

**LIMITED WARRANTY & LIMITATION OF LIABILITY**

Each Fluke product is warranted to be free from defects in material and workmanship under normal use and service. The warranty period is one year and begins on the date of shipment. Parts, product repairs and services are warranted for 90 days. This warranty extends only to the original buyer or end-user customer of a Fluke authorized reseller, and does not apply to fuses, disposable batteries or to any product which, in Fluke's opinion, has been misused, altered, neglected or damaged by accident or abnormal conditions of operation or handling. Fluke warrants that software will operate substantially in accordance with its functional specifications for 90 days and that it has been properly recorded on non-defective media. Fluke does not warrant that software will be error free or operate without interruption.

Fluke authorized resellers shall extend this warranty on new and unused products to end-user customers only but have no authority to extend a greater or different warranty on behalf of Fluke. Warranty support is available if product is purchased through a Fluke authorized sales outlet or Buyer has paid the applicable international price. Fluke reserves the right to invoice Buyer for importation costs of repair/replacement parts when product purchased in one country is submitted for repair in another country.

Fluke's warranty obligation is limited, at Fluke's option, to refund of the purchase price, free of charge repair, or replacement of a defective product which is returned to a Fluke authorized service center within the warranty period.

To obtain warranty service, contact your nearest Fluke authorized service center or send the product, with a description of the difficulty, postage and insurance prepaid (FOB Destination), to the nearest Fluke authorized service center. Fluke assumes no risk for damage in transit. Following warranty repair, the product will be returned to Buyer, transportation prepaid (FOB Destination). If Fluke determines that the failure was caused by misuse, alteration, accident or abnormal condition of operation or handling, Fluke will provide an estimate of repair costs and obtain authorization before commencing the work. Following repair, the product will be returned to the Buyer transportation prepaid and the Buyer will be billed for the repair and return transportation charges (FOB Shipping Point).

THIS WARRANTY IS BUYER'S SOLE AND EXCLUSIVE REMEDY AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. FLUKE SHALL NOT BE LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES OR LOSSES, INCLUDING LOSS OF DATA, WHETHER ARISING FROM BREACH OF WARRANTY OR BASED ON CONTRACT, TORT, RELIANCE OR ANY OTHER THEORY.

Since some countries or states do not allow limitation of the term of an implied warranty, or exclusion or limitation of incidental or consequential damages, the limitations and exclusions of this warranty may not apply to every buyer. If any provision of this Warranty is held invalid or unenforceable by a court of competent jurisdiction, such holding will not affect the validity or enforceability of any other provision.

Fluke Corporation  
P.O. Box 9090  
Everett, WA 98206-9090  
U.S.A.

Fluke Europe B.V.  
P.O. Box 1186  
5602 BD Eindhoven  
The Netherlands

**FLUKE®**

# 80K-6 High Voltage Probe

## Instruction Sheet

### Description

The 80K-6 is a high voltage probe designed to extend the voltage measuring capability of an ac/dc voltmeter to 6000 volts peak AC or DC 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. A 1000:1 voltage divider provides the probe with a high input impedance. The divider also provides high accuracy when used with a voltmeter having a 10 megohm input impedance. A molded plastic body houses the divider and protects the user from the voltage being measured.

### Specifications

The 80K-6 will achieve rated accuracy when it is used with an ac/dc voltmeter having 0.25% accuracy, or better, and an input impedance of 10 megohms  $\pm 10\%$ . Specifications for the probe are as follows:

|                         |   |
|-------------------------|---|
| <b>Voltage Range:</b>   | 0 to 6 kV, dc or peak ac                            |
| <b>Input Impedance:</b> | 75 megohms nominal                                  |
| <b>Division Ratio:</b>  | 1000:1  |
| <b>Accuracy:</b>        |   |
| DC to 500 Hz:           | $\pm 1\%$   |
| 500 Hz to 1 kHz:        | $\pm 2\%$   |
| Above 1 kHz:            | Output reading falls.<br>Typically, -30% at 10 kHz. |

