Piezo d_{33} Meter

KCF Technologies, Inc.

Part Number PM-3001

For safe operation, please read the manual carefully before turning on the meter.

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1. DESCRIPTION

The KCF PM-3001 d_{33} Meter is a special instrument for directly measuring the piezoelectric constant d_{33} values of piezoelectric ceramics, polymers, and single crystals.

This meter can also measure the d_{33} values in various single crystal directions for crystals such as lithium niobate, quartz, and tourmaline. This meter 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 a minimum of training required. Specimens of various sizes and shapes can easily be accommodated and measured. For example, the d_{33} value of disks, blocks, rings, tubes and semispherical shells can be easily measured on the KCF PM-3001 d_{33} Meter. The direct d_{33} value is displayed on a 3-1/2 inch digital meter. This instrument is valuable as a tool for quality assurance of piezoelectric materials, in-line production inspection, and for research and development applications involving piezoelectric materials.

2. SPECIFICATIONS

d_{33} Range:	X1 range:	10 to 2000 pC/N
	X0.1 range:	1 to 200 pC/N
Accuracy:	X1 range:	±2% of the d33 value in 100 to 2000 pC/N ±5% of the d33 value in 10 to 200 pC/N
	X0.1 range:	±2% of the d33 value in 10 to 200 pC/N ±5% of the d33 value in 1 to 20 pC/N
Resolution:	X1 range:	1 pC/N
	X0.1 range:	0.1 pC/N
Force:	0.25 N at	Frequency: 110Hz
Polarity indication:	Indicates polarity on upper face of test element in compression. (- sign means negative)	
Shunt Capacitance:	X1 range:	1 pF
	X0.1 range:	0.1 pF
Force Head Dimensions:	110x140mm	
Chassis Dimensions:	280x200x90mm	
Force Head Weight:	3 kg	
Chassis Weight:	2 kg	
Power:	110/220V, 50/60Hz, 20W	

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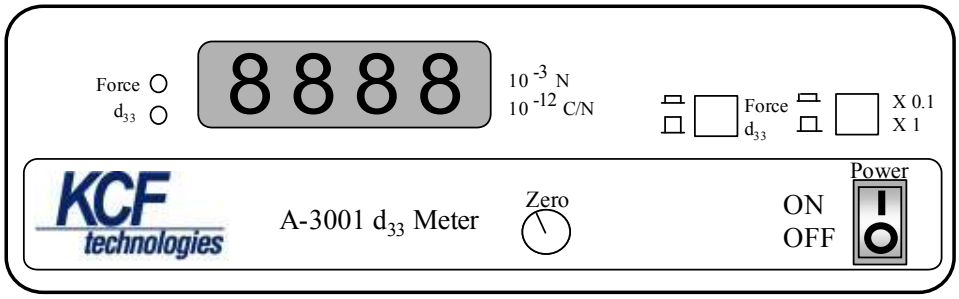
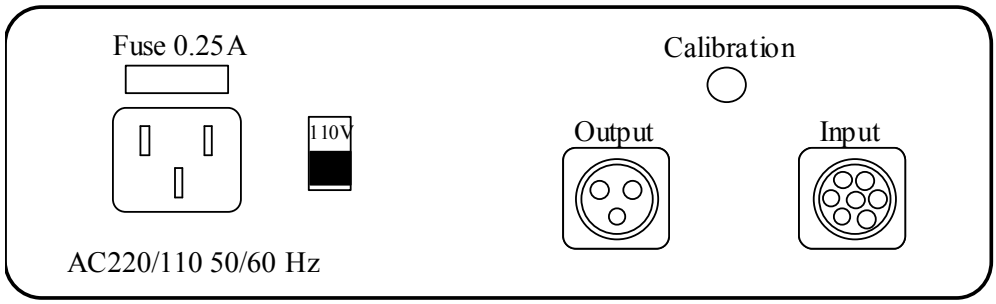


Front

3. FRONT PANEL OVERVIEW (LEFT TO RIGHT)

1. **3 1/2 inch digital display**: The display toggles between the force put on the test sample and the d_{33} value of the test sample. The d_{33} sign indicates the polarity on the upper face of test element in compression. (- sign means negative, no sign means positive)
2. **Force/d_{33} Key:** LED's to the left of the display indicate the operating mode. In Force mode, the digital display show the force put on the sample by the shaker (10^{-3}N). In d_{33} mode, the display shows the d_{33} value (10^{-12}C/N).
3. **d_{33} Range Key:** Chose from X0.1 or X1. In X1 range (for typical piezo materials, piezoceramics, etc.), the measuring range is 10 to 2000 pC/N and the resolution is 1 pC/N. In X0.1 range (for low piezoelectric constant materials such as piezo crystals), the measuring range is 1 to 200 pC/N and the resolution is 0.1pC/N.
4. **Zero Adjust:** Use this dial to adjust the zero position with no sample in the device (see calibration).
5. **Power switch:** Turn on the Power and the Force or d_{33} display light will turn on.



Back

4. BACK PANEL OVERVIEW (LEFT TO RIGHT)

1. **Output plug:** Three pins plug is connected with the shaker to supply shaker power, let shaker can output 110 Hz and 0.25 N force.
2. **Input plug:** Seven pins plug is connected with the shaker pick up the signal from shaker.
3. **AC power plug:** AC 60/50 Hz, 110/220 Volt AC plug with 0.5A Fuse for 110V AC power, 0.25A for 220V AC power supply. Before plug in AC power Please check local AC power voltage, and meter AC voltage set up.

