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 sensors product range stands for the highest precision and dynamics in confocal chromatic measurement technology. 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.

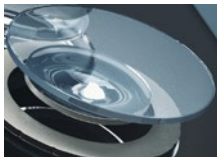

Fast surface compensation

For distance, thickness and multi-peak measurements


Shiny metals


Glass


Black rubber


Curved lenses

# Overview
# confocalDT

| Compact systems | | Measuring range | Measurement mode | Page |
|---|---|---|---|---|
| **confocalDT IFD2410** | Next generation confocal sensor system | 1.0 mm … 6.0 mm | Distance measurement<br>Thickness measurements | 10 - 11 |
| **confocalDT IFD2415** | Best in class -<br>Next-generation confocal sensor system | 1.0 mm … 10.0 mm | Distance measurement<br>Thickness measurements<br>Multi-peak measurement | 12 - 13 |
| **confocalDT IFD2411** | Compact confocal measuring system | 1.0 mm … 6.0 mm | Distance measurement<br>Thickness measurements | 14 - 15 |

| Sensors | | Measuring range | Measurement direction | Measurement mode | Page |
|---|---|---|---|---|---|
| **confocalDT IFS2402** | Confocal chromatic miniature sensors<br>ø4 mm | 0.5 mm ... 3.5 mm |  | Distance measurement | 16 - 17 |
| **confocalDT IFS2403** | Confocal chromatic hybrid sensors<br>ø8 mm | 0.4 mm ... 10 mm |  | Distance measurement<br>Thickness measurements | 18 - 19 |
| **confocalDT IFS2404** | Confocal chromatic sensors<br>ø12 mm | 2 mm |  | Distance measurement<br>Thickness measurements | 20 |
| **confocalDT IFS2405** | Precise confocal sensors<br>ø27 - 62 mm | 0.3 mm ... 30 mm |  | Distance measurement<br>Thickness measurements | 21 - 23 |
| **confocalDT IFS2406** | Confocal chromatic sensors for displacement and thickness measurements<br>ø20 - 27 mm | 2.5 mm ... 10 mm |  | Distance measurement<br>Thickness measurements | 24 - 25 |
| **confocalDT IFS2407** | High precision sensors for displacement and thickness measurements<br>ø12 - 54 mm | 0.1 mm ... 3 mm |  | Distance measurement<br>Thickness measurements | 26 - 27 |

Each sensor can be operated with every confocalDT controller.

| Controller | | Channels | Measuring rate | Page |
|---|---|---|---|---|
| **confocalDT IFC242x** | Confocal controller for industrial applications | 1 or 2 | up to 10 kHz | 28 - 29 |
| **confocalDT IFC246x** | Light-intensive controller for high speed measurements | 1 or 2 | up to 30 kHz | 30 - 31 |

| Accessories | Page |
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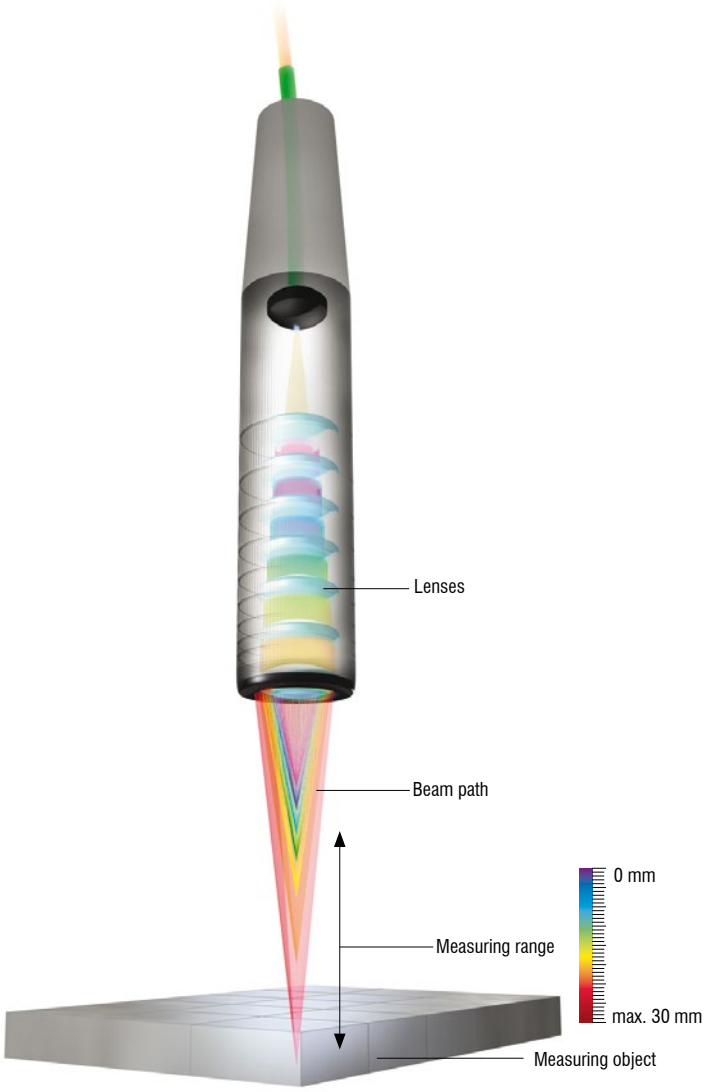
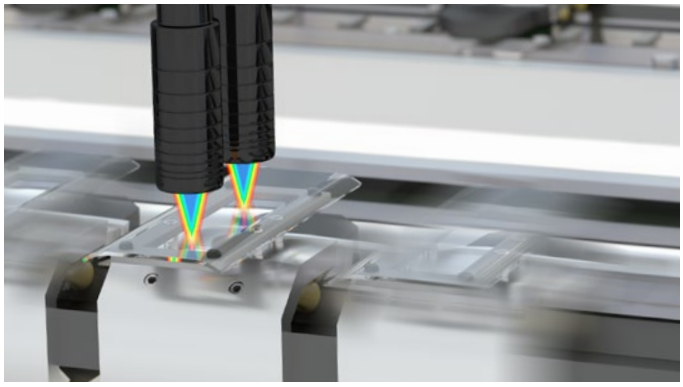
# Measuring principle and fields of application
# confocalDT

**The confocal chromatic measuring principle**

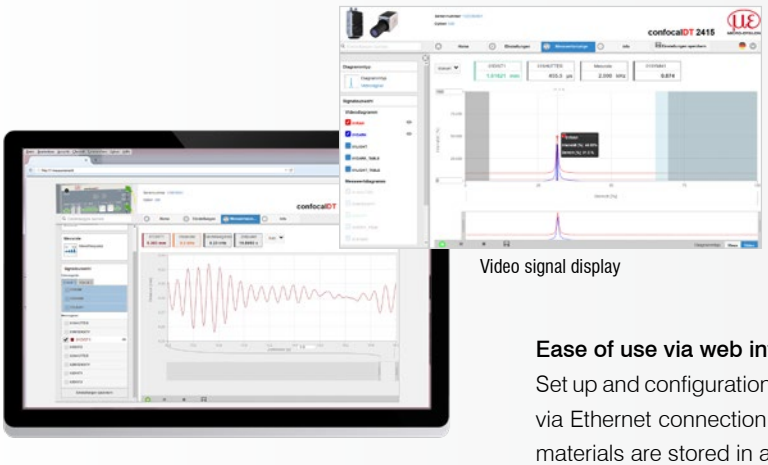
Polychromatic white light is focused onto the target surface by a multilens optical system. The special lens arrangeent splits the white light into monochromatic wavelengths by controlled chromatic aberration. To each wavelength, a specific distance is assigned by factory calibration. Only the wavelength 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. This sensor element detects the corresponding spectral color and evaluates it. In the case of multi-peak measurements, several distance points are evaluated accordingly.



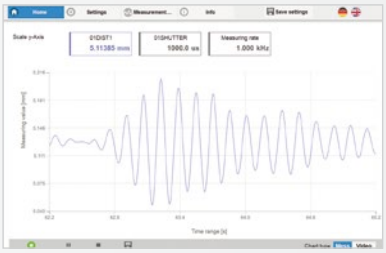



**High measuring rate for dynamic measurement tasks**

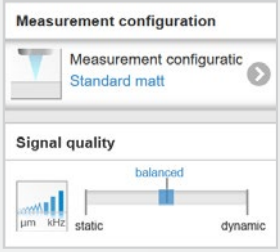
The confocalDT systems offer high measuring rates for measurement tasks with high dynamics. The controller dynamically regulates the exposure of the CCD line. This exposure control compensates for color and reflectivity changes of the measuring object in order to increase the measurement accuracy at high measuring rates.



Video signal display



Measurement chart




Presets for fast setting

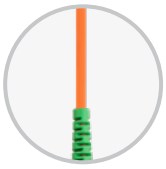
**Ease of use via web interface**

Set up and configuration of controller and sensors is handled in a user-friendly web interface via Ethernet connection. No additional software is required. For thickness measurements, materials are stored in an editable materials database.

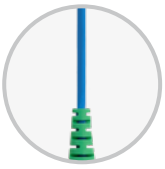
**Compact sensors for restricted installation spaces**

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.

**Robust optical fibers for all applications**



Standard fiber optics

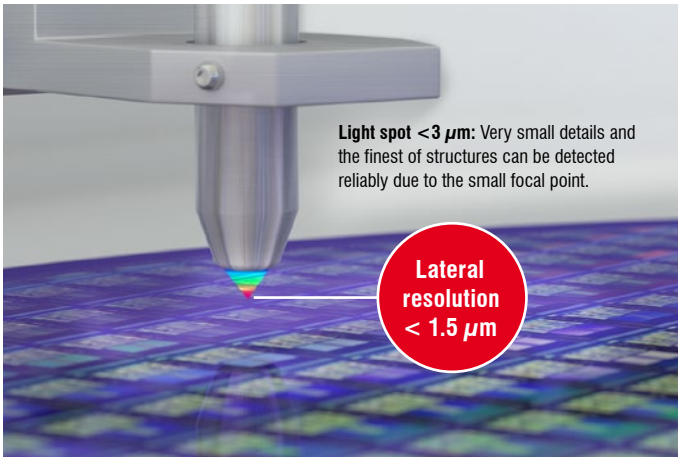


Drag-chain suitable fiber optics

Protective hose for mechanical stress

Robot-suitable fiber optics

Vacuum / UHV model

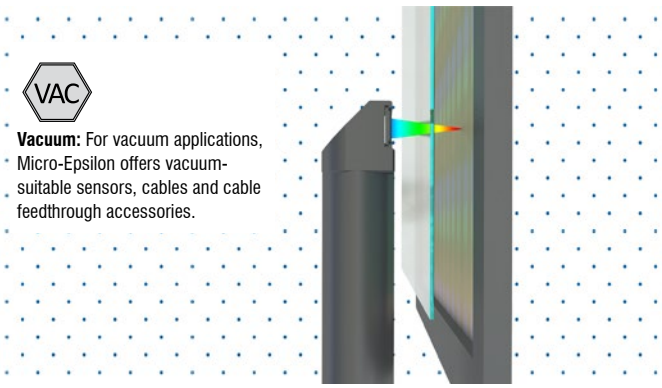



**Smallest light spot for high lateral resolution**

The confocalDT sensors are available with different aperture angles. A large aperture angle with a high numerical aperture (NA number) enables a small light spot (X-Y resolution) as well as a high Z-axis resolution, allowing the smallest details to be detected with high precision. The size of the light spot remains almost constant over the entire measuring range.


**Large measuring angle – ideal for curved and structured surfaces**

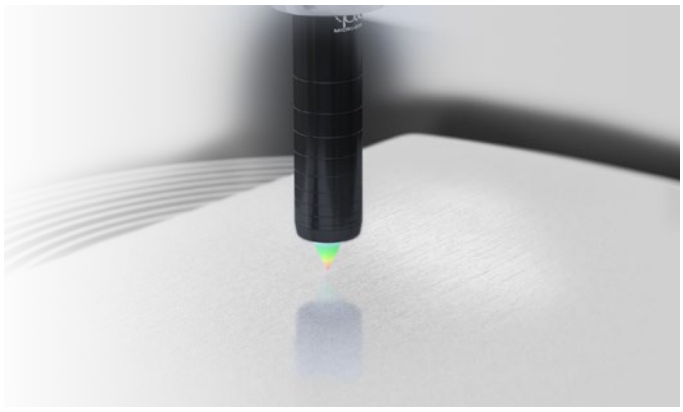
The confocalDT IFS sensors tolerate a large measuring angle up to 48°. Therefore, curved and structured surfaces can be detected reliably to generate stable signals.




**Vacuum applications**

The confocalDT sensors consist of passive components and do not emit heat. For the use in vacuum, special sensors, cables and other accessories are available.

# Absolute distance measurement
# confocalDT

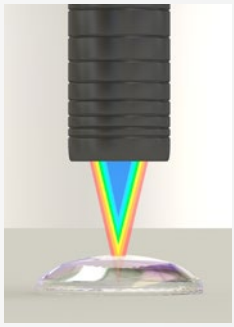


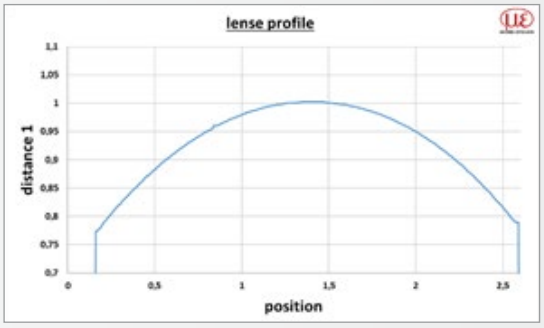
**High-precision displacement and distance measurements on almost all types of surface**

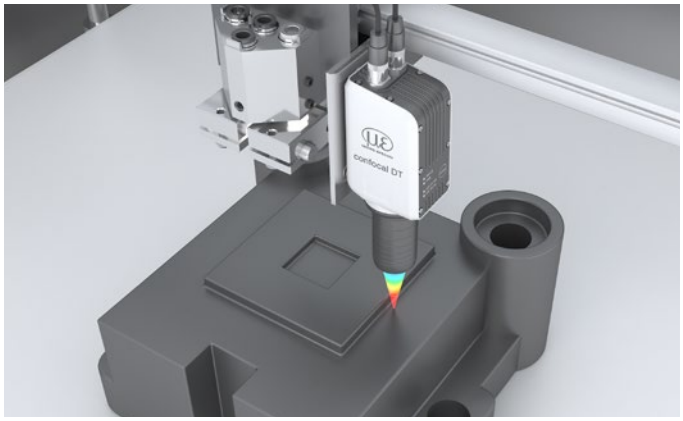
The confocal sensor systems from Micro-Epsilon are used for high-resolution displacement and distance measurements. Due to the innovative technology, measurements can be performed on both diffuse and specular surfaces with high stability. The high measuring rate also allows for high speed processes to be monitored reliably.

**Distance measurement on transparent objects**

High-precision distance measurement is required for contour measurement or positioning of glass lenses. The confocalDT sensors detect curved surfaces with a resolution of up to 18 nm. Thanks to their high measuring rate, the transparent targets can be measured at high speed.

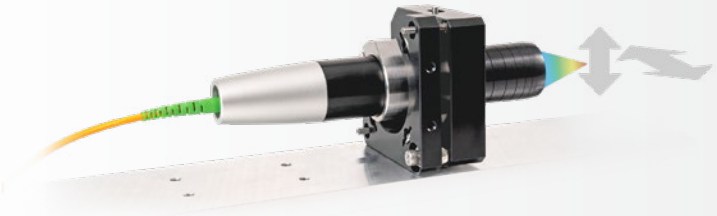




**High precision distance control**

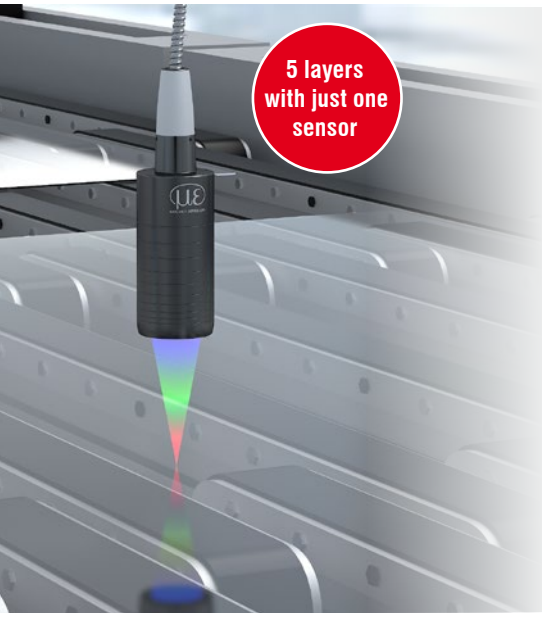
In 3D printing of complex components as well as in PCB printing, precise positioning with submicrometer accuracy is essential. Here, confocal sensors are used. These detect the distance with the highest precision and at the same time a high measuring rate in order to be able to monitor even dynamic processes.

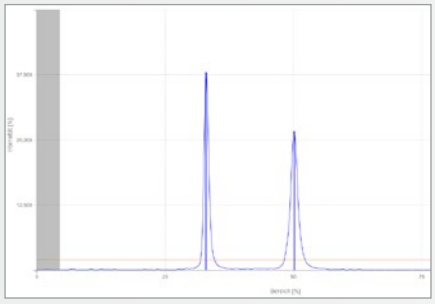


**Mounting adapter for fine adjustment**

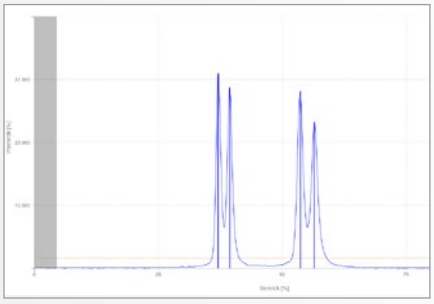
To achieve orthogonal alignment of the sensor for high-precision distance measurements, a mounting adapter is available for fine adjustment.

