



DIGITAL ROULETTE • 36 RED LEDS PLUS 2 GREEN LEDS  
• ALSO POWER OFF • CHIPS FOR BETTING • REALISTIC SOUNDS

**AK-300**  
Elenco Electronics  
Wheeling, IL USA

## PARTS LIST

If you are a student, and any parts are missing or damaged, please see instructor or bookstore.

If you purchased this meter kit from a distributor, catalog, etc., please contact Elenco Electronics (address/phone/e-mail is at the back of this manual) for additional assistance, if needed. **DO NOT** contact your place of purchase as they will not be able to help you.

### RESISTORS

Qty	Symbol	Value	Color Code	Part #
□ 1	R22	1kΩ 5% 1/4W	brown-black-red-gold	141000
□ 4	R1 - R4	1.2kΩ 5% 1/4W	brown-red-red-gold	141200
□ 1	R19	1.5kΩ 5% 1/4W	brown-green-red-gold	141500
□ 5	R5 - R9	10kΩ 5% 1/4W	brown-black-orange-gold	151000
□ 2	R15, R16	20kΩ 5% 1/4W	red-black-orange-gold	152000
□ 1	R13	47kΩ 5% 1/4W	yellow-violet-orange-gold	154700
□ 1	R17	56kΩ 5% 1/4W	green-blue-orange-gold	155600
□ 2	R11, R20	100kΩ 5% 1/4W	brown-black-yellow-gold	161000
□ 1	R24	270kΩ 5% 1/4W	red-violet-yellow-gold	162700
□ 1	R14	330kΩ 5% 1/4W	orange-orange-yellow-gold	163300
□ 1	R10	820kΩ 5% 1/4W	gray-red-yellow-gold	168200
□ 1	R23	1.8MΩ 5% 1/4W	brown-gray-green-gold	171800
□ 1	R12	2.2MΩ 5% 1/4W	red-red-green-gold	172200
□ 1	R18	3.3MΩ 5% 1/4W	orange-orange-green-gold	173300
□ 1	R21	4.7MΩ 5% 1/4W	yellow-violet-green-gold	174700

### CAPACITORS

Qty	Symbol	Value	Description	Part #
□ 1	C4	.001μF (102)	Discap	231036
□ 1	C2	.0033μF (332)	Mylar	233317
□ 1	C1	.022μF (223 or 203)	Discap	242280
□ 1	C5	.47μF	Electrolytic (Lytic)	254747
□ 2	C3, C6	1μF	Electrolytic (Lytic)	261047
□ 2	C7, C8	100μF	Electrolytic (Lytic)	281044

### SEMICONDUCTORS

Qty	Symbol	Value	Description	Part #
□ 2	D41, D43	1N4001	Diode	314001
□ 3	D39, D40, D42	1N4148	Diode	314148
□ 7	Q1 - Q4, Q7 - Q9	2N3904	Transistor	323904
□ 2	Q5, Q6	2N3906	Transistor	323906
□ 2	U1, U3	4017	Integrated Circuit	334017
□ 1	U2	4069	Integrated Circuit	334069
□ 36	D1 - D36		LED Red	350002
□ 2	D37, D38		LED Green	350010

### MISCELLANEOUS

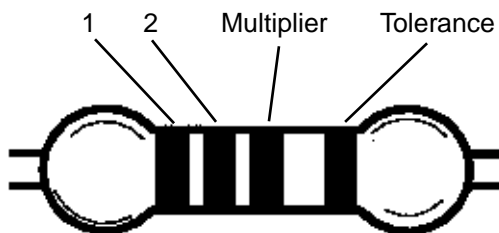
Qty	Symbol	Description	Part #	Qty	Symbol	Description	Part #
□ 1		PC Board	517100	□ 4		Flat Washer Black	645404
□ 1	S1	Push Button Switch	540101	□ 3		Flat Washer	645600
□ 1	BT1	Battery Holder 9V	590096	□ 1	U2	14-pin Socket	664014
□ 1	BZ1	Buzzer Piezoelectric	595201	□ 2	U1, U3	16-pin Socket	664016
□ 4		Plastic Spacer	624010	□ 1		Paper Clip	680018
□ 3		Screw 2-56 x 5/16"	641231	□ 1		4" Wire 22ga. Black Solid	814120
□ 8		Screw 4-40 x 1/4" Black	641433	□ 1		40" Wire 22ga. Bare	845000
□ 3		Nut 2-56 Hex	644201	□ 1		Solder Tube	9ST4A

## IDENTIFYING RESISTOR VALUES

Use the following information as a guide in properly identifying the value of resistors.

