



IDS3010

multi-axis laser interferometer

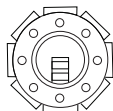
Displacement Sensing for Industry & Synchrotrons

Some of the most important tasks in industrial metrology applications are contactless measurements of distances and displacements, the detection of vibration amplitudes of machine components and tools, and the ultra-precise analysis of rotationally symmetric parts. Fields of application are extremely versatile and range from ultra-precision machining to semiconductor technology.

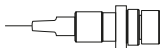
Requirements on accuracy, flexibility, and interconnectivity are constantly increasing and demand for ever more sophisticated solutions. These are supposed to combine highest precision, speed, and reliability - while providing remote access and software maintenance from virtually anywhere. attocube's IDS3010 sensor has been specifically designed for challenging OEM and synchrotron applications and fulfills future requirements on precision already today.



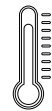
Universal Applicability



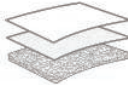
down to 5×10^{-11} mbar
UHV pressure



down to 1,2 mm
min. sensor head diameter

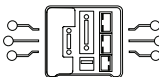


up to 150 °C
bakeable



down to 4% reflective
various surfaces

Compatibility & Traceability



multiple real-time
interfaces



certified accuracy
traceability

Precise & Fast



down to 1 nm
resolution



up to 5 meters
travel range



up to 10 MHz
bandwidth



up to 2 m/s
target velocity



Application Fields

IDS3010

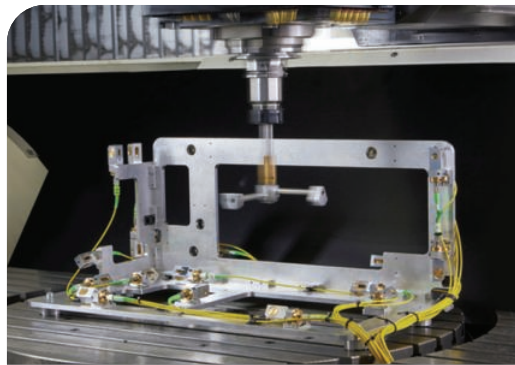
Having roots in the field of fundamental research, attocube offers a profound understanding of material characteristics and applied technologies not only in ambient, but also in extreme conditions. With the core competence in converting complex scientific devices into user-friendly industry products, attocube collaborated with today's technological pioneers and developed the first commercial fiber-based interferometer.

Therefore, the IDS3010 is designed for a broad range of applications where highest precision, reliability, space constraints, or challenging environmental conditions are key. This is especially relevant for the customer groups displayed in this snapshot, but also for many other unique applications. Contact us to discuss your special requirements and setup.



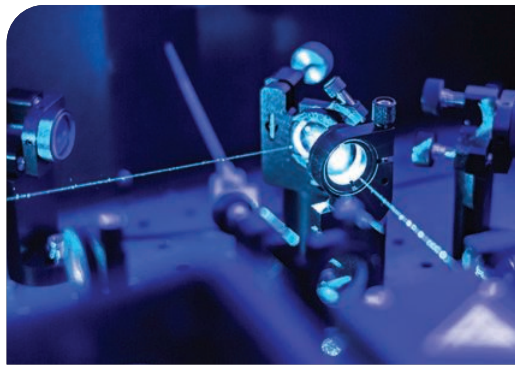
Semiconductor Equipment

high precision components for semiconductor equipment



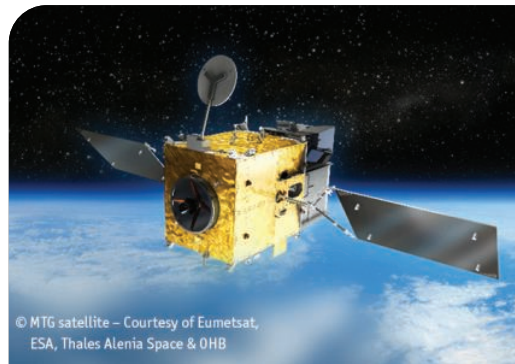
Precision Machining & Metrology

sensoric solutions for calibration and in-line motion control.