# Precise thickness measurement
# confocalDT



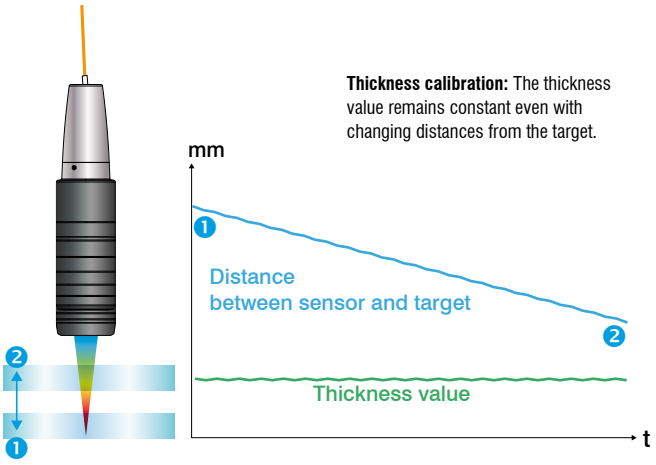
Thickness measurement signal



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. A sensor detects the material thickness with micrometer precision. Thanks to the integrated multi-layer measurement, the thickness of multi-layer objects such as laminated glass can be evaluated.

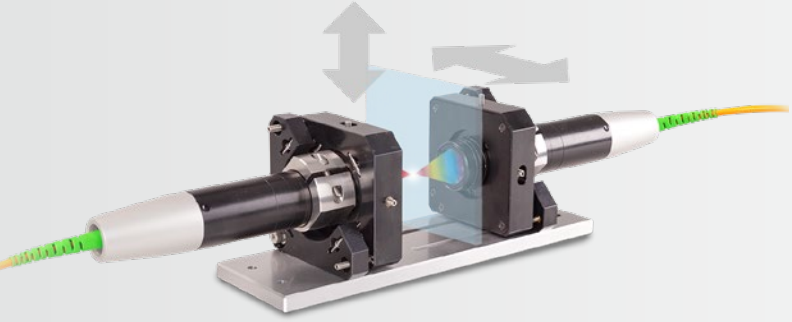




**Glass thickness measurement**

The confocalDT sensors are ideally suitable for one-sided thickness measurement of transparent objects such as bottles. Therefore, thicknesses between 5 µm and 30 mm can be measured. Even curved contours such as the bottle neck or bottoms are precisely detected. The color of the bottle does not matter for this measurement. This allows 100% end-of-line quality control to be performed inline.

**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. By selecting the respective target material, the distance-dependent error is automatically compensated for which enables to achieve the highest possible measurement accuracy.



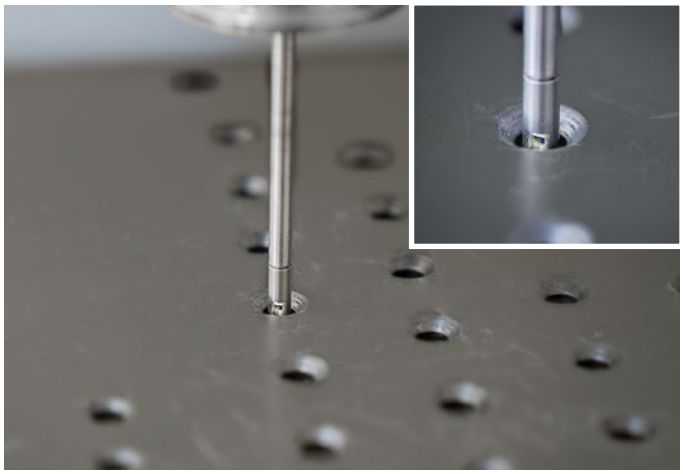
**Mounting adapter for two-sided thickness measurements**

The JMA-Thickness mounting adapter is used for the congruent alignment of two sensors.

# Applications
# confocalDT

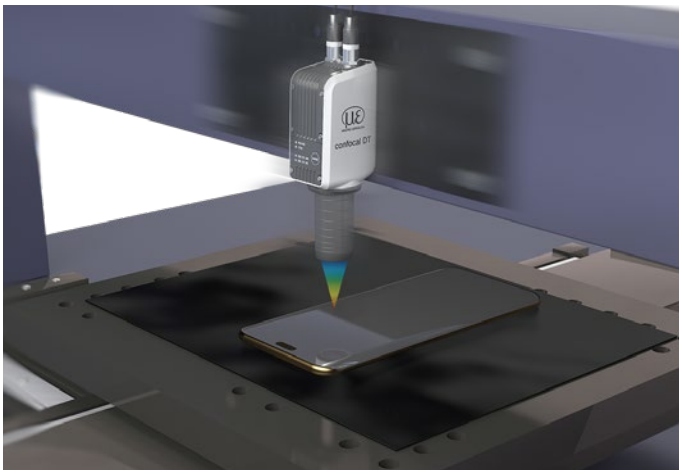
**Thickness measurement of displays and flat glass**
Glass sheets for the production of displays require a homogeneous thickness profile. Confocal chromatic sensors from Micro-Epsilon determine the thickness without making contact from one side.

*Recommended sensors: IFS2405*



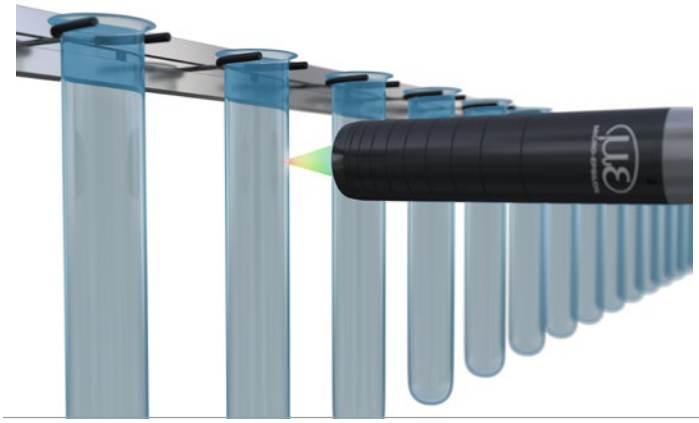
**Restricted installation space**
Miniature sensors with a diameter of 4 mm are suitable for measurements in confined installation spaces, e.g., for the inspection of boreholes. Furthermore, the 90° version of these sensors enables to measure the finest interior contours.

*Recommended sensors: IFS2402*



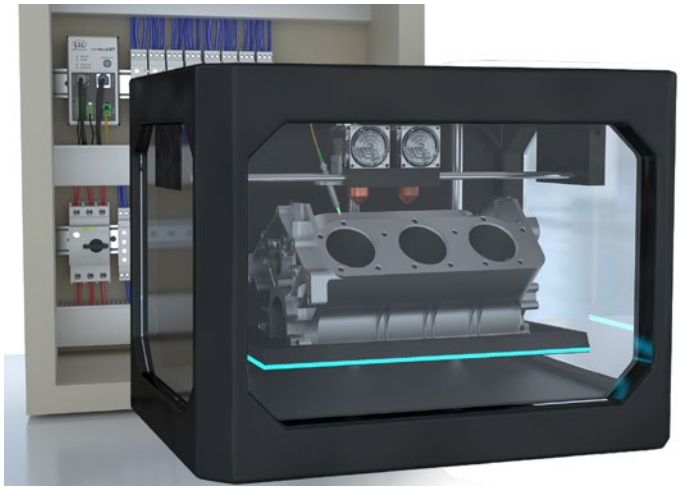
**Coordinate measuring machines**
The compact confocalDT 2410 / 2415 models have an integrated controller. Since no optical fiber is required, the space-saving sensor is particularly suitable for dynamic applications such as in measuring machines.

*Recommended sensors: IFD2410 / IFS2415*



**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.

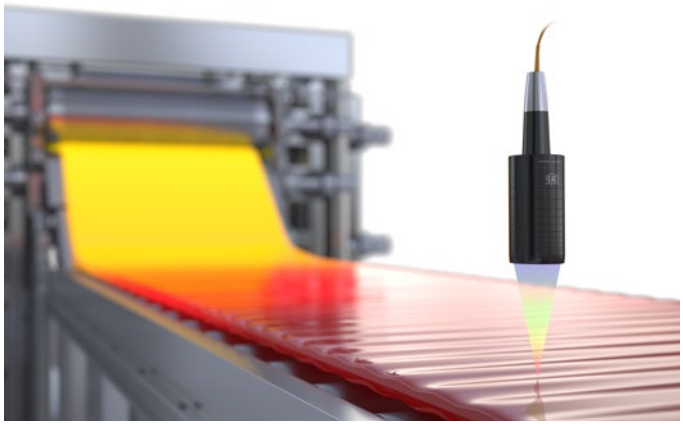
*Recommended sensors: IFS2406*



**Displacement and distance measurements in 3D printing machines**

The compact controllers of the confocalDT 2411 series are used for distance control in industrial printers. The sensor system impresses with a measuring rate of up to 8 kHz and a resolution of up to 12 nm. Due to their compact design, the controllers can be optimally integrated in the control cabinet.

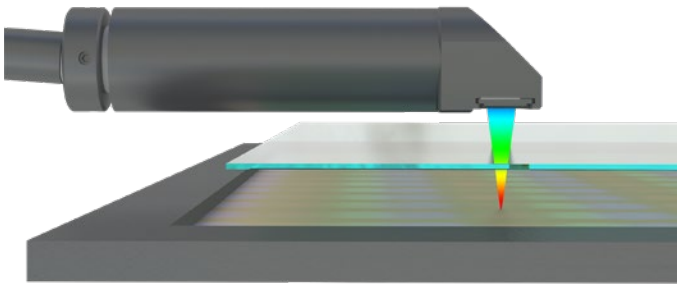
*Recommended sensors: IFD2411*



**Measuring on hot glass**

Confocal sensors can also be used for the measurement of hot glass. The large offset distance allows for the sensor to be mounted from a safe distance to the hot glass.

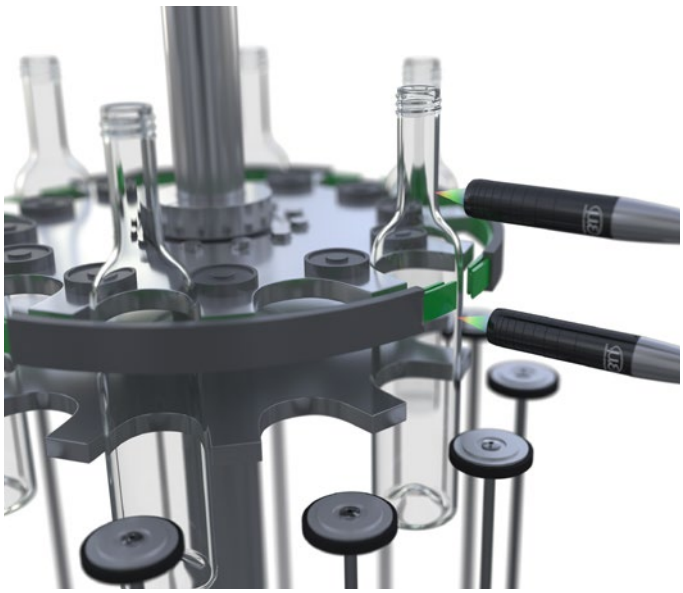
*Recommended sensors: IFS2405-28*



**Positioning of glass masks**

Confocal chromatic sensors monitor the gap between the mask and the glass. Thanks to the 90° design, the sensors can be integrated in an extremely space-saving manner.

*Recommended sensors: IFS2406/90-2,5*



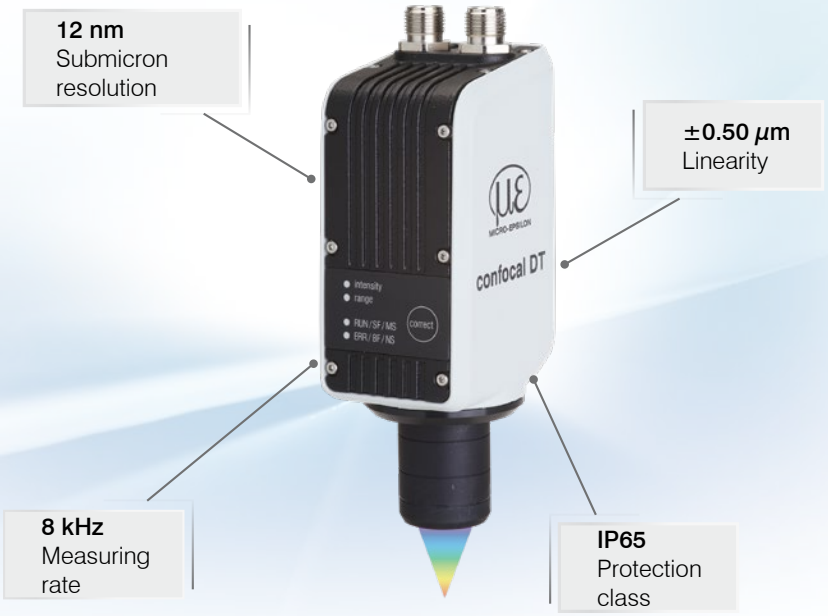
**Thickness measurement on the star wheel**

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

*Recommended sensors: IFS2406-10*

# Confocal chromatic sensor system with integrated controller
# confocalDT IFD2410

- All-in-One: sensor and controller in one compact housing (IP65)
- Adjustable measuring rate up to 8 kHz
- Simple integration without optical fibers
- Ethernet/EtherCAT/PROFINET/ Ethernet/IP/RS422/Analog
- Micron-precise measurement of distance and thickness




EtherCAT® PROFINET® EtherNet/IP®

**All-in-One: compact confocal sensor with optimal price/performance ratio**

The confocalDT IFD2410 is an innovative confocal sensor with integrated controller. The space-saving IP65-housing enables fast integration into plant equipment and machines as no optical fiber is required. This makes the IFD2410 ideally suited to high precision distance and thickness measurements in industrial series applications.

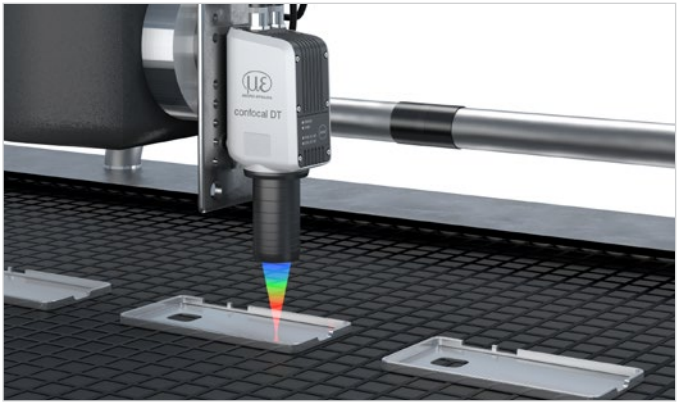
The active exposure regulation of the CCD line enables fast and accurate compensation of varying surfaces even in dynamic measurement processes up to 8 kHz. Based on its excellent price/performance ratio, the confocalDT IFD2410 sets a new benchmark in precise confocal measurement technology.

**Intelligent technology meets high performance and user-friendliness**

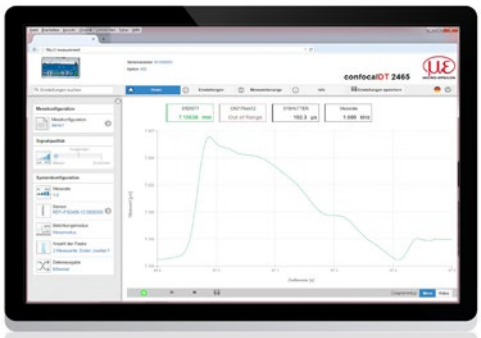
In Ethernet mode, the confocalDT IFD2410 can be set via the intuitive web interface. Industrial Ethernet ensures that the settings are automatically applied to the PLC environment. This eliminates time-consuming setting efforts in the programming environment.

**Fast, precise and compact**

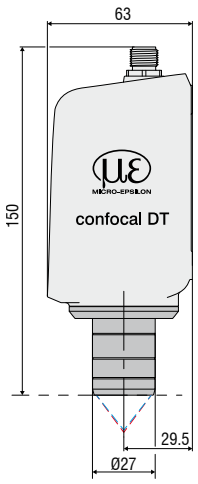
Its high performance and compact housing make this sensor ideally suitable for series applications in production lines and machines. These include inline inspection and coordinate measuring machines, inline thickness monitoring of flat glass and container glass as well as testing electronic components.



