MICRO-EPSILON

More Precision

interferoMETER IMS5420 // High precision inline wafer thickness measurement

High precision inline wafer thickness measurement
interferoMETER 5420

- Nanometer-precise thickness measurement from 0.05 to 1.05 mm (SI wafers)
- Undoped, doped and highly doped wafers
- Multi-peak: up to 5 layers in one measurement
- High resolution 1 nm
- Measuring rate up to 6 kHz for high speed measurements
- Ethernet / EtherCAT / RS422 / PROFINET / EtherNet/IP
- Easy configuration via web interface
- Flexible industrial integration
- Pilot laser for exact visualization of the measuring point

Stable wafer thickness measurement in inline processes

The IMS5420-TH absolute interferometer opens up new perspectives in the industrial thickness measurement of monocrystalline silicon wafers and silicon carbide wafers and comparable materials that are transparent for a wavelength range of 1,100 nm. Due to its broadband superluminescent diode (SLED), the IMS5420-TH can be used for undoped, doped and highly doped Si wafers. In wafer thickness measurements, the IMS5420-TH impresses with an excellent price-performance ratio.

Due to the optical transparency of silicon wafers in the wavelength range of 1,100 nm, interferometers can precisely detect their thickness. This enables wafer thickness measurements up to 1.05 mm. The measurable thickness of air gaps is even up to 4 mm.

The absolute interferometer achieves signal stability in the submicrometer range. Depending on the field of application, sensors with large offset distance or air purge system are available. The measuring system is therefore ideally suited for inline measurements.

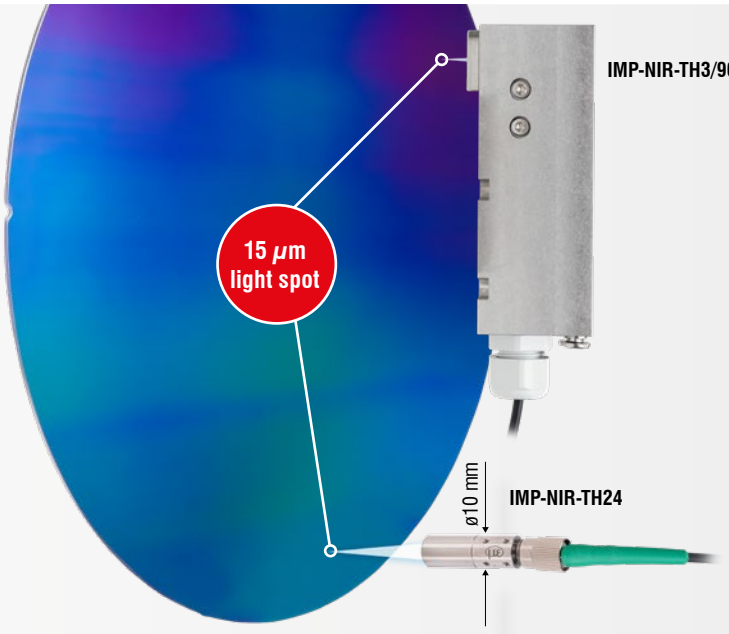
It is also available as a multipeak thickness measuring system which detects thicknesses of up to five layers, e.g., wafer thickness, air gap, films and coatings.

For thickness measurements in challenging environmental conditions such as wafer lapping, the IMS5420/IP67 controller with protection class IP67 and stainless steel housing is available.

Doping	Element	Specific resistance
P-	Boron	1-150 Ω·cm
N-	Phosphorus	1-200 Ω·cm
P+	Boron	0.01-0.02 Ω·cm
P++	Boron	0.005-0.01 Ω·cm

With multi-layer thickness measurements of silicon wafers, up to 5 layers from 50 to 1050 µm can be detected.

The measuring range for air gap measurement (with refractive index ~1) is 0.2 to 4.0 mm and for wafer thickness measurement (with refractive index ~3.82) 50 µm to 1.05 mm.



