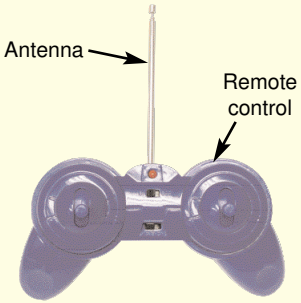
How To Use It

Install six “AA” batteries (not included) into the bottom of the Rover body and one 9V battery (not included) into the remote control unit. Install the antenna into the remote control unit by screwing it in.

Front of Rover



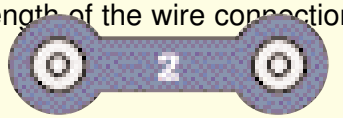
Place the decorative decal on the location shown.

The R/C Snap Rover Kit uses building blocks with snaps to build the different electrical and electronic circuits in the projects. Each block has a function: there are switch blocks, LED blocks, different length wire blocks, etc. These blocks are in different colors and have numbers on them so that you can easily identify them. The circuit you will build is shown in color and numbers, identifying the blocks that you will use and snap together to form a circuit.

For Example:

This is the switch block which is green and has the marking S1 on it.

This is a wire block which is blue and has different wire lengths. This one has the number 2, 3, 4, 5, 6, or 7 on it depending on the length of the wire connection required.

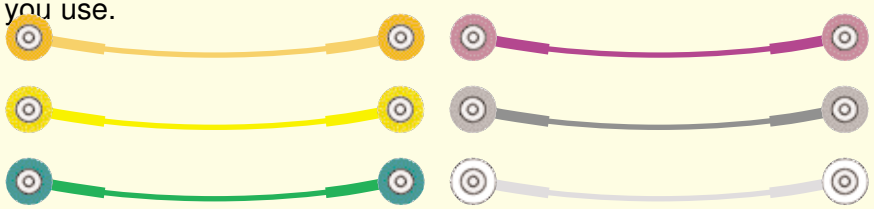


There is also a 1-snap wire that is used as a spacer or for interconnection between different layers.

A large clear plastic base grid is included with this kit to keep the circuit blocks together, it fits on top of the Rover body. You will see evenly spaced posts that the different blocks snap into, these keep your circuit together. The base has rows labeled A-G and columns labeled 1-10.

Next to each part in every circuit drawing is a small number in black. This tells you which level the component is placed at. Place all parts on level 1 first, then all of the parts on level 2, then all of the parts on level 3, etc.

Jumper wires are used to connect your circuits to the batteries and motors in the Rover body. Snap them on as shown in the projects. The colors are interchangeable, so it doesn’t matter which color you use.



Note: While building the projects, be careful not to accidentally make a direct electrical connection across the + and – snaps for the batteries (a “short circuit”), as this may damage and/or quickly drain the batteries.

Warning to Snap Circuits owners: Do not use parts from other Snap Circuits sets with this kit unless directed to do so. The Snap Rover uses higher voltage which could damage those parts. Page 22 and our web site www.snapcircuits.net has approved circuits that you can use.

About Your Snap Circuits Parts

Warning to Snap Circuits owners: Do not use parts from other Snap Circuits sets with this kit. The Snap Rover uses higher voltage which could damage those parts. Page 22 and our web site www.snapcircuits.net has approved circuits that you can

(Part designs are subject to change without notice).

Note: If you have a more advanced Model, there is additional information in your other project manual(s).

The **base grid** functions like the printed circuit boards found in most electronic products. It is a platform for mounting parts and wires (though the wires are usually "printed" on the board).

The blue **snap wires** are just wires used to connect other components, they are used to transport electricity and do not affect circuit performance. They come in different lengths to allow orderly arrangement of connections on the base grid.

The white, orange, yellow, green, gray, and purple **jumper wires** make flexible connections for times when using the snap wires would be difficult. They also are used to make connections off the base grid. The different colored wires all work the same way, and are interchangeable.

The **batteries** (in the Rover body) produce an electrical voltage using a chemical reaction. This "voltage" can be thought of as electrical pressure, pushing electrical "current" through a circuit. This voltage is much lower and much safer than that used in your house wiring. Using more batteries increases the "pressure" and so more electricity flows.

The **slide switch (S1)** connects (ON) or disconnects (OFF) the wires in a circuit. When ON it has no effect on circuit performance.

