



More Precision

interfero**METER** // White light interferometer





- *Absolute distance measurement with nanometer accuracy*
- *Distance-independent thickness measurement*
- *Best-in-Class: resolution < 30 picometers and outstanding linearity*
- *High signal stability due to new evaluation algorithms and active temperature compensation*
- *Simple parameter set up via web interface*

High precision distance and thickness measurements

The innovative white light interferometers from Micro-Epsilon set a benchmark in high precision distance and thickness measurements. These sensors enable stable measurement results with sub-nanometer resolution offering a comparatively large measuring range and offset distance. The interferometers are available in 3 series: the IMS5400-DS for high precision industrial distance measurements, the IMS5400-TH for accurate thickness measurements and the vacuum-suitable IMS5600-DS for distance measurements with picometer resolution.

System design

Interferometers consist of a controller, a sensor and a fiber optic cable. Flexible fiber optic cables are available in lengths up to 20 m and allow a spatial separation of sensor and controller. These sensors are designed for industrial measurement tasks. Therefore, they are equipped with a robust metal housing and flexible cables.



Integration in industrial environments

Robust sensors and a controller enclosed in metal make the interferometer ideal for integration into automated production systems and machines. These compact sensors are extremely space-saving and can also be integrated in confined spaces. The controller is installed in the control cabinet via DIN rail mounting and provides very stable measurement results due to active temperature compensation and passive cooling.

Interferometers at a glance

| System type | | Purpose | Resolution | Page |
|----------------------------------|--|-----------|------------|---------|
| interferoMETER IMS5400-DS | For absolute distance measurement with nanometer accuracy | Distance | < 1 nm | 4 - 5 |
| interferoMETER IMS5400-TH | For stable thickness measurement with submicron accuracy | Thickness | < 1 nm | 6 - 7 |
| interferoMETER IMS5600-DS | For absolute distance measurement with subnanometer accuracy | Distance | < 30 pm | 8 - 9 |
| Dimensions / Accessories | | | | 10 - 11 |

Ease of use via web interface

Due to a user-friendly web interface, no additional software is necessary to configure the controller and the sensors. The web interface is accessible via Ethernet connection and enables quick and easy setting of, e.g., averaging, measuring rate and presets.



EtherCAT
Technology Group

PROFI
NET

EtherNet/IP

Various interfaces for advanced automation

Integrated interfaces such as Ethernet, EtherCAT and RS422 as well as encoder connections, analog outputs, synchronization inputs and digital I/Os enable the connection to modern control systems and production programs.



- Absolute measurement with nanometer accuracy, suitable for the measurement of e.g. step profiles
- Compact and robust sensors with large offset distance
- Measuring rate up to 6 kHz for high speed measurements
- Ethernet, EtherCAT, RS422
- Robust controller with passive cooling
- Easy configuration via web interface

Absolute distance measurement with nanometer resolution

The IMS5400-DS white light interferometer opens up new perspectives in industrial distance measurement. The controller has an intelligent evaluation feature and enables absolute measurements with nanometer accuracy at a relatively large offset distance. Compared to other absolute measuring optical systems, the IMS5400-DS offers an unsurpassed combination of accuracy, measuring range and offset distance.

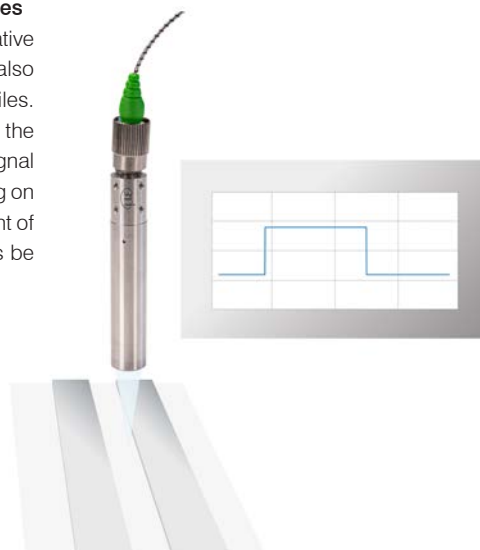
Small light spot for the smallest of details and structures

The sensors generate a constantly small light spot over the entire measuring range. The light spot diameter is only 10 μm and allows the detection of small details such as structures on semiconductors and miniaturized electronic components.



