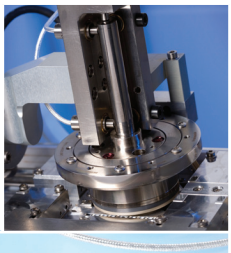
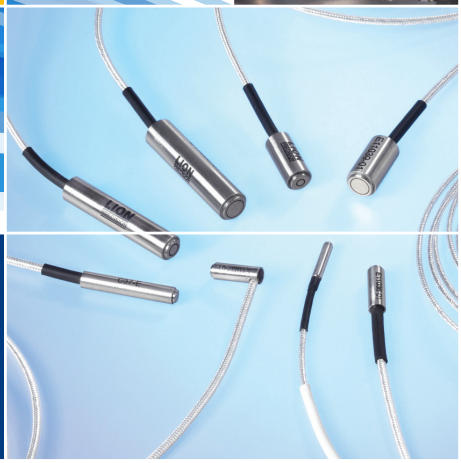
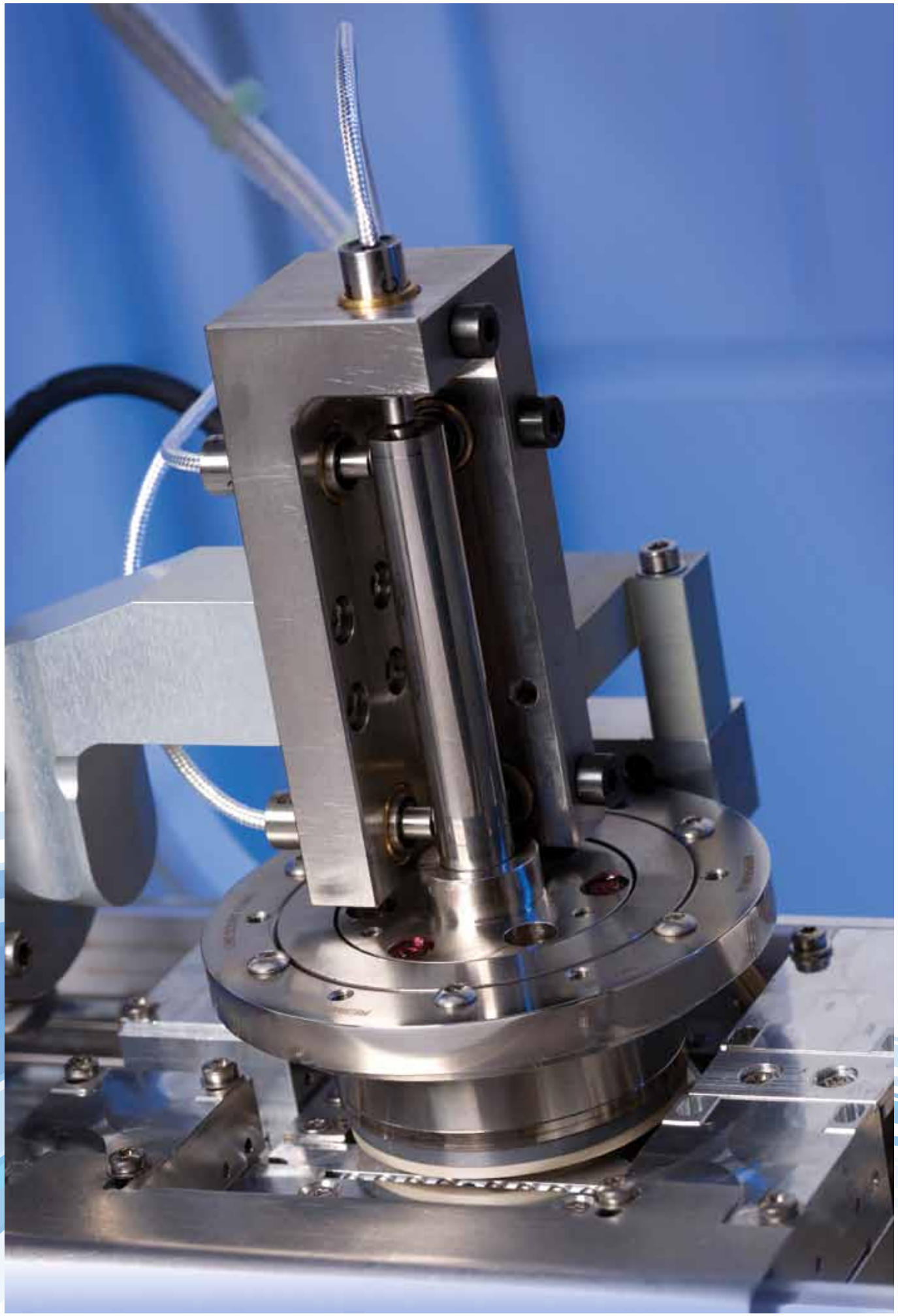
IBS
Precision Engineering

Understanding the true
meaning of **precision**





Non-contact position and displacement **measuring systems**



Contents


CPL190
ZERO
CPL190
ZERO
LION

Introduction and applications

For ultra-precision position and displacement measurement applications, non-contact methods offer several advantages.

They provide high dynamic response, measurement resolutions down to picometers, have low (or no) hysteresis, and can measure small, fragile parts with no risk of damaging delicate structures.

At IBS Precision Engineering we are expert in measurement solutions. For over 20 years we have been working with world-leading sensor provider Lion to deliver simply the best position and displacement measurement systems on the market. This means outstanding resolution, speed and reliability.

From servo controls for scanning electron microscopes to production quality controls for the latest disk drives, our sensors deliver precision where it counts.