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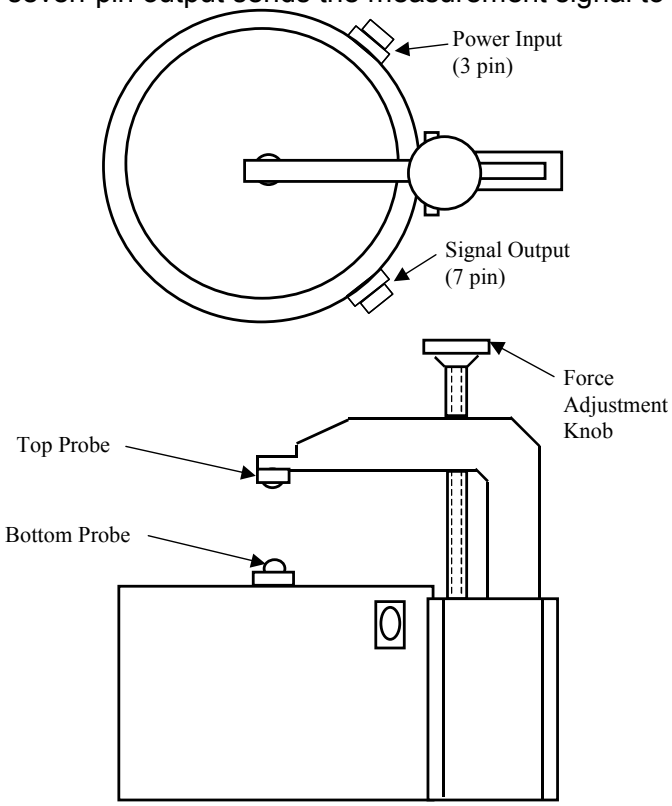
5. SHAKER OVERVIEW

1. **Force Adjustment Knob:** Turn the Force Adjustment Knob to position the top probe. The test sample will be clamped between the top probe and bottom probe. Do not tighten beyond finger tight.
2. **Top and Bottom Probe:** The probes clamp the sample, supply the shaker vibration, and transfer the signal from the test sample to measuring system.
3. **Output and Input connector:** A three-pin plug is connected with the meter to supply shaker power. A seven-pin output sends the measurement signal to the meter.



6. SETUP AND CALIBRATION

1. Connect the meter input and output plug with the shaker output and input plug using the two cables supplied with the system.
2. Turn on the meter for 15 minutes, Put the standard test sample between the top and bottom probes.
3. Turn the Force and D33 switch to Force. The meter readout should be (250 ±10)x10-3 N. If not, turn the Force Adjustment Knob until the readout is within the desired range.
4. Turn the Force and D33 switch to D33. The meter read out should be close the D33 value of the standard test sample. Write down the value of meter displayed for D1. Then turn the test sample 180°, measure the sample again. The meter will show opposite polarization and the D33 value for D2. If the two values are different D1≠D2, calculate the D3 by (D1 + D2) x 0.5. Using the Zero point adjust knob get the meter display show the D3 value. Now the test sample negative and positive value should be same.

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5. Adjust back panel calibration screw; let the meter display show same value as the standard test marked.
6. The meter is calibrated before shipment. It should be re-calibrated monthly, or before each intermittent use.

7. OPERATION

1. Put the test sample between the two probes. The probes should be as close to the sample center as possible. Turn the knob to adjust the force upon the sample. Do not tighten clamp too much to the sample. When the meter display is stable the value is shown. If the clamp is too tight or too loose, the results will be affected.
2. If you want measure samples of the same thickness, you can just push lightly down the bottom probe, then change the test sample. There is no need to adjust the knob.
3. Two different shape probe heads are supplied with the meter. It is recommended to use the corn shape probe head to measure most samples. When measuring a large flat-surfaced sample, use the flat probe on the bottom of the sample.
4. When measuring a large capacitance sample, the meter readout value must be modified. Otherwise the uncertainty will be greater than 1%. The following equation can be used to calculate the true value.

D_{33} (modified)= D_{33}(Display) x (1+C_c) For switch on " x1 "

D_{33} (modified)= D_{33}(Display) x (1+10C_c) For switch on " x0.1 "

where: C_c = capacitance of sample (μF)

8. CALCULATE ε_{33} AND G_{33}

- The relative dielectric constant ε_{33}= $(T \times C) \div (\varepsilon_0 \times S)$
- T = The thickness of the sample (m)
- S = The area of simple electrode(m^2)
- C= The capacitance of the sample (F)
- ε_0= 8.85 x 10^{-12} F/m
- Piezo voltage G_{33} = $D_{33} \div \varepsilon_{33}$

9. WARRANTY

KCF Technologies (“KCF”) warrants to the customer (“Customer”) that the PM3001 Piezoelectric d33 Meter (“Product”), including chassis and force head, shall be free from defects in material and workmanship for the duration stated below, which duration begins on the date of purchase by the Customer.

Warranty period: One Year

If KCF receives, during the applicable warranty period, notice of a defect in the Product, KCF shall either repair or replace the defective Product, at KCF’s option. If KCF is unable to repair or replace the Product, as applicable, KCF shall within a reasonable time after notification refund the purchase price for the Product. This warranty covers those defects that arise as a result of a normal use of this product, as outlined in this User’s Manual. Failure to read and follow the User Manual instructions, or failure to follow normal use guidelines will void the warranty.

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10. MAINTENANCE

This system is maintenance free. In case of malfunction, please contact:

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11. INCLUDED ACCESSORIES

1.	Cable (3 wire) with connectors	1 piece
2.	Cable (7 wire) with connectors	1 piece
3.	Power cord	1 piece
4.	Core shape probe head	2 pieces
5.	Plate shape probe head	2 pieces
6.	Standard test sample	1 piece
7.	Fuse	1 piece
8.	Operating manual	1 piece