BAND 1 1st Digit		BAND 2 2nd Digit		Multiplier		Resistance Tolerance	
Color	Digit	Color	Digit	Color	Multiplier	Color	Tolerance
Black	0	Black	0	Black	1	Silver	$\pm 10\%$
Brown	1	Brown	1	Brown	10	Gold	$\pm 5\%$
Red	2	Red	2	Red	100	Brown	$\pm 1\%$
Orange	3	Orange	3	Orange	1,000	Red	$\pm 2\%$
Yellow	4	Yellow	4	Yellow	10,000	Orange	$\pm 3\%$
Green	5	Green	5	Green	100,000	Green	$\pm .5\%$
Blue	6	Blue	6	Blue	1,000,000	Blue	$\pm .25\%$
Violet	7	Violet	7	Silver	0.01	Violet	$\pm .1\%$
Gray	8	Gray	8	Gold	0.1		
White	9	White	9				

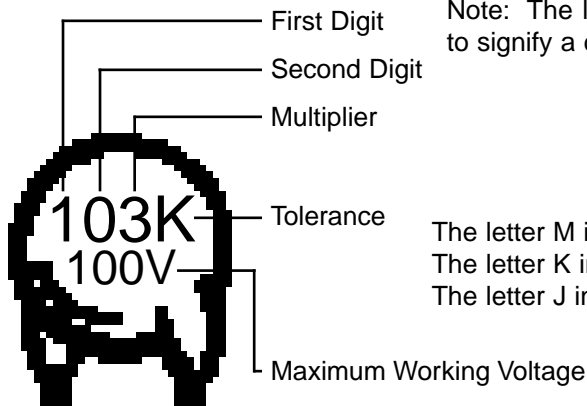
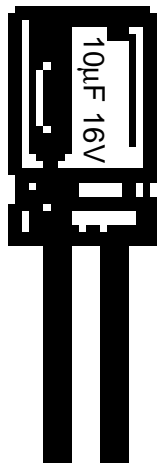
### BANDS



## IDENTIFYING CAPACITOR VALUES

Capacitors will be identified by their capacitance value in pF (picofarads), nF (nanofarads), or  $\mu\text{F}$  (microfarads). Most capacitors will have their actual value printed on them. Some capacitors may have their value printed in the following manner. The maximum operating voltage may also be printed on the capacitor.

Multiplier	For the No.	0	1	2	3	4	5	8	9
	Multiply By		1	10	100	1k	10k	100k	.01



Note: The letter "R" may be used at times to signify a decimal point; as in 3R3 = 3.3

The letter M indicates a tolerance of  $\pm 20\%$   
 The letter K indicates a tolerance of  $\pm 10\%$   
 The letter J indicates a tolerance of  $\pm 5\%$

The value is  $10 \times 1,000 = 10,000\text{pF}$  or  $.01\mu\text{F}$  100V

## METRIC UNITS AND CONVERSIONS

Abbreviation	Means	Multiply Unit By	Or
p	Pico	.000000000001	$10^{-12}$
n	nano	.000000001	$10^{-9}$
$\mu$	micro	.000001	$10^{-6}$
m	milli	.001	$10^{-3}$
-	unit	1	$10^0$
k	kilo	1,000	$10^3$
M	mega	1,000,000	$10^6$

1,000 pico units = 1 nano unit	1,000 nano units = 1 micro unit
1,000 micro units = 1 milli unit	1,000 milli units = 1 unit
1,000 units = 1 kilo unit	1,000 kilo units = 1 kilo unit

# INTRODUCTION

Electronic Roulette (roo-let) replaces the ivory ball with a circuit of flashing light emitting diodes (LEDs). Red LEDs are arranged in a circle next to a black or red number and two green LEDs are positioned next to "0" and "00". When the switch is pushed, the LEDs light one after another, in a sequence that represents the movement of the ivory ball. The number next to

