Chipsmall

Chipsmall Limited consists of a professional team with an average of over 10 year of expertise in the distribution of electronic components. Based in Hongkong, we have already established firm and mutual-benefit business relationships with customers from,Europe,America and south Asia,supplying obsolete and hard-to-find components to meet their specific needs.

With the principle of "Quality Parts,Customers Priority,Honest Operation,and Considerate Service",our business mainly focus on the distribution of electronic components. Line cards we deal with include Microchip,ALPS,ROHM,Xilinx,Pulse,ON,Everlight and Freescale. Main products comprise IC,Modules,Potentiometer,IC Socket,Relay,Connector.Our parts cover such applications as commercial,industrial, and automotives areas.

We are looking forward to setting up business relationship with you and hope to provide you with the best service and solution. Let us make a better world for our industry!

Contact us

Kitronik

TEST YOUR HAND-EYE COORDINATION WITH THIS

STEADY HAND GAME WITH LATCHING LED

Version 2.0
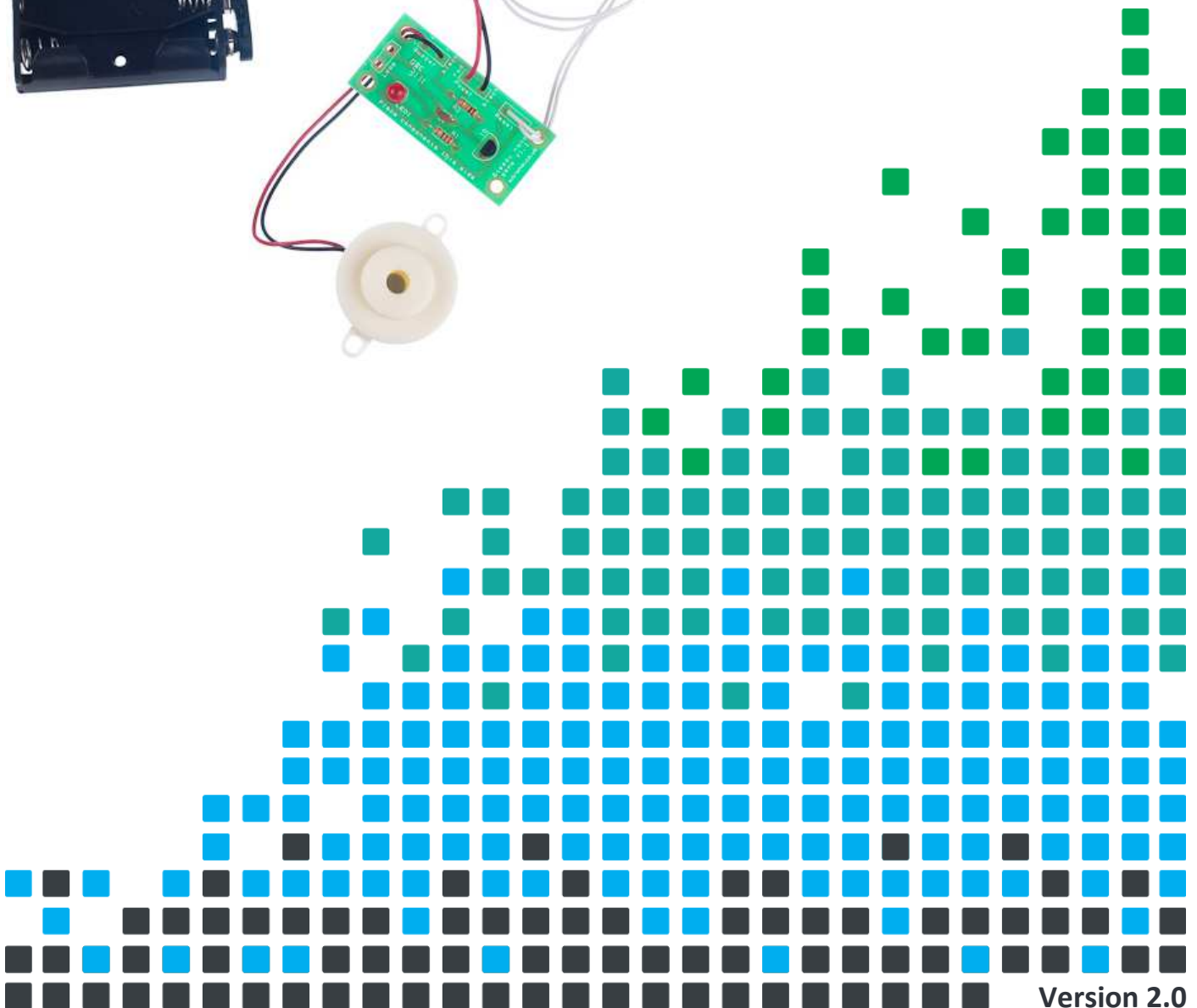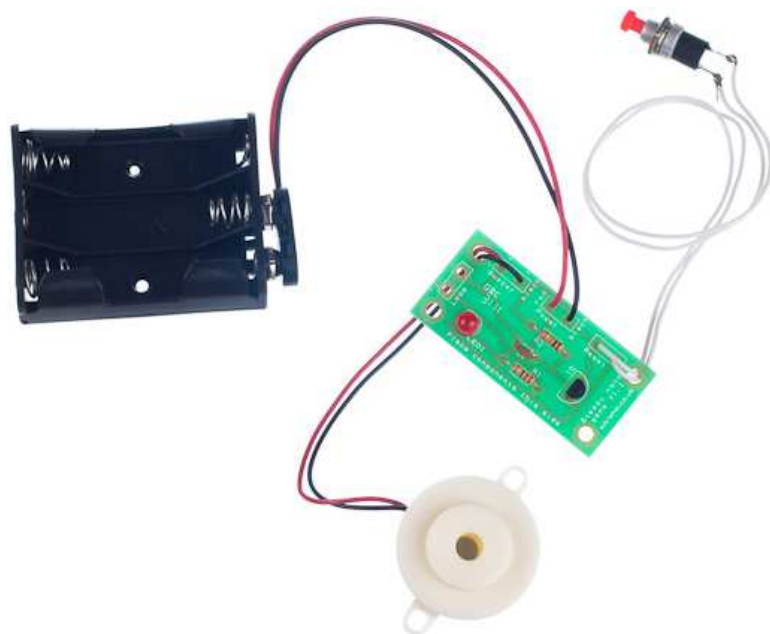
Build Instructions – Teacher's Notes

