More Precision

confocalDT // Confocal chromatic measuring system
Highest precision in confocal chromatic displacement and thickness measurements

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

<table>
<thead>
<tr>
<th>Sensor type</th>
<th>Measuring range</th>
<th>Measurement direction</th>
<th>Measurement mode</th>
<th>Page</th>
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</thead>
<tbody>
<tr>
<td>confocalDT IFS2402</td>
<td>0.4 mm ... 3.5 mm</td>
<td>Distance measurement</td>
<td>Distance measurement</td>
<td>8 - 9</td>
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<tr>
<td>confocalDT IFS2403</td>
<td>0.4 mm ... 10 mm</td>
<td>Distance measurement</td>
<td>Thickness measurement</td>
<td>10 - 11</td>
</tr>
<tr>
<td>confocalDT IFS2404</td>
<td>2 mm</td>
<td>Distance measurement</td>
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<td>12</td>
</tr>
<tr>
<td>confocalDT IFS2405</td>
<td>0.3 mm ... 30 mm</td>
<td>Distance measurement</td>
<td>Thickness measurement</td>
<td>13 - 15</td>
</tr>
<tr>
<td>confocalDT IFS2406</td>
<td>2.5 mm ... 10 mm</td>
<td>Distance measurement</td>
<td>Thickness measurement</td>
<td>16 - 17</td>
</tr>
<tr>
<td>confocalDT IFS2407</td>
<td>0.1 mm ... 3 mm</td>
<td>Distance measurement</td>
<td>Thickness measurement</td>
<td>18 - 19</td>
</tr>
</tbody>
</table>

Each sensor can be operated with every confocalDT controller.

<table>
<thead>
<tr>
<th>Controller type</th>
<th>Measurement channels</th>
<th>Measuring rate</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>confocalDT IFC242x</td>
<td>1 or 2</td>
<td>up to 6.5 kHz</td>
<td>20 - 21</td>
</tr>
<tr>
<td>confocalDT IFC2461</td>
<td>1</td>
<td>up to 25 kHz</td>
<td>22 - 23</td>
</tr>
<tr>
<td>confocalDT IFC2471 HS</td>
<td>1</td>
<td>up to 70 kHz</td>
<td>24 - 25</td>
</tr>
</tbody>
</table>
The confocal chromatic measuring principle
Polychromatic white light is focused onto the target surface by a multilens optical system. The lenses are arranged so that the white light is dispersed into monochromatic wavelengths by controlled chromatic aberration. To each wavelength, a specific distance is assigned by factory calibration. Only the wavelength which is exactly focused on the target is used for the measurement. An optical arrangement images the light reflected onto a light sensitive sensor element, on which the corresponding spectral color is detected and evaluated. In the case of multi-peak measurements, several distance points are evaluated accordingly.

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

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

Ready for vacuum
The confocalDT sensors consist of passive components and do not give off heat. Particularly for use in vacuum applications, Micro-Epsilon offers sensors, cables and accessories which can be used according to their respective specification.
Thickness calibration for precise thickness measurements regardless of distance

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

Ultra-small sensors for restricted installation spaces

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

The world’s smallest light spot for high lateral resolution

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

Thickness measurement of transparent materials in the micron range

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

**IFS2406**

**Applications**

**confocalDT**

**Restricted installation space**

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

**Thickness measurement of displays and flat glass**

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

**Coordinate measuring machines**

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

**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:**

**IFS2405**

**IFS2402**

**IFS2405 / IFS2407**
Measurement in recesses
Their narrow beam path enables the confocal sensors to measure in recesses. With the confocal measuring principle, also measurements on liquids are possible, e.g., for precise filling level control in trays.

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

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

Thickness measurement on the star wheel
Fast dual-channel thickness measurement of glass bottles in the industrial production process.

Recommended sensors:
IFS2403 / IFS2404

Recommended sensors:
IFS2405

Recommended sensors:
IFS2406
### Confocal chromatic miniature sensors

**confocalDT IFS2402**

- **Miniature sensors ø4mm with axial or radial (90°) measuring direction**
- **Submicrometer resolution**
- **Distance measurement**
- **Extremely small spot size**

**Dimensions in mm, not to scale**

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**Distance measurement**

- **Miniature sensors ø4mm with axial or radial (90°) measuring direction**
- **Extremely small spot size**
- **Submicrometer resolution**