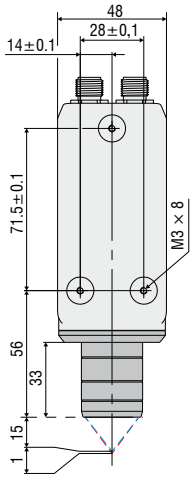

Inline measurement of smartphone housings

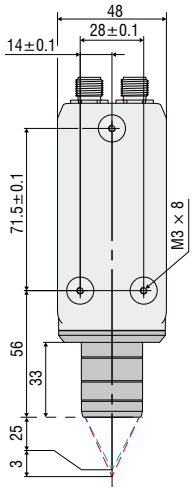


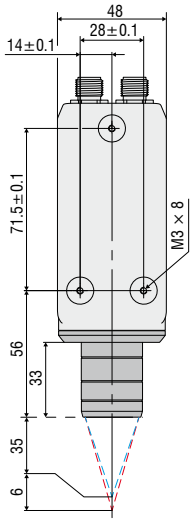

Simple parameter set up via integrated web interface




Dimensions in mm,
not to scale.




| Model | | IFD2410-1 | IFD2410-3 | IFD2410-6 |
|---|---|---|---|---|
| Measuring range | | 1.0 mm | 3.0 mm | 6.0 mm |
| Start of measuring range | approx. | approx. 15 mm | approx. 25 mm | approx. 35 mm |
| Resolution | static [1] | < 12 nm | < 36 nm | < 80 nm |
| | dynamic [2] | < 50 nm | < 125 nm | < 250 nm |
| Measuring rate | | continuously adjustable from 100 Hz to 8 kHz | | |
| Linearity [3] | Displacement and distance | < ±0.5 µm | < ±1.5 µm | < ±3.0 µm |
| | Thickness | < ±1.0 µm | < ±3.0 µm | < ±6.0 µm |
| Light source | | internal white LED | | |
| Permissible ambient light | | 30,000 lx | | |
| Light spot diameter [4] | | 12 µm | 18 µm | 24 µm |
| Measuring angle [5] | | ±25° | ±19° | ±10° |
| Numerical aperture (NA) | | 0.45 | 0.35 | 0.18 |
| Min. target thickness | | 0.05 mm | 0.15 mm | 0.3 mm |
| Target material | | Reflective, diffuse as well as transparent surfaces (e.g. glass) | | |
| Supply voltage | | 24 VDC ±10 % | | |
| Power consumption | | <5 W (24 V) | | |
| Signal input | | 2 x encoders (A+, A-, B+, B-, index); 3 x encoders (A+, A-, B+, B-)<br>2x HTL/TTL multifunction inputs: trigger in, slave in, zero setting, mastering, teach;<br>1x RS422 synchronization input: trigger in, sync in, master/slave, master/slave alternating | | |
| Digital interface | | EtherCAT / PROFINET / EtherNet/IP / RS422 / Ethernet (for parameter setting) | | |
| Analog output | | 4 … 20 mA / 0 … 5 V / 0 ... 10 V (16 bit D/A converter) | | |
| Switching output | | Error1-Out, Error2-Out | | |
| Digital output | | sync out | | |
| Connection | | 12-pin M12 connector for supply, encoder, EtherCAT, PROFINET, EtherNet/IP, RS422 and Sync<br>17-pin M12 plug for I/O analog and encoder<br>optional extension to 3 m / 6 m / 9 m / 15 m (see accessories for suitable connection cables) | | |
| Installation | | radial clamping, threaded hole, mounting adapter (see accessories) | | |
| Temperature range | Storage | -20 … +70 °C | | |
| | Operation | +5 … +50 °C | | |
| Shock (DIN EN 60068-2-27) | | 15g / 6 ms in XY axis, 1000 shocks each | | |
| Vibration (DIN EN 60068-2-6) | | 2g / 20 … 500 Hz in XY axis, 10 cycles each | | |
| Protection class (DIN EN 60529) | Sensor | IP64 (front) | | |
| | Controller | IP65 | | |
| Material | | Aluminum housing, passive cooling | | |
| Weight | | 490 g | 490 g | 490 g |
| Control and indicator elements | | Correct button: interfaces selection, two adjustable functions and reset to factory settings after 10 s;<br>4x color LEDs for Intensity, Range, RUN and ERR | | |

All data at constant ambient temperature (24 ±2 °C)

[1] Average from 512 values at 1 kHz, in the mid of the measuring range onto optical flat

[2] RMS noise relates to mid of measuring range (1 kHz)

[3] Maximum deviation from reference system over the entire measuring range, measured on front surface of ND filter

[4] In the mid of the measuring range

[5] Maximum sensor tilt angle that produces a usable signal on polished glass (n = 1.5) in the mid of the measuring range. The accuracy decreases when approaching the limit values.

# High performance sensor system with integrated controller
# confocalDT IFD2415

- All-in-One: sensor and controller in one compact housing (IP65)
- Adjustable measuring rate up to 25 kHz
- Ethernet/EtherCAT/PROFINET/ Ethernet/IP/RS422/Analog
- Micron-precise measurement of distance and thickness
- High precision distance and thickness measurements (5 layers)
- Short exposure time due to high light intensity


EtherCAT® PROFINET® EtherNet/IP®

**All-in-One: compact confocal sensor with high performance**

The confocalDT IFD2415 is a powerful confocal sensor with integrated controller. The space-saving IP65-housing enables fast integration into plant equipment and machines as no optical fiber is required. Furthermore, the IFD2415 is ideally suited to high precision distance and thickness measurements in industrial series applications. In addition, the sensor can be used with transparent materials for multi-layer thickness measurements of up to 5 layers.

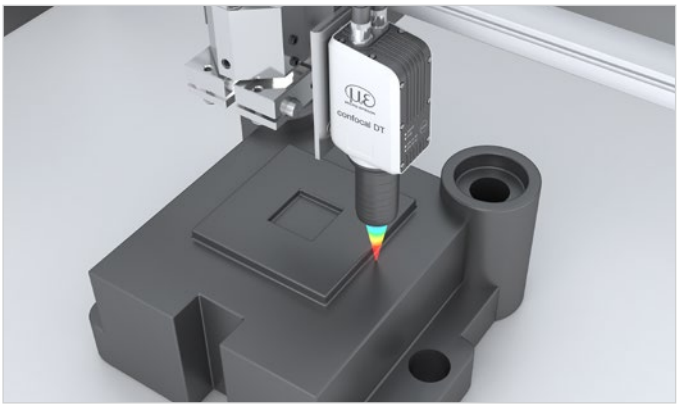
The active exposure time regulation of the CCD line enables fast and stable measurements of varying surfaces even in dynamic measurement processes up to 25 kHz. The measuring system is also characterized by high luminous intensity which enables fast and reliable measurements even on darker surfaces.

**Intelligent technology meets high performance and user-friendliness**

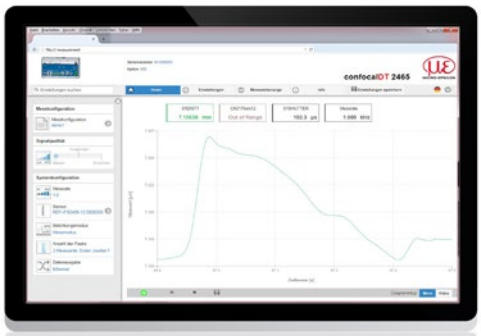
In Ethernet mode, the confocalDT IFD2415 can be set via the intuitive web interface. Industrial Ethernet ensures that the settings are automatically applied to the PLC environment. This eliminates time-consuming setting efforts in the programming environment.

**Fast, precise and compact**

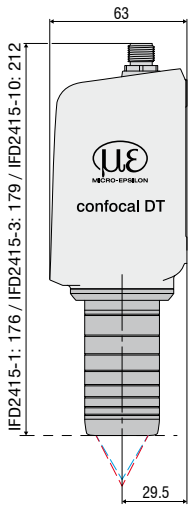
The unique combination of sensor and controller combined with excellent performance and high measuring rate make the confocalDT IFD2415 the best in its class. This compact sensor can be used in series applications such as, e.g., in inline inspection machines, robots, 3D printers and coordinate measuring machines.

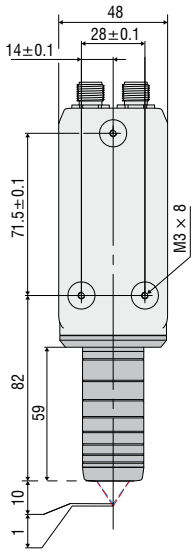


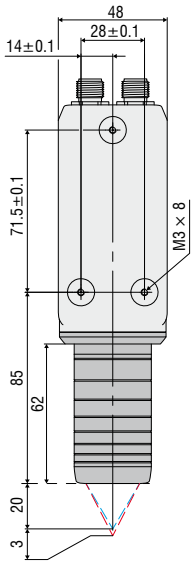
Displacement and distance measurement in 3D printing

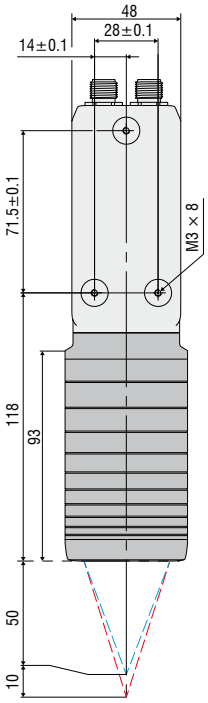


Simple parameter set up via integrated web interface




Dimensions in mm,
not to scale.

| Model | | IFD2415-1 | IFD2415-3 | IFD2415-10 |
|---|---|---|---|---|
| Measuring range | | 1.0 mm | 3.0 mm | 10.0 mm |
| Start of measuring range | approx. | approx. 10 mm | approx. 20 mm | approx. 50 mm |
| Resolution | static [1] | < 8 nm | < 15 nm | < 36 nm |
| | dynamic [2] | < 38 nm | < 80 nm | < 204 nm |
| Measuring rate | | continuously adjustable from 100 Hz to 25 kHz | | |
| Linearity [3] | Displacement and distance | < ±0.25 µm | < ±0.75 µm | < ±2.5 µm |
| | Thickness | < ±0.5 µm | < ±1.5 µm | < ±5.0 µm |
| Light source | | internal white LED | | |
| Permissible ambient light | | 30,000 lx | | |
| Light spot diameter [4] | | 8 µm | 9 µm | 16 µm |
| Measuring angle [5] | | ±30° | ±24° | ±17° |
| Numerical aperture (NA) | | 0.55 | 0.45 | 0.3 |
| Min. target thickness | | 0.05 mm | 0.15 mm | 0.5 mm |
| Target material | | Reflective, diffuse as well as transparent surfaces (e.g. glass) | | |
| Supply voltage | | 24 VDC ±10 % | | |
| Power consumption | | <7W (24 V) | | |
| Signal input | | 2x encoders (A+, A-, B+, B-, index); 3x encoders (A+, A-, B+, B-)<br>2x HTL/TTL multi-function inputs: trigger in, slave in, zero setting, mastering, teach-in;<br>1x RS422 synchronization input: trigger in, sync in, master/slave, master/slave alternating | | |
| Digital interface | | EtherCAT / PROFINET / Ethernet/IP / RS422 / Ethernet (for parameter setting) | | |
| Analog output | | 4 … 20 mA / 0 … 5 V / 0 ... 10 V (16 bit D/A converter) | | |
| Switching output | | Error1-Out, Error2-Out | | |
| Digital output | | sync out | | |
| Connection | | 12-pin M12 connector for supply, encoder, EtherCAT, PROFINET, Ethernet/IP, RS422 and Sync<br>17-pin M12 connector for I/O analog and encoder<br>optional extension to 3 m / 6 m / 9 m / 15 m possible (see accessories for suitable connection cables) | | |
| Installation | | radial clamping, threaded hole, mounting adapter (see accessories) | | |
| Temperature range | Storage | -20 … +70 °C | | |
| | Operation | +5 … +50 °C | | |
| Shock (DIN EN 60068-2-27) | | 15g / 6 ms in XY axis, 1000 shocks each | | |
| Vibration (DIN EN 60068-2-6) | | 2g / 20 … 500 Hz in XY axis, 10 cycles each | | |
| Protection class (DIN EN 60529) | Sensor | IP64 (front) | | |
| | Controller | IP65 | | |
| Material | | Aluminum housing, passive cooling | | |
| Weight | | approx. 500 g | approx. 600 g | approx. 800 g |
| Control and indicator elements | | Correct button: interfaces selection, two adjustable functions and reset to factory settings after 10 s;<br>4x color LEDs for Intensity, Range, RUN and ERR | | |

All data at constant ambient temperature (24 ±2 °C)

[1] Average from 512 values at 1 kHz, in the mid of the measuring range onto optical flat

[2] RMS noise relates to mid of measuring range (1 kHz)

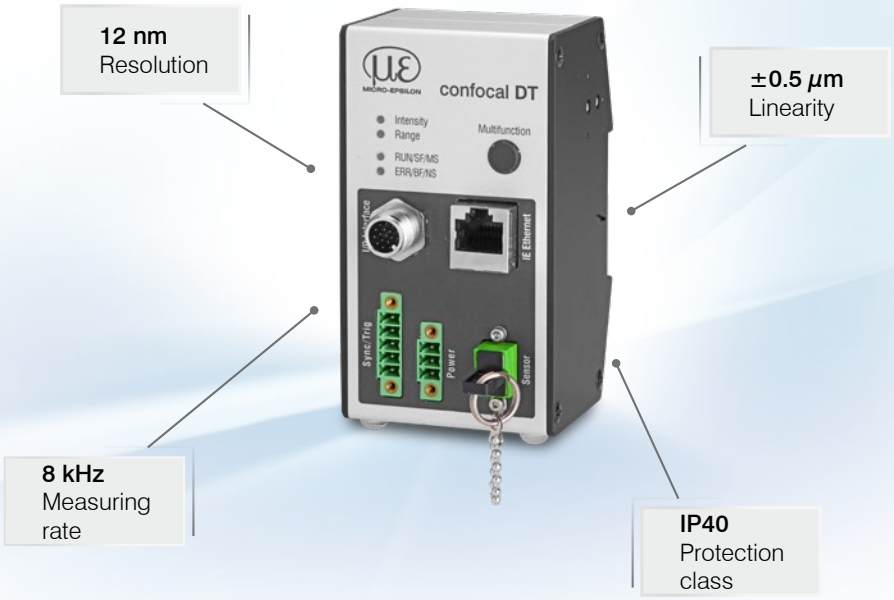
[3] Maximum deviation from reference system over the entire measuring range, measured on front surface of ND filter

[4] In the mid of the measuring range

[5] Maximum sensor tilt angle that produces a usable signal on polished glass (n = 1.5) in the mid of the measuring range. The accuracy decreases when approaching the limit values.

# Compact confocal measuring system for industrial series applications
# confocalDT IFD2411

- Most compact confocal controller
- Excellent price/performance ratio
- Robust aluminum housing (IP40)
- Direct PLC connection due to Industrial Ethernet
- For precise distance and thickness measurements




EtherCAT® PROFINET® EtherNet/IP®

**Most compact design with highest performance and integrated Industrial Ethernet**

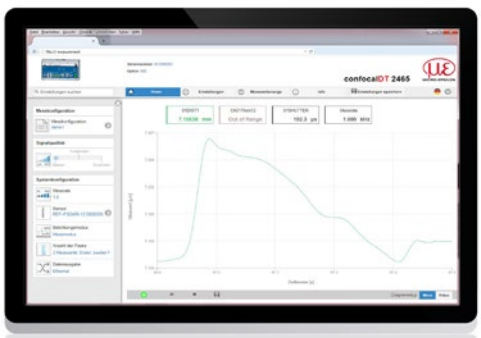
The compact confocal IFD2411 measuring system is a factory-calibrated measuring system for industrial series applications. As well as displacement and distance measurements, the system enables even thickness measurements of transparent materials. The IFD2411 confocal chromatic measuring system is a complete channel which contains a controller and an adapted sensor with measuring ranges of 1 mm, 2 mm, 3 mm and 6 mm. Due to its favorable price/performance ratio, this measuring system is ideal for series applications.

Thanks to the integrated Industrial Ethernet interface, you integrate the controller directly into the PLC. In Ethernet mode, the controller can be set via the intuitive web interface. Industrial Ethernet ensures that the settings are automatically applied to the PLC environment. This eliminates time-consuming setting efforts in the programming environment.

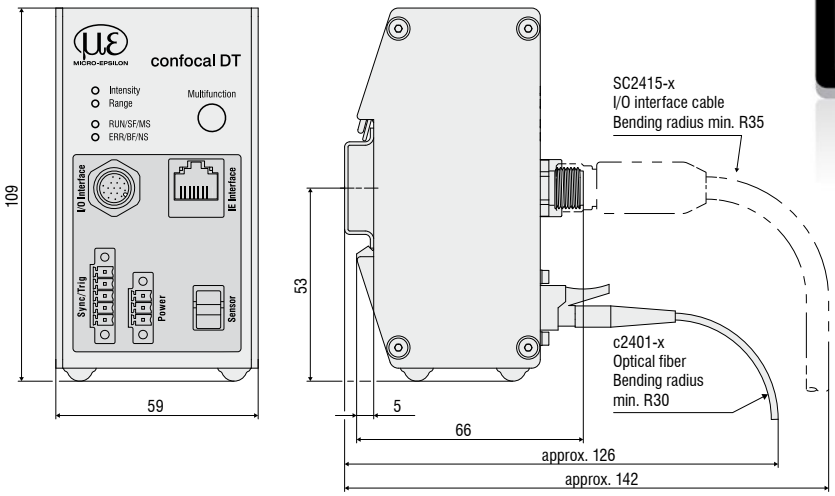
**Fast, precise and robust**

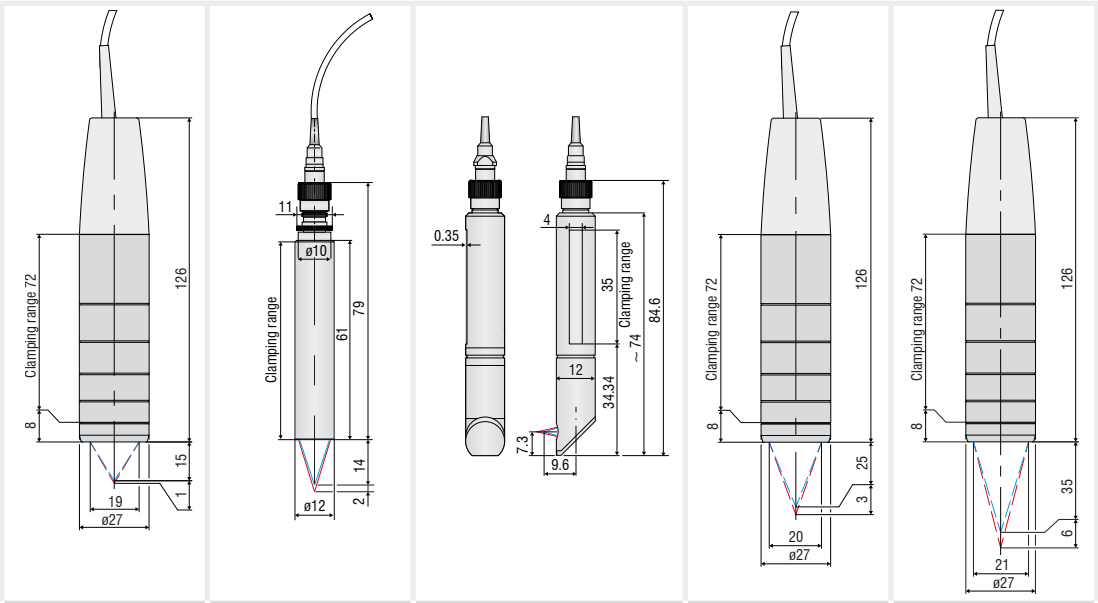
With an adjustable measuring rate of up to 8 kHz and sub-micrometer resolution of up to 12 nm, the IFD2411 is suitable for numerous measurement tasks. The active exposure regulation of the CCD line enables fast and reliable measurements on varying surfaces.

