Construction of a Touch Throttle for e-Bikes

This document describes the construction procedure for a touch throttle using readily available materials and electrical components.

The unit will be used in an e-bike with mid motor and integrated controller. The unit is compatible with hall sensor throttles that use a 3 wire interface (5 volts, Ground and Signal) and can be used with other motor controllers, **figure 1** is the schematic of the circuit.

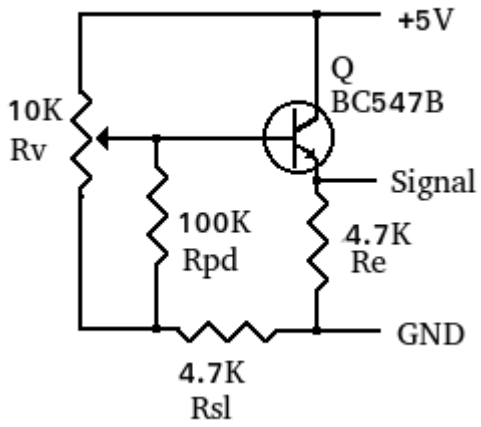

Figure 1. Touch Throttle Schematic

Parts List

1. Board - any small breadboard or prototyping board large enough to fit all parts.
2. Rv - ThinPot (10Kohm) - 25mm or 50mm ThinPot. For this unit we used a 25mm Thinpot.
3. Rpd 100Kohm, 1/4 watt resistor 5%
4. Rsl 4.7Kohm, 1/4 watt resistor 5%
5. Re 4.7Kohm, 1/4 watt resistor 5%
6. BC457B transistor
7. 3 conductor 24 AWG stranded cable, sufficiently long to reach from the handlebar to the motor controller.
8. Connector that matches the motor controller throttle input. For this application we used a 3 pin female Julet/Higo connector.
9. 2mm wide by 2 mm high by 25 mm long rubber or flexible plastic strip
10. 2 pieces of rigid material 10mm wide by 5 mm high by 2 mm thick. For this unit we used a 10mm rubber round faucet washer cut in half.
11. Plastic or metal bar 1/8 inch thick, 1/2 inch wide and 3 inches long. For this unit we used a piece of aluminum bar. The ThinPot must be mounted on a flat rigid surface. Any bending will cause the closely spaced surfaces of the Thinpot to make contact.
12. Handlebar mount reflector
13. Insulating tape. Required if the mounting bar is conductive
14. Flexible plastic dip or spray
15. plastic cement

The ThinPot was purchased from Mouser Electronics. The Connector was purchased from Amazon. All other electrical parts were purchased from Jameco Electronics.

Other materials were purchased from local hardware and Bike stores.

Figure 2 shows a 25mm ThinPot, numbers 1 to 3 identify the pins and letters A and B identify the extreme positions. Pin 3 positive results in maximum throttle in point A while pin 1 positive results in maximum throttle in point B

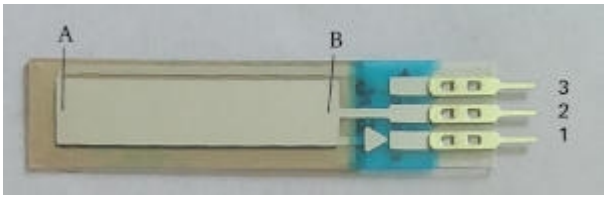

Figure 2. ThinPot connections

The table below shows the minimum and maximum throttle positions for the two possible connections of the ThinPot.

Pin 1	Pin 2	Pin 3	Pos. A	Pos. B
+5V	Signal	GND	Min. V	Max. V
GND	Signal	+5V	Max. V	Min. V

Assembly of the electrical components

Figure 3 shows the board used with the component location identified. It was cut from a larger protoboard. The right image shows all parts, except the ThinPot, soldered on the board. The 3 conductor cable cable was divided in two, the piece on the right side of the photo connects the ThinPot.