Absolute measurement of step profiles

Unlike interferometers based on relative measurements, the IMS5400-DS also enables the measurement of step profiles. Thanks to the absolute measurement, the scanning is performed with high signal stability and precision. When measuring on moving objects, the differences in height of heels, steps and depressions can thus be reliably detected.



| Model | | IMS5400-DS |
|-----------------------------------|------------|---|
| Measuring range | | 2.1 mm |
| Start of measuring range | | approx. 19 mm |
| Resolution ¹⁾ | | < 1 nm |
| Measuring rate | | continuously adjustable from 100 Hz to 6 kHz |
| Linearity ²⁾ | | < ±50 nm |
| Temperature stability | Sensor | Linearity typ. 0.1 nm / K (without offset displacement) |
| | Controller | temperature compensated, stability < 10 ppm between +15 ... +35 °C |
| Light source | | NIR-SLED, wavelength 840 nm |
| Laser safety class | | Class 1 according to DIN EN 60825-1: 2015-07 |
| Light spot diameter ³⁾ | | 10 µm |
| Max. tilt angle ⁴⁾ | | ±2° |
| Target material | | Glass, reflecting or diffuse surfaces ⁵⁾ |
| Supply voltage | | 24 VDC ±15 % |
| Power consumption | | approx. 10 W (24 V) |
| Signal input | | sync in, trigger in, 2x encoders (A+, A-, B+, B-, index) |
| Digital interface | | Ethernet / EtherCAT / RS422 |
| Analog output | | 4 ... 20 mA / 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 (controller) and FC socket (sensor); standard length 3 m, 5 m and 10 m; other cable lengths on request; bending radius: static 30 mm, dynamic 40 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) |
| Assembly | Sensor | Clamping, mounting adapter (see accessories) |
| | Controller | free-standing, DIN rail mounting |
| Temperature range | Storage | -20 ... +70 °C |
| | Operation | Sensor: +5 ... +70 °C; Controller: +15 ... +35 °C |
| Shock (DIN EN 60068-2-27) | | 15 g / 6 ms in XY axis, 1000 shocks each |
| Vibration (DIN EN 60068-2-6) | | 2 g / 20 ... 500 Hz in XY axis, 10 cycles each |
| Protection class (DIN EN 60529) | | IP40 (controller and sensor) |
| Material | Sensor | Stainless steel |
| | Controller | Aluminum housing, passive cooling |
| Control and display elements | | Multifunction button: two adjustable functions and reset to factory setting after 10 s; web interface for setup: selectable presets, freely selectable averaging possibilities, data reduction, setup management; 6 x color LEDs for intensity, range, SLED, pilot laser, status and power; pilot laser: switchable for sensor alignment (laser LED 635 nm, laser class 1, performance < 0.2 mW) |

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

¹⁾ Measuring rate 0.5 kHz, moving averaging over 64 values, measured at the front of a glass plate in the mid of the measuring range (2 sigma)

²⁾ Maximum deviation from reference system over the entire measuring range, measured on front surface of ND filter

³⁾ In the mid of the measuring range

⁴⁾ 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.

⁵⁾ Non-transparent materials require optically dense surface at a wavelength of 840 nm

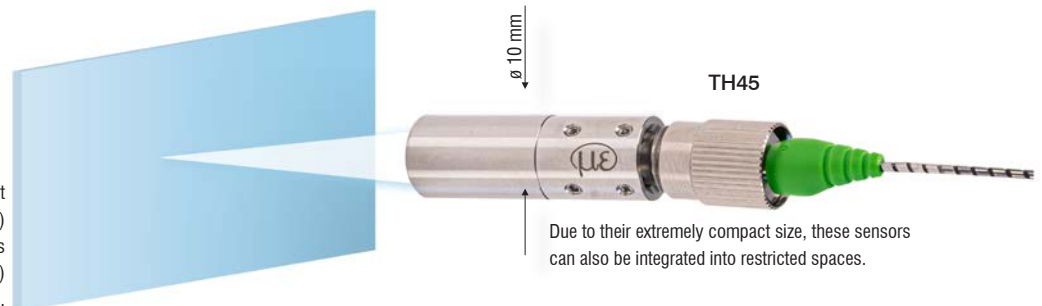


- Nanometer-precise thickness measurements even with varying distances and vibrating targets
- Stable measurement from a large distance, even of anti-reflection coated targets
- Industry optimized sensors with robust metal housing and flexible cables
- Measuring rate up to 6 kHz for high speed measurements
- Ethernet, EtherCAT, RS422