---

<table>
<thead>
<tr>
<th>Model</th>
<th>IFS2402-0.4</th>
<th>IFS2402-1.5</th>
<th>IFS2402-4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring range</td>
<td>0.4 mm</td>
<td>1.5 mm</td>
<td>3.5 mm</td>
</tr>
<tr>
<td>Start of measuring range</td>
<td>approx. 1.5 mm</td>
<td>0.9 mm</td>
<td>1.9 mm</td>
</tr>
<tr>
<td>Resolution</td>
<td>static 1) 16 nm</td>
<td>60 nm</td>
<td>100 nm</td>
</tr>
<tr>
<td>Linearity 3) Displacement and distance</td>
<td>&lt; ±0.3 μm</td>
<td>&lt; ±1.2 μm</td>
<td>&lt; ±3 μm</td>
</tr>
<tr>
<td>Light spot diameter</td>
<td>10 μm</td>
<td>20 μm</td>
<td>20 μm</td>
</tr>
<tr>
<td>Max. tilt angle 4)</td>
<td>±8°</td>
<td>±5°</td>
<td>±3°</td>
</tr>
<tr>
<td>Numerical aperture (NA)</td>
<td>0.25</td>
<td>0.20</td>
<td>0.10</td>
</tr>
<tr>
<td>Connection</td>
<td>integrated optical fiber 2 m with E2000/APC connector; extension up to 50 m; bending radius: static 30 mm; dynamic 40 mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Installation</td>
<td>Clamping, mounting adapter (see accessories)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature range</td>
<td>Storage: -20… +70 °C</td>
<td>Operation: +5… +70 °C</td>
<td></td>
</tr>
<tr>
<td>Shock (DIN EN 60068-2-27)</td>
<td>15 g / 6 ms in XY axis, 1000 shocks each</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vibration (DIN EN 60068-2-6)</td>
<td>2 g / 20 … 500 Hz in XY axis, 10 cycles each</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Protection class (DIN EN 60529)</td>
<td>IP64, front operated</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Material</td>
<td>Stainless steel housing, glass lenses</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>approx. 186 g (incl. optical fiber)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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1) Average from 512 values at 1 kHz, near to the midrange 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 sensor tilt angle that produces a usable signal on reflecting surfaces. The accuracy decreases when approaching the limit values.
<table>
<thead>
<tr>
<th>Model</th>
<th>IFS2402/90-1,5</th>
<th>IFS2402/90-4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring range</td>
<td>1.5 mm</td>
<td>2.5 mm</td>
</tr>
<tr>
<td>Start of measuring range</td>
<td>approx. 2.5 mm (^1)</td>
<td>2.5 mm (^1)</td>
</tr>
<tr>
<td>Resolution</td>
<td>static 60 nm</td>
<td>100 nm</td>
</tr>
<tr>
<td></td>
<td>dynamic 192 nm</td>
<td>480 nm</td>
</tr>
<tr>
<td>Linearity (^4) Displacement and distance</td>
<td>(&lt; \pm 1.2 \mu m)</td>
<td>(&lt; \pm 3 \mu m)</td>
</tr>
<tr>
<td>Light spot diameter</td>
<td>20 (\mu m)</td>
<td>20 (\mu m)</td>
</tr>
<tr>
<td>Max. tilt angle (^5)</td>
<td>(\pm 5^\circ)</td>
<td>(\pm 3^\circ)</td>
</tr>
<tr>
<td>Numerical aperture</td>
<td>0.20</td>
<td>0.10</td>
</tr>
<tr>
<td>Connection</td>
<td>integrated optical fiber 2 m with E2000/APC connector; extension up to 50 m; bending radius: static 30 mm, dynamic 40 mm</td>
<td></td>
</tr>
<tr>
<td>Installation</td>
<td>Clamping, mounting adapter (see accessories)</td>
<td></td>
</tr>
<tr>
<td>Temperature range</td>
<td>Storage</td>
<td>Operation</td>
</tr>
<tr>
<td></td>
<td>-20 … +70 °C</td>
<td>+5 … +70 °C</td>
</tr>
<tr>
<td>Shock (DIN EN 60068-2-27)</td>
<td>15 g / 6 ms in XY axis, 1000 shocks each</td>
<td></td>
</tr>
<tr>
<td>Vibration (DIN EN 60068-2-6)</td>
<td>2 g / 20 … 500 Hz in XY axis, 10 cycles each</td>
<td></td>
</tr>
<tr>
<td>Protection class (DIN EN 60529)</td>
<td>IP40</td>
<td></td>
</tr>
<tr>
<td>Material</td>
<td>Stainless steel housing, glass lenses</td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>approx. 186 g (incl. optical fiber)</td>
<td></td>
</tr>
</tbody>
</table>

\(^1\) Start of measuring range measured from sensor axis.

\(^2\) Average from 512 values at 1 kHz, near to the midrange 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 sensor tilt angle that produces a usable signal on reflecting surfaces. The accuracy decreases when approaching the limit values.
### Confocal chromatic hybrid sensors

**confocalDT IFS2403**

- **Hybrid sensors ø8mm with axial or radial (90°) measuring direction**
- **Submicrometer resolution**
- **One-sided thickness measurement**
- **Distance measurement**
- **Extremely small spot size**

<table>
<thead>
<tr>
<th>Model</th>
<th>IFS2403-0.4</th>
<th>IFS2403-1.5</th>
<th>IFS2403-4</th>
<th>IFS2403-10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring range</td>
<td>0.4 mm</td>
<td>1.5 mm</td>
<td>4 mm</td>
<td>10 mm</td>
</tr>
<tr>
<td>Start of measuring range</td>
<td>approx. 2.5 mm</td>
<td>8 mm</td>
<td>14.7 mm</td>
<td>11 mm</td>
</tr>
<tr>
<td>Resolution static</td>
<td>16 nm</td>
<td>60 nm</td>
<td>100 nm</td>
<td>250 nm</td>
</tr>
<tr>
<td>Resolution dynamic</td>
<td>47 nm</td>
<td>186 nm</td>
<td>460 nm</td>
<td>1250 nm</td>
</tr>
<tr>
<td>Linearity</td>
<td>&lt; ±0.3 µm</td>
<td>&lt; ±1.2 µm</td>
<td>&lt; ±3 µm</td>
<td>&lt; ±20 µm</td>
</tr>
<tr>
<td>Light spot diameter</td>
<td>9 µm</td>
<td>15 µm</td>
<td>28 µm</td>
<td>56 µm</td>
</tr>
<tr>
<td>Max. tilt angle</td>
<td>±20°</td>
<td>±16°</td>
<td>±6°</td>
<td>±6°</td>
</tr>
<tr>
<td>Numerical aperture (NA)</td>
<td>0.50</td>
<td>0.30</td>
<td>0.15</td>
<td>0.15</td>
</tr>
<tr>
<td>Min. target thickness</td>
<td>0.06 mm</td>
<td>0.23 mm</td>
<td>0.6 mm</td>
<td>1.5 mm</td>
</tr>
</tbody>
</table>