All of the parts that are required to build the steady hand PCB are individually bagged with the exception of the following:

- The tinned copper wire for the loop and bent wire track, which is supplied on around a 25 metre reel.
- The heavy duty wire for connecting the loop, which is supplied on a 25 metre reel.
- The heat shrink, which is supplied in lengths of 1.2 metres.

We would suggest that you set up two areas:

1. The first will have a 1 metre ruler, a pair of cutters and the tined copper and heavy duty wire. The student can then measure and cut themselves a 1 metre length of each.

2. The second will have a 15cm ruler, a pair of cutters and the heat shrink. The students can then measure and cut themselves a 15cm length.

The easiest way to shrink the heat shrink is by using a hot air gun.

Steady Hand Game Essentials

Build Instructions

Before you start, take a look at the Printed Circuit Board (PCB). The components go in the side with the writing on and the solder goes on the side with the tracks and silver pads.

1 — PLACE RESISTORS

Start with the two resistors:
The text on the PCB shows where R1, R2 etc go.
Ensure that you put the resistors in the right place.

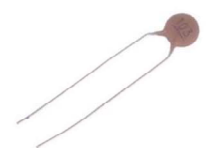| PCB Ref			Value	Colour Bands
R1			220Ω	Red, red, brown
R2	10KΩ	Brown, black, orange		
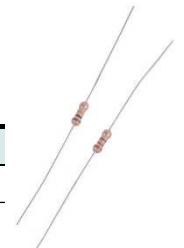
2 — SOLDER THE THYRISTOR

Solder the thyristor into the board where it is labelled Q1. Make sure that the device is the correct way around. The shape of the device should match the outline on the PCB

3 — SOLDER THE 10NF CAPACITOR

Solder the 10nF capacitor into the board where it is labelled C1.