Stable thickness measurement with varying measurement distances

The IMS5400-TH white light interferometer opens up new perspectives in industrial thickness measurement. The interferometer is used for highly accurate thickness measurements from a relatively large distance. A decisive advantage here is the distance-independent measurement, where a stable nanometer-accurate thickness value is achieved. This is how the target can move within the measuring range without influencing the accuracy. The large thickness measuring range allows the measurement of thin layers, flat glass and films. Since the white light interferometer works with an SLED in the near infrared range, it is possible to measure the thickness of optically non-dense objects such as anti-reflective coated glass.

The measuring range for air gap measurement
(with refractive index ~ 1)
is $50\text{ }\mu\text{m}$ to 2.1 mm and for glass thickness
measurement (with refractive index ~ 1.5)
 $35\text{ }\mu\text{m}$ to 1.4 mm .



| Model | | IMS5400-TH45 | IMS5400-TH70 |
|-----------------------------------|------------|---|--------------------|
| Working distance | | 45 mm \pm 3.5 mm | 70 mm \pm 2.1 mm |
| Measuring range (thickness) | | 0.035 ... 1.4 mm ¹⁾ | |
| Resolution ²⁾ | | < 1 nm | |
| Measuring rate | | continuously adjustable from 100 Hz to 6 kHz | |
| Linearity ³⁾ | | < \pm 100 nm | < \pm 200 nm |
| Temperature stability | Sensor | Linearity valid for the entire temperature range | |
| | Controller | temperature compensated, stability < 10 ppm between +15 ... +35 °C | |
| Light source | | NIR-SLED, wavelength 840 nm | |
| Laser safety class | | Class 1 according to DIN EN 60825-1: 2015-07 | |
| Light spot diameter ⁴⁾ | | 10 μ m | 5 μ m |
| Max. tilt angle ⁵⁾ | | \pm 2° | \pm 4° |
| Supply voltage | | 24 VDC \pm 15 % | |
| Power consumption | | approx. 10 W (24 V) | |
| Signal input | | sync in, trigger in, 2x encoders (A+, A-, B+, B-, index) | |
| Digital interface | | Ethernet / EtherCAT / RS422 | |
| Analog output | | 4 ... 20 mA / 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 (controller) and FC socket (sensor); standard length 3 m, 5 m and 10 m; other cable lengths on request; bending radius: static 30 mm, dynamic 40 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) | |
| Assembly | Sensor | Clamping, mounting adapter (see accessories) | |
| | Controller | free-standing, DIN rail mounting | |
| Temperature range | Storage | -20 ... +70 °C | |
| | Operation | Sensor: +5 ... +70 °C; Controller: +15 ... +35 °C | |
| Shock (DIN EN 60068-2-29) | | 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 (controller and sensor) | |
| Vacuum | | optional UHV (cable and sensor) | |
| Material | Sensor | Stainless steel | |
| | Controller | Aluminum housing, passive cooling | |
| Control and display elements | | Multifunction button: two adjustable functions and reset to factory setting after 10 s; web interface for setup: selectable presets, freely selectable averaging possibilities, data reduction, setup management; 6 x color LEDs for intensity, range, SLED, pilot laser, status and power; pilot laser: switchable for sensor alignment (laser LED 635 nm, laser class 1, performance < 0.2 mW) | |

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

¹⁾ Measuring range with $n=1.5$; for air gap measurement between two glass plates ($n=1$) the measuring range is 0.05 ... 2.1 mm.

The measuring object must be within the working distance.

