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Maintenance

Performance Test

Verify the probe accuracy by measuring a 25 kV dc ±0.25% voltage source. When used with a compatible dc voltmeter, the probe should measure the source with ±1% accuracy. No calibration adjustments are provided.

Cleaning

Use a soft cloth dampened in distilled water to clean the 80K-40. Never use solvents or abrasive cleaners. Make sure the 80K-40 is dry before reuse.

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FLUKE®

80K-40
High Voltage Probe

Instruction Sheet

Introduction

The Model 80K-40 is a high voltage accessory probe designed to extend the voltage measuring capability of an ac/dc voltmeter up to 40,000 volts Overvoltage Category I. This means the probe can only be used to make measurements on energy limited circuits within equipment. Examples include high voltage within televisions or photo copy machines. DO NOT use this probe to measure high voltages on power distribution systems. The probe is a precision 1000:1 voltage divider formed by two matched resistors. The unusually high input impedance offered by these resistors minimizes circuit loading and thereby, optimizes measurement accuracy. A special plastic body houses the divider and provides the user with isolation and protection from the voltage being measured.

Specifications

The 80K-40 will achieve rated accuracy when used with a voltmeter (ac or dc) having an input impedance of 10 MΩ ±1.0%.* Specifications for the probe are as follows:

†Voltage Range: 1 kV to 40 kV dc or peak ac, 28 kV rms ac

Input Resistance: 1000 MΩ

Division Ratio: 1000: 1 (1000X attenuator)

Accuracy DC:

20 kV to 35 kV: ±1% at 20°C to 30°C; add 1% at 10°C <20°C and >30°C to 45°C. (For total measurement accuracy add accuracy specification of voltmeter being used.)

0 kV to <20 kV and >35 kV to 40 kV: ±2%.

Accuracy AC: 60 Hz, ±5%.

Safety: Meets IEC 1010-2-031:1993, Type B, 40 kV dc or, peak ac, 28 kV rms ac, Overvoltage Category I (voltages derived from limited energy transformer).

* The input impedance of Autoranging Fluke handheld digital multimeters varies as a function of range. The only range that deviates significantly from 10 MΩ is the 3V (Models 21, 23, 25, 27, 70, 73, 75, 77) or 4V (Models 10, 11, 12, 29, 79, 83, 85, 86, 87, 88) range where the impedance is 11.11 MΩ. To enhance the measurement accuracy when using this range, apply a correction factor of 0.99, i.e. multiply the displayed reading by .99.

† This probe is intended for low energy applications such as CRT and similar circuits. Above 2000 meters altitude, and up to 5000 meters, derate linearly the working voltage from 40 kV peak to 28 kV peak, and derate linearly the transient overvoltage from 80 kV peak to 57 kV peak. Transient overvoltage refers to micro-second duration impulses caused by lightning or load switching. See International Electrotechnical Commission Publication 664-1980, Clause 3.9 Table II, and Appendix A.

Measurement Considerations

Before attempting to use the 80K-40, the following paragraphs should be read and understood. Particular attention should be given to Operator Safety.

PN 481978
January 1978, Rev.9, 3/97
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Operator Safety

Indicates the operator must refer to an explanation in this manual.

Indicates terminals at which lethal voltages may exist.

Warning

- **To avoid damage or electric shock:**
  - **Use within ratings and under dry (no condensation) conditions.**
  - **The 80K-40 user should be familiar with, and exercise, all possible high voltage safety practices.**
  - **When making a measurement, never make body contact with the probe tip or the red portion of the probe. Always hold the probe by its black handle.**
  - **Before making a measurement, make sure that the tab side of the output connector is connected to the voltmeter's low input terminal.**
  - **The clip lead must be attached to earth ground.**

Voltmeter Compatibility

Accuracy of the meter is not included in the accuracy of the probe, and must be added to the probe accuracy to determine system accuracy.

The 80K-40 is mechanically compatible with any ac or dc voltmeter or multimeter capable of accepting a standard spaced, 0.75" (19mm) double, banana plug, having standard, .160" (4mm) plugs.

