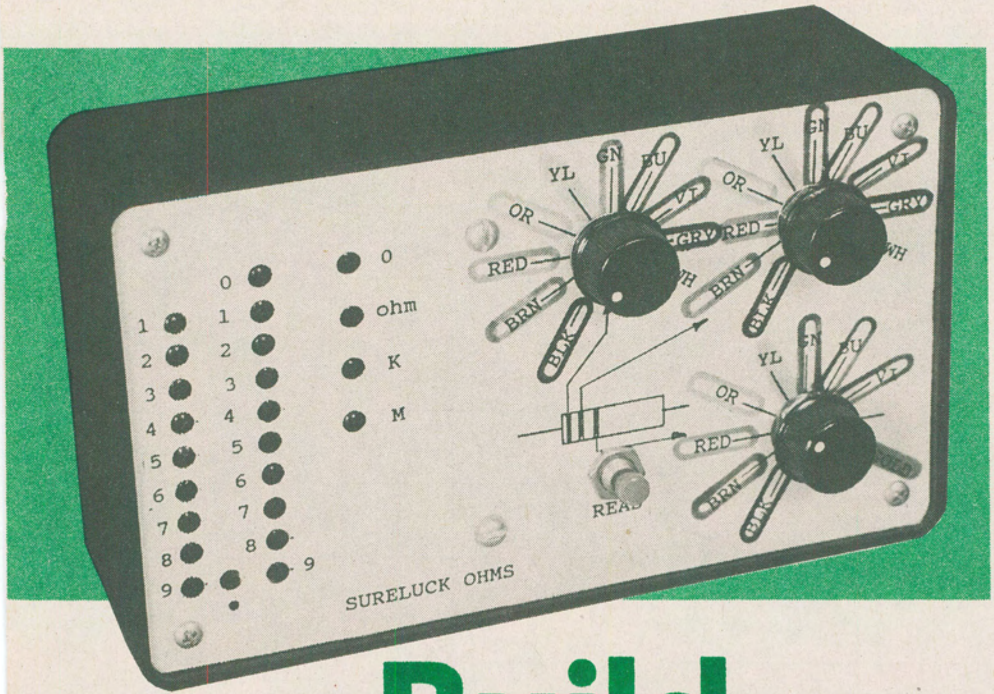


If selecting a required resistor solely by color code is giving you headaches, or if you simply don't know the code well enough to use it accurately, check out Sure-luck Ohms—the easy-to-build color-code sleuth!

Build "Sure-Luck" Ohms

BY CHARLES D. RAKES

Do you experience the "color-code blues" every time you search through your junkbox for a resistor? And do you make like a magician and vanish when a color-code question comes your way? Have you tried to teach a budding electronic enthusiast the resistor color code without resorting to some off-color memory scheme? If so build our *Sure-luck Ohms* color-code decoder and never ever again suffer from those resistor color-code blues.

Why, might you ask, should I go to the trouble of building an electronic gadget to read resistor color-code values when I can use a chart or color-code wheel? For one thing our Sure-luck Ohms is easier to read and the resistor values are indicated in OHMS, K ohms, and MEG ohms without showing all of those zeros that complicate the process when using a chart or wheel. If you can read numbers from 0 to 9 and know that "k" is the prefix for 1000, and "M" is the prefix of 1,000,000, you will not have any problem converting the colors on a resistor into a resistance value.

Take a look at any construction project, in this publication and most others, and you will find in the parts list and on the schematic diagram that the resistor values are usually shown in their shortest possible form. A two-thousand-two-hundred ohm resistor (2,200) will be shortened to read 2.2k and a two-million-two-hundred-thousand ohm resistor (2,200,000) will read 2.2 megohms. And that's what the circuitry in Sure-luck Ohms does to make decoding the color code on a resistor's body a snap.

About The Circuit. The schematic diagram for Sure-luck Ohms is shown in Fig. 1. The circuit is little more than a well-thought-out switching arrangement—built around three single-pole 10-position (SP10T) rotary switches—that are used to decipher the resistor color code that's stamped in the unit's body. To operated Sure-luck Ohms, the three switches are rotated to match the resistor's three colors. A pushbutton READ switch is then used to apply power to the circuit, and light the proper LED's to indicate the resistor's value. In between the switches and LED's is a bit of "diode-transistor logic" that turns on a flashing decimal point LED, the OHM LED, the K, or the M LED as required.

The function of S1 is the simplest of the three selector switches. When S1 is pressed, battery power is applied through a 470-ohm current-limiting resistor and the wiper of S1 to the selected LED to indicate the first digit of the resistor's value.