Thanks to its extremely compact design and its robust IP40 aluminum housing, the controller of the IFD2411 measuring system can be integrated in almost all existing plants and systems. Integrated DIN rail mounting enables fast installation in the control cabinet.



Simple parameter set up via integrated web interface






| Model | | IFD2411-1 | IFD2411-2 | IFD2411/90-2 | IFD2411-3 | IFD2411-6 |
|---|---|---|---|---|---|---|
| Measuring range | | 1.0 mm | 2.0 mm | | 3.0 mm | 6.0 mm |
| Start of measuring range | approx. | 15 mm | 14 mm | 9.6 mm [1] | 25 mm | 35 mm |
| Resolution | static [2] | < 12 nm | < 40 nm | | < 40 nm | < 80 nm |
| | dynamic [3] | < 50 nm | < 125 nm | | < 125 nm | < 250 nm |
| Measuring rate | | continuously adjustable from 100 Hz to 8 kHz | | | | |
| Linearity [4] | Distance | < ±0.3 µm | < ±1.0 µm | | < ±0.9 µm | < ±1.8 µm |
| | Thickness | < ±0.6 µm | < ±2.0 µm | | < ±1.8 µm | < ±3.6 µm |
| Multi-peak measurement | | 1 layer | | | | |
| Light source | | internal white LED | | | | |
| No. of characteristic curves | | up to 10 characteristic curves for different sensors per channel, selection via table in the menu | | | | |
| Permissible ambient light [5] | | 30,000 lx | | | | |
| Light spot diameter | | 12 µm | 10 µm | | 18 µm | 24 µm |
| Max. measuring angle [6] | | ±25° | ±12° | | ±19° | ±10° |
| Numerical aperture (NA) | | 0.45 | 0.25 | | 0.35 | 0.18 |
| Min. target thickness [7] | | 0.05 mm | 0.1 mm | | 0.15 mm | 0.3 mm |
| Target material | | reflective, diffuse as well as transparent surfaces (e.g. glass) | | | | |
| Synchronization | | yes | | | | |
| Supply voltage | | 24 VDC ±10 % | | | | |
| Power consumption | | < 7 W (24V) | | | | |
| Signal input | | sync-in / trig-in; 1x encoder (A+, A-, B+, B-, index) | | | | |
| Digital interface | | EtherCAT / PROFINET / Ethernet/IP / RS422 / Ethernet | | | | |
| Analog output | | Current: 4 … 20 mA; voltage: 0 ... 5V & 0 … 10 V (16 bit D/A converter) | | | | |
| Digital output | | sync-out | | | | |
| Connection | Optical | pluggable optical fiber via E2000 socket, length 2 m ... 50 m, min. bending radius 30 mm | | | | |
| | Electrical | 3-pin supply terminal strip; 5- or 6-pin I/O terminal strip (max. cable length 30 m);<br>17-pin M12 connector for RS422, analog and encoder;<br>RJ45 socket for Ethernet (out) / EtherCAT / PROFINET / Ethernet/IP (in/out) (max. cable length 100 m) | | | | |
| Installation | | Free-standing, DIN rail mounting | | | | |
| Temperature range | Storage | -20 … +70 °C | | | | |
| | Operation | Sensor: +5 … +70 °C; controller: +5 … +50 °C | | | | |
| Shock (DIN EN 60068-2-27) | | 15g / 6 ms in XYZ axis, 1000 shocks each | | | | |
| Vibration (DIN EN 60068-2-6) | | 2g / 20 … 500 Hz in XYZ axis, 10 cycles each | | | | |
| Protection class (DIN EN 60529) | Sensor | IP64 | | | | |
| | Controller | IP40 | | | | |
| Material | | Aluminum | | | | |
| Weight | Sensor | approx. 100 g | approx. 20 g | approx. 30 g | approx. 100 g | approx. 100 g |
| | Controller | approx. 335 g | | | | |
| No. of measurement channels | | 1 | | | | |
| Control and indicator elements | | Multifunction button: interfaces selection, two adjustable functions and reset to factory settings after 10 s;<br>4x color LEDs for Intensity, Range, RUN and ERR | | | | |

FSO = Full Scale Output

[1] Start of measuring range measured from sensor axis

[2] Average from 512 values at 1 kHz, in 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.

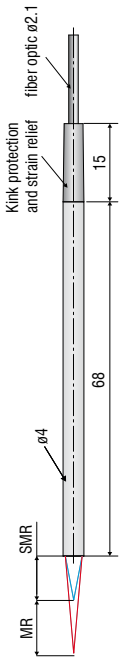
[5] Illuminant: light bulb

[6] Maximum measuring angle of the sensor that produces a usable signal on reflecting surfaces. The accuracy decreases when approaching the limit values.

[7] Glass sheet with refractive index n = 1.5 in midrange

# Confocal chromatic miniature sensors
# confocalDT IFS2402

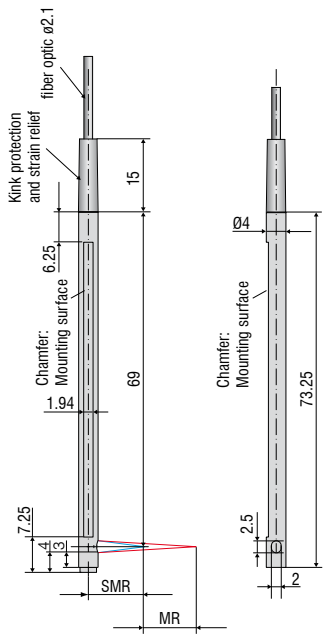
- Miniature sensors Ø4 mm with axial or radial beam path
- Submicron resolution
- For precise distance measurements
- Small light spot




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 |
| Target material | | reflective, diffuse as well as transparent surfaces (e.g. glass) [5] | | |
| Connection | | integrated optical fiber 2 m with E2000/APC connector; extension up to 50 m; bending radius: static 30 mm; dynamic 40 mm | | |
| Installation | | Clamping (mounting adapter see accessories) | | |
| Temperature range | Storage | -20 … +70 °C | | |
| | Operation | +5 … +70 °C | | |
| Shock (DIN EN 60068-2-27) | | 15g / 6 ms in XY axis, 1000 shocks each | | |
| Vibration (DIN EN 60068-2-6) | | 2g / 20 … 500 Hz in XY axis, 10 cycles each | | |
| Protection class (DIN EN 60529) | | IP64 (front) | | |
| Material | | Stainless steel housing, glass lenses | | |
| Weight | | approx. 186 g (incl. optical fiber) | | |

[1] Average from 512 values at 1 kHz, in 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] No thickness measurement possible Distance measurement only possible if thickness of glass > measuring range. Measurements on metal only possible to a limited extent.

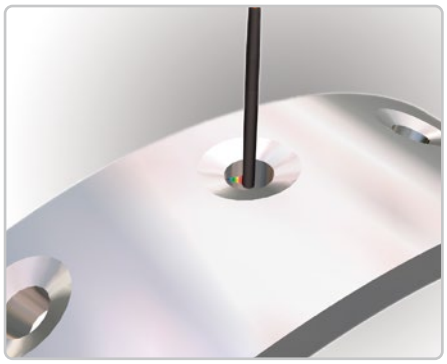



MR = Measuring range
SMR = Start of measuring range
Dimensions in mm, not to scale

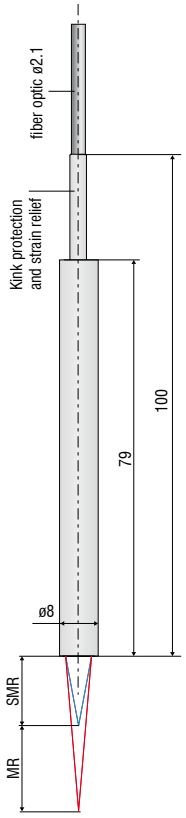
| Model | | IFS2402/90-1,5 | IFS2402/90-4 |
|---|---|---|---|
| Measuring range | | 1.5 mm | 2.5 mm |
| Start of measuring range | approx. | 2.5 mm [1] | 2.5 mm [1] |
| Resolution | static [2] | 60 nm | 100 nm |
| | dynamic [3] | 192 nm | 480 nm |
| Linearity [4] | Displacement and distance | < ±1.2 µm | < ±3 µm |
| Light spot diameter | | 20 µm | 20 µm |
| Max. measuring angle [5] | | ±5° | ±3° |
| Numerical aperture | | 0.20 | 0.10 |
| Target material | | reflective, diffuse as well as transparent surfaces (e.g. glass) [6] | |
| Connection | | integrated optical fiber 2 m with E2000/APC connector; extension up to 50 m; bending radius: static 30 mm, dynamic 40 mm | |
| Installation | | Clamping (mounting adapter see accessories) | |
| Temperature range | Storage | -20 … +70 °C | |
| | Operation | +5 … +70 °C | |
| Shock (DIN EN 60068-2-27) | | 15g / 6 ms in XY axis, 1000 shocks each | |
| Vibration (DIN EN 60068-2-6) | | 2g / 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, in 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] No thickness measurement possible Distance measurement only possible if thickness of glass > measuring range. Measurements on metal only possible to a limited extent.

# Confocal chromatic hybrid sensors
# confocalDT IFS2403



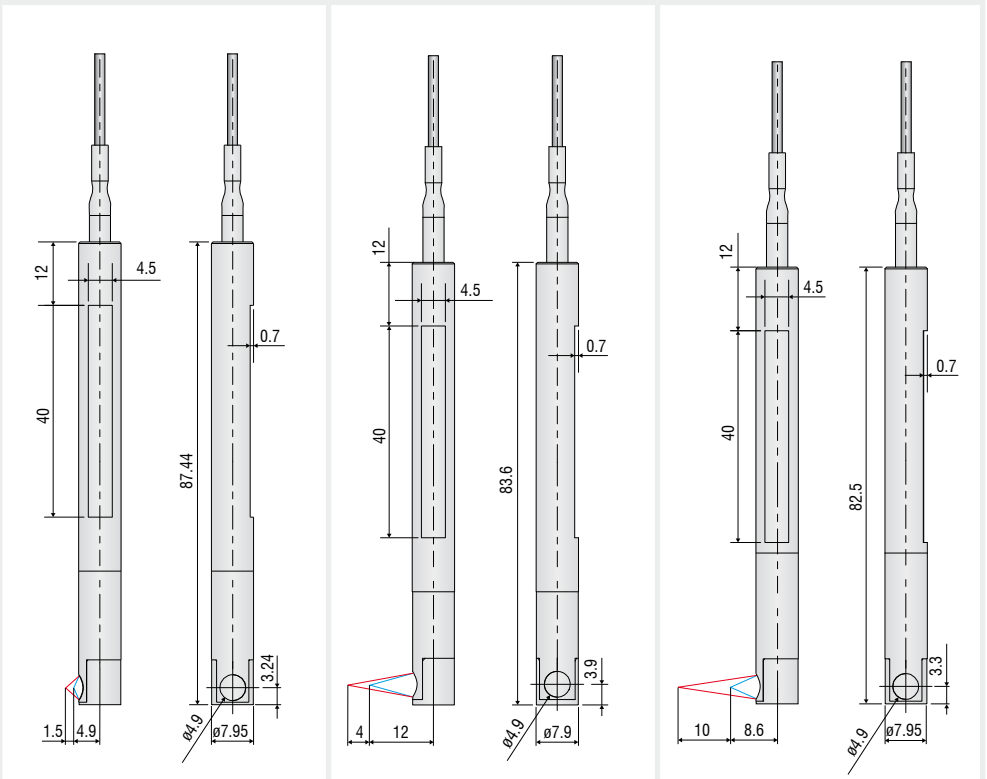
- Hybrid sensors ø8 mm with axial or radial beam path
- Submicron resolution
- For one-sided thickness measurements
- For precise distance measurements
- Small light spot




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 |
| Target material | | reflective, diffuse as well as transparent surfaces (e.g. glass) | | | |
| Connection | | integrated optical fiber 2 m with E2000/APC connector; extension up to 50 m; bending radius: static 30 mm, dynamic 40 mm | | | |
| Installation | | Clamping (mounting adapter see accessories) | | | |
| Temperature range | Storage | -20 … +70 °C | | | |
| | Operation | +5 … +70 °C | | | |
| Shock (DIN EN 60068-2-27) | | 15g / 6 ms in XY axis, 1000 shocks each | | | |
| Vibration (DIN EN 60068-2-6) | | 2g / 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, in 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



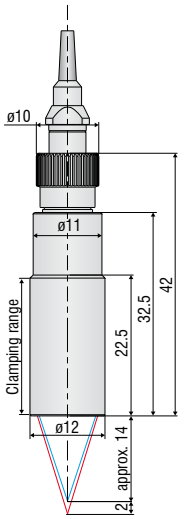

Dimensions in mm,
not to scale.

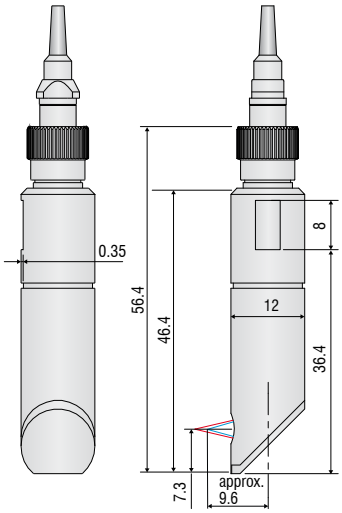
| Model | | IFS2403/90-1.5 | IFS2403/90-4 | IFS2403/90-10 |
|---|---|---|---|---|
| Measuring range | | 1.5 mm | 4 mm | 10 mm |
| Start of measuring range | approx. | 4.9 mm [1] | 12 mm [1] | 8.6 mm [1] |
| Resolution | static [2] | 60 nm | 100 nm | 250 nm |
| | dynamic [3] | 186 nm | 460 nm | 1250 nm |
| 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 |
| Target material | | reflective, diffuse as well as transparent surfaces (e.g. glass) | | |
| Connection | | integrated optical fiber 2 m with E2000/APC connector;<br>extension up to 50 m; bending radius: static 30 mm, dynamic 40 mm | | |
| Installation | | Clamping (mounting adapter see accessories) | | |
| Temperature range | Storage | -20 … +70 °C | | |
| | Operation | +5 … +70 °C | | |
| Shock (DIN EN 60068-2-27) | | 15g / 6 ms in XY axis, 1000 shocks each | | |
| Vibration (DIN EN 60068-2-6) | | 2g / 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) | | |

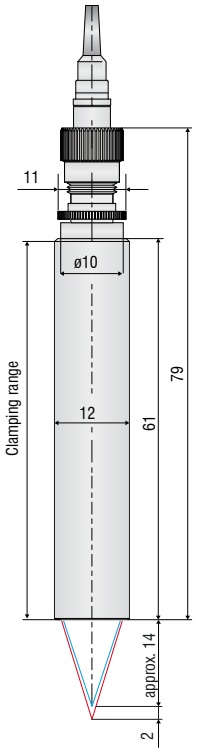
[1] Start of measuring range measured from sensor axis
[2] Average from 512 values at 1 kHz, in the mid of the measuring range onto optical flat
[3] RMS noise relates to mid of measuring range (1 kHz)
[4] All data at constant ambient temperature (25 ±1 °C) against optical flat; specifications can change 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



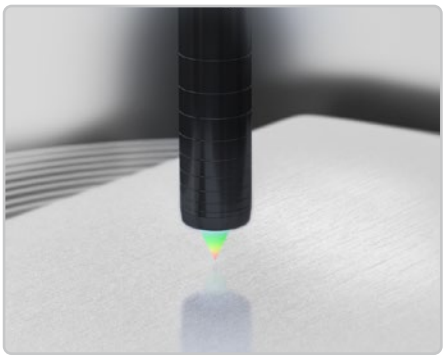




Dimensions in mm, not to scale.

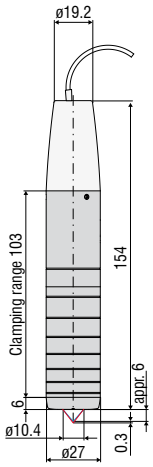
| Model | | IFS2404-2 | IFS2404/90-2 | IFS2404-2(001) |
|---|---|---|---|---|
| Measuring range | | 2 mm | 2 mm | 2 mm |
| Start of measuring range | approx. | 14 mm | 9.6 mm [1] | 14 mm |
| Resolution | static [2] | 40 nm | 40 nm | 40 nm |
| | dynamic [3] | 125 nm | 125 nm | 125 nm |
| Linearity [4] | Displacement and distance | < ±1 µm | < ±1 µm | < ±1 µm |
| | Thickness | < ±2 µm | < ±2 µm | < ±2 µm |
| Light spot diameter | | 10 µm | 10 µm | 10 µm |
| Max. tilt angle [5] | | ±12° | ±12° | ±12° |
| Numerical aperture (NA) | | 0.25 | 0.25 | 0.25 |
| Min. target thickness [6] | | 0.1 mm | 0.1 mm | 0.1 mm |
| Target material | | reflective, diffuse as well as transparent surfaces (e.g. glass) | | |
| Connection | | pluggable optical fiber via FC socket, type CS242-x/CS2401; standard length 2 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 |
| Installation | | Clamping (mounting adapter see accessories) | | |
| Temperature range | Storage | -20 … +70 °C | | |
| | Operation | +5 … +70 °C | | |
| Shock (DIN EN 60068-2-27) | | 15g / 6 ms in XY axis, 1000 shocks each | | |
| Vibration (DIN EN 60068-2-6) | | 2g / 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 | approx. 40 g |

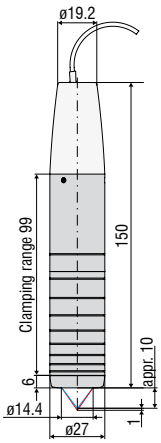
[1] Start of measuring range measured from sensor axis
[2] Average from 512 values at 1 kHz, in the mid of the measuring range onto optical flat
[3] RMS noise relates to mid of measuring range (1 kHz)
[4] All data at constant ambient temperature (25 ±1 °C) against optical flat; specifications can change 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

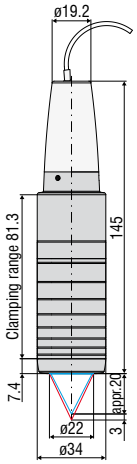
# Confocal sensors with high precision
# confocalDT IFS2405



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



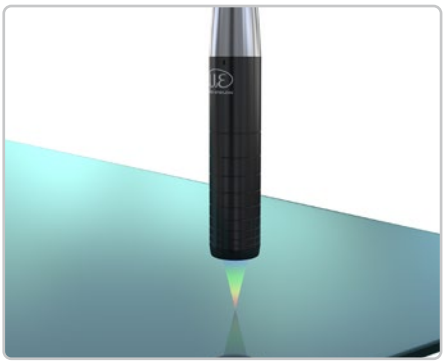




Dimensions in mm, not to scale.

