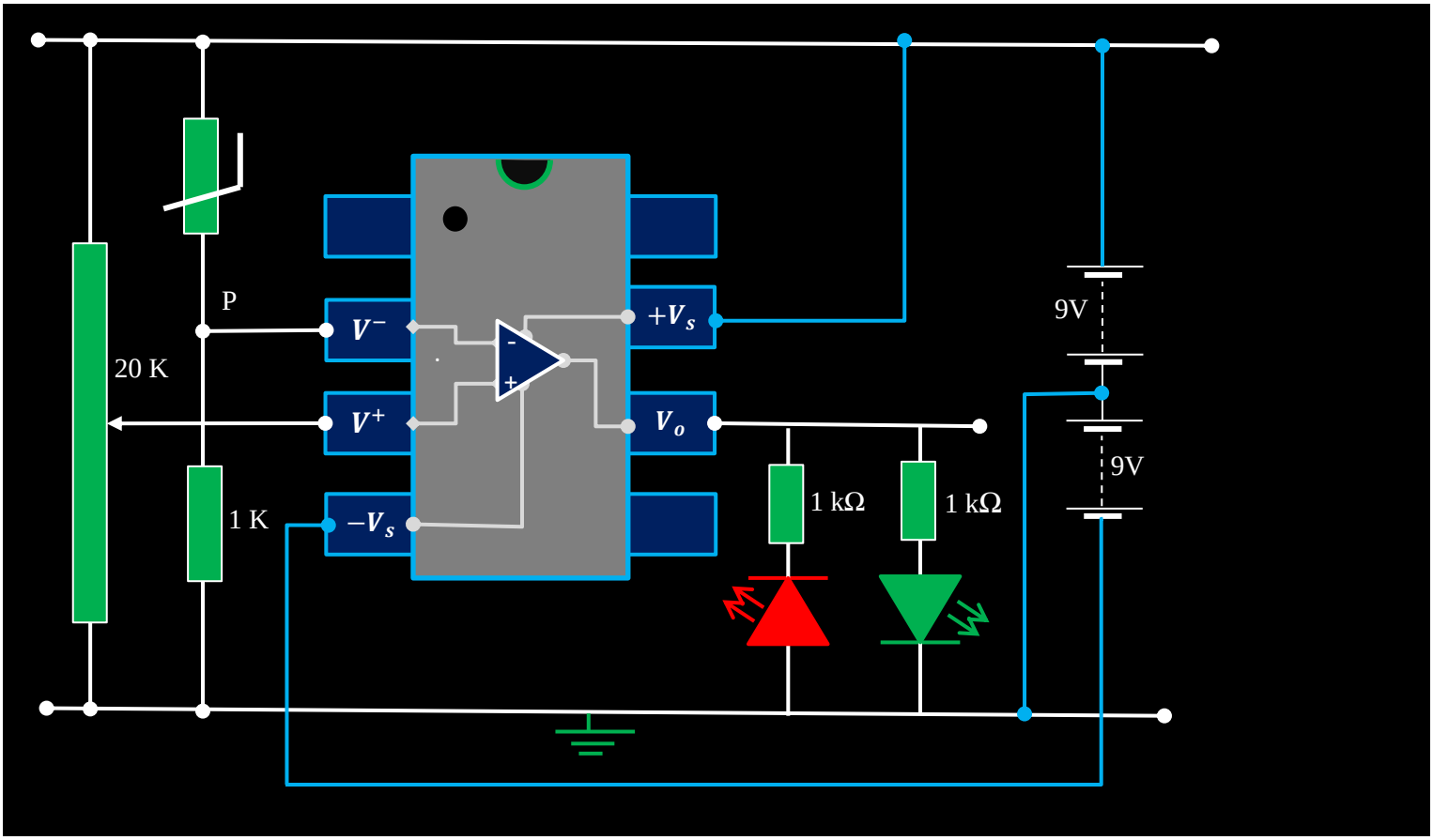
THE OPERATIONAL AMPLIFIER

Temperature Sensor

The op-amp is configured to sense heat (Temperature)



The resistance of the THERMISTOR decreases with increase in TEMPERATURE. This is a Negative Temperature Coefficient Thermistor (NTCT). That is, it has highest resistance at low temperatures and low resistance at high temperatures. The potential difference across the Thermistor therefore increases with decrease (or fall) in temperature. This means that the potential difference across the 1K resistor decreases with decrease in light intensity. The potential difference across the 1K resistor is equal to the inverting input since it is equal to the potential at point P. Since the potential difference across the 1K resistor is equal to the inverting input, then it is regarded as the input resistor.

The potentiometer on the other hand can be varied in order to fix the value of the non-inverting input. In order for the LED's to switch over at the slightest change in temperature, the difference between the two inputs must be very small. To set this value, one can connect a voltmeter between the two inputs and then vary the potentiometer while keeping an eye on the voltmeter.

NB: The setting must be done at different temperatures and according to what one desires.

APPLICATION

Variation in temperature of the thermistor (or the room or environment) can be achieved by either holding the thermistor between your thump and finger in order to warm it up or holding a cube of ice on the

thermistor in order to cool it down or exposing the thermistor to the sun so that it can warm up naturally due to the warmth from the sun. In the former case the thermistor could find numerous applications in industry and fire alarm systems or a device which warns on onset of winter or any changes in temperature of the environment in general.

Numerous output devices can now be used. These will be controlled by changes in temperature.

Carry out your own investigations to answer the following QUESTIONS

- With the difference between the two inputs being very small (close to zero) and positive, explain what happens to the LED's when you warm (increase the temperature of) the thermistor by holding it between your fingers.
- With the difference between the two inputs being very small (close to zero) and positive, explain what happens to the LED's when you decrease the temperature of the thermistor by hold an ice cube on the thermistor
- Now make the difference between the two inputs to be too large and repeat the procedures above. Explain each of your observations.
- Suppose you do not have a voltmeter, how would you use the LED's to make the difference between the two inputs very small?

<u>PROJECT (SUGGESTIONS)</u>

Use your knowledge from the investigations above to make a simple

- Domestic fire alarm
- thermometer