LION PRECISION

Example applications:

We provide sensor technologies based on capacitive or eddy-current technologies. Capacitive sensors provide extremely high precision and are ideal for clean environments. Eddy-current sensors provide high precision and are robust to a broader range of environments. Typical applications include:

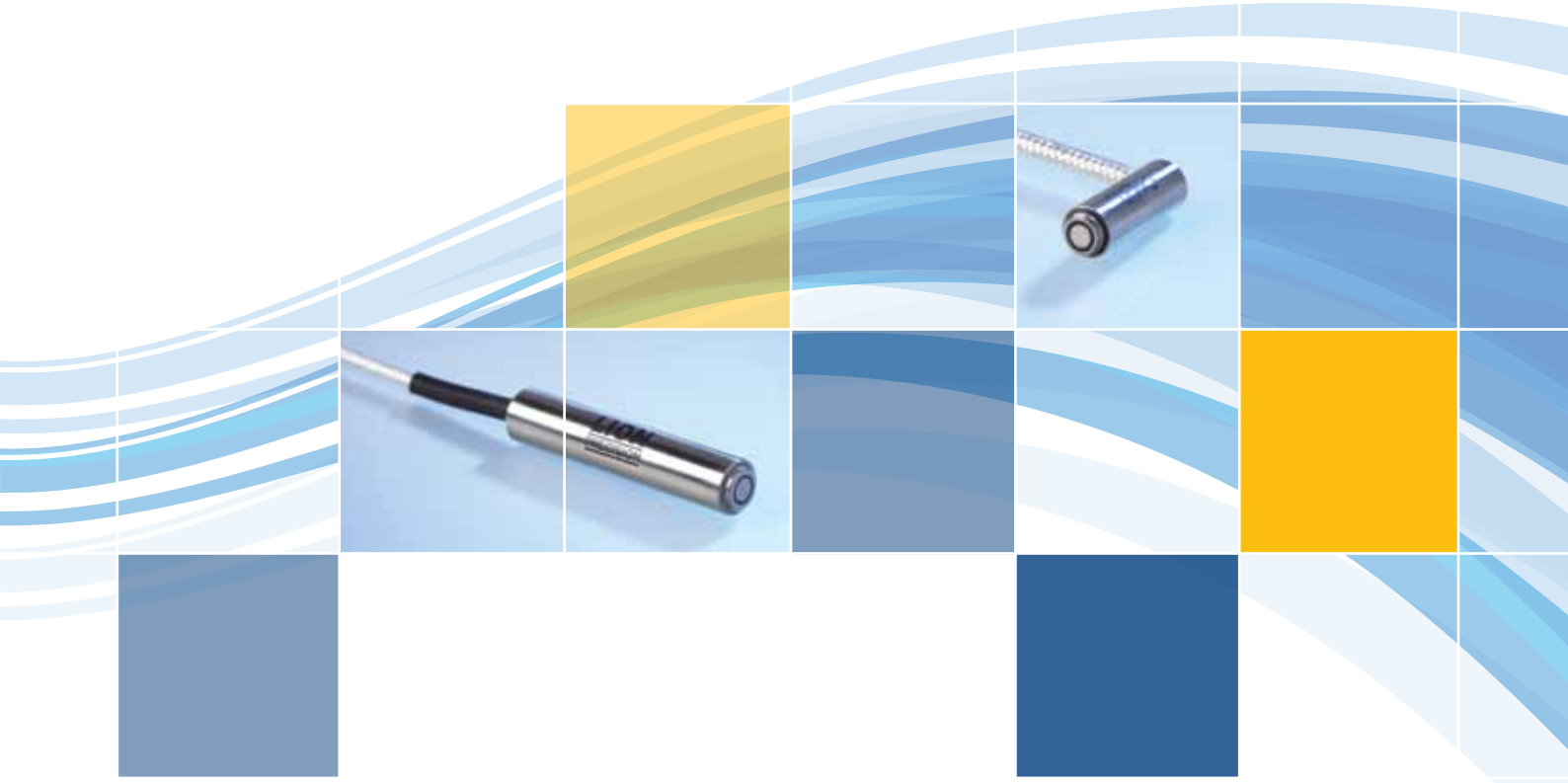
- Position or displacement measurement
- Thickness measurement
- Run-out / eccentricity measurement
- Deformation measurement
- Vibration measurement

See p30 for specific examples.

Designed for the highest performance, we deliver resolutions down to 50 picometers; bandwidths up to 100kHz and vacuum compatibility where required. Sensors are designed using the best materials. They employ advanced algorithms and electronic designs to ensure they are very linear, stable with temperature, and able to resolve incredibly small changes in target position to deliver ultra high resolution measurement. They can be provided in standard or tailored formats.

For our capacitive systems, please see pages 6 – 14.

For our eddy-current systems, please see pages 15 – 29.



Capacitive position and **displacement** measurement

In capacitive position sensors, the sensor surface acts as an electrified plate. This plate is brought into close proximity of the target, which acts as a second plate. Electronics continuously change the voltage on the sensor surface by an excitation voltage. The amount of current required to change the voltage is detected by the electronics and indicates the amount of capacitance between sensor and target.

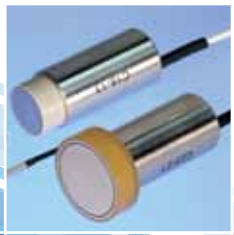
As the size of the sensor and the target, and the dielectric medium between them (usually air) remains constant, the only variable is the gap. All changes in capacitance are therefore the result of a change in the position of the target relative to the sensor. The sensor driver is calibrated to provide a specific voltage for a corresponding change in capacitance (i.e., gap or displacement). In turn this allows the displacement or position to be determined.

Target Material and Thickness

The electric field of a capacitive sensor seeks a conductive surface, meaning that these sensors are not affected by the target material (magnetic, nonmagnetic) provided that it is a conductor. Because the electric field resides at the surface of the conductor, target thickness is not important so conductive coatings can be measured as well as thicker conductive bodies.

Environment

Although capacitive sensors are not affected by the magnetic properties of a target, they are sensitive to the medium in the gap between the sensor and the target. Maintaining a steady dielectric constant in the gap is therefore important. The dielectric constant of air increases with humidity and will change the capacitance between sensor and target. Furthermore, moisture and other fluids can migrate into the sensor and negatively interact with its construction. Capacitive transducers are therefore not recommended for applications characterized by excessive dirt, dust, water, machining fluids, or oils.



