

# Precision Decade Resistor

Accurate, Stable and Low Zero Resistance

## GenRad 1433 Series

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The 1433 Decade Resistors are primarily intended for precision measurement applications where their excellent accuracy, stability, and low zero resistance are important. They are convenient resistance standards for checking the accuracy of resistance measuring devices and are used as components in dc and audio frequency impedance bridges. Many of the models can be used into the radio-frequency range.

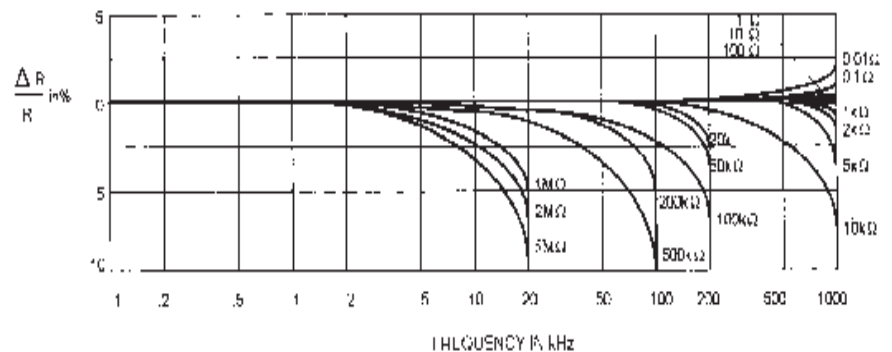


Model 1433 Precision Decade Resistor

- Resistance range from 1 mΩ to 111 MΩ
- High accuracy - 0.01% up to 10 MΩ steps.
- Low temperature coefficient
- Good frequency characteristics
- Excellent stability
- Low zero resistance
- May be used for RTD simulation
- Rack mount option

There is a large selection of models available, with 3 through 11 decades, covering a wide resistance range from 1 mΩ to over 111 MΩ. Each 1433 is an assembly of multiple long-contact-life switches and precision resistors in a single cabinet. The individual switches have solid silver contacts. The dials, labeled 0 to X (=10), offer continuous rotation from position to position with no stops. Each dial also has an overlap 10 position to eliminate the need of having to reset all dials when passing through a decade point. The resistance per step and maximum current of each dial is clearly shown on the front panel. Electrical shielding is provided by an attractive aluminum cabinet and front panel. The resistance elements have no electrical connection to the cabinet and panel; a separate shield terminal is provided.

Figure 1: Typical Frequency Characteristics



## SPECIFICATIONS

Over-all Accuracy: The difference between the resistance at any setting and at the zero setting is equal to the indicated value  $\pm (0.01\% + 2 \text{ m}\Omega)$ .

Resistance per Step	Total Decade Resistance	Stability ( $\pm$ ppm/year)	Long Term Stability ( $\pm$ ppm/3 years)	Temperature Coefficient ( $\pm$ ppm/ $^{\circ}$ C)	Max. Power (W/step)	Maximum current (per decade)	Maximum voltage (per step)
1 mΩ	10 mΩ	100	700	50	0.025	5 A	5 mV
10 mΩ	100 mΩ	50	350	20	0.2	4 A	40 mV
100 mΩ	1 Ω	30	50	20	0.25	1.6 A	0.16 V
1 Ω	10 Ω	10	25	20	0.6	0.8 A	0.8 V
10 Ω	100 Ω	10	25	15	0.6	0.25 A	2.5 V
100 Ω	1 kΩ	10	25	5	0.6	80 mA	8 V
1 kΩ	10 kΩ	10	25	5	0.5	23 mA	23 V
10 kΩ	100 kΩ	10	25	5	0.5	7 mA	70 V
100 kΩ	1 MΩ	10	25	5	0.5*	2.3* mA	230 V*
1 MΩ	10 MΩ	10	25	10	0.5*	0.7* mA	700 V*
10 MΩ	100 MΩ	25	40	10	0.1*	0.1* mA	1000 V*

\* Subject to maximum of 2000 V.

### SPECIFICATIONS

Typical Frequency Characteristics: See Figure 1.