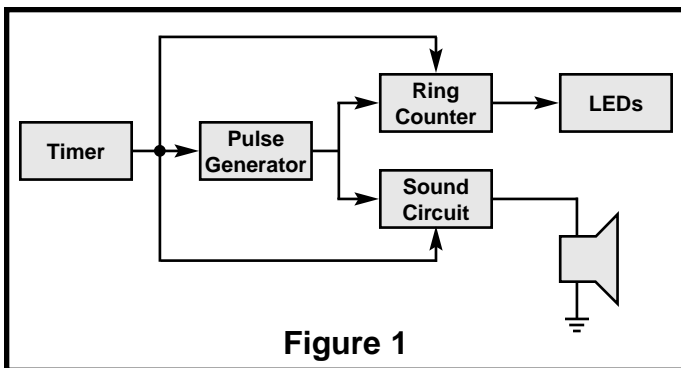
the lit LED when movement stops is the winning number. During movement, the sound of a bouncing ball is generated. If the switch is not pressed again, the circuits will automatically turn off, to conserve the battery power. A constant tone will alert you to check your number before automatic shut down.

# THEORY OF OPERATION

## THE BLOCK DIAGRAM

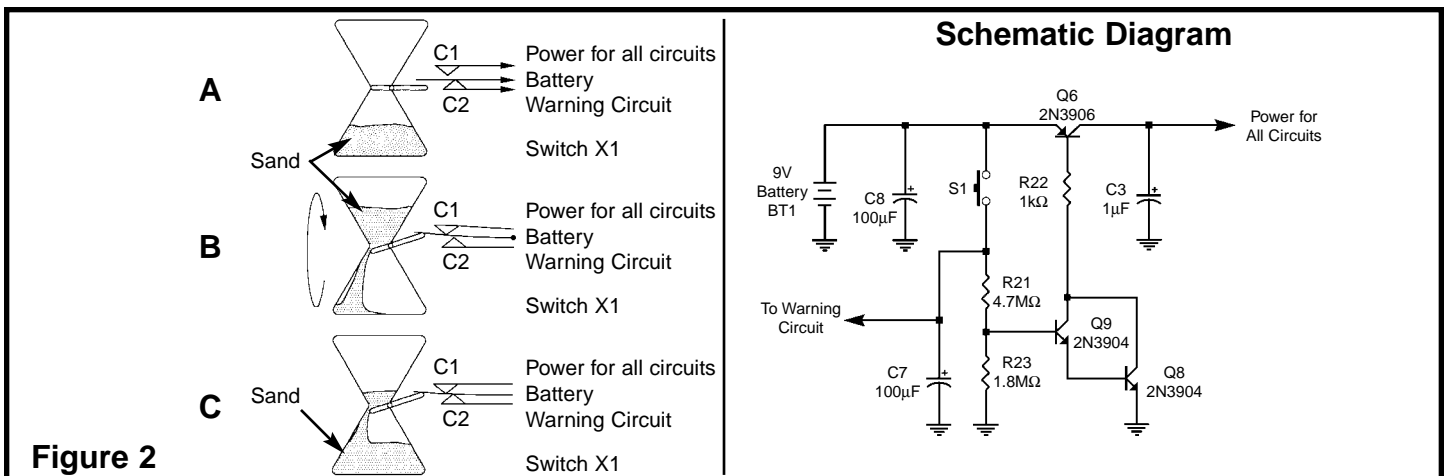
The function of many of the circuits will be presented in the form of an analogy (similar operation, but easier-to-understand system). In this manner, the operation of a circuit can be explained without the use of mathematics and equations.

Figure 1 shows a Block Diagram of the Electronic Roulette circuits. The Timer circuit is used to turn all the other circuits on and off. The Pulse Generator makes pulses that create the sound and force the ring counter to move the position of the lit LED. The Sound Circuit generates the sound of a bouncing ivory ball, and a warning tone a few seconds before power down. The Ring Counter lights each LED in a circular sequence. The LEDs represent the position of the ivory ball.