Capacitive measuring systems overview

Our state-of-the-art capacitive systems offer world beating accuracy and unmatched speed.

A range of systems is available depending on your needs: resolution; speed; ease of integration or all three. The capacitive position or displacement measuring system consists of a driver and probe(s). Each driver offers a range of probes. System performance is determined by the driver-probe combination. In this way the optimum system for your requirements can be specified.

Systems are factory calibrated for the chosen range and a traceable calibration certificate provided. Table 1 provides an overview of available drivers and their performance specifications.

Standard probes

The two primary aspects of a probe are body style and sensor area. The probe model number indicates these two aspects. For example, a C8-2.0 probe means a cylindrical probe with 8 mm diameter body and a 2,0 mm diameter sensing area. All probes offer:

- Special low-noise cable
- Thermally compensated to minimize drift
- Vacuum compatible as option

Tailored probes

Sometimes a unique probe shape or size is the only way to perform a specific measurement. We have extensive experience in the design and delivery of custom probes. Please contact us to discuss your needs.

Overview of Capacitive Measurements Systems (Table 1)

Driver name:	CPL490	CPL190/290	CPL230	CPL350
Strength	Best performance / bandwidth up to 50 kHz / modular design	High performance / modular design	Great performance / Compact size / Multi-channel	Great performance / Compact size / Single channel
Maximum resolution	0,05 nm @ 1 kHz	0,05 nm @ 100 Hz	0,07nm @ 100 Hz	0,07 nm @ 100 Hz
Typical resolution @ 15 kHz	0,0007% F.S.* RMS	0,003% F.S.* RMS	0,004% F.S.* RMS	0,004% F.S.* RMS
Max. bandwidth	50 kHz	15 kHz	15 kHz	15 kHz
Measurement range	10 - 100 µm	10 µm - 12,5 mm	10 µm - 12,5 mm	10 µm - 12,5 mm
Typical linearity	0,2% F.S.*	0,2% F.S.*	0,5% F.S.*	0,5% F.S.*
Number of channels	1-3	1-8	1-6	1
Zero/Offset adjust	Yes	Yes	No	No
Typical thermal drift	0,02% F.S.*/°C	0,04% F.S.*/°C	0,04% F.S.*/°C	0,04 F.S.*/°C
LED range indicator	Yes	Yes	No	No
Cost indication	€€€	€€	€	€
Other features	Optional signal processing and meter module / Easy DAQ connection	Optional signal processing and meter module / Easy DAQ connection	Embeddable / OEM design	Embeddable / OEM design
More details & probe options (click a system name)	CPL490	CPL190/290	CPL230	CPL350

* A probe is also refered to as sensor / F.S. = full scale

CPL490 Series

Ultimate Precision and Speed

The CPL490 is our highest performing dynamic capacitive measurement system delivering very high precision for very high speed applications. With high bandwidth resolutions up to 10 times greater compared to our other systems, we are proud to offer the most precise dynamic capacitive displacement system in the world.

At 1 kHz bandwidth, resolution is as low as 50 picometers. At 50kHz bandwidth, a remarkably high frequency for capacitive measuring systems, the precision is still less than 0,3 nanometers.

Key specifications

- Resolution down to 50 picometer (@1kHz)
- 1, 10, 15, 50 kHz bandwidth* (user selectable)
- Ranges from 10 to 200 µm
- Linearity 0.2%
- Temp. range 15-40 °C
- Small phase shift (excellent for servo applications)

Output features

- Adjustable zero
- Analog output (±10 V BNC)
- Differential output (±10 V National Instruments 68-pin connector)
- Up to 3 channels per systems

*100kHz available on request.

Probe choices

A range of advanced probes is available for the CPL490, each containing active electronics. The resolution depends on the selected probe, range and bandwidth.

Please note, the flat target surface diameter must be 1,3 times larger than the sensing area diameter to maintain specifications. The standard cable length is 2,0 meters.

CPL490 Probe Options

Probe model	Sensing area	Range (µm)†	Linearity (% F.S.*)	Resolution (nm) @ 1kHz	@ 10 kHz	@ 15 kHz	@ 50 kHz
2G-C8-0.5	0,5 mm	20-30	0,04	0,05	0,07	0,09	0,26
		25-75	0,02	0,17	0,27	0,35	1,0
		50-150	0,03	0,38	0,8	1,0	3,3
2G-C8-1.2	1,2 mm	25-75	0,02	0,15	0,20	0,22	0,63
		50-150	0,02	0,33	0,40	0,52	1,7
		100-300	0,02	0,68	1,0	1,3	3,8

† near gap-far gap

* F.S. = full scale

CPL190/CPL290 Series

Outstanding Performance, Flexible Modular Design

The CPL190 and CPL290 series set an industry standard for the combination of outstanding bandwidth, accuracy and resolution. With bandwidths up to 15 kHz, it offers signal to noise ratios low enough for sub nanometer resolution.

A modular system design supports up to 8 channels per system, synchronized to one another and with zero cross talk. This system is ideal for high precision applications both in the lab or integrated into instruments or machines.

The series is available in both single (CPL190) and dual (CPL290) range format.

Key specifications

- Resolution down to 50 picometer (@100Hz)
- 100 Hz, 1kHz, 10 kHz, 15kHz bandwidth (user selectable)
- Ranges from 10µm to 12.5mm
- Linearity 0.2%
- Temp. range 4-50 °C
- Dual range option (CPL290)

Output features

- Adjustable zero
- Analog output (±10 V BNC)
- Differential output (±10 V National Instruments 68-pin connector)
- LabView plug & play compatibility
- Up to 8 channels per system (synchronized)

Optional modules

MM190 Signal Processing and Display Module

- Five-digit display (metric or inch)
- Summing: A, B, A+B, A-B of any two channels
- Peak-capture: Max, Min, TIR, Tracking TIR (Self-resetting TIR)
- Analog output of conditioned signal through BNC
- Differential, analog output of conditioned signal through National Instruments 68-pin connector

TMP190 Index and Temperature Module

- Seven thermistors included
- Index and encoder inputs
- +5V and +15V encoder/prox power
- Single-ended or differential encoder input
- Encoder and index state indicators

Enclosures

The CPL190 and 290 systems come in a range of enclosures suitable for 1 - 8 sensors (1-, 2, 3-, 6-, 8-slots options).