|                                 |   |
|---------------------------------|---|
| <b>Temperature:</b>             |   |
| Storage:                        | -20 to 60°C   |
| Operating:                      | 0 to 50°C   |
| <b>Temperature Coefficient:</b> | 100 ppm/C   |
| <b>Relative Humidity:</b>       | 20 - 80%  |
| <b>Altitude:</b>                | 2000 m  |
| <b>Shock and Vibration:</b>     |   |
| Shock:                          | 1 m Drop  |
| Vibration:                      | 5-55 Hz swept sine 3 g max.                                 |
| <b>Dimensions:</b>              | 24.89 cm (9.8 in) (probe body), 5.10 cm (2.0 in) max. width |
| <b>Weight:</b>                  | 12.7 g (45 oz)  |

**Safety:**  
CAN/CSA C22.2 No. 1010.2.031-94 & IEC 1010-2-031:1993,  
Type B, 6 kVDC or peak AC, 4.24 kV rms AC, Overvoltage  
Cat. I (Voltage derived from limited energy transformers).

### Measurement Considerations

Before attempting to use the 80K-6, the following paragraphs should be read and understood. Particular attention should be given to Operator Safety.

### 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.
- To avoid electrical shock, the 80K-6 user should be familiar with, and exercise, all possible high-voltage safety practices. When handling the probe the following additional cautions must be taken:
  - 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 ground side of the output connector is connected to the voltmeter's common terminal.
  - The clip lead must be attached to earth ground.
  - Do not use the probe if it is damaged. Before using the probe, inspect it for cracks or missing plastic. Pay close attention to the probe body, tip and insulation surrounding the connectors.
  - Make sure the tip is firmly attached to the body.
  - When servicing, use only specified replacement parts.
  - Do not operate probe around explosive gas, vapor or dust.
  - Do not use the probe if it operates abnormally. Protection may be impaired. When in doubt have the probe serviced.

**Voltmeter Compatibility**

The 80K-6 is compatible with any ac or dc voltmeter that has an input impedance of 10 megohms  $\pm 10\%$ . Voltmeters with higher input impedances require the use of an external shunt to obtain an accurate measurement.

Use the following formula to determine the value of an external shunt resistor:

$$R_s = \frac{R_m \times 10}{R_m - 10}$$

Where:  $R_s$  = Shunt Resistance in Megohms  
 $R_m$  = Voltmeter Input Impedance in Megohms (> 10 megohms)

**Circuit Loading**

The 80K-6 represents a load of approximately 75 megohms to the circuit being measured (13  $\mu$ A per 1 kV). See Figure 1. To more accurately determine the load resistance, measure the resistance of the 80K-6 at its voltmeter connector and multiply the measured value by 1000.

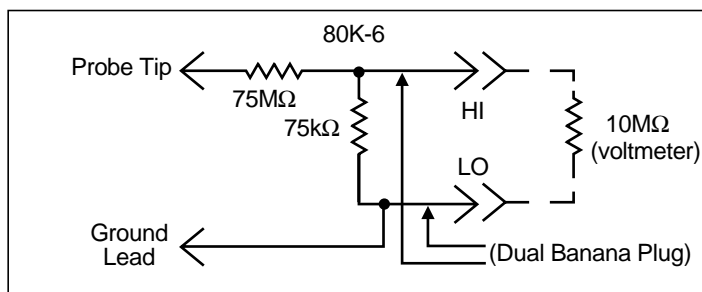


Figure 1. 80K-6 Schematic Diagram

80k6.eps

**Operation**

Use the following procedure to operate the 80K-6:

1. Inspect the probe. (Refer to the preceding Warning.)
2. Connect the probe cable to a compatible voltmeter. (Refer to the preceding Warning.) Use a shunt resistor if required.
3. Select an appropriate voltage range (1 volt reading per 1000 volt probe input).
4. Connect the ground lead of the probe to earth ground. (Refer to the preceding Warning.)
5. Hold the probe by the black handle and connect the probe tip to the circuit being measured. Observe the voltmeter reading.

**Maintenance****Performance Test**

Verify the probe accuracy by measuring a 5 kV dc  $\pm 0.25\%$  voltage source. When used with a compatible dc voltmeter, the probe should accurately measure the source voltage to within  $\pm 1\%$ . No calibration adjustments are provided on the probe.