The second rotary switch, S2, selects the LED for the resistor's second digit. The first position on all switches is marked black indicating a zero. Since S1 selects the resistor's first digit, a zero LED isn't needed, but in the second and third digit, the zero is necessary. If a resistor has a color code of brown-black-red, S1 will be in the brown (number 1) position and the S2 will be in the black (zero) position, and S3 will be in the red (number 2) position. But for the circuit to show a reading of 1k, the zero LED for the second digit must not light. That's where Q1 and D1–D3 come into play.

The wiper of S3 connects the 9-volt bus to the number-2 (red) position and on to the base of Q1 through D1. That turns Q1 on, clamping the voltage across the zero LED to ground, keeping it from lighting. The positive voltage at position 2 of S3 also supplies current

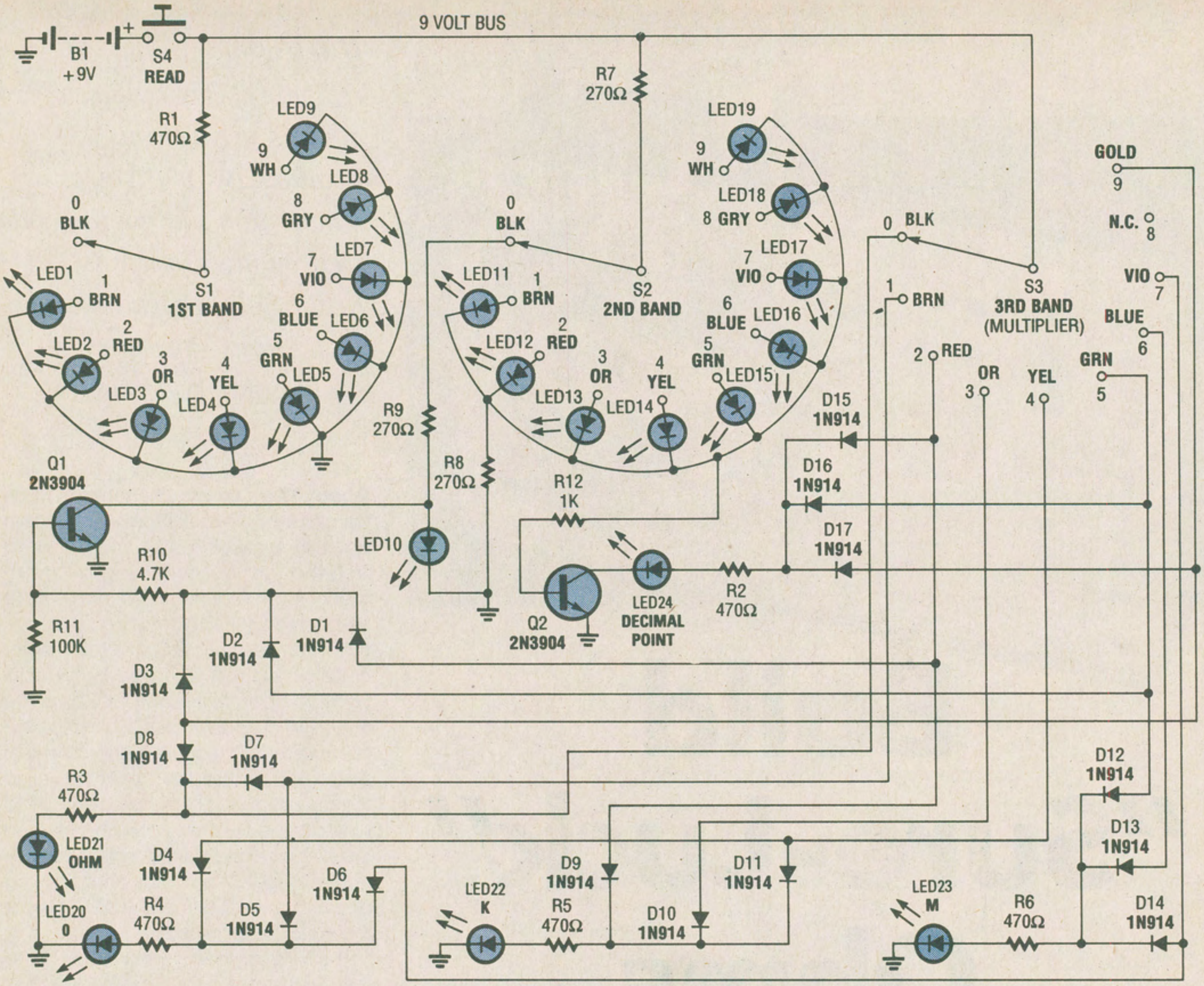


Fig. 1. Sure-luck Ohms is little more than a well-thought-out switching arrangement—comprised of three single-pole 10-position (SP10T) rotary switches—and LED's to decipher the resistor color code that's stamped on a resistor's body.

through D9 to turn on the OHM LED. Of course the READ switch must be activated for the LED's to light.

