white LED	
Measuring rate		continuously adjustable from 100 Hz to 10 kHz	
Resolution	Ethernet/EtherCAT	1 nm	
	RS422	18 bit	
	analog	16 bit (teachable)	
Storage		up to 20 calibration tables for different sensors per channel, menu selection	
Controller inputs/outputs		Sync-In/Trig-In, Sync-Out Error1-Out, Error2-Out encoder (3x A, B, Index) EtherCAT/Ethernet RS422 analog: current, voltage (16 bit D/A converter)	
EtherCAT		 Conformance tested	
Operating elements, controller display		On/Off switch; button for dark alignment (as well as for reset to factory setting after 10 sec) 4x LED for intensity, range, status, supply voltage	
Supply voltage, power consumption		Controller	24 VDC $\pm$ 15 %, approx. 10 W
Material		aluminum case for DIN rail mounting	
Protection class		IP40	
Temperature range	Operation	+5 ... +50 °C	
	Storage	-20 ... +70 °C	
Permissible ambient light		30,000 lx	
Shock		15 g, 6 ms	
Vibration		2 g / 10 Hz ... 500 Hz	
Connection	Cable (optical fiber)	2 ... 50 m	
	Connector	E2000	
	EtherCAT, Ethernet	CAT5E; cable length < 100 m	
Max. cable lengths (all cables are shielded)	Supply, RS422, Sync./error	< 30 m	
	analog	< 30 m	
	Encoder	< 3 m	

Controller IFC2451



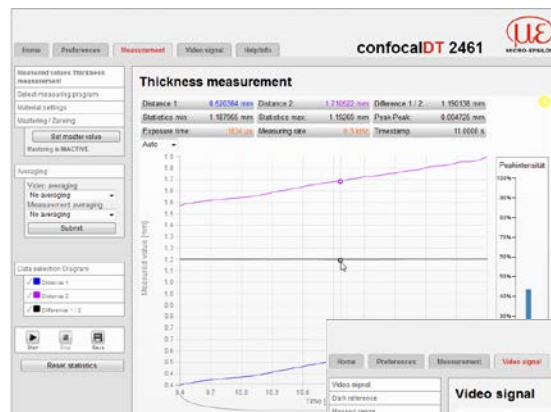


 25 kHz	Fast confocal controller: up to 25kHz
 INTER FACE	Interfaces: Ethernet / EtherCAT / RS422 / Analog
	Fast surface compensation
	Configuration via web interface
	Submicrometer resolution
	Multi-layer thickness measurement
	Robust design with passive cooling

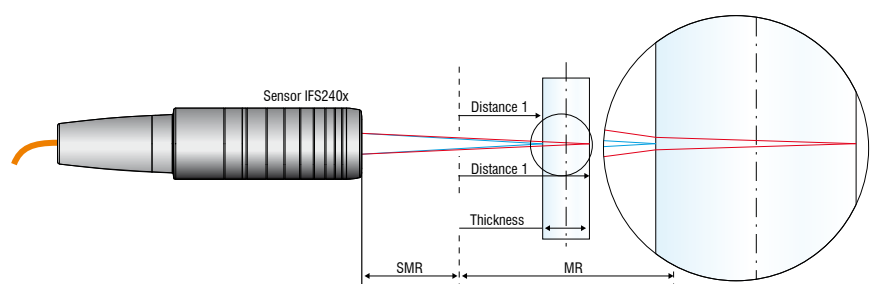
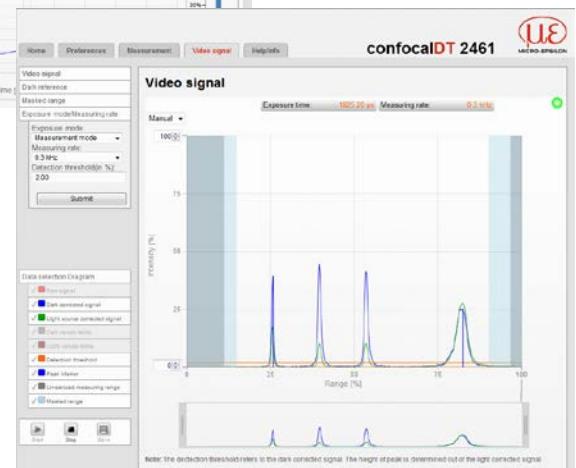
confocalDT 2461 systems are used for complex distance and thickness measurements. The IFC2461 controller is equipped with enhanced, optimized optical components enabling measuring rates up to 25 kHz without having to use an external light source. The high light intensity enables reliable measurements on difficult surfaces, e.g. on matt black objects or for multi-layer thickness measurement of glass. The active exposure regulation feature in 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 measurements or as a multi-peak version for thickness measurements.

