

Non-Contact
Position Measurement
Systems

ACCUMEASURE™ SERIES

Ultra-High-Precision Capacitance
Measurement Solutions for OEM,
Production, QC and Research Applications



Capacitance Systems for Demanding Measurement Applications

Outstanding accuracy, stability and repeatability are the hallmarks of MTI Instruments' (MTII's) non-contact capacitance systems. The Accumeasure™ family of products is designed to address the needs of product developers, process engineers, researchers, designers and others who need precise, reliable, non-contact measurements. Fast response time and extremely low noise levels make them ideal for critical measurements of targets such as rotating spindles and shafts, disks, tires, precision X-Y stages and piezoelectric elements.

Thousands of Accumeasure systems are installed worldwide and are considered the system of choice by major corporations around the world. MTII

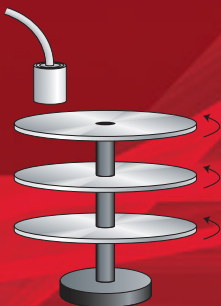
offers a variety of standard and custom capacitance amplifiers designed to meet your exact requirements. Our experienced engineers review all aspects of your application and design a cost-effective amplifier and probe system. With over 40 years of product line history and application knowledge in virtually every industry, our systems provide the highest resolution and accuracy available on the market today.

MTII offers simple single-channel systems for general displacement and position applications along with multiple-channel units for process control monitoring, differential measurements and profiling. MTII also offers battery-operated units for operation in remote locations or on test vehicles.

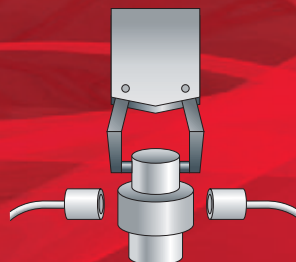
Accumeasure Advantages

- **Passive probes for operation in high-temperature and harsh environments**
- **Extended system ranges for added measurement flexibility**
- **Modular designs to accommodate expanding future needs**
- **Custom, low-cost OEM solutions**
- **Extremely low noise levels for sub-nanometer resolution and accuracy**
- **Large standoff distances for safe gaging of delicate parts**
- **Highly stable designs for long-term monitoring and analysis**

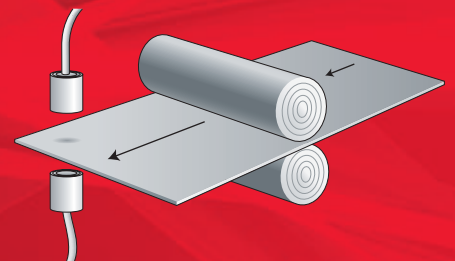
Computer Disk Run-out



Automated Quality Control Inspection



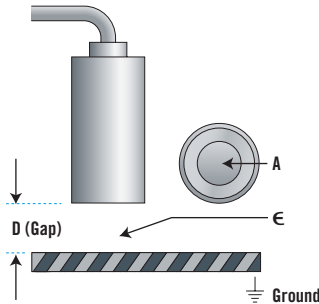
Sheet or Web Thickness



Theory of Operation

If a voltage is applied to one plate of a parallel plate capacitor, an electric field between the plates will be established. This field is the result of the difference between the electrical charges that are stored on each plate. Capacitance refers to the ability of these two plates to hold a charge. MTII's Accumeasure systems measure distance, displacement or motion by converting this capacitance to a linear output voltage.

Capacitance is determined by the plate area (A), plate separation distance (D) and dielectric properties (ε) of the material between the plates.



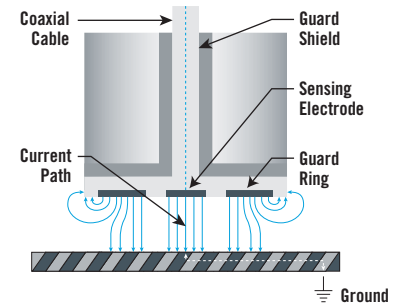
$$C = A\epsilon / D$$

In a typical system the capacitance probe acts as one of the plates while the target being measured acts as the other. The dielectric properties of the material within the gap typically remain constant along with the area of the probe; therefore, the only variable causing a capacitance change is the probe-to-target distance. Using a patented approach, MTII's Accumeasure systems convert this changing capacitance into a linear voltage proportional to the probe gap. The amount of voltage change for a given gap change is called the sensitivity.

