THE SCIENCE HUT

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https://thesciencehut.com/blogs/stem-hobbies/ultimate-guide-to-electronics

Morse Code Electronics Kit

1. Product overview and principles

1.1. No soldering is required for this DIY kit making it perfect for beginner enthusiasts.
1.2. This kit provides an engaging and educational experience in electronics and an introduction into the fascinating world of Morse code.
1.3. The kit uses the 1692 transmitter and receiver pair which are commonly used in wireless remote controls, sensor data transmission, and other short-range communication systems - a brief description follows:

1.4. Transmitter Module

1.4.1. The transmitter module is powered by a DC voltage, usually 3V to 12V.
1.4.2. It takes the data input from a microcontroller or a similar device.
1.4.3. An internal oscillator generates a carrier signal at a specific frequency (commonly 433 MHz).
1.4.4. The data input modulates the carrier signal using amplitude shift keying (ASK) or frequency shift keying (FSK).
1.4.5. The modulated RF signal is transmitted wirelessly through an antenna.

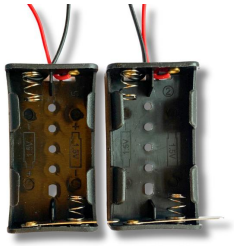
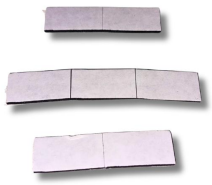
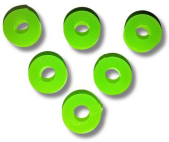
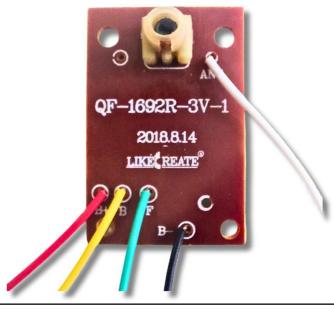
1.5. Receiver Module

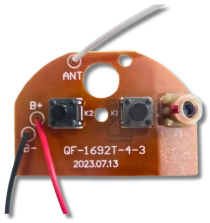
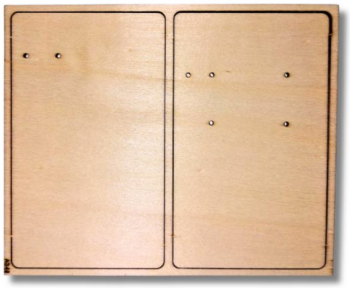
1.5.1. The receiver module is also powered by a DC voltage, typically 3V to 5V.
1.5.2. It receives the transmitted RF signal through its antenna.
1.5.3. The received signal is amplified to make it suitable for further processing.
1.5.4. The amplified signal is demodulated to extract the original data from the carrier wave.
1.5.5. The demodulated data is then output to a microcontroller or a similar device for processing or action - in the case of this kit, activation of a buzzer and an LED.

2. Materials and tools for electronics kit assembly

2.1. Wire snips (essential)
2.2. Screwdriver (included)
2.3. Safety glasses (recommended)
2.4. 4 x 1.5V AA batteries
2.5. Digital multimeter (recommended for troubleshooting, if needed)

3. Component list

#	Name	Quantity	Images / notes
1	3 mm screws	2	
2	6 mm screws	6	
3	Active buzzer	1	
4	Antennae *(one straight and one angled)*	2	
5	Battery compartments (AA)	2	
6	Double-sided adhesive pads	6	
7	Red LED	1	
8	Green LED	1	
9	Plastic spacer rings	6	
10	Receiver module	1	

#	Name	Quantity	Images / notes
11	Transmitter module	1	
12	Wire connectors	3	
13	Wooden base	2	
14	Screwdriver	1	

4. Safety

4.1. This kit contains many small components which may present a choking hazard. Therefore, keep the kit and all components out of reach of small children.

4.2. The kit includes a wooden base on which to mount components. This wooden base may form splinters which can become lodged under the skin. Therefore, before assembly, check the wooden base for loose splinters and remove them prior to assembly of the kit. They can be removed easily with a nail clippers or simply sanded away.