4 — SOLDER THE LED

Place the Light Emitting Diode (LED) into LED1. The LED won't work if it does not go in the right way around. If you look carefully one side of the LED has a flat edge, which must line up with the flat edge on the lines on the PCB. You may want to solder it at a specific height depending upon how you have designed your enclosure (if you are making one). Once you are happy, solder into place.

5 — FIT THE BUZZER

The buzzer should be soldered into the 'buzzer' terminal. The red wire must go to the '+' terminal (also marked with the text 'red') and the black wire must go to the '-' terminal (also marked with the text 'black').

6 — FIT THE BATTERY CLIP

Attach the battery clip. The red lead should be soldered to the '+' terminal (also marked with the text 'red') and the black lead should be soldered to the '-' terminal (also marked with the text 'black').

7 ### FIT THE RESET SWITCH

Attach the reset switch. First cut and strip two short lengths of the thin wire supplied. Solder one to each of the two terminals on the switch. Then solder the other end to the PCB where it is marked 'reset'. It does not matter which way around the two wires go.

8 ### CREATE THE LOOP

To create the loop, cut about 15 – 20cm from your piece of solid tinned copper wire. Bend the end to form the desired sized loop and handle. Solder the end to the middle of the wire, being careful to hold the wire with a pair of pliers and not your hands.

9 ### SOLDER THE LOOP

Strip both ends of the piece of flexible heavy-duty wire. Solder one end to the handle of the loop. Cut a 5cm length of heat shrink and slide it over the solder joint. Shrink into place using a hot air gun. Now solder the other end of the wire to the pad on the PCB labelled 'loop'.

10 ### CREATE THE SHAPE

The remaining piece of copper wire will form the shape that will have to be negotiated with the loop. Cut another 5cm piece of heat shrink and shrink it over one end of the wire (be careful as the wire will become hot). Make sure that the sharp end is fully covered.

11 ### SOLDER THE SHAPE

Slide the remaining 5cm piece of heat shrink over the other end of the solid tinned copper wire and shrink it so that a 1cm piece of metal is sticking out the end. Solder this end into the remaining pad on the PCB marked 'loop'.

12 ### BEND THE TRACK INTO PLACE

Bend the wire to form your desired shape track. If the wire has to be placed through a hole in an enclosure, you will probably want to do this before bending the wire.
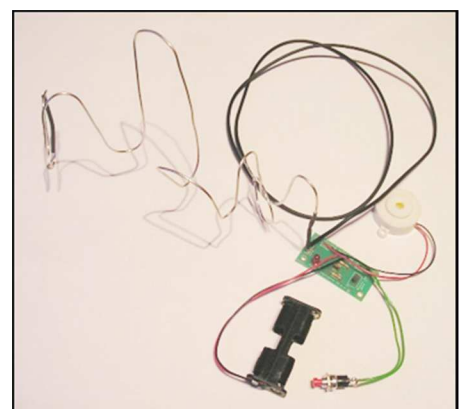
Checking Your Steady Hand Game PCB

Check the following before you connect power to the board:

Check the bottom of the board to ensure that:
- All these leads are soldered.
- Pins next to each other are not soldered together.

