

MICROPOTENTIOMETER - MODEL 440

FEATURES

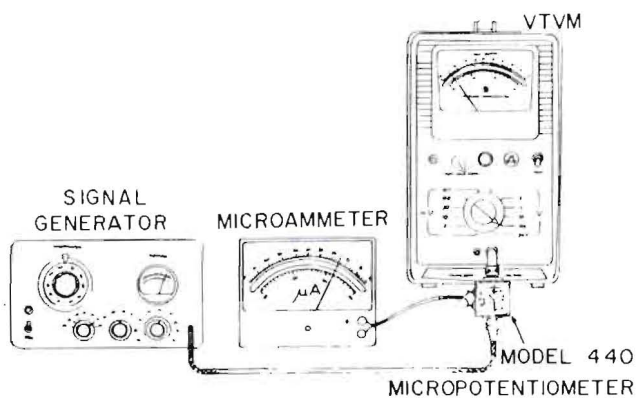
- A simple, robust device for use as a reference or working standard to develop accurately known low voltages at frequencies from 0 to 900 MHz
- A true-rms device, hence not dependent on a particular waveform
- Absolute values easily determined by dc measurements at any time
- The simplest and most accurate method known to
 - a) measure relative frequency response of ac voltmeters and oscilloscopes
 - b) measure absolute accuracy of ac voltmeters and oscilloscopes
 - c) measure absolute accuracy of output of signal generators

DESCRIPTION

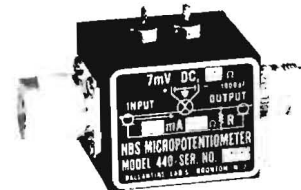
The Ballantine Model 440 Micropotentiometer is designed to provide a precisely determined voltage at its output terminal when 0 to 900 megohertz current is fed into the input terminal. The input current flows through a UHF-type thermocouple to a radial resistor of known constant value. The voltage developed across this resistor becomes the standard which is used to calibrate electronic voltmeters, signal generators, oscilloscopes, and other voltage-sensing devices.

The nominal output voltage of a Model 440 is given by the product of the heater current rating of the thermocouple and the resistance of the radial resistor. This voltage can be varied from 1/3 to 1-1/3 of the rated output by varying the thermocouple current over a four to one range.

Radial resistors are available in 21 nominal steps from 0.01 ohm to 22 ohms. Any of these resistors may be plugged into any thermocouple housing assembly having either a 5, 10, 15, 25, or 50 milliampere UHF thermocouple. To cover the complete range of voltages from 17 microvolts to 1.4 volts, see the proposed kit listed on page 2.



Model 440 Micropotentiometer being used to calibrate voltmeter on right.



Model 440 Micropotentiometer. Radial Resistor R is part of the Type N connector on the right. It may be removed and plugged into another housing having a different thermocouple rating than the 5 mA unit shown here.

APPLICATIONS

The Model 440 Micropotentiometer may be used to provide either a **relative** or an **absolute** voltage standard over the frequency range from 0 to 900 megahertz.

As a **relative** voltage standard it is useful in determining the frequency response of instruments such as voltmeters and oscilloscopes in terms of an arbitrary reference level and frequency. As an **absolute** voltage standard it is useful in calibrating devices such as voltmeters, signal generators and oscilloscopes at levels from 17 microvolts to 1.4 volts.

Drawing shows the arrangement for measuring the frequency response of a typical ac voltmeter. The input to the VTVM is held constant by adjusting the output of the signal generator to produce a standard reading on the microammeter at each desired frequency. The VTVM reading is observed for each frequency and results compared to the reading at some reference frequency, say 1000 Hz.

Ballantine Laboratories, Inc.