4.3. The kit is intended for ages 8 and up. Adult supervision is recommended.

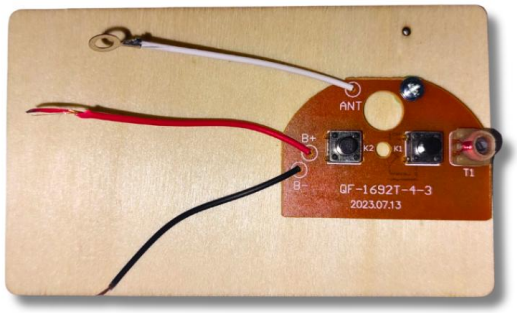
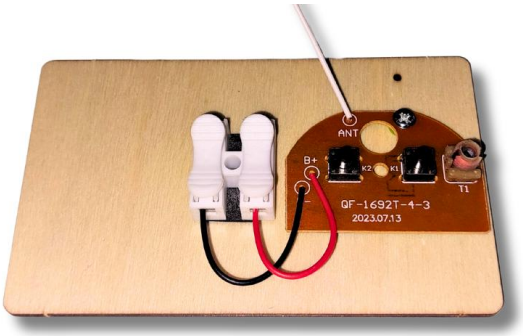
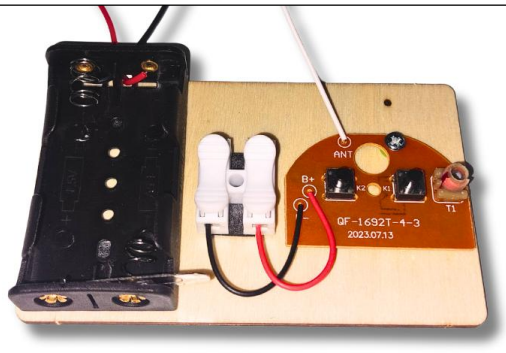
4.4. Ensure to work in a clean and tidy area on a flat, non-textured surface with plenty of space.

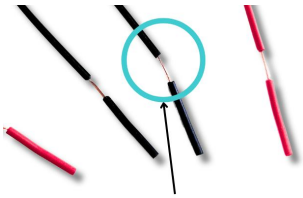
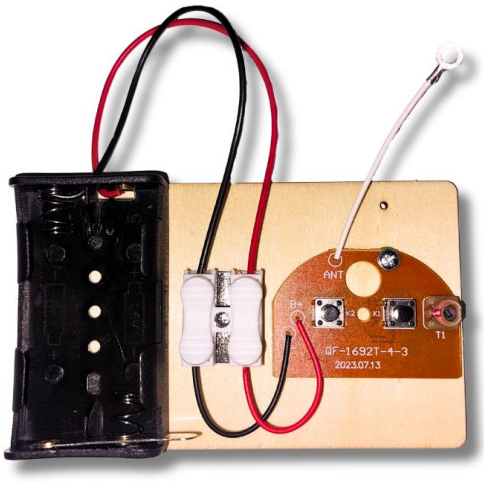
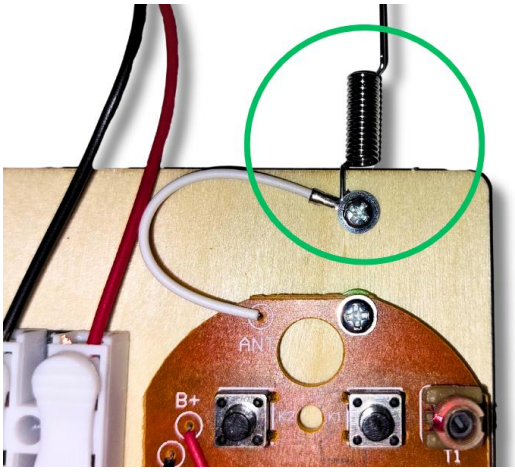
4.5. Assembling this kit does not require the use of a soldering iron; therefore, there are no safety considerations relating to soldering when making this kit.