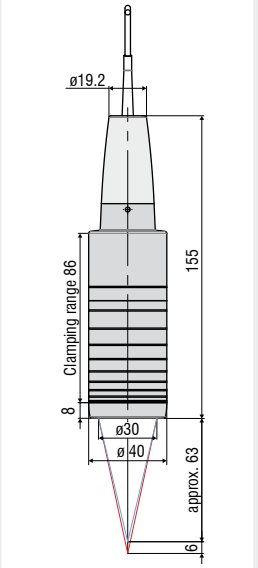
| Model | | IFS2405-0.3 | IFS2405-1 | IFS2405-3 |
|---|---|---|---|---|
| Measuring range | | 0.3 mm | 1 mm | 3 mm |
| Start of measuring range | approx. | 6 mm | 10 mm | 20 mm |
| Resolution | static [1] | 4 nm | 8 nm | 15 nm |
| | dynamic [2] | 18 nm | 38 nm | 80 nm |
| Linearity [3] | Displacement 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 |
| Target material | | reflective, diffuse as well as transparent surfaces (e.g. glass) | | |
| Connection | | pluggable optical fiber via FC socket, standard length 3 m; extension up to 50 m; bending radius: static 30 mm; dynamic 40 mm | | |
| Installation | | Clamping (mounting adapter see accessories) | | |
| Temperature range | Storage | -20 … +70 °C | | |
| | Operation | +5 … +70 °C | | |
| Shock (DIN EN 60068-2-27) | | 15g / 6 ms in XY axis, 1000 shocks each | | |
| Vibration (DIN EN 60068-2-6) | | 2g / 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 |

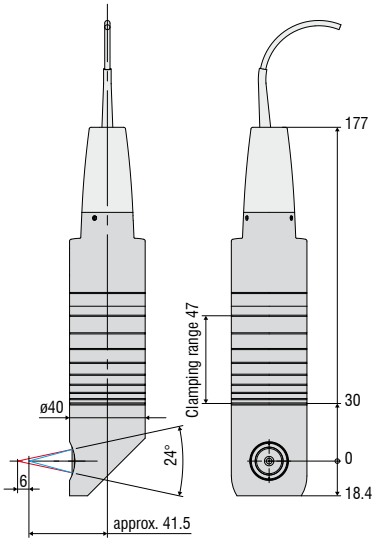
[1] Average from 512 values at 1 kHz, in the mid of the measuring range onto optical flat
[2] RMS noise relates to mid of measuring range (1 kHz)
[3] All data at constant ambient temperature (25 ±1 °C) against optical flat; specifications can change when measuring different objects.
[4] Maximum measuring 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

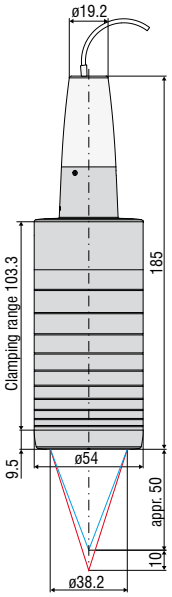
# Confocal sensors with high precision
# confocalDT IFS2405



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



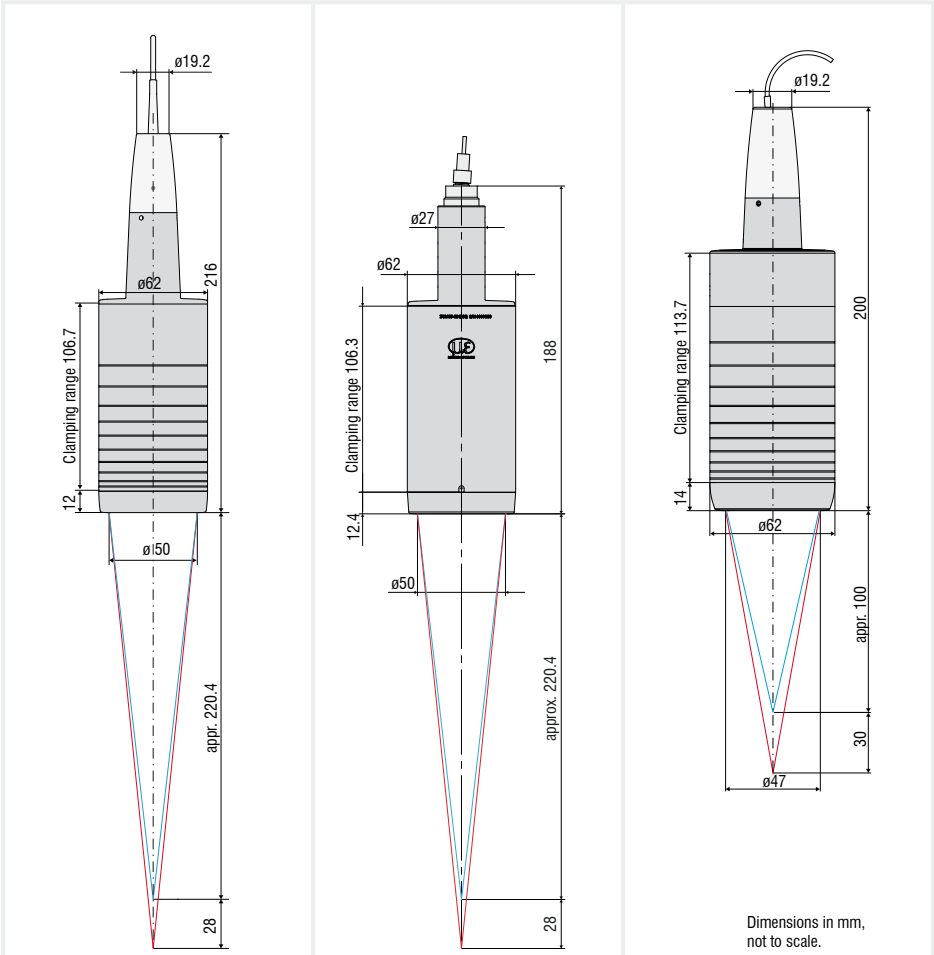




Dimensions in mm, not to scale.

| 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 |
| Target material | | reflective, diffuse as well as transparent surfaces (e.g. glass) | | |
| Connection | | pluggable optical fiber via FC socket, standard length 3 m; extension up to 50 m; bending radius: static 30 mm; dynamic 40 mm | | |
| Installation | | Clamping (mounting adapter see accessories) | | |
| Temperature range | Storage | -20 … +70 °C | | |
| | Operation | +5 … +70 °C | | |
| Shock (DIN EN 60068-2-27) | | 15g / 6 ms in XY axis, 1000 shocks each | | |
| Vibration (DIN EN 60068-2-6) | | 2g / 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 |

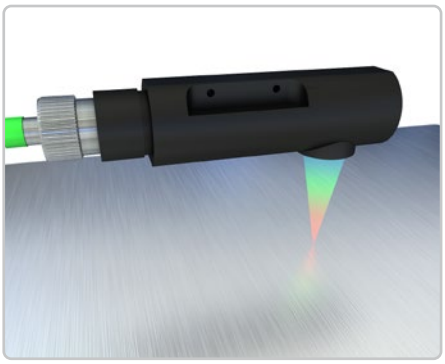
[1] Start of measuring range measured from sensor axis
[2] Average from 512 values at 1 kHz, in the mid of the measuring range onto optical flat
[3] RMS noise relates to mid of measuring range (1 kHz)
[4] All data at constant ambient temperature (25 ±1 °C) against optical flat; specifications can change 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



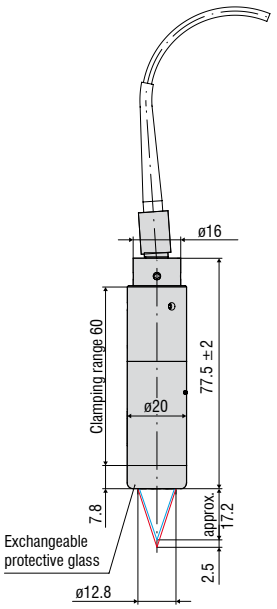

| Model | | IFS2405-28 | IFS2405-28/VAC(001) | IFS2405-30 |
|---|---|---|---|---|
| Measuring range | | 28 mm | | 30 mm |
| Start of measuring range | approx. | 220 mm | | 100 mm |
| Resolution | static [1] | 130 nm | | 93 nm |
| | dynamic [2] | 747 nm | | 530 nm |
| Linearity [3] | Displacement and 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 |
| Target material | | reflective, diffuse as well as transparent surfaces (e.g. glass) | | |
| Connection | | pluggable optical fiber via FC socket, standard length 3 m; extension up to 50 m; bending radius: static 30 mm; dynamic 40 mm | | |
| Installation | | Clamping (mounting adapter see accessories) | | |
| Temperature range | Storage | -20 … +70 °C | | |
| | Operation | +5 … +70 °C | | |
| Shock (DIN EN 60068-2-27) | | 15g / 6 ms in XY axis, 1000 shocks each | | |
| Vibration (DIN EN 60068-2-6) | | 2g / 20 … 500 Hz in XY axis, 10 cycles each | | |
| Protection class (DIN EN 60529) | | IP64 (front) | IP40 (vacuum compatible) | IP65 (front) |
| Material | | Aluminum housing, glass lenses | Burnished stainless steel housing | Aluminum housing, glass lenses |
| Weight [6] | | approx. 750 g | | approx. 730 g |

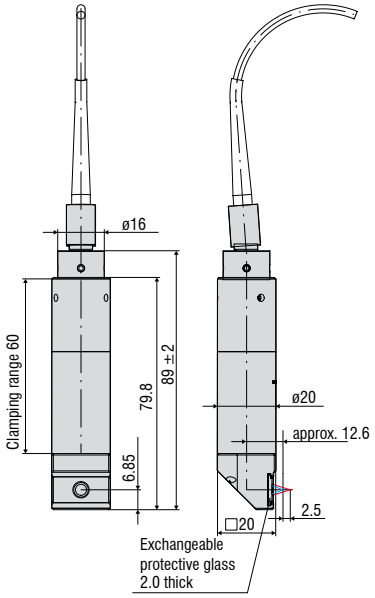
[1] Average from 512 values at 1 kHz, in the mid of the measuring range onto optical flat
[2] RMS noise relates to mid of measuring range (1 kHz)
[3] All data at constant ambient temperature (25 ±1 °C) against optical flat; specifications can change when measuring different objects.
[4] Maximum measuring 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

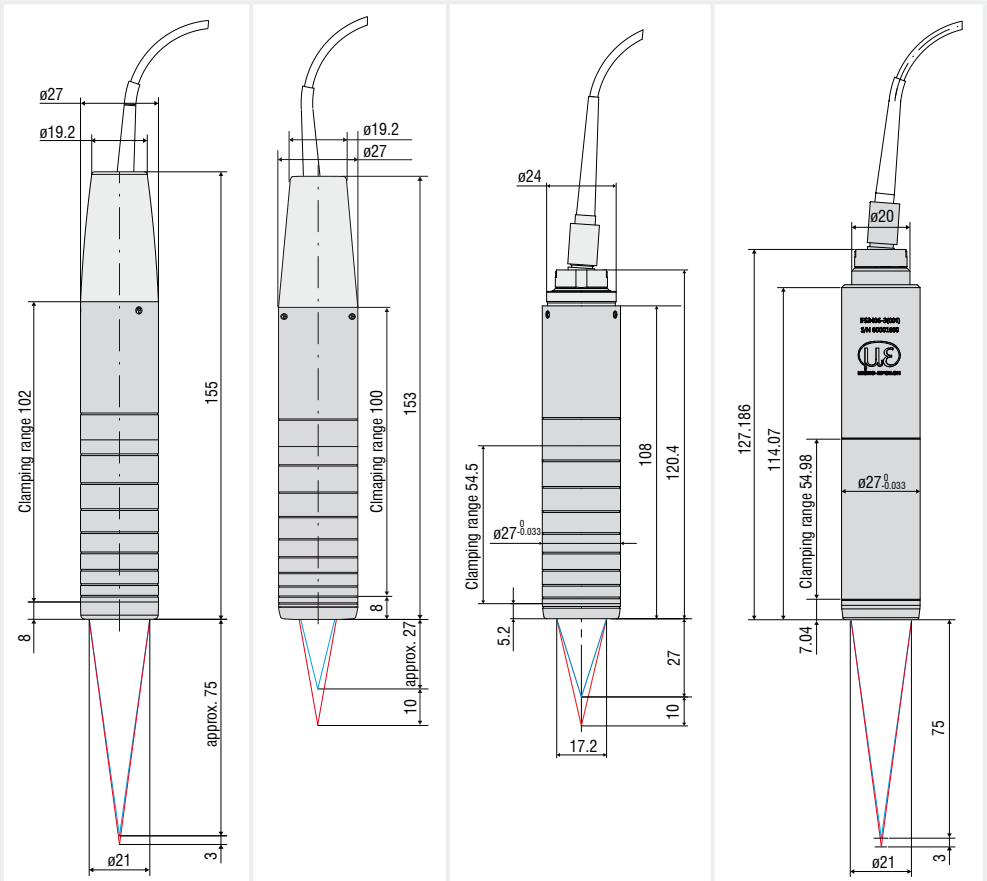



Dimensions in mm, not to scale.

| 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 |
| Target material | | reflective, diffuse as well as transparent surfaces (e.g. glass) | |
| Connection | | 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 | |
| Installation | | Clamping (mounting adapter see accessories) | |
| Temperature range | Storage | -20 … +70 °C | |
| | Operation | +5 … +70 °C | |
| Shock (DIN EN 60068-2-27) | | 15g / 6 ms in XY axis, 1000 shocks each | |
| Vibration (DIN EN 60068-2-6) | | 2g / 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, in 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

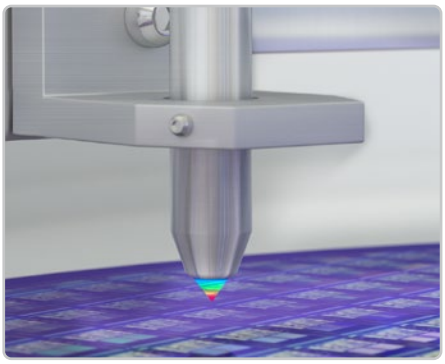



Dimensions in mm,
not to scale.

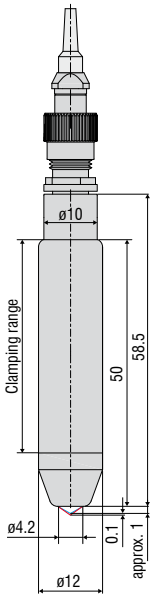
| Model | | IFS2406-3 | IFS2406-10 | IFS2406-10/VAC(001) | IFS2406-3/VAC(001) |
|---|---|---|---|---|---|
| Measuring range | | 3 mm | 10 mm | | 3 mm |
| Start of measuring range | approx. | 75 mm | 27 mm | | 75 mm |
| Resolution | static [1] | 32 nm | 38 nm | | 50 nm |
| | dynamic [2] | 168 nm | 207 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 |
| Target material | | reflective, diffuse as well as transparent surfaces (e.g. glass) | | | |
| Connection | | 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 |
| Installation | | Clamping (mounting adapter see accessories) | | | |
| Temperature range | Storage | -20 … +70 °C | | | |
| | Operation | +5 … +70 °C | | | |
| Shock (DIN EN 60068-2-27) | | 15g / 6 ms in XY axis, 1000 shocks each | | | |
| Vibration (DIN EN 60068-2-6) | | 2g / 20 … 500 Hz in XY axis, 10 cycles each | | | |
| Protection class (DIN EN 60529) | | IP65 (front) | | IP40 (vacuum compatible) | IP40 (vacuum compatible) |
| Material | | Aluminum housing, glass lenses | | Stainless steel housing, anodized aluminum housing | Stainless steel housing (1.4305), glass lenses |
| Weight [6] | | approx. 99 g | approx. 128 g | | approx. 250 g |

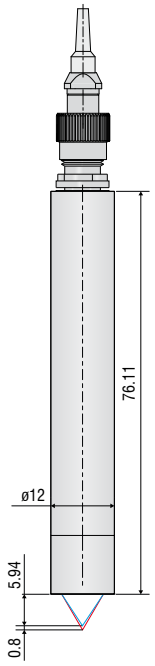
[1] Average from 512 values at 1 kHz, in the mid of the measuring range onto optical flat
[2] RMS noise relates to mid of measuring range (1 kHz)
[3] All data at constant ambient temperature (25 ±1 °C) against optical flat; specifications can change when measuring different objects.
[4] Maximum measuring 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

