Resistors

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Summary

The Resistors Widget is a special purpose calculator to decode the colored bands on resistors (and small capacitors).

Resistor Color Code

The Widget uses the old color code where resistors are marked with three or four colored bands. The first band (closest to an end of the resistor) indicates the first digit of the resistor value. The second band indicates the second digit, and the third band indicates a multiplier. The fourth band (if present) is colored silver or gold and indicates a tolerance value, with which we will not concern ourselves.

The color code is as follows:

	band1	band2	band3 (multiplier)
black		0	1
brown	1	1	10
red	2	2	100
orange	3	3	1000
yellow	4	4	10000
green	5	5	100000
blue	6	6	1000000
violet	7	7	10000000
gray	8	8	100000000
white	9	9	1000000000
silver			0.01
gold			0.1

The value (in ohms) is given by (10*band1 + band2)*band3. Note that band1 is never black.

So [yellow, violet, red] has the value ((10*4)+7)*100 = 4700.

Description

We have a keypad with twelve keys, one for each of the colors, and a thirteenth reset key.

The Widget uses a finite state machine model.

The state machine has three states:

1 the output field is clear (or contains the result of a previous calculation) and we are waiting for the first color
2 the first digit is in the output field and we are waiting for the second color
3 the first two digits are in the output field and we are waiting for the third color

The inputs to the state machine are the values of the 12 color keys.

As the colored keys are pressed the machine moves from state to state. Not all keys are valid in each state, so our program checks for valid keys and beeps when they are not.

Resistors with four encoding bands

Some resistors have four bands that encode the resistor value. The Widget has an option (in the preferences) to set the number of encoding bands. When there are four encoding bands, the fourth band is used as the multiplier band. Bands 1, 2 and 3 then specify three digits.

The value (in ohms) is given by (100*band1 + 10*band2 + band3)*band4.

International Notation

The Widget has a checkbox (in the preferences) to request output in International Notation.

Examples:

0.67	would be shown as 0R67
1.5	would be shown as 1R5
27	would be shown as 27R
320	would be shown as 320R
2200	would be shown as 2k2
6300000	would be shown as 6M3

The Widget has a popup menu (in the preferences) to choose between decoding resistors and (small) capacitors. The basic unit for resistors is ohms, but the coded capacitor values are in picoFarads.

Examples:

0.67	would be shown as 0p67
1.5	would be shown as 1p5
27	would be shown as 27p
320	would be shown as 320p
2200	would be shown as 2n2
6300000	would be shown as 6µ3

Author

Harry Whitfield <mailto:g6auc@arrl.net>.

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