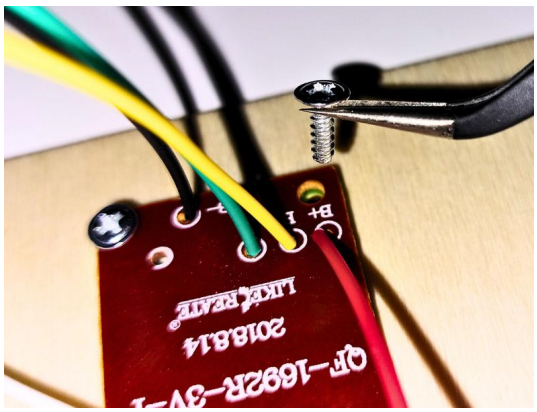
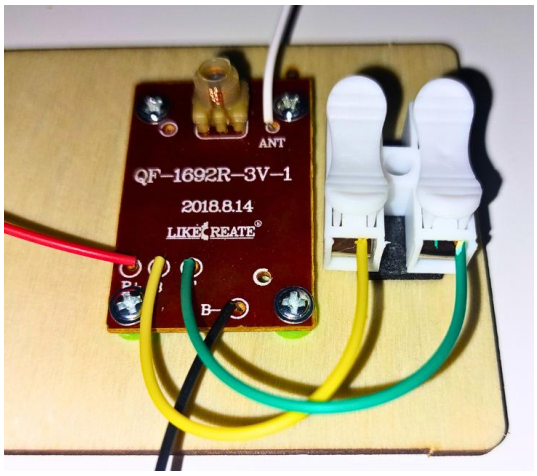
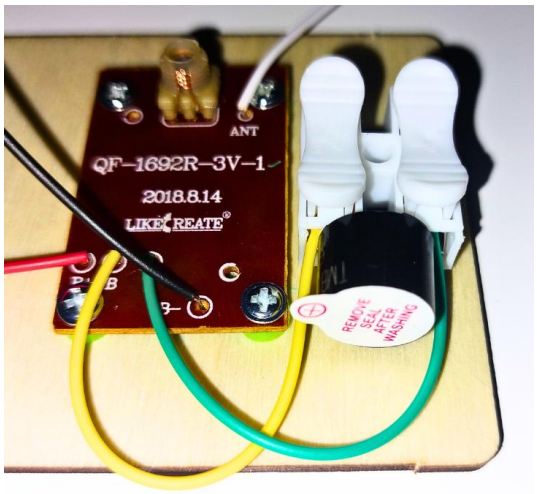
5. Assembly steps

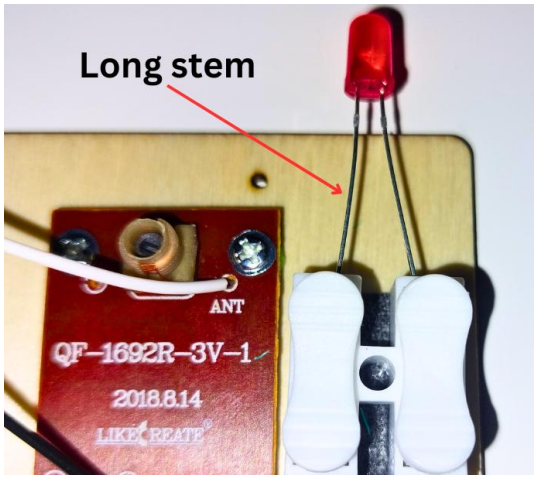
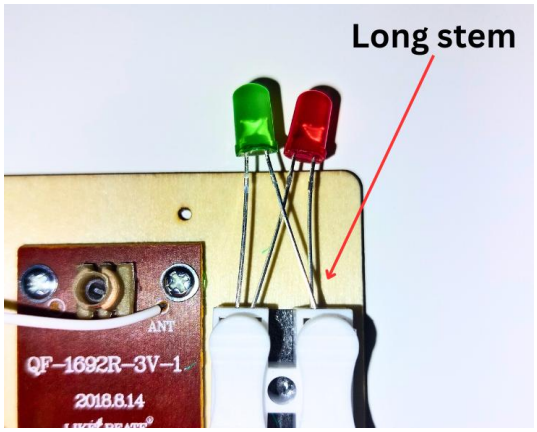
5.1. Ensure you have read the safety information in Section 4 before assembly.