Due to a user-friendly web interface, the entire configuration process of controller and sensors is carried out without using any additional software. Data output is via Ethernet, EtherCAT, RS422 or analog output.

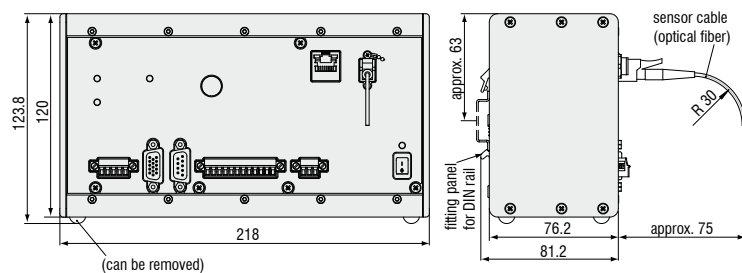


All settings are performed in the web interface. For thickness measurements, materials are stored in an expandable materials database.



Controller		IFC2461	IFC2461MP
Multi peak measurement		2 peaks	up to 6 peaks
Light source		internal white LED	
Measuring rate		continuously adjustable from 100 Hz to 25 kHz	
Resolution	Ethernet/EtherCAT	1 nm	
	RS422	18 bit	
	analog	16 bit (teachable)	
Storage		up to 20 calibration tables for different sensors per channel, menu selection	
Controller inputs/outputs		Sync-In/Trig-In, Sync-Out Error1-Out, Error2-Out encoder (3x A, B, Index) EtherCAT/Ethernet RS422 analog: current, voltage (16 bit D/A converter)	
EtherCAT			
Operating elements, controller display		On/Off switch; button for dark alignment (as well as for reset to factory setting after 10 sec) 4x LED for intensity, range, status, supply voltage	
Supply voltage, power consumption		24 VDC $\pm$ 15 %, approx. 10 W	
Material		aluminum case for DIN rail mounting	
Protection class		IP40	
Temperature range	Operation	+5 ... +50 °C	
	Storage	-20 ... +70 °C	
Permissible ambient light		30,000 lx	
Shock		15 g, 6 ms	
Vibration		2 g / 10 Hz ... 500 Hz	
Connection	Cable (optical fiber)	2 ... 50 m	
	Connector	E2000	
Max. cable lengths (all cables are shielded)	EtherCAT, Ethernet	CAT5E; cable length < 100 m	
	Supply, RS422, Sync./error	< 30 m	
	analog	< 30 m	
	Encoder	< 3 m	