VOLTAGE COVERAGE WITH DIFFERENT RADIAL RESISTOR — THERMOCOUPLE COMBINATIONS

RESISTOR* (OHMS, NOMINAL)	MIN - MAX MICROVOLTS**		
	5 mA THERMOCOUPLE	10 mA THERMOCOUPLE	15 mA THERMOCOUPLE
0.010	17 - 67	33 - 135	50 - 200
0.015	25 - 100	50 - 200	75 - 300
0.022	37 - 145	75 - 290	110 - 440
0.033	55 - 220	110 - 440	165 - 660
0.047	80 - 310	160 - 620	240 - 940
0.068	115 - 450	230 - 900	340 - 1,350
0.10	170 - 670	330 - 1,350	500 - 2,000
0.15	250 - 1,000	500 - 2,000	750 - 3,000
0.22	370 - 1,450	750 - 2,900	1,100 - 4,400
0.33	550 - 2,200	1,100 - 4,400	1,650 - 6,600
0.47	800 - 3,100	1,600 - 6,200	2,400 - 9,400
0.68	1,150 - 4,500	2,300 - 9,000	3,400 - 13,500
1.0	1,700 - 6,700	3,300 - 13,500	5,000 - 20,000
1.5	2,500 - 10,000	5,000 - 20,000	7,500 - 30,000
2.2	3,700 - 14,500	7,500 - 29,000	11,000 - 44,000
3.3	5,500 - 22,000	11,000 - 44,000	16,500 - 66,000
4.7	8,000 - 31,000	16,000 - 62,000	24,000 - 94,000
6.8	11,500 - 45,000	23,000 - 90,000	34,000 - 135,000
10.	17,000 - 67,000	33,000 - 135,000	50,000 - 200,000
15.	25,000 - 100,000	50,000 - 200,000	75,000 - 300,000
22.	37,000 - 145,000	75,000 - 290,000	110,000 - 440,000

*Resistance values are nominal $\pm 20\%$, each marked with its actual value

**25 mA or 50 mA thermocouples may be ordered for use with any of the radial resistors shown but normally are used to extend the voltage range to 0.72 or 1.4 volts respectively when using a radial resistor of nominal value 22 ohms.

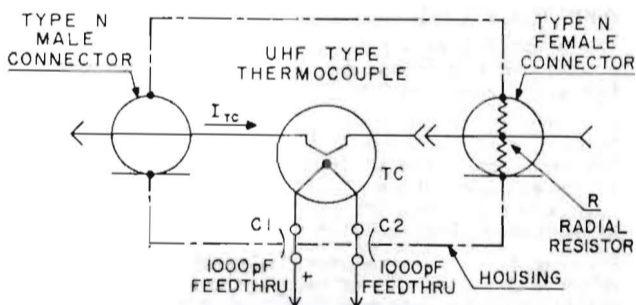
ORDERING INFORMATION

We recommend the Model 440-01 kit consisting of five radial resistors and three thermocouple housings in a mahogany case, to cover the full range of voltages from 17 microvolts to 1.4 volts. Resistors supplied are in nominal values of 0.01, 0.1, 1, 10 and 22 ohms. Housings have thermocouples of 5, 15 and 50 mA. Price of Model 440-01, including Ballantine calibration and certification to 500 MHz, is \$1100.

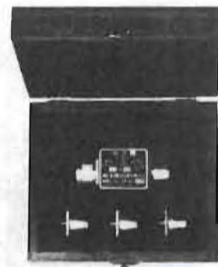
Any combination of resistors and thermocouple housings can be ordered separately. Use the above table to determine the correct combination for any particular output voltage range. Order the resistors by nominal resistance value and thermocouple housings by current rating. Each resistor is \$175, including Ballantine calibration and certification to 500 MHz. Thermocouple housings are \$75 each.

CALIBRATION

Each Model 440 Micropotentiometer is supplied with a Ballantine calibration and certification of rf to dc difference to 500 MHz. Calibration is directly traceable to a set of micropotentiometers specially calibrated by NBS for this purpose. Uncertainty is 3% to 5 MHz, 4% to 400 MHz, and 6% to 500 MHz. Tests at Ballantine, based on NBS-calibrated transfer voltmeters, indicate a typical ac to dc difference of less than 1/4% to 10 MHz, less than 1% to 100 MHz, less than 5% to 500 MHz, and less than 15% to 900 MHz.



Schematic circuit of Model 440 Micropotentiometer



Model 440 units are supplied in a mahogany case

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