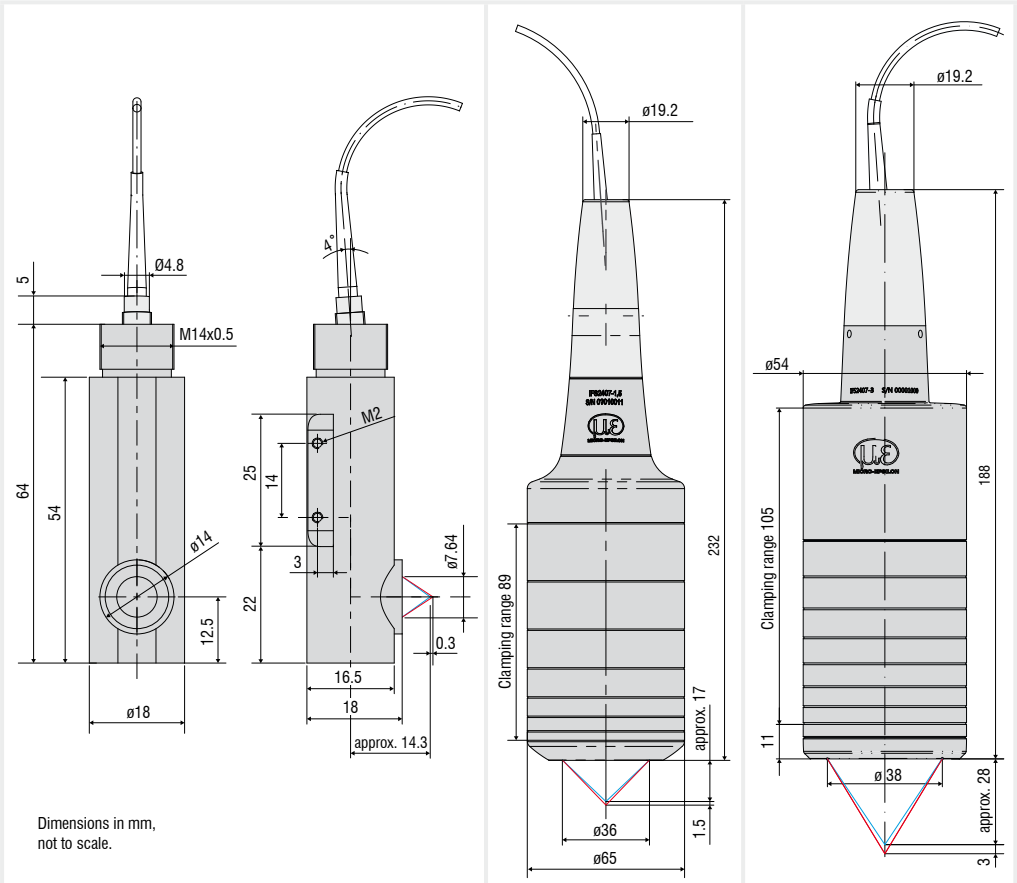



Dimensions in mm, not to scale.

| 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 |
| Target material | | reflective, diffuse as well as transparent surfaces (e.g. glass) | | |
| Connection | | pluggable optical fiber via FC socket, standard length 3 m; extension up to 50 m; bending radius: static 30 mm; dynamic 40 mm | | |
| Installation | | Clamping (mounting adapter see accessories) | | |
| Temperature range | Storage | -20 … +70 °C | | |
| | Operation | +5 … +70 °C | | |
| Shock (DIN EN 60068-2-27) | | 15g / 6 ms in XY axis, 1000 shocks each | | |
| Vibration (DIN EN 60068-2-6) | | 2g / 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, in 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 | IFS2407-1,5 | IFS2407-3 |
|---|---|---|---|---|
| Measuring range | | 0.3 mm | 1.5 mm | 3 mm |
| Start of measuring range | approx. | 5.3 mm | 17 mm | 28 mm |
| Resolution | static [1] | 6 nm | 6 nm | 13 nm |
| | dynamic [2] | 20 nm | 36 nm | 63 nm |
| Linearity [3] | Displacement and distance | < ±0.15 µm | < ±0.3 µm | < ±0.5 µm |
| | Thickness | < ±0.3 µm | < ±0.6 µm | < ±1 µm |
| Light spot diameter | | 6 µm | 5.5 µm | 9 µm |
| Max. measuring angle [4] | | ±27° | ±43° (±70°) [5] | ±30° |
| Numerical aperture (NA) | | 0.50 | 0.70 | 0.53 |
| Min. target thickness [5] | | 0.015 mm | 0.075 mm | 0.15 mm |
| Target material | | reflective, diffuse as well as transparent surfaces (e.g. glass) | | |
| Connection | | pluggable optical fiber via DIN 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 | |
| Installation | | 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) | | 15g / 6 ms in XY axis, 1000 shocks each | | |
| Vibration (DIN EN 60068-2-6) | | 2g / 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 [7] | | approx. 30 g | approx. 800 g | approx. 550 g |

[1] Average from 512 values at 1 kHz, in 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] Maximum measuring angle of the sensor up to which a usable signal can be obtained on diffusely reflecting metallic surfaces, whereby the accuracy decreases towards 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

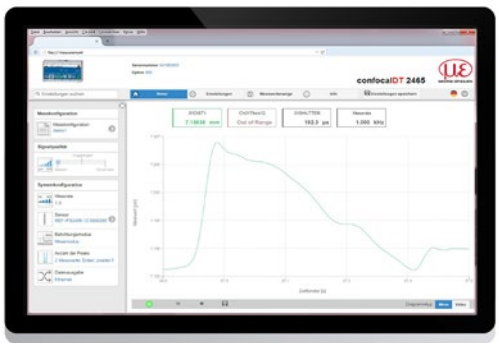
# The new confocal controller for industrial applications
# confocalDT IFC242x

- Measuring rate up to 10 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 fast and accurate compensation of varying surfaces.

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. 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.



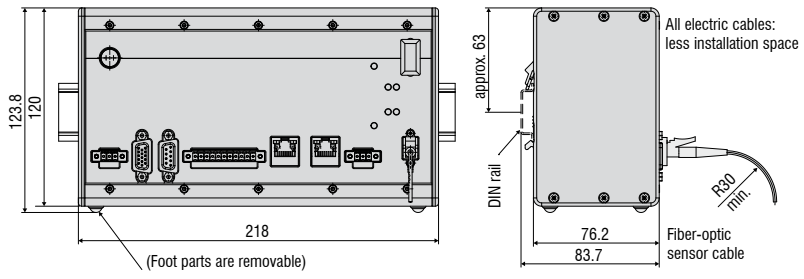
Settings are made via the web interface. For thickness measurements, materials are stored in an expandable materials database.

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

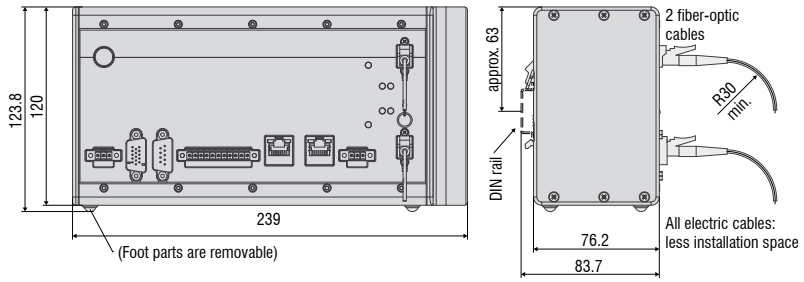
| Model | | IFC2421 | IFC2421MP | IFC2422 | IFC2422MP |
|---|---|---|---|---|---|
| Resolution | Ethernet/EtherCAT | 1 nm | | | |
| | RS422 | 18 bit | | | |
| | Analog | 16 bits (teachable) | | | |
| Measuring rate | | continuously adjustable from 100 Hz to 10 kHz [1] | | | |
| Linearity | | typ. < ±0.025 % FSO (depends on sensor) | | | |
| Multi-peak 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 [2] | | 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) or 3x encoders (A+, A-, B+, B-) | | | |
| Digital interface | | Ethernet; EtherCAT; RS422; PROFINET [3]; EtherNet/IP [3] | | | |
| 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 | | | |
| Connection | Optical | pluggable optical fiber via E2000 socket, length 2 m ... 50 m, min. bending radius 30 mm) | | | |
| | Electrical | 3-pin supply terminal strip;<br>encoder connection (15-pin, HD-sub socket, max. cable length 3 m, 30 m with external encoder supply);<br>RS422 connection socket (9-pin, Sub-D, max. cable length 30 m);<br>3-pin output terminal strip (max. cable length 30 m);<br>11-pin I/O terminal strip (max. cable length 30 m);<br>RJ45 socket for Ethernet (out) / EtherCAT (in/out) (max. cable length 100 m) | | | |
| Installation | | Free-standing, DIN rail mounting | | | |
| Temperature range | Storage | -20 … +70 °C | | | |
| | Operation | +5 ... +50 °C | | | |
| Shock (DIN EN 60068-2-27) | | 15g / 6 ms in XYZ axis, 1000 shocks each | | | |
| Vibration (DIN EN 60068-2-6) | | 2g / 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 [4] | | 1 | | 2 | |
| Control and indicator elements | | Multifunction button (two adjustable functions and reset to factory setting after 10 s);<br>5x LEDs for intensity, range, status and supply voltage | | | |

FSO = Full Scale Output
[1] Full measuring range up to 8 kHz. Sensor-dependent up to 80% FSO between 9 and 10 kHz.
[2] Illuminant: light bulb
[3] Connection via interface module (see accessories)
[4] 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. The controllers are available as a single- or dual-channel variant. 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.

Available as a standard version for distance and thickness measurements as well as a multi-peak version, the controllers are compatible with all sensor types of the IFS series. The multi-peak models are used for the thickness measurement of up to 5 transparent layers.

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.

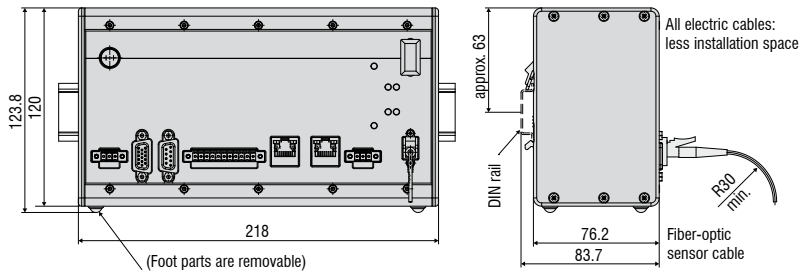
**High luminous intensity for challenging measuring objects**
A controller version with high light intensity is available for measuring low-reflecting objects. Especially with tilted or dark surfaces, the enhanced light intensity increases the proportion of reflected light and enables stable measurements.


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

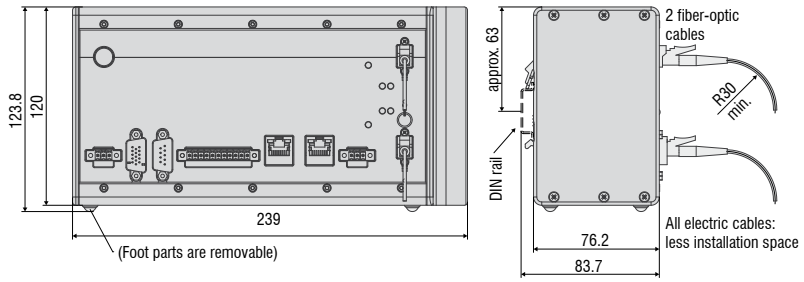
| Model | | IFC2465 | IFC2465MP | IFC2466 | IFC2466MP |
|---|---|---|---|---|---|
| Resolution | Ethernet/EtherCAT | 1 nm | | | |
| | RS422 | 18 bit | | | |
| | Analog | 16 bits (teachable) | | | |
| Measuring rate | | continuously adjustable from 100 Hz to 30 kHz | | | |
| Linearity | | typ. < ±0.025 % FSO (depends on sensor) | | | |
| Multi-peak measurement | | 1 layer | 5 layers | 1 layer | 5 layers |
| Light source | | internal white LED; high-power LED for variant with double light intensity | | | |
| 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; approx. 20 W with double light intensity option | | | |
| Signal input | | sync-in / trig-in; 2x encoders (A+, A-, B+, B-, index) or 3x encoders (A+, A-, B+, B-) | | | |
| 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 | | | |
| Connection | 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) | | | |
| Installation | | Free-standing, DIN rail mounting | | | |
| Temperature range | Storage | -20 … +70 °C | | | |
| | Operation | +5 ... +50 °C | | | |
| Shock (DIN EN 60068-2-27) | | 15g / 6 ms in XYZ axis, 1000 shocks each | | | |
| Vibration (DIN EN 60068-2-6) | | 2g / 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**