Optics and Photonics

precision components for optical systems and photonics assembly



Space

metrology solutions for ground testing and ground-based observatories



Large Scale Facilities

precision components for particle accelerator infrastructure and beamlines



Cryogenic Microscopy

metrology solutions for ultra precise closed-loop motion control

IDS3010 & ECU

specifications

The IDS3010 offers highest measurement performance and extensive connectivity for various environments. In order to reduce position inaccuracy due to air-induced variations of the index refraction, attocube supplies an environmental compensation unit (ECU). The ECU is plug and-play compatible with all IDS models and can be screw mounted.



IDS3010

Sensor IDS3010

Technical Specifications

number of sensor axes	3
working distance	0...5000 mm (depending on sensor head)
sensor resolution	1 µm
sensor repeatability	2 nm *
max. target velocity	2 m/s
measurement bandwidth	10 MHz

Modes of Operation

measurement modes	displacement
remote operation	integrated webserver
output signal: electronics	sin/cos, AquadB, HSSL, linear analog (optional), field bus systems on request
output signal: displacement measurement	laser light (IR)
output signal: alignment laser	laser light (VIS)

Interfaces

analog interfaces (real time)	sin/cos, linear analog (optional)
digital interfaces (real time)	AquadB, HSSL
field bus interfaces (optional)	Biss-C

Controller Hardware

chassis	55 x 52 x 195 mm³
weight	730 g
power supply	12 V DC
power consumption	8 W

Measurement Laser

laser source	DFB laser (class 1)
laser power	400 µW
laser wavelength	1530 nm

* at 20 mm working distance (vacuum); 100 Hz; 3σ

ECU

Technical Specifications

art. no.	1010698
dimensions	28 x 61 x 20.5 mm³
weight	41.5 g
integrated sensors	T, p, rH
interface	RJ12 connector
sensor mount	screw mount
working environment	non condensing
cable length	1,83 m

Measurement Accuracy (Sensors)

T-sensor	±0.1°C (0..50°C)
p-sensor	±1 hPa (300..1100 mbar)
rH-sensor	±2% (10..90%)
typ. accuracy setup	fguaranteed ± 1.0 ppm up to 5m; expected ± 0.0 ppm up to 4,2 m

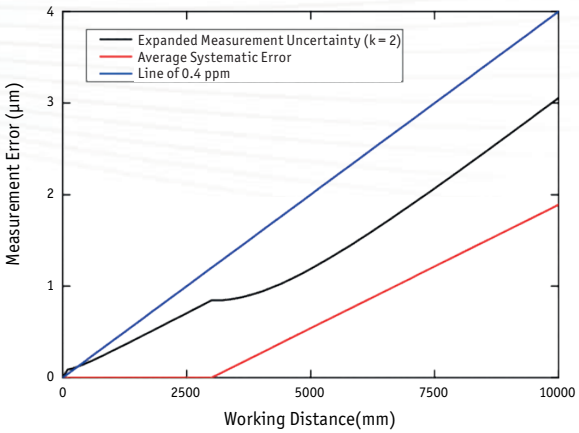


ECU

Certified Accuracy

attocube's IDS3010 was tested by the National Metrology Institute of Germany (PTB). The accuracy of the interferometers has been confirmed at various pressure, humidity and temperature conditions over several days, thus also confirming the high performance and reliability of attocube's ECU (environmental compensation unit). An accuracy of typically better ± 1 ppm can be achieved in air.

Download the calibration certificate for the IDS at our website:

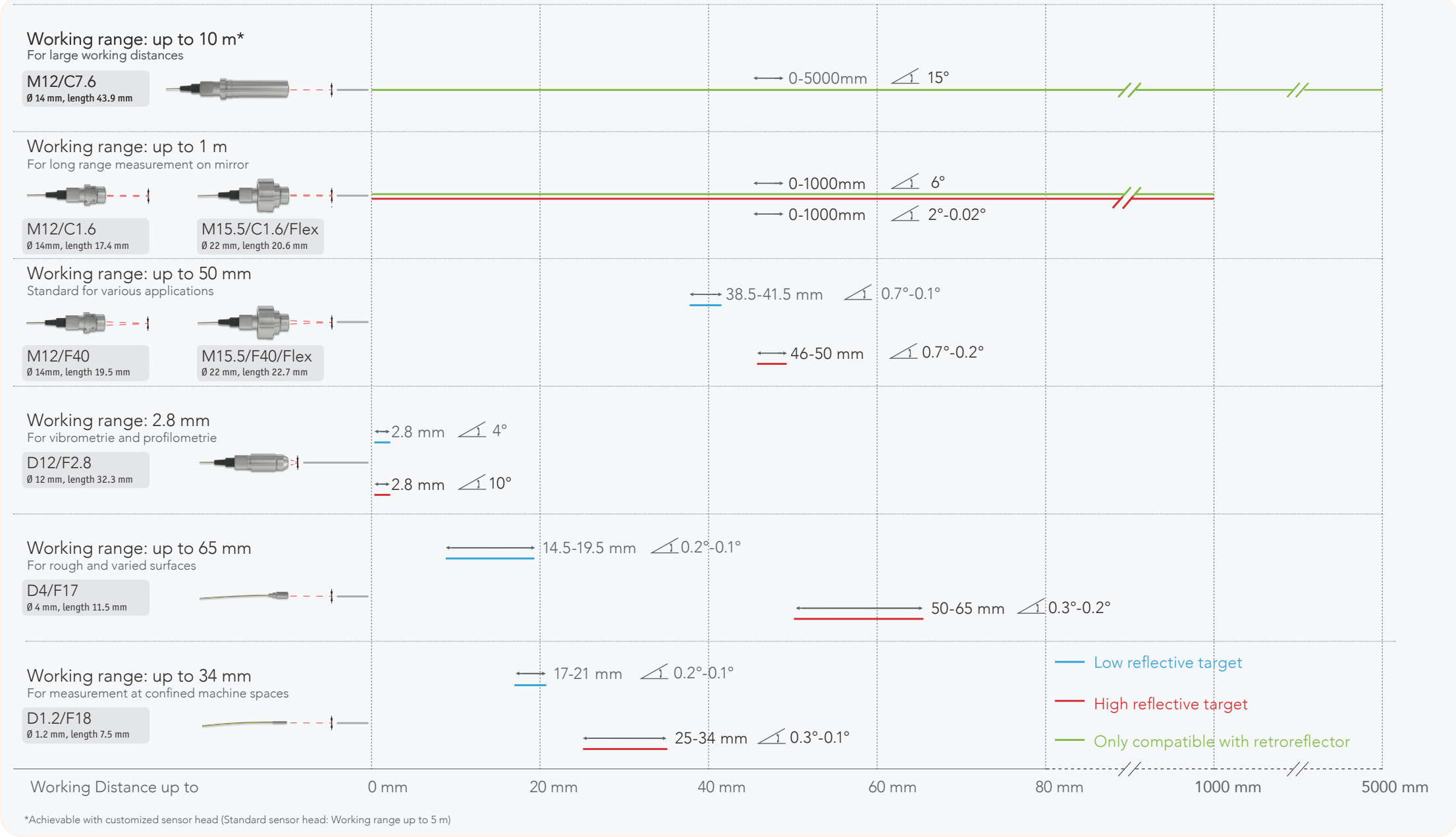


The figure above shows the systematic measurement error and the measurement uncertainty of the IDS as certified by the PTB. They depend on the working distance. The blue line represents a measurement error of 0.4 ppm that surrounds the other lines, while the average systematic error is always lower than 0.19 ppm.

Sensor Head Overview

highest measurement flexibility

The IDS can be operated with different sensor heads: ultra compact heads for the most confined spaces or alternative designs where priority is given to easy alignment or to the compatibility with various target materials (glass, aluminum, ceramic, etc.).



Focusing Sensor Heads

specifications



Sensor Heads	M15.5/F40/FLEX	M12/F40	M15.5/F40/FLEX	D4/F17	D1.2/F18
Modes of Operation					
optics types	focusing	focusing	focusing	focusing	focusing
dimensions	Ø 22 mm, length 22.7 mm	Ø 14 mm, length 19.5 mm	Ø 12 mm, length 32.3 mm	Ø 4 mm, length 11.5 mm	Ø 1.2 mm, length 7.5 mm
mounting	metric M15.5 x 0.5	metric M12 x 0.5	clamped	clamped	clamped
focal length	FC/PC	FC/PC	FC/PC	fiber glued	none (fiber glued)
connector	/RT/LT/HV/UHV/RAD	/RT/LT/HV/UHV/RAD	/RT/LT/HV/UHV/RAD	/RT/LT/HV/UHV/RAD	RT (LT/HV on request)
working environment	easy to mount and align	high versatility	short distance & wide angle	lower surface quality	ultra compact
benefits	monitoring and diagnostics of machine tools components	concentricity tests, detection of imbalances	of various geometrical shapes	deformation monitoring of work pieces during manufacturing	vibration measurements at confined machine spaces
exemplary applications					
Measurement Specifications					
focal length	40 mm	40 mm	2.8 mm	17 mm	18 mm
working range (glass)	38.5..41.5 mm	38.5..41.5 mm	2.8 mm ± 4 µm	14.5..19.5 mm	17..21 mm
alignment tolerance (glass)	± 0.35°	± 0.35°	± 4°	± 0.15°	± 0.175°
working range (mirror)	46..50 mm	46..50 mm	2.8 mm ± 20 µm	50..65 mm	25..34 mm
alignment tolerance (mirror)	± 0.35°	± 0.35°	± 10°	± 0.2°	± 0.3°