Check the top of the board to ensure that:
- The shape of the thyristor matches the outline on the PCB.
- The flat edge of the LED matches the outline on the PCB.
- The red and black leads on the buzzer and battery clip are connected the correct way around.
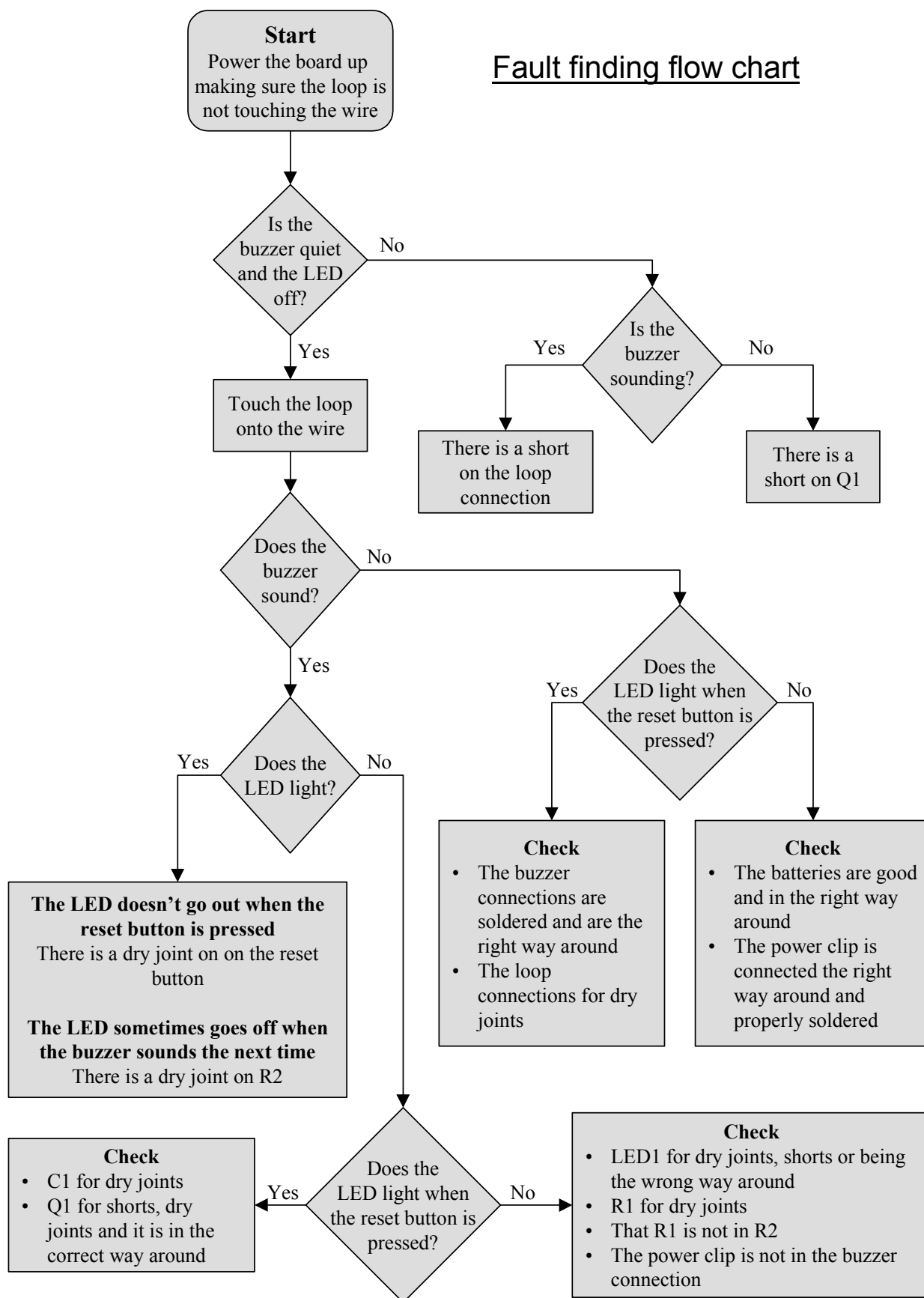- The colour bands on R1 are red, red and brown.

Testing the PCB

1. When you power up the board (with the loop not touching the wire) it should be silent.
2. Touching the loop against the wire will cause the buzzer to sound and the LED to light and stay lit.
3. Pressing and releasing the reset button will cause the LED to go out.

If this is not the case, recheck your board following the instructions above.

Steady Hand Game Essentials

www.kitronik.co.uk/2108

Kitronik

Fault finding flow chart

Start
Power the board up making sure the loop is not touching the wire

↓

Is the buzzer quiet and the LED off?