**Cleaning**

Use a soft cloth dampened with distilled water to clean the 80K-6. Never use solvents or abrasive cleaners.

**Disassembly**

Use the following procedure to disassemble the probe:

1. Unscrew the black handle from the probe, and slide the handle onto the cable.
2. Unscrew the metal tip one turn, and push in on the tip until the internal assembly snaps free of the housing. Remove the tip.
3. Withdraw the internal assembly from the probe by pulling the metal ring over the threads on the probe body.
4. Logically reverse this procedure to reassemble the probe.

**Caution**

**To avoid probe damage after repair, measure and, if necessary, adjust the outside distance between the ring and the probe coupling on the internal assembly before reassembling the probe. The distance must be 4.910 $\pm$ 0.020 inches. Make the adjustment using the solder connection at the rear of the metal probe coupling.**

**Replaceable Parts**

| Description           | Fluke Part No. |
|-----------------------|----------------|
| Tip, High Voltage     | 536946         |
| Body, Probe           | 580621         |
| Coupling, Probe       | 536961         |
| Divider, High Voltage | 632091         |
| Sleeve                | 580605         |
| Bus Wire, Probe       | 617290         |
| Instruction Sheet     | 613224         |
| Decal                 | 587063         |
| Alligator Clip        | 306753         |
| Boot                  | 217703         |

To order replacement parts, call 1-800-526-4731. Outside U.S.A. contact your nearest service center. For application and operation assistance or information on Fluke products, visit the Fluke Website at: [www.fluke.com](http://www.fluke.com) or call:

USA: 1-888-99 FLUKE (1-888-993-5853)  
 Canada: 1-800-36-FLUKE (1-800-363-5853)  
 Europe: +31 402-678-200  
 Japan: +81-3-3434-0181  
 Singapore: +65-738-5655  
 Anywhere in the world: +1-425-446-5500

# 80K-15

## Electronic Air Cleaner Probe

### Instruction Sheet

#### Introduction

The 80K-15 Electronic Air Cleaner Probe (hereafter referred to as “the probe”) is a low energy probe that extends the voltage measuring capability of an ac/dc voltmeter or multimeter.

Properly connected, the probe is rated to 15 kV Overvoltage Category I. The use of the probe is restricted to low energy applications, which are energy limited circuits like electrostatic air cleaners. **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.

#### ⚠ Read First: Safety Information

##### ⚠ Warning

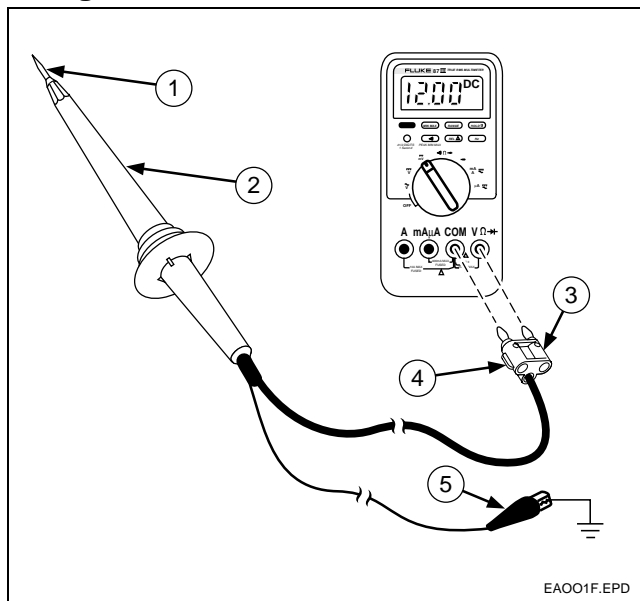
To avoid possible personal injury or electrical shock:

- Use the probe within its voltage ratings and in dry conditions (no condensation is present).
- Be familiar with and exercise all possible high voltage safety practices.
- DO NOT use this probe to measure high voltage on power distribution systems.
- Always hold the probe by its gray handle. Never allow the probe tip or the yellow part of the probe to make body contact.
- Before making a measurement, make sure that the side of the probe plug with the GND tab is plugged into the low (COM) terminal of the meter.
- Attach the grounding lead to earth ground.
- Use a meter with an impedance of  $10\text{ M}\Omega (\pm 1\%)$ . Using a meter with an input impedance less than  $10\text{ M}\Omega$  reduces the accuracy of the reading by causing it to be lower than the voltage present.
- DO NOT use the probe with a Fluke multimeter that is in the  $\text{V}\checkmark\text{Chek}^{\text{TM}}$  or Automatic Selection mode (i.e. Fluke 16, Fluke 12B etc.). The input impedance in these modes is very low.
- Make sure the probe tip is firmly attached to the body of the probe.
- DO NOT use the probe around explosive gas, vapor, or dust.
- DO NOT use the probe if it operates abnormally. Protection may be impaired. When in doubt have the probe serviced.

## Symbols

|  |   |
|--|---|
|  | Double insulated.   |
|  | Refer to explanation in this instruction sheet.                   |
|  | Lethal voltages may be present.                                   |
|  | Complies with relevant Canadian Standards Association directives. |
|  | Earth ground  |

## Using the Probe



|   |                         |
|---|-------------------------|
| ① | Probe tip               |
| ② | Probe body              |
| ③ | Plug                    |
| ④ | GND tab                 |
| ⑤ | Grounding lead clip     |
| ⑥ | Multimeter or voltmeter |

Figure 1. 80K-15 Electronic Air Cleaner Probe

The 80K-15 (Figure 1) is designed to work with a meter that has an input impedance of  $10\text{ M}\Omega$  ( $\pm 1\%$ ). A meter with an input impedance less than  $10\text{ M}\Omega$  can produce readings lower than the voltage present. This can pose a serious hazard when a dangerous voltage is present.

The 80K-15 represents a  $1000\text{ M}\Omega$  load to the circuit being measured, or  $1\text{ }\mu\text{A}$  per  $1\text{ kV}$ . Table 1 shows the circuit loading and input/output characteristics of the probe over its measurement range.

Taking care to follow the safety practices under “ Read First: Safety Information,” use the probe as follows:

1. Turn on a compatible voltmeter or multimeter and select the voltage measurement function.
2. Select an appropriate voltage range (i.e., 1 volt reading per 1000 volt input. See Table 1).
3. Connect the probe’s output leads to the voltmeter or multimeter input terminals.

4. Connect the alligator clip of the probe’s grounding lead to earth ground.
5. Touch the probe tip to the circuit being measured and read the measurement on the meter display. If necessary, apply a correction factor to the reading. (See “Note” in the “Specifications,” below.)

Table 1. 80K-15 Circuit Loading and Input/Output Characteristics

| Input Voltage | Loading Current  | Output Voltage |
|---------------|------------------|----------------|
| 10 V          | 10 nA            | 10 mV          |
| 100 V         | 100 nA           | 100 mV         |
| 1 kV          | 1 $\mu\text{A}$  | 1 V            |
| 10 kV         | 10 $\mu\text{A}$ | 10 V           |
| 15 kV         | 15 $\mu\text{A}$ | 15 V           |

## Specifications

The 80K-15 Electronic Air Cleaner Probe achieves its rated accuracy when it is used with a voltmeter or multimeter (ac or dc) with an input impedance of  $10\text{ M}\Omega \pm 1\%$ .

The accuracy of the probe does not include the accuracy of the meter. To get the accuracy of the system, the accuracy of the meter must be added to the accuracy of the probe.

### Note

The input impedance of the Autoranging mode on Fluke handheld digital multimeters varies by range.

The input impedance in almost all ranges of Fluke multimeters is  $\sim 10\text{ M}\Omega$ . The exceptions are: the 3 V range on the Fluke Models 21, 23, 25, 27, 70, 73, 75, 7; and the 4 V range on the Models 10, 11, 12, 16, 79, 83, 85, 86, 87, 88. In the ranges on these multimeters, the impedance is  $11.11\text{ M}\Omega$ .

