UNIVERSAL HIGH-RESISTANCE VOLTMETER

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The full-scale deflection of the universal high-input-resistance voltmeter circuit shown in the figure
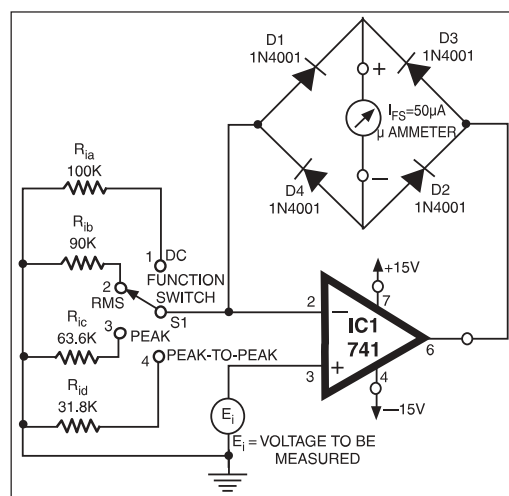
depends on the function switch position as follows:

(a) 5V DC on position 1

(b) 5V AC rms in position 2

(c) 5V peak AC in position 3

(d) 5V AC peak-to-peak in position 4

The circuit is basically a voltage-to-current converter. The design procedure is as follows:

Calculate R_I according to the application from one of the following equations:

(a) DC voltmeter: R_{IA} = full-scale E_{DC}/I_{FS}

(b) RMS AC voltmeter (sine wave only): R_{IB} = 0.9 full-scale E_{RMS}/I_{FS}

(c) Peak reading voltmeter (sine wave only): R_{IC} = 0.636 full-scale E_{PK}/I_{FS}

(d) Peak-to-peak AC voltmeter (sine wave only): R_{ID} = 0.318 full-scale $E_{PK-TO-PK}/I_{FS}$

The term I_{FS} in the above equations refers to meter's full-scale deflection current rating in amperes.

It must be noted that neither meter resistance nor diode voltage drops affects meter current.

Note: The results obtained during practical testing of the circuit in EFY lab are tabulated in Tables I through IV.

A high-input-resistance op-amp, a bridge rectifier, a microammeter, and a few other discrete components are all that are required to realise this versatile circuit. This circuit can be used for measurement of DC, AC RMS, AC peak, or AC peak-to-peak voltage by simply chang-

ing the value of the resistor connected between the inverting input terminal of the op-amp and ground. The voltage to be measured is connected to non-inverting input of the op-amp.

TABLE I
Position 1 of Function Switch

E_{dc} input	Meter Current
5.00V	44 µA
4.00V	34 µA
3.00V	24 µA
2.00V	14 µA
1.00V	4 µA

TABLE II
Position 2 of Function Switch

E_{rms} input	Meter Current
5V	46 µA
4V	36 µA
3V	26 µA
2V	18 µA
1V	10 µA

TABLE III
Position 3 of Function Switch

E_{Pk} input	Meter Current
5V peak	46 µA
4V peak	36 µA
3V peak	26 µA
2V peak	16 µA
1V peak	6 µA

TABLE IV
Position 4 of Function Switch

$E_{Pk-To-Pk}$	Meter Current
5V peak to peak	46 µA
4V peak to peak	36 µA
3V peak to peak	26 µA
2V peak to peak	16 µA
1V peak to peak	7 µA