Probe choices

Probe model numbers include shape (C=Cylindrical, R=Rectangular) and diameter or longest side in mm. (Full dimensions p14). Please note, the flat target surface diameter should be 1,3 times larger than the sensing area diameter to maintain specifications.

CPL190/290 Probe Options

Probe model	Sensing area	Range (µm)†	Linearity (% F.S.*)	Resolution (nm) @ 100Hz	@ 1 kHz	@ 10 kHz	@ 15 kHz
C3, C5	0,5 mm	20-30	0,25	0,06	0,10	0,40	0,50
		50-100	0,25	0,30	0,50	3,0	4,0
		60-140	0,25	0,50	1,0	5,0	
C3, C5	0,8 mm	75-100	0,15	0,2	0,5	1,2	1,5
		100-200	0,15	0,5	1,0	3,5	5,0
C5, C8	2,0 mm	20-30	0,15	0,05	0,08	0,15	0,25
		75-125	0,15	0,2	0,3	0,6	1,0
		125-375	0,10	0,8	1,0	4,0	5,0
		125-625	0,15	1,5	3,0	8,0	10
C8	3,2 mm	125-175	0,2	0,25	0,4	1,0	1,6
		250-750	0,15	2,0	3,0	6,0	10
		250-1500	0,2	10	15	20	30
C9,5, R20	5,6 mm	225-275	0,2	0,3	0,4	0,8	1,3
		500-1000	0,15	2,5	3,0	7,0	10
		250-2250	0,2	7,0	10	20	30
C18	13 mm	2000-4000	0,5	20	30	35	40
		2000-5200	0,5	30	40	50	60
		3000-8000	0,5	75	100	130	150
R45	19 mm	5000-7500	0,3	50	70	90	100
		3000-9000	1,0	90	120	160	180
C25	21 mm	5000-13000	0,5	75	100	130	150
		5000-17500	0,5	130	180	230	250

†near gap-far gap

* F.S. = full scale

CPL230/CPL350 Series

High Performance For Embedded Applications

The CPL230 and CPL350 systems offers high performance in a compact format; ideal for embedded or OEM applications. With one to six sensors available in a small footprint, they offer an adjustment free solution designed for easy integration.

Available in a single channel (CPL350) or multi-channel (CPL230) format; CPL230 channels may be synchronized for analysis of a common target.

Key specifications

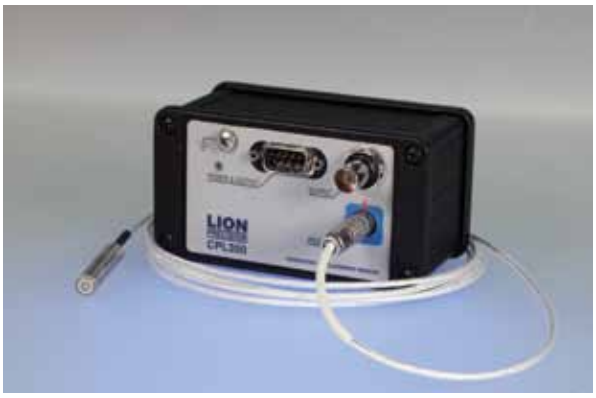
- Resolution down to 80 picometers (@ 100 Hz)
- 100 Hz, 1 kHz, 10 kHz, 15 kHz bandwidth (user selectable)
- Ranges from 10 µm to 12.5 mm
- Linearity 0,5%
- Small size, ideal for OEM and embedded applications

Output features

- Analogue output (BNC ±5 V CPL230; ±10 V CPL350)
- Differential output (±10 V)
- Up to 6 channels per system (synchronized)

Probe choices

Probe model numbers include shape (C=Cylindrical, R=Rectangular) and diameter or longest side in mm. (Full dimensions p14). Please note, the flat target surface diameter should be 1,3 times larger than the sensing area diameter to maintain specifications.



CPL230/CPL350 Probe Options

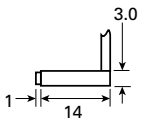
Probe model	Sensing area	Range (µm)†	Linearity (%F.S.*)	Resolution (nm) @ 100Hz	@ 1 kHz	@ 10 kHz	@ 15 kHz
C3, C5	0,5 mm	20-30	1,0	0,08	0,14	0,56	0,7
		50-100	0,50	0,42	0,7	4,2	5,60
		60-140	0,50	0,70	1,40	7,0	
C3, C5	0,8 mm	75-100	0,50	0,28	0,7	1,7	2,1
		100-200	0,50	0,7	1,4	4,9	7,0
C5, C8	2,0 mm	20-30	1,0	0,07	0,11	0,21	0,35
		75-125	0,3	0,28	0,42	0,84	1,4
		125-375	0,3	1,1	1,4	5,6	7,0
		125-625	0,3	2,1	4,2	11	14
C8	3,2 mm	125-175	0,3	0,35	0,56	1,4	2,2
		250-750	0,3	2,8	4,2	8,4	14
		250-1500	0,3	14	21	28	42
C9,5, R20	5,6 mm	225-275	0,3	0,42	0,56	1,1	1,8
		500-1000	0,3	3,5	4,2	9,8	14
		250-2250	0,3	9,8	14	28	42
C18	13 mm	2000-4000	0,5	28	42	49	56
		2000-5200	0,5	42	56	70	84
		3000-8000	0,5	100	140	180	210
R45	19 mm	5000-7500	0,5	70	100	100	140
		3000-9000	1,0	130	170	220	250
C25	21 mm	5000-13000	0,5	100	140	180	210
		5000-17500	0,5	180	250	320	350

†near gap-far gap

* F.S. = full scale

Capacitive Probe Dimensions

C3R



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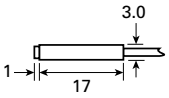

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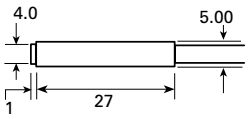