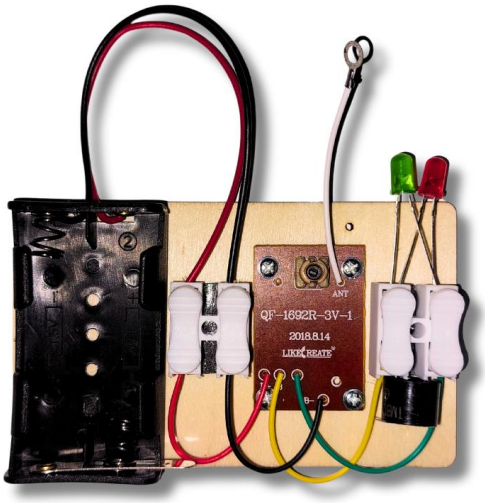
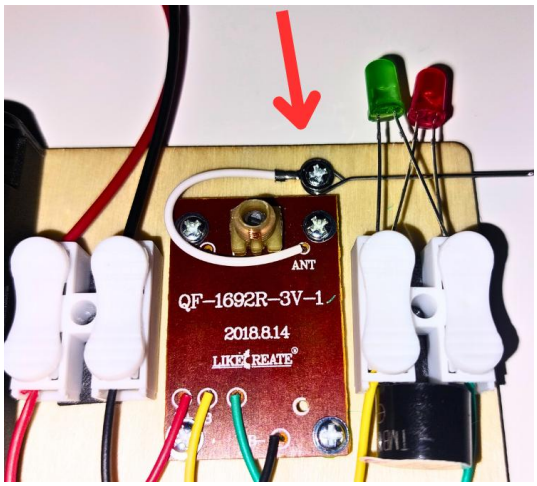
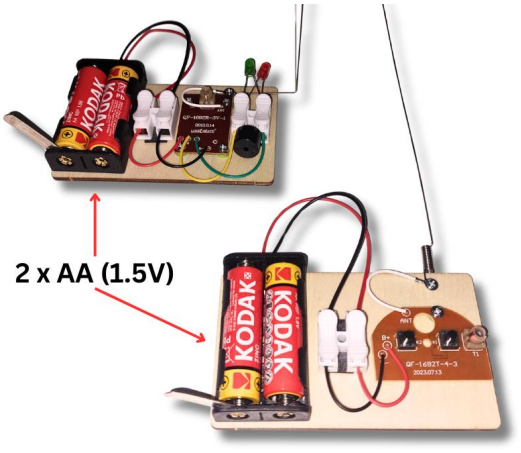
5.2. Identify and verify that all components in the Table in Section 3 are present, then follow the steps in the sections below to assemble the kit.

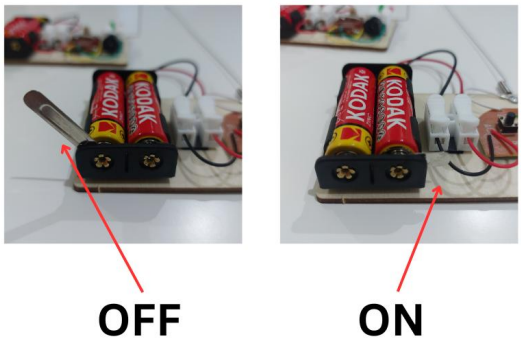
Step	Details	Illustration
1	Use the wooden base with 2 holes in it. Place a green plastic spacer over one of the holes, then place the Transmitter module over it. Secure the transmitter module in place with a 6 mm screw using the screwdriver (included). ***Note***: take care not to over-tighten screws.	
2	Place a single piece of double-sided adhesive pad onto the back of one of the wire connectors and secure in place on the wooden base beside the transmitter module, as shown. Insert the black and red wires from the transmitter module into the wire connector (black on the left; red on the right). To do this, simply press down on the top of the wire connector and gently insert the wires, making sure they are firmly in place. Make sure there is exposed copper on the ends of the wires before inserting into the connector. If not, use a wire strippers to remove some of the rubber insulation to expose the copper.	
3	Place two pieces of double-sided adhesive pad onto the back of one of the battery compartments as shown.	
4	Stick the battery compartment onto the wooden base as shown. Press down firmly to ensure the compartment is secured in place.	