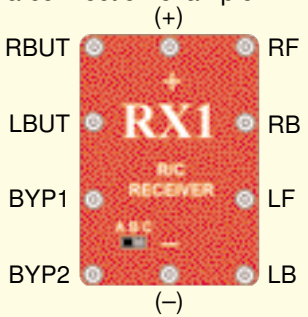
Resistors, such as the **100Ω resistor (R1) and 1KΩ resistor (R2)**, "resist" the flow of electricity and are used to control or limit the electricity in a circuit. Increasing circuit resistance reduces the flow of electricity.

The **LED (D4)** is a light emitting diode, and may be thought of as a special one-way light bulb. In the "forward" direction (indicated by the "arrow" in the symbol) electricity flows if the voltage exceeds a turn-on threshold (about 3V); brightness then increases. A high current will burn out the LED, so the current must be limited by other components in the circuit. LEDs block electricity in the "reverse" direction.

The **0.02µF (C1) and 470µF (C5) capacitors** are components that can store electrical pressure (voltage) for periods of time, higher values have more storage. Because of this storage ability they block unchanging voltage signals and pass fast changing voltages. Capacitors are used for filtering and delay circuits.

The **horn (W1)** converts electricity into sound by making mechanical vibrations. These vibrations create variations in air pressure which travel across the room. You "hear" sound when your ears feel these air pressure variations.

The **R/C Receiver (RX1)** is a complex module containing a radio receiver circuit, a specialized radio decoder integrated circuit, and other supporting components. It includes resistors, capacitors, inductors, and transistors that are always needed together. This was done to simplify the connections you need to make, otherwise this circuitry would not fit on the base grid. A description for this module is given here for those interested, see project 1 for a connection example:

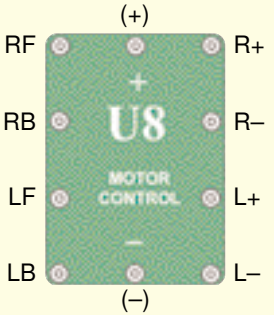


R/C Receiver:

(+) - power from batteries
(–) - power return to batteries
RBUT - right button function (active low)
LBUT - left button function (active low)
BYP1 - low frequency bypass
BYP2 - high frequency bypass
RF - right forward output (active high)
RB - right backward output (active high)
LF - left forward output (active high)
LB - left backward output (active high)
ABC switch - selects radio channel

Only connect this part as shown in the projects!

The **Motor Control (U8)** module contains 16 transistors and resistors that are usually needed to control the motors. A description for this module is given here for those interested, see project 1 for a connection example:

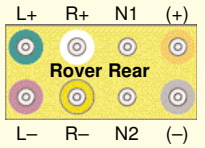


Motor Control:

(+) - power from batteries
(–) - power return to batteries
RF - right forward control input
RB - right backward control input
LF - left forward control input
LB - left backward control input
R+ - right forward motor drive
R – - right backward motor drive
L+ - left forward motor drive
L – - left backward motor drive

Only connect this part as shown in the projects!

The **motors** (in the Rover body) convert elecricity into mechanical motion. Electricity is closely related to magnetism, and an electric current flowing in a wire has a magnetic field similar to that of a very, very tiny magnet. Inside the motor is a coil of wire with many loops wrapped around metal plates. If a large electric current flows through the loops, it will turn ordinary metal into a magnet. The motor shell also has a magnet on it. When electricity flows through the coil, it magnetizes the metal plates and they repel from the magnet on the motor shell - spinning the shaft. A small gear is on the end of the shaft and spins with it.



Rover Rear:

(+) - power from batteries
(–) - power return to batteries
L+ - left forward motor drive
L – - left backward motor drive
R+ - right forward motor drive
R – - right backward motor drive
N1, N2 - not used

How It Works

Remote Control Transmitter:

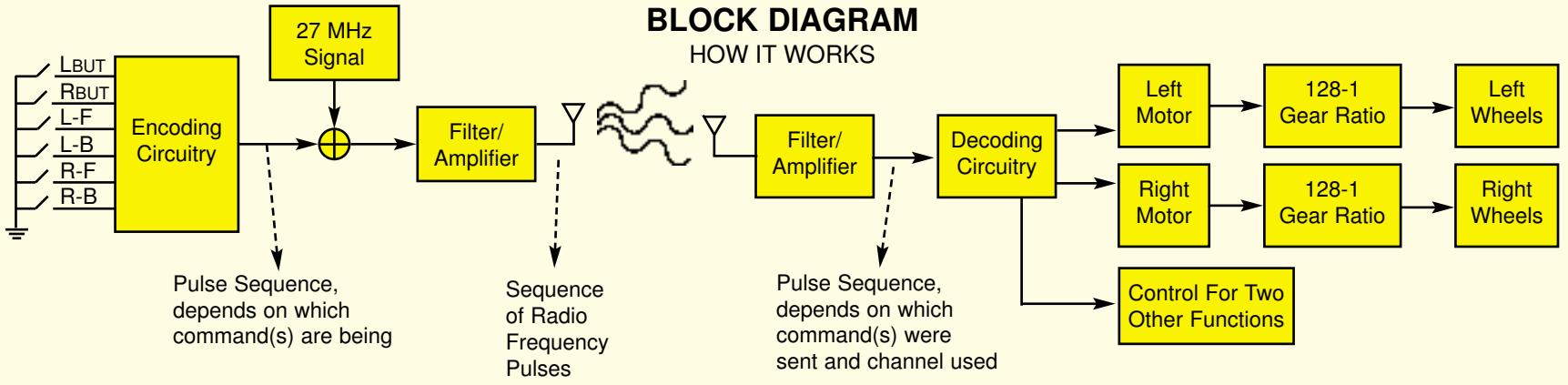
When the levers in the Remote Control Unit are pushed, electrical contacts are made connecting the 9V battery power to the transmitter, indicating which commands the user wants sent to the Rover. Forwards/Backwards commands for each set of wheels and two extra functions are controlled by different levers or buttons. Each of these use a different set of electrical contacts which encode a sequence of electrical pulses; the pulse sequence depends on which command(s) are being sent. Some of the pulses in the sequence represent which channel setting (A-B-C) the remote control is on. This allows three units to use the same operating frequency in the same room at the same time without interfering with each other. An electrical circuit that is tuned to a frequency of 27 MHz creates a signal that is sent to the antenna when the pulses are active. The antenna converts this electrical energy into radio energy, creating a stream of radio energy bursts, which travel through the air and are picked up by, and understood by, the radio receiver in the car. The frequency of 27 MHz was selected for your Rover with the approval of the FCC (the US government) to minimize radio interference between this product and all other electrical products.

Radio Receiver:

The Rover antenna collects radio energy and converts it back into electrical energy. If the Rover is turned on, then the radio receiver in the Rover is continuously monitoring the radio energy from its antenna. The receiver is basically a filter which is tuned to amplify any energy around 27 MHz and block energy the antenna picks up outside this region. If the Remote Control Transmitter is sending commands, then its radio signal will be picked up by the receiver and converted back into the original pulse sequence. Decoding circuitry then determines which commands were sent by examining the pulses in the sequence. Signals are then sent to motors that drive the wheels to execute the commands, or the other R/C Receiver outputs to control other functions. Commands sent to other receivers using a different channel setting (A-B-C) are ignored.

Characteristics of Radio Reception:

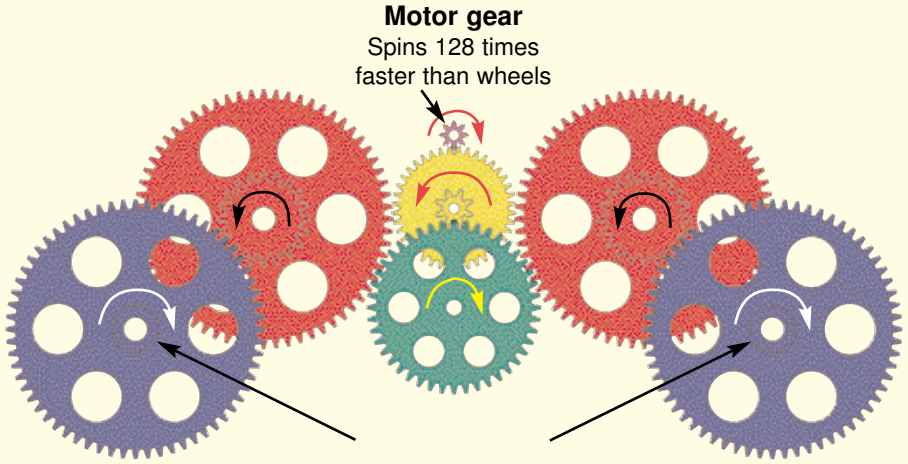
Many factors affect the ability of the Rover to receive commands from its Remote Control Transmitter. A weak battery in the Transmitter will result in a weaker transmitted signal; if the battery is very weak then the Transmitter may not function at all. The Transmitter's ability to convert electrical energy to radio energy is best when its antenna is fully extended and degrades as the antenna length is reduced. The same thing also applies to the Rover antenna's ability to convert the radio signal back into electrical energy for the receiver. The Transmitter's antenna transmits energy in all directions so as the range between it and the Rover is increased, less energy is received at the Rover. When operated with strong batteries and in an open area, the range will be at least 25 ft. Obstacles such as walls, furniture, and trees will degrade the radio signal's ability to travel through air and reduce the operating range, but will never block it completely. In some cases more radio energy may travel from the Transmitter to the Rover by going around obstacles than by going through them. In the Rover, weak batteries will reduce power to the motor and degrade the receiver's ability to filter, amplify, and decode commands from the Transmitter.