Compatible environments

- /RT (ambient conditions): 0 .. 100 °C, 1x10⁻⁴ mbar .. 10 bar
- /HV (high vacuum): 0 .. 150 °C, 1x10⁻⁸ mbar .. 10 bar
- /UHV (ultra high vacuum): 0 .. 150 °C, 1x10⁻¹⁰ mbar .. 10 bar
- /LT (low temperature): mK .. 423 K (150 °C 1x10⁻⁴ mbar .. 10 bar
- /RAD (radiation hard): 0 .. 150 °C, up to 10 MGy radiation dose

Naming Scheme

- F40: focussing head with 40 mm focal length
- C7.6: collimating head with 7.6 mm spot size
- FLEX: flexure structure with integrated (theta, phi) adjustment range
- D4: 4 mm mounting diameter
- M12: M12 x 0.5 metric thread mounting

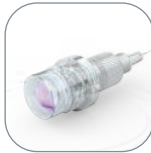
Collimating Sensor Heads

specifications



Sensor Heads	M12/C7.6	M15.5/C1.6/FLEX	M12/C1.6
Modes of Operation			
optics types	collimating	collimating	collimating
dimensions	Ø 14 mm, length 49.2 mm	Ø 22 mm, length 20.6 mm	Ø 14 mm, length 17.4 mm
mounting	metric M12 x 0.5	metric M15.5 x 0.5	metric M12 x 0.5
connector	FC/PC	FC/PC	FC/PC
working environment	/RT/LT/HV/UHV/RAD	/RT/LT/HV/UHV/RAD	/RT/LT/HV/UHV/RAD
benefits	long distances and working ranges	improved mounting & alignment	medium ranges on plane mirror
exemplary applications	calibration of large-scale machine tools	long rang angle detection on mirror	xy wafer stage position control
Measurement Specifications			
beam diameter	7.6 mm	1.6 mm	1.6 mm
working range	up to 5000 mm	up to 1000 mm	up to 1000 mm
alignment tolerance (mirror)	-	± 0.02°	± 0.02°
lateral alignment tolerance (retroreflector)	± 2 mm	± 0.5 mm	± 0.5 mm
alignment tolerance (retroreflector)	± 15°	± 6°	± 6°