**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)**
- 15 g / 6 ms in XY axis, 1000 shocks each

**Vibration (DIN EN 60068-2-6)**
- 2 g / 20 ... 500 Hz in XY axis, 10 cycles each

**Protection class (DIN EN 60529)**
- IP64 (front)

**Material**
- Stainless steel housing, glass lenses

**Weight**
- approx. 200 g (incl. optical fiber)

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1) Average from 512 values at 1 kHz, near to the midrange 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 sensor tilt angle 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
<table>
<thead>
<tr>
<th>Model</th>
<th>IFS2403/90-1.5</th>
<th>IFS2403/90-4</th>
<th>IFS2403/90-10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring range</td>
<td>1.5 mm</td>
<td>4 mm</td>
<td>10 mm</td>
</tr>
<tr>
<td>Start of measuring range</td>
<td>approx. 4.9 mm</td>
<td>12 mm</td>
<td>8.6 mm</td>
</tr>
<tr>
<td>Resolution static</td>
<td>60 nm</td>
<td>100 nm</td>
<td>250 nm</td>
</tr>
<tr>
<td>Dynamic</td>
<td>186 nm</td>
<td>460 nm</td>
<td>1250 nm</td>
</tr>
<tr>
<td>Linearity Displacement and distance</td>
<td>&lt; ±1.2 µm</td>
<td>&lt; ±3 µm</td>
<td>&lt; ±20 µm</td>
</tr>
<tr>
<td>Thickness</td>
<td>&lt; ±2.4 µm</td>
<td>&lt; ±6 µm</td>
<td>&lt; ±40 µm</td>
</tr>
<tr>
<td>Light spot diameter</td>
<td>15 µm</td>
<td>28 µm</td>
<td>56 µm</td>
</tr>
<tr>
<td>Max. tilt angle</td>
<td>±16°</td>
<td>±6°</td>
<td>±6°</td>
</tr>
<tr>
<td>Numerical aperture (NA)</td>
<td>0.30</td>
<td>0.15</td>
<td>0.15</td>
</tr>
<tr>
<td>Min. target thickness</td>
<td>0.23 mm</td>
<td>0.6 mm</td>
<td>1.5 mm</td>
</tr>
<tr>
<td>Connection</td>
<td>integrated optical fiber 2 m with E2000/APC connector; extension up to 50 m; bending radius: static 30 mm, dynamic 40 mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Installation</td>
<td>Clamping, mounting adapter (see accessories)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature range</td>
<td>Storage -20 ... +70 °C</td>
<td>Operation +5 ... +70 °C</td>
<td></td>
</tr>
<tr>
<td>Shock (DIN EN 60068-2-27)</td>
<td>15 g / 6 ms in XY axis, 1000 shocks each</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vibration (DIN EN 60068-2-6)</td>
<td>2 g / 20 ... 500 Hz in XY axis, 10 cycles each</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Protection class (DIN EN 60529)</td>
<td>IP64 (front)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Material</td>
<td>Stainless steel housing, glass lenses</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>approx. 200 g (incl. optical fiber)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1) Start of measuring range measured from sensor axis.
2) Average from 512 values at 1 kHz, near to the midrange 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 sensor tilt angle 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 sensor design ø12 mm**
- **Submicrometer resolution**
- **One-sided thickness measurement**
- **Distance measurement**
- **Extremely small spot size**

Dimensions in mm, not to scale

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**Model**

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

---

1) Start of measuring range measured from sensor axis.
2) Average from 512 values at 1 kHz, near to the midrange 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 sensor tilt angle 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.
Confocal sensors with high precision

ConfocalDT IFS2405

Dimensions in mm, not to scale

Robust sensors for various applications
One-sided thickness measurement
Distance measurement
Extremely small spot size
Submicrometer resolution
Large tilt angle

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 | 4 nm | 28 nm | 60 nm
| dynamic | 20 nm | 52 nm | 126 nm
Linearity | Displacement and distance | < ±0.15 μm | < ±0.25 μm | < ±0.75 μm
| Thickness | < ±0.3 μm | < ±0.5 μm | < ±1.5 μm
Light spot diameter | 6 μm | 8 μm | 9 μm
Max. tilt angle | ±34° | ±30° | ±24°
Numerical aperture (NA) | 0.60 | 0.55 | 0.45
Min. target thickness | 0.015 mm | 0.05 mm | 0.15 mm
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) | 15 g / 6 ms in XY axis, 1000 shocks each
Vibration (DIN EN 60068-2-6) | 2 g / 20 ... 500 Hz in XY axis, 10 cycles each
Protection class (DIN EN 60529) | IP64 (front)
Material | Aluminum housing, glass lenses
Weight | approx. 140 g | approx. 125 g | approx. 225 g

---

1) Average from 512 values at 1 kHz, near to the midrange 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 sensor tilt angle that produces a usable signal on reflecting surfaces. The accuracy decreases when approaching the limit values.
5) Glass with refractive index n = 1.5 throughout the entire measuring range. In the mid of the measuring range, also thinner layers can be measured.
Confocal sensors with high precision

<table>
<thead>
<tr>
<th>Feature</th>
<th>confocalDT IFS2405</th>
</tr>
</thead>
<tbody>
<tr>
<td>One-sided thickness measurement</td>
<td></td>
</tr>
<tr>
<td>Distance measurement</td>
<td></td>
</tr>
<tr>
<td>Extremely small spot size</td>
<td></td>
</tr>
<tr>
<td>Submicrometer resolution</td>
<td></td>
</tr>
<tr>
<td>Large tilt angle</td>
<td></td>
</tr>
</tbody>
</table>