If the resistor had been a 1.5k (brown-green-red) instead of a 1k, the wiper of S2 would be on the number 5 (green) position. Current would then flow through R7, LED15, R8, R12, and the base-emitter junction of Q2, turning it on and bringing the cathode of LED24 to ground. The wiper of S3 supplies a 9-volt source to its number-2 (red) position and on through D15, R2, and on to light the blinking, decimal-point indicator LED24.

The third zero (LED20), as well as the K (LED22) and M (LED23) indicators, are controlled by switch S3 and their simple diode logic.

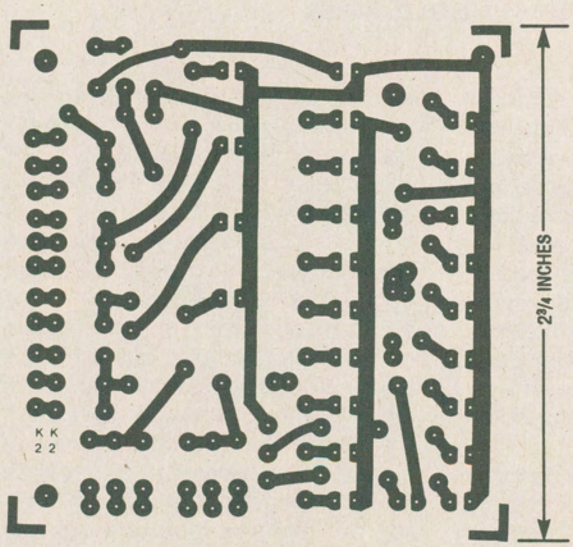


Fig. 2. To simplify assembly and reduce the possibility of error, printed-circuit construction is recommended. Here's a template for the circuit-board layout used by the author.

Construction. In the author's unit, the majority of the components are circuit-board mounted and housed in a 6¼ × 3¾ × 1^{15}⁄$_{16}$-inch plastic cabinet. The circuit is by no means complicated or critical, and can be built breadboard style if you wish. However, to simplify assembly and reduce the possibility of error, printed-circuit construction is recommended. Figure 2 shows a template for the printed-circuit layout used by the