²⁾ Measuring rate 0.5 kHz, moving averaging over 64 values, measured on an approx. 1 mm thick BK7 optical flat (2 sigma)

³⁾ Maximum thickness deviation when measuring on an approx. 1 mm thick BK7 optical flat ($n=1.5$) when passing through the measuring range

⁴⁾ With a working distance of 45 mm (TH-45) or 70 mm (TH-70)

⁵⁾ Maximum sensor tilt angle that produces a usable signal on an approx. 0.6 mm thick BK7 optical flat in the mid of the measuring range.

The accuracy decreases when approaching the limit values.



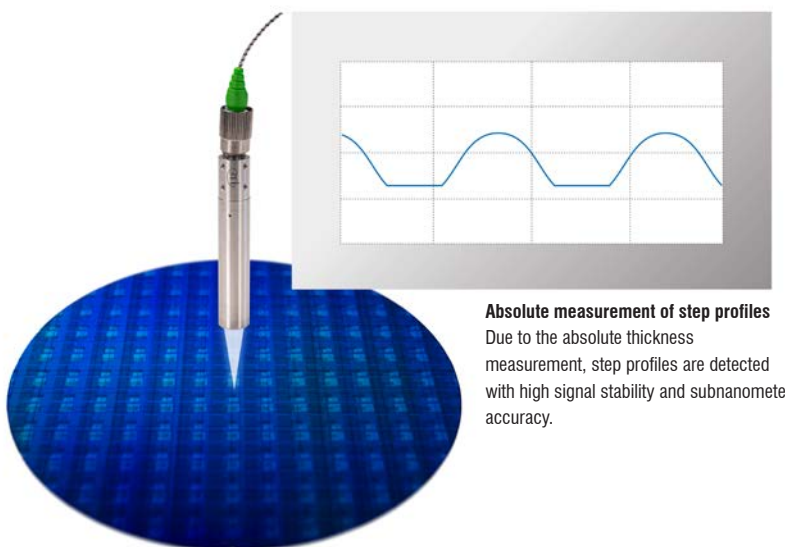
- Distance measurements with subnanometer precision
- Best-in-Class:
Resolution < 30 picometers
- Absolute measurements, suitable for step profiles
- Compact and robust sensors with large offset distance
- Measuring rate up to 6 kHz for high speed measurements
- Ethernet, EtherCAT, RS422

Designed for high-resolution distance measurements in clean rooms & vacuum

The white light interferometer IMS5600-DS is used for distance measurements with highest precision. The controller offers a special calibration with intelligent evaluation and enables absolute measurements with subnanometer resolution. The interferometer is used for measurement tasks with the highest accuracy requirements, e.g., in electronics and semiconductor production. For vacuum applications, Micro-Epsilon offers special sensors, cables and feed-through accessories. These sensors and cables are particle-free to a high degree and can even be used in UHV.

Absolute distance measurement with large measuring range and offset distance

The IMS5600-DS is used for high-precision displacement and distance measurements. The system provides absolute measurement values and can therefore also be used for distance measurement of step profiles. Thanks to the absolute measurement, sampling is performed without signal loss. When measuring on moving objects, the differences in height of heels, steps and depressions can thus be reliably detected. The measuring system offers sub-nanometer resolution with a large offset distance in relation to the measuring range.



Absolute measurement of step profiles

Due to the absolute thickness measurement, step profiles are detected with high signal stability and subnanometer accuracy.