**Model IFS2405-6**

- **Measuring range**: 6 mm
- **Start of measuring range**: 63 mm
- **Resolution**
  - static: 18 nm
  - dynamic: 93 nm
- **Displacement and distance**
  - Displacement: < ±1.5 µm
  - Distance: < ±3 µm
- **Light spot diameter**: 31 µm
- **Max. tilt angle**: ±10°
- **Numerical aperture (NA)**: 0.22
- **Min. target thickness**: 0.3 mm
- **Connection**: pluggable optical fiber via FC socket, standard length 3 m; extension up to 50 m; bending radius: static 30 mm; dynamic 40 mm
- **Temperature range**
  - Storage: -20 ... +70 °C
  - Operation: +5 ... +70 °C
- **Shock (DIN EN 60068-2-27)**
  - 15 g / 6 ms in XY axis, 1000 shocks each
- **Vibration (DIN EN 60068-2-6)**
  - 2 g / 20 ... 500 Hz in XY axis, 10 cycles each
- **Protection class (DIN EN 60529)**
  - IP64 (front)
- **Material**: Aluminum housing, glass lenses
- **Weight**: approx. 217 g

**Model IFS2405-10**

- **Measuring range**: 10 mm
- **Start of measuring range**: 50 mm
- **Resolution**
  - static: 60 nm
  - dynamic: 386 nm
- **Displacement and distance**
  - Displacement: < ±2.5 µm
  - Distance: < ±5 µm
- **Light spot diameter**: 16 µm
- **Max. tilt angle**: ±17°
- **Numerical aperture (NA)**: 0.30
- **Min. target thickness**: 0.5 mm
- **Connection**: pluggable optical fiber via FC socket, standard length 3 m; extension up to 50 m; bending radius: static 30 mm; dynamic 40 mm
- **Temperature range**
  - Storage: -20 ... +70 °C
  - Operation: +5 ... +70 °C
- **Shock (DIN EN 60068-2-27)**
  - 15 g / 6 ms in XY axis, 1000 shocks each
- **Vibration (DIN EN 60068-2-6)**
  - 2 g / 20 ... 500 Hz in XY axis, 10 cycles each
- **Protection class (DIN EN 60529)**
  - IP64 (front)
- **Material**: Aluminum housing, glass lenses
- **Weight**: approx. 500 g

---

1. Average from 512 values at 1 kHz, near to the midrange 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 sensor tilt angle that produces a usable signal on reflecting surfaces. The accuracy decreases when approaching the limit values.
5. Glass with refractive index n = 1.5 throughout the entire measuring range. In the mid of the measuring range, also thinner layers can be measured.
## Specifications

### Model IFS2405-28 IFS2405-30

<table>
<thead>
<tr>
<th>Parameter</th>
<th>IFS2405-28</th>
<th>IFS2405-30</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring range</td>
<td>28 mm</td>
<td>30 mm</td>
</tr>
<tr>
<td>Start of measuring range</td>
<td>approx. 220 mm</td>
<td>100 mm</td>
</tr>
<tr>
<td>Resolution</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Static (1)</td>
<td>250 nm</td>
<td>300 nm</td>
</tr>
<tr>
<td>Dynamic (2)</td>
<td>1420 nm</td>
<td>1040 nm</td>
</tr>
<tr>
<td>Linearity (3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Displacement and distance</td>
<td>&lt; ±7 µm</td>
<td>&lt; ±7.5 µm</td>
</tr>
<tr>
<td>Thickness</td>
<td>&lt; ±14 µm</td>
<td>&lt; ±15 µm</td>
</tr>
<tr>
<td>Light spot diameter</td>
<td>60 µm</td>
<td>50 µm</td>
</tr>
<tr>
<td>Max. tilt angle (4)</td>
<td>±5°</td>
<td>±9°</td>
</tr>
<tr>
<td>Numerical aperture (NA)</td>
<td>0.10</td>
<td>0.20</td>
</tr>
<tr>
<td>Min. target thickness (5)</td>
<td>2.2 mm</td>
<td>1.5 mm</td>
</tr>
<tr>
<td>Connection</td>
<td>pluggable optical fiber via FC socket, standard length 3 m; extension up to 50 m; bending radius: static 30 mm; dynamic 40 mm</td>
<td></td>
</tr>
<tr>
<td>Installation</td>
<td>Clamping, mounting adapter (see accessories)</td>
<td></td>
</tr>
<tr>
<td>Temperature range</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Storage</td>
<td>-20 ... +70 °C</td>
<td></td>
</tr>
<tr>
<td>Operation</td>
<td>+5 ... +70 °C</td>
<td></td>
</tr>
<tr>
<td>Shock (DIN EN 60068-2-27)</td>
<td>15 g / 6 ms in XY axis, 1000 shocks each</td>
<td></td>
</tr>
<tr>
<td>Vibration (DIN EN 60068-2-6)</td>
<td>2 g / 20 ... 500 Hz in XY axis, 10 cycles each</td>
<td></td>
</tr>
<tr>
<td>Protection class (DIN EN 60529)</td>
<td>IP64 (front)</td>
<td></td>
</tr>
<tr>
<td>Material</td>
<td>Aluminum housing, glass lenses</td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>approx. 750 g</td>
<td>approx. 730 g</td>
</tr>
</tbody>
</table>

1. Average from 512 values at 1 kHz, near to the midrange 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 sensor tilt angle that produces a usable signal on reflecting surfaces. The accuracy decreases when approaching the limit values.
5. Glass with refractive index n = 1.5 throughout the entire measuring range. In the mid of the measuring range, also thinner layers can be measured.
**Confocal chromatic sensors for displacement and thickness**