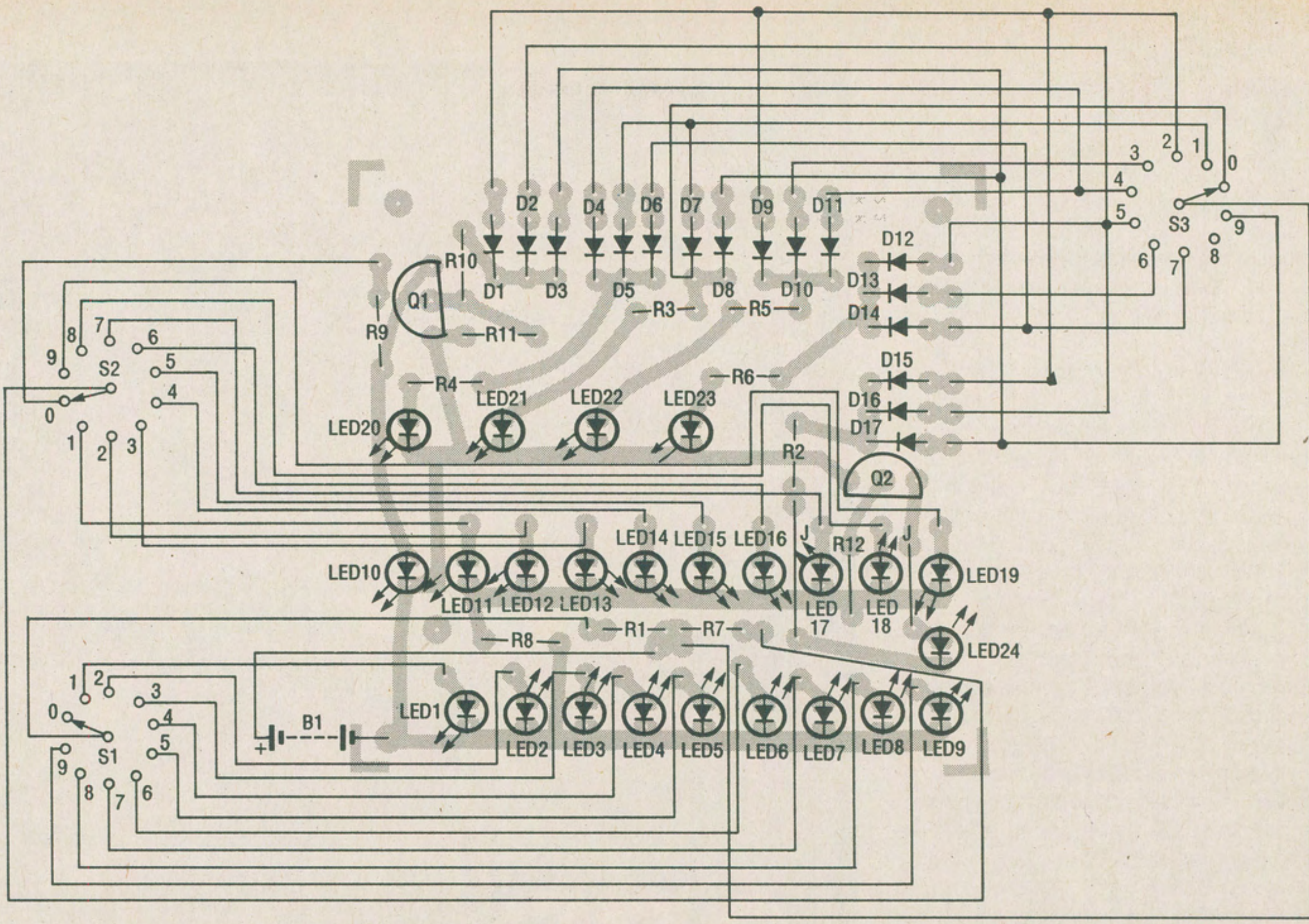
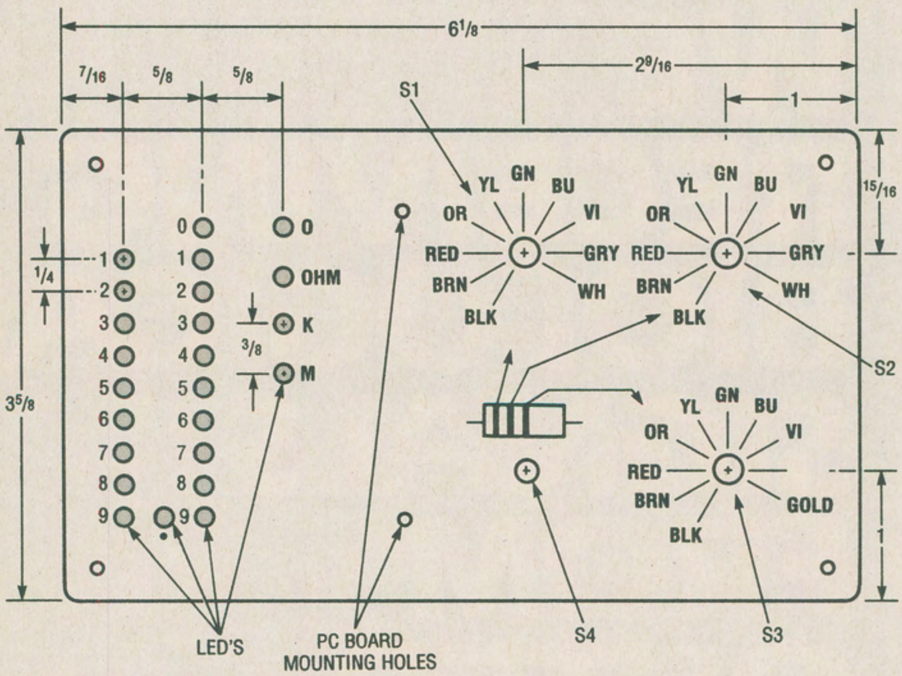


Fig. 3. Assemble the printed-circuit board using this illustration as a guide. When mounting the components to the board, be sure that the polarized parts (diodes and LED's) are properly oriented.



ALL DIMENSIONS IN INCHES

Fig. 4. Once the board has been assembled, prepare the front panel of the enclosure using this layout as a guide. Note that the front panel of the enclosure has 24 holes spaced to match the LED's mounted on the board.

author. Regardless of the method of construction taken, you should be able to build your own for under $20, or even less if you maintain a well stocked junkbox.