| Model | | IMS5600-DS |
|-----------------------------------|------------|---|
| Measuring range | | 2.1 mm |
| Start of measuring range | | approx. 19 mm |
| Resolution ¹⁾ | | < 30 pm |
| Measuring rate | | continuously adjustable from 100 Hz to 6 kHz |
| Linearity ²⁾ | | < ±10 nm |
| Temperature stability | Sensor | Linearity: typ. 0.1 nm / K (without offset displacement) |
| | Controller | temperature compensated, stability < 10 ppm between +15 ... +35 °C |
| Light source | | NIR-SLED, wavelength 840 nm |
| Laser safety class | | Class 1 according to DIN EN 60825-1: 2015-07 |
| Light spot diameter ³⁾ | | 10 µm |
| Max. tilt angle ⁴⁾ | | ±2° |
| Target material | | Glass, reflecting or diffuse surfaces ⁵⁾ |
| Supply voltage | | 24 VDC ±15 % |
| Power consumption | | approx. 10 W (24 V) |
| Signal input | | sync in, trigger in, 2x encoders (A+, A-, B+, B-, index) |
| Digital interface | | Ethernet / EtherCAT / RS422 |
| Analog output | | 4 ... 20 mA / 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 (controller) and FC socket (sensor); standard length 3 m, 5 m and 10 m; other cable lengths on request; bending radius: static 30 mm, dynamic 40 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) |
| Assembly | Sensor | Clamping, mounting adapter (see accessories) |
| | Controller | free-standing, DIN rail mounting |
| Temperature range | Storage | -20 ... +70 °C |
| | Operation | Sensor: +5 ... +70 °C; Controller: +15 ... +35 °C |
| Shock (DIN EN 60068-2-27) | | 15 g / 6 ms in XY axis, 1000 shocks each |
| Vibration (DIN EN 60068-2-6) | | 2 g / 20 ... 500 Hz in XY axis, 10 cycles each |
| Protection class (DIN EN 60529) | | IP40 (controller and sensor) |
| Vacuum | | optional UHV (cable and sensor) |
| Material | Sensor | Stainless steel |
| | Controller | Aluminum housing, passive cooling |
| Control and display elements | | Multifunction button: two adjustable functions and reset to factory setting after 10 s; web interface for setup: selectable presets, freely selectable averaging possibilities, data reduction, setup management; 6 x color LEDs for intensity, range, SLED, pilot laser, status and power; pilot laser: switchable for sensor alignment (laser LED 635 nm, laser class 1, performance < 0.2 mW) |

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

¹⁾ Measuring rate 0.5 kHz, moving average over 64 values, measured differentially between the front and back of a thin glass plate in the mid of the measuring range (2 sigma)

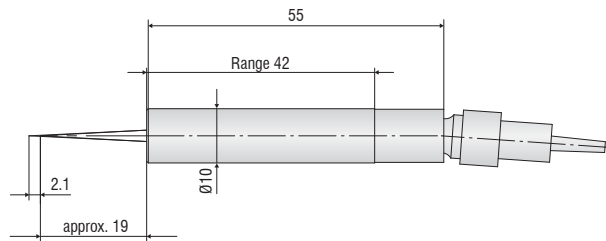
²⁾ Maximum deviation from reference system over entire measuring range, measured on front surface of ND filter

³⁾ In the mid of the measuring range

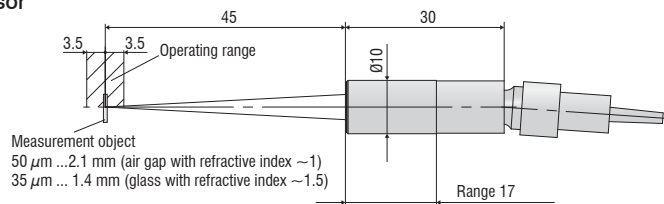
⁴⁾ Maximum sensor tilt angle that produces a usable signal on polished glass (n = 1.5) in the mid of the measuring range. The accuracy decreases when approaching the limit values.

⁵⁾ Non-transparent materials require optically dense surface at a wavelength of 840 nm