Controller

Model		IMS5420-TH	IMS5420MP-TH	IMS5420IP67-TH	IMS5420IP67MP-TH
Resolution [1]		< 1 nm			
Measuring rate		continuously adjustable from 100 Hz to 6 kHz			
Linearity [2]		< ±100 nm	< ±100 nm with one layer; < ±200 nm for other layers	< ±100 nm	< ±100 nm with one layer; < ±200 nm for other layers
Temperature stability		temperature compensated, stability < ±50 ppm between +10 ... +50 °C			
Multi-peak measurement		1 layer	up to 5 layers	1 layer	up to 5 layers
Light source		NIR-SLED, narrow wavelength band at approx. 1100 nm; pilot laser: laser LED, wavelength 635 nm		NIR-SLED, narrow wavelength band at approx. 1100 nm	
Laser class		Class 1 according to DIN EN 60825-1: 2022-07; Pilot laser: Class 1, power (< 0.2 mW)		Class 1 in accordance with DIN EN 60825-1: 2022-07	
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 / PROFINET [3]/ EtherNet/IP [3]		Ethernet / RS422 / PROFINET [3]/ EtherNet/IP [3]	
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 fiber optic cable via E2000 socket (controller); see accessories for cable lengths; bending radius: static 30 mm, dynamic 40 mm		Pluggable optical fiber via IP9 SC socket, standard lengths 1 m and 2 m, other cable lengths on request; bending radius: static 45 mm, dynamic 60 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)		4-pin M12 connector for supply; RS422 connector (5-pin, M12, max. cable length 30 m); RJ45 socket for Ethernet (out) / EtherCAT (in/out) (max. cable length 100 m)	
Mounting		Free-standing, DIN rail mounting		Through bores	
Temperature range	Storage	-20 ... +70 °C			
	Operation	+10 ... +50 °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		IP67	
Material		Aluminum housing, passive cooling		Stainless steel housing	
Control and indicator elements		Multifunction button: two adjustable functions and reset to factory settings after 10 s; web interface for setup: selectable presets, freely selectable averaging, data reduction, setup management; 6 x color LEDs for intensity, range, SLED, pilot laser, status and power; pilot laser: can be switched on for sensor alignment		Web interface for setup: selectable presets, freely selectable averaging, data reduction, setup management; power LED	

[1] All data at constant ambient temperature (22 ±3 °C). Measuring rate 0.5 kHz, moving average over 64 values, measured on an approx. 0.8 mm thick silicon (2 sigma) polished on both sides
[2] Maximum thickness deviation when measuring on an approx. 0.8 mm thick silicon polished on both sides (n = 3.8) when passing through the measuring range
[3] Optional connection via interface module (see accessories)

Article designations

IMS5420xx-THxx wafer thickness measuring system
(e.g. IMS5420-TH24)

IMS5xxx	-THxx
Controller model	**Sensor model**
IMS5420	TH24
IMS5420MP	TH24(204)
IMS5420IP67	TH3/90/IP68
IMS5420IP67MP	

Sensors for wafer thickness measurements
interferoMETER 5420

Sensors for the IMS5420 controller for wafer thickness measurement

Model		IMP-NIR-TH24	IMP-NIR-TH3/90/IP68
Working distance		24 mm ±3.0 mm	3 mm
Operating range		21 ... 27 mm [1]	1 ... 6 mm [1]
Measuring range (Thickness)	Silicon	0.05 ... 1.05 mm [2]	
	Air	0.2 ... 4 mm [3]	
Temperature stability		temperature compensated, stability < ±50 ppm between +10 ... +50 °C	
Light spot diameter [4]		15 µm	
Measuring angle [5]		±1.5°	
Connection	Optical	Pluggable fiber optic cable via FC socket (sensor); see accessories for cable lengths; bending radius: static 30 mm, dynamic 40 mm	Integrated optical fiber 4 m E2000/APC (controller)
Mounting		Radial clamping, mounting adapter (see accessories)	Direct fastening M4; through-bolt connection M3
Temperature range	Storage	-20 ... +70 °C	
	Operation	+10 ... +50 °C (front side)	
Dimensions		Ø10 mm x 25 mm	94 mm x 30 mm x 39 mm
Protection class (DIN EN 60529)		IP65 (front; optional IP67) [6]	IP68
Vacuum		on request UHV (cable and sensor)	-
Special features		-	with integrated air purge system
Material		Stainless steel	