To maintain a highly linear response it is important to establish a uniform electric field in the gap. To accomplish this MTII uses a "guarded" probe approach.

By design, the probe tip is completely surrounded by a "guard" ring precisely driven at the same potential and phase as the probe sensing area. Not only does this eliminate any external influences from noise but it also eliminates "fringing" of the field to the target being measured.

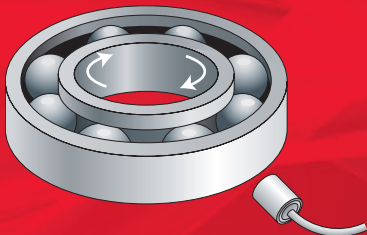
Linearity exceeding 0.01% of the full scale measurement range is attainable with this approach.



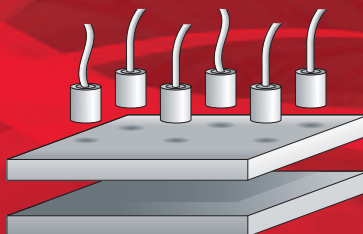
The standard measurement range of a probe is proportional to the area of the sensing element. The greater the area, the larger the measurement range and operating distance. During factory calibration special adjustments can be made to the amplifier to increase the measurement range by as much as 60 times. Care must be taken as linearity, resolution and accuracy may be affected. Contact MTII's application engineers for more details.

MTII also offers a unique "push/pull" capacitance technology for measurement of non-electrically grounded targets. It is ideal for applications where the target ground path becomes inconsistent or nonexistent, such as air bearing shafts or spindles. This revolutionary concept utilizes two probes built into one probe body. One probe "pushes" current while the other "pulls" current. With this arrangement the electrical ground path always remains constant, eliminating the adverse effects of poorly grounded systems.

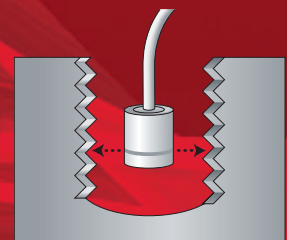
Bearing Defect Analysis



Leveling or Flatness Measurements



Thread Quality Inspection



Accumeasure Systems

Accumeasure 1500 – Modular, Multi-Channel Rack System

The foundation of the Accumeasure 1500 system is the AS-1515 chassis, which accepts capacitance amplifiers, summing amplifiers and digital displays.



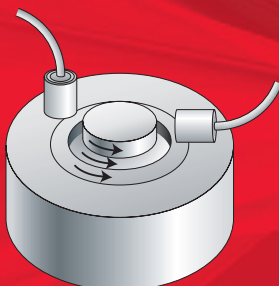
It is capable of performing up to 10 simultaneous measurements with individual rear-panel analog voltage outputs. The optional digital display, which occupies two slots of the AS-1515, provides voltage and displacement outputs for any selected channel. Each summing amplifier is capable of performing two independent sum, difference, average or thickness calculations. A mass-terminated, 25-pin “D” connector allows for easy connection to the Accumeasure 1500’s analog outputs and allows for multiple chassis synchronization. The Accumeasure 1500 also accepts MTII’s proprietary “push/pull” capacitance amplifiers for use on conductive or semiconductive targets and rotating elements where a poor or non-existent ground exists.

Accumeasure 9000 – High-Precision Single/Dual-Channel Amplifier System

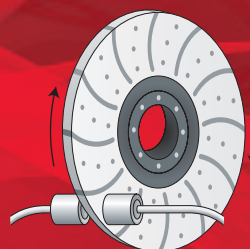
The Accumeasure 9000 is the ideal solution for high resolution, single or dual axis measurement applications. It features MTII’s latest technology in capacitance amplifier design, resulting in the lowest noise and highest stability available today. The Accumeasure 9000 has front-panel gain and offset adjustments along with a bar graph or digital display for easy probe positioning. The dual-channel version comes standard with a summing amplifier for sum, difference or thickness measurements.