Confocal DT IFS2406

---

### Models

<table>
<thead>
<tr>
<th>Model</th>
<th>IFS2406-2.5/VAC(003)</th>
<th>IFS2406/90-2.5/VAC(001)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring range</td>
<td>2.5 mm</td>
<td>2.5 mm</td>
</tr>
<tr>
<td>Start of measuring range</td>
<td>approx. 17.2 mm</td>
<td>12.6 mm ¹</td>
</tr>
<tr>
<td>Resolution</td>
<td>static ²</td>
<td>24 nm</td>
</tr>
<tr>
<td></td>
<td>dynamic ³</td>
<td>106 nm</td>
</tr>
<tr>
<td>Linearity ⁴</td>
<td>Displacement and distance</td>
<td>&lt; ±0.75 µm</td>
</tr>
<tr>
<td></td>
<td>Thickness</td>
<td>&lt; ± 1.5 µm</td>
</tr>
<tr>
<td>Light spot diameter</td>
<td>10 µm</td>
<td>10 µm</td>
</tr>
<tr>
<td>Max. tilt angle ⁵</td>
<td>± 16°</td>
<td>± 16°</td>
</tr>
<tr>
<td>Numerical aperture (NA)</td>
<td>0.30</td>
<td>0.30</td>
</tr>
<tr>
<td>Min. target thickness ⁶</td>
<td>0.125 mm</td>
<td>0.125 mm</td>
</tr>
</tbody>
</table>

### 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

<table>
<thead>
<tr>
<th>Storage</th>
<th>Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>-20 … +70 °C</td>
<td>+5 … +70 °C</td>
</tr>
</tbody>
</table>

### Shock (DIN EN 60068-2-27)

15 g / 6 ms in XY axis, 1000 shocks each

### Vibration (DIN EN 60068-2-6)

2 g / 20 … 500 Hz in XY axis, 10 cycles each

### Protection class (DIN EN 60529)

IP40 (vacuum compatible)

### Material

Stainless steel housing, glass lenses

### Weight

approx. 105 g | approx. 130 g

---

¹ Start of measuring range measured from sensor axis.

² Average from 512 values at 1 kHz, near to the midrange onto optical flat.

³ RMS noise relates to mid 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 sensor tilt angle 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.
<table>
<thead>
<tr>
<th>Model</th>
<th>IFS2406-3</th>
<th>IFS2406-10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring range</td>
<td>3 mm</td>
<td>10 mm</td>
</tr>
<tr>
<td>Start of measuring range</td>
<td>approx. 75 mm</td>
<td>27 mm</td>
</tr>
<tr>
<td>Resolution</td>
<td></td>
<td></td>
</tr>
<tr>
<td>static (1)</td>
<td>50 nm</td>
<td>60 nm</td>
</tr>
<tr>
<td>dynamic (2)</td>
<td>168 nm</td>
<td>385 nm</td>
</tr>
<tr>
<td>Displacement and distance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Linearity (3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thickness</td>
<td>&lt; ±3 µm</td>
<td>&lt; ±3 µm</td>
</tr>
<tr>
<td>Light spot diameter</td>
<td>35 µm</td>
<td>15 µm</td>
</tr>
<tr>
<td>Max. tilt angle (4)</td>
<td>±6.5°</td>
<td>±13.5°</td>
</tr>
<tr>
<td>Numerical aperture (NA)</td>
<td>0.14</td>
<td>0.25</td>
</tr>
<tr>
<td>Min. target thickness (5)</td>
<td>0.15 mm</td>
<td>0.5 mm</td>
</tr>
<tr>
<td>Connection</td>
<td>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</td>
<td></td>
</tr>
<tr>
<td>Installation</td>
<td>Clamping, mounting adapter (see accessories)</td>
<td></td>
</tr>
<tr>
<td>Temperature range</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Storage</td>
<td>-20 ... +70 °C</td>
<td></td>
</tr>
<tr>
<td>Operation</td>
<td>+5 ... +70 °C</td>
<td></td>
</tr>
<tr>
<td>Shock (DIN EN 60068-2-27)</td>
<td>15 g / 6 ms in XY axis, 1000 shocks each</td>
<td></td>
</tr>
<tr>
<td>Vibration (DIN EN 60068-2-6)</td>
<td>2 g / 20 ... 500 Hz in XY axis, 10 cycles each</td>
<td></td>
</tr>
<tr>
<td>Protection class (DIN EN 60529)</td>
<td>IP65 (front)</td>
<td></td>
</tr>
<tr>
<td>Material</td>
<td>Aluminum housing, glass lenses</td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>approx. 99 g</td>
<td>approx. 128 g</td>
</tr>
</tbody>
</table>

1) Average from 512 values at 1 kHz, near to the midrange 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 sensor tilt angle that produces a usable signal on reflecting surfaces. The accuracy decreases when approaching the limit values.
5) Glass with refractive index n = 1.5 throughout the entire measuring range. In the mid of the measuring range, also thinner layers can be measured.
High precision sensors for displacement and thickness measurements

**confocalDT IFS2407**

- Sensor design from ø12 mm
- Submicrometer resolution
- One-sided thickness measurement
- Distance measurement
- Extremely small spot size
- Large tilt angle