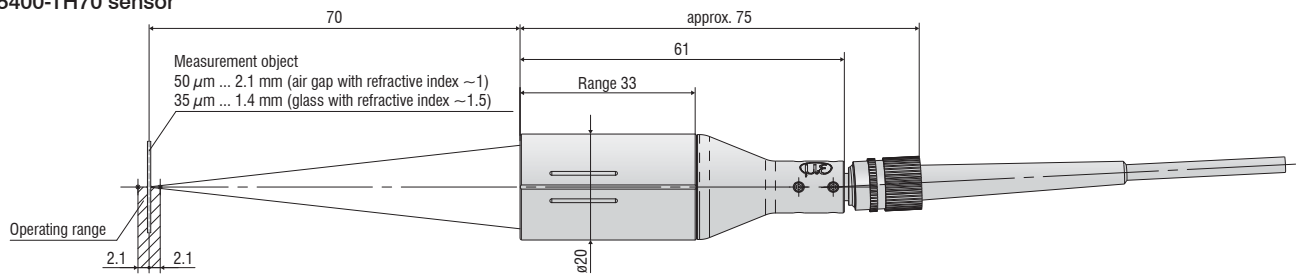
IMS5400-DS sensor



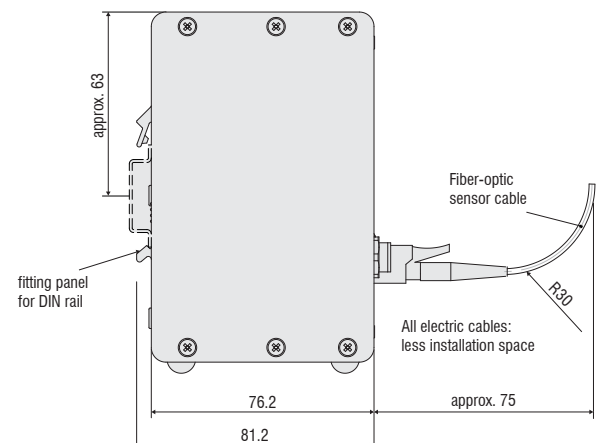
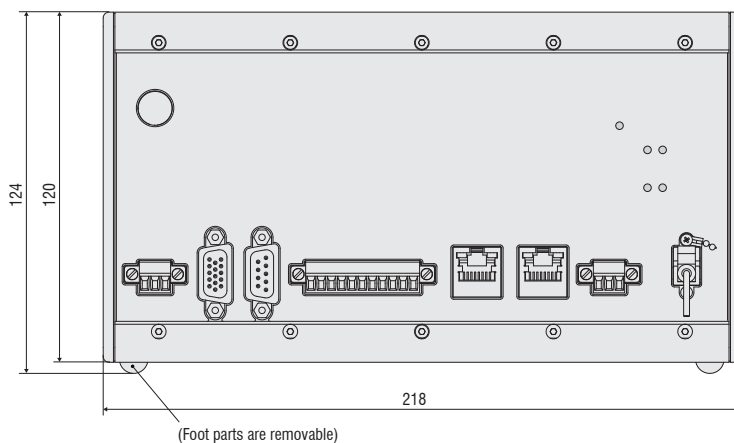
IMS5400-TH45 sensor



IMS5400-TH70 sensor



IMS5400-DS / IMS5400-TH / IMS5600-DS controllers



Cable

Standard E2000/APC (controller) and FC/APC connector (sensor)

| | |
|-------------------------------------|----------------------------|
| C5401-2 | Optical fiber, length 2 m |
| C5401-3 | Optical fiber, length 3 m |
| C5401-5 | Optical fiber, length 5 m |
| C5401-10 | Optical fiber, length 10 m |
| Other lengths up to 20 m on request | |

Drag chain E2000/APC (controller) and FC/APC connector (sensor)

| | |
|-------------------------------------|----------------------------|
| C5401-3(010) | Optical fiber, length 3 m |
| C5401-5(010) | Optical fiber, length 5 m |
| C5401-10(010) | Optical fiber, length 10 m |
| Other lengths up to 20 m on request | |

Vacuum cable FC/APC connector

| | |
|-------------|---------------------------|
| C5400-1/VAC | Optical fiber, length 1 m |
| C5400-2/VAC | Optical fiber, length 2 m |
| C5400-5/VAC | Optical fiber, length 5 m |

Flange for vacuum feed through

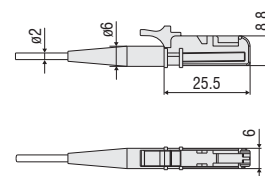
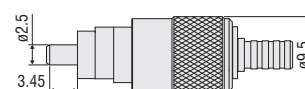
| | |
|------------------|-----------|
| C5405/VAC/1/CF16 | CF flange |
| C5405/VAC/1/KF16 | KF flange |

Mounting adapter

| | |
|------------|--------------------------------------|
| MA5400- 10 | Mounting adapter for IMP-DS19/ -TH45 |
| MA5400- 20 | Mounting adapter for IMP-TH70 |