* tolerance decreases if angular and lateral movements occur simultaneously



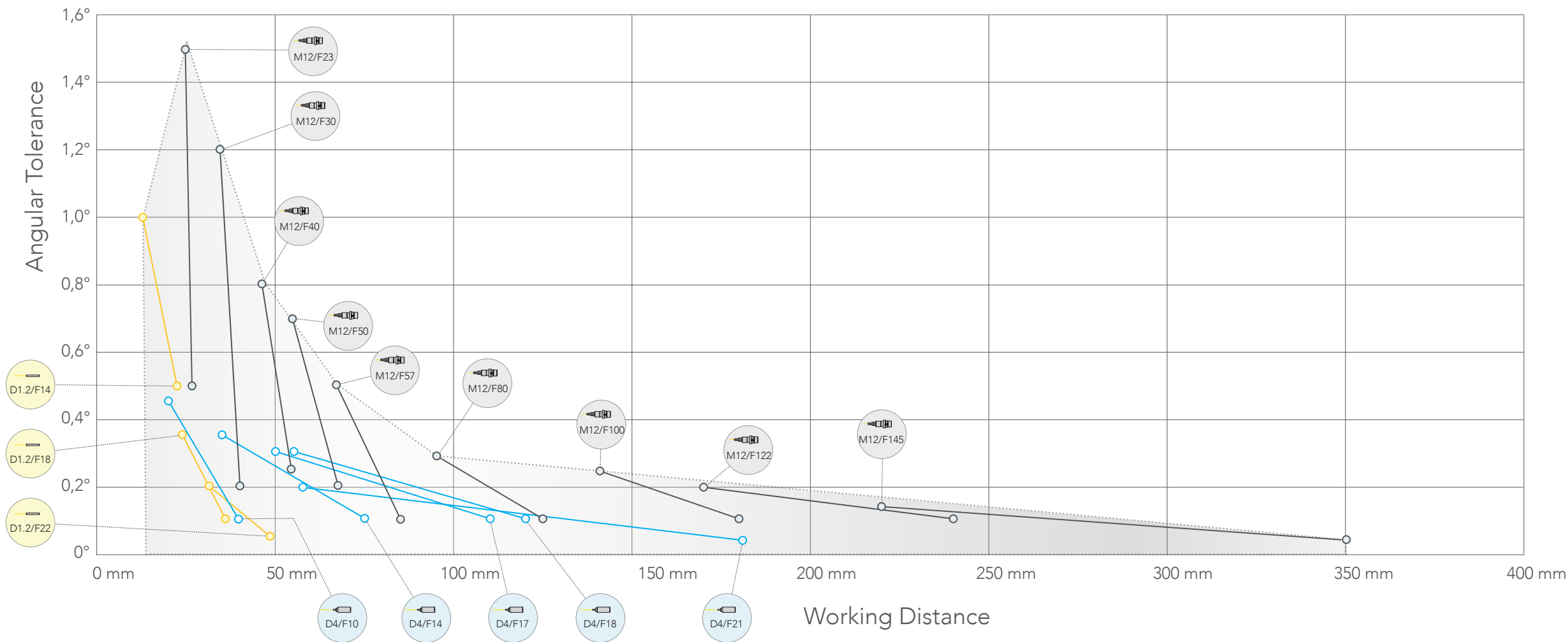
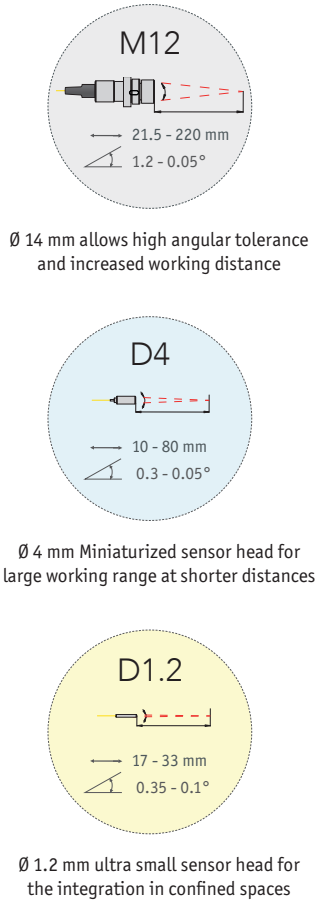
Customized Sensor Heads

Depending on your specific application, modifications concerning the type of optics, focal length, working environment, or filter options are possible.

High Reflective Targets

customized sensor heads

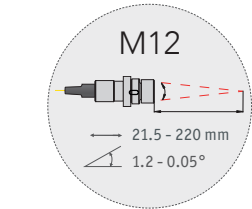
Each line represents one specific sensor head and shows the achievable working distance, working range and corresponding angular tolerance for high reflective targets (e.g. mirrors). The focal length can be freely chosen by the customer to also cover areas in between the shown sensor heads. Please note that the exact values can change in dependence of the specific measurement setup.



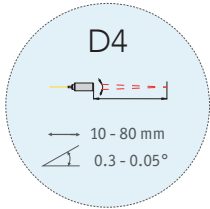
Low Reflective Targets

customized sensor heads

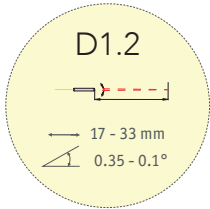
Each line represents one specific sensor head and shows the achievable working distance, working range and corresponding angular tolerance on low reflective targets (e.g. glass). The focal length can be freely chosen by the customer to also cover areas in between the shown sensor heads. Please note that the exact values can change in dependence of the specific measurement set-up.