**Dimensions in mm, not to scale**

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

1) Average from 512 values at 1 kHz, near to the midrange 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 sensor tilt angle that produces a usable signal on reflecting surfaces. The accuracy decreases when approaching the limit values.
5) Glass with refractive index n = 1.5 throughout the entire measuring range. In the mid of the measuring range, also thinner layers can be measured.
<table>
<thead>
<tr>
<th>Model</th>
<th>IFS2407/90-0.3</th>
<th>IFS2407-3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring range</td>
<td>0.3 mm</td>
<td>3 mm</td>
</tr>
<tr>
<td>Start of measuring range</td>
<td>approx. 5.3 mm</td>
<td>28 mm</td>
</tr>
<tr>
<td>Resolution</td>
<td>static 1) 10 nm</td>
<td>20 nm</td>
</tr>
<tr>
<td></td>
<td>dynamic 2) 20 nm</td>
<td>58 nm</td>
</tr>
<tr>
<td>Linearity 3)</td>
<td>Displacement and distance $&lt; \pm 0.15 \mu m$</td>
<td>$&lt; \pm 0.75 \mu m$</td>
</tr>
<tr>
<td></td>
<td>Thickness $&lt; \pm 0.3 \mu m$</td>
<td>$&lt; \pm 1.5 \mu m$</td>
</tr>
<tr>
<td>Light spot diameter</td>
<td>6 $\mu m$</td>
<td>9 $\mu m$</td>
</tr>
<tr>
<td>Max. tilt angle 4)</td>
<td>$\leq 27^\circ$</td>
<td>$\leq 30^\circ$</td>
</tr>
<tr>
<td>Numerical aperture (NA)</td>
<td>0.50</td>
<td>0.53</td>
</tr>
<tr>
<td>Min. target thickness 5)</td>
<td>0.015 mm</td>
<td>0.15 mm</td>
</tr>
<tr>
<td>Connection</td>
<td>pluggable optical fiber via FC socket, type C2407-x; standard length 3 m; extension up to 50 m; bending radius: static 30 mm, dynamic 40 mm</td>
<td>pluggable optical fiber via FC socket, type C2407-x; standard length 3 m; extension up to 50 m; bending radius: static 30 mm, dynamic 40 mm</td>
</tr>
<tr>
<td>Installation</td>
<td>Mounting holes (2x M2)</td>
<td>Clamping, mounting adapter (see accessories)</td>
</tr>
<tr>
<td>Temperature range</td>
<td>Storage $-20 \ldots +70 ^\circ C$</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Operation $+5 \ldots +70 ^\circ C$</td>
<td></td>
</tr>
<tr>
<td>Shock (DIN EN 60068-2-27)</td>
<td>15 g / 6 ms in XY axis, 1000 shocks each</td>
<td></td>
</tr>
<tr>
<td>Vibration (DIN EN 60068-2-6)</td>
<td>2 g / 20 \ldots 500 Hz in XY axis, 10 cycles each</td>
<td></td>
</tr>
<tr>
<td>Protection class (DIN EN 60529)</td>
<td>IP65 (front)</td>
<td></td>
</tr>
<tr>
<td>Material</td>
<td>Stainless steel housing, glass lenses</td>
<td>Aluminum housing, glass lenses</td>
</tr>
<tr>
<td>Weight</td>
<td>approx. 30 g</td>
<td>approx. 550 g</td>
</tr>
</tbody>
</table>

1) Average from 512 values at 1 kHz, near to the midrange onto optical flat
2) RMS noise relates to mid of measuring range (1 kHz)
3) All data at constant ambient temperature ($25 \pm 1 ^\circ C$) against optical flat; specifications can change when measuring different objects.
4) Maximum sensor tilt angle that produces a usable signal on reflecting surfaces. The accuracy decreases when approaching the limit values.
5) Glass with refractive index $n = 1.5$ throughout the entire measuring range. In the mid of the measuring range, also thinner layers can be measured.
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 feature in the CCD line is for accurate, fast surface compensation on changing surfaces.

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

Due to a user-friendly web interface, no additional software is necessary to configure the controller and the sensors. Data output is via Ethernet, EtherCAT, RS422 or analog output.
Model & IFC2421 & IFC2421MP & IFC2422 & IFC2422MP
Resolution Ethernet/EtherCAT 1 nm & & & & 
RS422 18 bit & & & & 
analog 16 bits (teachable) & & & & 
Measuring rate continuously adjustable from 100 Hz to 6.5 kHz & & & & 
Linearity typ. < ±0.025 % FSO (depends on sensor) & & & & 
Multi 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 1) 30,000 lx & & & & 
Synchronization yes & & & & 
Supply voltage 24 VDC ±15 % & & & & 
Power consumption approx. 10 W & & & & 
Signal input sync-in / trig-in; 2x encoder (A+, A-, B+, B-, Index) & & & & 
Digital interface Ethernet; EtherCAT, RS422; PROFINET 2); EtherNet/IP 2) & & & & 
Analog output Current: 4 … 20 mA; voltage: 0 … 10 V (16 bit D/A converter) & & & & 
Switching output Error1-Out, Error2-Out & & & & 
Digital output sync-out & & & & 
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) 15 g / 6 ms in XYZ axis, 1000 shocks each & & & & 
Vibration (DIN EN 60068-2-6) 2 g / 20 … 500 Hz in XYZ axis, 10 cycles each & & & & 
Protection class (DIN EN 60529) IP40 & & & & 
Material Aluminum & & & & 
Weight approx. 1.8 kg & approx. 2.25 kg & & & 
Compatibility compatible with all confocalDT sensors & & & & 
No. of measurement channels 3) 1 2 & & & & 
Control and display 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) Optional connection via interface module (see accessories)
3) No loss of intensity and linearity due to two synchronous measurement channels
confocalDT IFC2461 systems are used for complex distance and thickness measurements. The IFC2461 controller is equipped with enhanced, optimized optical components for measuring rates up to 25 kHz without having to use an external light source. The high light intensity enables reliable measurements on difficult surfaces, e.g., on matt black objects or for multi-layer thickness measurement of glass. The active exposure regulation feature in the CCD line is for accurate, fast surface compensation on changing surfaces during dynamic measurement processes.