Typical Values of  $R_0$ ,  $L_0$  and  $C$  for the Decade Resistors:  
 Zero Resistance ( $R_0$ ): 0.001  $\Omega$ /decade at dc (higher for 7-10 decades);  
 0.04  $\Omega$ /dial at 1 MHz; proportional to the square root of frequency  
 above 100 kHz. Zero Inductance ( $L_0$ ): 0.1  $\mu$ H/dial + 0.2  $\mu$ H

Effective Shunt Capacitance ( $C$ ): Value is determined largely by the highest decade in use. With the low terminal connected to the shield, a value of 15 to 20 pF/decade may be assumed, counting decades down from the highest. Thus, if the third decade from the top is the highest resistance, a value of 45 to 60 pF may be assumed. If the highest decade in the unit is in use, the effective capacitance is 15 to 20 pF, regardless of the settings of the lower resistance decades.

Temperature Coefficient of Resistance:

<10 ppm/ $^{\circ}$ C for 100  $\Omega$  and over;  
 +20 ppm/ $^{\circ}$ C for 10  $\Omega$  and under;  
 at room temperatures.

Assembly will increase the over-all temperature coefficient of the 0.1 and 0.01  $\Omega$ .

Switches: Continuous dial rotation; solid silver contacts; contact resistance of less than 1 m $\Omega$ ; capacitance of less than 1 pF between contacts; lifetime in excess of 1 million cycles.

Maximum Voltage to case: 2000 V pk.

Terminals: Gold plated, low thermal-emf jack-top binding posts on standard 3/4" spacing. Shield terminal provided.

Mechanical: Lab-bench cabinet.

Model	Dimensions	Weight
1 decade	7.7 cm W x 7.7 cm H x 8.4 cm D (3" x 3" x 3.3")	0.45 kg (1.0 lb)
2-4 decades	37.5 cm W x 8.9 cm H x 10.2 cm D (14.8" x 3.5" x 4")	1.7 kg (3.8 lb)
5 decades		2.0 kg (4.3 lb)
6 decades	43.9 cm W x 8.9 cm H x 10.2 cm D (17.3" x 3.5" x 4")	2.2 kg (4.8 lb)
7 decades		2.4 kg (5.3 lb)
8 decades		2.6 kg (5.7 lb)
9 decades	48.3 cm W x 17.8 cm H x 19.7 cm D (19.0" x 7.0" x 7.8")	5.1 kg (11.2 lb)
10 decades		5.3 kg (11.7 lb)
11 decades		5.4 kg (11.9 lb)

### ORDERING INFORMATION

Catalog No	Total ( $\Omega$ )	Min step	No of dials
1433-01	1,110	0.001	3
1433-00	111.10	0.01	4
1433-02	1,111.0	0.1	4
1433-04	11,110	1	4
1433-06	111,100	10	4
1433-08	1,111,000	100	4
1433-09	11,110,000	1000	4
1433-09A	111,100,000	10,000	4
1433-10	1,111.10	0.01	5
1433-10A	111.110	0.001	5
1433-12	11,111.0	0.1	5
1433-14	111,110	1	5
1433-16	1,111,100	10	5
1433-18	11,111,000	100	5
1433-18A	111,110,000	1000	5
1433-19	1,111.110	0.001	6
1433-20	11,111.10	0.01	6
1433-22	111,111.0	0.1	6
1433-24	1,111,110	1	6
1433-26	11,111,100	10	6
1433-27	111,111,000	100	6
1433-28	11,111.110	0.001	7
1433-29	111,111.10	0.01	7
1433-31	1,111,111	0.1	7
1433-33	11,111,110	1	7
1433-34	111,111,100	10	7
1433-35	111,111.110	0.001	8
1433-36	1,111,111.10	.01	8
1433-37	11,111,111.0	0.1	8
1433-38	111,111,110	1	8
1433-39	1,111,111.110	0.001	9
1433-39A	11,111,111.10	0.01	9
1433-39B	111,111,111.0	0.1	9
1433-40A	11,111,111.110	0.001	10
1433-40	111,111,111.10	0.01	10

**INCLUDES:**

- Calibration Certificate Traceable to SI

**OPTIONAL ACCESSORIES:**

- Calibration Data

- 1433-50      Rack Mount Kit (4 dial)
- 1433-51      Rack Mount Kit (5 dial)
- 1433-52      Rack Mount Kit (6 dial)
- 1433-53      Rack Mount Kit (7 dial)