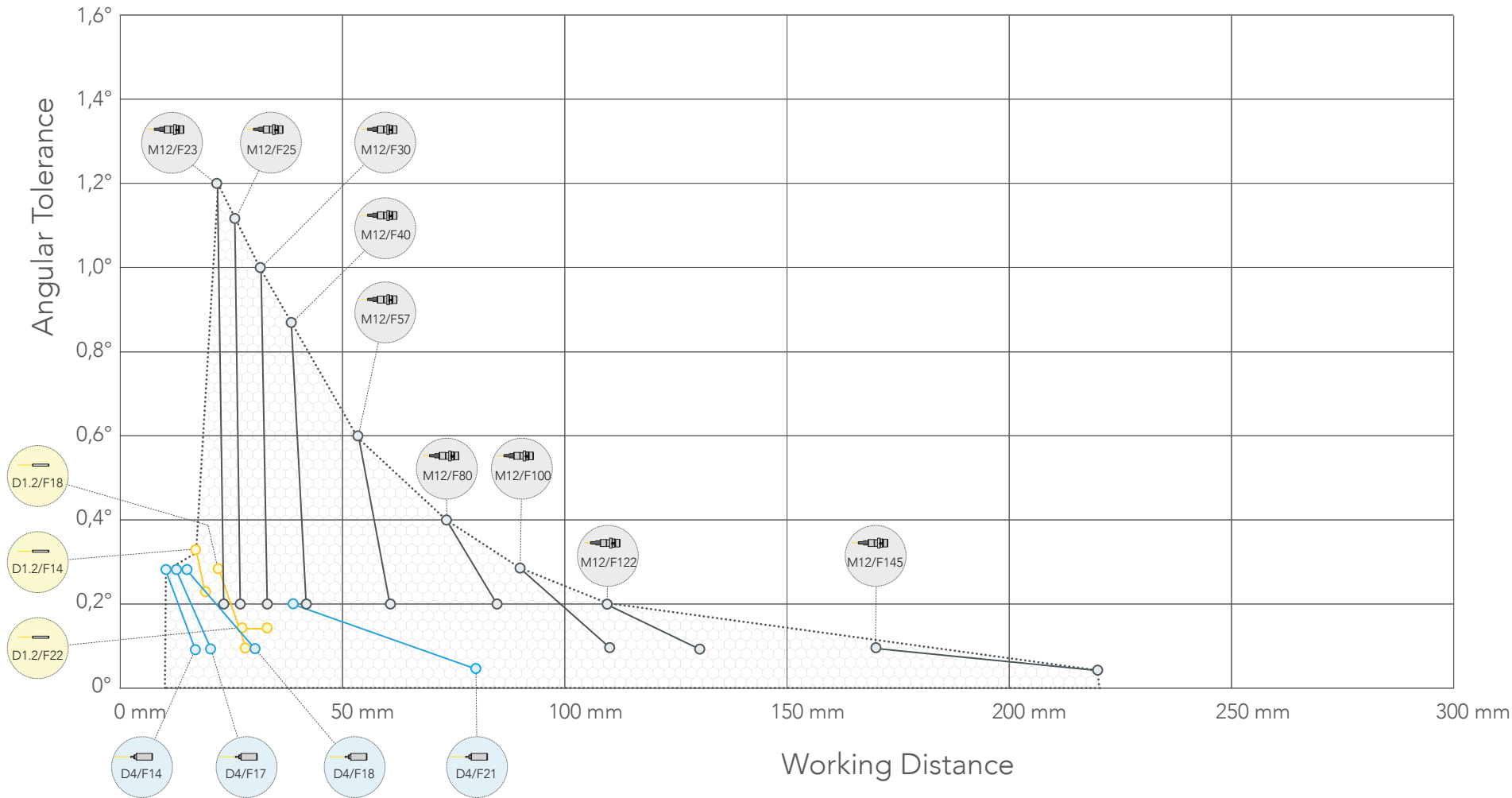
Ø 14 mm allows high angular tolerance and increased working distance