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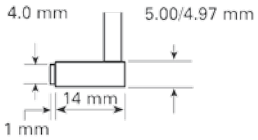

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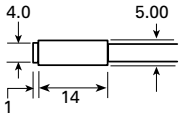

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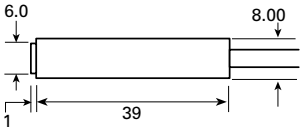

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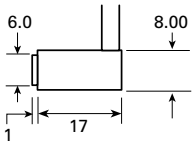

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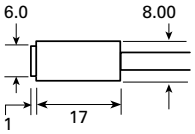

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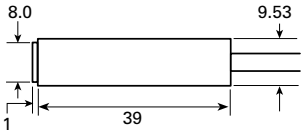
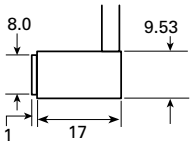
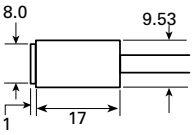


C9.5R



C9.5S



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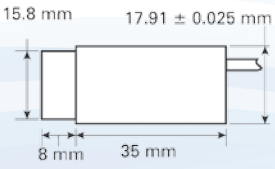

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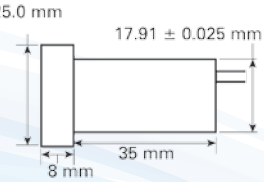
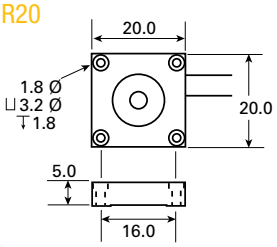
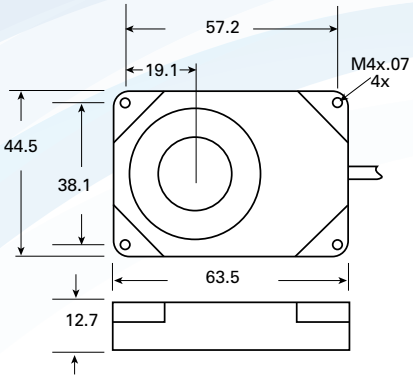


R20



R45



Eddy-current position and displacement measurement

Eddy-current sensors make use of electromagnetic induction to measure distance or displacement. The sensor incorporates a conducting helical coil of wire. When the sensor is placed in close proximity to a conducting target, the magnetic field associated with this coil sets up currents in the target. These currents produce magnetic fields which act to counter the magnetic field of the coil.

The interaction between the magnetic field of the coil and that produced in the target changes with the distance between the sensor and target. Measuring this effect provides a basis for determining the target-to-sensor position information. For precision displacement measurement and metrology applications, complex electronic designs are required to execute complex mathematical algorithms. Working in partnership with Lion Precision, we offer such high-performance sensors, which have outputs which are very linear, stable with temperature, and able to resolve incredibly small changes in target position resulting in high resolution measurements.

Environment

Eddy-current position sensors, are not affected by non-conductive materials in the sensor-to-target gap. This feature offers distinct advantages as these sensors are robust to dirt, dust and liquids such as machining fluids and oils. This insensitivity combined with their precision makes them indispensable in today's modern industrial operations.

Target material

The ideal target material for eddy current position and displacement measurement sensors are non-ferrous materials with low electrical resistance; materials such as aluminium, brass, and copper. However ferrous target materials can be used efficiently as well. In this instance, for optimum performance the sensor is supplied calibrated against the target material to be used in the application.

Eddy-current position and **displacement measuring** systems overview

For precision displacement, position measurement or metrology applications in environments involving liquids, dirt or other contaminants our high performance Eddy current measuring systems provide an outstanding solution. Low noise and very high speed are just some of the advantages.

The system consists of a driver and probe that, together with the calibration, determine the performance specifications. Table 2 provides an overview of available drivers and related performance. Further details, including the probes available for each driver is described in the following pages.

Systems are factory calibrated for the chosen range and material. A traceable calibration certificate is provided.

Critical specifications

- Nanometer resolution
- High bandwidth (up to 80 kHz)
- Low noise
- Great linearity
- Low temperature coefficient
- Insensitive to humidity and environmental contamination
- Vacuum compatible as option

Applications

Our high performance Eddy current sensors offer the best resolution available in an industrial environment. They are ideal for measuring high speed linear motion or rotating targets for example: valve stroke; shaft concentricity, axial or relative displacement; spindle thermal growth or vibrations; liquid gaps; measurements through foils; detection of moving objects for process control. They are suitable for pressurized or nuclear environments and can address large temperature ranges.

Overview of Eddy Current Measurements Systems (Table 2)

Driver name:	ECL202	ECL150	ECW110	ECL101	ECA101
Strength	Best performance	Multiple channel	Wireless system	Wide bandwidth	Basic non-linear
Maximum resolution	30 nm @ 100 Hz	35 nm @ 250 Hz	100 nm @ 1kHz	200 nm @ 80 kHz	60 nm @ 10 kHz
Typical resolution @ 15 kHz	0,007% F.S.* RMS	0,007% F.S.* RMS	0,007% F.S.* RMS	0,009% F.S.* RMS	0,02% F.S.* RMS
Max. bandwidth	15 kHz	15 kHz	1 kHz	80kHz	10 kHz
Selectable bandwidth (kHz)	0,1, 1, 10, 15	0,25, 1, 10, 15	1	80	10
Typical linearity	0,2% F.S.*	0,2% F.S.*	0,2% F.S.*	0,5% F.S.*	Non linear
Multichannel	No	Yes	Yes	No	No
Zero/Offset adjust	Yes (button)	No	No	Yes (screw)	Yes (screw)
Gain adjust	No	No	No	Yes (screw)	Yes(screw)
Setpoint / switch output	Yes	No	No	No	Yes
Typical thermal drift	0,01% F.S.*/°C	0,01% F.S.*/°C	0,01% F.S.*/°C	0,04% F.S.*/°C	0,2 F.S.*/°C
LED range indicator	Yes	Yes	No	Yes	Yes
Field calibration	No	No	No	Yes	Yes
Cost indication	€€€	€€€	€€€	€€	€
Other features	Digital technology, DIN Rail Bus for multiple units	Digital technology, IP6	Wireless communication to laptop or PC. 802.11 b/g/n standard.	Din rail mount	Din rail mount. Also available as OEM driver
More details & probe options (click a system name)	ECL202	ECL150	ECW110	ECL101	ECA101

* A probe is also refered to as sensor / F.S. = full scale

ECL202 Series

Top Performing System

The ECL202 eddy-current position and displacement measuring system delivers exceptional resolutions, down to 10nm, and bandwidths up to 15kHz. The electronics of the ECL202 are based on the latest FPGA digital technology, delivering excellent noise immunity and very high stability.