Controller IFC2461



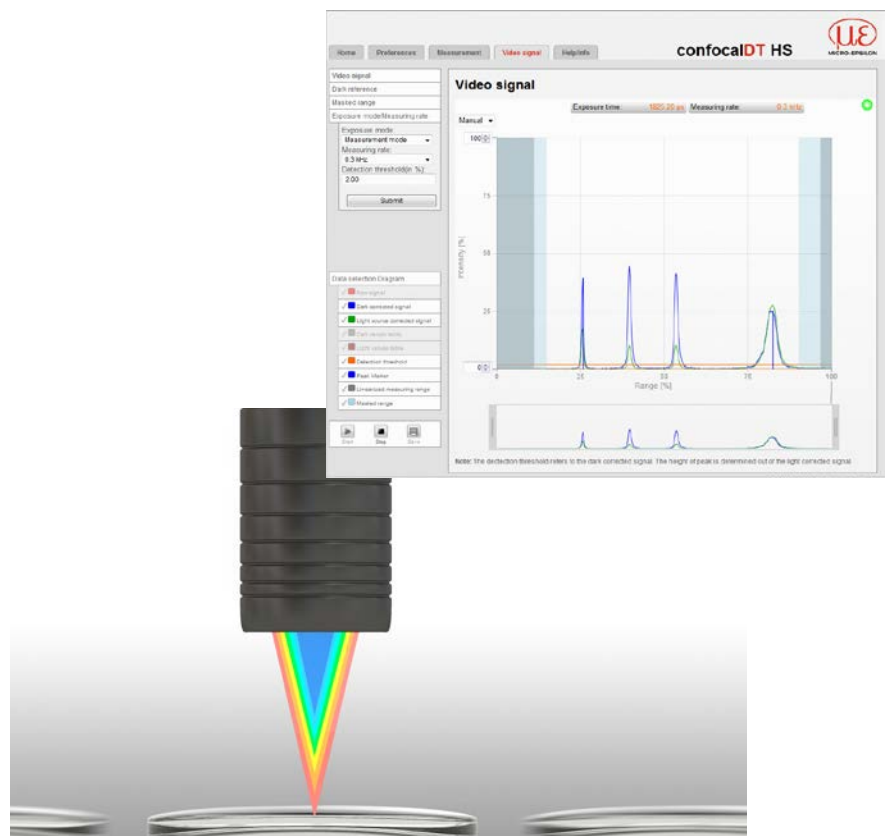


-  **Fastest controller worldwide:**
Measuring rate up to 70kHz
-  **Interfaces: Ethernet / EtherCAT / RS422 / Analog**
-  **Fast surface compensation**
-  **Configuration via web interface**
-  **Submicrometer resolution**
-  **Multi-layer thickness measurement**
-  **Robust design with passive cooling**

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 70kHz on reflecting surfaces without having to use an external light source. The confocalDT HS controllers are considered one of the fastest confocal measuring systems in the world. The active exposure regulation feature for the CCD line enables accurate, fast surface compensation on changing surfaces during dynamic measurement processes.

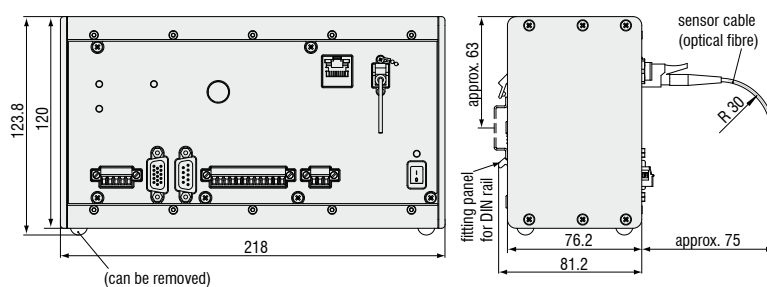
The controller can be operated with any IFS sensor and is available as a standard version for distance measurements or as a multi-peak version for thickness measurements.

Due to a user-friendly web interface, the entire configuration process of controller and sensors is carried out without using any additional software. Data output is via Ethernet, EtherCAT, RS422 or analog output.



Controller		IFC2471LED	IFC2471MP LED
Multi peak measurement		2 peaks	up to 6 peaks
Light source		internal white LED	
Measuring rate		continuously adjustable from 100 Hz to 70 kHz	
Resolution	Ethernet/EtherCAT	1 nm	
	RS422	18 bit	
	analog	16 bit (teachable)	
Storage		up to 20 calibration tables for different sensors per channel, menu selection	
Controller inputs/outputs		Sync-In/Trig-In, Sync-Out Error1-Out, Error2-Out encoder (3x A, B, Index) EtherCAT/Ethernet RS422 analog: current, voltage (16 bit D/A converter)	
EtherCAT			
Operating elements, controller display		On/Off switch; button for dark alignment (as well as for reset to factory setting after 10 sec) 4x LED for intensity, range, status, supply voltage	
Supply voltage, power consumption		24 VDC $\pm$ 15 %, approx. 10 W	
Material		aluminum case for DIN rail mounting	
Protection class		IP40	
Temperature range	Operation	+5 ... +50 °C	
	Storage	-20 ... +70 °C	
Permissible ambient light		30,000 lx	
Shock		15 g, 6 ms	
Vibration		2 g / 10 Hz ... 500 Hz	
Connection	Cable (optical fiber)	2 ... 50 m	
	Connector	E2000	
Max. cable lengths (all cables are shielded)	EtherCAT, Ethernet	CAT5E; cable length < 100 m	
	Supply, RS422, Sync./error	< 30 m	
	analog	< 30 m	
	Encoder	< 3 m	