Ø 4 mm Miniaturized sensor head for large working range at shorter distances



Ø 1.2 mm ultra small sensor head for the integration in confined spaces



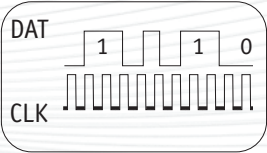


- ① GPIO – General Purpose Input/Output: BiSS-C (real-time)
- ② Main Power
- ③ Ethernet
- ④ HSSL, AquadB, sin/cos, linear analog (real-time)
- ⑤ ECU

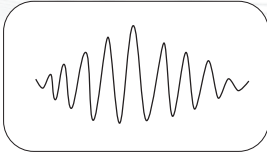
IDS3010

Interface Specifications

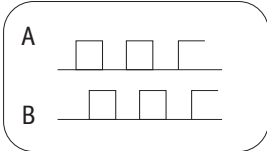
target velocity [m/s]	0.0001	0.0001	0.1	1	2
resolution HSSL (abs.) 8-48 bit, up to 25 MHz [nm]	0.001	0.001	0.001	0.001	0.001
resolution AquadB (inc.) at 25 MHz [nm]	0.004	0.04	4	40	80
resolution Sin/Cos (inc.) at 25 MHz [nm]	0.004	0.04	4	40	80



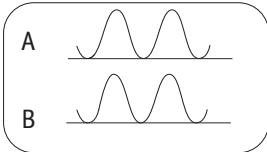
HSSL (digital; bandwidth up to 25 MHz and 8-48 bit resolution): attocube’s proprietary serial word protocol provides absolute position information - both in terms of the protocol and the measurement itself. The HSSL interface consists of one data and one clock signal (single ended or differential); position information is packed into one container of user-defineable bit-length, synchronization with the receiver is accomplished using the clock signal.



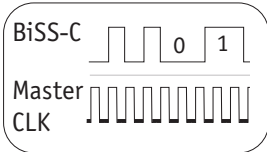
Linear Analog Output (analog; bandwidth up to 25 MHz; resolution freely assignable, 1pm - 2¹² pm, optional): The linear analog output interface is a digitally synthesized analog signal for high-frequency vibrometry applications. It enables the direct post-processing of measurement data with a, AC-coupling of 1.7 V. An adaptable high-pass filter prevents a drifting of the signal. The linear analog output is best used with differential signaling.



AquadB (digital; bandwidth up to 25 MHz; resolution freely assignable): The AquadB interface provides incremental displacement information on target displacement. Position resolution and (maximum) clock rate can be user defined using the IDS web interface. For maximum data bandwidth, the AquadB interface is best used with differential signaling.



Sin/cos (analog; bandwidth up to 25 MHz; resolution freely assignable, 1pm - 2²⁴ pm): The sin/cos signal is a digitally synthesized analog signal which provides incremental position information. As with the digital AquadB signal, the increment (i.e. resolution) is user-definable in the system's web interface. For maximum data bandwidth, the sin/cos signal is best used with differential signaling.



BiSS-C (digital; bandwidth up to 10 MHz; resolution freely assignable, 1pm – 2¹⁵ pm) is available as an own version of the interferometers. It provides point-to-point topology for data communication with motion controllers and is especially suitable for the easy integration of several sensors to an external master clock at multi device facilities such as synchrotrons and spallation sources. BiSS-C signals are routed through the 14 pin GPIO connector (all other real-time interfaces are disabled in this mode) and they are based on the differential RS-422 standard.

Software

saving and visualizing data



① Stopping and continuing data displaying

WAVE includes a function that stops the current displacements display to enable users to zoom into past data. The FFT plot automatically adapts to the zoomed time period.

② Time and displacement zoom: analyzing while measuring

The streaming function facilitates users to zoom into past measurements for a more detailed investigation of the captured motions.

③ Displacement data visualization: time-saving measurements

The window shows displacement data of the last 60 seconds at a low streaming rate of 1 kHz. For measurements requiring a higher bandwidth, like vibration analyses, the window can display data of the last 5 seconds at a streaming rate of 1 MHz (for one axis)

④ FFT Analysis: analyzing vibrations and overshoots

The real-time Fast-Fourier Transformation (FFT) enables frequency analyses of displacement data that are used for detecting the resonance frequency of components or for analyzing the spreading of mechanical oscillations.

⑤ Data cursor and saving in pause mode

During the Pause mode, moving the mouse over the plot will show the measurement values. It is possible to directly save the marked measurement data as a .csv-file during the pause mode.

