Kitronik

ESSENTIAL INFORMATION

BUILD INSTRUCTIONS
CHECKING YOUR PCB & FAULT-FINDING
MECHANICAL DETAILS
HOW THE KIT WORKS

LIGHT UP YOUR DAY WITH THIS

WINDUP TORCH KIT

Version 1.1

Windup Torch Kit Essentials

www.kitronik.co.uk/2164

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 THE SCHOTTKY DIODE

Start with the diode D1. The text on the PCB shows where D1 should go. The black band on the diode should match the drawing on the PCB to which end the diode goes. D1 is marked BAT 41.

2 PLACE THE ZENER DIODE

Next, place the second diode D2. The text on the PCB shows where D2 should go. The black band on the diode should match the drawing on the PCB to which end the diode goes. D2 is marked 1N750A.

3 PLACE THE RESISTOR

The resistor R1 is 100 Ω. The text on the PCB shows where R1 should go. It doesn't matter which way around the resistor goes into the board.

4 PLACE THE CAPACITOR

The capacitor fits in the centre of the PCB and needs to be fitted the correct way. To do this, make sure the negative band on the capacitor that's marked with '-' is placed in the '---' hole on the PCB.

5 PLACE THE LED

The LED to be placed in the holes indicated by LED. This component also needs to be fitted the correct way round. The longer leg of the LED should be placed into the '+' hole. This would leave the side of the component with a flat edge to be located into the '-' hole. If you wish to have the LED flat out of the PCB, as in the example, then bend the legs before soldering. The alternative is add wires between the LED and the board. If you do this it is a good idea to use different colour wires for the different legs.

6 CONNECT THE MOTOR

The motor is connected from its brush connections to the holes marked MOTOR with wires. It doesn't matter which way round the motor is connected, but the wire length will depend on the final design of your torch.

Checking Your Windup Torch PCB

Check the following before you wind up the torch for the first time.

- Check diode 1 and 2 are positioned correctly, with the bands towards the version text
- Check the Zener Diode (D2, marked 1N750) is positioned closest to the capacitor
- Check that the capacitor is positioned correctly, with the -ve stripe on the side where the --- is indicated on the PCB.
- Check the LED is attached with the correct polarity.

Check the bottom of the board to ensure that:

- All holes (except the two large mounting holes and one strain relief hole) are filled with the lead of a component or wire.
- All these leads are soldered.
- Pins next to each other are not soldered together.

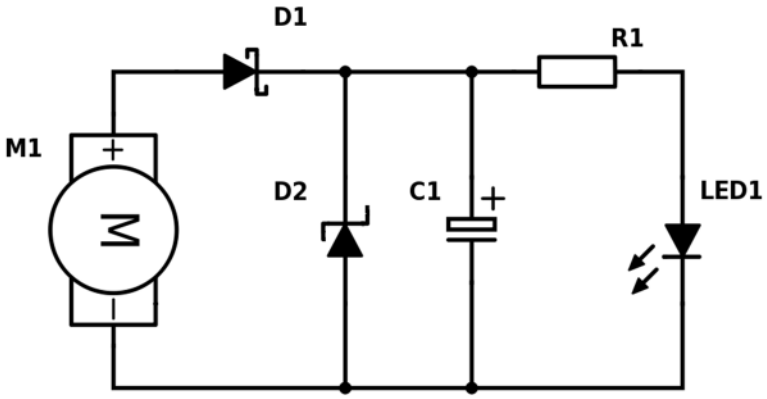
Using your torch

To use your torch simply wind the generator handle. After a few seconds of winding the LED should light up.
If it doesn't try turning the handle the other direction.
The gearbox attached to the motor has a built in, self-resetting, clutch mechanism. This makes a clicking noise when it is activated. Stop winding if you hear clicking and the clutch will reset. Try winding more gently if the clutch continues to activate.

If your torch doesn't stay lit long check the solder joints on the capacitor. A dry joint or a short will prevent the capacitor from storing charge, and keeping the LED lit.

Some of the winding energy goes to lighting the LED directly, and the excess is stored in the capacitor. Winding faster will increase the amount of stored energy, meaning the LED will stay lit for longer after winding stops.

How the Windup Torch Works



The circuit diagram for the Windup Torch is shown above. It is a very simple circuit. The motor (M1), acting as a generator, powers the circuit when turning the handle. The faster rotation of the generator the higher the voltage supplied to the circuit

The Schottky diode (D1) is to ensure that there is polarity protection if the generator is turned the opposite direction. The Schottky diode also has a low voltage drop, so the smallest amount possible of voltage is lost.

The Zener diode (D2) makes sure the voltage does not go to high and damage the capacitor. If the voltage from the generator (M1) climbs above 5V the Zener diode will breakdown and start to conduct, limiting the voltage across the capacitor to 5V. Once the voltage dips below 5V the Zener diode will recover, and stop conducting.

The capacitor stores the excess charge created by the generator, over the amount required to light the LED. When the generator stops the capacitor slowly discharges and keeps the LED illuminated.

