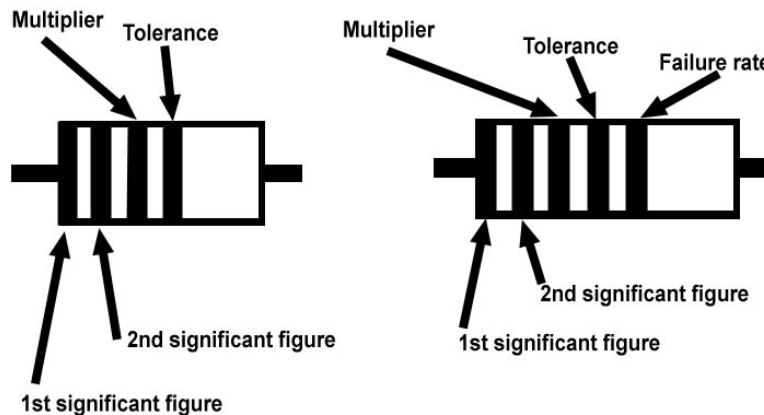


INTRODUCTION TO RESISTORS

INTRO TO RESISTORS:

- A resistor is an electrical component designed to have a specific resistance (or opposition) to the flow of electrons, measured in ohms (Ω).
- When installing a remote start or security system, resistors of a specific resistance may be needed to interface with the vehicle's circuits. Some of a vehicle's circuits may require a reduced voltage to operate a specific accessory or function. A resistor can be added to reduce the trigger voltage to the circuit. Resistors will not be required on most installations, but will be required for installations on many newer vehicles. For example, on a 2002 Dodge Intrepid, a positive pulse through a 2700-Ohm resistor to the door lock wire will lock the doors. If resistors are not included with the system you purchased, they can be found at almost any electronics parts store such as Radio Shack.
- Carbon-film resistors are the type most commonly used in vehicle security and convenience applications. Color bands on the resistor will indicate the value in ohms as well as its tolerance in a plus or minus percentage of accuracy. Resistors also have a watt rating to indicate the amount of power it can handle. If you exceed the power rating of a resistor, it will overheat and burn.

Symbol used in wiring schematics to indicate a resistor:



Resistors with black body are composition, non-insulated.
Resistors with colored body are composition, insulated.
Wire wound resistors have the 1st color band double-width.

RESISTOR COLOR CODES

COLOR	SIGNIFICANT FIGURES	MULTIPLIER	TOLERANCE	FAILURE RATE (% of failure per 1000 hours of operation)
BLACK	0	1	$\pm 20\%$	-
BROWN	1	10	$\pm 1\%$	1.0
RED	2	100	$\pm 2\%$	0.1
ORANGE	3	1,000	$\pm 3\%$	0.01
YELLOW	4	10,000	$\pm 4\%$	0.001
GREEN	5	100,000	-	-
BLUE	6	1,000,000	-	-
VIOLET	7	10,000,000	-	-
GRAY	8	100,000,000	-	-
WHITE	9		9	Solderable
GOLD	-	.01	$\pm 5\%$	-
SILVER	-	0.01	$\pm 10\%$	-
NO COLOR	-		$\pm 20\%$	-

EXAMPLE:

If the 1st band is ORANGE and the 2nd band is GREEN and the 3rd band is RED and the 4th band is GOLD then:
ORANGE 1st band=3, GREEN 2nd band=5, RED 3rd band=100, GOLD 4th band=5% so:
35X100=3500 RESISTOR VALUE IS 3500 OHMS WITH A TOLERANCE OF 5%.

TROUBLESHOOTING RESISTORS:

Troubleshooting resistors is pretty straightforward. Resistors almost always open when they go bad. An open resistor in a series circuit will stop current from flowing in the circuit. An open resistor in a parallel circuit will increase the resistance and decrease the total current.

RESISTOR VALUE	COLOR BANDS
249 OHMS	RED YELLOW WHITE BLACK BROWN
330 OHMS	ORANGE ORANGE BROWN GOLD
365 OHMS	ORANGE BLUE GREEN BLACK BROWN
390 OHMS	ORANGE WHITE BROWN GOLD
430 OHMS	YELLOW ORANGE BROWN GOLD
470 OHMS	YELLOW VIOLET BROWN GOLD
487 OHMS	YELLOW GRAY VIOLET BLACK BROWN
560 OHMS	GREEN BLUE BROWN GOLD
620 OHMS	BLUE RED BLACK BLACK BROWN
665 OHMS	BLUE BLUE GREEN BLACK BROWN
750 OHMS	VIOLET GREEN BROWN GOLD
820 OHMS	GRAY RED BROWN GOLD
867 OHMS	GRAY BLUE VIOLET BLACK BROWN
931 OHMS	WHITE ORANGE BROWN BLACK BROWN
1000 OHMS	BROWN BLACK RED GOLD
1200 OHMS	BROWN RED RED GOLD
1500 OHMS	BROWN GREEN RED GOLD
1870 OHMS	BROWN GRAY VIOLET BROWN BROWN
2000 OHMS	RED BLACK RED GOLD
2700 OHMS	RED VIOLET BLACK BROWN BROWN
3000 OHMS	ORANGE BLACK RED GOLD
4020 OHMS	YELLOW BLACK RED BROWN BROWN
4700 OHMS	YELLOW VIOLET RED GOLD
5360 OHMS	GREEN ORANGE BLUE BROWN BROWN
7150 OHMS	VIOLET BROWN GREEN BROWN BROWN
7500 OHMS	VIOLET GREEN RED GOLD
9100 OHMS	WHITE BROWN RED GOLD

In some cases, you'll need a resistor of a value other than what you have available. Different resistance values can be obtained by combining the resistors in a series or parallel connection.

SERIES CONNECTION

When two or more resistors are wired in series, the total value is the sum of the resistor values.
 $R_1 + R_2 = \text{Total resistance value}$



PARALLEL CONNECTION

When two or more resistors are wired in parallel, the total value is the total of the value of the first resistor multiplied by the second resistor divided by the sum of the first resistor and the second resistor.
 $(R_1 \times R_2) \div (R_1 + R_2) = \text{Total resistance value}$