Assemble the printed-circuit board using Fig. 3 as a guide. When mounting the components to the board be sure to orient the polarized parts (diodes and LED's) as shown. Note that all the LED's, except LED24, are mounted with their cathodes facing the left edge of the board. Also note that the cathodes of all of the LED's in row 1 and all but one in row 2 are common. The anode of LED24 is facing the left edge of the circuit board.

If you want to save a dollar, you can substitute a regular LED for the flashing unit used for the decimal point, LED24. All 17 of the 1N914 diodes are mounted on the board with their anodes connected to the pads that are located along the outside rim of the printed-circuit board. A jumper from the cathodes of D7 and D8 to S3 position zero (0) will have to be added for the OHM LED to light when decoding resistor values of 100 ohms and less. There's no hole in the circuit board for that jumper so just tack a wire on the back side of the board at the junction of R3, D7, and D8. Also note that there are two additional short jumpers on the board.

Using color-coded wiring between the board and the switches will help

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SURE-LUCK OHMS

(Continued from page 57)

simplify the job of keeping track of where you are and where you are headed. The rotary switches in the prototype are actually 12-position switches, which for some reason are easier to locate than 10-position units, but either will do.

Once the board has been assembled, prepare the front panel of the enclosure using the layout shown in Fig. 4. The 24 holes in the front panel of the enclosure are spaced to match the spacing of the LED's that are mounted on the board.

In the author's arrangement, the LED's do not extend through the front panel of the enclosure, but instead are mounted so that the crest of the LED lenses rest on the inside surface of the enclosure at the proper positions so that lighted LED's can be seen. The off-board components, which consists of four switches (three rotary and one pushbutton), are positioned on the front panel as shown in Fig. 4.

There are several schemes that can be used to label the front panel of the enclosure—anything from rub-on letters to cut-out letters and numbers glued in place. The ten colors used to mark the switch positions can be made with marking pencils. After finishing with the front panel's lettering and coloring, give it a good coat of clear plastic spray.

Check Out And Use. To check the circuit's operation, first set the three rotary switches (S1–S3) to black-black-black and press S4. The O (LED10) and OHM LED's should light. Switch S1 to brown and LED1, LED10, and the OHM LED should light. Set S1 to brown, S2 to green, and S3 to red and you should read 1.5k with the decimal point indicator, LED24, flashing. Keep checking each switch out one position at a time to be sure there are no wiring errors between the switches and circuit board.

Position 9 (GOLD) on S3 does not indicate the resistor's tolerance, but is used to decode a resistor of 10 ohms or less. You won't come across such values too often, but when you do the circuit will read them, too.

You can also work backwards: If you need a particular value of resistance, but do not know the color code for that value, the circuit can be used to figure it out. Simply press switch S4 and hold while rotating switches S1–S3. For instance, let's say you need a 1.2k resistor. Simply rotate S1 until the 1-position LED, which is located in the rightmost column, lights; then do the same for S2 until the 2-position LED lights; and finally rotate S3 until the K LED lights.

Finding the color codes of resistors with values of a hundred-thousand ohms is only slightly more difficult, because the O LED must be taken into account. For example, if a 750k resistor is needed, you would rotate S1 and S2 as described above, but S3 must be rotated until both the K and O LED's light—that's 75 followed by 0 for 750, and the K to indicate that that number is multiplied by 1000 for a total value of 750,000 or 750k.

You'll soon discover that old timers and new comers alike will find Sure-luck Ohms a valuable ally in decoding those hard to remember color-code values. ■

PARTS LIST FOR SURE-LUCK OHMS

SEMICONDUCTORS
Q1, Q2—2N3904 or 2N2222 general-purpose NPN silicon transistor
D1–D17—1N914 general-purpose small-signal silicon diode
LED1–LED23—Jumbo red LED
LED24—Flashing (Radio Shack 276-036) or standard LED, see text

RESISTORS
(All resistors are ¼-watt, 5% units.)
R1–R6—470-ohm
R7–R9—270-ohm
R10—4700-ohm
R11—100,000-ohm
R12—1000-ohm

ADDITIONAL PARTS AND MATERIALS
B1—9-volt transistor-radio battery
S1–S3—SP10T or SP12T rotary switch, see text
S4—SPST normally-open pushbutton switch
Printed-circuit board materials, enclosure, battery holder and connector, knobs, wire, solder, hardware, etc.

Note: The following items are available from Krystal Kits, P.O. 445, Bentonville, AR 72712. A kit containing the circuit board and all parts (excluding the cabinet, switches, knobs, and flashing LED) is available for $14.95 postage paid; the circuit board only is available for $7.95 postage paid. Arkansas residents please add applicable sales tax.