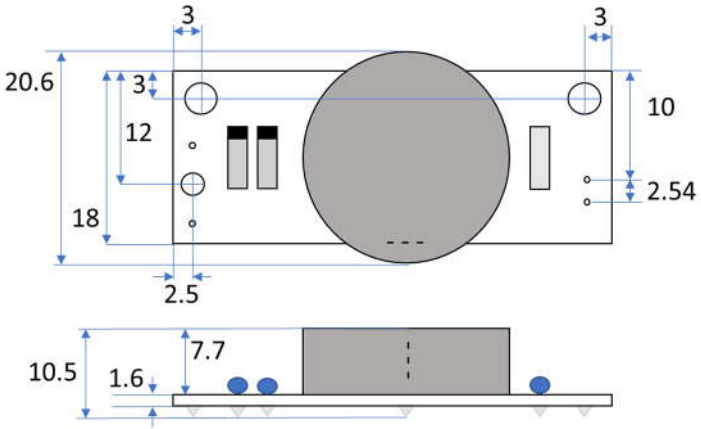
The resistor limits the amount of current to the LED.

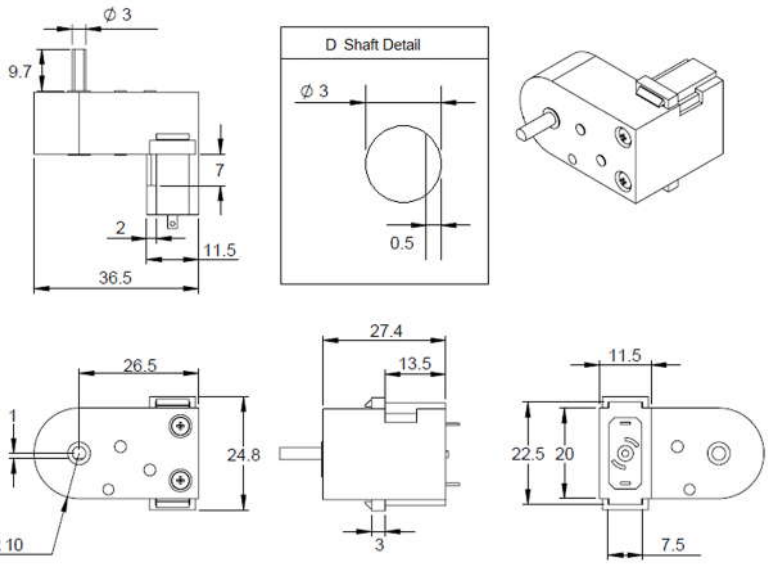
Rotating the motor generates the current to charge the capacitor and illuminate the LED. Because the LED is lit at the same time as the capacitor is charging it will take longer to charge the capacitor to keep the LED on than if the capacitor was charged and then the LED switched on.

Designing the Enclosure

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

- The size of the PCB.
- Where the generator will be mounted
- The winding handle
- Where the LED will be mounted
- There are 2 3.3mm holes in the corners of the PCB to secure the PCB in the enclosure.





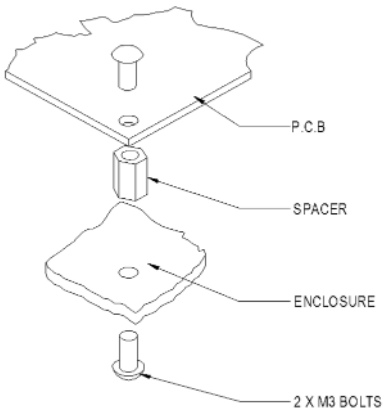
The following technical drawings of the built PCB and motor should help you to design your enclosure and winding handle. All dimensions are in mm

The 2 mounting holes are 3mm from the board edge.
The assembled PCB is approximately 10.5 mm tall including solder points.
The Capacitor is larger than the PCB, it is about 20.6mm in diameter, and 7.7mm tall.

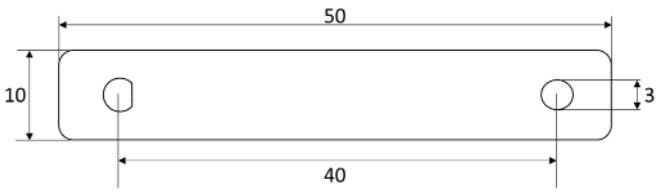
The generator wires run through a strain relief hole that is 2.5 mm in diameter.
The motor shaft is 3mm in diameter, with a flat 1mm from the centre.

Mounting the PCB to the enclosure

The drawing below shows how a hex spacer can be used with two bolts to fix the PCB to the enclosure.
Your PCB has two mounting holes designed to take M3 bolts.



A simple winding handle can be made using a laser cut sheet and an M3 nut and bolt. The drawing to the right shows suitable dimensions



Online Information

Two sets of information can be downloaded from the product page where the kit can also be reordered from. The 'Essential Information' contains all of the information that you need to get started with the kit and the 'Teaching Resources' contains more information on soldering, components used in the kit, educational schemes of work and so on and also includes the essentials. Download from:

www.kitronik.co.uk/2164


This kit is designed and manufactured in the UK by Kitronik

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