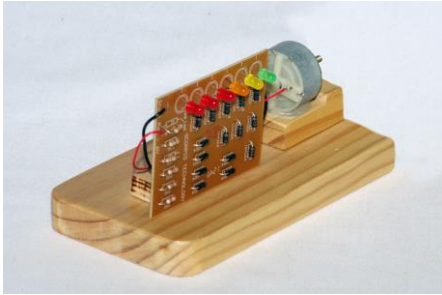
GENERATOR OUTPUT MONITOR

CONTENTS:

DESCRIPTION

The GENERATOR OUTPUT MONITOR project allows the user to monitor the output of a turbine. Graduated LEDs give an indication of the Turbine's output.



SECTION 1: GENERAL AND PLANNING INFORMATION

1. DESIGN CONSIDERATIONS

1.1 GENERAL

The tasks to complete the project include assembling and testing the circuit board and connecting to an appropriate power source. The kit contains a small generator, but can be used with other power sources or more powerful generators (keeping in mind the maximum power that can be put through the PCB / circuit.

1.2 ITEMS FOR INVESTIGATION

Areas of investigation could include alternative energy sources used to produce electricity.

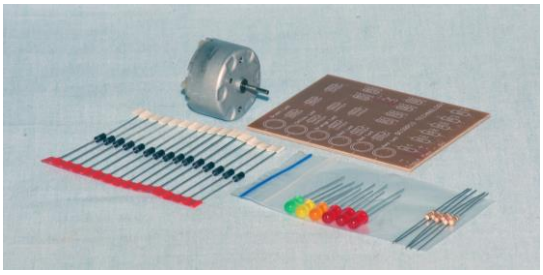
- Wind power
- Hydroelectric power
- Geothermal power
- Wave and tidal power
- Solar thermal power
- Nuclear fission

Although these are all different methods of producing electricity, all of them are used to turn generators to make electricity. A generator is simply a device that converts kinetic energy (the energy of movement) to electrical energy.

SECTION 1: COMPONENTS & MATERIAL REQUIRED

1.1 COMPONENTS SUPPLIED

The following components are supplied in the kit:



1.2 ADDITIONAL REQUIREMENTS

- Electric hook-up wire – Multi-strand in red and black
- Solder – 60/40, 0.71mm diameter – multicore flux
- Material for the platform (if required)

1.3 TOOLS REQUIRED

The following tools are required:

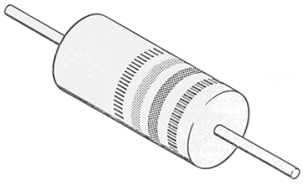
- Soldering equipment

SECTION 2: PRINTED CIRCUIT BOARD ASSEMBLY

2.1 COMPONENTS

There are only 3 types of components used in this circuit.

2.1.1. RESISTOR



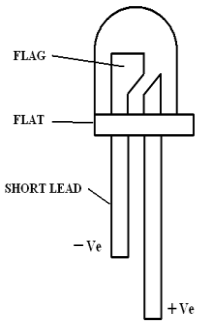
Resistors have a cylindrical body and are marked with coloured bands. The coloured bands are used to mark the value of the resistor. You should refer to the component parts list to identify the correct value resistors.

The resistors and their values are marked on the PCB. Resistors can be inserted into the PCB either way around. For neatness and to make it easier to read the resistor colour code, the Gold band on all resistors should face in the same direction.

2.1.2. DIODE

The diodes used in this project have a black body with a white band around one end. The white band indicates the negative end of the diode. It must be put facing in the correct direction for the circuit to operate. The position of the diodes and their direction are marked on the PCB.

2.1.3. LIGHT EMITTING DIODE (LED)



Light Emitting Diodes only work in one direction. They must be correctly oriented or they will not work.