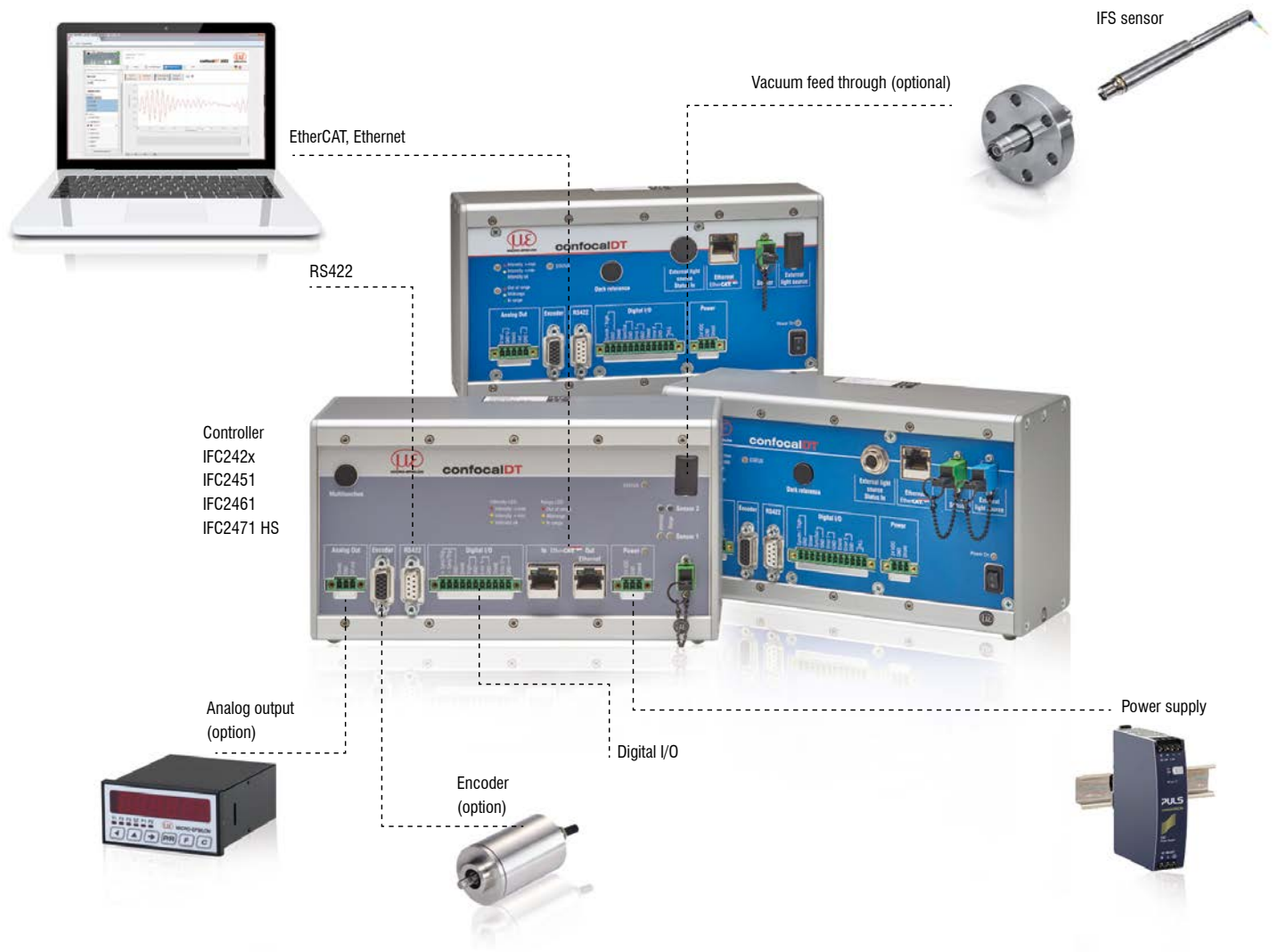
Controller IFC2471 LED



System design

The confocalDT system consists of:

- Sensor IFS240x
- Controller IFC24xx
- Fiber-optic cable



Customer-specific modifications

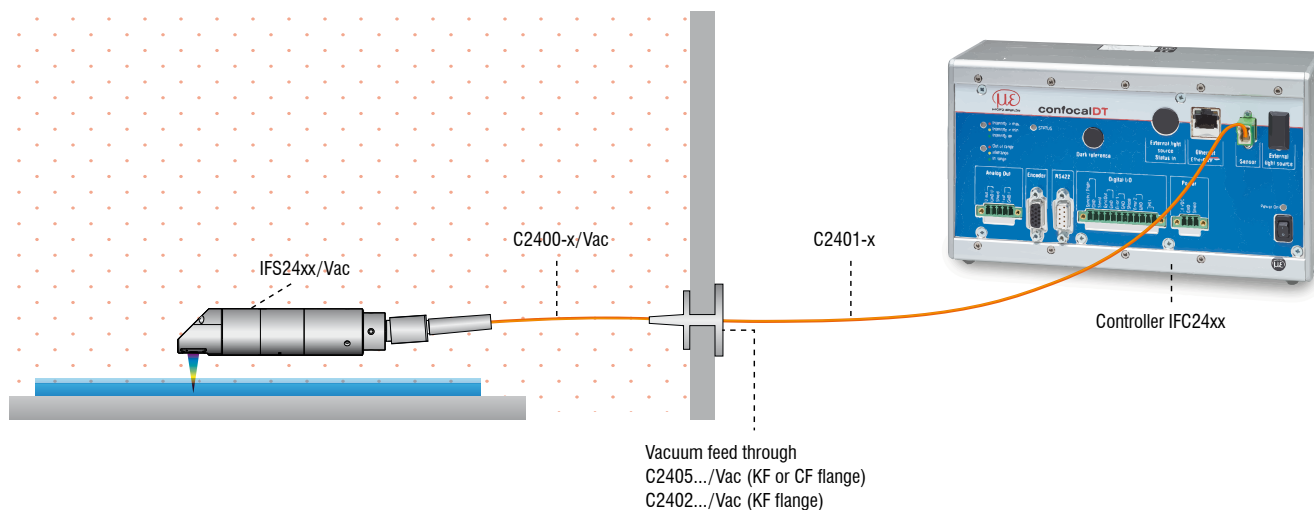
Application examples are often found where the standard versions of the sensors and the controller are performing at their limits. To facilitate such special tasks it is possible to customize the sensor design and to adjust the controller accordingly. Common requests for modifications include changes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



