APC International, Ltd.
Piezo d_{33} Test System

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APC Part number: 90-2030.1

DESCRIPTIONS

The part number 90-2030.1 (D_{33} Meter) is a special instrument for directly measuring the piezoelectric constant d_{33} values of piezoelectric ceramics and single crystals. This meter can also measure the d_{33} values in various single crystal directions for lithium niobate, quartz, and tourmaline. It is capable of measuring the d_{33} value over a very large range, at high resolution, and with a high degree of reliability. The measurement is quick and easily made with minimal training required. A variety of sizes and shapes can be easily accommodated and measured that includes discs, blocks, rings, tubes and semispherical shells. The direct value readout is displayed on a 3 ½ inch digital meter. This instrument is invaluable as a tool for quality assurance, production in-line inspection and research applications.

SPECIFICATIONS

D_{33} Range: x1 range: 10 to 2000 pC/N
x 0.1 range: 1 to 200 pC/N

Accuracy: x 1 range: ±5% of the d_{33} value in 100 to 2000 pC/N
±5% of the d_{33} value in 10 to 200 pC/N
x 0.1 range: ±5% of the d_{33} value in 10 to 200 pC/N
±5% of the d_{33} value in 1 to 20 pC/N
Resolution: x 1 range: 1 pC/N
x 0.1 range 0.1pC/N

Force frequency: 110Hz Amplitude 0.25N

Polarity indication:
Indicates polarity on upper face of test element in compression.
(- sign means negative, no sign is positive)

Shunt Capacitance; 1pF (for x 1 range)
0.1pF (for x 0.1 range)