## THE TIMER

When S1, the start button, is pushed, capacitor C7 (Figure 2, Schematic Diagram) is charged to the battery voltage. This is similar to flipping the "Timer Glass" shown in Figure 2a to produce the condition shown in Figure 2b. Just as the sand runs down holding the lever arm up (Figure 2b), the charges in the capacitor C7 forces transistors Q6, Q8, and Q9 on. As long as the lever arm is up in Figure 2b, the other circuits are powered through the contact C1 on switch X1. At first, due to the weight of the sand (similar to capacitor C7 being fully charged), the contact C2 will open and remain open. Right before the sand totally runs out (capacitor C7 has lost most of its charge), the contact C2 will close, as shown in Figure 2c, and sound an alarm to warn you that the contact C1 is about to open and turn all the power off, including the power to the warning circuit. Eventually all the sand runs out of the "Timer Glass" (capacitor C7 has discharged) and the power is turned off (Figure 2a). To make the timer stay on longer, you could get a bigger "Timer Glass" (larger capacitor for C7) that holds more sand and replace the smaller one.



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## COMPONENT CHECK

- Be sure that all components have been mounted in their correct places.
- Be sure that the LEDs have been installed correctly. The flat side of the LEDs should be in the same direction as shown on the top legend.
- Be sure that diodes D39 - D43 have not been installed backwards. The band on the diodes should be in the same direction as shown on the PC board.
- Are capacitors C5 - C8 installed correctly? These capacitors have polarity. Be sure that the negative lead is in the correct hole.
- Be sure that the ICs are installed correctly. The notch should be in the same direction as shown on the top legend of the PC board.
- Put a 9V alkaline battery into the battery holder and push the switch.

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## TROUBLESHOOTING

One of the most frequently occurring problems is poor solder connections.

1. Tug slightly on all parts to make sure that they are indeed soldered.
2. All solder connections should be shiny. Resolder any that are not.
3. Solder should flow into a smooth puddle rather than a round ball. Resolder any connection that has formed into a ball.
4. Have any solder bridges formed? A solder bridge may occur if you accidentally touch an adjacent foil by using too much solder or by dragging the soldering iron across adjacent foils. Break the bridge with your soldering iron.