How It Works (continued)

Rover Drive Mechanism:

The small gear on the Motor drives a larger gear, which drives a larger gear, which drives two larger gears (one on each side), which drive larger gears. The last, largest gears are fixed on shafts that are attached to the front and back wheels, making them move. Note that interlocking gears spin in opposite directions. Also notice that in the sets of interlocking gears between the Motor and the gears on the wheel shafts, the number of "teeth" is increased each time (40-8, 44-8, 64-44, and 64-20), for 128:1 gear ratio overall. This means the Motor must rotate 128 times to rotate the wheels once. The reason for this is that if the Motor were to drive the wheels directly then the Rover would be so fast that it would be impossible to control. Using the gears to reduce the speed also makes the wheels move with much greater force, preventing the Rover from getting stuck in rough terrain and allowing it to carry heavy loads uphill.



THE FCC

The Federal Communications Commission (FCC) regulates use of the radio frequency spectrum in the United States to prevent products from interfering with each other.

FCC regulations for your Rover require you to accept any interference from authorized sources and that you shut down if you are causing interference with other authorized products. Contact Elenco® Electronics if you need assistance.

You should never modify the electrical circuit components inside your car or Remote Control transmitter as this may cause malfunctions or violate FCC regulations for this product.

General Operating Instructions

Build the circuit for projects 1 or 2. Set the channel switches on the remote control unit and R/C Receiver module (RX1) to the same setting (A, B, or C). Place the Rover on a flat, open area, turn the ON/OFF switch on the remote control unit and the slide switch (S1) to ON, and extend the antenna on the Remote Control.

Push both levers forward to make Snap Rover go forward.

Push both levers backward to go backward.

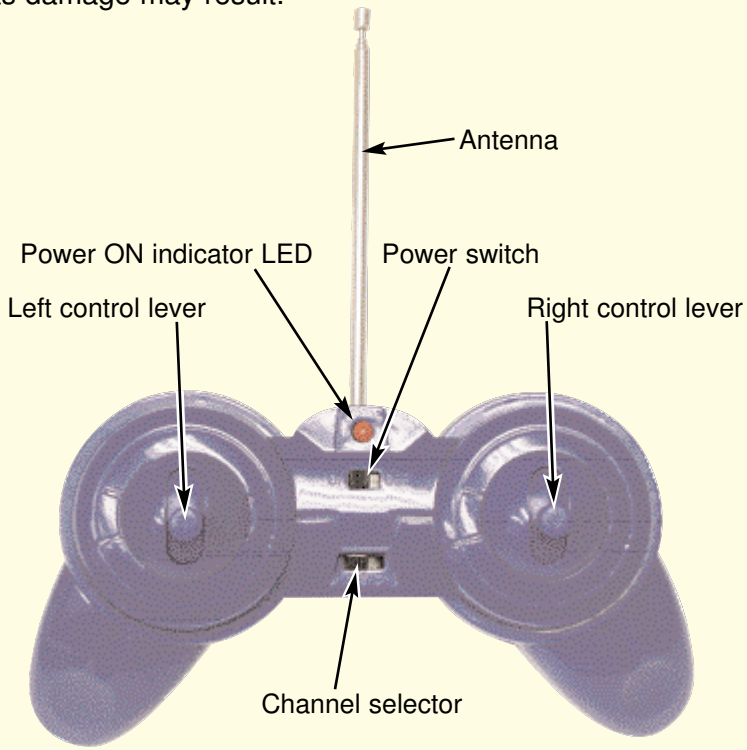
Push the left lever backward and the right lever forward to turn left.

Push the left lever forward and the right lever backward to turn right.

The buttons on the remote control unit are used to control sounds or lights (or other special functions) as described in the projects.

