

# Type MG Precision High Voltage Resistors

Part Performance and Size Options provide the Designer with High Voltage Module Optimization

Tolerance of  $\pm 1\%$  to  $\pm 0.1\%$ , Temperature Coefficient as tight as 80 ppm/ $^{\circ}\text{C}$ , combined with Excellent Long-Term Stability.

Caddock's Micronox<sup>®</sup> complex metal oxide resistance films are the source of the Type MG Precision High Voltage Resistors' outstanding combination of performance features:

- Resistance Tolerances from  $\pm 1\%$  to  $\pm 0.1\%$ .
- Temperature Coefficient, for standard resistance range, of 80 ppm/ $^{\circ}\text{C}$ , with resistance tolerances as tight as  $\pm 0.1\%$ .
- Type MG resistors have demonstrated stability of 0.01% per 1,000 hours in extended load life testing of standard resistance range values.
- Overvoltage capabilities of 150% of standard working voltages for all models and values (except "-15" ratings).
- Extended higher maximum operating voltage, "-15 ratings"
- Outstanding short term high voltage transient stability.
- Single resistor values as high as 10,000 Megohms.

This exceptional performance has been proven through many years of use in equipment that demands the highest reliability and stability, including TWT HV power supplies, electron microscopes, e-beam equipment, electrical distribution HV monitor dividers, X-ray systems, geophysical instruments, medical electronics, as well as HV probes and compact instrument probes.

## Preconditioning for Power and Voltage Ratings

All power ratings and maximum operating voltage ratings are for continuous duty. These ratings are based on pre-stress voltage levels applied during the manufacturing process to provide for stable resistor performance even under momentary overload conditions.

For certain models, the maximum operating voltage may be extended 60% higher than the operating voltage listed in the table by adding "-15" to the model number (Example: MG750-15-200M-1%; 16,000 Volts). Note: The resistance range is from "-15 Min." to "Std Max". The overload and overvoltage ratings do not apply to resistors with the "-15 rating".

## Non-Inductive Performance

All models are manufactured with Caddock's Non-Inductive Designs, which includes the serpentine resistive pattern that provides for neighboring lines to carry current in opposite directions, thereby achieving maximum cancellation of flux fields over the entire length of the resistor. This efficient non-inductive construction is accomplished without derating of any performance advantages.