The system provides a linear analogue voltage output (0 - 10 Volt) proportional to changes in the target position and a digital (switched) output with a user programmed switching threshold.

Key specifications

- Resolution down to 10 nm (@ 100 Hz)
- Bandwidth 100Hz, 1kHz, 10kHz, 15kHz (user selectable)
- Range from 0,25 mm to 15 mm
- Linearity 0,2%
- Temp. range: Driver 4-50°C Probe -25°C to +125°C*

*Optional high temp probes (see p28)

Output features

- Adjustable offset and set point
- Analogue output (0-10 VDC)
- Set point switch contacts
- Single channel
- Synchronisation kit available (up to 9 systems)

Probe choices

Probe model numbers include diameter in mm. (Full dimensions p29). The resolution depends on the selected probe, range and bandwidth. Please note, the target size must be at least 3 times this probe diameter to maintain specifications.

ECL202 Probe Options

Probe model	Range (mm)†	Material type	Resolution (nm) @ 100Hz	@ 1 kHz	@ 10 kHz	@ 15 kHz	Thermal drift* Probe - Driver
U3	0,05 - 0,3	Non-ferrous	10	15	25	30	0,04 - 0,04
		Ferrous	15	25	40	50	0,06 - 0,10
	0,05 - 0,55	Non-ferrous	25	30	60	65	0,04 - 0,04
		Ferrous	30	40	100	110	0,08 - 0,08
U5	0,25 - 0,87	Non-ferrous	30	35	70	75	0,04 - 0,04
		Ferrous	40	50	75	80	0,08 - 0,04
	0,25 - 1,50	Non-ferrous	45	65	140	150	0,04 - 0,10
		Ferrous	80	120	240	260	0,10 - 0,10
U8	0,35 - 1,35	Non-ferrous	20	30	50	60	0,02 - 0,04
		Ferrous	50	60	100	110	0,04 - 0,04
	0,35 - 2,35	Non-ferrous	40	60	135	145	0,02 - 0,04
		Ferrous	70	80	180	200	0,04 - 0,04
U12	0,60 - 2,20	Non-ferrous	40	50	100	110	0,01 - 0,01
		Ferrous	50	70	120	130	0,02 - 0,02
	0,60 - 4,10	Non-ferrous	60	90	210	240	0,02 - 0,01
		Ferrous	100	170	250	300	0,03 - 0,01
U18	0,75 - 5,75	Non-ferrous	80	130	300	340	0,01 - 0,01
		Ferrous	130	200	390	450	0,01 - 0,01
U25	1,25 - 9,25	Non-ferrous	180	250	500	600	0,01 - 0,01
		Ferrous	180	250	500	600	0,01 - 0,01
U38	1,50 - 14,0	Non-ferrous	200	350	700	800	0,01 - 0,01
		Ferrous	200	350	700	800	0,02 - 0,01
U50	2,0 - 17,0	Non-ferrous	300	400	800	900	0,01 - 0,01
		Ferrous	300	450	900	1000	0,01 - 0,01

†near gap-far gap

* Thermal Drift in % full scale /°C

ECL150 Series

Multi-Channel Sensing In A Small Package

The ECL150 eddy-current system provides up to 8 channels of high resolution position and displacement measurement in a small package. It is ideal for multi-sensing applications in industrial environments such as: synchronized x,y,z positioning; 5 degrees of freedom shaft measurement or multi-point thickness measurement.

Key specifications

- Resolution down to 35 nm (250Hz)
- 250Hz, 1kHz, 10kHz, 15kHz bandwidth (user selectable)
- Range 0,5 to 15mm
- Linearity 0,2%
- Temp. range: Driver 4-50°C Probe -25°C to +125°C*

*Optional high temp probes (see p28)

Output features

- Analogue output (±5 V)
- Low power/heat
- Small volume claim
- Available without enclosure
- Up to 8 channels per system (synchronized)

Probe choices

Probe model numbers include diameter in mm. (Full dimensions p29). The resolution depends on the selected probe, range and bandwidth. Please note, the target size must be at least 3 times the probe diameter to maintain specifications.

ECL150 Probe Options

Probe model	Range (mm)†	Material type	Resolution (nm) @ 250Hz	@ 1 kHz	@ 10 kHz	@ 15 kHz	Thermal drift* Probe - Driver
U3	0,05 - 0,55	Non-ferrous	35	45	60	65	0,04 - 0,04
		Ferrous	60	80	100	110	0,08 - 0,08
U5	0,25 - 1,50	Non-ferrous	75	100	140	150	0,04 - 0,10
		Ferrous	130	180	240	260	0,10 - 0,10
U8	0,35 - 2,35	Non-ferrous	75	100	135	145	0,02 - 0,04
		Ferrous	100	125	180	200	0,04 - 0,04
U12	0,60 - 4,10	Non-ferrous	120	160	210	240	0,02 - 0,01
		Ferrous	150	200	250	300	0,03 - 0,01
U18	0,75 - 5,75	Non-ferrous	170	240	300	340	0,01 - 0,01
		Ferrous	230	300	390	450	0,01 - 0,01
U25	1,25 - 9,25	Non-ferrous	330	430	600	650	0,01 - 0,01
		Ferrous	360	480	650	750	0,01 - 0,01
U38	1,50 - 14,0	Non-ferrous	600	750	1000	1200	0,01 - 0,01
		Ferrous	650	800	1100	1300	0,02 - 0,01
U50	2,0 - 17,0	Non-ferrous	750	1000	1300	1400	0,01 - 0,01
		Ferrous	800	1100	1400	1500	0,01 - 0,01

†near gap-far gap

* Thermal Drift in % full scale /°C

ECW110 Series

Wireless Performance

The ECW110 provides wireless precision measuring technology with up to 42hrs continuous measurement. For applications where cabling is an issue such as: robotics; measurement systems attached to a moving stage or moveable pallet; where space is of a premium and multiple sensors are essential.