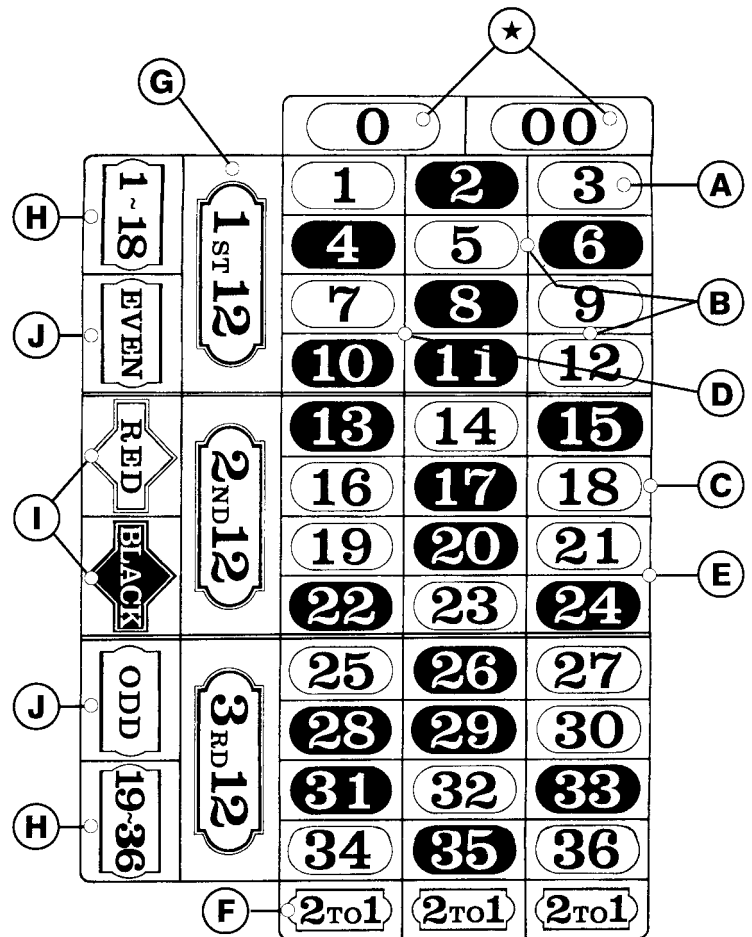
# OPERATING INSTRUCTIONS

## CHART A

Strategies	Explanation	Payoff
A) Single Straight	Chips on a number from 1-36 including 0 and 00.	36 times
B) Split	Chips on two numbers vertically or horizontally next to one another.	18 times
C) Street	Chips on three numbers horizontally in one line.	12 times
D) Corner	Chips on four numbers vertically and horizontally next to one another.	9 times
E) Line	Chips on six numbers in two horizontal lines next to one another.	6 times
F) Column	Chips on twelve numbers in one vertical line.	3 times
G) 1 <sup>ST</sup> Dozen 2 <sup>ND</sup> Dozen 3 <sup>RD</sup> Dozen	Chips on twelve numbers in 1 <sup>ST</sup> twelve, 2 <sup>ND</sup> twelve, or 3 <sup>RD</sup> twelve.	3 times
H) Low or High	Chips on eighteen numbers either from 1 to 18 or from 19 to 36.	2 times
I) Red or Black	Chips on "Red" or "Black" Betting on all numbers which are red or black.	2 times
J) Odd or Even	Chips on "Odd" or "Even" Betting on all numbers which are either odd or even.	2 times

Chip Values	
Gold.....	\$100
Green.....	\$25
Red.....	\$5
White.....	\$1

## CHART B



★ If the LED stops at 0 or 00 (green LEDs), only the players who have wagered directly on these numbers win with a return of 35 times. Players who have wagered on individual numbers do not lose on 0 or 00. They may take back their wager or leave it for the next game at full value.

## PROBABILITY

If among (F+U) equi-probable and mutually exclusive events, F is regarded as favorable and U as unfavorable, then for a single event, the probability of a favorable outcome is:  $\frac{F}{F+U}$

The probability of an unfavorable outcome is 1 minus the probability of a favorable outcome. In other words, since there is the same chance that any number may win on any spin (mutually exclusive events), the chances of winning equals the number of winning numbers divided by the total number of possible numbers. Roulette has 38 possible numbers that may win. Therefore, F+U is always equal to 38. If you wager on a single number, the chances of winning are 1 divided by 38, or

approximately 97.37%. If you win, the house pays you 36 times your wager. Multiplying your chance of winning times your payback shows the advantage for the house. In this case, the number is 94.74% which means the house has a 5.26% advantage over the players wagering on a single number.

If a wager is placed on black or red, the probability of winning is 18 divided by 38 because the number of black numbers and the number of red numbers is 18. The probability of a favorable outcome is one color is wagered equals 47.4%. The payout if you win is 2 to 1. This yields an advantage for the house of 1 - (0.474 x 2) or approximately 5.26%. As you can see, the house always has a 5.3% advantage.

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## RULES FOR PLAYING ROULETTE

The object of the game is to increase the value of your chips more than any other player. Chips with gold centers are worth \$100.00, green centers = \$25.00, red centers = \$5.00, and white centers are worth \$1.00. Each player starts with 1 green, 2 red, and 5 white chips (\$40.00). All the rest of the unused chips belong to the house. Determine how long the roulette table will be open, one hour for example. One person must act as the Croupier (kroo-pya). The Croupier is the attendant who collects and pays the stakes using the house's money. Since there is no way to predict the outcome of each spin, the Croupier may also be a player. It is possible for a person to play roulette alone and try to beat the house by increasing his total chip value.

The very first action in roulette is to place your wager on the gaming table. The types of bets and their rates of return are listed in Chart A. The method for placing a wager is shown in Chart B. Placing wagers starts when the Croupier announces "Place your Wagers!". All wagers must be in place when the Croupier announces "No more wagers!".

After all wagers have been placed, the start button is pressed by the Croupier and the lit LED that represents the ivory ball races around the circle adding excitement and anticipation to the game. The number next to the lit LED, when the motion stops, is the winning number. All wagers are paid by the Croupier according to the rates of return listed in Chart A.

The game ends when the house runs out of chips or the predetermined time period expires. To prevent a person from doubling his wager until he wins, a maximum limit of \$100 should be placed on each wager. When a player loses all of their chips, they may borrow from other players at whatever interest rate that player demands. At no time may a player borrow more than \$40.00. Once a player owes \$40.00 and has lost all of their chips, they are bankrupt and can no longer place wagers. A bankrupt player may assume the position of Croupier and earn \$1.00 from the house for every 10 spins to remain in the game. A Croupier who is not bankrupt is paid no salary by the house.

# SCHEMATIC DIAGRAM

