



Precision PiezoMeter Systems

A flexible, precision range of equipment for testing piezoelectric materials

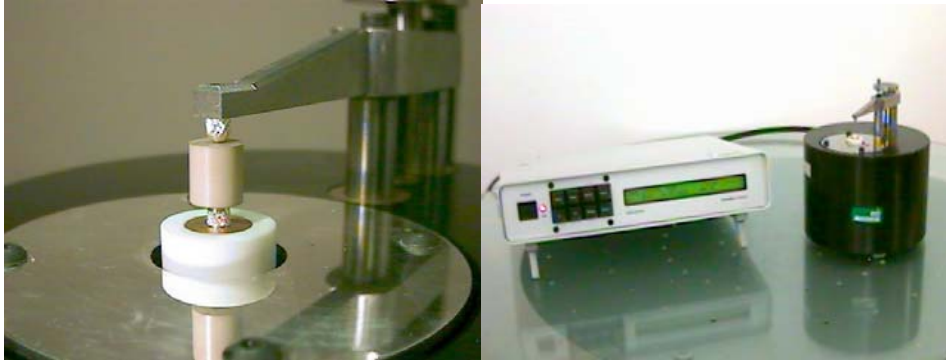
Applications:

- Assessment of materials
- Quality control in manufacture
- Research and development

Features:

- All systems directly measure d_{33} , the most important parameter determining the performance of any piezoelectric material.
- Suited to all types of piezoelectric materials, including ceramics and polymers in almost any shape and size.
- Variable force and variable frequency testing
- Industry-leading 0.01 pC/N resolution
- Stand-alone or PC driven operation
- Options to cover all applications areas - including options to measure d_{33} , d_{31} , d_{15} , g_{33} , g_{31} , g_{15} , C , ϵ_{33}^T , $\tan \delta$, etc.

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The Basic System

The PiezoMeter Systems provide a direct means of testing piezoelectric materials.

The PiezoMeter clamps the sample under test, and then subjects it to a low frequency oscillatory force. Processing of the electrical signals from the sample, and comparison with a built-in reference, enables the system to give a direct reading of d_{33} - one of the most useful parameters in evaluating the material.

This method of testing offers superior resolution and consistency compared to static methods of testing, and unlike resonance methods, is appropriate to almost any sample geometry. All that is required is an electroded area where one can apply the force and collect the charge.

The Piezotest Advantage

Piezotest have 17 years of experience in this field, and offer the market-leading solutions for piezoelectric materials testing.

The precision systems, models PM200 and PM300, offer high-performance mechanical and electronic systems. This allows measurements to be taken with a precision of 0.01 pC/N. This is unequalled by any other manufacturer.

Furthermore, use of digital signal processor technology offers noise- and jitter-free operation over the whole measurement range.

Quad Range Operation

Models PM200 and PM300 provide a wide testing range. This gives greater precision when testing materials such as PVDF polymers, due to an improved resolution of 0.1pC/N on samples with d_{33} of less than 100pC/N, and 0.01pC/N on samples of less than 10pC/N.

At the other extreme of the measurement range, these two systems will also test samples up to a maximum of 10,000 pC/N. This allows testing of the newest high-performance materials, and multi-layer actuators.

Capacitance and $\tan \delta$ Measurement

The PM300 PiezoMeter additionally has the ability to measure capacitance, C , and dissipation, $\tan \delta$, simultaneously with d_{33} . The capacitance of the sample is crucial to actuator and receiver performance. Together with d_{33} and sample dimensions, it may be used in calculating other piezoelectric constants such as g_{33} , and the permittivity, $\epsilon^{T_{33}}$.

If the customer needs to know these parameters, it is helpful that all necessary measurements should be taken by a single machine in a single process. The PM300 provides this convenience and efficiency.

Stand-Alone Operation

All PiezoMeter include a full-featured microprocessor subsystem. This provides a complete range of functions as a self-contained desktop unit, without the need for a computer.

The electronics unit has an alphanumeric display and a keypad to control all the main functions. It may also be used to provide a printout of measurements, when used with a standard computer printer. A statistical analysis of a set of data - such as a batch of elements - is carried out at the end of each print-out. There is also a facility to store up to one hundred measurements for a later recall and analysis.