Model No.	Wattage	Std. Max. Continuous Oper. Volt. (DC or AC <sub>rms</sub> )	Overload Rating	Coating Dielectric Strength (AC <sub>rms</sub> )	Resistance				Dimensions in inches and (millimeters)		
					Std Min	-15 Min	Std Max	Extended Max	A	B	C
MG650	0.5	600	Type 1	750	200 $\Omega$	N/A	5 Meg	N/A	.313 $\pm$ .020 (7.95 $\pm$ .51)	.094 $\pm$ .015 (2.39 $\pm$ .38)	.025 $\pm$ .002 (.64 $\pm$ .05)
MG655	0.5	600	Type 1	750	200 $\Omega$	N/A	8 Meg	N/A	.313 $\pm$ .030 (7.95 $\pm$ .76)	.109 $\pm$ .025 (2.77 $\pm$ .64)	.025 $\pm$ .002 (.64 $\pm$ .05)
MG660	0.6	1,000	Type 1	750	400 $\Omega$	N/A	10 Meg	N/A	.500 $\pm$ .030 (12.70 $\pm$ .76)	.094 $\pm$ .015 (2.39 $\pm$ .38)	.025 $\pm$ .002 (.64 $\pm$ .05)
MG680	0.8	2,000	Type 1	750	600 $\Omega$	N/A	20 Meg	N/A	.750 $\pm$ .030 (19.05 $\pm$ .76)	.094 $\pm$ .015 (2.39 $\pm$ .38)	.025 $\pm$ .002 (.64 $\pm$ .05)
MG710	1.0	4,000	Type 1	750	800 $\Omega$	N/A	50 Meg	N/A	1.000 $\pm$ .040 (25.40 $\pm$ 1.02)	.094 $\pm$ .015 (2.39 $\pm$ .38)	.025 $\pm$ .002 (.64 $\pm$ .05)
MG712	0.6	1,000	Type 2	750	800 $\Omega$	N/A	20 Meg	N/A	.400 $\pm$ .060 (10.16 $\pm$ 1.52)	.140 $\pm$ .030 (3.56 $\pm$ .76)	.025 $\pm$ .002 (.64 $\pm$ .05)
MG714	1.0	1,000	Type 2	750	200 $\Omega$	6.5 Meg	20 Meg	N/A	.562 $\pm$ .060 (14.27 $\pm$ 1.52)	.150 $\pm$ .030 (3.81 $\pm$ .76)	.032 $\pm$ .002 (.81 $\pm$ .05)
MG715	1.0	2,000	Type 2	750	400 $\Omega$	26 Meg	50 Meg	N/A	.750 $\pm$ .060 (19.05 $\pm$ 1.52)	.140 $\pm$ .030 (3.56 $\pm$ .76)	.025 $\pm$ .002 (.64 $\pm$ .05)
MG716	1.5	4,000	Type 2	750	600 $\Omega$	70 Meg	75 Meg	N/A	1.000 $\pm$ .060 (25.40 $\pm$ 1.52)	.140 $\pm$ .030 (3.56 $\pm$ .76)	.025 $\pm$ .002 (.64 $\pm$ .05)
MG717	1.5	2,000	Type 2	750	600 $\Omega$	17 Meg	75 Meg	225 M	.710 $\pm$ .050 (18.03 $\pm$ 1.27)	.240 $\pm$ .030 (6.10 $\pm$ .76)	.040 $\pm$ .002 (1.02 $\pm$ .05)
MG720	2.0	6,000	Type 2	750	1 K	N/A	150 Meg	N/A	1.500 $\pm$ .080 (38.10 $\pm$ 2.03)	.140 $\pm$ .030 (3.56 $\pm$ .76)	.025 $\pm$ .002 (.64 $\pm$ .05)
MG721	2.0	4,000	Type 2	750	200 $\Omega$	51 Meg	100 Meg	300 M	1.000 $\pm$ .050 (25.40 $\pm$ 1.27)	.240 $\pm$ .030 (6.10 $\pm$ .76)	.040 $\pm$ .002 (1.02 $\pm$ .05)
MG725	2.5	10,000	Type 2	750	1.5 K	N/A	200 Meg	N/A	2.000 $\pm$ .080 (50.80 $\pm$ 2.03)	.140 $\pm$ .030 (3.56 $\pm$ .76)	.025 $\pm$ .002 (.64 $\pm$ .05)
MG730	3.0	6,000	Type 2	1,000	500 $\Omega$	77 Meg	250 Meg	750 M	1.500 $\pm$ .080 (38.10 $\pm$ 2.03)	.240 $\pm$ .030 (6.10 $\pm$ .76)	.040 $\pm$ .002 (1.02 $\pm$ .05)
MG731	2.6	4,000	Type 2	1,000	200 $\Omega$	40 Meg	150 Meg	750 M	1.000 $\pm$ .060 (25.40 $\pm$ 1.52)	.315 $\pm$ .030 (8.00 $\pm$ .76)	.040 $\pm$ .002 (1.02 $\pm$ .05)
MG735	3.6	10,000	Type 2	1,000	750 $\Omega$	178 Meg	300 Meg	1,000 M	2.000 $\pm$ .080 (50.80 $\pm$ 2.03)	.240 $\pm$ .030 (6.10 $\pm$ .76)	.040 $\pm$ .002 (1.02 $\pm$ .05)
MG740	3.6	6,000	Type 2	1,000	300 $\Omega$	64 Meg	300 Meg	1,500 M	1.500 $\pm$ .060 (38.10 $\pm$ 1.52)	.315 $\pm$ .030 (8.00 $\pm$ .76)	.040 $\pm$ .002 (1.02 $\pm$ .05)
MG745	5.0	15,000	Type 2	1,000	1 K	288 Meg	500 Meg	1,500 M	3.000 $\pm$ .100 (76.20 $\pm$ 2.54)	.240 $\pm$ .030 (6.10 $\pm$ .76)	.040 $\pm$ .002 (1.02 $\pm$ .05)
MG750	5.0	10,000	Type 2	1,000	400 $\Omega$	128 Meg	500 Meg	2,500 M	2.125 $\pm$ .060 (53.98 $\pm$ 1.52)	.315 $\pm$ .030 (8.00 $\pm$ .76)	.040 $\pm$ .002 (1.02 $\pm$ .05)
MG780	7.5	15,000	Type 2	1,000	600 $\Omega$	192 Meg	750 Meg	3,750 M	3.125 $\pm$ .060 (79.38 $\pm$ 1.52)	.315 $\pm$ .030 (8.00 $\pm$ .76)	.040 $\pm$ .002 (1.02 $\pm$ .05)
MG785	8.0	20,000	Type 2	1,000	800 $\Omega$	320 Meg	1,000 Meg	5,000 M	4.000 $\pm$ .120 (101.60 $\pm$ 3.05)	.315 $\pm$ .030 (8.00 $\pm$ .76)	.040 $\pm$ .002 (1.02 $\pm$ .05)
MG810	10.0	25,000	Type 2	1,000	1 K	400 Meg	1,250 Meg	6,250 M	5.000 $\pm$ .120 (127.00 $\pm$ 3.05)	.315 $\pm$ .030 (8.00 $\pm$ .76)	.040 $\pm$ .002 (1.02 $\pm$ .05)
MG815	15.0	30,000	Type 2	1,000	1 K	384 Meg	2,000 Meg	10,000 M	6.000 $\pm$ .120 (152.40 $\pm$ 3.05)	.350 $\pm$ .040 (8.89 $\pm$ 1.02)	.040 $\pm$ .002 (1.02 $\pm$ .05)