To improve the measurement accuracy of the probe when using these ranges on the models indicated, apply a correction factor of 0.99 i.e., multiply the display reading by 0.99.

|                          |   |
|--------------------------|---|
| <b>Voltage Range:</b>    | 1 kV to 15 kV dc or peak ac,<br>10 kV rms ac  |
| <b>Maximum Current:</b>  | 20 $\mu\text{A}$  |
| <b>Input Resistance:</b> | 1000 $\text{M}\Omega$   |
| <b>Division Ratio:</b>   | 1000 : 1 (1000 x attenuation)   |
| <b>Accuracy DC:</b>      | $\pm 2\%$ in $10\text{ }^\circ\text{C}$ to $45\text{ }^\circ\text{C}$   |
| <b>Accuracy AC:</b>      | $\pm 5\%$ @ 60 Hz, in $20\text{ }^\circ\text{C}$ to $30\text{ }^\circ\text{C}$  |
| <b>Safety:</b>           | Complies with IEC 1010-2-31:1993,<br>Type B, 15 kV dc or peak ac, 10 kV<br>rms ac, Overvoltage Category I<br>(voltages derived from limited energy<br>transformer). |
| <b>Altitude:</b>         | 2000 meters   |

## **Performance Test**

Verify the accuracy of the probe by measuring a 15 kV dc ( $\pm 0.25\%$ ) voltage source. When used with a compatible dc voltmeter, the probe should measure the source with  $\pm 1\%$  accuracy. No calibration adjustments are needed.

## **Warranty**

### **LIMITED WARRANTY & LIMITATION OF LIABILITY**

This Fluke product will be free from defects in material and workmanship for one year from the date of purchase. This warranty does not cover fuses, disposable batteries or damage from accident, neglect, misuse or abnormal conditions of operation or handling. Resellers are not authorized to extend any other warranty on Fluke's behalf. To obtain service during the warranty period, send your defective tester to the nearest Fluke Authorized Service Center with a description of the problem.

THIS WARRANTY IS YOUR ONLY REMEDY. NO OTHER WARRANTIES, SUCH AS FITNESS FOR A PARTICULAR PURPOSE, ARE EXPRESSED OR IMPLIED. FLUKE IS NOT LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES OR LOSSES, ARISING FROM ANY CAUSE OR THEORY. Since some states or countries do not allow the exclusion or limitation of an implied warranty or of incidental or consequential damages, this limitation of liability may not apply to you.

Fluke Corporation  
P.O. Box 9090  
Everett, WA.  
98206-9090

Fluke Europe B.V.  
P.O. Box 1186  
5602 B.D. Eindhoven  
The Netherlands

10/96

## **Contacting Fluke**

**For application or operation assistance, or information on Fluke products, call:**

**USA: 1-888-99-FLUKE (1-888-993-5853)**  
**Canada: 1-800-36-FLUKE (1-800-363-5853)**  
**Europe: +31 402-678-200**  
**Japan: +81-3-3434-0181**  
**Singapore: +65-738-5655**  
**Anywhere in the world: +1-425-446-5500**

Or, visit Fluke's Web site at [www.fluke.com](http://www.fluke.com).

**Performance Test**

Verify the probe accuracy by measuring a 25 kV dc  $\pm 0.25\%$  voltage source. When used with a compatible dc voltmeter, the probe should measure the source with  $\pm 1\%$  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.

**LIMITED WARRANTY & LIMITATION OF LIABILITY**

Each Fluke product is warranted to be free from defects in material and workmanship under normal use and service. The warranty period is one year and begins on the date of shipment. Parts, product repairs and services are warranted for 90 days. This warranty extends only to the original buyer or end-user customer of a Fluke authorized reseller, and does not apply to fuses, disposable batteries or to any product which, in Fluke's opinion, has been misused, altered, neglected or damaged by accident or abnormal conditions of operation or handling. Fluke warrants that software will operate substantially in accordance with its functional specifications for 90 days and that it has been properly recorded on non-defective media. Fluke does not warrant that software will be error free or operate without interruption.