The 80K-40 probe is electrically compatible with any ac or dc voltmeter or multimeter that has an input impedance of 10 MΩ ±1%. Voltmeters or multimeters with other input impedances require the use of an external shunt or a correction factor to obtain an accurate measurement. Higher impedance voltmeters or multimeters should be equipped with a shunt, and lower impedance voltmeters or multimeters should be assigned correction factors. Applicable formulas follow:

a. The following formula is used to determine the value of an external shunt resistor (meter impedance >10 MΩ):

$$Rs = \frac{Rm \times 10}{Rm - 10}$$

Where: Rs = Shunt resistance in MΩ
Rm = Voltmeter input impedance in MΩ (>10 MΩ)

Example: If RM = 20 MΩ,

$$Rs = \frac{20 \times 10}{20 - 10} = \frac{200}{10} = 2.0 M\Omega$$

b. Use the following formula to calculate a correction factor (meter impedance <10 MΩ):

$$Cf = \frac{1.11 + Rm}{1.11 \times Rm}$$

Where: Cf=Correctionfactor (multiplier for meter reading)
Rm = Voltmeter input impedance in MΩ

Example: If Rm = 1 MΩ,

$$Cf = \frac{1.11 + 1}{1.11 \times 1} = \frac{2.11}{1.11} = 1.901$$

Therefore: A meter reading of 0.526 volts represents an input of: 0.526 x 1.901 = 1 or 1 kV.

Circuit Loading

The 80K-40 represents a 1000 MΩ load to the circuit being measured, or 1 μA per 1 kV. Table 1 shows the circuit loading and input/output characteristics of the probe over its measurement range.

Table 1. 80K-40 Circuit Loading and Input/Output Characteristics

Input Voltage	Loading Current	Output Voltage
10V	10 nA	10 mV
100V	100 nA	100 mV
1 kV	1μA	1V
10 kV	10 μA	10V
20 kV	20 μA	20V
30 kV	30 μA	30V
40 kV	40 μA	40V

Operation

Use the following procedure to operate the 80K-40:

1. Select and energize a compatible voltmeter.
2. Equip the voltmeter with a suitable shunt, if required.
3. Select an appropriate voltage range (1 volt reading per 1000 volt input. See Table 1).
4. Connect the probe's output leads to the voltmeter input terminals.
5. Connect the probe's clip lead to ground. See OPERATOR SAFETY.
6. Connect probe tip to circuit being measured and observe voltmeter reading. Apply correction factor to reading when necessary.

Theory Of Operation

The 80K-40 High Voltage probe, is designed to extend the voltage measurement range of an ac/dc voltmeter up to 40,000 volts. Electrically, the probe is a passive attenuator as shown in Figure 1. Its high input impedance (1000 MΩ), as well as its accuracy and stability characteristics are achieved through the use of special thick film resistors. When the probe is connected to a voltmeter with a 10 MΩ input resistance the probe becomes an accurate 1000:1 divider. Notice that the divider depends upon a ground lead to complete the low side of the circuit path. Therefore, this connection must always be secure before attempting a voltage measurement. Otherwise, instrument damage or a shock hazard will result.

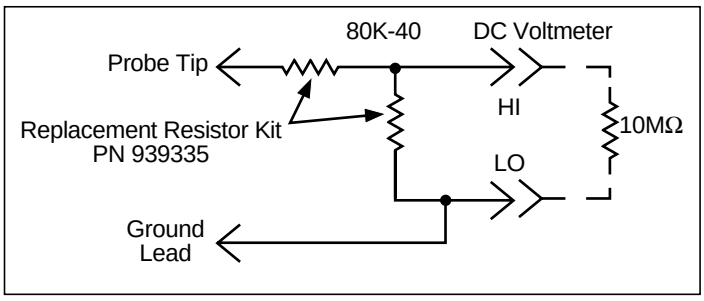


Figure 1. 80K-40 Simplified Circuit Diagram

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