Other accessories

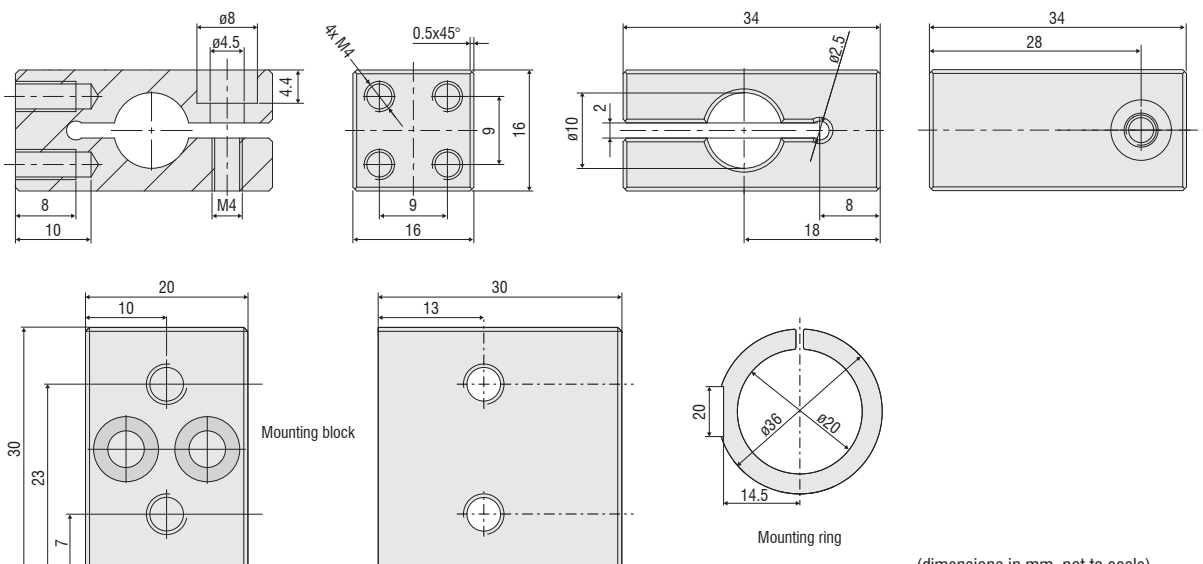
| | |
|-------------------|--|
| SC2471-x/IF2008 | IMC5400/5600 connector cable+ IF2008/PCIE, length 3 m / 10 m |
| SC2471-x/RS422/OE | IMC5400/5600 interface cable + IF2001/USB, length 3 m / 10 m |
| IF2001/USB | RS422/USB converter |
| IF2008/PCIE | Interface card |
| PS2020 | Power supply 24 V / 2.5 A |
| EC2471-3/OE | Encoder cable, 3 m |

E2000/APC standard connector**FC/APC standard connector**

C5405/VAC/1/CF16
C5405/VAC/1/KF16

Accessories: Sensor mounting adapter

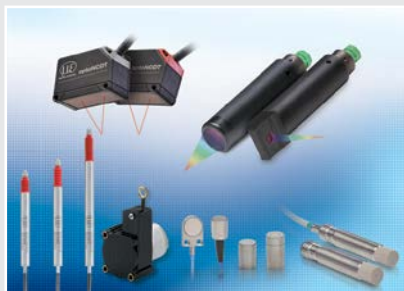
For DS19/TH45:
MA5400-10



For TH70:
MA5400-20

(dimensions in mm, not to scale)

Sensors and Systems from Micro-Epsilon



Sensors and systems for displacement, position and dimension



Sensors and measurement devices for non-contact temperature measurement



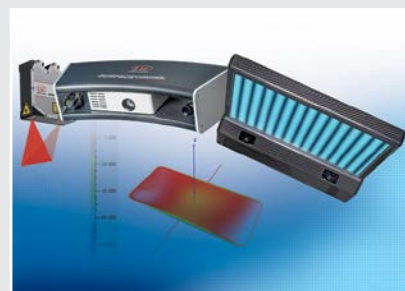
Measuring and inspection systems for quality assurance



Optical micrometers, fiber optics, measuring and test amplifiers



Color recognition sensors, LED Analyzers and inline color spectrometers



3D measurement technology for dimensional testing and surface inspection