[1] The object being measured must be completely within the working area.
[2] All data at constant ambient temperature (22 ±3 °C). Measuring range at n=3.82 (silicon); measurable thickness depends on doping (see table)
[3] For air gap measurement between two glass plates (n~1) the measuring range is 0.2 ... 4 mm. The measuring object must be within the working distance.
[4] With a working distance of 24 mm (TH-24) or 17.5 mm (204) and 3 mm for TH-3/90/IP68
[5] Maximum sensor tilt angle that produces a usable signal on an approx. 0.8 mm thick silicon in the mid of the measuring range. The accuracy decreases when approaching the limit values.
[6] Other protection classes on request

Connection options for the IMS5420 controller

Controller

IMS5420

IMS5420

Sensor cable

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

C5421-1	Optical fiber, length 1 m
C5421-2	Optical fiber, length 2 m
C5421-3	Optical fiber, length 3 m
C5421-5	Optical fiber, length 5 m

Other lengths up to 20 m on request

With protection class IP67, IP9 SC socket (controller) and FC/APC connector (sensor)

C5421/IP67-0,5	Optical fiber, length 0.5 m
C5421/IP67-1	Optical fiber, length 1 m
C5421/IP67-2	Optical fiber, length 2 m

Sensor

IMP-NIR-TH3/90/IP68

Sensor

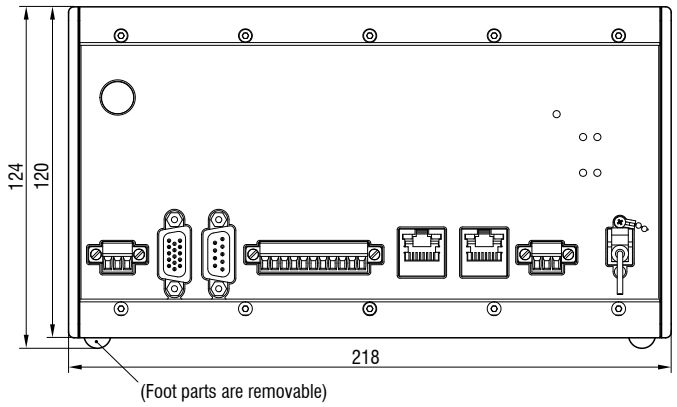
IMP-NIR-TH24

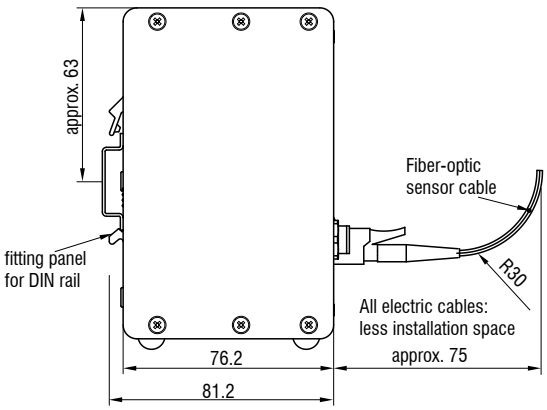
Optional accessories

Adjustable mounting adapters
Sensor mounting adapter

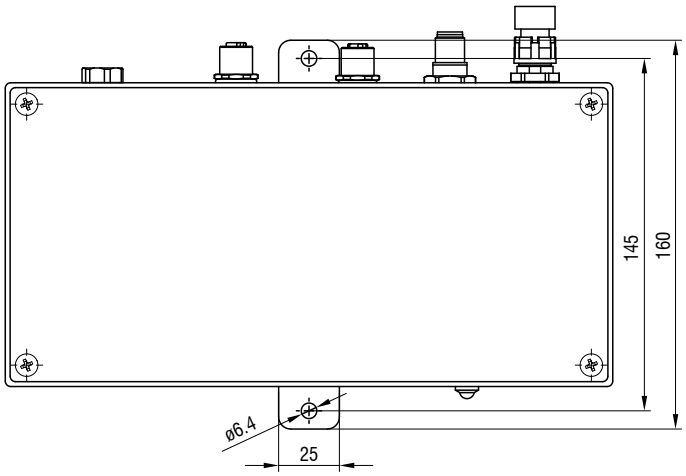
Dimensions

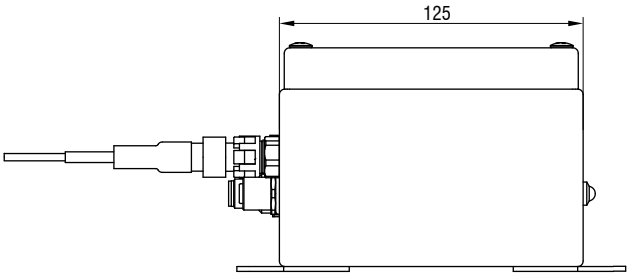
IMC5420 Controller

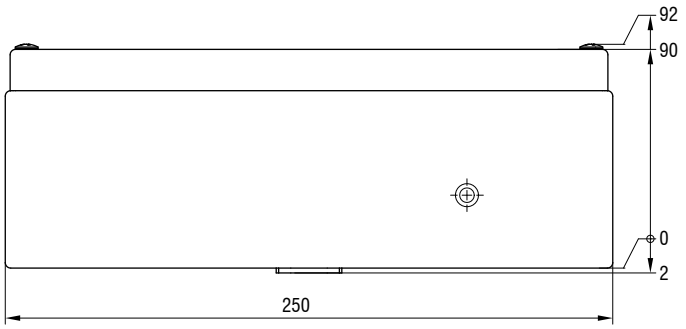




Controller IMC5420/IP67 Controller housing made of stainless steel and protection class IP67