The system communicates with a laptop using a dedicated Wi-Fi network at speeds up to 1KHz. The system consists of a driver and 1 to 3 probes.

Key specifications

- Resolution down to 100 nm
- 1 kHz bandwidth*
- Range 2 to 3,5mm
- Linearity 0,5%
- Temp. range: Driver 4-50°C Probe -25°C to +125°C*

*2kHz option available on request

Output features

- Dedicated and secure wireless network
- IEEE 802.11 b/g/n standard
- Up to 3 channels per system (synchronized)

ECW110 Probe Options

Probe model	Range (mm)†	Material type	Resolution @ 1 kHz (RMS in nm)
U8	0,35 - 2,35	Non-ferrous	100
		Ferrous	125
U12	0,60 - 4,10	Non-ferrous	160
		Ferrous	200

†near gap-far gap

ECL101 Range

High Bandwidth Performance

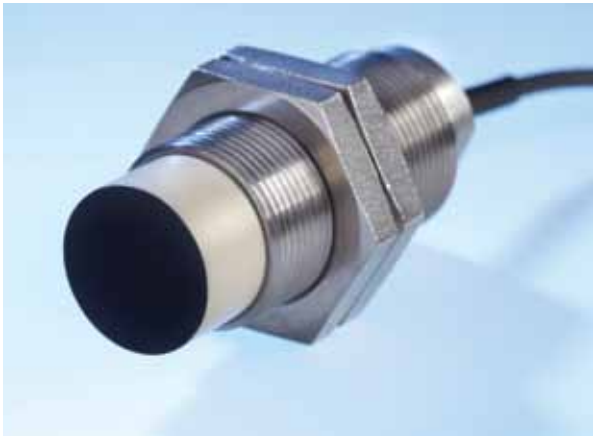
Where precision measurement is required for high speed applications, the ECL101 delivers linear output at up to an exceptional bandwidth of 80kHz. Typical examples of high speed applications include measurement of motion or thermal growth of high speed spindles; observation of high speed vibrations or ultrasonic applications.

Key specifications

- Resolution down to 30 nm (@ 1 kHz)
- 1kHz, 10kHz or 80 kHz bandwidth (factory set)
- Range 0,5mm to 15mm
- Linearity 0,25% (non-ferrous) 0.50% (ferrous)

Output features

- Adjustable offset
- Analogue outputs (0-10 VDC)
- In-field calibration possible
- Single channel



Probe choices

Probe model numbers include diameter in mm. (Full dimensions p29). The target size must be at least 3 times the probe diameter to maintain specifications. The resolution depends on the selected probe, range and bandwidth.

ECL101 Probe Options

Probe model	Range (mm)†	Material type	Resolution (nm) @ 1kHz	@ 10 kHz	@ 80 kHz
U3	0,05 - 0,55	Non-ferrous	30	60	200
		Ferrous	40	80	300
U5	0,25 - 1,50	Non-ferrous	60	100	250
		Ferrous	90	150	400
U8	0,35 - 2,35	Non-ferrous	100	160	400
		Ferrous	130	210	500
U12	0,60 - 4,10	Non-ferrous	200	280	700
		Ferrous	260	350	1200
U18	0,75 - 5,75	Non-ferrous	240	480	3200
		Ferrous	320	640	4500
U25	1,25 - 9,25	Non-ferrous	350	700	5300
		Ferrous	350	700	5300
U38	1,50 - 14,0	Non-ferrous	550	1100	8300
		Ferrous	550	1100	8300
U50	2,0 - 17,0	Non-ferrous	660	1300	10000
		Ferrous	660	1300	10000

†near gap-far gap

ECA101 System

Non-Linear System

For demanding analog proximity applications where a highly cost effective solution is required, the ECA101 system can deliver the precision you need. This non-linear system offers easy operation with an adjustable gain, offset and set point switch output.

Key specifications

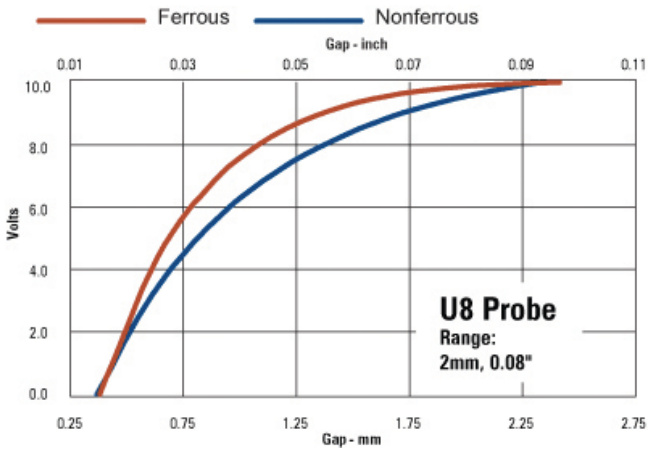
- Resolution 0,02% of range
- 10kHz bandwidth
- Range 0,5 to 15mm

Output features

- Adjustable gain and offset
- Adjustable set point switched outputs
- Analogue output (0-10 VDC)
- Non-linear system

Output linearity

The non-linear output depends on the selected probe. Example output given for the U8 probe at 2mm range.