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

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

All settings are performed in the web interface. For thickness measurements, materials are stored in an expandable materials database.
<table>
<thead>
<tr>
<th>Model</th>
<th>IFC2461</th>
<th>IFC2461MP</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Resolution</strong></td>
<td>Ethernet/EtherCAT</td>
<td>1 nm</td>
</tr>
<tr>
<td><strong>RS422</strong></td>
<td>RS422</td>
<td>18 bit</td>
</tr>
<tr>
<td><strong>analog</strong></td>
<td></td>
<td>16 bits (teachable)</td>
</tr>
<tr>
<td><strong>Measuring rate</strong></td>
<td>continuously adjustable from 100 Hz to 25 kHz</td>
<td></td>
</tr>
<tr>
<td><strong>Linearity</strong></td>
<td>typ. &lt; ±0.025 % FSO (depends on sensor)</td>
<td></td>
</tr>
<tr>
<td><strong>Multi peak measurement</strong></td>
<td>1 layer</td>
<td>5 layers</td>
</tr>
<tr>
<td><strong>Light source</strong></td>
<td>internal white LED</td>
<td></td>
</tr>
<tr>
<td><strong>No. of characteristic curves</strong></td>
<td>up to 20 characteristic curves for different sensors per channel, selection via table in the menu</td>
<td></td>
</tr>
<tr>
<td><strong>Permissible ambient light</strong></td>
<td>30,000 lx</td>
<td></td>
</tr>
<tr>
<td><strong>Synchronization</strong></td>
<td>yes</td>
<td></td>
</tr>
<tr>
<td><strong>Supply voltage</strong></td>
<td>24 VDC ±15 %</td>
<td></td>
</tr>
<tr>
<td><strong>Power consumption</strong></td>
<td>approx. 10 W</td>
<td></td>
</tr>
<tr>
<td><strong>Signal input</strong></td>
<td>sync-in / trig-in, 3x encoder (A, B, index)</td>
<td></td>
</tr>
<tr>
<td><strong>Digital interface</strong></td>
<td>Ethernet, EtherCAT, RS422, PROFINET, EtherNet/IP</td>
<td></td>
</tr>
<tr>
<td><strong>Analog output</strong></td>
<td>Current: 4 … 20 mA; voltage: 0 … 10 V / -10 … +10 V (16 bit D/A converter)</td>
<td></td>
</tr>
<tr>
<td><strong>Switching output</strong></td>
<td>Error1-Out, Error2-Out</td>
<td></td>
</tr>
<tr>
<td><strong>Digital output</strong></td>
<td>sync-out</td>
<td></td>
</tr>
<tr>
<td><strong>Connection</strong></td>
<td>optical</td>
<td>pluggable optical fiber via E2000 socket, length 2 m … 50 m, min. bending radius 30 mm</td>
</tr>
<tr>
<td><strong>electrical</strong></td>
<td></td>
<td>3-pin supply terminal strip; Encoder connection (15-pin, HD-sub socket, max. cable length 3 m); RS422 connection socket (9-pin, Sub-D, max. cable length 30 m); 3-pin output terminal strip (max. cable length 30 m); 12-pin I/O terminal strip (max. cable length 30 m); RJ45 socket for Ethernet / EtherCAT (max. cable length 100 m)</td>
</tr>
<tr>
<td><strong>Installation</strong></td>
<td>free-standing, DIN rail mounting</td>
<td></td>
</tr>
<tr>
<td><strong>Temperature range</strong></td>
<td>Storage</td>
<td>-20 … +70 °C</td>
</tr>
<tr>
<td></td>
<td>Operation</td>
<td>+5 … +50 °C</td>
</tr>
<tr>
<td><strong>Shock (DIN EN 60068-2-27)</strong></td>
<td>15g / 6 ms in XYZ axis, 1000 shocks each</td>
<td></td>
</tr>
<tr>
<td><strong>Vibration (DIN EN 60068-2-6)</strong></td>
<td>2 g / 20 … 500 Hz in XYZ axis, 10 cycles each</td>
<td></td>
</tr>
<tr>
<td><strong>Protection class (DIN EN 60529)</strong></td>
<td>IP40</td>
<td></td>
</tr>
<tr>
<td><strong>Material</strong></td>
<td>Aluminum</td>
<td></td>
</tr>
<tr>
<td><strong>Weight</strong></td>
<td>approx. 2.2 kg</td>
<td></td>
</tr>
<tr>
<td><strong>Compatibility</strong></td>
<td>compatible with all confocalDT sensors</td>
<td></td>
</tr>
<tr>
<td><strong>No. of measurement channels</strong></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td><strong>Control and display elements</strong></td>
<td>ON/OFF multifunction button (as well as dark alignment and reset to factory setting after 10 s); 4x LEDs for intensity, range, status, supply voltage</td>
<td></td>
</tr>
<tr>
<td><strong>Features</strong></td>
<td>particularly light-intensive</td>
<td></td>
</tr>
</tbody>
</table>

---

FSO = Full Scale Output

1) Illuminant: light bulb

2) Optional connection via interface module (see accessories)

---

**IFC2461 controller**

![Diagram of IFC2461 controller](image-url)
The confocalDT 2471 HS controllers are used for fast distance and thickness measurements of highly reflecting and specular surfaces. The controllers are equipped with enhanced optical components enabling measuring rates up to 70 kHz on reflecting surfaces without having to use an external light source. The confocalDT HS controllers are one of the fastest confocal measuring systems in the world. The active exposure regulation feature in the CCD line enables accurate, fast surface compensation on changing surfaces during dynamic measurement processes.