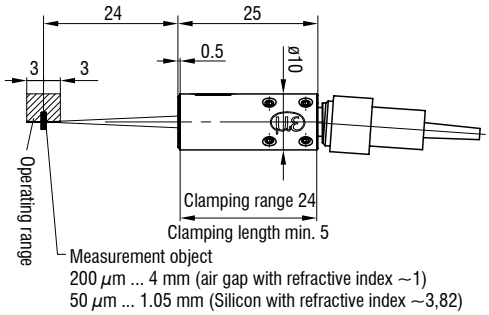




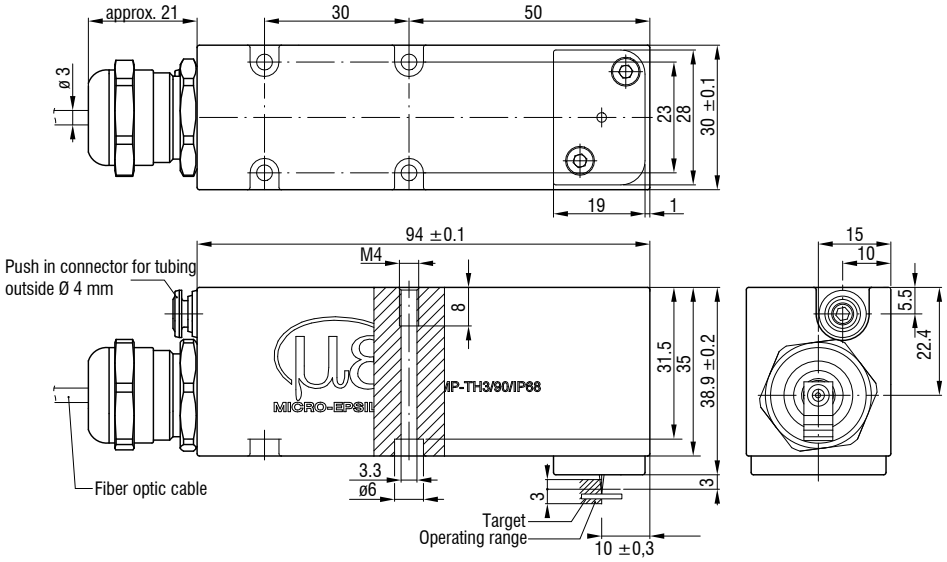
Thickness sensors

IMP-NIR-TH24

E2000/APC Standard connector



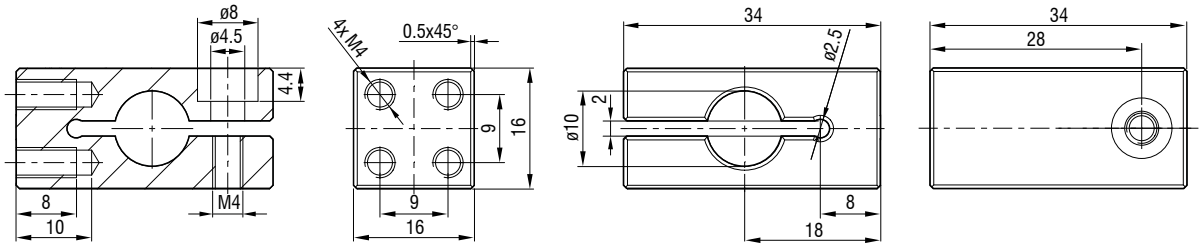
IMP-NIR-TH3/90/IP68



Optional accessories

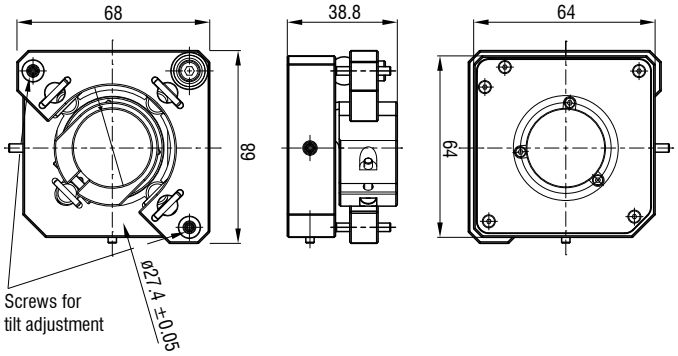
Mounting adapter for IMP-NIR-TH24 sensors

MA5400-10



Optional accessories
interferoMETER

JMA

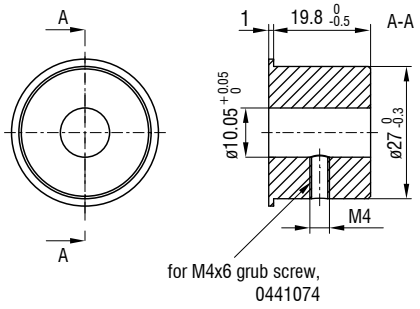


Scope of supply

- Adjustable mounting adapter
- Sensor holder for sensors Ø10 (and Ø20 mm)
- Screwdriver for positioning
- Setup guide

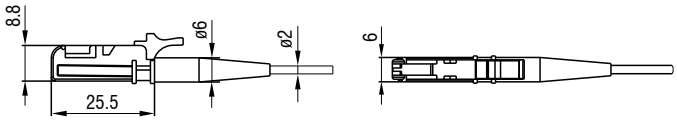
Sensor holder

Sensor holder for JMA-10

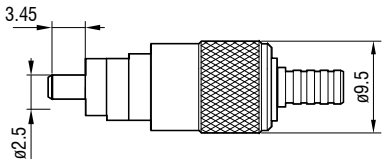


Connector

E2000/APC Standard connector



FC/APC Standard connector



(dimensions in mm, not to scale)

Cables

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

C5421-1	Optical fiber, length 1 m
C5421-2	Optical fiber, length 2 m
C5421-3	Optical fiber, length 3 m
C5421-5	Optical fiber, length 5 m