Computerised Operation

Whilst all PiezoMeter systems can operate on a stand alone basis, they may be interfaced to a computer system for further processing of results. This is achieved using a RS-232 communications link, present on almost all computers. A simple command set used via this link gives complete remote control of the PiezoMeter, including the setting of the measurement range and test frequency. Full documentation is given in the instruction manual. This gives customers the opportunity to write their own applications.

Computer Software Package

The screenshot displays the 'PiezoMeter Application - PiezoMeter1' software window. The main window shows sample details and a table of measurements. A 'Piezometer Control Panel' dialog box is open, allowing for manual input of parameters.

PiezoMeter1

Sample shape: Disc
Diameter (mm): 25.0
Thickness (mm): 7.0

Sample No.	Freq. Hz	d33 pC/N	Polarity +/-	Cap pF	Tan delta	g33 mV.m/N	Voltage Sens. dB re 1V/uPa	
001	100	100.0	+ve down	100	0.0150	70.12	-186.2	PASS
002	100	100.0	+ve down	100	0.0150	70.12	-186.2	PASS
003	100	100.0	+ve down	100	0.0150	70.12	-186.2	PASS

Statistical Analysis on Parts Passing all Tests

Number of parts: 3

Mean d33 (pC/N): 100.0
Std. Deviation: 0.0

Mean C (pF): 100.0
Std. Deviation: 0.0

Piezometer Control Panel

Sample Number : 4

d33 (pC/N) : 100.0 g33 (Vm/N) : 70.1

Polarity : +ve down Voltage Sens (dB) : -186.2

C (pF) : 100.0

Tan Delta : 0.0150 Quality Control : PASS

Freeze Result Store Reading

A standard software package for Windows, available from Piezotest, allows remote operation of the PM300 using a standard PC, together with real - time calculation and display of all measurements, including various derived constants.

For production and goods-inwards quality control purposes, it is possible to set upper and lower boundaries for all the main parameters, to allow for 'pass' and 'fail' conditions.

A statistical analysis may be carried out on all values where samples meet the 'pass' criteria.

The software may be used with any PC using Windows 98, Windows 2000, or Windows XP. The requirements are one free serial port, and 5MB of free hard disk space.

d₃₁ and d₁₅ Adapters

All PiezoMeter force heads are provided with the facility to connect suitable adapters for measuring d_{31} of ceramic materials. Naturally, the most suitable form for such devices depends on the shape and dimensions of the samples to be tested. Piezotest will be happy to quote for the provision of d_{31} or d_{15} adapters, given the approximate dimensions of the specimens to be tested, and an example specimen.

In research environments, testing of d_{31} is frequently required for small discs. With this in mind a standard adapter is available for testing of d_{31} of discs up to 10mm thick and 30mm diameter.

Custom Adaptations

For some customers, certain features may be required beyond those of the standard models. Piezotest or their agents will be happy to discuss any such requirements.

PiezoMeter System Selection

PiezoMeter Model	PM100	PM200	PM300
d_{33} very low range (0 to 10pC/N, 0.01pC/N resolution)	No	Yes	Yes
d_{33} low range (0 to 100pC/N, 0.1pC/N resolution)	Yes*	Yes	Yes
d_{33} high range (0 to 2000 pC/N, 1pC/N resolution)	Yes	Yes	Yes
d_{33} very high range (0 to 10000 pC/N, 10pC/N resolution)	No	Yes	Yes
Variable test frequency	Yes	Yes	Yes
Variable test force	No	Yes	Yes
Capacitance	No	No	Yes
Dissipation (Tan delta)	No	No	Yes
d_h Hydrostatic Pressure Head	No	No	Option
d_{31} Adapter	No	Option	Option
d_{15} Adapter	Option	Option	Option
Static Force Indicator	Option	Option	Option
Direct Print-out capability with PC Printer	Yes	Yes	Yes
Computer Interface	Yes	Yes	Yes
Windows Software Support	Yes	Yes	Yes

*Note that in the case of PM100, low range readings are taken with 0.1uF shunt capacitance; PM200 and PM300 use 1uF shunt capacitance for this range.

For further information, or to arrange a demonstration, contact:

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