⑥ Optional: manually defined formulas

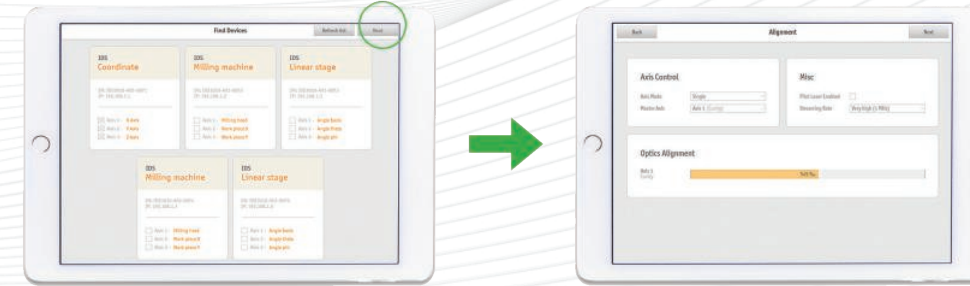
The optional available WAVE Feature Math allows for live computing and displaying the measurement signals. This enables to show more complex measurement data, e.g. differential measurements or angular measurements.

⑦ Optional: Advanced vibration analysis

The optional available WAVE Feature Vibro allows for changing window functions of the FFT and visualizing the signals as a power spectral density chart - even with logarithm axes.

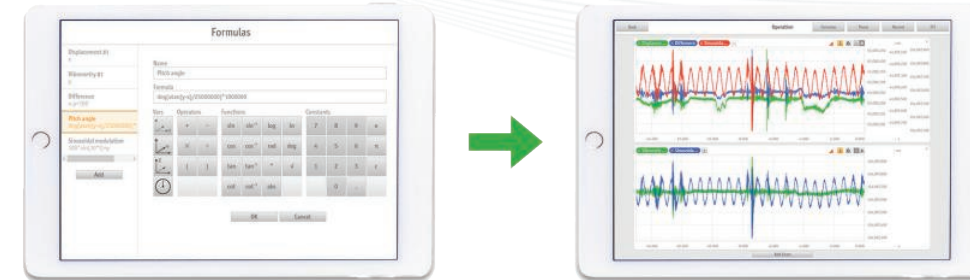
Device overview and alignment

The software tool WAVE displays all IDS devices that are connected to the computer (directly or via network). Furthermore, the alignment routine is also included.



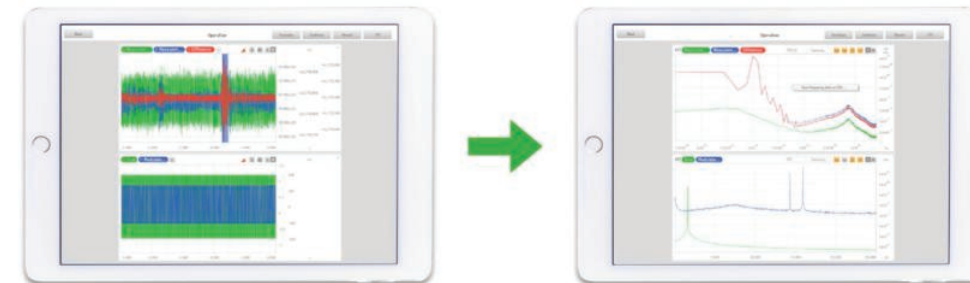
Optional: WAVE Math for mathematical operators and functions

The WAVE Feature Math allows for defining specific formulas for the measurement signals using operators (+, -, x, ÷), trigonometric or logarithmic functions. This facilitates to visualize differential displacements/vibrations or changes of tip-/tilt angles.



Optional: WAVE Vibro for live vibration analysis and visualization

The WAVE Feature Vibro allows for changing window functions of the FET and visualizing the signals as a power spectral density chart - even with logarithm axes. In pause mode, the FFT/PSD-data can be directly exported into a csv-file. These functions reduce the time for post-processing vibration data.



attocube systems AG Eglfinger Weg 2 | 85540 Haar
Germany | info@attocube.com | www.attocube.com

© 2022-01, attocube systems AG



Loan Kit

attocube's laser interferometer is suitable for a broad field of applications. For checking the performance of the IDS3010 and ensuring the suitability of a specific sensor head under real application conditions, attocube offers a loan service for extensive testing.