Other lengths up to 20 m on request

With protection class IP67, IP9 SC socket (controller) and FC/APC connector (sensor)

C5421/IP67-0,5	Optical fiber, length 0.5
C5421/IP67-1	Optical fiber, length 1
C5421/IP67-2	Optical fiber, length 2

Flange for vacuum feedthrough

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

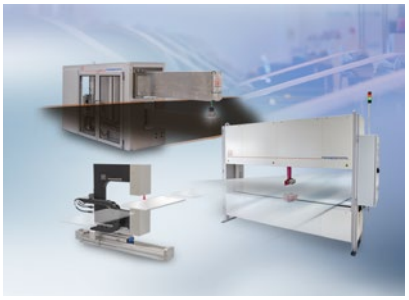
Other accessories

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
IF2035/PNET	Interface module for PROFINET integration
IF2035-EIP	Interface module for EtherNet/IP with DIN rail housing
PS2020	Power supply 24V / 2.5A
EC2471-3/OE	Encoder cable, 3 m

Sensors and Systems from Micro-Epsilon

Sensors and systems for displacement, distance and position

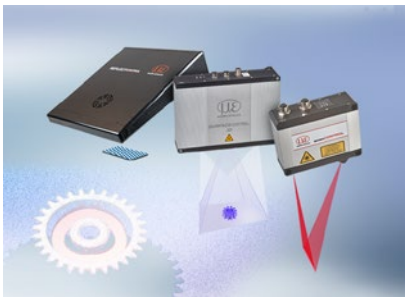
Sensors and measurement devices for non-contact temperature measurement



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

Modifications reserved / Y9761940-A012026LD

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**