**Lead Finish:** Solderable. Thin gold plate over thick nickel layer on copper core.

**Encapsulation:** High Temperature Silicone Conformal.

**Operating Temperature Range:** -55 $^{\circ}\text{C}$  to +225 $^{\circ}\text{C}$ , see Derating Curve.

## Specifications:

### Resistance Tolerance:

Resistance Range	Tolerance
Standard	$\pm 1\%$ ; also $\pm 0.1\%$ , $\pm 0.25\%$ , $\pm 0.5\%$
Std'd with "-15" rating	$\pm 1\%$ ; also $\pm 5\%$
Extended Range	$\pm 1\%$ ; also $\pm 5\%$

### Temperature Coefficient:

Resistance Range	TC Specifications
Standard and Std'd with "-15" rating	$\pm 80$ ppm/ $^{\circ}\text{C}$ from -15 $^{\circ}\text{C}$ to +105 $^{\circ}\text{C}$ , referenced to +25 $^{\circ}\text{C}$ .
Extended Range	$\pm 80$ ppm/ $^{\circ}\text{C}$ from +25 $^{\circ}\text{C}$ to +105 $^{\circ}\text{C}$ , -200 ppm/ $^{\circ}\text{C}$ to +50 ppm/ $^{\circ}\text{C}$ from -15 $^{\circ}\text{C}$ to +25 $^{\circ}\text{C}$ .

**Voltage Coefficient:** Contact Caddock Applications Engineering

**Overload/Overvoltage:** 5 times rated power with applied voltage not to exceed 1.5 times maximum continuous operating voltage for 5 seconds.

Type 1: DC Voltage

Type 2: DC Voltage or VAC<sub>rms</sub>

Resistance Range	Overload/Overvoltage, $\Delta R$
Standard	0.5% max.
Std'd with "-15" rating	N/A
Extended Range	0.8% max.

**Load Life:** 1,000 hours at +125 $^{\circ}\text{C}$  at rated voltage, not to exceed rated power.

Resistance Range	Load Life, $\Delta R$
Standard	0.5% max. at +125 $^{\circ}\text{C}$
Std'd with "-15" rating	0.8% max. at +85 $^{\circ}\text{C}$
Extended Range	0.8% max. at +125 $^{\circ}\text{C}$

**Thermal Shock:** Mil-Std-202, Method 107, Cond. C,  $\Delta R$  0.25% max.

**Moisture Resistance:** Mil-Std-202, Method 106,  $\Delta R$  0.4% max.

**Insulation Resistance:** 10,000 Megohms, min.

**CADDOCK ELECTRONICS, INC.**

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