→ No → **Is the buzzer sounding?**

- Yes → There is a short on the loop connection
- No → There is a short on Q1

↓ Yes

Touch the loop onto the wire

↓

Does the buzzer sound?

→ No → **Does the LED light when the reset button is pressed?**

- Yes → **Check**
  - The buzzer connections are soldered and are the right way around
  - The loop connections for dry joints
- No → **Check**
  - The batteries are good and in the right way around
  - The power clip is connected the right way around and properly soldered

↓ Yes

Does the LED light?

- Yes → **The LED doesn't go out when the reset button is pressed**
  There is a dry joint on on the reset button

  The LED sometimes goes off when the buzzer sounds the next time
  There is a dry joint on R2

- No → **Does the LED light when the reset button is pressed?**
  - Yes → **Check**
    - C1 for dry joints
    - Q1 for shorts, dry joints and it is in the correct way around
  - No → **Check**
    - LED1 for dry joints, shorts or being the wrong way around
    - R1 for dry joints
    - That R1 is not in R2
    - The power clip is not in the buzzer connection

Designing the Enclosure

When you design the enclosure, you will need to consider:

- The size of the PCB (below).
- The position of the LED and its size (5mm).
- Where the wire track and wire loop will be connected.
- Where the buzzer will be mounted (top right).
- The position of the reset switch (bottom right).
- Where the batteries will be housed (mid right, height 16mm).
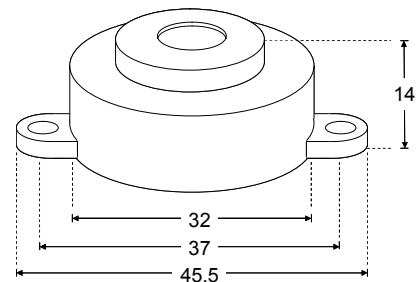
These technical drawings of the steady hand components should help you to plan this.
All dimensions are in mm.
The four PCB mounting holes are 3.3mm in diameter.
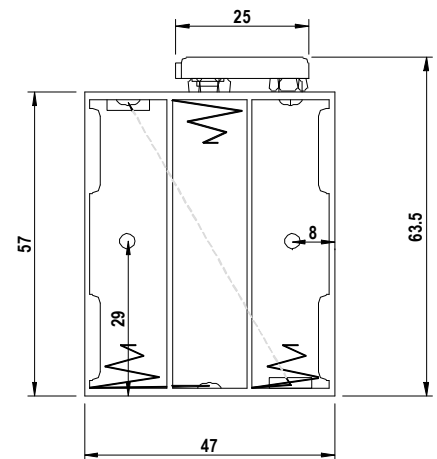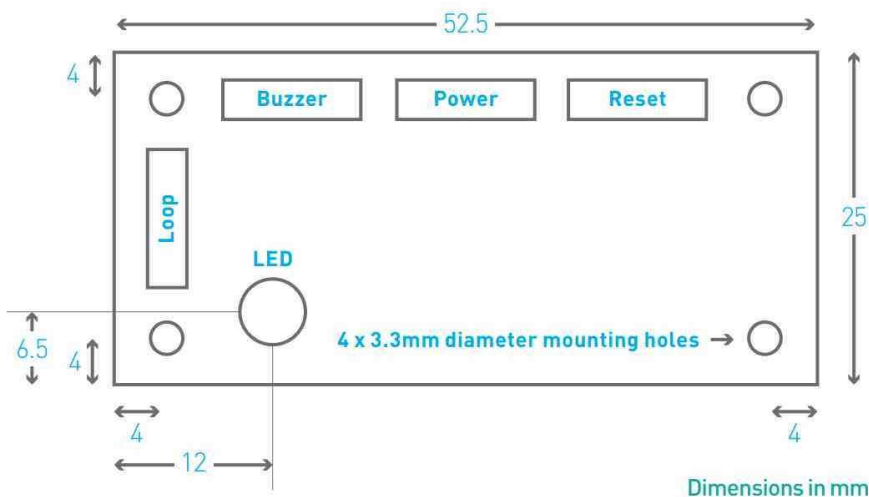
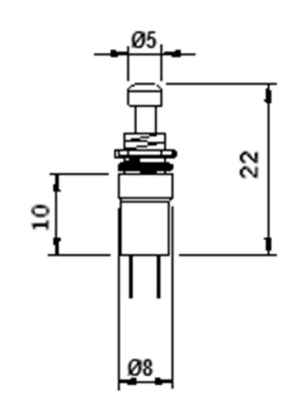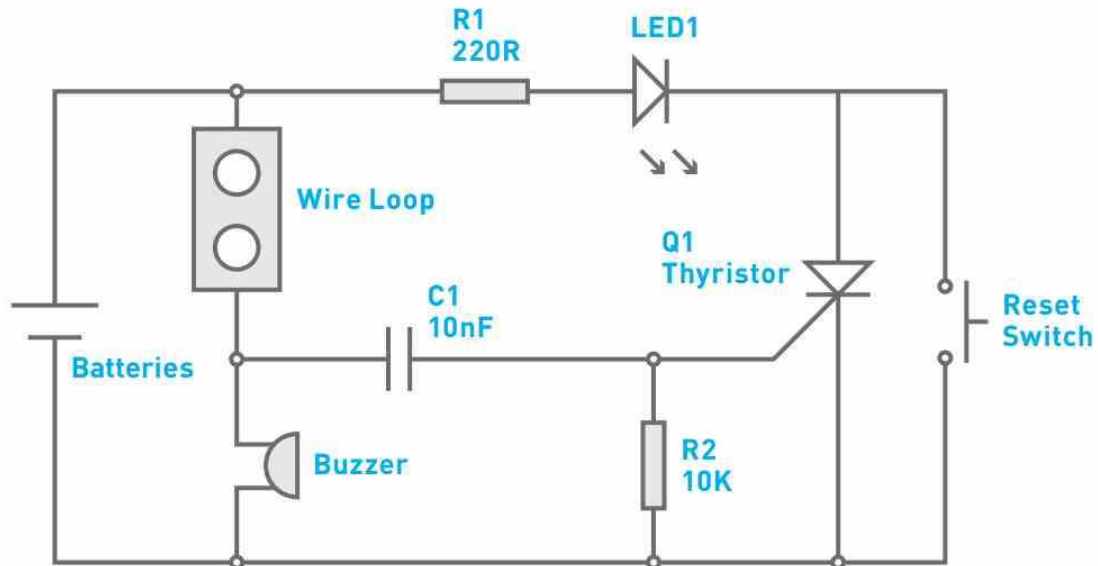**Mounting the PCB to the enclosure**

