

Advanced Piezo Task

Radiant has combined the original Piezo Task with specialized math filters to create this more advanced acquisition task that will accurately measure extremely small displacement butterfly loops. When the displacements being measured are so small, less than 300 nanometers, ambient environmental effects from vibration to air currents to thermal expansion of test fixtures will distort the results. Averaging alone will not do. Averaging alone simply adds the environmental distortions to the final measurement. Instead, each loop must be zero'd and de-trended individually before averaging and smoothing. The Advanced Piezo Task performs these actions as it collects the displacement data. Since the Precision Testers will accept displacement data from any displacement sensor, including interferometers and AFMs, Advanced Piezo makes it possible to directly measure the piston motion of thin ferroelectric films.



Advanced Piezo and TDC Compensation add extraordinary capabilities to Radiant's testers. Now, all you need is the test fixture. Consider mounting your samples in Radiant's new low-cost Precision Displacement Test Stand. It is so quiet that measurements below 10nm are possible in a lab setting using Advanced Piezo. More importantly, almost any thin film capacitor can be measured on the test stand!

Additional Features of Vision

All of Radiant's systems operate under the Vision Data Management software environment. Vision is a revolutionary test environment that allows the researcher to test a sample in any way he or she chooses in any order he or she chooses. Further, Vision provides the tools for the researcher to document the entire history of the sample under test, a critical component to determining the long term reliability of the devices.

Features include:

- Fully Automated hands-off test sequencing
- Built-in Exporting
 - * Exel
 - * Printer
 - * Text Files
 - * All experiment design/configuration information and all data
- GPIB control of thermal devices and generic control of any external instrument
- Automated measurement parameter range coverage
- Data Analysis and comparison tools
- Data smoothing and noise reduction tools . (Original data are preserved.)

RADIANT 
TECHNOLOGIES, INC.

World Leader in Piezoelectric Testing since 1988

Radiant's wealth of knowledge has helped to sustain its solid reputation for developing innovative applications to enhance the capabilities of its clients' products. Radiant offers a wide range of piezoelectric testing capabilities for MEMs, thin films, and bulk ceramics.

Radiant's Precision family of testers, including the inexpensive Radiant EDU, retains the important capability to measure piezoelectric properties. Every measurement task in the Vision Library (Hysteresis, Pulse, Leakage, IV, Small Signal Capacitance, PIEZO, and Chamber) will capture external sensor data during execution.

Piezoelectric Measuring Systems for:

MEMs

Piezoelectric Materials

Thin Film and Bulk Ceramic Devices

Sensors and Actuators

Measurements Include:

- Large Signal Polarization and Displacement
- Large Signal vs. Small Signal Measurement
- Piezoelectric vs. Unipolar, Bipolar, and DC Bias Voltages
- Direct D33 and D31 Measurements
- Capacitance and Piezoelectricity
- Hysteresis and Displacement

Radiant Technologies, Inc

2835D Pan American Fwy NE • Albuquerque, New Mexico 87107

Tel: 505-842-8007 • Fax : 505-842-0366 • www.ferrodevices.com • e-mail: radiant@ferrodevices.com

Displacement Sensors:

Any displacement sensor that outputs its measurements as a voltage may be connected to a Precision tester to capture the movements of a sample during a measurement. Radiant has extensive experience with the following sensor units:

Parameter: Instrument	Scale Factor	Absolute Resolution on Premier II	Noise Limited Resolution Premier II	Absolute Resolution on LC	Noise Limited Resolution LC
DI Dimension 3100 AFM	100 Å/V	0.008 Å	0.10 Å	0.031 Å	0.12 Å
Seiko Epson SPA 400 AFM	50 Å/V	0.004 Å	0.05 Å	0.025 Å	0.06 Å
Asylum SA AFM	700 Å/V	0.053 Å	7.00 Å	0.214 Å	0.84 Å
MTI2100 2032RX Photonic Sensor	5000 Å/V	0.380 Å	5.00 Å	1.525 Å	6.00 Å
MTI2100 2032R Photonic Sensor	19 µm/V	14.44 Å	190 Å	57.95 Å	228 Å
Polytec OFV534 Laser Vibrometer	500 Å/V	0.038 Å	0.10 Å	0.153 Å	0.60 Å
SIOS SP-S 120 Laser Vibrometer	2400 Å/V	0.182 Å	0.10 Å	0.732 Å	2.88 Å

Bulk Ceramics and MEMs

MTI2100:

The MTI2100 with the 2032RX module has a diameter of 300 microns and must be within 1 millimeter of the sample surface. The tip size of the MTI2100 makes it best suited for measuring bulk ceramics and larger piezoMEMs. The 2032R sensor module for the MTI2100 operates the same as the 2032RX but with 40 times less resolution. It is suitable for measuring bulk ceramics that move 0.5 microns or more during actuation. It has a minimum single-pass resolution of 0.019_ on the Premier II and 0.0228_ on the LC. This resolution gives a signal-to-noise ratio of 50:1 for a 1_ displacement. For smaller displacements of 0.5_ or less, clean signals can be achieved using averaging. Vision provides averaging tools in its Task Library.

SIOS SP-S 120:

The SIOS laser vibrometer has a much smaller spot size than the MTI2100 and a working distance of centimeters, making it easier to align with the sample. It also has a very high frequency response so it can be used at the 1 kHz to 100 Hz frequency range. With its scale factor and small spot size, the SIOS vibrometer is suitable for measuring the displacements of piezoMEMs. However, it does not have the resolution to measure piston motion of thin ferroelectric film capacitors.

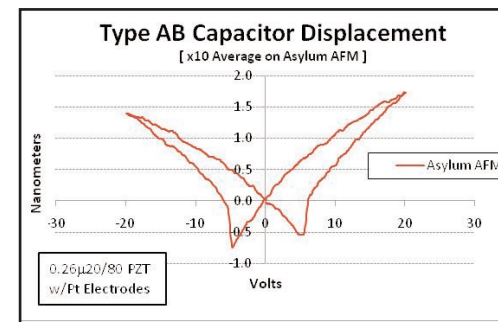
Thin Films and Piezoelectric Materials

Polytec OFV-534:

The OFV-534 provides a spot size as small as 1.5_ and a video camera with a microscope lens aligned with the laser interferometer beam. Consequently, the OFV-534 can be easily aligned on integrated scale piezoMEMs components having micron dimensions. The OFV-534 also has the scale factor to capture piston displacement of the capacitor surface. The Polytec sensor is suitable for direct study of the piezoelectric displacement of thin ferroelectric film capacitors while also being able to capture the much larger displacements of piezoMEMs actuators.

AFMs:

AFMs are the most sensitive displacement sensors of all with sub micron "spot" sizes. They can Theoretically measure displacements down to small fractions of Angstroms confined to areas with Nanometer dimensions. AFM are capable of producing extremely accurate Angstrom-level measurements over Sub micron areas. The AFM is best suited, then, for thin film capacitor piezoelectric displacements as well as those movements by integrated scale piezoMEMs.



Piston of one of our Type AB 20/80 PZT Capacitors measured on Asylum AFM

Features of Piezo Task – Vision Software

The Piezo Task adds to the standard Hysteresis Task automatic measurement of the output of a displacement meter to detect the motion at the surface of a Piezoelectric sample as it is stimulated by tester. The displacement meter output is connected to the SENSOR input at the rear of the Precision tester. The following measurements can be taken with Piezo Task:

Capacitance vs Displacement

Large and Small Signal Capacitance

Large and Small Signal Displacement

Capacitance vs. Piezoelectric

Direct D33 and D31

Displacement vs Voltage

Custom Displacement Profiles