Step	Details	Illustration
5	Remove the small loose piece of insulating material from the pre-stripped wires from the battery compartment (as shown below) to expose the copper wire, then insert the wires into the wire connector (black-to-black and red-to-red) as shown.  	
6	Attach the straight antenna using a 3 mm screw as shown. Note, this can be a cumbersome step. If possible, ask someone to hold the components in place while you install the screw.	
7	Use the second wooden base with the 5 holes in it. Place the green plastic spacers over the holes as shown.	

Step	Details	Illustration
8	Place the receiver module over the green plastic spacers and then secure it in place with 4 x 6 mm screws using the screwdriver (included). Again, this step can be a little cumbersome, so ask for help holding things in place if possible. You can use a tweezers to help with positioning the screws, as shown.	
9	Install a wire connector using a double-sided adhesive pad as shown. Install the yellow and green wires, yellow on the left and green on the right. Ensure there is copper exposed on the ends of the wires and that a secure connection is made.	
10	Install the active buzzer into the wire connector as shown. The buzzer has one stem longer than the other - the longer stem is the positive connection and should be installed in the left socket of the connector, along with the yellow wire from the receiver module. The positive connection is also marked with a '+' on the side of the buzzer. Ensure to push the buzzer firmly into the sockets as far as it will go and also ensure that it does not dislodge the yellow and green wires that were installed earlier.	

Step	Details	Illustration
11	Install the red LED as shown. The LED stems are different lengths. The long stem should be on the left (on the same side of the wire connector as the yellow wire).	
12	Install the green LED as shown. For the green LED, the long stem should be on the right (on the same side of the wire connector as the green wire).	
13	Install a second white wire connector to the left of the receiver module with a double-sided adhesive pad. Then, connect the red and black wires as shown - red on the left, black on the right.	

Step	Details	Illustration
14	As before, use 2 double-sided adhesive pads to stick the second battery compartment to the wooden base. Then connect the red and black wires as shown (black-to-black; red-to-red). Make sure the copper is exposed on the wires before installing into the wire connector.	
15	Connect the second antenna using a 3 mm screw. Again, this can be cumbersome and so some help to hold components in place while you install the screw is recommended.	
16	Place 2 x 1.5V AA batteries into the battery compartment of both the transmitter and the receiver. The batteries are a tight fit - be sure to press them firmly into place and ensure to insert the batteries the right way around (as shown printed inside the battery compartments).	

Step	Details	Illustration
17	To power the units on, simply move the metal strip so that it connects across the batteries as shown opposite. ***You're now ready to start sending and receiving signals!***	

6. Operation

6.1. Ensure both modules are powered on.
6.2. Start with the transmitter and receiver in close proximity to one another; i.e.: in the same room.
6.3. Press the buttons on the transmitter to send a signal - it should cause the LED's to flash and the buzzer to sound on the receiver.
6.4. Move the devices further away from one another and continue to send signals. Determine by experimentation how far away the signal can be transmitted and received, including going to different rooms in the house.
6.5. Once you've figured out the effective range of the device in your home, use the Morse code shown in Appendix I to send messages. Press and release the key to create the dots (short presses) and dashes (long presses).
6.6. The person receiving the signals should also have a copy of the Morse code (and a pen and paper) so they can decipher the dots and dashes back into letters to reconstruct the message.

7. Troubleshooting

7.1. If your device does not work or does not send a signal very far, try the following:
7.2. Check that the batteries are working - try them in another device or measure them with a multimeter. Also verify that the batteries are placed the correct way around in both the transmitter and the receiver.
7.3. Ensure that all connections are firmly in place. Visually inspect to ensure that the copper wire is making contact with the metal strip inside all connectors. Any gap at all between any wire, connector, or component breaks the circuit and the device will not work in this case.
7.4. Ensure there is sufficient insulating material stripped from each of the wires to expose enough copper to make a good connection.
7.5. Check the orientation of all components. LED's only allow current to flow in one direction - if they are inserted incorrectly, they will block the flow of current through the device and it will not work.