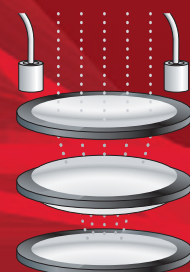
Shaft Run-out Analysis



Disk Thickness Variation and Run-out



Precision Lens Alignment and Focusing



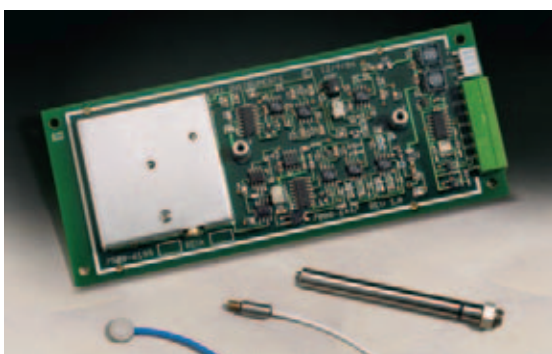


Accumeasure 5000 – High-Speed Single/Dual-Channel Amplifier System

For high-speed dynamic applications requiring up to 20 kHz response, the Accumeasure 5000 is the ideal instrument. It features an integral power supply, front-panel input connectors and offset and gain controls. The Accumeasure 5000 was designed for run-out applications where poor system grounds and motor noises can affect measurement accuracy. The dual-channel version comes standard with a summing amplifier for sum, difference or thickness measurements.



MicroCap OEM Board Level System – Custom Designs for Demanding High-Volume Applications



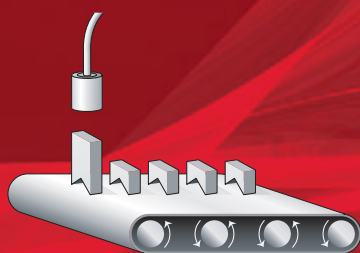
MTII offers a variety of standard and custom capacitance amplifier designs to meet your exact requirements. Our experienced engineers review all aspects of your application and design a cost-effective board level amplifier and probe system. With thorough application knowledge, our designs provide the highest resolution and most accurate systems available today.

Accumeasure 500 – Portable Rack System

The Accumeasure 500 is a compact modular rack system that can hold up to six measurement channels or summing amplifiers. The built-in power supply accommodates any standard universal power source. An optional 12 Vdc version is available for in-vehicle testing of displacement, vibration, run-out or thickness. The Accumeasure 500 also accepts MTII's proprietary "push/pull" capacitance amplifiers for use on conductive or semiconductive targets and rotating elements where a poor or non-existent ground exists.



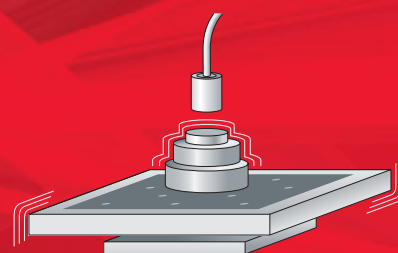
Automated Inspection

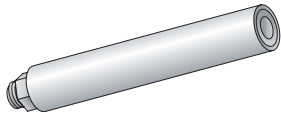


Tire Run-out or Bulging

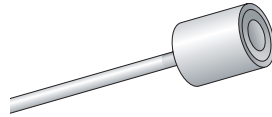


Vibration Analysis

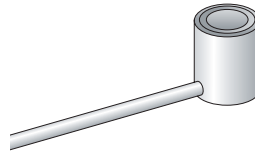




Connector Type Axial (CTA)



Integral Lead Axial (ILA)



Integral Lead Radial (ILR)



Pancake Radial (PCR)