<u>Never operate Snap Rover in the street.</u>

Never drive your Rover in rain, snow, mud, sand, dirt, or on a wet floor, as damage may result.



DO's and DON'Ts of Building Circuits

After building the circuits given in this booklet, you may wish to experiment on your own. Use the projects in this booklet as a guide, as many important design concepts are introduced throughout them. Every circuit will include a power source (the batteries), a resistance (which might be a resistor, motor, integrated circuit, etc.), and wiring paths between them and back. You must be careful not to create "short circuits" (very low-resistance paths across the batteries, see examples below) as this will damage components and/or quickly drain your batteries. Only connect the ICs using configurations given in the projects, incorrectly doing so may damage them. **Elenco® Electronics is not responsible for parts damaged due to incorrect wiring.**

Here are some important guidelines:

ALWAYS use eye protection when experimenting on your own.

ALWAYS include at least one component that will limit the current through a circuit, such as a resistor, motor, horn, or the RX1 and U8 modules (which must be connected properly).

ALWAYS use the LED and switches in conjunction with other components that will limit the current through them. Failure to do so will create a short circuit and/or damage those parts.

ALWAYS disconnect your batteries immediately and check your wiring if something appears to be getting hot.

ALWAYS check your wiring before turning on a circuit.

ALWAYS connect the RX1 and U8 modules using configurations given in the projects or as per the connection descriptions for the parts.

NEVER connect to an electrical outlet in your home in any way.

NEVER leave a circuit unattended when it is turned on.

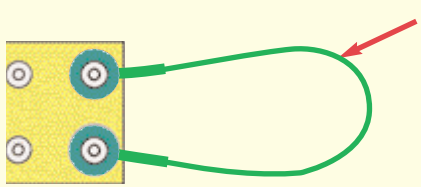
Note: If you have a more advanced model, there are additional guidelines in your other project manual(s).

For all of the projects given in this book, the parts may be arranged in different ways without changing the circuit. For example, the order of parts connected in series or in parallel does not matter — what matters is how combinations of these sub-circuits are arranged together.

WARNING: SHOCK HAZARD - Never connect Snap Circuits to the electrical outlets in your home in any way!

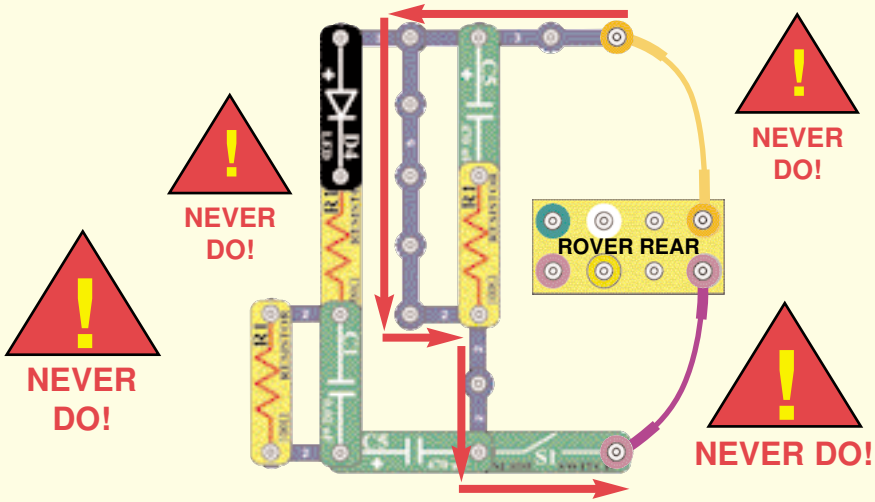
Examples of SHORT CIRCUITS - NEVER DO THESE!!!

NEVER DO!



Placing a jumper wire directly across the battery snaps is a SHORT CIRCUIT.

When the switch (S1) is turned on, this large circuit has a SHORT CIRCUIT path (as shown by the arrows). The short circuit prevents any other portions of the circuit from ever working.



You are encouraged to tell us about new circuits you create. Upon review, we will post them with your name in a special section on our web site. If we use them in future manual revisions, we will send you a copy of the manual so you can show your family and friends. Send your suggestions to Elenco® Electronics.

Warning to Snap Circuits owners: Do not use parts from other Snap Circuits sets with this kit except for the circuits on page 22. The Snap Rover uses higher voltage which could damage those parts. Our web site www.snapcircuits.net also

CAUTION: Do not mix alkaline, standard (carbon-zinc), or rechargeable (nickel-cadmium) batteries.