ECA101
SWITCH
NEAR
FAR
ZERO
GAIN
LION
PRECISION

Eddy-current probe dimensions

General

Standard temperature range:

- -25 to + 125 degrees Celcius
- IP67
- Jacketed cable for chemical resistance
- Vacuum compatible as option

Extended temperature range:

- -25 to +200 degrees Celcius
- IP63
- Teflon jacketed cable for chemical resistance and high temperature

Body styles

Probe model numbers are specified by their diameter and body style: i.e. a U8C probe has an 8mm diameter and a “C” body style. Probes can be ordered as vacuum compatible.

B probes - Threaded body style

The B body style provides a threaded, stainless steel housing for precise adjustment of axial position in a threaded mounting hole or a through hole using the two lock nuts provided.

C probes - Smooth body style

The C body style offers the strength of stainless steel housing for clamp or set screw mounting and easy adjustment of axial position.

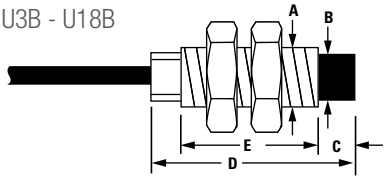
Tailored probes

Custom body styles may be provided on request.

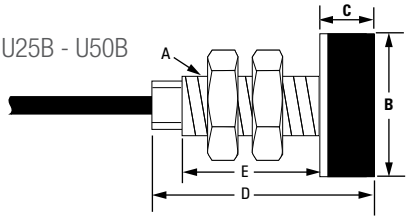
Probe designs & dimensions

See below for the available eddy-current probe designs. The corresponding sizes can be found in the tables.

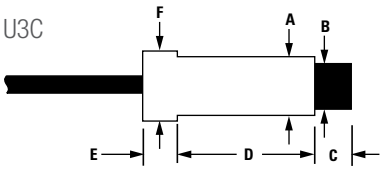
U3B - U18B



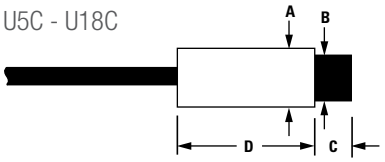
U25B - U50B



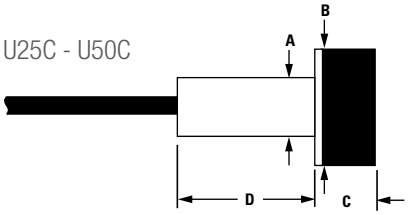
U3C



U5C - U18C



U25C - U50C



ECL101 Probe Options

Threaded probes	A	B (mm)	C (mm)	D (mm)	E (mm)
U3B	M3 x 0,5	2,0	3,0	21,1	13,0
U5B	M5 x 0,8	3,4	3,0	23,0	18,0
U8B	M8 x 1	6,2	5,0	25,0	18,0
U12B	M12 x 1	10,0	7,0	29,0	18,0
U18B	M18 x 1	15,8	9,0	44,0	31,0
U25B	M18 x 1	25,0	15,0	61,0	42,0
U38B	M18 x 1	38,0	20,0	80,0	54,0
U50B	M18 x 1	50,0	25,0	98,0	69,0

Smooth probes	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)	F (mm)
U3C	2,92	2,0	3,0	13,0	5,0	3,6
U5C	4,90	3,4	3,0	18,0		
U8C	7,90	6,20	5,0	18,0		
U12C	11,89	10,0	7,0	18,0		
U18C	17,91	15,8	9,0	31,0		
U25C	17,91	25,0	15,0	46,0		
U38C	17,91	38,0	20,0	60,0		
U50C	17,91	50,0	25,0	73,0		

Mounting eddy current probes

Probes must be mounted to avoid interaction between the sensing field and the mounting hardware. The area within 3 probe diameters to the sides and 1,5 diameters behind should be kept clear of any metallic objects other than the object to be measured. If this is not possible, custom calibration may be required.

Applications Examples
Capacitive & Inductive Sensors

SEM focus

An integrated probe system was developed for stage focusing. A tailored probe design with 45° surface was required to fit the available space; the probe was encapsulated to improve reliability and prevent charging issues. The probe was optimised to allow on/off switching within 1 ms. A dual range option was offered for high precision focus measurement. The system was supplied for a UHV environment with vacuum feed through.

Automotive bearings

In production (100%) measurement of bearing shell thickness with 2 opposed sensors was required. Measurement was to be carried out in the feeder resulting in a large variation in the position to the probe. This required a large stand-off and probe range, while maintaining sub-micron accuracy. Probes were calibrated against the convex/concave surface to eliminate linearity error caused by the small bearing shell radius. Up to 6 channels were implemented per machine to measure eccentricity. Synchronisation was applied to avoid cross talk.

Magnetic Levitation Stage

A contactless, wireless solution was developed for in vacuo real time control of the short stroke of a magnetically levitated precision stage. A set of synchronised probes were used to measure the z height and two rotations out of plane. 2kHz bandwidths were achieved with deterministic data transmission at latency figures of 300µs; sufficient for real time positioning control. Packet loss rates of 1.1e-7 were also realised to ensure reliability.

Disk Drive Run-Out

In production (100%) measurement of disk drive writing heads was required to minimise run out. Reducing this enables smaller track widths to be written and higher storage densities to be achieved. Extremely high resolution (sub-nanometre) was needed on very small targets (smallest target 0,2 mm). A tailored probe design was applied with a sensing area very close to the edge of a flat probe; a fork design was used to enable measurement of difficult to access locations. Eurocard design was realised for easy integration into the customer electronics.

Machine tool metrology frame

24 sensors were integrated into a machine tool bed to enable real time measurement of thermal and work piece related deformations. Wireless probes were employed to ease integration and provide cost effect smart metrology solution.

Spindle Error

A multichannel system has been developed to determine critical performance parameters including: radial and axial error motions, thermal drift and distortion due to environmental vibrations. Hardware developed can be synchronised with customer encoders or index pulses and employs an integrated temperature module. The system offers a dual range option for either standard or ultra-precision machines. Integrated data acquisition is employed for the highest accuracy, undisturbed by electrical influences.

Stealth Ships

Ultra precision probes were implemented under water to detect vibration and/or motion of moving surfaces on sea-going vessels (propellers, rudders...).

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