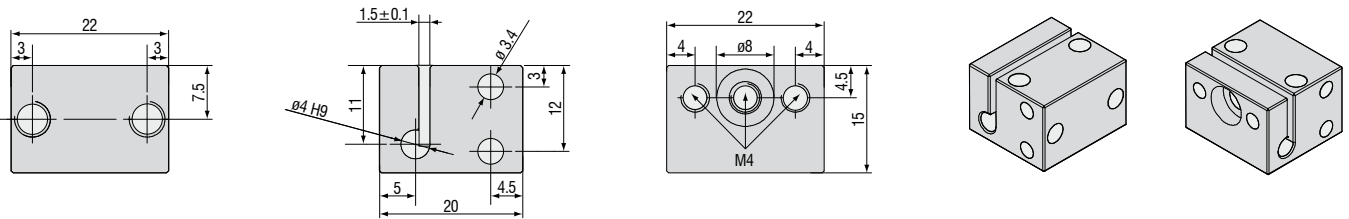
Possible modifications

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

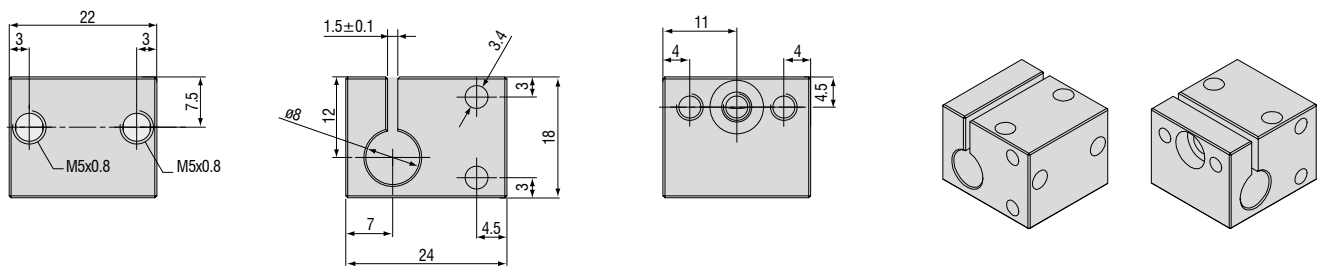
Vacuum setup



Accessories: mounting adapter
MA2402 for sensors 2402

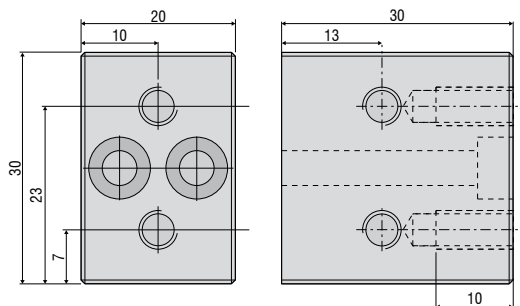


Accessories: mounting adapter
MA2403 for sensors 2403

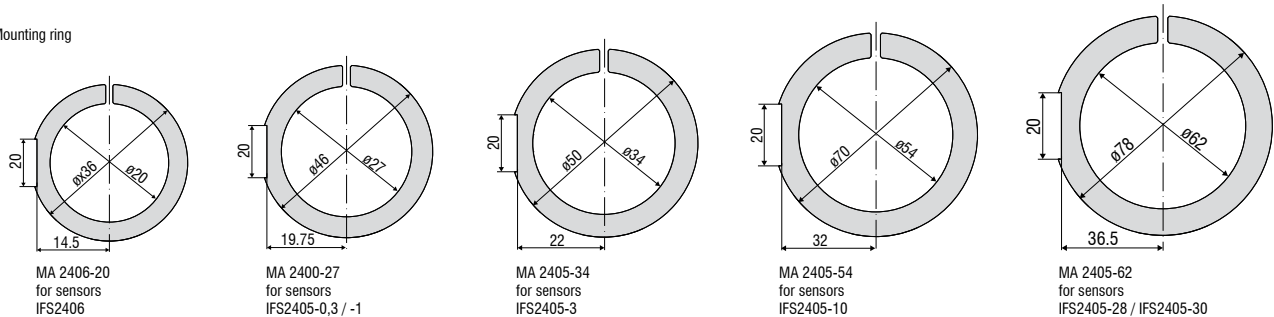


Accessories: mounting adapter
MA2400 for sensors IFS2405/IFS2406 (consisting of a mounting block and a mounting ring)

Mounting block



Mounting ring



Accessories

Software

IFD24n1-Tool Free demo software tool included

Accessories light source

IFL2422/LE Lamp module for IFC2422
 IFL24x1/LED Lamp module for IFC24x1
 IFL2451/LED(003) Lamp module for IFC2451(003)

Cables for IFS2402/IFS2403 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-x/PT Optical fiber with protection tube for mechanical stress
 (3 m, 10 m, customer-specific length up to 50 m)

Cables for IFS2405/IFS2406 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/PT-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 sensors

C2404-x Optical fiber with DIN connector and E2000/APC (2 m, 5 m)

Vacuum feed through

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

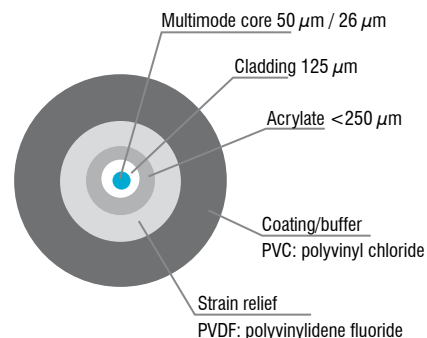
Other accessories

SC2471-x/USB/IND Connector cable IFC2451/61/71, 3 m, 10 m, 20 m
 SC2471-x/IF2008 Connector cable IFC2451/61/71-IF2008, 3 m, 10 m, 20 m
 PS2020 Power supply 24 V / 2.5 A
 EC2471-3/OE Encoder cable, 3 m

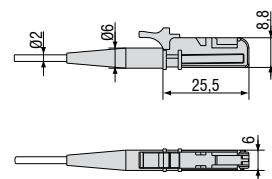
Optical fiber

Temperature range : -50 °C to 90 °C

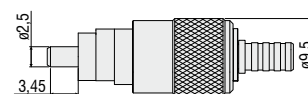
Bending radius: 30/40 mm



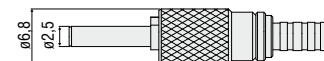
E2000/APC standard connector



FC/APC standard connector



DIN connector



High performance sensors made by Micro-Epsilon



Sensors and systems for displacement and position



Sensors and measurement devices for non-contact temperature measurement



2D/3D profile sensors (laser scanner)



Optical micrometers, fiber optic sensors and fiber optics



Color recognition sensors, LED analyzers and color inline spectrometer



Measurement and inspection systems