Standard Accumeasure Probes

Range Mils (µm)	Sensing Electrode Diameter in (mm)	Model Number	Length Inches (cm)	Diameter Inches (mm)	Model Number	Length Inches (cm)	Diameter Inches (mm)
1 (25)	0.042 (1.07)	ASP-1-CTA	2.50 (6.35)	0.250 (6.35)	ASP-1-ILA	0.375 (0.95)	0.093 (2.36)
2 (50)	0.060 (1.52)	ASP-2-CTA	2.50 (6.35)	0.250 (6.35)	ASP-2-ILA	0.375 (0.95)	0.112 (2.85)
5 (125)	0.097 (2.46)	ASP-5-CTA	2.50 (6.35)	0.250 (6.35)	ASP-5-ILA	0.375 (0.95)	0.156 (3.96)
10 (250)	0.138 (3.50)	ASP-10-CTA	2.50 (6.35)	0.250 (6.35)	ASP-10-ILA	0.375 (0.95)	0.219 (5.56)
20 (500)	0.197 (5.00)	ASP-20-CTA	2.50 (6.35)	0.437 (11.09)	ASP-20-ILA	0.375 (0.95)	0.312 (7.92)
50 (1250)	0.313 (7.95)	ASP-50-CTA	2.50 (6.35)	0.625 (15.87)	ASP-50-ILA	0.375 (0.95)	0.546 (13.87)
Range Mils (µm)	Sensing Electrode Diameter in (mm)	Model Number	Length Inches (cm)	Diameter Inches (mm)	Model Number	Length Inches (cm)	Diameter Inches (mm)
1 (25)	0.042 (1.07)	ASP-1-ILR	0.375 (0.95)	0.093 (2.36)	ASP-1-PCR	0.100 (0.254)	0.093 (2.36)
2 (50)	0.060 (1.52)	ASP-2-ILR	0.375 (0.95)	0.112 (2.85)	ASP-2-PCR	0.100 (0.254)	0.112 (2.85)
5 (125)	0.097 (2.46)	ASP-5-ILR	0.375 (0.95)	0.156 (3.96)	ASP-5-PCR	0.100 (0.254)	0.156 (3.96)
10 (250)	0.138 (3.50)	ASP-10-ILR	0.375 (0.95)	0.219 (5.56)	ASP-10-PCR	0.100 (0.254)	0.219 (5.56)
20 (500)	0.197 (5.00)	ASP-20-ILR	0.375 (0.95)	0.312 (7.92)	ASP-20-PCR	0.100 (0.254)	0.312 (7.92)
50 (1250)	0.313 (7.95)	ASP-50-ILR	0.375 (0.95)	0.546 (13.87)	ASP-50-PCR	0.100 (0.254)	0.546 (13.87)

Contact MTII for other standard or custom-designed probes.

Amplifier Specifications

Features	Accumeasure 1500	Accumeasure 9000	Accumeasure 5000	Accumeasure 500	MicroCap
Number of Channels	1-10	1 or 2	1 or 2	1-6	N/A
¹ Measurement Range inches (mm)	0-0.500 (0-12.5)	0-0.500 (0-12.5)	0-0.500 (0-12.5)	0-0.500 (0-12.5)	0-0.500 (0-12.5)
² Resolution (% of Full Scale)	0.005%	0.005%	0.01%	0.005%	0.005%
³ Accuracy (% of Full Scale)	0.02%	0.02%	0.02%	0.02%	0.02%
Frequency Response (Factory Selectable)	DC-5 kHz	DC-5 kHz	DC-20 kHz	DC-5 kHz	DC-5 kHz
Temperature Stability 40-100°F (4-40°C)	± 0.1%	± 0.1%	± 0.1%	± 0.1%	± 0.1%
⁴ Analog Output 0-10 Vdc	BNC/25-pin	BNC	BNC	BNC	Terminals
Output Impedance	50 Ω	50 Ω	50 Ω	50 Ω	50 Ω
Power Requirements	85-265 Vac 47-440 Hz	85-265 Vac 47-440 Hz	85-265 Vac 47-440 Hz	85-265 Vac 47-440 Hz Optional 12 Vdc	± 15 Vdc
Summing Amplifier	Optional	Standard in Dual-Channel Units	Standard in Dual-Channel Units	Optional	N/A
Operating Temperature	40-100°F (4-40°C)	40-100°F (4-40°C)	40-100°F (4-40°C)	40-100°F (4-40°C)	40-100°F (4-40°C)
Dimensions in. (mm)	14.3 x 6.0 x 14.3 (363 x 152 x 363)	9.5 x 6.25 x 2.0 (240 x 160 x 50)	7.5 x 2.5 x 11.25 (190 x 64 x 286)	6.88 x 5.5 x 13.38 (175 x 140 x 340)	5.9 x 2.4 x 0.5 (150 x 60 x 13)
Weight lbs. (kg)	Depends on # of channels selected	5.0 (2.3)	4.0 (1.8)	10.2 (4.6)	0.25 (0.10)

¹ Measurement range is determined by probe selected and amplifier gain (Range Extension). ² Resolution with 500 Hz frequency response filter and 1x amplifier range extension. ³ Accuracy depends on probe range and guard thickness. ⁴ The analog output can be configured for ± 5 Vdc with front-panel offset adjustment. Noise fluctuates based on response and range extension selected.