7.6. Ensure both antennae are secured in place with the screws and have not become loose while moving the modules around.

7.7. Ensure that you are not trying to send signals to far or through substantial obstacles. This is a simple Morse code device powered by only 3 Volts, and is intended only to demonstrate Morse code in action and to teach some basic electronics principles. The device should be capable of sending signals room-to-room in a typical family home. A professional Morse code device that can send signals for miles requires much higher power and voltage, often using mains power and antennae the size of buildings. Just a note: **do not attempt** to connect this device to the mains - it will instantly destroy it and you may be electrocuted!

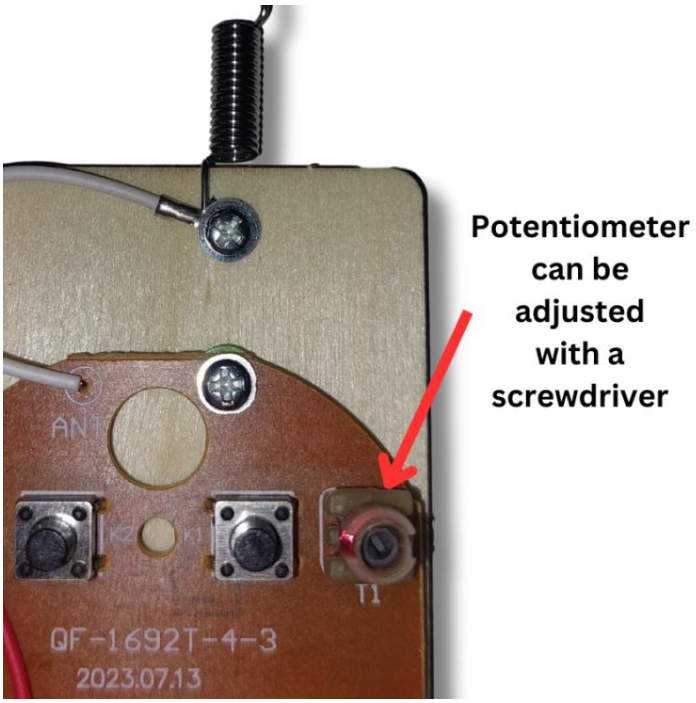
7.8. The potentiometers on both devices can be adjusted in order to improve the signal transmission and reception. To do this, use a small (2-3 mm) flat head precision screwdriver to turn the potentiometers - see illustration below. Move less than a quarter of a turn at a time then try to send and receive signals in order to determine the optimal setting.

7.9. Advanced troubleshooting: if you have electronics tools, you may wish to try the following additional steps…

7.9.1. Use a multimeter to check continuity through the entire circuit.

7.9.2. Solder the components using a soldering iron to establish more robust connections.

7.9.3. Experiment with different current and voltage inputs using a dedicated DC power supply to try to improve the quality and distance of the signal transmission - operational voltages recommended are from 3V to 5V for the receiver and 3V to 12V for the transmitter.



8. Some interesting facts about Morse Code!

8.1. Morse code was developed by Samuel Morse and Alfred Vail in the 1830s.
8.2. The universal distress signal "SOS" (··· --- ···) is easy to recognize and transmits quickly.
8.3. The most common letters in English, like 'E' and 'T', have the shortest codes, enhancing communication speed.
8.4. In aviation, Morse code is still used to identify navigational aids.
8.5. Morse code revolutionized long-distance communication via telegraph lines.
8.6. Morse code influenced early digital communication methods, paving the way for modern binary coding.

We hope you enjoy your device and thank you for your custom!

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Questions or comments? Feel free to contact us at info@thesciencehut.com

Appendix 1: Morse Code

International Morse Code

1. The length of a dot is one unit.
2. A dash is three units.
3. The space between parts of the same letter is one unit.
4. The space between letters is three units.
5. The space between words is seven units.