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

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

<table>
<thead>
<tr>
<th>Feature</th>
<th>IFC2471LED</th>
<th>IFC2471MP LED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Controller</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IFC2471 LED</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IFC2471MP LED</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model</td>
<td>IFC2471LED</td>
<td>IFC2471MP LED</td>
</tr>
<tr>
<td>IFC2471 LED</td>
<td>Ethernet/EtherCAT</td>
<td>Ethernet/EtherCAT</td>
</tr>
<tr>
<td>IFC2471MP LED</td>
<td>Ethernet/EtherCAT</td>
<td>Ethernet/EtherCAT</td>
</tr>
<tr>
<td>Resolution</td>
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</tr>
<tr>
<td>RS422</td>
<td>1 nm</td>
<td>1 nm</td>
</tr>
<tr>
<td>RS232</td>
<td>18 bit</td>
<td>18 bit</td>
</tr>
<tr>
<td>Measuring rate</td>
<td>continuously adjustable from 100 Hz to 70 kHz</td>
<td>continuously adjustable from 100 Hz to 70 kHz</td>
</tr>
<tr>
<td>Linearity</td>
<td>typ. &lt; ±0.025 % FSO (depends on sensor)</td>
<td>typ. &lt; ±0.025 % FSO (depends on sensor)</td>
</tr>
<tr>
<td>Multi peak measurement</td>
<td>1 layer</td>
<td>5 layers</td>
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<tr>
<td>Light source</td>
<td>internal white LED</td>
<td>internal white LED</td>
</tr>
<tr>
<td>No. of characteristic curves</td>
<td>up to 20 calibration tables for different sensors per channel, menu selection</td>
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</tr>
<tr>
<td>Permissible ambient light ¹</td>
<td>30,000 lx</td>
<td>30,000 lx</td>
</tr>
<tr>
<td>Synchronization</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>Supply voltage</td>
<td>24 VDC ±15 %</td>
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</tr>
<tr>
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<td>Ethernet, EtherCAT, RS422; PROFINET ²; EtherNet/IP ²</td>
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<td>Current: 4 … 20 mA; voltage: 0 … 10 V / -10 … +10 V (16 bit D/A converter)</td>
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</tr>
<tr>
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<td>sync-out</td>
</tr>
<tr>
<td>Connection</td>
<td>optical</td>
<td>optical</td>
</tr>
<tr>
<td>Connection</td>
<td>electrical</td>
<td>electrical</td>
</tr>
<tr>
<td>optical</td>
<td>pluggable optical fiber via E2000 socket, length 2 m…50 m, min. bending radius 30 mm</td>
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<tr>
<td>Encoder connection</td>
<td>3-pin supply terminal strip; Encoder connection (15-pin, HD-sub socket, max. cable length 3 m); RS422 connection socket (9-pin, Sub-D, max. cable length 30 m); 3-pin output terminal strip (max. cable length 30 m); 12-pin I/O terminal strip (max. cable length 30 m); RJ45 socket for Ethernet / EtherCAT (max. cable length 100 m)</td>
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<tr>
<td>Installation</td>
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</tr>
<tr>
<td>Temperature range</td>
<td>-20 … +70 °C</td>
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</tr>
<tr>
<td>Temperature range</td>
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</tr>
<tr>
<td>Shock (DIN EN 60068-2-27)</td>
<td>15 g / 6 ms in XYZ axis, 1000 shocks each</td>
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</tr>
<tr>
<td>Vibration (DIN EN 60068-2-6)</td>
<td>2 g / 20 … 500 Hz in XYZ axis, 10 cycles each</td>
<td>2 g / 20 … 500 Hz in XYZ axis, 10 cycles each</td>
</tr>
<tr>
<td>Protection class (DIN EN 60529)</td>
<td>IP40</td>
<td>IP40</td>
</tr>
<tr>
<td>Material</td>
<td>Aluminum</td>
<td>Aluminum</td>
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<td>No. of measurement channels</td>
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<td>ON/OFF multifunction button (as well as dark alignment and reset to factory setting after 10 s); 4x LEDs for intensity, range, status, supply voltage</td>
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</tr>
<tr>
<td>Features</td>
<td>particularly light-intensive and high measuring rate</td>
<td>particularly light-intensive and high measuring rate</td>
</tr>
</tbody>
</table>

¹ Illuminant: light bulb

² Optional connection via interface module (see accessories)

---

**Controller IFC2471 LED**

[Diagram of Controller IFC2471 LED]

(Foot parts are removable)

[Diagram of Fiber-optic sensor cable]
System design

The confocalDT system consists of:
- Sensor IFS240x
- Controller IFC24xx
- Fiber optic cable C24xx
**Customer-specific modifications**

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

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

Vacuum feed through
- IFS24xx/Vac
- C2400/PT-x-Vac
- C2401-x

Controller IFC24xx

Vacuum feed through
- C2405.../Vac (KF or CF flange)
- C2402.../Vac (KF flange)
Accessories

**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)
Accessories

Software
IFD24xx-Tool  Software demo tool included

Accessories light source
IFL2422/LE  Lamp module for IFC2422
IFL24x1/LED  Lamp module for IFC24x1

Cable extension for sensors
CE2402 cable with 2x E2000/APC connectors
CE2402-x  Extension for optical fiber (3 m, 10 m, 13 m, 30 m, 50 m)
CE2402-x/PT  Extension for optical fiber with protection tube for mechanical stress
            (3 m, 10 m, customer-specific length up to 50 m)

Cable for IFS2404 sensors
C2404-x  Optical fiber with FC/APC and E2000/APC connectors
         Fiber core diameter 20 µm (2 m)

Cables for IFS2405/IFS2406/2407-0,1 sensors
C2401 cable with FC/APC and E2000/APC connectors
C2401-x  Optical fiber (3 m, 5 m, 10 m, customer-specific length up to 50 m)
C2401/PT-x  Optical fiber with protection tube for mechanical stress
             (3 m, 5 m, 10 m, customer-specific length up to 50 m)
C2401-x(01)  Optical fiber core diameter 26 µm (3 m, 5 m, 15 m)
C2401-x(10)  Drag-chain suitable optical fiber (3 m, 5 m, 10 m)

C2400 cable with 2x FC/APC connectors
C2400-x  Optical fiber (3 m, 5 m, 10 m, customer-specific length up to 50 m)
C2400/PT-x  Optical fiber with protection tube for mechanical stress
             (3 m, 5 m, 10 m, customer-specific length up to 50 m)
C2400/PT-x-Vac  Optical fiber with protection tube suitable for use in vacuum
                (3 m, 5 m, 10 m, customer-specific length up to 50 m)

Cable for IFS2407/90-0,3 sensors
C2407-x  Optical fiber with DIN connector and E2000/APC (2 m, 5 m)

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

Other accessories
SC2471-x/USB/IND  Connector cable 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/ENET/IP  Interface module for EtherNet/IP connection

Optical fiber
Temperature range : -50 °C to 90 °C
Bending radius: 30/40 mm
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