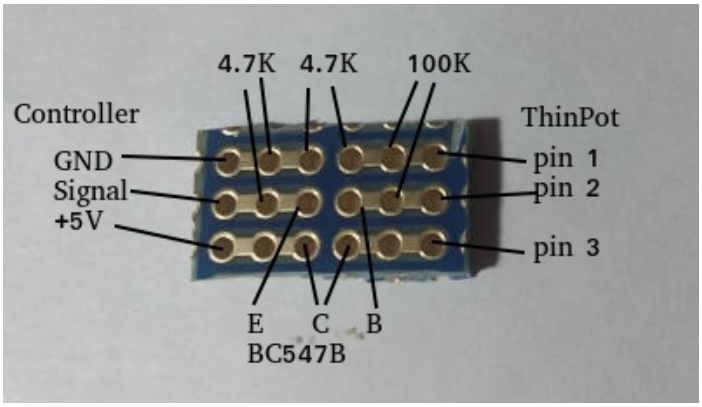

Figure 3. Left photo - Solder side of the protoboard with component locations. The transistor collector lead is used to jump the +5V connections, Right photo -Assembled board with all components and cables in place.

The ThinPot was soldered to the 3 conductor cable using the pin 3 positive configuration. **Warning: The ThinPot is heat sensitive and should be soldered using the same precautions as when soldering semiconductors.**

The wired ThinPot is shown in **figure 4**.

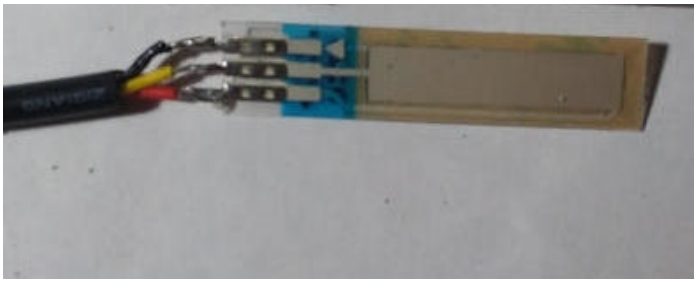

Figure 4. ThinPot with 3 conductor cable soldered.

The assembled circuit was tested at this point of the construction to verify proper functioning.

Handlebar support

The piece of aluminum bar was drilled at one end to fit the screw of the handlebar reflector. The reflector and its carrier were removed and the screw holding them saved, it will be used to attach the aluminum bar. **Figure 5** shows the handlebar reflector, and the drilled aluminum bar.

Figure 5. Handlebar support parts

The corners of the aluminum bar next to the mounting hole were cut off to allow it to turn freely when adjusting its position. The Thinpot has exposed crimped connectors that can be shorted if placed over an electrical conductor. A piece of insulating tape was placed over the area where the metal connectors rest to avoid shorting the connectors. **Figure 6** shows the bar with the insulating tape next to the Thinpot.

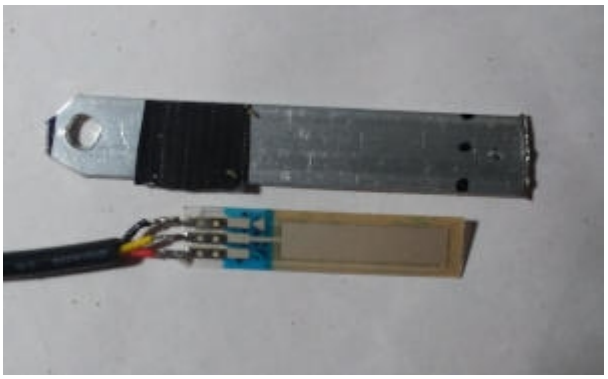

Figure 6. Aluminum bar with insulating tape.

The Thinpot has an adhesive backing, it was used to attach the Thinpot to the aluminum bar. A rubber strip was glued to the center of the active area of the Thinpot, and pieces of rubber were glued about 5mm from each end of the active area. These provide touch feedback while using the throttle. For this unit we used UHU brand plastic cement. **Figure 7** shows the rubber strip and end pieces. The piece closest to the soldered end is not clearly visible against the black insulating tape.

Figure 7. Thinpot with rubber strip and rubber end pieces.

The Throttle end and the circuit board were coated with flexible plastic, we used Plasti-Dip brand. The ThinPot is rated IP64 which is only splash protection, and the solder tabs are exposed. This coating is needed since the high input resistance of the emitter follower can result in activation of the throttle with moisture. In the final step the aluminum bar was attached to the handlebar support. **Figure 8.** shows the components coated with plastic and the finished Throttle.

Figure 8. Left photo-circuit board coated with plastic, center photo- Thinpot coated with plastic, right photo- The finished Throttle unit.

The throttle can be installed for operation with the index finger **(Figure 9)** or with the thumb **(Figure 10)**.

Figure 9. Left photo- Throttle installed for the index finger. Right photo - operation.

Figure 10. Left photo - Throttle installed for the thumb. Right photo - operation.