Dimensions: Force Head: 110x140mm Chassis: 280x200x90mm

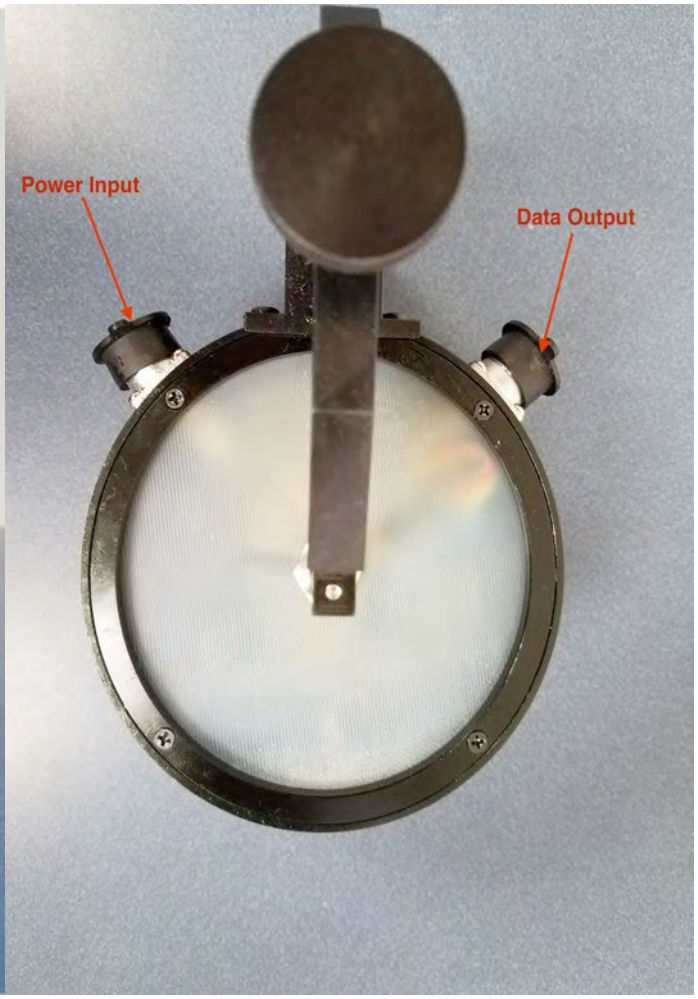
Weight: Force Head: 3kg Chassis: 2kg

FRONT PANEL OVERVIEW

1. D_{33} Range Key: Choose from x1 or x0.1. Button out position (x1), the measuring range is from 10 to 2000 pC/N, resolution is 1 pC/N for normal piezo material such as piezo ceramics. Button position in (x0.1), the measuring range is 1 to 100 pC/N, resolution is 0.1 pC/N for low piezo constant material such as piezo crystal.
2. Force and D_{33} Key: When display button is in, the force light is on. The digital display shows the force put on the sample by the shaker. The display should show at (250±10) x 10^{-3} N. If the force is too high or low, you must turn the knob of the shaker screw to adjust the clamping force on the test sample.
3. The 3 ½" digital display shows the force put on the test sample or the d_{33} value of the test sample. The display indicates polarity on the upper face of the test element in compression. (- sign means negative and no sign is positive).
4. The power switch turns the display and the display lights on and off.
5. Zero adjust screw: adjusting this screw can balance the system for a high accuracy measuring result. (see calibration)

BACK PANEL OVERVIEW

1. Output plug: A three-pin plug is connected with the shaker to the supply power and with an output of 110Hz and 0.25 N force.
2. Input plug: An eight-pin plug is connected with the shaker and picks up the signal from the shaker.
3. AC power plug: Universal AC 60/50 Hz, 110-240 V AC plug with a spare 2-amp fuse.



SHAKER OVERVIEW

1. Adjust knob: Turn the adjusting knob to drive the top probe up or down. The test sample will be clamped between the top probe and the bottom probe. Do not screw the sample too tight.
2. The top and bottom probes transfer a signal from the test sample to the measuring system, while holding the sample under test.
3. Output and input connector: There is a three-pin plug that connects the meter to the shaker and an eight-point output plug that sends the signal to the meter.

SETUP FOR D33 MEASUREMENT

1. Connect the meter input and output plugs with the shaker input and output plugs by the two cables supplied with the system.
2. Turn the meter on for 15 minutes and then put the D_{33} Test Sample between the top and bottom probes.
3. Turn the Force and D_{33} switch to Force. The meter read out should be $(250\pm10)\text{x}10^{-3}$ N. If it isn't, adjust the probes knob until the meter read out is $(250\pm10)\ \text{x}10^{-3}$ N.
4. Turn the Force and D_{33} switch to D_{33}. The meter read out should be close to the D_{33} value of the D_{33} Test Sample. Record the value of the meter displayed as D1. Flip the test sample 180 degrees and measure the sample again. The meter will show the opposite polarization and the D_{33} value. Record the D_{33} value as D2. If the two values are different (D1 & D2), then calculate the difference as D3 by (D1+D2) x 0.5.

Using the zero point adjust knob, adjust to set the meter display to show the D3 value. Now the D_{33} Test Sample negative and positive readings should be the same.

5. Adjust the back panel calibration screw and set the meter display to show the value listed on the D_{33} Test Sample Package
6. The manufacturer calibrates the meter before it is shipped but recalibrating to begin using and once a month is suggested.

OPERATION

1. Put the part to be tested between the two probes. Clamp the part as close to the center as possible. Turn the probe adjustment knob and lightly clamp the test part. Do not over tighten. When the meter display is stable it will display the results. Parts that are clamped too tight or too loose will impact the test results.
2. If you want to measure same thickness parts, you can push lightly down on the bottom probe and then change the test parts. There is no need to adjust the knob.
3. When measuring large capacitance samples, the meter read out value needs modified or the value will not be accurate. The following equation can be used to calculate the true value.
   d_{33} (modified) = d_{33} (Display) x (1+Cc) for switch on "x1"
   d_{33} (modified) = d_{33} (Display) x (10+Cc) for switch on "x0.1"
   Cc= capacitor of sample (μF)

CALCULATE *E*33 AND G33

The relative dielectric constant E_{33}=(TxC)÷(E0xS)

T= The thickness of the sample (m)
S= The area of the sample electrode (m^2)
C= The capacitance of the sample (F)
E0= 8.85 x 10^{-12} F/m

The piezo voltage g_{33}=d_{33}÷E_{33}

MAINTENANCE

This system is maintenance free. If you experience any problems please contact us for assistance.

ACCESSORIES

1. Three wire cables with connectors	1 piece
2. Seven wire cable with connectors	1 piece
3. Power cord	1 piece
4. Cone shaped probe head	2 pieces
5. D_{33} Test Sample	1 piece
6. Fuse- 2amp	1 piece
7. Operating manual	1 piece