

Instruction Sheet

Model 80K-40 High Voltage Probe

INTRODUCTION

The Model 80K40 is a high voltage accessory probe designed to extend the voltage measuring capability of an ac/dc voltmeter up to 40,000 volts. In essence the probe is a precision 1000:1 voltage divider formed by two matched metal-film 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 80K40 will achieve rated accuracy when used with a 0.25% voltmeter (ac or dc) having an input impedance of $10\text{ M}\Omega \pm 10\%$. Specifications for the probe are as follows:

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

Input Resistance: $1000\text{ M}\Omega$

Division Ratio: 1000:1 (1000X attenuator)

Accuracy DC:

Overall Accuracy: 20 kV to 30 kV $\pm 2\%$ (calibrated 1% at 25 kV)

Upper Limit: Changes linearly from 2% at 30 kV to 4% at 40 kV

Lower Limit: Changes linearly from 2% at 20 kV to 4% at 1 kV

Accuracy AC: $\pm 5\%$ at 60 Hz

MEASUREMENT CONSIDERATIONS

Before attempting to use the 80K40, the following paragraphs should be read and understood. Particular attention should be given to Operator Safety.

Voltmeter Compatibility

The 80K40 is compatible with any ac or dc voltmeter that has an input impedance of $10\text{ M}\Omega \pm 10\%$. Voltmeters with other input impedances require the use of an external shunt or a correction factor to obtain an accurate measurement. Higher impedance voltmeters should be equipped with a shunt, and lower impedance voltmeters should be assigned correction factors. Applicable formulas follow:

- a. The following formula is used to determine the value of an external shunt resistor:

$$R_s = \frac{R_m \times 10\text{ M}\Omega}{R_m - 10\text{ M}\Omega}$$

where: R_s = Shunt resistance in $\text{M}\Omega$

R_m = Voltmeter input impedance in $\text{M}\Omega$
($>10\text{ M}\Omega$)

Example: If $R_m = 100\text{ M}\Omega$,

$$R_s = \frac{100 \times 10}{100 - 10} = \frac{1000}{90} = 11.1\text{ M}\Omega$$

- b. Use the following formula to calculate a correction factor.

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

Where: C_f = Correction factor (multiplier for meter reading)

R_m = Voltmeter input impedance in $\text{M}\Omega$

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 80K40 represents a 1000 M Ω load to the circuit being measured, or 1 μ A per 1 kV. Table 1 shows the circuit loading and input/output characteristics of the probe over its measurement range.

Table 1.

80K40 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 μ A | 1V |
| 10 kV | 10 μ A | 10V |
| 20 kV | 20 μ A | 20V |
| 30 kV | 30 μ A | 30V |
| 40 kV | 40 μ A | 40V |

Operator Safety

To avoid electrical shock the 80K40 user should be familiar with, and exercise, all possible high-voltage safety practices. When handling the probe the following additional precautions must be taken:

WARNING

1. 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.
2. Before making a measurement, make sure that the tab side of the output connector is connected to the voltmeter's low input terminal.
3. The clip lead is intended to be grounded. To avoid electrical shock, attach the grounding clip to potentials below 30V AC, 42 volts peak, or 60V DC.

OPERATION

Use the following procedure to operate the 80K40:

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 80K40 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 M Ω), as well as its accuracy and stability characteristics are achieved through the use of special metal film resistors. When the probe is connected to a voltmeter with a 10 M Ω 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.

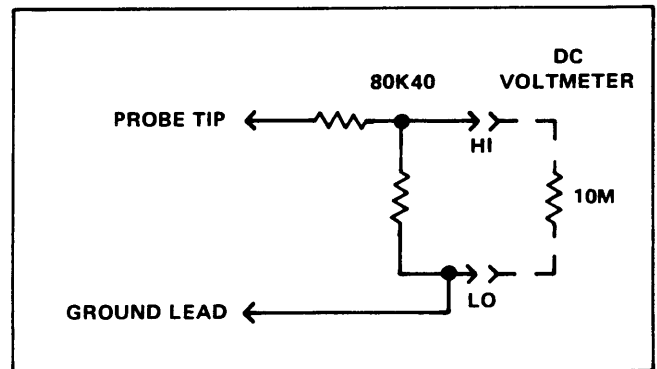


Figure 1. 80K40 Simplified Circuit Diagram

MAINTENANCE

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 80K40. Never use solvents or abrasive cleaners.