The drawing to the left shows how a hex spacer can be used with two bolts to fix the PCB to the enclosure.

Your PCB has four mounting holes designed to take M3 bolts.

How the Steady Hand Game Works

Buzzer

When the loop touches the section of bent wire, a circuit is completed that allows electricity (current) to flow from the batteries, through the loop and the bent wire circuit, and to the buzzer. This causes the buzzer to sound. When the loop is removed from the wire the buzzer will stop. This is the left section of the circuit.

Fail LED

There is an LED that comes on and stays on once the wire and loop have touched each other. This happens because when the loop and then bent wire touch, the left-hand side of C1 is taken to a high voltage. This causes a short high pulse on the right hand side of the capacitor, which is normally held at a low voltage by the 10KΩ resistor R2. As these are connected to the gate of the thyristor Q1, it causes the thyristor to become latched on. Now that the thyristor is latched on, electricity (current) can flow from the batteries, through the 220Ω resistor R1 and LED1. The LED will now be on. The 220Ω resistor R1 is used to control the brightness of the LED and stop it being damaged.

When the reset switch is pressed, there is no voltage across the thyristor Q1 (the anode is taken to 0V). This turns the thyristor off and it stops conducting. This means that electricity (current) can no longer flow through it so the LED1 turns off. You will notice that the LED1 is only turned off when the reset switch is released. This is because when it is pressed the electricity can flow through it, which keeps the LED on.