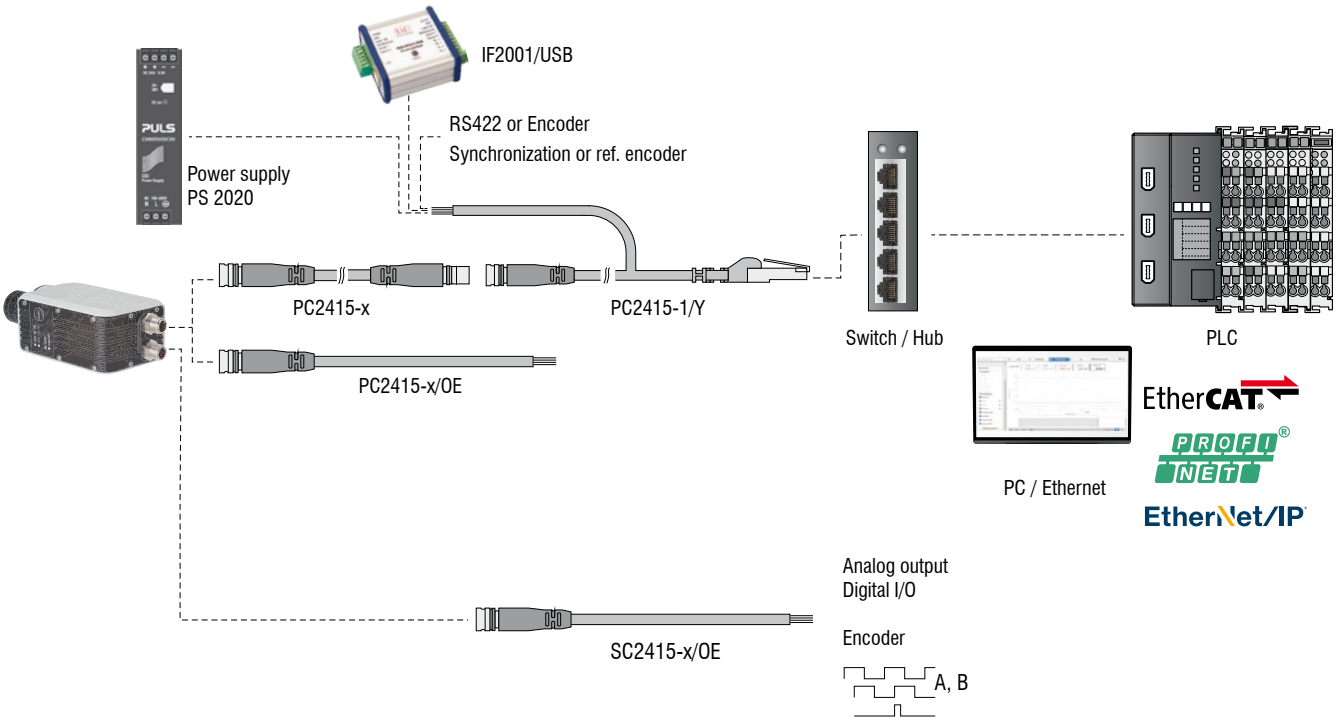


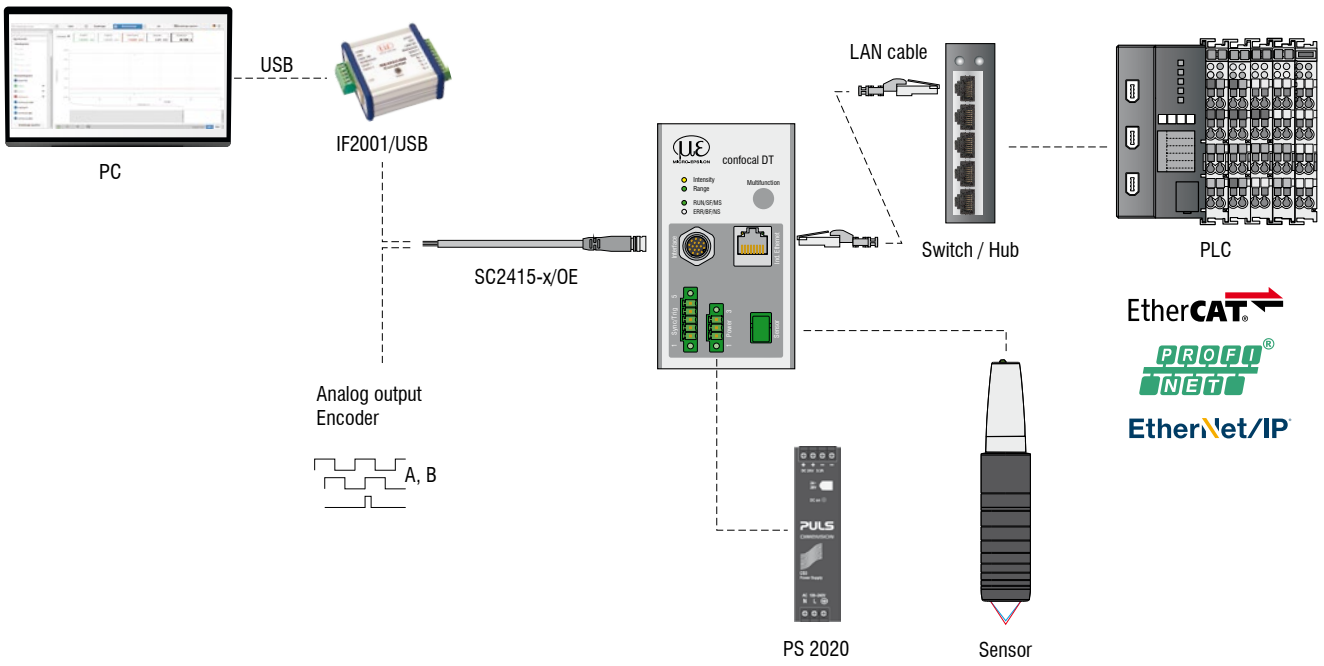

**IFC2466 Controller**



### Cable concepts for every application

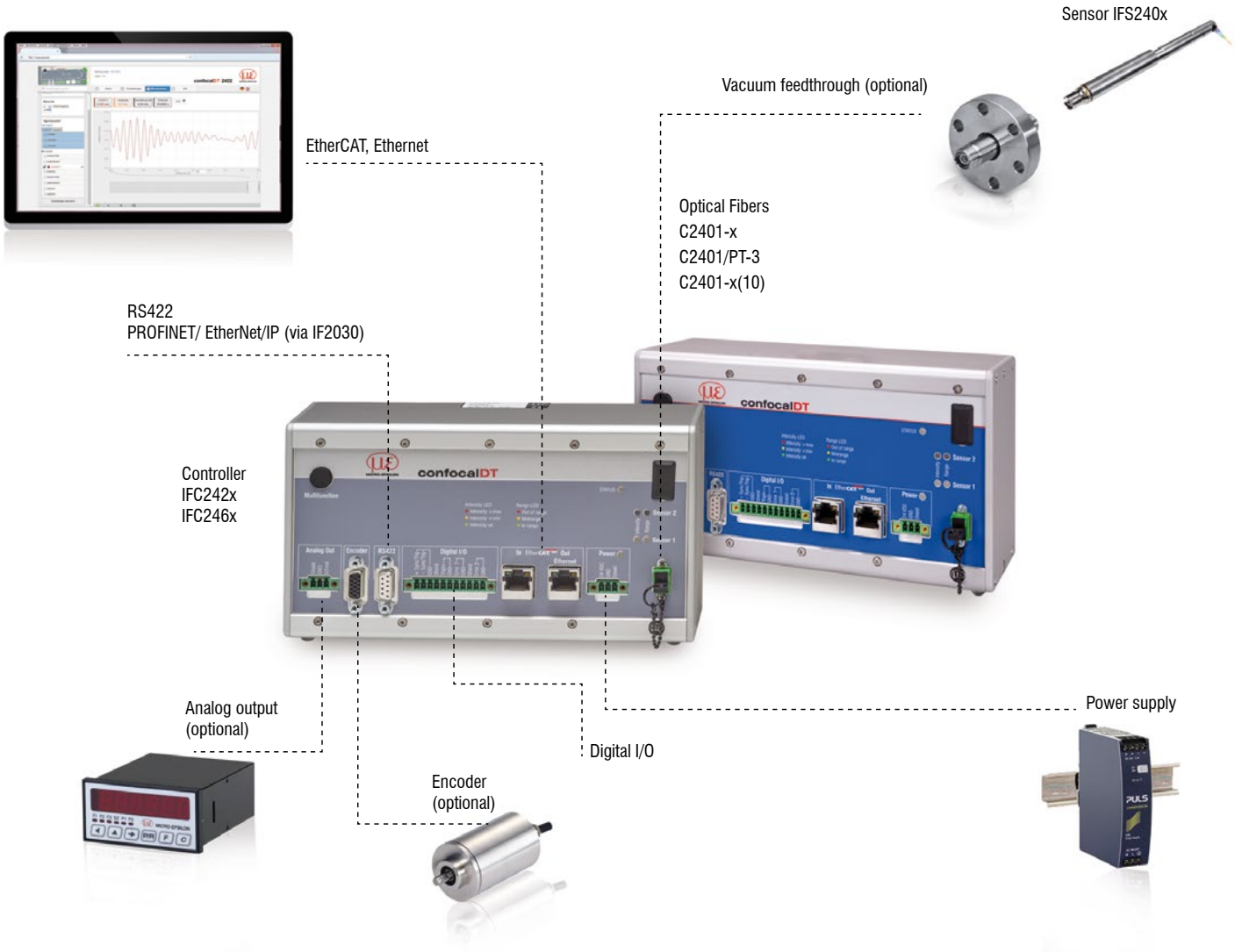
The connection options are diverse and can be adapted to your plant or machine concept.



**The confocalDT system consists of:**

- Sensor IFS240x
- Controller IFC24xx
- Fiber optic cable C24xx



# Customer-specific modifications
# confocalDT

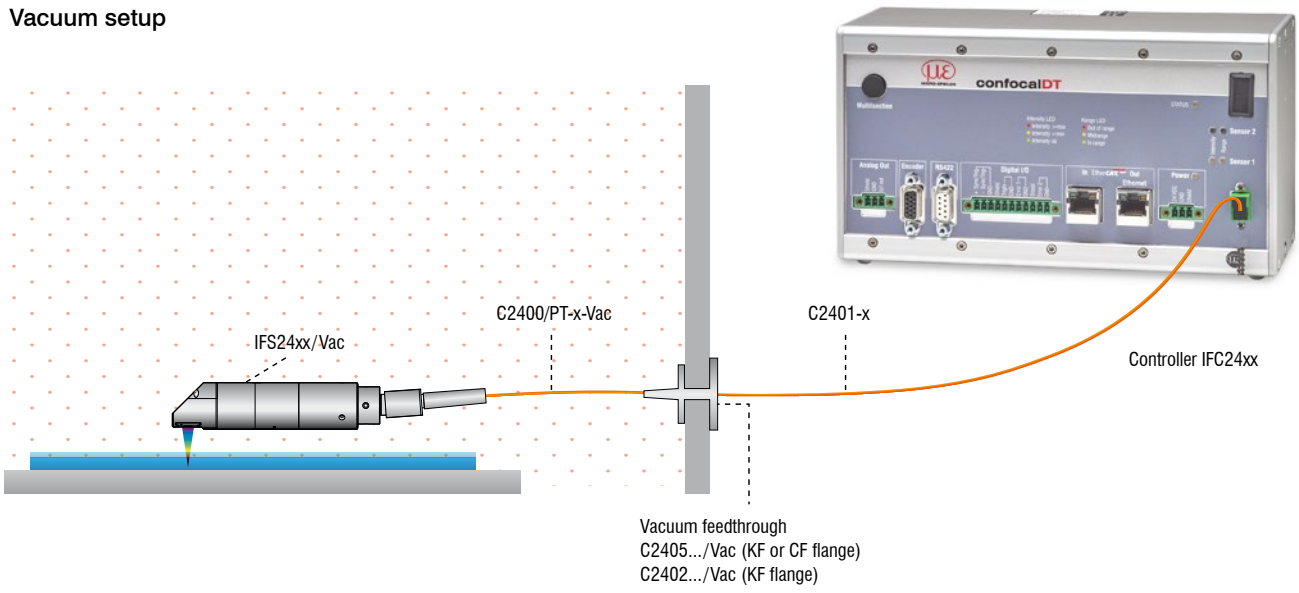
**Customer-specific modifications**

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**

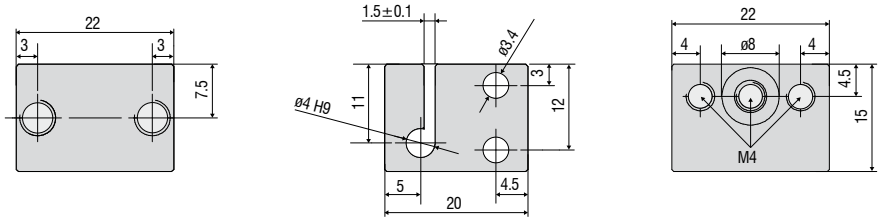
- Sensors with connector
- Cable length
- Vacuum suitability up to UHV
- Specific lengths
- Customer-specific mounting options
- Optical filter for ambient light compensation
- Housing material
- Measuring range / Offset distance

**Vacuum setup**

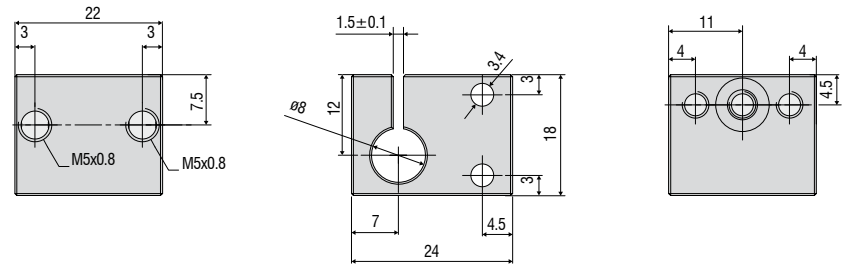


# Accessories
# Mounting adapter

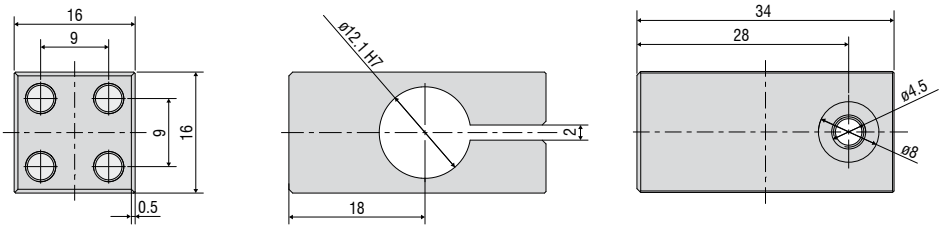
**Accessories: mounting adapter**
MA2402 for sensors 2402




**Accessories: mounting adapter**
MA2403 for sensors 2403

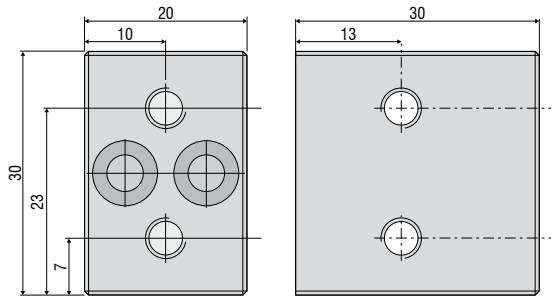



**Accessories: mounting adapter**
MA2404-12 for sensors IFS2404-2 / IFS2404/90-2 / IFS2407-0,1

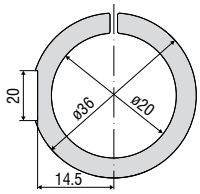



**Accessories: mounting adapter**
MA2400 for sensors IFS2405 / IFS2406 / IFS2407 (consisting of a mounting block and a mounting ring)

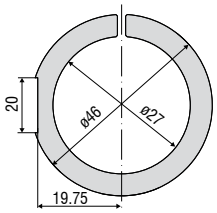
Mounting block



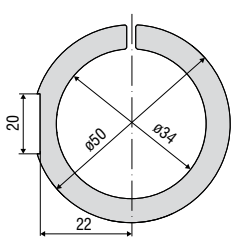

Mounting ring



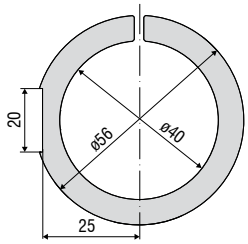

MA 2406-20 for sensors
IFS2406-2,5
IFS2406/90-2,5



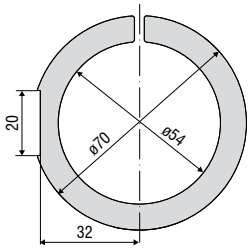

MA 2400-27 for sensors
IFS2405-0,3 / -1
IFS2406-3 / -10
IFD2411-x
IFD2410-x
IFD2415-1



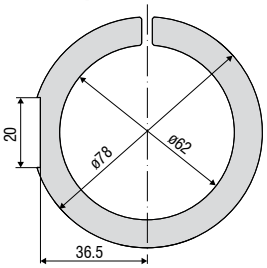

MA 2405-34 for sensors
IFS2405-3
IFD2415-3




MA 2405-40 for sensors
IFS 2405-6



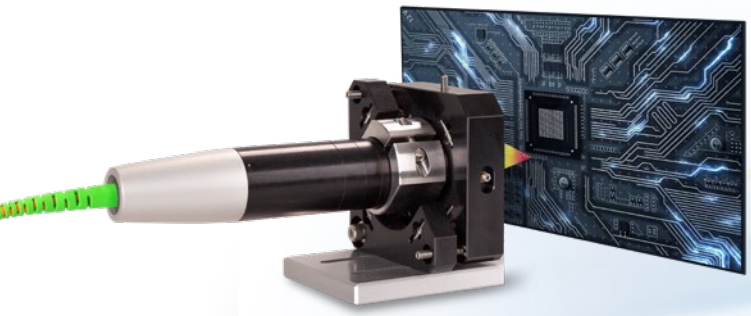

MA 2405-54 for sensors
IFS2405-10
IFS2407-3
IFD2415-10



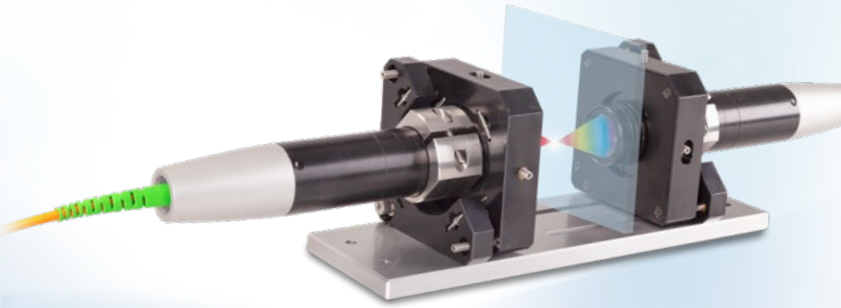

MA 2405-62 for sensors
IFS2405-28 / -30

Accessories

# Adjustable mounting adapters



JMA-xx mounting adapter for distance measurements

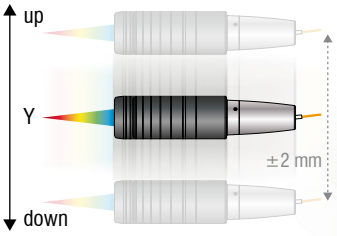


JMA-Thickness mounting adapter for two-sided thickness measurements

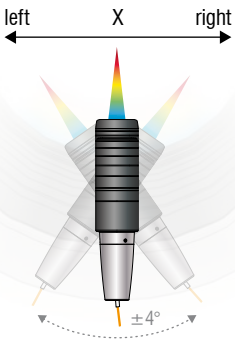
The adjustable JMA mounting adapter simplifies the alignment and fine adjustment of confocal sensors. The sensors are integrated and aligned directly in the machine together with the adapter. This corrects, e.g, minor deviations caused by mounting and compensates for tilted measuring objects. With two-sided thickness measurements, the JMA-Thickness mounting adapter supports the fine alignment of the two measuring points.