Fluke authorized resellers shall extend this warranty on new and unused products to end-user customers only but have no authority to extend a greater or different warranty on behalf of Fluke. Warranty support is available if product is purchased through a Fluke authorized sales outlet or Buyer has paid the applicable international price. Fluke reserves the right to invoice Buyer for importation costs of repair/replacement parts when product purchased in one country is submitted for repair in another country.

Fluke's warranty obligation is limited, at Fluke's option, to refund of the purchase price, free of charge repair, or replacement of a defective product which is returned to a Fluke authorized service center within the warranty period.

To obtain warranty service, contact your nearest Fluke authorized service center or send the product, with a description of the difficulty, postage and insurance prepaid (FOB Destination), to the nearest Fluke authorized service center. Fluke assumes no risk for damage in transit. Following warranty repair, the product will be returned to Buyer, transportation prepaid (FOB Destination). If Fluke determines that the failure was caused by misuse, alteration, accident or abnormal condition of operation or handling, Fluke will provide an estimate of repair costs and obtain authorization before commencing the work. Following repair, the product will be returned to the Buyer transportation prepaid and the Buyer will be billed for the repair and return transportation charges (FOB Shipping Point).

THIS WARRANTY IS BUYER'S SOLE AND EXCLUSIVE REMEDY AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. FLUKE SHALL NOT BE LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES OR LOSSES, INCLUDING LOSS OF DATA, WHETHER ARISING FROM BREACH OF WARRANTY OR BASED ON CONTRACT, TORT, RELIANCE OR ANY OTHER THEORY.

Since some countries or states do not allow limitation of the term of an implied warranty, or exclusion or limitation of incidental or consequential damages, the limitations and exclusions of this warranty may not apply to every buyer. If any provision of this Warranty is held invalid or unenforceable by a court of competent jurisdiction, such holding will not affect the validity or enforceability of any other provision.

Fluke Corporation  
P.O. Box 9090  
Everett, WA 98206-9090  
U.S.A.

Fluke Europe B.V.  
P.O. Box 1186  
5602 BD Eindhoven  
The Netherlands

**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  $10\text{ M}\Omega \pm 1.0\%$ . \* 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 M $\Omega$

**Division Ratio: 1000:** 1 (1000X attenuator)

**Accuracy DC:**

**20 kV to 35 kV:**  $\pm 1\%$  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:**  $\pm 2\%$ .

**Accuracy AC:** 60 Hz,  $\pm 5\%$ .

**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  $10\text{ M}\Omega$  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  $11.11\text{ M}\Omega$ . 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

© 1978, 1996, 1997 Fluke Corporation, All rights reserved. Printed in U.S.A.  
All product names are trademarks of their respective companies.

## 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):

$$R_s = \frac{R_m \times 10}{R_m - 10}$$

Where:  $R_s$  = Shunt resistance in MΩ  
 $R_m$  = Voltmeter input impedance in MΩ (>10 MΩ)

Example: If  $R_m = 20 \text{ M}\Omega$ ,

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

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

$$C_f = \frac{1.11 + R_m}{1.11 \times R_m}$$

Where:  $C_f$  = Correction factor (multiplier for meter reading)  
 $R_m$  = Voltmeter input impedance in MΩ

Example: If  $R_m = 1 \text{ M}\Omega$ ,

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

Therefore: A meter reading of 0.526 volts represents an input of:  $0.526 \times 1.901 = 1$  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          | 1 μA            | 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.

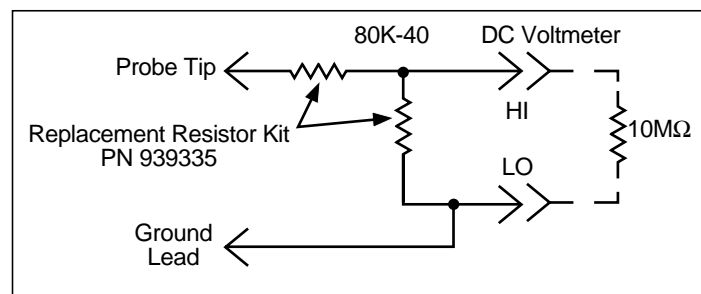


Figure 1. 80K-40 Simplified Circuit Diagram