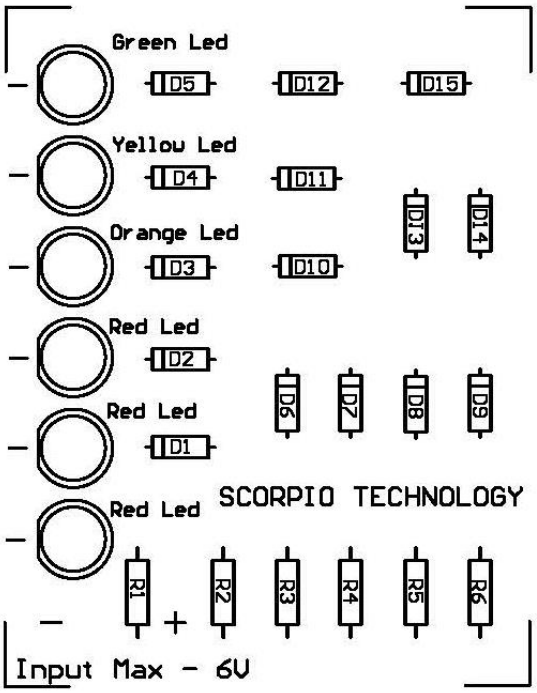
The negative lead can be identified in one of three ways (although not all LEDs use methods 2 & 3. The methods are:

1. The flag (the larger connection inside the body) identifies the negative lead. This is visible when the LED is held up to the light.
2. The shortest leg is negative.
3. A flat on the ridge, around the base of the LED is on the negative side.

The positions and colours of the LEDs are marked on the PCB.

2.2 Printed Circuit Board Assembly

CAUTION: Take care in orienting the Diodes and LEDs, otherwise the circuit will not work or will not work properly. Unsoldering and replacing wrongly positioned components will waste time. Do not overheat the PCB and components.



Position the components. Carefully check their positions and orientation before soldering.

Solder the components to the PCB in the following order: resistors, diodes (the band end is negative) and LEDs (flat is negative).

Trim the component leads as required.

SECTION 3: ELECTRICAL TESTING

- Inspect soldering for short circuits and poor soldering of component leads or pads.
- Connect the leads to a variable power supply. Make sure that the power supply is adjusted to zero volts. Connect the negative lead from the PCB to the negative terminal of the power supply and the positive lead to the power supply's positive terminal.
- Slowly adjust the power supply voltage. Once around 2.5 volts is reached the first LED should light. As you continue to adjust the voltage towards 6 volts the other LEDs will light.

WARNING: Do not adjust the voltage beyond 8 volts or you will burn out the LEDs.

- If the LEDs do not light, check orientation of the LEDs and diodes. If they are correct and the LEDs don't light check the PCB leads. Negative and positive must connect the correct way around to the power supply.
- If a LED only glows dimly, check that the resistors are in the correct position.
- Check that the LED is working by using a 220 Ohm resistor and 6Volt (battery) power.

SECTION 4: WIRING AND MECHANICAL ASSEMBLY

After testing, connect wires from the PCB to the generator terminals. Make sure that the positive (+) and negative (-) wires from the PCB connect to the correct terminals on the generator.

If the LEDs work correctly when connected to the power supply but don't light when connected to the generator (it must spin at 2000rpm for all LEDs to light), check that the positive and negative connections to the generator are correct.

SECTION 5: FURTHER DEVELOPMENT

We encourage you to continue developing application ideas with your GENERATOR OUTPUT MONITOR.

SECTION 6: THEORY

6.1 CIRCUIT OVERVIEW

The voltage from the Generator increases as its speed increases.

Once the voltage reaches slightly more that 2.3 volts (the operating voltage of a Red LED), the LED connected to the 47 Ohm resistor will illuminate. When the voltage has increased by 0.6 volts to 2.9 volts, the LED connected to the 100 Ohm resistor will light. This is because when current flows through a diode, 0.6 volts will fall across the diode. Each time the voltage increases by a further 0.6 volts another LED will illuminate.