❶ Max. shift in X ±2 mm

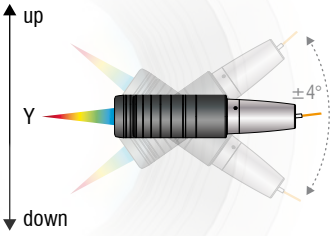

❷ Max. shift in Y ±2 mm




❸ Max. tilt angle in X ±4°

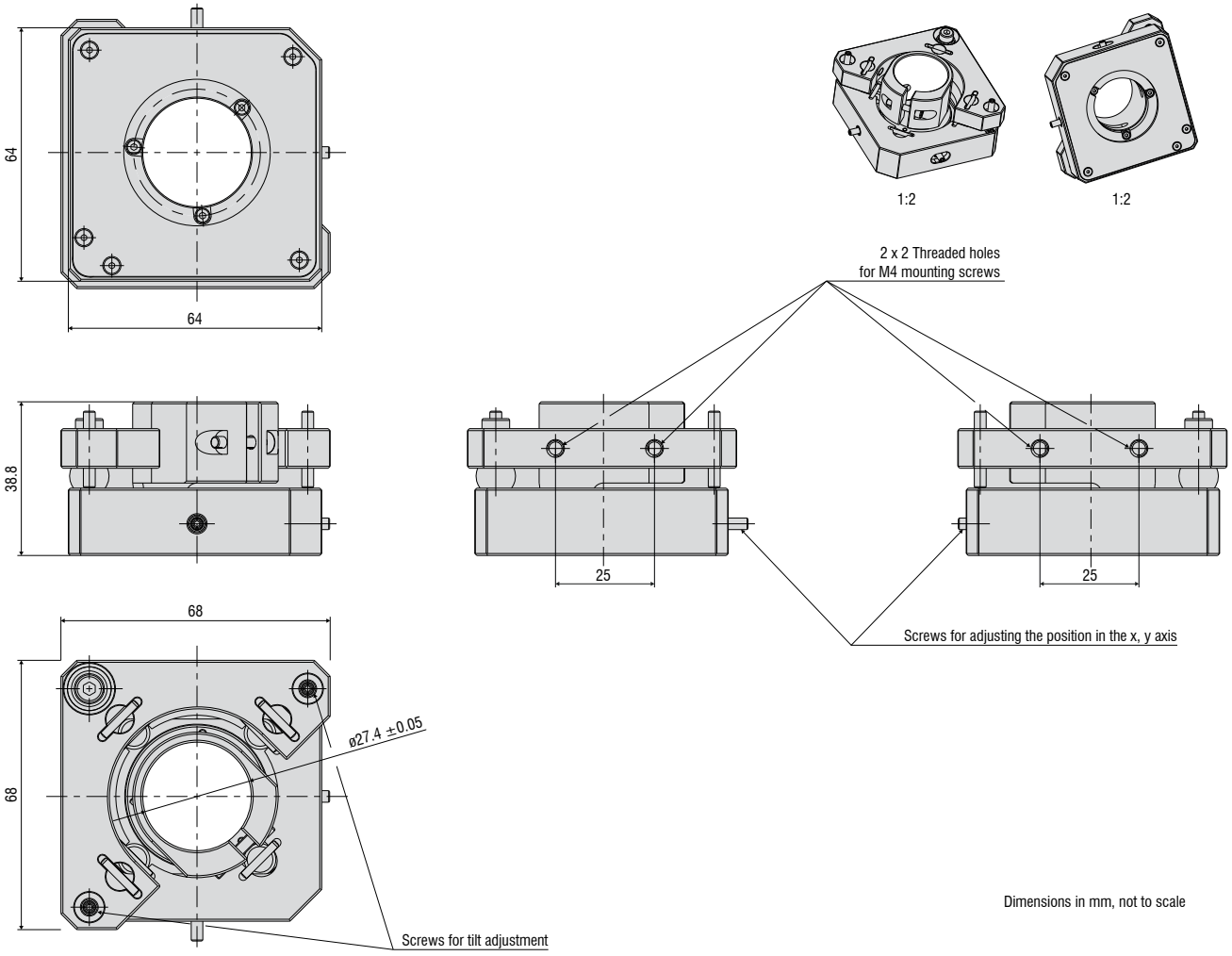



❹ Max. tilt angle in Y ±4°



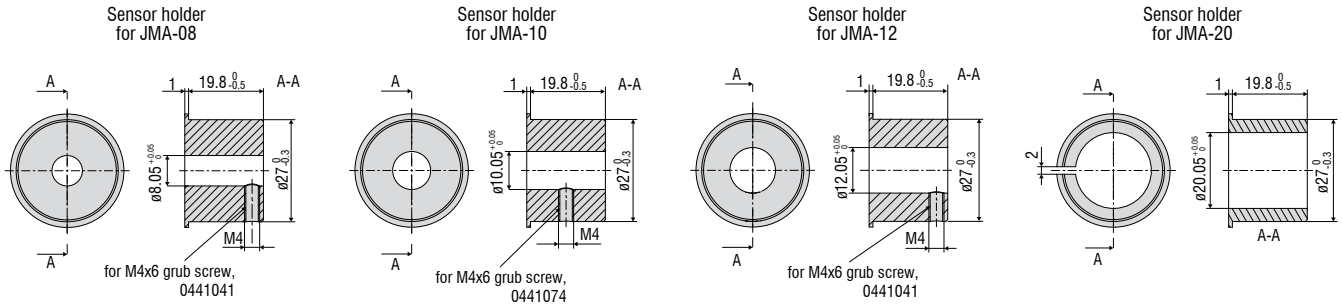
# Dimensions

### Adjustable mounting adapter JMA

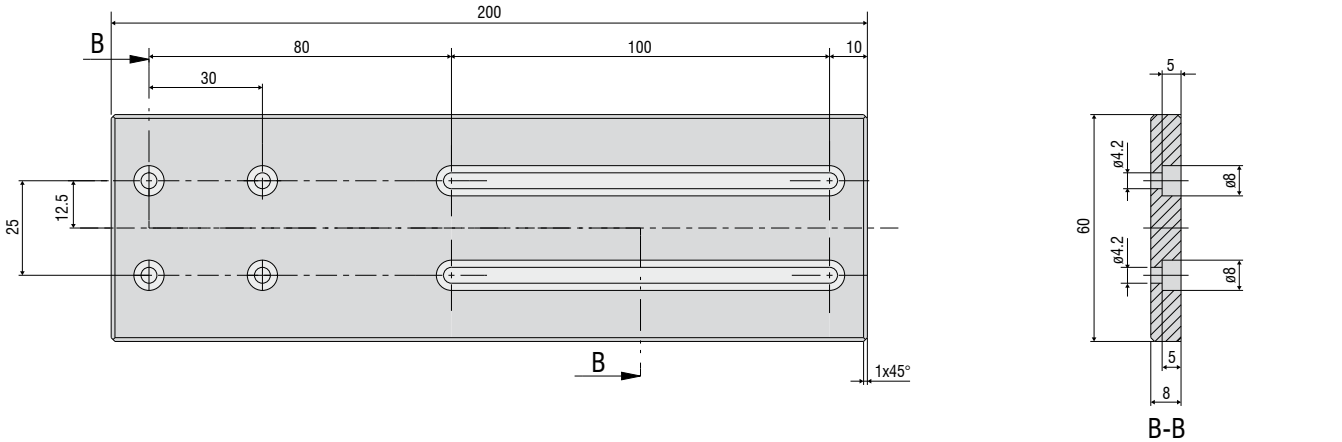



Dimensions in mm, not to scale

### Holder for smaller sensor diameters




### Mounting plate JMP for JMA-Thickness



# Accessories
# Mounting adapter for individual sensors

- Manual adjustment mechanism for easy and fast adjustment
- Optimal sensor alignment for best possible measurement results
- Ideally suitable for machine integration

Particularly for high resolution sensors with a small tilt angle, perpendicular installation is required. The JMA-xx mounting adapter enables fine alignment of the sensor to the target via the simple adjustment mechanism. This makes it easy to compensate for minor mounting deviations or tilted measuring objects.

- 1 JMA-xx
- 1 sensor holder for smaller diameters (not with JMA-27)
- 1 hexagon screwdriver for positioning
- Assembly instructions

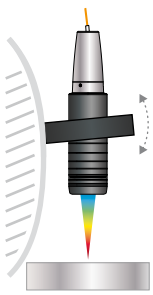
### Scope of supply

| Model | | JMA-08 | JMA-12 | JMA-20 | JMA-27 |
|---|---|---|---|---|---|
| Tilting range | X | ±4° (continuously adjustable) | | | |
| | Y | ±4° (continuously adjustable) | | | |
| Shifting range | X | ±2 mm (continuously adjustable) | | | |
| | Y | ±2 mm (continuously adjustable) | | | |
| Shock (DIN EN 60068-2-27) | | 15g / 6 ms in XYZ axis, 1000 shocks each | | | |
| Vibration (DIN EN 60068-2-6) | | 2g / 20 … 500 Hz in XYZ axis, 10 cycles each | | | |
| Adjustment mechanism | | Screw setting mechanism via M3x0.25 screw with hexagon socket 1.5 | | | |
| Installation | | 2x 2 mounting holes for M4x1 | | | |
| Sensor mounting | | Radial clamping for ø 8 mm | Radial clamping for ø 12 mm | Radial clamping for ø 20 mm | Radial clamping for ø 27 mm |
| Compatibility | | confocalDT: IFS2403 series | confocalDT: IFS2404-2 IFS2407-0,1 IFS2407-0,8 | confocalDT: IFS2406-2,5/VAC interferoMETER: IMP-TH70 | confocalDT: IFS2405-0,3 IFS2405-1 IFS2406-3 IFS2406-10 IFD2411-x |

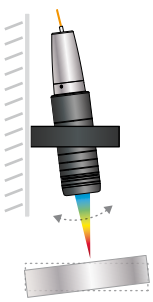
## Application examples:

### Alignment

Subsequent correction of the mounting position

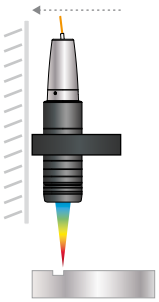


Compensates for incorrect target position



### Positioning

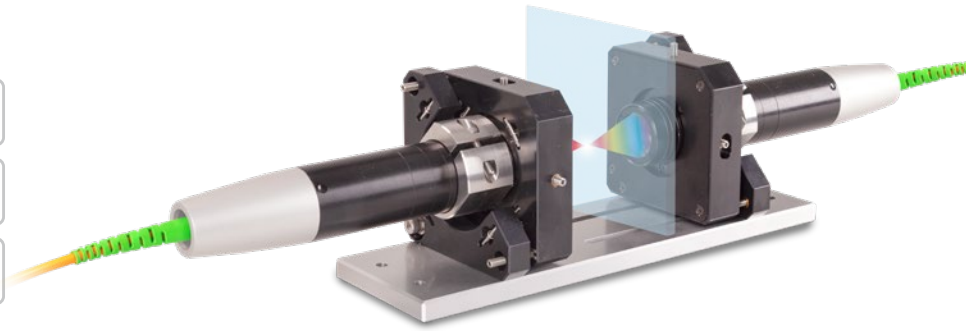
Shifting the sensor to target area



Accessories

# Mounting adapter for two-sided thickness measurements

- Optimal alignment of the optical axes enables high precision in two-sided thickness measurements
- Pre-assembled for easy installation and fast commissioning
- Ideally suitable for machine integration



For two-sided thickness measurements, the JMA-Thickness mounting adapter supports the alignment of the measuring points to one another. This means that the measuring points are arranged absolutely congruent to each other so that the sensors are positioned exactly on an optical axis. This prevents measurements at an offset and a reliable measurement result is achieved with the highest possible precision.

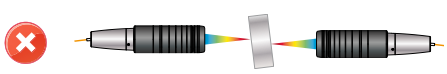
When delivered, the two mounting adapters are pre-mounted on a mounting plate and aligned with one another. This simplifies installation and the measuring system can be put into operation more quickly. After installation into the machine, the plate can be removed, if necessary.

### Scope of supply

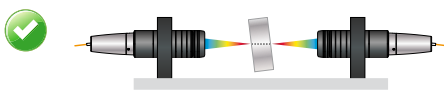
- 2 JMA-xx
- 1 JMP mounting plate
- 1 hexagon screwdriver 1.5 mm
- 1 Allen wrench 2.5 mm
- 1 Allen wrench 3.0 mm
- 1 Assembly instructions
- 2 optional reducing sleeves
  (depending on the package and the corresponding sensor)

| Model JMA-Thickness | -08 | -12 | -20 | -27 |
|---|---|---|---|---|
| Shock (DIN EN 60068-2-27) | 15g / 6 ms in XYZ axis, 1000 shocks each | | | |
| Vibration (DIN EN 60068-2-6) | 2g / 20 … 500 Hz in XYZ axis, 10 cycles each | | | |
| Adjustment mechanism | Screw setting mechanism via M3x0.25 screw with hexagon socket 1.5 | | | |
| Sensor mounting | Radial clamping for ø 8 mm | Radial clamping for ø 12 mm | Radial clamping for ø 20 mm | Radial clamping for ø 27 mm |
| Compatibility | confocalDT: IFS2403 series | confocalDT: IFS2404-2 IFS2407-0,1 | confocalDT: IFS2406-2,5/VAC interferoMETER: IMP-TH70 | confocalDT: IFS2405-0,3 IFS2405-1 IFS2406-3 IFS2406-10 IFD2411-x |

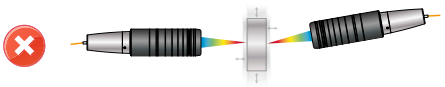
## More precision with two-sided thickness measurements



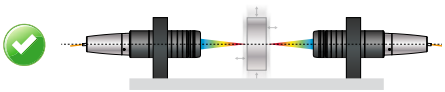
**Without JMA-Thickness:**
Measurement error with tilted target



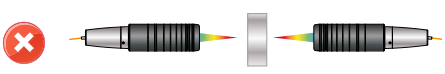
**With JMA-Thickness:**
Measures exactly at the opposite position



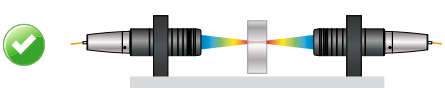
**Without JMA-Thickness:**
Incorrect thickness measurement with vibrations



**With JMA-Thickness:**
Sensors are on one optical axis –
provides stability even with vibrating objects



**Without JMA-Thickness:**
Sensors positioned incorrectly – no thickness measurement possible



**With JMA-Thickness:**
Optimal positioning support – object visible for both sensors

# Accessories
# Cables and connectors

### Software

| | |
|---|---|
| IFD24xx-Tool | Software demo tool included |

### Light source accessories

| | |
|---|---|
| IFL2422/LED | Lamp module for IFC2422 and IFC2466 |
| IFL24x1/LED | Lamp module for IFC2421 and IFC2465 |

### Optical fiber 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 | Optical fiber extension with protection tube for mechanical stress (3 m, 10 m, customer-specific length up to 50 m) |

### Optical fibers for IFS2404/IFS2404-2 and IFS2404/90-2 sensors

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

Optical fiber C2401-x

### Optical fibers for IFS2405/IFS2406/2407-0,1/ IFS2407-3/IFD2411-x 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) |

Optical fiber with coating C2401/PT3-x

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) |

Drag-chain suitable optical fiber C2401-x(10)

### Cables for IFD2410 /2415 sensors

| | |
|---|---|
| PC2415-x | Supply/interface cable, drag-chain suitable, 3 m, 6 m, 9 m, 15 m |
| PC2415-x/OE | Supply/interface cable open ends, drag-chain suitable, 3 m, 6 m, 9 m, 15 m |
| PC2415-1/Y | Supply/interface cable Y, open ends and RJ45 plug, drag-chain suitable, 1 m |
| SC2415-x/OE | Multifunction cable, open ends, drag-chain suitable, 3 m, 6 m, 9 m, 15 m |

### Cables for IFD2411 sensors

| | |
|---|---|
| SC2415-x/OE | Multifunction cable, open ends, drag-chain suitable, 3 m, 6 m, 9 m, 15 m |
| C2401-x | Optical fiber (3 m, 5 m, 10 m, customer-specific length up to 50 m) |

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

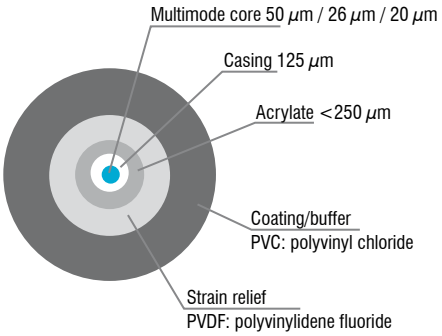
### Other accessories

| | |
|---|---|
| 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 24V / 2.5A |
| EC2471-3/OE | Encoder cable, 3m |
| IF2030/PNET | Interface module for PROFINET connection |
| IF2030/ENETIP | Interface module for EtherNet/IP connection |

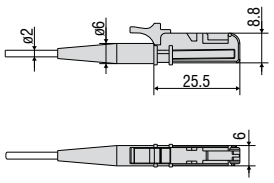
### Optical fiber

Temperature range : -50 °C to 90 °C

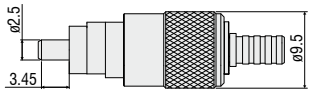
Bending radius: 30/40 mm



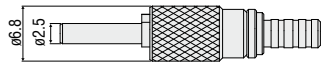

### E2000/APC standard connector




### FC/APC standard connector




### DIN connector



# Accessories
# Interface modules

| Module | IFD2410 | IFD2411 | IFD2415 | IFC242x | IFC246x |
|---|---|---|---|---|---|
| **IF2001/USB**<br>Single-channel RS422/USB converter cable | ✔ | ✔ | ✔ | ✔ | ✔ |
| **IF2004/USB**<br>RS422/USB converter to convert up to 4 digital signals to USB | ⊘ | ✔ | ⊘ | ✔ | ✔ |
| **IF2008/ETH**<br>Interface module for Ethernet connection for up to 8 sensors | ⊘ | ⊘ | ⊘ | ✔ | ✔ |
| **IF2008PCIE**<br>Interface card for multiple sensor signals; analog and digital interfaces | ⊘ | ✔ | ⊘ | ✔ | ✔ |
| **IF2035/PNET**<br>Interface module for Industrial Ethernet connection (PROFINET) | ⊘ | ⊘ | ⊘ | ✔ | ✔ |
| **IF2035/ENETIP**<br>Interface module for Industrial Ethernet connection (EtherNet/IP) | ⊘ | ⊘ | ⊘ | ✔ | ✔ |

### IF2001/USB converter RS422 to USB

The RS422/USB converter converts the digital signals of a confocal controller into a USB data packet. The sensor and the converter are connected via the RS422 interface of the converter. Data output is done via USB interface. The converter loops through further signals and functions such as laser on/off, switch signals and function output. The connected controllers and the converter can be programmed through software.

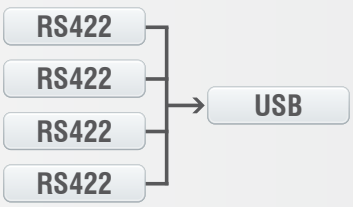


**Special features**

- Robust aluminum housing
- Easy sensor connection via screw terminals (plug and play)
- Conversion from RS422 to USB
- Supports baud rates from 9.6 kBaud to 12 MBaud

### IF2004/USB: 4-channel converter from RS422 to USB

The RS422/USB converter is used for transforming digital signals of up to four confocal controllers into USB data signals. The converter has four trigger inputs and a trigger output for connecting additional converters. Data is output via an USB interface. The connected controllers and the converter can be programmed through software. The COM interfaces can be used individually and can be switched.


**Special features**

- 4x digital signals via RS422
- 4x trigger inputs, 1x trigger output
- Synchronous data acquisition
- Data output via USB

## IF2008/ETH

### IF2008/ETH Interface module for Ethernet connection with up to 8 sensors

The IF2008/ETH integrates up to eight sensors and/or encoders with an RS422 interface into an Ethernet network. Four programmable switching in-/outputs (TTL and HTL logic) are available.

10 indicator LEDs directly on the module show both the channel and the device status. In addition, acquisition and output of data via Ethernet is in addition performed at high speeds up to 200 kHz. Parameter setting of the interface module can be easily done via the web interface.

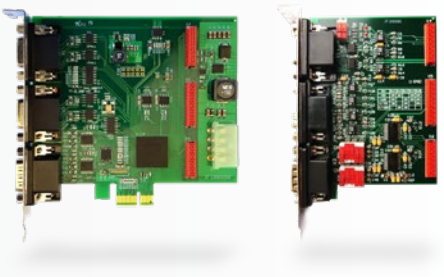

## IF2008PCIe / IF2008E

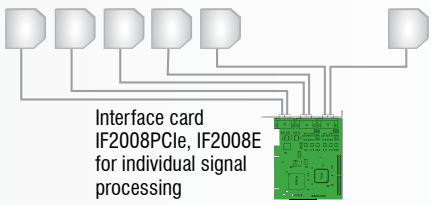
### Interface card for synchronous data acquisition

Absolute synchronous data acquisition is a decisive factor for the deflection or straightness measurement using several controllers. The IF2008PCIe interface card is designed for installation in PCs and enables the synchronous acquisition of four digital sensor signals and two encoders. The data is stored in a FIFO memory in order to enable resource-saving processing in blocks in the PC. The IF2008E expansion board enables to detect in addition two digital controller signals, two analog controller signals and eight I/O signals.

**Special features**

- IF2008PCIe - Basic printed circuit board: 4 digital signals and 2 encoders
- IF2008E - Expansion board: 2x digital signals, 2x analog signals and 8x I/O signals





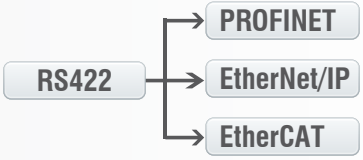

## IF2035

### Interface module for Industrial Ethernet connection

The IF2035 interface modules are designed for easy connection of Micro-Epsilon sensors to Ethernet-based fieldbuses. The IF2035 is compatible with sensors that output data via an RS422 or RS485 interface and supports the common Industrial Ethernet protocols EtherCAT, PROFINET and EtherNet/IP.

These modules operate on the sensor side with up to 4 MBd and have two network connections for different network topologies. In addition, the IF2035-EtherCAT offers a 4-fold oversampling function, which enables faster measurements than the bus cycle allows, if required. Installation in control cabinets is via a DIN rail.

EtherNet/IP
PROFINET
EtherCAT



## Sensors and Systems from Micro-Epsilon

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



MICRO-EPSILON

MICRO-EPSILON Headquarters
Koenigbacher Str. 15 · 94496 Ortenburg / Germany
Tel. +49 (0) 8542 / 168-0 · Fax +49 (0) 8542 / 168-90
info@micro-epsilon.com · **www.micro-epsilon.com**